1991

GMC TRUCK

LIGHT DUTY TRUCK FUEL AND EMISSIONS SERVICE MANUAL

INCLUDING DRIVEABILITY

(FUEL INJECTED GAS ENGINES ONLY)

FOREWORD

This Service Manual replaces Section 6C and 6E for 2.5L, 2.8L, 4.3L, 5.0L, 5.7L, and 7.4L gasoline engines with throttle body injection and supplements the following shop manuals:

- X-9132 10-30 Series R-V-P Light Duty Truck Service Manual
- X-9129 10 Series S-T Light Duty Truck Service Manual
- X-9130 10 Series M-Van Light Duty Truck Service Manual
- X-9131 10-30 Series C-K Light Duty Truck Service Manual
- X-9157 10-30 Series G Light Duty Truck Service Manual

This manual includes the general description of a system, diagnosis and on-vehicle service procedures for the fuel control and emissions used on light duty truck with a throttle body injection fuel control system.

Wiring diagrams for the above vehicles are also published in a separate "Truck Wiring Diagram" booklet.

This manual should be kept in a handy place for ready reference. If properly used, it will meet the needs of technicians and vehicle owners.

CAUTION:

These vehicles contain some parts dimensioned in the metric system as well as in the customary system. Some fasteners are metric and are very close in dimension to familiar customary fasteners in the inch system. It is important to note that, during any vehicle maintenance procedures, replacement fasteners must have the same measurements and strength as those removed, whether metric or customary. (Numbers on the heads of metric bolts and on surfaces of metric nuts indicate their strength. Customary bolts use radial lines for this purpose, while most customary nuts do not have strength markings.) Mismatched or incorrect fasteners can result in vehicle damage or malfunction, or possibly personal injury. Therefore, fasteners removed from the vehicle should be saved for re-use in the same location whenever possible. Where the fasteners are not satisfactory for re-use, care should be taken to select a replacement that matches the original. For information and assistance, see your authorized dealer.

CAUTION:

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed.

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of all motor vehicles. If part replacement is necessary, the part must be replaced with one of the same part number or with an equivalent part. Do not use a replacement part of lesser quality.

The service procedures recommended and described in this service manual are effective methods of performing service and repair. Some of these procedures require the use of tools specially designed for the purpose.

Accordingly, anyone who intends to use a replacement part, service procedure or tool, which is not recommended by the vehicle manufacturer, must first determine that neither his safety nor the safe operation of the vehicle will be jeopardized by the replacement part, service procedure or tool selected.

It is important to note that this manual contains various Cautions and Notices that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these "Cautions" and "Notices" are not exhaustive, because it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

ACTION SYMBOL USAGE

The general narrative writing style has been replaced in some procedures with action symbols. To improve readability and to provide emphases when needed, the following symbols are used in the text.

Remove or Disconnect	Inspect
Install or Connect	Measure
Disassemble	Tighten
Assemble	Important
Clean	Adjust

1991
LIGHT DUTY TRUCK
FUEL AND EMISSIONS
SERVICE MANUAL
FOR GASOLINE ENGINES
WITH
THROTTLE BODY INJECTION
S, T, C, K, R, V, P, TRUCK
AND
M, L-VAN, G-VAN
MODELS
10/1500 - 20/2500 - 30/3500
SERIES

The Table of Contents on this page indicates the sections covered in this manual. At the beginning of each individual section is a Table of Contents which gives the page number on which each major subject begins.

When reference is made in this manual to a brand name, number, or specific tool, an equivalent product may be used in place of the recommended item.

All information, illustrations, and specifications contained in this Manual are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

X - 9136

Printed in U.S.A.

SECTION 1

GENERAL INFORMATION

CONTENTS

ALL NEW GENERAL MOTORS VEHICLES ARE CERTIFIED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS CONFORMING TO THE REQUIREMENTS OF THE REGULATIONS FOR THE CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES. THIS CERTIFICATION IS CONTINGENT ON CERTAIN ADJUSTMENTS BEING SET TO FACTORY STANDARDS. IN MOST CASES, THESE ADJUSTMENT POINTS EITHER HAVE BEEN PERMANENTLY SEALED AND/OR MADE INACCESSIBLE TO PREVENT INDISCRIMINATE OR ROUTINE ADJUSTMENT IN THE FIELD. FOR THIS REASON, THE FACTORY PROCEDURE FOR TEMPORARILY REMOVING PLUGS, CAPS, ETC., FOR PURPOSES OF SERVICING THE PRODUCT, MUST BE STRICTLY FOLLOWED AND, WHEREVER PRACTICABLE, RETURNED TO THE ORIGINAL INTENT OF THE DESIGN.

GENERAL

All engines in this manual have a Computer Command Control system, with Electronic Control Module (ECM), or a Powertrain Control Module (PCM) to control the Throttle Body Injection (TBI) fuel system. The ECM/PCM varies the air/fuel ratio.

In addition, the ECM/PCM controls the ignition timing system as well as other emission control systems such as the exhaust gas recirculation system.

It is important to review the emission sections and ECM/PCM wiring diagrams for a specific engine to determine what is controlled by the ECM/PCM and what systems are non-ECM/PCM controlled.

- This section has a brief description of systems used to control fuel and emissions.
- Abbreviations that are used in driveability and emissions are listed at the end of the manual.
- Wiring harness service information, for harnesses used with the ECM/PCM, is also provided in the computer command control section.
- Special tools used to diagnose and repair a system are illustrated at the end of the manual.

VISUAL/PHYSICAL UNDERHOOD INSPECTION

<u>One of the most important checks that must be done as part of any diagnostic procedures or finding the cause of an emissions test failure, is a careful visual/physical underhood inspection.</u> This can often lead to fixing a problem without further steps. Inspect all vacuum hoses for correct routing, pinches, cuts, or disconnects. Be sure to inspect hoses that are difficult to see beneath the air cleaner, compressor, generator, etc. Inspect all the wires in the engine compartment for correct and good connections, burned or chafed spots, pinched wires, or contact with sharp edges or hot exhaust manifolds. This visual/physical inspection is very important. It must be done carefully and thoroughly.

BASIC ELECTRIC CIRCUITS

You should understand the basic theory of electricity, and know the meaning of voltage, amps, and ohms. You should understand what happens in a circuit with an open or a shorted wire. You should be able to read and understand a wiring diagram. A short to ground is referred to as a ground to distinguish it from a short between wires.

EMISSIONS

The exhaust emission control systems used on General Motors engines perform a specific function to lower exhaust emissions while maintaining good fuel economy and driveability.

MAINTENANCE SCHEDULE

Refer to the General Motors Maintenance Schedule in MAINTENANCE AND LUBRICATION (SECTION 0B) of the Truck Service Manual or in the glove box for the maintenance service that should be performed to retain emission control performance.

VEHICLE EMISSION CONTROL INFORMATION LABEL

The Vehicle Emission Control Information label (Figure 1-1) contains important emission specifications and setting procedures. In the upper left corner is exhaust emission information which identifies the year, the manufacturing division of the engine, the displacement in liters of the engine, the class of vehicle and type of fuel metering. Also there is an illustrated emission component and vacuum hose schematic. This label is located in the engine compartment of every General Motors Corporation vehicle. If the label has been removed, it can be ordered from the parts division (GMSPO). Refer to the Standard Parts Catalog.

SECTION DESCRIPTION

Section "2"
Driveability Symptoms

The fuel and emissions driveability diagnosis procedures apply to various systems in current GM vehicles. The procedures assume that the vehicle worked right at one time and the problem is due to time, wear, dirt or other causes. Start with the ECM/PCM diagnosis in "Computer Command Control," Section "3" and then to "Driveability Symptoms," Section "2" which references driveability symptoms.

Section "3"
Computer Command Control

This is an electronically controlled exhaust emission system that uses an Electronic Control Module (ECM) or Powertrain Control Module (PCM) to control fuel delivery, ignition timing, air management and exhaust gas recirculation. An ECM controls the engagement of the transmission converter clutch and the manual transmission shift light, while the PCM controls all transmission functions. This section diagnoses the system with the use of a "Scan" tool.

Section "4"
Fuel Control System

The ECM/PCM controls the air/fuel delivery to the combustion chamber by controlling the fuel flow through the injector(s). The ECM/PCM also controls idle speed. The in-tank fuel pump is controlled by the ECM/PCM. When ignition is turned "ON," the pump will run for 2 seconds for most systems, then stop unless the engine is cranking or running. On some vehicles, the fuel pump will run for 20 seconds. The fuel control system is used on all engines. The ECM/PCM may control the A/C clutch of the compressor and maintain idle speed to improve idle quality.

Section "5"
Evaporative Emission Control

This system has a canister which stores fuel vapor from the fuel tank. The fuel vapor is removed from the canister and consumed in the normal combustion process when the engine is running. This system is used on all engines and is not controlled by the ECM/PCM.

Section "6"
Ignition/Electronic Spark Timing

This system is controlled by the ECM/PCM which regulates ignition timing and is used on all engines.

Section "7"
Electronic Spark Control (ESC)

This system uses a knock sensor in connection with the ECM/PCM to control spark timing to allow the engine to have maximum spark advance without spark knock. This improves driveability and fuel economy and is used on all engines except the 2.5L.

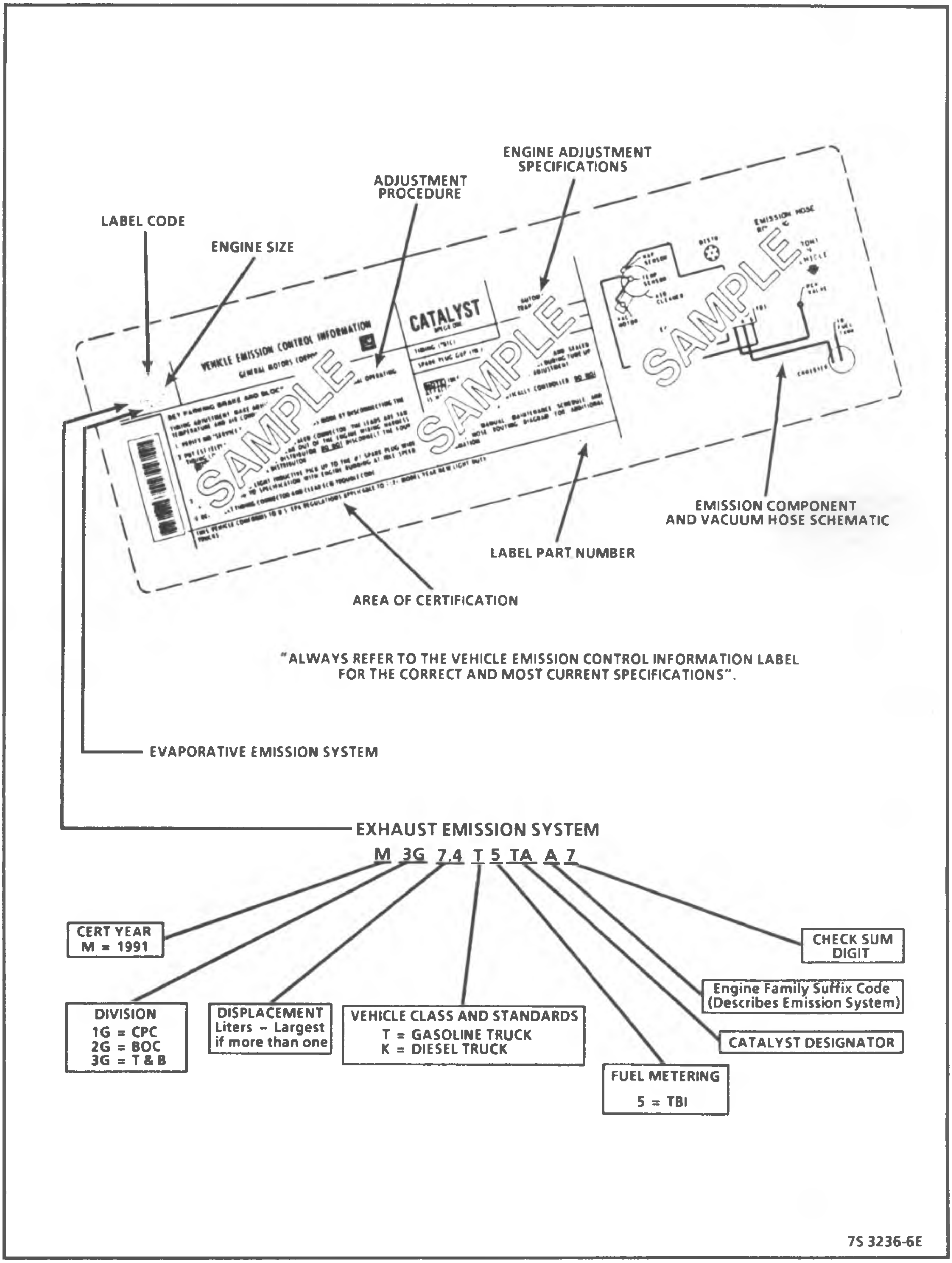


Figure 1-1 - Vehicle Emission Control Information Label

Section "8"
Air Management

This system provides additional oxygen to the exhaust gases to continue the combustion process. Air management is used only on engine/transmission combinations that require it to meet emission standards.

Section "9"
Exhaust Gas Recirculation (EGR)

The EGR system uses a valve to feed a small amount of exhaust gas back into the intake manifold to control formation of NOx. This system is used on all engines and is controlled by the ECM/PCM.

Section "10"
Torque Converter Clutch (TCC), and Manual Transmission Shift Light

The TCC is ECM controlled and is used on all engines with a Hydramatic 4L60 automatic transmission. This system reduces slippage losses in the torque convertor by coupling the engine flywheel to the output shaft of the transmission.

The ECM controls the shift light on all engines with manual transmission to indicate the best shift point for maximum fuel economy on vehicles below 8500 GVW.

Section "11"
Positive Crankcase Ventilation (PCV)

The PCV system passes crankcase vapors into the intake manifold. This system is not controlled by the ECM/PCM and is used on all engines.

Section "12"
Thermostatic Air Cleaner (THERMAC)

The THERMAC system regulates heated air through the air cleaner to provide uniform inlet air temperature which gives good driveability under various climatic conditions. This system is not controlled by the ECM/PCM and is used on all engines.

Section "13"
Special Tools

Refer to "Special Tools and Specifications," Section "13" for special tools and equipment needed to diagnose the fuel control and emissions systems.

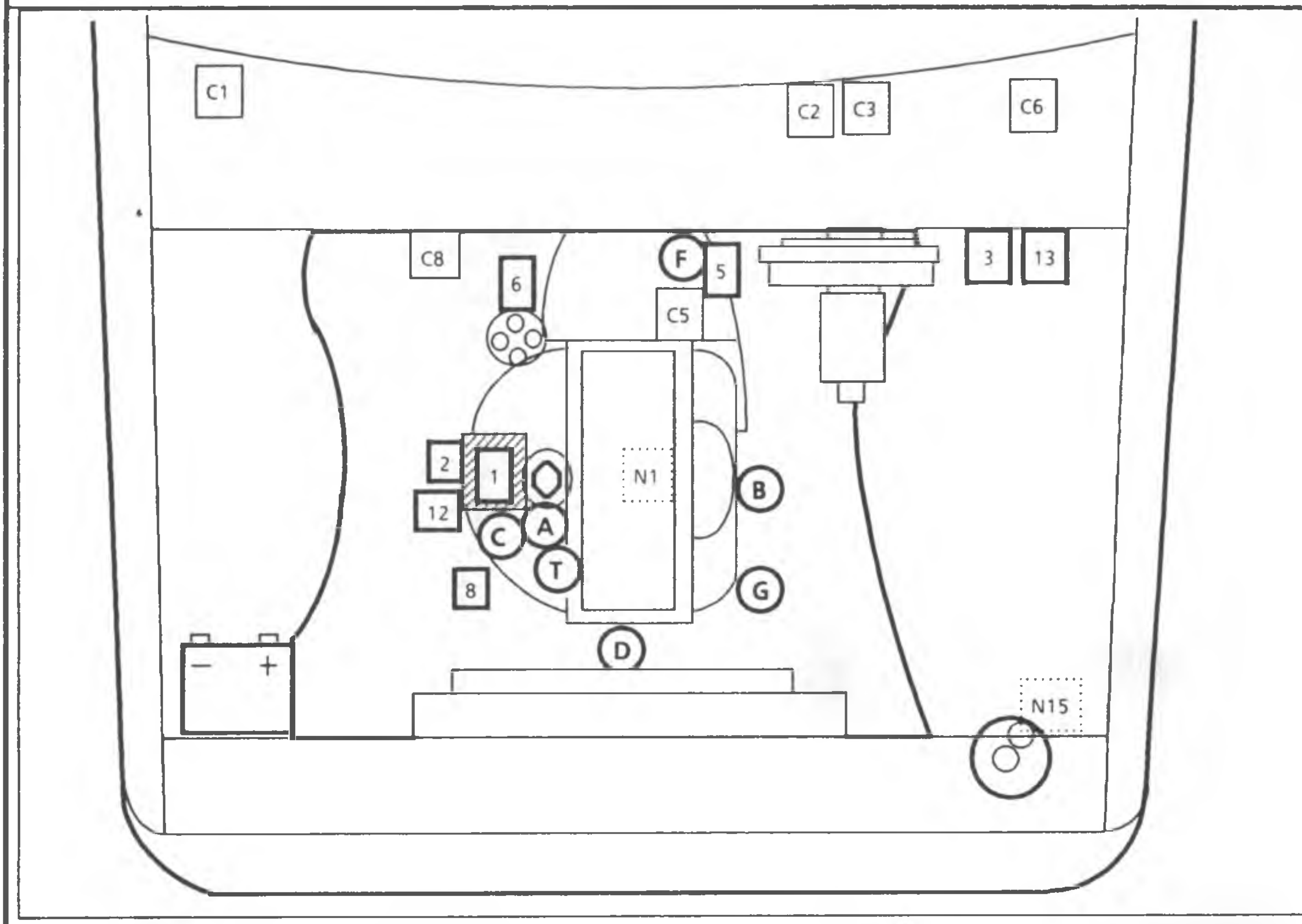
Section "14"
Abbreviations

Refer to "Abbreviations," Section "14," for abbreviations used in this manual.

COMPONENT LOCATIONS

There are many component systems used to control fuel and emissions. Each system is described in a section which includes general description of the system, diagnosis and on-vehicle service. Component locations for all series vehicles and all engines are illustrated in Figures 1-2 through 1-15. **The "Component Location" views show all emission systems that may be used for the particular vehicle/engine combination.** Not every vehicle requires all the systems or components shown, only the ones needed to meet emission standards for the area of certification.

'S' SERIES RPO: LN8/L38 ENGINE CODE: E/A 2.5L L4



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control
- 3 Fuel Pump relay
- 5 Transmission Converter Clutch Connector
- 6 Electronic Spark Timing Distributor (EST)
- 8 Oil Pressure Switch
- 12 Exhaust Gas Recirculation Vacuum Solenoid
- 13 A/C relay

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- G Power Steering Pressure
- T Intake Air Temperature (IAT)

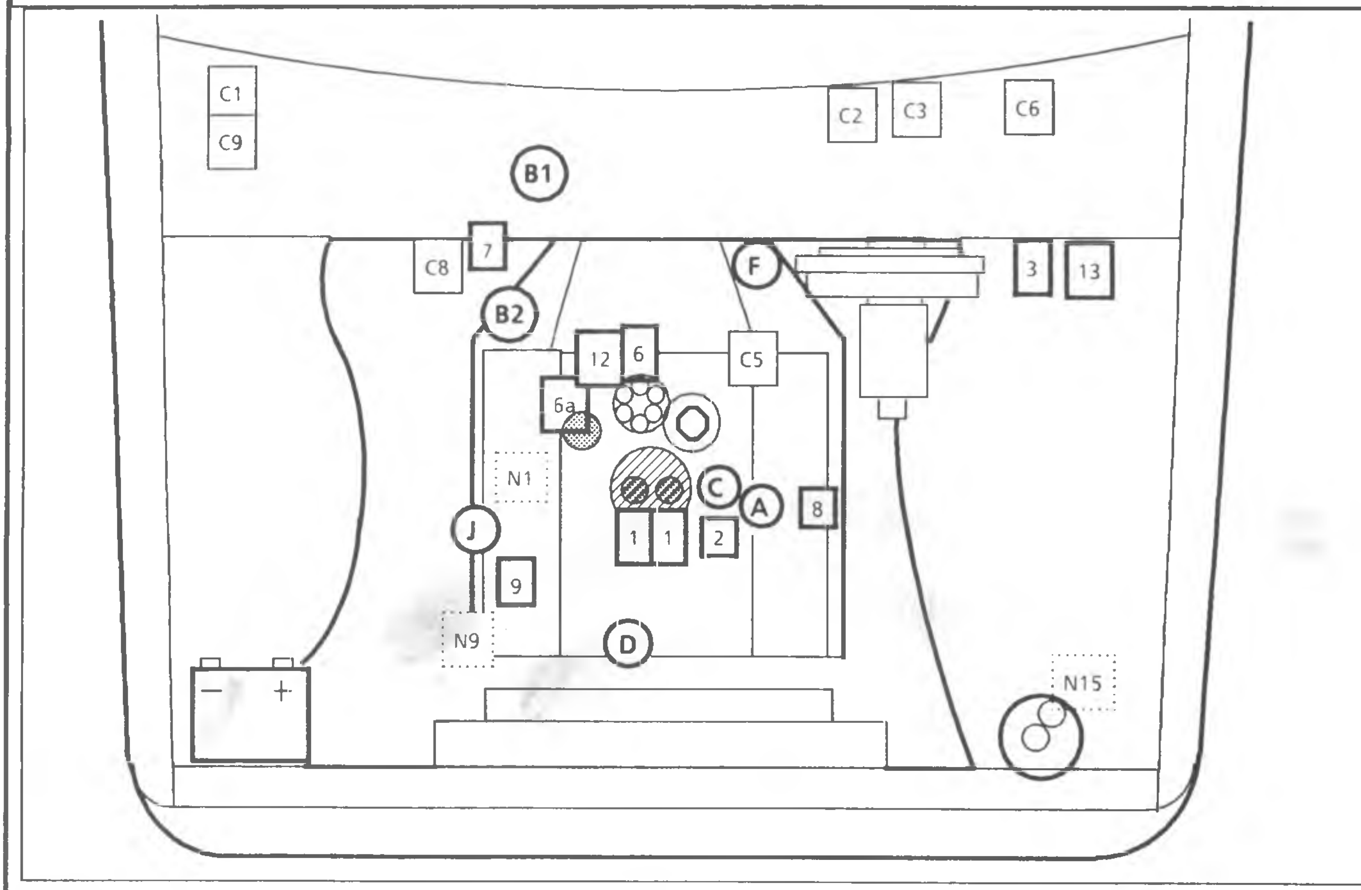
EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase vent valve (PCV)
- N15 Fuel Vapor Canister

6-21-90
7S 3310-6E

Figure 1-2 - Component Locations 2.5L ("S" Series)

'S' SERIES   RPO:LL2   ENGINE CODE:R   2.8L V6



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector
- C9 Elapsed Timer Module

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 7 Electronic Spark Control (ESC) module
- 8 Oil pressure switch
- 9 Electric Air Control (EAC) solenoid
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid
- 13 A/C Relay

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B1 Exhaust oxygen (Federal) (Crossover pipe)
- B2 Exhaust oxygen (California)
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control Knock (ESC)

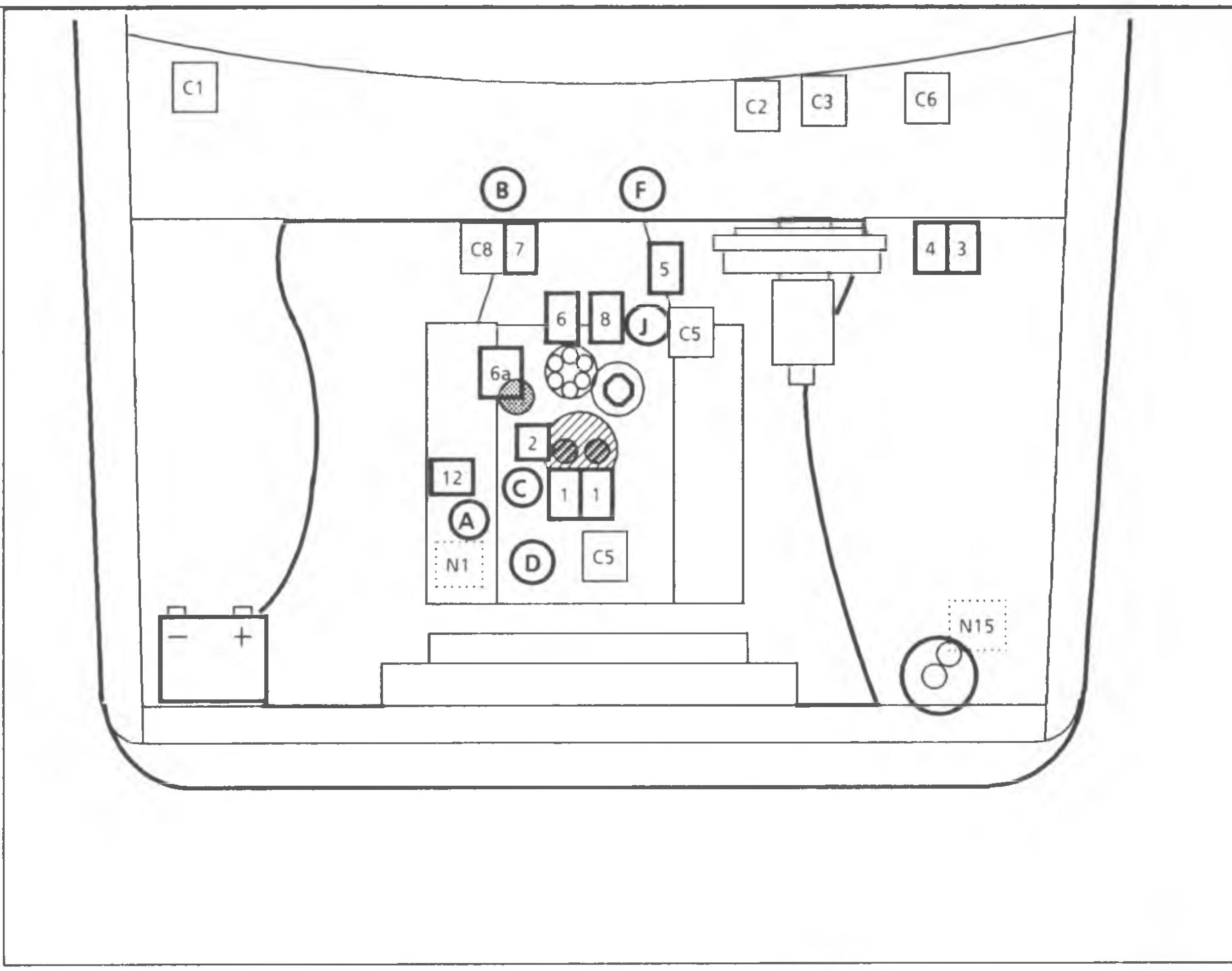
EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase vent valve (PCV)
- N9 Air Pump
- N15 Fuel Vapor Canister

7-13-90
7S 3298-6E

Figure 1-3 - Component Locations 2.8L ("S" Series)

'S/T' SERIES | RPO: LB4 | ENGINE CODE: Z | 4.3L V6



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 4 AC relay
- 5 Transmission Converter Clutch (TCC) Connector
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 7 Electronic Spark Control (ESC) module
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation Vacuum Solenoid (EVRV)

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) Sensor (Crossover pipe)
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control (ESC) Knock Sensor

EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N15 Fuel Vapor Canister

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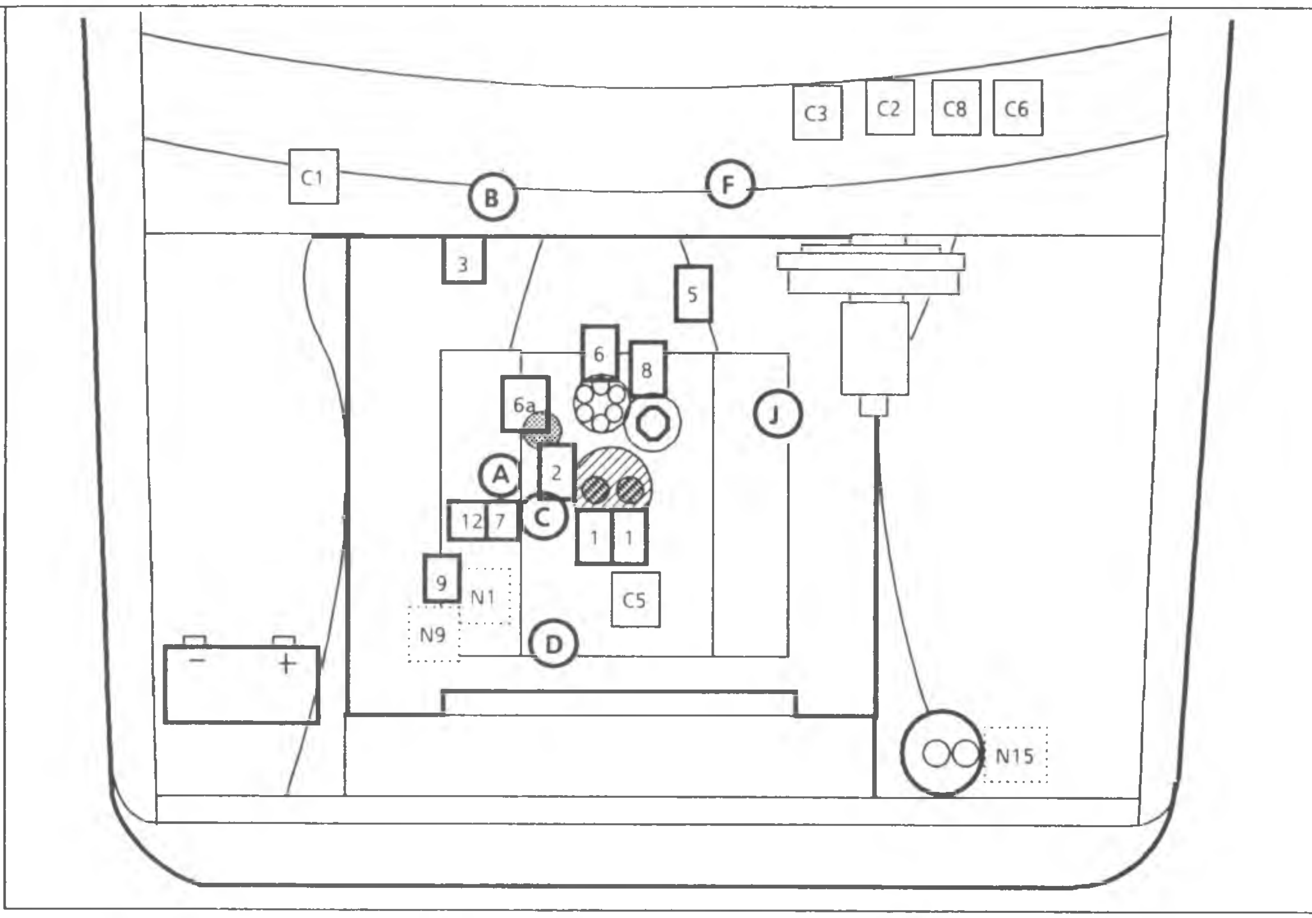
8S 4329-6E

Figure 1-4 - Component Locations 4.3L ("S/T" Series)

'C/K' SERIES RPO:LB4 ENGINE CODE:Z 4.3L V6



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Transmission Connector
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 7 Electronic Spark Control (ESC) module
- 8 Oil pressure switch
- 9 Electric Air Control (EAC) solenoid
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) Sensor
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control (ESC) Knock

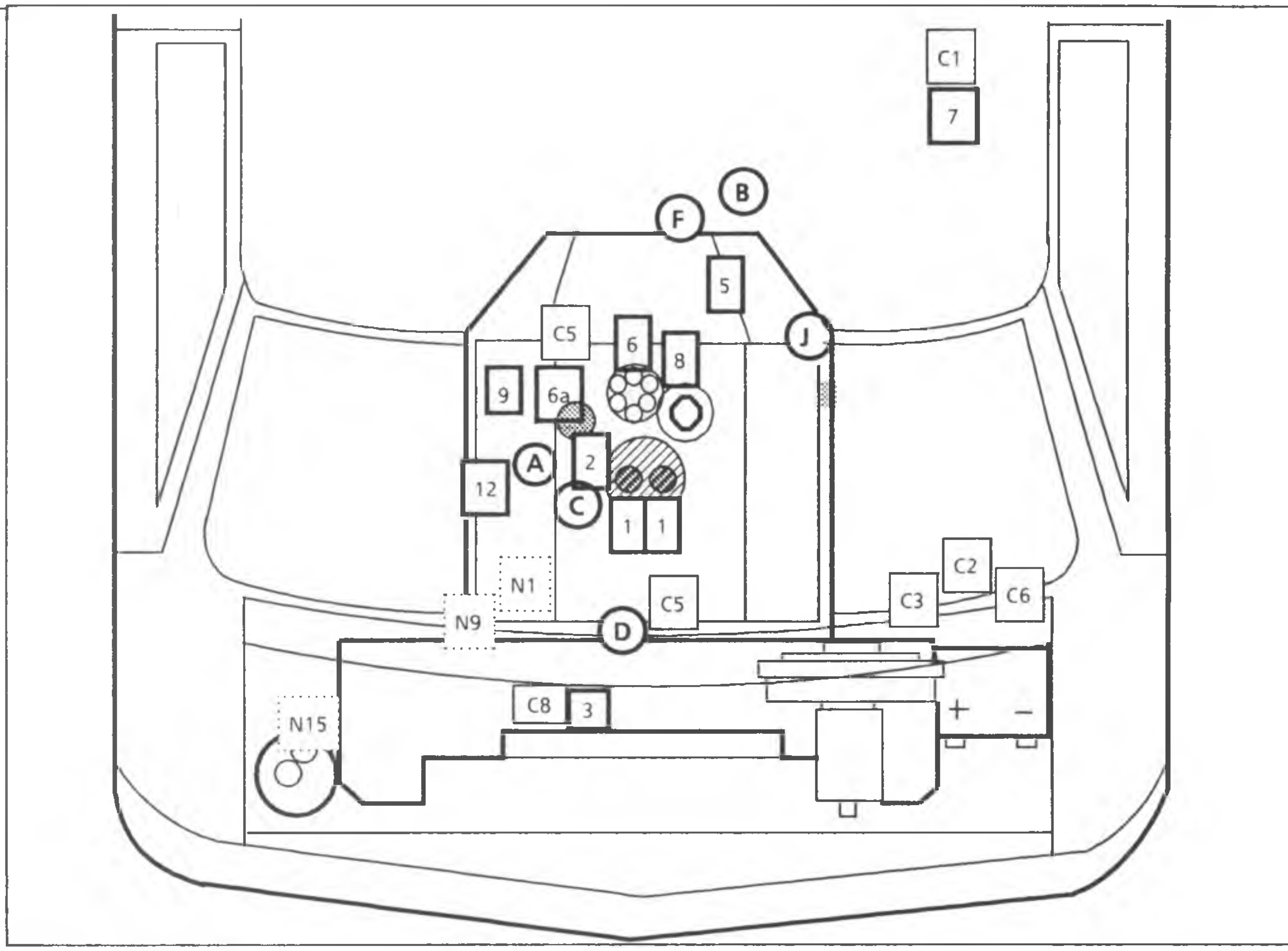
EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase vent valve (PCV)
- N9 Air Pump
- N15 Fuel Vapor Canister

7-13-90
7S 3300-6E

Figure 1-5 - Component Locations 4.3L ("C/K" Series)

'G' SERIES RPO: LB4 ENGINE CODE: Z 4.3L V6



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Transmission Connector
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 7 Electronic Spark Control (ESC) module
- 8 Oil pressure switch
- 9 Electric Air Control (EAC) solenoid
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) Sensor
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control (ESC) Knock

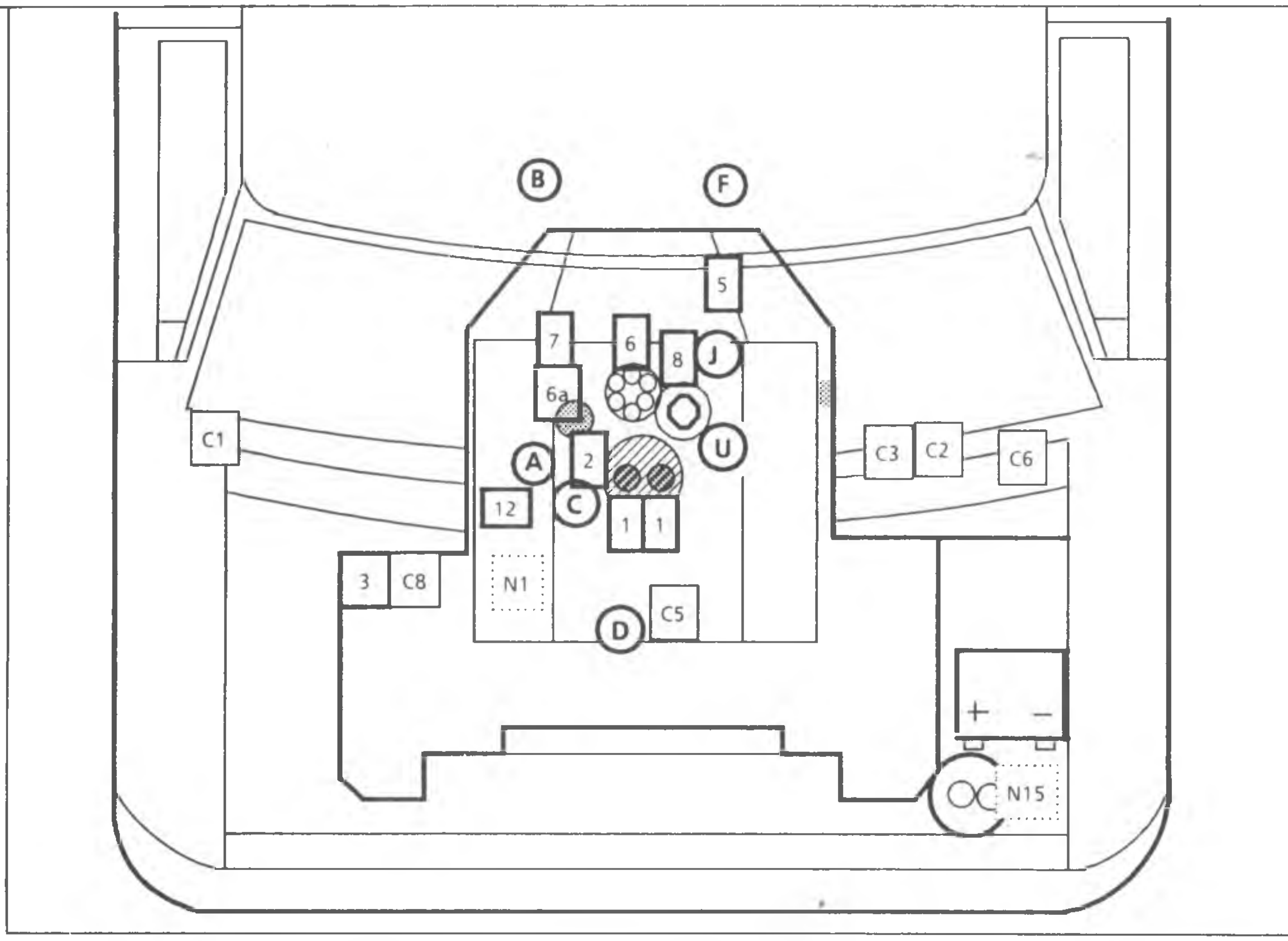
EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N9 Air Pump
- N15 Fuel Vapor Canister

7-16-90
7S 3301-6E

Figure 1-6 - Component Locations 4.3L ("G" Series)

'M/L' SERIES RPO: LB4 ENGINE CODE: Z 4.3L V6



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) Sensor
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control (ESC) Knock

EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N15 Fuel Vapor Canister

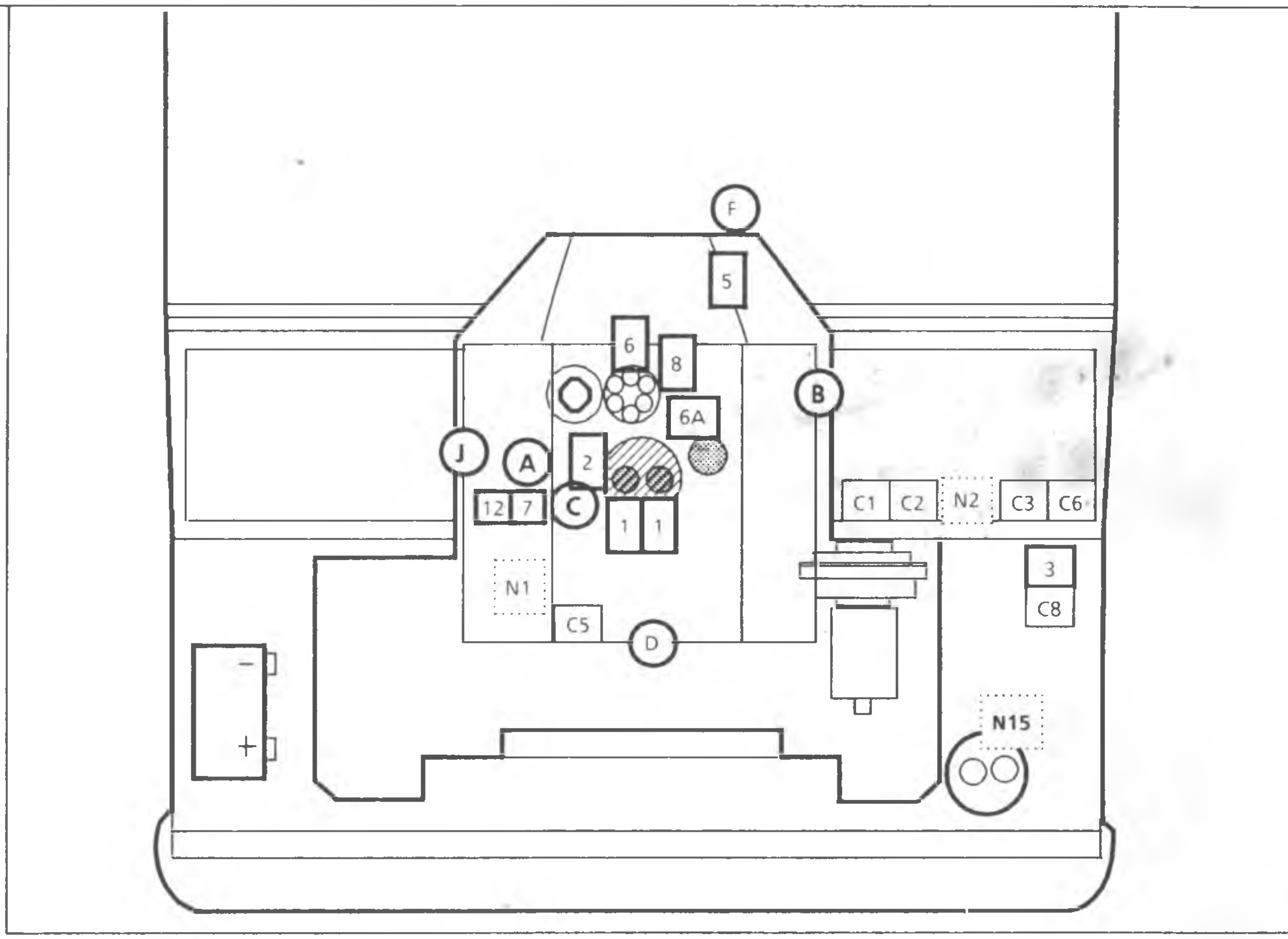
ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Transmission Connector
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 7 Electronic Spark Control (EST) module
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid

7-16-90
7S 3299-6E

Figure 1-7 - Component Locations 4.3L ("M/L" Series)

'P' SERIES RPO:LB4 ENGINE CODE:Z 4.3L V6



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) Sensor
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control (ESC) Knock

EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N2 Fuel Module
- N15 Fuel Vapor Canister

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Transmission Connector
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 7 Electronic Spark Control (ESC) module
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid

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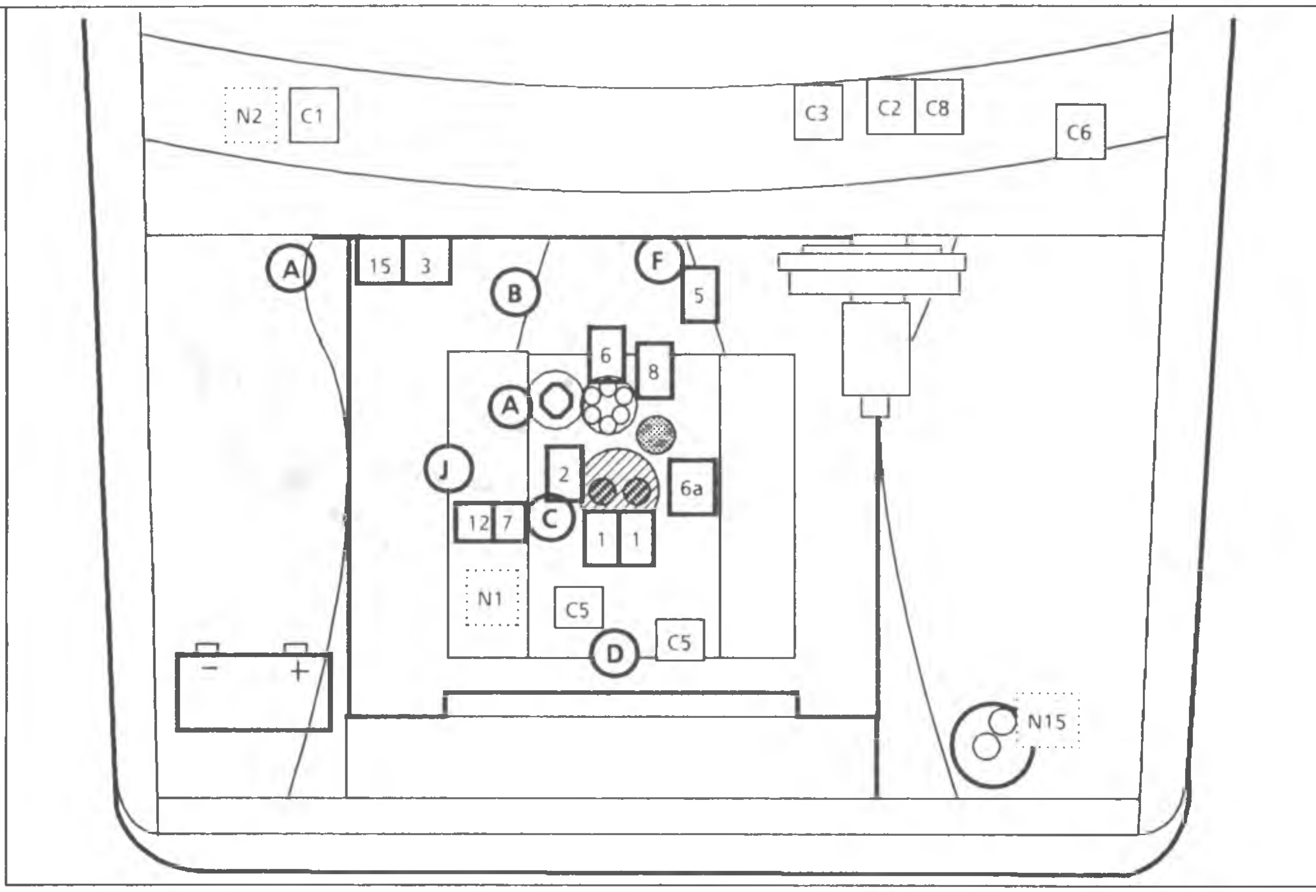
Figure 1-8 - Component Locations 4.3L ("P" Series)

'C/K' SERIES RPO: L03/L05 ENGINE CODE: H/K 5.0/5.7L V8



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Transmission Converter Clutch Connector
- 6 Electronic Spark Timing Distributor (EST)
- 6a Remote ignition coil
- 7 Electronic Spark Control module (ESC)
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid
- 15 Fuel Pump Fuse

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2)
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control (ESC) Knock

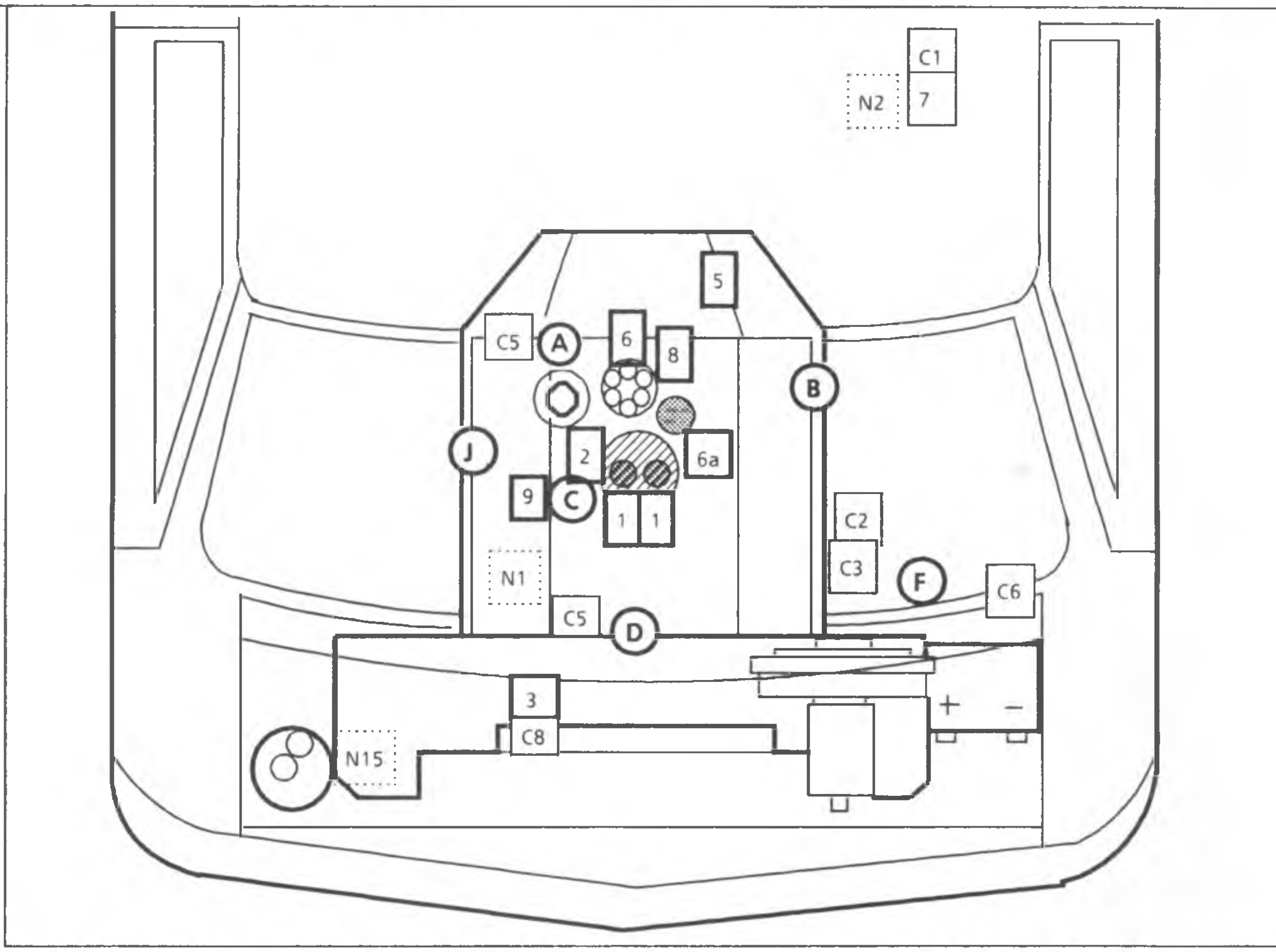
EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N2 Fuel Module (5.7L H.D. only)
- N15 Fuel Vapor Canister

7-13-90
7S 3303-6E

Figure 1-9 - Component Locations 5.0L/5.7L ("C/K" Series)

'G' SERIES RPO: L05 ENGINE CODE: K 5.7L V8



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Transmission Connector
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 7 Electronic Spark Control (ESC) module
- 8 Oil pressure switch
- 9 Exhaust Gas Recirculation Vacuum Solenoid

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) Sensor
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control (ESC) Knock

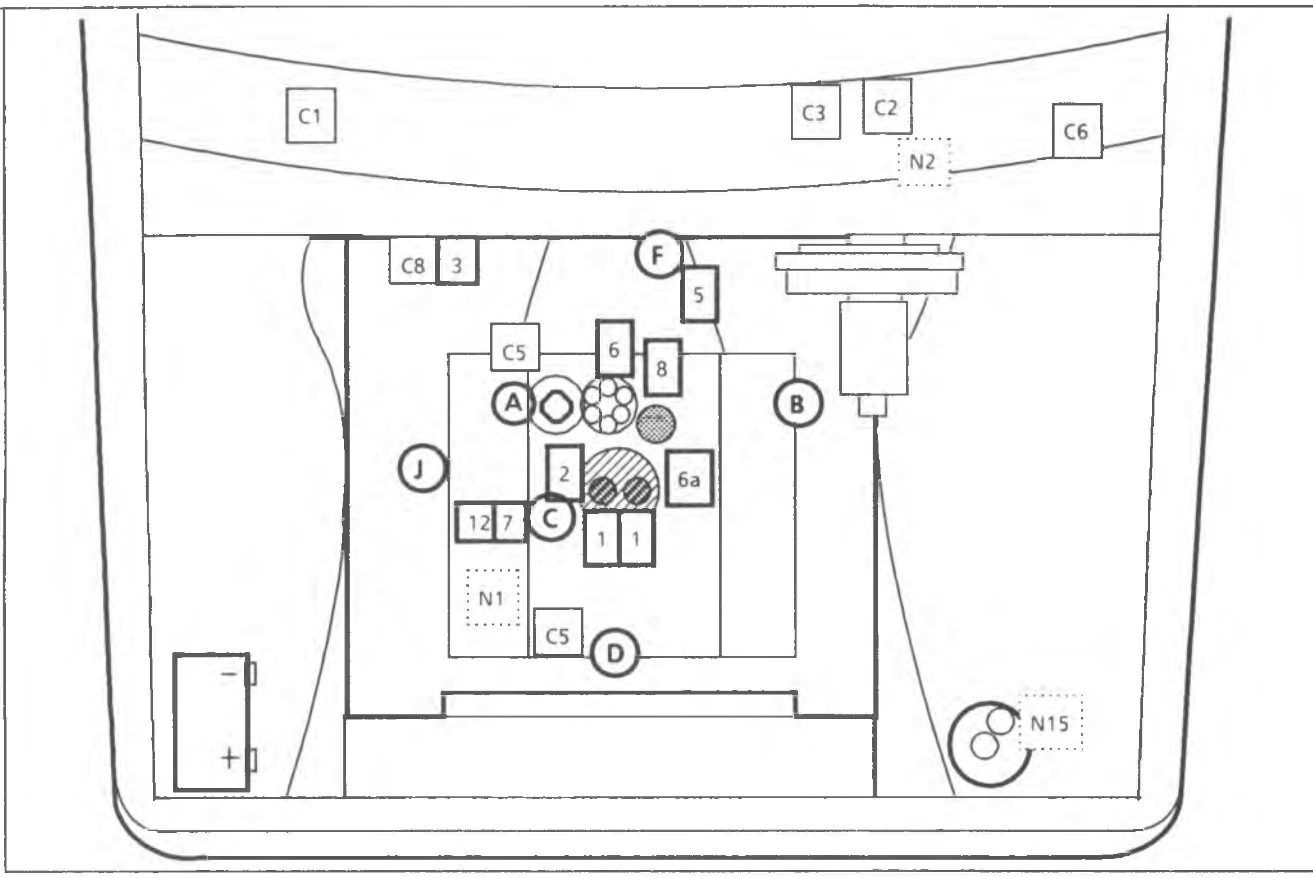
EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N2 Fuel Module
- N15 Fuel Vapor Canister

6-13-90
7S 3304-6E

Figure 1-10 - Component Locations 5.7L ("G" Series)

'R/V' SERIES RPO: L05 ENGINE CODE: K 5.7L V8



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Transmission Converter Clutch Connector
- 6 Electronic Spark Timing Distributor (EST)
- 6a Remote ignition coil
- 7 Electronic Spark Control (ESC) module
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2)
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control (ESC) Knock

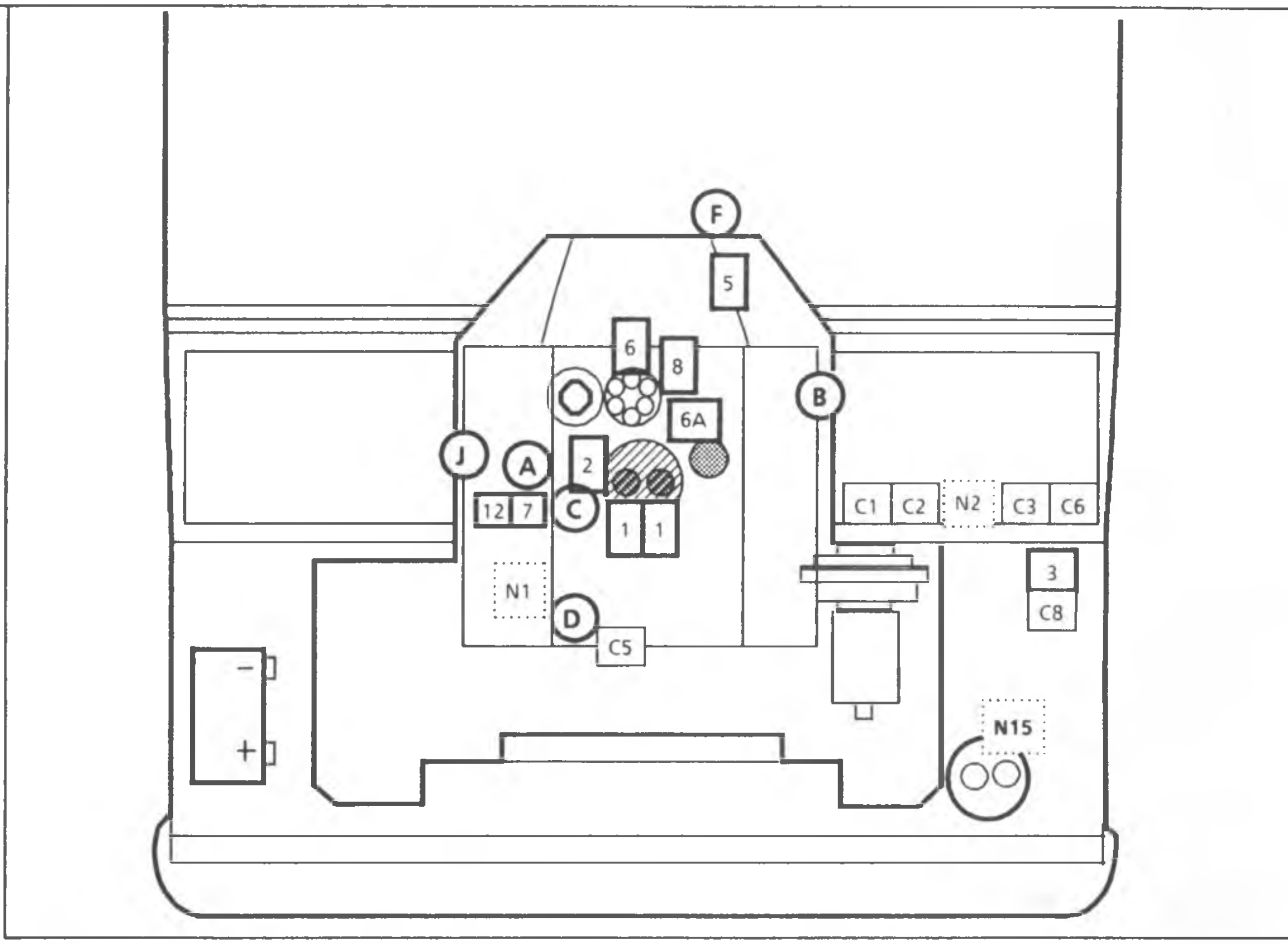
EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N2 Fuel Module (5.7L H.D. only)
- N15 Fuel Vapor Canister

7-16-90
7S 3305-6E

Figure 1-11 - Component Locations 5.7L ("RV" Series)

'P' SERIES RPO: L05 ENGINE CODE: K 5.7L V8



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Transmission Connector
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 7 Electronic Spark Control (ESC) module
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) Sensor
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control (ESC) Knock

