ENGINE PERFORMANCE

Self-Diagnostics - EEC-V - 4.2L

INTRODUCTION

Perform all steps in **BASIC TESTING - 4.2L** article in this section. If no fault is found while performing basic diagnostic procedures, proceed with self-diagnostics. If no diagnostic trouble codes or only pass codes are found during self-diagnostics, proceed to **TESTS W/O CODES - 4.2L** article in this section for diagnosis by symptom.

SELF-DIAGNOSTIC SYSTEM

DIAGNOSTIC FORMATS

QUICK TEST and CIRCUIT TESTS are diagnostic formats used to test and service EEC-V system. **QUICK TEST** allows technician to identify problems and retrieve diagnostic trouble codes. CIRCUIT TESTS check circuits, sensors and actuators.

Before starting any CIRCUIT TEST, follow all steps under QUICK TEST to find correct CIRCUIT TEST. If vehicle passes QUICK TEST and no driveability symptoms or intermittent faults exist, EEC-V system is okay.

DIAGNOSTIC TROUBLE CODES (DTC)

During QUICK TEST, 3 types of diagnostic trouble codes are retrieved: KOEO, KOER and Continuous Memory Codes. See **QUICK TEST** for self-test procedures. Codes may be cleared from PCM memory after they have been recorded or repaired. See **CLEARING CODES** .

KOEO & KOER Codes (Hard Faults)

These codes indicate faults are present at time of testing. A hard fault may cause CHECK ENGINE or Malfunction Indicator Light (MIL) to go on and remain on until fault is repaired. If KOEO or KOER codes are retrieved during **KOEO SELF-TEST** or KOER SELF-TEST, use the **DIAGNOSTIC TROUBLE CODE (DTC) REFERENCE CHARTS** to find correct testing and repair procedures.

Continuous Memory Codes (Intermittent Faults)

These codes are used to diagnose intermittent problems. Continuous Memory Codes are retrieved after **KOEO SELF-TEST** . These codes indicate a fault that may or may not be present at time of testing.

After noting and/or repairing fault, clear codes from memory. See **CLEARING CODES** . Intermittent faults may be caused by a sensor, connector or wiring-related problem. See INTERMITTENTS in **TESTS W/O CODES - 4.2L** article.

CAUTION: Continuous Memory Codes should be recorded when retrieved. These codes may be used to identify intermittent problems that exist after all

KOEO and KOER codes have been repaired. Some Continuous Memory Code faults may not be valid after KOEO and KOER codes are serviced.

RETRIEVING CODES

Fault codes are retrieved from EEC-V system through Data Link Connector (DLC). See **Fig. 1** . Self-diagnostic test procedures are for use with New Generation Star (NGS) scan tester. If a generic scan tester is used, ensure tool is certified ODB-II standard.

DATA LINK CONNECTOR (DLC) LOCATIONS

Application	Location
All Models	Below Instrument Panel To Right Of Steering Wheel

DATA LINK CONNECTOR (DLC) TERMINAL IDENTIFICATION

Terminal No.	Circuit
1	Ignition Control
2	BUS+ SCP
3	Not Used
4	Chassis Ground
5	Signal Return (SIG RTN)
6	Not Used
7	K Line ISO 9141
8	Not Used
9	Not Used
10	BUS- SCP
11	Not Used
12	Not Used
13	FEPS (Flash EEPROM)
14	Not Used
15	L Line ISO 9141
16	Battery Power

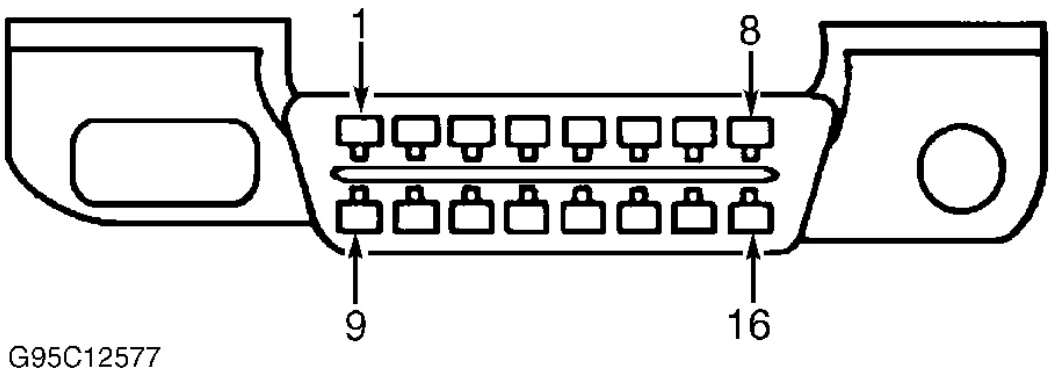


Fig. 1: Data Link Connector (DLC) Terminals
Courtesy of FORD MOTOR CO.

READING CODES

KOEO & KOER SELF-TEST Codes

Record codes in order received. These codes indicate current faults in system and should be serviced in order of appearance. Use **DIAGNOSTIC TROUBLE CODE (DTC) REFERENCE CHARTS** to identify correct CIRCUIT TEST to perform.

NOTE: If self-test will not activate or TOOL COMMUNICATION ERROR is received, go to CIRCUIT TEST QA , step 1).

Pass Codes

SYSTEM PASS indicates no diagnostic trouble codes were recorded in that portion of test. If SYSTEM PASS is not retrieved in **KOEO SELF-TEST** , codes retrieved during KOER SELF-TEST may not be valid.

Continuous Memory Codes

These codes result from information stored by PCM during continuous self-test monitoring. Use these codes for diagnosis only when **KOEO SELF-TEST** and KOER SELF-TEST result in SYSTEM PASS and all steps under **QUICK TEST** are successfully completed. These codes indicate faults previously recorded. Fault may or may not be currently present. See **DIAGNOSTIC TROUBLE CODE (DTC) REFERENCE CHARTS** .

CLEARING CODES

PCM Reset

After a PCM reset procedure, the following conditions will be met:

- All DTCs cleared from PCM memory.
- All freeze frame data cleared from PCM memory.
- All oxygen sensor test data cleared from PCM memory.
- OBD-II system monitor status is reset.
- DTC P1000 set in PCM memory.

To perform PCM reset using NGS scan tester, ensure connectors are properly connected. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 3** .
- Select year, engine, model and any additional information requested by scan tester (optional).
- Follow operating instructions from scan tester menu.
- Select GENERIC OBD-II FUNCTIONS. Press CONT button if monitors are not complete.
- Turn ignition on.
- Select CLEAR DIAGNOSTIC CODES.

All codes should now be cleared from PCM memory. If problem has not been corrected or fault is still present, hard code will immediately be reset in PCM memory.

CAUTION: DO NOT disconnect vehicle battery to clear trouble codes. This will erase operating information from Keep-Alive Memory (KAM). To clear KAM, disconnect negative battery terminal for at least 5 minutes.

CAUTION: When battery is disconnected, vehicle computer may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See the COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION section before disconnecting battery.

QUICK TEST

Description

Following procedures are functional tests of EEC-V system. These basic test steps must be followed in sequence to avoid misdiagnosis.

- Visual Check
- Equipment Hookup
- KOEO (Key On Engine Off) SELF-TEST
- KOER (Key On Engine Running) SELF-TEST
- Computed Timing Check
- Continuous Memory Self-Test

Diagnostic Aids

After each service or repair procedure has been completed, repeat QUICK TEST to ensure all EEC-V systems work properly and diagnostic trouble codes are no longer present.

VISUAL CHECK

Complete all steps in **BASIC TESTING - 4.2L** article before proceeding to self-diagnostic tests. Ensure vacuum hoses and EEC-V wiring harnesses are properly connected.

Apply parking brake, and place shift lever in Park (A/T) or Neutral (M/T) position. Block drive wheels. Turn off all electrical accessories.

EQUIPMENT HOOKUP

Connect appropriate test equipment to vehicle as follows:

Generic Scan Tester

Ensure scan tester meets or exceeds OBD-II standard. Follow manufacturer's instructions to hook up equipment and record diagnostic trouble codes.

New Generation STAR (NGS) Tester

Turn ignition switch to OFF position. Connect adapter cable lead to diagnostic tester. See **Fig. 2** . Connect service connectors of adapter cable to vehicle Data Link Connector (DLC). Go to **KOEO SELF-TEST** .

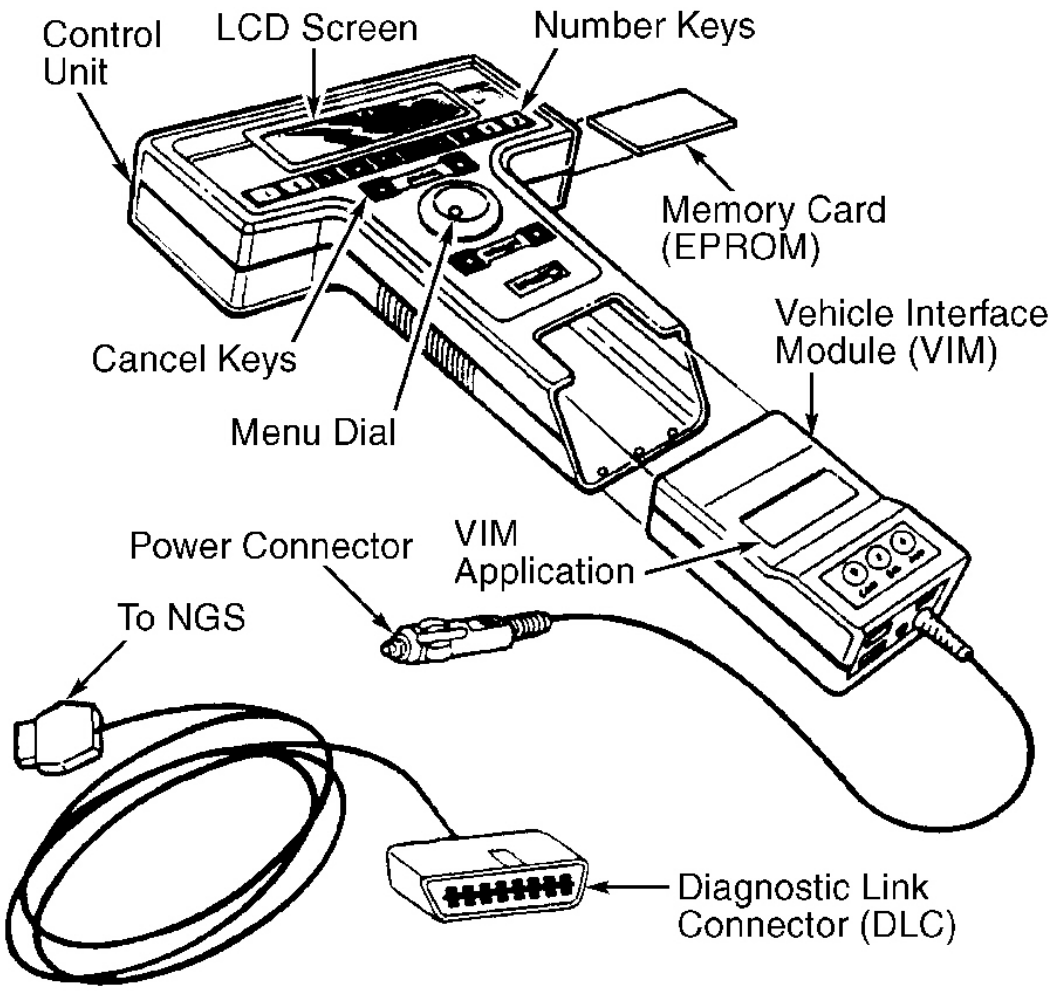


Fig. 2: New Generation Star (NGS) Scan Tester
Courtesy of FORD MOTOR CO.

KOEO SELF-TEST

Ensure engine is warmed to normal operating temperature. If engine does not start (or stalls after starting), continue KOEO SELF-TEST. Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu. See **Fig. 3** .
- Select year, engine, model and any additional information requested by scan tester.
- Select DIAGNOSTIC DATA LINK.

- Select PCM - POWERTRAIN CTRL MODULE.
- Select DIAGNOSTIC TEST MODE.
- Select KOEO ON-DEMAND SELF-TEST.
- Turn ignition on.
- Follow operating instructions from scan tester menu.

KOER SELF-TEST

Ensure engine is warmed to normal operating temperature. Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu. See **Fig. 3** .
- Select year, engine, model and any additional information requested by scan tester.
- Select DIAGNOSTIC DATA LINK.
- Select PCM - POWERTRAIN CTRL MODULE.
- Select DIAGNOSTIC TEST MODE.
- Select KOER ON-DEMAND SELF-TEST.
- Start engine and allow to idle.
- Follow operating instructions from scan tester menu.
- Perform BOO and TCS cycling (if equipped).

SERIES THROTTLE ASSEMBLY INSPECTION

Turn ignition off. Remove air tube from series throttle assembly. Check throttle plate for binding. Repair or replace as necessary. If fault cannot be isolated, go to **CIRCUIT TEST HT** , step 20).

CONTINUOUS MEMORY SELF-TEST (EMISSION RELATED)

Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 3** .
- Select year, engine, model and any additional information requested by scan tester (optional).
- Select GENERIC OBD-II OPTIONS. Press CONT button if monitors are not complete.
- Select DIAGNOSTIC TROUBLE CODES.
- Turn ignition on.
- Follow operating instructions from scan tester menu.

CONTINUOUS MEMORY SELF-TEST (EXPANDED MODE)

Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu. See **Fig. 3** .
- Select year, engine, model and any additional information requested by scan tester.
- Select DIAGNOSTIC DATA LINK.
- Select PCM - POWERTRAIN CTRL MODULE.
- Select DIAGNOSTIC TEST MODES.
- Select RETRIEVE/CLEAR CONTINUOUS DTCs.
- Turn ignition on.
- Follow operating instructions from scan tester menu.

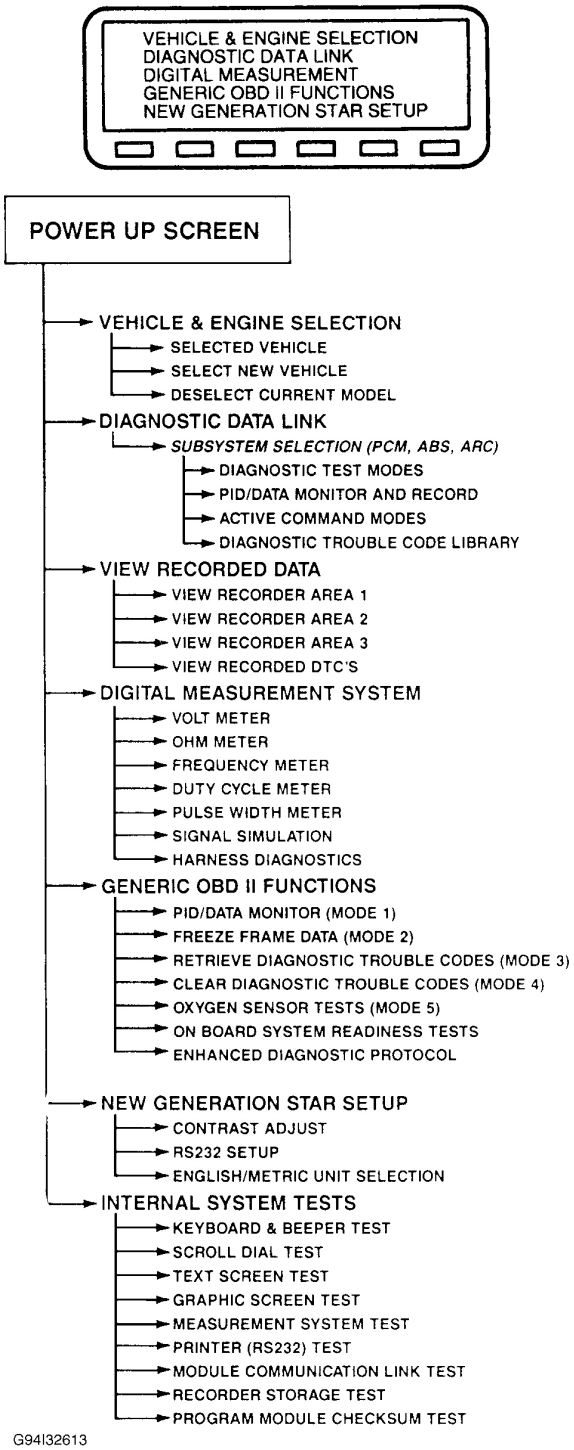


Fig. 3: New Generation Star (NGS) Main Menu & Mode Paths
Courtesy of FORD MOTOR CO.

ADDITIONAL SYSTEM FUNCTIONS

NOTE: Additional diagnostic system features are available to help diagnose driveability problems and service EEC-V systems.

GENERIC OBD-II PARAMETER IDENTIFICATION (PID)

Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 3** .
- Select year, engine, model and any additional information requested by scan tester (optional).
- Select GENERIC OBD-II OPTIONS. Press CONT button if monitors are not complete.
- Select PID/DATA MONITOR.
- Turn ignition on or start engine and allow to idle.
- Follow operating instructions from scan tester menu.
- Select PIDs and press START.

NON-GENERIC OBD-II PARAMETER IDENTIFICATION (PID)

Turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu. See **Fig. 3** .
- Select year, engine, model and any additional information requested by scan tester.
- Select GENERIC OBD-II OPTIONS. Press CONT button if monitors are not complete.
- Select DIAGNOSTIC DATA LINK.
- Select PCM - POWERTRAIN CTRL MODULE.
- Select DIAGNOSTIC TEST MODES.
- Select PID DATA MONITOR AND RECORD.
- Turn ignition on or start engine and allow to idle.
- Follow operating instructions from scan tester menu.
- Select PIDs and press START.

ON-BOARD SYSTEM READINESS (OSR) TEST MODE

All OBD-II scan testers must display OSR test. The OSR will display monitors on the vehicle and status of all monitors; complete or not complete. If not complete, the scan tester will display which monitor has not completed.

To enter OSR, turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 3** .

- Select year, engine, model and any additional information requested by scan tester.
- Follow operating instructions from scan tester menu.
- Select GENERIC OBD-II FUNCTIONS. Press TEST button if monitors are not complete.
- Start engine and allow to idle.
- Select ON-BOARD SYSTEM READINESS.

FREEZE FRAME DATA MODE

This mode allows access to emission related data values from specific generic PIDs. These values are immediately stored in continuous memory when an emission related fault occurs. This provides a snapshot of the conditions that were present when the fault occurred. Freeze frame will be stored until PCM memory is erased.

To access FREEZE FRAME DATA MODE, turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 3** .
- Select year, engine, model and any additional information requested by scan tester (optional).
- Follow operating instructions from scan tester menu.
- Select GENERIC OBD-II FUNCTIONS. Press CONT button if OBD-II monitors are not complete.
- Turn ignition on.
- Select FREEZE FRAME PID TESTS.

OXYGEN SENSOR TEST MODE

This mode allows access to on-board sensor fault limits and actual values during test cycle. The test cycle has specific engine operating conditions that must be met for completion. This information is used to determine the efficiency of the catalytic converter.

To access OXYGEN SENSOR TEST mode, turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu (optional). See **Fig. 3** .
- Select year, engine, model and any additional information requested by scan tester (optional).
- Follow operating instructions from scan tester menu.
- Select GENERIC OBD-II FUNCTIONS.
- Select OXYGEN SENSOR TESTS.
- Select appropriate oxygen sensor test and follow menu instructions.

OUTPUT TEST MODE

This mode allows a technician to energize and de-energize most of the system output actuators on command. After accessing OUTPUT TEST MODE, outputs and cooling fans can be turned on and off separately.

To access OUTPUT TEST MODE, turn ignition switch to OFF position. Ensure test equipment is properly attached. Program scan tester using the following steps:

- Select vehicle and engine selection menu. See **Fig. 3** .
- Select year, engine, model and any additional information requested by scan tester.
- Follow operating instructions from scan tester menu.
- Select DIAGNOSTIC DATA LINK.
- Select PCM - POWERTRAIN CTRL MODULE.
- Select DIAGNOSTIC TEST MODE.
- Select ACTIVE COMMAND MODE.
- Select OUTPUT TEST MODE.
- Turn ignition on.
- Follow operating instructions from scan tester menu.
- Select either LOW SPEED FAN, HIGH SPEED FAN or ALL ON mode.
- Select START to turn outputs on. This step may cause link up to PIDs.
- Select STOP to turn outputs off.

FAILURE MODE EFFECTS MANAGEMENT (FMEM)

FMEM mode allows system operation when sensors fail or transmit signals that are out of normal operating range. During FMEM mode, PCM substitutes a mid-range signal for defective sensor while continuing to monitor sensor. If faulty sensor signals return to normal operating range, PCM will use those signals. Depending on specific failure, a fault code may be set in PCM memory.

HARDWARE LIMITED OPERATIONAL STRATEGY (HLOS)

If a number of system or sensor failures are present and PCM is not receiving enough information to operate, PCM will switch to HLOS mode. PCM will output fixed values to allow operation of vehicle. Driveability concerns will be present. PCM will not output diagnostic trouble codes in this mode.

ON BOARD DIAGNOSTIC-II MONITOR

OBD-II OVERVIEW & SENSOR ILLUSTRATION DESCRIPTION

The California Air Resources Board (ARB) began regulation of On Board Diagnostic (OBD) systems for vehicles sold in California beginning with the 1988 model year. The first phase, OBD I, required monitoring of the fuel metering system, Exhaust Gas Recirculation (EGR) system, and additional emission-related components. The Malfunction Indicator Lamp (MIL) was required to light and alert the driver of the malfunction and the need for service of the emission control system. The MIL must be labeled CHECK ENGINE or SERVICE ENGINE SOON. A fault code or Diagnostic Trouble Code (DTC) is associated with the MIL identifying the specific area of the fault.

The OBD system was proposed by the California ARB to improve air quality by identifying vehicles exceeding

emission standards. Passage of the federal Clean Air Act Amendments in 1990 has also prompted the Environmental Protection Agency (EPA) to develop on board diagnostic requirements. California ARB OBD-II regulations will be followed until 1999 when the federal regulations will be used.

The OBD-II system meets government regulations by monitoring the emission control system. When a system or component exceeds emission thresholds or a component operates outside of tolerance, a DTC will be stored and the MIL will be turned on.

The OBD-II monitors detect system faults and initiate DTC setting and MIL activation. Fault detection strategy and MIL operation are associated with drive cycles. See **OBD-II DRIVE CYCLE** . A DTC is stored in the PCM keep alive random access memory when a fault is first detected. In most cases the MIL is turned on after two consecutive drive cycles with the fault existing.

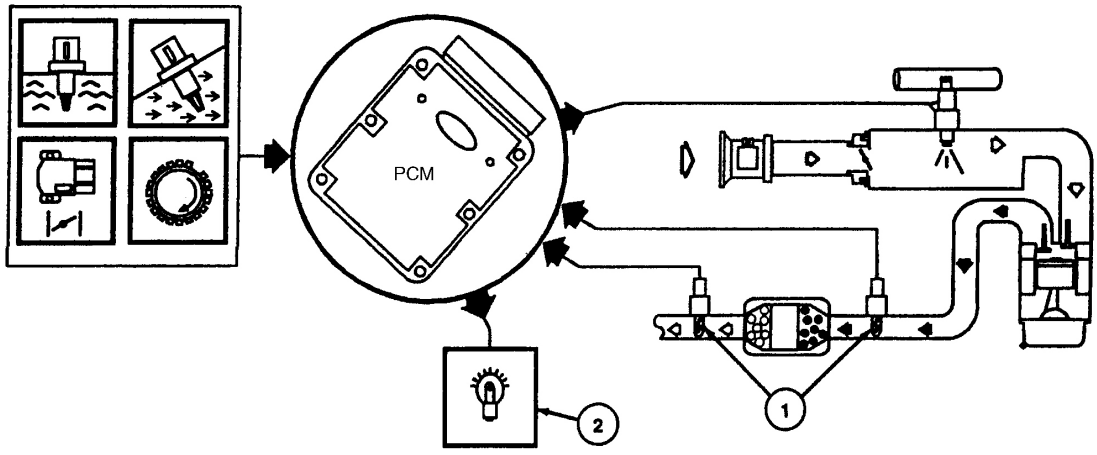
The DTC is cleared after 40 engine warm-up cycles without the fault being detected once the MIL is turned off. Once a monitor turns on the MIL, it will require 3 consecutive drive cycles without a fault for the MIL to turn off. The operation of each of the OBD-II monitors is discussed in detail within this section.

The on board diagnostic computer program in the electronic Engine Control (EC) system Powertrain Control Module (PCM) coordinates the OBD-II self-monitoring system. This program controls all the monitors and interactions, DTC and MIL operation, freeze frame data and scan tool interface. OBD-II Inspection Maintenance (IM) readiness DTC P1000 indicates that not all of the OBD-II monitors have been completed since the PCM's keep alive random access memory was last cleared. In certain states, it may be necessary to operate the vehicle until DTC P1000 is erased from the PCM in order to purchase a vehicle license.

Freeze frame data describes stored engine conditions such as state of the engine, state of fuel control, spark, rpm, load, and warm-up status at the point the first fault is detected. Previously stored conditions will be replaced only if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.

This section provides a general description of each OBD-II monitor. In these descriptions, the monitor strategy, hardware, testing requirements and methods are presented together to provide an overall understanding of each monitor operation. An illustration for each monitor is also provided to aid in the description. Refer to illustration, see **Fig. 4** . These illustrations should be used as typical examples and are not intended to represent all the possible configurations.

Each illustration depicts the Powertrain Control Module (PCM) as the main focus with the primary inputs and outputs for each monitor. The icons to the left of the PCM represent the inputs (for icon identification, refer to illustration. See **Fig. 5**) used by each of the monitor strategies to enable or activate the monitor. The components and subsystems to the right of the PCM represent the hardware and signals used while performing the tests and the systems being tested. See **Fig. 6** . The catalyst efficiency monitor illustration has numerous components and signals involved and is shown generically. When referring to the illustrations, match the numbers to the corresponding numbers in the monitor descriptions for a better comprehension of the monitor and associated Diagnostic Trouble Codes (DTCs). These monitor descriptions are intended as general information only. See **DRIVE CYCLES** for detailed testing instructions for each monitor. These icons are used in the illustrations of the OBD-II monitors and throughout this section.



1. HO2S(s)
2. Malfunction Indicator Light (MIL)

G00076237

Fig. 4: Identifying Catalyst Efficiency Monitor Components
Courtesy of FORD MOTOR CO.

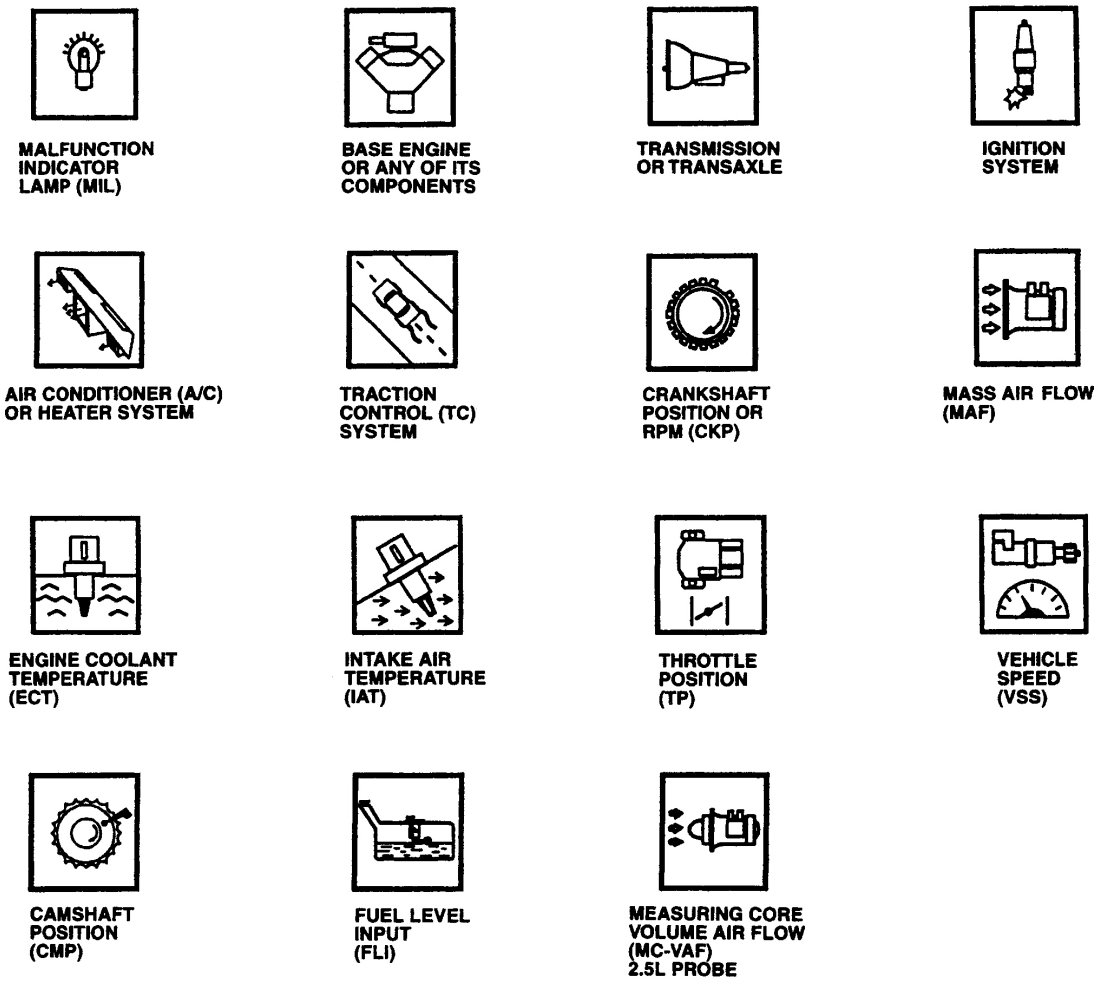


Fig. 5: Identifying Powertrain Control Module Input Sensor Icons
Courtesy of FORD MOTOR CO.

OBD-II DRIVE CYCLE

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

Description

The purpose of the OBD-II drive cycle is to execute the OBD-II monitors and identify any concerns with the OBD-II system. The DTC P1000 code will be erased of all OBD-II monitors have completed during the OBD-II drive cycle. The scan tool will be used to observe the status of each OBD-II monitor at the completion of the OBD-II drive cycle. The completion status of the Exhaust Gas Recirculation (EGR), Heated Oxygen Sensor (HO2S), Evaporative Emission (EVAP), Secondary Air Injection (AIR) (if applicable) and catalyst efficiency monitors can be monitored during the OBD-II drive cycle by viewing the ON-BOARD READINESS menu on

the scan tool. For the procedure of each OBD-II drive cycle, see **MONITOR REPAIR VERIFICATION DRIVE CYCLES** under DRIVE CYCLES.

CATALYST EFFICIENCY MONITOR FEDERAL TEST PROCEDURE

The federal test procedure catalyst efficiency monitor is an on-board strategy designed to monitor and determine when a catalytic converter has fallen below the minimum level of effectiveness in its ability to control exhaust emission. It relies mainly on the front and rear Heated Oxygen Sensors (HO2S) to infer catalyst efficiency based upon oxygen storage capacity. The front and rear HO2S switches are counted under specified conditions for the purpose of calculating rear to front HO2S switch ratio. After the switch ratio is calculated, it is compared against an emission threshold value. If the switch ratio is greater than the emission threshold, the catalyst has failed. The oxygen storage capacity of a high efficiency catalyst will have a low switch ratio and high HC efficiencies. As catalyst efficiency deteriorates, its ability to store oxygen declines and it will begin to have a higher switch ratio and low HC efficiencies. In general, as catalyst efficiency decreases, the switch ratio increases. Inputs from the Engine Coolant Temp (ECT) sensor, Intake Air Temp (IAT) sensor, and Throttle Position (TP) sensors are required to enable the federal test procedure catalyst monitor. To aid in monitor descriptions. refer to illustration. See **Fig. 4** .

1. In the federal test procedure catalyst efficiency monitor test, only switches during steady state cruise conditions of a drive cycle are counted. Switches at idle or other drive modes are not counted. The counting of front and rear HO2S switches continues until a drive cycle is completed. At that time, the ratio of total rear switches to total front HO2S switches is calculated. If the switch ratio is greater than the emission threshold, the catalyst has failed and a Diagnostic Trouble Code (DTC) is stored. The DTC associated with this test is DTC P0420.
2. Catalyst Efficiency DTC is stored in memory, and Malfunction Indicator Light (MIL) is turned on after catalyst efficiency monitor detects a malfunction up to 6 consecutive drive cycles.

COMPREHENSIVE COMPONENT MONITOR

The Comprehensive Component Monitor (CCM) is an on-board strategy designed to monitor a malfunction in any electronic component or circuit that provides input or output signal to the Powertrain Control Module (PCM) and is not exclusively monitored by another monitor system. Inputs and outputs are considered malfunctioning when at a minimum a failure exists due to a lack of circuit continuity, out-of-range value, or a failed rationality check.

The CCM covers many components and circuits and tests them in various ways depending on the hardware, function, and type of signal. See **Fig. 6** . For example, analog inputs are typically checked for opens, shorts, and out of range values. This type of monitoring is performed continuously. Some digital inputs rely on rationality checks. These tests may require the monitoring of several components and can only be performed under the appropriate test conditions. Outputs are checked for opens and shorts by monitoring the Output State Monitor (OSM) or circuit associated with the output driver when the output is energized or de-energized. Other outputs, such as relays, require additional OSM circuits to monitor the secondary side of the component. Some outputs are also monitored for the proper function by observing the reaction of the control system to a given change in the output command. An example of this would be the Idle Air Control (IAC) solenoid.

In general, the CCM covers a broad range of individual component and circuit checks and testing is performed under various conditions. The CCM is enabled shortly after the engine is started but requires certain conditions

to occur for some components before it can totally complete. A Diagnostic Trouble Code (DTC) is stored in continuous memory when a fault is determined, and the Malfunction Indicator Lamp (MIL) is activated if the fault detected affects emissions. Most of the CCM monitor tests are also performed during on demand self-test.

The following is an example of some of the input and output components monitored by the CCM. The components monitored may belong to the engine, ignition, transmission, air conditioning, traction control, or any other PCM supported subsystem:

1. Inputs: Mass Air Flow (MAF), Intake Air Temperature (IAT), Engine Coolant Temperature (ECT), Throttle Position Sensor A (TP-A), Throttle Position Sensor B (TP-B), Camshaft Position (CMP), Air Conditioning Pressure Sensor (ACPS).
2. Outputs: Fuel Pump (FP), Wide Open Throttle A/C Cutout (WAC), Idle Air Control (IAC), Shift Solenoid (SS), Torque Converter Clutch (TCC), Inlet Manifold Runner Control (IMRC), Vapor Management Valve (VMV).
3. Comprehensive component DTC is stored in memory, and Malfunction Indicator Light (MIL) is turned on after comprehensive component monitor detects a malfunction on 2 consecutive drive cycles, if the fault detected affects emissions.

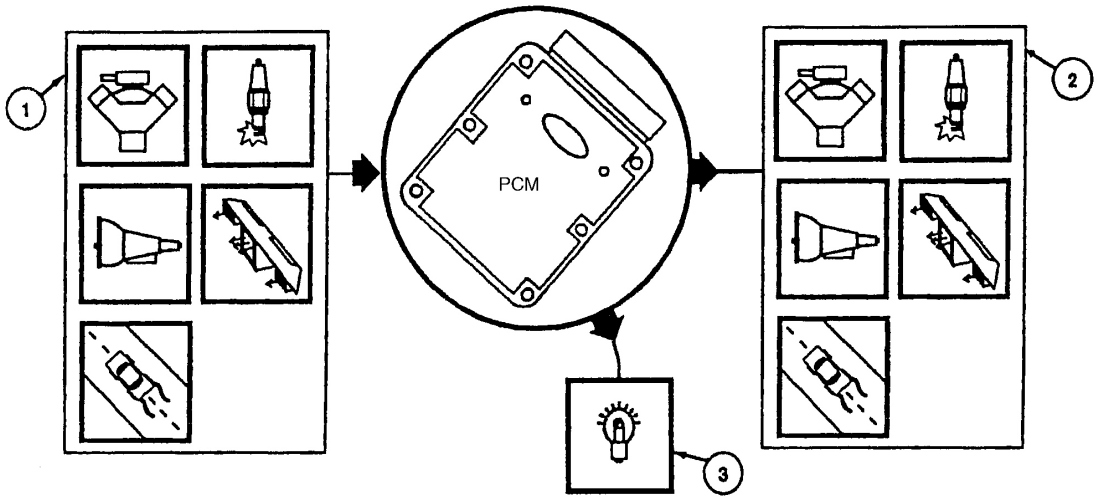


Fig. 6: Identifying Comprehensive Component Monitor Circuits
Courtesy of FORD MOTOR CO.

EVAPORATIVE EMISSION (EVAP) PURGE FLOW SYSTEM MONITOR

NOTE: The flow test will not run if a Purge Flow (PF) sensor or an EVAP canister purge valve malfunction is indicated. The Diagnostic Trouble Codes (DTCs) associated with an electrical fault of the PF sensor are P1444 (PF sensor circuit low input) and P1445 (PF sensor circuit high input). The DTC associated with an electrical fault of the EVAP canister purge valve is P0443 (EVAP canister purge

valve circuit malfunction).

The purpose of the EVAP purge flow system monitor is to verify the flow of fuel vapor from the EVAP canister purge valve to the engine. The electrical function of the Purge Flow (PF) sensor is initially checked before the flow test can begin. Inputs from the Intake Air Temp (IAT) sensor, Mass Air Flow (MAF) sensor and Vehicle Speed Sensor (VSS) are used to enable the flow test.

The flow test will detect a hose blockage or disconnection between the EVAP canister purge valve and the intake manifold. It will not detect a detached hose from either the valve to the EVAP canister or from the EVAP canister to the fuel tank.

The EVAP purge flow test will initiate when a 75% duty cycle is commanded on the EVAP canister purge valve during engine operation. At this time, the Purge Flow (PF) sensor will take a reading while fuel vapor is flowing to the engine. See **Fig. 7** . The EVAP canister purge valve is then commanded closed (from 75% to 0% duty cycle). A second reading will be taken by the PF sensor after a calibrated time period of no fuel vapor flow to the engine. If the PF sensor does not react as expected to the sudden lack of fuel vapor flow to the engine, the PCM generates an EVAP canister purge valve fault DTC. If the difference between the two PF sensor readings taken (flow versus no flow) is not greater than a calibrated threshold, DTC P1443 (EVAP canister purge valve malfunction) will be set.

The Malfunction Indicator lamp (MIL) is activated for DTCs P0433, P1443, P1444 and P1445 after two occurrences of the same fault.

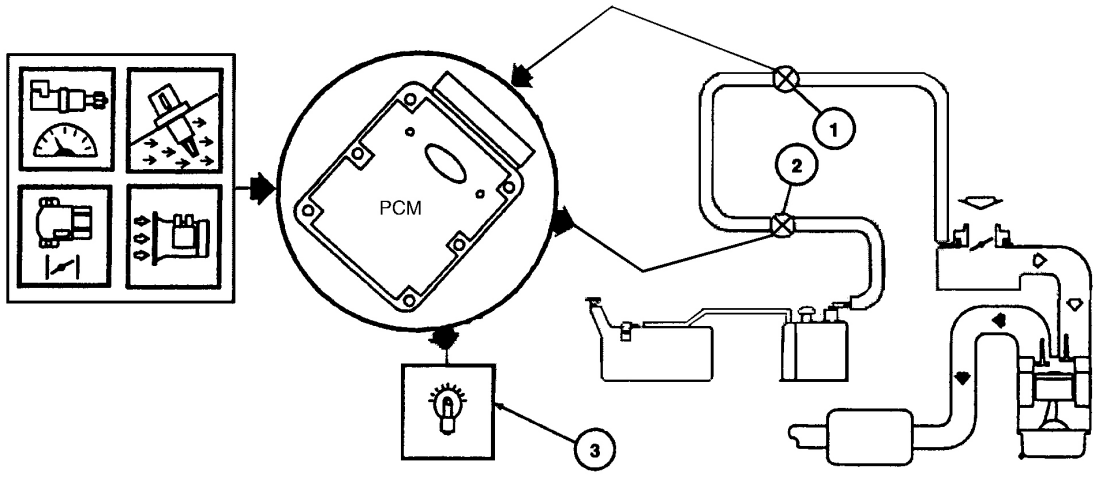


Fig. 7: Identifying Purge System Monitor Components
Courtesy of FORD MOTOR CO.

EVAPORATIVE EMISSION (EVAP) VAPOR MANAGEMENT FLOW SYSTEM MONITOR

NOTE: The Evaporative Emission (EVAP) vapor management flow test will not run if a EVAP canister purge valve malfunction is indicated. The Diagnostic Trouble Code (DTC) associated with an electrical fault of the EVAP canister purge valve is P0443 (EVAP system control valve circuit malfunction).

The EVAP vapor management flow system monitor is designed to verify that the EVAP canister purge valve is functioning properly and to verify the flow of fuel vapor from the EVAP canister purge valve to the engine. See **Fig. 8** . The electrical function of the EVAP canister purge valve is initially checked before the flow test can begin. Inputs from the Engine Coolant Temp (ECT) sensor, Intake Air Temp (IAT) sensor, Mass Air Flow (MAF) sensor and Vehicle Speed Sensor (VSS) are used to enable the flow test.

Before the flow test is performed, the PCM will calculate how much fuel vapor is present while purging under engine operation. If the amount of fuel vapor calculated is above a calibrated threshold, the PCM assumes that there must be fuel vapor flow to the engine and that the EVAP canister purge valve is functioning properly.

If the amount of fuel vapor calculated is below a calibrated threshold, the idle speed portion of the EVAP vapor management flow test must be executed to verify that the EVAP canister purge valve is functioning properly. An assumption of the flow test is that regardless of the fuel vapor in the EVAP canister, some portion of the fuel vapor flow will be air. The flow test will calculate the increase in the idle air requested by the PCM when the duty cycle on the EVAP canister purge valve is reduced from 75% to 0%.

If this condition exists, the idle speed portion of the EVAP vapor management flow test will be bypassed and the test will pass and complete. If the calculated increase in air flow exceeds a calibrated threshold, the PCM assumes the EVAP canister purge valve is functioning properly. If the calculated increase in air flow is negligible, the EVAP canister purge valve is not functioning properly. The DTC associated with this condition is P1443 (EVAP control system purge control valve malfunction).

The Malfunction Indicator Lamp (MIL) is activated for DTCs P0443 and P1443 after two occurrences of the same fault.

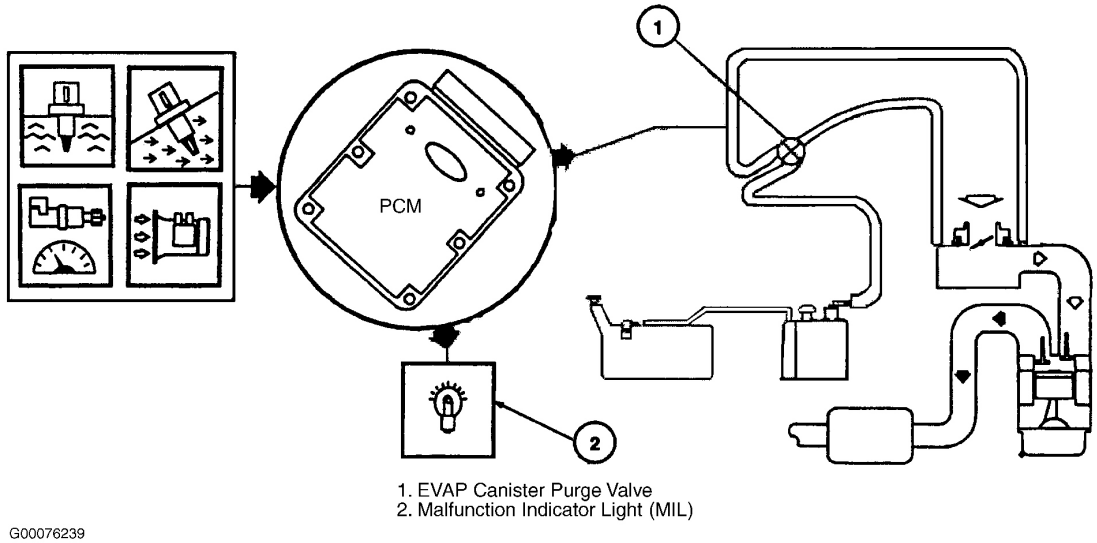


Fig. 8: Identifying EVAP Vapor Management Flow System Monitor Components
Courtesy of FORD MOTOR CO.

EVAPORATIVE EMISSION (EVAP) RUNNING LOSS SYSTEM MONITOR

NOTE: During the Evaporative Emission (EVAP) running loss system monitor repair verification drive cycle a PCM reset with key on, engine off will bypass the minimum soak time required to complete the monitor. The EVAP running loss system monitor will not run if the key is turned off after a PCM reset. The EVAP running loss system monitor will not run if a MAF sensor failure is indicated. The EVAP running loss system monitor will not initiate until the Heated Oxygen Sensor (HO2S) Monitor has completed

The Evaporative Emission (EVAP) running loss system monitor is an on-board strategy designed to detect a leak from a hole (opening) equal to or greater than 1.016 mm (0.040 inch) in the EVAP running loss system. See **Fig. 9** . The proper function of the individual components of the EVAP running loss system as well as its ability to flow fuel vapor to the engine is also examined. The EVAP running loss system monitor relies on the individual components of the EVAP running loss system to apply vacuum to the fuel tank and then seal the entire EVAP running loss system from atmosphere. The fuel tank pressure is then monitored to determine the total vacuum lost (bleed-up) for a calibrated period of time. Inputs from the Engine Coolant Temperature (ECT) sensor, Intake Air Temperature (IAT) sensor, Mass Air Flow (MAF) sensor, Vehicle Speed Sensor (VSS), Fuel Level Input (FLI) and Fuel Tank Pressure (FTP) sensor are required to enable the EVAP running loss system monitor.

The EVAP running loss system monitor is executed by the individual components of the EVAP running loss system as follows:

1. The function of the EVAP canister purge valve is to create a vacuum on the fuel tank. A minimum duty cycle on the EVAP canister purge valve (75%) must be met before the EVAP running loss system

monitor can begin.

2. The Canister Vent (CV) solenoid will close (100% duty cycle) with the EVAP canister purge valve at its minimum duty cycle to seal the EVAP running loss system from atmosphere and obtain a target vacuum on the fuel tank.
3. The Fuel Tank Pressure (FTP) sensor will be used by the EVAP running loss system monitor to determine if the target vacuum on the fuel tank is being reached to perform the leak check. Once the target vacuum on the fuel tank is achieved, the change in fuel tank vacuum for a calibrated period of time will determine if a leak exists.
4. If the initial target vacuum cannot be reached, DTC P0455 (large leak or no purge detected) will be set. The EVAP running loss system monitor will abort and not continue with the leak check portion of the test.

   If the initial target vacuum is exceeded, a system flow fault exists and DTC P1450 (unable to bleed-up fuel tank vacuum) is set. The EVAP running loss system monitor will abort and not continue with the leak check portion of the test.

   If the target vacuum is obtained on the fuel tank, the change in the fuel tank vacuum (bleed-up) will be calculated for a calibrated period of time. The calculated change in fuel tank vacuum will be compared to a calibrated threshold for a leak from a hole (opening) of 1.016 mm (0.040 inch) in the EVAP running loss system. If the calculated bleed-up is less than the calibrated threshold, the EVAP running loss system passes. If the calculated bleed-up exceeds the calibrated threshold, the test will abort and rerun the test up to 3 times.

   If the bleed-up threshold is still being exceeded after 3 tests, a vapor generation check must be performed before DTC P0442 (small leak detected) will be set. This is accomplished by returning the EVAP running loss system to atmospheric pressure by closing the EVAP canister purge valve and opening the CV solenoid. Once the FTP sensor observes the fuel tank is at atmospheric pressure, the CV solenoid closes and seals the EVAP running loss system.

   The fuel tank pressure build-up for a calibrated period of time will be compared to a calibrated threshold for pressure build-up due to vapor generation.

   If the fuel tank pressure build-up exceeds the threshold, the leak test results are invalid due to vapor generation. The EVAP running loss system monitor will pass and complete.

   If the fuel tank pressure build-up does not exceed the threshold, the leak test results are valid and DTC P0442 will be set.

   The Malfunction Indicator Lamp (MIL) is activated for DTCs P0442, P0455 and P1450 (or P446) after two occurrences of the same fault. The MIL can also be activated for any EVAP running loss system component DTCs in the same manner. The EVAP running loss system component DTCs P0443, P0452, P0453 and P1451 are tested as part of the Comprehensive Component Monitor (CCM).

5. The malfunction indicator lamp (MIL) is activated for DTCs P0442, P0455 and P1450 (or P446) after two occurrences of the same fault. The MIL can also be activated for any EVAP running loss system component DTCs in the same manner. The EVAP running loss system component DTCs P0443, P0452,

P0453 and P1451 are tested as part of the Comprehensive Component Monitor (CCM).

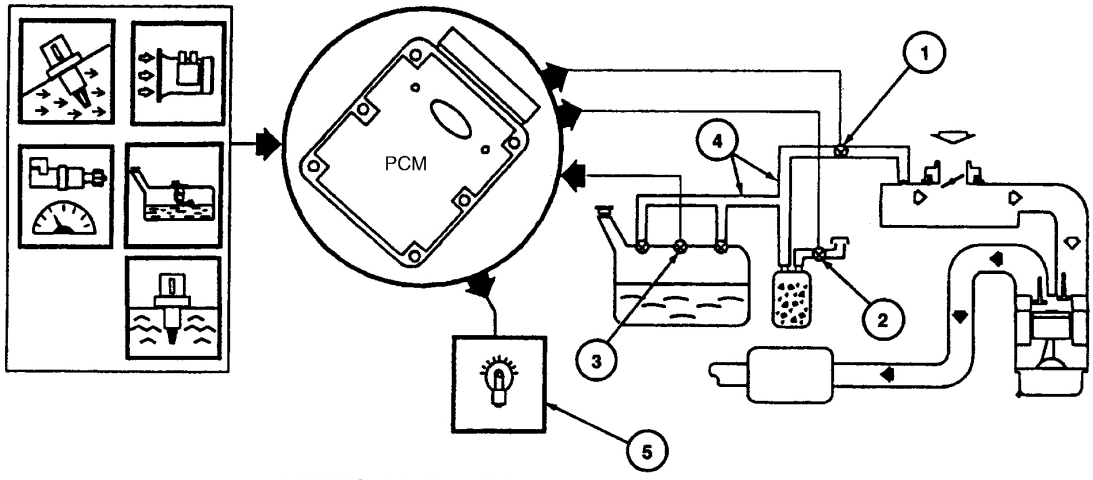


Fig. 9: Identifying EVAP Running Loss System Monitor Components
Courtesy of FORD MOTOR CO.

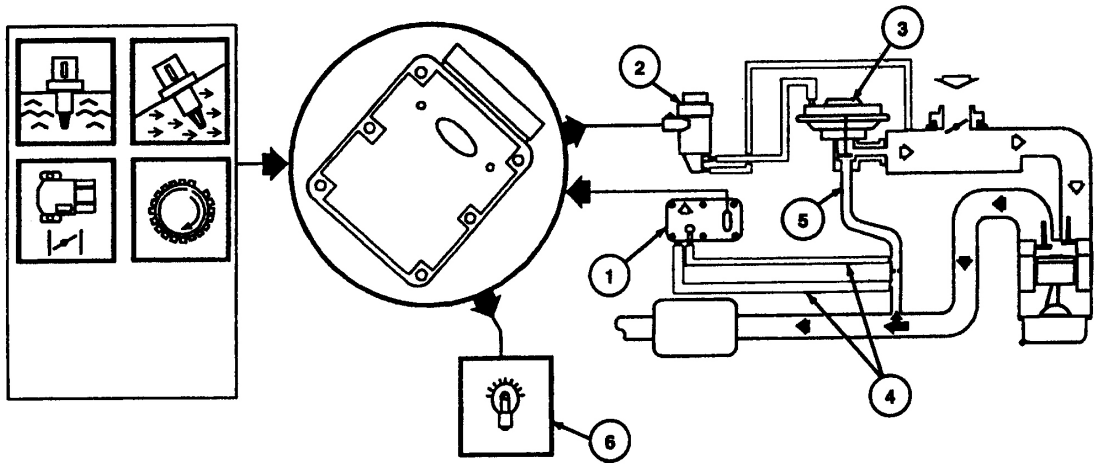
EXHAUST GAS RECIRCULATION MONITOR/DIFFERENTIAL PRESSURE FEEDBACK EGR

The Differential Pressure Feedback (DPF EGR) monitor is an on-board strategy designed to test the integrity and flow characteristics of the EGR system. The monitor is activated during EGR system operation after certain bases engine conditions are satisfied. Inputs from the Engine Coolant Temperature (ECT), Intake Air Temperature (IAT), Throttle Position (TP) and Crank Position (CKP) sensors are required to activate the EGR monitor. Once activated, the EGR monitor will perform each of the tests described below during the engine modes and conditions indicated. Some of the EGR monitor test are also performed during on demand self-test. To aid in monitor definition, refer to illustration. See **Fig. 10** .

1. The differential pressure feedback EGR sensor and circuit are continuously tested for opens and shorts. the monitor looks for the differential pressure feedback EGR circuit voltage to exceed the maximum or minimum allowable limits. The DTCs associated with this test are DTCs P1400 and P1401.
2. The EGR vacuum regulator solenoid is continuously tested for opens and shorts. The monitor looks for an EGR vacuum regulator circuit voltage that is inconsistent with the EGR vacuum regulator circuit commanded output state. The DTC associated with this test is DTC P1409.
3. The test for a stuck open EGR valve or EGR flow at idle is continuously performed whenever at idle (TP sensor indicating closed throttle). The monitor compares the differential pressure feedback EGR circuit voltage at idle to the differential pressure feedback EGR circuit voltage stored during key on engine off to determine if EGR flow is present at idle. The DTC associated with this test is DTC P0402.
4. The differential pressure feedback EGR sensor upstream hose is tested once per drive cycle for disconnect and plugging. The test is performed with EGR valve closed and during a period of acceleration. The PCM will momentarily command the EGR valve closed. The monitor looks for the

differential pressure feedback EGR sensor voltage to be inconsistent for a no flow voltage. A voltage increase or decrease during acceleration while the EGR valve is closed may indicate a fault with the signal hose during this test. The DTC associated with this test is DTC P1405.

5. The EGR flow rate test is performed during a steady state when engine speed and load are moderate and EGR vacuum regulator duty cycle is high. The monitor compares the actual differential pressure feedback EGR circuit voltage to a desired EGR flow voltage for that state to determine if EGR flow rate is acceptable or insufficient. This is a system type test and may trigger a DTC for any fault causing the EGR system to fail. The DTC associated with this test is DTC P0401. DTC P1408 is similar to P0401 but performed during KOER Self-Test conditions.
6. The Malfunction Indicator Light (MIL) is turned on after one of the above test fails on 2 consecutive drive cycles.



1. EGR Sensor
2. EGR Vacuum Regulator Solenoid
3. EGR Valve (DPFE)
4. DPFE Sensor Hoses
5. EGR Recirculation Tube
6. Malfunction Indicator Light (MIL)

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Fig. 10: Identifying EGR Monitor Components (Differential Pressure Feedback)
Courtesy of FORD MOTOR CO.

FUEL SYSTEM MONITOR

The fuel system monitor is an on-board strategy designed to monitor the adaptive fuel control system. The fuel control system uses adaptive fuel tables stored in Keep Alive Memory (KAM) to compensate for variability in fuel system components due to normal wear and aging. During closed looped vehicle operation, the adaptive fuel strategy learns the corrections needed to correct a "biased" rich or lean fuel system. The correction is stored in the adaptive tables. The fuel adaptive system has two means of adapting; a Long Term Fuel Trim (LONGFT) and a Short Term Fuel Trim (SHRTFT). LONGFT relies on adaptive fuel table, indicating long-term fuel adjustments. SHRTFT refers to the desired air/fuel ratio parameter LAMBSE (LAMBSE is calculated by the PCM from HO2S inputs and helps maintain a 14.7:1 air/fuel ratio during closed-loop operation). SHRTFT indicating short-term fuel adjustments. Inputs from the Engine Coolant Temperature (ECT), Intake Air Temperature (IAT), Measuring Core-Variable Air Flow (MC-VAF) or Mass Air Flow (MAF), sensors are required to activate the adaptive fuel control system, which in turn activates the fuel system monitor. Once activated, the fuel system monitor looks for the adaptive tables to reach the adaptive clip and LAMBSE to

exceed calibrated limit. To aid in monitor definition, refer to illustration. See **Fig. 11** .

The fuel system monitor will store the appropriate DTC when a fault is detected as described:

1. The Heated Oxygen Sensor (HO2S) detects the presence of oxygen in the exhaust and provides the PCM with feedback indicating the air/fuel ratio.
2. A correction factor is added to the fuel injection pulse-width calculation according to the Long and Short Term Fuel Trims as needed to compensate for variations in the fuel system.
3. When deviation in the parameter lambse gets larger and larger air/fuel control suffers and emissions increase. When lambse exceeds a calibrated limit and the adaptive fuel table has clipped, the fuel system monitor sets a Diagnostic Trouble Code (DTC) as follows: The DTCs associated with the monitor detecting a lean shift in fuel system operation are DTCs P0171 and P0174. The DTCs associated with the monitor detecting a rich shift in fuel system operation are DTCs P0172 and P0175.
4. Fuel system DTC is stored in memory, and Malfunction Indicator Light (MIL) is turned on after fuel system monitor detects a malfunction on 2 consecutive drive cycles.

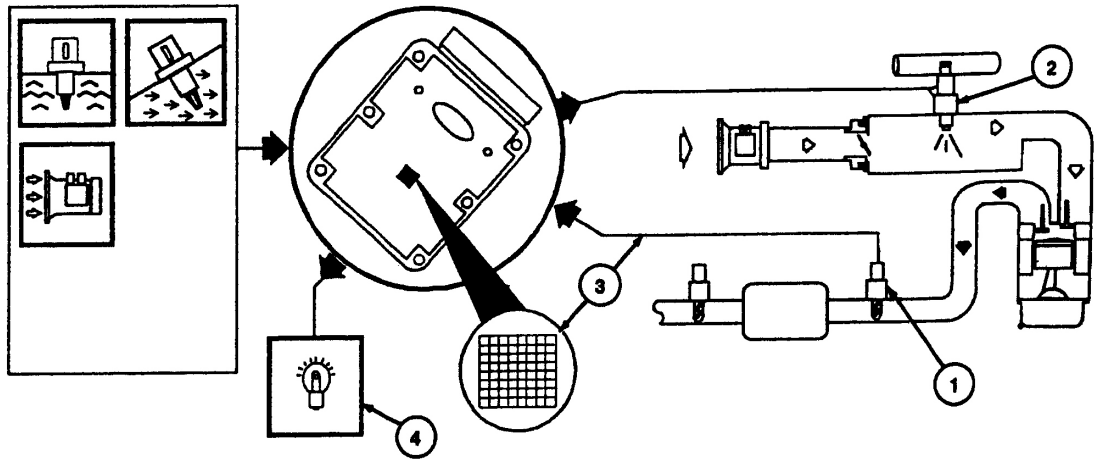


Fig. 11: Identifying Fuel System Monitor Components
Courtesy of FORD MOTOR CO.

HEATED OXYGEN SENSOR MONITOR

The H02S monitor is an on-board strategy designed to monitor the H02S sensors for a malfunction or deterioration which can affect emissions. The fuel control H02S is checked for proper output voltage and response rate (the time it takes to switch from lean to rich and vice versa). The H02S heater circuit is monitored by detecting proper voltage change as the heater is turned on and off. Downstream H02S used for catalyst monitor are also monitored for proper output voltage. The inputs from the Engine Coolant Temperature (ECT), Intake Air Temperature (IAT), Measuring Core-Variable Air Flow (MC-VAF) or Mass Air Flow (MAF), Throttle Position (TP) and Crank Position (CKP) sensors are required to activate the H02S monitor. The fuel system monitor and misfire monitor must also have completed successfully before the H02S monitor is enabled.

Some of the H02S monitor checks are also performed during on demand self-test. To aid in monitor definition, refer to illustration. See **Fig. 12** .

1. The H02S sensor senses the oxygen content in the exhaust flow and outputs a voltage between zero and 1.0 volt. Lean of stoichiometric (air/fuel ratio of approximately 14.7:1), the H02S will generate a voltage between zero and 0.4 volts. Rich of stoichiometric, the H02S will generate a voltage between 0.5 and 1.0 volt. The H02S monitor evaluates both the upstream (fuel control) and downstream (catalyst monitor) H02S for proper function.
2. Once the H02S monitor is enabled, the upstream H02S signal voltage amplitude and response frequency are checked. Excessive voltage is determined by comparing the H02S signal voltage to a maximum calibration threshold voltage. A fixed frequency closed loop fuel control routine and the upstream HO2S voltage amplitude and output response frequency are observed. A sample of the upsteam HO2S signal is evaluated to determine if the sensor is capable of switching or has a slow response rate. A HO2S heater circuit fault is determined by turning the heater on and off and looking for a corresponding change in the Output State Monitor (OSM) and by measuring the current going through the heater circuit. To aid in monitor definition, refer to illustration. See **Fig. 12** .

HO2S monitor DTCs can be categorized as follows:

- The DTCs associated with HO2S/O2S lack of switching are DTCs P1130, P1131, P1132, P1150, P1151 and P1152.
- The DTCs associated with HO2S/O2S slow response rate are DTCs P0133 and P0153.
- The DTCs associated with HO2S/O2S signal circuit malfunction are DTCs P0131, P0136, P0151 and P0156.
- The DTCs associated with a HO2S heater circuit malfunction are DTCs P0135, P0141, P0155 and P0161.
- The DTC associated with the downstream HO2S not running in on-demand is DTC P1127.
- The DTCs associated with swapped HO2S connectors are DTCs P1128 and P1129.

Heated Oxygen Sensor (HO2S) system DTC is stored in memory, and Malfunction Indicator Light (MIL) is turned on after HO2S monitor detects a malfunction on 2 consecutive drive cycles.

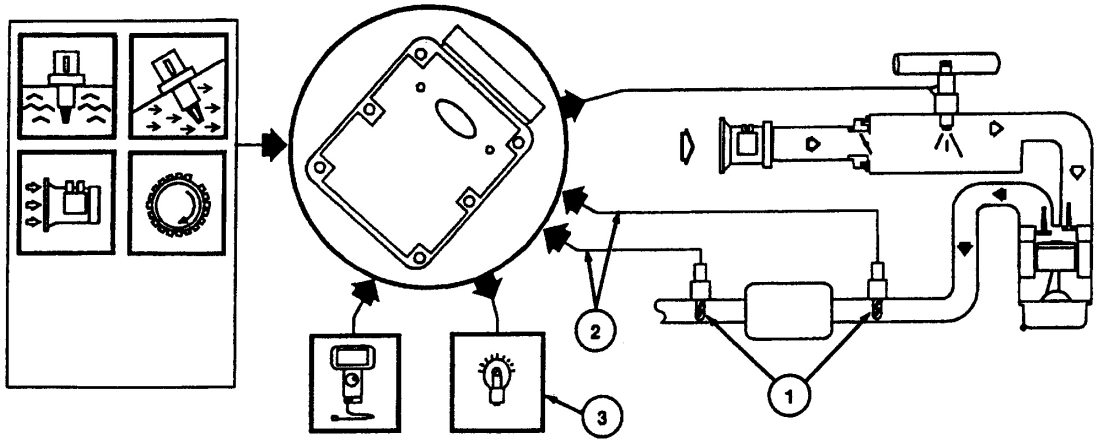


Fig. 12: Identifying Heated Oxygen Sensor Monitor Components
Courtesy of FORD MOTOR CO.

MISFIRE DETECTION MONITOR

The misfire monitor is an on-board strategy designed to monitor engine misfire and identify the specific cylinder in which the misfire has occurred. Misfire is defined as lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause. The misfire monitor will be enabled only when certain base engine conditions are first satisfied. Input from the Engine Coolant Temperature (ECT), Measuring Core-Variable Air Flow (MC-VAF) or Mass Air Flow (MAF), and Crank Position (CKP) sensors is required to enable the monitor. The misfire monitor is also performed during on demand self-test. To aid in monitor definition, refer to illustration. See **Fig. 13** .

1. The PCM synchronized ignition spark based on information received from the CKP sensor. The CKP signal generated is also the main input used in determining cylinder misfire.
2. The input signal generated by the CKP sensor is derived by sensing the passage of teeth from crankshaft position wheel mounted on the end of the crankshaft.
3. The input signal to the PCM is then used to calculate the time between CKP edges and also crankshaft rotational velocity and acceleration. By comparing the accelerations of each cylinder event, the power loss of each cylinder is determined. When the power loss of a particular cylinder is sufficiently less than a calibrated value and other criteria is met, then the suspect cylinder is determined to have misfired.
4. Misfire detection types:
    - Misfire Type (A). Upon detection of a Misfire type A: (200 revolutions) which would cause catalyst damage, the MIL will blink once per second during the actual misfire, and a DTC will be stored.
    - Misfire Type (B). Upon detection of a Misfire type B: (1000 revolutions) which will exceed the emissions threshold or cause a vehicle to fail an inspection and maintenance tailpipe emissions test, the MIL will illuminate and a DTC will be stored.

The DTC associated with multiple cylinder misfire for a Type A or Type B misfire is DTC P0300.

The DTCs associated with an individual cylinder misfire for a Type A or Type B misfire are DTCs P0301, P0302, P0303, 0304, 0305, P0306, P0307, and P0308, P0309 and P0310.

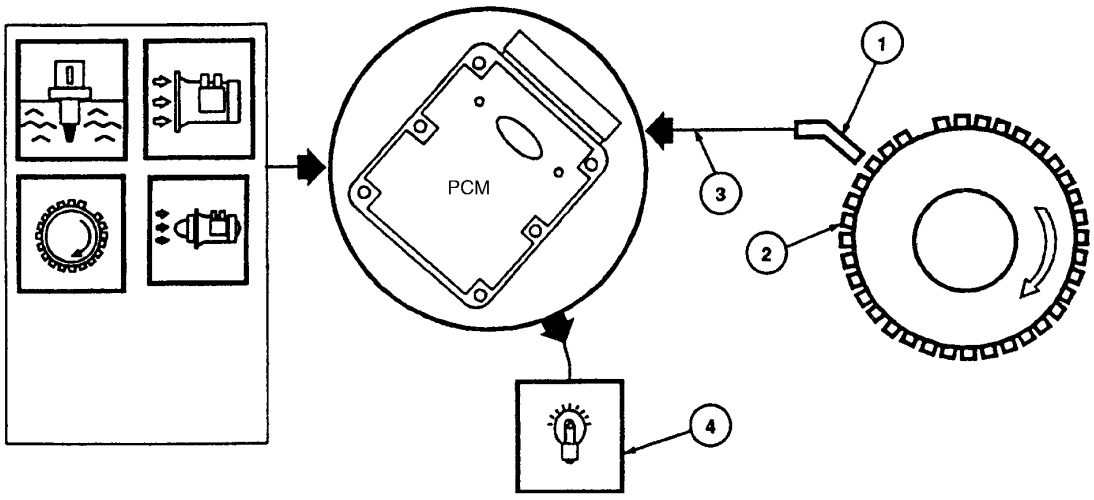


Fig. 13: Identifying Misfire Monitor Components
Courtesy of FORD MOTOR CO.

SECONDARY AIR INJECTION SYSTEM MONITOR (ELECTRIC AIR PUMP SYSTEM)

The Secondary Air Injection (AIR) system monitor is an on-board strategy designed to monitor the proper function of the secondary air system. The AIR monitor for the Electric Air Pump system consists of two monitor circuits: an AIR circuit to diagnose problems with the primary circuit side of the Solid State Relay (SSR), and an AIR monitor circuit to diagnose problems with the secondary circuit side of the Solid State Relay. A functional check is also performed that tests the ability of the AIR system to inject air into the exhaust. The functional check relies upon H02S sensor feedback to determine the presence of air flow. The monitor is enabled during AIR system operation and only after certain base engine conditions are first satisfied. Input is required from the Engine Coolant Temperature (ECT) sensor, Intake Air Temperature (IAT) sensor, Crank Position (CKP) sensor, and the H02S monitor test must also have passed without a fault detection to enable the AIR monitor. The AIR monitor is also activated during on demand self-test. To aid in monitor definition, refer to illustration. See **Fig. 14** .

1. The EAIR circuit is normally held high through the AIR Bypass solenoid and Solid State Relay when the output driver is off. Therefore a low AIR circuit indicates a driver is always on and a high circuit indicates an open in the PCM. The DTC associated with this test is DTC P0412.
2. The AIR monitor circuit is held low by the resistance path through the air pump when the pump is off. If the AIR monitor circuit is high there is either an open circuit to the PCM from the pump or there is power supplied to the Air Pump. If the AIR monitor is low when the pump is commanded on, there is either an open circuit from the SSR or the SSR has failed to supply power to the pump. The DTCs associated with

this test are DTCs P1413 and P1414.

3. The functional check may be done in two parts; at startup when the air pump is normally commanded on, or during a hot idle if the startup test was not able to be performed. The flow test relies upon the H02S sensor to detect the presence of additional air in the exhaust when introduced by the secondary air injection system. The DTC associated with this test is DTC P0411.
4. The Malfunction Indicator Light (MIL) is turned on after one of the above tests fails on 2 consecutive drive cycles.

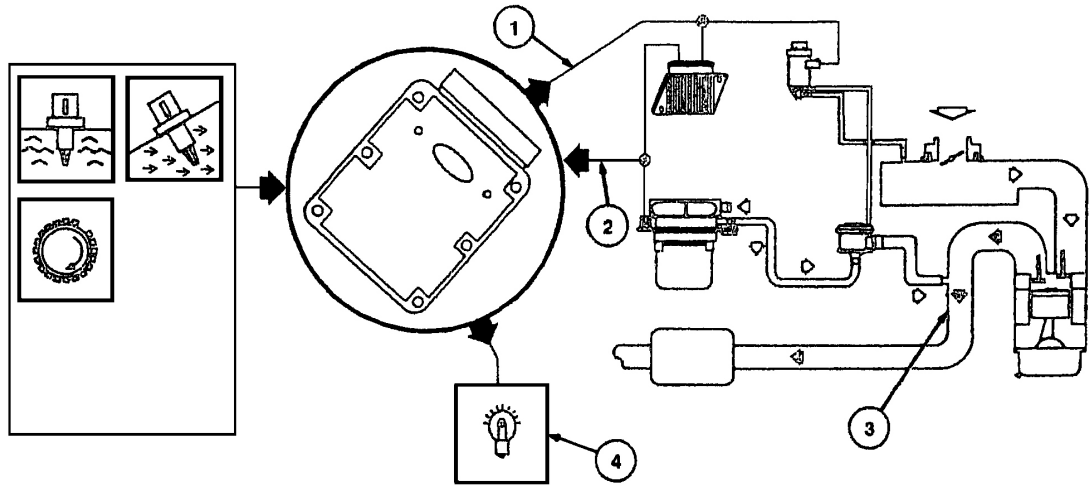


Fig. 14: Identifying Secondary Air Injection System Monitor Components (Electric Air Pump) Courtesy of FORD MOTOR CO.

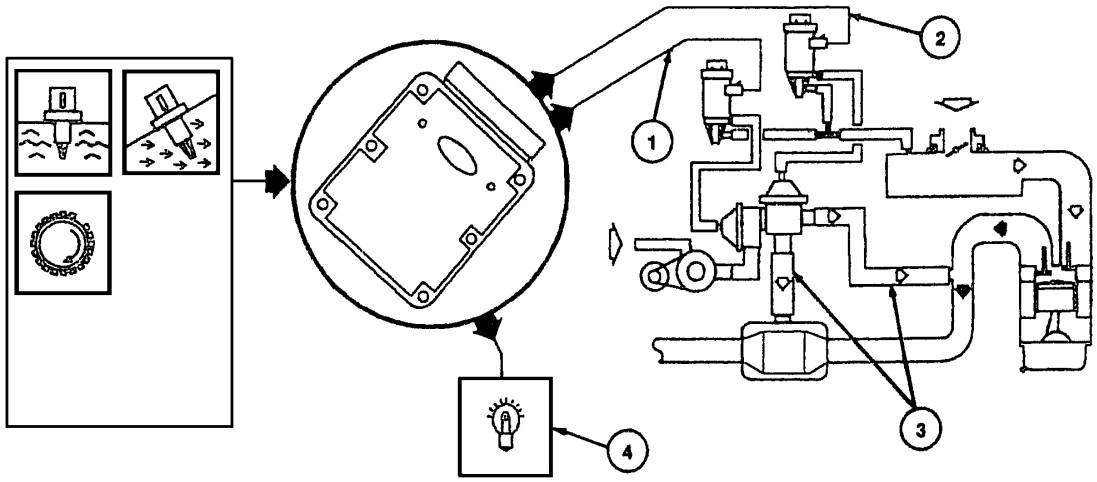
SECONDARY AIR INJECTION SYSTEM MONITOR (BELT DRIVEN AIR PUMP SYSTEM)

The Secondary Air Injection (AIR) system monitor is an on-board strategy designed to monitor the proper function of the secondary air system. The AIR monitor for the belt driven air pump system consists of two Output State Monitor configurations in the Powertrain Control Module (PCM); one circuit monitors the electrical circuit of the Secondary Air Injection Bypass (AIRS) solenoid, the second circuit monitors the electrical circuit of the Secondary Air Injection Diverter (AIRD) solenoid. A functional check is also performed that tests the ability of the AIR system to inject air into the exhaust. The functional check relies upon H02S sensor feedback to determine the presence of air flow. The monitor is enabled during AIR system operation and only after certain base engine conditions are first satisfied. Input is required from the Engine Coolant Temperature (ECT) sensor, Intake Air Temperature (IAT) sensor, Crank Position (CKP) sensor, and the H02S monitor must also have passed without a fault detection to enable the AIR monitor. The AIR monitor is also activated during on demand self-test. To aid in monitor definition, refer to illustration. See **Fig. 15** .

1. The AIRB solenoid circuit is monitored for open and shorted conditions by the AIRB output state monitor. The DTCs associated with this test are DTCs P0413 and P0414.
2. The AIRD solenoid circuit is monitored for open and shorted conditions by the AIRD output state

monitor. The DTCs associated with this test are DTCs P0416 and P0417.

3. An upstream and downstream functional air flow test is performed during idle, once per engine start-up, and only after all H02S monitor tests have been successfully performed. The flow test relies upon the upstream and downstream H02S to detect the presence of additional air in the exhaust when introduced by the secondary air injection system. The DTCs associated with this test are DTCs P0411 and P1411.
4. The Malfunction Indicator Light (MIL) is turned on after one of the above tests fail on 2 consecutive drive cycles.



1. Solenoid (AIRB) Circuit
2. Solenoid (AIRB) Circuit
3. Upstream/Downstream Air Flow
4. Malfunction Indicator Light (MIL)

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Fig. 15: Identifying Secondary Air Injection System Monitor Components (Belt Driven Air Pump) Courtesy of FORD MOTOR CO.

DRIVE CYCLES

OBD-II MONITOR DISPLAY ON SCAN TOOL

On-board system readiness function is available on New Generation Star (NGS) tester or generic scan tools. Readiness function indicates status of each OBD-II monitor. One Parameter Identification (PID) display on NGS tester, summarizers the status of all monitors.

OBD-II DRIVE CYCLE & DIAGNOSTIC TROUBLE CODES

A Diagnostic Trouble Code (DTC) will be stored in PCM memory after a malfunction is first detected. A DTC will be erased from the PCM's memory after 40 engine warm-up cycles without the malfunction being detected after the MIL is turned off. Once a monitor turns on the MIL, it will require 3 consecutive drive cycles without a fault for the MIL to turn off. Another method of erasing the DTC is by initiating a PCM reset. DTC memory storage requirements vary with each monitor. See appropriate monitor under **ON BOARD DIAGNOSTIC-II MONITOR** .

VEHICLE PREPARATION FOR OBD-II OR MONITOR REPAIR VERIFICATION DRIVE CYCLE

NOTE: Vehicles equipped with Power Take Off (PTO) must have this system disengaged before proceeding. Verify by viewing the PTO PID for OFF status.

1. Attach a scan tool and access the ECT, FLI, IAT PIDs:
   - Verify the IAT PID is between 50-100° F (10-38°C).
   - Verify the FLI PID is between 15% and 85% (only available on EVAP running loss systems).
2. Warm the vehicle until the ECT PID reaches a minimum of 130°F (54° C).
3. Clear all DTC's with the scan tool by pressing clear with the key on engine off. P1000 will remain. Leave the key in the ON position (do not move ignition switch to OFF position), and start the vehicle.
4. Access the ON-BOARD SYSTEM READINESS menu on the scan tool to view the status of the OBD-II monitors.
5. Proceed with the OBD-II drive cycle or selected monitor repair verification drive cycle. Once started, the engine must not be turned off.

OBD-II DRIVE CYCLE

NOTE: The IAT PID must be between 50-100°F (10-38℃) during the OBD II drive cycle to enter into all the OBD II monitors. The FLI PID must be between 15% and 85% at all times.

1. Drive in stop-and-go traffic with at least 4 idle periods (30 seconds each) while observing the status of the OBD II monitor on the scan tool. If the Exhaust Gas Recirculation (EGR), Heated Oxygen sensor (HO2S), Evaporative Emission (EVAP), Secondary Air (AIR) (if applicable) or catalyst efficiency monitor have not completed, drive on the highway at a constant speed over 40 MPH (64 km/hr), not to exceed 65 MPH (104 km/hr) for up to 15 minutes. Heavy accelerations, sudden decelerations and wide open throttles are not recommended. If the scan tool sends out a 3 pulse beep at any time, the OBD II drive cycle has completed.

NOTE: Vehicles equipped with the EVAP purge flow system or EVAP vapor management flow system monitor do not require EVAP monitor completion to clear the DTC P1000. See appropriate monitor under ON BOARD DIAGNOSTIC-II MONITOR . If the Exhaust Gas Recirculation (EGR), Heated Oxygen Sensor (HO2S), Evaporative Emission (EVAP), Secondary Air Injection (AIR) (if applicable) or catalyst efficiency monitor has not completed, perform the corresponding monitor verification drive cycle in this section.

2. Bring the vehicle to a stop and retrieve continuous memory DTCs to verify the DTC P1000 has been erased. See **QUICK TEST** .

MONITOR REPAIR VERIFICATION DRIVE CYCLES

Comprehensive Component Monitor Repair Verification Drive Cycle

1. Refer to and complete the vehicle check and preparation before initiating the following repair verification steps. See **VEHICLE CHECK/PREPARATION** .
2. Start the engine and go through the entire OBD II drive cycle until the comprehensive component monitor shows the completion status by clearing the code P1000 on the scan tool.
3. If the entire OBD II drive cycle has been performed and the comprehensive component monitor check has not completed, rerun quick test. See **QUICK TEST** .

EGR MONITOR REPAIR VERIFICATION DRIVE CYCLE

NOTE: Ambient air temperature or IAT PID must read a minimum of 32°F (0°C) to initiate the EGR monitor.

1. Refer to and complete the vehicle check and preparation before initiating the following repair verification steps. See **VEHICLE CHECK/PREPARATION** .
2. Start the engine and drive the vehicle for 6 minutes:
   - Drive in stop-and-go traffic for 5 minutes with at least 2 idle periods.
   - Accelerate to 45 MPH (72 km/h) at more than 1/2 throttle (35 MPH [56 km/h] on Escort/Tracer). Maintain speed for one minute.
3. Rerun quick test. See **QUICK TEST** .