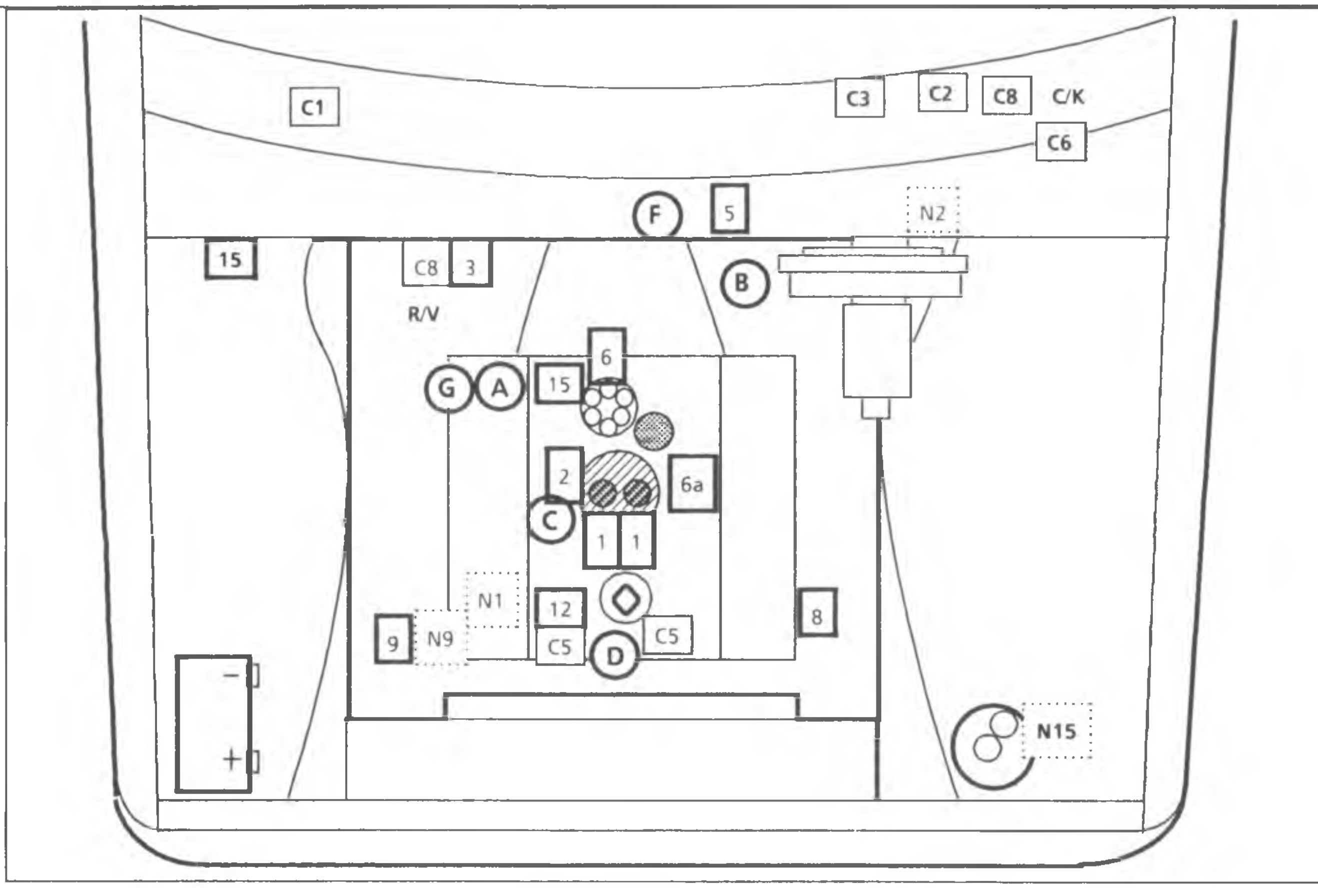
EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N2 Fuel Module
- N15 Fuel Vapor Canister

7-13-90
7S 3307-6E

Figure 1-12 - Component Locations 5.7L ("P" Series)

'C/K & R/V' SERIES RPO:L19 ENGINE CODE:N 7.4L V8



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Trans connector
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 8 Oil pressure switch
- 9 Electric Air Control (EAC) solenoid
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid
- 15 Electronic Spark Control (ESC) Module

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) Sensor
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- G Electronic Spark Control (ESC) knock

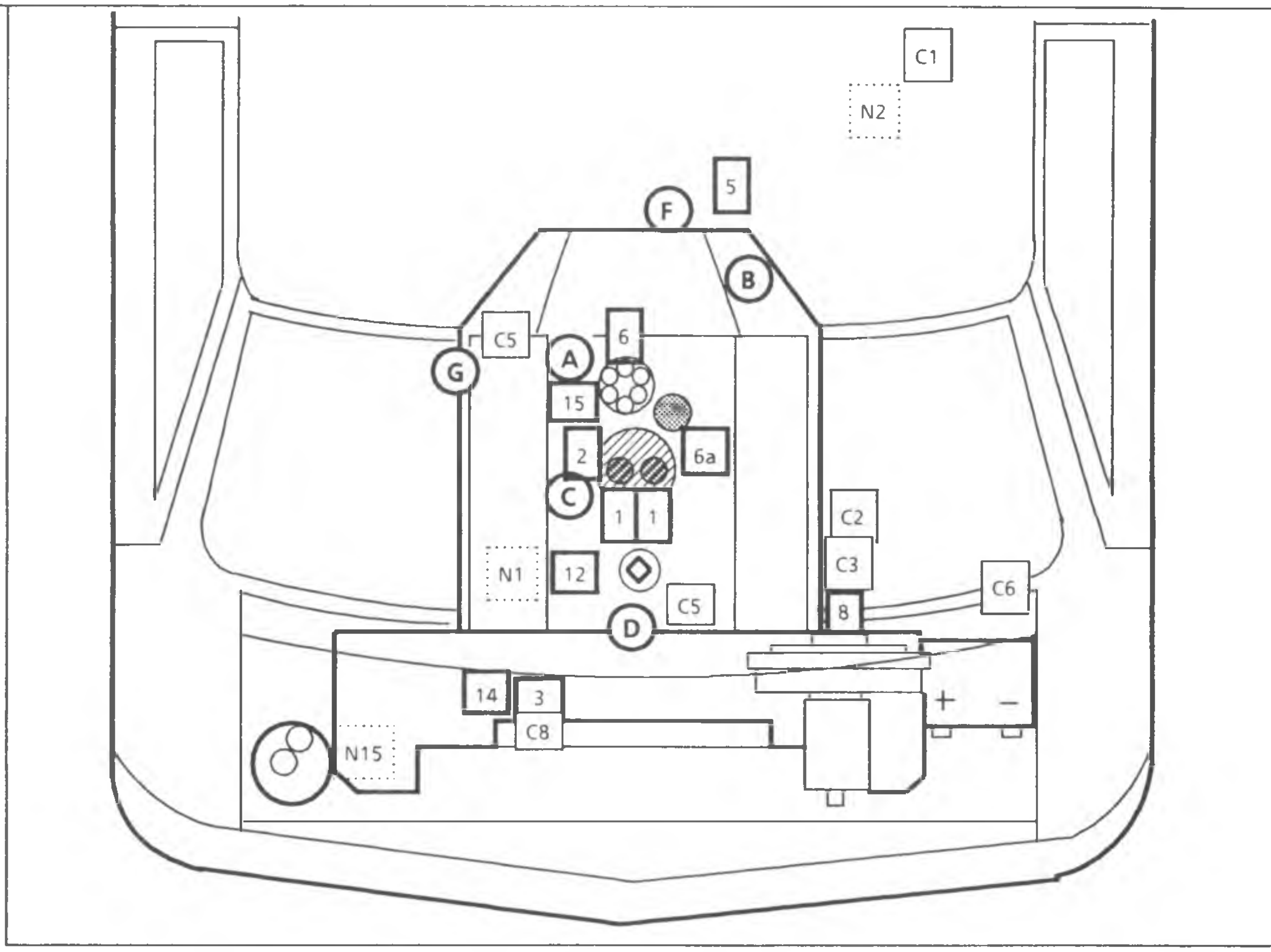
EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N2 Fuel Module
- N9 Air Pump
- N15 Fuel Vapor Canister

7-13-90
7S 3306-6E

Figure 1-13 - Component Locations 7.4L ("CK & RV" Series)

"G" SERIES RPO: L19 ENGINE CODE: N 7.4L V8



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "Service Engine Soon" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Trans connector
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 8 Oil pressure switch
- 12 Exhaust Gas Recirculation (EGR) Vacuum Solenoid
- 15 Electronic Spark Control (ESC) Module

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) Sensor
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- G Electronic Spark Control (ESC) Knock

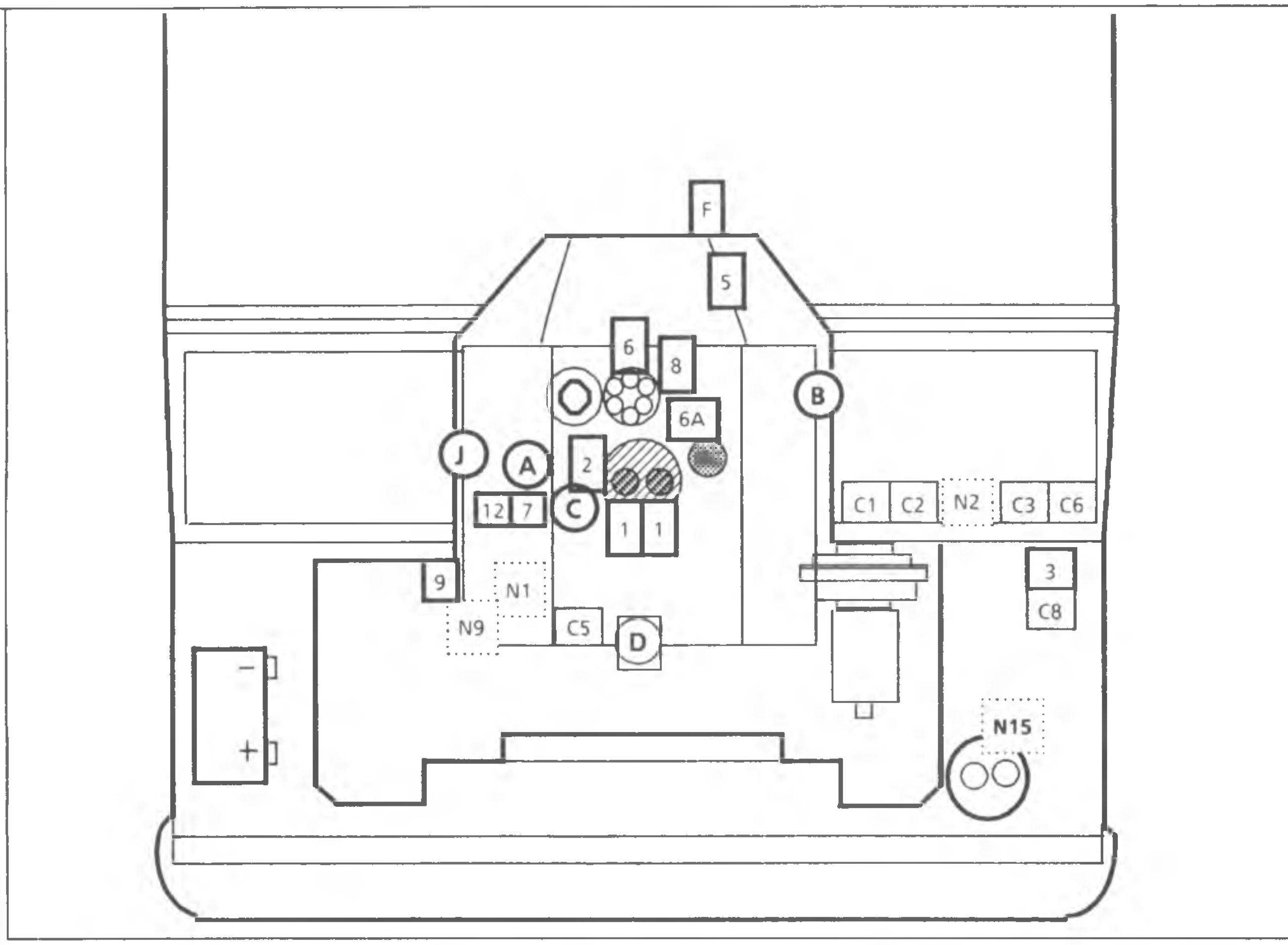
EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N2 Fuel Module
- N15 Fuel Vapor Canister

7-13-90
8S 4330-6E

Figure 1-14 - Component Locations 7.4L ("G" Series)

'P' SERIES RPO: L19 ENGINE CODE: N 7.4L V8



COMPUTER COMMAND CONTROL

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "Service Engine Soon" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector

ECM CONTROLLED COMPONENTS

- 1 Fuel injector
- 2 Idle Air Control (IAC)
- 3 Fuel pump relay
- 5 Transmission Connector
- 6 Electronic Spark Timing (EST) Distributor
- 6a Remote ignition coil
- 7 Electronic Spark Control (ESC) module
- 8 Oil pressure switch
- 9 Electric Air Control (EAC) solenoid
- 12 Exhaust Gas Recirculation Vacuum Solenoid

ECM INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) Sensor
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- J Electronic Spark Control (ESC) Knock

EMISSION COMPONENTS (NOT ECM CONTROLLED)

- N1 Crankcase Vent Valve (PCV)
- N2 Fuel Module
- N9 Air Pump
- N15 Fuel Vapor Canister

6-13-90
MS 10074

Figure 1-15 - Component Locations 7.4L ("P" Series)

SECTION 2
DRIVEABILITY SYMPTOMS
CONTENTS

IMPORTANT PRELIMINARY CHECKS

- Before using this section you should have performed the "Diagnostic Circuit Check."
- Verify the customer complaint, and locate the correct symptom below. Check the items indicated under that symptom.
- If the ENGINE CRANKS BUT WILL NOT RUN, use CHART A-3 in "Computer Command Control," Section "3".
- Several of the following symptom procedures call for a careful visual/physical check.

The importance of this step cannot be stressed too strongly - it can lead to correcting a problem without further checks and can save valuable time.

BEFORE STARTING

This check should include:

- ECM/PCM grounds for being clean, tight, and in their proper location. See "General Information," Section "1" for location.
- Vacuum hoses for splits, kinks and proper connections, as shown on "Vehicle Emission Control Information" label. Check thoroughly for any type of leak or restriction.
- Air leaks at throttle body mounting area and intake manifold sealing surfaces.
- Ignition wires for cracking, hardness, proper routing and carbon tracking.
- Wiring for proper connections, pinches, and cuts.
  If wiring harness or connector repair is necessary, refer to the "Introduction" in "Computer Command Control," Section "3" for correct procedure.
- The following symptom charts contain groups of possible causes for each symptom and cover several engines. **These procedures are not necessarily meant to be done in consecutive order.** If "Scanner" readings do not indicate the problems, then proceed in a logical order, easiest to check or most likely cause first. To determine if a particular system or component is used on a specific vehicle, refer to the "ECM/PCM Wiring Diagrams" for application.

INTERMITTENTS

(Page 1 of 2)

Definition: Problem may or may not turn "ON" the "Service Engine Soon" light, or store a code.

PRELIMINARY CHECKS

- Perform the careful visual/physical checks as described at start of "Driveability Symptoms," Section "2".

DIAGNOSTIC CODE CHARTS IN "COMPUTER COMMAND CONTROL" SECTION "3".

- DO NOT use the Diagnostic Code Charts in "Computer Command Control," Section "3" for intermittent problems. The fault must be present to locate the problem. If a fault is intermittent, use of diagnostic code charts may result in replacement of good parts.

FAULTY ELECTRICAL CONNECTIONS OR WIRING

- Most intermittent problems are caused by faulty electrical connections or wiring. Perform careful check of suspect circuits for:
  - Poor mating of the connector halves, or terminals, not fully seated in the connector body (backed out).
  - Improperly formed or damaged terminals. All connector terminals in problem circuit should be carefully reformed or replaced to insure proper contact tension.
  - Poor terminal to wire connection. This requires removing the terminal from the connector body to check. See "General Information" in "Computer Command Control," Section "3" "Wiring Harness Service."

ROAD TEST

- If a visual/physical check does not find the cause of the problem, the vehicle can be driven with a voltmeter connected to a suspected circuit or a "Scan" tool may be used. An abnormal voltage or "Scan" reading, when the problem occurs, indicates the problem may be in that circuit. If the wiring and connectors check OK, and a diagnostic code was stored for a circuit having a sensor, except for Codes 44 and 45, replace sensor.

INTERMITTENTS

(Page 2 of 2)

Definition: Problem may or may not turn "ON" the "Service Engine Soon" light, or store a code.

INTERMITTENT "SERVICE ENGINE SOON LIGHT"

- An intermittent "Service Engine Soon" light, and No Diagnostic Codes, may be caused by:
  - Electrical system interference caused by a defective relay, ECM/PCM driven solenoid, or switch. They can cause a sharp electrical surge. Normally, the problem will occur when the faulty component is operated.
  - Improper installation of electrical devices, such as lights, 2-way radios, electric motors, etc.
  - EST wires should be routed away from spark plug wires, ignition system components and generator. Wire for CKT 453 from ECM/PCM to ignition system should be a good ground.
  - Ignition secondary shorted to ground.
  - CKT 419 ("Service Engine Soon" light) or CKT 451 (diagnostic "test" terminal) intermittently shorted to ground.
  - ECM/PCM grounds. See "General Information," Section "1" for location.

LOSS OF DIAGNOSTIC CODE MEMORY

- To check, disconnect TPS and idle engine until "Service Engine Soon" light comes "ON." Code 22 should be stored, and kept in memory when the ignition is turned "OFF" for at least 10 seconds. If not, the ECM/PCM is faulty.

HARD START

(Page 1 of 2)

Definition: Engine cranks OK, but does not start for a long time. Does eventually run, or may start but immediately dies.

PRELIMINARY CHECKS

- Perform the careful visual/physical checks as described at start of "Driveability Symptoms," Section "2".

SENSORS

- **CHECK:** Coolant Temperature Sensor (CTS) - Using a "Scan" tool, compare coolant temperature with ambient temperature on a cold engine.
  - If coolant temperature reading is 5 degrees greater than or less than ambient air temperature on a cold engine, check for high resistance in coolant sensor circuit or sensor itself. Compare resistance value to the "Diagnostic Aids" chart in Code 15 chart.
- **CHECK:** Throttle Position Sensor (TPS) - If a sticking throttle shaft or binding linkage causes a high TPS voltage (open throttle indication), the ECM/PCM will not control idle. Monitoring TPS voltage. A "Scan" tool and/or voltmeter should read less than 1.25 volts with throttle closed. See "Fuel Control System," Section "4."

FUEL SYSTEM

- **NOTICE:** Fuel pump relay operation - pump should turn "ON" for 2 seconds when ignition is turned "ON." Use CHART A-5 in "Computer Command Control," Section "3."
- **CHECK:** Fuel Pressure, use CHART A-6 in "Computer Command Control," Section "3."
- **CHECK:** For water contaminated fuel.
- **CHECK:** For a faulty in-tank fuel pump check valve, which would allow the fuel in the lines to drain back to the tank after the engine is stopped. To check for this condition:
  1. Ignition "OFF."
  2. Disconnect fuel line at the filter. See "Fuel Control System," Section "4."
  3. Remove the tank filler cap.
  4. Connect a radiator test pump to the fuel line and apply 103 kPa (15 psi) pressure. If the pressure will hold for 60 seconds, the check valve is OK.
- **CHECK:** Fuel pump relay - Connect test light between fuel pump "test" terminal and ground. Light should be "ON" for 2 seconds following ignition "ON." If not, refer to Code 54 chart.

HARD START

(Page 2 of 2)

Definition: Engine cranks OK, but does not start for a long time. Does eventually run, or may start but immediately dies.

IGNITION SYSTEM

- **CHECK:** Ignition system for:
  - Proper ignition voltage output with spark tester J 26792 or equivalent (ST-125).
  - Spark plugs, wet plugs, cracks, wear, improper gap, burned electrodes or heavy deposits.
  - Bare and shorted wires
  - Moisture in distributor cap
  - Worn distributor shaft
  - Pickup coil resistance and connections
  - Loose ignition coil connections
- **NOTICE:** If engine starts, but then immediately stalls, disconnect the set timing connector. If engine then starts, and runs OK, replace distributor pickup coil.
- **CHECK:** CKT 423 (EST) for short to ground.

ADDITIONAL CHECKS

- **CHECK:** IAC operation - see Code 35 in "Computer Command Control," Section "3", and "Diagnosis" in "Fuel Control System," Section "4."
- **CHECK:** No crank signal - see "Computer Command Control," Section "3."
- **CHECK:** EGR operation - see "Exhaust Gas Recirculation (EGR) System," Section "9."
- **CHECK:** Service Bulletins for PROM/MEM-CAL updates.

SURGES AND/OR CHUGGLES

Definition: Engine power variation, under steady throttle or cruise. Feels like the vehicle speeds up and slows down, with no change in the accelerator pedal.

PRELIMINARY CHECKS

- Perform the careful visual/physical checks as described at start of "Driveability Symptoms," Section "2".
- Be sure driver understands Torque Converter Clutch (TCC) and A/C compressor operation in owner's manual.
- Use a "Scan" tool to make sure reading of VSS matches vehicle speedometer except vehicles with the 4L80-E transmission where some variation between VSS and speedometer is normal. See "Diagnostic Aids," in Code 24 in "Computer Command Control," Section "3".

SENSORS

- **CHECK:** Oxygen (O_2) sensor for silicon contamination from fuel, or use of improper RTV sealant. The sensor may have a white, powdery coating and result in a high but false signal voltage (rich exhaust indication). The ECM/PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem.

FUEL SYSTEM

- **NOTICE:** To determine if the condition is caused by a rich or lean system, the vehicle should be driven at the speed of the complaint. Monitoring block learn will help identify a problem.
  Lean - Block learn greater than 150. Refer to "Diagnostic Aids" on facing page of Code 44.
  Rich - Block learn less than 115. Refer to "Diagnostic Aids" on facing page of Code 45.
- **CHECK:** Fuel pressure while condition exists, use CHART A-6 in "Computer Command Control," Section "3".
- **CHECK:** In-line fuel filter. Replace if dirty or plugged. See CHART A-6 in "Computer Command Control," Section "3".

IGNITION SYSTEM

- **CHECK:** For proper ignition voltage output voltage using spark tester J 26792 or equivalent (ST-125).
- **CHECK:** Spark plugs. Remove spark plugs, check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Repair or replace as necessary.
- **CHECK:** Ignition timing. See "Vehicle Emission Control Information" label.

ADDITIONAL CHECKS

- **CHECK:** ECM/PCM grounds for being clean, tight, and in their proper locations.
- **CHECK:** Generator output voltage. Repair if less than 9 or more than 16 volts.
- **CHECK:** Vacuum lines for kinks or leaks.
- **CHECK:** For intermittent EGR. See "Exhaust Gas Recirculation (EGR) System," Section "9".
- **CHECK:** TCC operation. See "Automatic And Manual Transmission Controls," Section "10" or ELECTRONIC TRANSMISSION CONTROL (SECTION 7A4) of appropriate vehicle service manual.

LACK OF POWER, SLUGGISH, OR SPONGY

(Page 1 of 2)

Definition: Engine delivers less than expected power. Little or no increase in speed, when accelerator pedal is pushed down part way.

PRELIMINARY CHECKS

- Perform the careful visual/physical checks as described at start of "Driveability Symptoms," Section "2".
- Compare customer's vehicle to similar unit. Make sure the customer has an actual problem.
- Remove air filter and check air filter for dirt, or for being plugged, replace as necessary.
- Transmission shift pattern and down shift operation.
- If there is spray from only one injector, then, there is a malfunction in the injector assembly, or in the signal to the injector assembly. The malfunction can be isolated, by switching the injector connectors. If the problem remains with the original injector, after switching the connector, the injector is defective. Replace the injector. If the problem moves with the injector connector, the problem is an improper signal in the injector circuits, use CHART A-3 in "Computer Command Control," Section "3".

FUEL SYSTEM

- **CHECK:** For contaminated fuel.
- **CHECK:** For restricted fuel filter, contaminated fuel or improper fuel pressure, use CHART A-6 in "Computer Command Control," Section "3".

IGNITION SYSTEM

- **CHECK:** Proper ignition voltage output with spark tester J 26792 or equivalent (ST-125).
- **CHECK:** Ignition timing. See "Vehicle Emission Control Information" label.
- **CHECK:** Proper operation of EST. Refer to "Ignition System/EST," Section "6".

EXHAUST SYSTEM

- **CHECK:** Exhaust System for possible restriction: see "Computer Command Control," Section "3".

  Inspect exhaust system for damaged or collapsed pipes. Inspect muffler for heat distress or possible internal failure.

  1. With engine at normal operating temperature, connect a vacuum gage to any convenient vacuum port on intake manifold.
  2. Run engine at 1000 rpm and record vacuum reading.
  3. Increase rpm slowly to 2500 rpm. Note vacuum reading at steady 2500 rpm.
  4. If vacuum at 2500 rpm decreases more than 3" Hg, from reading at 1000 rpm, the exhaust system should be inspected for restrictions.
  5. Disconnect exhaust pipe from engine and repeat Steps 3 & 4. If vacuum still drops more than 3" Hg, with exhaust disconnected, check for exhaust manifold restriction and valve timing.

LACK OF POWER, SLUGGISH, OR SPONGY

(Page 2 of 2)

Definition: Engine delivers less than expected power. Little or no increase in speed, when accelerator pedal is pushed down part way.

ADDITIONAL CHECKS

- **CHECK:** ECM/PCM grounds for being clean, tight, and in their proper location. Refer to "General Information," Section "1".
- **CHECK:** EGR operation for being open or partly open all the time. See "Exhaust Gas Recirculation (EGR) System," Section "9".
- **CHECK:** Torque Converter Clutch (TCC) operation. Refer to "Automatic And Manual Transmission Controls," Section "10" or for 4L80-E, refer ELECTRONIC TRANSMISSION CONTROL (SECTION 7A4) of appropriate vehicle service manual.
- **CHECK:** A/C operation. Use A/C chart in "Computer Command Control," Section "3".
- **CHECK:** Generator output voltage. Repair if less than 9 or more than 16 volts.

ENGINE MECHANICAL

- **CHECK:** Engine compression. Refer to ENGINE MECHANICAL DIAGNOSIS (SECTION 6A).
- **CHECK:** Engine valve timing. Refer to ENGINE MECHANICAL DIAGNOSIS (SECTION 6A).
- **CHECK:** Engine for proper or worn camshaft. Refer to ENGINE MECHANICAL DIAGNOSIS (SECTION 6A).

DETONATION/SPARK KNOCK

(Page 1 of 2)

Definition: A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

PRELIMINARY CHECKS

- Perform the careful/physical visual checks as described at start of "Driveability Symptoms," Section "2".
- Make sure the customer has an actual problem.
- If there is spray from only one injector, then, there is a malfunction in the injector assembly, or in the signal to the injector assembly. The malfunction can be isolated, by switching the injector connectors. If the problem remains with the original injector, after switching the connector, the injector is defective. Replace the injector. If the problem moves with the injector connector, the problem is an improper signal in the injector circuits, use CHART A-3 in "Computer Command Control," Section "3".
- Park/Neutral (P/N) switch. Be sure "Scan" indicates drive with gear selector in drive. See "Computer Command Control," Section "3".

COOLING SYSTEM

- **CHECK:** For obvious over heating problems. Refer to COOLING AND RADIATOR (SECTION 6B) of appropriate service manual.
- **CHECK:** Low engine coolant.
- **CHECK:** Loose water pump belt
- **CHECK:** Restricted air flow to radiator, or restricted coolant flow.
- **CHECK:** Faulty or incorrect thermostat.
- **CHECK:** Correct coolant solution - should be a 50/50 mix of GM #1052753 anti-freeze coolant (or equivalent) and water.

SENSOR

- **CHECK:** Coolant Temperature Sensor (CTS), which has shifted in value.
  Compare CTS resistance to the "Diagnostic Aids" on Code 15 chart.

FUEL SYSTEM

- **NOTICE:** To determine if the condition is caused by a lean system, the vehicle should be driven at the speed of the complaint. Monitoring block learn will help identify the problem.
  Lean - Block learn greater than 150. Refer to "Diagnostic Aids" on facing page of Code 44.
- **CHECK:** Fuel pressure, use CHART A-6 in "Computer Command Control," Section "3".
- **CHECK:** For poor fuel quality, proper octane rating.
- **NOTE:** If "Scan" tool readings are normal and there are no engine mechanical faults, fill fuel tank with a premium gasoline that has a minimum octane rating of 92 and re-evaluate vehicle performance.

DETONATION/SPARK KNOCK

(Page 2 of 2)

Definition: A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

IGNITION SYSTEM

- **CHECK:** Spark plugs for proper heat range.
- **CHECK:** ESC system operation, see "Electronic Spark Control (ESC)," Section "7".
- **CHECK:** Ignition timing. See "Vehicle Emission Control Information" label.

ENGINE MECHANICAL

- **CHECK:** For carbon buildup. Remove carbon with top engine cleaner. Follow instructions on can.
- **CHECK:** For incorrect basic engine parts such as cam, heads, pistons, etc.
- **CHECK:** For excessive oil entering combustion chamber.

ADDITIONAL CHECKS

- **CHECK:** Proper operation of EGR valve.
- **CHECK:** Proper operation of Thermac. See "Thermostatic Air Cleaner (THERMAC)," Section "12".
- **CHECK:** For proper transmission shift points. Refer to AUTOMATIC TRANSMISSION DIAGNOSIS (SECTION 7A) of appropriate service manual.
- **CHECK:** Torque Converter Clutch (TCC) operation. See "Automatic And Manual Transmission Controls," Section "10".
- **CHECK:** For correct PROM/MEM-CAL (see Service Bulletins).

HESITATION, SAG, STUMBLE

Definition: Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually most severe when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough.

PRELIMINARY CHECKS

- Perform the careful visual/physical checks as described at start of "Driveability Symptoms," Section "2".

FUEL SYSTEM

- **CHECK:** Fuel pressure. See "Computer Command Control," Section "3".
- **CHECK:** Throttle Position Sensor (TPS) - Check TPS for binding or sticking. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).
- **CHECK:** MAP sensor response and accuracy. Use MAP sensor output check in "Computer Command Control" Section "3".
- **CHECK:** Water/Contaminated fuel.
- **CHECK:** Cannister purge system for proper operation. See "Evaporative Emission Control System (EECS)," Section "5".

IGNITION SYSTEM

- **CHECK:** Spark plug wires for being faulty.
- **CHECK:** Spark plugs for being fouled.
- **CHECK:** Open ignition system ground, CKT 453. See "Ignition System/EST," Section "6".
- **CHECK:** Ignition timing. See "Vehicle Emission Control Information" label.

ADDITIONAL CHECKS

- **CHECK:** For correct PROM/MEM-CAL (see Service Bulletins).
- **CHECK:** Generator output voltage. Repair, if less than 9 or more than 16 volts.
- **CHECK:** EGR valve operation. See "Exhaust Gas Recirculation (EGR) System," Section "9".

CUTS OUT, MISSES

Definition: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. The exhaust has a steady spitting sound at idle or low speed.

PRELIMINARY CHECKS

- Perform the careful visual checks as described at start of "Driveability Symptoms," Section "2".
- If there is spray from only one injector, then, there is a malfunction in the injector assembly, or in the signal to the injector assembly. The malfunction can be isolated, by switching the injector connectors. If the problem remains with the original injector, after switching the connector, the injector is defective. Replace the injector. If the problem moves with the injector connector, the problem is an improper signal in the injector circuits, use CHART A-3 in "Computer Command Control," Section "3".

IGNITION SYSTEM

- **CHECK:** For cylinder miss by:
  1. Start engine, allow engine to stabilize then disconnect IAC motor. Remove one spark plug wire at a time, using insulated pliers.

CAUTION: Do not perform this test for more than 2 minutes, as this may cause damage to the catalytic converter.

  2. If there is an rpm drop, on all cylinders, (equal to within 50 rpm), go to "Rough, Unstable Or Incorrect Idle, Stalling" symptom. Reconnect IAC motor with ignition "OFF."
  3. If there is no rpm drop on one or more cylinders, or excessive variation in drop, check for spark, on the suspected cylinder(s) with J 26792 (ST-125) Spark Tester or equivalent. If no spark, see "Ignition System/EST," Section "6". If there is spark, remove spark plug(s) in these cylinders and check for:
     - Insulation Cracks
     - Wear
     - Improper Gap
     - Burned Electrodes
     - Heavy Deposits
- **CHECK:** Spark plug wire resistance (should not exceed 30,000 ohms), also, check rotor and distributor cap.
- **NOTICE:** If the previous checks did not find the problem:
  - Visually inspect ignition system for moisture, dust, cracks, burns, etc. With engine running spray plug wires with fine water mist to check for shorts.

FUEL SYSTEM

- **CHECK:** Fuel Pressure, use CHART A-6 in "Computer Command Control," Section "3".
- **CHECK:** For contaminated fuel or restricted fuel filter.

ENGINE MECHANICAL

- **CHECK:** For proper valve timing. Remove rocker covers. Check for bent pushrods, worn rocker arms, broken or weak valve springs, worn camshaft lobes. Repair as necessary. Refer to ENGINE MECHANICAL DIAGNOSIS (SECTION 6A) of appropriate service manual.
- **CHECK:** Low compression. Perform compression check. Refer to ENGINE MECHANICAL DIAGNOSIS (SECTION 6A) of appropriate service manual.
- **CHECK:** Intake and exhaust manifold passages for casting flash.

POOR FUEL ECONOMY

Definition: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

PRELIMINARY CHECKS

- Perform the careful visual/physical checks as described at start of "Driveability Symptoms," Section "2".
- Check air cleaner element (filter) for dirt or being plugged.
- Visually (physically) check: Vacuum hoses for splits, kinks, and proper connections as shown on "Vehicle Emission Control Information" label.
- Perform "Diagnostic Circuit Check."
- Check owner's driving habits.
  - Is A/C "ON" full time (Defroster mode "ON")?
  - Are tires at correct pressure?
  - Are excessively heavy loads being carried?
  - Is acceleration too much, too often?
- **NOTICE:** Suggest owner fill fuel tank and recheck fuel economy. Suggest driver read "Important Facts on Fuel Economy" in Owner's Manual.

FUEL SYSTEM

- **CHECK:** Fuel type, quality and alcohol content.
- **CHECK:** Fuel pressure. Use CHART A-6 in "Computer Command Control," Section "3".

IGNITION SYSTEM

- **CHECK:** Spark plugs. Remove spark plugs, check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Repair or replace as necessary.
- **CHECK:** Ignition wires for cracking, hardness, and proper connections.
- **CHECK:** ESC operation. Refer to "Electronic Spark Control (ESC)," Section "7".
- **CHECK:** Ignition timing. See "Vehicle Emission Control Information" label.

COOLING SYSTEM

- **CHECK:** Engine coolant level.
- **CHECK:** Engine thermostat for faulty part (always open) or for wrong heat range. Refer to ENGINE COOLING (SECTION 6B) of appropriate service manual.

ADDITIONAL CHECKS

- **CHECK:** Transmission shift pattern.
- **CHECK:** TCC Operation - Use "Automatic and Manual Transmission Controls," Section "10" or for 4L80-E, refer to ELECTRONIC TRANSMISSION CONTROL (SECTION 7A4) of appropriate vehicle service manual. A "Scan" tool should indicate an rpm drop when the TCC is commanded "ON."
- **CHECK:** For proper calibration of speedometer.
- **CHECK:** For dragging brakes.

ROUGH, UNSTABLE OR INCORRECT IDLE, STALLING

(Page 1 of 2)

Definition: The engine runs unevenly at idle. If bad enough, the vehicle may shake. Also, the idle may vary in rpm (called "hunting"). Either condition may be severe enough to cause stalling. Engine idles at incorrect speed.

PRELIMINARY CHECKS

- Perform the careful visual/physical checks as described at start of "Driveability Symptoms," Section "2".

SENSORS

- **CHECK:** Oxygen (O2) sensor - Inspect sensor for silicon contamination from fuel, or use of improper RTV sealant. The sensor will have a white, powdery coating, and will result in a high but false signal voltage (rich exhaust indication). The ECM/PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem.
- **CHECK:** Throttle Position Sensor (TPS) - If a sticking throttle shaft or binding linkage causes a high TPS voltage (open throttle indication, the ECM/PCM will not control idle. Monitor TPS voltage. A "Scan" tool and/or voltmeter should read less than 1.25 volts with throttle closed. See "Fuel Control System," Section "4".
- **CHECK:** Coolant Temperature Sensor (CTS) - Using a "Scan" tool compare coolant temperature with ambient temperature on a cold engine.
  - If coolant temperature reads 5 degrees greater than or less than ambient air temperature. Check for high resistance in coolant sensor circuit or sensor itself. Compare resistance value to "Diagnostic Aids" on facing page of Code 15.
- **CHECK:** MAP sensor response and accuracy - Refer to MAP voltage output check in "Computer Command Control," Section "3".

FUEL SYSTEM

- **NOTICE:** To determine if the condition is caused by a rich or lean system, the vehicle should be driven at the speed of the complaint. Monitoring block learn will help identify problem.
  Lean - Block learn greater than 150. Refer to "Diagnostic Aids" on facing page of Code 44.
  Rich - Block learn less than 115. Refer to "Diagnostic Aids" on facing page of Code 45.
- **CHECK:** Evaporative Emission Control System, use CHART C-3.
- **CHECK:** Perform a cylinder compression check. See ENGINE MECHANICAL DIAGNOSIS (SECTION 6A) of appropriate service manual.
- **CHECK:** For injector(s) leaking. Check fuel pressure, use CHART A-6 in "Computer Command Control," Section "3".

IGNITION SYSTEM

- **CHECK:** Ignition System. Refer to "Ignition System/EST," Section "6".
- **CHECK:** Ignition Timing. See "Vehicle Emission Control Information" label.

ROUGH, UNSTABLE OR INCORRECT IDLE, STALLING

(Page 2 of 2)

Definition: The engine runs unevenly at idle. If bad enough, the vehicle may shake. Also, the idle may vary in rpm (called "hunting"). Either condition may be severe enough to cause stalling. Engine idles at incorrect speed.

ADDITIONAL CHECKS

- **CHECK:** Vacuum leaks can cause higher than normal idle and low IAC counts.
- **CHECK:** IAC operation - See Code 35 in "Computer Command Control," Section "3" and "Diagnosis" in "Fuel Control System," Section "4".
- **CHECK:** ECM/PCM grounds for clean, tight, and proper routing. See "General Information," Section "1".
- **CHECK:** P/N switch circuit. See "Computer Command Control" Section "3", or use "Scan" tool, and be sure tool indicates vehicle is in drive with gear selector in drive or overdrive.
- **NOTICE:** Use "Scan" tool to determine if ECM is receiving A/C request signal. Whenever A/C is selected, see "Diagnosis" in "Computer Command Control," Section "3".
  If problem exists with A/C "ON," check A/C system operation. See AIR CONDITIONING (SECTION 1B)
- **CHECK:** EGR "ON," while idling, will cause roughness, stalling and hard starting. See "Exhaust Gas Recirculation (EGR) System," Section "9".
- **CHECK:** Battery cables and ground straps should be clean and secure. Erratic voltage will cause IAC to change its position, resulting in poor idle quality.
- **CHECK:** IAC valve will not move, if system voltage is below 9 or greater than 16 volts.
- **CHECK:** A/C refrigerant pressure too high.
- **CHECK:** For overcharge or faulty high pressure switch.
- **CHECK:** PCV valve for proper operation by placing finger over inlet hole in valve end several times. Valve should snap back. If not, replace valve. See "Positive Crankcase Ventilation (PCV)," Section "11".
- **CHECK:** Air system. See "Air Management System," Section "8".

ENGINE MECHANICAL

- **CHECK:** For broken motor mounts.
- **CHECK:** For low compression See ENGINE MECHANICAL DIAGNOSIS (SECTION 6A) of appropriate service manual.

EXCESSIVE EXHAUST EMISSIONS OR ODORS

Definition: Vehicle fails an emission test. Vehicle has excessive "rotten egg" smell. Excessive odors do not necessarily indicate excessive emissions.

PRELIMINARY CHECKS

- Perform "Diagnostic Circuit Check."
- If EMISSION TEST shows excessive CO and HC check items which cause vehicle to run RICH. (Block Learn Memory (BLM) less than 115) refer to "Diagnostic Aids" on facing page of Code 45. Make sure engine is at normal operating temperature.
- If EMISSION TEST shows excessive NOx check items which cause car to run LEAN or too hot.

SENSORS

- **NOTICE:** If the "Scan" tool indicates a very high coolant temperature and the system is running LEAN: Check the Cooling System and Cooling Fan for proper operation.

FUEL SYSTEM

- **NOTICE:** If the system is running rich, (block learn less than 115), refer to "Diagnostic Aids" on facing page of Code 45. If the system is running lean, (block learn greater than 150), refer to "Diagnostic Aids" on facing page of Code 44.
- **CHECK:** For properly installed fuel cap.
- **CHECK:** Fuel pressure, use CHART A-6 in "Computer Command Control," Section "3".
- **NOTICE:** If test shows excessive NOx, check items which cause car to run LEAN or too hot.
- **CHECK:** Canister for fuel loading, see "Evaporative Emission Control System (EECS)," Section "5".

IGNITION SYSTEM

- **CHECK:** Ignition system. See "Ignition System/EST," Section "6".
- **CHECK:** For incorrect timing or excessive advance. See "Vehicle Emission Control Information" label.
- **CHECK:** Spark plugs, plug wires, and ignition components. Refer to ENGINE ELECTRICAL (SECTION 6D) of appropriate service manual.

ADDITIONAL CHECKS

- **CHECK:** For vacuum leaks.
- **CHECK:** For lead contamination of catalytic converter (look for the removal of fuel filler neck restrictor).
- **CHECK:** Carbon build-up. Remove carbon with top engine cleaner. Follow instructions on can.
- **CHECK:** EGR valve for not opening. See "Exhaust Gas Recirculation (EGR) System," Section "9".
- **CHECK:** PCV valve for being plugged, stuck, or blocked PCV hose, or fuel in the crankcase. See "Positive Crankcase Ventilation (PCV)," Section "11".
- **CHECK:** For presence of fuel in crankcase.

DIESELING, RUN-ON

Definition: Engine continues to run after key is turned "OFF," but runs very roughly. If engine runs smoothly, check ignition switch and adjustment.

PRELIMINARY CHECKS

- Perform the careful visual/physical checks as described at start of "Driveability Symptoms," Section "2".

FUEL SYSTEM

- **CHECK:** Evaporative system and fuel tank venting.
- **CHECK:** Injector(s) for leaking. Apply 12 volts to fuel pump "test" terminal to turn "ON" fuel pump and pressurize fuel system. Visually check injector(s) and TBI assembly for fuel leakage. Refer to "Fuel Control System," Section "4".

BACKFIRE

Definition: Fuel ignites in intake manifold, or in exhaust system, making a loud popping noise.

PRELIMINARY CHECKS

- Perform the careful visual/physical checks as described at start of "Driveability Symptoms," Section "2".

IGNITION SYSTEM

- **CHECK:** Proper ignition coil output voltage with spark tester J 26792 or equivalent (ST-125).
- **CHECK:** Spark plugs. Remove spark plugs, check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Repair or replace as necessary.
- **CHECK:** Ignition system. See "Ignition 'System/EST," Section "6".
- **CHECK:** For crossfire between spark plugs (distributor cap, spark plug wires, and proper routing of plug wires.) Refer to ENGINE ELECTRICAL (SECTION 6D) of appropriate service manual.
- **CHECK:** Ignition timing. See "Vehicle Emission Control Information" label.

ENGINE MECHANICAL

- **CHECK:** Compression. Perform a compression check - look for sticking or leaking valves. Refer to ENGINE MECHANICAL DIAGNOSIS (SECTION 6A).
- **CHECK:** Valve timing.
- **CHECK:** Intake manifold gasket for vacuum leaks.
- **CHECK:** Faulty A.I.R. check valve.
- **CHECK:** EGR operation for being open all the time. Use CHART C-7.
- **CHECK:** Intake and exhaust system for casting flash or other restrictions.

BLANK

SECTION 3
COMPUTER COMMAND CONTROL
(USING "SCAN" TOOL DIAGNOSIS)
CONTENTS

GENERAL DESCRIPTION

The Computer Command Control system has a computer (Electronic Control Module or Powertrain Control Module) to control the fuel delivery, ignition timing, some emission control systems and engagement of the transmission converter clutch, or the Manual Transmission Shift Light.

The system, through the Electronic or Powertrain Control Module (ECM/PCM), monitors a number of engine and vehicle functions (Figure 3-1) and controls the following operations:

- Fuel control
- Ignition/electronic spark timing
- Electronic spark control
- Air management
- Exhaust gas recirculation
- ECM - Torque Converter Clutch or Manual Transmission Shift Light.
- PCM - Transmission shift and shift quality functions. Specific transmission control diagnostics are covered in Section "7A4" of the appropriate vehicle service manual

The diagnosis in this section is provided when a "Scan" tool to interface with the Computer Command Control system is available.

TERMINAL IDENTIFICATION

- A GROUND
- B DIAGNOSTIC TERMINAL
- C A.I.R. (IF USED)
- E SERIAL DATA (SEE SPECIAL TOOLS)
- F T.C.C. (IF USED)
- G FUEL PUMP (CK)
- H BRAKE SENSE SPEED INPUT (CK)
- M SERIAL DATA (SEE SPECIAL TOOLS)

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Figure 3-2 - ALDL Connector

ALDL Connector
Figure 3-2

The Assembly Line Diagnostic Link (ALDL) twelve terminal connector is wired to the ECM/PCM and is located under the instrument panel in the passenger compartment.

This connector has terminals that are used to diagnose the system either with jumper wires or a "Scan" tool.

The following terminals are used:

A - This terminal provides a ground circuit to other terminals.

* OPERATING CONDITIONS SENSED

- A/C "On" or "OFF"
- Engine Coolant "Temperature"
- Engine Crank Signal
- Exhaust Oxygen(O_2) Sensor
- Distributor Reference
  - Crankshaft Position
  - Engine Speed (RPM)
- Manifold Absolute Pressure (MAP)
- Park/Neutral (P/N) Switch Position
- System Voltage
- Throttle Position Sensor (TPS)
- Transmission Gear Position
- Vehicle Speed (VSS)
- Fuel Pump Voltage
- Power Steering Pressure Switch (PSPS)
- EGR Vacuum
- E-Cell - 2.8L
- Engine Knock (ESC)
- Intake Air Temperature (IAT)

→ ELECTRONIC (ENGINE) CONTROL MODULE (ECM) →

* SYSTEMS CONTROLLED

- Air Management
- Exhaust Gas Recirculation (EGR)
- Electronic Spark Timing (EST)
- Fuel Control
  - Idle Air Control (IAC)
  - Electric Fuel Pump
- Transmission Converter Clutch (TCC), or Manual Transmission Shift Light
- Air Conditioning
- Diagnostics
  - "Service Engine Soon" Light
  - Diagnostic Terminal (ALDL)
  - Data Output (ALDL)
- Electronic Spark Control (ESC)

*All systems not used on all engines.

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Figure 3-1 - Computer Command Control System

B - This terminal is the "diagnostic terminal" for the ECM/PCM. When grounded to "A" terminal, the "Service Engine Soon" light will flash codes (key "ON" and engine "OFF") entering the diagnostic mode or flashes a field service mode (engine running) to determine if system is in a "Closed Loop" or "Open Loop" operation.

C - This terminal, on some air management systems, is wired to the ground side of the electric air control valve. It can be used to diagnose the air management system. Refer to "Air Management," Section "8."

E - This terminal is the serial data line on all engines except 2.5L and PCM equipped vehicles and is used by a "Scan" tool to read various system data information.

F - This terminal is used on ECM equipped vehicles to diagnose the TCC system and is wired to the ground side of the TCC solenoid. Refer to "Automatic Transmission Converter Clutch and Manual Transmission Shift Light," Section "10."

G - This terminal is used to diagnose the fuel pump circuit on all "C/K" series. On other engines the fuel pump test lead is in the engine compartment near the fuel pump relay. Refer to CHART A-5 or A-5A.

H - This terminal is used to diagnose the brake system on "C/K" trucks. Refer to "C/K Light Duty" Service Manual for additional information.

M - This terminal is the serial data line for the 2.5L engines and PCM equipped vehicles and is used by a "Scan" tool to read various system data information.

Wiring Harness and Connectors

A wiring harness electrically connects the ECM/PCM to various sensors, solenoid and relays within the system. Many connectors in the engine compartment are environmentally protected because of the systems low voltages and current levels.

Information Sensors

In addition to the ECM/PCM, the Computer Command Control system has the following information sensors:

- Oxygen (O_2) sensor
- Coolant Temperature Sensor (CTS)
- Throttle Position Sensor (TPS)
- Manifold Absolute Pressure (MAP) sensor
- Vehicle Speed Sensor (VSS)
- Intake Air Temperature (IAT) sensor
- Knock sensor

and the following input signals:

- Park/Neutral (P/N) switch signal
  OR
- Pressure Switch Manifold (PSM)
- Crank signal
- Distributor reference signal
- Power Steering Pressure Switch (PSPS) signal
- A/C control signal
- Transmission gear position signal

Electrostatic Discharge Damage

Electronic components used in control systems are often designed to carry very low voltage, and are very susceptible to damage caused by electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat, in which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTICE: To prevent possible Electrostatic Discharge damage:

- Do Not touch the ECM/PCM connector pins or soldered components on the ECM/PCM circuit board.
- When handling a PROM, CAL-PAK or MEM-CAL, Do Not touch the component leads, and Do Not remove integrated circuit from carrier.
- Be sure to follow the guidelines listed below if servicing any of these electronic components.

1. Do not open the replacement part package until it is time to install the part.
2. Avoid touching electrical terminals of the part.
3. Before removing the part from its package, ground the package to a known good ground on the vehicle.
4. Always touch a known good ground before handling the part. This step should be repeated before installing the part if the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance.

ELECTRONIC CONTROL MODULE
Figure 3-3 or 3-4

The Electronic Control Module (ECM) or Powertrain Control Module (PCM) is located in the passenger compartment and is the control center of the Computer Command Control system.

The ECM/PCM constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM/PCM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the "Service Engine Soon" light, and store a code or codes which identify the problem areas to aid the technician in making repairs. See diagnosis section for more information.

The ECM/PCM is designed to process the various input information (Figure 3-1) and then sends the necessary electrical responses to control fuel delivery, spark timing and other emission control systems. The input information has an interrelation to more than one output, therefore, if the one input failed it could effect more than one systems operation.

The ECM/PCM has a "learning" ability which allows it to make corrections for minor variations in the fuel system to improve driveability. If the battery is disconnected to clear codes, or for repair, the "learning" process has to begin all over again.

A change may be noted in the vehicle's performance. To "teach" the vehicle, make sure the engine is at operating temperature, and drive at part throttle, with moderate acceleration and idle conditions, until normal performance returns.

> **NOTICE:** The ECM/PCM must be maintained at a temperature below 85°C (185°F) at all times. This is most essential if the vehicle is put through a paint baking process. The ECM/PCM will become inoperative if its temperature exceeds 85°C (185°F). Therefore, it is recommended that temporary insulation be placed around the ECM/PCM during the time the vehicle is in a paint oven or other high temperature processes.

There are two types of ECM's used in light duty trucks.

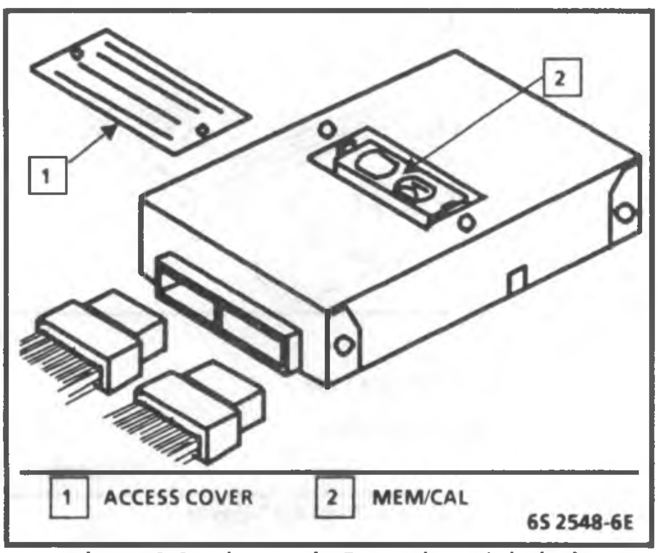


Figure 3-3 - Electronic Control Module (L4)

A vehicle equipped with a 4 cylinder engine has an ECM (referred to as GMP4) with two parts for service. A controller (an ECM without a MEM-CAL) and a MEM-CAL (Memory and Calibration unit).

Vehicles with a V6 or V8 cylinder engine have an ECM (referred to as GMCM) with three parts for service. A controller (an ECM without a PROM), a PROM with specific program information for an engine and vehicle and a CAL-PAK with specific calibration information.

Vehicles with the Hydramatic 4L80-E transmission have a Powertain Control Module (PCM) or GMP6 which use a Memory and Calibration unit (MEM-CAL)

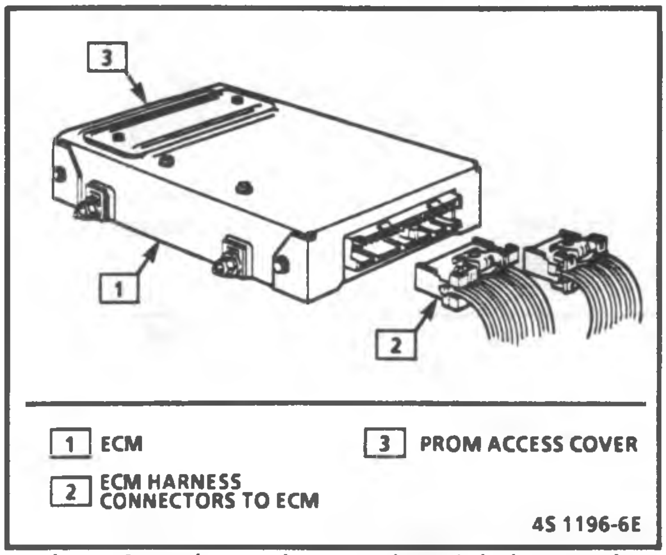


Figure 3-4 - Electronic Control Module (V6 & V8)

MEM-CAL (L4, or V6 & V8 Automatic Transmission Vehicles over 8500 GVW) *Figure 3-3*

This assembly contains both the functions of the PROM and CAL-PAK. Like the PROM, it contains the calibrations needed for a specific vehicle as well as the back-up fuel control circuitry required if the rest of the ECM/PCM becomes damaged or faulty.

PROM (V6 & V8 Manual Transmission Vehicles under 8600 GVW) *Figure 3-5*

Information for specific engine and vehicle is programmed using an integrated circuit called a PROM, (Programmable Read-Only Memory). In the parts book, it is listed as a calibrator. This allows one model of controller to be used for many different vehicles. The PROM is located inside the ECM and has information on the vehicle's weight, engine, transmission, axle ratio, and several others. While one ECM part number can be used by many vehicle lines, a PROM is very specific and must be used for the right vehicle.

For this reason, it is very important to check the latest parts book and Service Bulletin information for the correct part number when replacing a PROM.

CAL-PAK (V6 & V8)
Figure 3-5

A CAL-PAK is used to allow fuel delivery if other parts of the ECM are damaged. If the CAL-PAK is missing, it will result in a no start and run condition. NOTE: On some vehicles, the CAL-PAK is soldered in.

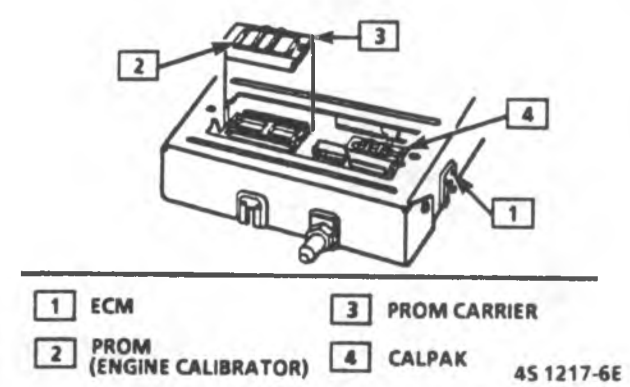


Figure 3-5 - PROM and CAL-PAK (V6 & V8 under 8600 GVW)

FUEL CONTROL

Fuel delivery is controlled by the Computer Command Control system. The general description of fuel control is in Section "4." This includes the fuel injector, pressure regulator, idle air control valve and the fuel pump electrical circuit.

INPUT INFORMATION

Coolant Temperature Sensor (CTS)
Figure 3-6

The Coolant Temperature Sensor (CTS) is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance (100,000 ohms at -40°C/-40°F) while high temperature causes low resistance (70 ohms at 130°C/266°F).

The ECM/PCM supplies a 5 volt signal to the Coolant Temperature Sensor (CTS) through a resistor in the ECM/PCM and measures the voltage. The voltage will be high when the engine is cold, and low when the engine is hot. By measuring the voltage, the ECM/PCM knows the engine coolant temperature. Engine coolant temperature affects most systems the ECM/PCM controls.

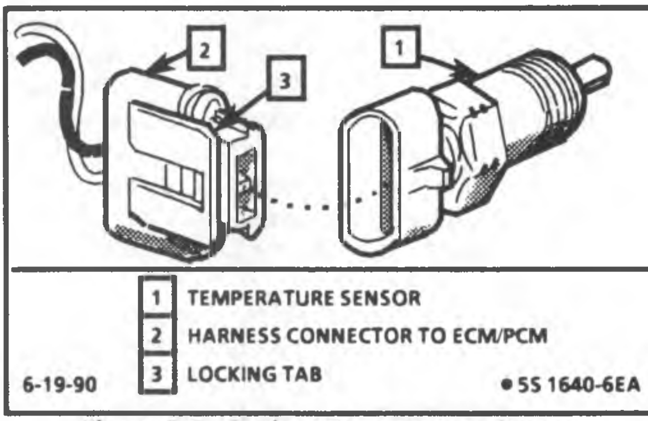


Figure 3-6 - Coolant Temperature Sensor

Manifold Absolute Pressure (MAP) Sensor
Figure 3-7

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure, which result from engine load and speed changes, and converts this to a voltage output.

A closed throttle on engine coastdown will produce a relatively low MAP output, while a Wide Open Throttle (WOT) will produce a high output. This high output is produced because the pressure inside the manifold is the same as outside the manifold, so 100% of the outside air pressure is measured.

The MAP sensor reading is the opposite of what you would measure on a vacuum gage. When manifold pressure is high, vacuum is low. The MAP sensor is also used to measure barometric pressure under certain conditions, which allows the ECM/PCM to automatically adjust for different altitudes.

The ECM/PCM sends a 5 volt reference signal to the MAP sensor. As the manifold pressure changes, the electrical resistance of the sensor also changes.

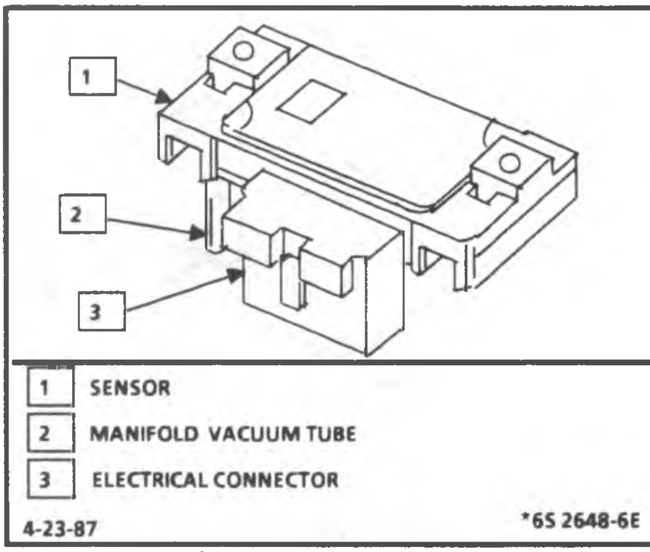


Figure 3-7 - MAP Sensor

By monitoring the sensor output voltage, the ECM/PCM knows the manifold pressure. A higher pressure, low vacuum (high voltage) requires more fuel, while a lower pressure, higher vacuum (low voltage) requires less fuel.

The ECM/PCM uses the MAP sensor to control fuel delivery and ignition timing.

Oxygen (O_2) Sensor
Figure 3-8

The exhaust Oxygen (O_2) sensor is mounted in the exhaust system where it can monitor the oxygen content of the exhaust gas stream. The oxygen content in the exhaust reacts with the oxygen sensor to produce a voltage output. This voltage ranges from approximately .1 volt (high oxygen - lean mixture) to .9 volt (low oxygen - rich mixture).

By monitoring the voltage output of the oxygen sensor, the ECM/PCM will know what fuel mixture command to give to the injector (lean mixture-low voltage-rich command, rich mixture-high voltage-lean command).

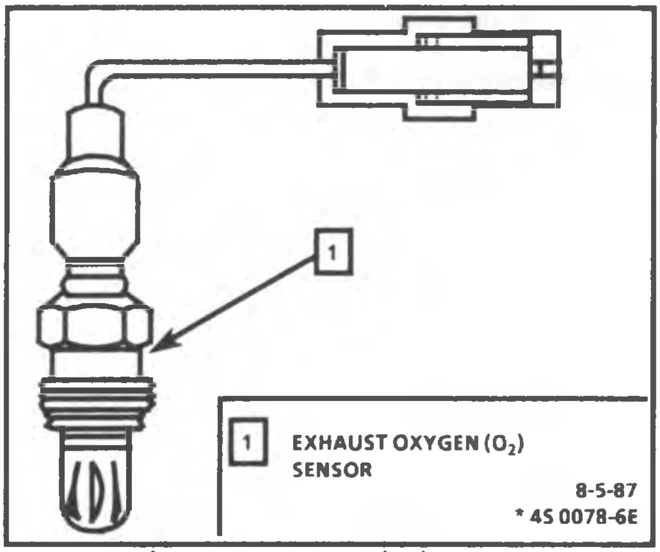


Figure 3-8 - Oxygen (O_2) Sensor

Throttle Position Sensor (TPS)
Figure 3-9 or 3-10

The Throttle Position Sensor (TPS) is connected to the throttle shaft on the TBI unit. It is a potentiometer with one end connected to 5 volts from the ECM/PCM and the other to ground. A third wire is connected to the ECM/PCM to measure the voltage from the TPS. As the throttle valve angle is changed (accelerator pedal moved), the output of the TPS also changes. At a closed throttle position, the output of the TPS is low (approximately .5 volt). As the throttle valve opens, the output increases so that, at Wide Open Throttle (WOT), the output voltage should be approximately 5 volts.

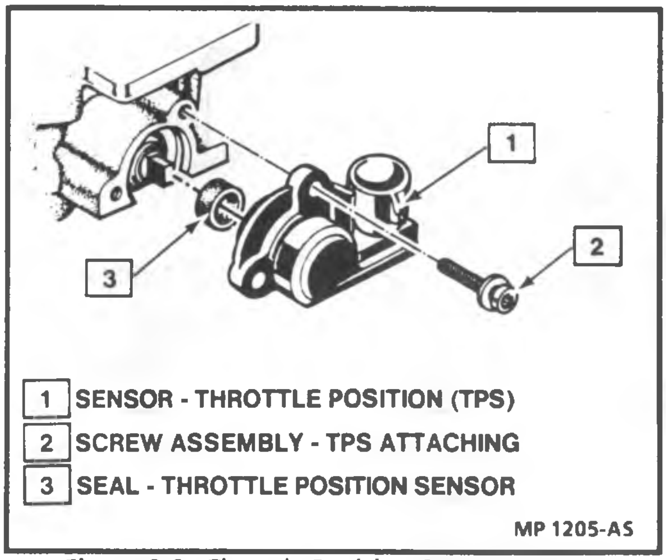


Figure 3-9 - Throttle Position Sensor - V6/V8

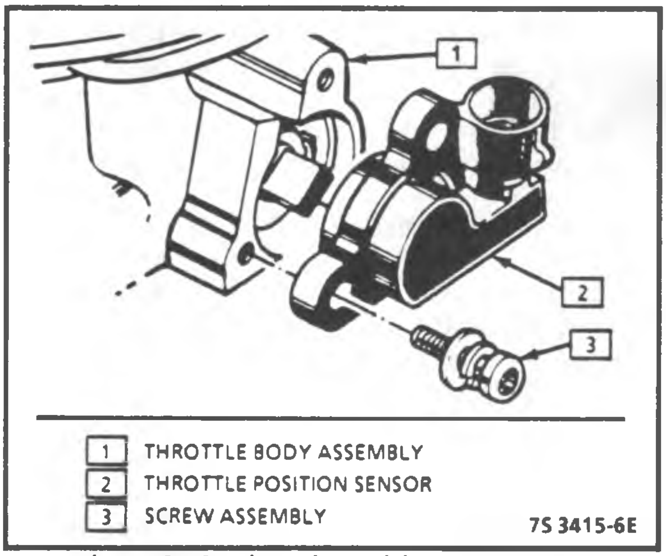


Figure 3-10 - Throttle Position Sensor - L4

By monitoring the output voltage from the TPS, the ECM/PCM can determine fuel delivery based on throttle valve angle (driver demand).

Intake Air Temperature (IAT) Sensor
Figure 3-11

The Intake Air Temperature (IAT) sensor is a thermistor (a resistor which changes value based on temperature) mounted on a 2.5L engine in the manifold.

Low temperature produces a high resistance (100,000 ohms at -40°C/-40°F) while high temperature causes low resistance (70 ohms at 130°C/266°F).

The ECM supplies a 5 volt signal to the sensor through a resistor in the ECM and measures the voltage. The voltage will be high when the manifold air is cold, and low when the air is hot. By measuring the voltage, the ECM knows the Intake Air Temperature (IAT).

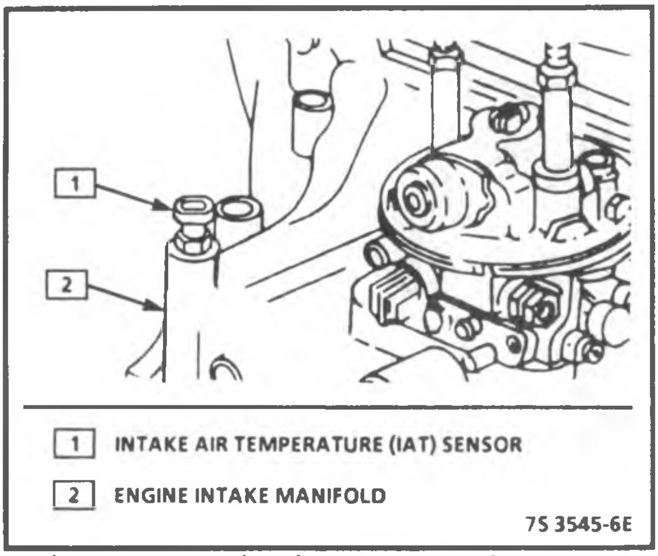


Figure 3-11 - Intake Air Temperature Sensor - L4

The IAT sensor signal is used by the ECM to delay EGR until the Intake Air Temperature (IAT) reaches about 5°C (40°F).

The ECM uses the signal to slightly retard the timing during high ambient air temperatures.

Vehicle Speed Sensor (VSS)

The Vehicle Speed Sensor (VSS) is made up of a coil mounted on the transmission and a tooth rotor mounted to the output shaft in the transmission. As each rotor tooth nears the coil, the coil produces an AC voltage pulse. As the vehicle speed increases the number of AC voltage pulses per second increases. The Digital Ratio Adapter Controller (DRAC) processes inputs from the VSS and output signal to the speedometer, ECM/PCM, and cruise control module. The DRAC takes the voltage pulses from the VSS and uses them to open and close four solid state output switches to ground at a rate proportional to vehicle speed. The DRAC is matched to the vehicle based on final drive ratio and tire size. It is important to ensure that the correct DRAC is installed in the vehicle if replacement is necessary.

Knock Sensor

Located on the engine block, the knock sensor retards ignition timing during a spark knock condition to allow the ECM/PCM to maintain maximum timing advance under most conditions.

Park/Neutral (P/N) Switch Signal

The Park/Neutral (P/N) switch, located on the steering column, is used on 4L60 automatic transmission equipped vehicles to indicate to the ECM when the transmission is in "Park" or "Neutral." This information is used to control the operation of the Transmission Converter Clutch (TCC) and Idle Air Control (IAC).

Pressure Switch Manifold (PSM)

A gear range sensing device called a Pressure Switch Manifold (PSM) is used by the PCM to sense what gear range has been selected by the vehicle operator. The PSM is located on the valve body and consists of five pressure switches combined into one unit.

Crank Signal

The ECM uses this signal to tell when the vehicle is in the STARTING mode. This information is used to allow enrichment and cancel diagnostics while engine is cranking.

Distributor Reference Signal

The distributor sends a signal to the ECM/PCM to indicate engine rpm. See "Ignition System/EST," Section "6" for further information.

Power Steering Pressure Switch (PSPS) Signal

The Power Steering Pressure Switch (PSPS) is used with the 4-cylinder engine and is located near the power steering gear. When steering is to the extreme left or right, the switch is closed and this signal will increase the idle speed and retard the spark for a stable idle.

A/C Control Signal

This signal indicates that the A/C control switch is turned "ON" and the pressure switch is closed. The ECM/PCM uses this signal to adjust the idle speed and on 2.5L, 2.8L, and 4.3L automatic transmission on S/T engines, engages the A/C compressor clutch.

Transmission Gear Position Signal

A switch, located inside the automatic transmission, opens when the transmission shifts to high gear. This signal is used for delayed disengagement of the Torque Converter Clutch (TCC). Refer to "Automatic Transmission Converter Clutch and Manual Transmission Shift Light," Section "10" for specific application.

Diagnostic Mode

If the diagnostic terminal "B", in ALDL connector, is grounded with the ignition "ON" and the engine stopped, the system will enter the diagnostic mode.

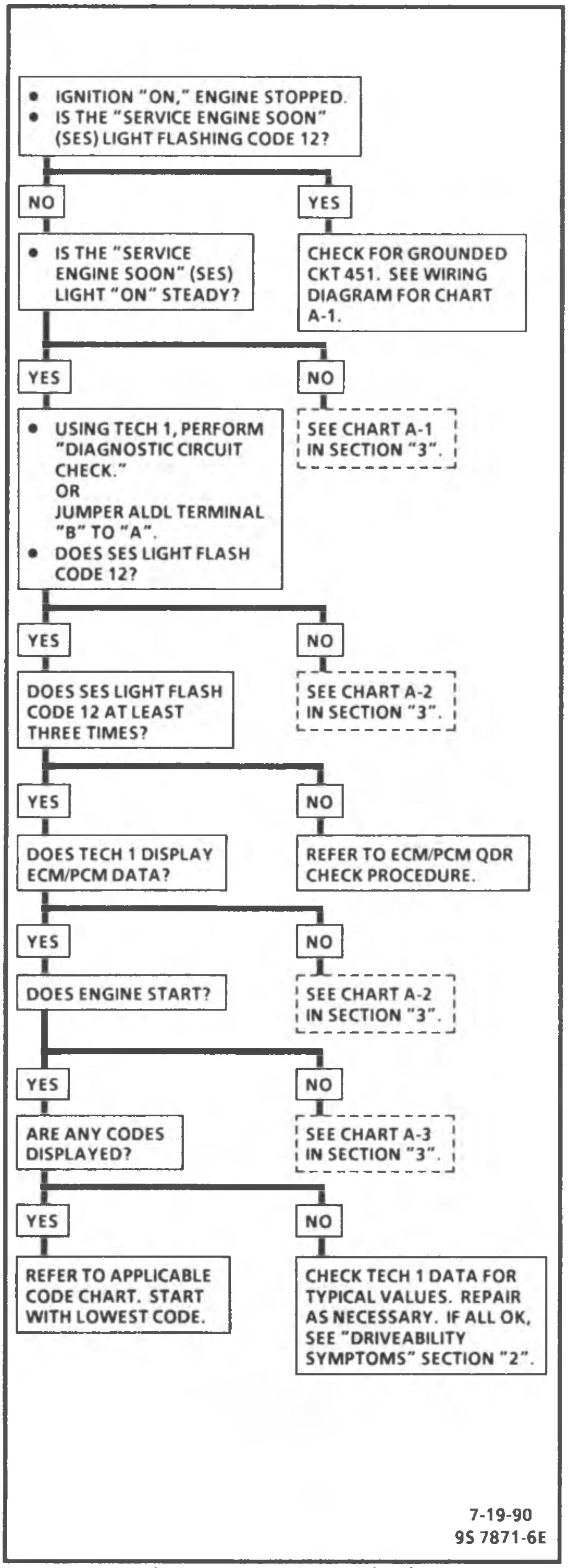


Figure 3-12 - System Check

With the key "ON" and the engine "OFF," jumper ALDL terminal "B" to "A." The "Service Engine Soon" light should flash Code 12 to indicate that the diagnostic system is working. Code 12 consists of "one flash" followed by a pause and then "two flashes." The code will repeat for a total of three times and will continue to repeat if there are no other codes stored. This procedure can also be done with some "Scan" tools. If the "Service Engine Soon" light flashes Code 12 less than 3 times, perform ECM/PCM Quad-Driver check procedures (Figures 3-18 and 3-19).

If Code 12 does not display, refer to CHART A-2. A flashing Code 12 does not mean an engine problem; it simply means that the diagnostic mode is working. Any other stored codes (Figure 3-16) will begin to flash after Code 12.

Field Service Mode

If the diagnostic terminal "B" is grounded with the engine running, the system will enter the field service mode. In this mode, the "Service Engine Soon" light will show whether the system is in "Open" or "Closed Loop" and fuel system is operating normally.

In "Open Loop," the light flashes in every 2.5 seconds in "Closed Loop" the light flashed every second.

Tech 1

The diagnostic procedures in this manual assume the use of a "Scan" tool. Since the Tech 1, produced by Expertec, is able to perform functions, such as, bidirectional communication that other "Scan" tools are unable to perform, it has been made an essential tool. Although, the term "Scan" tool will continue to be used for simplicity's sake, we recommend the Tech 1 be used when ever possible. In fact, any procedure calling for bidirectional communication with the PCM will require the use of a Tech 1. Explicit instructions on connecting, and using the various Tech 1 functions are contained in the Tech 1 owner's manual.

Tech 1 is designed to interface with the Computer Command Control system. It supplies a visual reading of most inputs to the ECM/PCM and some outputs.

Connect a "Scan" tool to the ALDL and cigarette/cigar lighter connector or 12 volts and there should be a visual instruction displayed. If there is no display or tool reads "No DATA or No ALDL" with ignition "ON," refer to CHART A-2.

With the tool in the code position, the display window will indicate any code stored in the ECM/PCM memory (Figure 3-16). Referring to the applicable code chart, the tool will "Scan" an input to determine if a specific circuit is operating properly. If there are no codes, the system check is completed. Additional information on "Scan" tools is in "Special Tools and Specifications," Section "13."

If there are additional driveability symptoms, refer to "Driveability Symptoms," Section "2".

If there are additional codes, refer to applicable code chart.

Engine Does Not Start

If the engine cranks but will not start, refer to CHART A-3 through A-6 to determine if there is a fuel or ignition problem.

Code System
Figure 3-16

The ECM/PCM is equipped with a self-diagnosis system which detects system failure and aids the technician in locating the circuit at fault via a code.

The ECM/PCM is really a computer. It uses sensors to look at many engine operating conditions. It has a memory and it knows what a certain sensor reading should be under certain conditions. These conditions are described on the facing page of each code chart. If a sensor reading is not what the ECM/PCM thinks it should be, the ECM/PCM will turn "ON" the "Service Engine Soon" light on the instrument panel, and will store a code in the memory. The code tells which circuit the trouble is in. A circuit consists of a sensor, such as coolant temperature, the wiring and connectors to it, and the ECM/PCM.

An "intermittent" code is one which does not reset and is not present while you are working on the vehicle. This is often caused by a loose connection. The facing page of a code chart will contain diagnostic aids to help in detecting intermittents.

A "hard" code is one which is present when you are working on the vehicle and still exists during diagnosis. The chart with the stored code number will lead you to the cause of the problem.

Clearing Codes

When the ECM/PCM sets a code, the "Service Engine Soon" light will come "ON" and a code will be stored in memory. If the problem is intermittent, the light will go out after 10 seconds when the fault goes away. However, the code will stay in the ECM/PCM memory for 50 starts or until the battery voltage to the ECM/PCM is removed. Removing battery voltage for 30 seconds will clear all stored codes.

Codes should be cleared after repairs have been completed. Also, some diagnostic charts will tell you to clear the codes before using the chart. This allows the ECM/PCM to set the code while going through the chart, which will help to find the cause of the problem more quickly.

NOTICE: To prevent ECM/PCM damage, the key must be "OFF" when disconnecting or reconnecting power to ECM/PCM (for example battery cable, ECM/PCM pigtail, ECM/PCM fuse, jumper cables, etc.).

DIAGNOSIS

The Computer Command Control system has a diagnostic system built into the ECM/PCM to indicate a failed circuit. An amber "Service Engine Soon" light on the instrument panel will illuminate if a problem has been detected when the engine and vehicle are running. This light is also used for a bulb and system check.

The System Check is the starting point for the diagnostic procedures or an emissions test failure. The diagnostic charts are related to the ECM/PCM and will determine if the ECM/PCM is working properly. This section diagnoses the fuel system controlled by the ECM/PCM and has charts to diagnose a circuit when the ECM/PCM has displayed a code.

The system requires an ALDL read-out "Scan" tool, tachometer, test light, ohmmeter, digital voltmeter with 10 megohms impedance (J 34029A), vacuum gage and jumper wires for diagnosis. Refer to "Special Tools and Specifications," Section "13" for additional information about special tools.

BULB CHECK

With the ignition "ON" and engine not running, the lamp should illuminate, which indicates that the ECM/PCM has completed the circuit to turn "ON" the light.

If the "Service Engine Soon" light is not "ON," refer to CHART A-1 for diagnosis.

When the engine is started, the light will turn "OFF." If the light remains "ON," refer to system check.

SYSTEM CHECK
Figure 3-12

Since this is the starting point for the diagnostic procedures or finding the cause of an emissions test failure, always begin here.

The system check is performed through the twelve terminal assembly line diagnostic link (ALDL) connector (Figure 3-2) under the instrument panel in the passenger compartment.

The Computer Command Control System Check is a procedure that determines the following:

1. Bulb Check - to check SES light circuit and that the ECM/PCM can complete the circuit.

2. Diagnostic Mode - this indicates if the diagnostic code system is working.
3. "Scan" Data - this determines if the ECM/PCM is supplying input and output visual data.
4. Engine Start - this step is done after it has been determined that the ECM/PCM will display codes and data.
5. Other Codes - Proceed to applicable chart if a code is displayed. Scanning the data for typical values may indicate a problem area if they are incorrect. If all systems appear to be functioning, review the "Driveability Symptoms," Section "2."

The system check starts with a bulb check. If there is no "Service Engine Soon" light, refer to CHART A-1.

ELECTRONIC CONTROL MODULE (ECM)/PCM

The diagnosis of the Electronic Control Module (ECM) or Powertrain Control Module (PCM) starts with the system check. The code system indicates a failure of a specific circuit and diagnosis may indicate replacement of the ECM/PCM. A Code 55 indicates that the ECM/PCM has failed and must be replaced.

If the ECM/PCM has been replaced and the condition was not corrected, the following information may be the cause:

- An incorrect ECM/PCM or PROM/MEM-CAL application may cause a malfunction and may or may not set a code.
- If the connector at the ECM/PCM is the possible problem, the terminal may have to be removed from the connectors in order to properly check them.
- Although the PROM/MEM-CAL rarely fails, it operates as part of the ECM/PCM, therefore, it could be the cause of the problem.
- Although a rare condition, the replacement ECM/PCM may be faulty.
- In the case of an intermittent problem, refer to "Driveability Symptoms," Section "2" and make a careful physical inspection of the system involved.
- A shorted solenoid, relay coil or harness may cause an ECM/PCM to fail and a replacement ECM/PCM to fail when it is installed. Use a short tester J 34636, BT-8405, or equivalent as a fast, accurate means of checking for a short circuit.
- Refer to ECM/PCM Quad-Driver (QDR) check before replacing ECM/PCM. (Figure 3-18 & 3-19.)

ECM/PCM Quad Driver (QDR) Check

The ECM/PCM uses an Integrated Circuit (IC) called a Quad-Driver (QDR) in place of separate transistors to turn "ON" or "OFF" different circuits controlled by the ECM/PCM. Each QDR has four separate outputs that can independently turn "ON or "OFF" four different circuits.

ECM/PCM on all engines are fault protected, therefore, a single faulty circuit may cause all four QDR outputs to be inoperative or "ON" all the time. A failed QDR usually results in either a shorted or open ECM/PCM output. Because of the increased current flow, two QDR outputs are used to drive the TCC solenoid.

Refer to the ECM/PCM QDR check procedure (Figures 3-18 and 3-19). This check will not test all ECM/PCM functions but it will determine if a specific circuit has caused a specific QDR to fail in the ECM/PCM.

A faulty circuit is the largest cause of a failed QDR, therefore, the check procedure should be used if there is an indication of an ECM/PCM replacement, especially if the removed ECM/PCM exhibits characteristics of a damaged QDR such as:

- "SES" light with no codes stored.
- Engine will not start and/or ECM/PCM will not flash Code 12.
- Flickering, intermittent, or dim "SES" light.
- Output, such as TCC circuit, is inoperative or "ON" at all times.
- Engine misfires, surges or stalls.
- "Scan" tool is erratic or inoperative.

The ECM/PCM used on all engines has IC circuits that are fault protected, therfore, if a circuit has failed, the IC may not be damaged and will keep the circuit open until the fault in the circuit has been corrected. When the fault has been corrected, reinstall ECM/PCM and check circuit. Replace ECM/PCM only if the circuit is still inoperative.

PROM

A PROM that has failed or was installed improperly will generally set a Code 51.

MEM-CAL

A MEM-CAL that has failed or was installed improperly will set a Code 51.

CAL-PAK

A no start and run condition will result if the CAL-PAK is not installed in the ECM/PCM. A CAL-PAK that is removed will set a Code 52.

FUEL CONTROL

Fuel delivery is controlled by the Computer Command Control system.

The diagnosis of fuel control starts with "Engine Cranks But Will Not Run" CHART A-3. This chart will test the fuel system and if there is a problem, will lead you to checking the fuel pump relay circuit, diagnosing the injector circuit or diagnosing the fuel system.

Fuel Injector

Testing the fuel injector circuit is in CHART A-3 with additional diagnosis in CHART A-4.

A fuel injector which does not open may cause a "no start" condition. An injector which is stuck partly open, could cause loss of pressure after sitting, so long crank times would be noticed on some engines. Also, dieseling could occur because some fuel could be delivered to the engine after the key is turned "OFF."

Pressure Regulator

Testing the pressure regulator circuit is in CHART A-3 and A-4.

If the pressure regulator in the TBI supplies pressure which is too low (below 62 kPa or 9 psi), poor performance could result. If the pressure is too high, unpleasant exhaust odor may result.

Idle Air Control (IAC)

The diagnosis of Idle Air Control (IAC) can be found in the Code 35 chart for 2.5L engines and "Fuel Control," Section "4" for all other engines.

If the IAC valve is disconnected or connected with the engine running, the idle rpm may be wrong. The IAC valve may be reset by turning the ignition switch "ON" and "OFF" one time.

The IAC valve affects only the idle characteristics of the engine. If it is open fully, too much air will be allowed in the manifold and idle speed will be high. If it is stuck closed, too little air will be allowed in the manifold, and idle speed will be too low. If it is stuck part way open, the idle may be rough, and will not respond to engine load changes.

Fuel Pump Circuit

Code 54 indicates a failure in the fuel pump circuit.

Two types of fuel pump relays are used on light duty trucks. The "S/T" and "M/L" series use one type while "C/K, R/V, G" and "P" series use the other type. Both relays have the same function, but terminal arrangement is different. Both relays have a terminal to test the fuel pump operation. This is either a separate terminal located near the relay or along the ECM/PCM harness or at terminal "G" in the ALDL connector. By applying voltage at this terminal, it can be determined if the fuel pump will operate. This terminal will also prime the fuel line to the TBI unit.

Refer to CHART A-5 or A-5A for diagnosis of the fuel pump relay circuit.

An inoperative fuel pump will cause a "no start" condition. A fuel pump which does not provide enough pressure can result in poor performance.

An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold. The oil pressure switch will turn "ON" the fuel pump, as soon as oil pressure reaches about 28 kPa (4 psi).

Fuel Module

On all 7.4L engine or a "G" Van with a 5.7L engine and all other 5.7L engines over 8500 GVW, a fuel module will override the ECM/PCM two second timer and the fuel pump will run for twenty seconds and then shut "OFF" if the vehicle is not started. This circuit corrects a hot restart vapor lock during high ambient temperatures.

Fuel Module Check

1. Disconnect the fuel module. (CHART A-5 or A-5A.)
2. With a test light and ignition "ON," probe connector terminal "C" to ground. Circuit is OK if light is "ON." There is an open if the light is "OFF."
3. Probe connector terminals "C" to "D" with test light. Circuit is OK if light is "ON. " There is an open in ground circuit if light is "OFF."
4. Ignition "OFF." Probe connector terminals "A" to "D" with test light. Ignition "ON," test light should illuminate for two seconds. There is an open in the circuit if the light is "OFF."
5. Replace fuel module if there is no twenty second fuel pump operation.

Fuel Pump Circuit (Two Fuel Tanks)

A quick check can be made by pressing the fuel tank selector switch with the ignition "ON" and listening for movement of the selector valve. Note that the selector switch is part of the fuel pump relay circuit, therefore, the valve will only operate for two seconds or twenty if equipped with a fuel module.

Refer to CHART A-5A for the diagnosis of the fuel pump relay circuit.

If the problem is "Engine Cranks But Will Not Run", this diagnosis is used because there is no fuel pump operation and will determine if the electrical system is operating.

The circled numbers on CHART A-5A refer to information provided below:

1. This procedure applies direct voltage to run the fuel pump. Toggling the fuel tank selector switch will test the operation of each fuel tank pump.
2. If neither pump will run, the contacts inside the relay or fuel tank selector switch may be inoperative. Check single connector (Figure 3-13) tan/white wire to the fuel pump relay on the cowl. Check the two terminal connector (Figure 3-13) tan and gray wire to the fuel pumps.

3. This step checks voltage from the battery and the ground circuit to the relay.
4. This test determines if there is voltage from the ECM/PCM terminal "A1" on the ECM/PCM to terminal "D" on the relay connector.
5. This completes the fuel pump relay circuit but if this diagnosis was used because the engine would not start, then diagnose the oil pressure switch.

Fuel Tank Selector Diagnosis (Two Fuel Tanks)

A quick check can be made by listening for selector valve operation when pressing fuel tank selector switch with the ignition "ON."

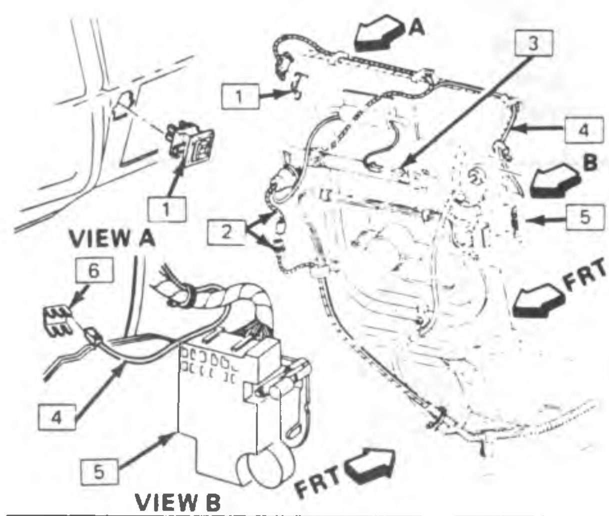
Checking selector valve circuit - CHART A-5A:

1. Disconnect fuel pump connector (Figure 3-13).
2. Disconnect fuel tank selector valve and meter switch connector (Figure 3-14).
3. Apply 12 volts to the fuel pump "test" terminal at the fuel pump relay.
4. Connect a test light between terminals "E" and "D" on the selector valve connector and move selector switch from top to bottom position. Light should be "ON" in both positions.
   - If light is "OFF" in both positions, check for open in that circuit or a faulty switch.
   - If light is "OFF" in one position, check for open in that circuit or a faulty switch.
   - If light is "ON" in both positions, check fuel gage circuit.
5. Disconnect 12 volts, connect fuel pump connector and check fuel gages.

Checking Fuel Gage (Two Fuel Tanks)

There should be a different quantity of fuel in the left and right fuel tanks. Refer to CHART A-5A for electrical circuit.

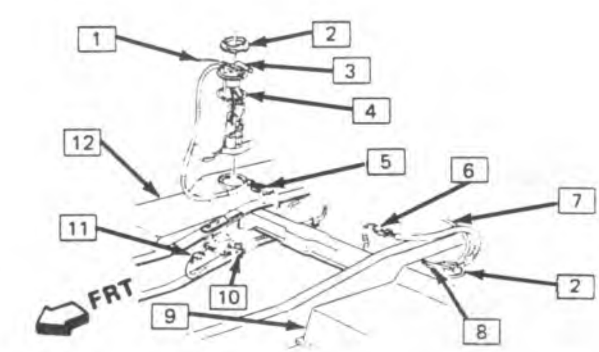
1. Disconnect fuel tank selector valve and meter switch connector. (Figure 3-14.)
2. Ignition "ON."
3. Jumper terminals "A" and "B" on the selector valve connector. Fuel gage should indicate quantity in the right fuel tank.
   Jumper terminals "C" and "B" and the gage should indicate quantity in the left fuel tank.
   - If there was no indication in either position, check for an open circuit from terminal "B" to the fuel gage. Make sure that the two terminal connector, with one pink wire that is located near the selector valve (Figure 3-15), is correctly connected.
   - If there was no indication in one position, check for an open circuit in that position or faulty sending unit.
   - If there is a change indicated between tanks, the circuit is OK.



1 FUEL TANK SELECTOR SWITCH
2 FUEL PUMP CONNECTOR
   A — TAN WIRE TO LEFT FUEL PUMP
   B — GRAY WIRE TO RIGHT FUEL PUMP
3 TAN WHITE WIRE TO FUEL PUMP RELAY
4 BLACK GROUND WIRE TO FUEL TANK SELECTOR SWITCH
5 FUSE PANEL
6 BUS BAR GROUND

8S 4332-6E

Figure 3-13 - Fuel Tank Selector Switch

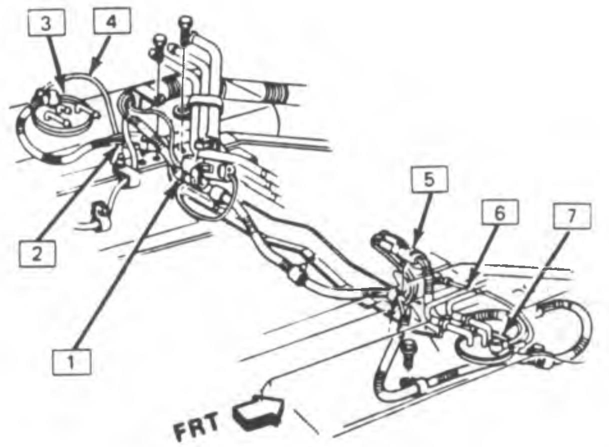


1 GROUND WIRE — LEFT UNIT
2 CAM
3 LEFT FUEL PUMP AND SENDING UNIT
4 "O" RING SEAL
5 LEFT UNIT CONNECTOR
6 RIGHT UNIT CONNECTOR
7 GROUND WIRE — RIGHT UNIT
8 RIGHT FUEL PUMP AND SENDING UNIT
9 RIGHT FUEL TANK
10 FUEL TANK SELECTOR VALVE AND METER SWITCH
11 SELECTOR VALVE AND METER SWITCH CONNECTOR
12 LEFT FUEL TANK

8S 4334-6E

Figure 3-14 - Selector Valve and Meter Switch Connector

4. Ignition "OFF," connect fuel tank selector valve and meter switch connector.
5. Perform fuel system pressure test (CHART A-6) if engine would not run in one or either selector switch positions.



1 REAR LAMP CONNECTOR — PINK WIRE FROM FUEL GAGE TO FUEL TANK SELECTOR VALVE AND METER SWITCH
2 LEFT FUEL PUMP AND SENDING UNIT CONNECTOR
3 LEFT FUEL PUMP AND SENDING UNIT CONNECTOR
4 LEFT GROUND WIRE
5 RIGHT FUEL PUMP AND SENDING UNIT CONNECTOR
6 RIGHT GROUND WIRE
7 RIGHT FUEL PUMP AND SENDING UNIT

8S 4333-6E

Figure 3-15 - Two Fuel Tank Wiring

COOLANT TEMPERATURE SENSOR

Code 14 or Code 15 indicates a failure in the coolant temperature sensor circuit.

Most "Scan" tools display engine temperature in degrees centigrade. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens.

MAP SENSOR

Code 33 or Code 34 indicates a failure in the MAP sensor circuit. Also refer to "MAP Output Check Diagnosis" on page 3-124 to check the MAP sensor if there is no code.

OXYGEN (O_2) SENSOR

Code 13 indicates an open in the Oxygen (O_2) sensor circuit. Code 44 indicates a shorted Oxygen (O_2) sensor circuit. Code 45 indicates a high voltage in the Oxygen (O_2) sensor circuit. If a code is set, the engine will always run in the "Open Loop" mode. The Oxygen (O_2) sensor voltage output can be measured with a digital voltmeter having at least a 10 megohm input impedance. Use of a standard shop type voltmeter will result in an inaccurate reading.

Normal "Scan" voltage varies between 100 mV to 999 mV (.1 and 1.0 volt) while in "Closed Loop." Code 13 sets in one minute if voltage remains between .35 and .55 volt, but the system will go "Open Loop" in about 15 seconds.

Using the "Scan," observe the block learn values at different rpm and air flow conditions to determine when Code 44 or Code 45 may have been set. If the condition for Code 44 exists, the block learn values will be around 150. If the condition for Code 45 exists, the block learn values will be around 115.

THROTTLE POSITION SENSOR (TPS)

When a code is set, the ECM/PCM will use an artificial value for throttle position and some engine performance will return.

A broken TPS can cause intermittent bursts of fuel from the injector(s) and an unstable idle because the ECM/PCM thinks the throttle is moving.

A "Scan" tool reads throttle position in volts and should read about .60 with the throttle closed, ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

"Scan" TPS while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from below 1.25 volts (1250 mV) when throttle was closed, to over 4.5 volts (4500 mV) when throttle is held at wide open throttle position.

TPS Output

TBI 220 and 700

This check should be performed when throttle body parts have been replaced. A Tech 1 can be used to read the TPS output voltage, or:

1. Connect digital voltmeter J 34029-A or equivalent, from TPS connector terminal "B" (BLK wire) to terminal "C" (DK BLU wire). Jumpers for terminal access can be made using terminals "1214836" and "12014837".
2. With ignition "ON," engine stopped, the TPS voltage should be less than 1.25 volts if more than 1.25 volts verify free throttle movement. If still more than 1.25 volts, replace TPS.
3. Remove the voltmeter and jumpers, reconnect the TPS connector to the sensor.

VEHICLE SPEED SENSOR (VSS)

The vehicle speed sensor circuit diagnosis is in Code 24 chart.

"Scan" reading should closely match speedometer readings, with the drive wheels turning.

INTAKE AIR TEMPERATURE (IAT) SENSOR

Code 23 indicates that there is an open in the IAT circuit. Code 25 indicates that there is a short to ground in the IAT circuit.

A "Scan" tool reads the temperature of the air entering the engine and should read close to ambient air temperature when the engine is cold, and rise as underhood temperatures increase.

EGR SYSTEM

Code 32 indicates that there is a failure in the EGR system circuit.

IDLE SPEED

Code 35 sets when there is a problem with idle air control on a 2.5L engine. Refer to "Diagnosis" in "Fuel Control," Section "4" for Idle Air Control (IAC) check for other engines.

- System too lean. (High air/fuel ratio) - Idle speed may be too high or too low. Engine speed may vary up and down, disconnecting IAC does not help. May set Code 44.
  "Scan" and/or voltmeter will read an oxygen sensor output less than 300 mV (.3 volt). Check for low regulated fuel pressure or water in fuel. A lean exhaust with an Oxygen (O_2) sensor output fixed above 800 mV (.8 volt) will be a contaminated sensor, usually silicone. This may also set a Code 45.
- System too rich (Low air/fuel ratio) - Idle speed too low. "Scan" counts usually above 80. System obviously rich and may exhibit black exhaust smoke. "Scan" tool and/or voltmeter will read an Oxygen (O_2) sensor signal fixed above 800 mV (.8 volt).

ELECTRONIC SPARK TIMING (EST)

When the system is running on the ignition module, that is, no voltage on the bypass line, the ignition module grounds the EST signal. The ECM/PCM expects to see no voltage on the EST line during this condition. If it sees a voltage, it sets Code 42 and will not go into the EST mode.

When the rpm for EST is reached (about 400 rpm), and bypass voltage is applied, the EST should no longer be grounded in the ignition module so the EST voltage should be varying.

If the bypass line is open or grounded, the ignition module will not switch to EST mode so the EST voltage will be low and Code 42 will be set.

If the EST line is grounded, the ignition module will switch to EST, but because the line is grounded there will be no EST signal. A Code 42 will be set.

Code 42 sets if there is an open or a short to ground in the EST or bypass circuit.

ELECTRONIC SPARK CONTROL (ESC)

Code 43 sets if there is an open or short to ground in the ESC circuit.

If the conditions for a Code 43 are present, the "Scan" will always display "YES." There should not be a knock at idle unless an internal engine problem, or a system problem exists.

SYSTEM OVER VOLTAGE

Code 53 sets if there is voltage greater than 17.1 volts for two seconds at ECM terminal "B1" or PCM terminal "D1." This indicates that there is a basic generator problem.

PARK/NEUTRAL (P/N) SWITCH

Diagnosis of the Park/Neutral (P/N) switch is on page 3-126 of this section.

CRANK SIGNAL

The crank signal diagnosis procedure is on page 3-130 of this section. If there is no crank signal to the ECM, the engine may be hard to start.

POWER STEERING PRESSURE SWITCH

The diagnosis of the power steering pressure switch is covered on page 3-132 of this section.

DISTRIBUTOR REFERENCE SIGNAL

The distributor reference signal is covered in "Ignition System/EST," Section "6" of the ignition system and Electronic Spark Control (ESC).

A/C CLUTCH CONTROL

The diagnosis of the A/C clutch control on a 2.5L engine is covered on page 3-134 of this section and on 2.8L engine and 4.3L "S/T" Automatic Transmission on page 3-138 of this section.

A/C "ON" SIGNAL

The diagnosis of the A/C "ON" signal on 4.3L S/T Manual Transmission, 4.3L and V8 engines on page 3-142 of this section.

EXHAUST SYSTEM

Refer to page 3-121 for diagnosis of a restricted exhaust system.

CODE IDENTIFICATION

The "Service Engine Soon" light will only be "ON" if the malfunction exists under the conditions listed below. If the malfunction clears, the light will go out and the code will be stored in the ECM/PCM. Any codes stored will be erased if no problem reoccurs within 50 engine starts.

CODE AND CIRCUIT	PROBABLE CAUSE
Code 13 - O_2 Sensor Open Oxygen Sensor Circuit	Indicates that the oxygen sensor circuit or sensor was open for one minute while off idle.
Code 14 - Coolant Sensor High Temperature Indication	Sets if the sensor or signal line becomes grounded for 3 seconds.
Code 15 - Coolant Sensor Low Temperature Indication	Sets if the sensor, connections, or wires open for 3 seconds.
Code 21 - TPS Signal Voltage High	TPS voltage greater than 2.5 volts for 3 seconds with less than 1200 RPM.
Code 22 - TPS Signal Voltage Low	A shorted to ground or open signal circuit will set code in 3 seconds.
Code 23 - IAT Low Temperature Indication	Sets if the sensor, connections, or wires open for 3 seconds.
Code 24 - VSS No Vehicle Speed Indication	No vehicle speed present during a road load decel.
Code 25 - IAT High Temperature Indication	Sets if the sensor or signal line becomes grounded for 3 seconds.
Code 32 - EGR	Vacuum switch shorted to ground on start up OR Switch not closed after the ECM/PCM has commanded EGR for a specified period of time. OR EGR solenoid circuit open for a specified period of time.

CODE AND CIRCUIT	PROBABLE CAUSE
Code 33 - MAP Sensor Low Vacuum	MAP sensor output to high for 5 seconds or an open signal circuit.
Code 34 - MAP Sensor High Vacuum	Low or no output from sensor with engine running.
Code 35 - IAC	IAC error
Code 42 - EST	ECM/PCM has seen an open or grounded EST or Bypass circuit.
Code 43 - ESC	Signal to the ECM/PCM has remained low for too long or the system has failed a functional check.
Code 44 Lean Exhaust Indication	Sets if oxygen sensor voltage remains below .2 volt for about 20 seconds.
Code 45 Rich Exhaust Indication	Sets if oxygen sensor voltage remains above 7 volt for about 1 minute.
Code 51	Faulty MEM-CAL, PROM, or ECM/PCM.
Code 52	Fuel CAL-PAK missing or faulty.
Code 53	System overvoltage. Indicates a basic generator problem.
Code 54 - Fuel Pump Low voltage	Sets when the fuel pump voltage is less than 2 volts when reference pulses are being received.
Code 55	Faulty ECM/PCM

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Figure 3-16 - ECM/PCM Code System

BLANK

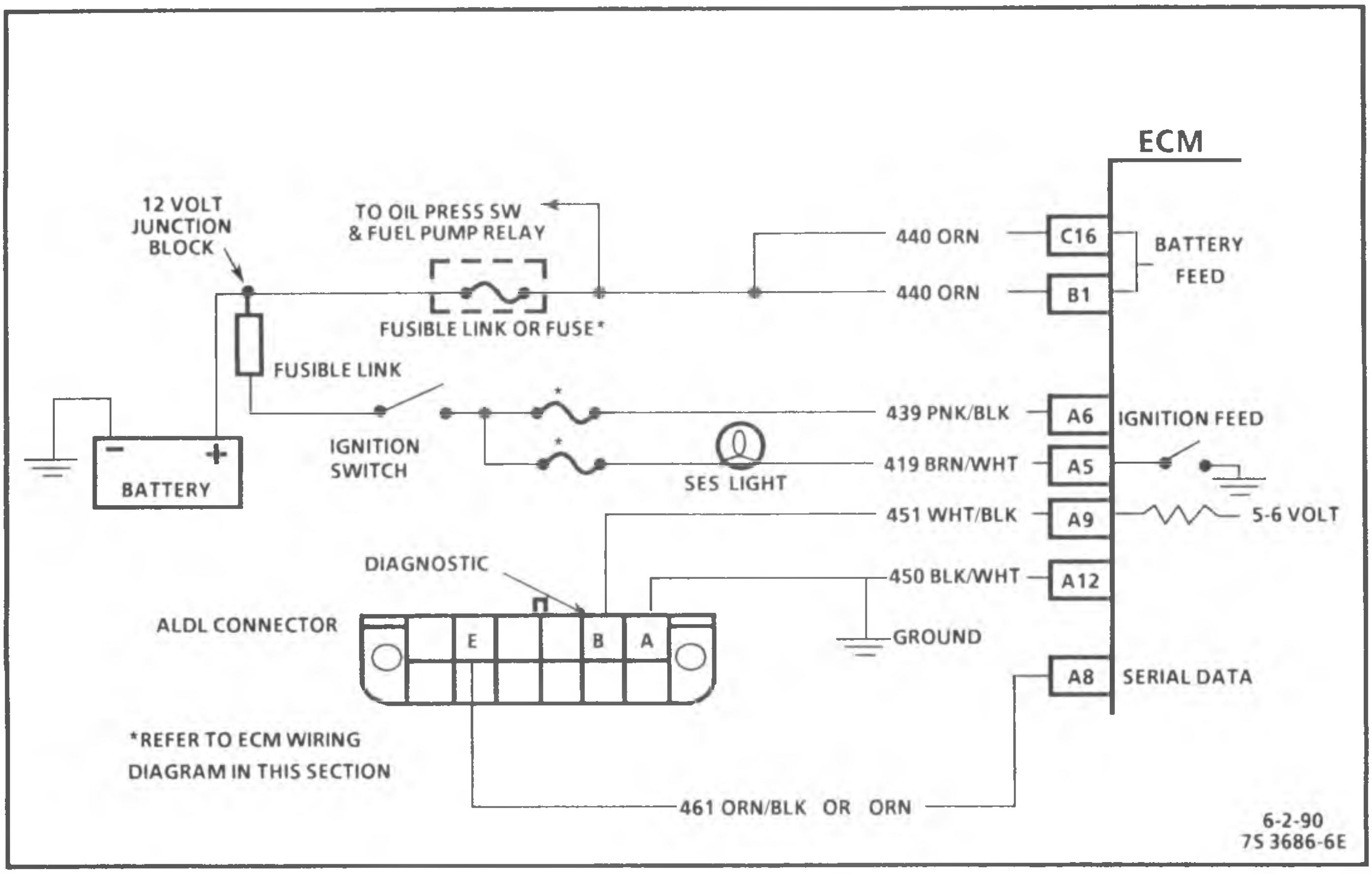


CHART A-1

NO "SERVICE ENGINE SOON" LIGHT
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

There should always be a steady "Service Engine Soon" light when the ignition is "ON" and engine stopped. Battery ignition voltage is supplied to the light bulb. The ECM will control the light and turn it "ON" by providing a ground path through CKT 419.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. If the fuse in holder is blown, refer to facing page of Code 54 for complete circuit.
2. Using a test light connected to 12 volts, probe each of the system ground circuits to be sure a good ground is present. See "ECM Terminal End View" in this section for ECM pin locations of ground circuits.

Diagnostic Aids:

If the engine runs OK, check:

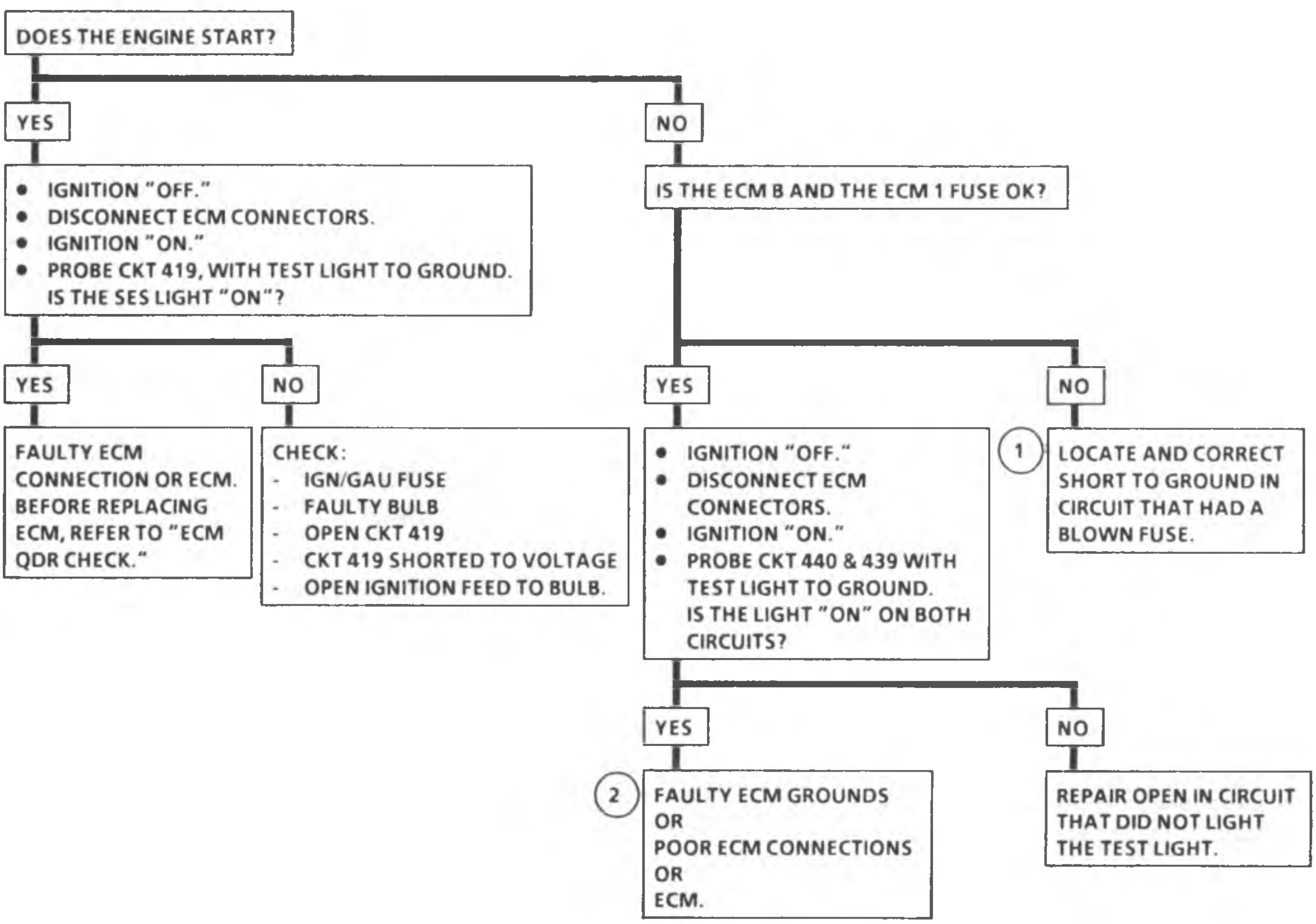
- Faulty light bulb.
- CKT 419 open.
- Gage fuse blown. This will result in no brake warning light, oil or generator lights, seat belt reminder, etc.

If the engine cranks but will not run, check:

- Continuous battery-fuse or fusible link open.
- ECM ignition fuse open.
- Battery CKT 440 to ECM open.
- Ignition CKT 439 to ECM open.
- Poor connection to ECM.

CHART A-1

NO "SERVICE ENGINE SOON" LIGHT
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION



"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

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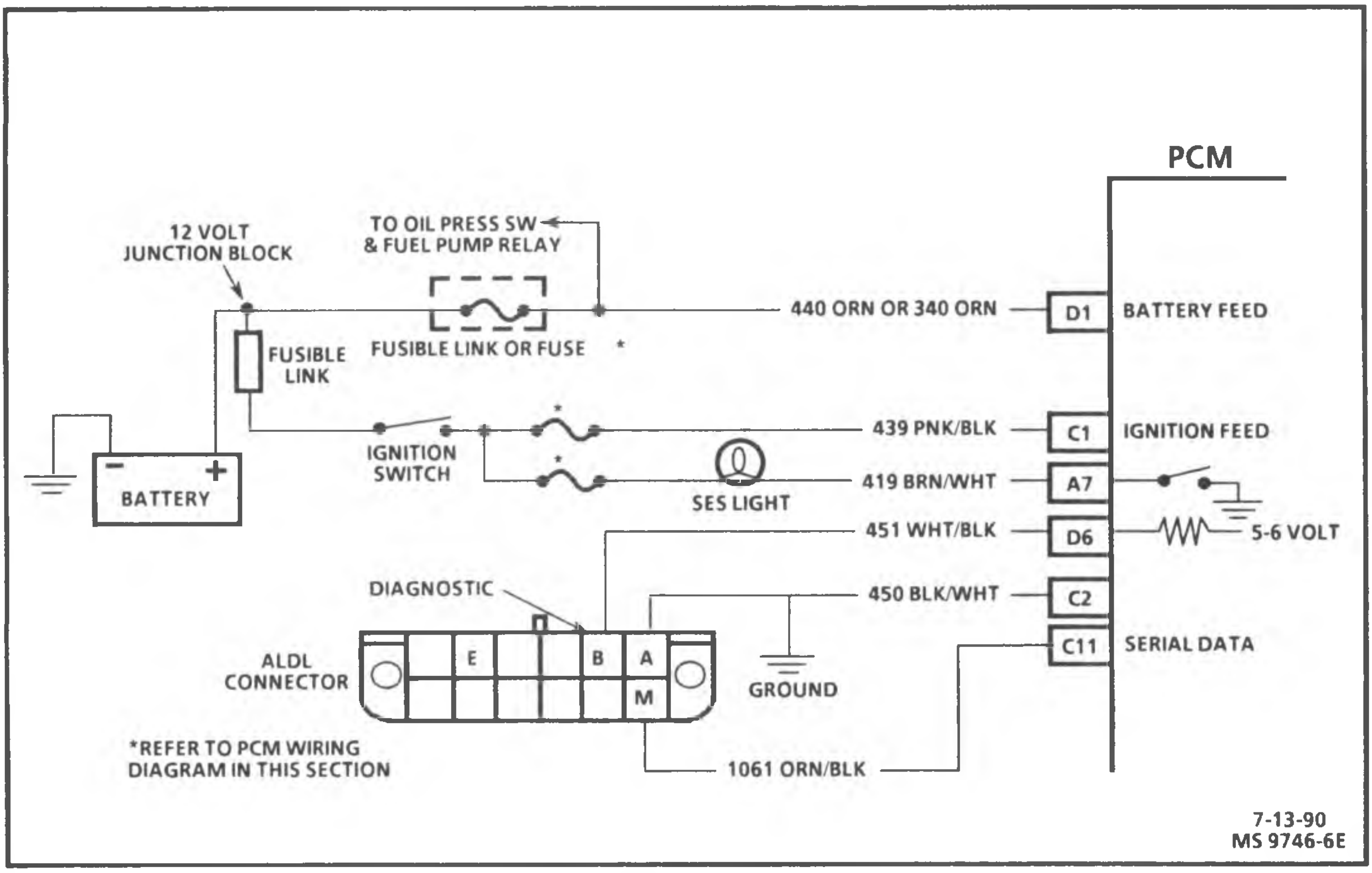


CHART A-1

NO "SERVICE ENGINE SOON" LIGHT
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

There should always be a steady "Service Engine Soon" light when the ignition is "ON" and engine stopped. Battery ignition voltage is supplied to the light bulb. The PCM will control the light and turn it "ON" by providing a ground path through CKT 419.

Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart.

1. If the fuse in holder is blown, refer to facing page of Code 54 for complete circuit.
2. Using a test light connected to 12 volts, probe each of the system ground circuits to be sure a good ground is present. See "PCM Terminal End View" in this section for PCM pin locations of ground circuits.

Diagnostic Aids:

If the engine runs OK, check:

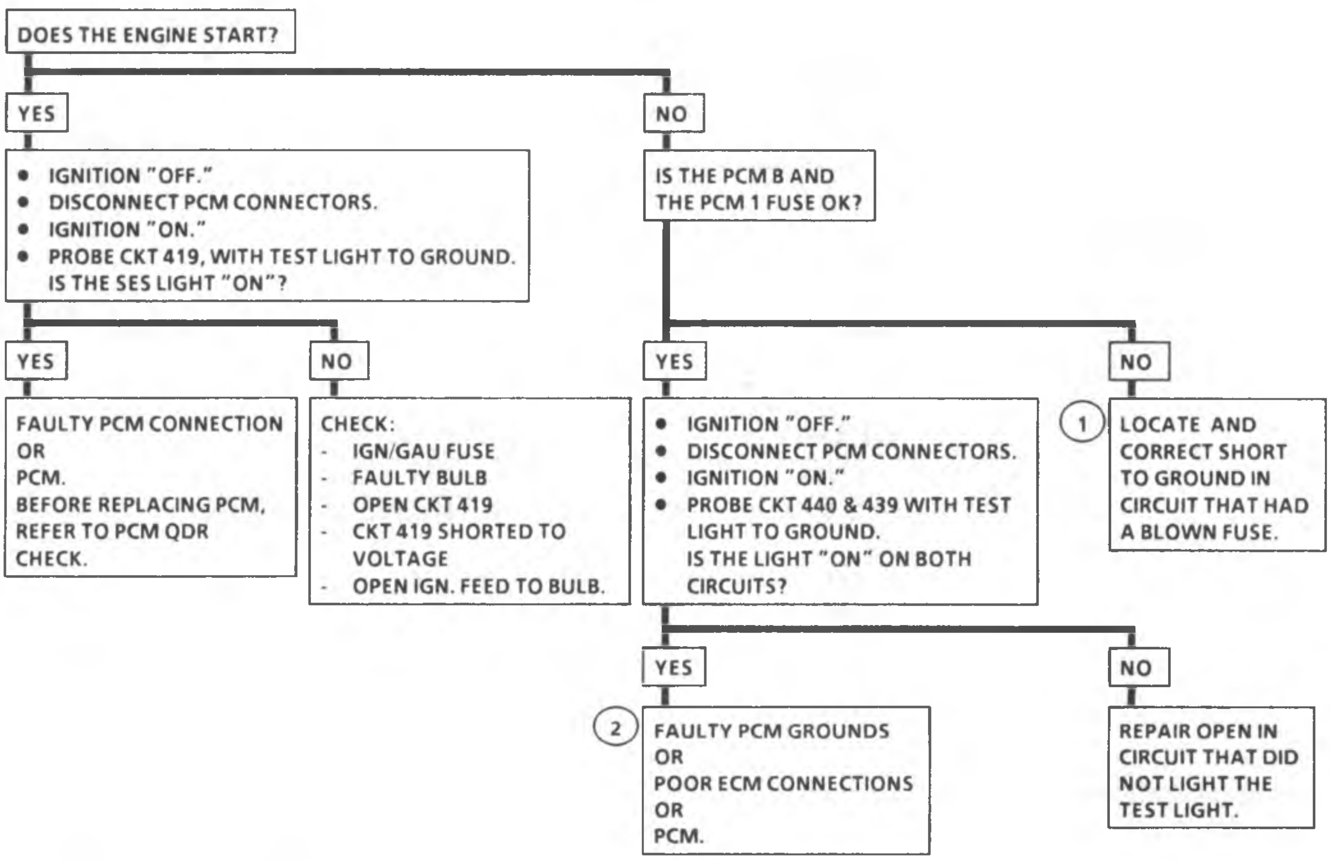
- Faulty light bulb.
- CKT 419 open.
- Gage fuse blown. This will result in no brake warning light, oil or generator lights, seat belt reminder, etc.

If the engine cranks but will not run, check:

- Continuous battery-fuse or fusible link open.
- PCM ignition fuse open.
- Battery CKT 440 to PCM open.
- Ignition CKT 439 to PCM open.
- Poor connection to PCM.

CHART A-1

NO "SERVICE ENGINE SOON" LIGHT
ALL VEHICLES WITH 4L80-E TRANSMISSION



"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

7-13-90
MS 9971-6E

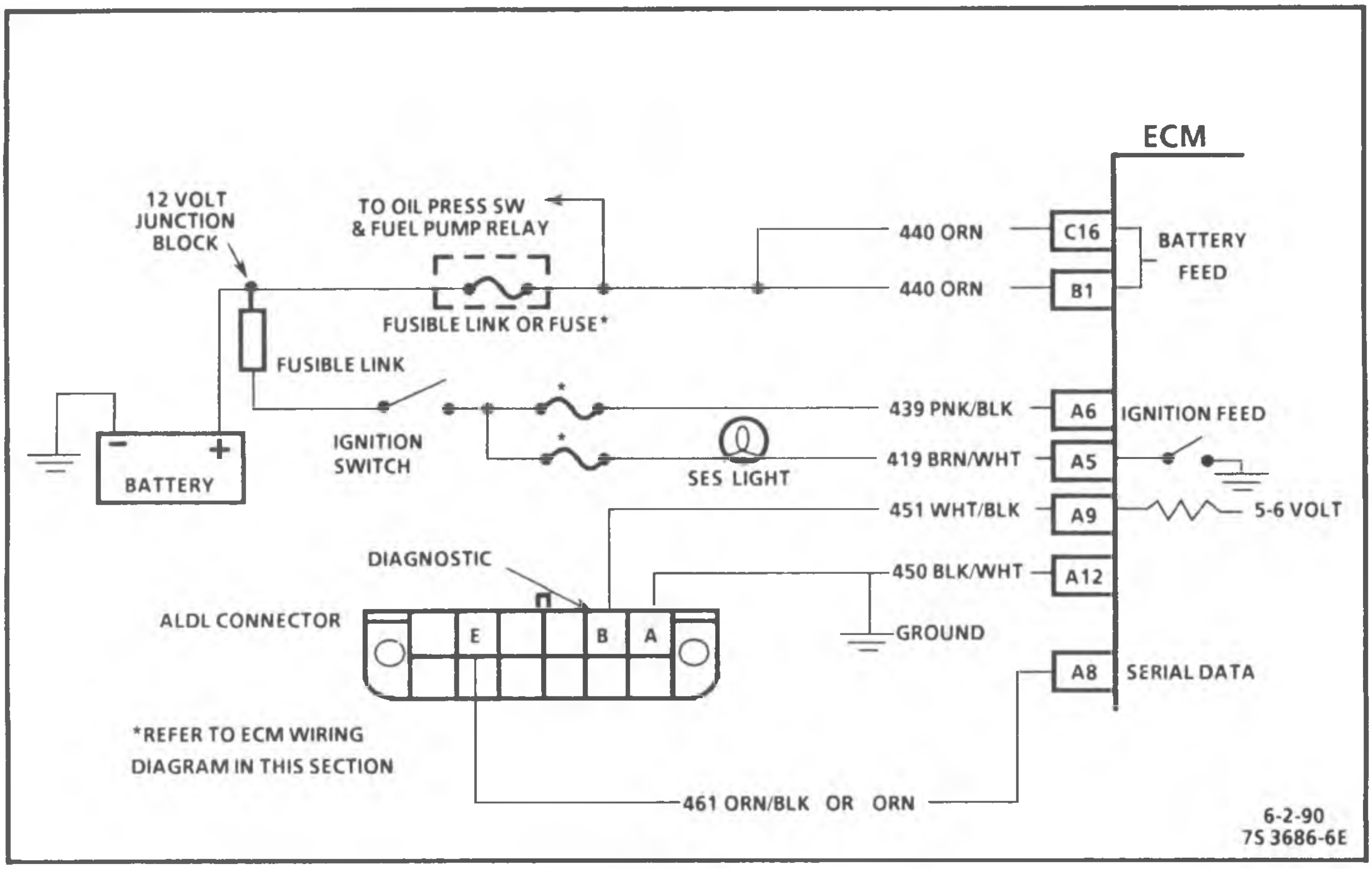


CHART A-2

NO ALDL DATA OR WON'T FLASH CODE 12
"SERVICE ENGINE SOON" LIGHT "ON" STEADY
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

There should always be a steady "Service Engine Soon" light when the ignition is "ON" and engine stopped. Battery ignition voltage is supplied to the light bulb. The ECM will turn the light "ON" by grounding CKT 419.

With the diagnostic terminal grounded, the light should flash a Code 12, followed by any trouble code(s) stored in memory.

A steady light suggests a short to ground in the light control CKT 419, or an open in diagnostic CKT 451.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. If there is a problem with the ECM that causes a "Scan" tool to not read serial data then the ECM should not flash a Code 12. If Code 12 does flash, be sure that the "Scan" tool is working properly on another vehicle. If the "Scan" is functioning properly and CKT 461 is OK, the PROM/MEM-CAL or ECM may be at fault for the No ALDL symptom.
2. If the light goes "OFF" when the ECM connector is disconnected, then CKT 419 is not shorted to ground.
3. This step will check for an open diagnostic CKT 451.
4. At this point the "Service Engine Soon" light wiring is OK. The problem is a faulty ECM or PROM/MEM-CAL. If Code 12 does not flash, the ECM should be replaced using the original PROM/MEM-CAL. Replace the PROM/MEM-CAL only after trying an ECM, as a defective PROM/MEM-CAL is an unlikely cause of the problem.

CHART A-2

NO ALDL DATA OR WON'T FLASH CODE 12
"SERVICE ENGINE SOON" LIGHT "ON" STEADY
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

- IGNITION "ON." ENGINE "OFF." IS THE "SES" LIGHT "ON"?

YES

- GROUND DIAGNOSTIC TERMINAL. DOES LIGHT FLASH CODE 12?

NO

SEE CHART A-1.