EVAP RUNNING LOSS MONITOR SYSTEM REPAIR VERIFICATION DRIVE CYCLE

1. Perform the preparation for OBD II drive cycle section. See **VEHICLE PREPARATION FOR OBD-II OR MONITOR REPAIR VERIFICATION DRIVE CYCLE** under DRIVE CYCLES.
2. With the scan tool, verify the FTP V PID reads between 2.4 and 2.8 volts with the gas cap removed. Reinstall gas cap.
3. With the scan tool, view the OBD II monitors through the ON-BOARD SYSTEM READINESS menu.
4. Drive the vehicle at a constant speed between 35 MPH (56 km/hr) and 65 MPH (104 km/hr) with throttle as steady as possible. Observe the HO2S monitor on the scan tool until it completes, or refer to **FUEL MONITOR OR HO2S MONITOR REPAIR VERIFICATION DRIVE CYCLE** .
5. Bring the vehicle to a stop and access the following PIDs with the scan tool:
   - IAT, FLI, FTP, V, EVAPPDC, EVAPCV.
6. Verify the following EVAP monitor entry condition:
   - IAT between 50-100°F (10-38°C).
7. Drive the vehicle on the highway with a constant speed over 64 km/hr (40 MPH) with throttle as steady as possible. During this time, verify the following additional EVAP monitor entry conditions using the FLI and FTPV PIDs:
   - FLI stable +/- 5% between the limits of 15% and 85% tank fill.
   - FTP V stable within +/- 0.1 volt.
8. Prior to running the EVAP monitor, when the EVAPPDC PID is less than 75%, the canister vent solenoid

is open and the system is unsealed. To initiate the EVAP monitor, the EVAPPDC PID must increase to at least 75%. At this time, the EVAPCV PID will then display 100% (canister vent solenoid closed to seal the system and the monitor will begin to run. Continue to drive at steady throttle with light steering until the EVAPCV PID displays 0% (canister vent solenoid open, system unsealed). If this step does not occur as described, proceed to the following note, otherwise proceed to next step.

NOTE: During the drive cycle or hot ambient temperatures, fuel vapor (from the canister and/or tank) may keep the test from starting. The following be observed on the scan tool when either:

- **The EVAPPDC PID never reaches 75% with stable FLI and FTP PID readings.**
- **The EVAPCV PID never goes to 100% (canister vent never closes) when the EVAPPDC PID is above the 75% minimum to start the test.**

9. Bring vehicle to a stop.
10. With the scan tool, view the EVAP monitor for completion through the On-Board System Readiness Menu. Repeat 7 if the EVAP monitor is not complete.

CATALYST MONITOR REPAIR VERIFICATION DRIVE CYCLE

1. Refer to and complete the vehicle check and preparation before initiating the following repair verification steps. See **VEHICLE CHECK/PREPARATION** .
2. Start the engine and drive the vehicle for 25 minutes:
   - Drive in stop-and-go traffic for 20 minutes, include 6 different constant speeds between 25 and 45 MPH (40 and 72 km/h).
   - Drive on expressway or highway for an additional 5 minutes.
3. Rerun quick test. See **QUICK TEST** .

FUEL MONITOR OR HO2S MONITOR REPAIR VERIFICATION DRIVE CYCLE

1. Refer to and complete the vehicle check and preparation before initiating the following repair verification steps. See **VEHICLE CHECK/PREPARATION** .
2. Start the engine and drive the vehicle for 7 minutes:
   - Drive in stop-and-go traffic for 6 minutes, include one idle.
   - Accelerate to 45 MPH (72 km/h) at more than 1/2 throttle (Escort/Tracer 35 MPH [56 km/h]). Maintain speed for one minute.
3. Rerun quick test. See **QUICK TEST** .

MISFIRE MONITOR REPAIR VERIFICATION DRIVE CYCLE

1. For applications with the Fuel Level Input (FLI) circuit to the PCM (pin 12), check the fuel gauge and the FLI PID on the scan tool (if available). The misfire monitor can only be tested if the fuel gauge reads above one quarter full or the FLI PID is above 15% (percentage fuel tank fill).

2. Start the engine and drive the vehicle to a location where speeds can reach 55 to 60 MPH (88 to 97 km/h) and coast down to 40 MPH (64 km/h) without traffic interference.
3. Accelerate at wide-open throttle to allow vehicle to shift at red-line (if equipped with a tachometer). Immediately return to normal speed limits.
4. Perform the following drive procedure 3 consecutive times:
   - Accelerate on highway to 60 MPH (97 km/h). Maintain speed for 30 seconds.
   - Coast down with foot off the accelerator pedal from 60 MPH to 40 MPH (97 km/h to 64 km/h).
5. Rerun quick test. See **QUICK TEST** .

SECONDARY AIR MONITOR REPAIR VERIFICATION DRIVE CYCLE

1. Refer to and complete the vehicle check and preparation before initiating the following repair verification steps. See **VEHICLE CHECK/PREPARATION** .
2. Start the engine and proceed through the entire OBD II drive cycle until the secondary air monitor shows the ON-BOARD READINESS menu completion status on the scan tool.
3. If the entire OBD II drive cycle has been performed and the secondary air monitor check has not completed, rerun quick test. See **QUICK TEST** .

VEHICLE CHECK/PREPARATION

WARNING: Vehicles are equipped with air bag supplemental restraint system. Before attempting any repairs involving steering column, instrument panel or related components, see SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM in appropriate AIR BAG RESTRAINT SYSTEMS article.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

Visual Checks

- Inspect the air cleaner and inlet ducting.
- Check all engine vacuum hoses for damage, leaks, cracks, kinks, proper routing, etc.
- Check electronic Engine Control (EC) system wiring harness for proper connections, bent or broken pins, corrosion, loose wires, proper routing, etc.
- Check the Powertrain Control Module (PCM), sensors and actuators for physical damage.
- Check the engine coolant for proper level and mixture.
- Check the transmission fluid level and quality.
- Make all necessary repairs before continuing with quick test.

Vehicle Preparation

- Perform all safety steps required to start and run vehicle tests. Apply parking brake, place shift lever firmly into PARK position (NEUTRAL on manual transmission), block drive wheels, etc.
- Turn off ALL electrical loads: radios, lamps, A/C, blower, fans, etc. Start engine and bring up to normal operating temperature before running quick test. See **QUICK TEST** .

SUMMARY

If no diagnostic trouble code is present but driveability problem still exists, proceed to **TESTS W/O CODES - 4.2L** article for symptom diagnosis or intermittent diagnostic procedures.

DIAGNOSTIC TROUBLE CODE (DTC) REFERENCE CHARTS

DTC REFERENCE CHART

DTC	Description	Circuit Test/Step: KOEO	Circuit Test/Step: KOER	Circuit Test/Step: CONT.
P0102	Mass Air Flow Circuit Low Input	-	DC/6	DC/6
P0103	Mass Air Flow Circuit High Input	DC/20	DC/20	DC/20
P0112	Intake Air Temperature Circuit Low Input	DA/20	DA/20	DA/90
P0113	Intake Air Temperature Circuit High Input	DA/10	DA/10	DA/90
P0117	Engine Coolant Temperature Circuit Low Input	DA/20	DA/20	DA/90
P0118	Engine Coolant Temperature Circuit High Input	DA/10	DA/10	DA/90
P0121	Throttle Position Circuit Performance Problem	-	DH/22	DH/22
P0122	Throttle Position Circuit Low Input	DH/11	DH/11	DH/11
P0123	Throttle Position Circuit High Input	DH/8	DH/8	DH/8
P0125	Insufficient Coolant Temperature For Closed Loop Fuel Control	-	-	DA/100
P0131	Heated Oxygen Sensor (HO2S-11) Circuit Out Of Range Low Voltage	-	-	H/27
P0133	Heated Oxygen Sensor (HO2S-11) Circuit Slow Response	-	-	H/20
P0135	Heated Oxygen Sensor (HO2S-11) Circuit Malfunction	H/30	H/30	H/30
P0136	Heated Oxygen Sensor (HO2S-	-	-	H/80

	12) Circuit Malfunction			
P0141	Heated Oxygen Sensor (HO2S-12) Circuit Malfunction	H/30	H/30	H/30
P0151	Heated Oxygen Sensor (HO2S-21) Circuit Out Of Range Low Voltage	-	-	H/27
P0153	Heated Oxygen Sensor (HO2S-21) Circuit Slow Response	-	-	H/20
P0155	Heated Oxygen Sensor (HO2S-21) Circuit Malfunction	H/30	H/30	H/30
P0156	Heated Oxygen Sensor (HO2S-22) Circuit Malfunction	-	-	H/80
P0161	Heated Oxygen Sensor (HO2S-22) Circuit Malfunction	H/30	H/30	H/30
P0171	System To Lean (Bank 1)	-	-	H/41
P0172	System To Rich (Bank 1)	-	-	H/41
P0174	System To Lean (Bank 2)	-	-	H/41
P0175	System To Rich (Bank 2)	-	-	H/41
P0222	Throttle Position Sensor B Low Input	HT/1	HT/1	HT/1
P0223	Throttle Position Sensor B High Input	HT/10	HT/10	HT/10
P0230	Fuel Pump Primary Circuit Malfunction	KA/1	KA/1	KA/40
P0231	Fuel Pump Secondary Circuit Low Input	KA/20	KA/20	KA/35
P0232	Fuel Pump Secondary Circuit High Input	KA/10	KA/10	KA/30
P0300	Random Misfire	-	HD/1	HD/1
P0301	Misfire Detection Monitor - Cylinder No. 1	-	HD/1	HD/1
P0302	Misfire Detection Monitor - Cylinder No. 2	-	HD/1	HD/1
P0303	Misfire Detection Monitor - Cylinder No. 3	-	HD/1	HD/1
P0304	Misfire Detection Monitor - Cylinder No. 4	-	HD/1	HD/1
P0305	Misfire Detection Monitor - Cylinder No. 5	-	HD/1	HD/1
P0306	Misfire Detection Monitor - Cylinder No. 6	-	HD/1	HD/1
P0320	Ignition Engine Speed Input Circuit Malfunction	-	-	**NC/1**

P0325	Knock Sensor 1 Circuit Malfunction (Bank 1)	-	DG/1	DG/1
P0326	Knock Sensor 1 Circuit Range/Performance (Bank 1)	-	DG/1	DG/1
P0330	Knock Sensor 2 Circuit Malfunction (Bank 2)	-	DG/1	DG/1
P0330	Knock Sensor 2 Circuit Range/Performance (Bank 2)	-	DG/1	DG/1
P0340	Camshaft Position Sensor Circuit Malfunction	-	DR/1	DR/1
P0350	Ignition Coil Primary/Secondary Circuit Malfunction	-	-	JE/60
P0351	Ignition Coil A Primary/Secondary Circuit Malfunction	-	-	JE/60
P0352	Ignition Coil B Primary/Secondary Circuit Malfunction	-	-	JE/60
P0353	Ignition Coil C Primary/Secondary Circuit Malfunction	-	-	JE/60
P0401	Exhaust Gas Recirculation Flow Insufficient	-	-	HE/70
P0402	Exhaust Gas Recirculation Flow Excessive	-	HE/20	HE/20
P0411	Secondary Air Injection System - Electric Air Pump	HM/7	HM/7	HM/7
P0412	Secondary Air Injection System Circuit Malfunction	HM/1	HM/1	HM/1
P0413	Secondary Air Injection System	HM/75	HM/75	HM/75
P0414	Secondary Air Injection System	HM/75	HM/75	HM/75
P0416	Secondary Air Injection System	HM/75	HM/75	HM/75
P0417	Secondary Air Injection System	HM/75	HM/75	HM/75
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	-	-	HF/1
P0430	Catalyst System Efficiency Below Threshold (Bank 2)	-	-	HF/1
P0442	Evaporative Emission Control System Leak (Small Leak)	-	-	HX/1
P0443	Evaporative Emission Control System Canister Purge Valve Circuit Malfunction	HX/7	HX/7	HX/6
P0446	Evaporative Emission Control System Excessive Fuel Tank	-	-	HX/13

	Vacuum			
P0452	Fuel Tank Pressure Sensor Circuit Low Voltage	HX/22	HX/22	HX/22
P0453	Fuel Tank Pressure Sensor Circuit High Voltage	HX/28	HX/28	HX/28
P0455	Evaporative Emission Control System Leak (No Purge Flow Or Large Leak)	-	-	HX/39
P0500	Vehicle Speed Sensor Malfunction	-	-	DP/1
P0501	Vehicle Speed Sensor Range/Performance	-	-	DP/1
P0503	Vehicle Speed Sensor Intermittent	-	-	DP/20
P0505	Vehicle Speed Sensor Intermittent	-	KE/2	-
P0603	Powertrain Control Module KAM Test Error	QB/1	-	-
P0605	Powertrain Control Module Read Only Memory Error	Replace PCM	Replace PCM	Replace PCM
P0703	Brake Switch Circuit Input Malfunction	-	-	FD/3
P0704	Clutch Pedal Position Switch Malfunction	TA/1	-	TA/1
P0705	Digital Transmission Range Circuit Failure	(1)	-	-
P0708	Digital Transmission Range Sensor/Transmission Range Sensor Circuit High Voltage	-	-	(1)
P0712	Transmission Fluid Temperature Sensor Circuit Grounded	(1)	(1)	(1)
P0713	Transmission Fluid Temperature Sensor Circuit Open	(1)	(1)	(1)
P0720	Insufficient Input From Output Shaft Speed Sensor	-	-	(1)
P0721	Noise Interference On Output Shaft Speed Sensor Signal	-	-	(1)
P0741	Torque Converter Clutch Slippage	-	-	(1)
P0743	Torque Converter Clutch Solenoid Circuit Failure	(1)	(1)	(1)
P0750	Shift Solenoid 1 Circuit Failure	(1)	(1)	(1)
P0751	Shift Solenoid 1 Functional Failure	-	-	(1)
P0755	Shift Solenoid 2 Circuit Failure	(1)	(1)	(1)

P0756	Shift Solenoid 2 Functional Failure	-	-	(1)
P0781	1-2 Shift Error	-	-	(1)
P0782	2-3 Shift Error	-	-	(1)
P0783	3-4 Shift Error	-	-	(1)
P1000	Monitor Testing Not Complete	(2)	(2)	QC/1
P1001	KOER Not Able To Complete, KOER Aborted	-	QA/1	-
P1100	Mass Air Flow Sensor Intermittent	-	-	DC/3
P1101	Mass Air Flow Sensor Out Of Self-Test Range	DC/2	DC/1	-
P1112	Intake Air Temperature Sensor Intermittent	-	-	DA/90
P1116	Engine Coolant Temperature Sensor Out Of Self-Test Range	DA/1	DA/1	-
P1117	Engine Coolant Temperature Sensor Intermittent	-	-	DA/90
P1120	Throttle Position Sensor Out Of Range Low (RATCH Too Low)	DH/3	DH/3	DH/3
P1121	Throttle Position Sensor Inconsistent With MAF Sensor	-	-	DH/15
P1124	Throttle Position Sensor Out Of Self-Test Range	DH/1	DH/1	DH/1
P1125	Throttle Position Sensor Intermittent	-	-	DH/20
P1127	Exhaust Not Warm Enough, Downstream Sensor Not Tested	-	H/100	-
P1128	Upstream Oxygen Sensors Swapped From Bank To Bank (HO2S-11-21)	-	H/110	-
P1129	Downstream Oxygen Sensors Swapped From Bank To Bank (HO2S-12-22)	-	H/110	-
P1130	Lack Of HO2S-11 Switch, Fuel Trim At Limit	-	-	H/40
P1131	Lack Of HO2S-11 Switch, Sensor Indicates Lean	-	H/40	H/40
P1132	Lack Of HO2S-11 Switch, Sensor Indicates Rich	-	H/40	H/40
P1137	Lack Of HO2S-12 Switch, Sensor Indicates Lean	-	H/80	-
P1138	Lack Of HO2S-12 Switch, Sensor	-	H/80	-

	Indicates Rich			
P1150	Lack Of HO2S-21 Switch, Fuel Trim At Limit	-	-	H/40
P1151	Lack Of HO2S-21 Switch, Sensor Indicates Lean	H/40	H/40	H/40
P1152	Lack Of HO2S-21 Switch, Sensor Indicates Rich	-	H/40	H/40
P1157	Lack Of HO2S-22 Switch, Sensor Indicates Lean	-	H/80	-
P1158	Lack Of HO2S-22 Switch, Sensor Indicates Rich	-	H/80	-
P1220	Series Throttle Control System Malfunction	HT/20	HT/20	HT/20
P1224	Throttle Position Sensor B Voltage Out Of Range	HT/40	HT/40	HT/40
P1260	Theft Detected - Vehicle Immobilized	-	-	QD/1
P1270	Engine RPM/Vehicle Speed Limiter	-	-	**ND/1**
P1309	Misfire Monitor Disabled	-	-	HD/40
P1390	Octane Adjust	FG/1	-	-
P1400	Differential Pressure Feedback Exhaust Gas Recirculation Sensor Circuit Low Voltage	HE/1	HE/1	HE/1
P1401	Differential Pressure Feedback Exhaust Gas Recirculation Sensor Circuit High Voltage	HE/10	HE/10	HE/10
P1405	Differential Pressure Feedback Exhaust Gas Recirculation Sensor Upstream Hose Off Or Plugged	-	-	HE/50
P1406	Differential Pressure Feedback Exhaust Gas Recirculation Sensor Downstream Hose Off Or Plugged	-	-	HE/60
P1408	Exhaust Gas Recirculation Flow Out Of Self-Test Range	-	HE/71	-
P1409	Exhaust Gas Recirculation Vacuum Regulator Solenoid Circuit Malfunction	HE/110	HE/110	HE/120
P1411	Secondary Air Injection System Downstream Flow	HM/40	HM/40	HM/40
P1413	Secondary Air Injection System Monitor Circuit Low	HM/18	HM/18	HM/18
P1414	Secondary Air Injection System	HM/25	HM/25	HM/25

	Monitor Circuit High			
P1442	Evaporative Emission Control System Leak (Small Leak)	-	-	HX/1
P1443	Very Small Or No Purge Flow Condition	-	-	HW/6
P1444	Purge Flow Sensor Circuit Low Input	-	-	HW/27
P1445	Purge Flow Sensor Circuit High Input	-	-	HW/33
P1450	Evaporative Emission Control System Excessive Fuel Tank Vacuum	-	-	HX/56
P1451	Evaporative Emission Control System Canister Vent Solenoid Circuit Malfunction	HX/65	HX/65	HX/65
P1452	Evaporative Emission Control System Unable To Bleed Up Fuel Tank Vacuum	-	-	HX/56
P1455	Evaporative Emission Control System Detected A Large Leak Or No Purge Flow	-	-	HX/40
P1460	Wide Open Throttle A/C Cutout Primary Circuit Malfunction	KM/1	KM/1	KM/30
P1464	A/C Demand Out Of Self-Test Range	KM/19	KM/19	-
P1500	Vehicle Speed Sensor Intermittent	-	-	DP/25
P1501	Vehicle Speed Sensor Out Of Self Test Range	-	DP/15	-
P1504	Idle Air Control Circuit Malfunction	KE/2	KE/2	KE/2
P1505	Idle Air Control System Reached Idle Air Trim Limit	KE/25	KE/25	KE/25
P1506	Idle Air Control Overspeed Error	-	KE/20	KE/20
P1507	Idle Air Control Underspeed Error	-	KE/2	KE/2
P1512	Intake Manifold Runner Control Malfunction (Stuck Closed)	-	-	HU/15
P1513	Intake Manifold Runner Control Malfunction (Stuck Closed)	-	-	HU/15
P1516	Intake Manifold Runner Control Input Error	HU/15	-	HU/15
P1517	Intake Manifold Runner Control Input Error	HU/15	-	HU/15
P1518	Intake Manifold Runner Control	HU/15	HU/15	HU/15

	Malfunction (Stuck Open)			
P1519	Intake Manifold Runner Control Malfunction (Stuck Closed)	HU/15	HU/15	HU/15
P1520	Intake Manifold Runner Control Circuit Malfunction	HU/15	HU/15	HU/15
P1537	Intake Manifold Runner Control Malfunction (Stuck Open)	HU/15	HU/15	HU/15
P1538	Intake Manifold Runner Control Malfunction (Stuck Open)	HU/15	HU/15	HU/15
P1549	Intake Manifold Communication Control Circuit Malfunction	HU/65	HU/65	HU/65
P1650	Power Steering Pressure Switch Malfunction	FF/1	FF/1	-
P1651	Power Steering Pressure Switch Signal Malfunction	-	FF/1	FF/1
P1701	Transmission/Transaxle Fault	-	-	(1)
P1703	Brake Switch Out Of Self-Test Range	FD/2	FD/1	-
P1705	Transmission Range Sensor Out Of Self-Test Range	(1)	(1)	-
P1709	Park/Neutral Position Switch Out Of Self-Test Range	TA/1	-	-
P1710	Transmission Fluid Temperature Sensor In Range Malfunction	(1)	(1)	(1)
P1711	Transmission Fluid Temperature Out Of Range	(1)	(1)	(1)
P1714	Shift Solenoid 1 Malfunction	-	-	(1)
P1715	Shift Solenoid 2 Malfunction	-	-	(1)
P1728	Transmission Slippage Error	-	-	(1)
P1731	1-2 Shift Error	-	-	(1)
P1732	2-3 Shift Error	-	-	(1)
P1733	3-4 Shift Error	-	-	(1)
P1740	Torque Converter Clutch Malfunction	-	-	(1)
P1741	Excessive Torque Converter Clutch Engagement Error	-	-	(1)
P1742	Torque Converter Clutch Solenoid Failed ON	-	-	(1)
P1743	Torque Converter Clutch Solenoid Failed ON	-	-	(1)
P1744	Excessive Torque Converter Clutch Slippage	-	-	(1)

P1746	Shorted Powertrain Control Module Output Driver	(1)	-	(1)
P1747	Electronic Pressure Control Solenoid Circuit Failure	(1)	-	(1)
P1751	Shift Solenoid 1 Functional Failure	-	-	(1)
P1756	Shift Solenoid 2 Functional Failure	-	-	(1)
P1767	Torque Converter Clutch Solenoid Circuit Failure	(1)	-	(1)
P1780	Transmission Control Switch Out Of Self-Test Range	-	TB/1	-
P1783	Transmission Fluid Temperature Exceeded	-	-	(1)
U1020	Module Communication Network Failure	-	-	(3)
U1039	Module Communication Network Failure	-	-	(3)
U1051	Module Communication Network Failure	-	-	(3)
U1135	Module Communication Network Failure	-	-	(3)
U1147	Vehicle Security Status Message Missing	-	-	(3)
U1451	Module Communication Network Failure	-	-	(3)

(1) Transmission/transaxle fault is indicated. See appropriate AUTOMATIC TRANSMISSION article.

(2) DTC P1000 indicates that OBD-II drive cycle has not been completed. Disregard this DTC in KOEO and KOER self-test and continue as directed.

(3) Module communication network failure is indicated. See appropriate MODULE COMMUNICATION NETWORK article in ACCESSORIES & EQUIPMENT.

PCM CONNECTOR IDENTIFICATION

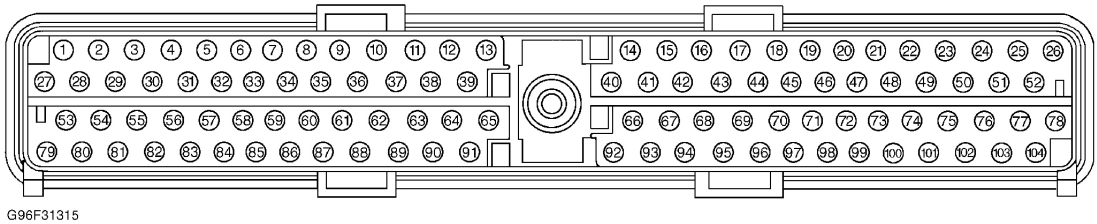


Fig. 16: Powertrain Control Module (PCM) Connector Terminal Identification

Courtesy of FORD MOTOR CO.

CIRCUIT TESTS

NOTE: A breakout box, connected to vehicle harness at PCM, is necessary to perform most circuit tests. References to Test Pin No. found in CIRCUIT TEST steps refer to test terminals on manufacturer's breakout box. Circuit diagrams at beginning of each test identify circuit and wire colors.

HOW TO USE CIRCUIT TESTS

1) Ensure all non-EEC related faults found while performing steps in **BASIC TESTING - 4.2L** article have been corrected. Follow each test step in order until fault is found. DO NOT replace any part unless directed to do so. When more than one code is retrieved, start with first code displayed.

2) CIRCUIT TESTS ensure electrical circuits are okay before sensors or other components are replaced. Always test circuits for continuity between sensor and PCM. Test all circuits for short to power, opens or short to ground. Voltage Reference (VREF) and Voltage Power (VPWR) circuits should be tested with ignition on or as specified in CIRCUIT TESTS.

3) DO NOT measure voltage or resistance at PCM. DO NOT connect any test light unless specified in testing procedure. All measurements are made by probing rear of connector (wiring harness side). Isolate both ends of a circuit and turn ignition off when checking for shorts or continuity, unless instructed otherwise.

4) Disconnect solenoids and switches from harness before measuring continuity and resistance or applying voltage. After each repair, check all component connections and repeat **QUICK TEST** .

5) An open circuit is defined as a resistance reading of greater than 5 ohms. This specification tolerance may be too high for some items in EEC-V system. If resistance approaches 5 ohms, always clean suspect connector and coat it with protective dielectric silicone grease. A short is defined as a resistance reading of less than 10,000 ohms to ground, unless stated otherwise in CIRCUIT TEST.

NOTE: In following tests, circuit diagrams and illustrations are courtesy of Ford Motor Co.

CIRCUIT TEST A - NO START VEHICLE WILL NOT START

CAUTION: Stop this test at first sign of a fuel leak. Do not allow smoking or an open flame in vicinity of vehicle during these tests.

Diagnostic Aids

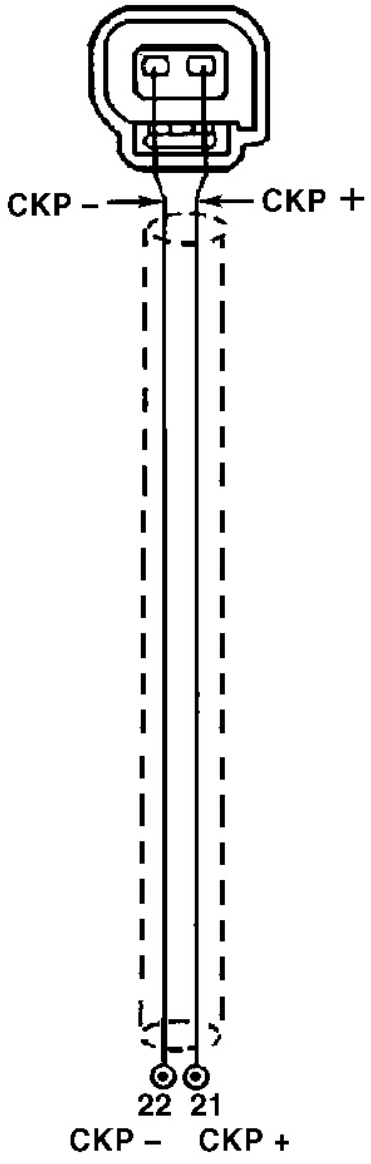
Enter this CIRCUIT TEST only when all steps under **QUICK TEST** have been successfully completed and engine still does not start or if directed here from another test or chart. This test is only intended to diagnose:

- Ignition Control Module (ICM).
- Powertrain Control Module (PCM).

- Spark (PCM-controlled).
- Wiring harness circuits (PIP, IGN GND and VPWR).

To prevent replacement of good components, be aware the following non-EEC related areas and components may be cause of problem:

- Fuel quality and quantity.
- Ignition (general condition).
- Engine mechanical components.
- Starter and battery circuits.
- Crankshaft Position (CKP) sensor.
- Ignition Control Module (ICM).
- Coil packs.



*TEST PINS LOCATED ON BREAKOUT BOX. ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

G95A35923

Fig. 17: Ignition System Test Circuits

1) Starting System Check Ensure Inertia Fuel Shutoff (IFS) switch is closed (button pushed in). Try to start engine. If engine does not crank, check vehicle starting and charging systems. If engine cranks, go to next step.

2) Attempt to start engine. If engine now starts, go to **CIRCUIT TEST Z** , step 50). If engine does not start, go to next step.

3) Check VREF At TP Sensor Turn ignition off. Disconnect TP sensor. Measure voltage between terminal VREF and SIG RTN at TP sensor wiring harness connector. See **Fig. 19** . If voltage is 4-6 volts, go to step 6). If resistance not 4-6 volts, go to **CIRCUIT TEST C** .

4) Check Flash EPROM (FEPS) Circuit For Short To Power With ignition on, measure voltage between negative battery terminal and DLC terminal No. 13. See **Fig. 1** . If voltage is less than 9 volts, go to next step. If voltage is 9 volts or more, repair circuit for a short to power and repeat quick test.

5) Check For Spark At Plugs Disconnect any spark plug wire. Connect spark tester between spark plug wire and ground. Connect Spark Plug Firing Indicator (D89P-6666-A). Crank engine while checking for spark. If spark is okay go to next step. If spark is not okay, go to **CIRCUIT TEST JD** , step 1).

6) Check Fuel Pressure Turn ignition off. Release fuel pressure. Install fuel pressure gauge. With scan tester connected, turn ignition on. Using scan tester, access OUTPUT TEST MODE and operate fuel pump to obtain maximum fuel pressure. For fuel pressure specifications, see **FUEL PRESSURE SPECIFICATIONS** article. If fuel pressure is as specified, go to next step. If fuel pressure is not as specified, go to **CIRCUIT TEST HC** , step 1).

7) Check Fuel Pressure Leakdown Leave fuel pressure gauge installed and ignition on. Turn ignition on. Using scan tester, access OUTPUT TEST MODE and operate fuel pump to obtain maximum fuel pressure. Exit OUTPUT TEST MODE and turn ignition off. If fuel pressure remains within 5 psi of maximum pressure for one minute after turning ignition off, go to next step. If fuel pressure does not remain as specified, go to **CIRCUIT TEST HC** , step 1).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 7) to step 17). NGV test procedures have been omitted.

17) Check PCM Driver To Coils Turn ignition off. Connect 12-volt test light between B+ and coil driver circuit. Crank engine while observing test light. Repeat procedure for each coil driver. Test light should blink brightly, once for each engine revolution. If test light blinks as specified, replace PCM and repeat **QUICK TEST** . If test light does not blink as specified, go to **CIRCUIT TEST JD** , step 4).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 17) to step 20). No test procedures have been omitted.

20) Identify Type Of No-Start Attempt to start engine. If engine now starts, go to **CIRCUIT TEST Z** , step 50). If engine does not start, go to next step.

NOTE: Ensure fuel pump inertia switch is closed (button pushed in).

21) Starting System Check Try to start engine. If engine cranks, go to next step. If engine does not crank, check vehicle starting and charging systems.

22) Check VREF At TP Sensor Turn ignition off. Disconnect TP sensor. Measure resistance between terminal VREF and SIG RTN at TP sensor wiring harness connector. If resistance is 4-6 volts, go to next step. If resistance is not 4-6 volts, go to **CIRCUIT TEST C** .

23) Check For Spark At Plugs Disconnect any spark plug wire. Connect spark tester between spark plug

wire and ground. Crank engine while checking for spark. If spark is okay, go to step 33). If spark is not okay, go to next step.

24) Check For Spark At Coil Disconnect coil secondary wire from distributor. Connect spark tester between wire and ground. Crank engine while checking for spark. If spark is not okay, go to next step. If spark is okay, go to **CIRCUIT TEST JB** , step 1).

25) Check Resistance Of IGN GND Circuit Ensure ignition is turned off. Disconnect Camshaft Position (CMP) sensor. Disconnect PCM 104-pin connector and inspect for damage. Repair as necessary. Install Breakout Box (014-00950) leaving PCM disconnected. Install EI Diagnostic Harness (007-00059) to breakout box. Connect B- to negative battery terminal. Connect ICM tee and CMP tee in-line with wiring harness. Ensure PIP OPEN/NORMAL/SPOUT OPEN switch or diagnostic is in NORMAL position. Install DI overlay. Measure resistance between test pin No. 23 and 35 (IGN GND) at breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

26) Reconnect CMP sensor. Connect PCM to breakout box. Turn breakout box timing switch to DIST position. Try to start engine. If engine starts, go to step 31). If engine does not start, go to next step.

27) Check SPOUT Signal Ensure ignition is off. While cranking engine, measure AC voltage between test pin No. 50 (SPOUT) and negative battery terminal. If voltage is 3-6 volts, go to **CIRCUIT TEST JD** . If voltage is not 3-6 volts, place timing switch in COMPUTED position and go to next step.

28) Check PIP & SPOUT Circuit For Short To Power Turn ignition off. Disconnect CMP, ICM and PCM. Turn ignition on. Measure voltage between test pin No. 49 (PIP) and negative battery terminal. Measure voltage between test pin No. 50 (SPOUT) and negative battery terminal. If voltage is less than 10.5 volts, go to next step. If voltage 10.5 volts or more, repair short to power and repeat **QUICK TEST** .

29) Check PIP & SPOUT Circuit For Short To Ground Turn ignition off. Measure resistance between breakout box test pin No. 49 (PIP) and test pins No. 23, 51, 91 and 103. Measure resistance between breakout box test pin No. 50 (SPOUT) and test pins No. 23, 51, 91 and 103. If resistance each is greater than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, repair short circuit and repeat **QUICK TEST** . If vehicle will not start, go to next step.

30) Isolate Shorts In PCM Ensure ignition is off. Connect PCM to breakout box. Measure resistance between breakout box test pin No. 49 (PIP) and test pins No. 71 and 97 for short to power. Measure resistance between breakout box test pin No. 49 (PIP) and test pins No. 51 and 103 for short to ground. Measure resistance between breakout box test pin No. 50 (SPOUT) and test pins No. 71 and 97 for short to power. Measure resistance between breakout box test pin No. 49 (PIP) and test pins No. 51 and 103 for short to ground.

If resistance each is greater than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, replace PCM and repeat **QUICK TEST** .

31) Check PIP Signal Ensure ignition is off and PCM is connected to breakout box. While cranking engine, measure voltage between test pin No. 49 and test pins No. 51 and 103. If voltage is 3-7 volts, replace PCM and repeat **QUICK TEST** . If voltage is not 3-7 volts, go to next step.

32) Check Resistance Of PIP Circuit Ensure ignition is off. Disconnect PCM from breakout box. Disconnect CMP and ICM. Measure resistance between breakout box test pin No. 49 and EI Diagnostic Harness test pins No. 15 and 34. If resistance is less than 5 ohms, reconnect all components and go to **CIRCUIT TEST JB** . If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

33) Check SPOUT Signal Ensure ignition is off. Connect PCM to breakout box. Ensure breakout box

timing switch is in COMPUTED position. While cranking engine, measure voltage between test pin No. 50 and test pins No. 51 and 103. If voltage is 3-6 volts, go to next step. If voltage is not 3-6 volts, go to step 28).

34) Check Fuel Pressure Turn ignition off. Release fuel pressure. Install fuel pressure gauge. With scan tester connected, turn ignition on. Using scan tester, access OUTPUT TEST MODE and operate fuel pump to obtain maximum fuel pressure. For fuel pressure specifications, see **FUEL PRESSURE SPECIFICATIONS** article. If fuel pressure is as specified, go to next step. If fuel pressure is not as specified, go to **CIRCUIT TEST HC** , step 1).

35) Check Fuel Pressure Leakdown Leave fuel pressure gauge installed and ignition on. Turn ignition on. Using scan tester, access OUTPUT TEST MODE and operate fuel pump to obtain maximum fuel pressure. Exit OUTPUT TEST MODE and turn ignition off. If fuel pressure remains within 5 psi of maximum pressure for one minute after turning ignition off, fuel system is okay and testing is complete. If fuel pressure does not remain as specified, go to **CIRCUIT TEST HC** , step 1).

CIRCUIT TEST B - EEC-V POWER RELAY

This circuit test is only intended to diagnose the following components and circuits:

- Vehicle wiring harness circuits (VPWR, IGNITION START/RUN, B+ and Ground).
- EEC-V power relay.
- Powertrain Control Module (PCM).

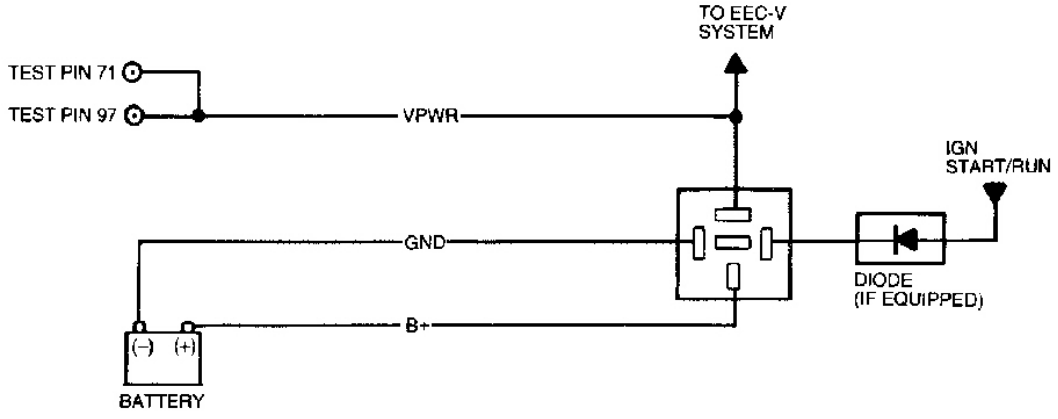


Fig. 18: EEC-V Power Relay Test Circuits

1) Check VPWR Circuit Resistance Turn ignition off. Disconnect Idle Air Control (IAC) solenoid and EEC-V power relay wiring harness connectors. Disconnect scan tool (if applicable). Measure resistance between VPWR terminal of IAC solenoid connector and VPWR terminal of EEC-V power relay. If resistance is less than 5 ohms, reconnect IAC solenoid and go to next step. If resistance is 5 ohms more,

repair open in VPWR circuit between EEC-V power relay and IAC solenoid.

2) Check Voltage To EEC-V Power Relay Leave ignition off and EEC-V power relay disconnected. Connect DVOM negative lead to negative battery terminal. Measure voltage at B+ terminal of EEC-V power relay connector. Turn ignition on. Measure voltage at IGN START/RUN. If voltage is less than 10.5 volts, repair open circuit and repeat **QUICK TEST** . If voltage is more than 10.5 volts, replace EEC-V power relay and repeat QUICK TEST.

3) Check Ground Circuit To EEC-V Power Relay Leave ignition off and EEC-V power relay disconnected. Measure voltage between Ground terminal and B+ terminal of EEC-V power relay. If resistance is more than 10.5 volts, replace EEC-V power relay. If resistance is 10.5 volts or less, repair open in Ground circuit and repeat **QUICK TEST** .

CIRCUIT TEST C - REFERENCE VOLTAGE

Diagnostic Aids

SIG RTN is a dedicated ground used by most EEC-V system sensors. VREF is a 5-volt reference voltage that is continuously output by PCM. This consistent voltage signal is used on all 3-wire sensors.

This circuit test is only intended to diagnose the following components and circuits:

- A/C Pressure sensor, DPFE sensor and TP sensor.
- Vehicle wiring harness circuits (SIG RTN and VREF).
- Powertrain Control Module (PCM).

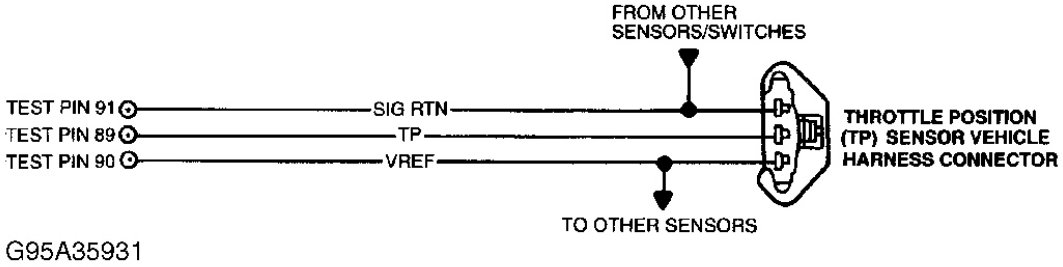


Fig. 19: Reference Voltage Circuits & Connector Terminals

Diagnostic Aids

If VREF voltage is more than 6 volts, go to step 35). If voltage is less than 6 volts, go to step 1).

1) Check Battery Voltage Turn ignition on. Measure voltage between battery terminals. If battery voltage is more than 10.5 volts, go to next step. If voltage is 10.5 volts or less, recharge or replace battery as necessary.

2) Check SIG RTN Circuit Disconnect suspect sensor wiring harness connector. Measure voltage

between SIG RTN terminal of suspect sensor and positive battery terminal. If voltage measurement is more than 10.5 volts and within one volt of battery voltage, go to next step. If voltage is less than 10.5 volts, go to step 25).

3) Check Scan Tool Ability To Access Parameter Identification (PID) PID is area of PCM Random Access Memory (RAM) that holds operating information for input and output data. If scan tool is able to access ECT PID, go to step 20). If scan tool is unable to access ECT PID, go to next step.

4) Check VPWR To Idle Air Control (IAC) Solenoid Turn ignition off. Disconnect TP sensor wiring harness connector. Disconnect IAC solenoid. Turn ignition on. Measure voltage between VPWR terminal (Red wire) at IAC wiring harness connector and negative battery terminal. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, reconnect wiring harness connector and go to **CIRCUIT TEST B** .

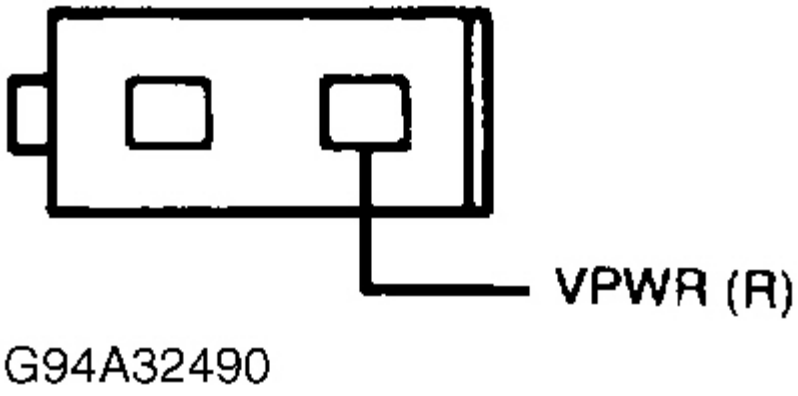


Fig. 20: IAC Wiring Harness Connector Terminals

5) Check For Shorted DPFE Or EGR Valve Position (EVP) Sensor Disconnect TP wiring harness connector. Disconnect DPFE sensor. Turn ignition on. Measure voltage between TP sensor wiring harness connector SIG RTN terminal and VREF terminal. If voltage measurement is 4-6 volts, replace DPFE or EVP sensor and repeat **QUICK TEST** . If voltage measurement is not 4-6 volts, proceed as follows:

- For models with Fuel Tank Pressure (FTP) sensor, go to next step.
- For models with A/C Pressure (ACP) sensor, go to step 7).
- For models with Power Steering Pressure (PSP) sensor, go to step 9).
- For models with Fuel Rail Pressure (FRP) sensor, go to step **10)** .
- For all other vehicles, go to step 15).

6) Check For Shorted Fuel Tank Pressure (FTP) Sensor Leave DPFE and TP sensor disconnected. Disconnect FTP sensor. Turn ignition on. Measure voltage between TP sensor wiring harness connector

SIG RTN terminal and VREF terminal. If voltage measurement is 4-6 volts, replace FTP sensor and repeat **QUICK TEST** . If voltage measurement is not 4-6 volts, proceed as follows:

- For models with A/C Pressure (ACP) sensor, go to next step.
- For all other vehicles, go to step 15).

7) Check For Shorted AC Pressure (ACP) Sensor) Leave DPFE and TP sensor disconnected. Disconnect ACP sensor. Turn ignition on. Measure voltage between TP sensor wiring harness connector SIG RTN terminal and VREF terminal. If voltage measurement is 4-6 volts, replace ACP sensor and repeat **QUICK TEST** . If voltage measurement is not 4-6 volts, proceed as follows:

- For models with Traction Assist, go to next step.
- For models without Traction Assist, go to step 15).

8) Check For Shorted TP-B Sensor Disconnect Throttle Position sensor B (TP-B). Leave ACP, DPFE and TP sensor disconnected. Turn ignition on. Measure voltage between TP sensor wiring harness connector SIG RTN terminal and VREF terminal. If voltage measurement is 4-6 volts, replace TP-B sensor and repeat **QUICK TEST** . If voltage measurement is not 4-6 volts, go to step 15).

9) Check For Shorted Power Steering Pressure (PSP) Sensor Leave DPFE and TP sensor disconnected. Disconnect PSP sensor. Turn ignition on. Measure voltage between TP sensor wiring harness connector SIG RTN terminal and VREF terminal. If voltage measurement is 4-6 volts, replace PSP sensor and repeat **QUICK TEST** . If voltage measurement is not 4-6 volts, go to step 15).

10) Check For Shorted Fuel Rail Pressure (FRP) Sensor Leave DPFE and TP sensor disconnected. Disconnect FPR sensor. Turn ignition on. Measure voltage between TP sensor wiring harness connector SIG RTN terminal and VREF terminal. If voltage measurement is 4-6 volts, replace FPR sensor and repeat **QUICK TEST** . If voltage measurement is not 4-6 volts, go to step 15).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 10) to step 13). No test procedures have been omitted.

13) Check For Shorted EGR Valve Position (EGRP) Sensor Leave TP sensor disconnected. Disconnect EGRP sensor. Turn ignition on. Measure voltage between TP sensor wiring harness connector SIG RTN terminal and VREF terminal. If voltage measurement is 4-6 volts, replace EGRP sensor and repeat **QUICK TEST** . If voltage measurement is not 4-6 volts, go to next step.

14) Check For Shorted EGR Boost (EGRB) Sensor Leave EGRP and TP sensor disconnected. Disconnect EGRB sensor. Turn ignition on. Measure voltage between TP sensor wiring harness connector SIG RTN terminal and VREF terminal. If voltage measurement is 4-6 volts, replace EGRB sensor and repeat **QUICK TEST** . If voltage measurement is not 4-6 volts, go to next step.

15) Check VPWR To PCM Turn ignition off. Leave all previously disconnected sensors disconnected. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Install Breakout Box (014-00950) leaving PCM disconnected. Turn ignition on. Measure voltage between test pins No. 71 (VPWR) and 77 (PWR GND). If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit between IAC splice and PCM.

16) Check VREF Circuit For Short To Ground Or SIG RTN Turn ignition off. Leave all previously disconnected sensors disconnected. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No. 90 (VREF) and test pins No. 51 and 103 (PWR GND), and 91 (SIG RTN). If any resistance is less than 10,000 ohms, repair VREF short to ground and repeat **QUICK TEST** . If resistance is 10,000 ohms or more, replace PCM and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 16) to step 20). No test procedures have been omitted.

20) Check VREF Resistance To PCM Turn ignition off. Ensure sensor with failed VREF circuit is disconnected. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Install Breakout Box (014-00950) leaving PCM disconnected. Measure resistance between test pin No. 90 (VREF) and VREF terminal at suspect sensor wiring harness connector. If resistance is less than 5 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open in VREF and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 20) to step 25). No test procedures have been omitted.

25) Check Scan Tool Ability To Access Parameter Identification (PID) If scan tool is able to access ECT PID, go to next step. If scan tool is unable to access ECT PID, go to step 28).

26) Check KOEO DTCs If KOEO DTCs are present for 2 or more sensors connected to SIG RTN circuit, go to next step. If KOEO DTCs are not as specified, repair open in SIG RTN to sensor where VREF circuit failed.

27) Check SIG RTN Circuit Resistance To PCM Turn ignition off. Disconnect scan tester from DLC. Disconnect sensor where VREF circuit failed. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Install Breakout Box (014-00950) leaving PCM disconnected. Measure resistance between test pin No. 91 (SIG RTN) and SIG RTN terminal of suspect sensor wiring harness connector. If resistance is less than 5 ohms, reconnect sensor and go to next step. If resistance is 5 ohms or more, repair open in SIG RTN circuit and repeat **QUICK TEST** .

28) Check PCM PWR GND Circuits Turn ignition off. Leave scan tester disconnected. Measure resistance between negative battery terminal and test pins No. 51, 77 and 103 (PWR GND). If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

29) Check Ground Circuits In PCM Leave ignition off and scan tester disconnected. Connect PCM to breakout box. Measure resistance between test pin No. 91 (SIG RTN) and test pins No. 51, 77 and 103 (PWR GND). If each resistance is less than 5 ohms, PWR GND and SIG RTN circuits are okay. Return to step 25) to verify results. If any resistance is 5 ohms or more, replace PCM and repeat **QUICK TEST** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 29) to step 35). No test procedures have been omitted.

35) Check VREF Circuit For Short To Power Turn ignition off. Ensure sensor with failed VREF circuit is disconnected. Leave all components connected to VREF circuit disconnected. See **Fig. 21** . Disconnect PCM. Turn ignition on. Measure voltage between VREF terminal at TP sensor wiring harness connector and negative battery terminal. If voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volt or more, repair VREF circuit for a short to power and repeat QUICK TEST.

Applications	TP	EGR	FTP	ACP	PSP	FRP
Probe	X	EGRVP, BARO				
2.5L Contour / Mystique, Thunderbird / Cougar	X	D.P.F. EGR				
Aerostar, Ranger	X	D.P.F. EGR				
Taurus / Sable, Taurus SHO, Town Car, Windstar	X	D.P.F. EGR	X			
Explorer / Mountaineer[a]	X	EGRV / D.P.F. EGR	X			
Crown Victoria (except NGV), Grand Marquis,	X	D.P.F. EGR	X			
5.4L E / F-Series (except NGV),	X	D.P.F. EGR	X			
4.2L F-Series, 4.6L, 5.4L, & 6.8L E / F-Series,	X	D.P.F. EGR	X			
Expedition / Navigator	X	D.P.F. EGR	X			
Continental	X	D.P.F. EGR	X	X		
Continental w / Traction control	X & TP-B	D.P.F. EGR	X	X		
Mark VIII	X	D.P.F. EGR	X	X		
Escort / Tracer	X	D.P.F. EGR		X	X	
2.0L Contour / Mystique	X	D.P.F. EGR			X	
Crown Victoria, 5.4L E / F-Series w / NGV	X	D.P.F. EGR				X

a (Mid model year)

G96H29121

Fig. 21: Components Connected To VREF Circuit

CIRCUIT TEST DA - TEMPERATURE SENSOR TEST (IAT & ECT)

Diagnostic Aids

Perform this test only when directed by QUICK TEST. Ambient air temperature must be at least 50°F (10°C) to receive valid input from IAT sensor. Engine coolant temperature must be more than 50°F (10°C) to pass **KOEO SELF-TEST** and more than 180°F (82°C) to pass KOER SELF-TEST. Voltage values in this test are based on a 5-volt VREF signal. Values may vary up to 15 percent due to sensor and VREF variations.

This circuit test is intended to diagnose the following components and circuits:

- Intake Air Temperature (IAT) sensor.
- Engine Coolant Temperature (ECT) sensor.
- Wiring harness circuits (IAT, ECT and SIG RTN).
- Powertrain Control Module (PCM).

To prevent replacing good components, ensure the following non-EEC areas or components are not cause of problem:

- Coolant level low.
- Cooling system, water pump or fan.
- Engine operating temperature.
- Engine oil level low.
- Thermostat.
- Air cleaner duct.
- Ambient temperature.

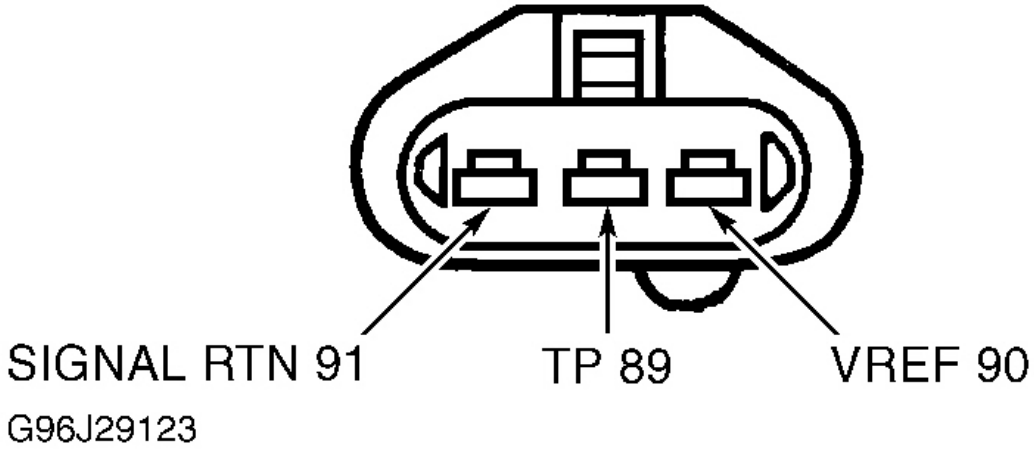


Fig. 22: Throttle Position (TP) Sensor Connector Terminals

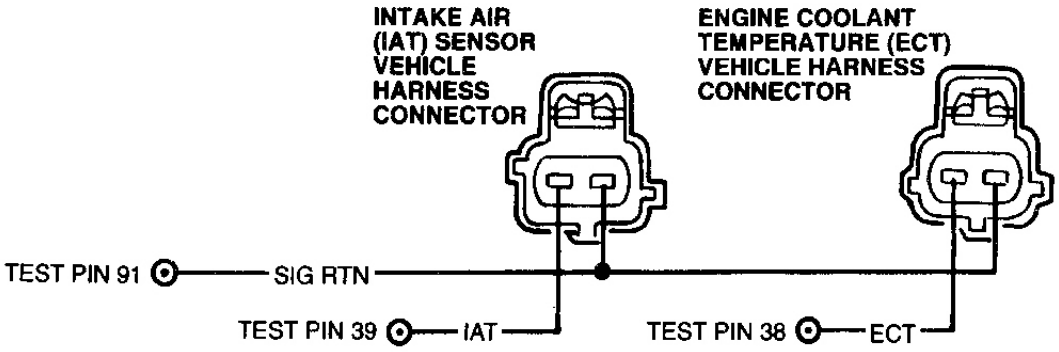


Fig. 23: Temperature Sensor Circuits & Connector Terminals

1) DTC P1116 This trouble code indicates sensor is out of self-test range. Correct range for measurement is .3-3.7 volts. Check for following possible causes:

- Low coolant level.
- Faulty harness connector.
- Faulty sensor.

Start engine and run until engine is at normal operating temperature. If vehicle cannot be started, go to step 3). Ensure upper radiator hose is hot and pressurized. Repeat **QUICK TEST** . If DTC P1116 is present, go to next step. If DTC P1116 is not present, fault is intermittent and cannot be duplicated at this time. testing is complete.

2) Check VREF Circuit Voltage At TP Sensor Turn ignition off. Disconnect Throttle Position (TP) sensor. Turn ignition on. Measure voltage at TP sensor wiring harness connector between VREF and SIG RTN terminal. See **Fig. 19** . If voltage is 4-6 volts, reconnect TP sensor and go to step 3). If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

3) Check Temperature Sensor Resistance (KOEO) Turn ignition off. Disconnect suspect sensor. Measure resistance between signal circuit (ECT or IAT) terminal and SIG RTN terminal at sensor wiring harness connector. See **ACT & ECT SENSOR SPECIFICATIONS** table. If resistance is not within specification, replace suspected sensor and repeat **QUICK TEST** . If resistance is within specification, perform following step as applicable:

- For diagnosing vehicles with ECT sensor related fault and a no-start condition, DO NOT service DTC P1116 at this time. Repair no-start condition and repeat **QUICK TEST** .
- For diagnosing vehicles without a no-start condition, go to next step.

4) Check Temperature Sensor Resistance (KOER) Warm engine to normal operating temperature. Turn ignition off. Disconnect suspect sensor. Start engine and operate at 2000 RPM for 2 minutes. Measure resistance between signal circuit (ECT or IAT) terminal and SIG RTN terminal at sensor wiring

harness connector. See ACT & ECT SENSOR SPECIFICATIONS table. If resistance is within specification, replace PCM, and repeat **QUICK TEST** . If sensor is not within specification replace sensor, and repeat QUICK TEST.

ACT & ECT SENSOR SPECIFICATIONS

Temperature °F (° C)	(1) Volts	(1) Ohms
50 (10)	3.51	58,750
68 (20)	3.07	27,300
86 (30)	2.60	24,270
104 (40)	2.13	16,150
122 (50)	1.70	10,970
140 (60)	1.33	7700
158 (70)	1.02	5370
176 (80)	0.78	3840
194 (90)	0.60	2800
212 (100)	0.46	2070
(1) Values may vary by 15 percent.		

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 4) to step 10). No test procedures have been omitted.

10) DTC P0118 Or P0113: Induce Opposite DTC (117 Or 112) DTC P0118 (ECT) or P0113 (IAT) indicate corresponding sensor signal is more than self-test maximum. Maximum signal voltage for ECT and IAT sensor is 4.6 volts. Possible causes for excess voltage signals are:

- Open circuit in wiring harness (IAT or ECT).
- Faulty connection.
- Faulty sensor.
- Faulty PCM.

Turn ignition off. Disconnect suspect temperature sensor. Connect a jumper wire between signal circuit (ECT or IAT) terminal and SIG RTN terminal at sensor wiring harness connector. With scan tester installed, turn ignition on.

NOTE: If communication link error is displayed, remove jumper wire and go to step 12).

Access ECT V or IAT V PID. If the PID is less than 0.2 volt, replace sensor and repeat **QUICK TEST** . If PID is 0.2 volt or more, remove jumper wire and go to next step.

11) Check Resistance Of Sensor Signal & SIG RTN Circuits Turn ignition off. Ensure suspect temperature sensor is disconnected. Disconnect PCM 104-pin connector. Check for damaged wiring, and repair as necessary. Install Breakout Box (014-00950), leaving PCM disconnected. Measure resistance

between test pin No. 38 (ECT sensor) or test pin No. 39 (IAT sensor) at breakout box and SIG RTN terminal at sensor wiring harness connector. Also, measure resistance between test pin No. 91 (SIG RTN) and SIG RTN circuit at sensor wiring harness connector. If both readings are less than 5 ohms, replace PCM, and repeat **QUICK TEST** . If either reading is 5 ohms or more, repair open circuit and repeat QUICK TEST.

12) Check For Sensor Signal Short To VREF Turn ignition off. Ensure suspect temperature sensor is disconnected. Measure resistance between test pin No. 90 (VREF) and test pin No. 38 (ECT sensor) or test pin No. 39 (IAT sensor) at breakout box. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** . If either resistance is less than 10,000 ohms, repair short circuit to VREF and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 12) to step 20). No test procedures have been omitted.

20) DTC P0117 Or P0112 DTC P0117 (ECT) or P0112 (IAT) indicates sensor signal is less than self-test minimum. Minimum signal for IAT and ECT sensor is 0.2 volt. Possible causes for this fault are:

- Circuit grounded in wiring harness.
- Faulty sensor.
- Faulty connection.
- Faulty PCM.

Turn ignition off. Disconnect wiring harness connector from suspect sensor. Check for damaged wiring, and repair as necessary. With scan tester connected, turn ignition on. Using scan tester, access ECT V of IAT V PID. If PID is less than 4.2 volts, go to next step. If PID is 4.2 volts or more, replace sensor and repeat **QUICK TEST** .

21) Check VREF Circuit Voltage At TP Sensor Turn ignition off. Disconnect TP sensor wiring harness connector. Turn ignition on. Measure voltage between VREF and SIG RTN at TP sensor wiring harness connector. If voltage is 4-6 volts, connect TP sensor and go to next step. If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

22) Check Signal Circuit For Short To Ground Turn ignition off. Disconnect suspect sensor. Disconnect PCM 104-pin connector. Check for damaged wiring, and repair as necessary. Install Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 38 (ECT) or No. 39 (IAT) and test pins No. 24, 51 and 91. If any reading is less than 10,000 ohms, repair short circuit, and repeat **QUICK TEST** . If all readings are 10,000 ohms or more, replace PCM and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 22) to step 90). No test procedures have been omitted.

90) Continuous Memory DTC P0112, P1112, P0113, P0117, P1117 Or P0118: Check Sensor These trouble codes indicate possible intermittent fault. Possible causes for these faults are:

- Faulty sensor.
- Faulty sensor connector.
- Open or grounded circuit in harness.

- Faulty PCM.

With scan tester connected, turn ignition on. Access ECT or IAT PID. While observing PID, tap on sensor to simulate road shock. Wiggle sensor connector. If no change in temperature reading occurs, go to next step. If any change in temperature occurs, isolate fault and repair as necessary.

91) Check EEC-V Wiring Harness While in PID, wiggle and bend small sections of wiring harness working toward PCM. If fault is indicated, isolate fault and repair as necessary. Clear memory, and repeat **QUICK TEST** . If no fault is found, go to step 92).

92) Inspect PCM & Wiring Harness Connectors Turn ignition off. Disconnect PCM 104-pin connector. Inspect connector for damaged pins, corrosion and loose wires. If connectors and terminals are damaged, repair as necessary and repeat **QUICK TEST** . If connectors and terminals are okay, fault cannot be duplicated at this time and testing is complete.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 92) to step 100). No test procedures have been omitted.

100) DTC P0125 These DTCs indicate ECT sensor has not reached normal operating temperature. Possible causes for this fault are:

- Insufficient engine warm-up time.
- Thermostat leaking or stuck open.
- Low coolant.

Repair cooling system as necessary. Clear PCM memory, and repeat **QUICK TEST** .

CIRCUIT TEST DB - ENGINE FUEL TEMPERATURE (EFT) SENSOR

Diagnostic Aids

Perform this test only when directed by QUICK TEST. EFT sensor will operate within the range of -40-248°F (-40-120°C). This circuit test is intended to diagnose the following components and circuits:

- EFT sensor.
- Wiring harness circuits (EFT and SIG RTN).
- Powertrain Control Module (PCM).

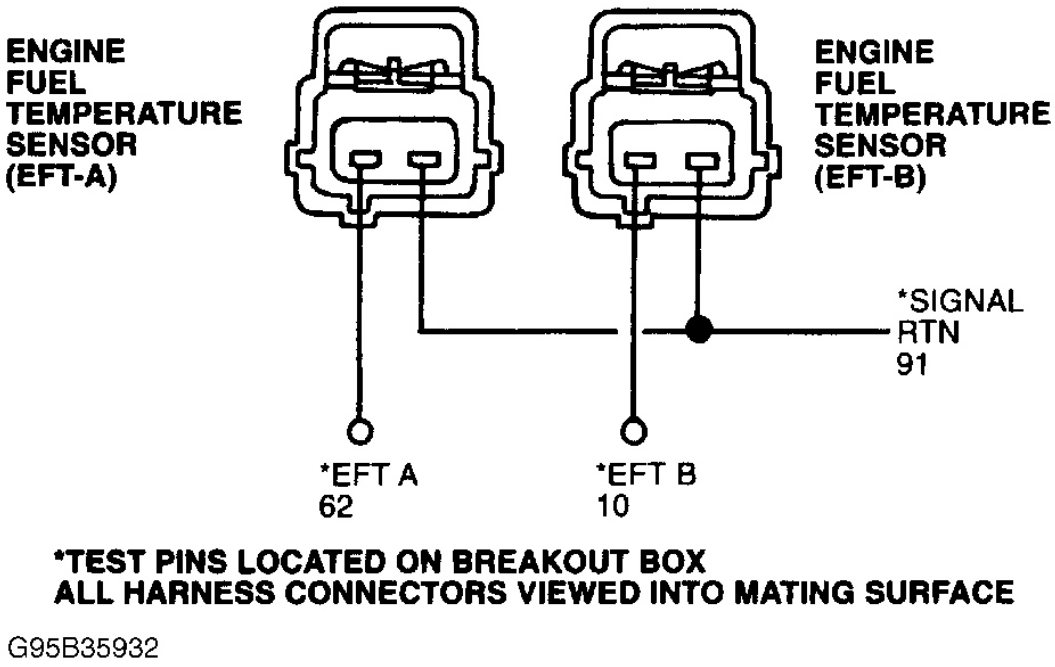


Fig. 24: EFT Connector Terminals

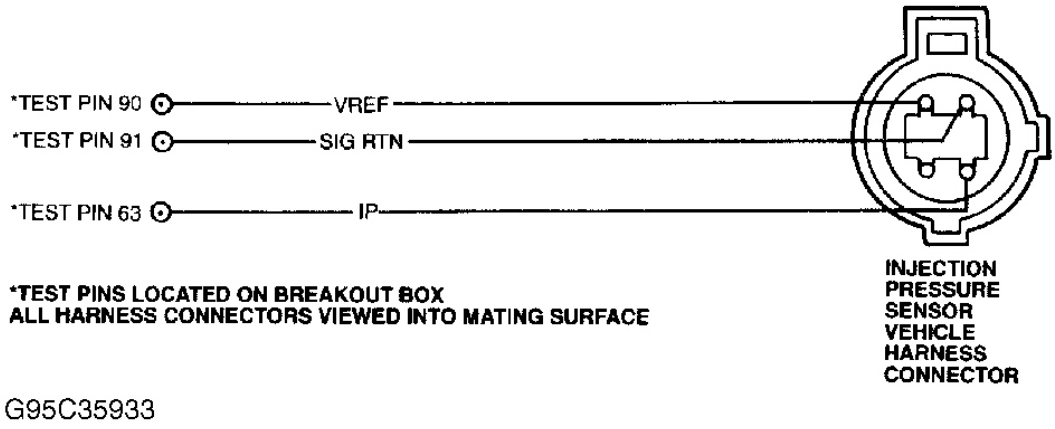


Fig. 25: Injector Pressure (IP) Sensor Connector Terminals

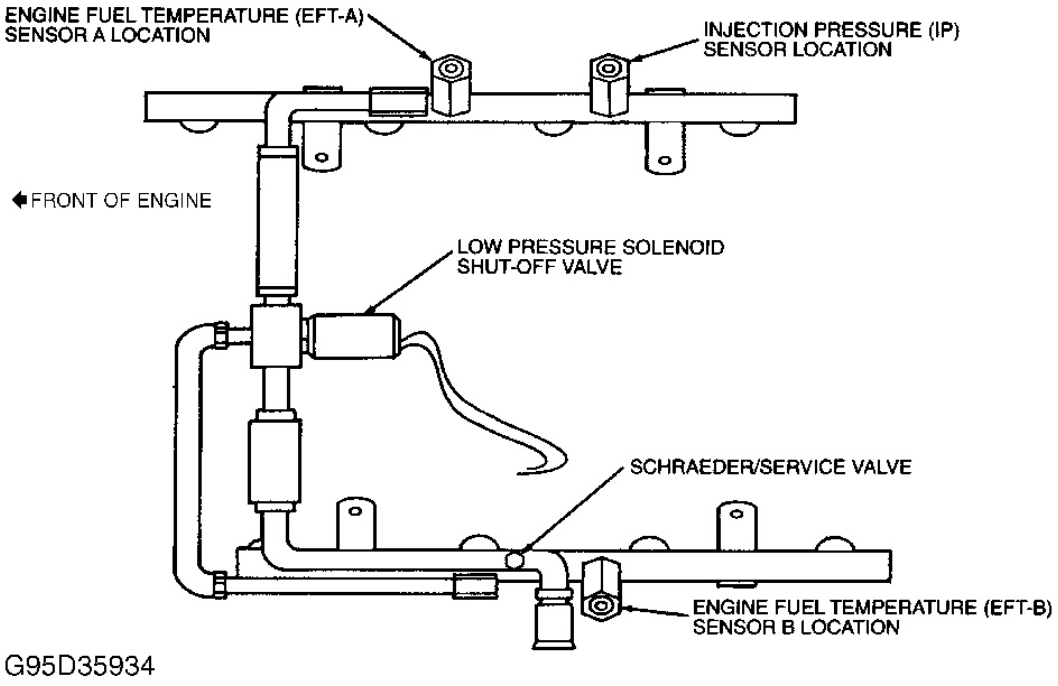


Fig. 26: Fuel Rail Components

EFT SENSOR SPECIFICATIONS

Temperature °F (°C)	(1) Volts	(1) Ohms
50 (10)	3.51	58,750
68 (20)	3.07	27,300
86 (30)	2.60	24,270
104 (40)	2.13	16,150
122 (50)	1.70	10,970
140 (60)	1.33	7700
158 (70)	1.02	5370
176 (80)	0.78	3840
194 (90)	0.60	2800
212 (100)	0.46	2070
248 (120)	0.27	1180
(1) Values may vary by 15 percent.		

1) DTC P0183 (EFT A) Or P0188 (EFT B) This trouble code indicates sensor signal is greater than self-test maximum. Self-test maximum is 4.6 volts. Check for following possible causes:

- Open circuit in wiring harness.

- Faulty harness connector.
- Faulty sensor.
- Faulty PCM.

Turn ignition off. Disconnect suspect temperature sensor. Connect a jumper wire between signal circuit (EFT A or EFT B) terminal and SIG RTN terminal at sensor wiring harness connector. With scan tester installed, turn ignition on.

NOTE: If communication link error is displayed, remove jumper wire and go to step 12).

Access EFT A or EFT B PID. If the PID is less than 0.2 volt, replace sensor and repeat **QUICK TEST** . If PID is 0.2 volt or more, remove jumper wire and go to next step.

2) Check Resistance Of Sensor Signal & SIG RTN Circuits Turn ignition off. Ensure suspect temperature sensor is disconnected. Disconnect PCM 104-pin connector. Check for damaged wiring, and repair as necessary. Install Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 62 (EFT A) or test pin No. 10 (EFT B) at breakout box and SIG RTN terminal at sensor wiring harness connector. Also, measure resistance between test pin No. 91 (SIG RTN) and SIG RTN circuit at sensor wiring harness connector. If both readings are less than 5 ohms, replace PCM, and repeat **QUICK TEST** . If either reading is 5 ohms or more, repair open circuit and repeat QUICK TEST.

3) Check For Sensor Signal Short To VREF Turn ignition off. Ensure suspect temperature sensor is disconnected. Disconnect PCM 104-pin connector. Check for damaged wiring, and repair as necessary. Install Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 90 (VREF) and test pin No. 62 (EFT A) or test pin No. 10 (EFT B) at breakout box. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** . If either resistance is less than 10,000 ohms, repair short circuit to VREF and repeat QUICK TEST.

4) DTC P0182 (EFT A) Or P0187 (EFT B) This trouble code indicates sensor signal is less than self-test minimum. Self-test minimum is 0.2 volts. Check for following possible causes:

- Wiring harness circuit short to ground.
- Faulty harness connector.
- Faulty sensor.
- Faulty PCM.

Turn ignition off. Disconnect suspect temperature sensor. With scan tester connected to DLC, turn ignition on. Access EFT A PID or EFT B PID. If the PID is less than 4.2 volt, replace sensor and repeat **QUICK TEST** . If the PID is 4.2 volt or more, go to next step.

5) Check VREF Circuit Voltage At Injection Pressure (IP) Sensor Turn ignition off. Disconnect IP sensor wiring harness connector. Turn ignition on. Measure voltage between VREF and SIG RTN at IP sensor wiring harness connector. If voltage is 4-6 volts, connect IP sensor and go to next step. If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

6) Check Signal Circuit For Short To Ground Turn ignition off. Disconnect suspect sensor. Disconnect PCM 104-pin connector. Check for damaged wiring, and repair as necessary. Install Breakout

Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 62 (EFT A) or 10 (EFT B) and test pins No. 24, 51 and 91. If any reading is less than 10,000 ohms, repair short circuit, and repeat **QUICK TEST** . If all readings are 10,000 ohms or more, replace PCM and repeat QUICK TEST.

7) Continuous Memory DTC P0182, P0183, P0187 Or P0188 These trouble codes indicate possible intermittent fault. Possible causes for these faults are:

- Faulty sensor.
- Faulty sensor connector.
- Open or grounded circuit in harness.
- Faulty PCM.

With scan tester connected, turn ignition on. Access EFT A or EFT B PID. While observing PID, tap on sensor to simulate road shock. Wiggle sensor connector. If no change in temperature reading occurs, go to next step. If any change in temperature occurs, isolate fault and repair as necessary.

8) Check EEC-V Wiring Harness While in PID, wiggle and bend small sections of wiring harness working toward PCM. If fault is indicated, isolate fault and repair as necessary. Clear memory, and repeat **QUICK TEST** . If no fault is found, go to next step.

9) Inspect PCM & Wiring Harness Connectors Turn ignition off. Disconnect PCM 104-pin connector. Inspect connector for damaged pins, corrosion and loose wires. If connectors and terminals are damaged, repair as necessary and repeat **QUICK TEST** . If connectors and terminals are okay, fault cannot be duplicated at this time and testing is complete.

CIRCUIT TEST DC - MASS AIRFLOW (MAF) SENSOR

Diagnostic Aids

Perform this test when directed by QUICK TEST. This CIRCUIT TEST is intended to diagnose the following:

- MAF sensor.
- Wiring harness circuits (VPWR, PWR GND, MAF SIG and MAF RTN).
- Powertrain Control Module (PCM).

To prevent replacement of good components, be aware the following non-EEC related areas may be cause of problem:

- Air cleaner element.
- Inlet air duct.
- Throttle body.

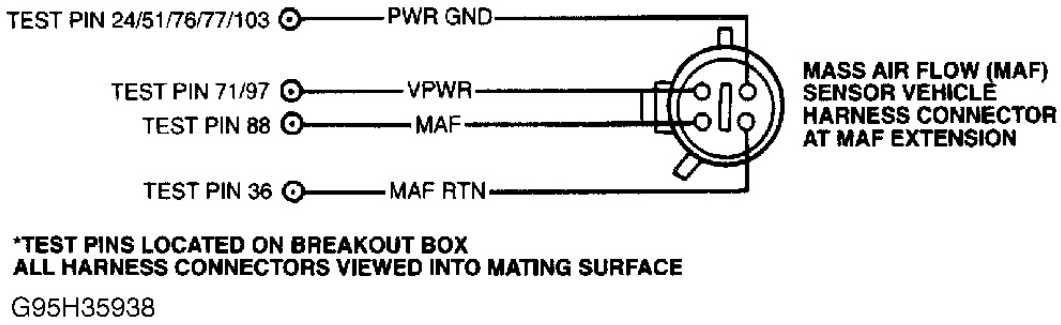


Fig. 27: MAF Sensor Extension Circuits & Connector Terminals

1) KOER DTC P1101: Check MAF Sensor Continuous Memory Codes DTC P1101, retrieved during KOER self-test, indicates MAF signal was not 0.34-1.96 volts during self-test. Drive vehicle for 10 minutes and repeat KOEO and Continuous Memory self-test. If any Continuous Memory DTC is present with KOER P1101, proceed as follows:

- Continuous Memory DTC P0102, go to step 6).
- Continuous Memory DTC P0103, go to step 20).
- All other Continuous Memory DTCs, service as necessary.

If no Continuous Memory DTCs are present with KOER P1101, go to next step.

NOTE: DTC P1101 may be caused by low battery or by use of a garage exhaust ventilation system. Ensure vehicle is vented to outside atmosphere before repeating QUICK TEST .

2) KOEO/KOER DTC P1101: MAF Output Voltage DTC P1101, retrieved during KOEO or KOER self-test, indicates voltage exceeded.2-volt test range. Possible causes for this fault are:

- Air leak before or after MAF sensor.
- Faulty or contaminated MAF sensor.
- Faulty MAF sensor wiring harness connector.
- Open PWR GND or MAF RTN circuit.
- Faulty PCM.

Turn ignition off. Ensure MAF sensor is connected. Disconnect PCM 104-pin connector and inspect for damage. Repair as necessary. Install Breakout Box (014-00950). Leave PCM connected to breakout box. With scan tester connected, turn ignition on. Measure voltage between test pin No. 88 (MAF SIG) and test pins No. 24 and 103 (PWR GND). If voltage is greater than 0.2 volt, go to step 12). If voltage is 0.2 volt or less, go to step 8).

3) Continuous Memory DTC P1100: Check MAF Circuit Intermittent Voltage Input DTC P1100,

retrieved from continuous memory indicates voltage went out of range (0.39-3.90 volts) sometime during previous 40 warm-up cycles. Possible causes for this fault are:

- Faulty MAF sensor.
- Faulty MAF sensor wiring harness circuit or connector.

Start engine and allow to idle. If engine does not idle smoothly, repair cause of rough idle condition before continuing. With scan tester connected, raise engine speed to 1500 RPM for 5 seconds, and return to idle. Access MAF PID. While observing PID, tap on sensor to simulate road shock. Wiggle sensor connector. If MAF PID voltage stays within 0.39-3.90 volt range, go to next step. If volt range is not as specified, check MAF sensor and connector. Repair or replace as necessary.

4) Check MAF Sensor Circuit Integrity Turn ignition off. Disconnect PCM 104-pin connector and inspect for damage. Repair as necessary. Install Breakout Box (014-00950). Connect PCM to breakout box. Turn ignition on. Connect voltmeter between test pin No. 36 (MAF RTN) and No. 88 (MAF SIG). While observing voltmeter, wiggle and bend wiring harness between sensor and dash panel. Wiggle and bend wiring harness between dash panel and PCM. If voltage reading goes out of normal range (0.39-3.90 volts), isolate fault and repair as necessary. Reset KAM and repeat **QUICK TEST** . If voltage does not go out of normal range, fault cannot be duplicated or identified at this time. Go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 4) to step 6). No test procedures have been omitted.

6) Continuous Memory & KOER DTC P0102: Check MAF Low Input Signal To PCM DTC P0102 indicates MAF signal was less than 0.39 volt sometime during normal engine operation. Possible causes for this fault are:

- Open or closed MAF circuit.
- Open circuit (MAF, MAF RTN, PWR GND, or VPWR).
- MAF circuit shorted to ground.
- Air leak before or after MAF sensor.
- Faulty MAF sensor or connector.
- Faulty TP system.
- Faulty PCM.

Ensure air induction system is okay. Repair if necessary. Start engine and allow to idle. If engine does not idle smoothly, repair cause of rough idle condition before continuing. With scan tester connected, raise engine speed to 1500 RPM and return to idle. Access MAF PID. If MAF PID is less than 0.39 volt, go to next step. If MAF PID is 0.6-1.0 volts, go to step 15). For all other MAF PID readings, go to step 2).

7) Check VPWR Circuit Voltage Turn ignition off. Disconnect MAF sensor. Turn ignition on. Measure voltage between VPWR terminal of MAF sensor wiring harness connector and negative battery terminal. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit.

8) Check Resistance Of VPWR Circuit Turn ignition off. Leave MAF sensor disconnected. Disconnect PCM 104-pin connector and inspect for damage. Repair as necessary. Install Breakout Box (014-00950),

leaving PCM disconnected. Measure resistance between VPWR terminal of MAF sensor wiring harness connector and test pins No. 71 and 97 (VPWR) at breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in VPWR circuit and repeat **QUICK TEST** .

9) Check MAF Circuit For Short To Ground & MAF RTN Circuit Leave ignition off and MAF disconnected. Ensure PCM is disconnected. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No. 88 (MAF SIG) and test pins No. 36 (MAF RTN), 51 and 103 (PWR GND) at breakout box. If resistance is 10,000 ohms or more, reconnect scan tester and go to next step. If resistance is less than 10,000 ohms, repair circuit short to ground and repeat **QUICK TEST** .

10) Check MAF RTN Circuit For Short To PWR GND Circuit Leave ignition off, PCM and MAF disconnected. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No. 36 (MAF SIG) and test pins No. 51 and 103 (PWR GND) at breakout box. If resistance is 10,000 ohms or more, reconnect scan tester and go to next step. If resistance is less than 10,000 ohms, repair circuit short to ground and repeat **QUICK TEST** .

11) Check Resistance Of MAF SIG Circuit Leave ignition off, PCM and MAF disconnected. Measure resistance between MAF terminal of MAF sensor wiring harness connector and test pin No. 88 (MAF SIG) at breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit in MAF SIG circuit and repeat **QUICK TEST** .

12) Check PWR GND Circuit To MAF Sensor Leave ignition off and MAF disconnected. Connect PCM to breakout box. Turn ignition on. Measure voltage between VPWR and PWR GND terminal of MAF sensor wiring harness connector. If voltage is less than 10.5 volts, go to next step. If voltage is 10.5 volts or more, go to step 14).

13) Check PWR GND Circuit Resistance Leave ignition off and MAF sensor disconnected. Disconnect PCM from breakout box. Disconnect scan tester from DLC (if applicable). Measure resistance between PWR GND terminal of MAF sensor wiring harness connector and negative battery terminal. If resistance is less than 10 ohms, go to next step. If resistance is 10 ohms or more, repair open in PWR GND circuit and repeat **QUICK TEST** .

14) Check MAF RTN Circuit Resistance Leave ignition off, PCM and MAF sensor disconnected. Measure resistance between MAF RTN terminal of MAF sensor wiring harness connector and test pin No. 36 (MAF RTN) at breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in MAF RTN and repeat **QUICK TEST** .