NO

(2)
- IGNITION "OFF."
- DISCONNECT ECM CONNECTORS.
- IGNITION "ON" AND NOTE "SERVICE ENGINE SOON" LIGHT.

YES

(1)
- IF PROBLEM WAS NO ALDL DATA:
- CHECK SERIAL DATA CKT 461 FOR OPEN
  OR
  SHORT TO GROUND
  OR
  SHORT TO VOLTAGE BETWEEN ECM AND ALDL CONNECTOR. IF OK, IT IS A FAULTY
  ECM
  OR
  PROM/MEM-CAL.

LIGHT "OFF"

(3)
- IGNITION "OFF."
- RECONNECT ECM.
- IGNITION "ON," ENGINE STOPPED.
- DIAGNOSTIC TERMINAL NOT GROUNDED.
- BACKPROBE ECM, CKT 451, WITH TEST LIGHT TO GROUND.

LIGHT "ON"

REPAIR SHORT TO GROUND IN CKT 419.

NO CODE 12

(4)
- CHECK PROM/MEM-CAL FOR PROPER INSTALLATION.
- IF OK, REPLACE ECM USING ORIGINAL PROM/MEM-CAL.
- RECHECK FOR CODE 12.

NO CODE 12

REPLACE PROM/MEM-CAL.

CODE 12

SYSTEM OK.

CODE 12

- CHECK FOR OPEN IN ALDL DIAGNOSTIC TERMINALS "B" AND CKT 451 TO ECM.
- IF OK, CHECK FOR OPEN IN ALDL TERMINAL "A" TO ECM AND ECM GROUND, CKT 450.

"*AFTER REPAIRS,*" CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

7-13-90
7S 3688-6E

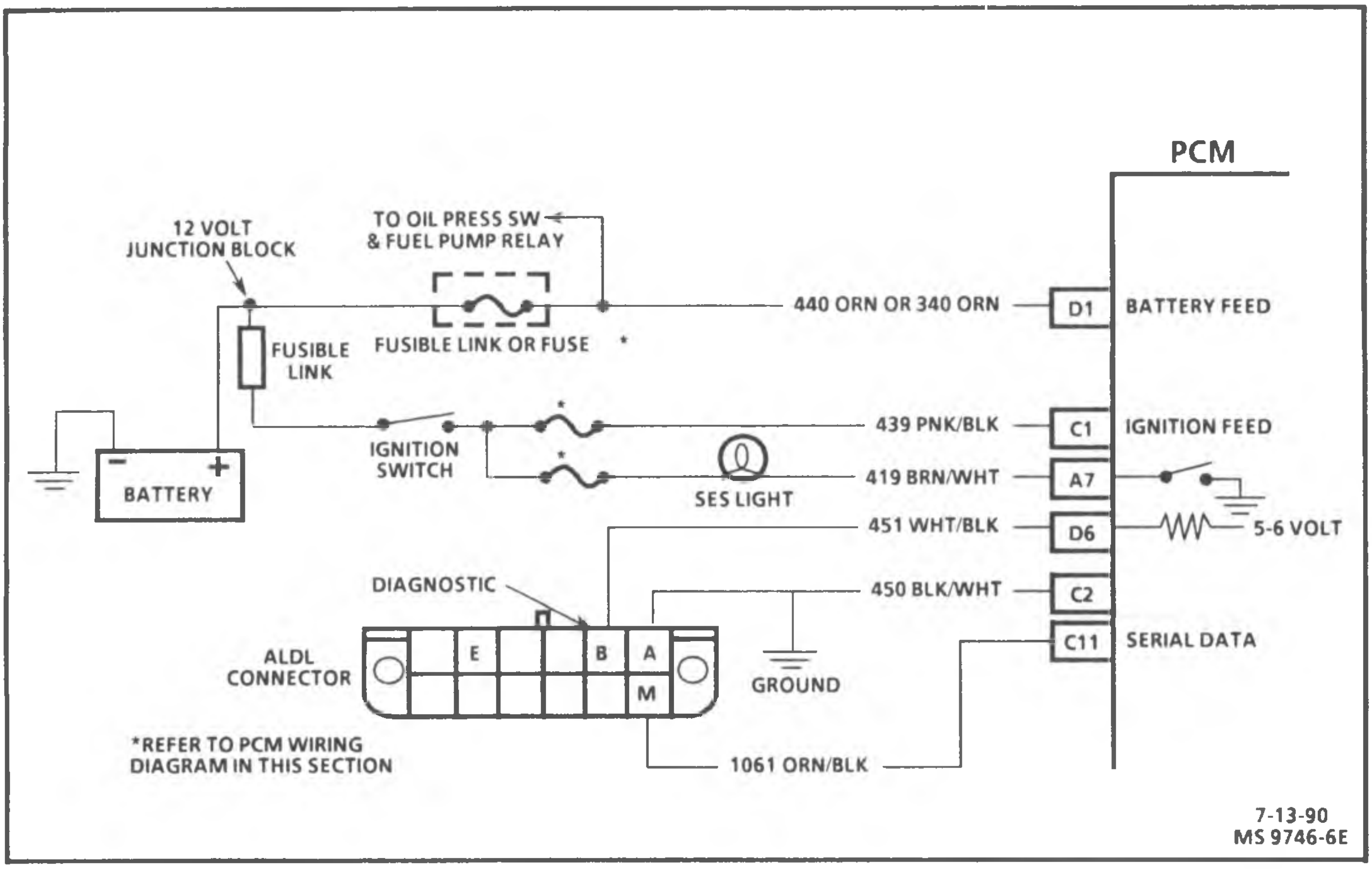


CHART A-2

NO ALDL DATA OR WON'T FLASH CODE 12
"SERVICE ENGINE SOON" LIGHT "ON" STEADY
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

There should always be a steady "Service Engine Soon" light when the ignition is "ON" and engine stopped. Battery ignition voltage is supplied to the light bulb. The PCM will turn the light "ON" by grounding CKT 419.

With the diagnostic terminal grounded, the light should flash a Code 12, followed by any trouble code(s) stored in memory.

A steady light suggests a short to ground in the light control CKT 419, or an open in diagnostic CKT 451.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. If there is a problem with the PCM that causes a "Scan" tool to not read serial data then the PCM should not flash a Code 12. If Code 12 does flash, be sure that the "Scan" tool is working properly on another vehicle. If the "Scan" is functioning properly and CKT 461 is OK, the PROM/MEM-CAL or PCM may be at fault for the No ALDL symptom.
2. If the light goes "OFF" when the PCM connector is disconnected, then CKT 419 is not shorted to ground.
3. This step will check for an open diagnostic CKT 451.
4. At this point the "Service Engine Soon" light wiring is OK. The problem is a faulty PCM or PROM/MEM-CAL. If Code 12 does not flash, the PCM should be replaced using the original PROM/MEM-CAL. Replace the PROM/MEM-CAL only after trying a PCM, as a defective PROM/MEM-CAL is an unlikely cause of the problem.

CHART A-2

NO ALDL DATA OR WON'T FLASH CODE 12 "SERVICE ENGINE SOON" LIGHT "ON" STEADY ALL VEHICLES WITH 4L80-E TRANSMISSION

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

7-13-90
MS 9970-6E

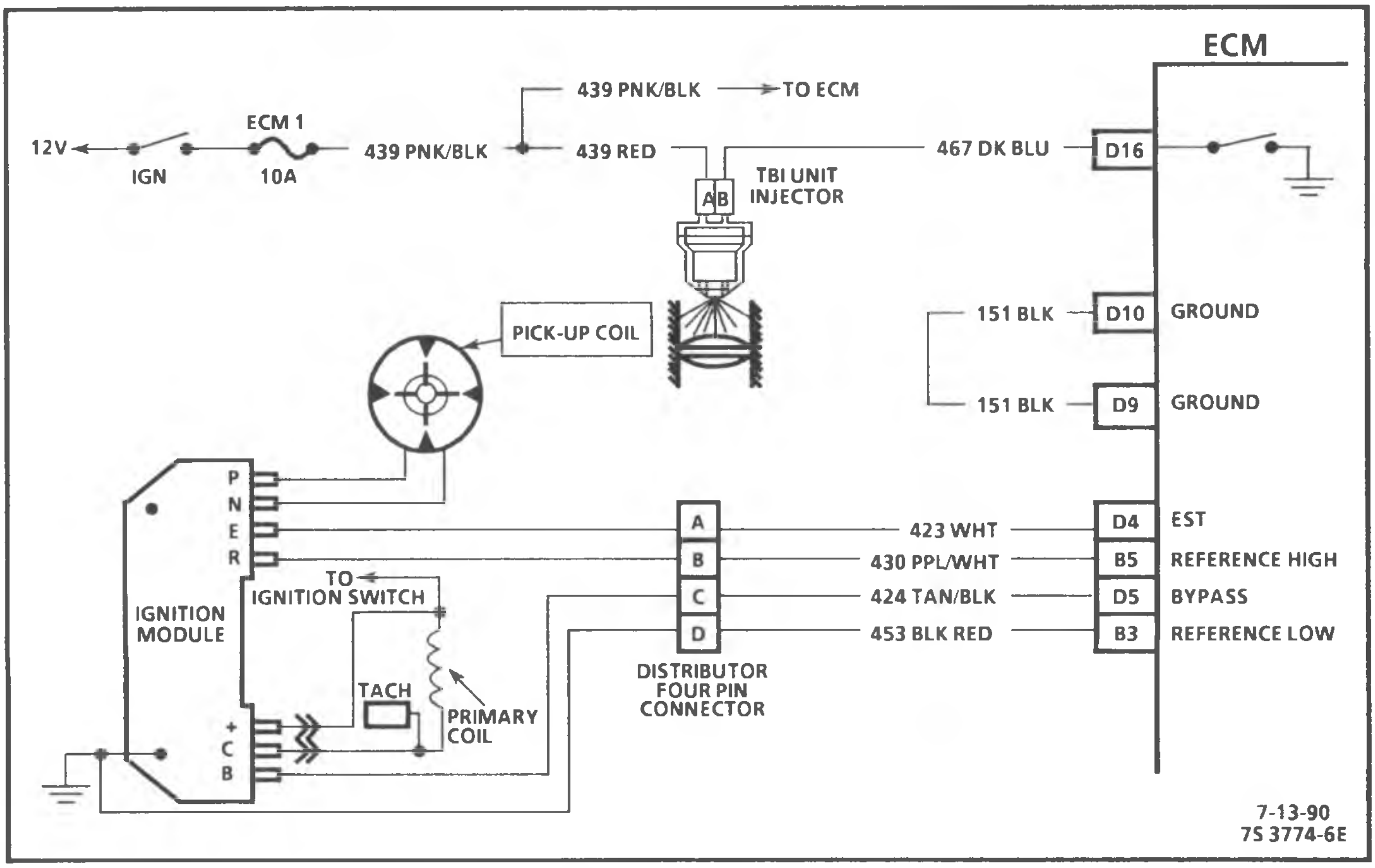


CHART A-3

ENGINE CRANKS BUT WILL NOT RUN
2.5L ENGINE

Circuit Description:

This chart assumes that battery condition and engine cranking speed are OK, and there is adequate fuel in the tank. This chart should be used on engines using the Model 700 throttle body.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. A "Service Engine Soon" light "ON" is a basic test to determine if there is a 12 volt supply and ignition 12 volts to ECM. No ALDL may be due to an ECM problem and CHART A-2 will diagnose the ECM. If TPS is over 2.5 volts the engine may be in the clear flood mode which will cause starting problems. If coolant sensor is below –30°C, the ECM will provide fuel for this extremely cold temperature which will severely flood the engine.
2. Voltage at the spark plug is checked using spark tester tool ST-125 (J 26792) or equivalent. No spark indicates a basic ignition problem.
3. While cranking engine there should be no fuel spray with injector disconnected. Replace an injector if it sprays fuel or drips like a leaking water faucet.
4. Use an injector test light like J 34730, BT-8329A or equivalent, to test injector circuit. A blinking light indicates the ECM is controlling the injector.
5. This test will determine if there is fuel pressure at the injector and that the injector is operating.

Diagnostic Aids:

If no trouble is found in the fuel pump circuit or ignition system and the cause of a "Engine Cranks But Will Not Run" has not been found, check for:

- Fouled spark plugs
- EGR valve stuck open
- Low fuel pressure. See CHART A-6.
- Water or foreign material in the fuel system.
- A ground CKT 423 (EST) may cause a "No Start" or a "Start then Stall" condition.
- Basic engine problem.

CHART A-3

ENGINE CRANKS BUT WILL NOT RUN
2.5L ENGINE

IF CODE 54 IS STORED, USE THAT CHART FIRST

1
- IGN "ON" - IF S.E.S. LIGHT IS OFF, SEE CHART A-1.
- INSTALL "SCAN" TOOL - IF "NO ALDL", SEE CHART A-2.
- CHECK THE FOLLOWING:
  - TPS - IF OVER 2.5V AT CLOSED THROTTLE, SEE CODE 21.
  - COOLANT - IF BELOW -30°C, SEE CODE 15.
- IGN. "OFF" FOR 10 SECONDS. IGN "ON", LISTEN FOR PUMP TO RUN. DOES IT?

NO → SEE FUEL PUMP RELAY CIRCUIT CHART A-5

YES →

2
- DISCONNECT ONE SPARK PLUG WIRE.
- INSTALL A SPARK TESTER (ST-125 OR EQUIVALENT).
- CRANK ENGINE AND CHECK FOR SPARK.

IS THERE SPARK?

NO → SEE IGNITION SYSTEM CHECK IN SECTION "6"

YES →

3
- RECONNECT SPARK PLUG WIRE.
- DISCONNECT INJECTOR CONNECTOR.
- CRANK ENGINE.

IS THERE FUEL SPRAY FROM INJECTOR?

YES → FAULTY INJECTOR SEAL OR INJECTOR

NO →

4
- CONNECT INJECTOR TEST LIGHT TO HARNESS CONNECTOR.
- CRANK ENGINE.

DOES TEST LIGHT BLINK?

NO → SEE INJECTOR CIRCUIT DIAGNOSIS CHART A-4

YES →

5
- RECONNECT INJECTOR CONNECTOR.
- CRANK ENGINE.

IS THERE FUEL SPRAY FROM INJECTOR?

YES → NO TROUBLE FOUND. SEE DIAGNOSTIC AIDS ON FACING PAGE.

NO →
- IGN "OFF".
- INSTALL FUEL PRESSURE GAGE, REFER TO FUEL SYSTEM PRESSURE TEST IN SECTION "4".
- IGN "ON".
- FUEL PRESSURE SHOULD BE 62-90 KPa (9-13 psi)

IS IT?

YES → FAULTY INJECTOR

NO → SEE FUEL SYSTEM DIAGNOSIS CHART A-6

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

2-2-90
7S 3775-6E

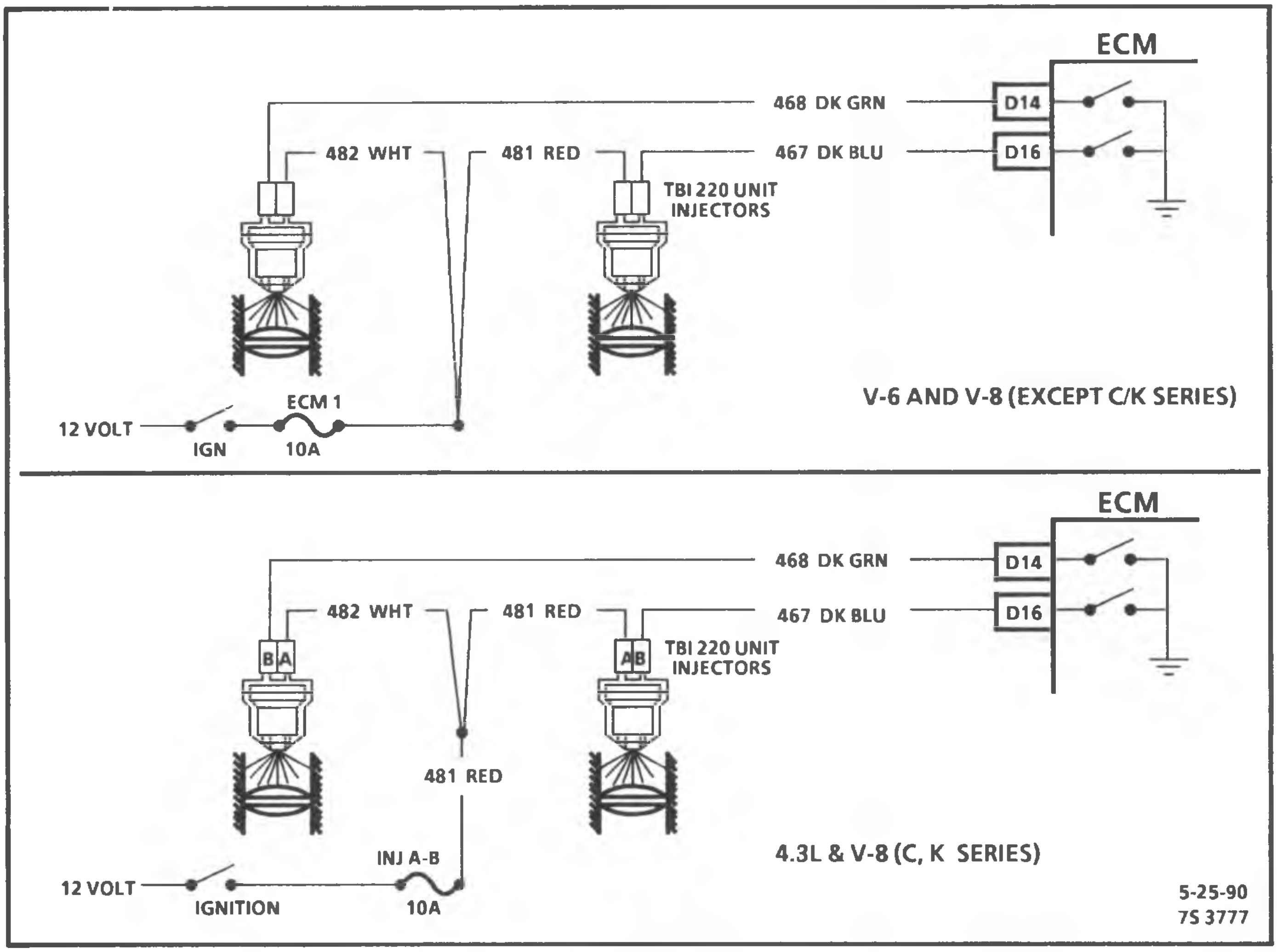


CHART A-3

ENGINE CRANKS BUT WILL NOT RUN
ALL ENGINES EXCEPT 2.5L & VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

This chart assumes that battery condition and engine cranking speed are OK, and there is adequate fuel in the tank. This chart should be used on engines using the Model 220 throttle body.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. A "Service Engine Soon" light "ON" is a basic test to determine if there is a 12 volt supply and ignition 12 volts to ECM. No ALDL may be due to an ECM problem and CHART A-2 will diagnose the ECM. If TPS is over 2.5 volts the engine may be in the clear flood mode which will cause starting problems. If coolant sensor is below -30°C, the ECM will provide fuel for this extremely cold temperature which will severely flood the engine.
2. Voltage at the spark plug is checked using spark tester tool ST-125 (J 26792) or equivalent. No spark indicates a basic ignition problem.
3. While cranking engine there should be no fuel spray with injectors disconnected. Replace an injector if it sprays fuel or drips like a leaking water faucet.
4. Use an injector test light like BT-8320, or equivalent, to test each injector circuit. A blinking light indicates the ECM is controlling the injectors.
5. This test will determine if there is fuel pressure at the injectors and that the injectors are operating.

Diagnostic Aids:

If no trouble is found in the fuel pump circuit or ignition system and the cause of a "Engine Cranks But Will Not Run" has not been found, check for:

- Fouled spark plugs.
- EGR valve stuck open.
- Low fuel pressure. See CHART A-6.
- Water or foreign material in the fuel system.
- A grounded CKT 423 (EST) may cause a "No Start" or a "Start then Stall" condition.
- Basic engine problem.

CHART A-3

ENGINE CRANKS BUT WILL NOT RUN ALL ENGINES EXCEPT 2.5L & VEHICLES WITH 4L80-E TRANSMISSION

IF CODE 54 IS STORED, USE THAT CHART FIRST

1
- IGN "ON" - IF S.E.S. LIGHT IS OFF, SEE CHART A-1.
- INSTALL "SCAN" TOOL - IF "NO ALDL", SEE CHART A-2.
- CHECK THE FOLLOWING:
  - TPS - IF OVER 2.5V AT CLOSED THROTTLE, SEE CODE 21.
  - COOLANT - IF BELOW -30°C, SEE CODE 15.
- IGN. "OFF" FOR 10 SECONDS. IGN. "ON".
  - ONE FUEL TANK:
    LISTEN FOR PUMP TO RUN. DOES IT?
  - TWO FUEL TANKS:
    LISTEN FOR PUMP IN EACH TANK USING SELECTOR SWITCH. BOTH PUMPS MUST RUN.
    DO THEY BOTH RUN?

NO: SEE FUEL PUMP RELAY CIRCUIT CHART A-5 OR A-5A

YES:

2
- DISCONNECT ONE SPARK PLUG WIRE.
- INSTALL A SPARK TESTER (ST 125 OR EQUIVALENT)
- CRANK ENGINE AND CHECK FOR SPARK.
  IS THERE SPARK?

NO: SEE IGNITION SYSTEM CHECK IN SECTION 6

YES:

3
- RECONNECT SPARK PLUG WIRE.
- DISCONNECT INJECTOR CONNECTORS.
- CRANK ENGINE.
  IS THERE FUEL SPRAY FROM ONE OR BOTH INJECTORS?

YES: FAULTY INJECTOR SEAL OR INJECTOR

NO:

4
- CONNECT INJECTOR TEST LIGHT TO ONE HARNESS CONNECTOR.
- CRANK ENGINE.
- REPEAT TEST ON OTHER CONNECTOR
  DOES TEST LIGHT BLINK ON BOTH TESTS?

NO: SEE INJECTOR CIRCUIT DIAGNOSIS CHART A-4

YES:

5
- RECONNECT INJECTOR CONNECTORS.
- CRANK ENGINE.
  IS THERE FUEL SPRAY FROM INJECTORS?

YES: NO TROUBLE FOUND. SEE DIAGNOSTIC AIDS ON FACING PAGE.

ONE ONLY: FAULTY INJECTOR

NO:
- IGN "OFF:.
- INSTALL FUEL PRESSURE GAGE, REFER TO FUEL SYSTEM PRESSURE TEST IN SECTION 4.
- IGN "ON".
- FUEL PRESSURE SHOULD BE 62-90 KPa (9-13 psi)
  IS IT?

YES: FAULTY INJECTORS

NO: SEE FUEL SYSTEM DIAGNOSIS CHART A-6

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

2-2-90
7S 3778-6E

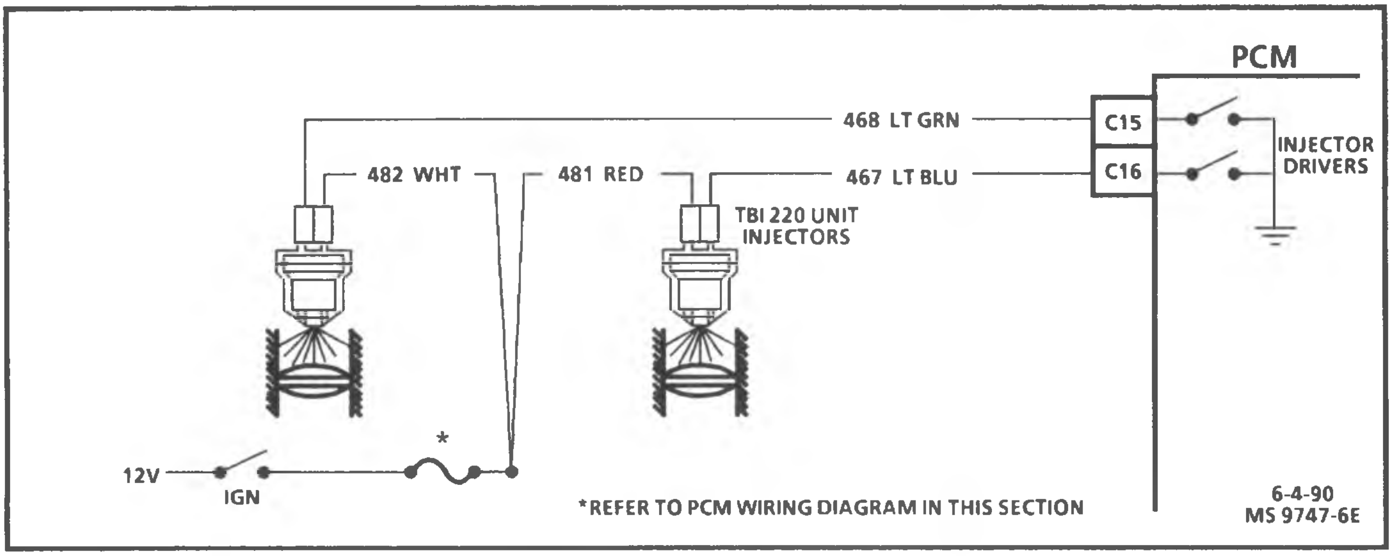


CHART A-3

ENGINE CRANKS BUT WILL NOT RUN
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

This chart assumes that battery condition and engine cranking speed are OK, and there is adequate fuel in the tank. This chart should be used on engines using the Model 220 throttle body.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. A "Service Engine Soon" light "ON" is a basic test to determine if there is a 12 volt supply and ignition 12 volts to PCM. No ALDL may be due to a PCM problem and CHART A-2 will diagnose the PCM. If TPS is over 2.5 volts the engine may be in the clear flood mode which will cause starting problems. If coolant sensor is below –30°C, the PCM will provide fuel for this extremely cold temperature which will severely flood the engine.
2. Voltage at the spark plug is checked using spark tester tool ST-125 (J 26792) or equivalent. No spark indicates a basic ignition problem.
3. While cranking engine there should be no fuel spray with injectors disconnected. Replace an injector if it sprays fuel or drips like a leaking water faucet.
4. Use an injector test light like BT-8320, or equivalent, to test each injector circuit. A blinking light indicates the PCM is controlling the injectors.
5. This test will determine if there is fuel pressure at the injectors and that the injectors are operating.

Diagnostic Aids:

If no trouble is found in the fuel pump circuit or ignition system and the cause of a "Engine Cranks But Will Not Run" has not been found, check for:

- Fouled spark plugs.
- EGR valve stuck open.
- Low fuel pressure. See CHART A-6.
- Water or foreign material in the fuel system.
- A grounded CKT 423 (EST) may cause a "No Start" or a "Start then Stall" condition.
- Basic engine problem.

CHART A-3

ENGINE CRANKS BUT WILL NOT RUN ALL VEHICLES WITH 4L80-E TRANSMISSION

IF CODE 54 IS STORED, USE THAT CHART FIRST

1
- IGN "ON" - IF S.E.S. LIGHT IS OFF, SEE CHART A-1.
- INSTALL "SCAN" TOOL - IF "NO ALDL", SEE CHART A-2.
- CHECK THE FOLLOWING:
  - TPS - IF OVER 2.5V AT CLOSED THROTTLE, SEE CODE 21.
  - COOLANT - IF BELOW -30°C, SEE CODE 15.
- IGN. "OFF" FOR 10 SECONDS. IGN. "ON".
  - ONE FUEL TANK:
    LISTEN FOR PUMP TO RUN. DOES IT?
  - TWO FUEL TANKS:
    LISTEN FOR PUMP IN EACH TANK USING SELECTOR SWITCH. BOTH PUMPS MUST RUN.
    DO THEY BOTH RUN?

NO → SEE FUEL PUMP RELAY CIRCUIT CHART A-5 OR A-5A

YES →

2
- DISCONNECT ONE SPARK PLUG WIRE.
- INSTALL A SPARK TESTER (ST 125 OR EQUIVALENT)
- CRANK ENGINE AND CHECK FOR SPARK.
  IS THERE SPARK?

NO → SEE IGNITION SYSTEM CHECK IN SECTION 6

YES →

3
- RECONNECT SPARK PLUG WIRE.
- DISCONNECT INJECTOR CONNECTORS.
- CRANK ENGINE.
  IS THERE FUEL SPRAY FROM ONE OR BOTH INJECTORS?

YES → FAULTY INJECTOR SEAL OR INJECTOR

NO →

4
- CONNECT INJECTOR TEST LIGHT TO ONE HARNESS CONNECTOR.
- CRANK ENGINE.
- REPEAT TEST ON OTHER CONNECTOR
  DOES TEST LIGHT BLINK ON BOTH TESTS?

NO → SEE INJECTOR CIRCUIT DIAGNOSIS CHART A-4

YES →

5
- RECONNECT INJECTOR CONNECTORS.
- CRANK ENGINE.
  IS THERE FUEL SPRAY FROM INJECTORS?

YES → NO TROUBLE FOUND. SEE DIAGNOSTIC AIDS ON FACING PAGE.

ONE ONLY → FAULTY INJECTOR

NO →
- IGN "OFF:.
- INSTALL FUEL PRESSURE GAGE, REFER TO FUEL SYSTEM PRESSURE TEST IN SECTION 4.
- IGN "ON".
- FUEL PRESSURE SHOULD BE 62-90 KPa (9-13 psi)
  IS IT?

YES → FAULTY INJECTORS

NO → SEE FUEL SYSTEM DIAGNOSIS CHART A-6

"*AFTER REPAIRS,*" CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

2-2-90
7S 3778-6E

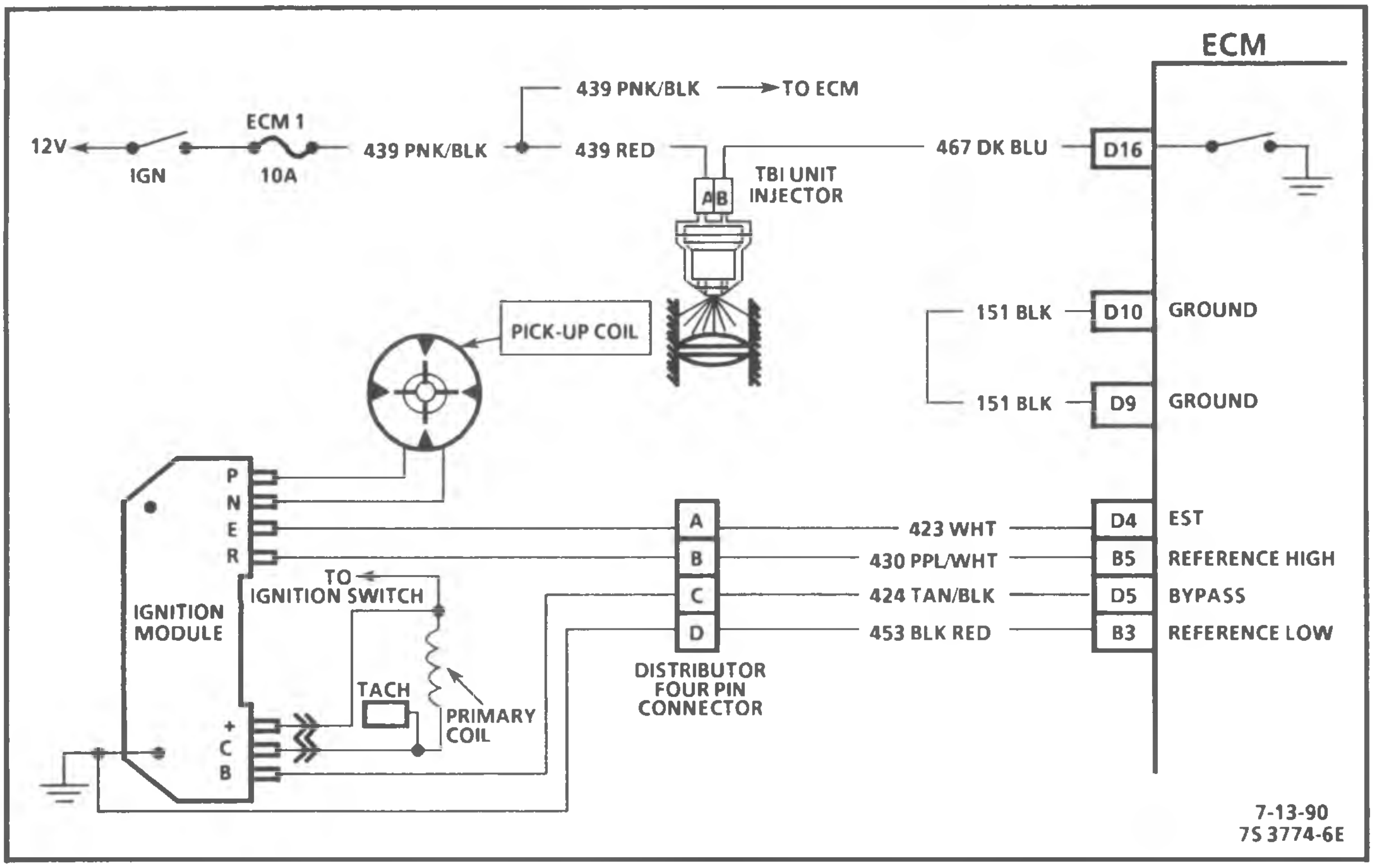


CHART A-4

INJECTOR CIRCUIT DIAGNOSIS
2.5L ENGINE

Circuit Description:

This chart should only be used if diagnosis in CHART A-3 indicated an injector circuit problem.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test will determine if the ignition module is generating a reference pulse, if the wiring is at fault or if the ECM is at fault. By touching and removing a test light, connected to 12 volts, to CKT 430, a reference pulse should be generated. If injector test light blinks, the ECM and wiring are OK.
2. This step tests for 12 volts to the injector. It will also determine if there is a short to voltage on the ECM side of the circuit.
3. This test checks for continuity to the ECM.

CHART A-4

INJECTOR CIRCUIT DIAGNOSIS
2.5L ENGINE

FROM CHART A-3 INJECTOR TEST LIGHT DOES NOT BLINK

NO LIGHT

1
- DISCONNECT DISTRIBUTOR 4-WAY CONNECTOR.
- IGNITION "ON."
- MOMENTARILY TOUCH HARNESS CONNECTOR TERMINAL CKT 430 WITH TEST LIGHT TO 12 VOLTS.

IMPORTANT: INJECTOR TEST LIGHT SHOULD "BLINK" EACH TIME THE TEST LIGHT IS REMOVED FROM CKT 430.

NO BLINKING INJECTOR LIGHT

INJECTOR LIGHT "BLINKS"

- FAULTY IGNITION MODULE OR CONNECTION.

2

CHECK FOR:
- OPEN OR GROUNDED CKT 430.
- FAULTY CONNECTION AT ECM CONNECTOR TERMINAL B5.
- OPEN CIRCUIT BETWEEN ECM TERMINALS "D9" AND "D10".

IF "OK":
- IGNITION "ON."
- PROBE EACH INJECTOR HARNESS CONNECTOR TERMINAL WITH A TEST LIGHT TO GROUND.

LIGHT "ON" ONE TERMINAL.

3
- IGNITION "OFF."
- RECONNECT INJECTOR CONNECTOR
- DISCONNECT C-D (32 PIN) ECM CONNECTOR.
- IGNITION "ON."
- PROBE CONNECTOR TERMINAL D16 WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

FAULTY ECM CONNECTION AT D16, OR FAULTY ECM.

LIGHT "OFF"

FAULTY CONNECTION OR OPEN CKT 467.

LIGHT "OFF" BOTH TERMINALS.

REPAIR OPEN IGNITION CKT 439.

LIGHT "ON" BOTH TERMINALS.

REPAIR SHORT TO VOLTAGE CKT 467 AND RETEST WITH OLD ECM.

STEADY LIGHT

CHECK FOR SHORT TO GROUND INJECTOR CKT 467.

IF CKT 467 IS NOT GROUNDED, CHECK RESISTANCE ACROSS TERMINALS INJECTOR, SHOULD BE OVER 1.3 OHMS.

OK

FAULTY ECM.

NOT OK

FAULTY INJECTOR AND ECM.

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

5-26-90
7S 3930-6E

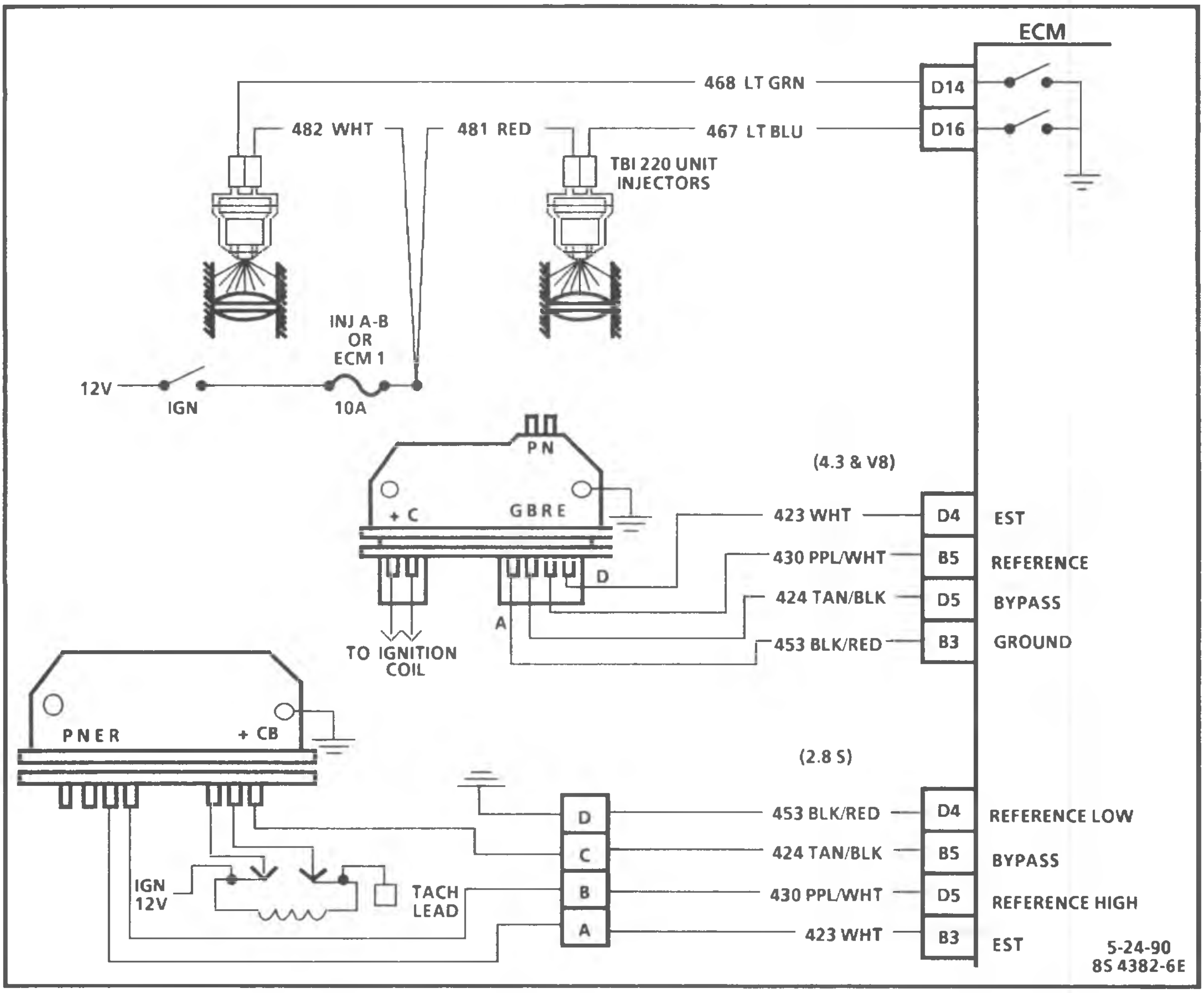


CHART A-4

INJECTOR CIRCUIT DIAGNOSIS
ALL ENGINES EXCEPT 2.5L & VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

This chart should only be used if diagnosis in CHART A-3 indicated an injector circuit problem. If both injector circuits fail to blink when tested, diagnose one injector circuit at a time.

Test Description: Number(s) below refer to circled numbers on the diagnostic chart.

1. This test will determine if the ignition module is generating a reference pulse, if the wiring is at fault or if the ECM is at fault. By touching and removing a test light, connected to 12 volts, to CKT 430, a reference pulse should be generated. If injector test light blinks, the ECM and wiring are OK.
2. This step tests for 12 volts to the injector. It will also determine if there is a short to voltage on the ECM side of the circuit.
3. This test checks for continuity to the ECM.

CHART A-4

INJECTOR CIRCUIT DIAGNOSIS
ALL ENGINES EXCEPT 2.5L & VEHICLES WITH 4L80-E TRANSMISSION

FROM CHART A-3
INJECTOR TEST LIGHT
DOES NOT BLINK

NO LIGHT, ONE OR BOTH

1
- DISCONNECT DISTRIBUTOR 4-WAY CONNECTOR.
- IGNITION "ON."
- MOMENTARILY TOUCH HARNESS CONNECTOR TERMINAL CKT 430 WITH TEST LIGHT TO 12 VOLTS.

IMPORTANT: INJECTOR TEST LIGHT SHOULD "BLINK" EACH TIME THE TEST LIGHT IS REMOVED FROM CKT 430.

NO BLINKING INJECTOR LIGHT

2
CHECK FOR:
- OPEN OR GROUNDED CKT 430.
- FAULTY CONNECTION AT ECM CONNECTOR TERMINAL "B5" OR "D5" (2.8L "S").

IF "OK":
- IGNITION "ON."
- PROBE EACH INJECTOR HARNESS CONNECTOR TERMINAL WITH A TEST LIGHT TO GROUND.

LIGHT "ON" ONE TERMINAL

3
- IGNITION "OFF."
- RECONNECT INJECTOR CONNECTOR
- DISCONNECT C-D (32 PIN) ECM CONNECTOR.
- IGNITION "ON."
- PROBE CONNECTOR TERMINAL " D14" OR "D16" WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

FAULTY ECM CONNECTION "D14" OR "D16" OR FAULTY ECM.

LIGHT "OFF"

FAULTY CONNECTION OR OPEN CKT 467 OR 468.

LIGHT "OFF" BOTH TERMINALS

REPAIR OPEN IGNITION CKT 481 OR 482.

LIGHT "ON" BOTH TERMINALS

REPAIR SHORT TO VOLTAGE CKT 467 OR 468 AND RETEST WITH OLD ECM.

INJECTOR LIGHT "BLINKS"

- FAULTY IGNITION MODULE OR CONNECTION.

STEADY LIGHT, ONE OR BOTH

CHECK FOR SHORT TO GROUND INJECTOR CKT 467 OR 468.

IF CIRCUIT IS NOT SHORTED TO GROUND, CHECK RESISTANCE ACROSS INJECTOR TERMINALS. SHOULD BE OVER 1.3 OHMS.

OK

FAULTY ECM.

NOT OK

FAULTY INJECTOR AND ECM.

"*AFTER REPAIRS,*" CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

7-16-90
7S 3931-6E

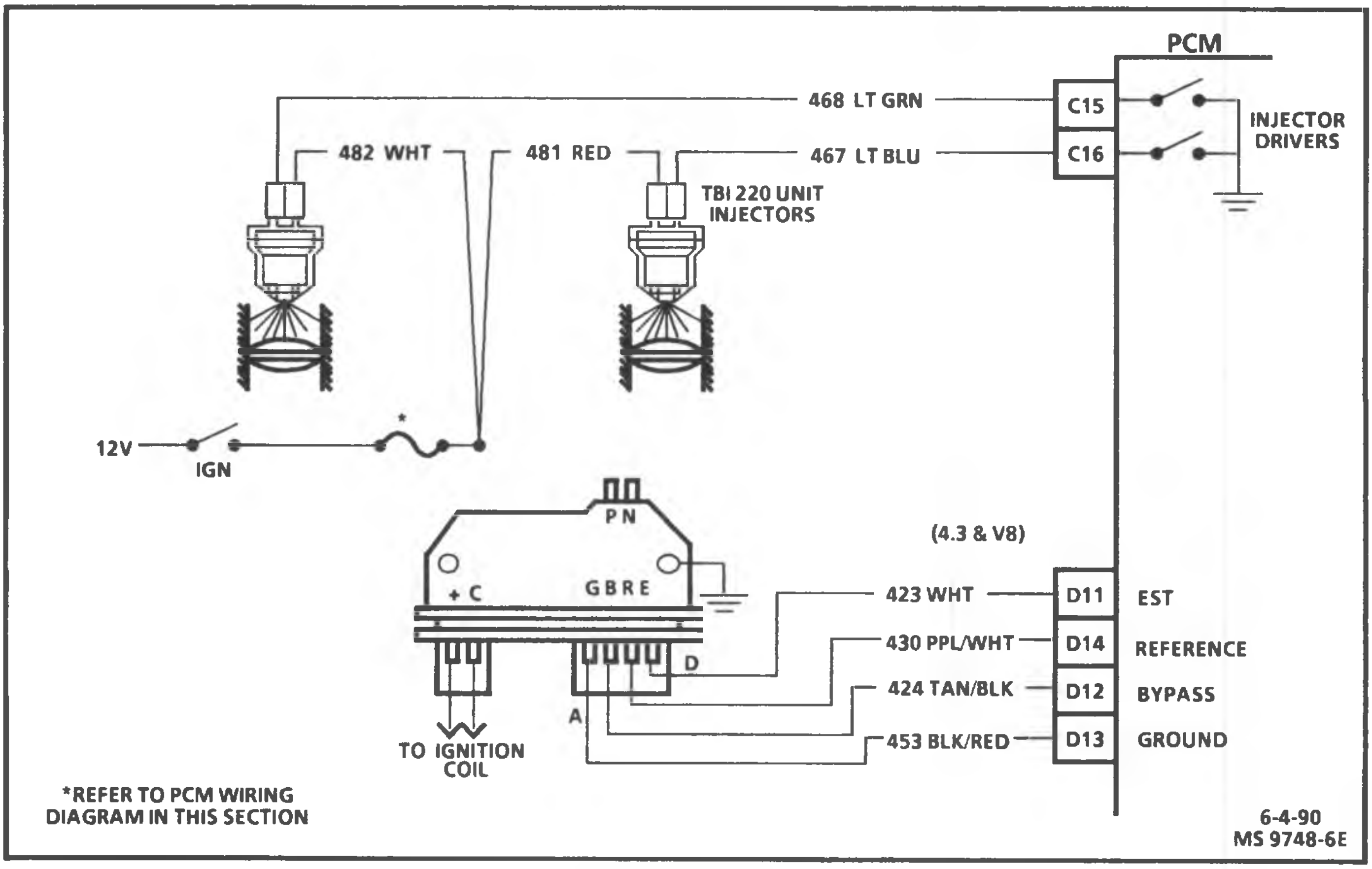


CHART A-4

INJECTOR CIRCUIT DIAGNOSIS
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

This chart should only be used if diagnosis in CHART A-3 indicated an injector circuit problem.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test will determine if the ignition module is generating a reference pulse, if the wiring is at fault or if the PCM is at fault. By touching and removing a test light, connected to 12 volts, to CKT 430, a reference pulse should be generated. If injector test light blinks, the PCM and wiring are OK.
2. This step tests for 12 volts to the injector. It will also determine if there is a short to voltage on the PCM side of the circuit.
3. This test checks for continuity to the PCM.

CHART A-4

INJECTOR CIRCUIT DIAGNOSIS
ALL VEHICLES WITH 4L80-E TRANSMISSION

FROM CHART A-3
INJECTOR TEST LIGHT
DOES NOT BLINK

NO LIGHT, ONE OR BOTH

1
- DISCONNECT DISTRIBUTOR 4-WAY CONNECTOR.
- IGNITION "ON."
- MOMENTARILY TOUCH HARNESS CONNECTOR TERMINAL CKT 430 WITH TEST LIGHT TO 12 VOLTS. IMPORTANT: INJECTOR TEST LIGHT SHOULD "BLINK" EACH TIME THE TEST LIGHT IS REMOVED FROM CKT 430.

NO BLINKING INJ. LIGHT

2
CHECK FOR:
- OPEN OR GROUNDED CKT 430.
- FAULTY CONNECTION AT PCM CONNECTOR TERMINAL "D14".

IF "OK":
- IGNITION "ON."
- PROBE EACH INJECTOR HARNESS CONNECTOR TERMINAL WITH A TEST LIGHT TO GROUND.

LIGHT "ON" ONE TERMINAL.

3
- IGNITION "OFF."
- RECONNECT INJECTOR CONNECTOR
- DISCONNECT C-D (32 PIN) PCM CONNECTOR.
- IGNITION "ON."
- PROBE CONNECTOR TERM. "C15" OR "C16" WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

FAULTY PCM CONNECTION "C15"
OR
"C16",
OR
FAULTY PCM.

LIGHT "OFF"

FAULTY CONNECTION
OR
OPEN CKT 467 OR 468.

LIGHT "OFF" BOTH TERMINALS.

REPAIR OPEN IGNITION CKT 481 OR 482.

LIGHT "ON" BOTH TERMINALS.

REPAIR SHORT TO VOLTAGE CKT 467 OR 468 AND RETEST WITH OLD PCM.

INJECTOR LIGHT "BLINKS"

- FAULTY IGNITION MODULE OR CONNECTION.

STEADY LIGHT, ONE OR BOTH

CHECK FOR SHORT TO GROUND INJECTOR CKT 467 OR 468.

IF CIRCUIT IS NOT SHORTED TO GROUND, CHECK RESISTANCE ACROSS INJECTOR TERMINALS, SHOULD BE OVER 1.3 OHMS.

OK

FAULTY PCM.

NOT OK

FAULTY INJECTOR AND PCM.

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

6-4-90
MS 9969-6E

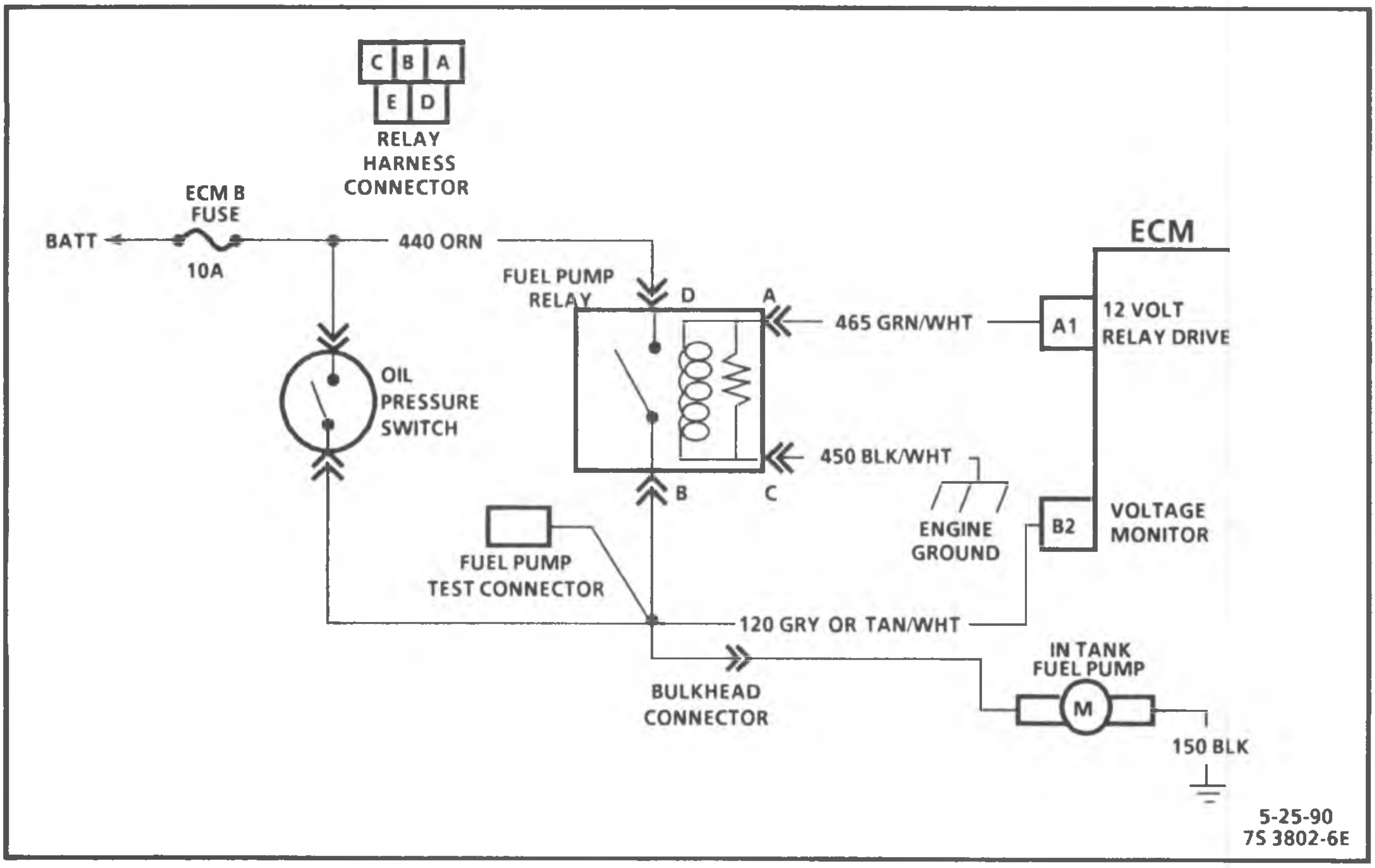


CHART A-5

FUEL PUMP RELAY CIRCUIT DIAGNOSIS "S/T & M/L" SERIES

Circuit Description:

When the ignition switch is turned "ON," the ECM will turn "ON" the in-tank fuel pump. It will remain "ON" as long as the engine is cranking or running, and the ECM is receiving distributor reference pulses. If there are no reference pulses, the ECM will shut "OFF" the fuel pump within 2 seconds after ignition "ON" or engine stops.

The pump will deliver fuel to the TBI unit where the system pressure is controlled to about 62 to 90 kPa (9 to 13 psi). Excess fuel is then returned to the fuel tank.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Turns "ON" the fuel pump if CKT 120 wiring is OK. If the pump runs, it maybe a fuel pump relay circuit problem, which the following steps will locate.
2. The next two steps check for power and ground circuits to the relay.
3. Determines if ECM can control the relay.
4. The oil pressure switch serves as a backup for the fuel pump relay to help prevent a "no start" situation. If the fuel pump relay was found to be inoperative, the oil pressure switch circuit should also be tested to determine why it did not operate the fuel pump.

CHART A-5

FUEL PUMP RELAY CIRCUIT DIAGNOSIS "S/T & M/L" SERIES

FROM CHART A-3
FUEL PUMP DOES NOT RUN

1
- APPLY FUSED 12V TO FUEL PUMP TEST TERMINAL
- LISTEN FOR IN TANK FUEL PUMP. DOES IT RUN?

NO

OPEN IN CKT 120 OR CKT 150 TO THE FUEL PUMP OR FAULTY PUMP.

YES

- REMOVE 12V FROM TEST TERMINAL
- IGNITION "OFF" FOR TEN SECONDS.
- IGNITION "ON." LISTEN FOR IN TANK FUEL PUMP. PUMP SHOULD RUN FOR 2 SECONDS AFTER IGNITION ON. DOES IT?

YES

NO TROUBLE FOUND

NO

2
- DISCONNECT PUMP RELAY.
- IGNITION "ON" ENGINE STOPPED.
- PROBE RELAY HARNESS-CONNECTOR TERMINAL CKT 440 WITH A TEST LIGHT TO GROUND.

LIGHT" OFF"

REPAIR OPEN CKT 440.

LIGHT" ON"

CONNECT A TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINAL CKTS 450 AND 440.

LIGHT" OFF"

REPAIR OPEN GROUND CKT 450.

LIGHT" ON"

3
- CONNECT TEST LIGHT BETWEEN TERMINAL CKT 465 AND GROUND.
- IGNITION "OFF" FOR 10 SECONDS.
- IGNITION "ON." TEST LIGHT SHOULD LIGHT FOR 2 SECONDS. DOES IT?

NO

OPEN OR SHORT TO GROUND IN CKT 465
OR
FAULTY ECM CONNECTIONS
OR
ECM.

YES

4
- FAULTY CONNECTION AT RELAY TERMINAL "A" OR FAULTY RELAY.

IF ORIGINAL SYMPTOM WAS "ENGINE CRANKS BUT WILL NOT RUN," CONTINUE TESTING OIL PRESSURE SWITCH.
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- OIL PRESSURE NORMAL.
- DISCONNECT FUEL PUMP RELAY. ENGINE SHOULD CONTINUE TO RUN. DOES IT?

NO

OPEN IN CKT 440 OR 120 TO THE OIL PRESSURE SWITCH OR FAULTY OIL PRESSURE SWITCH

YES

- RECONNECT FUEL PUMP RELAY.
- IGNITION "OFF."
- PROBE FUEL PUMP TEST TERMINAL WITH A TEST LIGHT TO GROUND.

NO LIGHT

NO TROUBLE FOUND

LIGHT

FAULTY OIL PRESSURE SWITCH

"*AFTER REPAIRS,*" CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

4-19-90
7S 3803-6E

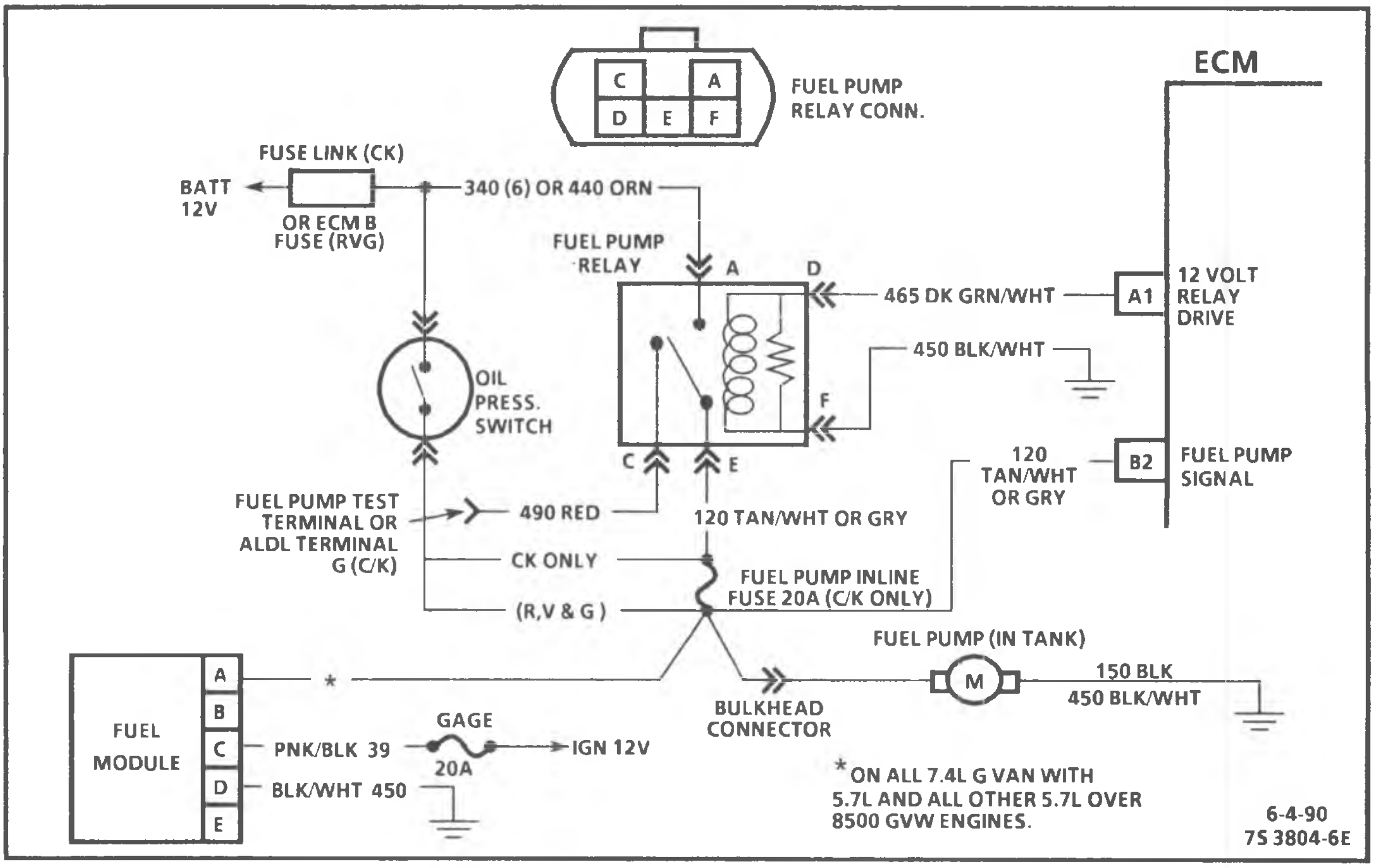


CHART A-5

FUEL PUMP RELAY CIRCUIT DIAGNOSIS
(ONE FUEL TANK)
"C/K, R/V & G" SERIES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

When the ignition switch is turned "ON," the Electronic Control Module (ECM) will turn "ON" the in-tank fuel pump. It will remain "ON" as long as the engine is cranking or running, and the ECM is receiving distributor reference pulses. If there are no reference pulses, the ECM will shut "OFF" the fuel pump within 2 seconds after ignition "ON" or engine stops, except when a fuel module is used.

The pump will deliver fuel to the TBI unit where the system pressure is controlled to about 62 to 90 kPa (9 to 13 psi). Excess fuel is then returned to the fuel tank.

A fuel module is used on all 7.4L, G van with 5.7L and all other 5.7L over 8500 GVW engines to correct a hot restart (vapor lock) during a high ambient condition. It is designed to over-ride the ECM two second pump operation and will run the fuel pump for twenty seconds at initial ignition "ON."