15) Check MAF Circuit For Short To Ground In PCM Leave ignition off and MAF disconnected. Connect PCM to breakout box. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No. 88 (MAF SIG) and test pins No. 36 (MAF RTN), 51 and 103 (PWR GND) at breakout box. If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, replace PCM and repeat **QUICK TEST** .

16) Leave ignition off, PCM and MAF disconnected. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No. 36 (MAF RTN) and test pins No. 51 and 103 (PWR GND) at breakout box. If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, replace PCM and repeat **QUICK TEST** .

17) Check MAF Circuit Output Ensure ignition is off. Reconnect MAF sensor. Connect PCM to breakout box. Start engine and allow to idle. If engine does not idle smoothly, repair cause of rough idle condition before continuing. Measure voltage between test pin No. 88 (MAF SIG) and negative battery cable. If voltage is 0.34-1.96 volts, go to next step. If voltage is not 0.34-1.96 volts, replace MAF sensor and repeat **QUICK TEST** .

18) Ensure ignition is off, MAF sensor and PCM are connected. With engine idling, measure voltage

between test pin No. 36 (MAF RTN) and 88 (MAF SIG). If voltage is 0.34-1.96 volts, go to next step. If voltage is not 0.34-1.96 volts, replace MAF sensor and repeat **QUICK TEST** .

19) Check MAF Circuit Output With Scan Tester Start engine and allow to idle. Access MAF PID on scan tester. If PID voltage is 0.34-1.96 volts, fault is intermittent and cannot be identified at this time. Go to **CIRCUIT TEST Z** . If voltage is not 0.34-1.96 volts, replace PCM and repeat **QUICK TEST** .

20) DTC P0103: Check MAF High Input Signal To PCM DTC P0103 indicates MAF signal was more than 4.70 volts sometime during normal engine operation. Possible causes for this fault are as follows:

- Restricted MAF sensor screen.
- MAF SIG circuit shorted to VPWR.
- Faulty MAF sensor or connector.
- Faulty PCM.

Ensure air induction system is okay. Repair if necessary. Start engine and allow to idle. If engine does not idle smoothly, repair cause of rough idle condition before continuing. With scan tester connected, raise engine speed to 1500 RPM and return to idle. Access MAF PID. PID reading should be more than 4.60 volts. Turn ignition off. Disconnect MAF sensor. Start engine and allow to idle. Access MAF PID. If PID voltage reading does not drop to less than 0.39 volt, go to next step. If PID voltage reading does drop to less than 0.39 volt, replace MAF sensor.

21) Check MAF SIG Circuit For Short To Power Leave ignition off and MAF sensor disconnected. Disconnect PCM 104-pin connector and inspect for damage. Repair as necessary. Install Breakout Box (014-00950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 88 (MAF SIG) and test pins No. 24 and 103 at breakout box. If voltage is less than 10.5 volts, go to next step. If voltage is 10.5 volts or more, repair MAF SIG circuit short to power.

22) Check MAF SIG Circuit For Short To Power In PCM Leave ignition off and MAF sensor disconnected. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No. 88 (MAF SIG) and test pins No. 71 and 97 (VPWR) at breakout box. If resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10,000 ohms or less, repair short between MAF SIG and VREF circuit. Repeat QUICK TEST.

CIRCUIT TEST DF - VEHICLE SPEED CIRCUIT (VSC) CHECK

Diagnostic Aids

Perform this test only when directed by QUICK TEST. This test is intended to diagnose the following:

- Wiring harness circuits (VSC SIG and VSC GND).
- Powertrain Control Module (PCM).

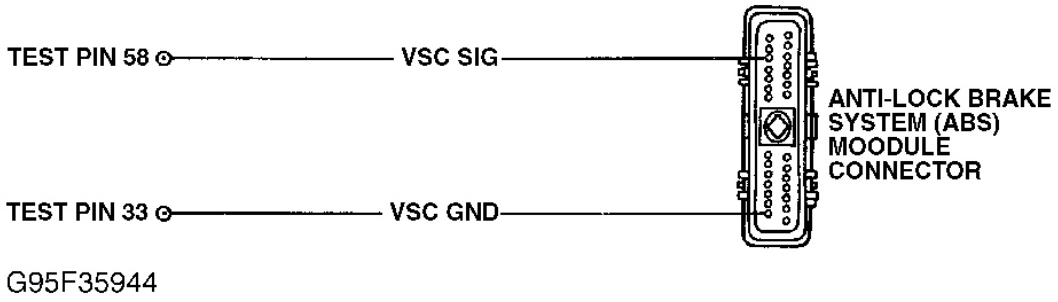


Fig. 28: ABS Module VSC Connector Terminals

1) DTC P0500: Check Vehicle Speed PID DTC P0500 indicates that PCM has detected error in vehicle speed information received from ABS module. Possible causes for this fault are:

- Open or short in harness.
- Faulty ABS module.
- Faulty Powertrain Control Module (PCM).

Turn ignition off. Connect scan tester to Diagnostic Link Connector (DLC). Turn ignition on. Using scan tester, access VSS PID. Road test vehicle as follows:

- Gradually accelerate vehicle to 50 MPH while observing VVV PID MPH.

If VSS PID matches speedometer, fault is intermittent; go to step 4). If VSS PID does not match speedometer, go to next step.

2) Check Circuit Resistance Turn ignition off. Disconnect PCM 104-pin connector. Inspect connector for damaged pins, corrosion and loose wires. Repair as necessary. Install EEC-IV Breakout Box (014-00950), leaving PCM disconnected. Disconnect ABS wiring harness connector. Measure resistance between VSC GND terminal of ABS module wiring harness connector and test pin No. 33 at breakout box. Measure resistance between VSC SIG terminal of ABS module wiring harness connector and test pin No. 58 at breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit, and repeat **QUICK TEST** .

3) Check Circuit For Short To Ground Leave PCM and ABS module disconnected. Disconnect scan tester from DLC (if applicable). Turn ignition off. Measure resistance between test pin No. 58 and test pins No. 33 (VSC GND), 51 and 103 (PWR GND) No. 71 (VPWR) and No. 91 (SIG RTN). Measure resistance between test pin No. 33 and test pin No. 71. If any reading is less than 10,000 ohms, repair short circuit, and go to step 5). If all readings are 10,000 ohms or more, check for fault in ABS system. If no faults are present, replace PCM.

4) Visual Inspection Turn ignition off. Visually inspect VSC wiring harness for any of the following conditions:

- Loose or corroded ABS module connector.

- Loose or corroded PCM connector.
- Incorrect routing of VSC wiring harness.

If any faults are present, repair as necessary and go to next step. If all readings are 10,000 ohms or more, check for fault in ABS system.

5) Test Drive Vehicle Ensure engine is warmed to normal operating temperature. Perform the following drive cycle 3 times:

A/T Equipped Vehicles

- Place gear selector in Drive.
- Accelerate heavily to 35 MPH.
- Coast down to idle speed and stop vehicle.

M/T Equipped Vehicles

- Place gear selector in first gear.
- Accelerate heavily to 35 MPH, not shifting higher than second gear.
- Coast down to idle speed and stop vehicle.

After third drive cycle, perform **QUICK TEST** . If any DTCs are present, go to appropriate CIRCUIT TEST. If DTCs are not present, testing is complete.

CIRCUIT TEST DG - KNOCK SENSOR (KS)

Diagnostic Aids

Perform this test only when directed by QUICK TEST. This test is intended to diagnose the following:

- Knock Sensor (KS).
- Wiring harness circuits (KS and SIG RTN).
- Powertrain Control Module (PCM).

To prevent replacement of good components, be aware the following non-EEC related areas may be at fault:

- Poor fuel quality.
- Ignition system.
- Ignition or valve timing.
- Engine mechanical condition.

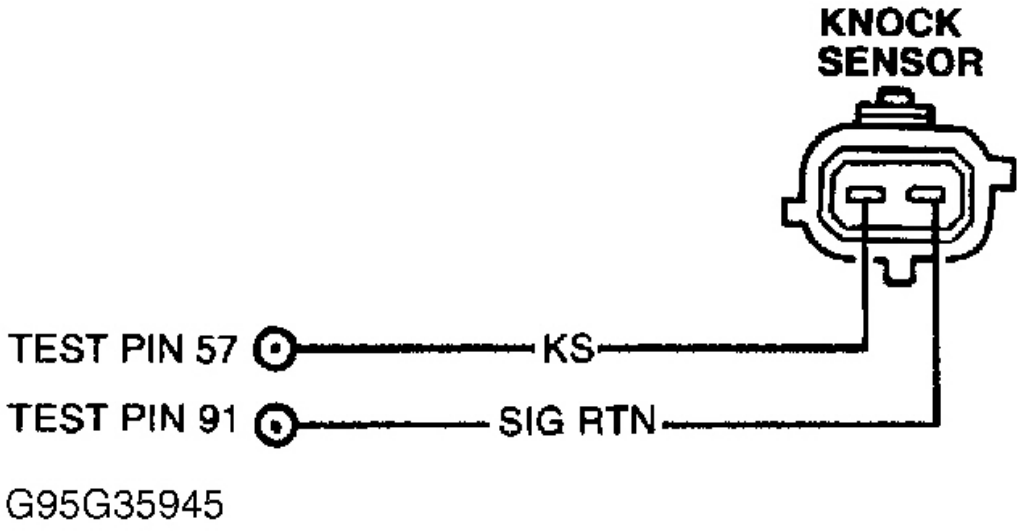


Fig. 29: Single KS Sensor Test Circuits & Connector Terminals

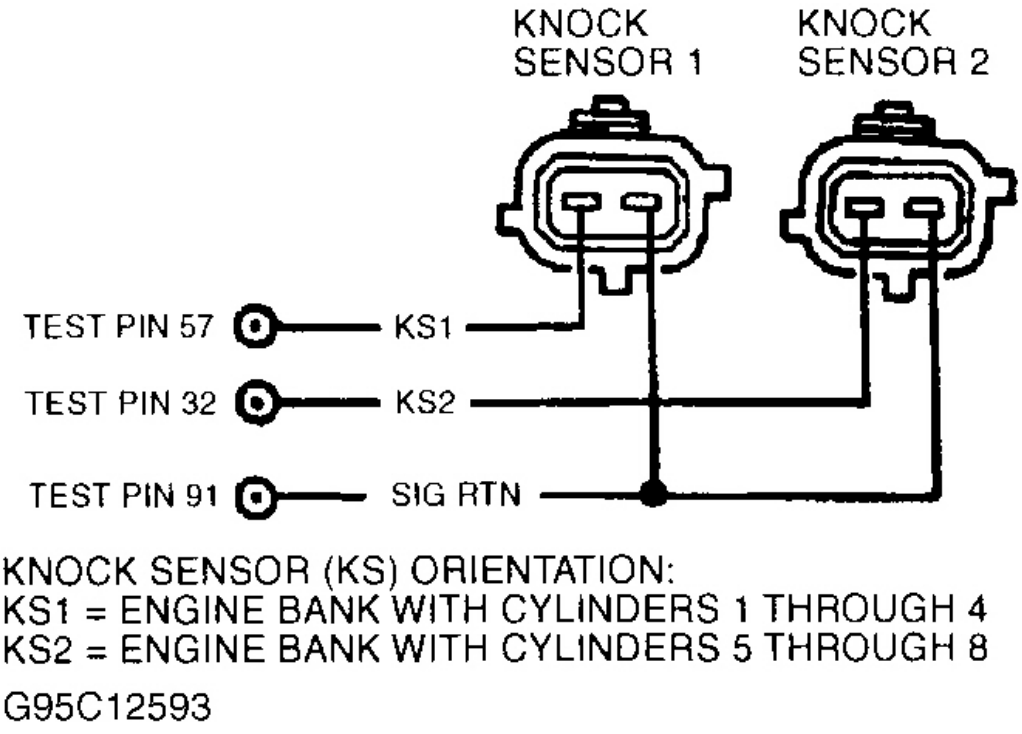


Fig. 30: Dual KS Sensor Test Circuits & Connector Terminals

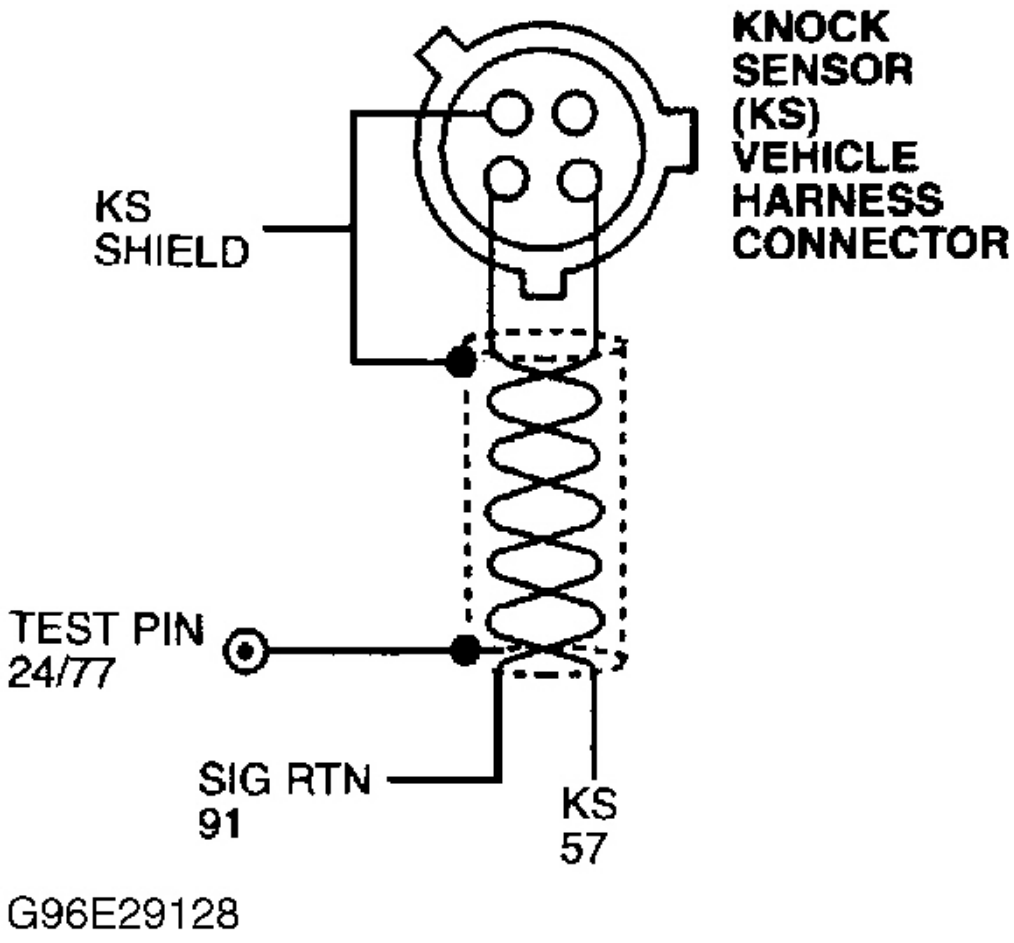


Fig. 31: Quad KS Sensor Test Circuits & Connector Terminals

1) Check Sensor Voltage DTC P0325, P0326, P0330 and P0331 indicate that ignition timing was not adjusted after spark knock has occurred. Possible causes for this fault are:

- High altitude interference.
- Open or short in harness.
- Faulty knock sensor.
- Faulty Powertrain Control Module (PCM).

Turn ignition off. Disconnect PCM 104-pin connector. Inspect connector for damaged and repair as necessary. Install EEC-V Breakout Box (014-00950). Connect PCM to breakout box. Turn ignition on. Measure voltage between suspect sensor test pin and test pin No. 91 (SIG RTN). If voltage is 2.4-2.6 volts, go to next step. If voltage is less than 2.4 volts, go to step 5). If voltage is more than 2.6 volts, go to

step 6).

2) Check For Intermittent Circuit Fault Leave ignition on. Measure voltage between suspect sensor test pin and test pin No. 91. While observing voltmeter, wiggle small sections of wiring harness starting at the knock sensor and going to the PCM. Lightly tap on knock sensor and PCM. If voltmeter reading stays within normal operating range (2.4-2.6 volts), go to next step. If voltmeter reading goes out of range, isolate fault and repair as necessary. Clear PCM memory and repeat **QUICK TEST** .

3) Check For Voltage Increase Turn ignition off. Leave PCM connected to breakout box. Disconnect scan tester from DLC. Set voltmeter on AC scale. Start engine and allow to idle. Measure voltage between suspect sensor test pin and test pin No. 91. Raise engine speed to 3000 RPM. If AC voltage increases, replace PCM and repeat **QUICK TEST** . If AC voltage does not increase, go to next step.

4) Check Circuit Resistance Turn ignition off. Disconnect PCM from breakout box. Disconnect suspect sensor. Measure resistance of KS circuit (KS1 or KS2) between suspect sensor connector terminal and breakout box. Measure resistance of SIG RTN circuit between suspect sensor connector terminal and breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

5) Check Circuit For Short To Ground Leave suspect sensor disconnected. Measure resistance between KS circuit (KS1 and KS2) test pins and test pin No. 91. Measure resistance between KS circuit test pins and the following power ground test pins No. 24, 51, 76, 77 and 103. Measure resistance between KS circuits and ground. If all resistance measurements are 10,000 ohms or more, replace knock sensor and repeat **QUICK TEST** . If any resistance measurement is less than 10,000 ohms, repair short circuit and repeat QUICK TEST.

6) Check Circuit For Short To Power Leave ignition on. Measure voltage between KS circuit (KS1 and KS2) test pins and the following power ground test pins No. 24, 51, 76, 77 and 103. If each voltage measurement is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If any voltage measurement is 0.5 volt or more, repair circuit short to power and repeat QUICK TEST.

7) Check PCM For Short To Ground Turn ignition off. Connect PCM to breakout box. Leave suspect sensor disconnected. Measure resistance between test pin No. 32 or 57 (KS) and test pin No. 91 (SIG RTN). If resistance measurement is 10,000 ohms or more, go to next step. If resistance measurement is less than 10,000 ohms, replace PCM and repeat **QUICK TEST** .

8) Check KS Resistance Leave ignition off. Disconnect PCM from breakout box. Measure resistance between test pin No. 32 or 57 (KS) and test pin No. 91 (SIG RTN) at breakout box. If resistance measurement is 5.11 megaohms or more, replace KS. Perform a complete drive cycle and repeat **QUICK TEST** . If resistance measurement is less than 5.11 megaohm, replace KS and repeat QUICK TEST. If fault is still present, replace PCM.

CIRCUIT TEST DH - THROTTLE POSITION (TP) SENSOR

Diagnostic Aids

Perform this test only when directed by QUICK TEST. This test is intended to diagnose the following:

- TP sensor.
- Wiring harness circuits (PWR GND, SIG RTN, TP, VPWR and VREF).
- Powertrain Control Module (PCM).

Normal range of throttle angle measurement for TP sensor is 0-85 degrees. To pass **QUICK TEST** procedure, range of throttle rotation (in degrees) must be within 3 percent of specification.

To prevent replacement of good components, be aware the following non-EEC related areas may be at fault:

- Idle speed.
- Binding throttle shaft or linkage.
- TP sensor not seated.

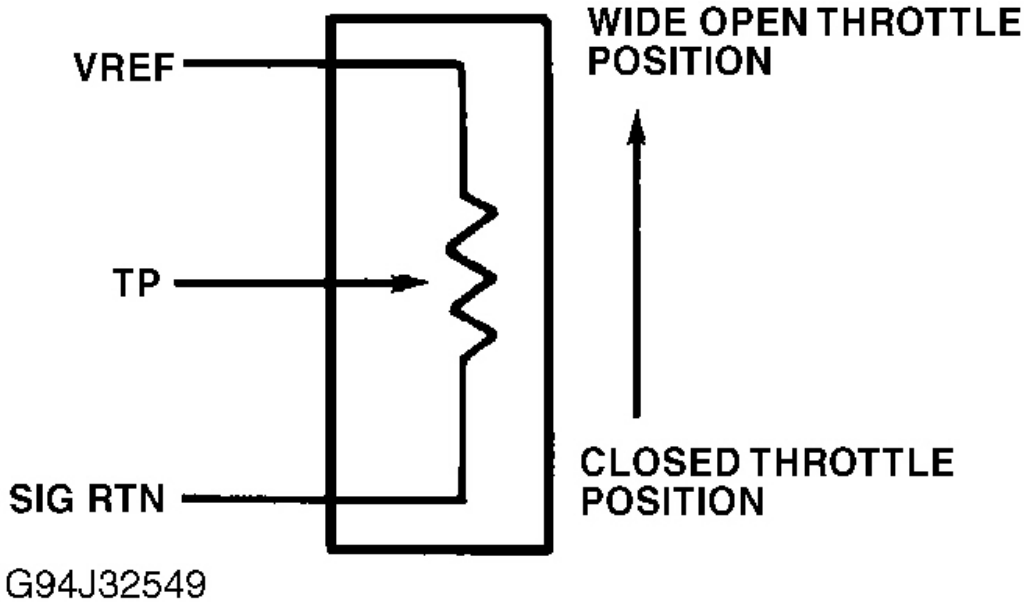


Fig. 32: TP Sensor Schematic

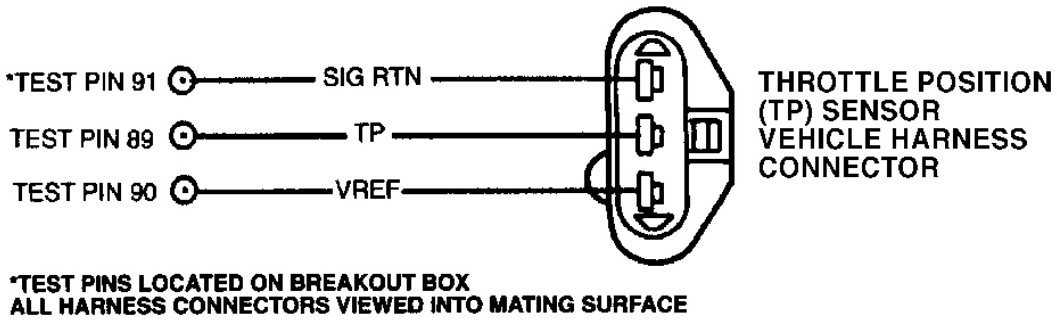


Fig. 33: TP Sensor Circuit & Connector Terminals

1) KOEO/KOER DTC P1124: Check For Other Codes DTC P1124 indicates TP sensor rotational setting may be out of self-test range. Possible causes for this fault are:

- Faulty TP sensor.
- Faulty Powertrain Control Module (PCM).

Perform KOEO and KOER self-test. Check for DTC P1400. If DTC P1400 is present, service code and repeat **QUICK TEST** . If DTC P1400 is not present with DTC P1124, go to next step.

2) Check For Binding Throttle Plate Inspect throttle body for binding. If throttle body is binding, check for binding throttle or cruise control linkage, vacuum line or harness interference. Repair as necessary, and repeat **QUICK TEST** . If no mechanical problem is found, go to step 8).

3) DTC P1120: Check For Binding Throttle Plate DTC P1120 indicates TP sensor closed throttle position is below range of 3.4 percent (.17 volt) Possible causes for this fault are:

- Damaged wiring harness or connectors.
- Open in VREF circuit.
- Faulty TP sensor.
- Faulty Powertrain Control Module (PCM).

Inspect TP sensor connector for damage or corrosion. Inspect wiring harness between TP sensor and PCM for damage or corrosion. Repair as necessary, and repeat **QUICK TEST** . If no mechanical problem is found, go to next step.

4) Check For Stuck TP Sensor Turn ignition off. Connect scan tester to DLC. Access TP PID on scan tester. While observing TP PID, slowly move throttle through range from closed to wide open throttle. If TP PID indicates any sudden drops to below 0.49 volt, go to next step. If TP PID increase and decrease is gradual and smooth, go to step 20).

5) Check VREF Circuit Voltage With TP sensor disconnected, turn ignition on. Measure voltage between VREF and SIG RTN terminals at TP sensor wiring harness connector. If voltage is 4-6 volts, go

to next step. If voltage is not 4-6 volts, reconnect sensor and go to **CIRCUIT TEST C** .

6) Check TP Circuit Resistance Turn ignition off. Leave TP sensor disconnected. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 89 (TP) and TP terminal of TP sensor wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in TP circuit.

7) Check TP Sensor Signal To PCM Turn ignition off. Connect PCM to breakout box. Start engine and idle for 2 minutes. While slowly opening throttle, measure voltage between test pin No. 89 (TP) and 91 (SIG RTN) at breakout box. If at any time voltage enters 0.17-0.40 volt range, replace TP sensor. If voltage does not enter 0.17-0.40 volt range, go to next step.

8) DTC P0123 This code indicates TP signal is more than self-test maximum. Possible causes for this fault are:

- TP sensor not seated correctly.
- Faulty TP sensor.
- TP circuit shorted to VREF or VPWR.
- VREF circuit shorted to VPWR.
- Open in SIG RTN circuit.
- Faulty PCM.

Turn ignition off. Disconnect TP sensor wiring harness connector. Inspect for damage and repair as necessary. Turn ignition on. Access TP PID on scan tester. If PID voltage is 0.17 volt or more, go to step 10). If PID voltage is less than 0.17 volt, go to next step.

9) Check VREF Circuit Voltage With TP sensor disconnected, turn ignition on. Measure voltage between VREF and SIG RTN terminals at TP sensor wiring harness connector. If reading is 4-6 volts, go to next step. If reading is not 4-6 volts, reconnect sensor and go to **CIRCUIT TEST C** .

10) Check TP Circuit For Short To Power Turn ignition off. Leave TP sensor disconnected. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 89 (TP) and test pins No. 71, 90 and 97 (VPWR) at breakout box. If any resistance is less than 10,000 ohms, repair TP circuit short to VREF and repeat **QUICK TEST** . If each resistance is 10,000 ohms or more, replace PCM and repeat QUICK TEST.

11) DTC P0122 This code indicates TP signal is less than self-test minimum of 0.17 volt. Possible causes for this fault are:

- TP sensor not seated correctly.
- Faulty TP sensor.
- Open TP or VREF circuit.
- TP circuit shorted to SIG RTN or PWR GND.
- Faulty PCM.

Turn ignition off. Disconnect TP sensor wiring harness connector. Inspect for damage and repair as necessary. Connect jumper wire between VREF and TP terminals at TP wiring harness connector. Turn ignition on. Access TP PID on scan tester. If PID voltage is more than 4.60 volts, replace TP sensor and

repeat **QUICK TEST** . If PID voltage is 4.60 volts or less, remove jumper wire and go to next step. If scan tester is unable to access TP PID, go to step 14).

12) Check VREF Circuit Voltage With TP sensor disconnected, turn ignition on. Measure voltage between VREF and SIG RTN terminals at TP sensor wiring harness connector. If voltage is 4-6 volts, go to next step. If voltage is not 4-6 volts, reconnect sensor and go to **CIRCUIT TEST C** .

13) Check TP Circuit Resistance Turn ignition off. Leave TP sensor disconnected. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 89 (TP) and TP terminal of TP sensor wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in TP circuit.

14) Check TP Circuit For Short To SIG RTN Or PWR GND Leave ignition off and TP sensor disconnected. Measure resistance between test pin No. 89 (TP) and test pins No. 91 (SIG RTN), 24 and 103 (PWR GND) at breakout box. If any resistance is less than 10,000 ohms, repair TP circuit short to SIG RTN or PWR GND and repeat **QUICK TEST** . If both resistances are 10,000 ohms or more, replace PCM and repeat QUICK TEST.

15) Continuous Memory Code P1121 This code indicates TP signal is inconsistent with MAF sensor signal. Possible causes for this fault are as follows:

- TP sensor not seated correctly.
- Faulty TP sensor.
- Air leak between MAF sensor and throttle body.

If engine will start, go to next step. If engine is a no-start, check for cracks or openings in air induction system between MAF sensor and throttle body. If air induction system is okay, go to **CIRCUIT TEST A** .

16) Check Operation Of TP Sensor Start engine and allow to idle. Access TP PID on scan tester. While observing TP PID, slowly move throttle through range from closed position to wide open throttle. If TP PID indicates any sudden drops to below 0.53 volt, or increases to more than 1.27 volts, replace TP sensor and repeat **QUICK TEST** . If TP PID increase and decrease is gradual and smooth, and within 0.53-1.27 volt range, go to next step.

17) Check Operation Of TP Sensor While Driving Vehicle Connect scan tester to DLC. Drive vehicle while accessing TP PID and LOAD PID. If TP PID is 2.44 volts or less and LOAD PID is more than 25 percent, go to next step. If TP PID is more than 2.44 volts and LOAD PID is less than 25 percent, check for cracks or openings in air induction system between MAF sensor and throttle body. If air induction system is okay, replace TP sensor.

18) Check TP Sensor Low With Engine Under Load Start engine and allow to idle. If engine does not start, go to **CIRCUIT TEST A** . Access TP PID and LOAD PID on scan tester. If TP PID is 0.24 volt or more and LOAD PID is less than 60 percent, fault is intermittent and cannot be located at this time. Testing is complete. If TP PID is less than 0.24 volts and LOAD PID is 60 percent or more, clear PCM memory. Perform test drive utilizing all phases of vehicle operation. Perform **QUICK TEST** . If DTC P1121 is still present, replace MAF sensor.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 18) to step 20). No test procedures have been omitted.

20) Continuous Memory Code P1120 Or P1125 Theses codes indicate TP signal went below 0.49 volt or above 4.60 volts sometime during the last 80 drive cycles. Possible causes for this fault are:

- Faulty TP sensor wiring harness or connector.
- Faulty TP sensor.

With scan tester connected, start engine and allow to idle. Raise engine speed to 1500 RPM for 5 seconds and return to idle. Using scan tester, access TP PID. While observing PID, lightly tap on TP sensor to simulate road shock. Wiggle sensor connector and wiring harness. If TP PID reading stays within normal operating range (0.49-4.60 volts), go to next step. If TP PID reading goes out of range, replace TP sensor.

21) Check Wiring Harness Between TP Sensor & PCM Turn ignition off. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Install EEC-V Breakout Box (014-00950). Connect PCM to breakout box. Connect DVOM between test pin No. 89 (TP) and 91 (SIG RTN). While observing DVOM, wiggle small sections of wiring harness starting at the TP sensor and going to the PCM. If DVOM reading stays within normal operating range (0.49-4.60 volts), problem is intermittent and cannot be identified at this time. Go to **CIRCUIT TEST Z** . If DVOM reading goes out of range, isolate fault and repair as necessary. Clear PCM memory and repeat **QUICK TEST** .

22) DTC P0121: Verify KOER Self-Test Completion Start engine and allow to idle. Using scan tester, enter KOER self test. If DTC P0121 is present or KOER cannot be terminated, go to next step. If specified symptoms are not present, problem is intermittent and cannot be identified at this time.

23) With engine idling, place gear selector in Drive or Reverse. If KOER self-test terminates, go to next step. If KOER self-test does not terminate, turn ignition off and wait for 15 seconds. Start engine and allow to idle. Enter KOER self-test. If DTC P0121 is present or KOER self-test cannot be terminated, go to next step. If specified symptoms are not present, problem is intermittent and cannot be identified at this time.

24) Check Circuit Continuity Turn ignition off. Check continuity in TP circuit between TP sensor connector and PCM connector terminal No. 89. Check continuity in SIG RTN circuit between TP sensor connector and PCM connector terminal No. 91. If continuity is present, replace TP sensor and repeat **QUICK TEST** . If continuity is not present, repair open circuit and repeat QUICK TEST.

CIRCUIT TEST DK - MISFIRE DETECTION (MD) SENSOR

Diagnostic Aids

Perform this test only when directed by QUICK TEST. This test is intended to diagnose the following:

- Wiring harness circuits (MD and SIG RTN).
- Faulty MD sensor.
- Faulty Powertrain Control Module (PCM).

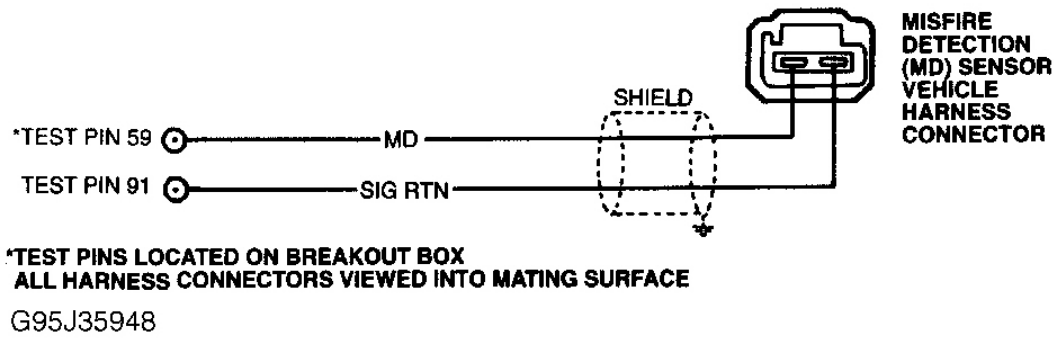


Fig. 34: MD Test Circuits & Connector Terminals

1) DTC P0385 DTC P0385 indicates that self-test has detected a MD sensor/circuit failure. Possible causes for these faults are:

- Wiring harness open (MD or SIG RTN).
- MD circuit shorted to power or ground.
- Faulty MD sensor.
- Powertrain Control Module (PCM).

If engine will start, go to next step. If engine will not start, no-start condition has caused DTC P0385. Service or repair as necessary and repeat **QUICK TEST** .

2) Check For Intermittent Circuit Fault Clear all DTCs from PCM memory. Start engine and raise speed to 1500 RPM for 10 seconds 3 times. Turn ignition off. Connect scan tester to DLC. Using scan tester, retrieve all Continuous Memory DTCs. If DTC P0385 is present, go to step 5). If DTC P0385 is not present, fault is intermittent and cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 2) to step 5). No test procedures have been omitted.

5) Check Circuit Resistance Turn ignition off. Disconnect MD wiring harness connector. Disconnect PCM 104-pin connector. Inspect connector for damaged and repair as necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance of MD circuit between wiring harness connector terminal and test pin No. 59 at breakout box. Measure resistance of SIG RTN circuit between wiring harness connector terminal and test pin No. 91 at breakout box. If either resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

6) Check MD Circuit For Short To Power Leave MD sensor and PCM disconnected. Turn ignition on. Measure voltage between test pin No. 59 (MD) and test pins No. 51 and 103 (PWR GND) at breakout box. If both voltage measurements are 1.0 volt or less, go to next step. If either voltage measurement is more than 1.0 volt, repair circuit short to power and repeat **QUICK TEST** .

7) Check MD Circuit For Short To Ground Leave MD sensor and PCM disconnected. Turn ignition

off. Measure resistance between test pin No. 59 (MD) and test pins No. 51, 103 (PWR GND) and 91 at breakout box. If each resistance measurement is 10,000 ohms or more, go to next step. If either resistance measurement is less than 10,000 ohms, repair circuit short and repeat **QUICK TEST** .

8) Check For Short In PCM Leave ignition off and MD sensor disconnected. Connect PCM to breakout box. Measure resistance between test pin No. 59 (MD) and test pins No. 23 (IGN GND), 51, 103 (PWR GND), 71 and 97 (VPWR) and 91 (SIG RTN) at breakout box. If each resistance measurement is 500 ohms or more, go to next step. If either resistance measurement is less than 500 ohms, replace PCM and repeat **QUICK TEST** .

9) Check For Short In PCM Leave ignition off and PCM disconnected. Reconnect MD sensor. Set voltmeter on AC scale. Start engine and allow to idle. With engine idling, measure voltage between test pin No. 59 (MD) and test pins No. 51 and 103 (PWR GND) at breakout box. If AC voltage varies more than 0.1 volt, replace PCM and repeat **QUICK TEST** . If AC voltage does not vary more than 0.1 volt, go to next step.

10) Check MD Sensor Trigger Wheel Turn ignition off. Inspect MD sensor trigger wheel for damage. Ensure trigger wheel is not loose or misaligned. Service or repair as necessary and repeat **QUICK TEST** . If trigger wheel is okay, replace MD sensor and repeat QUICK TEST.

CIRCUIT TEST DP - VEHICLE SPEED SENSOR (VSS)

Diagnostic Aids

Delayed engagement of transmission may be caused by mechanical malfunction. Harsh shifts and/or erratic speedometer reading may be caused by a failed speedometer or an open or intermittent ground within the instrument panel (electronic instrument cluster).

Perform this test when directed by QUICK TEST. This CIRCUIT TEST is intended to diagnose:

- Vehicle Speed Sensor (VSS).
- VSS wiring harness circuits. (VSS+ and VSS-).
- Powertrain Control Module (PCM).

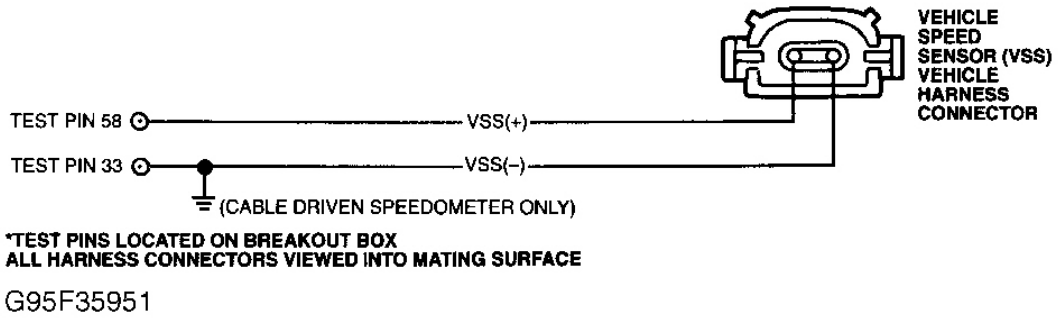


Fig. 35: VSS Circuit & Connector Terminals

1) DTC P0500 Or P0501 These codes indicate PCM detected incorrect output from VSS sometime during vehicle operation. Possible causes for this code are:

- Faulty VSS.
- Open or shorted circuit.
- Faulty PCM.

Turn ignition off. Disconnect VSS sensor. Remove PCM 104-pin connector. Inspect connector for damaged pins, corrosion and loose wires. Repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 58 and VSS(+) terminal at VSS wiring harness connector. Measure resistance between test pin No. 33 and VSS(-) terminal at VSS wiring harness connector. If resistance readings are less than 5 ohms, go to next step. If either resistance reading is 5 ohms or more, repair open circuit in VSS wiring harness. Clear PCM memory and go to step 27).

2) Check VSS Circuits For Shorts To Power Or Ground Turn ignition off. Ensure PCM and VSS are disconnected. Measure resistance as follows:

- Between test pin No. 33 and test pin No. 58 and 71 (VPWR).
- Between test pin No. 58 and test pins No. 24, 51, 76 and 103 (PWR GND).
- Between test pin No. 58 and test pins No. 71 (VPWR) and 91 (SIG RTN).

If all readings are more than 500 ohms, go to next step. If any reading is 500 ohms or less, repair short in wiring harness. Clear PCM memory and go to step 27).

3) Check VSS Resistance Turn ignition off. Disconnect VSS wiring harness connector. Measure resistance between VSS terminals. If resistance is not 190-250 ohms, replace VSS and go to step 27). If resistance is 190-250 ohms, replace PCM and go to step 27).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 3) to step 5). No test procedures have been omitted.

5) DTC P0500 This code indicates PCM detected incorrect output from VSS sometime during vehicle operation. Possible causes for this code are:

- Faulty VSS.
- Open or shorted circuit.
- Faulty PCM.

Turn ignition off. Disconnect VSS sensor. Remove PCM 104-pin connector. Inspect connector for damaged pins, corrosion and loose wires. Repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Check voltage between test pins No. 58 and 103 at breakout box while slowly rotating drive wheels. If voltage fluctuates 1.0-5.0 volts as wheels are rotated, replace PCM and go to step 27). If voltage does not fluctuate 1.0-5.0 volts, go to next step.

6) Check VPWR To VSS Turn ignition off. Disconnect VSS wiring harness connector. Turn ignition on. Measure voltage at connector as follows:

- Between VPWR and PWR GND terminals.
- Between VSS+ and VSS- terminals.

If voltage is 10.5 volts or more, go to next step. If voltage is 10.5 volts or less, go to step 10).

7) Check VSS Circuits For Short To Power Turn ignition off. Ensure PCM and VSS are disconnected. Measure voltage between test pins No. 58 and 103 at breakout box. If voltage is 1.0 volt or more, repair short to power and go to step 27). If voltage is less than 1.0 volt, go to next step.

8) Check VSS Circuits For Short To Ground Turn ignition off. Ensure PCM and VSS are disconnected. Measure resistance between test pin No. 58 and 103 at breakout box. If resistance is more than 3000 ohms, go to next step. If resistance is 3000 ohms or less, repair short to ground and go to step 27).

9) Check VSS Circuit Resistance Turn ignition off. Ensure PCM and VSS are disconnected. Measure resistance between test pin No. 58 and the VSS or VSS+ terminal at VSS wiring harness connector. If all resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and go to step 27).

10) Check VSS Ground Circuit Resistance Turn ignition off. Ensure PCM and VSS are disconnected. Measure resistance between chassis ground and PWR GND or VSS(-) terminal at VSS wiring harness connector. If resistance is less than 5 ohms, repair open in power circuit to VSS and go to step 27). If resistance is 5 ohms or more, repair open in ground circuit and go to step 27).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 10) to step 15). No test procedures have been omitted.

15) KOER DTC P1501: Check PCM VSS PID For Input Signal This code indicates VSS input signal is out of range. A DTC 1501 will be set and self-test will abort whenever PCM detects VSS input signal during KOER self-test. Possible causes for this code are:

- Noisy VSS input signal from RFI/EMI external source (ignition wires, charging circuits etc.).

Turn ignition off. Connect scan tester to DLC. Start engine and allow to idle. Using scan tester, access VSS PID and observe vehicle speed input to PCM. While observing VSS PID, increase engine speed to 2000 RPM and decrease to idle several times. If VSS PID reading is less than 3 MPH, fault cannot be duplicated at this time. Testing is complete. If VSS PID reading is 3 MPH or more, go to step 22).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 15) to step 20). No test procedures have been omitted.

20) Continuous Memory P0503: Check For Intermittent Fault This code indicates poor VSS performance. Possible causes for this code are:

- Noisy VSS input signal from RFI/EMI external source (ignition wires, charging circuits etc.).
- Damaged circuit.
- Faulty VSS.
- Faulty VSS gear(s).

Turn ignition off. Disconnect VSS sensor. Visually inspect VSS and VSS circuits for potential faults as follows:

- Loose VSS circuit connectors.
- Loose VSS circuit connector pins.
- Damaged VSS wiring harness insulation.
- Incorrect VSS circuit routing.
- Incorrect VSS installation.

If no faults are found, go to next step. If faults are found, repair or replace as necessary. Clear PCM memory and go to step 27).

21) Check PCM VSS PID For Input Signal Turn ignition off. Connect scan tester to DLC. Test drive vehicle, averaging 30 MPH. While driving at a steady speed, check for VSS PID variations of more than 5 MPH for 10 seconds or more. If any variations occur, go to next step. If variations do not occur, fault cannot be duplicated at this time. Testing is complete.

22) Visually inspect VSS wiring harness. Ensure wiring is not routed near ignition wires or alternator wires. Verify VSS wiring harness is shielded and grounded (if applicable). Repeat step 1) to verify circuit continuity. If faults are found, repair or replace as necessary. Clear PCM memory and go to step 27). If no faults are found, fault cannot be duplicated at this time. Testing is complete.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 22) to step 25). No test procedures have been omitted.

25) DTC P1500 This code indicates PCM detected intermittent input from VSS. Possible causes for this code are:

- Intermittent open or shorted circuit.
- Faulty VSS.
- Faulty PCM.

Turn ignition off. Disconnect VSS sensor. Visually inspect VSS and VSS circuits for potential faults as follows:

- Loose VSS circuit connectors.
- Loose VSS circuit connector pins.
- Damaged VSS wiring harness insulation.
- Incorrect VSS circuit routing.
- Incorrect VSS installation.

If no faults are found, go to **CIRCUIT TEST Z** . If faults are found, repair or replace as necessary. Clear PCM memory and go to step 27).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips

from step 25) to step 27). No test procedures have been omitted.

27) VSS Drive Cycle Record and clear continuous memory codes. Warm engine to normal operating temperature. Perform appropriate drive cycle as follows:

- On models with A/T, place gear selector in Drive position. Accelerate hard to 35 MPH and coast down to a stop. Repeat procedure 3 times. Shut off engine. Repeat **QUICK TEST** . Service codes as necessary. If no codes are present, testing is complete.
- On models with M/T, start in first gear, shifting no higher than second gear. Accelerate moderately to 40 MPH. Coast down to idle, and stop. Repeat procedure 3 times. Shut engine off. Repeat **QUICK TEST** . Service codes as necessary. If no codes are present, testing is complete.

CIRCUIT TEST DR - CYLINDER IDENTIFICATION (CID) CIRCUIT

Diagnostic Aids

CID signal provides PCM information for fuel injector synchronization. The CID signal originates from Camshaft Position (CMP) sensor.

Enter this CIRCUIT TEST only when instructed during QUICK TEST. This test is only intended to diagnose the following:

- CID, PWR GND, SIG RTN and VPWR wiring harness circuits.
- Faulty Camshaft Position (CMP) sensor.
- Faulty Powertrain Control Module (PCM).

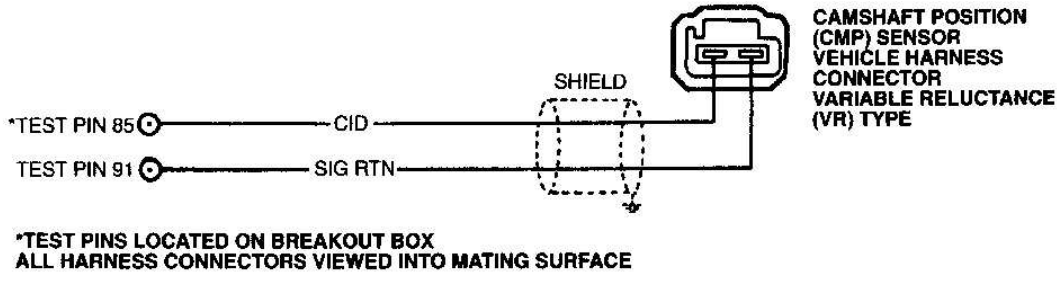


Fig. 36: CMP Test Circuit & Connector Terminals (2-Terminal Applications)

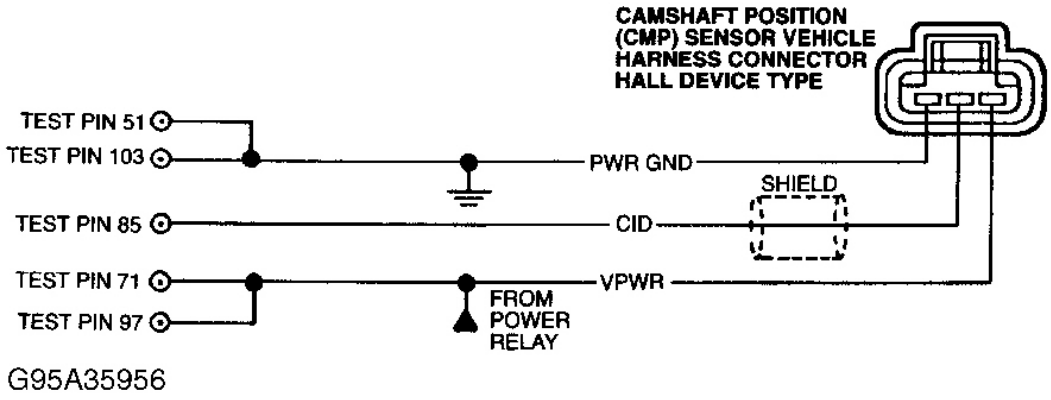


Fig. 37: CMP Test Circuit & Connector Terminals (3-Terminal Applications)

1) DTC P0340 This code indicates error has been detected in CMP sensor circuit. Possible causes for this fault are:

- CID circuit open or shorted wiring harness.
- PWR GND or VPWR circuit open (Hall Type CMP).
- SIG RTN circuit open (Variable Reluctance Type CMP).
- Faulty CMP sensor.
- Faulty ICM.
- Faulty PCM.

If engine starts, go to step 2). If engine does not start, go to **CIRCUIT TEST A** .

2) Attempt To Generate DTC P0340 Clear PCM memory. Start engine. Raise engine speed to 1500 RPM for 10 seconds. Return to idle speed. Raise speed to 1500 RPM for 10 seconds again. Turn ignition off. Perform QUICK-TEST to retrieve Continuous Memory DTCs. If DTC P0340 is not present, go to **CIRCUIT TEST Z** . If DTC P0340 is present, go to next step for Hall Type CMP or step 5) for Variable Reluctance Type CMP.

3) Check VPWR Circuit Voltage Turn ignition off. Disconnect CMP wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal at CMP sensor wiring harness connector and negative battery terminal. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VREF circuit. Clear PCM memory and repeat **QUICK TEST** .

4) Check PWR GND To CMP Sensor Turn ignition off. Ensure CMP sensor is disconnected. Measure resistance between PWR GND circuit at CMP sensor wiring harness connector and negative battery terminal. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in PWR GND circuit. Clear PCM and repeat **QUICK TEST** .

5) Check Resistance Of CID Circuits Leave ignition off. Disconnect PCM 104-pin connector. Inspect for damaged terminals and repair if necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 85 (CID) at breakout box and CID terminal at

CMP sensor wiring harness connector. Also measure resistance between test pin No. 91 (SIG RTN) and SIG RTN terminal at CMP sensor wiring harness connector.

If each resistance measurement is less than 5 ohms, go to next step. If either resistance is 5 ohms or more, repair open circuit. Clear PCM memory and repeat **QUICK TEST** .

6) Check CID Circuit For Short To Power Leave CMP sensor disconnected. Turn ignition on. Measure voltage between test pin No. 85 and test pins No. 51 and 103 (PWR GND) at breakout box. If voltage is less 1.0 volt, go to next step. If voltage is 1.0 volt or more, repair CID circuit short to power. Clear PCM memory and repeat **QUICK TEST** .

7) Check CID Circuit For Short To Ground Turn ignition off. Leave CMP sensor and PCM disconnected. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No. 85 and test pins No. 51, 103 (PWR GND) and 91 (SIG RTN) at breakout box. If resistance is 10,000 or more, go to next step. If any resistance measurement is less than 10,000 ohms, repair short to ground or SIG RTN in CID circuit. Clear PCM memory and repeat **QUICK TEST** .

8) Check For Short In PCM Leave ignition off and CMP sensor disconnected. Connect PCM to breakout box. Measure resistance between test pin No. 85 and test pins No. 23, 51, 71, 91, 97 and 103 at breakout box. If each resistance measurement is 500 ohms or more, go to next step for Variable Reluctance type CMP or step 10) for Hall type CMP. If any resistance measurement is less than 500 ohms, replace PCM and repeat **QUICK TEST** .

9) Check CMP Sensor Output Turn ignition off. Reconnect CMP sensor wiring harness connector. Set DVOM on AC scale to monitor less than 5 volts. Start engine. Measure voltage between test pins No. 85 and test pins No. 51 and 103 while varying engine speed. If voltage varies more than 0.1 volt, replace PCM and repeat **QUICK TEST** . If voltage does not vary more than 0.1 volt, replace CMP sensor and repeat QUICK TEST.

10) Check CMP Sensor Output Turn ignition off. Disconnect PCM. Ensure CMP sensor is installed properly. Reconnect CMP sensor wiring harness connector. Using starter, bump engine (do not allow engine to start) for at least 10 engine revolutions. Measure voltage between test pins No. 85 and test pins No. 51 and 103. If voltage switches from below 2 volts to more than 8 volts, replace PCM and repeat **QUICK TEST** . If voltage does not switch as specified, replace CMP sensor and repeat QUICK TEST.

CIRCUIT TEST FB - POWER TAKE OFF (PTO)

Diagnostic Aids

Perform this test when directed by QUICK TEST. This CIRCUIT TEST is intended to diagnose:

- PTO wiring harness circuit.
- Powertrain Control Module (PCM).

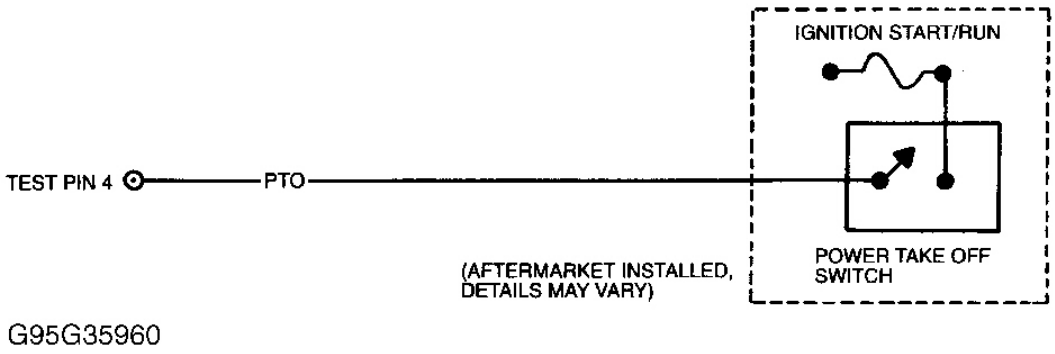


Fig. 38: PT0 Test Circuit & Switch Schematic

1) Check PTO Switch For Short To Power PTO signals PCM that additional load is being applied to engine. If PTO circuit failure occurs, a fault code may be set. Possible causes for this code are:

- PTO circuit shorted to power.
- Faulty Powertrain Control Module (PCM).

Turn ignition off. Disconnect PTO switch wiring harness connector. Connect scan tester to DLC. Turn ignition on. Access PTO STAT PID. If PTO STAT PID is on, go to next step. If PTO STAT PID is off, repair or replace switch as necessary. Road test vehicle and repeat **QUICK TEST** .

2) Check PTO Circuit For Short To Power Leave ignition off and PTO switch disconnected. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Measure voltage test pin No. 4 and test pins No. 51 and 103 at breakout box. If voltage is less than one volt, replace PCM and repeat **QUICK TEST** . If voltage is one volt or more, repair circuit short to power and repeat QUICK TEST.

3) MIL On: Check PTO PID Turn ignition off. Connect scan tester to DLC. Turn ignition on. Access PTO STAT PID. If PTO STAT PID is available and displaying on or off, go to next step. If PTO STAT PID is not as specified, go to step 9).

4) Check PTO Circuit With Scan Tester With ignition on and PTO STAT PID accessed, cycle PTO switch. If PTO STAT PID cycles on, delays, and then cycles off, PTO input is okay and testing is complete. If PTO STAT PID does not cycle as specified, go to next step.

5) Check PTO Circuit For Short To Ground Turn ignition off. Leave PTO switch disconnected. Disconnect scan tester from DLC. Measure resistance between chassis ground and PTO circuit terminal at PTO switch connector. If resistance is 10,000 ohms or less, go to next step. If resistance is more than 10,000 ohms, go to step 7).

6) Isolate Short To Chassis Ground Leave ignition off and PTO sensor disconnected. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 4 (PTO) and test pins No. 77 and 103 at breakout box. If resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10,000 ohms or less, repair PTO circuit short to chassis ground and repeat QUICK

TEST.

7) Leave ignition off and PTO sensor disconnected. Connect scan tester to DLC. Connect jumper wire between positive battery terminal and PTO terminal at PTO switch wiring harness connector. Turn ignition on. Access PTO STAT PID. If PTO STAT PID is on, PTO input is okay and testing is complete. Check switch for malfunction and repair as necessary. If PTO STAT PID is off, go to next step.

8) Check Circuit Resistance Leave ignition off and PTO sensor disconnected. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 4 (PTO) and PTO circuit terminal at PTO switch connector. If resistance is less than 5 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open in PTO circuit and repeat QUICK TEST.

9) Perform KOEO and KOER self-test. If any DTCs are present, repair as necessary. If no DTCs are present, go to next step.

10) Road test vehicle under various conditions. Retrieve all Continuous Memory DTCs and service as necessary. If no DTCs are present, fault cannot be duplicated at this time. If symptom is still present, go to **CIRCUIT TEST Z** .

CIRCUIT TEST FD - BRAKE ON-OFF (BOO) SWITCH

Diagnostic Aids

Perform this test when directed by QUICK TEST. This test is intended to diagnose a faulty BOO switch, circuit or PCM. To prevent replacement of good components, be aware following non-EEC related areas may be at fault:

- Brakelight bulb.
- Brakelight switch or brakelight fuse.

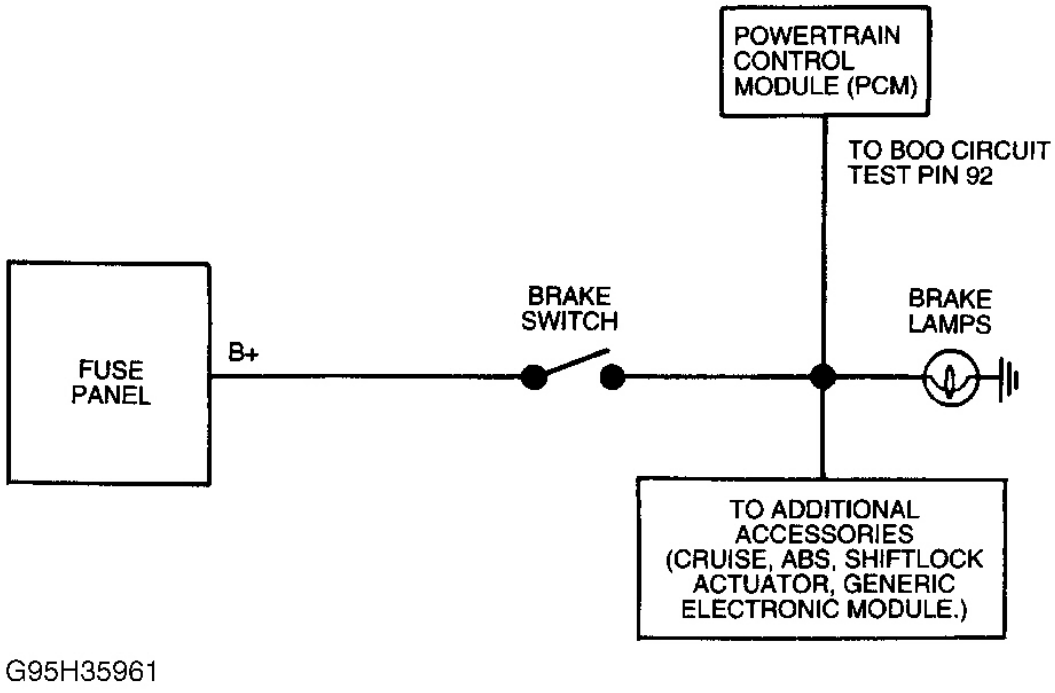


Fig. 39: BOO Switch Circuit

1) DTC P1703: Verify Brake Pedal Was Depressed This code indicates that when brake pedal is applied during KOER SELF-TEST, BOO signal did not cycle high and low. Possible causes for this fault are as follows:

- Brake pedal not applied during self-test.
- Brake pedal applied during entire self-test.
- Open brakelight circuit.
- Short to ground or power.
- Faulty brakelight switch.
- Faulty Powertrain Control Module (PCM).

If brake was not applied during KOER SELF-TEST, repeat test. Depress and release brake pedal only once during test. If pedal was depressed, go to next step.

2) DTC P1703 This code indicates that voltage was present at BOO circuit during **KOEO SELF-TEST** . Possible causes for this fault are as follows:

- Brake pedal applied during KOEO SELF-TEST.
- BOO circuit short to power.
- Faulty brakelight switch.

If brake was applied during **KOEO SELF-TEST** , repeat test. If pedal was not depressed, go to next step.

3) Check Operation Of Brakelights With ignition on, check operation of brakelights. If brakelights operate normally, go to next step. If brakelights do not operate, go to step 5). If brakelights are always on, go to step 7).

4) Check For BOO PID Cycling Turn ignition off. Connect scan tester to DLC. Using scan tester, access BOO PID. Apply and release brake several times while observing BOO PID. If BOO PID voltage does not cycle on and off, go to step 10). If BOO PID voltage cycles, go to step 10) under **CIRCUIT TEST Z** .

5) Check For Power To Brakelight Switch Ensure related fuses and brakelight bulbs are in good condition. Turn ignition off. Disconnect brakelight switch (located on brake pedal). Measure voltage between B+ input to brakelight switch and ground. If voltage is more than 10 volts, go to next step. If voltage is less than 10 volts, repair open in B+ circuit to brakelight switch and repeat **QUICK TEST** .

6) Check Brakelight Switch With brakelight switch disconnected, measure resistance between switch terminals. If resistance is 5 ohms or more, replace brakelight switch and repeat **QUICK TEST** . If resistance is less than 5 ohms, repair open circuit between switch and stoplight ground and repeat QUICK TEST.

7) Verify Brake Switch Is Not Always Closed Turn ignition off. Disconnect brakelight switch (located on brake pedal). Turn ignition on. If brakelights are still on, go to next step. If brakelights are not on, verify correct installation of brakelight switch. If installation is okay, replace brakelight switch and repeat **QUICK TEST** .

8) Check For Short To Power In PCM Turn ignition off. Disconnect PCM. Turn ignition on. Check brakelights. If brakelights are on, go to next step. If brakelights are off, replace PCM and repeat **QUICK TEST** .

9) Check For Short To Power In Shift Lock Actuator Turn ignition off. Ensure PCM and brakelight switch are disconnected. Disconnect shift lock actuator, cruise control module, ABS module and Generic Electronic Module (if equipped). Turn ignition on. If brakelights are still on, repair short to power in BOO circuit and repeat **QUICK TEST** . If brakelights are off, repair short circuit in shift lock actuator circuit, cruise control system circuit or ABS circuit. Reconnect all components and repeat QUICK TEST.

10) Check For BOO PID Cycling Turn ignition off. Disconnect PCM 104-pin connector. Inspect connector for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Using DVOM, measure voltage between test pin No. 92 and test pins No. 51 and 77 while applying and releasing brake. If voltage cycles on and off, replace PCM and repeat **QUICK TEST** . If voltage does not cycle, repair open in BOO circuit between PCM and BOO circuit connection splice to B+ circuit.

CIRCUIT TEST FE - ELECTRICAL LOAD INPUTS

Diagnostic Aids

Electrical load inputs are used for idle speed control strategy so correct idle can be maintained regardless of electrical demands on engine. PCM uses blower motor, headlights, rear window defroster, and daytime running lights (if equipped) to determine electrical load status.

Perform this test when directed by QUICK TEST, CIRCUIT TEST S or if directed by other test procedures.

This CIRCUIT TEST is intended to diagnose:

- Blower (BLR) motor input circuit.
- Daytime Running Lights (DRL) input circuit.
- Headlight (HDL) input circuit.
- Rear window Defroster (DEF) input circuit.
- Powertrain Control Module (PCM).

SWITCH CIRCUIT LOGIC

Application	Switch Position	Voltage
Blower Motor	1 Or 2	10-17
	3 Or 4	Less Than 1.5
Daytime Running Lights	Off	10-17
	On	Less Than 1.5
Headlights	Off	Less Than 1.5
	On	10-17
Rear Window Defroster	Off	10-17
	On	Less Than 3.0

1) Isolate Faulty System If idle speed fault occurs when blower motor is on, go to step 10). If idle speed fault occurs when daytime running lights are on, go to step 20). If idle speed fault occurs when headlights are on, go to step 30). If idle speed fault occurs when rear window defroster is on, go to step 40).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 1) to step 10). No test procedures have been omitted.

10) Check Blower Motor Switch (Low Speed) Turn ignition and all accessories off. Remove PCM 104-pin connector. Inspect connector for damaged pins, corrosion and loose wires. Repair as necessary. Install EEC-IV Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Turn climate control motor switch to low-speed position "1" or "2". Measure voltage between chassis ground and test pin No. 10 at breakout box. If voltage is not 10-17 volts, go to step 13). If voltage is 10-17 volts, go to next step.

11) Check Blower Motor Switch (High Speed) Turn ignition and all accessories off. Turn climate control motor switch to high-speed position "3" or "4". Turn ignition on. Measure voltage between chassis ground and test pin No. 10 at breakout box. If voltage is less than 1.5 volts, replace PCM and confirm idle speed fault has been corrected. If voltage is 1.5 volts or more, go to next step.

12) Check Blower Circuit For Short To Power Turn ignition off. Disconnect high speed blower motor relay connector. Relay is located behind right side of instrument panel on blower assembly. Measure resistance between test pin No. 10 and test pins No. 71 and 91 at breakout box. If all readings are more than 10,000 ohms, check for damaged blower motor switch or relay. If any reading is 10,000 ohms or less, repair short circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected.

13) Check Blower Circuit Resistance Turn ignition off. Disconnect blower motor relay. Measure resistance between BLR terminal at power distribution box and test pin No. 10 at breakout box. If

resistance is 5 ohms or more, repair open circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected. If resistance is less than 5 ohms, go to next step.

14) Check Blower Circuit For Short To Ground Turn ignition off. Disconnect high speed blower motor relay. Measure resistance between test pin No. 10 and test pins No. 23, 76 and 91 at breakout box. If all readings are more than 10,000 ohms, check for damaged blower motor switch or relay. If any reading is 10,000 ohms or less, repair short circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 14) to step 20). No test procedures have been omitted.

20) Check DRL Circuit Voltage (Headlights On) Turn ignition off. Disconnect PCM 60-pin connector. Inspect connector for damaged pins, corrosion and loose wires. Repair as necessary. Install EEC-IV Breakout Box (014-000950), leaving PCM disconnected. Apply parking brake. Turn ignition on. Turn headlights on. Turn accessories off. Measure voltage between chassis ground and test pin No. 14 at breakout box. If voltage is not 10-17 volts, go to step 23). If voltage is 10-17 volts, go to next step.

21) Check DRL Circuit Voltage (Headlights Off) Turn headlights off. Release parking brake. Turn ignition on. Measure voltage between chassis ground and test pin No. 14 at breakout box. If voltage is less than 1.5 volts, replace PCM. Remove breakout box and confirm idle speed fault has been corrected. If voltage is 1.5 volts or more, go to next step.

22) Check DRL Circuit For Short To Power Turn ignition off. Ensure PCM is disconnected. Disconnect daytime running lights relay. Measure resistance between test pin No. 14 and test pins No. 71 and 97 at breakout box. If all readings are more than 10,000 ohms, check daytime running lights module for malfunction. If any reading is 10,000 ohms or less, repair short circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected.

23) Check DRL Circuit Resistance Turn ignition off. Disconnect daytime running lights relay. Measure resistance between DRL circuit terminal at DRL wiring harness connector and test pin No. 14 at breakout box. If resistance is 5 ohms or more, repair open circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected. If resistance is less than 5 ohms, go to next step.

24) Check DRL Circuit For Short To Ground Turn ignition off. Measure resistance between test pin No. 14 and test pins No. 23, 76 and 91 at breakout box. If all readings are more than 10,000 ohms, check daytime running lights module for malfunction. If any reading is 10,000 ohms or less, repair short circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 24) to step 30). No test procedures have been omitted.

30) Check Headlight Circuit Voltage (Headlights Off) Turn ignition off. Remove PCM 60-pin connector. Inspect connector for damaged pins, corrosion and loose wires. Repair as necessary. Install EEC-IV Breakout Box (014-000950), leaving PCM disconnected. Turn all accessories off. Turn ignition on. Measure voltage between chassis ground and test pin No. 49 at breakout box. If voltage is 1.5 volts or more, go to step 34). If voltage is less than 1.5 volts, go to next step.

31) Check Headlight Circuit Voltage (Headlights On) Turn all accessories off. Turn ignition on. Turn headlights on. Measure voltage between chassis ground and test pin No. 49 at breakout box. If voltage is 10-17 volts, replace PCM. Remove breakout box and confirm idle speed fault has been corrected. If

voltage is not 10-17 volts, go to next step.

32) Check HDL Circuit Resistance Turn ignition off. Disconnect headlight relay. Relay is located in engine compartment relay box. Measure resistance between HDL circuit terminal at power distribution box and test pin No. 49 at breakout box. If resistance is 5 ohms or more, repair open circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected. If resistance is less than 5 ohms, go to next step.

33) Check HDL Circuit For Short To Ground Turn ignition off. Disconnect headlight relay. Measure resistance between test pin No. 49 and test pins No. 23, 76 and 91 at breakout box. If all readings are more than 10,000 ohms, check headlight switch for malfunction. If any reading is 10,000 ohms or less, repair short circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected.

34) Check HDL Circuit For Short To Power Turn ignition off. Disconnect headlight relay. Measure resistance between test pin No. 49 and test pins No. 71 and 97 at breakout box. If all readings are more than 10,000 ohms, check headlight switch for malfunction. If any reading is 10,000 ohms or less, repair short circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 34) to step 40). No test procedures have been omitted.

40) Check Rear Window Defroster Turn ignition off. Disconnect rear window defroster coil connector. Turn ignition on. Using DVOM, measure voltage between coil connector and defroster coil. If voltage is 10-127 volts when defroster on and less than one volt with defroster off, go to next step. If voltage is not as specified, repair rear window defroster.

41) Check DEF Circuit Voltage (Defrost Off) Turn ignition off. Turn all accessories off. Remove PCM 104-pin connector. Inspect connector for damaged pins, corrosion and loose wires. Repair as necessary. Install EEC-IV Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between chassis ground and test pin No. 66 at breakout box. If voltage is 10-17 volts, go to next step. If voltage is not 10-17 volts, go to step 44).

42) Check DEF Circuit Voltage (Defrost On) Turn ignition on. Turn rear window defroster on. Measure voltage between chassis ground and test pin No. 66 at breakout box. If voltage is less than 3 volts, replace PCM. Remove breakout box and confirm idle speed fault has been corrected. If voltage is 3 volts or more, go to next step.

43) Check DEF Circuit For Short To Power Turn ignition off. Disconnect rear window defroster relay. Relay is located in left side of trunk. Measure resistance between test pin No. 66 and test pins No. 71 and 97 at breakout box. If all readings are more than 10,000 ohms, check DEF switch or relay for malfunction. If any reading is 10,000 ohms or less, repair short circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected.

44) Check DEF Circuit Resistance Leave ignition off and rear window defroster switch disconnected. Measure resistance between DEF circuit terminal at power distribution box connector and test pin No. 23 at breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected.

44) Check DEF Circuit For Short To Ground Leave ignition off and rear window defroster switch disconnected. Measure resistance between test pin No. 66 and test pins No. 23, 76 and 91 at breakout box.

If all readings are more than 10,000 ohms, check DEF switch and relay circuit for malfunction. If any reading is 10,000 ohms or less, repair short circuit. Remove breakout box, reconnect all components, and confirm idle speed fault has been corrected.

CIRCUIT TEST FF - POWER STEERING PRESSURE (PSP) SWITCH

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. Some vehicles may not have power steering, but PCM may be equipped with PSP switch software strategy. If a KOEO DTC P1650 or P1651 is displayed, check if vehicle is equipped with power steering. If vehicle is not equipped with power steering, disregard DTC P1650 or P1651. This test is only intended to diagnose:

- Wiring harness circuits (SIG RTN and PSP).
- PSP switch.
- Powertrain Control Module (PCM).

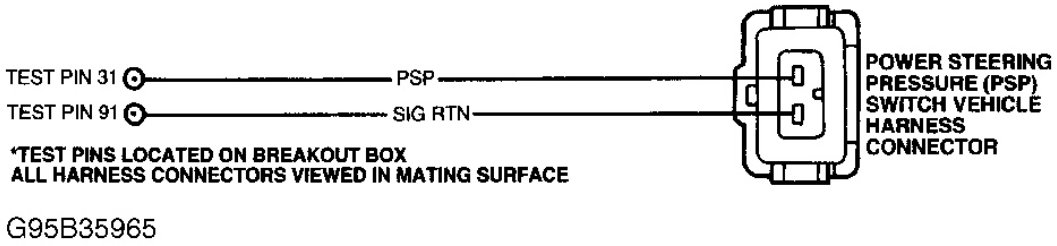


Fig. 40: PSP Test Circuit & Connector Terminals

1) DTC P1650 Or P1651 DTC P1650 indicates PSP signal is out of self-test range. DTC P1651 indicates PSP signal malfunction. Possible causes for this fault are as follows:

- Open or short in wiring harness.
- Faulty PSP switch.
- Faulty PSP switch/shorting bar damage.
- Faulty Powertrain Control Module (PCM).

Start engine and allow to idle. Using scan tester, access PSP PID (if scan tester cannot access PSP PID, go to next step). Turn steering wheel left, then right. If scan tester does not indicate on/off switching, go to step 3). If scan tester indicates on/off switching, go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 1) to step 3). No test procedures have been omitted.

3) Check PSP Switch Operation Turn ignition off. Install tachometer. Start engine and allow to idle.

Disconnect PSP switch. Connect jumper wire between PSP terminal and SIG RTN terminal of connector. If engine speed increases when switch is disconnected, replace switch and repeat **QUICK TEST** . If engine speed does not increase when switch is disconnected, go to next step.

4) Check PSP Circuit Resistance Turn ignition off. Leave PSP switch disconnected. Turn ignition off. Disconnect 104-pin PCM connector. Inspect connector for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 31 (PSP) at breakout box and PSP terminal of PSP switch connector. Measure resistance between test pin No. 91 (SIG RTN) at breakout box and SIG RTN terminal of PSP switch connector. If both resistance measurement are less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

5) Check For Short In PSP Circuit Leave ignition off and PSP switch disconnected. Measure resistance between test pin No. 31 (PSP) and 91 at breakout box. Measure resistance between test pin No. 31 and chassis ground. If both resistance measurements are 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, repair short circuit and repeat **QUICK TEST** .

6) Check Switch Resistance Turn ignition off. Start engine and allow to idle. Disconnect PSP switch. Measure resistance between PSP switch signal and chassis ground while turning steering wheel. If resistance is less than 10 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10 ohms or more, replace PSP switch and repeat QUICK TEST.

CIRCUIT TEST FG - OCTANE ADJUST

Diagnostic Aids

Enter this test when directed by QUICK TEST. This test is only intended to diagnose:

- Harness circuits (SIG RTN and OCT ADJ).
- Octane adjust shorting bar connector.

Purpose of Octane Adjust Shorting Bar is to provide optimum spark advance for fuel used. If engine detonates (spark knock), remove Octane Shorting Bar. This retards spark advance about 3-4 degrees. If engine continues to detonate, use fuel with a higher octane rating.

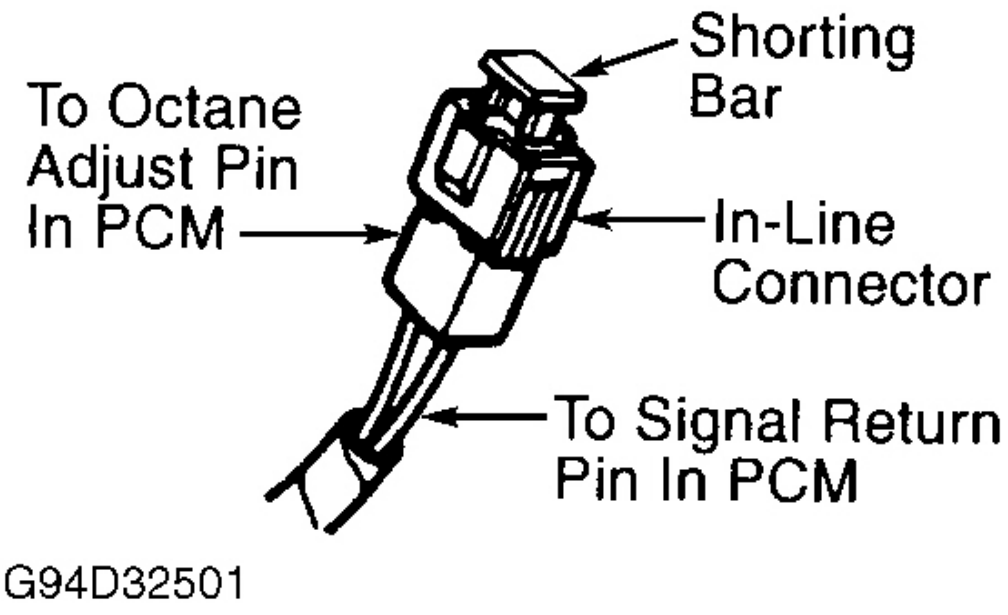


Fig. 41: Octane Adjust Components

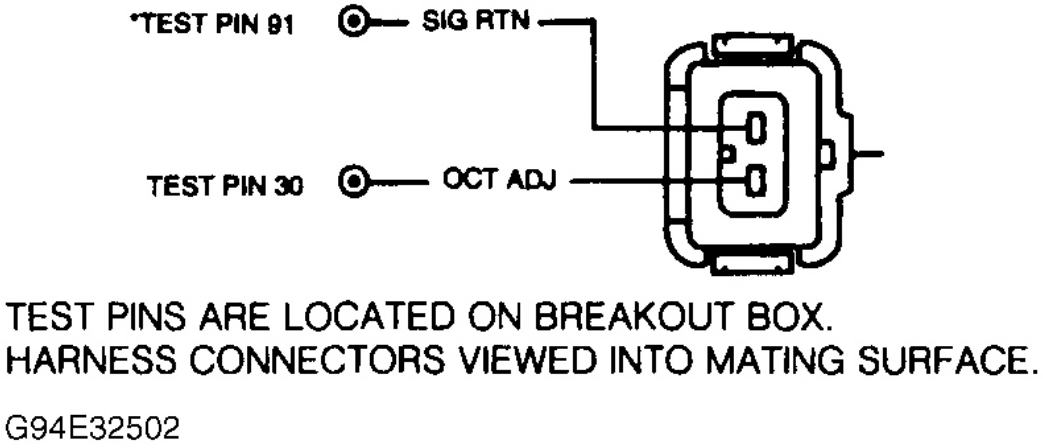


Fig. 42: Octane Adjust Circuit

1) DTC P1390 This code indicates Octane Adjust (OCT ADJ) shorting bar is not in place or OCT ADJ

circuit is open. Turn ignition off. Inspect Octane Adjust in-line connector. If shorting bar has been removed, go to next step. If shorting bar is in place, go to step 4).

2) Check For Modification Decal If vehicle has modification decal indicating OCT ADJ shorting bar was removed as a factory authorized procedure, testing is complete. If engine is detonating, go to **TESTS W/O CODES - 4.2L** article. If vehicle does not have modification decal, go to next step.

3) Check For DTC P1390 Replace OCT ADJ shorting bar. Perform **KOEO SELF-TEST** . If DTC P1390 is present, go to next step. If DTC P1390 is not present, testing is complete. If there are no codes and driveability faults are present, go to **TESTS W/O CODES - 4.2L** article.

4) Check Octane Adjust Circuit Resistance Continuity should exist from OCT ADJ circuit, through in-line connector and shorting bar, to SIG RTN circuit. Turn ignition off. Disconnect 104-pin PCM connector. Inspect connector for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 30 (OCT ADJ) and 91 (SIG RTN) at breakout box. If resistance is less than 5 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open OCT ADJ circuit, shorting bar or SIG RTN circuit. Repeat QUICK TEST.

5) Check For DTC P1390 Start engine. Warm it to normal operating temperature. Turn ignition off. Perform **KOEO SELF-TEST** . If DTC P1390 is not present, go to next step. If DTC P1390 is present, return to step 1).

6) Verify In-Line Shorting Bar Is Installed Turn ignition off. Inspect OCT ADJ in-line connector. If shorting bar is installed, go to step 8). If shorting bar is not installed, go to next step.

7) Check For Modification Decal If vehicle has modification decal indicating OCT ADJ shorting bar was removed as a factory authorized procedure, go to step 10). If vehicle does not have a modification decal, replace shorting bar. If engine is detonating, go to **TESTS W/O CODES - 4.2L** article.

8) Check For Technical Service Bulletin (TSB) If a TSB authorizing removal of OCT ADJ shorting bar exists, go to next step. If authorizing TSB does not exist, testing is complete. If engine is detonating, go to **TESTS W/O CODES - 4.2L** article.

9) Remove OCT ADJ Shorting Bar Turn ignition off. Remove OCT ADJ shorting bar. Test drive vehicle to verify complaint. If detonation is present, go to next step. If detonation is not present, testing is complete.

10) Check Octane Adjust Circuit For Short To Ground Turn ignition off. Disconnect 104-pin PCM connector. Inspect connector for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between OCT ADJ terminal at in-line connector and test pins No. 51, 91 and 103 at breakout box. If each resistance is more than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, repair short circuit. If engine is still detonating, go to **TESTS W/O CODES - 4.2L** article.

11) Check PCM Turn ignition off. Disconnect OCT ADJ shorting bar. Connect PCM to breakout box. Turn ignition on. Measure voltage between breakout box OCT ADJ terminal of in-line connector and test pins No. 51 and 103. If voltage is less than 4 volts, replace PCM. If voltage is 4 volts or more, remove breakout box. If engine is still detonating, go to **TESTS W/O CODES - 4.2L** article.

CIRCUIT TEST H - FUEL CONTROL

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. Only use this test

to diagnose the following:

- HO2S and sensor connection.
- Vacuum systems.
- Fuel injector and/or fuel injector circuitry.
- Powertrain Control Module (PCM).
- Electrical circuits (HO2S, HO2S GND, INJ 1-8, VPWR and SIG RTN).

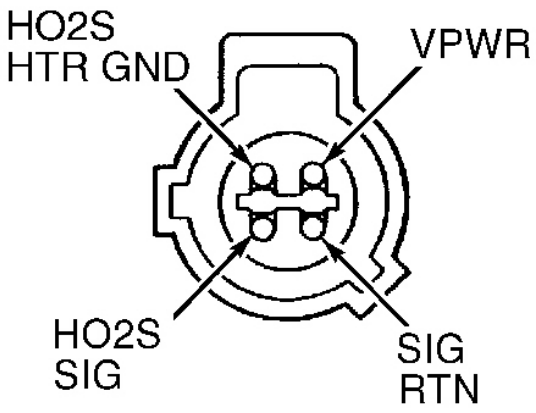
NOTE: HO2S may be displayed on scan tester as 02S.

To prevent replacement of good components, be aware the following non-EEC areas may be cause of driveability concerns:

- Ignition system.
- Faulty evaporative emission system.
- EGR and/or PCV system.
- Air intake system.
- Engine oil contamination.
- Fuel system.
- Exhaust system leaks or restriction.
- Engine cooling system.

CIRCUIT TEST ACRONYMS

Acronym	Definition
DLC	Data Link Connector
HO2S	Heated Oxygen Sensor
PID	Parameter Identification



NOTE: Location of the small index tabs may differ from illustration. Use large index tabs as your reference. Some connectors may not have small index tabs.

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Fig. 43: HO2S Connector Terminals

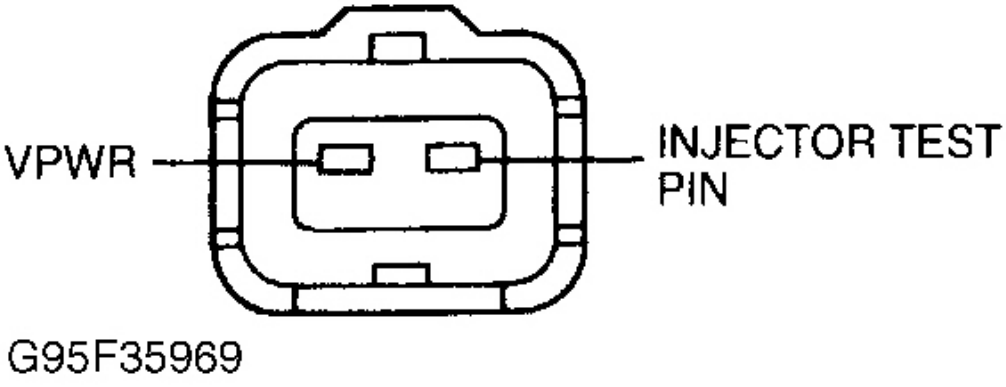

Fig. 44: Fuel Injector Connector Terminals

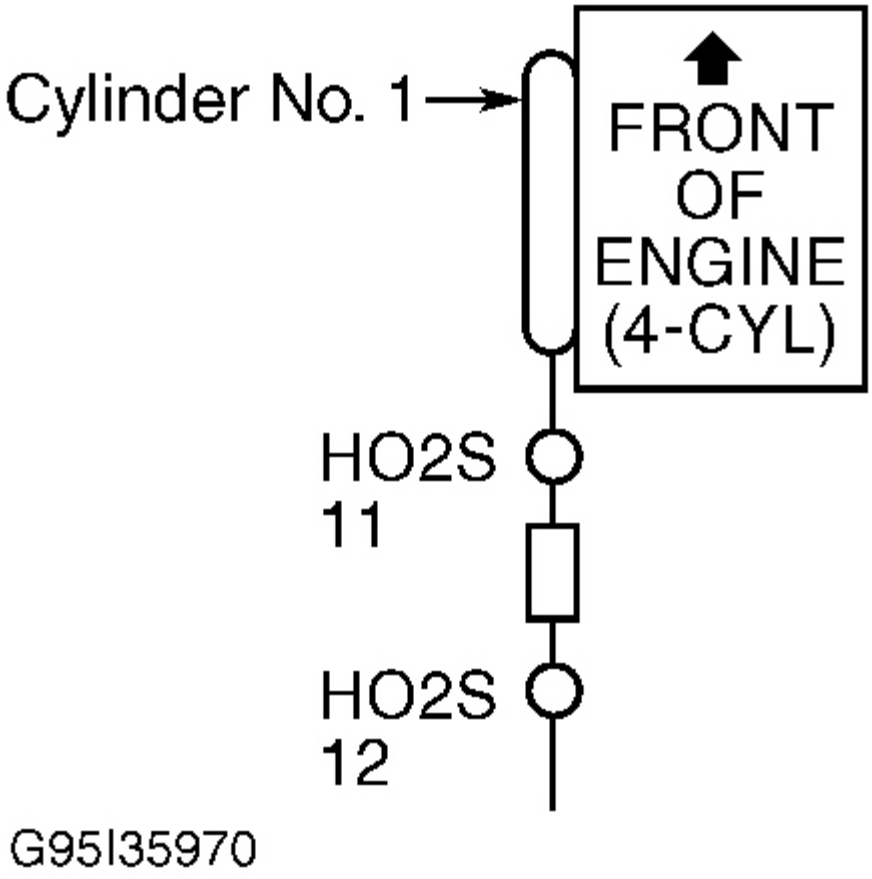

Fig. 45: Locating HO2S (4-Cylinder)

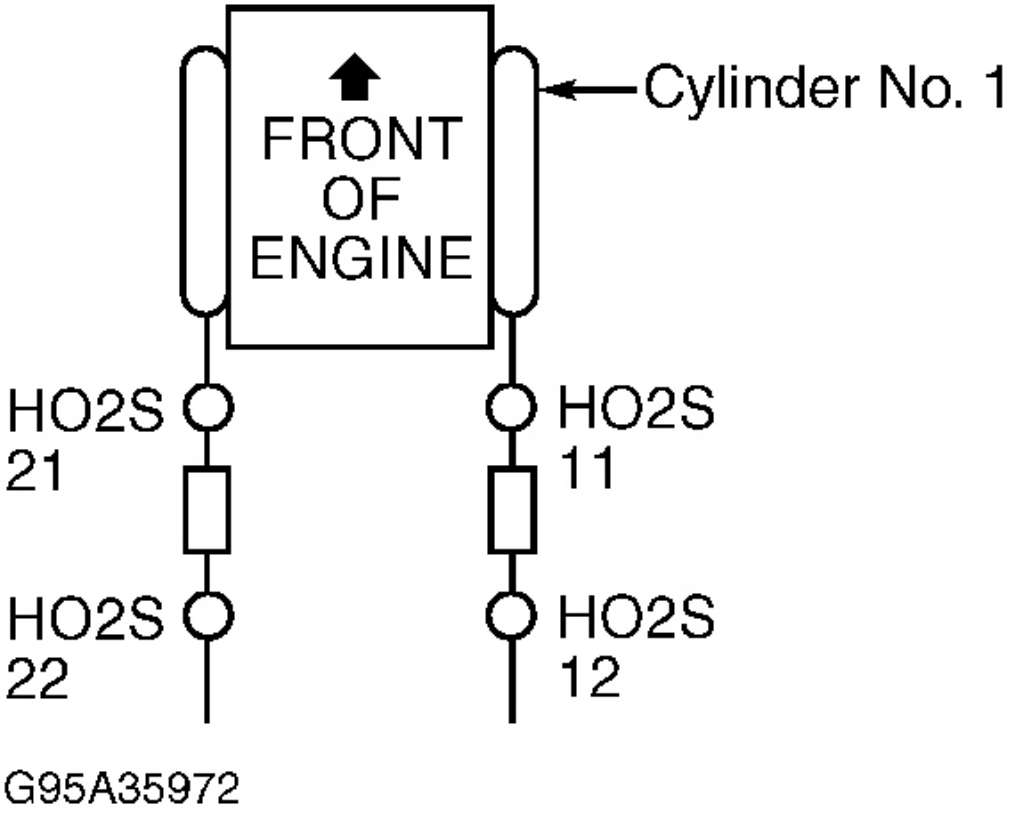

Fig. 46: Locating HO2S (V8 Or V6 With Dual Exhaust)

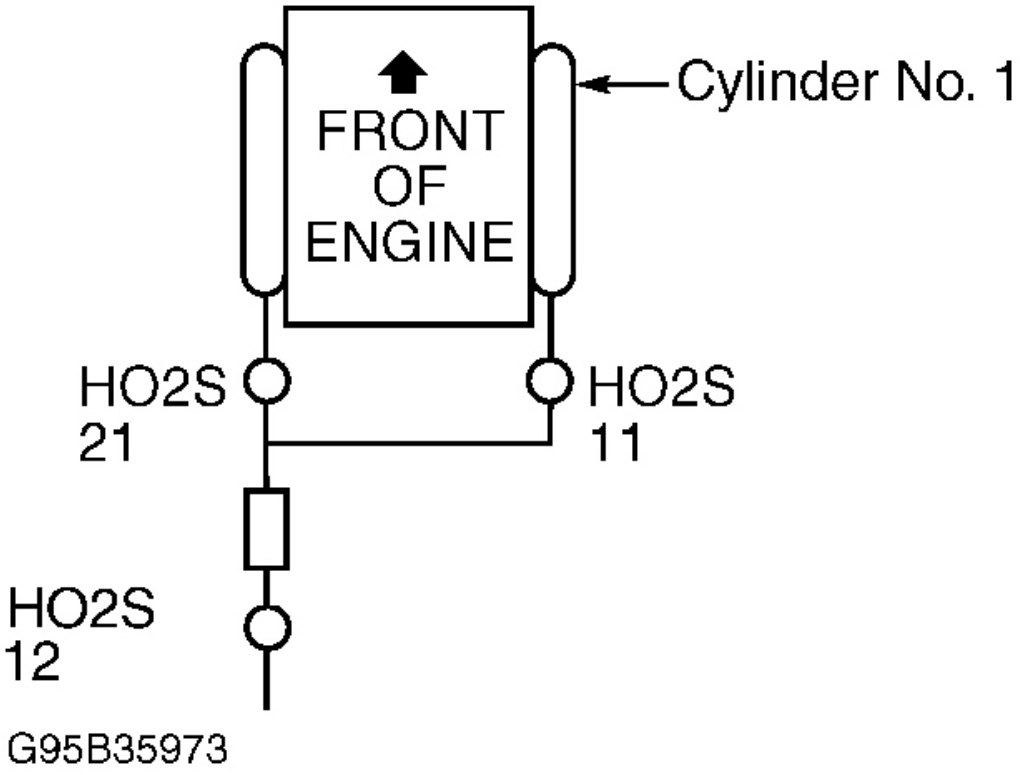

Fig. 47: Locating HO2S (V8 Or V6 With Single Exhaust)

HO2S TEST PIN IDENTIFICATION(1)

HO2S Pin No.	HO2S SIG	HO2S HTR
11	60	93
12	35	95
21	87	94
22	61	96

(1) On all models, SIG RTN is test pin No. 91. VPWR is test pin No. 71 and 97.

NOTE: Test procedure begins with step 20). No test procedures have been omitted.

20) Perform KOER Self-Test If DTC P1127, P1128 or P1129 are present, service before proceeding. If specified DTCs are not present, go to next step.

21) DTC P0133 & P0153 This code indicates that response rate is below calibration in HO2S as follows:

- DTC P0133 for right front (or front, except V8) HO2S.

- DTC P0153 for left front (or rear, except V8) HO2S.

Possible causes are as follows:

- Open or shorted circuit.
- Exhaust leak.
- Excessive fueling.
- HO2S coated with contaminants.
- Faulty MAF sensor.
- Leak in air induction system.

With scan tester connected, turn ignition on. Access Generic OBD-II functions and enter. Select Diagnostic Monitoring Test Results and enter. Scroll to Test ID: 01 and enter. Press Start. If measured value is 614 or more, fault cannot be duplicated or identified at this time and testing is complete. If measurement fault is less than 614, go to next step.

22) Check For HO2S Contamination Check following possibilities as potential source of contamination:

- Use of unapproved silicon sealers.
- Use of unapproved cleaners.
- Fuel contaminated by silicon additives.
- Fuel contaminated by lead.
- Excessive oil burning.
- Antifreeze leaking internally.

If any of these conditions are present, repair or replace as necessary. Replace HO2S. Change oil, filter and repeat **QUICK TEST** . If none of these conditions are present, go to next step.

23) Check For Unmetered Air Leaks Vacuum or air leaks in non-EEC-V areas could cause fault code to set. Check the following as potential source of air leak:

- Leaking vacuum hoses.
- Leaking intake manifold gasket.
- EGR system.
- PCV system.
- Poorly seated oil dip stick and/or dipstick tube.

If any of these conditions are present, repair or replace as necessary. Perform drive cycle and repeat **QUICK TEST** . If none of these conditions are present, go to next step.

24) Check HO2S Circuits Turn ignition off. Disconnect PCM and suspect HO2S wiring harness connector. Inspect connectors for damage and repair as necessary. Connect jumper wire between HO2S SIG and VPWR at sensor wiring harness connector. With scan tester connected to DLC, turn ignition on.

Access HO2S PID. If PID voltage is less than 1.5 volts, go to next step. If PID voltage is 1.5 volts or more, replace HO2S and change engine oil. Test drive vehicle and repeat **QUICK TEST** .

25) Check HO2S Signal Circuit Resistance Turn ignition off. Disconnect PCM 104-pin connector. Inspect connector for damage and repair if necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between suspect HO2S test pin at breakout box and HO2S terminal at wiring harness connector. Measure resistance between suspect SIG RTN test pin at breakout box and SIG RTN terminal at wiring harness connector. If either resistance is 5 ohms or more, repair open circuit. Drive vehicle at 55 MPH for 5 minutes and repeat **QUICK TEST** . If each resistance is less than 5 ohms, go to next step.

26) Check HO2S For Short Circuit Ensure ignition is off and PCM is disconnected. Disconnect scan tester from DLC. Measure resistance between suspect HO2S test pin and test pins No. 71 and 97 (VPWR) at breakout box. Measure resistance between suspect HO2S test pin and test pin No. 91 (SIG RTN) at breakout box. If either resistance is less than 10,000 ohms, repair short circuit. Drive vehicle for 5 miles at 55 MPH and repeat **QUICK TEST** . If each resistance is 10,000 ohms or more, replace PCM.

27) DTC P0131 & P0151: Contaminated HO2S/Voltage Shift These DTCs are set when HO2S generates negative voltage. Possible causes are as follows:

- Crossed HO2S SIG / SIG RTN circuit.
- HO2S contaminated with water, fuel, etc.

Check for moisture in HO2S connector and repair if necessary. If connector is okay, go to next step.

28) Check HO2S For Short Circuit Ensure ignition is off. Disconnect suspect HO2S. Disconnect PCM 104-pin connector. Inspect connectors for damage and repair if necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between suspect sensor HO2S SIGNAL and SIG RTN terminal and test pins indicated as follows:

- DTC P0131, test pin No. 60.
- DTC P0151, test pin No. 87.

If resistance is less than 5 ohms, replace HO2S and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair circuit and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 28) to step 30). No test procedures have been omitted.

30) DTC P0135, P0141, P0155 Or P0161: Check HO2S Heater Signal Circuit DTCs P0135, P0141, P0155 and P0161 received separately indicate a short to ground or open in HO2S heater circuit. DTCs received in pairs, such as P0135 and P0155 or P0141 and P0161, indicate HO2S heater signal circuit shorted to a power source greater than 2.0 volts.

DTCs received in pairs with one downstream heater code and one upstream heater code are treated as the following separate codes.

- DTC P0135 for right front HO2S.
- DTC P0155 for left front HO2S.

- DTC P0141 for right rear HO2S.
- DTC P0161 for left rear HO2S.

Possible causes are as follows:

- Signal shorted in wiring harness or HO2S.
- Water in connectors.
- Cut or pulled wires.
- Open in PWR GND or VPWR circuit.

Inspect HO2S connectors for damage or poor connection. Repair or replace connectors as necessary. If HO2S connectors are okay, go to next step.

31) Perform KOEO SELF-TEST Start engine and operate at 2000 RPM for 5 minutes. Turn ignition off. Perform KOEO SELF-TEST. If DTC P0135, P0141, P0155 or P0161 are present, go to next step. If specified DTCs are not present, go to **CIRCUIT TEST Z** .

32) Check For Voltage At HO2S Heater Wiring Harness Connector Turn ignition off. Disconnect suspect HO2S. Inspect wiring harness for damage and repair as necessary. Turn ignition on. Measure voltage between SIG RTN and VPWR terminal at HO2S wiring harness connector. If voltage is 10.5 volts or less, go to next step. If voltage is more than 10.5 volts, go to step 34).

33) Turn ignition off. With suspect sensor disconnected, measure resistance between VPWR terminal at HO2S wiring harness connector and test pins No. 71 and 97 at breakout box. If resistance is less than 4 ohms, go to next step. If resistance is 4 ohms or more, check circuit fuse. If fuse is okay, repair open circuit and repeat **QUICK TEST** .

34) Check HO2S Heater Resistance Turn ignition off. With suspect sensor disconnected, measure resistance between HO2S HEATER GND terminal and VPWR terminal at HO2S wiring harness connector. If resistance is 3-30 ohms, go to next step. If resistance is not 3-30 ohms, replace HO2S sensor and repeat **QUICK TEST** .

35) Leave ignition off and suspect sensor disconnected. Measure resistance between HO2S HEATER GND terminal at HO2S wiring harness connector and HO2S case. Measure resistance between HO2S HEATER GND terminal and SIG RTN terminal at HO2S wiring harness connector. Measure resistance between VPWR terminal at HO2S wiring harness connector and HO2S case. If each resistance measurement is more than 10,000 ohms, go to next step. If any resistance is 10,000 ohms or less, replace HO2S and repeat **QUICK TEST** .

36) Check For Short Circuit Leave ignition off and sensor disconnected. Disconnect scan tester from DLC (if applicable). Disconnect PCM 104-pin connector. Inspect connector for damage and repair if necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between suspect sensor and test pins indicated as follows:

- DTC P0135 (RF), test pin No. 93 and test pins No. 24, 91, 97 and 103.
- DTC P0141 (RR), test pin No. 95 and test pins No. 24, 91, 97 and 103.
- DTC P0155 (LR), test pin No. 94 and test pins No. 24, 91, 97 and 103.
- DTC P0161 (LR), test pin No. 96 and test pins No. 24, 91, 97 and 103.

If resistance is more than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, repair short in circuit and repeat **QUICK TEST** .

37) Leave ignition off and sensor disconnected. Measure resistance between HO2S HEATER GND terminal at HO2S wiring harness connector and appropriate test pin as follows:

- Right front (or front) HO2S sensor; test pin No. 93.
- Left front HO2S sensor; test pin No. 94.
- Right rear (or rear) HO2S sensor; test pin No. 95.
- Left rear HO2S sensor; test pin No. 96.

If resistance is 4 ohms or more, repair open circuit or excessive resistance in wiring harness and repeat **QUICK TEST** . If resistance is less than 4 ohms, replace PCM and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 37) to step 40). No test procedures have been omitted.

40) DTC P1130, P1150, P1131, P1151, P1132 Or P1152: HO2S Not Switching DTCs P1131 and P1151 indicate air/fuel ratio is correcting rich for an overly lean condition. DTCs P1132 and P1152 indicate air/fuel ratio is correcting lean for an overly rich condition.

DTCs P1130 and P1150 indicate fuel system has reached maximum compensation and HO2S is not switching at the adaptive limits.

Possible causes are as follows:

- Fuel system malfunction.
- EGR system malfunction.
- Air intake or vacuum system leak.
- Engine oil level too high.
- Excessive internal engine wear.

Inspect engine for obvious defects in specified systems. Repair or replace as necessary. If no faults are found, go to next step.

41) DTC P0171, P0172, P0174 Or P0175: HO2S Not Switching DTCs P0171 and P0174 indicate air/fuel ratio is correcting rich for an overly lean condition. DTCs P0172 and P0175 indicate air/fuel ratio is correcting lean for an overly rich condition.

Possible causes are as follows:

- Fuel system malfunction.
- EGR system malfunction.
- Air intake or vacuum system leak.

- Engine oil level too high.
- Excessive internal engine wear.

Inspect engine for obvious defects in specified systems. Repair or replace as necessary. If no faults are found, go to next step.

42) Perform KOER Self-Test With ignition off, connect scan tester to DLC. Disconnect fuel vapor hose from intake manifold. Plug fitting at intake manifold. Start engine, and operate at 2000 RPM for one minute. Perform KOER self-test and proceed as follows:

- If DTCs P1127, P1128 or P1129 are present, go to appropriate CIRCUIT TEST.
- If DTCs P0131 or P0151 are present in continuous memory, go to step 27).
- If DTCs P1131, P1130 or P1151, P1150 are present, go to step **43)** .
- If DTCs P1130, P1132 or P1150, P1152 are present, go to step **49)** .

If none of these DTCs are present, proceed as follows:

- If diagnosing DTCs P1130, P1150, P1171, P1172, P1174 or P1175, go to step 52).
- If diagnosing DTCs P1132 or P1152, go to **CIRCUIT TEST HW** , step 13).
- If diagnosing any other DTCs, go to **CIRCUIT TEST Z** .

43) Disconnect suspect HO2S. Turn ignition on. Using scan tool, access HO2S PID of suspect sensor. Connect jumper wire between HO2S SIG and VPWR circuit at HO2S harness connector. If spark occurs, remove jumper wire and go to step 47). If HO2S voltage is more than 1.3 volts, go to next step. If voltage is 1.3 volts or less, go to step 46).

44) Check Circuit Resistance Turn ignition off. Connect PCM to breakout box. Measure resistance between battery ground terminal and SIG RTN terminal of HO2S harness connector. If resistance is less than 5 ohms, go to step 52). If resistance is 5 ohms or more, go to next step.

45) Turn ignition off. Disconnect PCM from breakout box. Measure resistance between test pin No. 91 (SIG RTN) at breakout box and SIG RTN terminal of HO2S harness connector. If resistance is less than 5 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open circuit and repeat QUICK TEST.

46) Check Resistance Of HO2S Ground Circuits Turn ignition off. Install breakout box, leaving PCM disconnected. Disconnect suspect HO2S wiring harness connector. Inspect connector for damage and repair as necessary. Measure resistance between HO2S test pin at breakout box and HO2S terminal at sensor wiring harness connector. If resistance is less than 5 ohms, go to next step. If any resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

47) Check HO2S Circuit For Short To Ground Turn ignition off. Leave breakout box installed and PCM disconnected. Disconnect HO2S. Measure resistance between HO2S SIG circuit test pin and test pins No. 24, 51, 77, 91 and 103 at breakout box. If all readings are 10,000 ohms or more, go to next step. If any reading is less than 10,000 ohms, repair short circuit and repeat **QUICK TEST** .

48) Check HO2S For Short To Ground Ensure ignition is off and PCM is disconnected. Reconnect HO2S to wiring harness connector. Measure resistance between HO2S SIG RTN test pin and test pin No. 91 at breakout box. If resistance measurement is less than 10,000 ohms, replace HO2S and repeat **QUICK TEST** . If resistance is 10,000 ohms or more, replace PCM.

49) Check HO2S PID Leave ignition off and HO2S disconnected. Turn ignition on. Using scan tool, access HO2S PID of suspect sensor. If HO2S PID voltage is more than 0.2 volts, go to next step. If HO2S voltage is 0.2 volts or less, go to step 51).

50) Check For Short To Power Turn ignition off. Disconnect scan tester from DLC (if applicable). Disconnect PCM 104-pin connector. Inspect connector for damaged pins, corrosion and loose wires. Repair wiring as necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Leave suspect HO2S disconnected. Measure resistance between HO2S terminal of wiring harness connector and following test pins at breakout box:

- DTC P01130 and P01132; test pin No. 60 and test pins No. 71, 93 and 97.
- DTC P01150 and P01152; test pin No. 87 and test pins No. 71, 94 and 97.

If each resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If any resistance is 10,000 ohms or less, repair short to power and repeat QUICK TEST.

51) Turn ignition off. Disconnect suspect HO2S. Turn ignition on. Using scan tool, access HO2S PID of suspect sensor. If HO2S voltage is more than 0.45 volts, replace HO2S and repeat **QUICK TEST** . If voltage is 0.45 volts or less, go to next step.

52) Check Fuel Pressure Release fuel system pressure. With ignition off, install fuel pressure gauge. Ensure manifold vacuum is connected to fuel pressure regulator. Start engine and operate at 2500 RPM. If vehicle will not start, cycle key on and off. For fuel pressure specifications, see **FUEL PRESSURE SPECIFICATIONS** article. If fuel system pressure is as specified, go to next step. If fuel system pressure is not as specified, go to **CIRCUIT TEST HC** .

53) Check System Ability To Hold Fuel Pressure With fuel pressure gauge installed, cycle ignition from OFF to ON position 3-4 times to pressurize fuel system (DO NOT start engine). If fuel pressure does not remain at specification for 60 seconds, go to step 4) under **CIRCUIT TEST HC** . If fuel pressure remains within 5 psi of highest fuel pressure reading for 60 seconds, proceed as follows:

- For no-start vehicles, go to step 55).
- For DTCs P1130, P01150, P0171, P0172, P0174 and P0175, go to step 54).
- For HO2S DTCs displayed with misfire DTCs, go to step 56).
- For all other DTCs, go to step 60).

54) Check Ability To Hold Fuel Pressure With fuel pressure gauge installed, cycle ignition from OFF to ON position 3-4 times to pressurize fuel system (DO NOT start engine). Note fuel pressure. If fuel pressure remains within 5 psi of original pressure for at least 10 seconds, go to step 56). If fuel pressure drops more than 5 psi, go to step 58).

55) Check Ability Of Injectors To Deliver Fuel With fuel pressure gauge installed, cycle ignition from OFF to ON position 3-4 times to pressurize fuel system (DO NOT start engine). Note fuel pressure. Disconnect Inertia Fuel Switch (IFS). Crank engine for 5 seconds. If fuel pressure remains within 5 psi (34 kPa) of original pressure, reconnect IFS switch and go to next step. If fuel pressure drops more than 5 psi (34 kPa), repair fuel system as necessary. See FUEL SYSTEM in **SYSTEM/COMPONENT TESTS - 4.2L** article.

56) Check Fuel Injector & Circuit Resistance Turn ignition off. Disconnect PCM 104-pin connector. Inspect connector for damage or corrosion and repair as necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure and record resistance between suspected fuel injector circuit test pin and test pin No. 71 and 97 at breakout box. Refer to FUEL INJECTOR INJ CIRCUIT

IDENTIFICATION table. Resistance should be 11-18 ohms. If resistance is not correct, go to next step. If resistance is correct, go to step 59).

FUEL INJECTOR INJ CIRCUIT IDENTIFICATION

Injector No.	Test Pin No.
1	75
2	101
3	74
4	100
5 (1)	73
6 (1)	99
7 (1)	72
8 (1)	98
9 (1)	68
10 (1)	42
(1) If equipped.	

57) Check Resistance Of Fuel Injector Circuit Turn ignition off. Disconnect suspect fuel injector wiring harness connector. Measure resistance between test pins No. 71 and 97 at breakout box and fuel injector VPWR terminal at wiring harness connector. Measure resistance between fuel injector signal test pin(s) at breakout box and same fuel injector circuit terminal at each fuel injector wiring harness connector. If each resistance is less than 5 ohms, go to next step. If each resistance is 5 ohms or more, repair open circuit. and repeat **QUICK TEST** .

58) Check Fuel Injector Circuit For Short To Power Or Ground Turn ignition off. Disconnect suspect fuel injector wiring harness connector. Measure resistance between fuel injector test pin and test pins No. 24, 71, 97 and 103 at breakout box. Also, measure resistance between fuel injector test pin(s) at breakout box and chassis ground. If each resistance is 10,000 ohms or more, go to next step. If any resistance is less than 10,000 ohms, repair short circuit and repeat **QUICK TEST** .

59) Check Fuel Injector Drive Signal With ignition off, connect PCM to breakout box. Connect non-powered 12-volt test light between suspect fuel injector and test pins No. 71 and 97. Crank or start engine. If test light glows dimly, go to next step. If test light does not glow dimly (no light/bright light), replace PCM and repeat **QUICK TEST** .

60) Check Fuel Injector Flow & Leakage Turn ignition off. Remove breakout box. Reconnect PCM. Use Rotunda Injector Tester (113-00001) to flow test fuel injectors. If fuel injector flow or leakage rate is not okay, replace fuel injector, and repeat **QUICK TEST** . If flow rate for each fuel injector is okay, proceed as follows:

- For DTCs P1131 and P1151, go to next step.
- For DTCs P0171, P0174, P1130, and P1150, go to step 62).
- For DTCs P1132 and P1152, go to step 65).
- For DTCs P1172 and P1175, go to **CIRCUIT TEST Z** .

61) Check Secondary Air Injection If vehicle is not equipped with secondary air injection, go to next

step. Turn ignition off. Disconnect secondary air injection hoses. Plug air injection ports. With engine at operating temperature, perform KOER self-test. If DTC P1131 or P01151 are present, reconnect hose and go to next step. If specified DTCs are not present, go to step 7) under **CIRCUIT TEST HM** .

62) Check air induction system for leaks or restrictions. Check PCV system for leaks or restrictions. Check vacuum hoses for damage and tight connection. Repair or replace as necessary. If no faults are found, go to next step.

63) Check Cylinder Compression Using compression gauge, check cylinder compression. If cylinder compression is not okay, repair engine as necessary. Clear PCM memory and repeat **QUICK TEST** . If compression is okay, go to next step (DTCs P1130, P1150, P1131 and P1151) or step 65) (DTCs P1132 and P1152). If misfire DTCs are displayed with fuel control DTCs, go to **CIRCUIT TEST HD** , step 20).

64) Check HO2S Integrity DTCs P0130, P0150, P0131, and P0151 indicate HO2S switches slow or doesn't switch, is always lean or fuel is at adaptive limit. Possible causes are as follows:

- Moisture inside HO2S causing short to ground.
- HO2S coated with contaminates.
- HO2S circuit open or shorted to ground.

Turn ignition off. Inspect HO2S and circuit for damage or contamination. Repair or replace HO2S or wiring as necessary. Start engine and operate at 2000 RPM for 3 minutes. Turn ignition off. Connect scan tool to DLC. Perform KOER self-test while monitoring HO2S voltage. If HO2S voltage is 0.5 volt or more at the end of test, go to step 70). If voltage is less than 0.5 volt, replace HO2S sensor and repeat **QUICK TEST** .

65) Perform KOER Self-Test Start engine, and warm it to normal operating temperature. Turn ignition off. Disconnect suspect HO2S. Using a jumper wire, connect HO2S terminal of wiring harness connector to negative battery terminal. Perform KOER self-test. If DTC P1131 or P1151 is present, remove jumper wire and go to next step. If DTC P1131 or P1151 is not present, check PCM connector and service if necessary. If connector is okay, replace PCM. Repeat **QUICK TEST** .

66) HO2S Check Leave HO2S disconnected. Connect DVOM between HO2S SIG terminal and SIG RTN terminal of HO2S wiring harness connector. Disconnect any vacuum hose from vacuum tree. Start engine and operate at 2000 RPM. If DVOM reads less than 0.4 volt within 30 seconds, go to step 70). If DVOM does not read as specified, replace HO2S and repeat **QUICK TEST** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 66) to step 70). No test procedures have been omitted.

70) Monitor HO2S PID Connect scan tester to DLC. Start engine and allow to idle. Using scan tester, access HO2S PID. Observe HO2S PID while shaking and bending wiring harness between HO2S and PCM. If HO2S voltage stays at 0.45 volt, go to next step. If HO2S voltage is more than 0.45 volt or less than 0.45 volt, isolate fault and repair as necessary.

71) Monitor HO2S PID During Test Drive Leave scan tester connected to DLC. Using an assistant, test drive vehicle under various conditions while observing HO2S PID. If HO2S voltage switches from about 0.4 to 0.6 volt, system is okay and testing is complete. If voltage does not switch, replace HO2S and repeat **QUICK TEST** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 71) to step 80). No test procedures have been omitted.

80) DTC P0136, P1137, P1138, P0156, P1157 & P1158 DTCs P0136 and P0156 indicate that output voltage of downstream HO2S is not within a functional window. If DTC P0136/P0156 is present, go to next step. If DTC P0136/P0156 is not present, go to step 82).

KOER DTCs P1137, P1138, P1157 and P0158 indicate fuel control malfunction monitored as voltage change downstream HO2S. Possible causes are as follows:

- Damaged wiring harness or connector.
- Exhaust system leaks.
- Contaminated or defective HO2S.

Inspect for faults. Repair or replace as necessary. If no faults are found, go to next step.

81) Perform KOER Self-Test Start engine, and operate at 2000 RPM for 3 minutes. With scan tester connected, perform KOER self-test. If DTCs P1137 P1138, P1157 or P1158 are present, go to next step. If specified DTCs are not present, fault is intermittent. Go to **CIRCUIT TEST Z** .

82) Check Exhaust System Leaks in exhaust system can cause DTCs P0136 and P0156. Possible causes are as follows:

- Incorrect HO2S torque.
- Exhaust system leaks.

Inspect entire exhaust system including catalyst and HO2S. Repair or replace as necessary. Clear PCM memory and repeat **QUICK TEST** . If not faults are present, go to next step.

83) Check HO2S Circuit For Short Circuit Leave ignition off and suspect HO2S disconnected. Disconnect scan tester from DLC. Disconnect PCM 104-pin connector. Inspect connector for damaged pins, corrosion and loose wires. Repair circuit as necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between HO2S test pin and test pins No. 24, 71, 90 (VREF), 91 (SIG RTN), 97 (VPWR), and 103 (PWR GND) at breakout box. Measure resistance between HO2S test pin and VPWR test pin at breakout box. If resistance is more than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, repair short circuit in wiring harness. Clear PCM memory. Drive vehicle for 5 miles and repeat **QUICK TEST** .

84) Check Ground Circuit Resistance Leave ignition off and suspect HO2S disconnected. Measure resistance between HO2S SIG test pin at breakout box and HO2S SIG terminal at wiring harness connector. Measure resistance between SIG RTN test pin at breakout box and SIG RTN terminal at wiring harness connector. If resistance is 5 ohms or more, repair open circuit in wiring harness and repeat **QUICK TEST** . If resistance is less than 5 ohms, go to next step.

85) Check HO2S Circuit Turn ignition off. Connect scan tester to DLC. Ensure suspect HO2S and PCM are connected. Turn ignition on. Access HO2S PID of suspect sensor. If voltage reading is 1.5 or more, go to step 88). If voltage is less than 1.5 volts, go to next step.

86) Check Circuit Resistance Turn ignition off. Connect PCM to breakout box. Measure resistance between PWR GND test pin and SIG RTN test pin at breakout box. If resistance is less than 5 ohms, go to

next step. If resistance is 5 ohms or more, replace PCM and repeat **QUICK TEST** .

87) Check HO2S PID Leave ignition off and HO2S disconnected. Using jumper wire, connect VPWR and HO2S signal terminal of wiring harness connector. Turn ignition on. Using scan tool, access HO2S PID of suspect sensor. If HO2S PID voltage is more than 1.5 volts, replace HO2S. Clear PCM memory. Drive vehicle for 5 miles and repeat **QUICK TEST** . If HO2S PID voltage is 1.5 volts or less, replace PCM. Clear PCM memory. Drive vehicle for 5 miles and repeat QUICK TEST.

88) Check PCM Voltage Leave suspect HO2S disconnected. Turn ignition on. Measure voltage between SIG RTN terminal at HO2S wiring harness connector and negative battery terminal. Measure voltage between HO2S SIG terminal at wiring harness connector and negative battery terminal. If voltage is 1.5 volts or more, replace PCM and repeat **QUICK TEST** . If voltage is less than 1.5 volts, replace HO2S and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 88) to step 100). No test procedures have been omitted.

100) KOER DTC P0127 DTC P0127 indicates that HO2S heater was not on during KOER self-test and testing of HO2S did not occur. Possible cause is cool exhaust system. Connect scan tester to DLC. Using scan tester, access all HO2S HEATER. If all PIDs indicate ON, repeat **QUICK TEST** . If any PIDs are off, operate engine until all PIDs are on; repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 100) to step 110). No test procedures have been omitted.

110) Check For Crossed HO2S Circuit Turn ignition off. Disconnect suspect HO2S. Inspect connector for indication of crossed wires or incorrect installation. Repair or replace if necessary and repeat KOER self-test. If no faults are found, go to next step.

111) Leave ignition off and suspect HO2S disconnected. Disconnect PCM 104-pin connector. Inspect connector for damaged pins, corrosion and loose wires. Repair circuit as necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between suspect circuit terminal at wiring harness connector and corresponding test pin at breakout box. If resistance is less than 5 ohms, fault is intermittent and cannot be duplicated at this time. Repeat **QUICK TEST** to verify DTC is present. If resistance is 5 ohms or more, repair circuit. Clear PCM memory. Drive vehicle for 5 miles and repeat QUICK TEST.

CIRCUIT TEST HC - FUEL DELIVERY SYSTEM

Diagnostic Aids

Perform this test when directed by QUICK TEST or if directed by other test procedures. This test is used to diagnose:

- Fuel pressure.
- Fuel filter.
- Fuel return.
- Fuel supply.

- Fuel injector.
- Engine vacuum systems.
- Chassis components.

WARNING: Fuel system remains under high pressure even when engine is not running. To avoid injury, release fuel pressure before disconnecting any fuel system hose or component.

CIRCUIT TEST ACRONYMS

Acronym	Definition
DLC	Data Link Connector
PID	Parameter Identification

1) Check System Integrity Turn ignition off. Inspect fuel system for leaks, damage or kinked hoses. Inspect wiring harness for damage or loose connectors. Ensure battery is fully charged and fuses are okay. Ensure fuel filter has been serviced in the previous 1000 miles. If vehicle does not start, ensure vehicle has fuel in tank and inertia switch is set correctly. Repair or replace as necessary. If no faults are found, go to next step.

2) Check Fuel Pressure Release fuel system pressure. Turn ignition off. Install fuel pressure gauge. Connect scan tester to DLC. Turn ignition on. Access scan tester Output Test Mode. Operate fuel pump at maximum fuel pressure for 8 seconds. For fuel pressure specifications, see **FUEL PRESSURE SPECIFICATIONS** article. If fuel pressure is as specified, go to next step. If fuel pressure is more than specified, go to step 8). If fuel pressure is less than specified, go to step 11).

3) Check System Ability To Hold Fuel Pressure With fuel pressure gauge installed, turn ignition off. Exit Output Test Mode. If fuel pressure remains within 5 psi of specification for 60 seconds, go to step 5). If fuel pressure does not remain within 5 psi of specification for 60 seconds, go to next step.

4) Check Pressure Regulator Diaphragm With fuel pressure gauge installed, start engine and operate for 10 seconds. Turn ignition off and wait 10 seconds. Start engine again and operate for 10 seconds. Turn ignition off. Disconnect and inspect hose from fuel pressure regulator. If hose is wet with fuel, replace fuel pressure regulator. If hose is dry, go to step 10).

5) Check Fuel Pressure; Test Drive Vehicle With fuel pressure gauge installed, disconnect and plug fuel pressure regulator hose. Ensure fuel pressure gauge can be seen by vehicle operator. Drive vehicle while noting gauge reading during heavy acceleration. If gauge reading stays within 3 psi of original pressure reading, go to next step. If gauge reading does not stay within 3 psi of original pressure reading, go to step 11).

6) Check Fuel Pressure Regulator; Test Drive Vehicle With fuel pressure gauge installed, reconnect fuel pressure regulator hose. Install vacuum gauge to intake manifold. Ensure both gauges can be seen by vehicle operator. Drive vehicle while noting gauges during heavy acceleration. Gauge readings should be as follows:

- Fuel pressure gauge reading increases and vacuum gauge reading decreases.
- Fuel pressure gauge reading decreases and vacuum gauge reading increases.

If gauge readings are correct, fuel system is okay and testing is complete. If gauge readings are not correct, go to next step.

7) Check Vacuum Supply Turn ignition off. Disconnect and plug fuel pressure regulator hose. Install vacuum pump to fuel pressure regulator. Start engine and operate at idle. Observe fuel pressure gauge while applying vacuum to regulator. If fuel pressure changes as vacuum changes, repair restriction in vacuum system. If fuel pressure does not change as vacuum changes, replace fuel pressure regulator.

8) Check Fuel Pressure Regulator Leave ignition off and scan tester connected to DLC. Release fuel system pressure. Disconnect fuel hose at fuel rail. Connect hose to fuel rail and put opposite end of hose in clean, one quart container. Turn ignition on. Enter Output Test Mode (OTM) to turn fuel pump on. Note fuel pressure and fuel returning to container. For fuel pressure specifications, see **FUEL PRESSURE SPECIFICATIONS** article. Exit OTM to turn fuel pump off. If fuel pressure is as specified with fuel returning to container, go to next step. If fuel pressure is not as specified with fuel returning to container, replace fuel pressure regulator. If fuel pressure is zero, go to step 12).

9) Check Fuel Pressure & Return Release fuel system pressure. Turn ignition off. Connect scan tester to DLC. Remove fuel return line at the fuel rail. Connect a hose from fuel rail to a container with a capacity of 1 quart or more. Turn ignition on. Using scan tester, access Output Test Mode. Note fuel pressure and flow into container. For fuel pressure specifications, see **FUEL PRESSURE SPECIFICATIONS** article. If fuel pressure is as specified and flowing steadily into container, go to next step. If fuel pressure is more than specified, replace fuel pressure regulator. If fuel pressure is less than specified, go to step 11).

10) Check Fuel Return System Turn ignition off. Release fuel system pressure. Disconnect fuel hose at fuel pressure regulator. Check fuel return system for kinked or restricted hoses. Disconnect fuel return hose near fuel tank. Apply 3-5 psi to fuel hose from pressure regulator side. If air flows freely, replace fuel pump. If air does not flow freely, repair or replace hose as necessary.

11) Check Fuel Injector Flow & Leakage Turn ignition off. Use Rotunda Injector Tester (113-00001) to flow test fuel injectors. If flow rate for each fuel injector is within specification, system is okay and testing is complete. If flow rate for any fuel injector is not within specification, replace defective fuel injector and repeat **QUICK TEST** .

12) Check Fuel Pump Voltage Turn ignition off. Ensure scan tester is connected to DLC. Ensure IFS switch is set correctly. Disconnect fuel pump wiring harness connector. Check connector terminals for damage and repair as necessary. Turn ignition on. Using scan tester, enter Output Test Mode (OTM) and activate fuel pump circuit. Check voltage at fuel pump connector terminals. If voltage is 10.5 volts or more, check fuel pump ground connection. Repair as necessary. If ground connector is okay, replace fuel pump. If voltage is less than 10.5 volts, isolate source of low voltage and repair as necessary.

13) Check Fuel Supply System Turn ignition off. Release fuel system pressure. Check fuel return system for kinked or restricted hoses. Disconnect fuel supply hose at fuel rail and at the fuel pump. Apply 3-5 psi to fuel hose from fuel rail. If air flows freely, replace fuel module. If air does not flow freely, repair or replace hose as necessary.

CIRCUIT TEST HD - MISFIRE DETECTION MONITOR

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. Only use this test to diagnose:

- Ignition system.

- Fuel pressure.
- Fuel injectors.
- Engine vacuum system.
- Evaporative system.
- Canister purge solenoid.
- Internal engine wear.

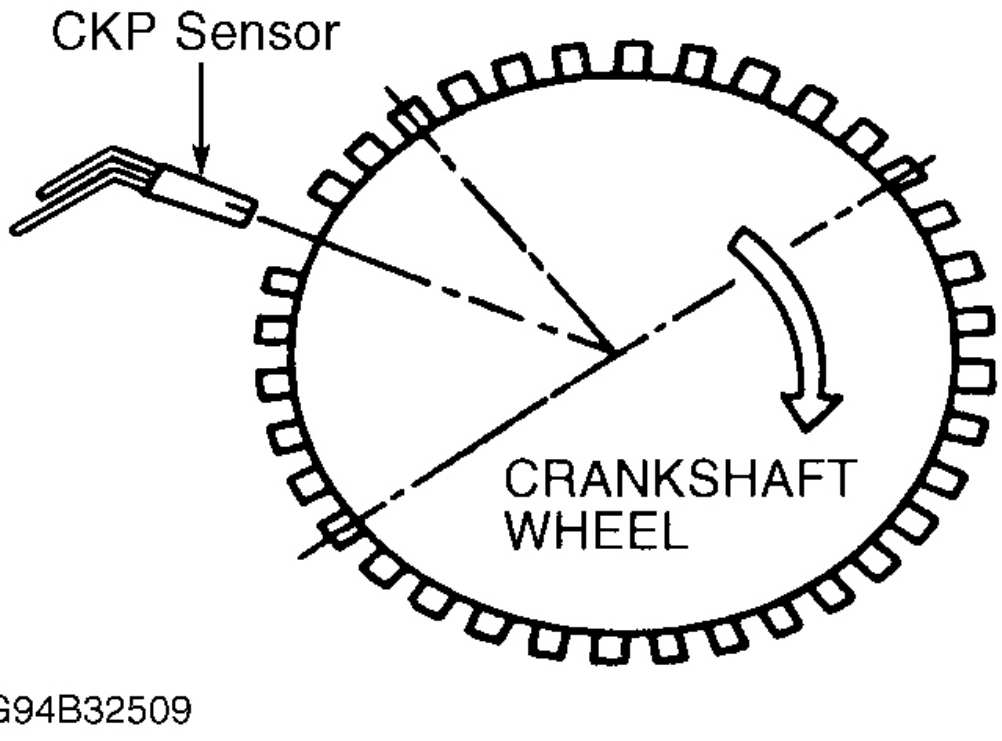

Fig. 48: CKP Sensor & Crankshaft Wheel

MISFIRE TROUBLE CODES

Service DTC	Application
P0301	Cylinder No. 1 (Test Pin No. 75)
P0302	Cylinder No. 2 (Test Pin No. 101)
P0303	Cylinder No. 3 (Test Pin No. 74)
P0304	Cylinder No. 4 (Test Pin No. 100)
P0305	Cylinder No. 5 (Test Pin No. 73)
P0306	Cylinder No. 6 (Test Pin No. 99)

P0307	Cylinder No. 7 (Test Pin No. 72)
P0308	Cylinder No. 8 (Test Pin No. 98)
P0300	Multiple Cylinder Misfire Or Defective CKP Sensor

1) Check Possible Cause Of Misfire If vehicle runs out of fuel, a trouble code may be stored in PCM memory. Ensure vehicle has not recently run out of fuel. Clear PCM memory and repeat **QUICK TEST** if necessary. If vehicle is equipped with crankshaft pulley-mounted pulse ring, go to next step. If vehicle is not equipped with crankshaft pulley-mounted pulse ring, go to step 3).

2) Check Crankshaft Pulley Turn ignition off. Remove front cover if necessary. Check crank pulley and pulse ring for damage or looseness. Repair or replace as necessary. If no faults are found, go to next step.

3) Check For Continuous DTCs If continuous codes are present, service as necessary. Disregard misfire codes at this time. If no other misfire codes are present, go to next step.

4) Check For KOEO DTCs If any KOEO DTCs are present, service as necessary. Disregard misfire codes at this time. If any other DTCs are present, proceed to appropriate CIRCUIT TEST. If no KOEO DTCs are present, check spark plugs and spark plug wires. If spark plugs and spark plug wires are okay, go to next step.

5) Check For KOER DTCs If any KOER DTCs except P1131 or P1151 are present, service as necessary. Disregard misfire codes at this time. If KOER DTCs P1131 or P1151 are present, go to step 8). If no KOER DTCs are present, check spark plugs and spark plug wires. If spark plugs and spark plug wires are okay, go to next step.

6) Check/Compare PID Values Turn ignition and all accessories off. Connect scan tester to DLC. Ensure engine is warmed to operating temperature. Turn ignition on. Using scan tester, access and record DPFEGR PID. Start engine and allow to idle. Record DPFEGR PID. If both DPFEGR PID voltage values are within 0.15 volts of each other, go to step 8). If DPFEGR PID voltage is not as specified, go to **CIRCUIT TEST HE** , step 100).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 6) to step 8). No test procedures have been omitted.

8) Check Fuel Injector & Circuit Resistance Turn ignition off. Disconnect PCM 104-pin connector. Inspect pins for damage and repair if necessary. Install EEC-V Breakout Box (014-00959), leaving PCM disconnected. Measure and record resistance between suspected fuel injector test pin and test pin No. 71 and 97 at breakout box. If resistance is 11-18 ohms, go to step 9). If resistance is not 11-18 ohms, go to step 56) under **CIRCUIT TEST H** .

9) Check Fuel Injector Drive Signal With ignition off, connect PCM to breakout box. Connect a non-powered 12-volt test light between test pin No. 71 or 97 and suspect fuel injector test pin at breakout box. Crank or start engine. If test light glows dimly, system is operating correctly. Go to next step. If test light does not glow dimly (no light/bright light), replace PCM and repeat **QUICK TEST** .

10) Check Fuel Pressure Turn ignition off. Release fuel pressure. Install fuel pressure gauge. Start engine and allow to idle. Note fuel pressure gauge reading. Increase engine speed to 2500 RPM and maintain for one minute. For fuel pressure specifications, see **FUEL PRESSURE SPECIFICATIONS** article. If fuel pressure is as specified, go to next step. If fuel pressure is not as specified, go to **CIRCUIT TEST HC** .

11) Check System Ability To Hold Fuel Pressure Start engine and allow to idle. Note fuel pressure

gauge reading. Increase engine speed to 2500 RPM and maintain for one minute. Check for fuel leaking from around fuel injectors, fuel pressure regulator and fuel hoses. Repair if necessary. Turn ignition off. Turn ignition on and note fuel pressure gauge reading. If fuel pressure remains at specification for one minute, go to next step. If fuel pressure does not remain at specification for one minute, go to step 3) under **CIRCUIT TEST HC** .

12) Check Fuel Injector Flow & Leakage Turn ignition off. Use Rotunda Injector Tester (113-00001) to flow test fuel injectors. If flow rate for each fuel injector is okay, go to step 20). If flow rate for any fuel injector is not okay, replace defective fuel injector and repeat **QUICK TEST** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 12) to step 20). No test procedures have been omitted.

20) Check Vacuum System Inspect all vacuum hoses for kinks or damage. Ensure all vacuum connections are clean and tight. Repair or replace as necessary. If vacuum system is okay, go to next step.

NOTE: The misfire monitor can be affected by the evaporative emission system.

21) Check Evaporative Emission System Inspect carbon canister. Replace carbon canister if it contains liquid fuel. If carbon canister is okay, go to next step.

22) Pressure Test Evaporative System Remove vapor line from canister and install vacuum tee. Connect a pressure gauge to one side of tee and low pressure air pump to other side of tee. Apply 0.75 psi (5.2 kPa). If evaporative emission system holds pressure, reconnect vapor line and go to next step. If system does not hold pressure, isolate fault and repair as necessary.

23) Check Vacuum In Evaporative System Inspect vacuum hoses between engine and carbon canister for restrictions or damage. Ensure all vacuum connections are clean and tight. Repair or replace as necessary. If system is okay, go to next step for vehicles with EVAP canister purge solenoid, or step 26) for vehicles equipped with Vapor Management Valve (VMV).

24) Check Canister Purge Solenoid (CANP) Turn ignition off. Disconnect CANP solenoid wiring harness connector. Inspect connector for damaged pins and repair as necessary. Using jumper wire, apply 12 volts to VPWR (Red wire) terminal of CANP wiring harness connector. Connect CANP (Gray/Yellow wire) terminal to ground. Connect vacuum pump to manifold side of CANP solenoid and apply 16 in. Hg. When 12 volts is applied, solenoid should open and pass air freely. Replace solenoid if it does not function correctly. If solenoid does function correctly, go to next step.

25) Check Engine Condition Inspect engine for obvious faults. Ensure compression is even and within specification. Check PCV system for restrictions or leaks. Repair or replace as necessary. If no faults can be found, misfire trouble code is intermittent. Go to **CIRCUIT TEST Z** .

26) Check Vapor Management Valve (VMV) Housing Turn ignition off. Ensure vehicle is at room temperature. Connect vacuum pump to fuel vapor port of VMV and apply 16 in. Hg. If vacuum is held, go to next step. If vacuum is not held, replace VMV and repeat **QUICK TEST** .

27) Leave ignition off. Disconnect hose from vacuum input port of VMV. Connect vacuum pump to VMV vacuum input port and apply 10-15 in. Hg. If little or no vacuum is lost, service VMV filter. If filter is okay, replace VMV. Repeat **QUICK TEST** . If vacuum is not as specified, go to step 25).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips

from step 27) to step 30). No test procedures have been omitted.

30) Check For Additional Misfire DTCs If any DTCs except P0300 are present, go to step 1). If no other DTCs are present, go to next step.

31) Check For Continuous DTCs If continuous codes are present, service as necessary. If no other misfire codes are present, go to next step.

32) Check/Compare PID Values Turn ignition and all accessories off. Connect scan tester to DLC. Ensure engine is warmed to operating temperature. Turn ignition on. Using scan tester, access and record DPFEGR PID. Start engine and allow to idle. Record DPFEGR PID. If both DPFEGR PID voltage values are within 0.15 volts of each other, go to step 8). If DPFEGR PID voltage is not as specified, go to **CIRCUIT TEST HE** , step 100).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 32) to step 40). No test procedures have been omitted.

40) DTC P1309 This fault indicates misfire detection monitor malfunction. Turn ignition and all accessories off. Disconnect PCM 104-pin connector. Inspect pins for damage and repair if necessary. Install EEC-V Breakout Box (014-00959), leaving PCM disconnected. Connect DVOM between test pins No. 85 and No. 51 or 103. Using starter, bump engine in short bursts for at least 10 revolutions. DO NOT allow engine to start. If voltage switches from below 0.2 volts to over 8.0 volts, check CMP sensor for correct installation. If sensor is correctly installed, replace PCM and repeat **QUICK TEST** . If voltage does not switch from below 0.2 volts to over 8.0 volts, replace CMP sensor and repeat QUICK TEST.

CIRCUIT TEST HE - EGR SYSTEM

Diagnostic Aids

Perform this test when instructed by QUICK TEST. This test is only intended to diagnose:

- Differential Pressure Feedback Electronic (DPFE) sensor.
- DPFE sensor hoses.
- Electronic Vacuum Regulator (EVR).
- Orifice tube assembly.
- Faulty EGR valve.
- Wiring harness circuits (DPFE SIG, EVR, EVR PWR, SIG RTN and VREF).
- Faulty Powertrain Control Module (PCM).

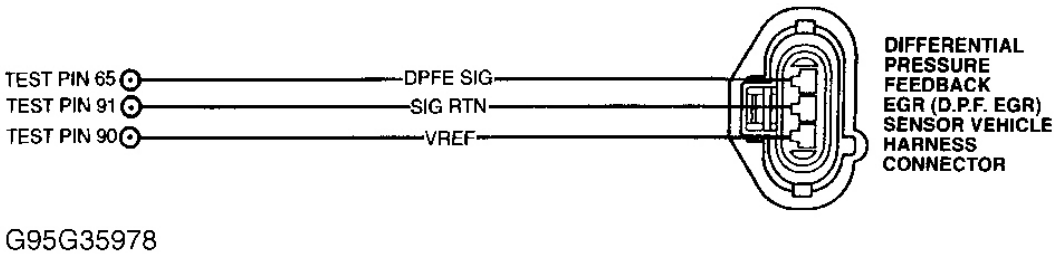

Fig. 49: DPFE Sensor Wiring Harness Connector Terminals

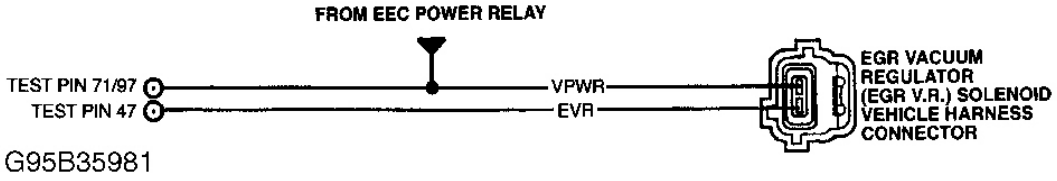

Fig. 50: EVR Solenoid Wiring Harness Connector Terminals

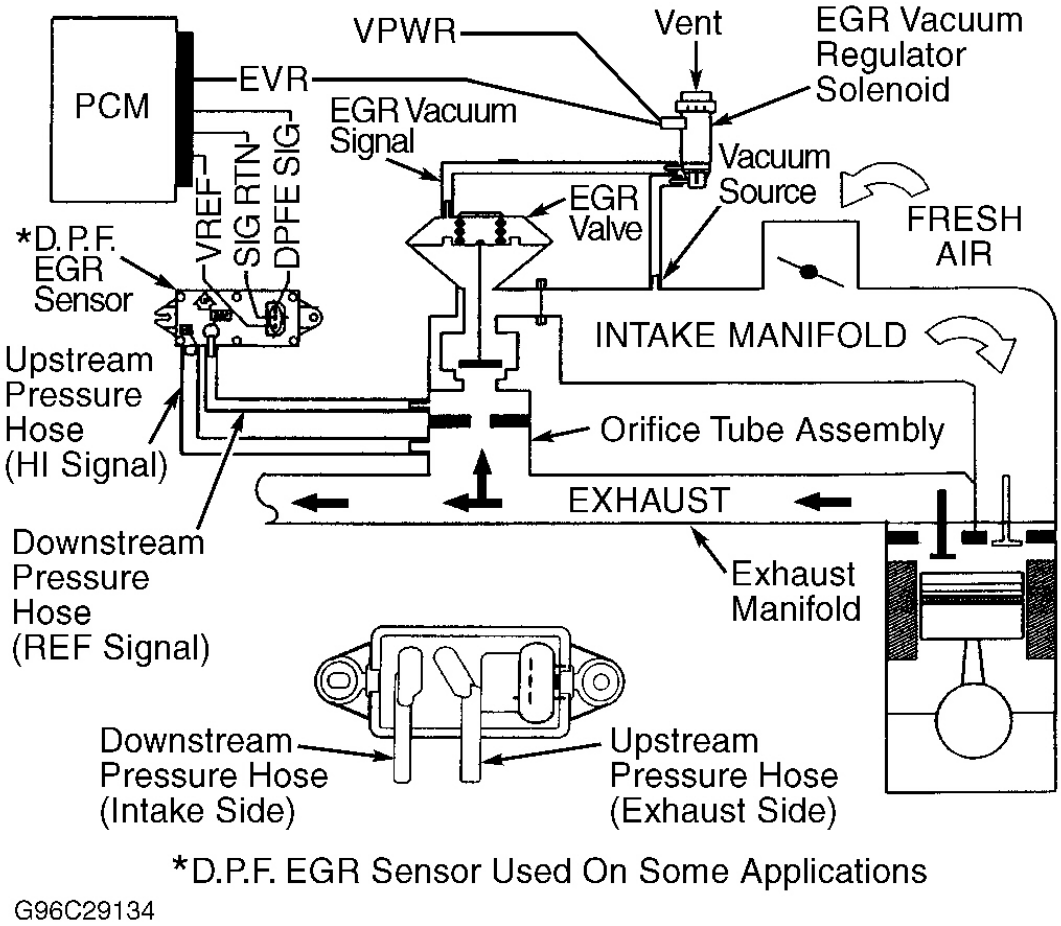

Fig. 51: DPFE System Components

1) DTC P1400: Check DPFE Voltage This code indicates open in DPFE SIG circuit. Possible causes for this fault are:

- Leaking upstream pressure hose.
- DPFE SIG shorted to GND or SIG RTN circuit.
- VREF shorted to GND or SIG RTN circuit.
- Faulty DPFE sensor.
- Faulty PCM.

Turn ignition off. Connect scan tester to DLC. Turn ignition on. Using scan tester, access DPFEGR PID. If voltage is less than 0.2 volt, go to next step. If voltage is 0.2 volt or more, go to step 6).

2) Generate Opposite DPFE Signal Turn ignition off. Disconnect DPFE wiring harness connector. Using a jumper wire, connect DPFE SIG and VREF terminals at wiring harness connector. Turn ignition on. Using scan tester, access DPFE SIG PID. If scan tester error occurs, disconnect jumper wire and go to

step 3). If DPFEGR PID value is not 4-6 volts, go to step 3). If DPFEGR PID value is 4-6 volts, replace DPFE sensor and repeat **QUICK TEST** .

3) Measure VREF Voltage At DPFE Sensor Leave DPFE sensor disconnected. Turn ignition on. Measure voltage between SIG RTN terminal and VREF terminal at DPFE wiring harness connector. If voltage is 4-6 volts, go to step 4). If VREF voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

4) Check DPFE SIG For Short To Ground Leave DPFE sensor disconnected. Turn ignition off. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 65 (DPFE SIG) and 91 (SIG RTN) and test pins No. 51 and 103 (PWR GND). If each measurement is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** . If any measurement is less than 10,000 ohms, repair short circuit and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 4) to step 6). No test procedures have been omitted.

6) Wiggle Test Sensor & Harness With ignition off, connect scan tester to DLC. Turn ignition on. Access DPFE PID with scan tester. Observe DPFE PID for indication of fault while shaking and bending DPFE sensor wiring harness and connector. Tap lightly on DPFE sensor to simulate road shock. An indication of fault is a sudden change in DPFE PID voltage. If fault is indicated, isolate and repair as necessary. If no fault is indicated, go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 6) to step 10). No test procedures have been omitted.

10) DTC P1401: Check DPFE Signal Voltage This code indicates PCM has detected DPFE SIG circuit input above maximum. Possible causes for this fault are:

- Open circuit in DPFE SIG or SIG RTN circuit.
- DPFE SIG shorted to VREF or PWR circuit.
- VREF shorted to PWR circuit.
- Faulty DPFE sensor.
- Faulty PCM.

With ignition off, connect scan tester to DLC. Turn ignition on. Access DPFEGR PID. If DPFEGR PID voltage is more than 4.0 volts, go to next step. If DPFEGR PID voltage is 4.0 volts or less, go to step 19).

11) Check DPFE SIG For Short To Power Turn ignition off. Disconnect DPFE wiring harness connector. Turn ignition on. Measure voltage between DPFE SIG terminal at wiring harness connector and negative battery terminal. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, go to step 13).

12) Leave ignition off and DPFE sensor disconnected. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 65 (DPFE SIG) and test pins No. 51 and 103 (PWR GND) at breakout box. If voltage is 10.5 volts or more, repair short between DPFE SIF and PWR circuit. Repeat **QUICK TEST** . If voltage is less than 10.5 volts, replace PCM and repeat

QUICK TEST.

13) Generate Opposite DPFE Signal Turn ignition off. Disconnect DPFE wiring harness connector. Using a jumper wire, connect DPFE SIG and SIG RTN terminals at wiring harness connector. Turn ignition on. Using scan tester, access DPFEGR SIG PID. If scan tester error occurs, disconnect jumper wire and go to step 18). If DPFEGR PID value is .05 volt or more, go to step 16). If DPFEGR PID value is less than .05 volt, disconnect jumper wire and go to next step.

14) Verify VREF Is Within Range Leave DPFE sensor disconnected. Turn ignition on. Measure voltage between SIG RTN terminal and VREF terminal at DPFE wiring harness connector. If voltage is 4-6 volts, go to next step. If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

15) Check DPFE SIG For Short To VREF Leave DPFE sensor disconnected. Turn ignition off. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 65 (DPFE SIG) and 90 (VREF) at breakout box. If resistance is 10,000 ohms or more, replace DPFE sensor and repeat **QUICK TEST** . If resistance is less than 10,000 ohms, repair short circuit and repeat QUICK TEST.

16) Check DPFE SIG For Open Circuit Leave ignition off and DPFE sensor disconnected. Measure resistance between test pin No. 65 (DPFE SIG) and DPFE SIG terminal at DPFE sensor wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

17) Check SIG RTN For Open Circuit Leave ignition off and DPFE sensor disconnected. Measure resistance between test pin No. 91 (SIG RTN) and SIG RTN terminal of DPFE sensor wiring harness connector. If resistance is less than 5 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open in SIG RTN circuit and repeat QUICK TEST.

18) Check DPFE SIG For Short To VREF Leave ignition off and DPFE sensor disconnected. Measure resistance between test pin No. 65 (DPFE SIG) and 90 (VREF) at breakout box. If resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10,000 ohms or less, repair short between DPFE SIG and VREF circuit. Repeat QUICK TEST.

19) Wiggle Test Sensor & Harness With ignition off, connect scan tester to DLC. Turn ignition on. Access DPFE PID with scan tester. Observe DPFE PID for indication of fault while shaking and bending DPFE sensor wiring harness and connector. An indication of fault is a sudden change in DPFE PID voltage. Tap lightly on DPFE sensor to simulate road shock. If fault is indicated, isolate and repair as necessary. If no fault is indicated, go to **CIRCUIT TEST Z** .

20) DTC P0402: Check EGR Flow At Idle This code indicates PCM has detected EGR flow at idle. Possible causes for this fault are:

- EGR valve stuck open.
- EVR solenoid vent plugged.
- EVR circuit shorted to ground.
- Excessively worn or damaged vacuum hose.
- Faulty EVR solenoid.
- Faulty PCM.

NOTE: If Continuous Memory Code P1405 is present, go to step 50).

With ignition off, disconnect and plug EGR vacuum hose. Perform KOER self-test. If DTC P0402 is present, service or replace EGR valve. If DTC P0402 is not present or vehicle will not start/run, go to next step.

21) Turn ignition off. Reconnect EGR vacuum hose. Perform KOER self-test. If DTC P0402 is present, go to next step. If DTC P0402 is not present or vehicle will not start/run, go to step 30).

22) Check EGR System Using vehicle's vacuum diagram label, check EGR system vacuum hoses for damage, tight connections and correct routing. If hoses are okay, go to next step. If hoses are not okay, repair as necessary. Clear PCM memory and repeat **QUICK TEST** .

23) Check DPFE Sensor Output Turn ignition off. Disconnect pressure hoses at DPFE sensor. Connect vacuum pump to DPFE sensor downstream port marked REF. Turn ignition on. Using scan tester, access DPFEGR PID. PID voltage should be 0.35-1.25 volts. Using vacuum pump, apply 8-9 in. Hg. PID voltage should be more than 4 volts. When vacuum is quickly released, PID voltage should drop to less than one volt. If PID voltage is not as specified, replace DPFE sensor and repeat **QUICK TEST** . If PID voltage is as specified, go to next step.

24) Check EGR Flow At Idle With EVR Solenoid Disconnected Turn ignition off. Disconnect EGR valve vacuum hose. Connect vacuum gauge to hose. Start engine and allow to idle. While observing vacuum gauge, disconnect EVR solenoid. If vacuum gauge reads 1.6 in. Hg or more, go to next step. If vacuum gauge reads less than 1.6 in. Hg, go to step 26).

25) Check EVR Vent Turn ignition off. Disconnect EVR solenoid vent cap and vacuum hoses. Remove EVR filter and inspect for restriction. Using a vacuum pump, apply 15 in. Hg to EVR vent. If EVR solenoid is plugged or restricted, repair or replace as necessary. Clear PCM memory and repeat **QUICK TEST** . If solenoid is not plugged or restricted, replace EVR solenoid. Clear PCM memory and repeat QUICK TEST.

26) Check EVR Solenoid Coil Resistance Turn ignition off. Disconnect EVR solenoid wiring harness connector. Measure resistance between EVR terminals. If resistance is 26-40 ohms, go to next step. If resistance is not 26-40 ohms, replace EVR solenoid. Clear PCM memory and repeat **QUICK TEST** .

27) Check EVR Circuit For Short To Ground Leave ignition off and EVR solenoid disconnected. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 47 (EVR) and test pins No. 51 and 103 (PWR GND) at breakout box. If resistance is more than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, repair short between EVR circuit and ground.

28) Check EVR Circuit For Short To VREF Leave ignition off and EVR solenoid disconnected. Measure resistance between test pin No. 47 (EVR) and test pins No. 90 (VREF) at breakout box. If resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 28) to step 30). No test procedures have been omitted.

30) Check DPFE Sensor Output Leave ignition off. Connect scan tester to DLC. Disconnect pressure hoses at DPFE sensor. Connect vacuum pump to DPFE sensor port marked REF. Turn ignition on. Using scan tester, access DPFEGR PID. PID voltage should be 0.35-1.25 volt. Apply 9 in. Hg to DPFE sensor. PID voltage should be more than 4.0 volts. Release vacuum from sensor. PID voltage should drop to less than one volt in less than 3 seconds. If voltage readings are as specified, go to next step. If voltage readings are not as specified, replace DPFE sensor. Clear PCM memory and repeat **QUICK TEST** .

31) Check DPFE SIG Voltage Leave ignition on. Using scan tester, access DPFEGR PID. PID voltage should be 0.35-1.25 volt. Connect vacuum hose to EGR valve and plug hose. Start engine and allow to idle. Observe DPFEGR PID voltage at idle and compare to KOEO voltage. If voltage is higher at idle, apply 2-3 in. Hg to EGR valve and release vacuum. Repeat several times while observing DPFEGR PID voltage on scan tool. DPFEGR PID voltage should increase as valve begins to open and return to initial value as vacuum is released. A slow to return voltage is an indication of a slow closing EGR valve. If DPFEGR PID does not indicate fault, go to next step. If fault is indicated by DPFE PID, service or replace EGR VALVE. Clear PCM memory and repeat **QUICK TEST** .

32) Check EGR Valve Vacuum While Wiggling EVR Circuit Turn ignition off. Disconnect vacuum hose at EGR valve and connect to vacuum gauge. Turn ignition on. Observe vacuum gauge for indication of fault while wiggling EVR wiring harness and connector. Fault is indicated by a sudden jump in vacuum reading. Tap lightly on sensor to simulate road shock. If no faults are indicated, go to next step. If fault is indicated, isolate and repair as necessary. Clear PCM memory and repeat **QUICK TEST** .

33) Check EVR Solenoid For Restriction Turn ignition off. Disconnect EVR solenoid vent filter. Inspect for contamination or water. Remove EGR vacuum hose and inspect for restriction. Repair or replace as necessary. If no faults can be found, problem is intermittent and cannot be identified at this time. Go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 33) to step 40). No test procedures have been omitted.

40) DTC P1403: Check For Reversed Pressure Hoses Check hoses for proper connection. DPFE port marked HI should connect to exhaust side of orifice tube. DPFE port marked REF should connect to intake side of orifice tube. See **Fig. 50** . If hoses are not routed correctly, repair as necessary. Clear PCM memory and repeat **QUICK TEST** . If hoses are routed correctly, problem cannot be identified at this time. Clear PCM memory and repeat QUICK TEST.

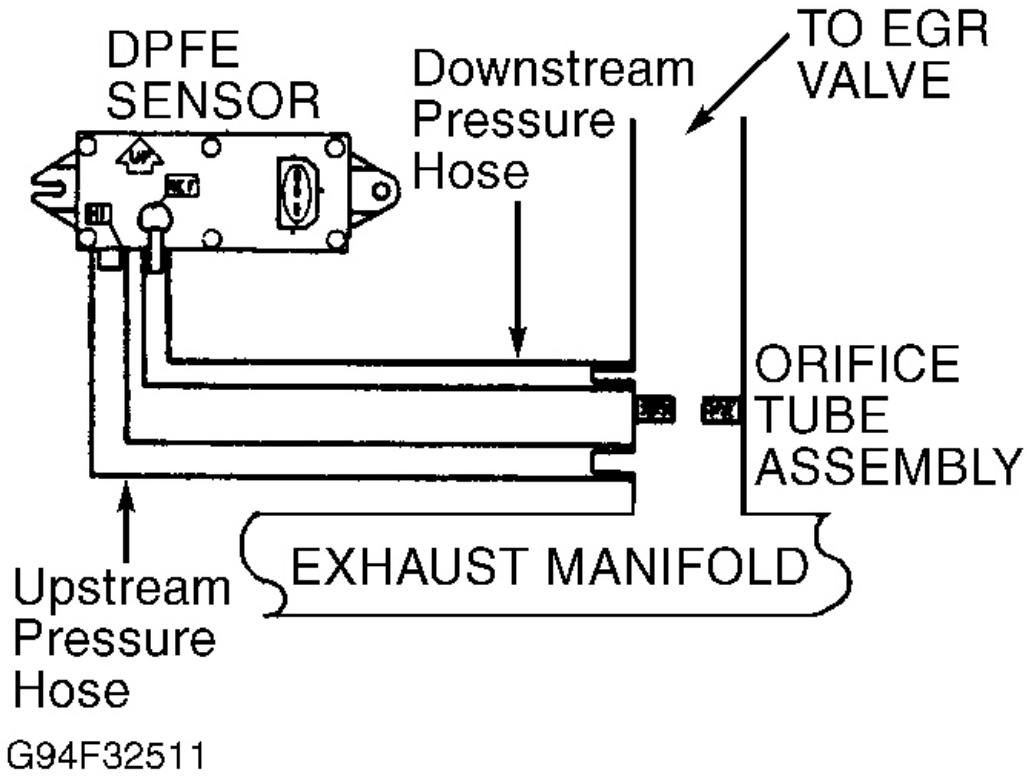

Fig. 52: DPFE Vacuum Circuit

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 40) to step 50). No test procedures have been omitted.

50) DTC P1405: Check For Upstream Pressure Hose Connection Check upstream hose for clean, tight connection. See **Fig. 52** . Repair as necessary. Clear PCM memory and repeat **QUICK TEST** . If hose is okay, go to next step.

51) Inspect Upstream Pressure Hose Check upstream hose for clean, tight connection. Ensure hose is not pinched, wet or contaminated. Repair as necessary. Clear PCM memory and repeat **QUICK TEST** . If hose is okay, go to next step.

52) Inspect Orifice Tube Assembly & DPFE Sensor Check DPFE sensor port for restriction or damage. Inspect exhaust manifold side pressure pick-up tube at the orifice tube assembly for restriction or damage. Repair as necessary. Clear PCM memory and repeat **QUICK TEST** . If no faults are found, clear PCM memory and repeat QUICK TEST. If hose is okay, go to next step.

53) Check DPFE Sensor Output Leave ignition off. Connect scan tester to DLC. Disconnect pressure hoses at DPFE sensor. Connect vacuum pump to DPFE sensor port marked REF. Turn ignition on. Using scan tester, access DPFEGR PID. PID voltage should be 0.35-1.25 volt. Apply 9 in. Hg to DPFE sensor.

PID voltage should be more than 4.0 volts. Release vacuum from sensor. PID voltage should drop to less than one volt in less than 3 seconds. If voltages are not as specified, replace DPFE sensor and repeat **QUICK TEST** . If voltage readings are as specified, fault is intermittent and cannot be duplicated at this time. Clear PCM memory and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 53) to step 60). No test procedures have been omitted.

60) DTC P1406: Check For Downstream Pressure Hose Connection Check downstream hose for clean, tight connection. See **Fig. 50** . Repair as necessary. Clear PCM memory and repeat **QUICK TEST** . If hose is okay, go to next step.

61) Inspect Downstream Pressure Hose Check downstream hose for clean, tight connection. Ensure hose is original equipment. Ensure hose is not pinched, wet or contaminated. Repair as necessary. Clear PCM memory and repeat **QUICK TEST** . If hose is okay, go to next step.

62) Inspect Orifice Tube Assembly & DPFE Sensor Check DPFE sensor port for restriction or damage. Inspect intake manifold side pressure pick-up tube at the orifice tube assembly for restriction or damage. Repair as necessary. Clear PCM memory and repeat **QUICK TEST** . If no faults are found, go to next step.

63) Check DPFE Sensor Output Leave ignition off. Connect scan tester to DLC. Disconnect pressure hoses at DPFE sensor. Connect vacuum pump to DPFE sensor port marked REF. Turn ignition on. Using scan tester, access DPFEGR PID. PID voltage should be 0.35-1.25 volt. Apply 9 in. Hg to DPFE sensor. PID voltage should be more than 4.0 volts. Release vacuum from sensor. PID voltage should drop to less than one volt in less than 3 seconds. If voltages are not as specified, replace DPFE sensor and repeat **QUICK TEST** . If voltage readings are as specified, fault is intermittent and cannot be duplicated at this time. Clear PCM memory and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 63) to step 70). No test procedures have been omitted.

70) DTC P0401 These codes indicate self-test has detected no EGR flow. Possible causes are as follows:

- EGR valve stuck closed.
- EGR valve diaphragm leak.
- EGR flow plugged or restricted.
- Faulty EGR hose.
- EVR VPWR circuit open.
- EVR VPWR circuit to PCM open or shorted to PWR.
- DPFE sensor VPWR circuit open.
- DPFE sensor hoses faulty.
- Faulty DPFE sensor.
- Faulty EVR solenoid.
- Faulty PCM.

If fault is currently present, KOER code P1408 should be present. Perform KOER self-test. If DTC P1408

is present, go to next step. If DTC P1408 is not present, go to step 90).

71) DTC P1408 This code indicates KOER self-test has detected EGR flow out of range. Possible causes are as follows:

- EGR valve stuck closed.
- EGR valve diaphragm leak.
- EGR flow plugged or restricted.
- Faulty EGR hose.
- EVR VPWR circuit open.
- EVR VPWR circuit to PCM open or shorted to PWR.
- DPFE sensor VPWR circuit open.
- DPFE sensor hoses faulty or reversed.
- Downstream pressure hoses plugged or removed.
- Faulty orifice tube assembly.
- Faulty DPFE sensor.
- Faulty EVR solenoid.
- Faulty PCM.

Retrieve Continuous Memory DTCs. If any codes except DTCs P1403 or P1406 are present, service as necessary before continuing. If DTC 1406 is present, go to step 60). If no codes are present, go to next step.

72) Perform KOER SELF-TEST While Monitoring EGR Vacuum Disconnect vacuum hose from EGR valve. Connect hose to vacuum gauge. Perform KOER self-test while monitoring gauge. Disregard DTCs set during this test. During test, if EGR vacuum should rise to 3.0 in. Hg or more, go to next step. If vacuum stays below 3.0 in. Hg, go to step 80).

73) Inspect DPFE Pressure Hoses Check both hoses for correct routing. Ensure hoses are not restricted or plugged or leaking. Inspect DPFE sensor and orifice tube assembly for restriction or damage at pick-up tube. If no faults are found, go to next step. If faults are found, repair or replace as necessary. Clear PCM memory and repeat **QUICK TEST** .

74) Check VREF Voltage At DPFE Sensor Turn ignition off. Disconnect DPFE sensor wiring harness connector. Turn ignition on. Measure voltage between VREF terminal and SIG RTN terminal at DPFE sensor wiring harness connector. If voltage is 4-6 volts, reconnect DPFE sensor and go to next step. If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

75) Vacuum Check DPFE Sensor Output Turn ignition off. Connect scan tester to DLC. Disconnect pressure hoses at DPFE sensor. Connect vacuum pump to DPFE sensor port marked REF. Turn ignition on. Using scan tester, access DPFEGR PID. PID voltage should be 0.35-1.25 volt. Apply 8-9 in. Hg to DPFE sensor. PID voltage should be more than 4.0 volts. Release vacuum from sensor. PID voltage should drop to less than one volt in less than 3 seconds. If voltage readings are not as specified, replace DPFE sensor. Clear PCM memory and repeat **QUICK TEST** . If voltages are as specified, go to next step.