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This procedure applies direct voltage to run the fuel pump. If the pump runs, it may be a fuel pump relay circuit problem which the following step will locate.
2. This step checks voltage from the battery and the ground circuit to the relay.
3. This test determines if there is voltage from the ECM, terminal "A," to terminal "D" on the relay connector.
4. This completes the fuel pump relay circuit but if this diagnosis was used because the engine would not run then oil pressure switch should also be diagnosed.

Diagnostic Aids:

An inoperative fuel module may be the cause of a hot stall/no start condition. Check for power and ground circuit to the fuel module and a complete circuit to the pump from terminal "A." If OK, and the pump does not run for the specified 20 seconds at initial ignition "ON," replace the fuel module.

CHART A-5

FUEL PUMP RELAY CIRCUIT DIAGNOSIS
(ONE FUEL TANK)
"C/K, R/V & G" SERIES EXCEPT 4L80-E TRANSMISSION

FROM CHART A-3
FUEL PUMP DOES NOT RUN

1
- APPLY FUSED 12V TO FUEL PUMP TEST TERMINAL
- LISTEN FOR IN TANK FUEL PUMP.
  DOES IT RUN?

YES

- REMOVE 12V FROM TEST TERMINAL.
- IGNITION "OFF" FOR 10 SECONDS.
- DISCONNECT FUEL MODULE*
- IGNITION "ON". LISTEN FOR IN TANK FUEL PUMP. PUMP SHOULD RUN FOR 2 SECONDS AFTER IGNITION IS ON.
  DOES IT?

NO

OPEN IN CKT 120/920, RELAY OR CKT 150/450 TO THE FUEL PUMP OR FAULY PUMP.

NO

2
- DISCONNECT PUMP RELAY.
- IGNITION "ON" ENGINE STOPPED.
- PROBE RELAY HARNESS-CONNECTOR TERMINAL CKT 440/340 WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

CONNECT A TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINAL CKTS 450 AND 440/340.

LIGHT" ON"

3
- CONNECT TEST LIGHT BETWEEN TERMINAL CKT 465 AND GROUND.
- IGNITION "OFF" FOR 10 SECONDS.
- IGNITION "ON". TEST LIGHT SHOULD LIGHT FOR 2 SECONDS.
  DOES IT?

LIGHT" OFF"

REPAIR OPEN GROUND CKT 450.

LIGHT" OFF"

REPAIR OPEN CKT 440/340.

YES

IF NO FUEL MODULE, NO TROUBLE FOUND.
IN RELAY CIRCUIT WITH FUEL MODULE:
- IGNITION "OFF", CONNECT MODULE & WAIT 10 SECONDS.
- IGNITION "ON", FUEL PUMP SHOULD RUN FOR ABOUT 20 SECONDS.
  DOES IT?

NO

REFER TO FUEL MODULE CHECK PROCEDURE.

YES

NO TROUBLE FOUND

* FUEL MODULE IS ON ALL 7.4L, G VAN WITH 5.7L AND ALL OTHER 5.7L OVER 8500 GVW ENGINES.

YES

4
- FAULTY CONNECTION AT RELAY TERMINAL "D" OR FAULTY RELAY. CONNECT FUEL MODULE IF REMOVED.

IF ORIGINAL SYMPTOM WAS "ENGINE CRANKS BUT WILL NOT RUN", CONTINUE TESTING OIL PRESSURE SWITCH.
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- OIL PRESSURE NORMAL.
- DISCONNECT FUEL PUMP RELAY. ENGINE SHOULD CONTINUE TO RUN.
  DOES IT?

NO

OPEN OR SHORT TO GROUND IN CKT 465 OR FAULTY ECM.

YES

- RECONNECT FUEL PUMP RELAY.
- IGNITION "OFF".
- PROBE FUEL PUMP TEST TERMINAL WITH A TEST LIGHT TO GROUND.

NO LIGHT

NO TROUBLE FOUND

LIGHT

FAULTY OIL PRESSURE SWITCH

NO

OPEN IN CKT 440/340 OR 120 TO THE OIL PRESSURE SWITCH OR FAULTY OIL PRESSURE SWITCH.

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

5-26-90
7S 3805-6E

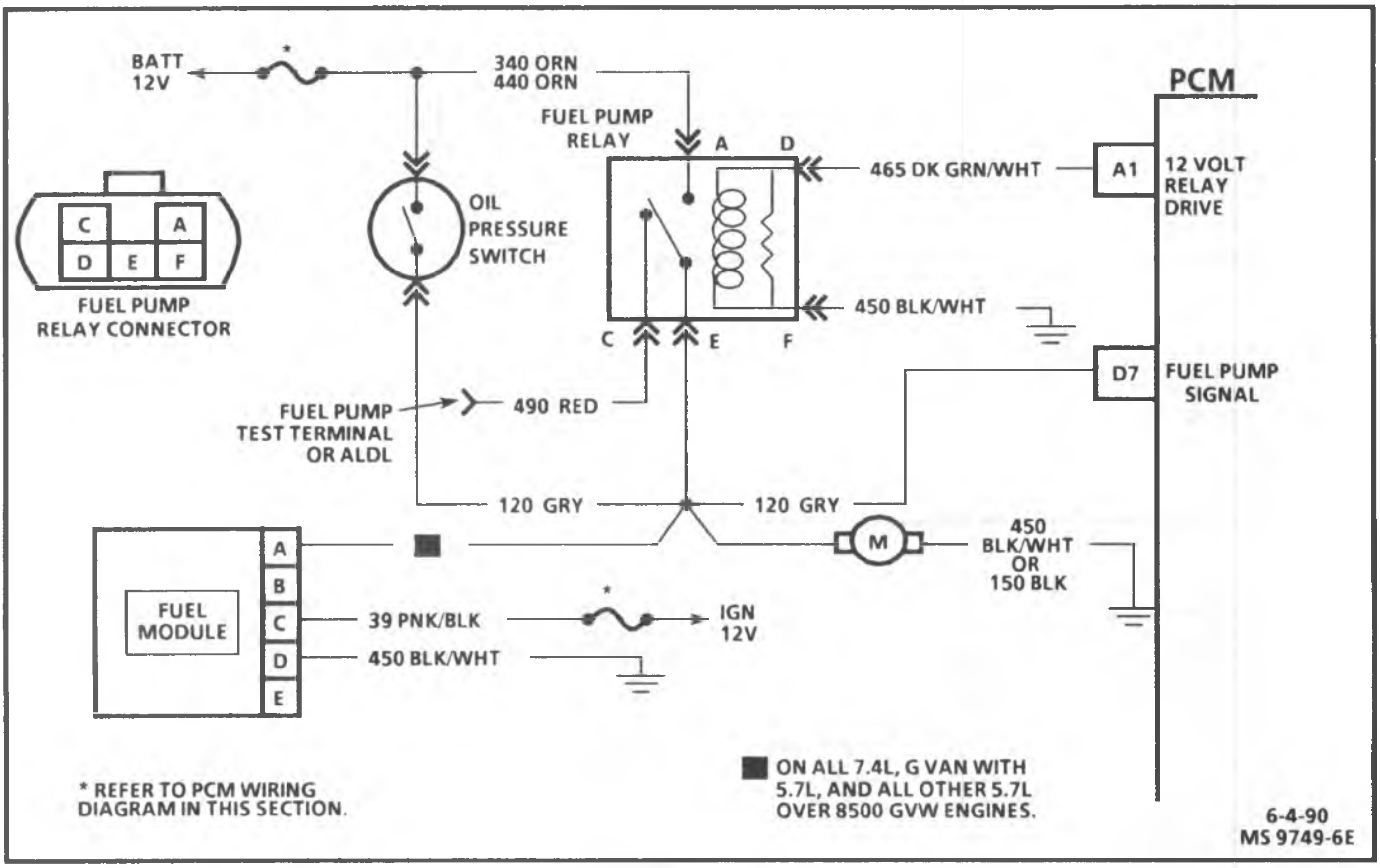


CHART A-5

FUEL PUMP RELAY CIRCUIT DIAGNOSIS
(ONE FUEL TANK)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

When the ignition switch is turned "ON," the Powetrain Control Module (PCM) will turn "ON" the in-tank fuel pump. It will remain "ON" as long as the engine is cranking or running, and the ECM is receiving distributor reference pulses. If there are no reference pulses, the PCM will shut "OFF" the fuel pump within 2 seconds after ignition "ON" or engine stops.

A fuel module is used on all light duty vehicles over 8500 GVW, except 4.3L and all 5.7L "G" Vans, to insure a rapid hot restart during high ambient air temperature conditions. It is designed to over-ride the PCM two second pump operation and will run the fuel pump for twenty seconds at initial ignition "ON."

The pump will deliver fuel to the TBI unit where the system pressure is controlled to about 62 to 90 kPa (9 to 13 psi). Excess fuel is then returned to the fuel tank.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This procedure applies direct voltage to run the fuel pump. If the pump runs, it may be a fuel pump relay circuit problem which the following step will locate.
2. This step checks voltage from the battery and the ground circuit to the relay.
3. This test determines if there is voltage from the PCM, terminal, "A" to terminal "D" on the relay connector.
4. This completes the fuel pump relay circuit but if this diagnosis was used because the engine would not run then oil pressure switch should also be diagnosed.

Diagnostic Aids:

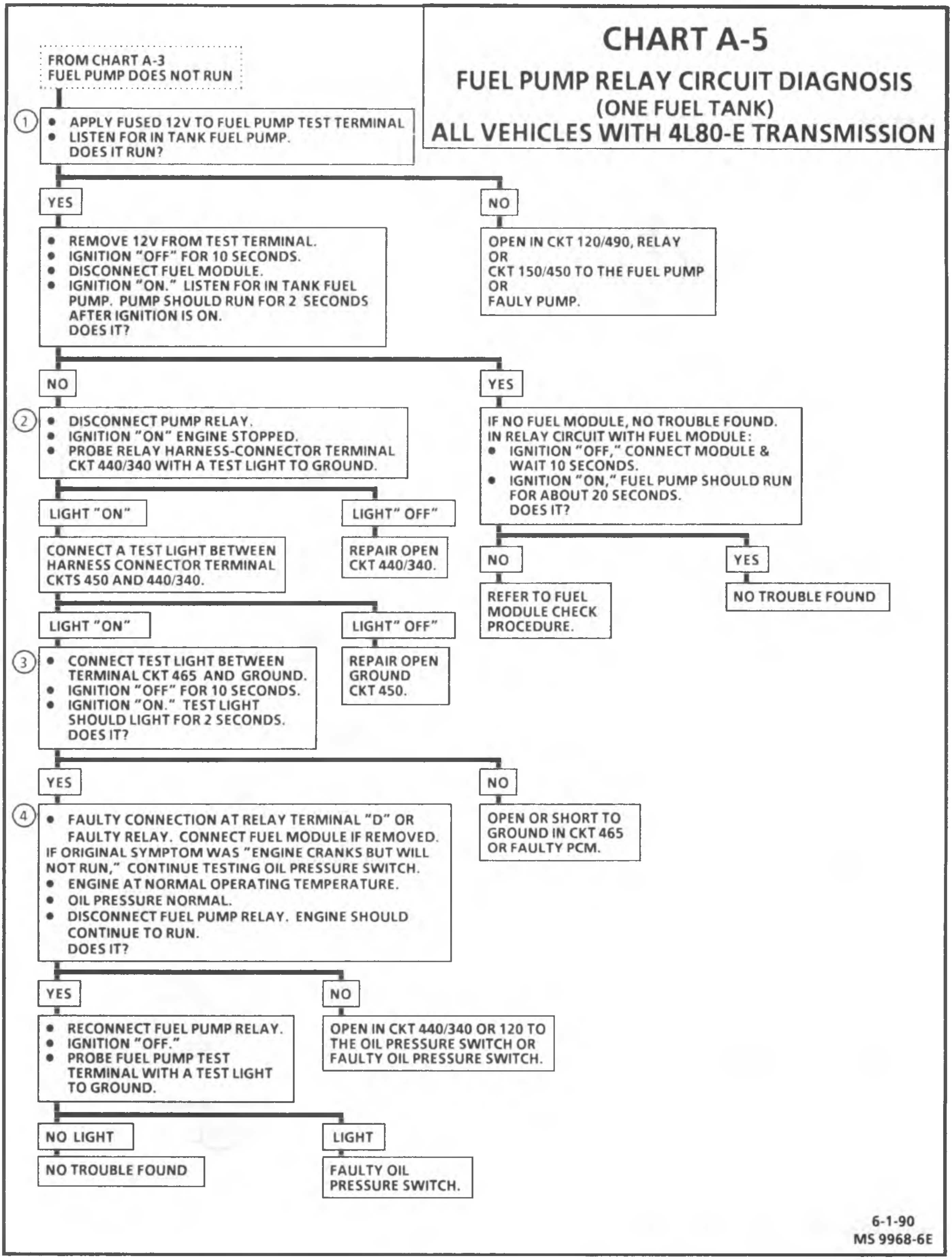
An inoperative fuel module may be the cause of a hot stall/no start condition. Check for power and ground circuit to the fuel module and a complete circuit to the pump from terminal "A." If OK, and the pump does not run for the specified 20 seconds at initial ignition "ON," replace the fuel module.

CHART A-5

FUEL PUMP RELAY CIRCUIT DIAGNOSIS

(ONE FUEL TANK)

ALL VEHICLES WITH 4L80-E TRANSMISSION



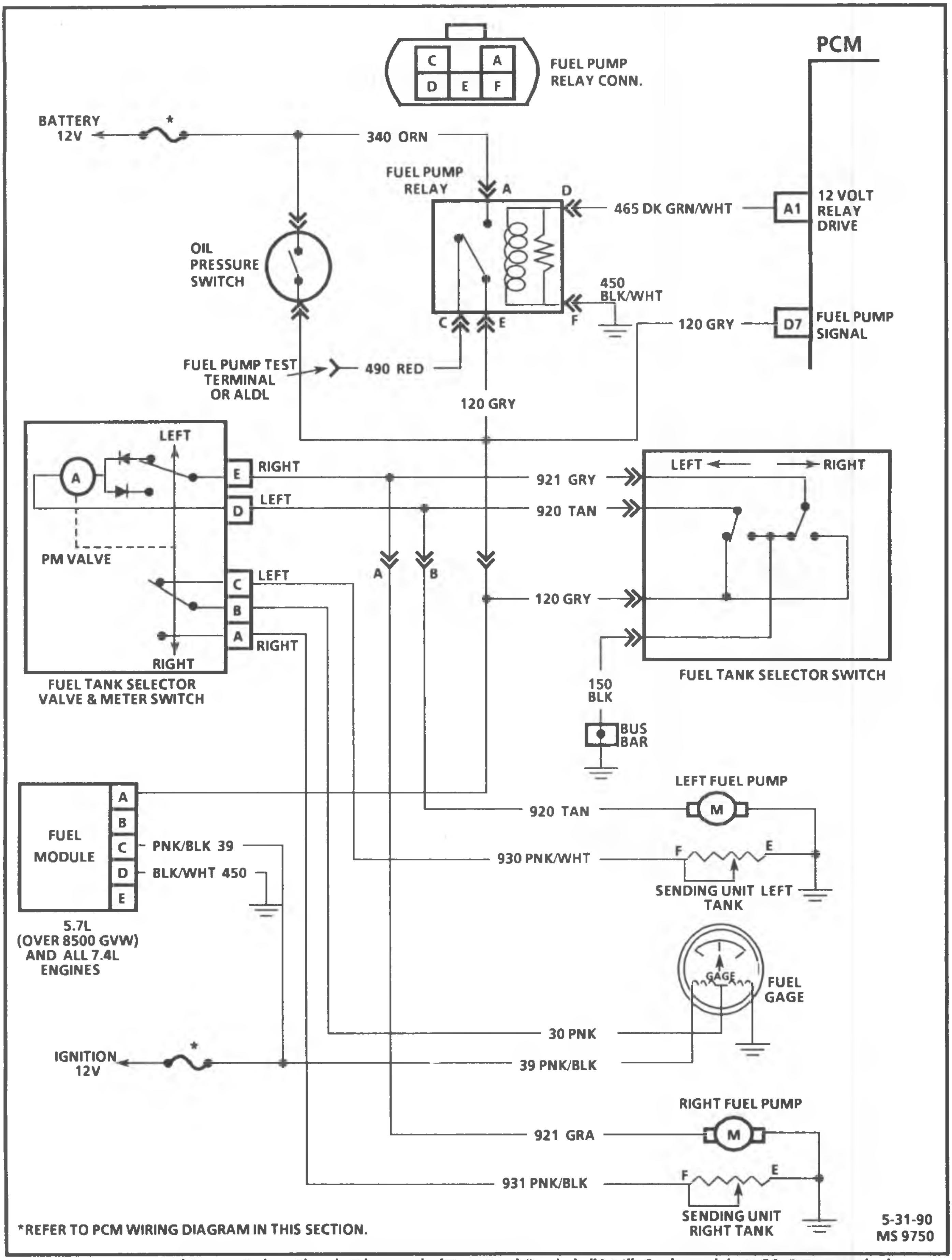


CHART A-5A, Fuel Pump Relay Circuit Diagnosis (Two Fuel Tanks) "R/V" Series with 4L80-E Transmission

CHART A-5A

FUEL PUMP RELAY CIRCUIT DIAGNOSIS (TWO FUEL TANKS) "R/V" SERIES WITH 4L80-E TRANSMISSION

FROM CHART A-3--FUEL PUMP WILL NOT RUN.

1.
- APPLY FUSED 12V TO FUEL PUMP TEST TERMINAL.
- LISTEN FOR SELECTOR VALVE AND FUEL PUMP IN EACH FUEL TANK USING SELECTOR SWITCH.

DO THEY BOTH RUN?

YES

- REMOVE 12V FROM TEST TERMINAL.
- IGNITION "OFF" FOR 10 SECONDS. SELECTOR SWITCH DEPRESSED AT TOP.
- DISCONNECT FUEL MODULE.
- IGNITION "ON". LISTEN FOR FUEL PUMP IN RIGHT TANK. PUMP SHOULD RUN FOR 2 SECONDS.

DOES IT?

NO

2. IF NEITHER PUMP WILL RUN, CHECK FOR AN OPEN IN CKT 120, RELAY OR SELECTOR SWITCH.
IF ONE PUMP WILL RUN, CHECK FOR AN OPEN IN THE CIRCUIT THAT IS INOPERATIVE INCLUDING SELECTOR SWITCH.
CHECK GROUND CIRCUIT AT FUEL PUMPS.
IF VALVE INOPERATIVE REFER TO FUEL TANK SELECTOR DIAGNOSIS.

(DOES IT?) **NO**

- DISCONNECT PUMP RELAY.
- IGNITION "ON" ENGINE STOPPED.
- PROBE RELAY HARNESS CONNECTOR TERMINAL CKT 340 WITH A TEST LIGHT TO GROUND.

LIGHT SHOULD BE "ON."
IS IT?

(DOES IT?) **YES**

NO TROUBLE FOUND IN RELAY CIRCUIT. REFER TO FUEL TANK SELECTOR DIAGNOSIS.
WITH FUEL MODULE:
- IGNITION "OFF," CONNECT MODULE & WAIT 10 SECONDS.
- IGNITION "ON," RIGHT FUEL PUMP SHOULD RUN FOR ABOUT 20 SECONDS.

DOES IT?

- **NO** — REFER TO FUEL MODULE CHECK PROCEDURE.
- **YES** — NO TROUBLE FOUND. REFER TO FUEL TANK SELECTOR DIAGNOSIS.

(IS IT?) **YES**

3. CONNECT A TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINAL CKTS 450 AND 340.
LIGHT SHOULD BE "ON."
IS IT?

(IS IT?) **NO** — REPAIR OPEN CKT 340.

(IS IT?) **YES**

4.
- CONNECT TEST LIGHT BETWEEN TERMINAL CKT 465 AND GROUND.
- IGNITION "OFF" FOR 10 SECONDS.
- IGNITION "ON." TEST LIGHT SHOULD LIGHT FOR 2 SECONDS.

DOES IT?

(IS IT?) **NO** — REPAIR OPEN GROUND CIRCUIT 450.

(DOES IT?) **YES**

5.
- FAULTY CONNECTION AT RELAY TERMINAL "D" OR FAULTY RELAY. CONNECT FUEL MODULE IF REMOVED.
- CONTINUE TEST IF ORIGINAL SYMPTOM WAS "ENGINE CRANKS BUT WILL NOT RUN."
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- OIL PRESSURE NORMAL. START ENGINE.
- DISCONNECT FUEL PUMP RELAY. ENGINE SHOULD CONTINUE TO RUN.

DOES IT?

(DOES IT?) **NO** — OPEN OR SHORT TO GROUND IN CKT 465 OR FAULTY PCM.

* FUEL MODULE IS ON ALL 7.4L AND 5.7L (OVER 8500 GVW) ENGINES

(DOES IT?) **YES**

- RECONNECT FUEL PUMP RELAY.
- IGNITION "OFF."
- PROBE FUEL PUMP TEST TERMINAL WITH A TEST LIGHT TO GROUND.

LIGHT SHOULD BE "OFF."
IS IT?

(DOES IT?) **NO** — OPEN IN CKT 340 OR 120 TO THE OIL PRESSURE SWITCH OR FAULTY OIL PRESSURE.

- **YES** — NO TROUBLE FOUND
- **NO** — FAULTY OIL PRESSURE SWITCH.

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

6-6-90
MS 9967-6E

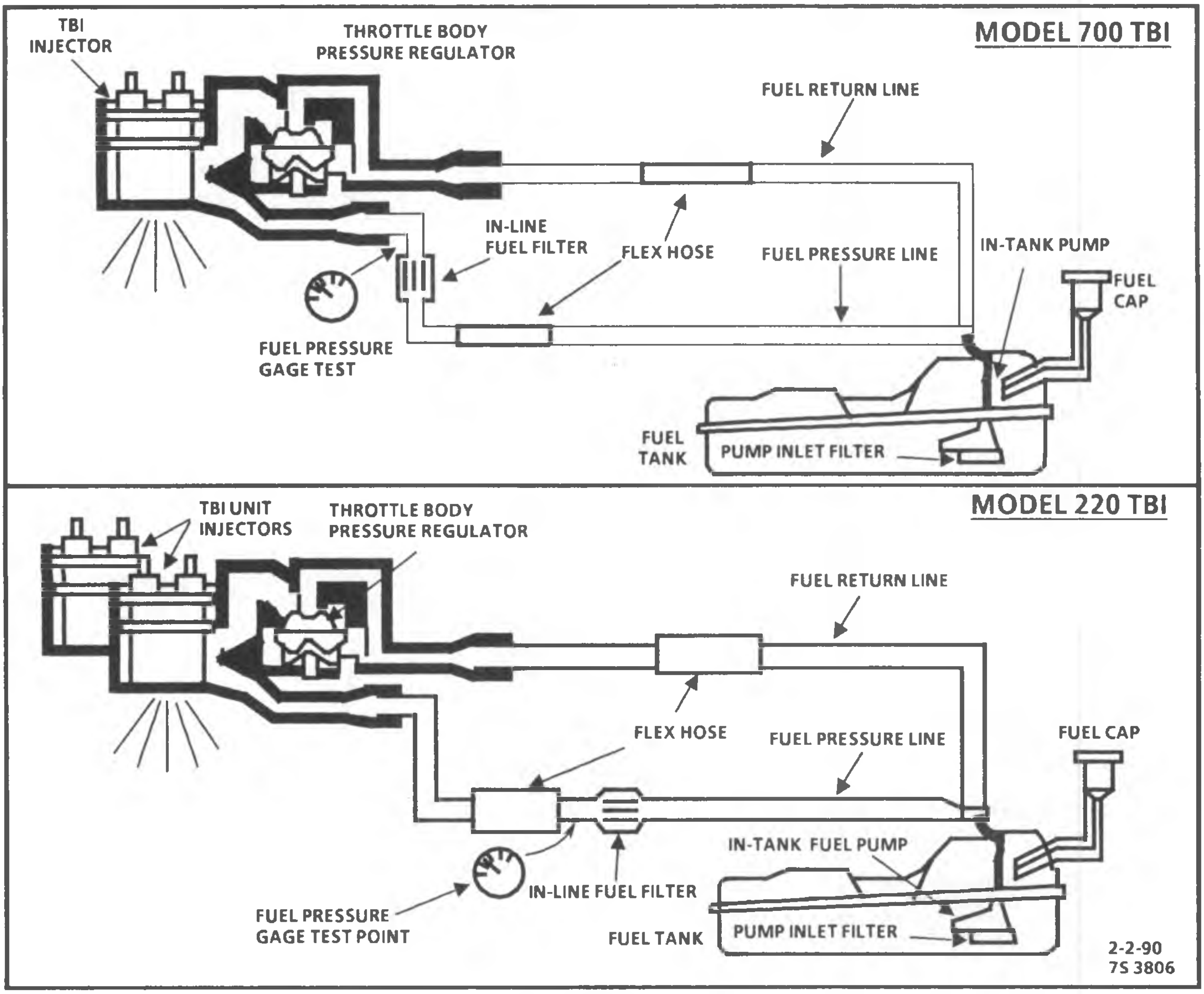


CHART A-6

FUEL SYSTEM PRESSURE TEST ALL VEHICLES

Circuit Description:

When the fuel pump is running, fuel is delivered to the injector(s) and then to the regulator where the system pressure is controlled to about 62 to 90 kPa (9 to 13 psi). Excess fuel is then returned to the fuel tank.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Pressure, but less than 62 kPa (9 psi) falls into two areas:

- Regulated pressure but less than 62 kPa (9 psi) - Amount of fuel to injector OK but pressure is too low. System will be lean running and may set Code 44. Also, hard starting cold and poor overall performance.
- Restricted flow causing pressure drop - Normally, a vehicle with a fuel pressure of less than 62 kPa (9 psi) at idle will not be driveable. However, if the pressure drop occurs only while driving, the engine could surge and stop when pressure is too low.

2. Restricting the outlet side of the gage allows the pump to develop its maximum pressure (dead head pressure). With battery voltage applied to the pump "test" terminal, fuel pressure should rise to 90 to 103 kPa (13 to 15 psi) as the pressure gage outlet hose is gradually pinched.
3. This test determines if the high fuel pressure is due to a restricted fuel return line or a throttle body pressure regulator problem.

Diagnostic Aids:

- If the vehicle is equipped with a fuel module, the module must be disconnected before performing the fuel system pressure test. Refer to "Fuel Control," Section "4".
- Fuel system is under pressure. To avoid fuel spillage, refer to procedures in "Fuel Control," Section "4" for testing or making repairs requiring disassembly of fuel lines or fittings.
- On V6 engines, the fuel pressure drops to almost zero psi after pump shuts "OFF."

CHART A-6

FUEL SYSTEM PRESSURE TEST ALL VEHICLES

SEE "DIAGNOSTIC AIDS" BEFORE BEGINNING

- IGNITION "OFF" FOR TEN SECONDS.
- IGNITION "ON." LISTEN FOR IN TANK FUEL PUMP. AFTER IGNITION IS "ON," PUMP SHOULD RUN FOR 2 SECONDS OR 20 SECONDS IF EQUIPPED WITH FUEL MODULE.

YES

- IGNITION "OFF."
- FUEL TANK QUANTITY OK.
- INSTALL PRESSURE GAGE AS OUTLINED IN SECTION 4.
- IGNITION "ON," NOTE PRESSURE WITHIN 2 SECONDS.

NO

SEE FUEL PUMP RELAY CIRCUIT CHART A-5 OR A-5A.

FUEL PRESSURE IS BELOW 62 kPa (9 psi) OR ABOVE 89 kPa (13 psi).

FUEL PRESSURE IS 62-90 kPa (9-13 psi)

NO PROBLEM FOUND

(1) LESS THAN 62 kPa (9 psi)

- INSTALL PRESSURE GAGE ON INLET SIDE OF FUEL FILTER AND REINSTALL FILTER OUTLET LINE.
- APPLY 12V TO TEST TERMINAL.
- NOTE PRESSURE.*

LESS THAN 62 kPa (9 psi)

(2)
- IGNITION "OFF."
- DISCONNECT INJECTOR.
- APPLY 12 VOLTS TO FUEL PUMP TEST CONNECTOR.
- GRADUALLY PINCH PRESSURE GAGE OUTLET HOSE AND NOTE PRESSURE.*

ABOVE 89 kPa (13 psi)

TBI 220
REPLACE FUEL METER COVER WHICH INCLUDES PRESSURE REGULATOR.
TBI 700
REPLACE PRESSURE REGULATOR ASSY.

PRESSURE, BUT LESS THAN 62 kPa (9 psi)

CHECK FOR RESTRICTED FUEL LINE FROM FUEL TANK TO GAGE OR FAULTY IN-TANK
- FUEL PUMP
- COUPLING HOSE
- PUMP INLET FILTER
- WRONG FUEL PUMP

FAULTY FUEL TANK SELECTOR VALVE & METER SWITCH (TWO TANKS).

ABOVE 62 kPa (9 psi)

REPLACE FILTER AND RECHECK.

ABOVE 89 kPa (13 psi)

(3)
- DISCONNECT INJECTOR CONNECTOR.
- DISCONNECT FUEL RETURN LINE FLEXIBLE HOSE.
- ATTACH 5/16 I.D. FLEX HOSE TO THROTTLE BODY SIDE OF RETURN LINE. INSERT THE OTHER END IN AN APPROVED GASOLINE CONTAINER.
- NOTE FUEL PRESSURE WITHIN 2 SECONDS AFTER IGNITION "ON."*

ABOVE 89 kPa (13 psi)

CHECK FOR RESTRICTED FUEL LINE BETWEEN GAGE AND RETURN LINE FLEXIBLE HOSE

IF LINE OK:
TBI 220
REPLACE FUEL METER COVER WHICH INCLUDES PRESSURE REGULATOR.
TBI 700
REPLACE PRESSURE REGULATOR ASSY.

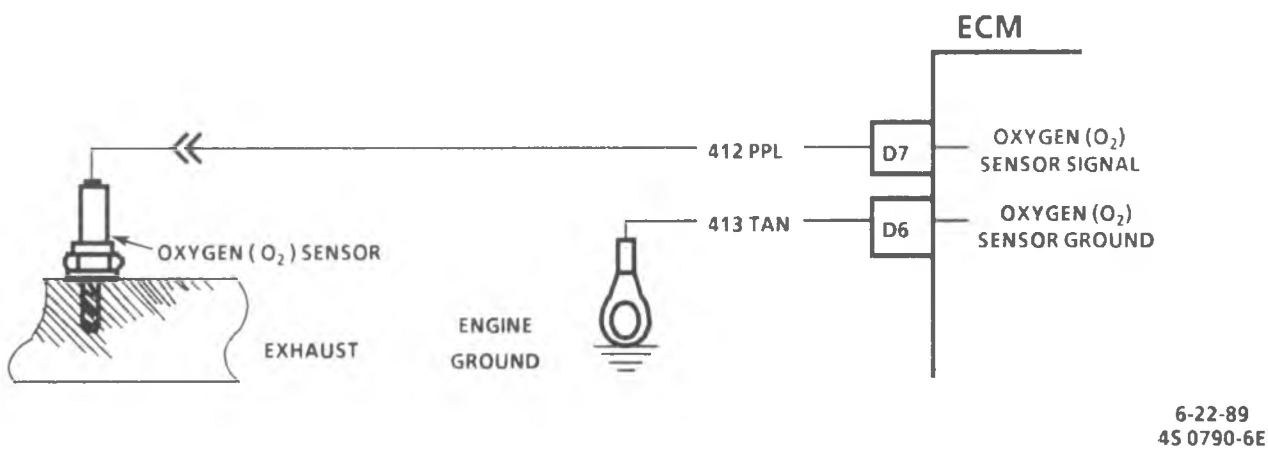
62-89 kPa (9-13 psi)

LOCATE AND CORRECT RESTRICTED FUEL RETURN LINE TO TANK

* ON TWO FUEL TANK SYSTEM, CHECK FUEL PRESSURE IN EACH POSITION OF THE FUEL PRESSURE SELECTOR SWITCH.

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

2-2-90
7S 3807



CODE 13

OXYGEN (O_2) SENSOR CIRCUIT
(OPEN CIRCUIT)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The ECM supplies a voltage of about .45 volt between terminals "D6" and "D7". (If measured with a 10 megohm digital voltmeter, this may read as low as .32 volt.) The Oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down through about .10 volt if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below about 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 13 will set if:
   - Engine temperature greater than 70°C (158°F).
   - At least 2 minutes engine time after start.
   - Oxygen sensor signal voltage steady between .35 and .55 volt.
   - Throttle Position Sensor (TPS) signal above idle.
   - All conditions must be met for about 60 seconds.

     If the conditions for a Code 13 exist, the system will not go "Closed Loop."
2. This will determine if the sensor is at fault or the wiring or ECM is the cause of Code 13.
3. In doing this test, use only a high impedance digital volt ohmmeter. This test checks the continuity of CKTs 412 and 413 because if CKT 413 is open, the ECM voltage on CKT 412 will be over .6 volt (600 mV).

Diagnostic Aids:

Normal "Scan" voltage varies between 100 mV to 999 mV (.1 and 1.0 volt) while in "Closed Loop." Code 13 sets in one minute if voltage remains between .35 and .55 volt, but the system will go "Open Loop" in about 15 seconds. Verify a clean tight ground connection for CKT 413. Open CKT 412 or 413 will result in a Code 13.

CODE 13

OXYGEN (O_2) SENSOR CIRCUIT
(OPEN CIRCUIT)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

1 ENGINE AT NORMAL OPERATING TEMPERATURE (ABOVE 80°C/176°F).
- RUN ENGINE ABOVE 1200 RPM FOR TWO MINUTES.
- DOES TECH 1 TOOL INDICATE "CLOSED LOOP"?

YES: CODE 13 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NO:

2
- DISCONNECT O_2 SENSOR.
- JUMPER HARNESS CKT 412 (ECM SIDE) TO GROUND.
- TECH 1 SHOULD DISPLAY O_2 VOLTAGE BELOW .2 VOLT (200 mv) WITH ENGINE RUNNING. DOES IT?

YES: FAULTY O_2 SENSOR CONNECTION OR SENSOR.

NO:

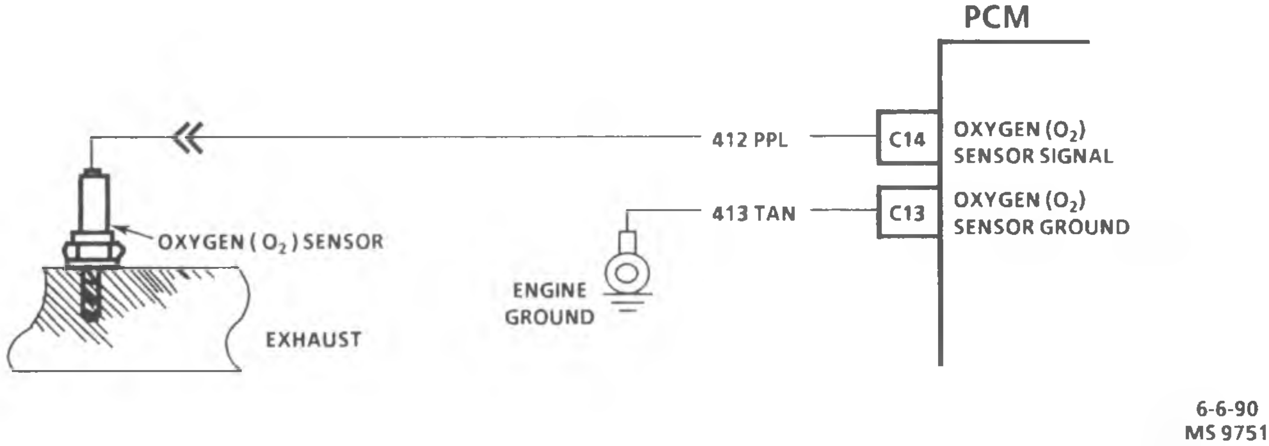
3
- REMOVE JUMPER.
- IGNITION "ON," ENGINE "OFF."
- CHECK VOLTAGE OF CKT 412 (ECM SIDE) AT O_2 SENSOR HARNESS CONNECTOR USING A DVM.

.3-.6 VOLT (300 - 600 mV): FAULTY ECM.

OVER .6 VOLT (600 mV): OPEN CKT 413 OR FAULTY CONNECTION OR FAULTY ECM.

LESS THAN .3 VOLT (300 mV): OPEN CKT 412 OR FAULTY ECM CONNECTION OR FAULTY ECM.

"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 13

OXYGEN (O_2) SENSOR CIRCUIT
(OPEN CIRCUIT)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The PCM supplies a voltage of about .45 volt between terminals "C14" and "C13". (If measured with a 10 megohm digital voltmeter, this may read as low as .32 volt.) The Oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down through about .10 volt if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below about 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 13 will set if:
   - Engine temperature greater than 70°C (158°F).
   - At least 2 minutes engine time after start.
   - Oxygen sensor signal voltage steady between .35 and .55 volt.
   - Throttle Position Sensor (TPS) signal above idle (9%).
   - All conditions must be met for about 60 seconds.

     If the conditions for a Code 13 exist, the system will not go "Closed Loop."
2. This will determine if the sensor is at fault or the wiring or PCM is the cause of Code 13.
3. In doing this test, use only a high impedance digital volt ohmmeter. This test checks the continuity of CKTs 412 and 413 because if CKT 413 is open, the PCM voltage on CKT 412 will be over .6 volt (600 mV).

Diagnostic Aids:

Normal "Scan" voltage varies between 100 mV to 999 mV (.1 and 1.0 volt) while in "Closed Loop." Code 13 sets in one minute if voltage remains between .35 and .55 volt, but the system will go "Open Loop" in about 15 seconds. Verify a clean tight ground connection for CKT 413. Open CKT 412 or 413 will result in a Code 13.

CODE 13

OXYGEN (O_2) SENSOR CIRCUIT
(OPEN CIRCUIT)
ALL VEHICLES WITH 4L80-E TRANSMISSION

1 ENGINE AT NORMAL OPERATING TEMPERATURE (ABOVE 80°C/176°F).
- RUN ENGINE ABOVE 1200 RPM FOR TWO MINUTES.
- DOES TECH 1 TOOL INDICATE "CLOSED LOOP"?

NO

2
- DISCONNECT O_2 SENSOR.
- JUMPER HARNESS CKT 412 (PCM SIDE) TO GROUND.
- TECH 1 SHOULD DISPLAY O_2 VOLTAGE BELOW .2 VOLT (200 mV) WITH ENGINE RUNNING.
  DOES IT?

YES

CODE 13 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NO

3
- REMOVE JUMPER.
- IGNITION "ON," ENGINE "OFF."
- CHECK VOLTAGE OF CKT 412 (PCM SIDE) AT O_2 SENSOR HARNESS CONNECTOR USING A DVM.

YES

FAULTY O_2 SENSOR CONNECTION
OR
SENSOR.

.3-.6 VOLT
(300 - 600 mV)

FAULTY PCM.

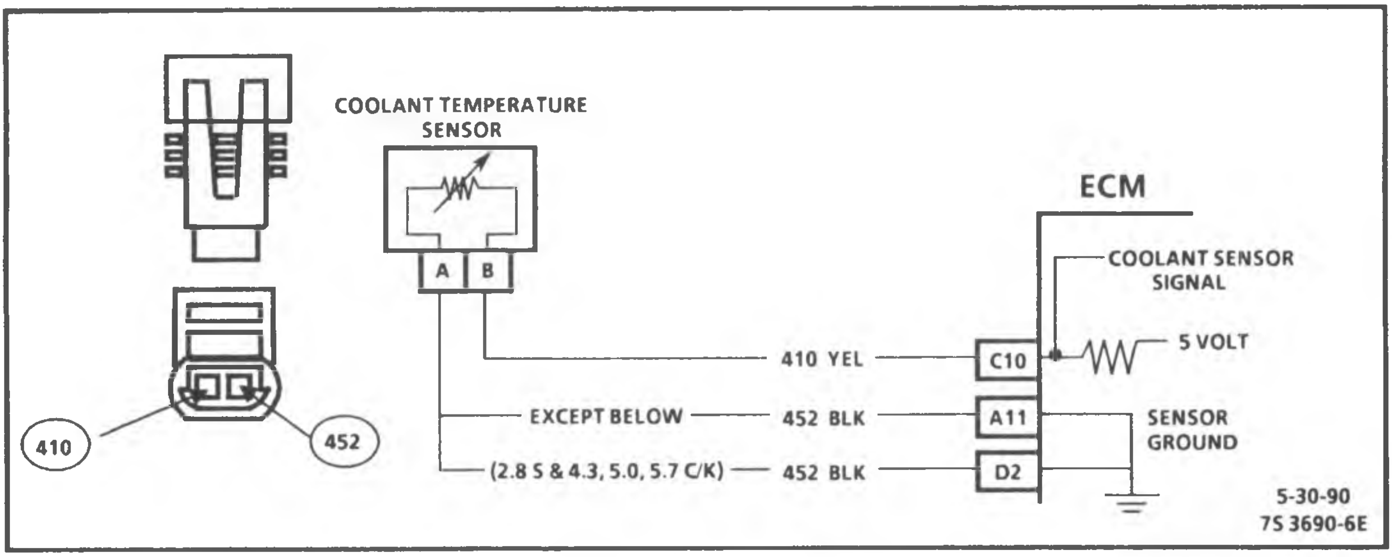
OVER .6 VOLT
(600 mV)

OPEN CKT 413
OR
FAULTY CONNECTION
OR
FAULTY PCM.

LESS THAN .3 VOLT
(300 mV)

OPEN CKT 412
OR
FAULTY PCM CONNECTION
OR
FAULTY PCM.

"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 14

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(HIGH TEMPERATURE INDICATED)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The Coolant Temperature Sensor (CTS) is a thermistor that controls the signal voltage to the ECM. The ECM applies a voltage on CKT 410 to the sensor. When the engine is cold, the sensor (thermistor) resistance is high, therefore the ECM will see high signal voltage.

As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature (85°C to 95°C), the voltage will measure about 1.5 to 2.0 volts.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks to see if code was set as result of a hard failure or intermittent condition.
   - Code 14 will set if:
     Signal voltage indicates a coolant temperature above 135°C (270°F) for 6 seconds.
2. This test simulates conditions for a Code 15. If the ECM recognizes the open circuit (high voltage) and displays a low temperature, the ECM and wiring are OK.

Diagnostic Aids:

Check harness routing for a potential short to ground in CKT 410.

"Scan" tool displays engine temperature in degrees centigrade. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens.

See "ECM Intermittent Codes or Performance" in "Driveability Symptoms," Section "2".

The "Temperature to Resistance Value" scale at the right may be used to test the coolant sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

CODE 14

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(HIGH TEMPERATURE INDICATED)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

1 DOES TECH 1 DISPLAY COOLANT TEMPERATURE OF 130°C (266°F) OR HIGHER?

YES

2 • DISCONNECT COOLANT TEMPERATURE SENSOR.
TECH 1 SHOULD DISPLAY COOLANT TEMPERATURE BELOW -30°C (-22°F).
DOES IT?

YES

REPLACE COOLANT TEMPERATURE SENSOR.

NO

CKT 410 SHORTED TO GROUND
OR
CKT 410 SHORTED TO SENSOR GROUND CIRCUIT
OR
FAULTY ECM.

NO

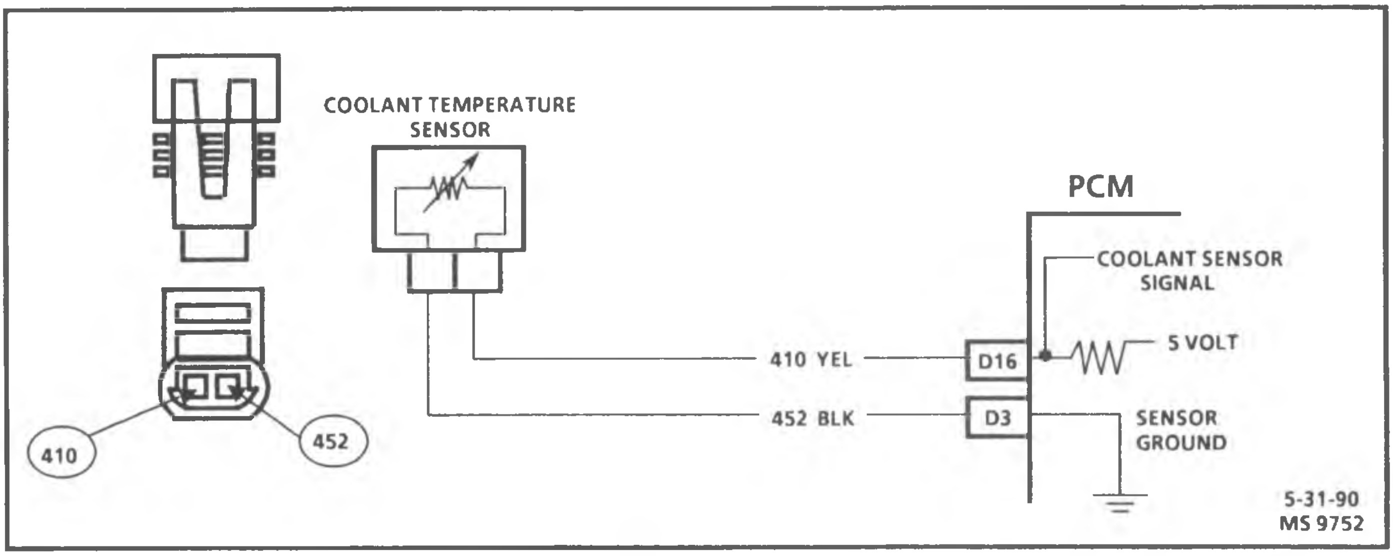
CODE 14 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

DIAGNOSTIC AID

COOLANT SENSOR
TEMPERATURE VS. RESISTANCE VALUES
(APPROXIMATE)

°C	°F	OHMS
100	212	177
90	194	241
80	176	332
70	158	467
60	140	667
50	122	973
45	113	1188
40	104	1459
35	95	1802
30	86	2238
25	77	2796
20	68	3520
15	59	4450
10	50	5670
5	41	7280
0	32	9420
-5	23	12300
-10	14	16180
-15	5	21450
-20	-4	28680
-30	-22	52700
-40	-40	100700

"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 14

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(HIGH TEMPERATURE INDICATED)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The Coolant Temperature Sensor (CTS) is a thermistor that controls the signal voltage to the PCM. The PCM applies a voltage on CKT 410 to the sensor. When the engine is cold, the sensor (thermistor) resistance is high, therefore the PCM will see high signal voltage.

As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature (85°C to 95°C), the voltage will measure about 1.5 to 2.0 volts.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 14 will set if:
   - Signal voltage indicates a coolant temperature above 135°C (270°F) for 6 seconds.
2. This test will determine if CKT 410 is shorted to ground which will cause the conditions for Code 14.

Diagnostic Aids:

Check harness routing for a potential short to ground in CKT 410.

"Scan" tool displays engine temperature in degrees centigrade. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens.

See "PCM Intermittent Codes or Performance" in "Driveability Symptoms," Section "2".

The "Temperature to Resistance Value" scale at the right may be used to test the coolant sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

CODE 14

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(HIGH TEMPERATURE INDICATED)
ALL VEHICLES WITH 4L80-E TRANSMISSION

1. DOES TECH 1 DISPLAY COOLANT TEMPERATURE OF 130°C (266°F) OR HIGHER?

YES

2. • DISCONNECT COOLANT TEMPERATURE SENSOR.
   TECH 1 SHOULD DISPLAY COOLANT TEMPERATURE BELOW -30°C (-22°F). DOES IT?

   YES

   REPLACE COOLANT TEMPERATURE SENSOR.

   NO

   CKT 410 SHORTED TO GROUND
   OR
   CKT 410 SHORTED TO SENSOR GROUND CIRCUIT
   OR
   FAULTY PCM.

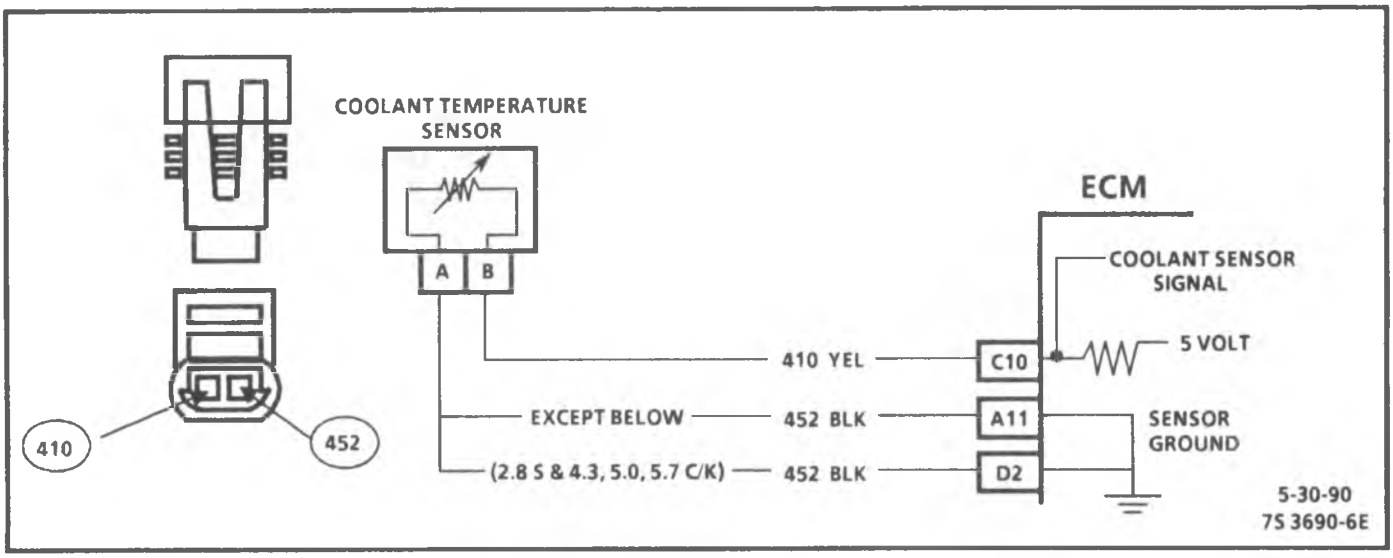
NO

CODE 14 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

DIAGNOSTIC AID

COOLANT SENSOR		
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)		
°C	°F	OHMS
100	212	177
90	194	241
80	176	332
70	158	467
60	140	667
50	122	973
45	113	1188
40	104	1459
35	95	1802
30	86	2238
25	77	2796
20	68	3520
15	59	4450
10	50	5670
5	41	7280
0	32	9420
-5	23	12300
-10	14	16180
-15	5	21450
-20	-4	28680
-30	-22	52700
-40	-40	100700

"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 15

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(LOW TEMPERATURE INDICATED)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The Coolant Temperature Sensor (CTS) is a thermistor that controls the signal voltage to the ECM. The ECM applies a voltage on CKT 410 to the sensor. When the engine is cold, the sensor (thermistor) resistance is high, therefore the ECM will see high signal voltage.

As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature (85°C to 95°C), the voltage will measure about 1.5 to 2.0 volts.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks to see if code was set as result of a hard failure or intermittent condition.
   - Code 15 will set if:
     - Signal voltage indicates a coolant temperature less than -33°C (-27°F) for 30 seconds.
2. This test simulates a Code 14. If the ECM recognizes the low signal voltage (high temperature), and the "Scan" reads 130°C (266°F) or above, the ECM and wiring are OK.
3. This test will determine if CKT 410 is open. There should be 5 volts present at sensor connector if measured with a DVOM. This will determine if there is a wiring problem or a faulty ECM.

Diagnostic Aids:

A "Scan" tool reads engine temperature in degrees centigrade. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens.

A faulty connection, or an open in CKTs 410 or 452 will result in a Code 15.

See "ECM Intermittent Codes on Performance" in "Driveability Symptoms," Section "2".

The "Temperature To Resistance Value" scale at the right may be used to test the coolant sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

CODE 15

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(LOW TEMPERATURE INDICATED)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

(1)
- DOES TECH 1 DISPLAY COOLANT TEMPERATURE OF -30°C (-22°F) OR LESS?

YES

(2)
- DISCONNECT COOLANT TEMPERATURE SENSOR.
- JUMPER HARNESS TERMINALS TOGETHER.
- TECH 1 SHOULD DISPLAY 130°C (266°F) OR MORE. DOES IT?

NO

(3)
- JUMPER CKT 410 TO GROUND.
- TECH 1 SHOULD DISPLAY OVER 130°C (266 °F). DOES IT?

YES

OPEN COOLANT TEMPERATURE SENSOR GROUND CIRCUIT, FAULTY CONNECTION OR FAULTY ECM.

NO

OPEN CKT 410, FAULTY CONNECTION AT ECM, OR FAULTY ECM.

YES

FAULTY CONNECTION OR COOLANT TEMPERATURE SENSOR.

NO

CODE 15 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

DIAGNOSTIC AID

COOLANT SENSOR
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)

°C	°F	OHMS
100	212	177
90	194	241
80	176	332
70	158	467
60	140	667
50	122	973
45	113	1188
40	104	1459
35	95	1802
30	86	2238
25	77	2796
20	68	3520
15	59	4450
10	50	5670
5	41	7280
0	32	9420
-5	23	12300
-10	14	16180
-15	5	21450
-20	-4	28680
-30	-22	52700
-40	-40	100700

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

2-22-90
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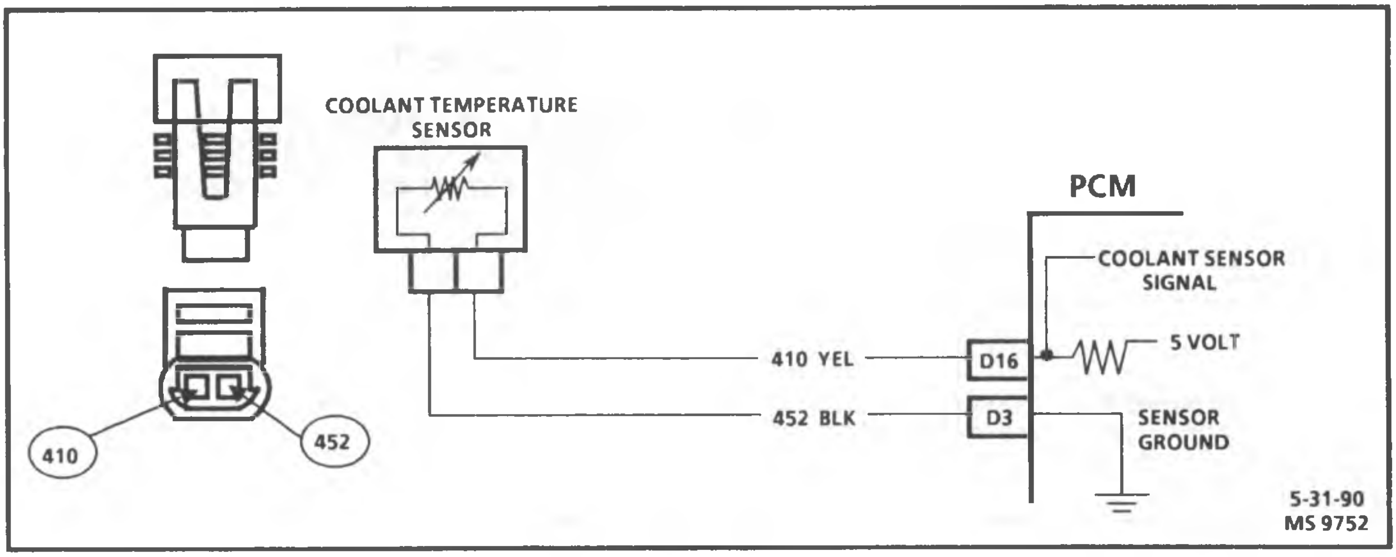


CODE 15

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(LOW TEMPERATURE INDICATED)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The Coolant Temperature Sensor (CTS) is a thermistor that controls the signal voltage to the PCM. The PCM applies a voltage on CKT 410 to the sensor. When the engine is cold, the sensor (thermistor) resistance is high, therefore the PCM will see high signal voltage.

As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature (85°C to 95°C), the voltage will measure about 1.5 to 2.0 volts.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 15 will set if:
   - Signal voltage indicates a coolant temperature less than -33°C (-27°F) for 30 seconds.
2. This test simulates a Code 14. If the PCM recognizes the low signal voltage (high temperature), and the "Scan" reads 130°C or above, the PCM and wiring are OK.
3. This test will determine if CKT 410 is open. There should be 5 volts present at sensor connector if measured with a DVOM.

Diagnostic Aids:

A "Scan" tool reads engine temperature in degrees centigrade. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens.

A faulty connection, or an open in CKTs 410 or 452 will result in a Code 15.

See "PCM Intermittent Codes on Performance" in "Driveability Symptoms," Section "2".

The "Temperature To Resistance Value" scale at the right may be used to test the coolant sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

CODE 15

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(LOW TEMPERATURE INDICATED)
ALL VEHICLES WITH 4L80-E TRANSMISSION

1. • DOES TECH 1 DISPLAY COOLANT TEMPERATURE OF -30°C (-22°F) OR LESS?

YES →

2. • DISCONNECT COOLANT TEMPERATURE SENSOR.
   • JUMPER HARNESS TERMINALS TOGETHER.
   • TECH 1 SHOULD DISPLAY 130°C (266°F) OR MORE.
   DOES IT?

NO →

CODE 15 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

(Step 2) NO →

3. • JUMPER CKT 410 TO GROUND.
   • TECH 1 SHOULD DISPLAY OVER 130°C (266 °F).
   DOES IT?

(Step 2) YES →

FAULTY CONNECTION OR COOLANT TEMPERATURE SENSOR.

(Step 3) YES →

OPEN COOLANT TEMPERATURE SENSOR GROUND CIRCUIT, FAULTY CONNECTION
OR
FAULTY PCM.

(Step 3) NO →

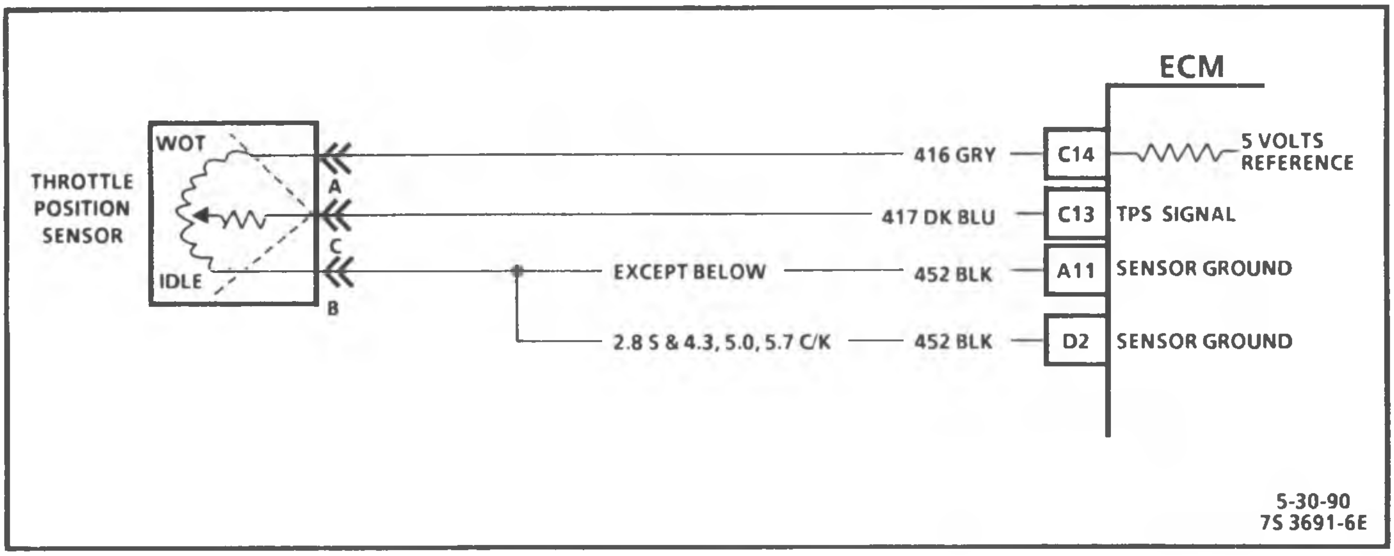
OPEN CKT 410, FAULTY CONNECTION AT FAULTY PCM.

DIAGNOSTIC AID

COOLANT SENSOR
TEMPERATURE VS. RESISTANCE VALUES
(APPROXIMATE)

°C	°F	OHMS
100	212	177
90	194	241
80	176	332
70	158	467
60	140	667
50	122	973
45	113	1188
40	104	1459
35	95	1802
30	86	2238
25	77	2796
20	68	3520
15	59	4450
10	50	5670
5	41	7280
0	32	9420
-5	23	12300
-10	14	16180
-15	5	21450
-20	-4	28680
-30	-22	52700
-40	-40	100700

6-5-90
MS 9965-6E



CODE 21

THROTTLE POSITION SENSOR (TPS) CIRCUIT
(SIGNAL VOLTAGE HIGH)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The Throttle Position Sensor (TPS) provides a voltage signal that changes relative to the throttle blade angle. Signal voltage will vary from about .5 volt at idle to about 4 volts at Wide Open Throttle (WOT).

The TPS signal is one of the most important inputs used by the ECM for fuel control and for most of the ECM control outputs.

On nonadjustable TPS switches, each time voltage drops below 1.25 volts and stops, the ECM assumes this value is 0 throttle angle and measures percent throttle from this point on.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step checks to see if Code 21 is the result of a hard failure or an intermittent condition.
   - Code 21 will set if:
     - Engine running
     - TPS signal voltage is greater than about 2.5 volts
     - 2.8L MAP sensor less than 2 volts
     - All conditions met for 8 seconds.