76) Check EGR Valve Function Turn ignition off. Leave scan tester connected to DLC. Disconnect and plug hose at EGR valve. Connect vacuum pump to EGR valve. Start engine and allow to idle. Using scan

tester, access DPFEGR and RPM PIDs. Slowly apply 5-10 in. Hg to EGR valve and hold for 10 seconds. It may be necessary to increase engine speed to obtain 800 RPM. As vacuum increases, PID voltage should rise (up to 2.5 volts). When vacuum is held steady, PID voltage should hold steady. If vacuum is as specified, reconnect all components and go to step 85). If vacuum is not as specified, service or replace EGR valve. Clear PCM memory and repeat **QUICK TEST** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 76) to step 80). No test procedures have been omitted.

80) Check EVR Solenoid Vacuum Inspect EVR solenoid and EGR vacuum hoses for leaks, restrictions, damage or incorrect routing. Repair as necessary. Disconnect vacuum hoses at EVR solenoid. Connect vacuum pump to EVR solenoid vacuum supply hose. Start engine and allow to idle. If vacuum gauge reading is 15 in. Hg or more, go to next step. If vacuum gauge reading is less than 15 in. Hg, isolate fault and repair as necessary. Clear PCM memory and repeat **QUICK TEST** .

81) Check VPWR To EVR Solenoid Turn ignition off. Disconnect EVR solenoid wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal at EVR solenoid wiring harness connector and chassis ground. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit. Clear PCM memory and repeat **QUICK TEST** .

82) Check Resistance At EVR Solenoid Turn ignition off. Leave EVR solenoid wiring harness connector disconnected. Measure resistance across EVR solenoid terminals. If resistance is 26-40 ohms, go to next step. If resistance is not 26-40 ohms, replace EVR solenoid. Clear PCM memory and repeat **QUICK TEST** .

83) Check EVR For Short To PWR Leave EVR solenoid disconnected. Turn ignition off. Disconnect PCM 104-pin connector. Inspect for damage pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 47 (EVR) at breakout box and chassis ground. If voltage is less than one volt, go to next step. If voltage is one volt or more, repair EVR circuit short to PWR. Clear PCM memory and repeat **QUICK TEST** .

84) Check EVR Circuit For Open In Harness Leave ignition off and EVR solenoid disconnected. Measure resistance between test pin No. 47 (EVR) and EVR terminal at EVR solenoid wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in EVR circuit. Clear PCM memory and repeat **QUICK TEST** .

85) Check EVR Solenoid Vacuum Output Capability Leave ignition off. Connect EVR solenoid to wiring harness connector. Connect PCM to breakout box. Disconnect hose from EGR valve. Connect EGR vacuum hose to vacuum gauge. Start engine and allow to idle. Connect test pin No. 47 (EVR) at breakout box to chassis ground. If vacuum gauge reading is 4 in. Hg or more, replace PCM and repeat **QUICK TEST** . If vacuum gauge is less than 4 in. Hg, replace EVR solenoid. Clear PCM memory and repeat **QUICK TEST** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 85) to step 90). No test procedures have been omitted.

90) Check EGR System Leave ignition off. Check entire EGR system for deterioration or signs of failure. Repair or replace as necessary. If system is okay, go to next step.

91) Check EGR Valve Operation Leave ignition off. Disconnect EGR valve. Connect vacuum pump to EGR valve. Connect scan tester to DLC. Disconnect and plug hose at EGR valve. Connect vacuum pump

to EGR valve. Start engine and allow to idle. Using scan tester, access DPFEGR PIDs. Slowly apply 5-10 in. Hg to EGR valve and hold for 5 seconds. It may be necessary to increase engine speed to avoid stalling. When vacuum increases, PID voltage should increase as EGR valve opens. EGR operation should be smooth with no binding. If EGR valve opens smoothly and holds vacuum, go to next step. If EGR valve is not as specified, service or replace EGR valve. Clear PCM memory and repeat **QUICK TEST** .

NOTE: In cold climate, EGR valve may freeze shut and thaw when engine warms, causing intermittent trouble code to be set in PCM memory.

92) Check EVR For Short To PWR Turn ignition off. Leave EGR valve hose connected to vacuum gauge. Disconnect PCM 104-pin connector. Inspect for damage pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Connect jumper wire between test pin No. 47 (EVR) at breakout box and chassis ground to turn EVR on. Vacuum gauge reading should be more than 4.0 in. Hg. Observe vacuum gauge for fault while tapping lightly on EVR solenoid. Fault will be indicated by a sudden drop of vacuum. Wiggle EVR vacuum hoses, wiring harness and connector. If fault is indicated, isolate and repair as necessary. Clear PCM memory and repeat **QUICK TEST** . If no faults are indicated, symptom cannot be identified at this time. Go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 92) to step 100). No test procedures have been omitted.

100) Check EGR Valve & Vacuum Supply Perform **QUICK TEST** and service any other DTCs if present. If no other DTCs are present, disconnect and plug EGR vacuum supply hose. Turn ignition on. Using scan tester, access DPFEGR PID. PID voltage should be 0.35-1.25 volt. Start engine and allow to idle. DPFEGR PID voltage should increase about 1.5 volts. If voltage is as specified, service or replace EGR valve. If voltage is not as specified, inspect EGR vacuum regulator solenoid vent and vent filter. If no faults are found, replace EGR vacuum regulator solenoid.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 100) to step 110). No test procedures have been omitted.

110) DTC P1409 This code indicates self-test has detected electrical malfunction in EVR circuit. Possible causes are as follows:

- EVR circuit open or shorted.
- Faulty EVR solenoid.
- Faulty PCM.

Turn ignition off. Leave EVR solenoid wiring harness connector disconnected. Measure resistance across EVR solenoid terminals. If resistance is 26-40 ohms, go to next step. If resistance is not 26-40 ohms, replace EVR solenoid. Clear PCM memory and repeat **QUICK TEST** .

111) Check VPWR To EVR Solenoid Turn ignition off. Disconnect EVR solenoid wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal at EVR solenoid wiring harness

connector and chassis ground. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit. Clear PCM memory and repeat **QUICK TEST** .

112) Check EVR Circuit Continuity Leave ignition off and EVR solenoid disconnected. Disconnect PCM 104-pin connector. Inspect for damage pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 47 (EVR) and EVR terminal at EVR solenoid wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in EVR circuit. Clear PCM memory and repeat **QUICK TEST** .

113) Check EVR For Short To PWR Leave EVR solenoid disconnected. Turn ignition off. Turn ignition on. Measure resistance between test pin No. 47 (EVR) and test pins No. 71 and 97 (VPWR) at breakout box. Measure resistance between test pin No. 47 (EVR) and test pins No. 24 and 103 (PWR GND) at breakout box. If each resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If any resistance is less than 10,000 ohms, repair EVR circuit short to PWR or PWR GND and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 113) to step 120). No test procedures have been omitted.

120) Continuous Memory DTC P1409 This continuous DTC indicates self-test has detected electrical malfunction in EVR circuit. Possible causes are as follows:

- EVR circuit open or shorted.
- Faulty EVR solenoid.
- Faulty PCM.

Turn ignition off. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 47 (EVR) and No. 24 (PWR GND) at breakout box. Voltage should be more than 10.5 volts. Observe voltmeter for indication of fault while wiggling EVR wiring harness and connector. Fault is indicated by a sudden jump in voltage reading. Tap lightly on sensor to simulate road shock. If fault is indicated, isolate and repair as necessary. If no faults are indicated, symptom cannot be identified at this time. Go to **CIRCUIT TEST Z** .

CIRCUIT TEST HF - CATALYST EFFICIENCY MONITOR & EXHAUST SYSTEMS

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the exhaust system and downstream HO2S.

Internal damage of a catalytic converter is usually caused by abnormal engine operation upstream of catalyst. Conditions that produce higher than normal temperatures in the catalytic converter, such as cylinder misfire, are likely suspects.

MISFIRE DIAGNOSTIC TROUBLE CODES

DTC	Application
P0300	(1)

P0301	Cylinder No. 1 (Test Pin No. 75)
P0302	Cylinder No. 2 (Test Pin No. 101)
P0303	Cylinder No. 3 (Test Pin No. 74)
P0304	Cylinder No. 4 (Test Pin No. 100)
P0305	Cylinder No. 5 (Test Pin No. 73)
P0306	Cylinder No. 6 (Test Pin No. 99)
P0307	Cylinder No. 7 (Test Pin No. 72)
P0308	Cylinder No. 8 (Test Pin No. 98)
(1) Multiple cylinder misfire or faulty CKP sensor.	

1) DTC P0420, P0421, P0430 & P0431: Check Possible Cause Of Misfire DTC P0420 and P0421 indicates bank one catalyst system efficiency is minimum requirement. DTC P0430 and P0430 indicates bank 2 catalyst system efficiency is minimum requirement. Possible causes are as follows:

- Use of leaded fuel.
- Oil contamination.
- Cylinder misfire.
- Fuel pressure too high.
- HO2S sensor improperly connected.
- Damaged exhaust system component.
- Faulty ECT sensor.
- Faulty HO2S.

Ensure ignition timing is correct. Retrieve all Continuous Memory DTCs. If misfire code(s) is not present, go to next step. If misfire code(s) is present, isolate cylinder and repair as necessary.

2) Check HO2S Monitor DTCs If DTCs P0136, P0138, P0140, P0141, P0156, P0158, P0160, or P0161 were present in step 1), service as necessary before continuing. If none of these codes are present in step 1), go to next step.

3) Check ECT Sensor DTCs If DTCs P0117, P0118, P0125 or P1117 were present in step 1), service as necessary before continuing. If none of these codes are present in step 1), go to next step.

4) If any codes except P0420, P0421, P0430 and/or P0430 were present in step 1), service as necessary before continuing. If no codes except P0420 and/or P0430 were present in step 1), go to next step.

5) Check Rear HO2S Wiring Harness Turn ignition off. Ensure HO2S wiring harness is correctly routed and connectors are tight. Repair or replace as necessary. If wiring harness and connectors are okay, go to next step.

6) Check Fuel Pressure Turn ignition off. Release fuel pressure. Install fuel pressure gauge. Start engine and allow to idle. Note fuel pressure gauge reading. Increase engine speed to 2500 RPM and maintain for one minute. For fuel pressure specifications, see **FUEL PRESSURE SPECIFICATIONS** article. If fuel pressure is as specified, go to next step. If fuel pressure is not as specified, go to **CIRCUIT TEST HC** .

7) Check For Exhaust System Leaks If exhaust system leaks, it may cause catalyst monitor efficiency test to fail. Inspect exhaust system for cracks, loose connections or punctures. Repair or replace as necessary. If exhaust system is okay, go to next step.

8) Check For Exhaust System Restrictions Inspect exhaust system for collapsed areas, dents or excessive bending. Repair or replace as necessary. If exhaust system is okay, go to next step.

9) Check Manifold Vacuum Install tachometer. Connect vacuum gauge to intake manifold vacuum source. Start engine and raise engine speed to 2000 RPM. Manifold vacuum should rise to more than 16 in. Hg. If manifold vacuum is okay, go to next step. If manifold vacuum is low, go to step 11).

10) Leave tachometer and vacuum gauge connected. Start engine and raise engine speed to 2000 RPM. On a non-restricted system, manifold vacuum should quickly rise to normal range as increased RPM is maintained. On a restricted system, manifold vacuum will slowly rise to normal range as increased RPM is maintained. If manifold vacuum is okay, no indication of exhaust leak or restriction has been detected and testing is complete. If manifold vacuum is low or slow to respond, go to next step.

11) Leave tachometer and vacuum gauge connected. Remove exhaust pipe from exhaust manifold. Start engine and raise engine speed to 2000 RPM. If manifold vacuum is now okay, fault is downstream from exhaust manifold. Reconnect exhaust pipe to exhaust manifold and go to next step. If manifold vacuum is still low or slow to respond, fault is in exhaust manifold or intake manifold gasket. Repair or replace as necessary and repeat **QUICK TEST** .

12) Leave tachometer and vacuum gauge connected. Disconnect muffler/tailpipe assembly from rear of catalytic converter. Start engine and raise engine speed to 2000 RPM. If manifold vacuum is now okay, fault is in muffler/tailpipe assembly. Repair or replace as necessary and test drive vehicle to verify elimination of symptom. If manifold vacuum is still not okay, fault is in catalytic converter. Repair or replace as necessary. Check tailpipe/muffler assembly for debris from catalytic converter. Test drive vehicle to verify elimination of symptom.

CIRCUIT TEST HG - PCV SYSTEM

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. Use this test to diagnose Positive Crankcase Ventilation (PCV) valve and related vacuum hoses.

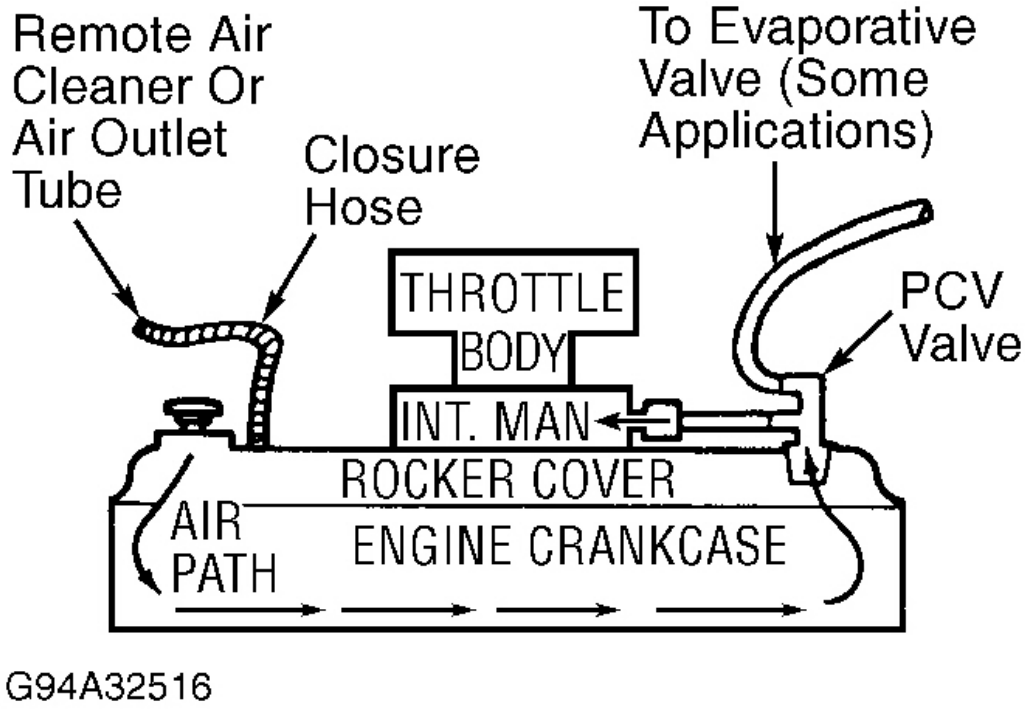

Fig. 53: PCV System Schematic

1) Check PCV Valve Remove PCV valve. Shake valve and listen for rattle. If PCV valve rattles when shaken, go to next step. Replace PCV valve if it does not rattle when shaken.

2) Check PCV System Start engine and warm to normal operating temperature. Disconnect hose from remote air cleaner or outlet tube. Place a stiff piece of paper over end of hose. If vacuum from hose does not hold paper in place for one minute, go to next step. If vacuum from hose holds paper in place for one minute, PCV system is okay and testing is complete.

3) Check Evaporative Emission System Disconnect evaporative emission hose from PCV system and plug connector. Place a stiff piece of paper over end of hose. If vacuum from hose does not hold paper in place for one minute, isolate vacuum leak or restriction and repair as necessary. If vacuum from hose holds paper in place for one minute, proceed as follows:

- On models equipped with Fuel Tank Pressure (FTP) sensor, go to step 47) of **CIRCUIT TEST HX** .
- On models not equipped with Fuel Tank Pressure (FTP) sensor, go to step 10) of **CIRCUIT TEST HW** .

CIRCUIT TEST HM - SECONDARY AIR INJECTION (AIR) SYSTEM

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Wiring harness circuits (BATT+, EAIR, EAIR MONITOR and Ground).
- Solid State Relay (SSR).
- Electric Air Pump (EAP).
- Air injection by-pass solenoid.
- Air injection diverter solenoid.
- Air injection diverter valve.
- Air injection by-pass solenoid.
- Powertrain Control Module (PCM).

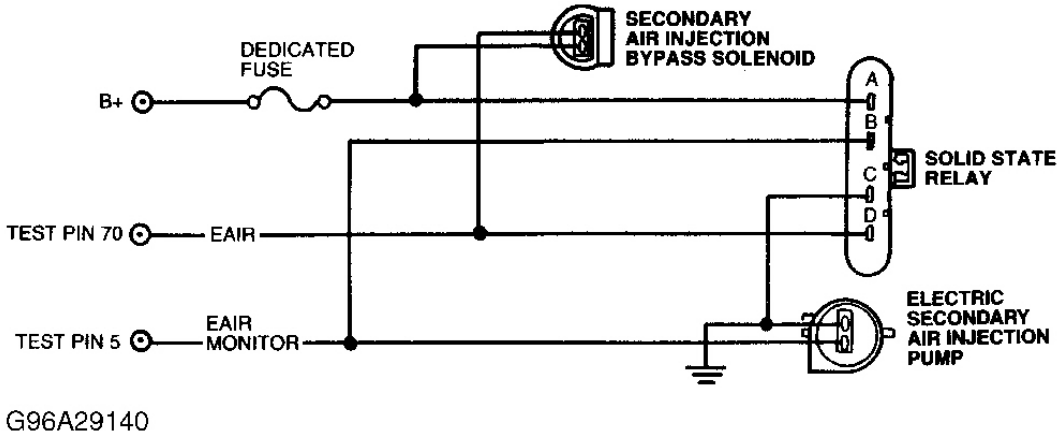

Fig. 54: Electric AIR Test Circuit & Connector Terminals

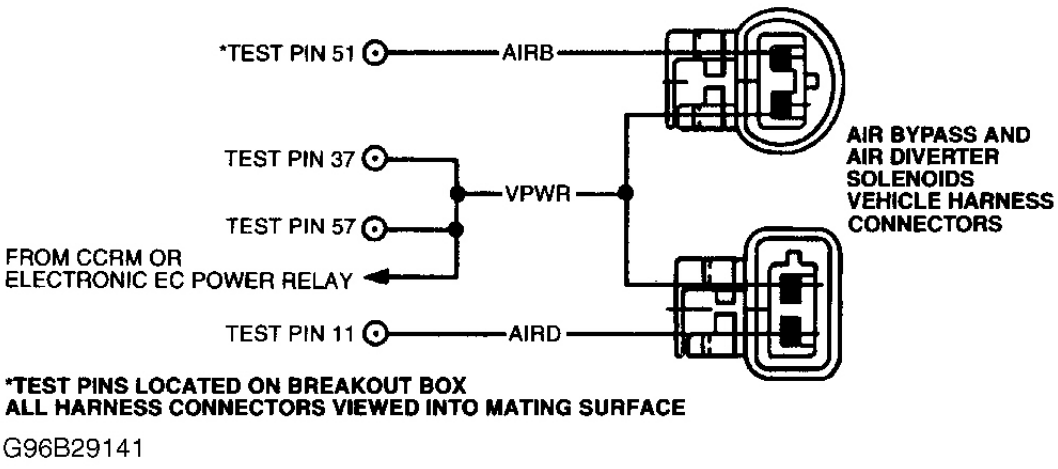

Fig. 55: Mechanical AIR Test Circuit & Connector Terminals

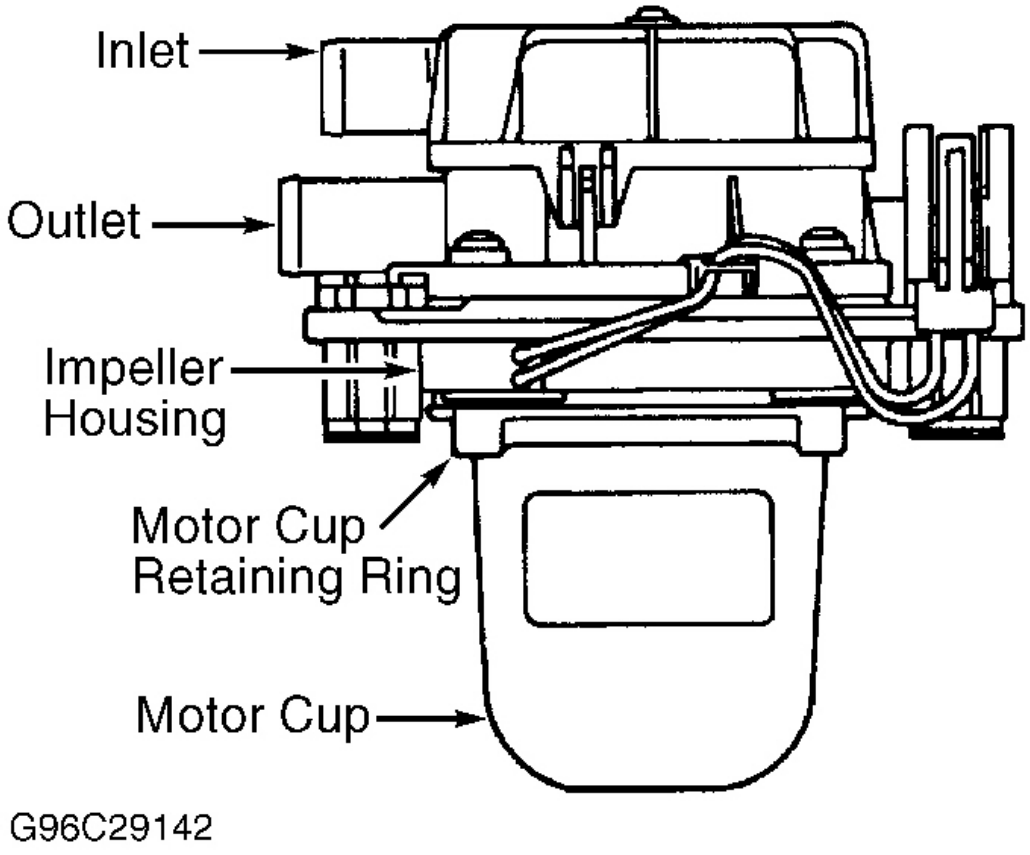

Fig. 56: Electric AIR Pump Components

1) DTC P0412: Check BATT+ At SSR This DTC indicates EAIR primary circuit failure. Possible causes are as follows:

- EAIR circuit open or short to power.
- AIR by-pass solenoid failure.
- Faulty Solid State Relay (SSR).
- Faulty PCM.

Turn ignition off. Disconnect SSR. Turn ignition on. Measure voltage between SSR connector BATT+ terminal and negative battery terminal. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, go to step 6).

2) Check EAIR Circuit Resistance Turn ignition off. Leave SSR disconnected. Disconnect AIR by-pass solenoid. Temporarily remove secondary air dedicated fuse. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM

disconnected. Measure resistance between test pin No. 70 (EAIR) at breakout box and EAIR terminal at SSR connector. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** . If resistance is less than 5 ohms, go to next step.

3) Check EAIR Circuit Short To Power Leave ignition off. Measure resistance between test pin No. 70 and test pins No. 51, 71, 90, 97 and 103 at breakout box. If resistance is more than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, repair short circuit and repeat **QUICK TEST** .

4) Leave ignition off. Reconnect AIR by-pass solenoid. Measure resistance between test pin No. 70 and test pins No. 51, 71, 90, 97 and 103 at breakout box. If resistance is more than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, replace AIR by-pass solenoid and repeat **QUICK TEST** .

5) Leave ignition off. Reconnect SSR. Measure resistance between test pin No. 70 and test pins No. 51, 71, 90, 97 and 103 at breakout box. If resistance is more than 10,000 ohms, go to step 14) if DTC P0411 or P1411 is present or step 9) if specified DTCs are not present. If resistance is 10,000 ohms or less, repair EAIR circuit and repeat **QUICK TEST** .

6) Check BATT+ Circuit Resistance Leave ignition off. Disconnect SSR. Measure resistance between SSR connector terminal "A" and AIR system dedicated fuse. If resistance is less than 5 ohms, replace dedicated fuse and go to step 8). If resistance is 5 ohms or more, repair open in BATT+ circuit and repeat **QUICK TEST** .

7) DTC P0411 Or P1411 Check secondary air hoses for damage, wear or poor connections. Repair or replace as necessary. If all hoses are okay, go to next step.

8) Check Electric Pump Operation Turn ignition off. Disconnect air hoses from AIR diverter valve(s). Start engine and allow to idle. After a 5 second delay, airflow should be present for 30-90 seconds. If airflow is present, go to step 15). If airflow is not present, go to step 11).

9) Check For Vacuum At Diverter Valve Turn ignition off. Reconnect PCM. Disconnect vacuum hose from diverter valve. Start engine and allow to idle. After a 5 second delay, vacuum should be present for 30-90 seconds. If vacuum is present, go to next step. If vacuum is not present, go to step 30).

10) Check Diverter Valve Turn ignition off. Reconnect vacuum hose at diverter valve. Disconnect and plug air tube from diverter valve outlet side. Check diverter valve for damage and repair if necessary. Start engine and allow to idle. After a 5 second delay, vacuum should be present for 30-90 seconds. If vacuum is present, go to next step. If vacuum is not present, go to step 30).

11) Check EAIR MONITOR Circuit Voltage Turn ignition off. Disconnect electric air pump. Turn ignition on. Measure voltage between EAIR MONITOR circuit at the connector and chassis ground. Voltage should be 10.5 volts or more for 20-30 seconds after a 5-10 second delay. If voltage is as specified, go to step 13). If voltage is not as specified, go to next step.

12) Check Ground Circuit Leave ignition off and air pump disconnected. Measure resistance between air pump connector ground terminal and chassis ground. If resistance is less than 5 ohms, go to step 19). If resistance is 5 ohms or more, repair open in ground circuit and repeat **QUICK TEST** .

13) Check Air Pump Hoses Turn ignition off. Inspect hoses between air pump and air control valves. If hoses are damaged or restricted, repair or replace as necessary and repeat **QUICK TEST** . If hoses are okay, replace electric AIR pump and repeat QUICK TEST.

14) Check For Voltage At SSR Turn ignition off. Reconnect AIR bypass solenoid and SSR. With breakout box installed and PCM connected, turn ignition on. Measure voltage between chassis ground and test pin No. 5 at breakout box. Also, measure voltage between chassis ground and test pin No. 70 at breakout box. If voltage is less than 10.5 volts, replace PCM and repeat **QUICK TEST** . If voltage is 10.5 volts or more, replace SSR and repeat QUICK TEST.

15) Check Air Pump For Water Turn ignition off. Disconnect electric AIR hoses and wiring harness connector. Check air pump for water. If water is present, repair or replace as necessary. If water is not present, go to step 9).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 15) to step 18). No test procedures have been omitted.

18) DTC 1413: Check For Voltage At SSR Leave ignition off. Disconnect SSR. Turn ignition on. Measure voltage between SSR connector BATT+ terminal and chassis ground. If voltage is less than 10.5 volts, go to step 24). If voltage is 10.5 volts or more, go to next step.

19) Check EAIR MONITOR Circuit Voltage Leave ignition off. Reconnect SSR. Disconnect electric AIR pump wiring harness connector. Turn ignition on. Measure voltage between connector EAIR MONITOR terminal and chassis ground. If voltage is less than 10.5 volts and DTC P0411 is present, replace AIR pump. If voltage is less than 10.5 volts and DTC P0411 is not present, go to next step. If voltage is 10.5 volts or less, go to step 23).

20) Check EAIR MONITOR Circuit For Short To Power Turn ignition off. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 5 at breakout box and chassis ground. If voltage is 10.5 volts or less, go to next step. If voltage is more than 10.5 volts, replace PCM and repeat **QUICK TEST** .

21) Check EAIR MONITOR Circuit Continuity Turn ignition off. Disconnect SSR. Measure resistance between test pin No. 5 at breakout box and EAIR MONITOR terminal at SSR connector. Measure resistance between EAIR MONITOR terminal at SSR connector and EAIR MONITOR terminal at air pump connector. If both resistance measurements are 5 ohms or more, repair open in EAIR MONITOR circuit and repeat **QUICK TEST** . If resistance is less than 5 ohms, go to next step.

22) Check EAIR MONITOR Circuit For Short To Ground Turn ignition off. Leave SSR and air pump disconnected. Measure resistance between test pin No. 5 and test pins No. 51, 76 and 91 at breakout box. If each resistance measurement is more than 10,000 ohms, replace SSR and repeat **QUICK TEST** . If any resistance measurement is 10,000 ohms or less, repair EAIR MONITOR circuit short to ground and repeat QUICK TEST.

23) Check EAIR MONITOR Circuit Voltage Leave ignition off. Reconnect air pump. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Start engine and allow to idle. Measure voltage between test pin No. 5 and chassis ground. After about 5 seconds, voltage should be 10.5 volts or more. If voltage is as specified, replace PCM and repeat **QUICK TEST** . If voltage is not as specified, repair open in EAIR MONITOR circuit and repeat QUICK TEST.

24) Check BATT+ Circuit Continuity Turn ignition off. Leave SSR disconnected. Measure resistance between SSR connector terminal "A" and AIR system dedicated fuse. If resistance is less than 5 ohms, replace dedicated fuse and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open in BATT+ circuit and repeat QUICK TEST.

25) DTC P1414: Check EAIR MONITOR Circuit Continuity Turn ignition off. Disconnect air pump and SSR wiring harness connectors. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 5 at breakout box and EAIR MONITOR terminal at air pump connector. If resistance is 5 ohms or more, repair open in EAIR MONITOR circuit and repeat **QUICK TEST** . If

resistance is less than 5 ohms, go to next step.

26) Leave ignition off, SSR relay and AIR pump disconnected. Disconnect PCM wiring harness connector. Measure resistance between pump terminals. If resistance is 0.5-5.0 ohms, go to next step. If resistance is not 0.5-5.0 ohms, replace AIR pump and repeat **QUICK TEST** .

27) Check EAIR MONITOR Circuit For Short To Power Turn ignition off. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 5 at breakout box and chassis ground. If voltage is 10.5 volts or less, go to next step. If voltage is more than 10.5 volts, replace PCM and repeat **QUICK TEST** .

28) Leave ignition on. Measure voltage between test pin No. 5 at breakout box and chassis ground. Measure voltage between test pin No. 70 at breakout box and chassis ground. If either voltage measurements is 10.5 volts or less, replace PCM and repeat **QUICK TEST** . If both voltage measurements are more than 10.5 volts, replace SSR and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 28) to step 30). No test procedures have been omitted.

30) Check Air Pump Hoses Turn ignition off. Inspect air inlet hose. If hose is damaged or restricted, repair or replace as necessary and repeat **QUICK TEST** . If hose is okay, go to next step.

31) Check Air By-Pass Solenoid Disconnect air injection by-pass solenoid wiring harness connector. Connect scan tester to DLC. Turn ignition on. Using scan tester, access Output Test Mode (OTM). Connect voltmeter to air injection by-pass solenoid connector. Observe voltmeter while cycling outputs on and off. If voltage cycles 0.5 volt or more, go to next step. If voltage does not cycle 0.5 volt or more, go to step 33).

32) Remain in OTM. Reconnect air injection by-pass solenoid wiring harness connector. Disconnect vacuum hose from air injection by-pass solenoid. Connect vacuum hose to vacuum pump. Apply 16 in Hg. to solenoid. Observe voltmeter while cycling outputs on and off. If vacuum releases as outputs cycle, repair vacuum hose between solenoid and air control valve. If vacuum does not release as throttle cycles, replace air injection by-pass solenoid hose.

33) Check Air By-Pass Solenoid Resistance Turn ignition off. Disconnect air injection by-pass solenoid wiring harness connector. Measure resistance between connector terminals. If resistance is 50-100 ohms, go to next step. If resistance is not 50-100 ohms, replace air injection by-pass solenoid.

34) Check BATT+ Circuit Voltage Leave air injection by-pass solenoid disconnected. Turn ignition on. Measure voltage between connector BATT+ terminal and negative battery terminal. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in BATT+ circuit and repeat **QUICK TEST** .

35) Check EAIR Circuit Continuity Leave air injection by-pass solenoid disconnected. Turn ignition off. Disconnect SSR wiring harness connector. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 70 at breakout box and EAIR terminal at air pump connector. If resistance is 5 ohms or more, repair open in EAIR circuit and repeat **QUICK TEST** . If resistance is less than 5 ohms, go to next step.

36) Check EAIR Circuit For Short To Ground Turn ignition off. Leave air injection by-pass solenoid and SSR disconnected. Measure resistance between test pin No. 70 and test pins No. 51, 76 and 91 at breakout box. If each resistance measurement is 10,000 ohms or more, go to next step. If any resistance

measurement is less than 10,000 ohms, repair EAIR circuit short to ground and repeat **QUICK TEST** .

37) Check EAIR Circuit For Short To Power Leave ignition off. Leave air injection by-pass solenoid and SSR disconnected. Measure resistance between test pin No. 70 and test pins No. 71 and 97 at breakout box. If each resistance measurement is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 37) to step 40). No test procedures have been omitted.

40) DTC P0411 Check vacuum hoses for restrictions, damage or improper routing. Check AIR pump condition. If belt is broken or loose, go to step 81). If any other faults are found, repair as necessary. If no faults are found, go to next step.

41) Check For Vacuum At Diverter Valve Turn ignition off. Disconnect control vacuum hose from diverter valve. Start engine and allow to idle. If vacuum is present at hose, go to next step. If vacuum is not present, go to step 63).

42) Check Diverter Valve Turn ignition off. Disconnect vacuum hose at diverter valve outlet. Check diverter valve outlet for heat damage and repair if necessary. If no damage is present, go to next step.

43) Connect vacuum pump to AIR diverter valve. Apply 10 in Hg. If vacuum is held, go to next step. If vacuum is not held, replace AIR diverter valve and verify symptom is not present.

44) Start engine and allow to idle. Increase engine speed to 1500 RPM. If air flow is present at valve outlet, go to next step. If air flow is not present, go to step 71).

45) Vent auxiliary vacuum source. Ensure air flow switches from valve outlet to dump port or silencer port. If air flow does not switch, replace AIR diverter valve. If air flow switches, go to next step.

46) Turn ignition off. Disconnect vacuum hose from AIR bypass valve outlet. Check bypass valve outlet for heat damage and repair if necessary. If no damage is present, go to next step.

47) Remove vacuum supply hose from valve. While checking vacuum, start engine and allow to idle. Vacuum should be present after a 10 second delay. If vacuum is as specified, go to next step. If vacuum is not as specified, go to step 63).

48) Connect vacuum pump to AIR bypass valve. Apply 10 in Hg. and hold. If vacuum is held, go to next step. If vacuum is not held, replace AIR bypass valve and verify symptom is not present.

49) Start engine and allow to idle. Check for vacuum at AIR bypass valve supply hose. If air flow is present, go to next step. If air flow is not present, go to step 71).

50) Connect vacuum pump to AIR bypass valve. Start engine and allow to idle. Apply 10 in Hg to valve. Increase engine speed to 1500 RPM. If air flow is present at valve outlet, go to next step. If air flow is not present, replace AIR diverter valve and verify symptom is not present.

51) Allow engine to idle. Vent auxiliary vacuum source. Ensure air flow switches from valve outlet to dump port or silencer port. If air flow does not switch, replace AIR diverter valve. If air flow switches, go to step 63).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 51) to step 63). No test procedures have been omitted.

63) Check Air By-Pass & Air Diverter Solenoid Turn ignition off. Disconnect suspect solenoid wiring

harness connector. Connect scan tester to DLC. Using scan tester, access Output Test Mode (OTM). Connect DVOM positive lead to VPWR circuit terminal of connector. Connect negative lead to signal terminal of connector. Observe voltmeter while cycling outputs on and off. If voltage cycles, go to next step. If voltage does not cycle, remove DVOM and go to step 76).

64) Check Vacuum To AIR Diverter Or AIR Bypass Solenoid Leave ignition off. Remove vacuum hose from suspect solenoid. Start engine and allow to idle. If vacuum is present, replace solenoid. If vacuum is not present, go to next step.

65) Check Vacuum Supply To Reservoir Turn ignition off. Remove vacuum inlet hose at reservoir marked MAN or VAC. Start engine and allow to idle. If vacuum is present at hose, go to next step. If vacuum is not present, go to step 69) (if vehicle has check valve) or repair vacuum hose (if vehicle does not have check valve).

66) Check Reservoir Turn ignition off. Connect vacuum gauge to outlet hose at reservoir (not marked MAN or VAC). Start engine and allow to idle for 30 seconds. If vacuum increases 15-20 in Hg., replace reservoir outlet hose. If vacuum is not as specified, replace reservoir

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 66) to step 69). No test procedures have been omitted.

69) Check Air Flow At Check Valve Turn ignition off. Mark check valve for installation reference. Remove check valve. Connect vacuum pump to Black side of check valve. Connect vacuum gauge to opposite end of valve. Apply 16 in Hg. and hold. If vacuum is held, go to next step. If vacuum is not held, replace check valve.

70) Leave ignition off. Remove vacuum pump from check valve. If vacuum is held, no faults are present and testing is complete. If vacuum is not held, replace check valve.

71) Check Belt Tension Ensure belt tension is correct. If belt tension is correct, go to next step. If belt tension is not correct, go to step 81).

72) Check Air Pump Operation Leave ignition off. Disconnect air supply hose from AIR diverter valve. Start engine and allow to idle. Check air flow at pump outlet while varying engine speed. If air flow does not increase as engine speed increases, go to next step. If air flow increases as engine speed increases, no faults are present and testing is complete.

73) Check Silencer & Filter Remove inlet hose (if equipped). Inspect inlet port for restriction or blockage and repair as necessary. If no faults are found, replace AIR pump.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 73) to step 75). No test procedures have been omitted.

75) DTC P0413, DTC P0414, P0416 Or P0417; Voltage For AIR Solenoid Does Not Change Turn ignition off. Disconnect AIR bypass or diverter solenoid connector. Turn ignition on. Measure voltage between VPWR terminal at connector and negative battery terminal. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open circuit and repeat **QUICK TEST** .

76) Check AIR By-Pass & Diverter Solenoid Resistance Turn ignition off. Disconnect AIR by-pass and diverter solenoid wiring harness connector. Measure resistance between connector terminals. If resistance is 50-100 ohms, go to next step. If resistance is not 50-100 ohms, replace solenoid and repeat **QUICK TEST** .

77) Check AIRB & AIRD Circuit Resistance Leave ignition off and solenoids disconnected. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 11 at breakout box and AIRD terminal at solenoid connector. Measure resistance between test pin No. 51 at breakout box and AIRB terminal at solenoid connector. If either resistance measurement is 5 ohms or more, repair open circuit and repeat **QUICK TEST** . If both resistance measurements are less than 5 ohms, go to next step.

78) Check AIRB & AIRD Circuit For Short To Ground Leave ignition off and solenoids disconnected. Measure resistance between test pin No. 11 (AIRD) and test pins No. 51, 91 and 103 at breakout box. Measure resistance between test pin No. 51 (AIRB) and test pins No. 51, 91 and 103 at breakout box. If each resistance measurement is 10,000 ohms or more, go to next step. If any resistance measurement is less than 10,000 ohms, repair circuit short to ground and repeat **QUICK TEST** .

79) Check AIRB & AIRD Circuit For Short To Power Leave ignition off and solenoids disconnected. Measure resistance between test pin No. 11 and test pins No. 71 and 97 at breakout box. Measure resistance between test pin No. 51 and test pins No. 71 and 97 at breakout box. If any resistance measurement is less than 10,000 ohms, repair short to power and repeat **QUICK TEST** . If each resistance measurement is 10,000 ohms or more, replace PCM and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 79) to step 81). No test procedures have been omitted.

81) Excessive Belt Noise Check belt tension. If belt is loose, tighten as necessary. If belt is not loose, check pulley and mounting brackets. Check for seized AIR pump or broken bolts. Repair or replace as necessary. If no faults are present, testing is complete.

CIRCUIT TEST HT - TRACTION ASSIST (TA) SYSTEM

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- TA series throttle.
- Series throttle stepper motor.
- Series throttle controller.
- Wiring harness circuits (TP-B, VREF, SIG RTN, VPWR, PWR GND, TAPW, TA-B1, TA-B2, BCOMM, TA-A1, TA-A2 & ACOMM).
- Throttle Position Sensor B (TP-B).
- Powertrain Control Module (PCM).

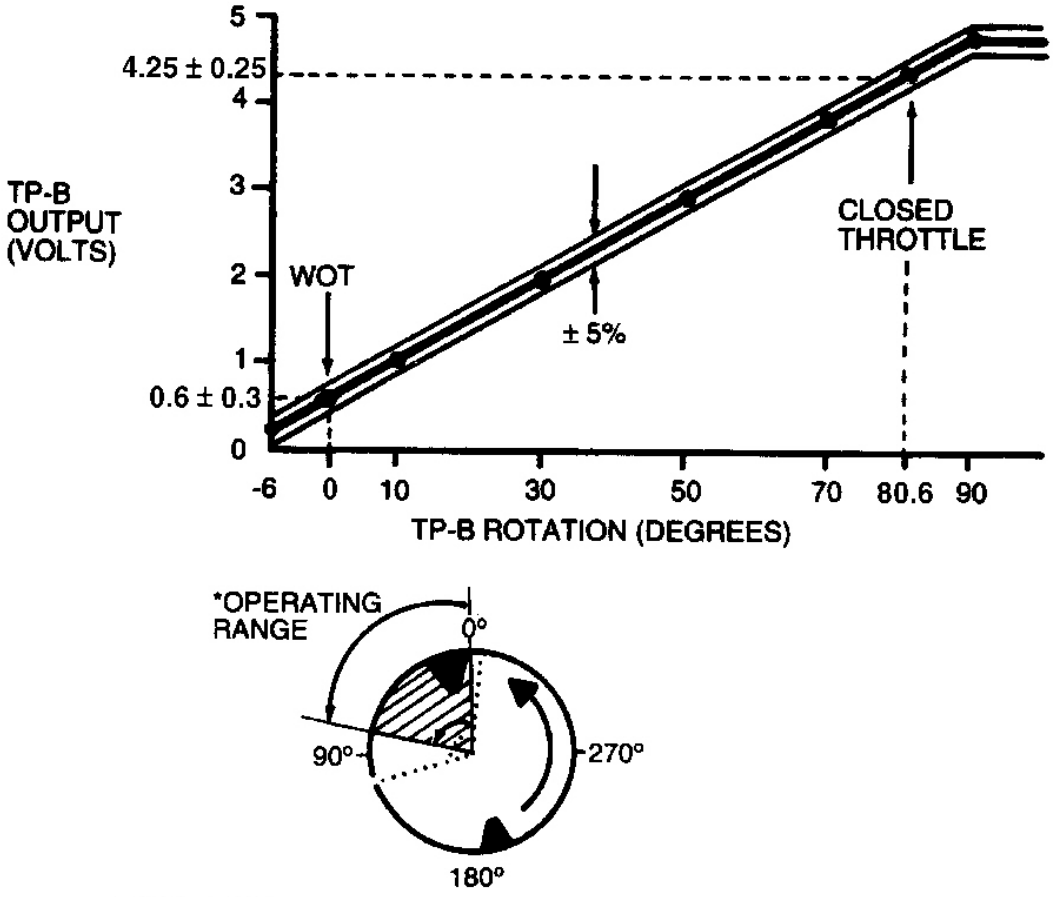

Fig. 57: TP-B Operational Range

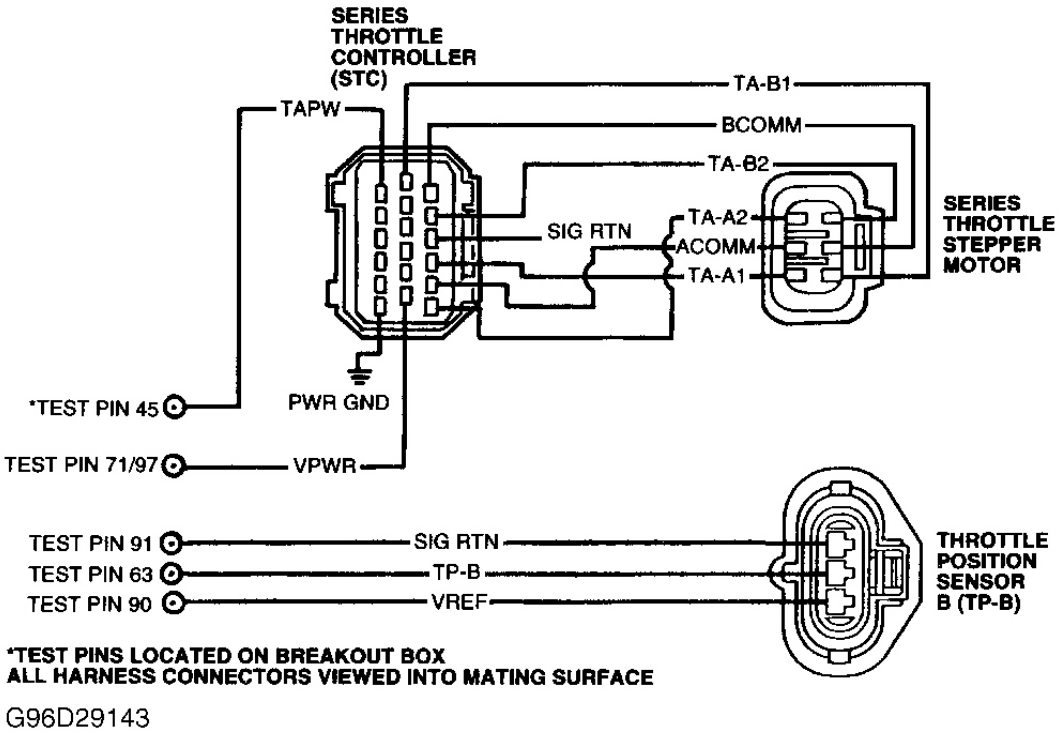

Fig. 58: TA System Connectors & Test Circuits

1) DTC P0222: Verify TP-B Voltage This DTC indicates TP-B voltage was below minimum during self-test. Possible causes are as follows:

- Open or shorted TP-B circuit.
- Open or shorted VREF circuit.
- Faulty TP-B.
- Faulty PCM.

Turn ignition off. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access TPB PID. If TPB PID voltage is less than 0.2 volts, go to next step. If TPB PID voltage is 0.2 volt or more, go to step 6).

2) Turn ignition off. Disconnect TP-B wiring harness connector. Inspect connector for damage and repair if necessary. Connect jumper wire between connector terminals TP-B (Yellow/White wire) and VREF (Brown/White wire). Turn ignition on. Using scan tester, access TPB PID. If PID cannot be accessed, go to step 5). If PID voltage is 4-6 volts, replace TP-B and repeat **QUICK TEST** . If voltage is not 4-6 volts, go to next step.

3) Leave TP-B disconnected. Turn ignition on. Measure voltage between terminals SIG RTN and VREF at TP-B connector. If voltage is 4-6 volts, go to next step. If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

4) Check TP-B For Open Circuit Turn ignition off. Disconnect PCM 104-pin connector. Inspect pins for damage and repair if necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 63 (TP-B) at the breakout box and TP-B terminal of TP-B wiring harness connector. If resistance is 5 ohms or more, repair open in TP-B circuit and repeat **QUICK TEST** . If resistance is less than 5 ohms, go to next step.

5) Check TP-B Circuit For Short To Ground Or SIG RTN Turn ignition off. Disconnect scan tool from DLC (if applicable). Measure resistance between test pin No. 63 (TP-B) and test pins No. 51, 91 and 103 (PWR GND) at the breakout box. If each resistance measurement is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** . If any resistance measurement is less than 10,00 ohms, repair TP-B circuit short to ground or SIG RTN and repeat **QUICK TEST** .

6) Wiggle Test Turn ignition on. Using scan tester, access TPB PID. Observe PID for signs of fault. A fault will be indicated by change in PID voltage. Lightly tap on sensor. Wiggle wiring harness between TP-B and PCM. If fault is indicated, isolate and repair as necessary. If no faults are indicated, go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 6) to step 10). No test procedures have been omitted.

10) DTC P0223: Verify TP-B Voltage This DTC indicates TP-B voltage was above maximum during self-test. Possible causes are as follows:

- TP-B circuit shorted to VREF.
- TP-B circuit shorted to PWR.
- SIG RTN circuit open.
- Faulty TP-B.
- Faulty PCM.

Turn ignition off. Disconnect TP-B wiring harness connector. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access TPB PID. If PID voltage is more than 4 volts, go to next step. If voltage is 4 volts or less, go to step 16).

11) Check TP-B For Short To Power Turn ignition off. Disconnect TP-B sensor wiring harness connector. Inspect connector for damage and repair if necessary. Turn ignition on. Measure voltage between TP-B terminal at connector and negative battery terminal. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, go to step 13).

12) Turn ignition off. Disconnect PCM 104-pin connector. Inspect pins for damage and repair if necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 63 (TP-B) and test pins No. 51 and 103 (PWR GND) at the breakout box. If voltage is 10.5 volts or more, repair short between PWR and TP-B circuit. Repeat **QUICK TEST** . If voltage is less than 10.5 volts, replace PCM and repeat QUICK TEST.

13) Leave TP-B wiring harness connector disconnected. Turn ignition on. Using scan tester, access TPB PID. If PID voltage is less than 0.1 volt, go to next step. If voltage is 0.1 volt or more, go to step 15).

14) Leave TP-B disconnected and ignition on. Measure voltage between SIG RTN and VREF terminals at connector. If voltage is 4-6 volts, replace TP-B sensor and repeat **QUICK TEST** . If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

15) Check TP-B Circuit For Short To VREF Leave TP-B disconnected and ignition on. Measure resistance between test pin No. 63 (TP-B) and 90 (VREF) at the breakout box. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** . If resistance is less than 10,000 ohms, repair TP-B circuit short to VREF and repeat QUICK TEST.

16) Wiggle Test Turn ignition on. Using scan tester, access TPB PID. Observe PID for signs of fault. A fault will be indicated by change in PID voltage. Lightly tap on sensor. Wiggle wiring harness between TP-B and PCM. If fault is indicated, isolate and repair as necessary. If no faults are indicated, go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 16) to step 20). No test procedures have been omitted.

20) DTC P1220: Inspect Series Throttle (ST) System This DTC indicates series throttle control malfunctioned during self-test. Possible causes are as follows:

- Stepper motor circuit fault.
- PWR GND circuit open to Series Throttle Controller (STC).
- SIG RTN circuit open to STC.
- VPWR circuit open to STC.
- TAPW circuit open or shorted.
- Faulty Series Throttle (ST).
- Faulty ST stepper motor.
- Faulty STC.
- Faulty PCM.

Turn ignition off. Remove air tube from ST. Inspect ST assembly for loose components or restrictions. Check throttle plate for binding. If throttle plate binds, go to next step. If throttle does not bind, go to step 22).

21) Inspect ST Motor Turn ignition off. Remove TA assembly (do not separate ST from main throttle body). Remove ST stepper motor. Cycle throttle plate through full range of travel. Throttle plate should travel freely and throttle gear should contact stop screws in both directions. If throttle plate binds, replace ST stepper motor and repeat **QUICK TEST** . If throttle does not bind, replace series throttle and repeat QUICK TEST.

22) Turn ignition on. Using scan tester, access TPB PID. If PID voltage is less than 4.5 volts, go to next step. If voltage is 4.5 volts or more, go to step 33).

23) Measure ST Stepper Motor Coil Resistance Turn ignition off. Disconnect ST stepper motor wiring harness connector. Check for 1-5 ohms resistance at the following ST stepper motor terminals:

- TA-B1 and BCOMM.
- TA-B2 and BCOMM.
- TA-A1 and ACOMM.
- TA-A2 and ACOMM.

If each coil measurement is 1-5 ohms, go to next step. If any measurement is not 1-5 ohms, replace ST stepper motor and repeat **QUICK TEST** .

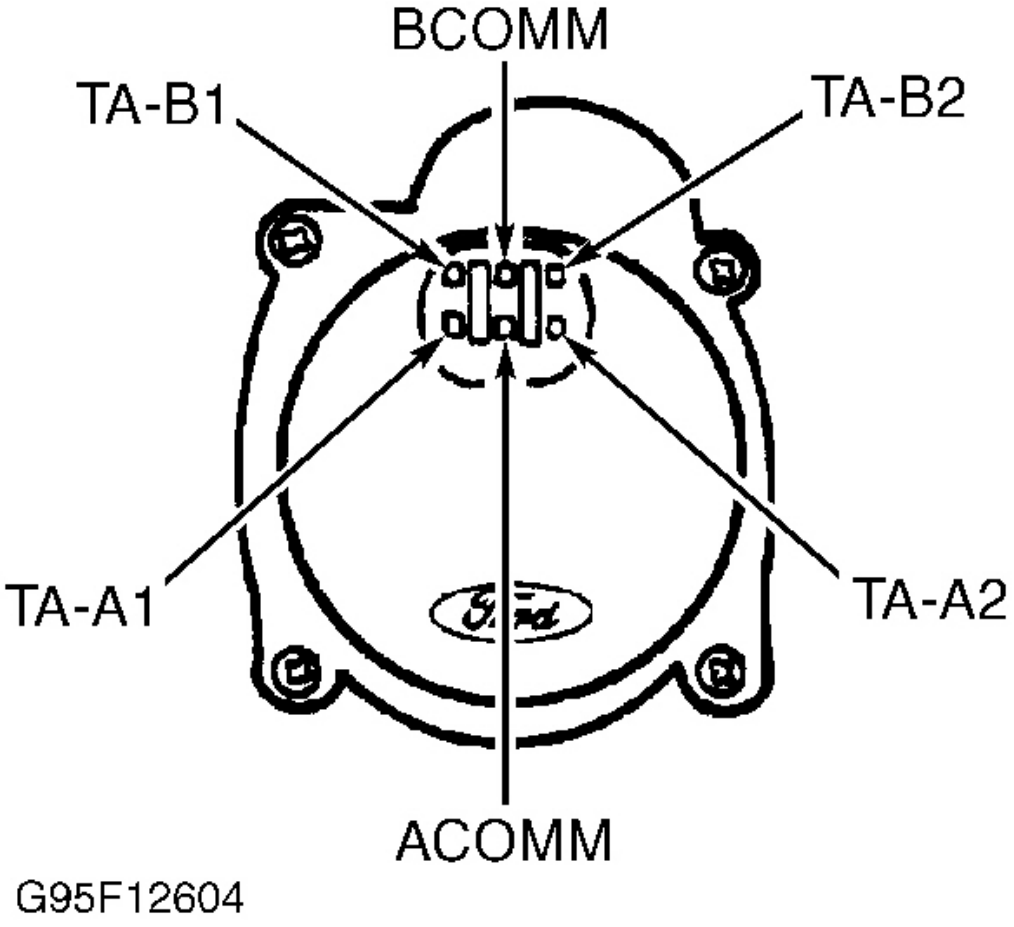

Fig. 59: Stepper Motor Terminals

24) Check ST Stepper Motor Coil For Short Circuit Leave ignition off and ST stepper motor disconnected. Measure resistance between ST stepper motor terminals ACOMM and BCOMM. Measure resistance between ST stepper motor terminals ACOMM/BCOMM and motor housing. If either resistance measurement is 10,000 ohms or less, replace ST stepper motor and repeat **QUICK TEST** . If all resistance measurements are 10,000 ohms or more and DTC P1220 is present, go to next step. If DTC P1220 is not present, check brake system mechanical components for malfunction and repair as necessary.

25) Check ST Stepper Motor Circuit Continuity Leave ignition off and ST stepper motor disconnected. Disconnect Series Throttle Controller (STC). Measure resistance of each circuit between

ST stepper motor connector and STC connector. If any resistance measurement is 5 ohms or more, repair open circuit and repeat **QUICK TEST** . If all resistance measurements are less than 5 ohms, go to next step.

26) Check ST Stepper Motor Circuit For Short Leave ignition off. Disconnect scan tester from DLC (if applicable). Measure resistance of each terminal of ST stepper motor connector and all other terminals of ST stepper motor connector. Measure resistance of each terminal of ST stepper motor connector and negative battery terminals. If all resistance measurements are 10,000 ohms or more, go to next step. If any resistance measurements is 10,000 ohms or less, repair short circuit and repeat **QUICK TEST** .

27) Check Circuit Voltage To STC Leave STC disconnected. Turn ignition on. Measure voltage between VPWR terminal of STC connector and chassis ground. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit and repeat **QUICK TEST** .

28) Turn ignition off. Leave STC disconnected. Measure resistance between SIG RTN terminal of STC connector and chassis ground. Measure resistance between PWR GND terminal of STC connector and chassis ground. If both resistance measurements are less than 5 ohms, go to next step. If either resistance measurements are 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

29) Leave ignition off and STC disconnected. Disconnect PCM 104-pin connector. Inspect pins for damage and repair if necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 45 (TAPW) and TAPW terminal of STC wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in TAPW circuit and repeat **QUICK TEST** .

30) Leave STC disconnected. Turn ignition on. Measure voltage between test pin No. 45 and negative battery terminal. If voltage is less than .05 volt, go to next step. If voltage is .05 volt or more, repair TAPW circuit short to power and repeat **QUICK TEST** .

31) Turn ignition off. Leave STC disconnected. Measure resistance between test pin No. 45 (TAPW) and test pins No. 51, 91 and 103 at the breakout box. If resistance is less than 10,000 ohms, repair short circuit and repeat **QUICK TEST** . If resistance is 10,000 ohms or more and DTC P1220 is present, go to next step. If resistance is 10,000 ohms or more and DTC P1220 is not present, fault is intermittent and cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

Diagnostic Aid

On every power-up, the series throttle is commanded to self-test from the PCM. To verify this signal, go to next step.

32) Leave ignition off and STC disconnected. Connect DVOM between test pin No. 45 (TAPW) and 91 (SIG RTN) at the breakout box. While observing DVOM, turn ignition on. If DVOM indicates a brief change of voltage (2.0 volt minimum) as ignition is turned on, replace STC and repeat **QUICK TEST** . If DVOM does not indicate a brief change of voltage, replace PCM and repeat QUICK TEST.

33) Turn ignition off. Disconnect TP-B sensor wiring harness connector. Measure voltage between connector terminals SIG RTN and VREF. If voltage is 4-6 volts, replace TP-B and repeat **QUICK TEST** . If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 33) to step 40). No test procedures have been omitted.

40) DTC P1224: Check ST Assembly This DTC should be disregarded if any other DTCs are present. DTC P1224 indicates TP-B voltage was out of range during self-test. Possible causes are as follows:

- TP-B sensor binding or sticking.
- Throttle stop screw misadjusted.
- Faulty TP-B.
- Faulty ST.

Disconnect air tube from ST assembly. Check throttle linkage for binding or sticking. Repair if necessary. If throttle linkage is okay, go to next step.

41) Turn ignition off. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access TPB PID. While observing PID voltage, push throttle plate shut and then release. Throttle plate should not bind or stick. If TPB-PID is 0.3-0.9 volt at wide open throttle, go to next step. If TPB-PID is not 0.3-0.9 volt at wide open throttle, check ST stepper motor and TP-B for damage. If no damage is present, replace TP-B and repeat **QUICK TEST** .

42) Measure VREF At TP-B Sensor Turn ignition off. Disconnect TP-B wiring harness connector. Inspect connector for damage and repair if necessary. Turn ignition on. Measure voltage between SIG RTN and VREF terminal of TP-B wiring harness connector. If voltage is 4-6 volts, replace TP-B and repeat QUICK TEST. If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

CIRCUIT TEST HU - AIR INTAKE SYSTEM

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Accelerator linkage.
- Air cleaner assembly.
- Air inlet tube.
- Clean air tube and resonator.
- Throttle body assembly.
- IMRC actuator assembly.
- Intake Manifold Runner Control (IMRC) assembly.
- Wiring harness circuits (IMRC, IMRC MONITOR, SIG RTN, PWR GND and VPWR).
- Powertrain Control Module (PCM).

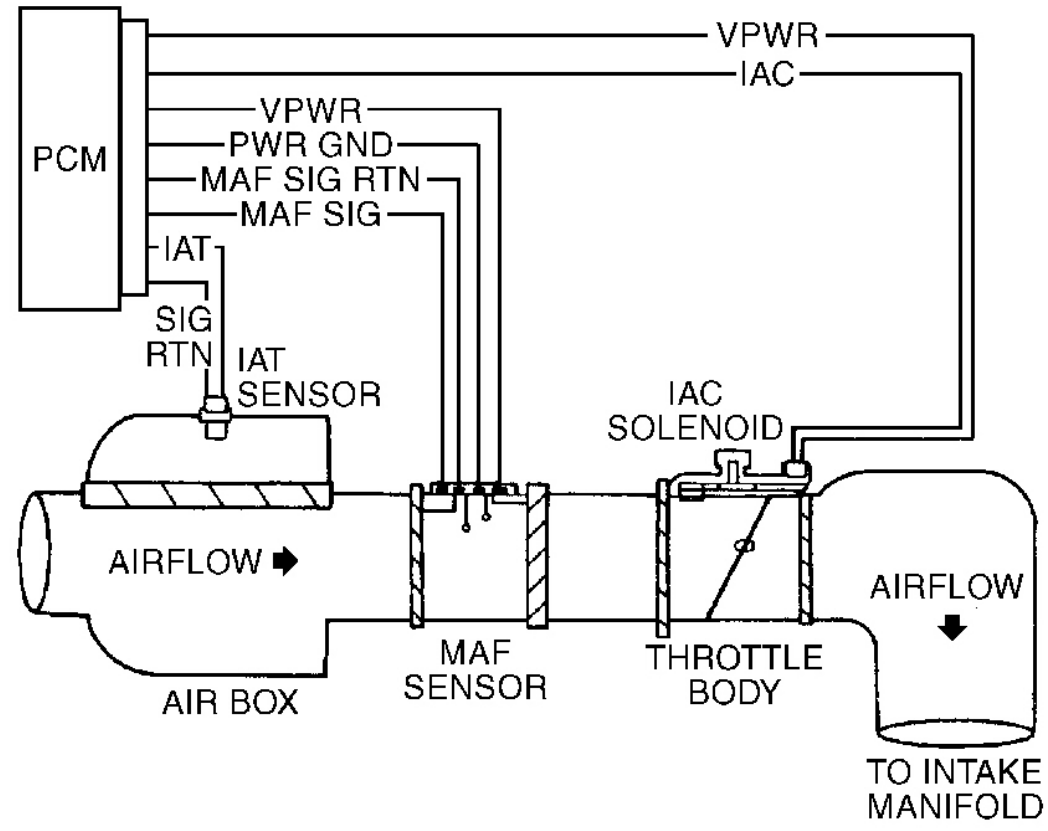

Fig. 60: Air Intake Circuit & Components Schematic

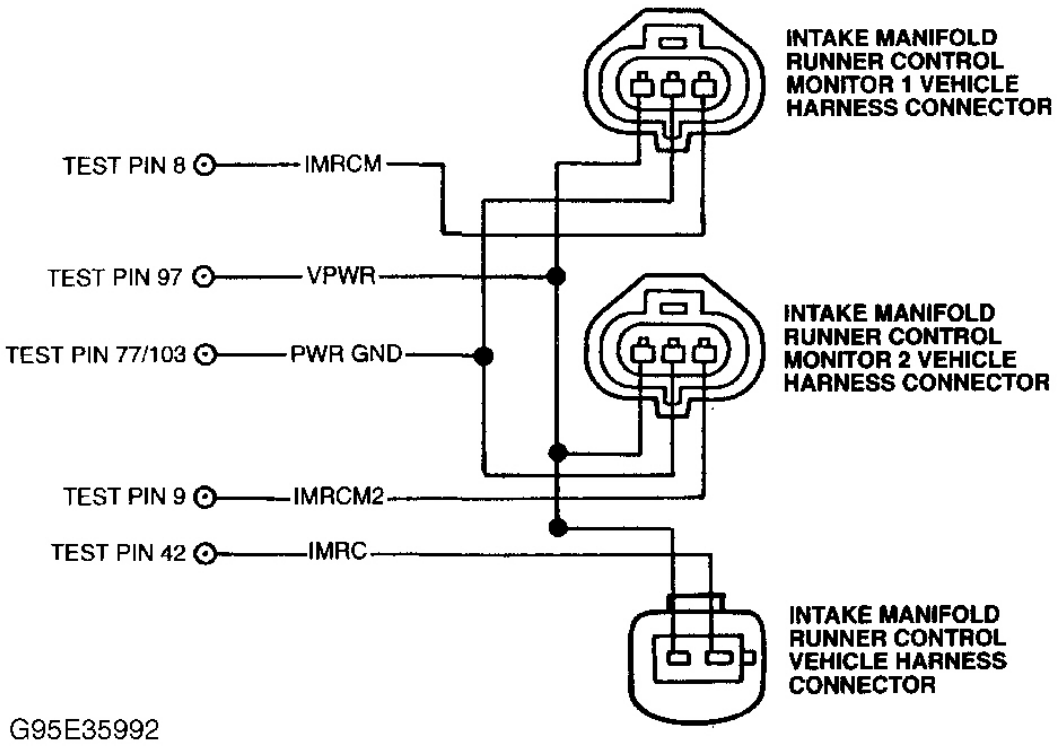

Fig. 61: IMRC Connector Terminals

1) Confirm Drive Symptom Test drive vehicle. Check for any of the following symptoms:

- Accelerator pedal sticking or binding.
- Hard start/long cranking.
- Hesitation or stalls at idle.
- Rough idle.
- Lack of power.

If symptom is present, go to next step. If symptom is not present, fault cannot be duplicated or identified at this time and testing is complete.

2) Check Accelerator Linkage If linkage sticks, binds or grabs, go to next step. If linkage operation is okay, go to step 7).

3) Turn ignition off. Disconnect accelerator linkage from throttle body. Inspect cable for freedom of travel from accelerator pedal to throttle body linkage cable connector. If cable moves freely, go to next step. If cable does not move freely, repair or replace as necessary.

4) Check Throttle Return Screw Leave ignition off and accelerator linkage disconnected from throttle body. Remove clean air tube from throttle body. Inspect clean air tube for dirt or contamination and repair as necessary. Check throttle return screw. If throttle return screw is in contact with throttle linkage lever

arm when throttle is fully closed, go to step 6). If throttle screw is not as specified, place a .002" (.05 mm) feeler gauge between throttle return screw and lever arm. Turn screw until it contacts feeler gauge. Remove feeler gauge. Turn throttle adjust screw 1/2 turn clockwise and go to next step.

5) Check TP Sensor Range Turn ignition off. Connect scan tester to DLC. Turn ignition on. Using scan tester, access TP PID. While observing TP PID, slowly move throttle from closed to open position. TP PID reading changes should be smooth while rotating throttle. At closed position, TP PID reading should be 0.53-1.27 volts (11-25%). If TP PID is as specified, remove scan tester and go to next step. If TP PID is not as specified, replace throttle body assembly.

6) Check Throttle Body Turn ignition off. Disconnect cable from throttle body. Remove clean air tube. Snap throttle from wide open to closed position several times. Slowly cycle throttle from closed to wide open position. Check for freedom of travel especially during initial throttle opening. If throttle moves freely, fault cannot be duplicated or identified at this time and testing is complete. If throttle does not rotate freely, replace throttle body assembly.

7) Check Air Filter Check air filter and element. Clean or replace as necessary. If air filter and element are okay, go to next step.

8) Check Engine Operation Ensure that the following engine systems are in good operating condition before continuing:

- Engine cooling system.
- Exhaust system.
- Fuel pressure.
- PCV system.

If systems are operating correctly, go to next step. If systems are not operating correctly, go to CIRCUIT TEST as indicated:

- Exhaust system; **CIRCUIT TEST HF** .
- Fuel pressure; **CIRCUIT TEST HC** .
- PCV system; **CIRCUIT TEST HG** .
- Engine cooling system; repair as necessary.

9) Check For Vacuum Leaks Start engine and allow to idle. Inspect inlet air system from MAF sensor to intake manifold for cracks, loose connections or faulty gaskets. Inspect intake manifold, EGR diaphragm and vacuum hoses for leaks. Repair or replace as necessary. If no faults are found, go to next step.

10) Check Idle Speed Turn all accessories off. Start engine and warm to normal operating temperature. Connect scan tester to DLC. Using scan tester, access IAC PID, idle air percent duty cycle. IAC PID reading should be approximately 20-45 percent at idle speed. If IAC PID values are as specified, go to next step. If IAC PID values are not as specified, go to step 12).

11) Check Idle Control Pressure Leave accessories off. With engine operating at idle, goose throttle and return to idle position. If engine stalls or engine speed fluctuates excessively before returning to idle, go to next step. If engine does not stall or fluctuate, air intake system is okay and testing is complete.

12) Check IAC Solenoid Function Leave accessories off. With engine operating at idle, disconnect IAC solenoid wiring harness connector. If engine speed does not change, replace IAC solenoid and clear Keep Alive Memory (KAM). If engine speed changes, proceed as follows:

- For vehicles without fast idle symptom, go to next step.

- For vehicles with fast idle symptom, go to step 14).

13) Check Throttle Body Turn ignition off. Remove throttle body. With throttle fully closed, ensure light cannot be seen between throttle bore and plate. Snap throttle from wide open to closed position several times. Slowly cycle throttle from closed to wide open position. Check for freedom of travel especially during initial throttle opening. If throttle body is okay, fault cannot be duplicated or identified at this time and testing is complete. If faults are present, replace throttle body and clear Keep Alive Memory (KAM).

14) Check IAC Circuit For Short To Ground Leave accessories off and IAC solenoid disconnected. Turn ignition off. Disconnect PCM 104-pin connector. Inspect pins for damage and repair if necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 83 (IAC) and test pins No. 51 and 103 (PWR GND) at the breakout box. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** . If resistance is less than 10,000 ohms, repair short circuit and repeat QUICK TEST.

15) DTC P1512, P1513, P1516, P1517, P1518, P1519, P1520, P1537 & P1538 DTCs P1516 and P1517 indicate control circuit failure. DTCs P1518, P1537 and P1538 indicate IMRC stuck open. DTCs P1512, P1513 and P1519 indicate IMRC stuck closed. DTC P1520 indicates control circuit failure. Possible causes are as follows:

- Cables improperly routed, binding or seized.
- Damaged or disconnected IMRC housing return springs.
- Lever return stop obstructed or bent.
- Lever wide open stop obstructed or bent.
- IMRC actuator cable or gears seized.

Visually inspect IMRC cables for correct routing. Ensure cable core wire has slack at IMRC housing and stop screw contacts plate. If adjustment is required, see INTAKE MANIFOLD RUNNER CONTROL (IMRC) in **ADJUSTMENTS - 4.2L** article. Operate IMRC plates while checking for binding or sticking. If any faults are found, repair as necessary. If no faults are found, go to next step.

16) Check IMRC Function If IMRC is vacuum controlled, start engine and allow to idle for 20 seconds. Turn ignition off. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access Output Test Mode (OTM). Turn all outputs on. When IMRC is turned on, both levers should contact wide open stop. One or both levers should contact wide open stop (one lever being slightly off is acceptable). IRMC levers should cycle fully from closed to open position. If faults are present, go to next step. If no faults are present proceed as follows:

- With DTC P1512 and/or P1513, go to step 41).
- With DTC P1516 and/or P1517, go to step 64).
- With DTC P1518, go to step 26).
- With DTC P1519, go to step 29).
- With DTC P1537 and/or P1538, go to step 52).

17) Check IMRC Operation Start engine and allow to idle. Apply parking brake. Raise engine speed to more than 3500 RPM. When engine speed exceeds 3500 RPM, one or both levers should contact wide open stop (one lever being slightly off is acceptable). When engine speed drops to less than 3000 RPM, one or both levers should contact closed plate stop screw. If levers do not cycle, go to next step. If levers

cycle as specified, proceed as follows:

- With DTC P1512 and/or P1513, go to step 41).
- With DTC P1516 and/or P1517, go to step 64).
- With DTC P1518, go to step 26).
- With DTC P1519, go to step 29).
- With DTC P1537 and/or P1538, go to step 52).

18) Turn ignition off. Disconnect cables from IMRC assembly. Operate both levers while checking for binding or sticking. If any faults are found, repair as necessary. If no faults are found, proceed as follows:

- With DTC P1512 and/or P1513, go to step 41).
- With DTC P1516 and/or P1517, go to step 64).
- With DTC P1518, go to step 26).
- With DTC P1519, go to step 29).
- With DTC P1537 and/or P1538, go to step 52).

19) Verify IMRC Circuit Fault Possible causes are as follows:

- IMRC control circuit open or shorted to PWR GND or SIG RTN.
- VREF circuit open or shorted to IMRC control circuit.
- Faulty IMRC module.
- Faulty Powertrain Control Module (PCM).

Turn ignition off. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access IMRCF PID. If IMRCF PID display is on, go to next step. If IMRCF PID display is not on, go to step 36).

20) Check IMRC Voltage Turn ignition off. Disconnect IMRC module wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal at IMRC wiring harness connector and negative battery terminal. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit. Clear PCM memory and repeat **QUICK TEST** .

21) Measure voltage between PWR GND terminal and VPWR terminal at IMRC wiring harness connector. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in PWR GND circuit. Clear PCM memory and repeat **QUICK TEST** .

22) Check IMRC Circuit Driver For Short To Ground Turn ignition off. Measure resistance between IMRC terminal at wiring harness connector and negative battery terminal. If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, go to step 39).

23) Check IMRC Circuit Driver For Short To Ground Leave ignition off and IMRC module disconnected. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure voltage between test pin No. 42 and test pins No. 51 and 103 (PWR GND) at breakout box. If voltage is less than one volt, go to next step. If either voltage is more than one volt, repair short circuit and repeat **QUICK TEST** .

24) Check IMRC Circuit Driver For Open Circuit Leave ignition off and IMRC module disconnected. Measure resistance between IMRC test at breakout box and IMRC terminal at wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

25) Verify PCM IMRC Driver Reconnect IMRC module. Turn ignition on. Connect jumper wire between test pin No. 42 and test pin No. 51 or 103 at breakout box. If IMRC plates open, replace PCM and repeat **QUICK TEST** . If IMRC plates do not open, replace IMRC module and repeat QUICK TEST.

26) DTC P1518: Check IMRC MONITOR Circuit DTC P1518 indicates low circuit voltage. Possible causes are as follows:

- IMRC control circuit shorted.
- Faulty IMRC module.
- Faulty Powertrain Control Module (PCM).

Ensure IMRC plates are closed. If IMRC plates are open, go to step 20). Turn ignition off. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access IMRCM PID. If PID voltage is 1.6 volts or more, go to step 34). If PID voltage is less than 1.6 volts, go to next step.

27) Turn ignition off. Disconnect IMRC module wiring harness connector. Turn ignition on. Using scan tester, access IMRCM PID. If PID voltage is 1.6 volts or more of what PID was with IMRC module disconnected, replace IMRC module. If PID voltage is less than 1.6 volts of what PID was with IMRC module disconnected, go to next step.

28) Turn ignition off. Leave IMRC module disconnected. Measure resistance between IMRC terminal at wiring harness connector and negative battery terminal. Measure resistance between IMRC terminal and SIG RTN terminal at wiring harness connector. If resistance is 10,000 ohms or more, replace PCM. If resistance is less than 10,000 ohms, repair short in IMRCM circuit and repeat **QUICK TEST** .

29) DTC P1519 DTC P1519 indicates IMRC input is greater than expected. Possible causes are as follows:

- IMRC circuit open.
- IMRC circuit shorted to ground or VREF.
- SIG RTN circuit open.
- Faulty IMRC module.
- Faulty Powertrain Control Module (PCM).

Turn ignition off. Disconnect IMRC wiring harness connector. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Connect jumper wire between IMRC wiring harness connector terminal IMRCM and terminal PWR GND or SIG RTN. Using scan tester, access IMRCM PID (if scan tester communication exists, remove jumper wire and go to step 38). If IMRCM PID voltage is 0.2 volt or less, go to step 40). If IMRCM PID voltage is more than 0.2 volt, remove jumper wire and go to next step.

30) Turn ignition off. Leave IMRC module disconnected. Disconnect scan tester from DLC. Measure resistance between SIG RTN terminal at IMRC wiring harness connector and negative battery terminal. If resistance is 5 ohms or less, go to next step. If resistance is more than 5 ohms, repair open in SIG RTN circuit and go to step 33).

31) Check IMRCM Circuit Continuity Leave ignition off and IMRC module disconnected. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 8 (IMRCM) and

IMRCM terminal at wiring harness connector. If resistance is less than 5 ohms, replace PCM and go to step 33). If resistance is 5 ohms or more, repair open in IMRCM circuit and go to step 33).

32) Check Circuit Operation Turn ignition off. Reconnect all components. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access Output Test Mode (OTM). While in OTM, access IMRCM PID and IMRC PID voltage. Connect DVOM between test pin No. 8 and test pins No. 51 and 103. If PID voltage and DVOM voltage are less than 1.6 volts, go to step 34). If either voltage is more than 1.6 volts, replace IMRC module and go to next step.

33) IMRC Drive Cycle Clear PCM memory. Using scan tester, access IMRC PID, IMRCM PID and RPM PID. Test drive vehicle with transmission in Overdrive. Complete 3 cycles from complete stop to speed requiring engine speed in excess of 3500 RPM. Stop vehicle. Repeat **QUICK TEST** and retrieve all DTCs. If any DTCs are present, go to appropriate CIRCUIT TEST. If any other DTCs are present, service as necessary. If no DTCs are present, testing is complete.

34) Wiggle Test Turn ignition off. Disconnect IMRC module. Connect jumper wire between IMRC wiring harness connector terminals IMRCM and SIG RTN. Turn ignition on. Using scan tester, access IMRCM PID. Observe PID for signs of fault. A fault will be indicated by change in PID voltage from less than 0.2 volt to more than 1.6 volts. Wiggle wiring harness between IMRC connector and PCM connector. If fault is indicated, isolate and repair as necessary. If no faults are indicated, remove jumper wire and go to next step.

35) Leave IMRC module disconnected. Turn ignition on. Using scan tester, access IMRCM PID. Observe PID for signs of fault. A fault will be indicated by change in PID voltage to less than 1.6 volt. Wiggle wiring harness between IMRC connector and PCM connector. If fault is indicated, isolate and repair as necessary. If no faults are indicated, go to **CIRCUIT TEST Z** .

36) Continuous Memory DTC P1520: Intermittent Circuit Malfunction Turn ignition off. Reconnect all components. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access Output Test Mode (OTM). While in OTM, access IMRCM PID and IMRC PID. Connect DVOM between test pin No. 42 and test pins No. 51 and 103. Command outputs on. Observe PID for signs of fault. A fault will be indicated by sudden change in PID voltage. Wiggle wiring harness between IMRC connector and PCM connector. If fault is indicated, isolate and repair as necessary. If no faults are indicated, go to next step.

37) Turn ignition on. While observing IMRC plates, wiggle wiring harness between IMRC module and PCM connector. If IMRC plates move while wiggling harness, fault is indicated. Isolate and repair if necessary. If no faults are indicated, go to **CIRCUIT TEST Z** .

38) Leave ignition off and IMRC disconnected. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 8 (IMRCM) and 90 (VREF) at breakout box. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** . If resistance is less than 10,000 ohms, repair short between IMRCM and VREF circuit.

39) Leave ignition off and IMRC disconnected. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 42 and test pins No. 51 and 103 (PWR GND) at breakout box. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** . If resistance is less than 10,000 ohms, repair short to PWR GND in IMRC control circuit.

40) Check IMRC Circuit Turn ignition off. Reconnect all components. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access Output Test Mode (OTM). While in OTM, turn all outputs on. Observe IMRC levers. If levers cycle open during output command, go to step 32). If

levers do not cycle open during output command, go to step 20).

41) Check IMRC Actuator DTC P1512, P1513, P1516 and P1517 indicates IMRC plates are stuck open. Possible causes are as follows:

- Broken or restricted vacuum hoses.
- IMRC circuit open.
- IMRC circuit shorted to ground or VREF.
- SIG RTN circuit open.
- Faulty IMRC module.
- Faulty Powertrain Control Module (PCM).

For vacuum operated systems, start engine and allow to idle for 20 seconds. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access IMRCM PID and IMRC2M PID (if applicable). Manually rotate IMRC levers. If PID voltage is 1.0 volts or more as levers are rotated, go to step 47). If PID voltage is not as specified, go to next step.

42) Check IMRC Monitor Signal For vacuum operated systems, start engine and allow to idle for 20 seconds. With scan tester connected to DLC, turn ignition on. Using scan tester, access IMRCM PID and IMRC2M PID. Disconnect both IMRC actuator wiring harness connectors. Using jumper wire, connect IMRCM and IMRC2M connector terminals to ground. If PID voltage change is less than 1.0 volt, go to next step. If PID voltage change is 1.0 volt or more, go to step 44).

43) Check IMRC Monitor Resistance Turn ignition off. Leave both IMRC actuator wiring harness connectors disconnected. Measure resistance between IMRC terminal and PWR GND terminal at actuator. Measure resistance between IMRC terminal and VPWR terminal at actuator. If resistance is not 100-10,000 ohms, replace IMRC actuator and go to step 33). If resistance is 100-10,000 ohms, fault cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

44) Check IMRC Monitor Power Ground Leave ignition off and both IMRC actuator wiring harness connectors disconnected. Measure resistance between PWR GND terminal at actuator and chassis ground. If resistance is less than 100 ohms, go to next step. If resistance is 100 ohms or more, repair open circuit go to step 33).

45) Check IMRC Monitor Signal Short To Power Leave ignition off and both IMRC actuator wiring harness connectors disconnected. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Connect negative lead of DVOM to test pin No. 77 or 103 (PWR GND) at breakout box. Check voltage at test pin No. 8. and 9. If voltage is less than 1.0 volt, go to next step. If voltage is 1.0 volt or more, repair circuit short to VPWR and go to step 33).

46) Check IMRC Monitor Signal Return Turn ignition off. Leave both IMRC actuator wiring harness connectors disconnected. Measure resistance between IMRCM terminal at actuator and test pin No. 8 and 9. If resistance is less than 5 ohms, replace PCM and go to step 33). If resistance is 5 ohms or more, repair open in IMRCM circuit and go to step 33).

47) Check IMRC Output Test Mode Connect scan tester to DLC. Turn ignition on. Using scan tester, access IMRCM PID and IMRC2M PID. Observe PID values. Start engine and allow to idle. Access IMRCM PID and IMRC2M PID. If PID values change, fault is intermittent and cannot be duplicated at this time. Go to **CIRCUIT TEST Z** . If PID values do not change, go to next step.

48) Check Bank One IMRC Vacuum Signal Turn ignition off. Disconnect left IMRC actuator vacuum

hose. Ensure hose is not damaged or restricted. Connect vacuum hose to vacuum gauge. Start engine and allow to idle. If vacuum reading is less than 10 in. Hg, go to next step. If vacuum reading is 10 in. Hg or more, replace IMRC actuator and go to step 33).

49) Check Bank 2 IMRC Vacuum Signal Turn ignition off. Disconnect right IMRC actuator vacuum hose. Ensure hose is not damaged or restricted. Connect vacuum hose to vacuum gauge. Start engine and allow to idle. If vacuum reading is less than 10 in. Hg, go to next step. If vacuum reading is 10 in. Hg or more, replace IMRC actuator and go to step 33).

50) Check IMRC Circuit To PCM Turn ignition off. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 42 and test pins No. 77 and 103 at breakout box. If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, repair IMRCM circuit short to PWR GND and go to step 33).

51) Check IMRC Circuit For Short Turn ignition off. Connect PCM to breakout box. With vacuum gauge connected to IMRC actuator vacuum hose, start engine and allow to idle. Connect jumper wire between test pin No. 42 and test pin No. 77 or 103 (PWR GND) at breakout box. If vacuum reading is less than 10 in. Hg, replace PCM and go to step 33). If vacuum reading is 10 in. Hg or more, replace IMRC actuator and go to step 33).

52) Check IMRC Actuator DTC P1516, P1517, P1537 and P1538 indicates IMRC plates are stuck open. Possible causes are as follows:

- Broken or restricted vacuum hoses.
- IMRC circuit open.
- IMRC circuit shorted to ground or VREF.
- SIG RTN circuit open.
- Faulty IMRC module.
- Faulty Powertrain Control Module (PCM).

For vacuum operated systems, start engine and allow to idle for 20 seconds. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access IMRCM and IMRC2M PID. If PID voltage is less than 1.0 volt, go to next step. If PID voltage is 1.0 volts or more, fault is intermittent. Go to step 54).

53) Check IMRC PID Reading For vacuum operated systems, start engine and allow to idle for 20 seconds. With ignition on, use scan tester to access IMRCM PID and IMRC2M PID. Proceed as follows:

- Disconnect left IMRC actuator connector and note PID voltage.
- Disconnect right IMRC actuator connector and note PID voltage.
- Reconnect right IMRC actuator connector and note PID voltage.
- Reconnect left IMRC actuator connector and note PID voltage.

If PID values increase is 1.0 volt or more, isolate and replace defective IMRC actuator. Go to step 33). If PID values do not increase more than 1.0 volt, go to step 55).

54) Wiggle Test For vacuum operated systems, start engine and allow to idle for 20 seconds. After about 30 seconds, vacuum will bleed off and PID values will change. Restart engine if necessary. With ignition

on, use scan tester to access IMRCM PID and IMRC2M PID. Turn ignition ON. Wiggle IMRC wiring harness between actuator and PCM. Observe PID for signs of fault. A fault will be indicated by a sudden drop in PID voltage. Wiggle wiring harness between IMRC connector and PCM connector. If fault is indicated, isolate and repair as necessary. Go to step 33). If no faults are indicated, fault cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

55) Check IMRC Vacuum Supply Turn ignition off. Disconnect IMRC actuator vacuum hose. Ensure hose is not damaged or restricted. Connect vacuum hose to vacuum gauge. Start engine and allow to idle. If vacuum reading is 10 in. Hg or more, go to next step. If vacuum reading is less than 10 in. Hg, repair vacuum circuit and go to step 33).

56) Turn ignition off. Disconnect left IMRC actuator vacuum hose. Ensure hose is not damaged or restricted. Connect vacuum hose to vacuum gauge. Start engine. Raise engine speed to 3500 RPM. If vacuum reading is less than 10 in. Hg, go to next step. If vacuum reading is 10 in. Hg or more, go to step 60).

57) Check VPWR Circuit Turn ignition off. Disconnect IMRC actuator wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal of connector and chassis ground. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open circuit and go to step 33).

58) Check IMRC Circuit For Open Turn ignition off. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 42 at breakout box and IMRC terminal at actuator wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in IMRC circuit and go to step 33).

59) Check IMRC Circuit To PCM Turn ignition on. Measure voltage between test pin No. 42 and test pins No. 77 and 103 at breakout box. If voltage is 10.5 volts or more, repair IMRC circuit short to VREF or VPWR. If voltage is less than 10.5 volts, replace IMRC vacuum actuator. Go to step 33).

60) Check VPWR Circuit Turn ignition off. Disconnect both IMRC sensor wiring harness connectors. Turn ignition on. Measure voltage between VPWR terminal of each connector and chassis ground. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit and go to step 33).

61) IMRCM Circuit Check For Short To Ground Turn ignition off. Leave both IMRC sensor wiring harness connectors disconnected. Disconnect scan tester from DLC. Measure resistance between IMRCM terminal at both connectors and chassis ground. If resistance is more than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, go to step 63).

62) IMRC Sensor Check Leave ignition off and both IMRC sensor wiring harness connectors disconnected. Measure resistance between IMRC terminal and PWR GND terminal at both sensors. If resistance is 1000-10,200 ohms, reconnect all components and go to step 33). If resistance is not 1000-10,200 ohms, replace IMRC sensor and go to step 33).

63) Check PCM For Internal Short Leave ignition off and both IMRC sensor wiring harness connectors disconnected. Measure resistance between test pin No. 8 and test pins No. 77 and 103 at breakout box.

64) Determine IMRC Fault Path DTC P1516 or P1517 indicate IMRC plates are open or closed time exceeded PCM program. For vacuum operated systems, start engine and allow to idle for 20 seconds. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access IMRCM PID. Access IMRC2M PID. If PID voltage is less than 3.0 volts, go to step 29) for electronic controlled systems or step 41) for vacuum controlled systems. If PID voltage is 3.0 volts or more, go to step 26) for electronic controlled systems or step 55) for vacuum controlled systems.

65) Check IMT Valve & Vacuum Actuator Connection Turn ignition off. Disconnect IMT valve and vacuum actuator wiring harness connector. Inspect for damaged or loose pins and repair if necessary. If no faults are found, go to next step.

66) Check IMT Valve & Vacuum Actuator VPWR Circuit For Open Turn ignition off. Measure resistance between chassis ground and VPWR terminal at IMT valve wiring harness connector. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VREF circuit.

67) Check IMT Valve & Vacuum Actuator Circuit For Open Turn ignition off. Leave IMT valve wiring harness connector disconnected. Disconnect PCM 104-pin connector. Inspect for damaged pins and repair if necessary. Connect EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 46 at breakout box and IMT VALVE terminal at harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in IMT VALVE circuit.

68) Check IMT Valve & Vacuum Actuator Circuit For Short To PWR GND Leave ignition off. Disconnect scan tester from DLC (if applicable). Leave PCM and IMT valve wiring harness connector disconnected. Measure resistance between test pin No. 46 and test pins No. 77 and 103 at breakout box. If resistance is more than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, repair IMT VALVE circuit short to PWR GND circuit.

69) Check IMT VALVE Circuit Short To VREF Or VPWR Leave PCM and IMT valve wiring harness connector disconnected. Turn ignition on. Measure voltage between test pin No. 46 and test pins No. 77 and 103 at breakout box. If voltage is 10.5 volts or more, repair IMT VALVE circuit short to VREF or VPWR. If voltage is less than 10.5 volts, go to next step.

70) Check IMT Valve Actuator Internal Resistance Turn ignition off. Reconnect IMT valve wiring harness connector. Leave breakout box installed and PCM disconnected. Disconnect scan tester from DLC (if applicable). Measure resistance between test pins No. 46 and 97 (VPWR) at breakout box. If resistance is 65-85 ohms (SOHC engine) or 5-300 ohms (all except SOHC engine), replace PCM. If resistance is not as specified, replace IMT VALVE.

71) Perform IMRC Wiggle Test Turn ignition off. Connect scan tester to DLC. Turn ignition on. Using scan tester, access IMRCM PID. Observe PID values while wiggling wiring harness between IMRC monitor connector and PCM. If PID value fluctuates, isolate fault and repair as necessary. If PID value does not fluctuate, replace PCM and go to step 38).

CIRCUIT TEST HW - EVAPORATIVE EMISSION PURGE FLOW SYSTEM

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Leaks in fuel tank, filler cap or vapor hoses.
- Wiring harness circuits (CANP SIG, PF, PWR GND, VMV and VPWR).
- Faulty Canister Purge (CANP) solenoid.
- Faulty Purge Flow (PF) Sensor.
- Faulty Vapor Management Valve (VMV).
- Faulty carbon canister.

- Faulty PCM.

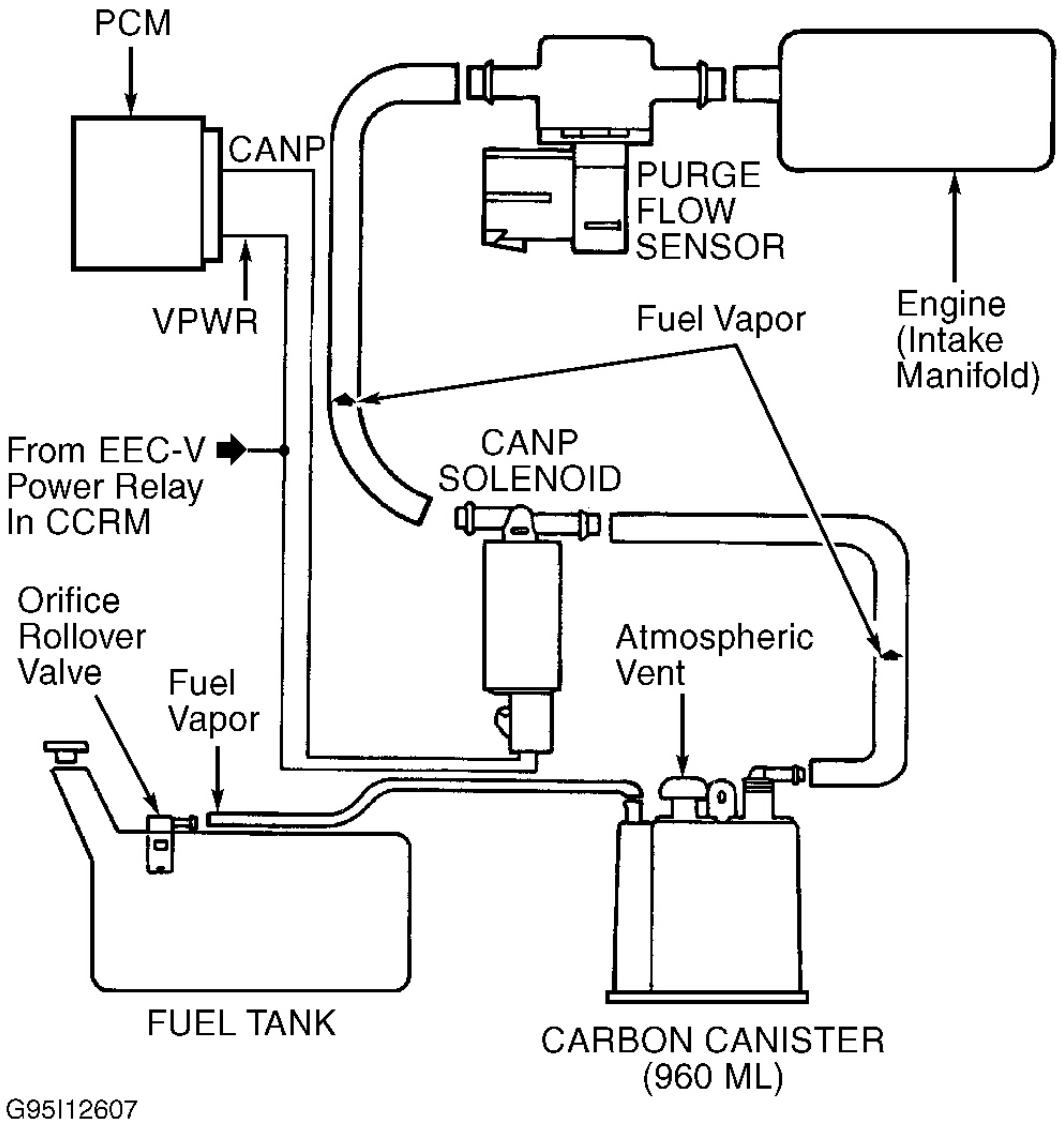

Fig. 62: EVAP Components Using Purge Flow System

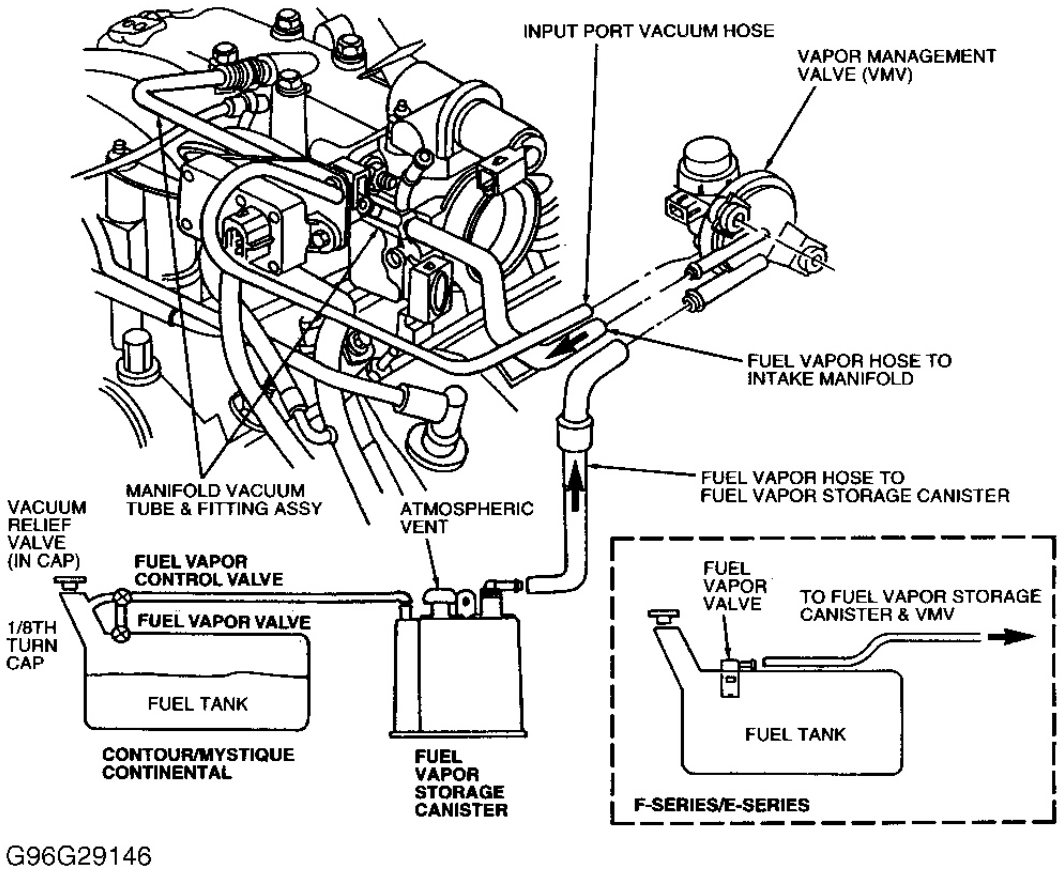

Fig. 63: EVAP Components Using Vapor Management System

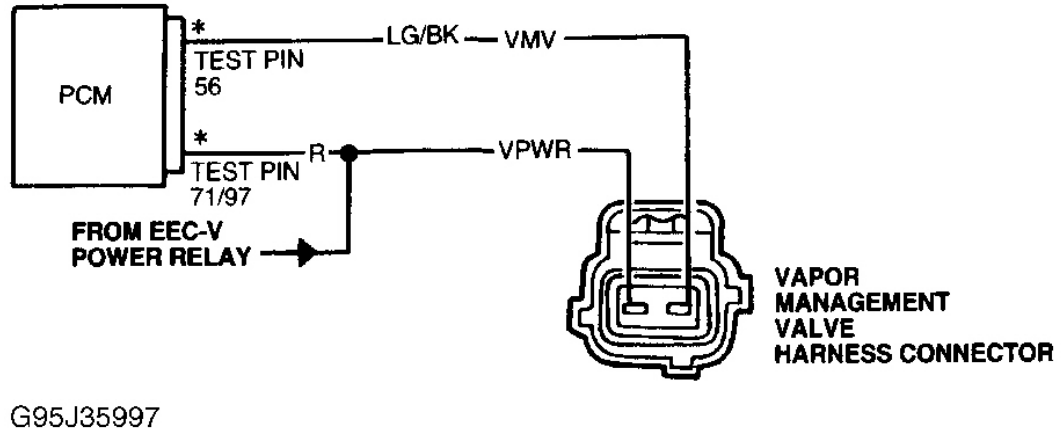

Fig. 64: VMV Test Circuit & Connector Terminals

1) DTC P0443: Check VPWR Circuit Voltage Disconnect Canister Purge (CANP) solenoid or Vapor Management Valve (VMV) wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal of CANP solenoid or VMV wiring harness connector and battery ground. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit and repeat **QUICK TEST** .

2) Check Component Resistance Turn ignition off. Leave CANP or VMV wiring harness connector disconnected. Measure resistance between CANP solenoid or VMV terminals. For CANP solenoid, if resistance is 30-90 ohms, go to next step. For VMV, if resistance is 30-36 ohms, go to step 4). If resistance is not as specified, replace CANP solenoid or VMV. Clear PCM memory and repeat **QUICK TEST** .

3) Check CANP Solenoid For Internal Short Turn ignition off. Leave wiring harness connector disconnected. Measure resistance between each solenoid terminal and CANP solenoid housing. If each resistance measurement is more than 90 ohms, CANP solenoid is okay. Go to next step. If resistance is not as specified, replace CANP solenoid. Clear PCM memory and repeat **QUICK TEST** .

4) Check VMV Circuit Continuity Leave ignition off and CANP or VMV wiring harness connector disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance as follows:

- For CANP solenoid, between test pin No. 67 at breakout box and EVAP CANP terminal of CANP solenoid wiring harness connector.
- For VMV, between test pin No. 56 at breakout box and VMV terminal of VMV wiring harness connector.

If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

5) Check Circuit For Short To PWR GND Leave ignition off. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No. 67 (CANP solenoid) or 56 (VMV) and test pins No. 24 and 103. If each resistance is more than 10,000 ohms, go to step 17). If resistance is 10,000 ohms or less, repair EVAP CANP/VMV circuit short to PWR GND circuit. Clear PCM memory and repeat **QUICK TEST** .

6) Continuous Memory DTC P1443 This DTC can set by Idle Air Control (IAC) valve speed error during vehicle operation. If Continuous Memory DTC P1507 is also present, go to **CIRCUIT TEST KE** , step 30). Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access IAC PID, TP PID and RPM PID. Turn all accessories off. Start engine and allow to idle. IAC duty cycle should be 20-45%. Observe IAC PID and RPM PID for indication of fault while shaking and bending IAC valve wiring harness and connector. A fault will be indicated by sudden increase of engine speed and decrease in IAC duty cycle. If fault is indicated, isolate and repair as necessary. If no fault is go to step 8).

7) Check Purge Flow (PF) Sensor Connect scan tester to Data Link Connector (DLC). Start engine and allow to idle. Disconnect PF sensor wiring harness connector. Inspect connector for damage and repair if necessary. Using scan tester, access PF PID. If voltage fluctuates, go to step 9). If voltage does not fluctuate as specified, go to next step.

8) Continuous Memory DTC P1443; Visually Inspect EVAP System Leave ignition off. Ensure fuel fill cap is installed correctly. Check vacuum hose between fuel tank and carbon canister for faults. Check for carbon canister cracks or damage. Check for fuel tank damage. Check for damaged orifice rollover valve. Repair or replace as necessary. If no faults are found on models equipped with CANP solenoid, go to next step. If no faults are found on models equipped with VMV, go to step 21).

9) Check CANP Solenoid For Vacuum Leak Leave ignition off. Disconnect CANP solenoid wiring harness connector. Disconnect hoses from CANP solenoid. Connect vacuum pump to intake manifold side of CANP solenoid. Using vacuum pump, apply 16 in. Hg to solenoid. If vacuum is held for 20 seconds, leave pump connected and go to next step. If vacuum is not held for 20 seconds, replace CANP solenoid and repeat **QUICK TEST** .

10) Leave ignition off and CANP solenoid wiring harness connector disconnected. Connect scan tester to DLC. Turn ignition on. Using scan tester, access Output Test Mode and command CANP solenoid on. Using vacuum pump, apply 16 in. Hg to solenoid. When CANP solenoid is commanded on, vacuum should be released. If solenoid does not operates as specified, replace CANP solenoid and repeat **QUICK TEST** .

If solenoid operates as specified, check fuel vapor hoses between carbon canister and CANP solenoid for damage or restriction. Repair as necessary.

11) Check For Vacuum At Purge Flow (PF) Sensor Turn ignition off. Ensure PF sensor is connected. Reconnect CANP solenoid. Remove hose from manifold vacuum at PF sensor and attach vacuum gauge to hose. Start engine and allow to idle. If vacuum is 10 in Hg. or more, check for small vacuum leak between PF sensor and intake manifold. Repair as necessary and repeat **QUICK TEST** . If vacuum is less than 10 in Hg., repair large vacuum leak or blockage in hose between PF sensor and intake manifold. Repair as necessary and repeat QUICK TEST. If DTC P1443 is still present, go to next step.

12) Check CANP Solenoid Resistance Turn ignition off. Leave CANP wiring harness connector disconnected. Measure resistance between CANP solenoid terminals. If resistance is 30-90 ohms, go to next step. If resistance is not as specified, replace CANP solenoid. Clear PCM memory and repeat **QUICK TEST** .

13) Check Circuit For Short To VPWR Leave ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 67 (CANP solenoid) or 56 (VMV) and test pins No. 71 and 97 at breakout box. If each resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10,000 ohms or less, repair EVAP CANP/VMV circuit short to VPWR circuit. Clear PCM memory and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 13) to step 21). No test procedures have been omitted.

21) Check VMV Housing Turn ignition off. Reconnect VMV wiring harness connector. Disconnect VMV fuel vapor hose from intake manifold port at VMV. Disconnect VMV fuel vapor hose from vapor canister port at VMV. Attach vacuum pump with gauge to intake manifold port at VMV. Using vacuum pump, apply 16 in. Hg to VMV. If vacuum is not held, replace VMV and repeat **QUICK TEST** . If vacuum is held, go to next step.

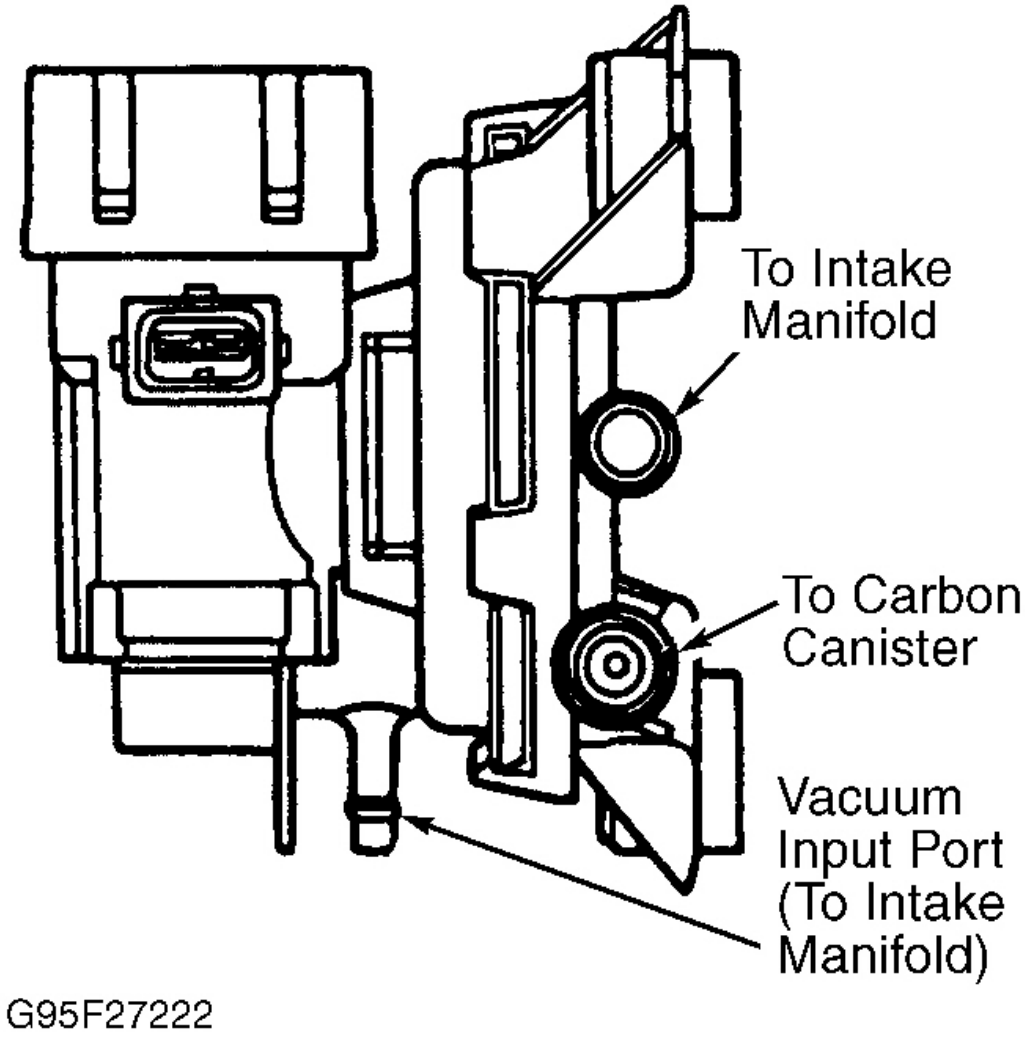

Fig. 65: VMV Hose Ports

22) Check VMV Filter Turn ignition off. Disconnect vacuum input hose from VMV. Using a vacuum pump, apply 15 in. Hg to VMV. If vacuum is not held, remove vacuum pump and go to next step. If vacuum is held or bleeds off slowly, service VMV filter. If filter cannot be serviced, replace VMV.

23) Check VPWR Circuit Voltage Turn ignition off. Connect PCM to breakout box. Disconnect VMV wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal of VMV wiring harness connector and battery ground. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit and repeat **QUICK TEST** .

24) Check VMV Turn ignition off. Ensure PCM is connected to breakout box. Reconnect VMV vacuum input hose. Disconnect fuel vapor to carbon canister hose. Connect vacuum gauge to vacuum port. Start

engine and allow to idle for 5 minutes. Vacuum gauge should read zero. Connect jumper wire between test pin No. 56 (VMV) and test pin No. 51 or 103 at breakout box. Vacuum should be about engine manifold vacuum. If vacuum is not as specified, replace VMV and repeat **QUICK TEST** . If vacuum is as specified, remove vacuum gauge and jumper wire. Go to next step.

25) Turn ignition off. Reconnect VMV wiring harness connector. Disconnect upper and lower hose from VMV. Start engine and allow to idle. Check for vacuum at open end of hoses. If vacuum is present, leave hoses disconnected and go to next step. If vacuum is not present, check hoses for correct routing. Ensure hoses are not damaged or restricted. Repair or replace as necessary.

26) Turn ignition off. Ensure VMV wiring harness connector is connected. Disconnect vacuum input hose from VMV. Using a vacuum pump, apply 16 in. Hg to VMV. If vacuum bleeds off immediately, fault is intermittent and cannot be duplicated at this time. Testing is complete. If vacuum is not bled off immediately, check hoses for damage or restriction. Repair or replace as necessary and repeat **QUICK TEST** .

27) Continuous Memory DTC P1444 Turn ignition off. Disconnect PF sensor wiring harness connector. Inspect pins for damage and repair as necessary. Reconnect PF sensor wiring harness connector. Connect scan tester to Diagnostic Link Connector (DLC). Turn ignition on. Using scan tester, access PF PID. If PF PID voltage is 0.4 volt or less, go to next step. If PF PID voltage is 0.2 volt or less, go to step 30). If voltage is more than 0.4 volt or more, fault is intermittent. Go to step 32).

28) Turn ignition off. Disconnect PF sensor wiring harness connector. Ensure PF sensor temperature is 55-80°F (13-27°C). Measure resistance between PF sensor terminal No. 1 and No. 2. Resistance should be less than 160 ohms. Measure resistance between PF sensor terminal No. 1 and No. 3. Resistance should be less than 190 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace PF sensor and repeat **QUICK TEST** .

29) Check For Open In VPWR Circuit Leave ignition off and PF sensor disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between pin No. 1 at PF sensor and test pins No. 71 and 91 at breakout box. If resistance is less than 5 ohms, go to next step for DTC P1444 or step 34) for DTC P1445. If resistance is 5 ohms or more, repair open in VPWR and repeat **QUICK TEST** .

30) Leave ignition off and PF sensor disconnected. Ensure PF sensor temperature is 55-80°F (13-27°C). Measure resistance between PF sensor terminal No. 2 and No. 3. If resistance is more than 25.5 ohms, go to next step. If resistance is not as specified, replace PF sensor and repeat **QUICK TEST** .

31) Check PF Circuit For Short To VPWR Leave ignition off and PF sensor disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Disconnect scan tester from DLC (if applicable). Measure resistance between breakout box test pin No. 11 and test pins No. 24 and 103. If each resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If any resistance is 10,000 ohms or less, repair PF circuit short to PWR GND. Clear PCM memory and repeat QUICK TEST.

32) Wiggle Test Solenoid & Harness Turn ignition off. Using scan tester, access PF PID. Observe PF PID for indication of fault while shaking and bending PF sensor wiring harness and connector. A fault will be indicated by sudden change of voltage. Tap lightly on PF sensor to simulate road shock. If fault is indicated, isolate and repair as necessary. If no fault is indicated, go to **CIRCUIT TEST Z** .

33) Continuous DTC P1445 Turn ignition off. Disconnect PF sensor wiring harness connector. Inspect pins for damage and repair as necessary. Reconnect PF sensor wiring harness connector. Connect scan tester to Diagnostic Link Connector (DLC). Turn ignition on. Using scan tester, access PF PID. If PF PID

voltage is more than 4.8 volts, go to step 28). If voltage is 4.8 volts or less, go to step 39).

34) Check Purge Flow (PF) Sensor Turn ignition off. Disconnect PF sensor wiring harness connector. Allow sensor to cool to room temperature. Measure resistance between terminal No. 1 and No. 2. If resistance is 40-230 ohms, go to next step. If resistance is not 40-230 ohms, replace PF sensor and repeat **QUICK TEST** .

35) Check PF Circuit Short To VPWR Leave PF sensor disconnected. Turn ignition on. Measure voltage between PF terminal of sensor wiring harness connector and battery ground. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, go to step 37).

36) Turn ignition off. Leave PF sensor disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between breakout box test pin No. 11 and test pins No. 24 and 103. If voltage is greater than 10.5 volts, repair PF circuit short to VPWR and repeat **QUICK TEST** . If voltage is 10.5 volts or less, replace PCM and repeat QUICK TEST.

37) Check PF Circuit For Open in Harness Turn ignition off. Leave PF sensor disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between breakout box test pin No. 11 and PF terminal at sensor wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in PF circuit. Clear PCM memory and repeat **QUICK TEST** .

38) Check PWR GND Circuit For Open in Harness Leave ignition off and PF sensor disconnected. Measure resistance between breakout box test pins No. 24 and 103. If resistance is less than 5 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open in PWR GND circuit and repeat QUICK TEST.

39) Wiggle Test Solenoid & Harness Turn ignition off. Connect scan tester to DLC. Using scan tester, access PF PID. Observe PF PID for indication of fault while shaking and bending PF sensor wiring harness and connector. A fault will be indicated by sudden change of voltage. Tap lightly on PF sensor to simulate road shock. If fault is indicated, isolate and repair as necessary. If no fault is indicated, go to **CIRCUIT TEST Z** .

40) Continuous Memory DTC P0443: Check VMV Circuit For Intermittent Failure Repeat **QUICK TEST** . If Continuous Memory DTC P0443 is still present, go to next step. If Continuous Memory DTC P0443 is not present, go to step 1).

41) Wiggle Test Solenoid & Harness Turn ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Using DVOM, measure resistance between test pin No. 67 (CANP solenoid) or 56 (VMV) and test pins No. 71 and 97. Observe DVOM for indication of fault while shaking and bending VMV wiring harness and connector. A fault will be indicated by resistance measurement of less than 30 ohms or more than 36 ohms (VMV) or 90 ohms (CANP solenoid). Tap lightly on VMV to simulate road shock. If fault is indicated, isolate and repair as necessary. If no fault is indicated, go to **CIRCUIT TEST Z** .

CIRCUIT TEST HX - EVAPORATIVE EMISSION (EVAP) MONITOR & SYSTEM

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used

to diagnose the following:

- Leaks in fuel tank, filler cap or vapor hoses.
- Faulty Canister Vent (CV) solenoid.
- Faulty Fuel Tank Pressure (FTP) Sensor.
- Faulty fuel vapor valve.
- Faulty fuel vapor control valve (if equipped).
- Faulty carbon canister.
- Wiring harness circuits (CV, FTP, PWR GND, VMV, VPWR and VREF).
- Faulty PCM.

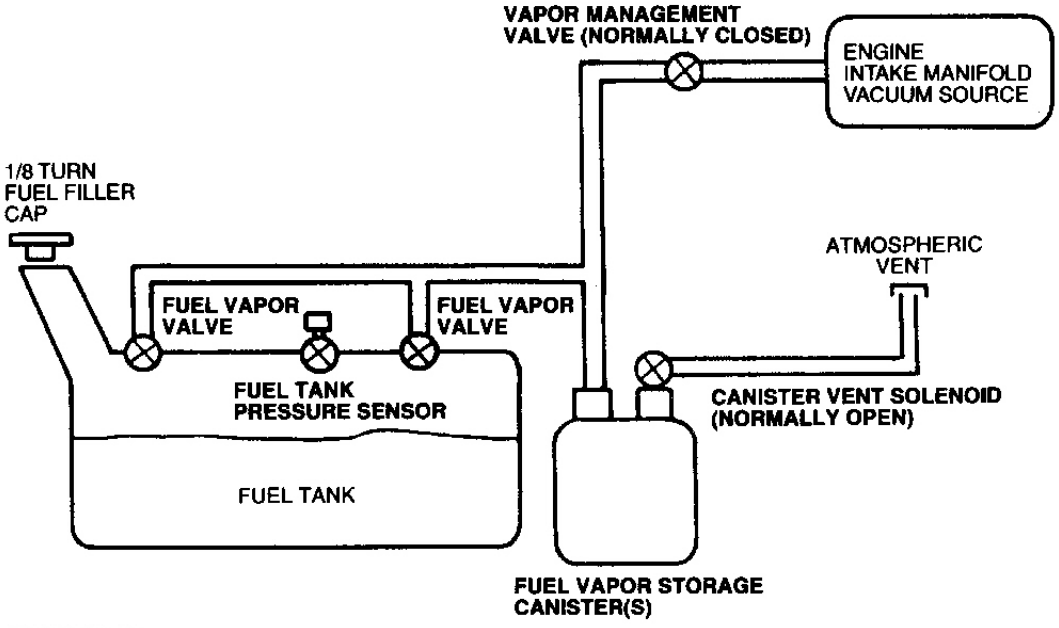

Fig. 66: EVAP Components

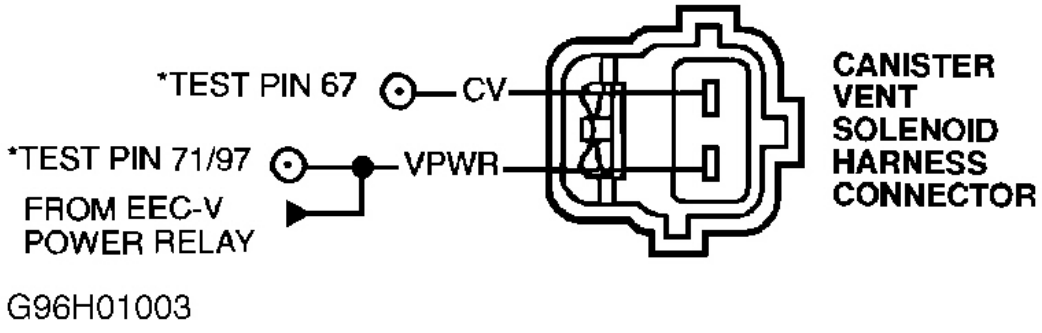

Fig. 67: CV Solenoid Connector & Test Circuit

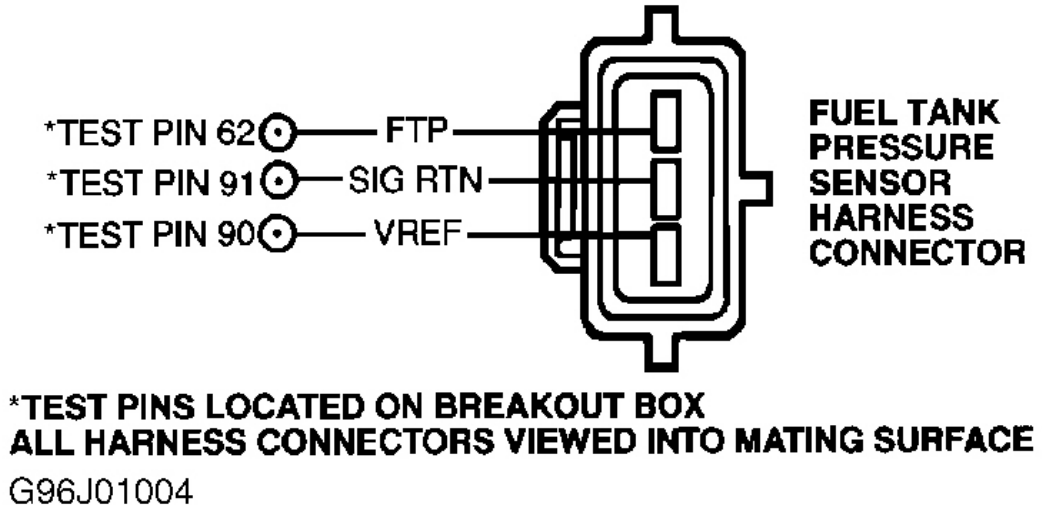

Fig. 68: FTP Connector & Test Circuit

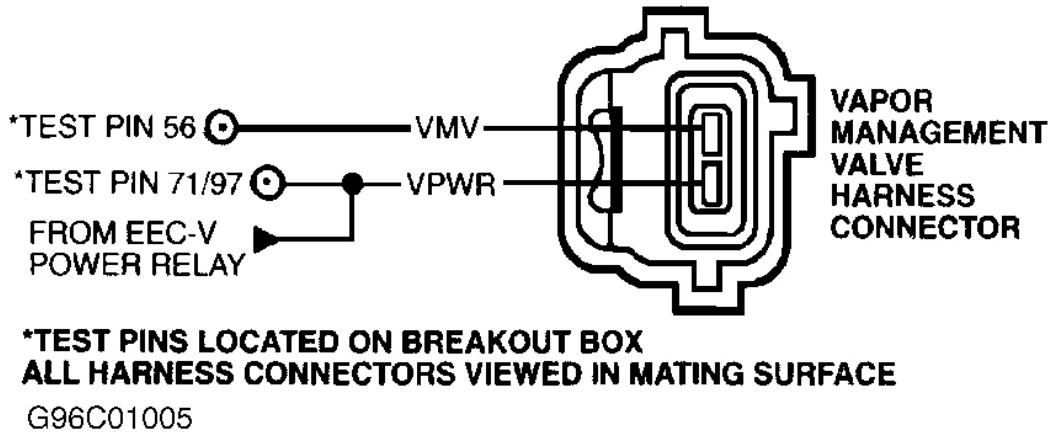

Fig. 69: VMV Connector & Test Circuit

1) Continuous Memory DTC P0442 Or P1442 Turn ignition off. Ensure fuel fill cap is correctly installed. Ensure cap is not damaged or excessively worn. Service or replace as necessary and verify symptom is repaired. If fuel fill cap is okay, go to next step.

2) Leave ignition off. Check all fuel vapor hoses for damage or restrictions. Ensure hose connections are tight. Service or replace as necessary and verify symptom is repaired. If fuel vapor hoses are okay, go to step 61).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 2) to step 6). No test procedures have been omitted.

6) Continuous Memory DTC P0443 Perform **QUICK TEST** . If DTC P0443 is present in Continuous Memory only, go to step 12). If DTC P0443 is present in KOEO or KOER self-test, go to next step.

7) DTC P0443: Check VPWR Circuit Voltage Turn ignition off. Disconnect Vapor Management Valve (VMV) wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal of VMV wiring harness connector and battery ground. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit and repeat **QUICK TEST** .

8) Check VMV Resistance Turn ignition off. Leave VMV wiring harness connector disconnected. Measure resistance between CANP solenoid or VMV terminals. If resistance is 30-36 ohms, go to next step. If resistance is not as specified, replace VMV and repeat **QUICK TEST** .

9) Check VMV Circuit Resistance Leave ignition off and VMV wiring harness connector disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 56 at breakout box and VMV terminal of VMV wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

10) Check Circuit For Short To PWR GND Leave ignition off and VMV wiring harness connector disconnected. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No.

56 (VMV) and test pins No. 24 and 103. If resistance is 10,000 ohms or less, repair VMV circuit short to PWR GND circuit. Clear PCM memory and repeat **QUICK TEST** . If each resistance is more than 10,000 ohms, go to step 57) if DTC P1450 is present or go to next step if DTC P1450 is not present.

11) Leave ignition off and VMV disconnected. Turn ignition on. Measure voltage between breakout box test pin No. 56 and test pins No. 51 and 103. If voltage is greater than 10.5 volts, repair VMV circuit short to VPWR and repeat **QUICK TEST** . If voltage is 10.5 volts or less, replace PCM and repeat QUICK TEST.

12) Wiggle Test VMV & Harness Turn ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Using DVOM, measure resistance between test pin No. 56 (VMV) and test pins No. 71 and 97. Observe DVOM for indication of fault while shaking and bending VMV wiring harness and connector. A fault will be indicated by resistance measurement of less than 30 ohms or more than 36 ohms. Tap lightly on VMV to simulate road shock. If fault is indicated, isolate and repair as necessary. If no fault is indicated, go to **CIRCUIT TEST Z** .

13) Continuous Memory DTC P0446 Turn ignition off. Remove fuel fill cap. Connect scan tester to DLC. Turn ignition on. Using scan tester, access FTP V PID. Record FTP V PID voltage. Install fuel fill cap to first click. If FTP V PID voltage is 2.4-2.8 volts, go to step 15). If FTP V PID voltage is not 2.4-2.8 volts, go to next step.

14) Check VREF At FTP Connector Turn ignition off. Disconnect FTP wiring harness connector. Turn ignition on. Measure voltage between VREF terminal and SIG RTN terminal at wiring harness connector. If voltage is 4-6 volts, replace FTP sensor and repeat **QUICK TEST** . If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

15) Check Carbon Canister Check for restrictions at carbon canister atmosphere vent port. Check for restrictions in purge air inlet tube (large diameter hose) between CV solenoid and atmosphere. Repair or replace as necessary. If no faults are found, go to next step.

16) Check CV Solenoid Filter Port Disconnect purge air inlet tube (large diameter hose) from CV solenoid. If vehicle is not equipped with purge air inlet tube, go to next step. Locate opposite end of tube (in fuel filter housing). Drop a 3/8" ball bearing into tube. If ball bearing passes through tube, go to next step. If ball bearing does not pass through tube, service or replace tube as necessary and repeat **QUICK TEST** .

17) Check CV Solenoid Mechanical Operation Remove CV solenoid hose. Connect vacuum pump to solenoid. Using vacuum pump, apply 16 in. Hg to solenoid. If vacuum is held for one minute, replace CV solenoid and repeat **QUICK TEST** . If vacuum is not held for one minute, go to step 8) for Pickup or go to next step for all models except Pickup.

18) DTC P0446 Turn ignition off. Connect scan tester to DLC. Turn ignition on. Using scan tester, access EVAPCVF PID. If scan tester indicates YES, go to next step. If scan tester does not indicate YES, go to step 21).

19) Check CV Solenoid Resistance Turn ignition off. Disconnect CV solenoid wiring harness connector. Measure resistance between CV and VPWR terminal at solenoid. If resistance is less than 45 ohms, replace CV solenoid and repeat **QUICK TEST** . If resistance is 45 ohms or more, go to next step.

20) Check Circuit For Short To PWR GND Leave ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 67 (CV) and test pins No. 51 and 103. If each resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10,000 ohms or less, repair CV circuit short to PWR GND circuit. Clear PCM memory and repeat

QUICK TEST.

21) Wiggle Test CV Solenoid & Harness Turn ignition on. Using scan tester, access EVAPCVF PID. Observe EVAPCVF PID for indication of fault while shaking and bending CV solenoid wiring harness and connector. A fault will be indicated by a change in EVAPCVF PID voltage. Tap lightly on CV solenoid to simulate road shock. If fault is indicated, isolate and repair as necessary. If no fault is indicated, go to **CIRCUIT TEST Z** .

22) DTC P0452; Check For Fuel Saturation Of FTP Sensor Turn ignition off. Connect scan tester to DLC. Check FTP wiring harness connector for damage or fuel contamination. Repair or replace if necessary. If connector is okay, go to next step.

23) Verify FTP Signal Voltage Leave ignition off. Connect scan tester to DLC. Turn ignition on. Using scan tester, access FTP V PID. If FTP V PID is less than 0.22 volts, go to next step. If FTP V PID is 0.22 volts or more, go to step 27).

24) Induce Opposite FTP Signal Leave ignition off. Disconnect FTP wiring harness connector. Connect jumper wire between FTP terminal and VREF terminal at connector. Turn ignition on. Using scan tester, access FTP V PID. If scan tester error occurs, go to next step. If FTP V PID is 4-6 volts, replace FTP and repeat **QUICK TEST** . If FTP V PID is not 4-6 volts, remove jumper wire and go to next step.

25) Check VREF At FTP Connector Turn ignition off. Disconnect FTP wiring harness connector. Turn ignition on. Measure voltage between VREF terminal and SIG RTN terminal at wiring harness connector. If voltage is 4-6 volts, go to next step. If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

26) Check Circuit For Short To PWR GND Or SIG RTN Leave ignition off and FTP disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Disconnect scan tester from DLC. Measure resistance between test pin No. 62 (FTP) and test pins No. 51, 91 and 103. If each resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10,000 ohms or less, repair FTP circuit short to SIG RTN or PWR GND circuit. Clear PCM memory and repeat QUICK TEST.

27) Wiggle Test CV Solenoid & Harness Turn ignition on. Using scan tester, access FTP V PID. Observe FTP V PID for indication of fault while shaking and bending FTP sensor wiring harness and connector. A fault will be indicated by a change in FTP V PID voltage. Tap lightly on FTP sensor to simulate road shock. If fault is indicated, isolate and repair as necessary. If no fault is indicated, go to **CIRCUIT TEST Z** .

28) DTC P0453 Turn ignition off. Connect scan tester to DLC. Turn ignition on. Using scan tester, access FTP V PID. If FTP V PID is 4.5 volts or less, go to step 37). If FTP V PID is more than 4.5 volts, go to next step.

29) Check FTP Signal For Short To Power Leave ignition off. Disconnect FTP wiring harness connector. Turn ignition on. Measure voltage between negative battery terminal and FTP terminal at wiring harness connector. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, go to step 31).

30) Check FTP Circuit For Short To VPWR Leave FTP disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 62 (FTP) and test pins No. 51 and 103 at breakout box. If either voltage is less than 10.5 volts, replace PCM and repeat **QUICK TEST** . If all voltages are 10.5 volts or more, repair FTP circuit short to VPWR. Clear PCM memory and repeat QUICK TEST.

31) Induce Opposite FTP Signal Turn ignition off. Leave FTP wiring harness connector disconnected. Connect jumper wire between FTP terminal and SIG RTN terminal at connector. Turn ignition on. Using

scan tester, access FTP V PID. If scan tester error occurs, go to step 36). If FTP V PID is less than 0.1 volt, remove jumper wire and go to next step. If FTP V PID is 0.1 volts or more, go to step 34).

32) Check VREF At FTP Connector Leave ignition off. Disconnect FTP wiring harness connector. Measure voltage between SIG RTN terminal and VREF terminal at wiring harness connector. If voltage is 4-6 volts, go to next step. If voltage is not 4-6 volts, go to CIRCUITTEST C.

33) Check FTP Circuit For Short To VREF Leave ignition off and FTP disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Disconnect scan tester from DLC. Measure resistance between test pins No. 62 (FTP) and 90 (VREF) at breakout box. If resistance is more than 10,000 ohms, replace FTP sensor and repeat **QUICK TEST** . If resistance is 10,000 ohms or less, repair FTP circuit short to VREF. Clear PCM memory and repeat QUICK TEST.

34) Check FTP Circuit Resistance Leave ignition off and FTP disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Disconnect scan tester from DLC. Measure resistance between test pin No. 62 (FTP) and FTP terminal at FTP wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in FTP circuit. Clear PCM memory and repeat **QUICK TEST** .

35) Check SIG RTN Circuit Resistance Leave ignition off and FTP disconnected. Measure resistance between test pin No. 91 and SIG RTN terminal at FTP wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in SIG RTN circuit. Clear PCM memory and repeat **QUICK TEST** .

36) Check FTP Circuit For Short To VREF Leave ignition off and FTP disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pins No. 62 (FTP) and 90 (VREF) at breakout box. If resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10,000 ohms or less, repair FTP circuit short to VREF. Clear PCM memory and repeat QUICK TEST.

37) Wiggle Test CV Solenoid & Harness Turn ignition on. Using scan tester, access FTP V PID. Observe FTP V PID for indication of fault while shaking and bending FTP sensor wiring harness and connector. A fault will be indicated by a change in FTP V PID voltage. Tap lightly on FTP sensor to simulate road shock. If fault is indicated, isolate and repair as necessary. If no fault is indicated, go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 37) to step 40). No test procedures have been omitted.

40) Continuous Memory P0455 Or P1455 Turn ignition off. Ensure fuel fill cap is correctly installed and in good condition. Check carbon canister for damage. Check fuel vapor hoses for correct routing. Check fuel tank and fill pipe for damage. Repair or replace as necessary. If no faults are present, go to step 44) for models with VMV or next step for models with CV solenoid.

41) Check CV Circuit Resistance Turn ignition off. Disconnect CV solenoid wiring harness connector. Disconnect PCM from breakout box. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 67 at breakout box and CV terminal at CV solenoid wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in CV circuit. Clear PCM memory and repeat

QUICK TEST .

42) Check CV Circuit For Short To Power Turn ignition on. Measure voltage between test pin No. 67 and test pin No. 51 or 103 at breakout box. If voltage is more than 10.5 volts, repair CV circuit short to VPWR. If voltage is 10.5 volts or less, go to next step.

43) Check VPWR Circuit Voltage Turn ignition off. Connect PCM to breakout box. Disconnect CV solenoid wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal of CV solenoid wiring harness connector and battery ground. If voltage is 10.5 volts or more, replace CV solenoid. If voltage is less than 10.5 volts, repair open in VPWR circuit and repeat **QUICK TEST** .

44) Check Intake Manifold Vacuum At VMV Leave ignition off. Connect VMV wiring harness connector. Disconnect hoses from VMV at intake manifold. Start engine and allow to idle. Check for vacuum at intake manifold. If vacuum is present, go to next step. If vacuum is not present, isolate fault and repair as necessary.

45) Check VMV Ability To Hold Vacuum Leave ignition off. Connect vacuum pump to disconnected end of VMV hose. Using vacuum pump, apply 16 in. Hg. If vacuum bleeds off immediately, go to next step. If vacuum does not bleed off immediately, isolate hose restriction and repair as necessary.

46) Check VMV Turn ignition off. Reconnect VMV wiring harness connector. Disconnect VMV fuel vapor hose from intake manifold port at VMV. Attach vacuum pump with gauge to intake manifold port at VMV. Using vacuum pump, apply 16 in. Hg to VMV. If vacuum bleeds off immediately, go to next step. If vacuum is not bled off immediately, replace VMV.

47) Check VMV Turn ignition off. Ensure PCM is connected to breakout box. Reconnect VMV vacuum input hose. Disconnect fuel vapor to carbon canister hose. Connect vacuum gauge to vacuum port. Start engine and allow to idle for 5 minutes. Vacuum gauge should read zero. Connect jumper wire between test pin No. 56 (VMV) and test pin No. 51 or 103 at breakout box. Vacuum should be about engine manifold vacuum. If vacuum is not as specified, replace VMV. If vacuum is as specified, remove vacuum gauge and jumper wire. Go to next step.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 47) to step 56). No test procedures have been omitted.

56) DTC P1450 Or P1452 Turn ignition off. Remove input vacuum hose from VMV. Connect vacuum pump to VMV. Using vacuum pump, apply 10 in. Hg to solenoid. If vacuum is held for one minute, replace VMV and go to step 61). If vacuum is not held for one minute, remove vacuum pump and go to step 15).

57) Check VREF Connectors Leave ignition off. Check VREF circuit terminal at FTP sensor and PCM. If terminal connectors are okay, go to next step. If terminal connectors are faulty, go to step 61).

58) Check CV Circuit Resistance Turn ignition off. Disconnect FTP solenoid wiring harness connector. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 90 at breakout box and VREF terminal at FTP sensor wiring harness connector. If resistance is less than 5 ohms, replace FTP sensor and go to next step. If resistance is 5 ohms or more, repair open in VREF circuit and go to next step.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 58) to step 61). No test procedures have been omitted.

61) Verify EVAP System Repair With ignition on and scan tester connected to DLC, clear PCM memory. Start engine and allow to idle for at least 4 minutes. Drive vehicle 45-60 MPH in high gear for about 8 minutes. Drive vehicle in city traffic condition averaging 25-40 MPH. Ensure at least 5 stop with idle periods of 10 seconds or more. Accelerate vehicle to 45-60 MPH and operate in high gear for about 8 minutes. Stop vehicle and repeat **QUICK TEST** . If DTC P1000 is present, repeat this step. If any other DTCs are present, service as necessary. See **DIAGNOSTIC TROUBLE CODE (DTC) REFERENCE CHARTS** . If no DTCs are present, testing is complete.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 61) to step 65). No test procedures have been omitted.

65) Continuous Memory DTC P1451: Check VPWR To CV Solenoid Turn ignition off. Disconnect CV solenoid wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal of CV solenoid wiring harness connector and negative battery terminal. If voltage is greater than 10.5 volts, go to next step. If voltage is 10.5 volts or less, replace PCM and repeat **QUICK TEST** .

66) Check CV Solenoid Resistance Turn ignition off. Disconnect CV solenoid wiring harness connector. Measure resistance between CV and VPWR terminal at solenoid. If resistance is 45-65 ohms, go to next step. If resistance is 45 ohms or more, replace CV solenoid and repeat **QUICK TEST** .

67) Check CV Circuit Resistance Leave ignition off and CV solenoid disconnected. Disconnect PCM 104-pin wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 67 at breakout box and CV terminal at CV solenoid wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in CV circuit and repeat **QUICK TEST** .

68) Check CV Circuit Short To PWR GND Leave ignition off and CV solenoid disconnected. Disconnect scan tester (if applicable). Measure resistance between test pin No. 67 and test pins No. 51 and 103 at breakout box. If resistance is less than 10,000 ohms, repair CV circuit to PWR GND and repeat **QUICK TEST** . If resistance is 10,000 ohms or more, reconnect scan tester and go to next step.

69) Check CV Circuit Short To PWR Leave CV solenoid disconnected. Turn ignition on. Measure voltage between chassis ground and test pin No. 67 at breakout box. If voltage is less than 1.0 volt, go to next step. If voltage is 1.0 volt or more, repair CV circuit to PWR, VREF, VPWR or chassis ground.

70) Check CV Signal From PCM Turn ignition off. Reconnect CV solenoid. Connect PCM to breakout box. Start engine and allow to idle. Measure voltage between test pin No. 67 and test pins No. 51 and 103 at breakout box. If voltage is 10-14 volts, replace CV solenoid and repeat **QUICK TEST** . If voltage is not 10-14 volts, replace PCM and repeat QUICK TEST.

CIRCUIT TEST JB - IGNITION MISFIRE UNDER LOAD

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Spark plugs.
- Spark plug wires.

MISFIRE TROUBLE CODES

Service Code	Application
90	Pass
P0301	Cylinder No. 1 (Test Pin No. 75)
P0302	Cylinder No. 2 (Test Pin No. 101)
P0303	Cylinder No. 3 (Test Pin No. 74)
P0304	Cylinder No. 4 (Test Pin No. 100)
P0305	Cylinder No. 5 (Test Pin No. 73)
P0306	Cylinder No. 6 (Test Pin No. 99)
P0307	Cylinder No. 7 (Test Pin No. 72)
P0308	Cylinder No. 8 (Test Pin No. 98)

1) Check Possible Cause Of Misfire Connect engine oscilloscope to vehicle. View parade pattern of ignition secondary system. Go to next step.

NOTE: Damaged or contaminated secondary ignition components may cause high catalyst temperatures. Check areas near catalyst and muffler for heat damage.

2) Start engine. Normal spark output voltage is 20,000 volts. Maximum spark output variation is 8000 volts. If spark output is not as specified, go to next step. If spark output voltage is as specified, testing is complete. Go to step 8) under **CIRCUIT TEST HD** .

3) If average spark output voltage is more than 20,000 volts with spark output variation less than 8000 volts, check spark plugs for wear and spark plug wires for 7000 ohms per foot maximum resistance. If spark output voltage is not as specified, go to next step.

4) If spark output voltage variation is more than 8000 volts, check spark plugs for wide gap or worn electrode. If spark output voltage variation is less than 8000 volts, go to next step.

5) If spark output voltage is consistently high in selected cylinders only, check for defective spark plug or wire. If spark output voltage is not as specified, go to next step.

6) If spark output voltage is consistently low in all cylinders, check spark plugs for narrow gap and spark plug wires for grounding. If spark output voltage is not as specified, go to next step.

7) If average spark output voltage is 15,000 volts or less with spark output variation less than 5000 volts, testing is complete. Go to **CIRCUIT TEST HD** , step 8). If spark output voltage is not as specified, go to next step.

8) If average spark output voltage is more than 15,000 volts with spark output variation less than 5000 volts, check spark plugs for wear and spark plug wire for 7000 ohms per foot maximum resistance. If spark output voltage is not as specified, go to next step.

9) If spark output voltage variation is more than 5000 volts, check spark plugs for wide gap or worn electrode. If spark output voltage variation is less than 5000 volts, go to next step.

10) If spark output voltage is consistently high in selected cylinders only, check for defective spark plug or wire. If spark output voltage is not as specified, go to next step.

11) If spark output voltage is consistently low in all cylinders, check spark plugs for narrow gap and spark plug wires for grounding. If spark output voltage is not as specified, ignition secondary system is

okay and testing is complete.

CIRCUIT TEST JD - INTEGRATED IGNITION-NO START

Diagnostic Aids

When making a voltage check, a ground reading is a value of less than one volt. A power reading is a value of battery voltage, or up to 2 volts less than battery voltage.

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Crankshaft Position (CKP) sensor.
- CKP wiring harness or connector(s).
- Spark plug wires.
- Faulty Powertrain Control Module (PCM).

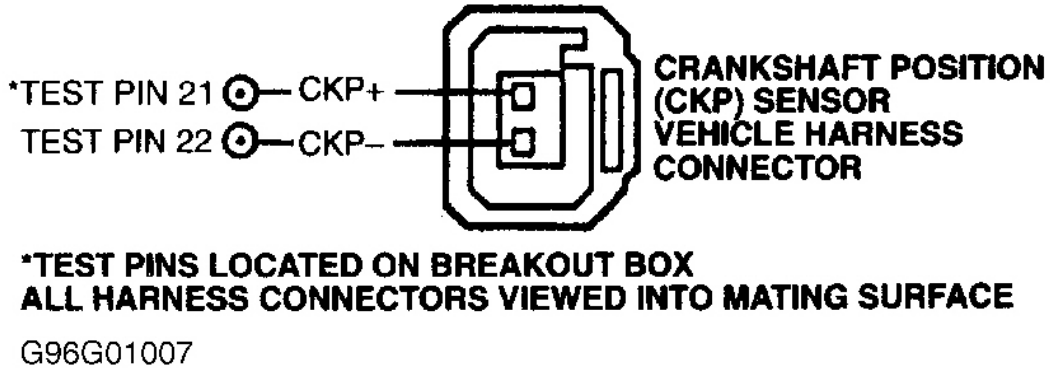

Fig. 70: CKP Sensor Connector Terminals & Test Circuits

1) Check Spark Plugs & Wires Remove and check spark plugs. Check all spark plug wires for damaged insulation or poor connectors. Check primary ignition wiring. Check CKP sensor connector. Repair or replace if necessary. If no faults are found, go to next step.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 1) to step 4). No test procedures have been omitted.

4) Check CKP+ Circuit To PCM Turn ignition off. Disconnect scan tester from DLC. Disconnect PCM. Check PCM wiring harness connector for damage and repair if necessary. Install Breakout Box (014-000950). Connect PCM wiring harness connector to breakout box. Turn ignition on. Measure voltage between pin No. 21 (CKP+) at breakout box and negative battery terminal. If voltage is not 1-2 volts, go

to next step. If voltage is 1-2 volts, go to step 10).

5) Check CKP Sensor Turn ignition off. Disconnect CKP wiring harness connector. Turn ignition on. Measure voltage between pin No. 21 (CKP+) at breakout box and negative battery terminal. If voltage is 1-2 volts, go to next step. If voltage is not 1-2 volts, go to step 18).

6) Leave ignition on. Measure voltage between pin No. 22 (CKP-) at breakout box and negative battery terminal. If voltage is 1-2 volts, replace CKP sensor and repeat **QUICK TEST** . If voltage is not 1-2 volts, go to next step.

7) If voltage in step 6) was less than 1.0 volt, go to next step. If voltage in step 6) was more than 1.0 volts, go to step 9).

8) Turn ignition off. Disconnect PCM from breakout box. Measure resistance between pin No. 22 (CKP-) at breakout box and negative battery terminal. If resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10,000 ohms or less, repair CKP- circuit short to ground.

9) Leave PCM disconnected from breakout box. Turn ignition on. Measure voltage between pin No. 22 (CKP-) at breakout box and negative battery terminal. If voltage is less than 0.5 volts, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volts or more, repair CKP sensor short to power and repeat QUICK TEST.

10) Set DVOM on AC voltage scale. Crank starter while measuring voltage between pin No. 21 (CKP+) and No. 22 (CKP-) at breakout box. After stabilizing, if AC voltage is less than 0.4 volt, go to next step. If AC voltage is 0.4 volt or more, go to step 60) under **CIRCUIT TEST JE** .

11) Turn ignition off. Disconnect PCM from breakout box. Set DVOM on AC voltage scale. Crank starter while measuring voltage between pin No. 21 (CKP+) and No. 22 (CKP-) at breakout box. After stabilizing, if voltage is less than 0.4 volt, go to next step. If voltage is 0.4 volt or more, replace PCM and repeat **QUICK TEST** .

12) Turn ignition off. Measure resistance between pin No. 21 (CKP+) and No. 22 (CKP-) at breakout box. If resistance is 300-800 ohms, go to step 16). If resistance is not 300-800 ohms, go to next step.

13) If resistance in step 12) was more than 300 ohms, go to next step. If resistance in step 12) was 300 ohms or less, go to step 17).

14) Check CKP Sensor Turn ignition off. Install EI Diagnostic Harness (007-00059) to Breakout Box (014-000950). Connect EI Diagnostic Harness between CKP sensor and wiring harness connector. Use appropriate overlay. Connect diagnostic harness negative lead to battery negative terminal. Leave positive lead disconnected. Set diagnostic harness box type switch to "4/6" or "8" cylinder position. Measure resistance between breakout box test pins No. 21 (CKP+I) and J31 (CKP+S). If resistance is less than 1050 ohms, go to next step. If resistance is 1050 ohms or more, repair open in CKP+ circuit and repeat **QUICK TEST** .

15) Leave ignition off. Measure resistance between breakout box pin No. 22 (CKP-I) and No. J32 (CKP-S). If resistance is less than 1050 ohms, replace CKP sensor and repeat **QUICK TEST** . If resistance is 1050 ohms or more, repair open in CKP- circuit.

16) Check CKP Sensor & Trigger Wheel Leave ignition off. Check CKP sensor and trigger wheel for damage. Repair or replace as necessary. If CKP sensor and trigger wheel are not damaged, ignition system is okay and testing is complete. If symptom is still present, go to **TESTS W/O CODES - 4.2L** article.

17) Leave ignition off. Disconnect CKP sensor from wiring harness connector. Measure resistance between breakout box pin No. 21 (CKP+I) and No. J22 (CKP-I). If resistance is more than 1000 ohms, replace CKP sensor and repeat **QUICK TEST** . If resistance is 1000 ohms or less, repair CKP- circuit

short to CKP+ circuit.

18) If voltage in step 5) was less than 1.0 volt, go to next step. If voltage in step 5) was 1.0 volt or more, go to step 20).

19) Check CKP Sensor For Short To Ground Turn ignition off. Disconnect PCM from PCM breakout box. Measure resistance between breakout box test pins 21 (CKP+I) and negative battery terminal. If resistance is less than 10,000 ohms, repair CKP+ circuit short to ground and repeat **QUICK TEST** . If resistance is 10,000 ohms or more, replace PCM and repeat QUICK TEST.

20) Check CKP Sensor For Short To Power Turn ignition on. Measure voltage between breakout box test pins 21 (CKP+I) and negative battery terminal. If voltage is more than 0.5 volt, repair CKP+ circuit short to power and repeat **QUICK TEST** . If resistance is 0.5 volt or less, replace PCM and repeat QUICK TEST.

CIRCUIT TEST JE - INTEGRATED IGNITION COIL FAILURE

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Ignition coil packs.
- Ignition coil wiring harness.
- Powertrain Control Module (PCM).

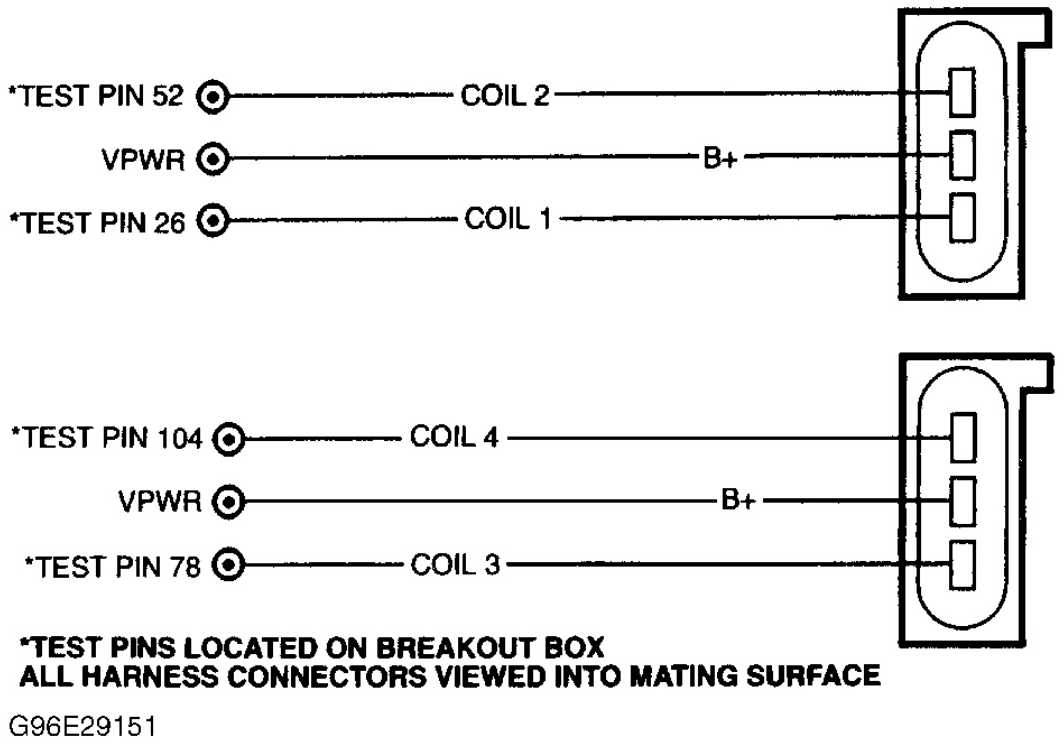

Fig. 71: 4-Tower Coil Pack Test Circuits & Connector Terminals

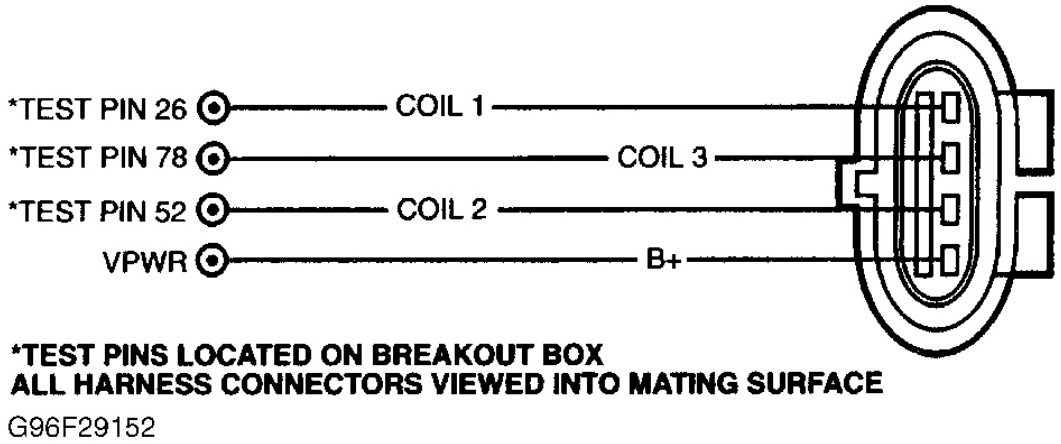

Fig. 72: Horizontal 6-Tower Coil Pack Test Circuits & Connector Terminals

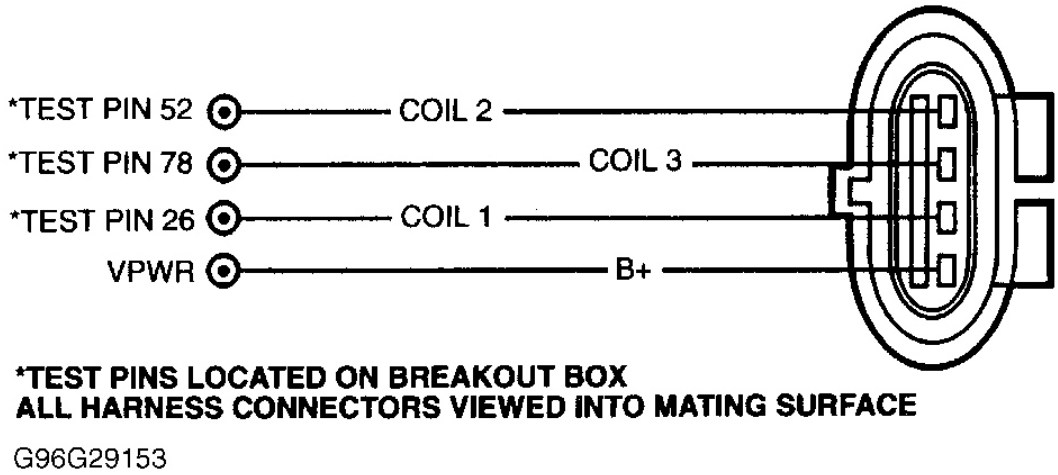

Fig. 73: Vertical 6-Tower Coil Pack Test Circuits & Connector Terminals

1) DTC P0350, P0351 & P0352 Using a spark tester, check for spark at all spark plug wires while cranking engine. If consistent spark is present at all spark plug wires, system is okay, go to step 50) of **CIRCUIT TEST Z** . If consistent spark is not present, go to next step.

2) Check Secondary Ignition Check spark plugs, spark plug wires and coils for damage, looseness or shorting. Repair or replace as necessary. If secondary ignition looks okay, go to next step.

3) Check For COIL PWR At Coil Turn ignition off. Install EI Diagnostic Harness (007-00059) to Breakout Box (014-000950) and ICM. Use appropriate overlay. Connect right (Blue) coil tee. Connect diagnostic harness negative lead to battery negative terminal. Leave positive lead disconnected. Set diagnostic harness box type switch to "4/6" cylinder position. Turn ignition on. Measure voltage between breakout box test pins J5 (COIL PWR) and J7 (B-). If voltage is 10 volts or more, go to next step. If voltage is less than 10 volts, repair open in COIL PWR circuit. Clear PCM memory and repeat **QUICK TEST** .

WARNING: Unless otherwise instructed, PCM must not be connected to breakout box when performing ignition system testing.

4) Check C1C Circuit At Coil Pack Turn ignition on. Measure voltage between breakout box test pins J3 (C1C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, go to step 12).

5) Check C2C Circuit At Coil Pack Turn ignition on. Measure voltage between breakout box test pins J6 (C2C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, go to step 14).

6) Check C1I Circuit At PCM Turn ignition off. Connect PCM wiring harness connector to breakout box. Turn ignition on. Measure voltage between breakout box test pins J7 (B-) and J26 (C1I). If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C1I circuit.

7) Check C2 Circuit At ICM Leave ignition on. Measure voltage between breakout box test pins J7 (B-) and J52 (C2). If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C2 circuit.

8) Check C1 Circuit At Coil Turn ignition off. Disconnect coil from diagnostic harness coil tee. Turn ignition on. Measure voltage between breakout box test pins J3 (C1) and J7 (B-). If DC voltage is less than 0.5 volt, go to next step. If DC voltage is 0.5 volt or more, go to step 16).

9) Check C2 Circuit At Coil Leave ignition on. Measure voltage between breakout box test pins J6 (C2) and J7 (B-). If DC voltage is 0.5 volt or more, go to step 17). If DC voltage is less than 0.5 volt, go to next step.

10) Check C1C Circuit At Coil While Cranking Connect positive lead of EI Diagnostic Harness (007-00059) to battery positive terminal. Connect incandescent test light between breakout box test pins J1 (B+) and J3 (C1). Crank engine. If test light blinks brightly once every engine revolution, go to next step. If test light does not blink as indicated, replace PCM and repeat **QUICK TEST** .

11) Check C2C Circuit At Coil While Cranking Connect incandescent test light between breakout box test pins J1 (B+) and J6 (C2C). Crank engine. If test light blinks brightly once every engine revolution, replace coil pack and repeat **QUICK TEST** . If test light does not blink as indicated, replace PCM and repeat QUICK TEST.

12) Check Right Coil Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J3 (C1C) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace right coil pack. Clear PCM memory and repeat **QUICK TEST** .

13) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J3 (C1C) and J7(B-). If resistance is less than 10,000 ohms, repair short to ground in C1 circuit. If resistance is 10,000 ohms or more, replace PCM. Repeat **QUICK TEST** .

14) Check Coil No. 2 Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J6 (C2C) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace coil pack. Clear PCM memory and repeat **QUICK TEST** .

15) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J6 (C2C) and J7(B-). If resistance is less than 10,000 ohms, repair C2C circuit short to ground. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** .

NOTE: If C2 circuit is shorted to ground, coil damage may occur.

16) Check Coil No. 1 Turn ignition off. Disconnect PCM from vehicle harness connector. Turn ignition on. Measure voltage between breakout box test pins J3 (C1C) and J7 (B-). If DC voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volt or more, repair C1C circuit short to power. Clear PCM memory and repeat **QUICK TEST** .

17) Check Coil No. 2 Turn ignition on. Measure voltage between breakout box test pins J6 (C2C) and J7 (B-). If DC voltage is less than 0.5 volt, replace PCM. Clear PCM memory and repeat **QUICK TEST** . If voltage is 0.5 volt or more, repair C2C circuit short to power. Clear PCM memory and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips

from step 17) to step 20). No test procedures have been omitted.

20) DTC P0350, P0351, P0352, P0353 & P0354 Using a spark tester, check for spark at all spark plug wires while cranking engine. If consistent spark is present at all spark plug wires, system is okay and testing is complete. If consistent spark is not present, go to next step.

21) Check For Spark At Right Spark Plugs If spark is present at right spark plugs, go to next step. If spark is not present at right spark plugs, go to step 38).

22) Check Left Spark Plugs & Wires Turn ignition off. Check left side spark plugs and wires for damage or wear. Check all wiring harnesses and connectors damage, burned insulation or poor connections. Repair or replace as necessary. If no faults are found, go to next step.

23) Check For COIL PWR At Left Coil Turn ignition off. Install EI Diagnostic Harness (007-00059) to Breakout Box (014-000950) and ICM. Use appropriate overlay. Connect left (Yellow) coil tee. Connect diagnostic harness negative lead to battery negative terminal. Leave positive lead disconnected. Set diagnostic harness box type switch to 8-cylinder position. Turn ignition on. Measure voltage between breakout box test pins J7 (B-) and J11 (COIL VBAT). If voltage is 10 volts or more, go to next step. If voltage is less than 10 volts, repair open in COIL PWR circuit to front coil. Clear PCM memory and repeat **QUICK TEST** .

WARNING: Unless otherwise instructed, PCM must not be connected to breakout box when performing ignition system testing.

24) Check C3 Circuit At Coil Pack Turn ignition on. Measure voltage between breakout box test pins J10 (LC3C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If DC voltage is 10.0 volts or less, go to step 32).

25) Check C4 Circuit At Coil Pack Turn ignition on. Measure voltage between breakout box test pins J18 (LC4C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If DC voltage is 10.0 volts or less, go to step 34).

26) Check C3 Circuit At PCM Turn ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install a second EEC-V Breakout Box (014-000950). Connect PCM to second breakout box. Turn ignition on. Measure voltage between breakout box test pins J7 (B-) and test pin No. 78 at second breakout box. If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C3 circuit.

27) Check C4 Circuit At PCM Leave ignition on. Measure voltage between breakout box test pins J7 (B-) and test pin No 104 at second breakout box. If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C4 circuit.

28) Check C3 Circuit At Coil Turn ignition off. Disconnect left coil from diagnostic harness coil tee. Turn ignition on. Measure voltage between breakout box test pins J10 (LC3C) and J7 (B-). If DC voltage is less than 0.5 volt, go to next step. If DC voltage is 0.5 volt or more, go to step 36).