   With throttle closed, the TPS should read less than 1.25 volts. See "Diagnostic Aids."
2. With the TPS sensor disconnected, the TPS voltage should go low if the ECM and wiring is OK.
3. Probing CKT 452 with a test light checks the 5 volt return circuit. This step isolates a faulty sensor ECM or an open CKT 452.

Diagnostic Aids:

A "Scan" tool reads throttle position in volts. Should read about .45 to .95 volt with throttle closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

Also some "Scan" tools will read throttle angle .0% = closed throttle 100% = WOT.

"Scan" TPS while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from below 1.25 volts (1250 mV) when throttle was closed, to over 4.5 volts (4500 mV) when throttle is held at Wide Open Throttle (WOT) position.

A Code 21 will result if CKT 452 is open or CKT 417 is shorted to voltage.

Refer to "Driveability Symptoms," Section "2" for "ECM Intermittent Codes or Performance."

CODE 21

THROTTLE POSITION SENSOR (TPS) CIRCUIT
(SIGNAL VOLTAGE HIGH)

ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

1 • THROTTLE CLOSED.
DOES "SCAN" TOOL DISPLAY TPS OVER 1.25 VOLTS?

YES

2 • DISCONNECT SENSOR. "SCAN" TOOL SHOULD DISPLAY TPS BELOW .2 VOLT (200mv).
DOES IT?

NO

CODE 21 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

YES

3 • PROBE SENSOR GROUND CIRCUIT WITH A TEST LIGHT CONNECTED TO BATTERY VOLTAGE.

NO

CKT 417 SHORTED TO VOLTAGE
OR
FAULTY ECM.

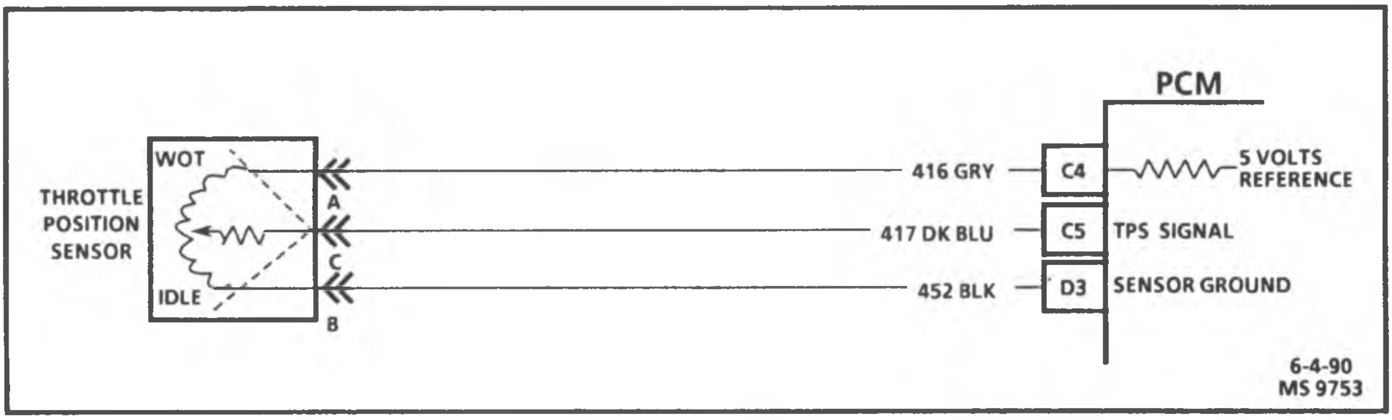
LIGHT "ON"

FAULTY CONNECTION
OR
SENSOR.

LIGHT "OFF"

OPEN SENSOR GROUND CIRCUIT
OR
FAULTY ECM.

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 21

THROTTLE POSITION SENSOR (TPS) CIRCUIT
(SIGNAL VOLTAGE HIGH)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The Throttle Position Sensor (TPS) provides a voltage signal that changes relative to the throttle blade angle. Signal voltage will vary from about .5 volt at idle to about 40 volts at Wide Open Throttle (WOT).

The TPS signal is one of the most important inputs used by the PCM for fuel control and for most of the PCM control outputs.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 21 will set if:
   - Engine running.
   - TPS signal voltage is greater than about 4.9 volts at Wide Open Throttle (WOT).
   - All conditions met for 1 second.

   With throttle closed, the TPS should read less than 1.25 volts. See "Diagnostic Aids."
2. With the TPS sensor disconnected, the TPS voltage should go low if the PCM and wiring is OK.
3. Probing CKT 452 with a test light checks the 5 volt return circuit.

Diagnostic Aids:

A "Scan" tool reads throttle position in volts and should read about .5 to 1.25 volts with throttle closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward WOT.

Also some "Scan" tools will read throttle angle .0% = closed throttle 100% = WOT.

Refer to "Driveability Symptoms," Section "2" for "PCM Intermittent Codes or Performance."

"Scan" TPS while depressing accelerator pedal with engine stopped and ignition "ON." Display should vary from below 1.25 volts (1250 mV) when throttle was closed, to over 4.0 volts (4000 mV) when throttle is held at Wide Open Throttle (WOT) position.

CODE 21

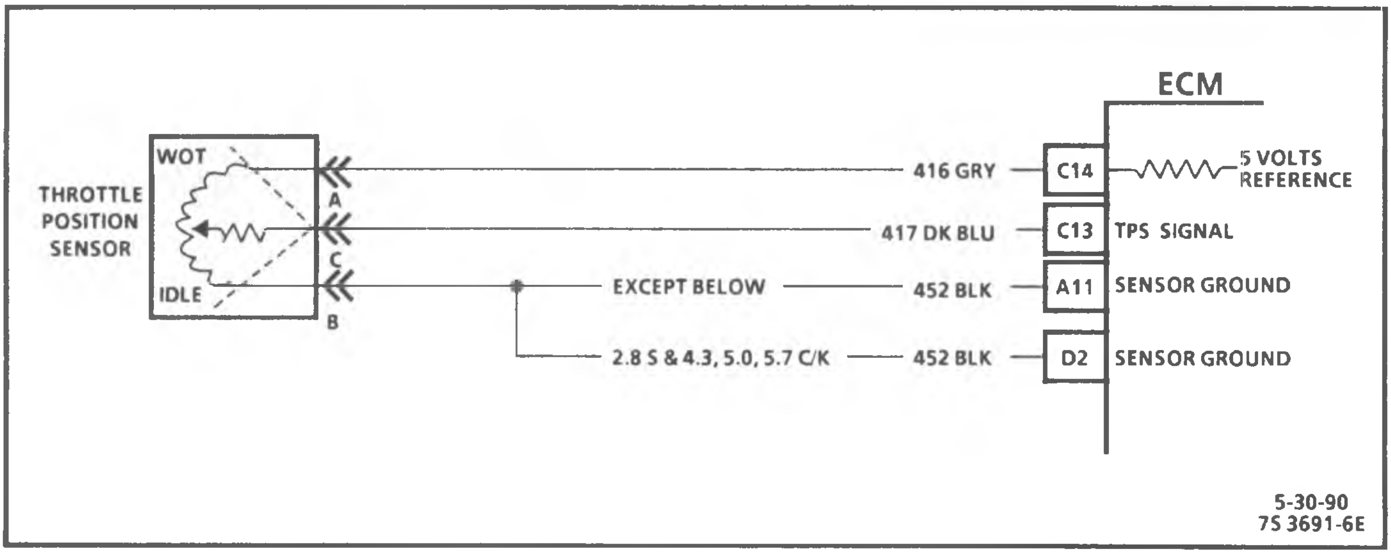
THROTTLE POSITION SENSOR (TPS) CIRCUIT
(SIGNAL VOLTAGE HIGH)
ALL VEHICLES WITH 4L80-E TRANSMISSION

1. • THROTTLE CLOSED.
DOES "SCAN" TOOL DISPLAY TPS OVER 1.25 VOLTS?

- YES
  2. • DISCONNECT SENSOR. "SCAN" TOOL SHOULD DISPLAY TPS BELOW .2 VOLT (200mV).
  DOES IT?
  - YES
    3. • PROBE SENSOR GROUND CKT 452 WITH A TEST LIGHT CONNECTED TO BATTERY VOLTAGE .
    - LIGHT "ON"
      - FAULTY CONNECTION OR SENSOR.
    - LIGHT "OFF"
      - OPEN SENSOR GROUND CIRCUIT OR FAULTY PCM.
  - NO
    - CKT 417 SHORTED TO VOLTAGE OR FAULTY PCM.
- NO
  - FULLY DEPRESS THROTTLE.
  DOES "SCAN" TOOL READ OVER 4.9 VOLTS?
    - YES
      - REPLACE THROTTLE POSITION SWITCH.
    - NO
      - PROBLEM IS INTERMITTENT. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-14-90
MS 9964-6E



CODE 22

THROTTLE POSITION SENSOR (TPS) CIRCUIT
(SIGNAL VOLTAGE LOW)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The Throttle Position sensor (TPS) provides a voltage signal that changes relative to the throttle blade. Signal voltage will vary from about .5 volt at idle to about 5 volts at Wide Open Throttle (WOT).

The TPS signal is one of the most important inputs used by the ECM for fuel control and for most of the ECM control outputs.

On TPS switches each time voltage drops below 1.25 volts and stops, the ECM assumes this valve is 0 throttle angle and measures percent throttle from this point on.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step checks to see if Code 22 is the result of a hard failure or an intermittent condition.
   - Code 22 will set if:
     - Engine running.
     - TPS signal voltage is less than about .2 volt for 2 seconds.
2. Simulates Code 21: (high voltage) - If the ECM recognizes the high signal voltage, the ECM and wiring are OK.
3. The ECM recognizes the voltage as over 4 volts, indicating the CKT 417 and the ECM are OK.
4. This simulates a high signal voltage to check for an open in CKT 417.
5. If CKT 416 is shorted to ground, there may also be a stored Code 34.

Diagnostic Aids:

A "Scan" tool reads throttle position in volts. Should read about .45 to .95 volt with throttle closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT).

An open or short to ground in CKTs 416 or 417 will result in a Code 22.

Refer to "Drivability symptoms," Section "2" for "ECM Intermittent Codes or Performance."

"Scan" TPS while depressing accelerator pedal with engine stopped and ignition "ON". Display should vary from below 1.25 volts (1250 mV) when throttle was closed, to over 4.5 volts (4500 mV) when throttle is held at Wide Open Throttle (WOT) position.

CODE 22

THROTTLE POSITION SENSOR (TPS) CIRCUIT
(SIGNAL VOLTAGE LOW)

ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

1. • THROTTLE CLOSED.
   DOES TECH 1 DISPLAY THROTTLE POSITION .2V (200 mV) OR BELOW?

YES

2. • DISCONNECT TPS SENSOR.
   • JUMPER CKTs 416 & 417 TOGETHER.
   TECH 1 SHOULD DISPLAY THROTTLE POSITION OVER 4.0V (4000 mV).
   DOES IT?

NO

• CODE 22 IS INTERMITTENT.
IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NO

4. • PROBE CKT 417 WITH A TEST LIGHT CONNECTED TO BATTERY VOLTAGE.
   TECH 1 SHOULD DISPLAY THROTTLE POSITION OVER 4.0V (4000 mV).
   DOES IT?

YES

3. • REPLACE TPS.

YES

5. CKT 416 OPEN OR SHORTED TO GROUND
   OR
   FAULTY CONNECTION
   OR
   FAULTY ECM.

NO

CKT 417 OPEN OR SHORTED TO GROUND,
OR
SHORTED TO THROTTLE POSITION SENSOR GROUND CIRCUIT
OR
FAULTY ECM CONNECTION
OR
FAULTY ECM.

"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

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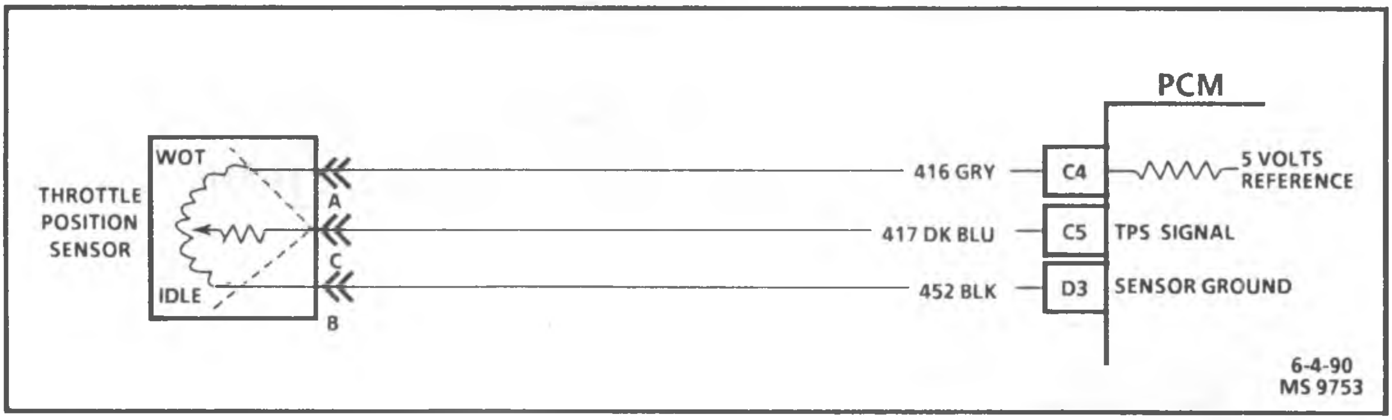
MS 9565-6E



CODE 22

THROTTLE POSITION SENSOR (TPS) CIRCUIT
(SIGNAL VOLTAGE LOW)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The Throttle Position sensor (TPS) provides a voltage signal that changes relative to the throttle blade. Signal voltage will vary from about .5 volt at idle to about 4.0 volts at Wide Open Throttle (WOT).

The TPS signal is one of the most important inputs used by the PCM for fuel control and for most of the PCM control outputs.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 22 will set if:
   - Engine running.
   - TPS signal voltage is less than about .2 volt for 1 second.
2. Simulates Code 21: (high voltage) If the PCM recognizes the high signal voltage the PCM and wiring are OK.
3. Replace TPS.
4. This simulates a high signal voltage to check for an open in CKT 417.

Diagnostic Aids:

A "Scan" tool reads throttle position in volts and should read about .45 to 1.25 volts with throttle closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward WOT.

An open or short to ground in CKTs 416 or 417 will result in a Code 22.

Refer to "Drivability symptoms," Section "2" for "PCM Intermittent Codes or Performance."

"Scan" TPS while depressing accelerator pedal with engine stopped and ignition "ON". Display should vary from below 1.25 volts (1250 mV) when throttle was closed, to over 4.0 volts (4000 mV) when throttle is held at Wide Open Throttle (WOT) position.

CODE 22

THROTTLE POSITION SENSOR (TPS) CIRCUIT
(SIGNAL VOLTAGE LOW)
ALL VEHICLES WITH 4L80-E TRANSMISSION

1
- THROTTLE CLOSED.
  DOES TECH 1 DISPLAY THROTTLE POSITION .2V (200 mV) OR BELOW?

YES

2
- DISCONNECT TPS SENSOR.
- JUMPER CKTS 416 & 417 TOGETHER.
  TECH 1 SHOULD DISPLAY THROTTLE POSITION OVER 4.0 V (4000 mV).
  DOES IT?

NO

- CODE 22 IS INTERMITTENT.
  IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NO

4
- PROBE CKT 417 WITH A TEST LIGHT CONNECTED TO BATTERY VOLTAGE.
  TECH 1 SHOULD DISPLAY THROTTLE POSITION OVER 4.0V (4000 mV).
  DOES IT?

YES

3
- REFER TO FACING PAGE FOR SPECIFIC INSTRUCTIONS.

YES

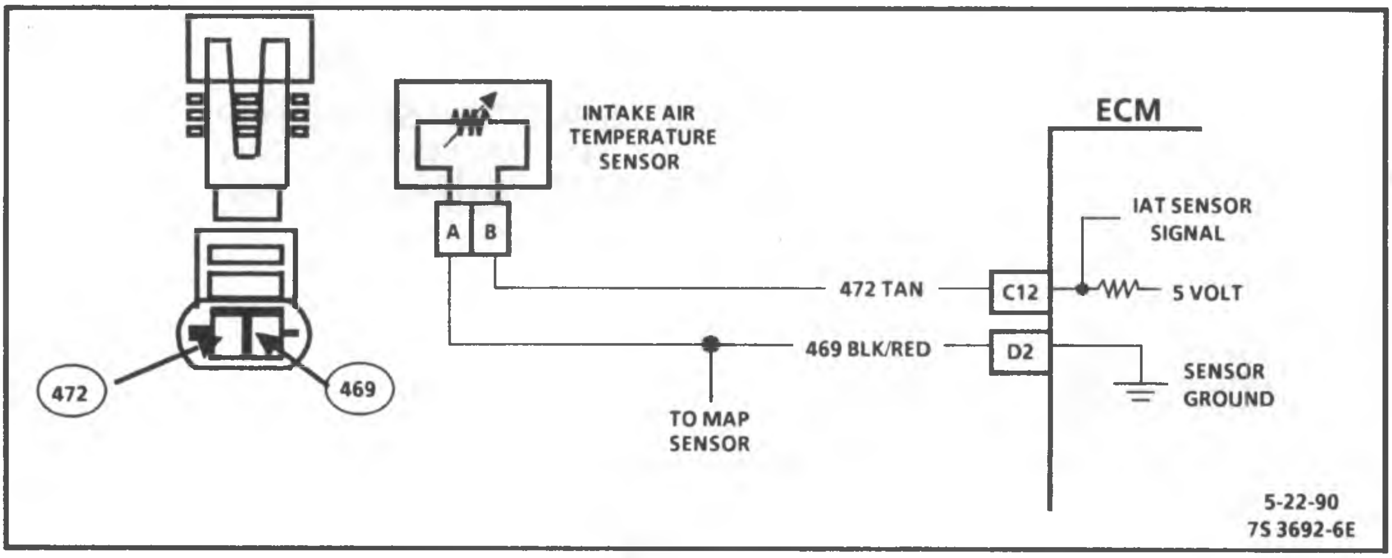
CKT 416 OPEN OR SHORTED TO GROUND
OR
FAULTY CONNECTION
OR
FAULTY PCM.

NO

CKT 417 OPEN OR SHORTED TO GROUND, OR SHORTED TO THROTTLE POSITION SENSOR GROUND CIRCUIT
OR
FAULTY PCM CONNECTION
OR
FAULTY PCM.

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

6-5-90
MS 9963-06E



CODE 23

INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT
(LOW TEMPERATURE INDICATED)
2.5L ENGINE

Circuit Description:

The Intake Air Temperature (IAT) sensor is a thermistor that controls the signal voltage to the ECM. The ECM applies a voltage (4-6 volts) on CKT 472 to the sensor. When the air is cold, the sensor (thermistor) resistance is high, therefore, the ECM will see a high signal voltage. If the air is warm, the sensor resistance is low, therefore, the ECM will see a low voltage.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if Code 33 is the result of a hard failure or an intermittent condition.
   - Code 23 will set if all conditions are met:
     - A signal voltage indicates a Intake Air Temperature (IAT) below -30°C (-22°F) for 12 seconds.
     - Time since engine start is 1 minute or longer.
     - No VSS (vehicle not moving)
2. A Code 23 will set, due to an open sensor, wire, or connection. This test will determine if the wiring and ECM are OK.
3. This will determine if the signal CKT 472 or the 5 volt return CKT 469 is open.

Diagnostic Aids:

A "Scan" tool reads temperature of the air entering the engine and should read close to ambient air temperature when engine is cold, and rises as underhood temperature increases.

Carefully check harness and connections for possible open CKT 472 or 469.

Refer to "Drivability Symptoms," Section "2" for "ECM Intermittent Codes or Performance."

The "Temperature to Resistance Value" scale at the right may be used to test the IAT sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

CODE 23

INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT
(LOW TEMPERATURE INDICATED)
2.5L ENGINE

1 • DOES TECH 1 "SCAN" TOOL DISPLAY IAT -30°C (-22°F) OR COLDER?

YES

2
- DISCONNECT SENSOR.
- JUMPER HARNESS TERMINALS TOGETHER.
- TECH 1 "SCAN" TOOL SHOULD DISPLAY TEMPERATURE OVER 130°C (266°F).

DOES IT?

YES

FAULTY CONNECTION OR SENSOR.

NO

3
- JUMPER CKT 472 TO GROUND.
- TECH 1 "SCAN" TOOL SHOULD DISPLAY TEMPERATURE OVER 130°C (266°F).

DOES IT?

YES

OPEN SENSOR GROUND CIRCUIT, FAULTY CONNECTION OR FAULTY ECM.

NO

OPEN CKT 472, FAULTY CONNECTION OR FAULTY ECM.

NO

CODE 23 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

DIAGNOSTIC AID

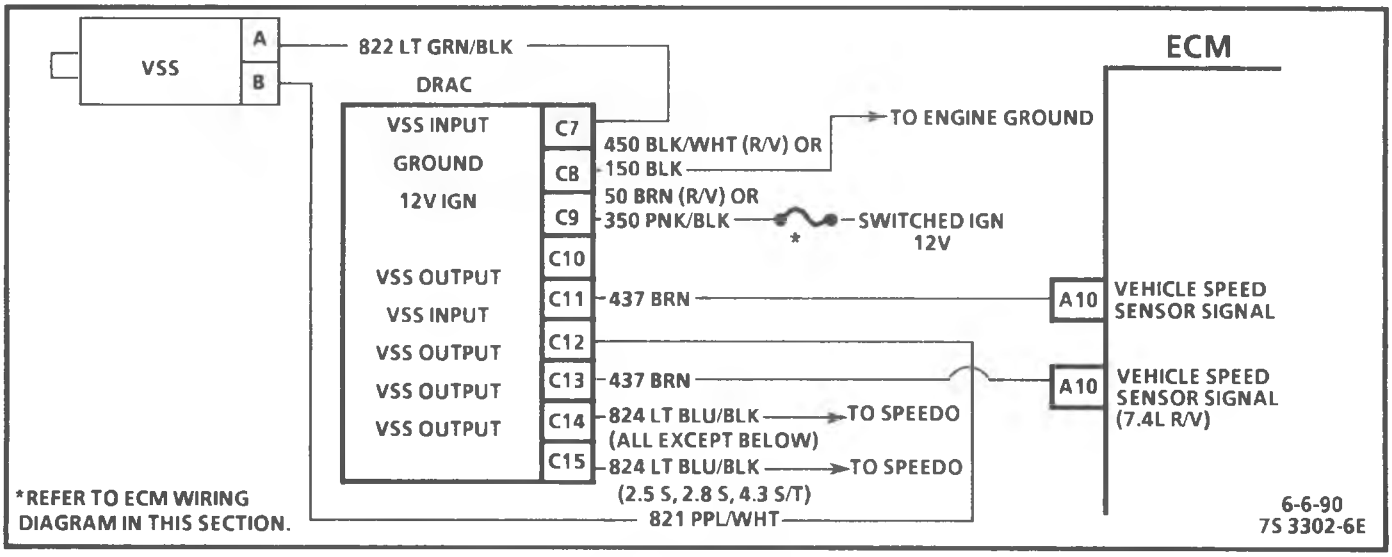
IAT SENSOR

TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)

°F	°C	OHMS
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

3-2-90
• 7S 3285-6E



CODE 24

VEHICLE SPEED SENSOR (VSS) CIRCUIT FAULT
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION OR "C/K" SERIES

Circuit Description:

The ECM applies and monitors 12 volts on CKT 437. CKT 437 connects to the DRAC, which alternately grounds CKT 437, when receiving voltage pulses from Vehicle Speed Sensor (VSS) when drive wheels are turning. This pulsing action takes place about 2000 times per mile and the ECM will calculate vehicle speed based on the time between "pulses."

A "Scan" tool reading should closely match the speedometer reading with drive wheels turning.

Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 24 will set if:
   - CKT 437 voltage is constant.
   - Engine speed is more than 1200 rpm .
   - Vehicle speed signal indicates less than 2 mph (3 km/h) on Tech 1.
   - Automatic transmission in drive
   - All conditions must be met for 5 seconds.

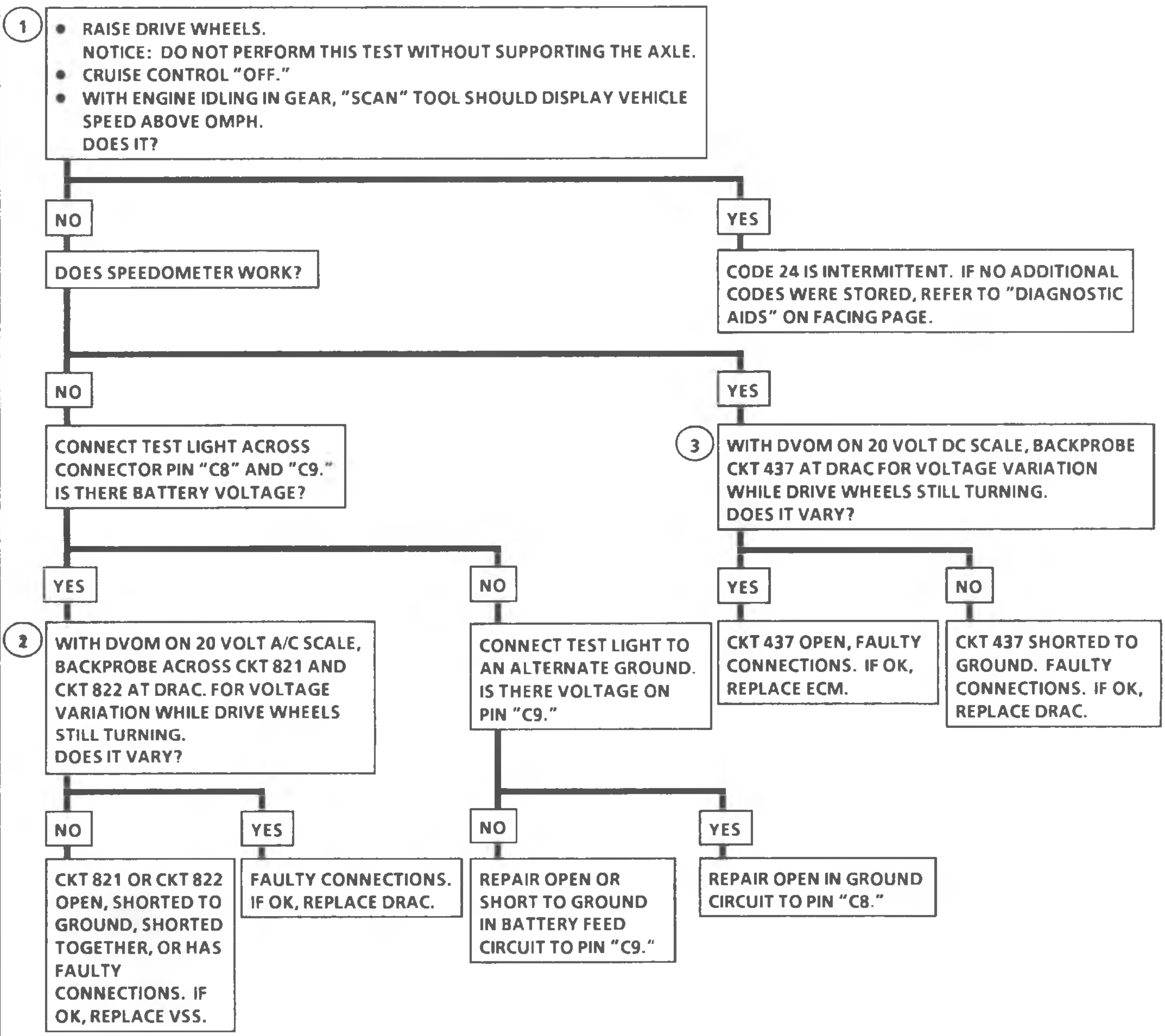
   These conditions are met during a road load deceleration except 2.8L which sets on acceleration or at highway speed.
2. This test determines if the DRAC is receiving the A/C signal from the VSS.
3. This test monitors the DRAC voltage on CKT 437. With the wheels turning, the pulsing action will result in a varying voltage. The variation will be greater at low wheel speeds to an average of 4-6 volts at about 20 mph (32 km/h).

Diagnostic Aids:

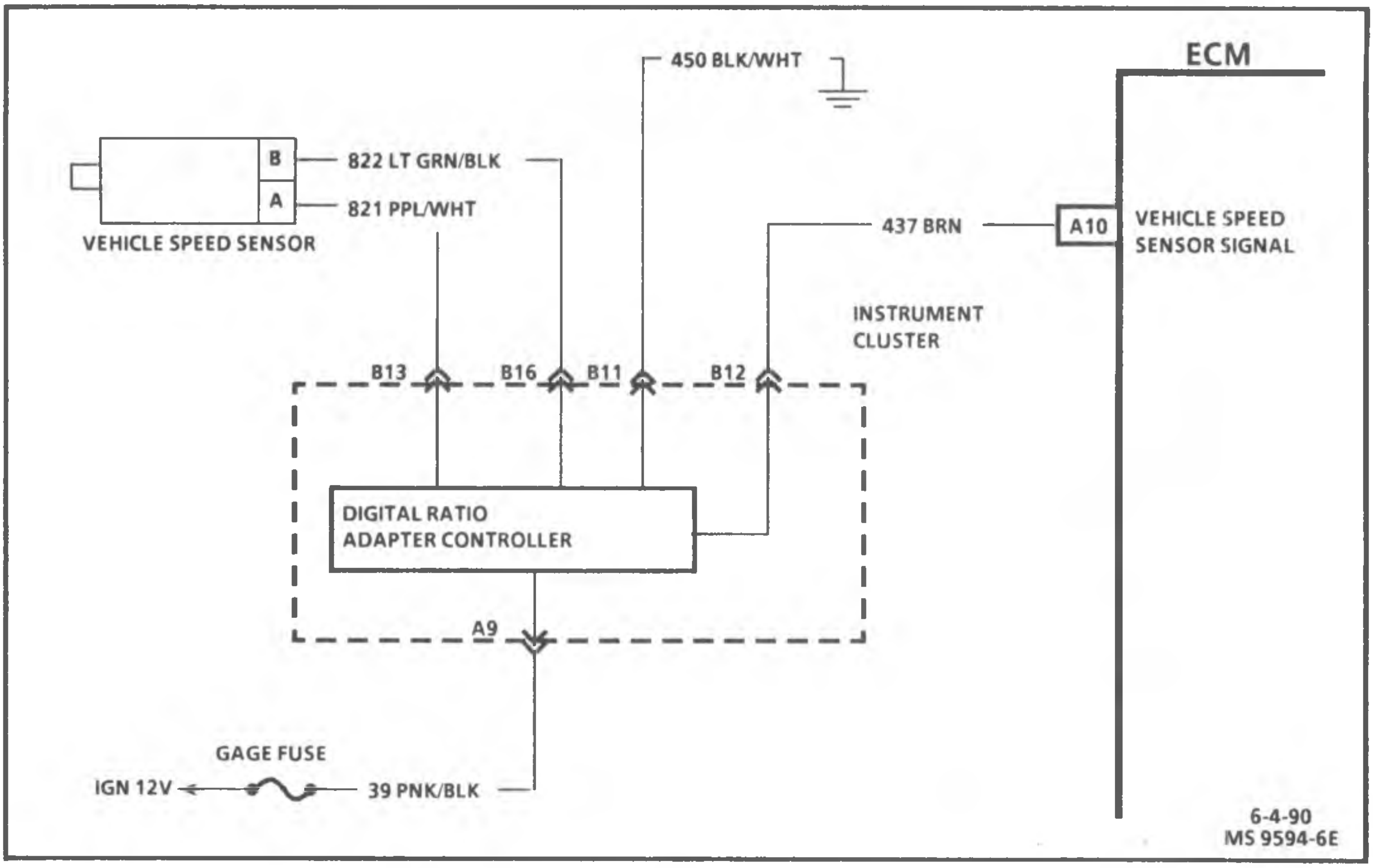
1. "Scan" reading should closely match speedometer reading, with drive wheels turning.
2. Check Park/Neutral (P/N) switch diagnosis chart if vehicle equipped with automatic transmission.
3. If Park/Neutral (P/N) switch is OK, refer to "ECM Intermittent Codes or Performance" in "Driveability Symptoms, Section "2".

CODE 24

VEHICLE SPEED SENSOR (VSS) CIRCUIT FAULT
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION OR "C/K" SERIES



"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 24

VEHICLE SPEED SENSOR (VSS) CIRCUIT FAULT "C/K" SERIES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The ECM applies and monitors 12 volts on CKT 437. CKT 437 connects to the DRAC, which is located in the instrument cluster, and alternately grounds CKT 437 when receiving voltage pulses from the VSS while drive wheels are turning. This pulsing action takes place about 2000 times per mile and the ECM will calculate vehicle speed based on the time between "pulses."

A "Scan" tool reading should closely match the speedometer reading with drive wheels turning.

Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 24 will set if:
   - CKT 437 voltage is constant.
   - Engine speed is more than 1200 rpm .
   - Vehicle speed signal indicates less than 2 mph (3 km/h) on Tech 1.
   - Automatic transmission in drive
   - All conditions must be met for 10 seconds.

   These conditions are met during a road load deceleration.
2. This test monitors the ECM voltage on CKT 437. With the wheels turning, the pulsing action will result in a varying voltage. The variation will be greater at low wheel speeds to an average of 4-6 volts at about 20 mph (32 km/h).

Diagnostic Aids:

1. "Scan" reading should closely match speedometer reading, with drive wheels turning.
2. Check Park/Neutral (P/N) switch diagnosis chart.
3. If Park/Neutral (P/N) switch is OK, refer to "ECM Intermittent Codes or Performance" in "Driveability Symptoms, Section "2".
4. The DRAC is located in the instrument cluster.

CODE 24

VEHICLE SPEED SENSOR (VSS) CIRCUIT FAULT
"C/K" SERIES EXCEPT WITH 4L80-E TRANSMISSION

DISREGARD CODE 24 IF SET WHILE DRIVE WHEELS ARE NOT TURNING.

1

- ASSUMES SPEEDOMETER IS WORKING OK.
- RAISE DRIVE WHEELS.
- NOTICE: DO NOT PERFORM THIS TEXT WITHOUT SUPPORTING THE AXLE.
- CRUISE CONTROL "OFF."
- WITH GEAR SELECTOR IN DRIVE, TURN DRIVE WHEEL BY HAND.

DOES "SCAN" TOOL DISPLAY VEHICLE SPEED ABOVE OMPH?

NO

2

WITH DRIVE WHEELS STILL TURNING, CHECK FOR VOLTAGE VARIATION ON CIRCUIT 437 AT ECM PIN "A10" WITH DVOM ON 20 VOLT DC SCALE.
DOES IT VARY ?

NO

REMOVE INSTRUMENT CLUSTER, CHECK FOR FAULTY CONNECTIONS. IF OK, FAULTY INSTRUMENT CLUSTER.

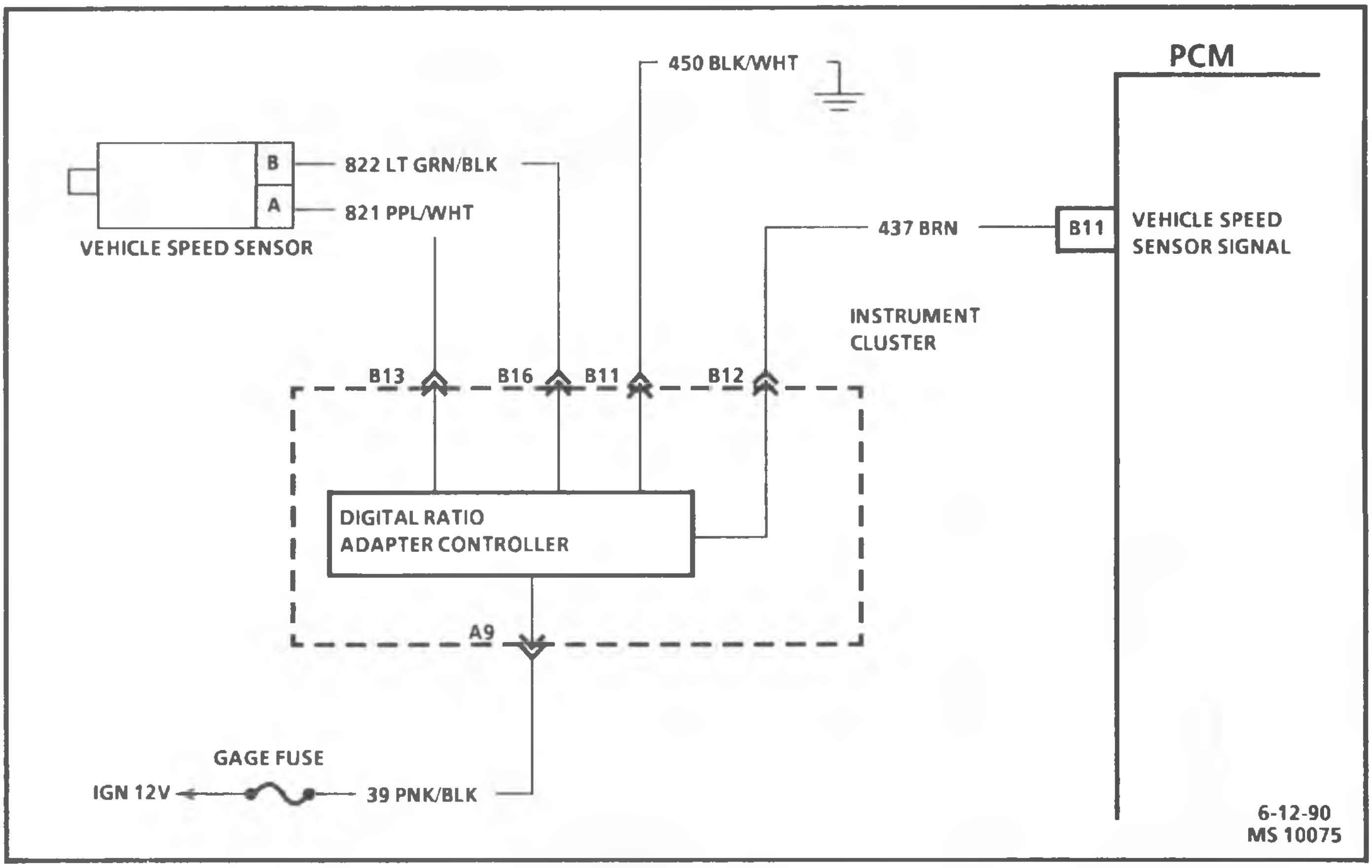
YES

FAULTY ECM CONNECTORS OR ECM.

YES

CODE 24 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 24

VEHICLE SPEED SENSOR (VSS) FAULT
"C/K" TWO WHEEL DRIVE WITH 4L80-E TRANSMISSION

Circuit Description:

The output sensor circuit consists of a magnetic induction type sensor, digital ratio adapter, located in the instrument cluster and wiring. Gear teeth cut in the outside diameter of the rear internal gear induce an alternating current in the sensor. On two wheel drive vehicles, this current is transmitted to an instrument cluster where it is passed on to the PCM. The digital ratio adapter compensates for various axle ratios and converts the signal to a square wave for use buy the speedometer, cruise control, and antilock brake system. Since vehicle speed is taken from the transfer case on four wheel drive vehicles, the transmission output sensor signal on these units goes directly to the PCM.

Code 24 will set if range selected or indicated is not Park or Neutral. Input speed is at least 3000 rpm. Output rpm is less than 200 for at lest 1 second.

If the input speed sensor is not operational at start up, this can cause the vehicle speed sensor to read zero.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Test one verifies an vehicle speed sensor voltage at the PCM .
2. Test two directly verifies the operation of the vehicle speed sensor.
3. Test three checks CKTs 821 and 822 up to the instrument cluster.

Diagnostic Aids:

Check all connections especially those at the transmission pass-thru connector.

If the input speed sensor is not functioning at start up, it will cause the vehicle speed sensor to read zero.

While Code 24 is set, the "Scan" tool will display an rpm derived from input speed.

CODE 24

VEHICLE SPEED SENSOR (VSS) FAULT "C/K" TWO WHEEL DRIVE WITH 4L80-E TRANSMISSION

(1)
- CLEAR CODES RAISE DRIVE WHEELS.
- WITH A VOLTMETER ON THE DC 20 VOLT SCALE, BACKPROBE THE PCM CONNECTOR CKT 437 TO GROUND.
- ENGINE RUNNING.
- TRANSMISSION IN GEAR.

LESS THAN 1 VOLT

DOES SPEEDOMETER WORK?

1.5 TO 2.5 VOLTS

PROBLEM IS INTERMITTENT. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

NO

(2) REMOVE VEHICLE SPEED SENSOR CONNECTOR. MEASURE VOLTAGE ACROSS OUTPUT SENSOR PINS A/C 200 VOLT SCALE. ENGINE RUNNING, TRANSMISSION IN DRIVE. DOES VOLTAGE VARY FROM ZERO UP WITH VEHICLE SPEED?

YES

CHECK FOR OPEN OR SHORTED CKT 437. IF OK, PROBLEM IS FAULTY INSTRUMENT CLUSTER.

YES

(3)
- RECONNECT VEHICLE SPEED SENSOR.
- REMOVE INSTRUMENT CLUSTER.
- DRIVE WHEELS STILL RAISED TRANSMISSION IN GEAR.
- MEASURE VOLTAGE ACROSS INSTRUMENT CLUSTER HARNESS CONNECTOR PINS "B13" AND "B16" WITH VOLTMETER ON A/C 200 VOLT SCALE.
- DOES VOLTAGE VARY FROM ZERO UP WITH VEHICLE SPEED.

NO

REPLACE VEHICLE SPEED SENSOR.

NO

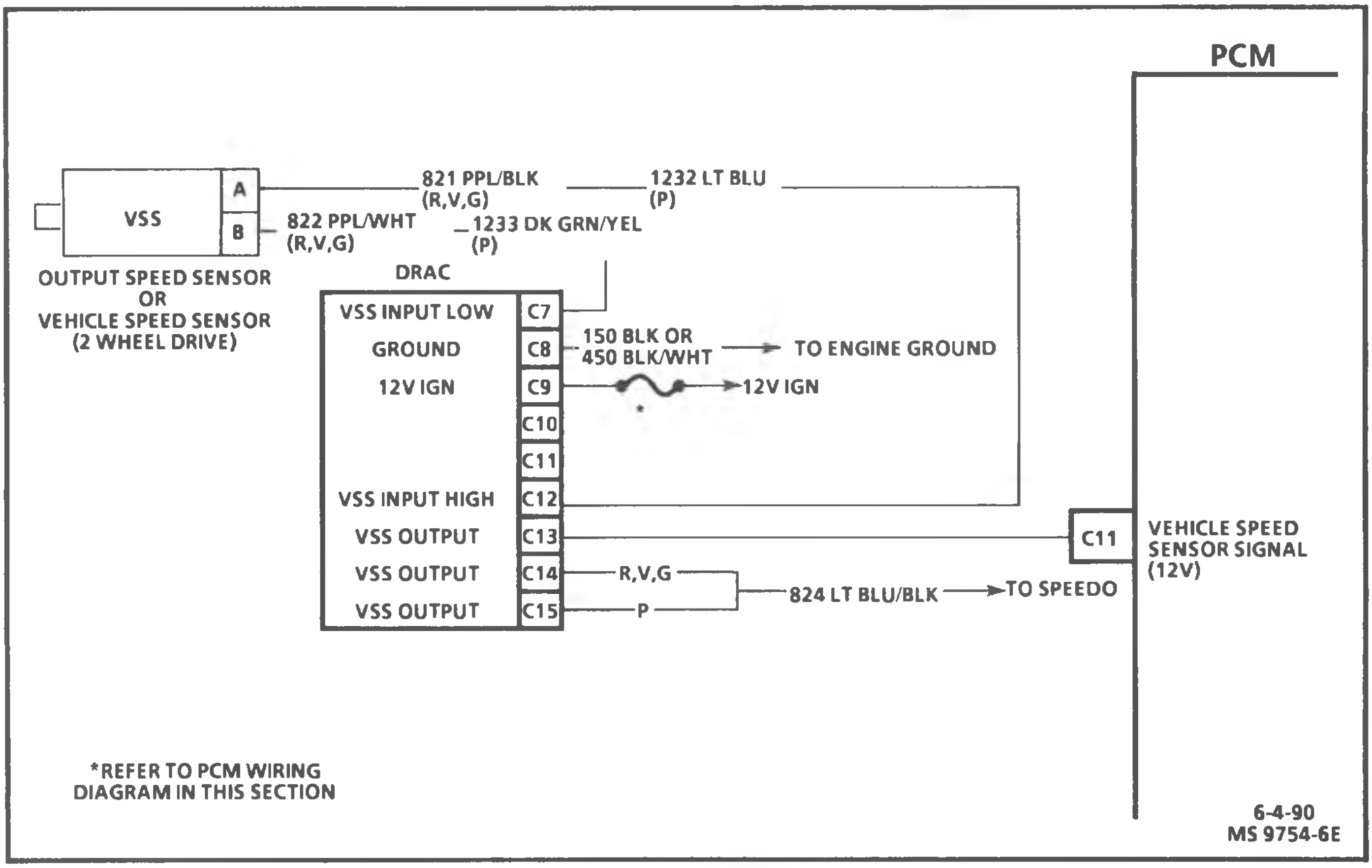
PROBLEM IS POOR CONNECTION AT VEHICLE SPEED SENSOR
OR
OPEN
OR
SHORTED CKT 821 OR 822.

YES

PROBLEM IS FAULTY CONNECTION AT INSTRUMENT CLUSTER
OR
FAULTY INSTRUMENT CLUSTER.

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-14-90
MS 10076



CODE 24

VEHICLE SPEED SENSOR (VSS)
(2 WHEEL DRIVE)
ALL VEHICLES EXCEPT "C/K" SERIES WITH 4L80-E TRANSMISSION

Circuit Description:

The Vehicle Speed Sensor (VSS) circuit consists of a magnetic induction type sensor, digital ratio adapter and wiring. Gear teeth pressed on the outside diameter of the output carrier assembly induce an alternating current in the sensor. On two wheel drive vehicles, this current is transmitted to a digital ratio adapter where it is passed on to the PCM. The digital ratio adapter compensates for various axle ratios and converts the signal to a square wave for use by the speedometer, cruise control and antilock brake system. Since vehicle speed is taken from the transfer case on four wheel drive vehicles, the transmission vehicle speed sensor signal on these units goes directly to the PCM. Code 24 will set when vehicle speed is less than 200 rpm for 1.5 seconds while engine speed is greater than 3000 rpm. Park/Neutral (P/N) not selected.

If the input speed sensor is not operational at start up, this can cause the vehicle speed sensor to read zero.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. The first test checks the vehicle speed sensor signal to the PCM.
2. Test two checks the vehicle speed sensor signal to the digital ratio adapter.
3. Test three directly verifies the vehicle speed sensor signal.

Diagnostic Aids:

Check all connections especially at the transmission pass-thru connector. See "ECM/PCM Intermittent Codes" in "Driveability Symptoms," Section "2."

CODE 24

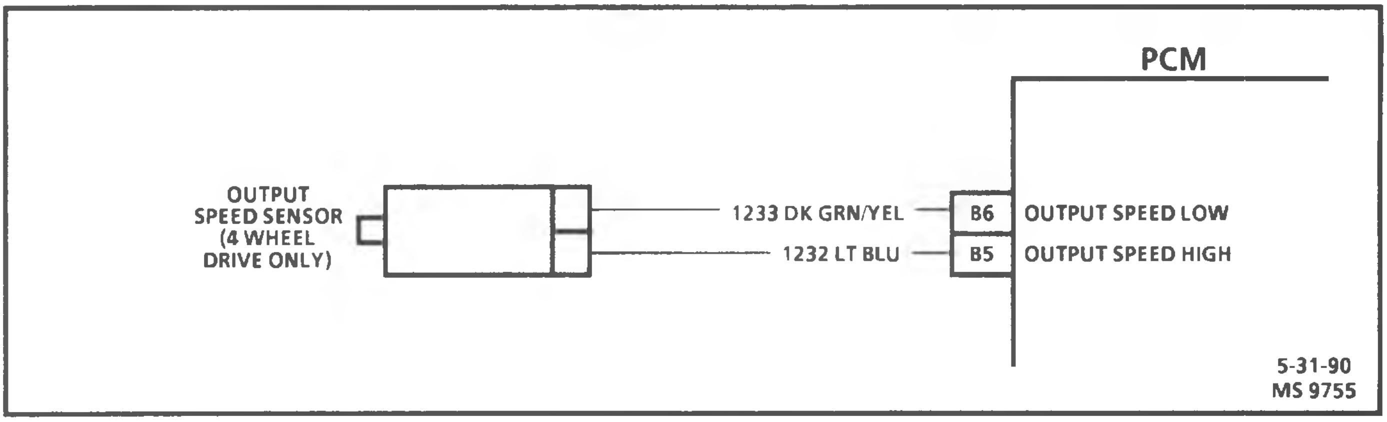
VEHICLE SPEED SENSOR (VSS)
(2 WHEEL DRIVE)
ALL VEHICLES EXCEPT "C/K" SERIES WITH 4L80-E TRANSMISSION

1.
- RAISE DRIVE WHEELS.
- WITH A VOLTMETER ON THE DC 20 VOLT SCALE, BACKPROBE THE PCM CONNECTOR CKT 437 TO GROUND.
- ENGINE RUNNING.
- TRANSMISSION IN GEAR.

- **LESS THAN 1 VOLT** → DOES SPEEDOMETER WORK?
  - **NO** → (2) BACK PROBE ACROSS DIGITAL RATIO ADAPTER CKT 821/1232 AND 822/1233. VOLTMETER ON A/C 200 VOLT SCALE, TRANSMISSION IN GEAR, ENGINE RUNNING. DOES VOLTAGE INCREASE FROM ZERO UP WITH VEHICLE SPEED?
    - **NO** → (3) REMOVE VEHICLE SPEED SENSOR CONNECTOR. MEASURE VOLTAGE ACROSS VEHICLE SPEED SENSOR PINS A/C 200 VOLT SCALE. ENGINE RUNNING, TRANSMISSION IN DRIVE. DOES VOLTAGE VARY FROM ZERO UP WITH VEHICLE SPEED?
      - **NO** → REPLACE VEHICLE SPEED SENSOR.
      - **YES** → PROBLEM IS POOR VEHICLE SPEED SENSOR CONNECTION, OPEN CKT 821/1232 OR 822/1233 OR GROUNDED CKT 821/1232.
    - **YES** → CHECK CONNECTIONS AT DIGITAL RATIO ADAPTER. IF OK, REPLACE DIGITAL RATIO ADAPTER.
  - **YES** → CHECK FOR OPEN OR SHORTED CKT 437. IF OK, REPLACE DIGITAL RATIO ADAPTER.
- **1.5 TO 2.5 VOLTS** → PROBLEM IS INTERMITTENT. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-14-90
MS 9962-6E



CODE 24

OUTPUT SPEED SENSOR
(4 WHEEL DRIVE)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The output speed sensor circuit is the magnetic induction type. Gear teeth pressed on the outside diameter of the output carrier assembly induce an alternating current in the sensor. Since vehicle speed is taken from the transfer case on four wheel drive vehicles, the transmission output speed sensor signal on these units goes directly to the PCM. Code 24 will set when engine speed is above 3000 rpm and output speed sensor reading is below 200 rpm for 1.5 seconds, Park/Neutral (P/N) not selected.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. The first test checks the output speed sensor signal at the PCM.
2. The second test directly checks the output speed sensor operation.

Diagnostic Aids:

Check all connections especially at the transmission pass-thru connector. See "Intermittent Codes" in "Drivability Symptoms," Section "2."

Check input speed sensor reading. A faulty input speed sensor during start-up will cause the PCM to read output at 0 rpm.

For internal transmission problems, see 4L80-E TRANSMISSION (SECTION 7A2) of appropriate vehicle service manual.

CODE 24

OUTPUT SPEED SENSOR
(4 WHEEL DRIVE)
ALL VEHICLES WITH 4L80-E TRANSMISSION

1
- CLEAR CODES.
- BACK PROBE ACROSS CKT 1233 AND 1232 AT PCM CONNECTOR.
- VEHICLE WHEELS RAISED, ENGINE RUNNING IN GEAR.
- VOLTMETER ON A/C 200 VOLT SCALE.
- DOES VOLTAGE VARY FROM 0 UP WITH RPM INCREASE?

NO

2
- WITH VEHICLE STILL RAISED, DISCONNECT OUTPUT SPEED SENSOR CONNECTOR.
- ENGINE RUNNING.
- TRANSMISSION IN GEAR.
- VOLTMETER ON A/C 200 VOLT SCALE.
- MEASURE VOLTAGE ACROSS SENSOR. DOES VOLTAGE VARY WITH RPM?

YES

PROBLEM IS:
- POOR CONNECTION AT PCM
- POOR CONNECTION AT OUTPUT SPEED SENSOR
- OPEN CKT 1233/CKT 1232
- SHORTED CKT 1233

NO

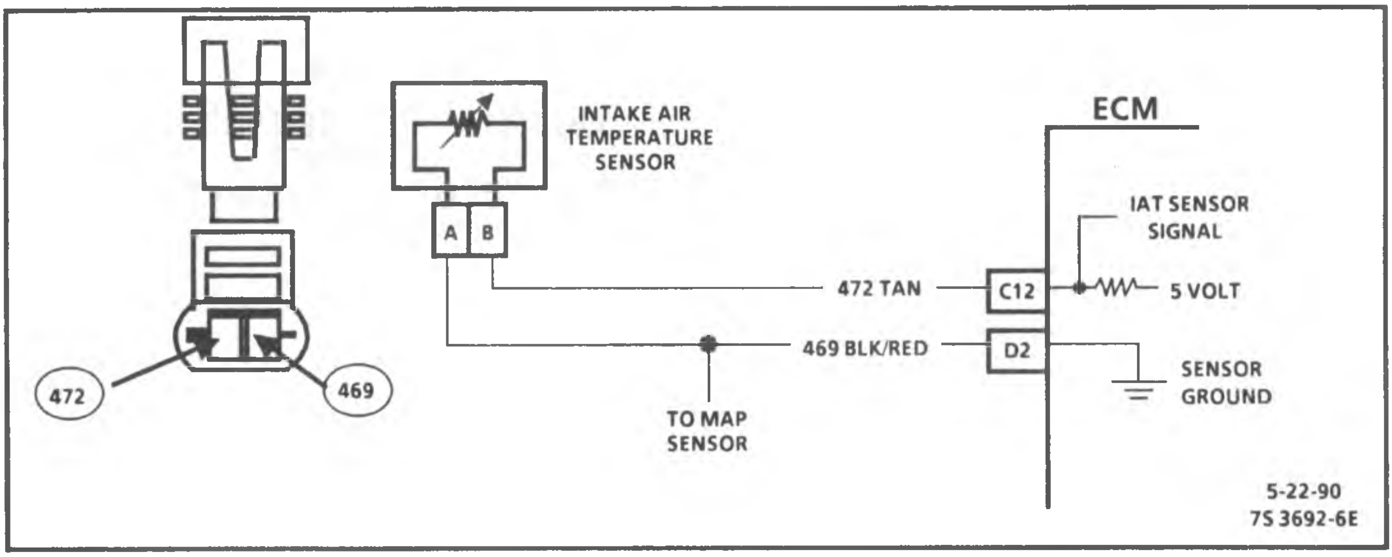
REPLACE OUTPUT SPEED SENSOR.

YES

PROBLEM IS INTERMITTENT OR INTERNAL TRANSMISSION. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-14-90
MS 9973-6E



CODE 25

INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT
(HIGH TEMPERATURE INDICATED)
2.5L ENGINE

Circuit Description:

The Intake Air Temperature (IAT) sensor is a thermistor that controls the signal voltage to the ECM. The ECM applies a voltage (4-6 volts) on CKT 472 to the sensor. When the air is cold, the sensor (thermistor) resistance is high, therefore, the ECM will see a high signal voltage. As the air warms, the sensor resistance becomes less, and the voltage drops.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 25 will set if:
   - Signal voltage indicates a Intake Air Temperature (IAT) above 150°C (302°F) for 2 seconds.
   - Time since engine start is 1 minute or longer.
   - A vehicle speed is present.

Diagnostic Aids:

A "Scan" tool reads temperature of the air entering the engine and should read close to ambient air temperature when engine is cold, and rises as underhood temperature increases.

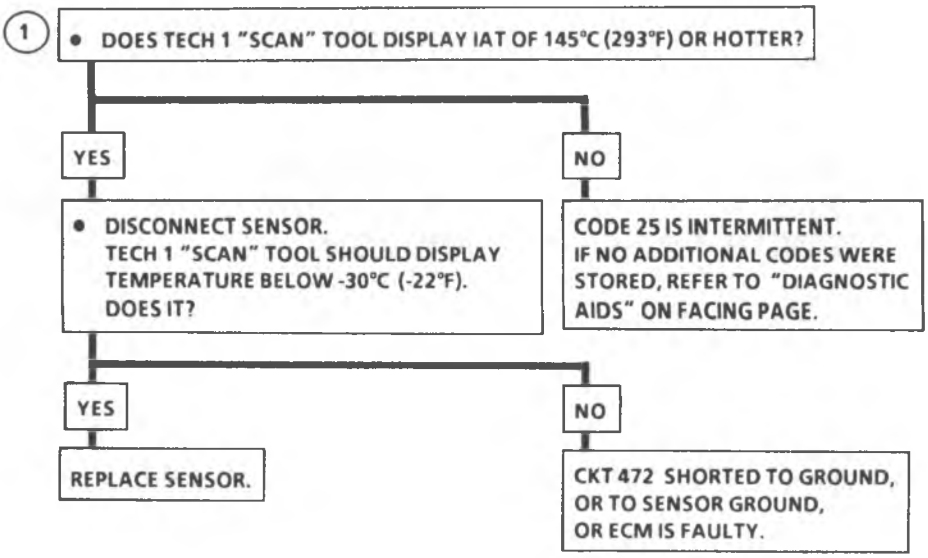
Check harness routing for possible short to ground in CKT 472.

Refer to "Driveability Symptoms," Section "2" for "ECM Intermittent Codes or Performance."

The "Temperature to Resistance Value" scale at the right may be used to test the IAT sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor could result in poor driveability complaints.

CODE 25

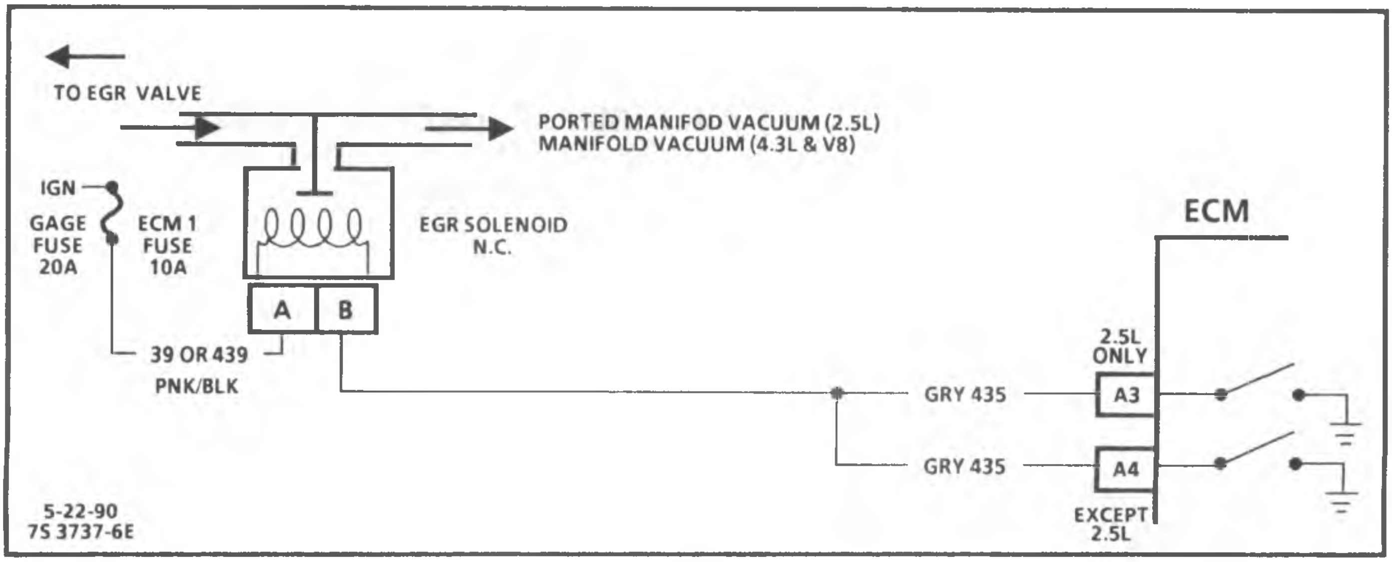
INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT
(HIGH TEMPERATURE INDICATED)
2.5L ENGINE



DIAGNOSTIC AID

IAT SENSOR		
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)		
°F	°C	OHMS
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 32

EXHAUST GAS RECIRCULATION (EGR) SYSTEM
2.5L (S), 4.3L (M/L, C/K, G, P), 5.0L (C/K), 5.7L (C/K, R/V, G) UNDER 8600 GVW
EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The ECM operates a solenoid to control the exhaust gas recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the ECM energizes the solenoid which then allows vacuum to pass to the EGR valve.

The ECM monitors EGR effectiveness by de-energizing the EGR control solenoid thereby shutting off vacuum to the EGR valve diaphragm. With the EGR valve closed, and O_2 sensor fluctuating normally, fuel integrator counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, a Code 32 will be set.