29) Check C4 Circuit At Coil Leave ignition on. Measure voltage between breakout box test pins J18 (LC4C) and J7 (B-). If DC voltage is less than 0.5 volt, go to next step. If DC voltage is 0.5 volt or more, go to step 37).

30) Check C3 Circuit At Coil While Cranking Connect positive lead of EI Diagnostic Harness (007-00059) to battery positive terminal. Connect incandescent test light between breakout box test pins J1 (B+) and J10 (LC3C). Crank engine. If test light blinks brightly once every engine revolution, go to next

step. If test light does not blink as indicated, replace PCM and repeat **QUICK TEST** .

31) Check C4 Circuit At Coil While Cranking Connect incandescent test light between breakout box test pins J1 (B+) and J18 (LC4C). Crank engine. If test light blinks brightly once every engine revolution, replace left coil pack and repeat **QUICK TEST** . If test light does not blink as indicated, replace PCM and repeat QUICK TEST.

32) Check Left Coil Pack Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J10 (C3C) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace front coil pack. Clear PCM memory and repeat **QUICK TEST** .

33) Check C3 Circuit Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J10 (C3C) and J7 (B-). If resistance is less than 10,000 ohms, repair short to ground in C3 circuit. If resistance is 10,000 ohms or more, replace PCM. Repeat **QUICK TEST** .

NOTE: If C3 circuit is shorted to ground, coil damage may occur.

34) Check C4 Circuit Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J18 (LC4C) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace front coil pack. Clear PCM memory and repeat **QUICK TEST** .

35) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J18 (LC4C) and J7(B-). If resistance is less than 10,000 ohms, repair C4 circuit short to ground. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** .

NOTE: If C4 circuit is shorted to ground, coil damage may occur.

36) Turn ignition on. Measure voltage between breakout box test pins J10 (LC3C) and J7 (B-). If voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volts or more, repair C3 circuit short to power and repeat QUICK TEST.

37) Check C3 Circuit Turn ignition off. Disconnect PCM from vehicle harness connector. Turn ignition on. Measure voltage between breakout box test pins J18 (LC4C) and J7 (B-). If DC voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volt or more, repair C4 circuit short to power. Clear PCM memory and repeat QUICK TEST.

38) Check Right Spark Plugs & Wires Turn ignition off. Check right side spark plugs and wires for damage or wear. Check all wiring harnesses and connectors damage, burned insulation or poor connections. Repair or replace as necessary and repeat **QUICK TEST** . If no faults are found, go to next step.

39) Check For COIL PWR At Right Coil Turn ignition off. Connect EI Diagnostic Harness (007-00059) to Breakout Box (014-000950). Use appropriate overlay. Connect right coil tee. Connect diagnostic harness negative lead to battery negative terminal. Leave positive lead disconnected. Set diagnostic harness box type switch to 8-cylinder position. Turn ignition on. Measure voltage between breakout box test pins J5 (COIL VBAT) and J7 (B-). If voltage is 10 volts or more, go to next step. If voltage is less than 10 volts, repair open in COIL PWR circuit. Clear PCM memory and repeat **QUICK TEST** .

WARNING: Unless otherwise instructed, PCM must not be connected to breakout box when performing ignition system testing.

40) Check C1 Circuit At Right Coil Pack Turn ignition on. Measure voltage between breakout box test pins J3 (RC1C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If DC voltage is 10.0 volts or less, go to step 48).

41) Check C2 Circuit At Right Coil Pack Turn ignition on. Measure voltage between breakout box test pins J6 (RC2C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If DC voltage is 10.0 volts or less, go to step 50).

42) Check C1 Circuit At PCM Turn ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install a second EEC-V Breakout Box (014-000950). Connect PCM to second breakout box. Turn ignition on. Measure voltage between breakout box test pin J7 (B-) and test pin No. 26 (RC1) at second breakout box. If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C1 circuit.

43) Check C2 Circuit At PCM Leave ignition on. Measure voltage between breakout box test pins J7 (B-) and test pin No. 52 (RC2) at second breakout box. If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C2 circuit.

44) Check C1 Circuit At Coil Turn ignition off. Disconnect rear coil from diagnostic harness coil tee. Turn ignition on. Measure voltage between breakout box test pins J23 (RC1C) and J7 (B-). If DC voltage is less than 0.5 volt, go to next step. If DC voltage is 0.5 volt or more, go to step 52).

45) Check C2 Circuit At Coil Leave ignition on. Measure voltage between breakout box test pins J6 (RC2C) and J7 (B-). If DC voltage is less than 0.5 volt, go to next step. If DC voltage is 0.5 volt or more, go to step 53).

46) Check C1 Circuit At Coil While Cranking Connect positive lead of EI Diagnostic Harness (007-00059) to battery positive terminal. Connect incandescent test light between breakout box test pins J1 (B+) and J3 (RC1C). Crank engine. If test light blinks brightly once every engine revolution, go to next step. If test light does not blink as indicated, replace PCM and repeat **QUICK TEST** .

47) Check C2 Circuit At Coil While Cranking Connect incandescent test light between breakout box test pins J1 (B+) and J6 (RC2C). Crank engine. If test light blinks brightly once every engine revolution, replace rear coil pack and repeat **QUICK TEST** . If test light does not blink as indicated, replace PCM and repeat QUICK TEST.

48) Check C1 Circuit Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J3 (RC1C) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace rear coil pack. Clear PCM memory and repeat **QUICK TEST** .

49) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J3 (RC1C) and J7 (B-). If resistance is less than 10,000 ohms, repair short to ground in C1 circuit. If resistance is 10,000 ohms or more, replace PCM. Repeat **QUICK TEST** .

NOTE: If C1 circuit is shorted to ground, coil damage may occur.

50) Check C2 Circuit Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J6 (RC2C) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace rear coil pack. Clear PCM memory and repeat

QUICK TEST .

51) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J6 (RC2C) and J7 (B-). If resistance is less than 10,000 ohms, repair C2 circuit short to ground. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** .

NOTE: If C2 circuit is shorted to ground, coil damage may occur.

52) Check C1 Circuit Turn ignition on. Measure voltage between breakout box test pins J3 (RC1C) and J7 (B-). If voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volts or more, repair C1 circuit short to power and repeat QUICK TEST.

53) Check C2 Circuit Turn ignition off. Disconnect PCM from vehicle harness connector. Turn ignition on. Measure voltage between breakout box test pins J6 (RC2C) and J7 (B-). If DC voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volt or more, repair C2 circuit short to power. Clear PCM memory and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 53) to step 60). No test procedures have been omitted.

60) DTC P0350, P0351, P0352 & P0353 Using a spark tester, check for spark at all spark plug wires while cranking engine. If consistent spark is present at all spark plug wires, system is okay and testing is complete. If consistent spark is not present, go to next step.

61) Check Secondary Ignition Check spark plugs, spark plug wires and coils for damage, looseness or shorting. Repair or replace as necessary. If secondary ignition looks okay, go to next step.

62) Check For COIL PWR At Coil Turn ignition off. Install EI Diagnostic Harness (007-00059) to Breakout Box (014-000950) and ICM. Use appropriate overlay. Connect (Blue) coil tee. Connect diagnostic harness negative lead to battery negative terminal. Leave positive lead disconnected. Set diagnostic harness box type switch to 4/6-cylinder position. Turn ignition on. Measure voltage between breakout box test pins J5 (COIL PWR) and J7 (B-). If voltage is 10 volts or more, go to next step. If voltage is less than 10 volts, repair open in COIL PWR circuit. Clear PCM memory and repeat **QUICK TEST** .

WARNING: Unless otherwise instructed, PCM must not be connected to breakout box when performing ignition system testing.

63) Check C1 Circuit At Coil Pack Turn ignition on. Measure voltage as follows:

- For horizontal connector coil pack, between breakout box test pins J3 (C1C) and J7 (B-).
- For vertical connector coil pack, between breakout box test pins J6 (C1C) and J7 (B-).

If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, go to step 75).

64) Check C2 Circuit At Coil Pack Turn ignition on. Measure voltage as follows:

- For horizontal connector coil pack, between breakout box test pins J6 (C2C) and J7 (B-).
- For vertical connector coil pack, between breakout box test pins J3 (C2C) and J7 (B-).

If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, go to step 77).

65) Check C3 Circuit At Coil Pack Turn ignition on. Measure voltage between breakout box test pins J10 (C3C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, go to step 79).

66) Check C1 Circuit At PCM Turn ignition off. Connect PCM wiring harness connector to breakout box. Turn ignition on. Measure voltage between breakout box test pins J7 (B-) and J26 (C1). If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C1 circuit and repeat **QUICK TEST** .

67) Check C2 Circuit At PCM Leave ignition on. Measure voltage between breakout box test pins J7 (B-) and J52 (C2). If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C2 circuit.

68) Check C3 Circuit At PCM Leave ignition on. Measure voltage between breakout box test pins J7 (B-) and J78 (C3). If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C3 circuit.

69) Check C1 Circuit At Coil Turn ignition off. Disconnect coil from diagnostic harness coil tee. Turn ignition on. Measure voltage as follows:

- For horizontal connector coil pack, between breakout box test pins J3 (C1C) and J7 (B-).
- For vertical connector coil pack, between breakout box test pins J6 (C1C) and J7 (B-).

If DC voltage is less than 0.5 volts, go to next step. If voltage is 0.5 volts or more, go to step 81).

70) Check C2 Circuit At Coil Leave ignition on. Measure voltage as follows:

- For horizontal connector coil pack, between breakout box test pins J6 (C2C) and J7 (B-).
- For vertical connector coil pack, between breakout box test pins J3 (C2C) and J7 (B-).

If DC voltage is less than 0.5 volts, go to next step. If voltage is 0.5 volts or more, go to step 82).

71) Check C3 Circuit At Coil Leave ignition on. Measure voltage between breakout box test pins J10 (C3C) and J7 (B-). If DC voltage is less than 0.5 volt, go to next step. If DC voltage is 0.5 volt or more, go to step 83).

72) Check C1 Circuit At Coil While Cranking Connect positive lead of EI Diagnostic Harness (007-00059) to battery positive terminal. Connect incandescent test light as follows:

- For horizontal connector coil pack, between breakout box test pins J1 (B+) and J3 (C1C).
- For vertical connector coil pack, between breakout box test pins J1 (B+) and J6 (C1C).

Crank engine. If test light blinks brightly once every engine revolution, go to next step. If test light does not blink as indicated, replace PCM and repeat **QUICK TEST** .

73) Check C2 Circuit At Coil While Cranking Connect incandescent test light as follows:

- For horizontal connector coil pack, between breakout box test pins J1 (B+) and J6 (C2C).
- For vertical connector coil pack, between breakout box test pins J1 (B+) and J3 (C2C).

Crank engine. If test light blinks brightly once every engine revolution, go to next step. If test light does not blink as indicated, replace PCM and repeat **QUICK TEST** .

74) Check C3 Circuit At Coil While Cranking Connect incandescent test light between breakout box test pins J1 (B+) and J10 (C3C). Crank engine. If test light blinks brightly once every engine revolution, replace coil pack and repeat **QUICK TEST** . If test light does not blink as indicated, replace PCM and repeat QUICK TEST.

75) Check C1 Circuit For Short To Ground Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins as follows:

- For horizontal connector coil pack, between breakout box test pins J3 (C1C) and J7 (B-).
- For vertical connector coil pack, between breakout box test pins J6 (C1C) and J7 (B-).

If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace coil pack. Clear PCM memory and repeat **QUICK TEST** .

76) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins as follows:

- For horizontal connector coil pack, between breakout box test pins J3 (C1C) and J7 (B-).
- For vertical connector coil pack, between breakout box test pins J6 (C1C) and J7 (B-).

If resistance is less than 10,000 ohms, repair short to ground in C1 circuit. If resistance is 10,000 ohms or more, replace PCM. Repeat **QUICK TEST** .

NOTE: If C1 circuit is shorted to ground, coil damage may occur.

77) Check Coil No. 2 Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance as follows:

- For horizontal connector coil pack, between breakout box test pins J6 (C2C) and J7 (B-).
- For vertical connector coil pack, between breakout box test pins J3 (C2C) and J7 (B-).

If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace coil pack. Clear PCM memory and repeat **QUICK TEST** .

78) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance as follows:

- For horizontal connector coil pack, between breakout box test pins J6 (C2C) and J7 (B-).
- For vertical connector coil pack, between breakout box test pins J3 (C2C) and J7 (B-).

If resistance is less than 10,000 ohms, repair C2 circuit short to ground. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** .

NOTE: If C1 circuit is shorted to ground, coil damage may occur.

79) Check C3 Circuit Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J7 (B-) and J10 (C3C). If resistance is less than 2000 ohms, go

to next step. If resistance is 2000 ohms or more, replace coil pack. Clear PCM memory and repeat **QUICK TEST** .

80) Turn ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J7 (B-) and J10 (C3C). If resistance is less than 10,000 ohms, repair C3 circuit short to ground. If resistance is 10,000 ohms or more, replace PCM. Clear PCM memory and repeat **QUICK TEST** .

81) Check C1 Circuit Turn ignition off. Disconnect PCM wiring harness connector. Turn ignition on. Measure voltage as follows:

- For horizontal connector coil pack, between breakout box test pins J3 (C1C) and J7 (B-).
- For vertical connector coil pack, between breakout box test pins J6 (C1C) and J7 (B-).

If voltage is 0.5 volts or more, repair C1 circuit short to power. If DC voltage is less than 0.5 volts, replace PCM. Clear PCM memory and repeat **QUICK TEST** .

82) Check C2 Circuit Turn ignition off. Disconnect PCM wiring harness connector. Turn ignition on. Measure voltage as follows:

- For horizontal connector coil pack, between breakout box test pins J6 (C2C) and J7 (B-).
- For vertical connector coil pack, between breakout box test pins J3 (C2C) and J7 (B-).

If voltage is 0.5 volts or more, repair C2 circuit short to power. If DC voltage is less than 0.5 volts, replace PCM. Clear PCM memory and repeat **QUICK TEST** .

83) Check C3 Circuit Turn ignition off. Disconnect PCM wiring harness connector. Measure voltage between breakout box test pins J7 (B-) and J10 (C3C). If voltage is 0.5 volts or more, repair C3 circuit short to power. If DC voltage is less than 0.5 volts, replace PCM. Clear PCM memory and repeat **QUICK TEST** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 83) to step 90). No test procedures have been omitted.

90) DTC P0350, P0351, P0352, P0353 & P0354 Using a spark tester, check for spark at all spark plug wires while cranking engine. If consistent spark is present at all spark plug wires, ignition system is okay. Go to step 50) of **CIRCUIT TEST Z** . If consistent spark is not present, go to next step.

91) Check For Spark At Right Spark Plugs If spark is present at right spark plugs, go to next step. If spark is not present at right spark plugs, go to step 108).

92) Check Left Spark Plugs & Wires Turn ignition off. Check left side spark plugs and wires for damage or wear. Check all wiring harnesses and connectors damage, burned insulation or poor connections. Check sensor shield connector. Repair or replace as necessary. If no faults are found, go to next step.

93) Check For COIL PWR At Left Coil Turn ignition off. Install EI Diagnostic Harness (007-00059) to Breakout Box (014-000950) and ICM. Use appropriate overlay. Connect left (Yellow) coil tee. Connect diagnostic harness negative lead to battery negative terminal. Leave positive lead disconnected. Set diagnostic harness box type switch to 8-cylinder position. Turn ignition on. Measure voltage between breakout box test pins J11 (COIL VBAT) and J7 (B-). If voltage is 10 volts or more, go to next step. If

voltage is less than 10 volts, repair open in COIL PWR circuit. Clear PCM memory and repeat **QUICK TEST** .

94) Check C3 Circuit At Coil Pack Turn ignition on. Measure voltage between breakout box test pins J10 (LC3C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If DC voltage is 10.0 volts or less, go to step 102).

95) Check C4 Circuit At Coil Pack Turn ignition on. Measure voltage between breakout box test pins J18 (LC4C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If DC voltage is 10.0 volts or less, go to step 104).

96) Check C3 Circuit At PCM Turn ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install a second EEC-V Breakout Box (014-000950). Connect PCM to second breakout box. Turn ignition on. Measure voltage between breakout box test pins J7 (B-) and test pin No. 78 at second breakout box. If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C3 circuit.

97) Check C4 Circuit At PCM Leave ignition on. Measure voltage between breakout box test pins J7 (B-) and test pin No 104 (LC4) at second breakout box. If DC voltage is more than 10.0 volts, go to next step. If DC voltage is 10.0 volts or less, repair open in C4 circuit.

98) Check C3 Circuit At Coil Turn ignition off. Disconnect left coil from diagnostic harness coil tee. Turn ignition on. Measure voltage between breakout box test pins J10 (LC3) and J7 (B-). If DC voltage is less than 0.5 volt, go to next step. If DC voltage is 0.5 volt or more, go to step 106).

99) Check C4 Circuit At Coil Leave ignition on. Measure voltage between breakout box test pins J18 (LC4C) and J7 (B-). If DC voltage is less than 0.5 volt, go to next step. If DC voltage is 0.5 volt or more, go tostep 107).

100) Check C3 Circuit At Coil While Cranking Connect positive lead of EI Diagnostic Harness (007-00059) to battery positive terminal. Connect incandescent test light between breakout box test pins J1 (B+) and J10 (LC3C). Crank engine. If test light blinks brightly once every engine revolution, go to next step. If test light does not blink as indicated, replace PCM and repeat **QUICK TEST** .

101) Check C4 Circuit At Coil While Cranking Connect incandescent test light between breakout box test pins J1 (B+) and J18 (LC4C). Crank engine. If test light blinks brightly once every engine revolution, replace cylinder No. 2 coil pack and repeat **QUICK TEST** . If test light does not blink as indicated, replace PCM and repeat QUICK TEST.

102) Check Left Coil Pack Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J10 (C3C) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace cylinder No. 2 coil pack. Clear PCM memory and repeat **QUICK TEST** .

103) Check C3 Circuit Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J10 (C3C) and J7 (B-). If resistance is less than 10,000 ohms, repair short to ground in C3 circuit. If resistance is 10,000 ohms or more, replace PCM. Repeat **QUICK TEST** .

NOTE: If C3 circuit is shorted to ground, coil damage may occur.

104) Check C4 Circuit Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J18 (LC4C) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace cylinder No. 2 coil pack. Clear PCM memory

and repeat **QUICK TEST** .

105) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J18 (LC4C) and J7(B-). If resistance is less than 10,000 ohms, repair C4 circuit short to ground. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** .

NOTE: If C4 circuit is shorted to ground, coil damage may occur.

106) Check C3 Circuit Turn ignition off. Disconnect PCM from vehicle harness connector. Turn ignition on. Measure voltage between breakout box test pins J10 (LC3C) and J7 (B-). If DC voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If DC voltage is 0.5 volt or more, repair C3 circuit short to power. Clear PCM memory and repeat QUICK TEST.

107) Check C4 Circuit Turn ignition off. Disconnect PCM wiring harness connector. Turn ignition on. Measure voltage between breakout box test pins J18 (LC4C) and J7 (B-). If voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volts or more, repair C4 circuit short to power and repeat QUICK TEST.

108) Check Right Spark Plugs & Wires Turn ignition off. Check right side spark plugs and wires for damage or wear. Check all wiring harnesses and connectors damage, burned insulation or poor connections. Repair or replace as necessary and repeat **QUICK TEST** . If no faults are found, go to next step.

109) Check For COIL PWR At Right Coil Turn ignition off. Connect right coil tee. Turn ignition on. Measure voltage between breakout box test pins J5 (COIL VBAT) and J7 (B-). If voltage is 10 volts or more, go to next step. If voltage is less than 10 volts, repair open in COIL PWR circuit to right coil. Clear PCM memory and repeat **QUICK TEST** .

WARNING: Unless otherwise instructed, PCM must not be connected to breakout box when performing ignition system testing.

110) Check C1 Circuit At Coil Pack Turn ignition on. Measure voltage between breakout box test pins J3 (RC1C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If DC voltage is 10.0 volts or less, go to step 118).

111) Check C2 Circuit At Coil Pack Turn ignition on. Measure voltage between breakout box test pins J6 (RC2C) and J7 (B-). If DC voltage is more than 10.0 volts, go to next step. If DC voltage is 10.0 volts or less, go to step 120).

112) Check C1 Circuit At PCM Turn ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install a second EEC-V Breakout Box (014-000950). Connect PCM to second breakout box. Turn ignition on. Measure voltage between breakout box test pins J7 (B-) and test pin No. 26 (RC1) at second breakout box. If DC voltage is more than 10.0 volts, go to next step. If DC voltage is 10.0 volts or less, repair open in C1 circuit.

113) Check C2 Circuit At PCM Leave ignition on. Measure voltage between breakout box test pins J7 (B-) and test pin No. 52 (RC2) at second breakout box. If DC voltage is more than 10.0 volts, go to next step. If voltage is 10.0 volts or less, repair open in C2 circuit.

114) Check C1 Circuit At Coil Turn ignition off. Disconnect right coil from diagnostic harness coil tee. Turn ignition on. Measure voltage between breakout box test pins J3 (RC1C) and J7 (B-). If DC voltage is less than 0.5 volt, go to next step. If DC voltage is 0.5 volt or more, go to step 122).

115) Check C2 Circuit At Coil Leave ignition on. Measure voltage between breakout box test pins J6 (RC2C) and J7 (B-). If DC voltage is less than 0.5 volt, go to next step. If DC voltage is 0.5 volt or more, go to step 123).

116) Check C1 Circuit At Coil While Cranking Turn ignition off. Reconnect coil lead. Connect positive lead of EI Diagnostic Harness (007-00059) to battery positive terminal. Connect incandescent test light between breakout box test pins J1 (B+) and J3 (RC1C). Using starter, crank engine. If test light blinks brightly once every engine revolution, go to next step. If test light does not blink as indicated, replace PCM and repeat **QUICK TEST** .

117) Check C2 Circuit At Coil While Cranking Connect incandescent test light between breakout box test pins J1 (B+) and J6 (RC2). Using starter, crank engine. If test light blinks brightly once every engine revolution, replace cylinder No. 1 coil pack and repeat **QUICK TEST** . If test light does not blink as indicated, replace PCM and repeat QUICK TEST.

118) Check C1 Circuit Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J3 (RC1C) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace cylinder No. 1 coil pack. Clear PCM memory and repeat **QUICK TEST** .

119) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J3 (RC1C) and J7 (B-). If resistance is less than 10,000 ohms, repair short to ground in C1 circuit. If resistance is 10,000 ohms or more, replace PCM. Repeat **QUICK TEST** .

NOTE: If C1 circuit is shorted to ground, coil damage may occur.

120) Check C2 Circuit Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J6 (RC2C) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace cylinder No. 1 coil pack. Clear PCM memory and repeat **QUICK TEST** .

121) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J6 (RC2C) and J7 (B-). If resistance is less than 10,000 ohms, repair C2 circuit short to ground. If resistance is 10,000 ohms or more, replace PCM and repeat **QUICK TEST** .

NOTE: If C2 circuit is shorted to ground, coil damage may occur.

122) Check C1 Circuit Turn ignition off. Disconnect PCM wiring harness connector.Turn ignition on. Measure voltage between breakout box test pins J3 (RC1C) and J7 (B-). If voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volts or more, repair C1 circuit short to power and repeat QUICK TEST.

123) Check C2 Circuit Turn ignition off. Disconnect PCM from vehicle harness connector. Turn ignition on. Measure voltage between breakout box test pins J6 (RC2C) and J7 (B-). If DC voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volt or more, repair C2 circuit short to power. Clear PCM memory and repeat QUICK TEST.

CIRCUIT TEST JF - INTEGRATED IGNITION COIL ON PLUG FAILURE

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Ignition Coils.
- Ignition Coils Harness.
- Powertrain Control Module (PCM).

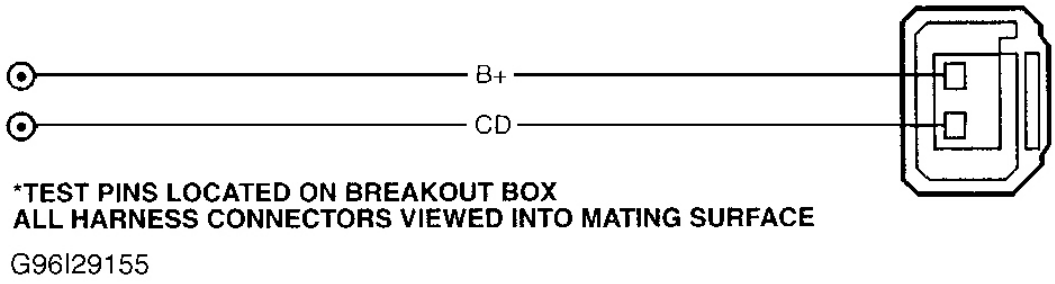

Fig. 74: Coil On Plug Ignition Coil Test Circuit & Connector Terminals

1) Continuous Memory DTC P0351, P0352, P0353, P0354, P0355, P0356, P0357, P0358, P0359 & P0360 Check spark plug and connectors for damage, looseness or shorting. Check coils and coil boots for damage, looseness or shorting. Repair or replace as necessary. If no faults are found, go to next step.

2) Check Resistance Between Coil Pins & Spring Terminal Turn ignition off. Remove suspect ignition coil. Measure resistance between B+ circuit terminal and coil spring. Measure resistance between CD circuit terminal and coil spring. If both resistance measurements are 4000-10,000 ohms, go to next step. If resistance is not as specified, replace coil and repeat **QUICK TEST** .

3) Check Resistance Between Coil Pins Leave ignition off. Measure resistance between coil terminals. If resistance is 0.3-0.8 ohms, go to next step. If resistance is not as specified, replace coil and repeat **QUICK TEST** .

4) Check Coil B+ Circuit Signal Leave ignition off. Disconnect PCM 104-pin connector. Turn ignition on. Measure voltage between ground and suspect coil B+ terminal. If voltage is 10 volts or more, turn ignition off. Reconnect PCM harness connector and go to next step. If voltage is less than 10 volts, check fuses and B+ circuit for open or short. Repair as necessary and repeat **QUICK TEST** .

5) Perform QUICK TEST If DTC P0351, P0352, P0353, P0354, P0355, P0356, P0357, P0358, P0359 or P0360 are present, go to step 7). If specified DTCs are not present, go to next step.

6) If DTC P0340 and P0350 are present, go to step 1) of **CIRCUIT TEST DR** . If specified DTCs are not present, go to step 5) of **CIRCUIT TEST HD** .

7) Check For Power To Coil Turn ignition off. Install EI Diagnostic Harness (007-00059) to Breakout Box (014-000950). Use appropriate overlay. Connect coil tee. Connect diagnostic harness negative lead to battery negative terminal. Leave positive lead disconnected. Set diagnostic harness box type switch to "8" cylinder position. Turn ignition on. Measure voltage between breakout box test pins J31 (COIL+) and J7 (B-). If voltage is 10 volts or more, go to next step. If voltage is less than 10 volts, repair open in COIL PWR circuit. Clear PCM memory and repeat **QUICK TEST** .

8) Measure voltage between breakout box test pins J32 (COIL-) and J7 (B-). If voltage is 10 volts or more, go to next step. If voltage is less than 10 volts, go to step 11).

9) Check For Coil At Connector Turn ignition off. Disconnect coil tee. Turn ignition on. Measure voltage between breakout box test pins J32 (COIL-) and J7 (B-). If voltage is 0.5 volts or less, go to next step. If voltage is more than 0.5 volts, go to step 13).

10) Check Coil While Cranking Connect positive lead of EI Diagnostic Harness (007-00059) to battery positive terminal. Connect incandescent test light between breakout box test pins J1 (B+) and J32 (COIL-). Crank engine. If test light blinks brightly once every engine revolution, go to next step. If test light does not blink as indicated, replace PCM and repeat **QUICK TEST** .

11) Check For Coil Short To Ground Turn ignition off. Disconnect coil from diagnostic harness coil tee. Measure resistance between breakout box test pins J32 (COIL-) and J7 (B-). If resistance is less than 2000 ohms, go to next step. If resistance is 2000 ohms or more, replace coil pack. Clear PCM memory and repeat **QUICK TEST** .

12) Leave ignition off. Disconnect PCM wiring harness connector. Measure resistance between breakout box test pins J32 (COIL-) and J7 (B-). If resistance is less than 10,000 ohms, repair short to ground in C1 circuit. If resistance is 10,000 ohms or more, replace PCM. Repeat **QUICK TEST** .

13) Check Coil For Short To Power Turn ignition off. Disconnect PCM from vehicle harness connector. Turn ignition on. Measure voltage between breakout box test pins J32 (Coil-) and J7 (B-). If DC voltage is less than 0.5 volt, replace PCM and repeat **QUICK TEST** . If voltage is 0.5 volt or more, repair circuit short to power. Clear PCM memory and repeat QUICK TEST.

CIRCUIT TEST KA - FUEL PUMP RELAY

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Fuel pump relay.
- Inertia Fuel Shutoff (IFS) switch.
- Wiring harness circuits (B+, FUEL PUMP, FPM, POWER-TO-PUMP and VPWR).
- Powertrain Control Module (PCM).

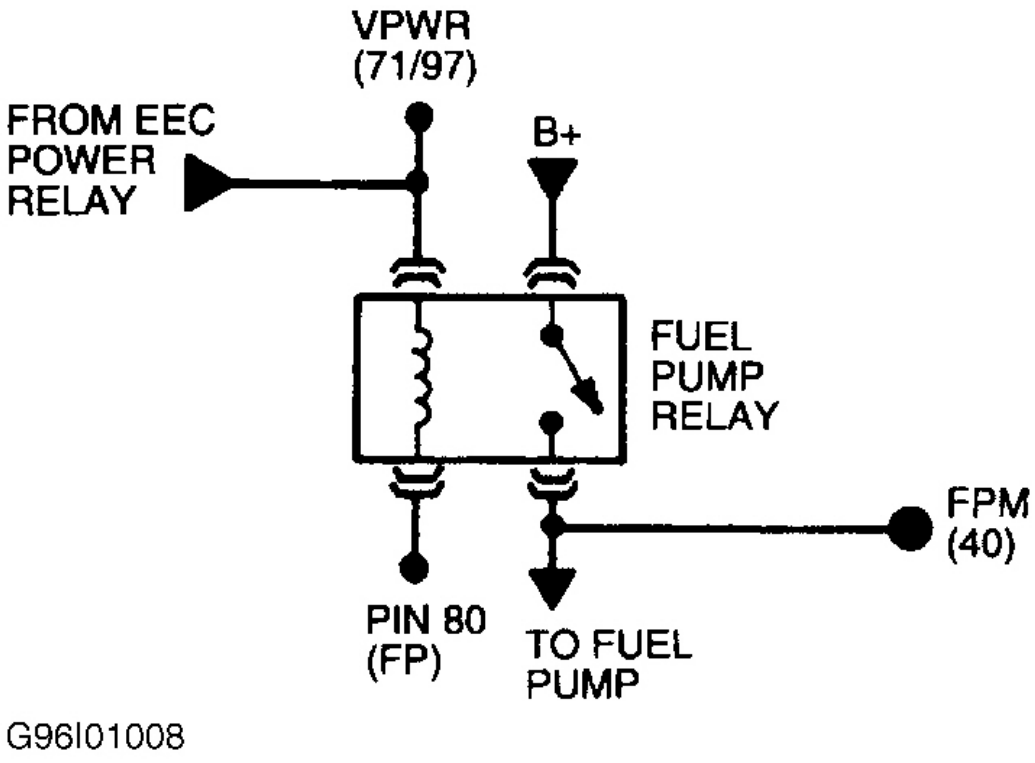

Fig. 75: Typical Fuel Pump Relay Schematic

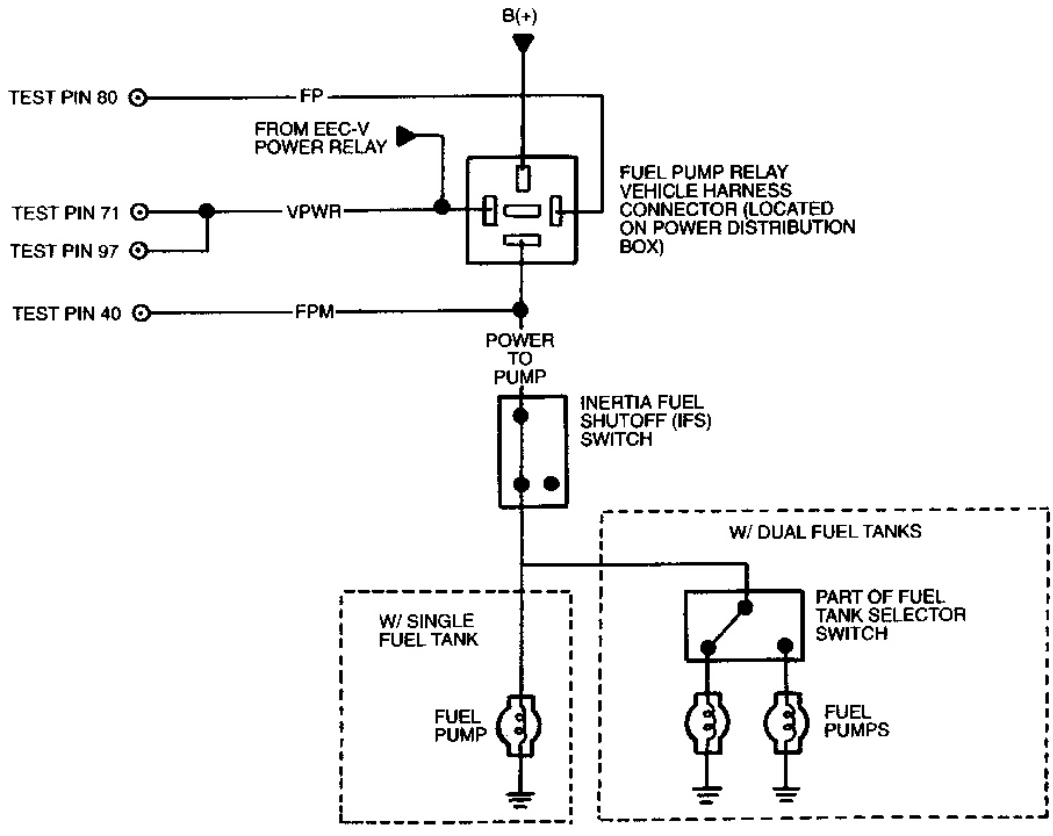

Fig. 76: Fuel System Test Circuit & Connector Terminals

1) KOEO & KOER DTC P0230 Fuel pump primary circuit has been indicated. Possible causes are as follows:

- Open or shorted circuit.
- Faulty fuel pump relay.
- Faulty PCM.

For Continuous Memory DTC P0230, go to step 40). Disconnect fuel pump relay wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal at connector and chassis ground. If 10.5 volts or more are present, go to next step. If less than 10.5 volts are present, repair open in VPWR circuit between EEC power relay and fuel pump relay.

NOTE: To Identify fuel pump relay terminals, refer to numbers molded on relay.

2) Check Fuel Pump Relay Turn ignition off. Leave fuel pump relay disconnected. Measure resistance between terminals No. 1 or No. 85 and all other terminals.

Resistance should be either 40-120 ohms, or greater than 10,000 ohms. Replace fuel pump relay if resistance is not as specified. If resistance is okay, go to next step.

3) Check Fuel Pump Circuit Leave ignition off and fuel pump relay disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 80 and chassis ground. If voltage is one volt or less, go to next step. If voltage is more than one volt, repair short to power in FUEL PUMP circuit and repeat **QUICK TEST** .

4) Leave ignition off and fuel pump relay disconnected. Disconnect scan tester from Data Link Connector (DLC). Measure resistance between test pin No. 80 and test pins No. 51, 91 and 103. If each resistance measurement is more than 10,000 ohms, go to next step. If any resistance measurement is 10,000 ohms or less, repair short circuit and repeat **QUICK TEST** .

5) Leave ignition off and fuel pump relay disconnected. Measure resistance between FUEL PUMP terminal at fuel pump relay wiring harness connector and test pin No. 80 at breakout box. If resistance is less than 5 ohms and DTC P0231 or P0232 is present with DTC P0230, go to next step. If resistance is less than 5 ohms and specified DTCs are not present, replace PCM and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open circuit and repeat QUICK TEST.

6) Check PCM Fuel Pump Circuit Leave ignition off. Reconnect PCM and fuel pump relay. Connect scan tester to DLC. Turn ignition on. Using scan tester, access FPA PID or FPF PID. If scan tester indicates YES or ON, replace PCM and repeat **QUICK TEST** . If scan tester does not indicate YES or ON, go to next step.

7) Leave scan tester accessed to FPA PID or FPF PID. Using starter, crank engine. If scan tester indicates YES or OFF during crank, replace PCM and repeat **QUICK TEST** . If scan tester does not indicate YES or ON during crank, fuel pump primary circuit is okay. If DTC P0231 is present, go to step 20). If DTC P0232 is present, go to step 10).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 7) to step 10). No test procedures have been omitted.

10) KOEO & KOER DTC P0232 If engine starts, go to next step. If engine does not start, go to step 15). For Continuous Memory DTC P0232, go to step 30).

11) Check Fuel Pump Turn ignition on for 5 seconds. Listen for operational noise from fuel pump. If fuel pump can be heard, go to next step. If fuel pump cannot be heard, go to step 13).

12) Check Fuel Pump Relay Turn ignition off. Disconnect fuel pump relay. Turn ignition on. Listen for operational noise from fuel pump. If fuel pump operates, repair short to power in FPM or POWER-TO-PUMP circuit and repeat **QUICK TEST** . If fuel pump still does not operate, replace fuel pump relay and repeat QUICK TEST.

13) Check FPM Circuit Turn ignition off. Leave fuel pump relay disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 40 and POWER-TO-PUMP terminal at fuel pump relay wiring harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

14) Check PCM Fuel Pump Circuit Leave ignition off. Reconnect PCM and fuel pump relay. Connect scan tester to DLC. Turn ignition on. Using scan tester, access FPM PID. If scan tester indicates OFF, fuel pump primary circuit is okay and testing is complete. If scan tester does not indicate OFF, replace

PCM and repeat **QUICK TEST** .

15) Check IFS Switch Turn ignition off. Locate IFS switch in trunk near left hinge. Measure resistance between terminals "C" and NC of IFS switch. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, reset or replace IFS switch and repeat **QUICK TEST** .

16) Leave ignition off and IFS switch disconnected. Disconnect fuel pump relay. Measure resistance between POWER-TO-PUMP terminal at fuel pump relay connector and POWER-TO-PUMP terminal at IFS connector. If resistance is less than 7 ohms, go to next step. If resistance is 7 ohms or more, repair open in POWER-TO-PUMP circuit and repeat **QUICK TEST** .

17) Leave ignition off, fuel pump relay and IFS switch disconnected. Measure resistance between fuel pump motor ground circuit at connector and chassis ground. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in fuel pump motor ground circuit and repeat **QUICK TEST** .

18) Leave ignition off, fuel pump relay and IFS switch disconnected. Measure resistance between POWER-TO-PUMP terminal at fuel pump connector and POWER-TO-PUMP terminal at IFS connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in POWER-TO-PUMP circuit and repeat **QUICK TEST** .

19) Leave ignition off, fuel pump relay and IFS switch disconnected. Measure resistance between fuel pump motor terminals. If resistance is less than 10 ohms, fuel pump circuits are okay and testing is complete. If resistance is 10 ohms or more, replace fuel pump and repeat **QUICK TEST** .

20) KOEO & KOER DTC P0231 If engine starts, replace PCM and repeat **QUICK TEST** . If engine does not start, go to next step.

21) Check B+ To Fuel Pump Relay Turn ignition off. Disconnect fuel pump relay wiring harness connector. Measure voltage between chassis ground and B+ terminal at fuel pump relay wiring harness connector. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, check circuit fuse. If fuse is okay, repair open in B+ circuit and repeat **QUICK TEST** .

22) Check POWER-TO-PUMP Circuit Resistance Leave ignition off and fuel pump relay disconnected. Measure resistance between negative battery terminal and POWER-TO-PUMP terminal at fuel pump relay wiring harness connector. If resistance is less than 10 ohms, replace fuel pump relay and repeat **QUICK TEST** . If resistance is 10 ohms or more, repair open in POWER-TO-PUMP circuit and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 22) to step 30). No test procedures have been omitted.

30) Continuous Memory DTC P0232 Turn ignition off. Connect scan tester to Data Link Connector. Using scan tester, access FRM PID. Observe PID for indication of fault while wiggling and bending POWER-TO-PUMP circuit between fuel pump relay and fuel pump. Fault will be indicated by FPM PID turning on. Wiggle and bend FPM circuit between PCM and POWER-TO-PUMP circuit splice. Wiggle and bend fuel pump ground circuit at fuel pump. Check connectors for clean tight connection. If any faults are found, isolate and repair as necessary. If no faults are found, fault cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 30) to step 35). No test procedures have been omitted.

35) Continuous Memory DTC P0231 Turn ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Connect jumper wire between test pins No. 77 (PWR GND) and 80 (FP). Connect DVOM between test pins No. 40 (FPM) and 51 (GND). Voltage should be 10 volts or more. Observe DVOM for indication of fault while wiggling and bending B+ circuit to fuel pump relay. Fault will be indicated by sudden change in DVOM voltage. Wiggle and bend POWER-TO-PUMP circuit between fuel pump relay and FPM circuit splice. Lightly tap on fuel pump relay. Check connectors for clean tight connection. If any faults are found, isolate and repair as necessary. If no faults are found, fault cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 35) to step 40). No test procedures have been omitted.

40) Continuous Memory DTC P0230 Turn ignition off. Connect scan tester to Data Link Connector. Turn ignition on and wait 5 seconds. Using scan tester, access FPA PID. Observe PID for indication of fault while wiggling and bending FUEL PUMP circuit between fuel pump relay and PCM. Fault will be indicated by FPA PID turning on. Wiggle and bend FPM circuit between PCM and POWER-TO-PUMP circuit splice. Wiggle and bend VPWR circuit between fuel pump relay and EEC-V power relay. Check connectors for clean tight connection. If any faults are found, isolate and repair as necessary. If no faults are found, fault cannot be duplicate

CIRCUIT TEST KC - FUEL SHUTOFF VALVE RELAY

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Fuel shutoff valve relay.
- Inertia Fuel Shutoff (IFS) switch.
- Wiring harness circuits (B+, FSV, FSVM, Ground, POWER-TO-FUEL SHUTOFF VALVE and VPWR).
- Powertrain Control Module (PCM).

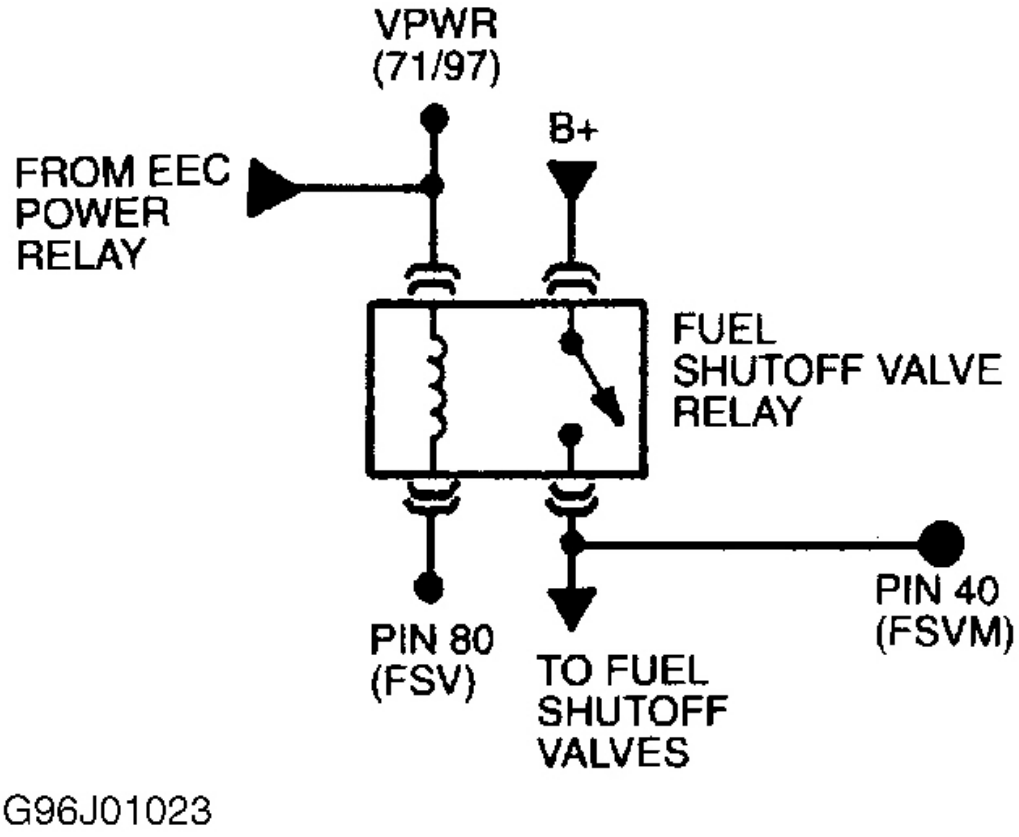

Fig. 77: Typical Fuel Pump Relay Schematic

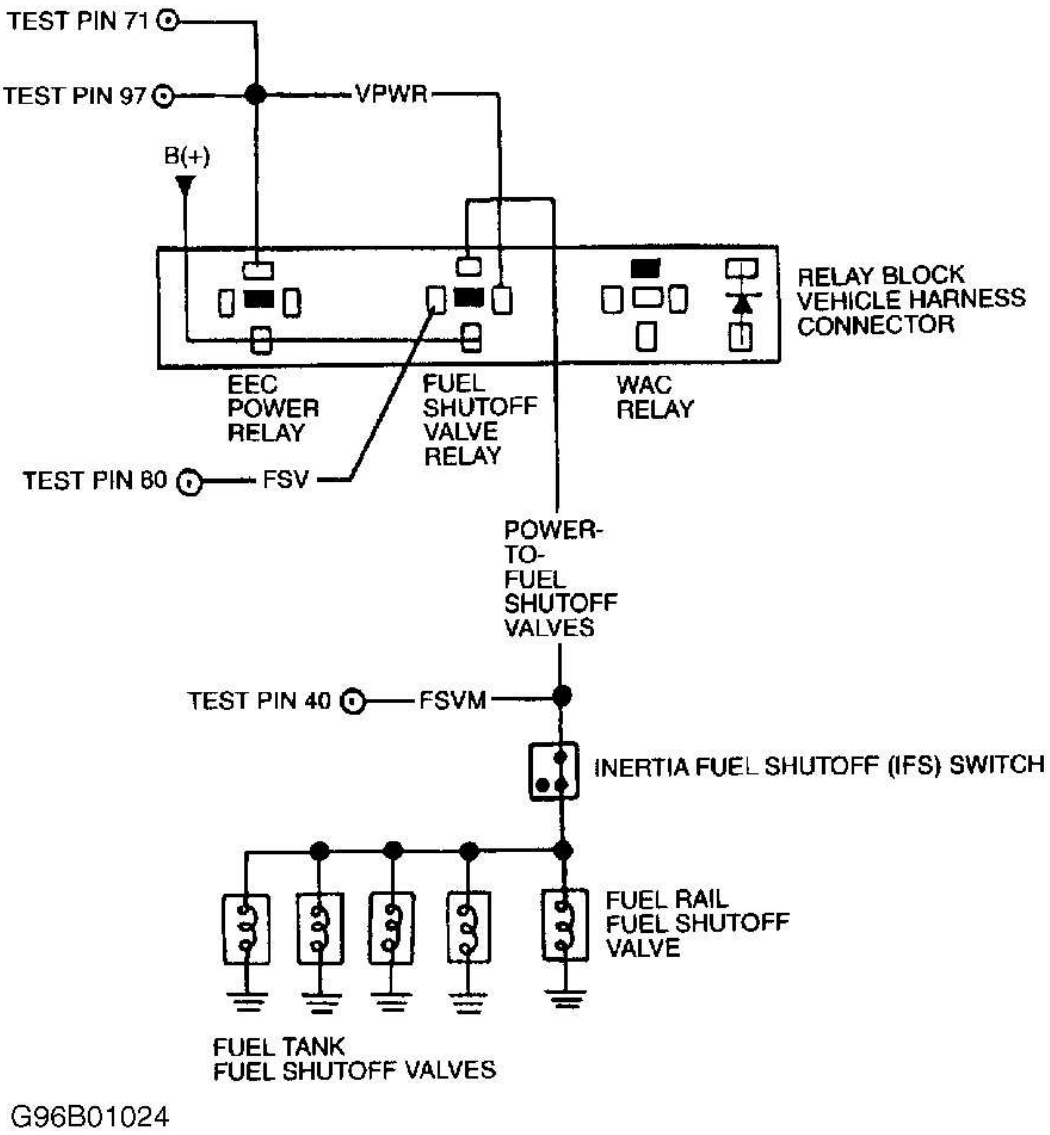

Fig. 78: Fuel Shutoff System Test Circuit & Connector Terminals

1) KOEO & KOER DTC P0230 Fuel shutoff valve primary circuit has been indicated. Possible causes are as follows:

- Open or shorted circuit.
- Faulty fuel shutoff valve relay.
- Faulty PCM.

For Continuous Memory DTC P0230, go to step 40). Disconnect fuel shutoff valve relay wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal at connector and chassis ground.

If 10.5 volts or more are present, go to next step. If less than 10.5 volts are present, repair open in VPWR circuit between EEC power relay and fuel shutoff valve relay.

2) Check Fuel Shutoff Valve Relay Turn ignition off. Leave fuel shutoff valve relay disconnected. Measure resistance between terminals No. 85 and 86 at fuel shutoff valve relay. Resistance should be 40-120 ohms. Measure resistance between terminals No. 30 and 87 at fuel shutoff valve relay. Resistance should be more than 10,000 ohms. If resistance is not as specified, replace fuel shutoff valve relay. If resistance is as specified, go to next step.

3) Check Fuel Shutoff Valve Circuit Leave ignition off and fuel shutoff valve relay disconnected. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 80 (FSV) and chassis ground. If voltage is one volt or less, go to next step. If voltage is more than one volt, repair short to power in FSV circuit and repeat **QUICK TEST** .

4) Leave ignition off and fuel shutoff valve relay disconnected. Disconnect scan tester from Data Link Connector (DLC). Measure resistance between test pin No. 80 (FSV) and test pins No. 51, 103 (PWR GND) and 91 (SIG RTN). If each resistance measurement is more than 10,000 ohms, go to next step. If any resistance measurement is 10,000 ohms or less, repair short circuit and repeat **QUICK TEST** .

5) Leave ignition off and fuel shutoff valve relay disconnected. Measure resistance between FSV terminal at fuel shutoff valve relay wiring harness connector and test pin No. 80 at breakout box. If resistance is less than 5 ohms and DTC P0231 or P0232 is present with DTC 230, go to next step. If resistance is less than 5 ohms and specified DTCs are not present, replace PCM and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open circuit and repeat QUICK TEST.

6) Check PCM Fuel Shutoff Valve Circuit Leave ignition off. Remove breakout box. Reconnect PCM and fuel shutoff valve relay. Connect scan tester to DLC. Turn ignition on. Using scan tester, access FSVF PID. If scan tester indicates YES, replace PCM and repeat **QUICK TEST** . If scan tester does not indicate YES, go to next step.

7) Leave scan tester accessed to FSV PID. Using starter, crank engine. If scan tester indicates YES during crank, replace PCM and repeat **QUICK TEST** . If scan tester does not indicate YES during crank, fuel shutoff valve primary circuit is okay. If DTC P0231 is present, go to step 20). If DTC P0232 is present, go to step 10).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 7) to step 10). No test procedures have been omitted.

10) KOEO & KOER DTC P0232 If engine starts, go to next step. If engine does not start, go to step 15). For Continuous Memory DTC P0232, go to step 30).

11) Check Power To Fuel Shutoff Valve Turn ignition and all accessories off. Disconnect scan tester from DLC (if applicable). Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 40 (FSVM) and 51 (PWR GND) at breakout box. If voltage is more than 1.5 volts, go to next step. If voltage is 1.5 volts or less, go to step 13).

12) Check Fuel Shutoff Valve Relay Turn ignition off. Disconnect fuel shutoff valve relay. Turn ignition on. Measure voltage between test pin No. 40 (FSVM) and 51 (PWR GND) at breakout box. If voltage is less than 1.5 volts, replace fuel shutoff valve relay and repeat **QUICK TEST** . If voltage is 1.5 volts or more, repair short to power in FSVM or POWER-TO-FUEL SHUTOFF VALVE circuit and

repeat QUICK TEST.

13) Check FSVM Circuit Turn ignition off. Leave fuel shutoff valve relay disconnected. Measure resistance between test pin No. 40 and POWER-TO-FUEL SHUTOFF VALVE circuit at fuel pump relay wiring harness connector. If resistance is less than 5 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open circuit and repeat QUICK TEST.

14) Check IFS Switch Turn ignition off. Locate IFS switch in trunk near left hinge. Measure resistance between terminals "C" and NC of IFS switch. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, reset or replace IFS switch and repeat **QUICK TEST** .

15) Check Circuit Continuity Leave ignition off, IFS switch and fuel shutoff valve relay disconnected. Measure resistance of POWER-TO-FUEL SHUTOFF VALVE circuit between fuel shutoff valve relay connector and IFS connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in POWER-TO-FUEL SHUTOFF VALVE circuit between IFS switch and FSVM connection. Clear PCM memory and repeat **QUICK TEST** .

16) Leave ignition off, fuel shutoff valve relay and IFS switch disconnected. Measure resistance between POWER-TO-FUEL SHUTOFF VALVE circuit at IFS connector and chassis ground. If resistance is less than 10 ohms, fault cannot be located and testing is complete. If resistance is 10 ohms or more, repair open circuit and repeat **QUICK TEST** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 16) to step 20). No test procedures have been omitted.

20) DTC P0231 If engine starts, replace PCM and repeat **QUICK TEST** . If engine does not start, go to next step. For Continuous Memory DTC P0231, go to step 35).

21) Check B+ To Fuel Shutoff Valve Relay Turn ignition off. Disconnect fuel shutoff valve relay wiring harness connector. Measure voltage between chassis ground and B+ terminal at wiring harness connector. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, check circuit fuse. If fuse is okay, repair open in B+ circuit and repeat **QUICK TEST** .

22) Check POWER-TO-FUEL SHUTOFF VALVES Circuit Resistance Leave ignition off and fuel shutoff valve relay disconnected. Measure resistance between negative battery terminal and POWER-TO-FUEL SHUTOFF VALVES terminal at wiring harness connector. If resistance is less than 10 ohms, replace fuel shutoff valve relay and repeat **QUICK TEST** . If resistance is 10 ohms or more, repair open in POWER-TO-FUEL SHUTOFF VALVES circuit and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 22) to step 30). No test procedures have been omitted.

30) Continuous Memory DTC P0232 Turn ignition off. Connect scan tester to Data Link Connector (DLC). Using scan tester, access FSVM PID. Observe PID for indication of fault while wiggling and bending POWER-TO-FUEL SHUTOFF VALVES circuit. Fault will be indicated by FSVM PID turning on. Wiggle and bend fuel shutoff valve ground circuit. Check connectors for clean tight connection. If any faults are found, isolate and repair as necessary. If no faults are found, fault cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 30) to step 35). No test procedures have been omitted.

35) Continuous Memory DTC P0231 Turn ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Connect jumper wire between test pins No. 77 (PWR GND) and 80 (FSV). Connect DVOM between test pins No. 40 (FSVM) and 51 (PWR GND). Voltage should be 10 volts or more. Observe DVOM for indication of fault while wiggling and bending B+ circuit to fuel shutoff valve relay. Fault will be indicated by sudden change in DVOM voltage. Wiggle and bend POWER-TO-FUEL SHUTOFF VALVES circuit between fuel shutoff valve relay and FSVM circuit splice. Lightly tap on fuel shutoff valve relay. Check connectors for clean tight connection. If any faults are found, isolate and repair as necessary. If no faults are found, fault cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 35) to step 40). No test procedures have been omitted.

40) Continuous Memory DTC P0230 Turn ignition off. Connect scan tester to Data Link Connector. Turn ignition on and wait 5 seconds. Using scan tester, access FSVF PID. Observe PID for indication of fault while wiggling and bending FUEL shutoff valve circuit between fuel shutoff valve relay and PCM. Fault will be indicated if FSVF PID switches to YES. Wiggle and bend FSV circuit between PCM and fuel shutoff valve relay. Wiggle and bend VPWR circuit between fuel shutoff valve relay and EEC-V power relay. Check connectors for clean tight connection. If any faults are found, isolate and repair as necessary. If no faults are found, fault cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

CIRCUIT TEST KE - IDLE AIR CONTROL (IAC) VALVE

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Throttle linkage.
- Wiring harness circuits (IAC and VPWR).
- Faulty Idle Air Control (IAC) valve.
- Faulty throttle body.
- Faulty Powertrain Control Module (PCM).

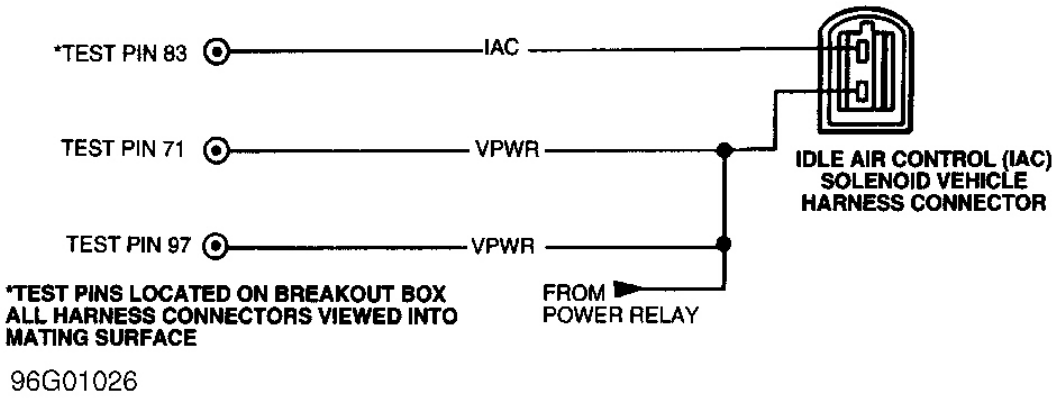

Fig. 79: IAC Circuit & Connector Terminals

1) DTC P0505, P1504 Or P1507 Perform KOER self-test. If DTC P0505, P1504 or P1507 is present, go to next step. If DTC P0505 or P1507 is not present, IAC system is okay and testing is complete.

2) DTC P0505 & P1507 DTC P0505 indicates that IAC system malfunction has been detected. DTC P1504 indicates that IAC circuit malfunction has been detected. DTC P1507 indicates that IAC system under speed fault has been detected. Possible causes are as follows:

- IAC circuit open or shorted to PWR.
- VPWR circuit open.
- Contaminated IAC valve assembly.
- Damaged throttle body.
- Faulty PCM.

Turn ignition off. Disconnect IAC solenoid. Turn ignition on. Measure voltage between VPWR terminal of IAC solenoid wiring harness connector and battery ground terminal. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open VPWR circuit and repeat **QUICK TEST** .

3) Check IAC Solenoid Resistance Turn ignition off. Connect DVOM positive lead to VPWR terminal of IAC solenoid wiring harness connector. Connect DVOM negative lead to IAC terminal. If resistance is 6-13 ohms, go to next step. If resistance is not 6-13 ohms, replace IAC valve assembly and repeat **QUICK TEST** .

4) Check IAC Solenoid Internal Short To Case Turn ignition off. Measure resistance between each wiring harness connector terminal and IAC housing. If each resistance is 10,000 ohms or more, go to next step. If either resistance is less than 10,000 ohms, replace IAC solenoid assembly and repeat **QUICK TEST** .

5) Check Air Inlet System Turn ignition off. Remove air filter. Inspect air filter, MAF sensor and air inlet system for excessive dirt or contamination. Repair or replace as necessary and repeat **QUICK TEST** . If air filter is okay, go to next step.

6) Check For Vacuum Leaks Start engine and allow to idle. Inspect air inlet system any of the following

possible faults:

- Cracked or punctured air inlet tube.
- Loose inlet air tube or air cleaner housing.
- Loose or damaged throttle body.
- Contaminated or damaged IAC valve assembly.
- Faulty EGR valve or gasket.
- Faulty PCV valve or hose.

Check entire system for vacuum leaks. Repair or replace as necessary. If no vacuum leaks are found, go to next step.

7) Check IAC Circuit Continuity Leave ignition off. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between breakout box test pin No. 83 (IAC) and IAC terminal at IAC solenoid wiring harness connector. If resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** . If resistance is less than 5 ohms, go to next step.

8) Check IAC Circuit For Short To Power Turn ignition on. Measure voltage between breakout box test pin No. 83 (IAC) and chassis ground. If voltage is one volt or more, repair circuit short to power and repeat **QUICK TEST** . If voltage is less than one volt, go to next step.

9) Check IAC Circuit For Short To Ground Turn ignition off. Measure resistance between test pin No. 83 (IAC) and test pins No. 51 and 103 (PWR GND) at breakout box. If resistance is more than 10,000 ohms, go to next step. If resistance is less than 10,000 ohms, repair circuit short to ground and repeat **QUICK TEST** .

10) Check IAC Signal From PCM Leave ignition off. Connect PCM to breakout box. Connect IAC solenoid to wiring harness connector. Connect DVOM between test pin No. 83 (IAC) and test pin No. 51 (PWR GND) at breakout box. Start engine and slowly increase speed to 3000 RPM. If voltage is 3.0-11.5 volts, remove IAC solenoid and check throttle body. If throttle body is okay, replace IAC assembly and repeat **QUICK TEST** . If voltage is not 3.0-11.5 volts, replace PCM and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 10) to step 20). No test procedures have been omitted.

20) DTC P1506 This code indicates that IAC system has reached over speed malfunction. Possible causes are as follows:

- IAC circuit short to ground.
- IAC assembly stuck open.
- Air intake leaks or restrictions.
- Damaged throttle body.
- Contaminated or damaged IAC valve assembly.
- Faulty Powertrain Control Module (PCM).

Check entire system for vacuum leaks. Repair or replace as necessary. If no vacuum leaks are found, go to next step.

21) Check EVAP System Turn ignition off. Disconnect hoses from EVAP canister purge valve or solenoid. Attach vacuum pump with gauge to carbon canister hose port. See **Fig. 80** . Using vacuum pump, apply 16 in. Hg to port. If vacuum bleeds off within 20 seconds, replace EVAP canister purge valve or solenoid and repeat **QUICK TEST** . If vacuum is not bled off immediately, go to next step.

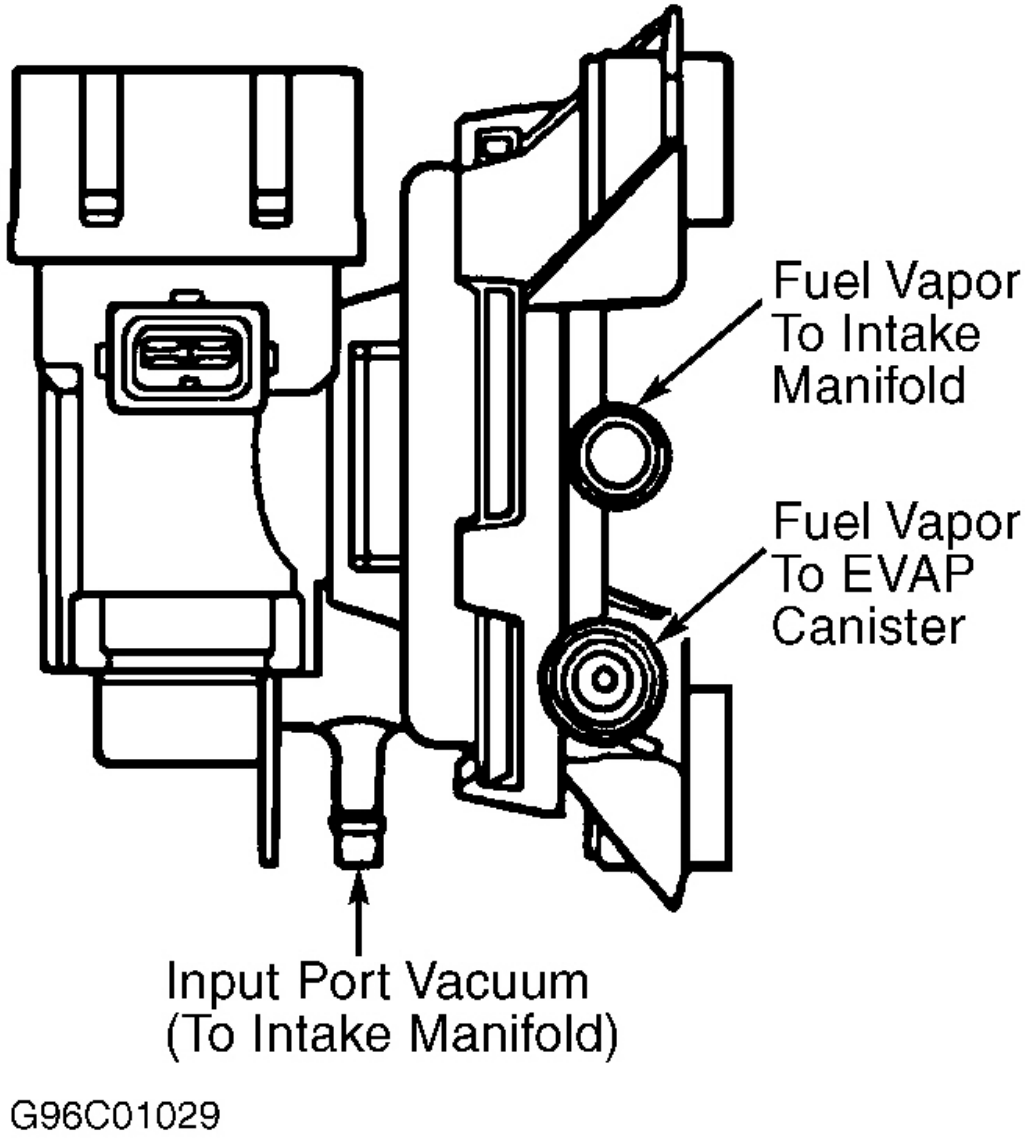

Fig. 80: EVAP Canister Purge Hose Ports

22) Check IAC Solenoid Function Start engine and allow to idle. Ensure transmission is in Park or Neutral and engine is warmed to normal operating temperature. Disconnect IAC solenoid wiring harness

connector. If engine speed drops, go to next step. If engine speed does not drop, check throttle body for damage. If throttle body is okay, replace IAC solenoid and repeat **QUICK TEST** .

23) Check IAC Circuit For Short To Ground Turn ignition off. Disconnect scan tester from DLC. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 83 (IAC) and test pins No. 51 and 103 (PWR GND) at breakout box. If resistance is more than 10,000 ohms and idle speed is normal, go to step 30). If resistance is more than 10,000 ohms and high idle speed is present, replace PCM and repeat **QUICK TEST** . If resistance is less than 10,000 ohms, repair circuit short to ground and repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 23) to step 25). No test procedures have been omitted.

25) DTC P1505: Check Inlet Air Supply DTC P1505 indicates that IAC system has reached the adaptive learning limit. Possible causes are as follows:

- Air intake leaks or restrictions.
- Throttle body linkage binding.
- Contaminated or damaged IAC valve assembly.
- Damaged throttle body.

Inspect air intake system for leaks. Repair or replace as necessary. If air intake system is okay, go to next step.

26) Check Air Inlet System Turn ignition off. Remove air filter. Inspect air filter, MAF sensor and air inlet system for excessive dirt or contamination. Repair or replace as necessary and repeat **QUICK TEST** . If air filter is okay, go to next step.

27) Check Throttle Body Leave ignition off. Disconnect accelerator cable and air cleaner tube from throttle body. Check cable and throttle body linkage for binding or interference. If faults are present, go to step 3) under **CIRCUIT TEST HU** . If no faults are present, go to step 8) under **CIRCUIT TEST HU** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 27) to step 30). No test procedures have been omitted.

30) Check IAC System For Intermittent Open Or Short Circuit Connect scan tester to DLC. Ensure all accessories are off and engine is warmed to normal operating temperature. Turn ignition on. Access IAC PID and RPM PID. IAC duty cycle should be 20-45 percent. Observe IAC PID and RPM PID for indication of fault while wiggling and bending wiring harness between IAC solenoid and PCM. Fault will be indicated by sudden change in IAC PID or RPM PID value. If any faults are found, isolate and repair as necessary. Repeat **QUICK TEST** . If no faults are found, problem cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

CIRCUIT TEST KL - SHIFT INDICATOR LIGHT (SIL)

Diagnostic Aids

Perform this test only when directed here by a driveability symptom. This test is only intended to diagnose:

- Wiring harness circuits (SIL).
- Top gear switch.
- SIL dimmer relay.
- SIL bulb and SIL circuit fuse.
- Powertrain Control Module (PCM).

1) Check SIL Operation Inspect SIL while driving vehicle. SIL should turn on when optimum-shift RPM for each gear is reached. Light should be off in top gear. If SIL light is always on, check for short to ground in SIL circuit. If light is always off, check for open in SIL circuit. If light is always on, go to step 4). If light is not always on, go to next step.

2) Check SIL Circuit Fuse Turn ignition off. Remove and inspect SIL fuse. If fuse is okay, go to next step. Replace fuse if blown. If fuse blows again, repair short to ground between fuse and SIL bulb. Check SIL operation.

3) Check SIL Bulb Turn ignition off. Remove and inspect SIL bulb. If bulb is burned out, replace bulb and check SIL operation. If bulb is okay, go to step 5).

4) Check SIL Circuit For Short To Ground Turn ignition off. Put transmission in high gear. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pins No. 53 and 60 at breakout box. If resistance is 10,000 ohms or less, repair short between top gear switch and PCM. Reconnect all components, and repeat **QUICK TEST** . If resistance is more than 10,000 ohms, replace PCM and repeat QUICK TEST.

5) Check For Voltage To SIL Socket Turn ignition off. Remove SIL bulb. Place transmission in any gear except top gear. Turn ignition on. Measure voltage between power contact at SIL socket and chassis ground. If voltage is more than 10.5 volts, go to step 7). If voltage is 10.5 volts or less, connect SIL bulb and go to next step.

6) Check Operation Of Top Gear Switch Top gear switch is normally closed and should only be open when vehicle is shifted into top gear. Turn ignition off. Disconnect top gear switch. Place transmission in any gear except top gear. Measure resistance between top gear switch terminals. If resistance is less than 5 ohms, repair open in IGNITION RUN circuit to SIL bulb socket. Check SIL operation. If resistance is 5 ohms or more, replace top gear switch. Check SIL operation.

7) Check Continuity Of SIL Circuit Turn ignition off. Remove SIL bulb. Disconnect PCM wiring harness connector. Inspect pins for damage and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Measure resistance between test pin No. 72 and SIL power contact at SIL bulb socket. If resistance is less than 5 ohms, replace PCM. Check SIL operation. If resistance is 5 ohms or more, repair open circuit. Remove breakout box, reconnect all components and check SIL operation.

CIRCUIT TEST KM - WOT A/C CUT-OFF (WAC)

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Wiring harness circuits (ACCS, POWER-TO-CLUTCH, VPWR and WAC).
- Faulty WAC relay.
- Faulty Powertrain Control Module (PCM).

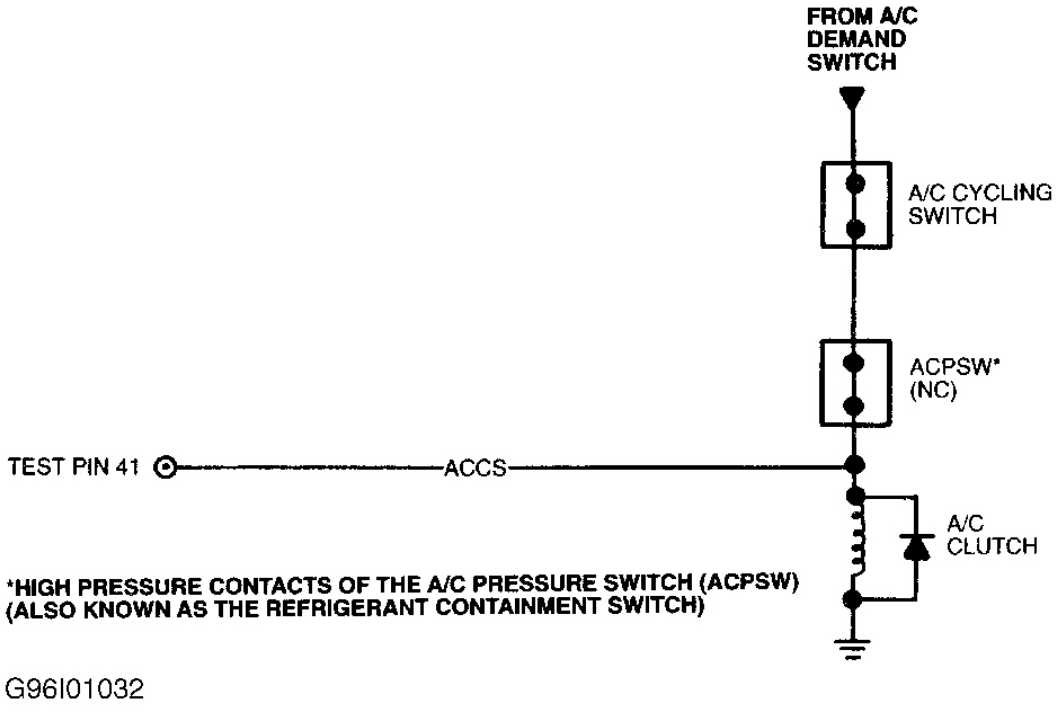

Fig. 81: WAC Test Circuits & Connector Terminals

1) DTC P1460: Verify ACCS PID Is Off Turn ignition off. Ensure A/C and defroster are off. Connect scan tester to Data Link Connector (DLC). Start engine and allow to idle. Using scan tester, access ACCS PID. If ACCS PID is off, go to next step. If ACCS PID is on, go to step 20).

2) Check VPWR Circuit Turn ignition off. Disconnect WAC relay wiring harness connector. Turn ignition on. Measure voltage between VPWR terminal at connector and chassis ground. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in VPWR circuit. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat **QUICK TEST** .

3) Check WAC Relay Leave ignition off and WAC relay disconnected. Check resistance between relay terminals No. 85 and 86.

Replace WAC relay if resistance is not 40-120 ohms. If resistance is okay, check resistance between relay terminals No. 85 and 30, No. 85 and 87, No. 85 and 87A.

If resistance is okay, go to next step. If resistance less than 10,000 ohms, replace WAC relay. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat **QUICK TEST** .

4) Check WAC Circuit Turn ignition off. Leave WAC relay disconnected. Disconnect PCM wiring harness connector. Inspect connector for damage or corrosion, and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 69 (WAC) at breakout box and chassis ground. If voltage is less than one volt, go to next step. If voltage is one volt or more, repair circuit short to power. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat **QUICK TEST** .

5) Turn ignition off. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No. 69 (WAC) and test pins No. 51, 91 and 103 (PWR GND) at breakout box. If resistance is more than 10,000 ohms, go to next step. If resistance is less than 10,000 ohms, repair circuit short to ground. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat **QUICK TEST** .

6) Leave ignition off and relay disconnected. Measure resistance between breakout box test pin No. 69 and WAC terminal at relay harness connector. If resistance is less than 5 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 5 ohms or more, repair open circuit. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat QUICK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 6) to step 10). No test procedures have been omitted.

10) Check For Voltage To A/C Cycling Switch Turn ignition off. Disconnect A/C cycling switch. Turn A/C switch on. Measure voltage between chassis ground and A/C Demand terminal of A/C cycling switch. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, check for fault in A/C demand switch, EATC module or related wiring harness. See the A/C-HEATER SYSTEM article in the AIR CONDITIONING & HEAT section.

11) Check Continuity Of ACPSW Contacts Turn ignition off. Leave A/C switch on. Measure resistance between ACPSW high pressure contacts. If resistance is less than 5 ohms, reconnect ACPSW and go to next step. If resistance is 5 ohms or more, check for low refrigerant charge.

12) Check For Voltage To A/C Pressure Switch (ACPSW) Leave ignition off and A/C cycling switch disconnected. Disconnect ACPSW. Turn A/C switch on. Measure voltage between chassis ground and A/C Demand terminal at the ACPSW wiring harness connector. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, check for fault in A/C demand switch, EATC module or related wiring harness. See A/C-HEATER SYSTEM in the AIR CONDITIONING & HEAT section.

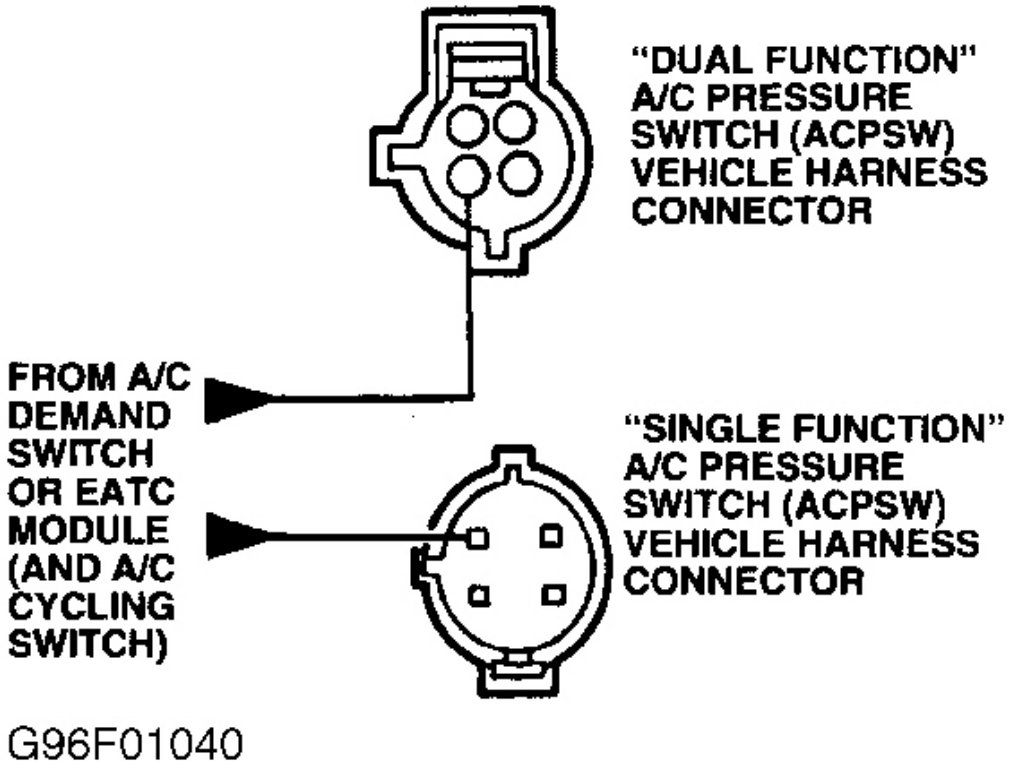

Fig. 82: ACPSW Connector Terminals

13) Check For Voltage To PCM Leave A/C switch on. Turn ignition off. Reconnect ACPSW. Disconnect PCM wiring harness connector. Inspect connector for damage or corrosion, and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 41 (ACCS) and test pin No. 77 (PWR GND) at breakout box. If voltage is one volt or more, repair open circuit between ACPSW and PCM. If voltage is more than 10.5 volts, replace PCM and verify symptom is corrected.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 13) to step 19). No test procedures have been omitted.

19) DTC P1464: Check ACCS PID Turn ignition off. Ensure A/C and defroster are off. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access ACCS PID. If ACCS PID is on, go to next step. If ACCS PID is off, verify self-test results. Leave A/C and defroster off and repeat **QUICK TEST** .

20) Turn ignition off. Disconnect ACPSW. Turn ignition on. Using scan tester, access ACCS PID. If ACCS PID is off, check for fault in A/C demand switch, EATC module or related wiring harness. See

A/C-HEATER SYSTEM article in the AIR CONDITIONING & HEAT section. If ACCS PID is on, go to step 22).

21) Check For Short To Power Turn ignition off. Disconnect WAC relay. Turn ignition on. Measure voltage between chassis ground and POWER-TO-CLUTCH terminal of WAC relay connector. If voltage is less than one volt, go to next step. If voltage is one volt or more, repair circuit short to power. Verify symptom is corrected.