The ECM will check EGR operation when:

- Vehicle speed is above 50 mph.
- Engine vacuum is between 15 and 55 kPa.
- No change in throttle position while test is being run.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. With the ignition "ON," engine stopped, the solenoid should not be energized and vacuum should not pass to the EGR valve. Grounding the diagnostic terminal will energize the solenoid and allow vacuum to pass to valve.
2. Checks for plugged EGR passages. If passages are plugged, the engine may have severe detonation on acceleration.
3. The "Service Engine Soon" light should also flash while the diagnostic terminal is grounded. If the light does not flash, this may indicate that the "Quad-Driver" has been damaged by low resistance in TCC circuit.
4. This vehicle must be driven during this test in order to produce sufficient engine load to operate the EGR. Lightly accelerating (approximately 1/4 throttle) will produce a large and stable enough reading to determine if the ECM is commanding the system "ON."

Diagnostic Aids:

- Before replacing ECM, use an ohmmeter and check the resistance of each ECM controlled relay and solenoid coil. For example: TCC, etc., refer to "ECM QDR Check Procedure," Figure 3-18. See "ECM Wiring Diagram" for coil terminal ID of solenoid(s) and relay(s) to be checked. Replace any solenoid where resistance measures less than 20 ohms.

CODE 32

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

2.5L (S), 4.3L (M/L, C/K, G, P), 5.0L (C/K), 5.7L (C/K, R/V, G) UNDER 8600 GVW EXCEPT WITH 4L80-E TRANSMISSION

IF ANY OTHER CODES ARE STORED, DIAGNOSE THEM FIRST. IF VEHICLE EXHIBITS A ROUGH OR INCORRECT IDLE, REPAIR IDLE COMPLAINT FIRST. SEE SECTION "2".

NOTICE: DISCONNECT TECH 1 WHEN USING THIS CHART.

1
- DISCONNECT EGR SOLENOID VACUUM HOSE (MANIFOLD SIDE).
- CHECK VACUUM SOURCE TO SOLENOID (IF NOT OK, REPAIR).
- CHECK VACUUM HOSE BETWEEN SOLENOID AND VALVE FOR RESTRICTIONS.
- INSTALL A HAND HELD VACUUM PUMP WITH GAGE ON MANIFOLD SIDE OF EGR SOLENOID.
- IGNITION "ON," ENGINE STOPPED.
- DIAGNOSTIC TERMINAL GROUNDED.
- APPLY VACUUM.
- OBSERVE EGR VALVE.
- VALVE SHOULD MOVE. DOES IT?

NO

3 IS SES LIGHT FLASHING?

YES

- INSTALL A VACUUM GAGE IN VACUUM LINE AT VALVE.
- REPEAT TEST.
- DOES GAGE INDICATE VACUUM?

NO

- DISCONNECT SOLENOID CONNECTOR.
- PROBE HARNESS CONNECTOR TERMINAL "A" WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

CONNECT A TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS "A" & "D".

LIGHT "ON"

- CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS "A" & "B".
- GROUND DIAGNOSTIC TERMINAL.

LIGHT "ON"

REPLACE SOLENOID.

LIGHT

OPEN CKT 435 OR FAULTY ECM. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

LIGHT "OFF"

REPAIR OPEN IN GROUND CIRCUIT.

LIGHT "OFF"

REPAIR OPEN IN CKT 439.

YES

REPLACE EGR VALVE.

NO

REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

YES

2
- PLUG VACUUM HOSE FROM THROTTLE BODY.
- REMOVE GROUND FROM DIAGNOSTIC TERMINAL.
- START AND IDLE ENGINE.
- LIFT UP ON EGR VALVE AND OBSERVE IDLE.

IDLE ROUGHENS

4
- RECONNECT EGR SOLENOID.
- CONNECT VACUUM GAGE TO VACUUM HOSE AT EGR VALVE,
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- PUT TRANSMISSION IN GEAR.
- LIGHTLY ACCELERATE FROM A STOP.
- OBSERVE VACUUM GAGE, SHOULD BE LESS THAN 10" VACUUM.

OK

NO TROUBLE FOUND. SEE "INTERMITTENTS" IN SECTION "2".

NOT OK

OVER 10" VACUUM

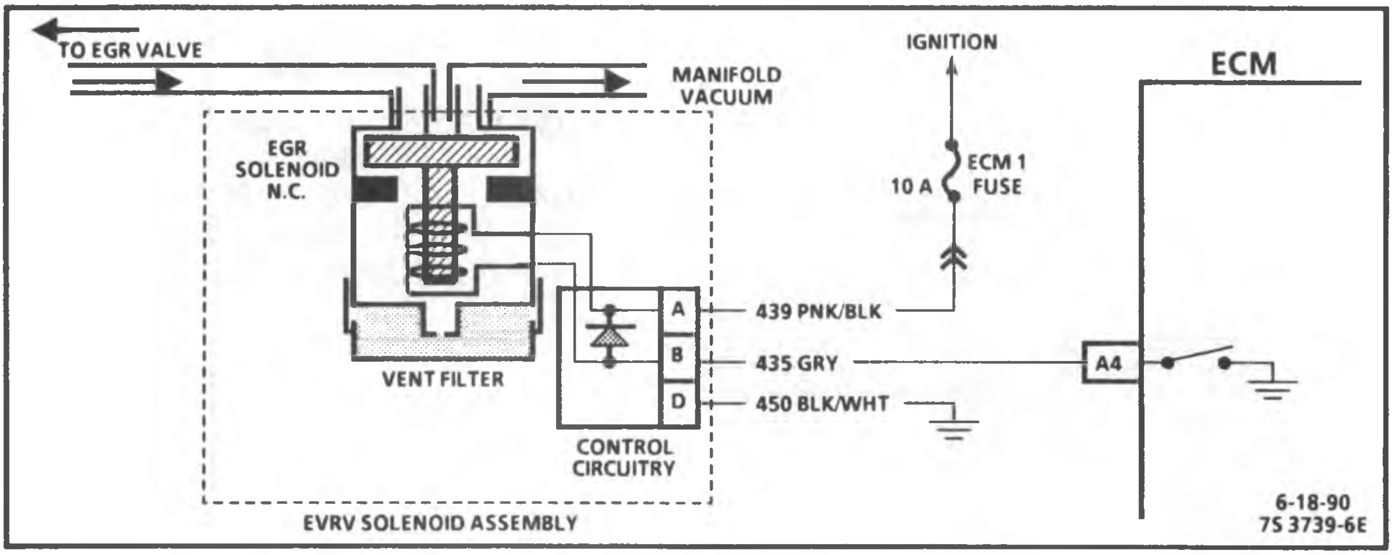
REPLACE EGR FILTER.

NO CHANGE

- REMOVE EGR VALVE.
- CHECK PASSAGES FOR BEING PLUGGED. IF NOT PLUGGED REPLACE EGR VALVE.

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-14-90
7S 3847-6E



CODE 32

EXHAUST GAS RECIRCULATION (EGR) SYSTEM
2.8L (S), 4.3L (S/T), 7.4L (C) MANUAL TRANSMISSION EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The ECM operates a EVRV solenoid, which is a pulse width modulated EGR control, to control the Exhaust Gas Recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the ECM energizes the solenoid which then allows vacuum to pass to the EGR valve.

The ECM monitors EGR effectiveness by de-energizing the EGR control solenoid thereby shutting off vacuum to the EGR valve diaphragm. With the EGR valve closed, and O_2 sensor fluctuating normally, fuel integrator counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, a Code 32 will be set.

The ECM will check EGR operation when:

- Vehicle speed is above 50 mph.
- Engine vacuum is between 12.5 and 55 kPa.
- No change in throttle position while test is being run.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. With the ignition "ON," engine stopped, the solenoid should not be energized and vacuum should not pass to the EGR valve. Grounding the diagnostic terminal will energize the solenoid and allow vacuum to pass to valve.
2. Checks for plugged EGR passages. If passages are plugged, the engine may have severe detonation on acceleration.
3. The "Service Engine Soon" light should also flash while the diagnostic terminal is grounded. If the light does not flash, this may indicate that the "Quad-Driver" has been damaged by low reistance in the TCC circuit.
4. The vehicle must be driven during this test in order to produce sufficient engine load to operate the EGR. Lightly accelerating (approximately 1/4 throttle) will produce a large and stable enough reading to determine if the ECM is commanding the system "ON."

Diagnostic Aids:

Before replacing ECM, use an ohmmeter and check the resistance of each ECM controlled relay and solenoid coil. For example: TCC, etc., refer to "ECM QDR Check Procedure," Figure 3-18.

See "ECM Wiring Diagram" for coil terminal identification of solenoid(s) and relay(s) to be checked.

Replace any solenoid where resistance measures less than 20 ohms.

CODE 32

EXHAUST GAS RECIRCULATION (EGR) SYSTEM 2.8L (S), 4.3L (S/T), 7.4L (C) MANUAL TRANSMISSION EXCEPT WITH 4L80-E TRANSMISSION

IF ANY OTHER CODES ARE STORED, DIAGNOSE THEM FIRST.
IF VEHICLE EXHIBITS A ROUGH OR INCORRECT IDLE, REPAIR IDLE COMPLAINT FIRST. SEE SECTION "2".

NOTICE: DISCONNECT TECH 1 WHEN USING THIS CHART.

1
- DISCONNECT EGR SOLENOID VACUUM HOSE (MANIFOLD SIDE).
- CHECK VACUUM SOURCE TO SOLENOID (IF NOT OK, REPAIR).
- CHECK VACUUM HOSE BETWEEN SOLENOID AND VALVE FOR RESTRICTIONS.
- INSTALL A HAND HELD VACUUM PUMP WITH GAGE ON MANIFOLD SIDE OF EGR SOLENOID.
- IGNITION "ON," ENGINE STOPPED.
- DIAGNOSTIC TERMINAL GROUNDED.
- APPLY VACUUM.
- OBSERVE EGR VALVE.
- VALVE SHOULD MOVE. DOES IT?

NO

3 IS SES LIGHT FLASHING?

YES
- INSTALL A VACUUM GAGE IN VACUUM LINE AT VALVE.
- REPEAT TEST.
- DOES GAGE INDICATE VACUUM?

NO
- DISCONNECT SOLENOID CONNECTOR.
- PROBE HARNESS CONNECTOR TERMINAL "A" WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

CONNECT A TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS "A" & "D".

LIGHT "ON"
- CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS "A" & "B".
- GROUND DIAGNOSTIC TERMINAL.

LIGHT "ON"

REPLACE SOLENOID.

LIGHT

OPEN CKT 435 OR FAULTY ECM. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

LIGHT "OFF"

REPAIR OPEN IN GROUND CIRCUIT.

LIGHT "OFF"

REPAIR OPEN IN CKT 439.

YES

REPLACE EGR VALVE.

NO

REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

YES

2
- PLUG VACUUM HOSE FROM THROTTLE BODY.
- REMOVE GROUND FROM DIAGNOSTIC TERMINAL.
- START AND IDLE ENGINE.
- LIFT UP ON EGR VALVE AND OBSERVE IDLE.

IDLE ROUGHENS

4
- RECONNECT EGR SOLENOID.
- CONNECT VACUUM GAGE TO VACUUM HOSE AT EGR VALVE,
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- PUT TRANSMISSION IN GEAR.
- LIGHTLY ACCELERATE FROM A STOP.
- OBSERVE VACUUM GAGE, SHOULD BE LESS THAN 10" VACUUM.

OK

NO TROUBLE FOUND. SEE "INTERMITTENTS" IN SECTION "2".

NOT OK

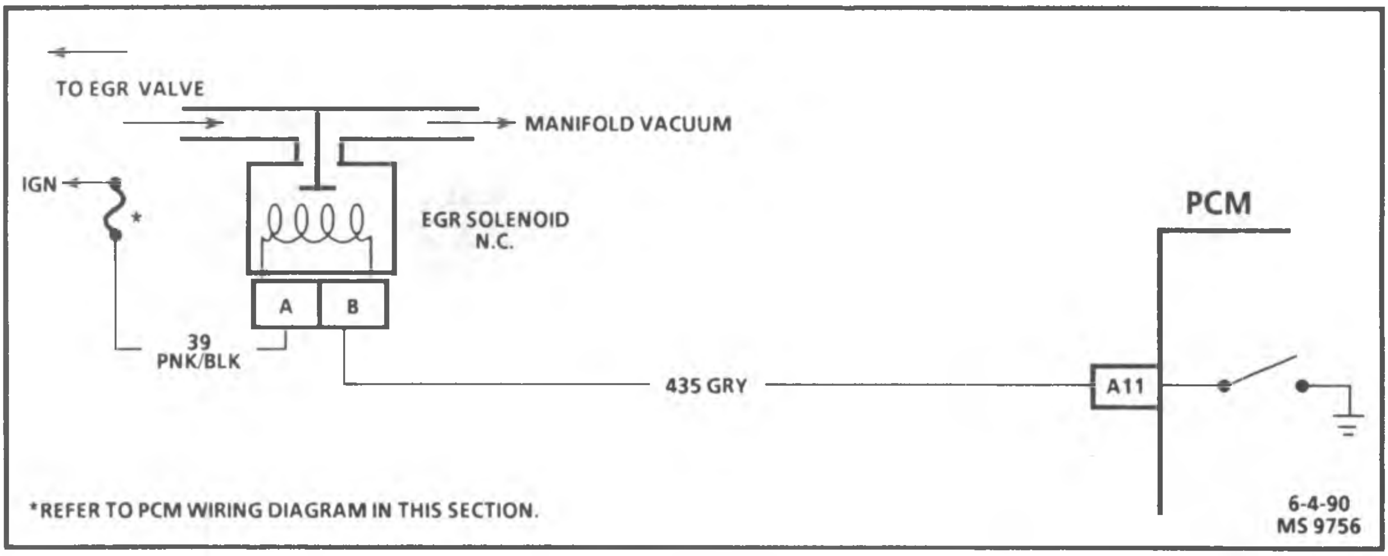
OVER 10" VACUUM

REPLACE EGR FILTER.

NO CHANGE
- REMOVE EGR VALVE.
- CHECK PASSAGES FOR BEING PLUGGED. IF NOT PLUGGED REPLACE EGR VALVE.

"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-14-90
7S 3847-6E



CODE 32

EXHAUST GAS RECIRCULATION (EGR) SYSTEM
4.3L (C/K, G, P) MODEL WITH 4L80-E TRANSMISSION

Circuit Description:

The PCM operates a solenoid to control the Exhaust Gas Recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the PCM energizes the solenoid which then allows vacuum to pass to the EGR valve.

The PCM monitors EGR effectiveness by de-energizing the EGR control solenoid thereby shutting off vacuum to the EGR valve diaphragm. With the EGR valve closed, and O_2 sensor fluctuating normally, fuel integrator counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, a Code 32 will be set.

The ECM will check EGR operation when:

- Engine speed is above 2000 rpm.
- Engine vacuum is between 8 and 30 kPa.
- No change in throttle position while test is being run.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. By commanding the EGR solenoid "ON," vacuum is applied to the EGR valve and the vacuum should hold.
2. When the diagnostic terminal is ungrounded, the vacuum to the EGR valve should bleed off through a vent in the solenoid and the valve should close. The gage may or may not bleed off but this does not indicate a problem.
3. This test will determine if the electrical control part of the system is at fault or if the connector or solenoid is at fault.
4. This system uses a negative backpressure valve which should hold vacuum with engine "OFF."
5. When engine is started, exhaust backpressure should cause vacuum to bleed off and valve should fully close.

Diagnostic Aids:

Before replacing PCM, use an ohmmeter and check the resistance of each PCM controlled relay and solenoid coil.

See "PCM Wiring Diagram" for coil terminal ID of solenoid(s) and relay(s) to be checked.

Replace any solenoid where resistance measures less than 20 ohms.

CODE 32

EXHAUST GAS RECIRCULATION (EGR) SYSTEM
4.3L (C/K, G, P) MODEL WITH 4L80-E TRANSMISSION

BEFORE USING THIS CHART, CHECK VACUUM SOURCE TO EGR SOLENOID, ALSO CHECK HOSES FOR LEAKS OR RESTRICTIONS. SHOULD BE AT LEAST (7") HG VACUUM AT 2000 RPM.

1
- DISCONNECT EGR SOLENOID VACUUM LINE FROM THROTTLE BODY.
- IGNITION "ON," ENGINE STOPPED.
- INSTALL A HAND HELD VACUUM PUMP WITH GAGE TO THROTTLE BODY SIDE OF EGR SOLENOID.
- APPLY VACUUM AND OBSERVE EGR VALVE DIAPHRAGM.
- VALVE SHOULD MOVE.

DOES IT?

YES

2
- WITH THE TECH 1, COMMAND EGR SOLENOID "OFF."
- VACUUM SHOULD BLEED OFF AND VALVE SHOULD CLOSE.

DOES IT?

YES

4
- IGNITION "OFF."
- CONNECT A VACUUM PUMP TO EGR VALVE.
- USING A MIRROR, OBSERVE EGR DIAPHRAGM WHILE APPLYING VACUUM.
- DIAPHRAGM SHOULD MOVE FREELY AND HOLD VACUUM FOR AT LEAST 20 SECONDS.

DOES IT?

YES

5
- APPLY VACUUM TO EGR VALVE.
- START ENGINE AND IMMEDIATELY OBSERVE VACUUM GAGE ON VACUUM PUMP.
- VALVE IS GOOD IF DIAPHRAGM HAS MOVED TO SEATED POSITION (VALVE CLOSED) AND VACUUM DROPPED WHILE STARTING ENGINE.

VACUUM DROPPED

BE SURE VACUUM HOSE BETWEEN SOLENOID AND EGR VALVE IS OK. (NO LEAKS OR RESTRICTIONS) IF NO PROBLEM IS FOUND, THE EGR CIRCUIT IS OK.

NO VACUUM DROP

- REMOVE EGR VALVE.
- CHECK PASSAGES FOR BEING PLUGGED. IF NOT PLUGGED, REPLACE VALVE.

NO (4)

REPLACE EGR VALVE.

NO (2)

3
- DISCONNECT SOLENOID ELECTRICAL CONNECTOR.

DOES VACUUM BLEED OFF?

YES

CKT 435 SHORTED TO GROUND OR FAULTY PCM. **

NO

REPLACE SOLENOID.

NO (1)

- CONNECT VACUUM PUMP TO EGR VALVE SIDE OF HARNESS.
- APPLY VACUUM AND OBSERVE VALVE.
- VALVE SHOULD MOVE.

DOES IT?

YES

- DISCONNECT EGR ELECTRICAL CONNECTOR.
- CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS.
- IGNITION "ON," ENGINE "OFF."
- TEST LIGHT SHOULD LIGHT.

DOES IT?

NO

CONNECT TEST LIGHT BETWEEN HARNESS TERMINAL "A" AND GROUND.

NO LIGHT

REPAIR OPEN CKT 439.

LIGHT

REPAIR OPEN CKT 435. IF NOT OPEN, IT IS A FAULTY PCM. **

YES

FAULTY SOLENOID CONNECTION OR FAULTY SOLENOID.

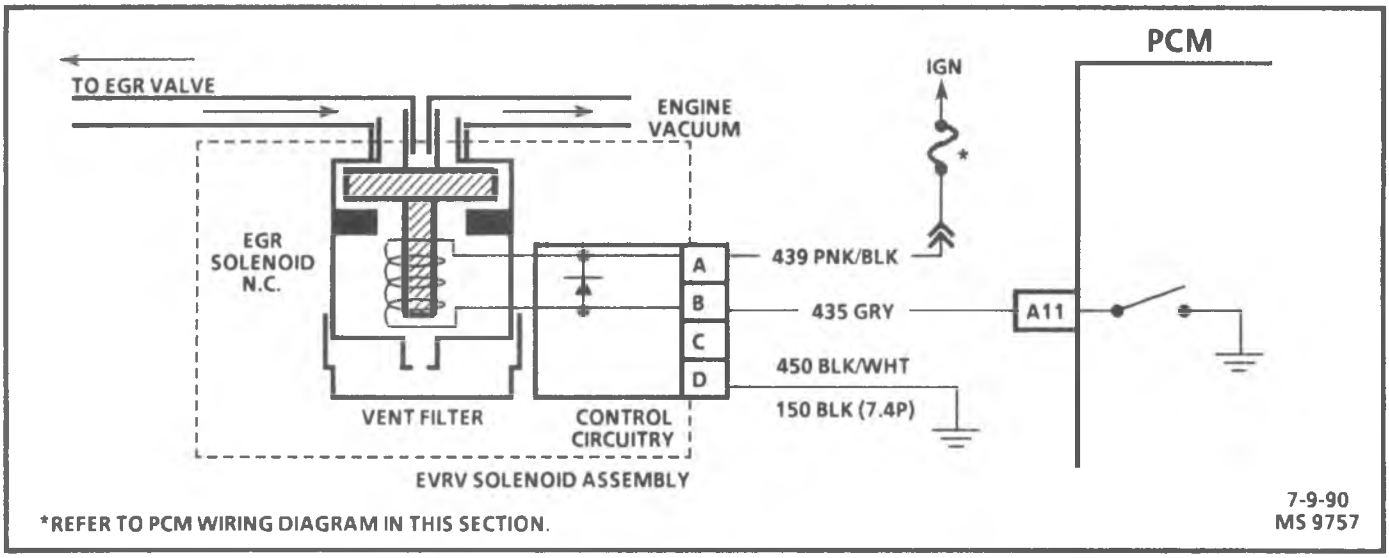
NO

- FAULTY VACUUM HOSE TO EGR VALVE OR FAULTY VALVE.

** BEFORE REPLACING PCM, REFER TO PCM QDR CHECK PROCEDURE.
REPLACE ANY RELAY OR SOLENOID IF THE COIL RESISTANCE MEASURES LESS THAN 20 OHMS.

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-19-90
MS 9961-6E



CODE 32

EXHAUST GAS RECIRCULATION (EGR) SYSTEM
ALL VEHICLES WITH 4L80-E TRANSMISSION EXCEPT 4.3L (C/K, G, P) MODEL

Circuit Description:

The PCM operates a solenoid to control the Exhaust Gas Recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the PCM energizes the solenoid which then allows vacuum to pass to the EGR valve.

The PCM monitors EGR effectiveness by de-energizing the EGR control solenoid thereby shutting off vacuum to the EGR valve diaphragm. With the EGR valve closed, and O_2 sensor fluctuating normally, fuel integrator counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, a Code 32 will be set.

The PCM will check EGR operation when:

- Engine speed is greater than 1600 rpm.
- Engine vacuum is between 20 and 60 kPa.
- No change in throttle position while test is being run.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. With the ignition "ON," engine stopped, the solenoid should not be energized and vacuum should not pass to the EGR valve. Energizing the solenoid will allow vacuum to pass to the valve.
2. Checks for plugged EGR passages. If passages are plugged, the engine may have severe detonation on acceleration.
3. The vehicle must be driven during this test in order to produce sufficient engine load to operate the EGR. Lightly accelerating (approximately 1/4 throttle) will produce a large and stable enough reading to determine if the PCM is commanding the system "ON."

Diagnostic Aids:

Before replacing PCM, use an ohmmeter and check the resistance of each PCM controlled relay and solenoid coil.

See "PCM Wiring Diagram" for coil terminal identification of solenoid(s) and relay(s) to be checked.

Replace any solenoid where resistance measures less than 20 ohms.

CODE 32

EXHAUST GAS RECIRCULATION (EGR) SYSTEM ALL VEHICLES WITH 4L80-E TRANSMISSION EXCEPT 4.3L (C/K, G, P) MODEL

IF ANY OTHER CODES ARE STORED, DIAGNOSE THEM FIRST.
IF VEHICLE EXHIBITS A ROUGH OR INCORRECT IDLE, REPAIR IDLE COMPLAINT FIRST. SEE SECTION "2".

1
- DISCONNECT EGR SOLENOID VACUUM HOSE (MANIFOLD SIDE).
- CHECK VACUUM SOURCE TO SOLENOID (IF NOT OK, REPAIR).
- CHECK VACUUM HOSE BETWEEN SOLENOID AND VALVE FOR RESTRICTIONS.
- INSTALL A HAND HELD VACUUM PUMP WITH GAGE ON MANIFOLD SIDE OF EGR SOLENOID.
- IGNITION "ON," ENGINE STOPPED.
- WITH TECH 1 COMMAND EGR SOLENOID "ON."
- APPLY VACUUM.
- OBSERVE EGR VALVE.
- VALVE SHOULD MOVE. DOES IT?

NO

- INSTALL A VACUUM GAGE IN VACUUM LINE AT VALVE.
- REPEAT TEST.
- DOES GAGE INDICATE VACUUM?

NO

- DISCONNECT SOLENOID CONNECTOR.
- PROBE HARNESS CONNECTOR TERMINAL "A" WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

CONNECT A TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS "A" & "D".

LIGHT "ON"

- CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS "A" & "B".
- WITH TECH 1 COMMAND EGR SOLENOID ON.

LIGHT "ON"

REPLACE SOLENOID.

LIGHT

OPEN CKT 435 OR FAULTY ECM. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

LIGHT "OFF"

REPAIR OPEN IN GROUND CIRCUIT.

LIGHT "OFF"

REPAIR OPEN IN CKT 439.

YES

REPLACE EGR VALVE.

YES

2
- PLUG VACUUM HOSE FROM THROTTLE BODY.
- EGR SOLENOID IN NORMALLY CLOSED POSITION.
- START AND IDLE ENGINE.
- LIFT UP ON EGR VALVE AND OBSERVE IDLE.

IDLE ROUGHENS

3
- RECONNECT EGR SOLENOID.
- CONNECT VACUUM GAGE TO VACUUM HOSE AT EGR VALVE.
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- PUT TRANSMISSION IN GEAR.
- LIGHTLY ACCELERATE FROM A STOP.
- OBSERVE VACUUM GAGE, SHOULD BE LESS THAN 10" VACUUM.

OK

NO TROUBLE FOUND. SEE INTERMITTENTS IN SECTION "2".

NOT OK

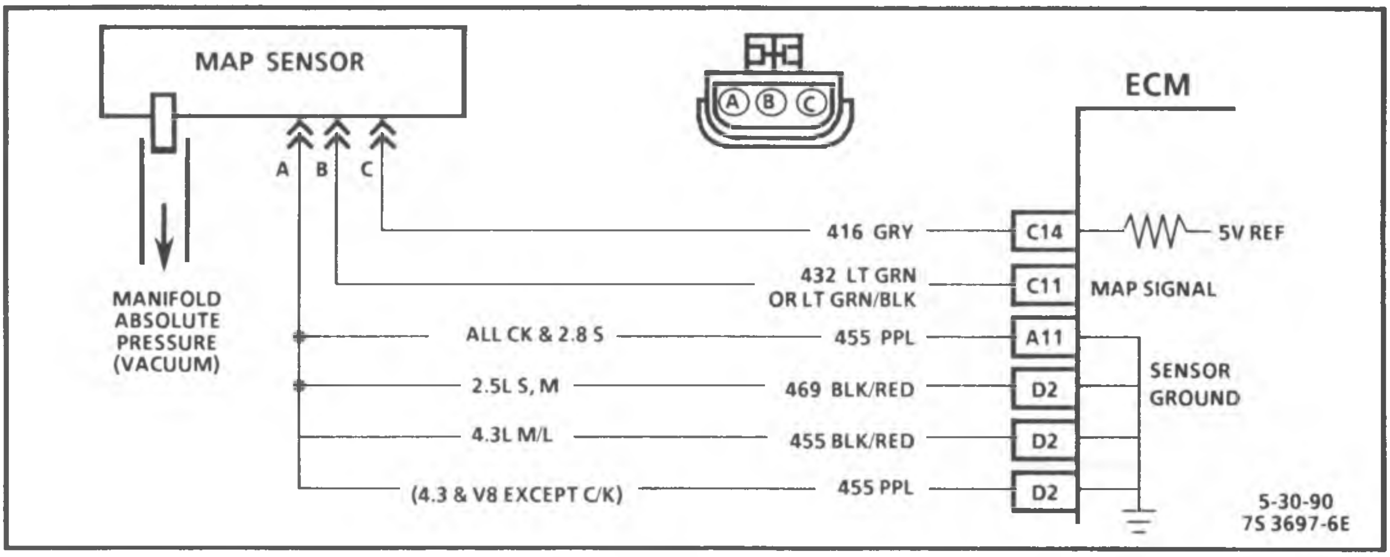
OVER 10" VACUUM

REPLACE EGR FILTER.

NO CHANGE

- REMOVE EGR VALVE.
- CHECK PASSAGES FOR BEING PLUGGED. IF NOT PLUGGED REPLACE EGR VALVE.

""*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 33

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH - LOW VACUUM)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The ECM receives this information as a signal voltage that will vary from about 1 to 1.5 volts at closed throttle (idle) to 4-4.6 volts at Wide Open Throttle (WOT) (low vacuum).

If the MAP sensor fails, the ECM will substitute a fixed MAP value and use the Throttle Position Sensor (TPS) to control fuel delivery.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if Code 33 is the result of a hard failure or an intermittent condition.
   A Code 33 will set under the following conditions:
   - MAP signal voltage is too high (low vacuum).
   - TPS less than 4%.
   - These conditions exist longer than 5 seconds.
   - Engine misfire or a low unstable idle may set Code 33.
2. This step simulates conditions for a Code 34. If the ECM recognizes the change, the ECM and CKT 416 and CKT 432 are OK. If CKT 455/469 is open, there may also be a stored Code 23.

Diagnostic Aids:

With the ignition "ON" and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Readings should be the same ± .4 volt.

A Code 33 will result if CKT 455/469 is open or if CKT 432 is shorted to voltage or to CKT 416.

If Code 33 is intermittent, refer to "Driveability Symptoms," Section "2."

- Check all connections.
- Disconnect sensor from bracket and twist sensor connections. Output changes greater than .1 volt indicates a bad connector or connection. If OK, replace sensor.

NOTE: Make sure electrical connector remains securely fastened.

- Refer to "MAP Output Check" in "Computer Command Control," Section "3" for further diagnosis.

CODE 33
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH - LOW VACUUM)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

1
- IF ENGINE IDLE IS ROUGH, UNSTABLE OR INCORRECT OR IF MANIFOLD VACUUM, AT IDLE, IS BELOW 15", CORRECT BEFORE USING CHART. SEE "SYMPTOMS" IN SECTION "2."
- ENGINE IDLING.
- DOES "SCAN" DISPLAY A MAP OF 4.0 VOLTS OR OVER?

YES

2
- IGNITION "OFF."
- DISCONNECT MAP SENSOR ELECTRICAL CONNECTOR.
- IGNITION "ON."
- "SCAN" SHOULD READ A VOLTAGE OF 1 VOLT OR LESS. DOES IT?

NO

CODE 33 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

YES

- PROBE CKT 455/469 WITH A TEST LIGHT TO 12 VOLT.
- TEST LIGHT SHOULD LIGHT. DOES IT?

NO

CKT 432 SHORTED TO VOLTAGE
OR
SHORTED TO CKT 416
OR
FAULTY ECM.

YES

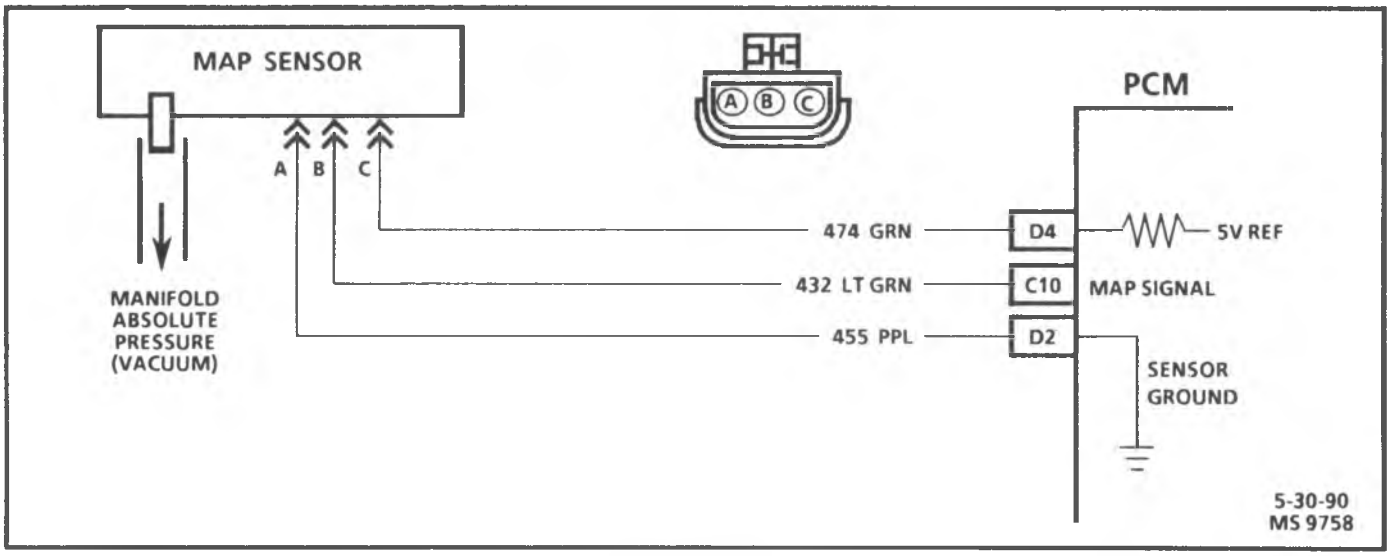
PLUGGED OR LEAKING SENSOR VACUUM HOSE
OR
FAULTY MAP SENSOR. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NO

OPEN CIRCUIT 455/469.

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-14-90
MS 9566-6E



CODE 33

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH - LOW VACUUM)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The PCM receives this information as a signal voltage that will vary from about 1 to 1.5 volts at closed throttle (idle) to 4-4.6 volts at Wide Open Throttle (WOT) (low vacuum).

If the MAP sensor fails, the PCM will substitute a fixed MAP value and use the Throttle Position Sensor (TPS) to control fuel delivery.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step will determine if Code 33 is the result of a hard failure or an intermittent condition.
   A Code 33 will set under the following conditions:
   - MAP signal voltage is too high (low vacuum).
   - TPS less than 4%.
   - These conditions exist longer than 5 seconds.
   - Engine misfire or a low unstable idle may set Code 33.
2. This step simulates conditions for a Code 34. If the PCM recognizes the change, the PCM and CKT 474 and CKT 432 are OK. If CKT 455 is open, there may also be a stored Code 23.

Diagnostic Aids:

With the ignition "ON" and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the PCM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Readings should be the same ± .4 volt.

A Code 33 will result if CKT 455 is open or if CKT 432 is shorted to voltage or to CKT 474.

If Code 33 is intermittent, refer to "Driveability Symptoms," Section "2."

- Check all connections.
- Disconnect sensor from bracket and twist sensor connections. Output changes greater than .1 volt indicates a bad connector or connection. If OK, replace sensor.

  NOTE: Make sure electrical connector remains securely fastened.

- Refer to "MAP Output Check" in "Computer Command Control," Section "3" for further diagnosis.

CODE 33

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH - LOW VACUUM)
ALL VEHICLES WITH 4L80-E TRANSMISSION

1
- IF ENGINE IDLE IS ROUGH, UNSTABLE, OR INCORRECT, CORRECT CONDITION BEFORE USING CHART. SEE "SYMPTOMS" IN SECTION "2".
- ENGINE IDLING.
- DOES TECH 1 DISPLAY A MAP VOLTAGE OF 4.0 VOLTS OR OVER?

YES

2
- IGNITION "OFF."
- DISCONNECT MAP SENSOR ELECTRICAL CONNECTOR.
- IGNITION "ON."
- TECH 1 SHOULD READ A VOLTAGE OF 1 VOLT OR LESS.
  DOES IT?

NO

CODE 33 IS INTERMITTENT.
IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

YES

- PROBE SENSOR GROUND CIRCUIT WITH A TEST LIGHT TO BATTERY VOLTAGE.
- TEST LIGHT SHOULD LIGHT.
  DOES IT?

NO

CKT 432 SHORTED TO VOLTAGE.
SHORTED TO CKT 474
OR
FAULTY PCM.

YES

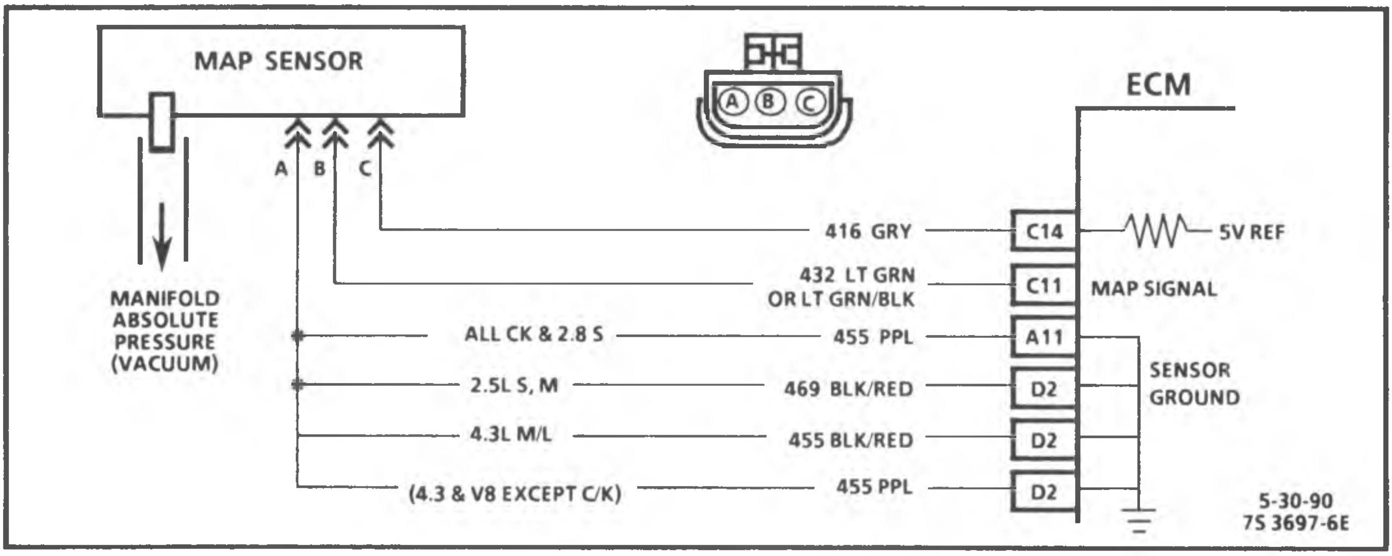
PLUGGED
OR
LEAKING SENSOR VACUUM HOSE
OR
FAULTY MAP SENSOR.

NO

OPEN SENSOR GROUND CIRCUIT.

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

6-6-90
MS 9959-6E



CODE 34

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE LOW - HIGH VACUUM)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The ECM receives this information as a signal voltage that will vary from about 1-1.5 volts at idle to 4-4.6 volts at Wide Open Throttle (WOT).

A "Scan" tool displays manifold pressure in volts. low pressure (high vacuum) reads a low voltage while a high pressure (low vacuum) reads a high voltage.

If the MAP sensor fails the ECM will substitute a fixed MAP value and use the Throttle Position Sensor (TPS) to control fuel delivery.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if Code 34 is the result of a hard failure or an intermittent condition. A Code 34 will set when:
   - When engine is less than 1200 rpm.
   - Manifold pressure reading less than 14 kPa, conditions met for 1 second.
     OR
   - Engine speed is greater than 1200 rpm.
   - Throttle angle over 21%.
   - Manifold pressure less than 14 kPa, conditions met for 1 second.
2. Jumpering harness terminals "B" to "C" (5 volts to signal circuit) will determine if the sensor is at fault, or if there is a problem with the ECM or wiring.
3. The "Scan" tool may not display 5 volts. The important thing is that the ECM recognized the voltage as more than 4 volts, indicating that the ECM and CKT 432 are OK.

Diagnostic Aids:

An intermittent open in CKT 432 or CKT 416 will result in a Code 34.

With the ignition "ON" and the engine "OFF," the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude.

Comparison of this reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Reading should be the same ± .4 volt. Also, MAP output check in "Computer Command Control," Section "3" can be used to test the MAP sensor.

Refer to "Intermittents," in "Driveability Symptoms," Section "2."

- Disconnect sensor from bracket and twist sensor by hand (only) to check for intermittent connections. Output changes greater than .1 volt indicates a bad connector or connection. If OK, replace sensor.

NOTE: Make sure electrical connector remains securely fastened.

Refer to "MAP Output Check" in "Computer Command Control," Section "3" for further diagnosis.

CODE 34

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE LOW - HIGH VACUUM)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

1
- ENGINE IDLING.
  DOES TECH 1 DISPLAY MAP VOLTAGE BELOW .25 VOLT?

YES

2
- IGNITION "OFF."
- DISCONNECT SENSOR ELECTRICAL CONNECTOR.
- JUMPER HARNESS TERMINALS "B" TO "C".
- IGNITION "ON."
- MAP VOLTAGE SHOULD READ OVER 4.7 VOLTS.
  DOES IT?

NO

CODE 34 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NO

3
- IGNITION "OFF."
- REMOVE JUMPER WIRE.
- PROBE TERMINAL "B" (CKT 432) WITH A TEST LIGHT TO BATTERY VOLTAGE.
- IGNITION "ON."
- TECH 1 SHOULD READ OVER 4 VOLTS.
  DOES IT?

YES

FAULTY CONNECTION
OR
SENSOR.

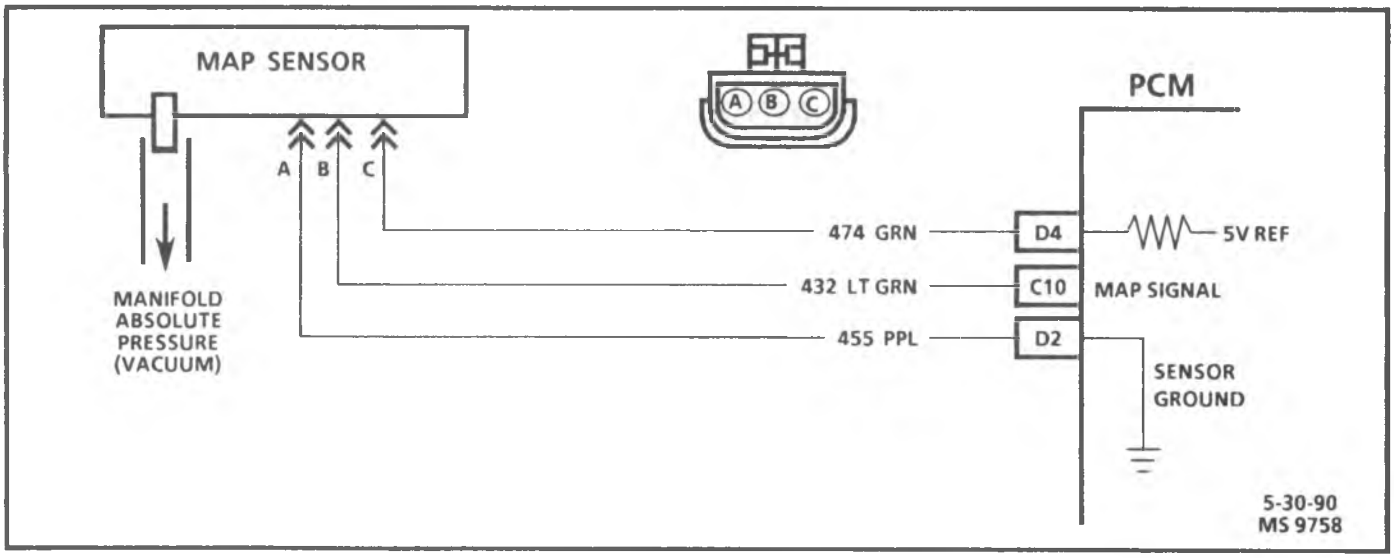
YES

5 VOLT REFERENCE CIRCUIT OPEN
OR
SHORTED TO GROUND
OR
FAULTY ECM.

NO

CKT 432 OPEN
OR
CKT 432 SHORTED TO GROUND
OR
CKT 432 SHORTED TO SENSOR GROUND
OR
FAULTY ECM.

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 34

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE LOW - HIGH VACUUM)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The PCM receives this information as a signal voltage that will vary from about 1-1.5 volts at idle to 4-4.6 volts at Wide Open Throttle (WOT).

A "Scan" tool displays manifold pressure in volts. Low pressure (high vacuum) reads a low voltage while a high pressure (low vacuum) reads a high voltage.

If the MAP sensor fails the PCM will substitute a fixed MAP value and use the Throttle Position Sensor (TPS) to control fuel delivery.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if Code 34 is the result of a hard failure or an intermittent condition. A Code 34 will set when:
   - When engine is less than 1200 rpm.
   - Manifold pressure reading less than 14 kPa, conditions met for 1 second.

     OR
   - Engine speed is greater than 1200 rpm.
   - Throttle angle over 21%.
   - Manifold pressure less than 14 kPa, conditions met for 1 second.
2. Jumpering harness terminals "B" to "C" (5 volts to signal circuit) will determine if the sensor is at fault, or if there is a problem with the PCM or wiring.
3. The "Scan" tool may not display 5 volts. The important thing is that the PCM recognized the voltage as more than 4 volts, indicating that the PCM and CKT 432 are OK.

Diagnostic Aids:

An intermittent open in CKT 432 or CKT 474 will result in a Code 34.

With the ignition "ON" and the engine "OFF," the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the PCM as an indication of vehicle altitude.

Comparison of this reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Reading should be the same ± .4 volt. Also, MAP output check in "Computer Command Control," Section "3" can be used to test the MAP sensor.

Refer to "Intermittents," in "Driveability Symptoms," Section "2."

- Disconnect sensor from bracket and twist sensor by hand (only) to check for intermittent connections. Output changes greater than .1 volt indicates a bad connector or connection. If OK, replace sensor.

NOTE: Make sure electrical connector remains securely fastened.

Refer to "MAP Output Check" in "Computer Command Control," Section "3" for further diagnosis.

CODE 34

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE LOW - HIGH VACUUM)
ALL VEHICLES WITH 4L80-E TRANSMISSION

1 • ENGINE IDLING.
DOES TECH 1 DISPLAY MAP VOLTAGE BELOW .25 VOLT?

YES

2
- IGNITION "OFF."
- DISCONNECT SENSOR ELECTRICAL CONNECTOR.
- JUMPER HARNESS TERMINALS "B" TO "C".
- IGNITION "ON."
- MAP VOLTAGE SHOULD READ OVER 4.7 VOLTS.
DOES IT?

NO

CODE 34 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

(Step 2) NO

3
- IGNITION "OFF."
- REMOVE JUMPER WIRE.
- PROBE TERMINAL "B" (CKT 432) WITH A TEST LIGHT TO BATTERY VOLTAGE.
- IGNITION "ON."
- TECH 1 SHOULD READ OVER 4 VOLTS.
DOES IT?

(Step 2) YES

FAULTY CONNECTION
OR
SENSOR.

(Step 3) YES

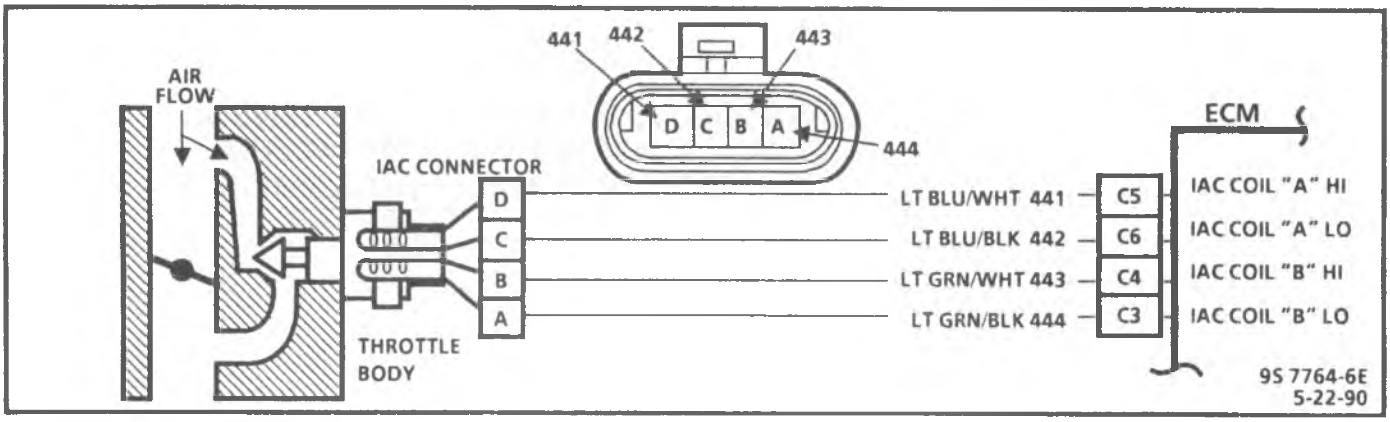
5 VOLT REFERENCE CIRCUIT OPEN
OR
SHORTED TO GROUND
OR
FAULTY PCM.

(Step 3) NO

CKT 432 OPEN
OR
CKT 432 SHORTED TO GROUND
OR
CKT 432 SHORTED TO SENSOR GROUND
OR
FAULTY PCM.

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

6-6-90
MS 9958-6E



CODE 35

IDLE AIR CONTROL (IAC) SYSTEM
2.5L ENGINE

Circuit Description:

The ECM controls idle rpm with the IAC valve. To increase idle rpm, the ECM moves the IAC vale away from it's seat, allowing more air to pass by the throttle plate. To decrease rpm, it moves the IAC valve toward it's seat, reducing air flow by the throttle plate. A "Scan" tool will read the ECM commands to the IAC valve in counts. The higher the counts, the more air allowed (higher idle). The lower the counts, the less air allowed (lower idle).

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. The IAC tester is used to extend and retract the IAC valve. Valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be retested when removed from the throttle body.
2. This step checks the quality of the IAC movement in step 1. Between 700 rpm and about 1500 rpm, the engine speed should change smoothly with each flash of the tester light in both extend and retract. If the IAC valve is retracted beyond the control range (about 1500 rpm), it may take many flashes in the extend position before engine speed will begin to drop. This is normal on certain engines, fully extending the IAC may cause engine stall. This may be normal.
3. Steps 1 and 2 verified proper IAC valve operation while this step checks the IAC circuits. Each lamp on the node light should flash red and green while the IAC valve is cycled. While the sequence of color is not important if either light is "OFF" or does not flash red and green, check the circuits for faults, beginning with poor terminal contacts.

IAC VALVE RESET PROCEDURE

- Ignition "OFF" for 10 seconds
- Start and run engine for 5 seconds
- Ignition "OFF" for 10 seconds

Diagnostic Aids:

A slow, unstable, or fast idle may be caused by a non-IAC system problem that cannot be overcome by the IAC valve. Out of control range IAC "Scan" tool counts will be above 60 if idle is too low, and zero counts if idle is too high. The following checks should be made to repair a non-IAC system problem.

- Vacuum Leak (High Idle) - If idle is too high, stop the engine. Fully extend (low) IAC with tester. Start engine. If idle speed is above 800 rpm, locate and correct vacuum leak including PCV system. Also check for binding of throttle blade or linkage.
- System too lean (High Air/Fuel Ratio) - The idle speed may be too high or too low. Engine speed may vary up and down and disconnecting the IAC valve does not help. Code 44 may be set "Scan" O_2 voltage will be less than 300 mV (.3 volt). Check for low regulated fuel pressure water in the fuel or a restricted injector.
- System too rich (Low Air/Fuel Ratio) - The idle speed will be too low. "Scan" tool IAC counts will usually be above 80. System is obviously rich and may exhibit black exhaust smoke.
  "Scan" tool O_2 voltage will be fixed above 800 mV (.8 volt).
  Check for high fuel pressure, leaking or sticking injector. Silicone contaminated O_2 sensors "Scan" voltage will be slow to respond.
- Throttle body - Remove IAC and inspect bore for foreign material.
- Refer to "Rough, Unstable, Incorrect Idle or Stalling Symptom" in "Driveability Symptoms," Section "2."
- If intermittent poor driveability symptoms are resolved by disconnecting the IAC, carefully recheck connections, valve terminal resistance, or replace IAC.
- A/C Compressor or relay failure - See "A/C Diagnosis" if circuit is shorted to ground. If the relay is faulty, idle problem may exist.
- Refer to "Rough, Unstable, Incorrect Idle or Stalling Symptoms" in "Driveability Symptoms," Section "2."

CODE 35

IDLE AIR CONTROL (IAC) SYSTEM
2.5L ENGINE

NOTE: IF A REPAIR HAS BEEN MADE REFER TO THE IAC RESET PROCEDURE ON THE FACING PAGE BEFORE RETESTING.

1
- IGNITION "OFF," CONNECT IAC DRIVER * TO IAC VALVE.
- SET PARKING BRAKE, BLOCK WHEELS, A/C "OFF."
- IDLE ENGINE IN PARK (A/T) OR NEUTRAL (M/T).
- INSTALL "SCAN" TOOL AND DISPLAY RPM.
- WITH IAC DRIVER, EXTEND AND RETRACT IAC VALVE.
- ENGINE RPM SHOULD DECREASE AND INCREASE AS IAC IS CYCLED.

RPM CHANGES

2
- RPM SHOULD CHANGE SMOOTHLY WITH EACH FLASH OF THE IAC DRIVER LIGHT FROM 700 RPM TO ABOUT 1500 RPM.
  DOES IT?

YES

3
- INSTALL APPROPRIATE IAC NODE LIGHT * IN ECM HARNESS.
- CYCLE IAC DRIVER AND NOTE LIGHTS.
- BOTH LIGHTS SHOULD CYCLE RED AND GREEN BUT NEVER "OFF" AS RPM IS CHANGED OVER ITS RANGE.
  DO THEY?

NO

IF CIRCUIT(S) DID NOT TEST GREEN AND RED, CHECK FOR:
- FAULTY CONNECTOR TERMINAL CONTACTS.
- OPEN CIRCUITS INCLUDING CONNECTIONS.
- CIRCUITS SHORTED TO GROUND OR VOLTAGE.
- FAULTY ECM CONNECTION OR ECM.
  REPAIR AS NECESSARY AND RETEST.

YES

- USING THE OTHER CONNECTOR ON THE IAC DRIVER PIGTAIL, CHECK RESISTANCE ACROSS IAC COILS.
- SHOULD BE 40 TO 80 OHMS BETWEEN IAC TERMINALS "A" TO "B" AND "C" TO "D".

OK

- CHECK RESISTANCE BETWEEN IAC TERMINALS "B" AND "C" AND "A" AND "D".
- SHOULD BE INFINITE.

OK

IDLE AIR CONTROL VALVE AND CIRCUIT OK. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NOT OK

REPLACE IAC VALVE AND RETEST.

NOT OK

REPLACE IAC VALVE AND RETEST.

NO

- CHECK IAC PASSAGES.
- IF OK, REPLACE IAC.

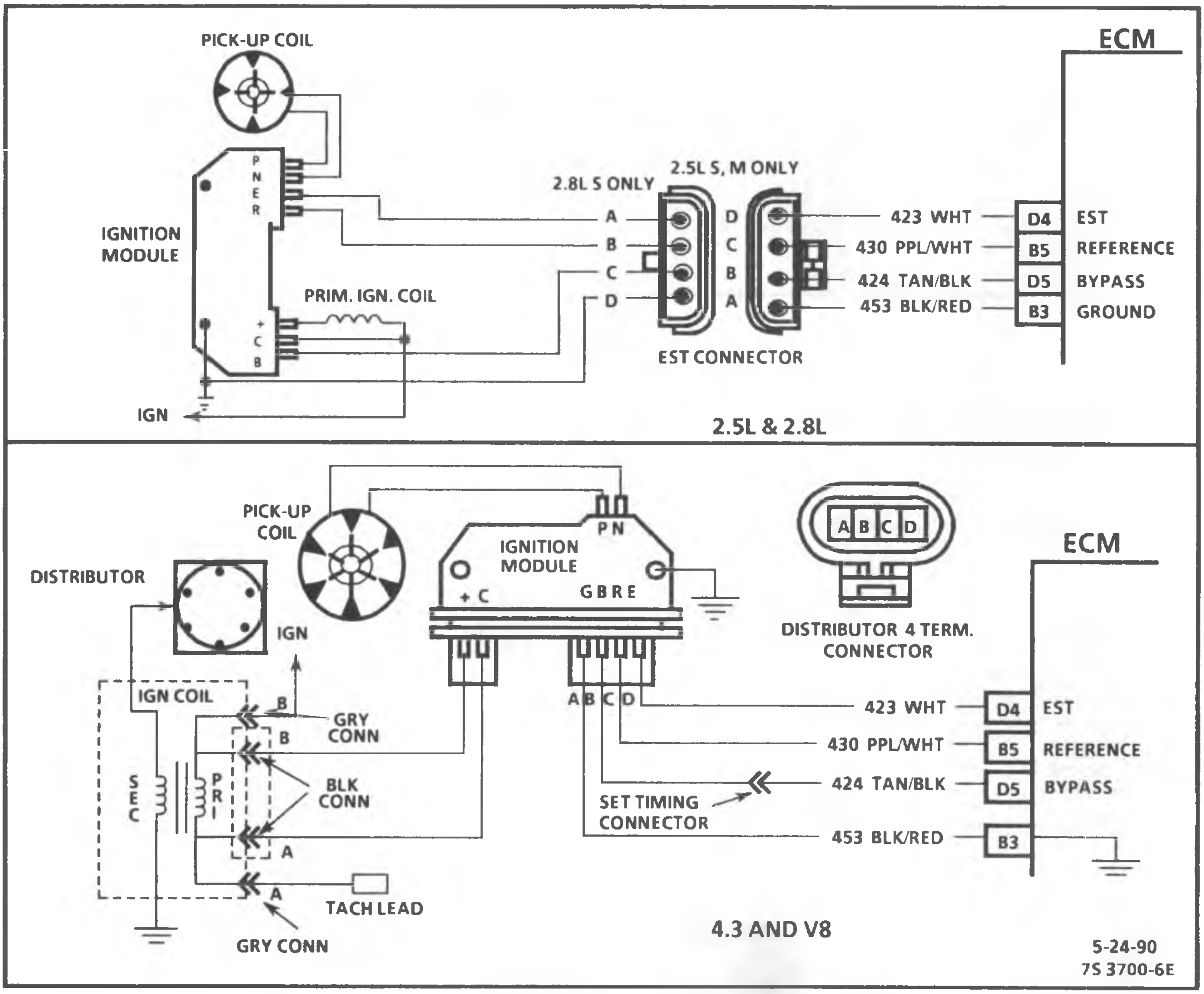
NO RPM CHANGE

- CHECK IAC PASSAGES.
- IF OK, REPLACE IAC.

* IAC DRIVER AND NODE LIGHT REQUIRED KIT
222-L FROM: CONCEPT TECHNOLOGY, INC.
J 37027 FROM: KENT-MOORE, INC.

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

2-7-90
• 9S 7497-6E



CODE 42

ELECTRONIC SPARK TIMING (EST)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description

Refer to page 3-15 for EST and Code 42.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 42 means the ECM has seen an open or short to ground in the EST or bypass circuits. This test confirms Code 42 and that the fault causing the code is present.
2. Checks for a normal EST ground path through the ignition module. An EST CKT 423 shorted to ground will also read less than 500 ohms; however, this will be checked later.
3. As the test light voltage touches CKT 424, the module should switch causing the ohmmeter to "overrange" if the meter is in the 100-200 ohm position.

   Selecting the 10-20,000 ohms position will indicate above 5000 ohms. The important thing is that the module "switched."
4. The module did not switch and this step checks for:
   - EST CKT 423 shorted to ground.
   - Bypass CKT 424 open.
   - Faulty ignition module connection or module
5. Confirms that Code 42 is a faulty ECM and not an intermittent in CKTs 423 or 424.

Diagnostic Aids:

The Tech 1 does not have any ability to help diagnose a Code 42 problem.

Refer to "Driveability Symptoms," Section "2," for "ECM Intermittent Code or Performance."

CODE 42

ELECTRONIC SPARK TIMING (EST)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

1
- CLEAR CODES.
- IDLE ENGINE FOR 1 MINUTE OR UNTIL CODE 42 SETS.

DOES CODE 42 SET?

NO → CODE 42 INTERMITTENT. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

YES →

2
- IGNITION "OFF."
- DISCONNECT ECM CONNECTORS.
- IGNITION "ON."
- OHMMETER SELECTOR SWITCH IN THE 1000 TO 2000 OHMS RANGE.
- PROBE ECM HARNESS CONNECTOR CKT 423 WITH AN OHMMETER TO GROUND.

IT SHOULD READ LESS THAN 1000 OHMS.
DOES IT?

NO → OPEN CKT 423, FAULTY CONNECTION OR FAULTY IGNITION MODULE.

YES →
- PROBE ECM HARNESS CONNECTOR CKT 424 WITH A TEST LIGHT TO BATTERY VOLTAGE.

LIGHT "ON" →
- DISCONNECT IGNITION MODULE 4-WAY CONNECTOR.

LIGHT "ON" → CKT 424 SHORTED TO GROUND.

LIGHT "OFF" → FAULTY IGNITION MODULE.

LIGHT "OFF" →

3
- WITH OHMMETER STILL CONNECTED TO ECM HARNESS CKT 423 AND GROUND. AGAIN PROBE ECM HARNESS CKT 424 WITH THE TEST LIGHT CONNECTED TO BATTERY VOLTAGE. (AS TEST LIGHT CONTACTS CKT 424, RESISTANCE SHOULD SWITCH FROM UNDER 1000 TO OVER 2000 OHMS,)

DOES IT?

NO →

4
- DISCONNECT DIST. 4-WAY CONNECTOR . NOTE OHMMETER THAT IS STILL CONNECTED TO CKT 423 AND GROUND. RESISTANCE SHOULD HAVE GONE HIGH (OPEN CIRCUIT) .

DOES IT?

YES → CKT 424 OPEN, FAULTY CONNECTIONS OR FAULTY IGNITION MODULE.

NO → CKT 423 SHORTED TO GROUND.

YES →

5
- RECONNECT ECM AND IDLE ENGINE FOR ONE MINUTE OR UNTIL CODE 42 SETS.