22) Check ACCS Circuit For Short To Power Turn ignition off. Leave ACPSW and WAC relay disconnected. Disconnect PCM wiring harness connector. Inspect connector for damage or corrosion, and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 41 (ACCS) and test pins No. 51 and 103 (PWR GND) at breakout box. If voltage is more than one volt, repair circuit short to power. If voltage is one volt or less, proceed as follows:

- For vehicles without WAC relay, replace PCM and repeat QUICK TEST.
- For all other models, go to next step.

23) Check ACCS Circuit Voltage To PCM Turn ignition off. Reconnect WAC relay. Leave ACPSW disconnected. Turn ignition on. Measure voltage between test pin No. 41 (ACCS) and test pins No. 51 and 103 (PWR GND) at breakout box. If voltage is more than one volt, replace WAC relay and verify symptom is corrected. If voltage is one volt or less, replace PCM and verify symptom is corrected.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 23) to step 30). No test procedures have been omitted.

30) Continuous Memory DTC P1460 This DTC indicates WAC circuit failure. If vehicle is not equipped with A/C, disregard this DTC. Turn ignition off. Disconnect A/C cycling switch or low pressure switch. Connect jumper wire between switch terminals. Turn ignition and A/C switch on. Check for indication of fault while wiggling and bending WAC circuit between WAC relay and PCM. Fault will be indicated by A/C clicking on. Wiggle and bend WAC circuit between PCM (terminal No. 69) and WAC relay. Lightly tap on WAC relay. Check connectors for clean tight connection. If any faults are found, isolate and repair as necessary. If no faults are found, go to next step.

31) Turn ignition off. Connect scan tester to Data Link Connector (DLC). Leave A/C switch on. Turn ignition on. Using scan tester, access Output Test Mode. Turn all outputs off. Check for indication of fault while wiggling and bending WAC or ACON circuit between PCM (terminal No. 69) and WAC and A/C relay. Fault will be indicated by A/C clicking on. Check connectors for clean tight connection. If any faults are found, isolate and repair as necessary. If no faults are found, fault cannot be duplicated at this time. Go to **CIRCUIT TEST Z** .

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 31) to step 50). No test procedures have been omitted.

50) Check Voltage To A/C Clutch Turn ignition off. Disconnect A/C clutch. Connect scan tester to DLC. Turn ignition on. Using scan tester, access Output Test Mode. Command outputs on. Measure voltage between A/C clutch connector terminals. If voltage is 10.5 volts or less, check for fault in A/C demand switch, EATC module or related wiring harness. See the A/C-HEATER SYSTEM article in the AIR CONDITIONING & HEAT section.

51) Check Voltage To A/C Relay Turn ignition off. Disconnect A/C relay. Turn ignition on. Measure

voltage between chassis ground and B+ terminal of A/C relay connector. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, check for damaged fuse. If fuse is okay, repair open in circuit.

52) Check Circuit Resistance Turn ignition off. Leave A/C relay and A/C clutch disconnected. Measure resistance between power terminal of A/C relay and A/C clutch harness connectors. Measure resistance between ground terminal of A/C relay and A/C clutch harness connectors. If each resistance measurement is less than 5 ohms, replace A/C relay. If either resistance measurement is 5 ohms or more, repair open circuit.

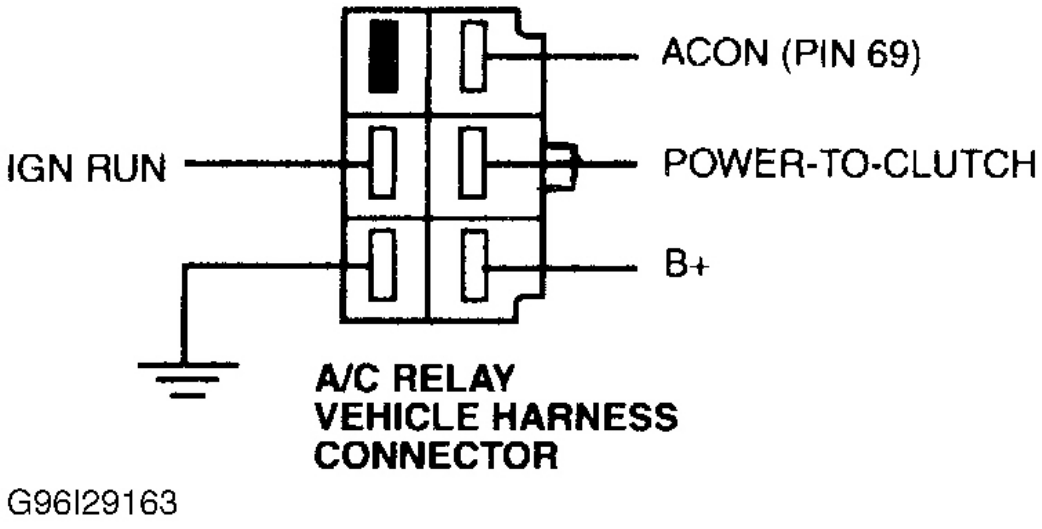

Fig. 83: A/C Relay Connector Terminals

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 52) to step 60). No test procedures have been omitted.

60) KOEO/KOER DTC P1460; Check Voltage To A/C Relay Turn ignition off. Disconnect A/C relay. Turn ignition on. Measure voltage between chassis ground and IGN RUN terminal of A/C relay connector. If voltage is 10.5 volts or more, go to next step. If voltage is less than 10.5 volts, repair open in IGN RUN circuit. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat **QUICK TEST** .

61) Check ACON Circuit For Short To Power Turn ignition off. Leave A/C relay disconnected. Disconnect PCM wiring harness connector. Inspect connector for damage or corrosion, and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between chassis ground and test pin No. 69 (ACON) at breakout box. If voltage is one volt or less, go to next step. If voltage is more than one volt, repair circuit short to power. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat **QUICK TEST** .

62) Check ACON Circuit For Short To Ground Turn ignition off. Disconnect scan tester from DLC (if

applicable). Measure resistance between chassis ground and test pin No. 69 (WAC) at breakout box. If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, repair circuit short to ground. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat **QUICK TEST** .

63) Check ACON Circuit Continuity Leave ignition off and A/C relay disconnected. Measure resistance between test pin No. 69 at breakout box and ACON terminal at A/C relay connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat **QUICK TEST** .

64) Check A/C Relay Leave ignition off. Reconnect A/C relay. Turn ignition on. While observing A/C clutch, connect and remove jumper wire between ground and breakout box test pin No. 69 (ACON). If A/C clutch does not engage and disengage when jumper wire is connected and removed, replace A/C relay.

If A/C clutch engages and disengages when jumper wire is connected and removed, remove jumper wire and breakout box. Start engine and allow to idle for 15 seconds with A/C on. Turn ignition and A/C off. Repeat **QUICK TEST** . If DTC P1460 is still present, replace PCM.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 64) to step 70). No test procedures have been omitted.

70) DTC P1464: Check ACCS PID Turn ignition off. Ensure A/C and defroster are off. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access ACCS PID. If ACCS PID is off, go to next step. If ACCS PID is on, go to step 72).

71) Check Low Pressure (LP) Switch Turn ignition off. Disconnect LP switch. Measure resistance between chassis ground and both terminals of LP switch. If each resistance measurement is 10,000 ohms or more, check for faulty A/C demand switch. See A/C-HEATER SYSTEM article in the AIR CONDITIONING & HEAT section. If switch is okay, repair circuit short to ground between LP switch and A/C demand switch. If resistance is less than 10,000 ohms, replace LP switch and verify symptom is corrected.

72) Check ACD Circuit To PCM For Short To Ground Leave ignition off and LP switch disconnected. Disconnect PCM wiring harness connector. Measure resistance between chassis ground and PCM side of LP switch. If resistance is 10,000 ohms or more, replace PCM and verify symptom is corrected. If resistance is less than 10,000 ohms, repair short to ground and verify symptom is corrected.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 72) to step 75). No test procedures have been omitted.

75) Check Power To A/C Clutch Circuit For Short To Power Ensure that A/C relay and A/C clutch are disconnected. Turn ignition on. Measure voltage between negative battery terminal and power side of A/C clutch harness connector. If voltage is one volt or less, go to next step. If voltage is more than one volt, repair circuit short to power and verify symptom is corrected.

76) Check A/C Relay Turn ignition off. Measure resistance between POWER-TO-CLUTCH terminal and IGN RUN terminal at A/C relay. Measure resistance between POWER-TO-CLUTCH terminal and B+ terminal at A/C relay. If either resistance measurement is less than 10,000 ohms, replace A/C relay and verify symptom is corrected. If both resistance measurements are more than 10,000 ohms, no faults

are present. Testing is complete.

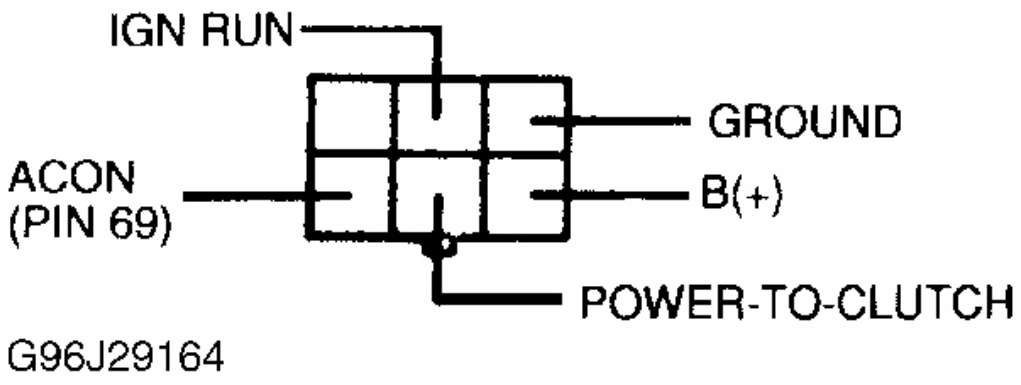

Fig. 84: A/C Relay Terminals

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 76) to step 80). No test procedures have been omitted.

80) Check WOT A/C Cutoff Relay Turn ignition off. Disconnect WOT A/C cutoff relay. Measure resistance between relay terminals No. 3 and 4. If resistance is 5 ohms or more, replace WOT A/C cutoff relay. If resistance is less than 5 ohms, go to next step.

81) Check Voltage To A/C Clutch Relay Turn ignition off. Disconnect A/C clutch relay. Turn ignition on. Measure voltage between negative battery terminal and IGN RUN terminal of relay. If voltage is less than 10.5 volts, check fuse. If fuse is okay, repair open or short in IGN RUN circuit. If voltage is 10.5 volts or more, go to next step.

82) Check Ground To A/C Clutch Relay Turn ignition off. Measure resistance between negative battery terminal and GROUND terminal of relay. If resistance is more than 5 ohms, repair open in ground circuit. If resistance is 5 ohms or less, go to next step.

83) Check A/C Demand Circuit Turn ignition off. Measure resistance of A/C demand circuit between A/C clutch relay connector and WOTA/C cutoff relay connector. If resistance is more than 5 ohms, repair open in circuit. If resistance is 5 ohms or less, go to next step.

84) Check A/C Clutch Circuit Turn ignition off. Disconnect A/C clutch harness connector Measure resistance of A/C demand circuit between A/C clutch relay connector and WOT A/C cutoff relay connector. If resistance is more than 5 ohms, repair open in circuit. If resistance is 5 ohms or less, replace A/C clutch relay.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 84) to step 90). No test procedures have been omitted.

90) Check ACCS PID Turn ignition off. Disconnect A/C clutch relay and A/C Pressure Switch (ACPSW). Turn ignition on. Using scan tester, access ACCS PID. If ACCS PID is off, replace A/C clutch relay and verify symptom is corrected. If ACCS PID is on, go to next step.

91) Check A/C Demand Circuit With ignition on, measure voltage between negative battery terminal and A/C demand circuit at WOT A/C cutoff relay harness connector. If voltage is more than 1.0 volt, repair circuit short to power. If resistance is 5 ohms or less, replace A/C clutch relay.

92) Turn ignition off. Disconnect WOT A/C cutoff relay. Using scan tester, access ACCS PID. If ACCS PID is off, replace WOT A/C cutoff relay and verify symptom is corrected. If ACCS PID is on, go to next step.

93) Check ACCS Circuit To PCM For Short To Power Turn ignition off. Leave ACPSW, A/C relay and WAC relay disconnected. Disconnect PCM wiring harness connector. Inspect connector for damage or corrosion, and repair as necessary. Install EEC-V Breakout Box (014-000950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 41 (ACCS) and test pins No. 51 and 103 (PWR GND) at breakout box. If voltage is more than 1.0 volt, repair circuit short to power and verify symptom is corrected. If voltage is 1.0 volt or less, replace PCM and verify symptom is corrected.

CIRCUIT TEST MB - OUTPUT TEST MODE NOT FUNCTIONING

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Connection between scan tester and PCM.
- Connection between scan tester and battery power supply.
- Correct key sequence executed for outputs.

1) Check Scan Tester Installation Turn ignition off. Check connection between scan tester and Data Link Connector (DLC) for damage or contamination. Service or adjust as necessary. If connector is okay, go to next step.

2) Check connector and wiring harness cable between scan tester and battery power supply for correct installation, damage or poor connection. Repair as necessary. Ensure correct key sequence for outputs is executed. See scan tester manufacturer instructions.

CIRCUIT TEST NB - MALFUNCTION INDICATOR LIGHT (MIL)

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Wiring harness circuit (MIL).
- Faulty Powertrain Control Module (PCM).

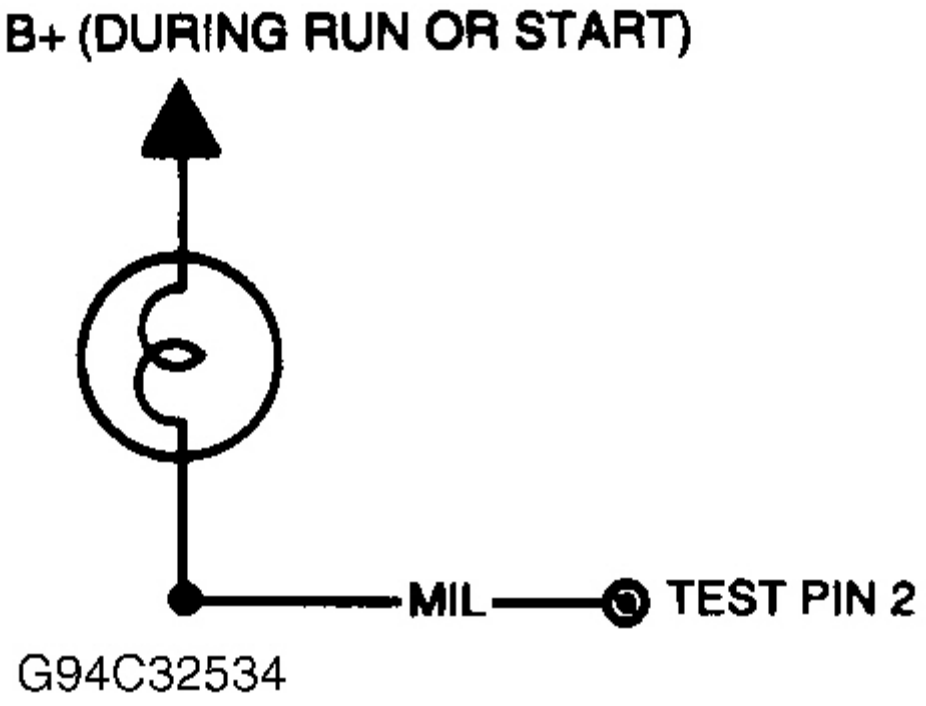

Fig. 85: MIL Circuit Schematic

1) MIL Always On Perform KOEO SELF-TEST. If any trouble codes are present, service as necessary before continuing. If no trouble codes are present, turn ignition off. Disconnect PCM 104-pin connector. Inspect pins for damage. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure and record resistance between test pins No. 2 and No. 51 and 103 (PWR GND). If resistance is less than 5 ohms, repair short circuit between test pin No. 2 and MIL. If resistance is 5 ohms or more, replace PCM.

2) MIL Does Not Come On Turn ignition on. Measure voltage between ground side of MIL fuse and negative battery terminal. If voltage is 10.5 volts or less, go to next step. If voltage is more than 10.5 volts, go to step 4).

3) Check For B+ At Fuse Leave ignition on. Measure voltage between positive side of MIL fuse and negative battery terminal. If voltage is 10.5 volts or less, repair open in MIL or B+ circuit. If voltage is more than 10.5 volts, replace MIL fuse.

4) Check For B+ At MIL Bulb Leave ignition on. Measure voltage between instrument cluster connector terminal B+ and negative battery terminal. If voltage is 10.5 volts or less, repair open in fuse, MIL bulb or B+ circuit. If voltage is more than 10.5 volts, go to next step.

5) Check Continuity Of MIL Circuit Turn ignition off. Measure resistance between instrument cluster connector MIL terminal and test pin No. 2 of breakout box. If resistance is less than 5 ohms, replace PCM. If MIL is still on, fault is in instrument cluster. If resistance is 5 ohms or more, repair open in MIL

circuit.

CIRCUIT TEST NC - IGNITION DIAGNOSTIC MONITOR (IDM)

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Faulty Powertrain Control Module (PCM).

Continuous Memory DTC P0320

This code indicates that (2) successive erratic Profile Ignition Pulses (PIP) have occurred. Possible causes are as follows:

- Loose wires and/or connectors.
- Short circuit to ground in ignition secondary system.
- Incorrect 2-way radio installation.

If any of the specified causes were present, repair or replace as necessary. If vehicle will not start, go to **CIRCUIT TEST A** . If fault is intermittent, go to step 50) of **CIRCUIT TEST Z** . If vehicle will start and none of the specified causes were present, replace PCM and repeat **QUICK TEST** .

CIRCUIT TEST ND - ENGINE RPM/VEHICLE SPEED LIMITER

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures.

DTC P1270

This DTC indicates that engine or vehicle speed has exceeded calibrated limit. Possible causes are as follows:

- Wheel slippage caused by mud, ice, water, snow, etc.
- Over revved engine.
- Vehicle driven at excessive rate of speed.

If any of the specified causes have occurred, system is okay. Clear PCM memory. If none of specified causes have occurred, clear PCM memory. If no other faults are present, testing is complete.

CIRCUIT TEST QA - UNABLE TO ACTIVATE SELF-TEST/SCP COMMUNICATION ERROR CODE NOT LISTED

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Standard Corporate Protocol (SCP) communication circuits BUS (+) and BUS (-).
- Wiring harness circuits (CHASSIS GROUND, PWR GND and VBAT).
- Faulty Powertrain Control Module (PCM).

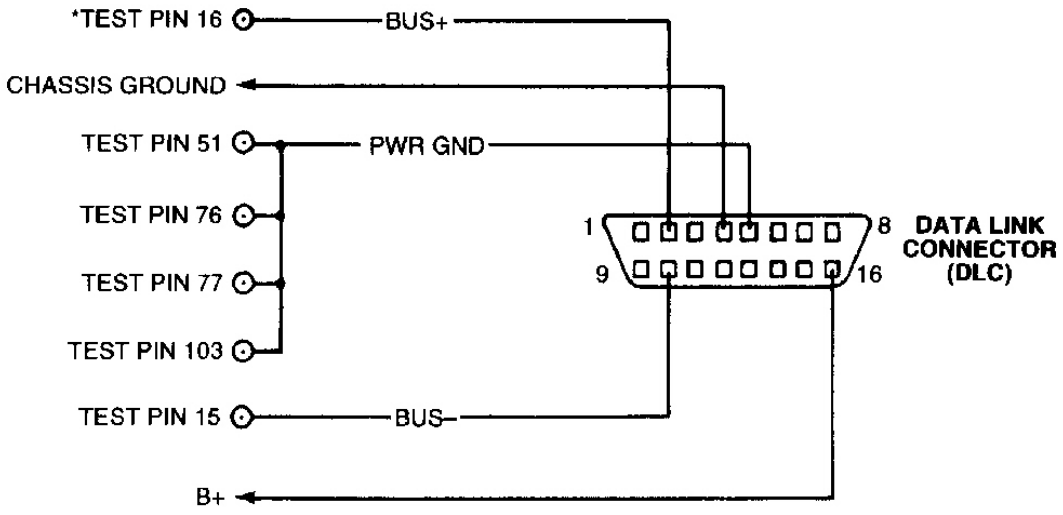

Fig. 86: Data Link Connector (DLC) Test Circuit & Connector Terminals

1) Verify Self-Test Procedure Is Correct Ensure scan tester is correctly attached to DLC located under dash panel. Ensure scan tester is not damaged or defective. Verify correct self-test procedure is used. Correct as necessary. If no faults are found, go to next step.

2) Check For VREF At TP Sensor Turn ignition off. Disconnect TP sensor. Turn ignition on. Measure voltage between SIG RTN terminal and VREF terminal at TP wiring harness connector. See **Fig. 87** . If voltage is 4-6 volts, go to next step. If voltage is not 4-6 volts, go to **CIRCUIT TEST C** .

NOTE: KOER self-test failure or Communication Error message could result if a failure is present in MAF sensor, MLP sensor, VSS or related circuits.

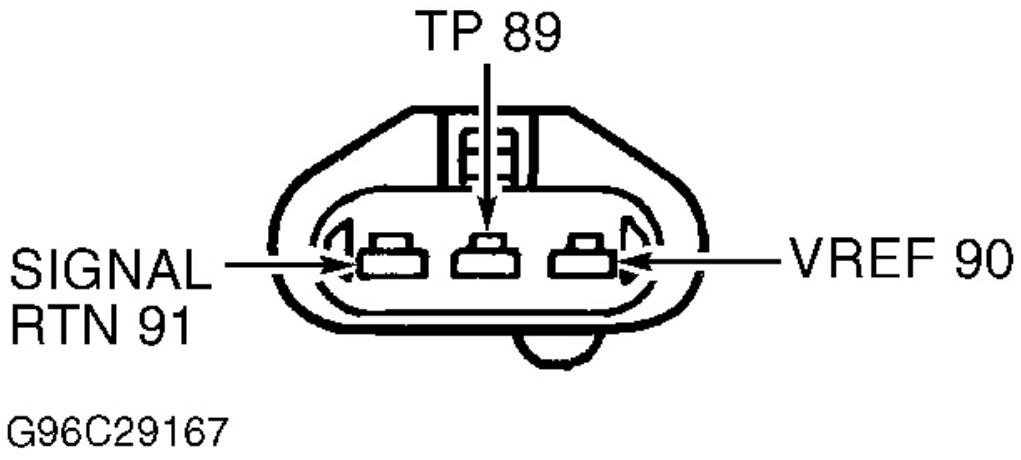

Fig. 87: TP Sensor Harness Connector Terminals

3) Ability To Access Continuous Memory DTCs If Continuous Memory DTCs were accessible, go to next step. If Continuous Memory DTCs were not accessible, go to step 7).

4) Ability To Activate KOEO SELF-TEST If KOEO SELF-TEST was entered, go to next step. If KOEO SELF-TEST was not entered, go to step 6).

5) Ability To Activate KOER Self-Test If KOER self-test was entered, DTC is false. Obtain PCM part number and check manufacturer for correct PCM application. If KOER self-test was not entered, go to next step for alternative fuel models or step 7) for all other models.

6) If self-test was performed using gasoline, go to next step. If self-test was performed on alternative fuel, repeat **QUICK TEST** using gasoline. If still unable to retrieve trouble codes, go to next step.

7) Perform **QUICK TEST** . If any DTCs are present, service as necessary before continuing. If unable to retrieve trouble codes, go to next step.

8) Check For Voltage At Data Link Connector (DLC) Inspect DLC for damage and repair as necessary. Turn ignition on. Measure voltage between B+ terminal of DLC and engine ground. If 10.5 volts or more are present, go to next step. If less than 10.5 volts are present, repair open in B+ circuit and repeat **QUICK TEST** .

9) Check DLC Ground Circuit Continuity Turn ignition off. Measure resistance between CHASSIS GROUND terminal of DLC and engine ground. If less than 5 ohms are present, go to next step. If 5 ohms or more are present, repair open in CHASSIS GROUND circuit and repeat **QUICK TEST** .

10) Check DLC PWR GND Circuit Continuity Turn ignition off. Disconnect PCM 104-pin connector. Inspect pins for damage and repair if necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pins No. 51 and 103 (PWR GND) at the breakout box and PWR GND terminal of DLC. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in PWR GND circuit to DLC and repeat **QUICK TEST** .

11) Check BUS(-) Circuit Leave ignition off. Measure resistance between test pin No. 15 (BUS-) at the

breakout box and BUS(-) terminal of DLC. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in BUS(-) circuit to DLC and repeat **QUICK TEST** .

12) Leave ignition off. Disconnect scan tester from DLC (if applicable). Measure resistance between test pin No. 15 at the breakout box and engine ground. If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, repair short to ground in BUS(-) circuit and repeat **QUICK TEST** .

13) Turn ignition on. Measure voltage between test pin No. 15 and test pins No. 51 and 103 (PWR GND) at the breakout box and engine ground. If voltage is less than 6.0 volts, go to next step. If voltage is 6.0 volts or more, repair short to power in BUS(-) circuit and repeat **QUICK TEST** .

14) Check BUS(+) Circuit Continuity Turn ignition off. Measure resistance between test pin No. 16 (BUS+) at the breakout box and BUS(+) terminal of DLC. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in BUS(+) circuit to DLC and repeat **QUICK TEST** .

15) Check BUS(+) Circuit For Short To Ground Leave ignition off and scan tester disconnected from DLC. Measure resistance between chassis ground and test pin No. 16 (BUS+) at the breakout box. If resistance is more than 10,000 ohms, go to next step. If resistance is 10,000 ohms or less, repair BUS(+) circuit short to ground and repeat **QUICK TEST** .

16) Check BUS(+) Circuit For Short To Power Turn ignition on. Measure voltage between test pin No. 16 and test pins No. 51 and 103 (PWR GND) at the breakout box. If voltage is less than 1.0 volt, go to next step. If voltage is 1.0 volt or more, repair short to power in BUS(+) circuit and repeat **QUICK TEST** .

17) Power Take Off (PTO) Applications If vehicle is equipped with PTO, go to next step. If vehicle is not equipped with PTO, replace PCM and repeat **QUICK TEST** .

18) Check PTO On/Off Input Turn ignition off. While toggling switch, measure voltage between test pin No. 4 (PTO) and test pins No. 51 and 103 (PWR GND) at the breakout box. If voltage is less than 1.0 volt with PTO off, and 1.0 volt or more with PTO on, PTO circuit is okay. Replace PCM and repeat **QUICK TEST** . If voltage is not as specified, go to **CIRCUIT TEST FB** .

CIRCUIT TEST QB - DIAGNOSTIC TROUBLE CODE P0603

Diagnostic Aids

KAPWR is interrupted when PCM or battery is disconnected. DTC P0603 may be generated during the next PCM power-up.

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Battery terminal condition.
- Keep Alive Power (KAPWR) circuit routing.
- KAPWR circuit condition.
- Faulty Powertrain Control Module (PCM).

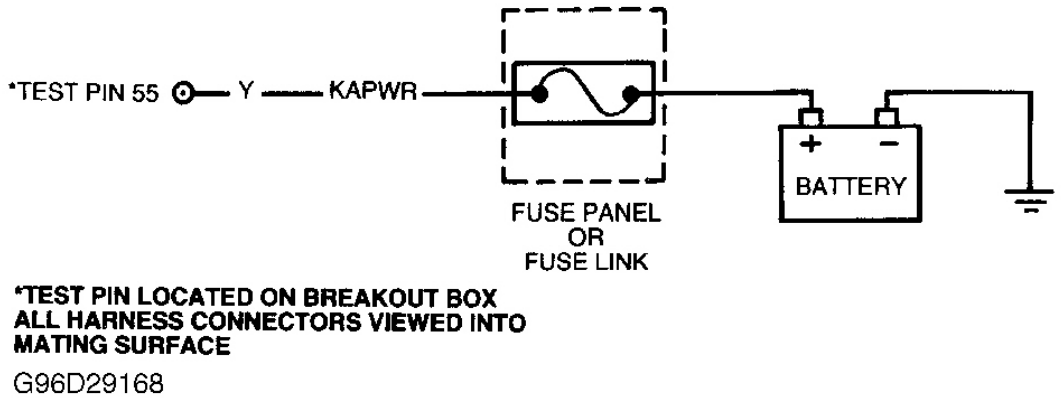

Fig. 88: Keep Alive Power (KAPWR) Circuit Schematic

1) DTC P0603: Check Battery Terminals Inspect battery terminals for corrosion or loose connection. Service or replace as necessary. If battery terminals are okay, go to next step.

2) Check Wiring Harness Inspect wiring harness and connectors for damage or corrosion. Ensure wiring harness is not improperly routed too close to ignition or exhaust components. Service or replace if necessary. If wiring harness looks okay, go to next step.

3) Check KAPWR Circuit Turn ignition off. Disconnect PCM 104-pin connector. Inspect pins for damage. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Connect DVOM between test pin No. 55 (KAPWR) and test pins No. 51 and 103 (PWR GND) at breakout box. Shake and bend small sections of wiring harness between PCM and dash panel. If voltage is continuously 10.5 volts or more, go to next step. If voltage drops to less than 10.5 volts, isolate open in KAPWR circuit and repair as necessary. Repeat **QUICK TEST** .

4) Check For DTC P0603 Perform KOEO SELF-TEST. If DTC P0603 is present, replace PCM and repeat **QUICK TEST** . If any other DTCs are present, service as necessary. If no trouble codes are present, testing is complete.

CIRCUIT TEST QC - DIAGNOSTIC TROUBLE CODE P1000

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This code indicates that On Board Diagnostics II (OBD II) system self-testing has not been completed. To erase DTC P1000, a complete drive cycle, with successful OBD II system self-test, must occur.

A drive cycle consists of vehicle warmed to normal engine temperature and operated in all speed ranges. After self-test successfully completes, SYSTEM PASS can be obtained from PCM.

DTC P1000 will set in PCM memory when any of the following conditions occur:

- Battery or PCM has been disconnected.

- An OBD II monitor has failed before completion of drive cycle.
- PCM memory has been erased with a scan tester.

1) Check For Other DTCs If any trouble codes are present, service as necessary. If no trouble codes are present, and vehicle is equipped with PTO, go to next step. If no trouble codes are present, and vehicle is not equipped with PTO, go to step 3).

2) Check PTO PID Turn ignition off. Connect scan tester to Data Link Connector (DLC). Start engine and allow to idle. Using scan tester, access PTO STAT PID. Cycle PTO switch/activator on and off. If PTO STAT PID does not cycle on and off, go to **CIRCUIT TEST FB** . If PTO STAT PID cycles on, pauses, and then cycles off, PTO is okay. Go to next step.

3) Attempt To Remove DTC P1000 Test drive vehicle to complete drive cycle. Cruise at 20-45 MPH for at least 4 minutes. Cruise at 30-40 MPH for at least 60 seconds. Cruise at 40-65 MPH for at least 80 seconds. If DTC P1000 is still present, go to next step. If DTC P1000 is not present, testing is complete.

4) Check VSS PID Turn ignition off. Connect scan tester to Data Link Connector (DLC). Using scan tester, access VSS PID. Test drive vehicle to complete drive cycle. If VSS PID is more than zero, go to next step. If VSS PID is zero, repair open in VSS circuit and repeat **QUICK TEST** .

5) Check ECT Temperature Ensure engine is at operating temperature. Using scan tester, access ECT PID. If ECT PID is more than 180°F (82°C), repeat step 3). If ECT PID is less than 180°F (82°C), repair cooling system fault and repeat **QUICK TEST** .

CIRCUIT TEST QD - DIAGNOSTIC TROUBLE CODE P1260

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This code indicates that anti-theft system has been activated. When activated, anti-theft system will disable fuel system. To disarm anti-theft system, use key or remote keyless entry to unlock door.

1) Check For Other DTCs If any other DTCs are present, service as necessary. If no DTCs other than P1260 are present, go to next step.

2) Use key or remote keyless entry to disarm anti-theft system. Clear PCM memory. Start engine. If engine starts, testing is complete. If engine does not start, go to next step.

3) Perform **QUICK TEST** . If DTC P1260 is still present, fault is in anti-theft system.

CIRCUIT TEST TA - PARK & NEUTRAL POSITION (PNP) SWITCH/CLUTCHPEDAL POSITION (CPP) SWITCH

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Wiring harness circuits (CPP, PNP and SIG RTN).
- Faulty Clutch Pedal Position (CPP) switch.

- Faulty Park & Neutral Position (PNP) switch.
- Faulty Powertrain Control Module (PCM).

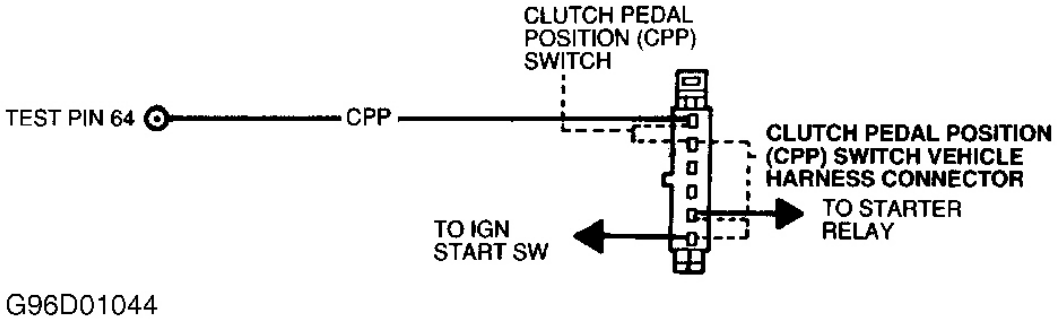

Fig. 89: CPP Switch Test Circuit & Connector Terminals

1) DTC P0704 & P1709: Check CPP/PNP Switch Function These DTCs indicate CPP/PNP switch malfunction. Possible causes are as follows:

- Starter relay disconnected during KOER self-test.
- CPP/PNP switch circuit damage.
- Faulty CPP/PNP switch.
- Faulty Powertrain Control Module (PCM).

Turn ignition off. Connect scan tester to Data Link Connector (DLC). Ensure shift lever is in Neutral. Turn ignition on. Using scan tester, access CPP/PNP PID. While observing CPP/PNP PID, apply and release clutch pedal. If CPP/PNP PID does not cycle on and off, go to next step. If CPP/PNP PID cycles on and off, check PCM connector. If connector is okay, replace PCM.

2) Check CPP/PNP Switch Turn ignition off. Locate CPP switch near clutch pedal or PNP switch near transmission shift linkage. Inspect switch and bracket for damage and repair if necessary. Disconnect CPP/PNP switch wiring harness connector. Inspect terminals for damage and repair if necessary. Measure resistance between switch terminals. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, replace CPP/PNP switch and repeat **QUICK TEST** .

3) Check CPP Circuit Turn ignition off. Disconnect scan tester. Disconnect PCM 104-pin connector. Inspect pins for damage. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 64 (CPP) at breakout box and CPP terminal at CPP switch wiring harness connector. Measure resistance between test pin No. 91 (SIG RTN) at breakout box and SIG RTN terminal at CPP/PNP switch wiring harness connector. If both resistance measurements are less than 5 ohms, go to next step. If either resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

4) Leave ignition off and CPP switch disconnected. Measure resistance between chassis ground and test pins No. 64 and 91 (SIG RTN) at breakout box. If resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10,000 ohms or more, repair short circuit and repeat QUICK

TEST.

5) DTC P0704 & P1709: Check CPP/PNP Switch Function These DTCs indicate CPP/PNP switch malfunction. Possible causes are as follows:

- Starter relay disconnected during KOER self-test.
- CPP/PNP switch circuit damage.
- Faulty CPP/PNP switch.
- Faulty Powertrain Control Module (PCM).

Turn ignition off. Ensure shift lever is in Neutral. Connect scan tester to Data Link Connector (DLC). Turn ignition on. Using scan tester, access CPP/PNP PID. While observing CPP/PNP PID, apply and release clutch pedal; place shift lever in gear then return to Neutral. If CPP/PNP PID does not cycle on and off, go to next step. If CPP/PNP PID cycles on and off, check PCM connector. If connector is okay, replace PCM.

6) Check CPP/PNP Switch Turn ignition off. Locate CPP switch near clutch pedal or PNP switch near transmission shift linkage. Inspect switch and brackets for damage and repair if necessary. Disconnect CPP/PNP switch wiring harness connector. Inspect terminals for damage and repair if necessary. Measure resistance between CPP switch terminals with clutch pedal down. Measure resistance between PNP switch terminals with shift lever in Neutral. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, replace CPP/PNP switch and repeat **QUICK TEST** .

7) Check CPP/PNP Circuit Turn ignition off. Disconnect scan tester. Disconnect PCM 104-pin connector. Inspect pins for damage. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Measure resistance between test pin No. 64 (CPP) at breakout box and CPP/PNP terminal at CPP/PNP switch wiring harness connector. Measure resistance between test pin No. 91 (SIG RTN) at breakout box and SIG RTN terminal at CPP/PNP switch wiring harness connector. If both resistance measurements are less than 5 ohms, go to next step. If either resistance is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

8) Leave ignition off and CPP/PNP switch disconnected. Measure resistance between chassis ground and test pins No. 64 and 91 (SIG RTN) at breakout box. If resistance is more than 10,000 ohms, replace PCM and repeat **QUICK TEST** . If resistance is 10,000 ohms or more, repair short circuit and repeat QUICK TEST.

CIRCUIT TEST TB - TRANSMISSION CONTROL SWITCH (TCS)/TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Wiring harness circuits (TCIL and TCS).
- Faulty Powertrain Control Module (PCM).

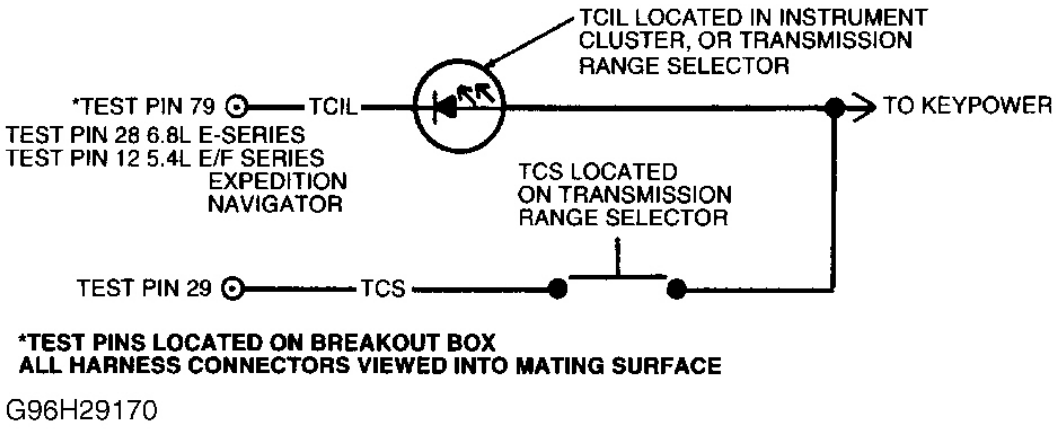

Fig. 90: TCIL & TCS Circuit Schematic

1) DTC P1780 Turn ignition off. Connect scan tester to Data Link Connector (DLC). Start engine and allow to idle. Using scan tester, access TCS PID. Cycle TCS switch, then hold depressed. If TCS PID is on, go to next step. If TCS PID is off, repeat KOER self-test to cycle TCS.

2) Check TCS Circuit Voltage Turn ignition off. Disconnect PCM 104-pin connector. Inspect pins for damage. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Turn ignition on. Measure voltage between test pin No. 29 (TCS) and test pins No. 24 and 77 (PWR GND) at breakout box while cycling TCS. If voltmeter reading does not cycle when TCS is cycled, go to next step. If voltmeter reading cycles when TCS is cycled, replace PCM and repeat **QUICK TEST** .

3) Check Circuit For Short To Ground Turn ignition off. Disconnect TCS. Inspect pins for damage and repair if necessary. Measure resistance between breakout box test pin No. 29 (TCS) and test pins No. 24 and 77 (PWR GND). If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, repair short circuit and repeat **QUICK TEST** .

4) Check Continuity Of TCS Circuits Leave ignition off. Connect ohmmeter positive lead to TCS key power at the fuse panel. Connect negative lead to power terminal of TCS wiring harness connector. Note resistance measurement. Measure resistance between breakout box test pin No. 29 (TCS) and TCS terminal of TCS connector. If both resistance measurements are less than 5 ohms, go to next step. If either resistance measurement is 5 ohms or more, repair open circuit and repeat **QUICK TEST** .

5) Check Circuit For Short To Power Leave ignition off. Measure resistance between breakout box test pin No. 29 (TCS) and test pins No. 71 and 97 (VPWR). If resistance is 10,000 ohms or more, replace TCS switch and repeat **QUICK TEST** . If resistance is less than 10,000 ohms, repair short circuit and repeat QUICK TEST.

6) Check TCIL PID Turn ignition off. With scan tester connected to Data Link Connector (DLC), access TCIL PID. Cycle TCS switch. If TCIL PID changes from ON to OFF, fault is intermittent. Go to **CIRCUIT TEST Z** . If TCIL PID does not change as specified, go to next step.

7) Check For Short to Ground In TCIL Circuit Turn ignition off. Disconnect PCM 104-pin connector. Inspect pins for damage and repair if necessary. Turn ignition on. If TCIL goes off, replace PCM. If TCIL remains on, repair TCIL circuit short to ground.

8) Check For DTC P1780 Perform KOER self-test. If DTC P1780 is not present, go to next step. If DTC P1780 is present, go to step 1).

9) Turn ignition on. Measure voltage between TCIL test pin and test pins No. 24 and 76 (PWR GND) at breakout box. If voltage is 2 volts or more, replace PCM. If voltage is less than 2 volts, check indicator bulb and fuse. If bulb and fuse are okay, repair open circuit between test pin No. 79 and ignition switch.

CIRCUIT TEST TG - 4X4 LOW (4X4L) RANGE

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. This test is used to diagnose the following:

- Generic electronic module wiring harness circuits.
- Powertrain Control Module (PCM).

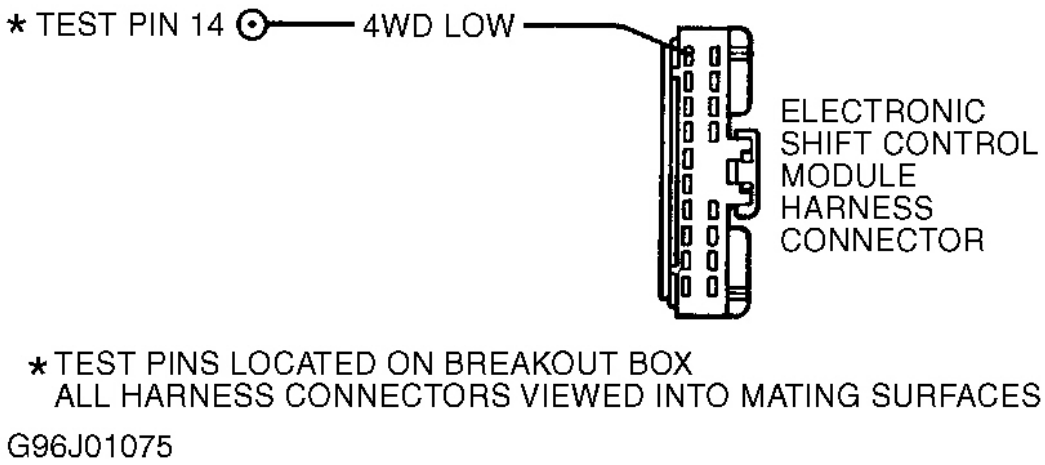

Fig. 91: Electronic Shift Control Module Test Circuit (Electronic Shift)

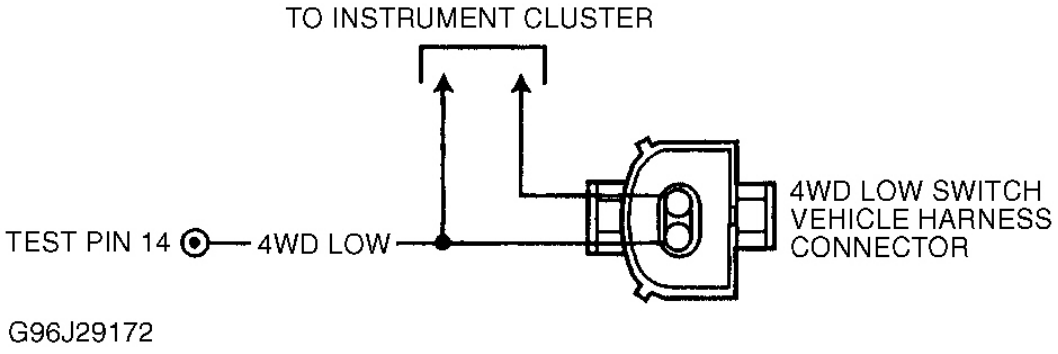

Fig. 92: 4x4 Low Switch Test Circuit & Connector Terminals (Mechanical Shift)

1) DTC P1729 & P1781 DTC P1729 indicates 4x4 switch open or short circuit. DTC P1781 indicates 4x4L switch position closed during QUICK TEST. If switch position was not 4x2 or 4x4H during KOEO QUICK TEST, select 4x2 or 4x4H and repeat QUICK TEST. If switch position was as specified, go to next step.

2) Check Intermittent Circuit Failure Turn ignition off. Connect scan tester to DLC. Using scan tester, access 4x4L PID. Turn ignition on. Cycle switch to 4x2. Shake and bend sections of wiring harness between generic electronic module and transfer case wiring harness connector. Shake and bend sections of wiring harness between generic electronic module PCM. Tap wiring harness connector to simulate road shock. If scan tester voltage fluctuates, isolate fault and repair as necessary. If scan tester voltage does not fluctuate, go to next step.

3) Check Signal From PCM Turn ignition off. Disconnect PCM 104-pin connector. Inspect pins for damage and repair if necessary. Install EEC-V Breakout Box (014-00950), leaving PCM disconnected. Turn ignition on. While cycling switch, measure voltage between breakout box test pin No. 14 and No. 24 (PWR GND). If voltage cycles, replace PCM and repeat **QUICK TEST** . If voltage does not cycle, go to next step.

4) Check Circuit Continuity Turn ignition off. Disconnect electronic shift control module. Inspect pins for damage and repair if necessary. Measure resistance between breakout box test pin No. 14 and 4X4L terminal at module wiring harness connector. If resistance is 5 ohms or less, go to next step. If resistance is more than 5 ohms, repair open circuit and repeat **QUICK TEST** .

5) Check For Short To Power Or Ground Leave ignition off. Reconnect electronic shift control module. Measure resistance between breakout box test pin No. 14 and No. 24. Measure resistance between breakout box test pin No. 14 and test pins No. 71 and 97 (VPWR). If any resistance measurement is more than 10,000 ohms, repair transfer case mechanical fault. If any resistance measurement is 10,000 ohms or less, repair short circuit and repeat **QUICK TEST** .

CIRCUIT TEST Z - INTERMITTENT

Diagnostic Aids

Perform this test when instructed during QUICK TEST or if directed by other test procedures. Before

continuing with this circuit test, ensure that the following areas are in good condition:

- Air induction system.
- Vacuum hoses and connections.
- Wiring harness connectors.
- Fuel level and quality.
- Added aftermarket equipment.
- Base engine.

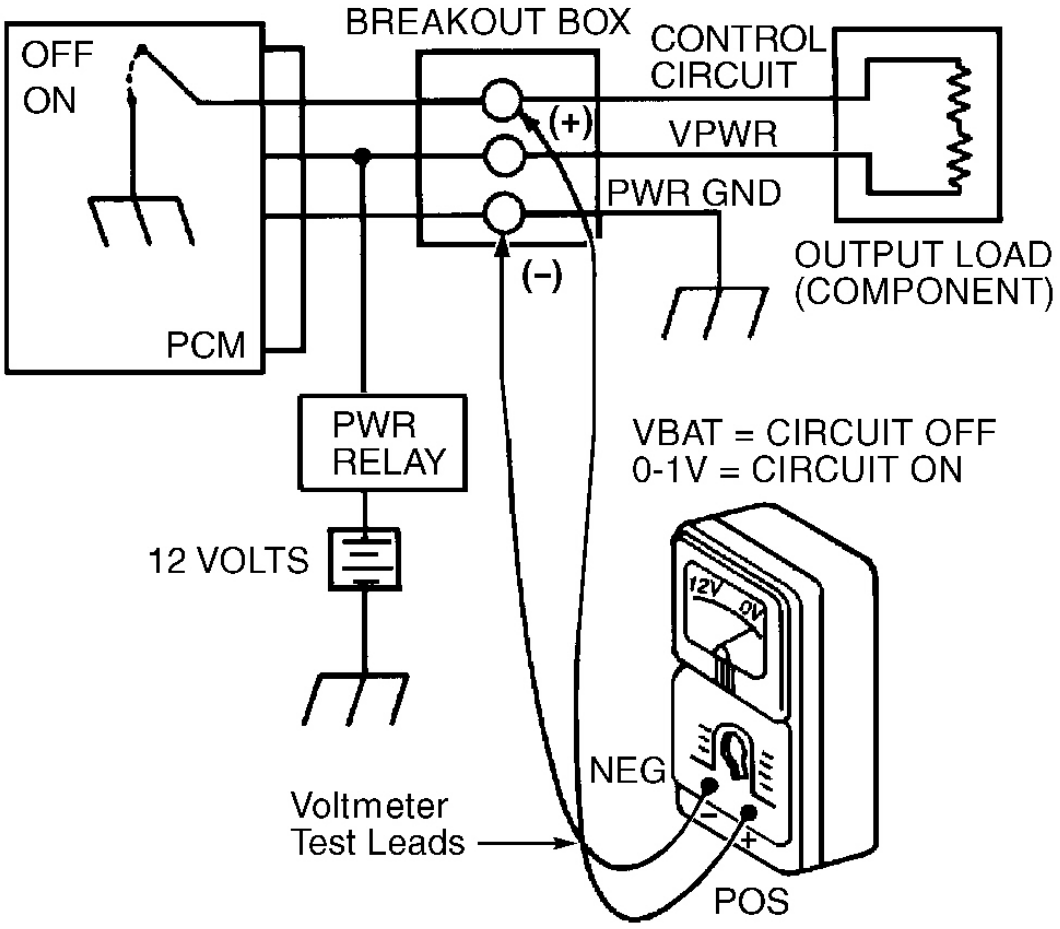

Fig. 93: Testing Typical PCM Output Control Circuit

1) Intermittent Test Procedure Proceed to the appropriate circuit test as follows:

INPUT CIRCUIT TEST PRIORITY

Circuit	(1) Step 10)	(2) Step 30)	(3) Step 40)
ACCS	1st	3rd	2nd
BOO	1st	3rd	2nd
CMP (4)	1st	2nd	3rd
DPFEGR	1st	2nd	3rd
ECT	1st	2nd	3rd
FP	1st	3rd	2nd
IAT	1st	2nd	3rd
IMRCM	1st	2nd	3rd
MAF	1st	2nd	3rd
OCTADJ	1st	3rd	2nd
O2S	1st	3rd	2nd
PF	1st	2nd	3rd
PSP	1st	3rd	2nd
TCS	1st	N/A	2nd
TFT	1st	3rd	2nd
TP	1st	3rd	2nd
TPB	1st	3rd	2nd
TR	1st	3rd	2nd
VSS	1st	3rd	2nd

(1) Input test (sensor) procedure.

(2) Water soak check procedure.

(3) Road test procedure.

(4) Go to step 50) before performing WATER SOAK TEST.

OUTPUT CIRCUIT TEST PRIORITY

Circuit	(1) Step 20)	(2) Step 30)	(3) Step 40)
ACP	1st	3rd	2nd
AIR	1st	3rd	2nd
EVAPCVA	1st	3rd	2nd
EVAPCP	1st	3rd	2nd
EPC	1st	3rd	2nd
EVRVR	1st	3rd	2nd
FPM	1st	3rd	2nd
HFC	1st	3rd	2nd
HTR11A	1st	3rd	2nd
HTR12A	1st	3rd	2nd
HTR21A	1st	3rd	2nd

HTR22A	1st	3rd	2nd
IAC	1st	3rd	2nd
IMRC	1st	3rd	2nd
INJ	1st	3rd	2nd
LFC	1st	3rd	2nd
MIL	1st	N/A	2nd
SS1	1st	3rd	2nd
SS2	1st	3rd	2nd
SS3	1st	3rd	2nd
TCTC (4)	1st	3rd	2nd
TCC	1st	3rd	2nd
TCIL	1st	N/A	2nd
WAC	1st	3rd	2nd
4X4L	1st	3rd	2nd

(1) Output test (actuator) procedure.

(2) Water soak check procedure.

(3) Road test procedure.

(4) Go to step 50) before performing WATER SOAK TEST.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 1) to step 10). No test procedures have been omitted.

10) Intermittent Input Test (Sensor) Procedure Turn ignition off. Connect scan tester to DLC. Access PIDs from the area of suspected wiring or component fault. Turn ignition on. While observing PID value, wiggle and pull on component wiring and connector. See PIN VOLTAGE/PID VALUE CHARTS article. Lightly tap on component. If PID value(s) is okay, go to next step. If sudden change occurs in PID value or PID value drops out of sensor range, isolate fault and repair as necessary. If fault cannot be located, replace suspect component. If replacement component does not repair fault, install original component and go to next step.

11) Leave ignition on with PIDs accessed. While observing PID value, wiggle and pull on wiring harness between suspect component and PCM. Lightly tap on component. If PID value(s) remain within specification, go to next step. If sudden change occurs in PID value or PID value drops out of sensor range, isolate fault and repair as necessary. If fault cannot be located, replace PCM. If replacement PCM does not repair fault, install original PCM. Return to step 1) and choose another procedure.

12) Intermittent Input KOER Wiggle Test Leave ignition on with PIDs accessed. Access PIDs from the area of suspected wiring or component fault. Start engine and allow to idle. While observing PID value, wiggle and pull on component wiring and connector. See PIN VOLTAGE/PID VALUE CHARTS article. Lightly tap on component. If PID value(s) is okay, go to next step. If sudden change occurs in PID value or PID value drops out of sensor range, isolate fault and repair as necessary. If fault cannot be located, replace suspect component. If replacement component does not repair fault, install original component and go to next step.

13) Leave engine running at idle speed with PIDs accessed. While observing PID value, wiggle and pull on wiring harness between suspect component and PCM. Lightly tap on component. If PID value(s) remain within specification, fault cannot be identified with this procedure. Return to step 1) and choose another procedure. If sudden change occurs in PID value or PID value drops out of sensor range, isolate fault and repair as necessary. If fault cannot be located, replace PCM. If replacement PCM does not repair fault, install original PCM. Return to step 1) and choose another procedure.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 13) to step 20). No test procedures have been omitted.

20) Intermittent Output Test (Actuator) Procedure If no symptoms or trouble codes are present, perform road test procedure specified insteps 40) through 43). Turn ignition off. Connect scan tester to DLC. Access PIDs from the area of suspected wiring or component fault. Record trouble codes in PCM memory, if present. Disconnect 104-pin connector from PCM. Install Breakout Box (014-000959). Connect PCM to breakout box. Connect positive lead of voltmeter to output control circuit of suspect component. See **Fig. 93** . Connect negative lead to ground. Turn ignition on. Using scan tester, enter Output Test Mode. Activate suspect component. While observing voltmeter reading and PID value, lightly tap on component. Compare readings to specification. See PIN VOLTAGE/PID VALUE CHARTS article. If readings are correct and remain stable within one volt, go to next step. If readings are incorrect or unstable within one volt, replace component. If replacement component does not repair fault, install original component and go to next step.

21) Leave ignition on with PIDs accessed. While observing voltmeter reading and PID value, wiggle and pull on wiring harness between suspect component and PCM. Lightly tap on component. Compare readings to specification. See PIN VOLTAGE/PID VALUE CHARTS article. If readings are correct and remain stable within one volt, fault cannot be identified with this procedure. Return to step 1) and choose another procedure. If readings are incorrect or unstable within one volt, isolate fault and repair as necessary.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 21) to step 30). No test procedures have been omitted.

30) Intermittent Water Soak Check Procedure Turn ignition off. Connect scan tester to DLC. Access PIDs from the area of suspected wiring or component fault. Start engine and allow to idle. Spray water on suspect component, circuit and connector. Watch for fault indicated by incorrect PID value, sudden change in PID value or fluctuating engine speed. If no faults occur, go to next step. If fault occurs, isolate and repair as necessary.

31) With engine running, spray water on spark plugs, spark plug wires, ICM, CKP sensor and CMP sensor. Watch for fault indicated by incorrect PID value, sudden change in PID value or fluctuating engine speed. See PIN VOLTAGE/PID VALUE CHARTS article. If no faults occur, fault cannot be identified with this procedure. Return to step 1) and choose another procedure. If fault occurs, isolate and repair as necessary.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 31) to step 40). No test procedures have been omitted.

40) Intermittent Road Test Procedure This procedure will monitor PIDs and components using a scan tester on a road test. An assistant is necessary for some procedures.

This procedure is performed under 4 different conditions; KOEO, engine running at idle speed, 30 MPH and 55 MPH. Compare information with specifications listed in PIN VOLTAGE/PID VALUE CHARTS article.

Turn ignition off. Connect scan tester to DLC. Access PIDs from the area of suspected wiring or fault. Compare values to KOEO values given in PIN VOLTAGE/PID VALUE CHARTS article. Watch for fault indicated by PID value out of specification. If no faults occur, go to next step. If fault occurs, go to step 10) for input system fault or step 20) for output system fault.

41) With scan tester connected to DLC, remain in PID access mode. Start engine and allow to idle. With engine warmed to operating temperature, watch for fault indicated by incorrect PID value, sudden change in PID value or fluctuating engine speed. Compare values to HOT IDLE values given in PIN VOLTAGE/PID VALUE CHARTS article. If values remain within specification, go to next step. If values do not remain within specification, go to step 10) for input system fault or step 20) for output system fault.

42) Leave scan tester connected to DLC in PID access mode. Ensure all accessories are off. Using an assistant, test drive vehicle at 30 MPH. Watch for fault indicated by incorrect PID value, sudden change in PID value or fluctuating engine speed. Compare values to 30 MPH values given in PIN VOLTAGE/PID VALUE CHARTS article. If values remain within specification, go to next step. If values do not remain within specification, go to step 10) for input system fault or step 20) for output system fault.

43) Leave scan tester connected to DLC in PID access mode. Test drive vehicle at 55 MPH. Watch for fault indicated by incorrect PID value, sudden change in PID value or fluctuating engine speed. Compare values to 55 MPH values given in J- PIN VOLTAGE/PID VALUE CHARTS article. If values remain within specification, fault cannot be identified with this procedure. Return to step 1) and choose another procedure. If values do not remain within specification, go to step 10) for input system fault or step 20) for output system fault.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 43) to step 50). No test procedures have been omitted.

50) Intermittent Ignition Test Procedure Ensure all accessories are off. Perform **QUICK TEST** . If trouble codes are present, service as necessary before continuing. If no trouble codes are present, connect Intermittent Ignition Analyzer (007-000075) and go to next step. If intermittent ignition analyzer is not available, return to step 1) and choose another procedure.

51) Turn ignition off. Ensure all accessories are off. Install correct overlay on front of tester panel. Install program cartridge in slot. Connect EI HIGH DATA RATE harness adapter to DIST tester. Ensure that CKP SIMULATION switch and WIGGLE TEST switch are off. Disconnect ICM wiring harness connector. Check connector terminals for damage or contamination and repair as necessary. Attach male ICM connector of tester to ICM wiring harness connector. Attach female ICM connector of tester to ICM. Turn ignition on and press tester RESET button. If tester performs self-test and VPWR LED comes on, go to step 53). If tester does not perform self-test or VPWR LED does not come on, go to next step.

52) Scan Tester Check Turn ignition off. Disconnect intermittent ignition analyzer. Connect jumper wire

between VPWR terminal of tester and positive battery terminal. Connect jumper wire between PWR GND terminal of tester and negative battery terminal. If tester passes self-test, go to step 220). If tester does not pass self-test, repair or replace as necessary and go to next step.

53) Recreate Fault Turn ignition on. Check Fault Memory and System Status LEDs. If LEDs are not on, go to next step. If LEDs are on, go to step 270).

54) Test drive vehicle. If vehicle will not start, crank engine for 5-10 seconds. If FAULT MEMORY or SYSTEM STATUS are not on, go to step 1). If FAULT MEMORY or SYSTEM STATUS LEDs are on, go to step 270).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 54) to step 190). No test procedures have been omitted.

190) Check For VPWR Turn ignition on. Measure voltage between VPWR jack of intermittent ignition analyzer and negative battery terminal. If voltage is 6 volts or more, go to next step. If voltage is less than 6 volts, repair open in VPWR circuit to ICM.

191) Check PWR GND Circuit Turn ignition off. Measure resistance between PWR GND jack of intermittent ignition analyzer and negative battery terminal. If resistance is less than 5 ohms, go to next step. If voltage is 5 ohms or more, repair open in PWR GND circuit to ICM.

192) Wiggle Check Connect jumper wire between PWR GND jack of intermittent ignition analyzer and negative battery terminal. Shake and bend wiring harness and connectors. If the intermittent ignition analyzer performs reset, repair open in VPWR circuit to ICM. If the intermittent ignition analyzer does not perform reset, repair open in PWR GND circuit to ICM.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 192) to step 220). No test procedures have been omitted.

220) Check For Coil Faults Turn ignition on. Press ignition analyzer RESET button. If COIL FAULT MEMORY LED is off, go to next step. If COIL FAULT MEMORY LED is on or flashing, go to step 229).

221) Check CASE GND/CKP SHIELD Turn ignition on. If CASE GND/CKP SHIELD FAULT MEMORY LED is off, go to next step. If CASE GND/CKP SHIELD FAULT MEMORY is on or flashing, go to step 253).

222) Check CKP BIAS Leave ignition on. If CKP BIAS SYSTEM STATUS LED is on, go to next step. If CKP BIAS SYSTEM STATUS LED is off, go to step 243).

223) Test drive vehicle. If vehicle will not start, crank engine for 5-10 seconds. If COIL FAULT MEMORY LEDs are not on, go to next step. If COIL FAULT MEMORY LEDs are on, go to step 229).

224) Leave ignition on. If CASE GND/CKP SHIELD FAULT MEMORY LEDs are not on, go to next step. If CASE GND/CKP SHIELD FAULT MEMORY LEDs are on, go to step 253).

225) Leave ignition on. If CKP FAULT MEMORY LEDs are not on, go to next step. If CKP FAULT MEMORY LEDs are on, go to step 247).

226) Leave ignition on. If CTO FAULT MEMORY LEDs are not on, go to next step. If CTO FAULT MEMORY LEDs are on, go to step 239).

227) Leave ignition on. If CKP SIGNAL SYSTEM STATUS LEDs are on, ignition system is okay and testing is complete. If CKP SIGNAL SYSTEM STATUS LEDs are not on, go to step 247).

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 227) to step 229). No test procedures have been omitted.

229) VBATC Circuit Check Turn ignition off. Disconnect ignition coil packs. Connect Intermittent Ignition Analyzer (007-000075). Turn ignition on. Measure voltage between B+ terminal at ignition coil pack wiring harness connector and PWR GND jack of ignition analyzer. If voltage is 10-14 volts, go to next step. If voltage is not 10-14 volts, repair open in B+ circuit.

230) Check For Short Turn ignition off. Measure resistance between PWR GND jack and COIL jack of ignition analyzer. Measure resistance between VPWR jack and COIL jack of ignition analyzer. If resistance is 6000 ohms or more, go to next step. If resistance is less than 6000 ohms, go to step 236).

231) Check Coil Line Resistance Turn ignition off. Measure resistance between each COIL jack of ignition analyzer and same terminal at ignition coil harness connector. If resistance is 5000 ohms or less, go to next step. If resistance is more than 5000 ohms, repair circuit and retest system.

232) Check Coil Line For Short Leave ignition off. Measure resistance between each COIL jack of ignition analyzer. If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, go to step 237).

233) Check For Hard Faults Reconnect coil packs. Turn ignition on. Press ignition analyzer RESET button. Wait for initialization and coil test. If COIL FAULT MEMORY LED is off, go to next step. If CKP SHD LED is on or flashing, go to step 238).

234) Wiggle Test Mode B Turn intermittent ignition analyzer WIGGLE TEST switch on. Turn MODE switch to "B". Press RESET button and wait 5 seconds for initialization. If fault memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

235) Turn ignition off. Disconnect coil packs. Turn ignition on. Press RESET button and wait 5 seconds for initialization. If fault memory LEDs are off, replace PCM. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

236) Circuit Check Turn ignition off. Disconnect PCM. Reconnect DIST to vehicle harness. Measure resistance between each COIL jack and PWR GND jack of ignition analyzer. Measure resistance between COIL jack and VPWR jack. If resistance is 10,000 ohms or more, replace PCM. If resistance is less than 10,000 ohms, repair open in COIL circuit.

237) Turn ignition off. Disconnect PCM. Measure resistance between each COIL jack and all other COIL jacks of intermittent ignition analyzer. If each resistance is 10,000 ohms or more, replace PCM. If resistance is less than 10,000 ohms, repair open in COIL circuit.

238) System Visual Check Leave ignition off. Check ignition system for damage, loose connections or corrosion. Repair if necessary. If ignition system looks okay, replace ignition coil pack(s).

239) Circuit Check Turn ignition off. Measure resistance between CTO jack and PWR GND jack of ignition analyzer. Measure resistance between CTO jack and VPWR jack. If resistance is 1000 ohms or less, go to next step. If resistance is more than 1000 ohms, go to step 241).

240) Leave ignition off. Disconnect PCM. Reconnect DIST to vehicle harness. Measure resistance between CTO jack and PWR GND jack of ignition analyzer. Measure resistance between CTO jack and VPWR jack. If resistance is 1000 ohms or more, replace PCM. If resistance is less than 1000 ohms, repair fault in CTO circuit.

241) Wiggle Test Mode B Turn ignition on. Turn WIGGLE TEST switch on. Set MODE switch to "B". Press intermittent ignition analyzer RESET button and wait 5 seconds for initialization. If all fault

memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

242) For 4 or 6 cylinder models, set MODE switch to "A". For 8 cylinder models, set MODE switch to "C". Press intermittent ignition analyzer RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, replace PCM and retest. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

243) Check CKP BIAS Turn ignition off. Disconnect CKP sensor harness connector. Turn ignition on. Press ignition analyzer RESET button and wait 5 seconds for initialization. If CKP BIAS SYSTEM STATUS LEDs are off, go to next step. If CKP BIAS SYSTEM STATUS LEDs are on, go to step 245).

244) Turn ignition off. Disconnect PCM. Reconnect DIST to vehicle harness. Measure resistance between CKP+ jack and PWR GND jack of ignition analyzer. Measure resistance between CKP+ jack and VPWR jack. If resistance is 10,000 ohms or more, replace PCM. If resistance is less than 10,000 ohms, repair fault in CKP circuit.

245) Circuit Check Leave ignition off. Measure resistance between CKP- jack and PWR GND jack of ignition analyzer. Measure resistance between CKP- jack and VPWR jack. If resistance is 10,000 ohms or less, go to next step. If resistance is more than 10,000 ohms, replace CKP sensor and retest.

246) Turn ignition off. Disconnect PCM. Reconnect DIST to vehicle harness. Measure resistance between CKP- jack and PWR GND jack of ignition analyzer. Measure resistance between CKP- jack and VPWR jack. If resistance is 10,000 ohms or more, replace PCM. If resistance is less than 10,000 ohms, repair fault in CKP circuit.

247) Check CKP Signal Press ignition analyzer RESET button and wait 5 seconds for initialization. Crank or start engine. If CKP SIGNAL SYSTEM STATUS LEDs are off, go to next step. If CKP SIGNAL SYSTEM STATUS LEDs are on, go to step 252).

248) Circuit Check Turn ignition off. Disconnect CKP sensor. Measure resistance between CKP+ terminal of CKP sensor wiring harness connector and CKP+ jack of intermittent ignition analyzer. Measure resistance between CKP- terminal of CKP sensor wiring harness connector and CKP- jack of intermittent ignition analyzer. If both resistance measurements are less than 5000 ohms, go to next step. If resistance is 5000 ohms or more, repair CKP circuit and retest.

249) Leave ignition off. Measure resistance between CKP+ jack and CKP- jack of ignition analyzer. If resistance is less than 10,000 ohms, go to next step. If resistance is 10,000 ohms or more, go to step 251).

250) Leave ignition off. Disconnect PCM. Reconnect DIST to vehicle harness. Measure resistance between CKP+ jack and CKP- jack of ignition analyzer. If resistance is less than 10,000 ohms, repair CKP circuit and retest. If resistance is 10,000 ohms or more, replace PCM and retest.

251) Sensor Check Turn ignition off. Inspect CKP sensor and data wheel for damage, correct alignment and air gap. Service sensor and data wheel as necessary. If no problems are found, replace CKP sensor.

252) Wiggle Test Mode B Turn ignition on. Turn WIGGLE TEST switch on. Set MODE switch to "B". Press intermittent ignition analyzer RESET button and wait 5 seconds for initialization. If any fault memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

253) Check CKP SHD For Short To Power Measure resistance between CASE GND/CKP SHD jack and VPWR jack of ignition analyzer. If resistance is less than 10,000 ohms, go to next step. If resistance is 10,000 ohms or more, go to step 255).

254) Isolate Short Leave ignition off. Disconnect PCM. Reconnect DIST to vehicle harness. Measure resistance between CASE GND/CKP SHD jack and VPWR jack of ignition analyzer. If resistance is less

than 10,000 ohms, repair CASE GND/CKP SHD circuit and retest. If resistance is 10,000 ohms or more, replace PCM and retest.

255) Wiggle Test Mode B Turn ignition on. Turn WIGGLE TEST switch on. Set MODE switch to "B". Press intermittent ignition analyzer RESET button and wait 5 seconds for initialization. If any fault memory LEDs are off, repair CASE GND/CKP SHD circuit and retest. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 255) to step 270). No test procedures have been omitted.

270) Check For Coil Fault If COIL FAULT MEMORY LED is off, go to next step. If COIL FAULT MEMORY LED is on, go to step 277).

271) Check For IDM Fault If IDM FAULT MEMORY LED is off, go to next step. If IDM FAULT MEMORY is on or flashing, go to step 287).

272) Check PIP Active Fault If PIP ACTIVE SYSTEM STATUS LED is on, go to next step. If PIP ACTIVE SYSTEM STATUS LED is off, go to step 291).

273) If PIP FAULT MEMORY LED is off, go to next step. If PIP FAULT MEMORY LED is on, go to step 291).

274) If PIP DUTY FAULT MEMORY LED is off, go to next step. If PIP DUTY FAULT MEMORY LED is on, go to step 291).

275) Check For Base Timing Fault If BASE TIMING SYSTEM STATUS LED is off, go to next step. If BASE TIMING SYSTEM STATUS LED is on, go to step 302).

276) Check For SPOUT Fault If SPOUT FAULT MEMORY LED is off, go to step 59). If SPOUT FAULT MEMORY LED is on, go to step 310).

277) Check Coil Voltage Turn ignition on. Measure voltage between COIL jack and IGN GND jack of ignition analyzer. If voltage is 10-14 volts, go to next step. If voltage is not 10-14 volts, go to step 280).

278) Check For Short To PWR Turn ignition off. Disconnect ignition coil. Measure resistance between COIL jack and ICM PWR jack of ignition analyzer. If resistance is 2000 ohms or less, go to next step. If resistance is more than 2000 ohms, go to step 284).

279) Turn ignition off. Disconnect ICM. Measure resistance between COIL jack and ICM PWR jack of ignition analyzer. If resistance is 10,000 ohms or less, repair circuit and retest. If resistance is less than 2000 ohms, replace ICM.

280) Check Coil Pack PWR Turn ignition off. Disconnect ignition coil. Turn ignition on. Measure voltage between COIL jack and IGN GND jack of ignition analyzer. If voltage is 10-14 volts, go to next step. If voltage is not 10-14 volts, repair circuit and retest.

281) Check For Short To GND Turn ignition off. Measure resistance between COIL jack and ICM GND jack of ignition analyzer. If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, go to step 283).

282) Check Harness Resistance Turn ignition off. Measure resistance between COIL jack of ignition analyzer and COIL terminal of harness connector. If resistance is 5 ohms or more, repair circuit. If resistance is less than 5 ohms, replace ignition coil.

283) Check Harness For Short To GND Turn ignition off. Disconnect ICM. Measure resistance between COIL jack and ICM GND jack of ignition analyzer. If resistance is 10,000 ohms or more,

replace ICM. If resistance is less than 10,000 ohms, repair circuit.

284) Check Coil Reconnect coil. Turn ignition on. Press ignition analyzer RESET button and wait 5 seconds for initialization. If COIL FAULT MEMORY LED is on, replace coil. If COIL FAULT MEMORY LED is off, go to next step.

285) Wiggle Test Mode B Turn ignition on. Turn WIGGLE TEST switch on. Set MODE switch to "B". Press RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

286) Turn ignition off. Disconnect coil. Turn ignition on. Press ignition analyzer RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, replace ICM and retest. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

287) Perform QUICK TEST If any KOEO or KOER DTCs are present, go to appropriate CIRCUIT TEST. If Continuous Memory DTC P1351 is present, go to step 289). If no DTCs are present, go to next step.

288) Wiggle Test Mode B Turn ignition on. Turn WIGGLE TEST switch on. Set MODE switch to "B". Press RESET button and wait 5 seconds for initialization. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located. If all fault memory LEDs are off, fault cannot be duplicated at this time. Go to step 1) and choose another procedure.

289) Turn ignition off. Install EEC-V Breakout Box (014-00950) leaving PCM disconnected. Measure resistance between IDM/START jack of intermittent ignition analyzer test pin No. 48 at the breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open circuit and retest.

290) Wiggle Test ROVING Turn ignition off. Connect PCM to breakout box. Using jumper wire, connect ROVING jack of intermittent ignition analyzer to test pin No. 48 at the breakout box. Turn WIGGLE TEST switch on. Set MODE switch to "B". Press RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, fault cannot be duplicated at this time. Go to step 1) and choose another procedure.

291) Check For Short Turn ignition off. Measure resistance between IGN GND jack and PIP jack of intermittent ignition analyzer. Measure resistance between ICM PWR jack and PIP jack of intermittent ignition analyzer. If both resistance measurements are 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, go to step 294).

292) Check Circuit Resistance Turn ignition off. Disconnect distributor connector. Measure resistance between PIP jack of ignition analyzer and PIP terminal of distributor connector. If resistance is 5 ohms or more, repair circuit and retest. If resistance is less than 5 ohms, go to next step.

293) Wiggle Test Mode B Turn ignition off. Reconnect distributor connector. Turn ignition on. Turn WIGGLE TEST switch on. Set MODE switch to "B". Press RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

294) Wiggle Test Mode A Leave ignition on. Set MODE switch to "A". Press RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

295) Wiggle Test Mode C Leave ignition on. Set MODE switch to "C". Press RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

296) Wiggle Test ROVING Turn ignition off. Using jumper wire, connect ROVING jack and PIP jack of intermittent ignition analyzer. Turn ignition on. Set MODE switch to "B". Press RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

297) Wiggle Test ROVING At PCM Turn ignition off. Install EEC-V Breakout Box (014-00950) leaving PCM disconnected. Using jumper wire, connect ROVING jack of intermittent ignition analyzer to test pin No. 49 at the breakout box. Turn ignition on. Press RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

298) PIP Sensor Check Turn ignition off. Remove distributor cap. Inspect PIP sensor and pulse wheel for damage, correct mounting and alignment. Service sensor and data wheel as necessary. If no problems are found, go to next step.

299) Check For Short Turn ignition off. Disconnect PCM. Measure resistance between IGN GND jack and PIP jack of ignition analyzer. Measure resistance between ICM PWR jack and PIP jack of ignition analyzer. If both resistance measurements are 10,000 ohms or more, replace PCM. If either resistance measurement is less than 10,000 ohms, go to next step.

300) Leave ignition off. Disconnect ICM. Measure resistance between IGN GND jack and PIP jack of ignition analyzer. Measure resistance between ICM PWR jack and PIP jack of ignition analyzer. If both resistance measurements are 10,000 ohms or more, replace ICM. If either resistance measurement is less than 10,000 ohms, go to next step.

301) Leave ignition off. Disconnect distributor harness connector. Measure resistance between IGN GND jack and PIP jack of ignition analyzer. Measure resistance between ICM PWR jack and PIP jack of ignition analyzer. If both resistance measurements are 10,000 ohms or more, repair or replace PIP sensor harness. If either resistance measurement is less than 10,000 ohms, go to next step.

302) Check Base Timing Status If BASE TIMING LED is on continuously with no FAULT MEMORY LEDs, replace ICM. If LEDs are not as specified, go to next step.

303) Turn ignition off. Measure resistance between IGN GND jack and SPOUT jack of ignition analyzer. Measure resistance between ICM PWR jack and SPOUT jack of ignition analyzer. If both resistance measurements are 10,000 ohms or more, go to next step. If either resistance measurement is less than 10,000 ohms, go to step 310).

304) Check SPOUT Circuit Resistance Turn ignition off. Disconnect PCM. Measure resistance between SPOUT jack of ignition analyzer and test pin No. 50 at the breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair circuit and retest.

305) Check PIP Circuit Resistance Leave ignition off. Measure resistance between PIP jack of ignition analyzer and test pin No. 50 at the breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair circuit and retest.

306) Check IGN GND Circuit Resistance Leave ignition off. Measure resistance between IGN GND jack of ignition analyzer and test pin No. 23 at the breakout box. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair circuit and retest.

307) Wiggle Test Mode B With ignition off, reconnect PCM. Turn ignition on. Turn WIGGLE TEST switch on. Set MODE switch to "B". Press RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

308) Wiggle Test Mode C Leave ignition on. Set MODE switch to "C". Press RESET button and wait 5

seconds for initialization. If all fault memory LEDs are off, go to next step. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

309) Wiggle Test ROVING At PCM Turn ignition off. Install EEC-V Breakout Box (014-00950) leaving PCM disconnected. Using jumper wire, connect ROVING jack of intermittent ignition analyzer to test pin No. 36 at the breakout box. Turn ignition on. Press RESET button and wait 5 seconds for initialization. If all fault memory LEDs are off, replace PCM. If any fault memory LEDs are on, press RESET button and continue to test until intermittent is located.

310) Check Harness & PCM For Shorts Turn ignition off. Disconnect ICM. Measure resistance between IGN GND jack and SPOUT jack of ignition analyzer. Measure resistance between ICM PWR jack and SPOUT jack of ignition analyzer. If both resistance measurements are 10,000 ohms or more, replace ICM and retest. If either resistance measurement is less than 10,000 ohms, go to step 310).

311) Check Harness & PCM For Shorts Turn ignition off. Disconnect PCM. Measure resistance between IGN GND jack and SPOUT jack of ignition analyzer. Measure resistance between ICM PWR jack and SPOUT jack of ignition analyzer. If both resistance measurements are 10,000 ohms or more, replace PCM and retest. If either resistance measurement is less than 10,000 ohms, repair or replace harness and retest.

312) Check ICM GND Turn ignition off. Measure resistance between negative battery terminal and IGN GND jack of ignition analyzer. If resistance is 5 ohms or less, go to next step. If resistance is more than 5 ohms, go to step 315).

313) Check ICM PWR Turn ignition on. Measure voltage between negative battery terminal and IGN PWR jack of ignition analyzer. If voltage is 6 volts or more, go to next step. If voltage is less than 6 volts, repair ICM PWR circuit and retest.

314) Turn ignition off. Connect jumper wire between negative battery terminal and IGN GND jack of ignition analyzer. Turn ignition on. Press RESET button and wait 5 seconds for initialization. If ignition analyzer resets, repair ICM PWR circuit and retest. If ignition analyzer does not reset, repair IGN GND circuit and retest.

315) Check Circuit Resistance Turn ignition off. Disconnect distributor connector. Measure resistance between IGN GND jack of ignition analyzer and IGN GND terminal of distributor connector. If resistance is 5 ohms or more, repair circuit and retest. If resistance is less than 10,000 ohms, go to next step.

316) Check Distributor Ground Leave ignition off. Measure resistance between negative battery terminal and metal surface of distributor. If resistance is 5 ohms or more, check distributor for correct mounting, negative battery cable ground connection and distributor ground circuit. If resistance is less than 5 ohms, service or replace PIP sensor or harness.