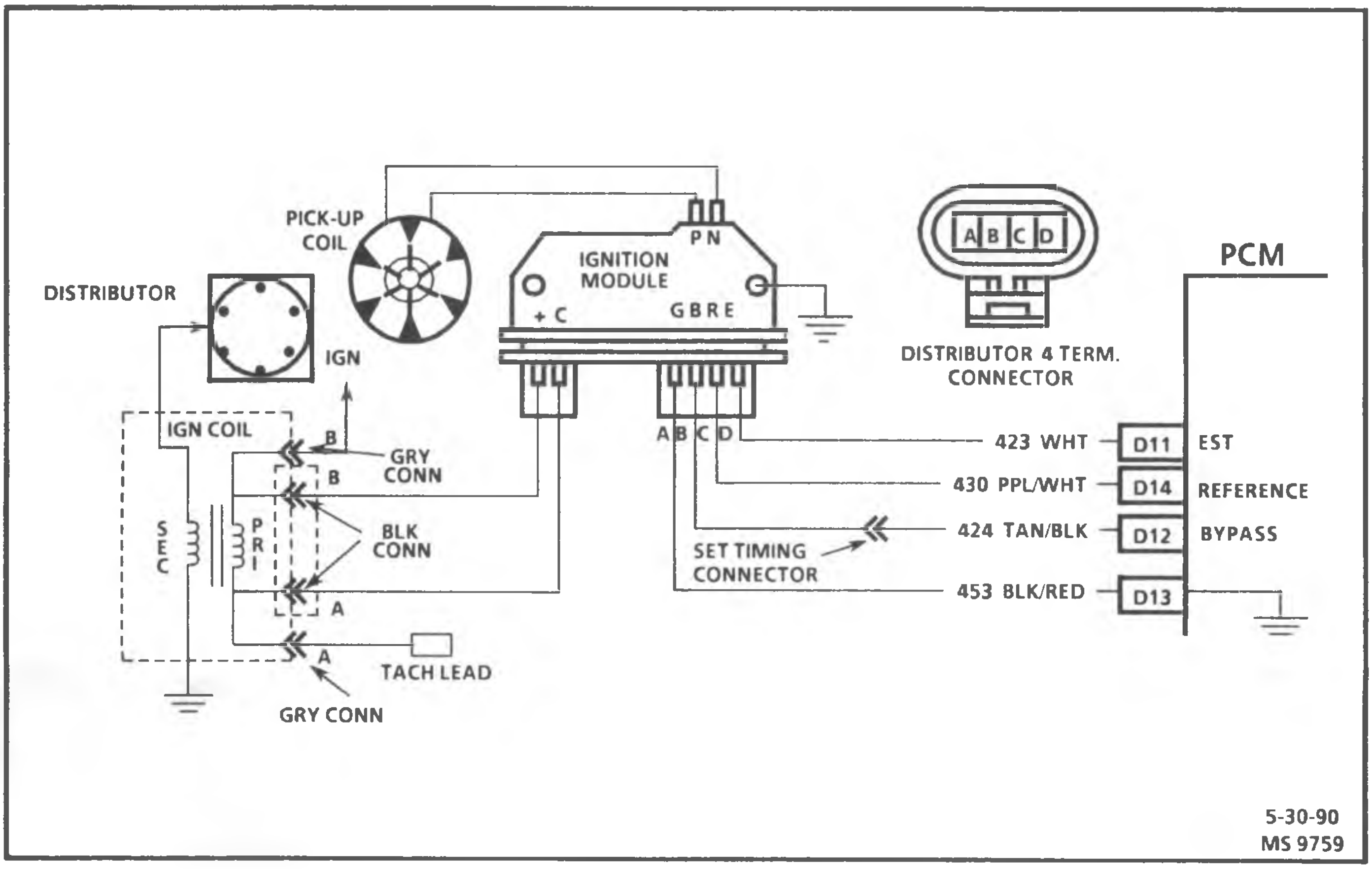
DOES CODE SET?

YES → FAULTY ECM

NO → CODE 42 INTERMITTENT. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

2-6-90
• 7S 3291-6E



CODE 42

ELECTRONIC SPARK TIMING (EST)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description

Refer to page 3-15 for EST and Code 42.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 42 means the PCM has seen an open or short to ground in the EST or bypass circuits. This test confirms Code 42 and that the fault causing the code is present.
2. Checks for a normal EST ground path through the ignition module. An EST CKT 423 shorted to ground will also read less than 500 ohms; however, this will be checked later.
3. As the test light voltage touches CKT 424, the module should switch causing the ohmmeter to "overrange" if the meter is in the 100-200 ohm position. Selecting the 10-20,000 ohms position will indicate above 5000 ohms. The important thing is that the module "switched."
4. The module did not switch and this step checks for:
   - EST CKT 423 shorted to ground.
   - Bypass CKT 424 open.
   - Faulty ignition module connection or module.
5. Confirms that Code 42 is a faulty PCM and not an intermittent in CKTs 423 or 424.

Diagnostic Aids:

The Tech 1 does not have any ability to help diagnose a Code 42 problem.

Refer to "Driveability Symptoms," Section "2," for "PCM Intermittent Code or Performance."

CODE 42

ELECTRONIC SPARK TIMING (EST)
ALL VEHICLES WITH 4L80-E TRANSMISSION

1
- CLEAR CODES.
- IDLE ENGINE FOR 1 MINUTE OR UNTIL CODE 42 SETS.

DOES CODE 42 SET?

YES

2
- IGNITION "OFF."
- DISCONNECT PCM CONNECTORS.
- IGNITION "ON."
- OHMMETER SELECTOR SWITCH IN THE 1000 TO 2000 OHMS RANGE.
- PROBE PCM HARNESS CONNECTOR CKT 423 WITH AN OHMMETER TO GROUND.

IT SHOULD READ LESS THAN 1000 OHMS.
DOES IT?

NO

CODE 42 INTERMITTENT. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

YES

- PROBE PCM HARNESS CONNECTOR CKT 424 WITH A TEST LIGHT TO BATTERY VOLTAGE.

NO

OPEN CKT 423, FAULTY CONNECTION OR FAULTY IGNITION MODULE.

LIGHT "OFF"

3
- WITH OHMMETER STILL CONNECTED TO PCM HARNESS CKT 423 AND GROUND. AGAIN PROBE ECM HARNESS CKT 424 WITH THE TEST LIGHT CONNECTED TO BATTERY VOLTAGE. (AS TEST LIGHT CONTACTS CKT 424, RESISTANCE SHOULD SWITCH FROM UNDER 1000 TO OVER 2000 OHMS,)

DOES IT?

LIGHT "ON"

- DISCONNECT IGNITION MODULE 4-WAY CONNECTOR.

LIGHT "ON"

CKT 424 SHORTED TO GROUND.

LIGHT "OFF"

FAULTY IGNITION MODULE.

NO

4
- DISCONNECT DIST. 4-WAY CONNECTOR . NOTE OHMMETER THAT IS STILL CONNECTED TO CKT 423 AND GROUND. RESISTANCE SHOULD HAVE GONE HIGH (OPEN CIRCUIT) .

DOES IT?

YES

CKT 424 OPEN, FAULTY CONNECTIONS OR FAULTY IGNITION MODULE.

NO

CKT 423 SHORTED TO GROUND.

YES

5
- RECONNECT PCM AND IDLE ENGINE FOR ONE MINUTE OR UNTIL CODE 42 SETS.

DOES CODE SET?

YES

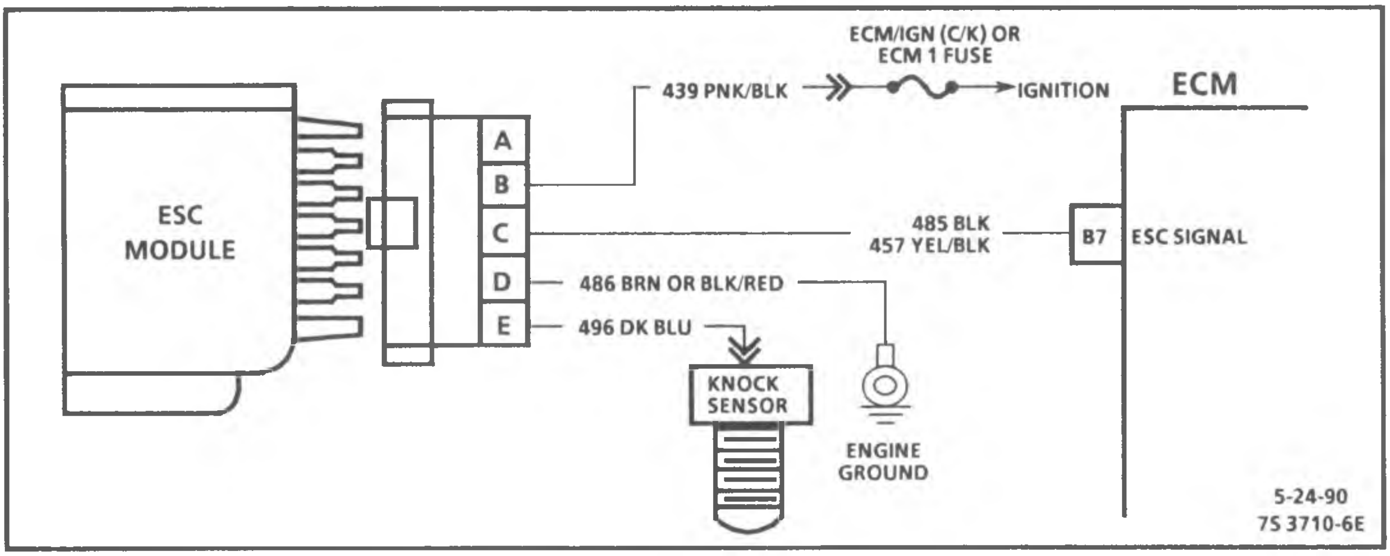
FAULTY PCM

NO

CODE 42 INTERMITTENT. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

6-6-90
MS 9954-6E



CODE 43

ELECTRONIC SPARK CONTROL (ESC) CIRCUIT
ALL ENGINES EXCEPT 2.5L & VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

Electronic Spark Control (ESC) is accomplished with a module that sends a voltage signal to the ECM. As the knock sensor detects engine knock, the voltage from the ESC module to the ECM drops, and this signals the ECM to retard timing. The ECM will retard the timing when knock is detected and rpm is above about 900 rpm.

Code 43 means the ECM has seen low voltage at CKT 485 terminal "B7" for longer than 5 seconds with the engine running or the system has failed the functional check.

The ECM continually monitors voltage on CKT 485 terminal "B7" if a knock signal (low voltage) is detected but for less than 5 seconds the ESC system is considered operational and Code 43 will not set. If, however, low voltage is detected for more than 5 seconds or signal voltage remains high, a functional check will be performed. To perform this, the ECM will advance the spark timing when coolant temperature is above 95°C and the engine is under heavy load (near WOT). The ECM then checks the signal voltage at "B7" to see if a knock is detected. If no knock is detected, the "Service Engine Soon" light will remain "ON" until the ignition is turned "OFF" or until a knock signal is detected. The functional check will only be performed once per start up.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. If the conditions for a Code 43 are present, the "Scan" will always display "YES." There should not be a knock at idle unless an internal engine problem, or a system problem exists.
2. This test will determine if the system is functioning at this time. Usually a knock signal can be generated by tapping on the right exhaust manifold. If no knock signal is generated, try tapping on block close to the area of the sensor.
3. Because Code 43 sets when the signal voltage on CKT 485/457 remains low, this test should cause the signal on CKT 485/457 to go high. The 12 volts signal should be seen by the ECM as "no knock" if the ECM and wiring are OK.
4. This test will determine if the knock signal is being detected on CKT 496 or if the ESC module is at fault.
5. If CKT 496 is routed to close to secondary ignition wires, the ESC module may see the interference as a knock signal.
6. This checks the ground circuit to the module. An open ground will cause the voltage on CKT 485/457 to be about 12 volts which would cause the Code 43 functional test to fail.
7. Connecting CKT 496 with a test light to 12 volts should generate a knock signal. This will determine if the ESC module is operating correctly.

Diagnostic Aids:

Code 43 can be caused by a faulty connection at the knock sensor at the ESC module or at the ECM. Also check CKT 485/457 for possible open or short to ground.

Refer to "Driveability Symptoms," Section "2," for "ECM Intermittent Codes or Performance."

CODE 43

ELECTRONIC SPARK CONTROL (ESC) CIRCUIT ALL ENGINES EXCEPT 2.5L & VEHICLES WITH 4L80-E TRANSMISSION

(1)
- ENGINE IDLING.
- "SCAN" SET ON KNOCK SIGNAL.

IS THERE A KNOCK SIGNAL INDICATED?

YES

(3)
- DISCONNECT ESC MODULE.
- ENGINE IDLING.
- PROBE HARNESS TERMINAL "C" (CKT 485) WITH A TEST LIGHT CONNECTED TO 12 VOLTS.

AFTER 5 SECONDS, DOES "SCAN" DISPLAY A KNOCK SIGNAL?

NO

- IGNITION "ON."
- PROBE TERMINAL "B" (CKT 439) WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

(4)
- REMOVE CKT 496 FROM CONNECTOR.
- RECONNECT ESC MODULE.
- ENGINE IDLING.

IS THERE A KNOCK SIGNAL INDICATED?

YES

FAULTY CONNECTIONS OR ESC MODULE.

NO

(5)
- IF AN AUDIBLE KNOCK CAN BE HEARD, REPAIR INTERNAL ENGINE PROBLEM. IF OK, CHECK FOR ROUTING OF WIRE FROM KNOCK SENSOR TO ESC MODULE FOR PICKING UP FALSE KNOCK SIGNALS FROM AN ADJACENT WIRE. REROUTE AS NECESSARY. IF ROUTING IS CORRECT, REPLACE KNOCK SENSOR.

LIGHT "OFF"

OPEN CKT 439.

YES

CKT 485 OPEN, SHORTED TO GROUND, OR FAULTY ECM.

NO

(2)
- ENGINE IDLING.
- TAP ENGINE BLOCK IN AREA OF KNOCK SENSOR.
- IS A KNOCK SIGNAL INDICATED WHILE TAPPING ON ENGINE?

NO

(4)
- DISCONNECT ESC MODULE.
- PROBE HARNESS TERMINAL "D" (CKT 486) WITH A TEST LIGHT TO 12 VOLTS.

LIGHT "ON"

(7)
- RECONNECT ESC MODULE.
- DISCONNECT KNOCK SENSOR.
- ENGINE IDLING.
- MOMENTARILY TOUCH KNOCK SENSOR HARNESS (CKT 496) WITH A TEST LIGHT TO 12 VOLTS.
- EACH TIME THE TEST LIGHT CONTACTS CKT 496, A KNOCK SIGNAL SHOULD BE GENERATED.
- IS A KNOCK SIGNAL INDICATED WITH "SCAN"?

YES

FAULTY CONNECTION AT SENSOR OR FAULTY KNOCK SENSOR.

NO

CKT 496 OPEN, SHORTED TO GROUND, FAULTY CONNECTION AT ESC MODULE, OR FAULTY ESC MODULE.

LIGHT "OFF"

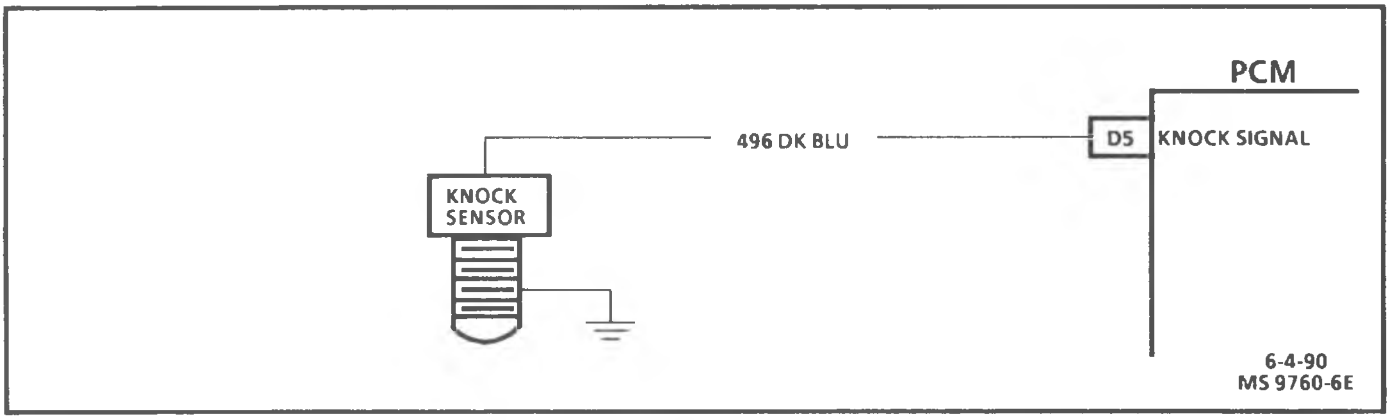
REPAIR OPEN GROUND CKT 486.

YES

CODE 43 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-14-90
7S 3292-6E



CODE 43

ELECTRONIC SPARK CONTROL (ESC) CIRCUIT ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The Code 43 circuit consists of a knock sensor with one wire that goes directly to the PCM. There are two Code 43 checks performed by the PCM. One check consists or monitoring CKT 496 for a voltage that is more than 4.16 volts and less than .64 volt.

If voltage is either too high or too low, for 26 or more seconds, Code 43 will set. Once engine temperature reaches 87.5°C or more, but not over 104°C, and MAP and engine speed are below 81 kPa and 3200 rpm respectively, the PCM will perform a self check by advancing the timing incrementally while anticipating a knock signal. If no knock signal is received during two consecutive tests, Code 43 will be set.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. The first test is to determine if the system is functioning at the present time.
2. Test two determines the state of the 5 volt reference voltage applied to the knock sensor circuit.

Diagnostic Aids:

The PCM applies 5 volts to CKT 496. A 3500 ohm resistor in the knock sensor reduces the voltage to about 2.5 volts. When knock occurs, the knock sensor produces a small AC voltage that rides on top of the 2.5 volts already applied. An AC voltage monitor in the PCM is able to read this signal as knock and incrementally retard spark.

For further information, refer to "Driveability Symptoms," Section "2," for "PCM/ECM Intermittent Codes or Performance."

CODE 43

ELECTRONIC SPARK CONTROL (ESC) CIRCUIT
ALL VEHICLES WITH 4L80-E TRANSMISSION

1
- ENGINE IDLING.
- ENGINE TEMP ABOVE 70°.
- SCAN ON KNOCK SIGNAL.
- TAP ON ENGINE NEAR KNOCK SENSOR IS THERE A KNOCK SIGNAL?

NO

2
- ENGINE IDLING.
- WITH A DVOM MEASURE VOLTAGE FROM PCM CKT 496 AT PCM TO GROUND.

5.0 VOLTS

- REMOVE KNOCK SENSOR CONNECTOR.
- WITH AN OHMMETER, CHECK RESISTANCE BETWEEN KNOCK SENSOR TERMINAL AND ENGINE BLOCK. SHOULD BE 3300 TO 4500 Ω. IS IT?

YES

FAULTY CONNECTION AT KNOCK SENSOR OR OPEN CKT 496.

NO

FAULTY KNOCK SENSOR.

2.3 - 2.8 VOLTS

REMOVE KNOCK SENSOR CONNECTOR WITH AN OHMMETER CHECK RESISTANCE FROM KNOCK SENSOR TERMINAL TO ENGINE BLOCK. SHOULD BE 3300 TO 4500 OHMS. IS IT?

YES

FAULTY MEM-CAL OR PCM.

NO

REPLACE KNOCK SENSOR.

.4 VOLTS OR LESS

REMOVE KNOCK SENSOR CONNECTOR. DOES VOLTAGE GO UP TO 5V?

NO

SHORTED CKT 496 OR FAULTY PCM.

YES

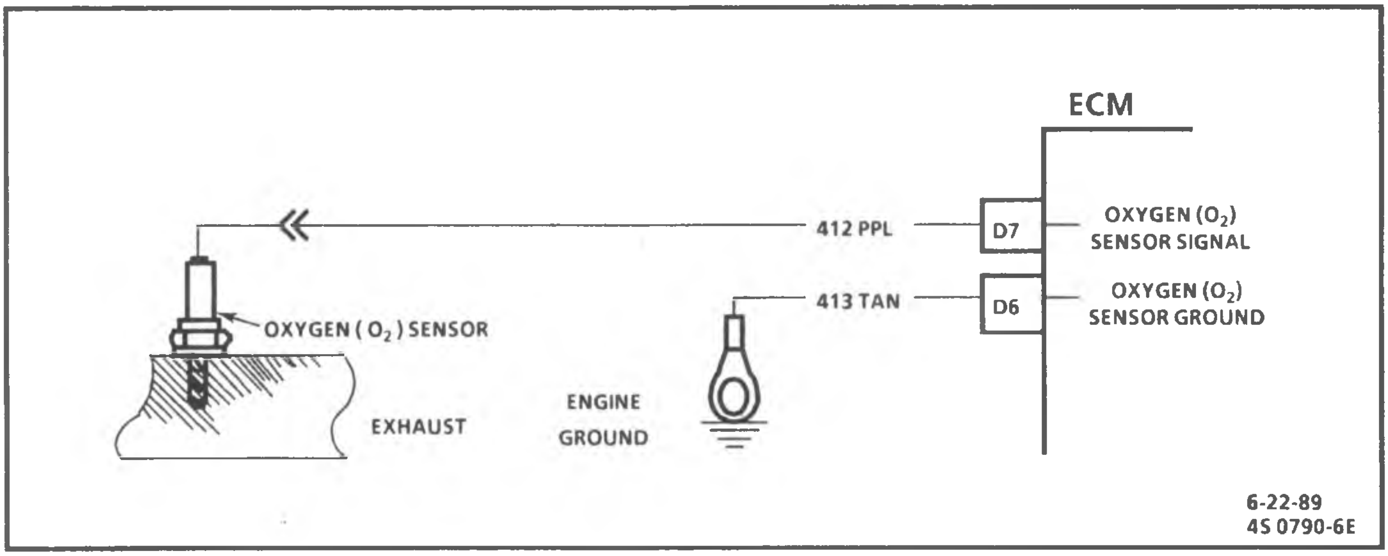
FAULTY KNOCK SENSOR.

YES

PROBLEM IS INTERMITTENT. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-20-90
MS 10044



CODE 44

LEAN EXHAUST INDICATED
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The ECM supplies a voltage of about .45 volt between terminals "D6" and "D7". (If measured with a 10 megohm digital voltmeter, this may read as low as .32 volt.) The Oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down through about .10 volt if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below about 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 44 is set when the Oxygen (O_2) sensor signal voltage on CKT 412:
   - Remains below .2 volt from 60 seconds to 4 minutes.
   - And the system is operating in "Closed Loop" depending on which engine.

Diagnostic Aids:

Using the "Scan," observe the block learn values at different rpm and air flow conditions. The "Scan" also displays the block cells, so the block learn values can be checked in each of the cells to determine when the Code 44 may have been set. If the conditions for Code 44 exists, the block learn values will be around 150.

- Oxygen (O_2) Sensor Wire. Sensor pigtail may be mispositioned and contacting the exhaust manifold.
- Check for intermittent ground in wire between connector and sensor.
- Fuel Contamination. Water, even in small amounts, near the in-tank fuel pump inlet, can be delivered to the injectors. The water causes a lean exhaust and can set a Code 44.
- Fuel Pressure. System will be lean if pressure is too low. It may be necessary to monitor fuel pressure while driving the vehicle at various road speeds and/or loads to confirm. See "Fuel System Diagnosis."
- AIR System. Be sure air is not being directed to the exhaust ports while in "Closed Loop." If the block learn value goes down while squeezing air hose to left side of exhaust ports, refer to "Air Management," Section "8."

  If the above are OK, it is a faulty Oxygen (O_2) sensor.
- CKT 413. If CKT 413 is open, the voltage at terminal "D7" will be about .45 volt. This may also cause Code 13 to set.
- If all check OK, the Oxygen (O_2) sensor is faulty.

CODE 44

LEAN EXHAUST INDICATED
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

1
- RUN WARM ENGINE (75°C/167°F TO 95°C/203°F) AT 1200 RPM.
- DOES TECH 1 INDICATE O_2 SENSOR VOLTAGE FIXED BELOW .35 VOLT (350 mV)?

YES

- DISCONNECT O_2 SENSOR.
- WITH ENGINE IDLING, TECH 1 SHOULD DISPLAY O_2 SENSOR VOLTAGE BETWEEN .35 VOLT AND .55 VOLT (350 mV AND 550 mV).
  DOES IT?

YES

REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

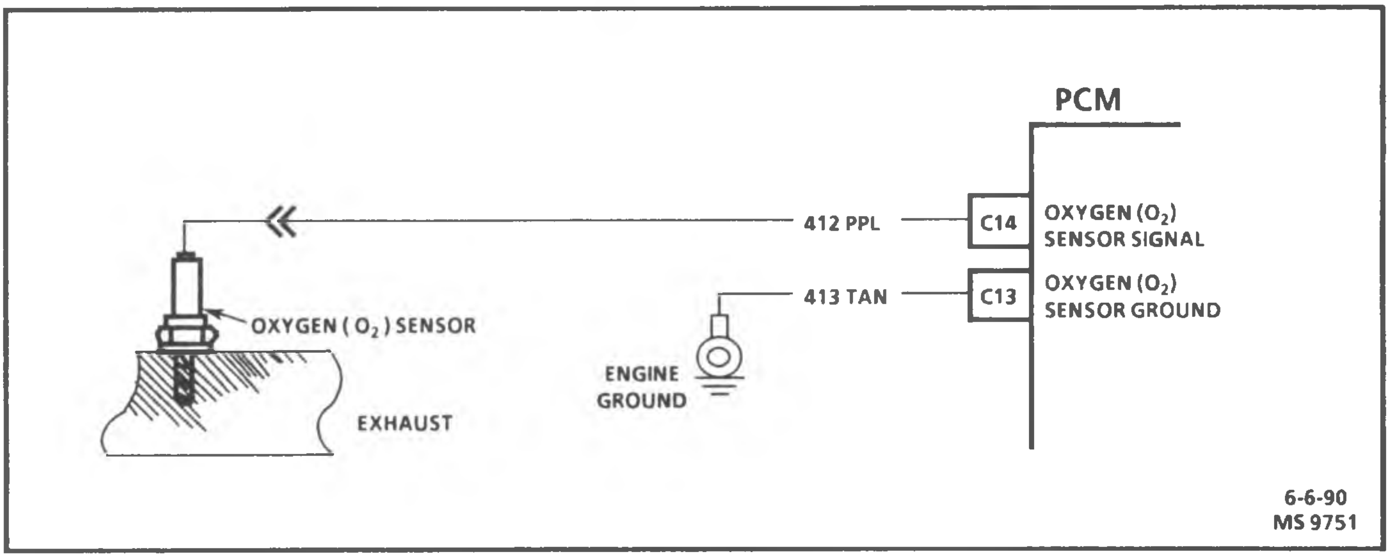
NO

CKT 412 SHORTED TO GROUND OR FAULTY ECM.

NO

CODE 44 IS INTERMITTENT.
IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 44

LEAN EXHAUST INDICATED
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The PCM supplies a voltage of about .45 volt between terminals "C14" and "C13". (If measured with a 10 megohm digital voltmeter, this may read as low as .32 volt.) The Oxygen (O_2) sensor varies the voltage within a range of near 1 volt if the exhaust is rich, down through about .10 volt if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 44 is set when the Oxygen (O_2) sensor signal voltage on CKT 412:
   - Remains below .2 volt for 4 minutes
   - And the system is operating in "Closed Loop."

Diagnostic Aids:

Using the "Scan," observe the block learn values at different rpm and air flow conditions. The "Scan" also displays the block cells, so the block learn values can be checked in each of the cells to determine when the Code 44 may have been set. If the conditions for Code 44 exists, the block learn values will be around 150.

- Oxygen (O_2) Sensor Wire. Sensor pigtail may be mispositioned and contacting the exhaust manifold.
- Check for intermittent ground in wire between connector and sensor.
- Fuel Contamination. Water, even in small amounts, near the in-tank fuel pump inlet, can be delivered to the injectors. The water causes a lean exhaust and can set a Code 44.
- Fuel Pressure. System will be lean if pressure is too low. It may be necessary to monitor fuel pressure while driving the vehicle at various road speeds and/or loads to confirm. See "Fuel System Diagnosis."
- AIR System. Be sure air is not being directed to the exhaust ports while in "Closed Loop." If the block learn value goes down while squeezing air hose to left side of exhaust ports, refer to "Air Management," Section "8."

  If the above are OK, it is a faulty Oxygen (O_2) sensor.
- CKT 413. If CKT 413 is open, the voltage at terminal "C14" will be about .45 volt. This may also cause Code 13 to set.
- If all check OK, the Oxygen (O_2) sensor is faulty.

CODE 44

LEAN EXHAUST INDICATED
ALL VEHICLES WITH 4L80-E TRANSMISSION

1

- RUN WARM ENGINE (75°C/167°F TO 95°C/203°F) AT 1200 RPM.
- DOES TECH 1 INDICATE O_2 SENSOR VOLTAGE FIXED BELOW .35 VOLT (350 mV)?

YES

- DISCONNECT O_2 SENSOR.
- WITH ENGINE IDLING, TECH 1 SHOULD DISPLAY O_2 SENSOR VOLTAGE BETWEEN .35 VOLT AND .55 VOLT (350 mV AND 550 mV).
  DOES IT?

YES

REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

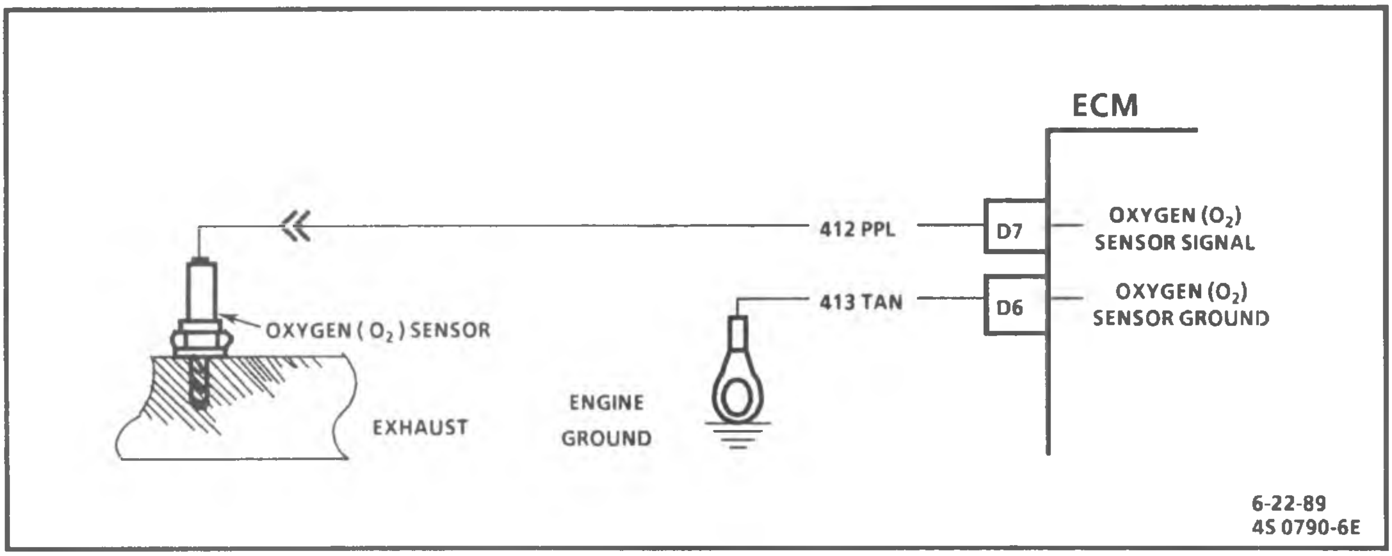
NO

CKT 412 SHORTED TO GROUND OR FAULTY PCM.

NO

CODE 44 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

7-18-90
MS 9955-6E



CODE 45

RICH EXHAUST INDICATED
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The ECM supplies a voltage of about .45 volt between terminals "D6" and "D7". (If measured with a 10 megohm digital voltmeter, this may read as low as .32 volt.) The Oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down through about .10 volt if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below about 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 45 is set when the Oxygen (O_2)sensor signal voltage or CKT 412:
   - Remains above .7 volt for 60 seconds, and in "Closed Loop."
   - Engine time after start is 1 minute or more.
   - Throttle angle greater than 5% (about .2 volt above idle voltage).

Diagnostic Aids:

Using the "Scan," observe the block learn values at different rpm and air flow conditions to determine when the Code 45 may have been set. If the conditions for Code 45 exist, the block learn values will be around 115.

- Fuel Pressure. System will go rich if pressure is too high. The ECM can compensate for some increase. However, if it gets too high, a Code 45 may be set.
  See Fuel System diagnosis chart.
- Leaking Injector.
- Check for fuel contaminated oil.
- HEI Shielding. An open ground CKT 453 (ignition system reference low) may result in EMI, or induced electrical "noise." The ECM looks at this "noise" as reference pulses.
  The additional pulses result in a higher than actual engine speed signal. The ECM then delivers too much fuel, causing system to go rich. Engine tachometer will also show higher than actual engine speed which can help in diagnosing this problem.
- Canister Purge. Check for fuel saturation. If full of fuel, check canister control and hoses. See "Evaporative Emission Control," Section "5."
- MAP Sensor. An output that causes the ECM to sensor a higher than normal manifold pressure (low vacuum) can cause the system to go rich. Disconnecting the MAP sensor will allow the ECM to set a fixed value for the MAP sensor. Substitute a different MAP sensor if the rich condition is gone while the sensor is disconnected.
- Pressure Regulator. Check for leaking fuel pressure regulator diaphragm by checking for presence of liquid fuel in the vacuum line to the regulator.
- Check for leaking fuel pressure regulator diaphragm by checking vacuum line to regulator for fuel.
- TPS. An intermittent TPS output will cause the system to go rich, due to a false indication of the engine accelerating.

CODE 45

RICH EXHAUST INDICATED
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

(1)
- RUN WARM ENGINE (75°C/167°F TO 95°C/203°F) AT 1200 RPM.
- DOES TECH 1 DISPLAY O_2 SENSOR VOLTAGE FIXED ABOVE .75 VOLT (750 mV)?

YES

- DISCONNECT O_2 SENSOR AND JUMPER HARNESS CKT 412 TO GROUND.
- TECH 1 SHOULD DISPLAY O_2 BELOW .35 VOLT (350 mV).
  DOES IT?

YES

REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NO

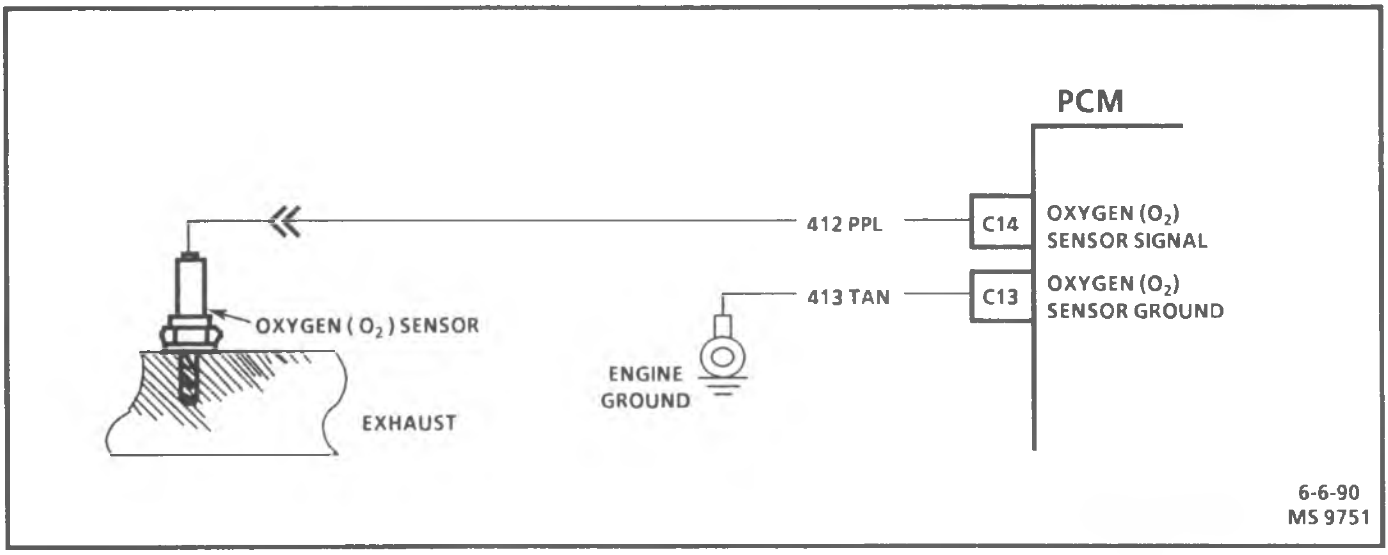
REPLACE ECM.

NO

CODE 45 IS INTERMITTENT.
IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

"*AFTER REPAIRS*," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

4-25-90
• 7S 3192-6E



CODE 45

RICH EXHAUST INDICATED
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The PCM supplies a voltage of about .45 volt between terminals "C14" and "C13". (If measured with a 10 megohm digital voltmeter, this may read as low as .32 volt.) The Oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down through about .10 volt if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below about 315°C (600°F). An open sensor circuit or cold sensor causes "Open Loop" operation.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 45 is set when the oxygen sensor signal voltage or CKT 412:
   - Remains above .7 volt for 60 seconds, and in "Closed Loop."
   - Engine time after start is 1 minute or more.
   - Throttle angle greater than 5%. (about .2 volt above idle voltage)

Diagnostic Aids:

Using the "Scan," observe the block learn values at different rpm and air flow conditions to determine when the Code 45 may have been set. If the conditions for Code 45 exist, the block learn values will be around 115.

- Fuel Pressure. System will go rich if pressure is too high. The PCM can compensate for some increase. However, if it gets too high, a Code 45 may be set.
  See Fuel System diagnosis chart.
- Leaking Injector.
- Check for fuel contaminated oil.
- HEI Shielding. An open ground CKT 453 (ignition system reference low) may result in EMI, or induced electrical "noise." The PCM looks at this "noise" as reference pulses.
  The additional pulses result in a higher than actual engine speed signal. The PCM then delivers too much fuel, causing system to go rich. Engine tachometer will also show higher than actual engine speed which can help in diagnosing this problem.
- Canister Purge. Check for fuel saturation. If full of fuel, check canister control and hoses. See "Evaporative Emission Control," Section "5."
- MAP Sensor. An output that causes the PCM to sensor a higher than normal manifold pressure (low vacuum) can cause the system to go rich. Disconnecting the MAP sensor will allow the PCM to set a fixed value for the MAP sensor. Substitute a different MAP sensor if the rich condition is gone while the sensor is disconnected.
- Pressure Regulator. Check for leaking fuel pressure regulator diaphragm by checking for presence of liquid fuel in the vacuum line to the regulator.
- Check for leaking fuel pressure regulator diaphragm by checking vacuum line to regulator for fuel.
- TPS. An intermittent TPS output will cause the system to go rich, due to a false indication of the engine accelerating.

CODE 45

RICH EXHAUST INDICATED
ALL VEHICLES WITH 4L80-E TRANSMISSION

1

- RUN WARM ENGINE (75°C/167°F TO 95°C/203°F) AT 1200 RPM.
- DOES TECH 1 DISPLAY O_2 SENSOR VOLTAGE FIXED ABOVE .75 VOLT (750 mV)?

YES

- DISCONNECT O_2 SENSOR AND JUMPER HARNESS CKT 412 TO GROUND.
- TECH 1 SHOULD DISPLAY O_2 BELOW .35 VOLT (350 mV).
  DOES IT?

NO

CODE 45 IS INTERMITTENT.
IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

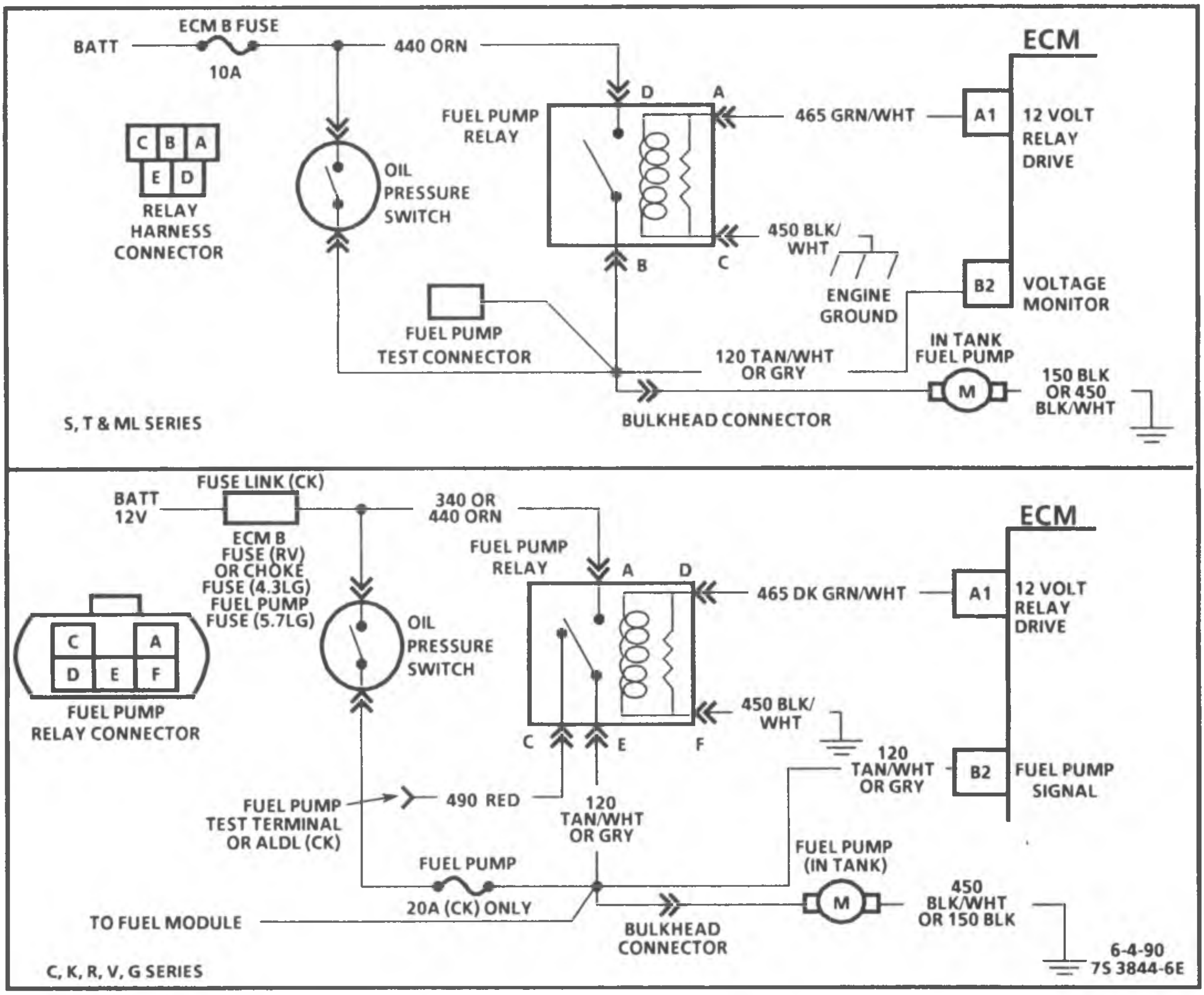
YES

REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NO

REPLACE PCM.

"*AFTER REPAIRS,*" REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.



CODE 54

FUEL PUMP CIRCUIT
(LOW VOLTAGE)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description

The status of the fuel pump CKT 120 is monitored by the ECM at terminal "B2" and is used to compensate fuel delivery based on system voltage. This signal is also used to store a code if the fuel pump relay is defective or fuel pump voltage is lost while the engine is running. There should be about 12 volts on CKT 120 for at least 2 seconds after the ignition is turned "ON," or any time reference pulses are being received by the ECM.

Code 54 will set if the voltage at terminal "B2" is less than 2 volts for 1.5 seconds since the last reference pulse was received. This code is designed to detect a faulty relay, causing extended crank time, and the code will help the diagnosis of an engine that "Cranks But Will Not Run."

If a fault is detected during start-up, the "Service Engine Soon" light will stay "ON" until the ignition is cycled "OFF."

Diagnostic Aids:

- See "ECM Intermittent Codes or Performance" in "Driveability Symptoms," Section "2".

CODE 54
FUEL PUMP CIRCUIT
(LOW VOLTAGE)
ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

DISCONNECT FUEL MODULE IF EQUIPPED. ON TWO FUEL TANK SYSTEM, CHECK PUMP OPERATION IN EACH TANK.

- IGNITION "OFF" FOR 10 SECONDS
- IGNITION "ON".
- LISTEN FOR IN-TANK FUEL PUMP.
- PUMP SHOULD RUN AFTER IGNITION "ON."
  DOES IT?

NO

- IGNITION "OFF."
- USING A FUSED JUMPER WIRE, CONNECT FUEL PUMP "TEST" CONNECTOR TO FIXED 12 VOLTS.
  DOES PUMP RUN?

YES

- IGNITION "OFF."
- DISCONNECT FUEL PUMP RELAY.
- PROBE CKT 440/340 WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

CONNECT TEST LIGHT BETWEEN CKTS 440/340 & 450.

LIGHT "ON"

- CONNECT TEST LIGHT BETWEEN HARNESS CKT 465 AND GROUND.
- IGNITION "OFF" FOR 10 SECONDS.
  NOTE TEST LIGHT AFTER IGNITION "ON."

LIGHT "ON" 2 SECONDS

- FAULTY CONNECTION AT RELAY TERMINAL "D" OR FAULTY RELAY. CONNECT MODULE IF REMOVED.
- CONTINUE TEST IF ORIGINAL SYMPTOM WAS "ENGINE CRANKS BUT WILL NOT RUN."
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- OIL PRESSURE NORMAL. START ENGINE.
- DISCONNECT FUEL PUMP RELAY. ENGINE SHOULD CONTINUE TO RUN.
  DOES IT?

YES

- RECONNECT FUEL PUMP RELAY.
- IGNITION "OFF."
- PROBE FUEL PUMP "TEST" TERMINAL WITH A TEST LIGHT TO GROUND.

LIGHT "OFF"

FUEL PUMP CIRCUIT OK.

LIGHT "ON"

FAULTY OIL PRESSURE SWITCH.

NO

FAULTY OIL PRESSURE SWITCH.

LIGHT "OFF"

CKT 465 OPEN, SHORTED TO GROUND, OR FAULTY ECM.

LIGHT "OFF"

REPAIR OPEN CKT 450.

LIGHT "OFF"

REPAIR OPEN IN CKT 440/340.

NO

- DISCONNECT FUEL PUMP RELAY.
- USING THE FUSED JUMPER WIRE, CONNECT CKT 120 TO 12 VOLTS.
  DOES PUMP RUN?

YES

FAULTY RELAY.

NO

OPEN CKT 120, FAULTY IN-TANK PUMP OR FAULTY PUMP

YES

- CLEAR CODES.
- START AND RUN ENGINE FOR 30 SECONDS OR UNTIL CODE 54 SETS.
  DOES CODE SET?

YES

- BACK PROBE ECM TERMINAL "B2" WITH A TEST LIGHT TO GROUND.
- IGNITION "OFF" FOR 10 SECONDS.
  NOTE LIGHT AFTER IGNITION "ON."

LIGHT "ON"

FAULTY CONNECTION AT ECM OR FAULTY ECM.

LIGHT "OFF"

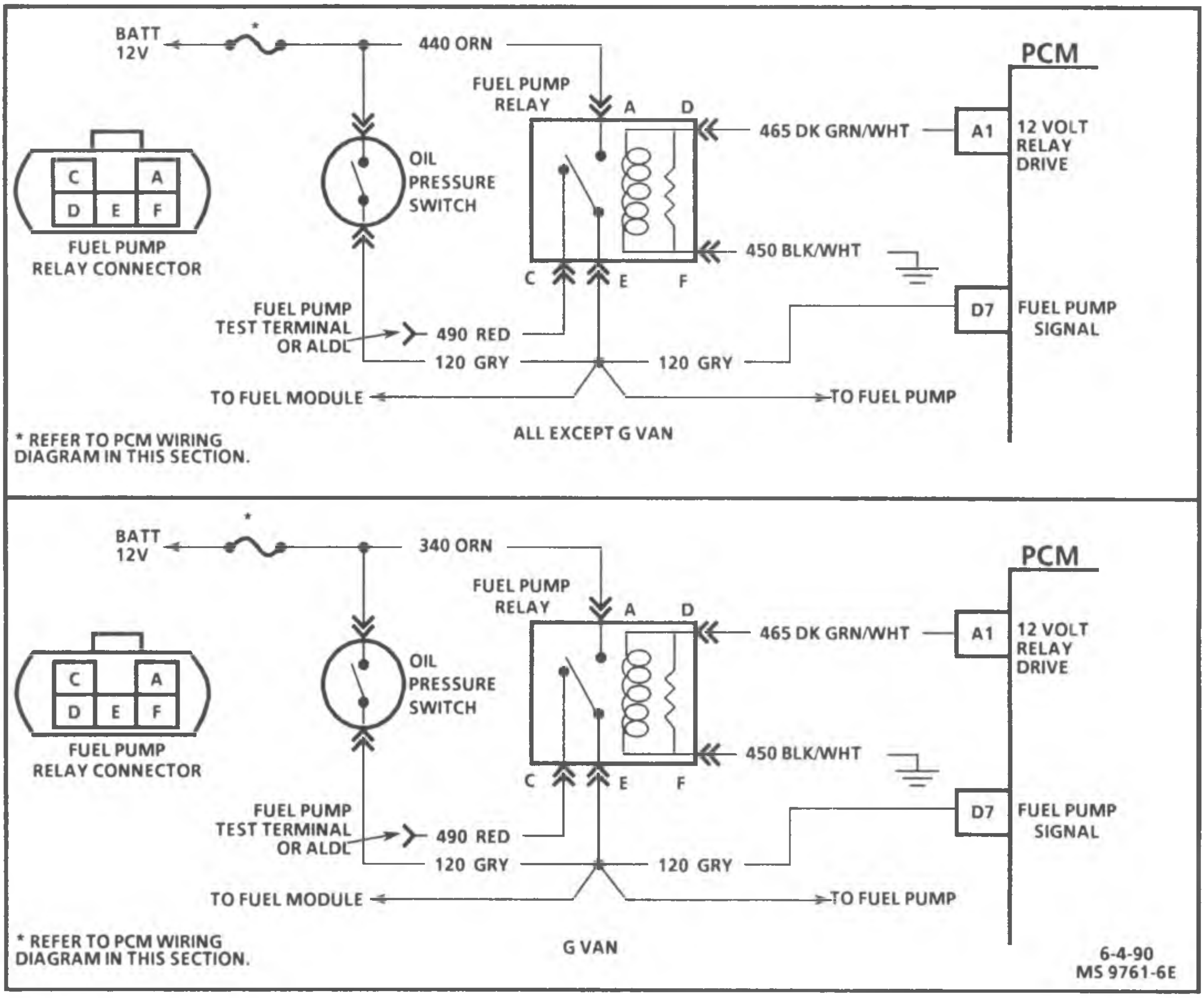
OPEN CKT 120 TO ECM.

NO

CODE 54 IS INTERMITTENT. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

7-14-90
7S 3794-6E



CODE 54

FUEL PUMP CIRCUIT
(LOW VOLTAGE)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description

The status of the fuel pump CKT 120 is monitored by the PCM at terminal "D7" and is used to compensate fuel delivery based on system voltage. This signal is also used to store a code if the fuel pump relay is defective or fuel pump voltage is lost while the engine is running. There should be about 12 volts on CKT 120 for at least 2 seconds after the ignition is turned "ON," or any time reference pulses are being received by the PCM.

Code 54 will set if the voltage at terminal "D7" is less than 2 volts for 1.5 seconds since the last reference pulse was received. This code is designed to detect a faulty relay, causing extended crank time, and the code will help the diagnosis of an engine that "Cranks But Will Not Run."

If a fault is detected during start-up, the "Service Engine Soon" light will stay "ON" until the ignition is cycled "OFF."

Diagnostic Aids:

- See "PCM Intermittent Codes or Performance" in "Driveability Symptoms," Section "2".

CODE 54
FUEL PUMP CIRCUIT (LOW VOLTAGE) ALL VEHICLES WITH 4L80-E TRANSMISSION

DISCONNECT FUEL MODULE IF EQUIPPED.
ON TWO FUEL TANK SYSTEM, CHECK PUMP OPERATION IN EACH TANK.

- IGNITION "OFF" FOR 10 SECONDS
- IGNITION "ON."
- LISTEN FOR IN-TANK FUEL PUMP.
- PUMP SHOULD RUN AFTER IGN. "ON." DOES IT?

NO

- IGNNITION "OFF."
- USING A FUSED JUMPER WIRE, CONNECT FUEL PUMP TEST CONN. TO FIXED 12 VOLTS.
- DOES PUMP RUN?

YES

- IGNITION "OFF."
- DISCONNECT FUEL PUMP RELAY.
- PROBE CKT 340/440 WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

CONNECT TEST LIGHT BETWEEN CKTS 340/440 & 450

LIGHT "ON"

- CONNECT TEST LIGHT BETWEEN HARNESS CKT. 465 AND GND.
- IGN. "OFF" FOR 10 SECONDS.
- NOTE TEST LIGHT AFTER IGN. "ON."

LIGHT "ON" 2 SECONDS

- FAULTY CONNECTION AT RELAY TERMINAL "D" OR FAULTY RELAY. CONNECT MODULE IF REMOVED.
- CONTINUE TEST IF ORIGINAL SYMPTOM WAS "ENGINE CRANKS BUT WILL NOT RUN"
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- OIL PRESSURE NORMAL. START ENGINE.
- DISCONNECT FUEL PUMP RELAY. ENGINE SHOULD CONTINUE TO RUN. DOES IT?

YES

- RECONNECT FUEL PUMP RELAY.
- IGNITION "OFF."
- PROBE FUEL PUMP TEST TERMINAL WITH A TEST LIGHT TO GROUND.

LIGHT "OFF"

FUEL PUMP CIRCUIT OK

LIGHT "ON"

FAULTY OIL PRESSURE SWITCH

NO

FAULTY OIL PRESSURE SWITCH

LIGHT "OFF"

CKT 465 OPEN, SHORTED TO GROUND, OR FAULTY PCM.

LIGHT "OFF"

REPAIR OPEN CKT 450

LIGHT "OFF"

REPAIR OPEN IN CKT 340/440

NO

- DISCONNECT FUEL PUMP RELAY.
- USING THE FUSED JUMPER WIRE, CONNECT CKT 120 TO 12 VOLTS. DOES PUMP RUN?

YES

FAULTY RELAY

NO

OPEN CKT 120, FAULTY IN-TANK PUMP OR FAULTY PUMP GROUND.

YES

- CLEAR CODES.
- START AND RUN ENGINE FOR 30 SECONDS OR UNTIL CODE 54 SETS. DOES CODE SET?

YES

- BACK PROBE PCM TERM. D7 WITH A TEST LIGHT TO GROUND.
- IGN "OFF" FOR 10 SEC.
- NOTE LIGHT AFTER IGN. "ON."

LIGHT "ON"

FAULTY CONNECTION AT PCM OR FAULTY PCM.

LIGHT "OFF"

OPEN CKT 120 TO PCM.

NO

CODE 54 IS INTERMITTENT. REFER TO DIAGNOSTIC AIDS ON FACING PAGE.

7-18-90
MS 9957-6E

CODE 51
CODE 52
CODE 53
CODE 55

CODE 51

FAULTY MEM-CAL
(2.5L ENGINE AND VEHICLES WITH 4L80-E TRANSMISSION)
OR
PROM PROBLEM
(EXCEPT 2.5L ENGINE AND WITH 4L80-E TRANSMISSON)

CHECK THAT ALL PINS ARE FULLY INSERTED IN THE SOCKET. IF OK, REPLACE PROM, CLEAR MEMORY, AND RECHECK. IF CODE 51 REAPPEARS, REPLACE ECM/PCM.

CODE 52

FUEL CAL-PAK MISSING

CHECK FOR MISSING CAL-PAK AND THAT ALL PINS ARE FULLY INSERTED IN THE SOCKET. IF OK, REPLACE ECM. NOTE: ON SOME VEHICLES THE CAL-PAK IS SOLDERED IN.

CODE 53

SYSTEM OVER VOLTAGE

THIS CODE INDICATES THERE IS A BASIC GENERATOR PROBLEM.

- CODE 53 WILL SET IF VOLTAGE AT ECM/PCM TERMINAL "B1" IS GREATER THAN 17.1 VOLTS FOR 2 SECONDS.
- CHECK AND REPAIR CHARGING SYSTEM.

CODE 55

FAULTY ECM/PCM
ALL ENGINES
EXCEPT 2.5L ENGINE

BE SURE ECM/PCM GROUNDS ARE OK AND THAT MEM-CAL IS PROPERLY LATCHED. IF OK, REPLACE ECM/PCM.

7-14-90
7S 3784-6E

RESTRICTED EXHAUST SYSTEM CHECK
ALL ENGINES

Proper diagnosis for a restricted exhaust system is essential before any components are replaced. Either of the following procedures may be used for diagnosis, depending upon engine or tool used:

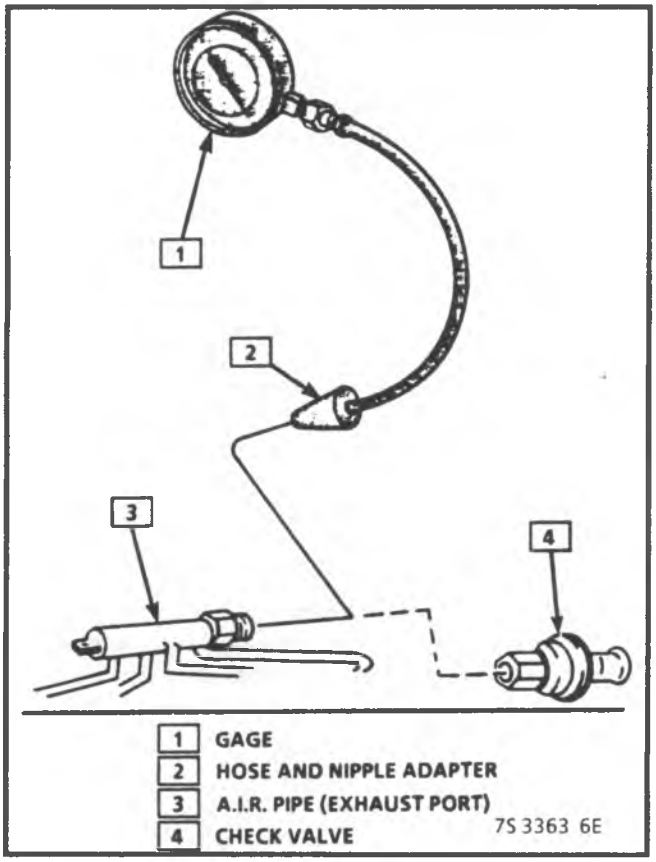
CHECK AT A. I. R. PIPE:

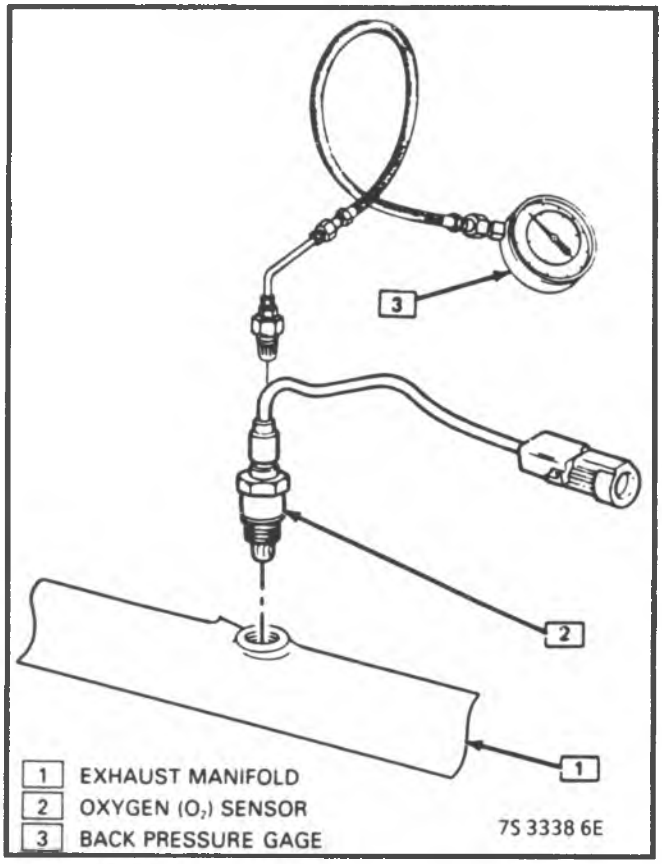
1. Remove the rubber hose at the exhaust manifold A.I.R. pipe check valve. Remove check valve.
2. Connect a fuel pump pressure gauge to a hose and nipple from a Propane Enrichment Device (J 26911) (see illustration).
3. Insert the nipple into the exhaust manifold A.I.R. pipe.

OR

CHECK AT O_2 SENSOR:

1. Carefully remove O_2 sensor.
2. Install Borroughs exhaust backpressure tester (BT 8515 or BT 8603) or equivalent in place of O_2 sensor (see illustration).
3. After completing test described below, be sure to coat threads of O_2 sensor with anti-seize compound P/N 5613695 or equivalent prior to re-installation.



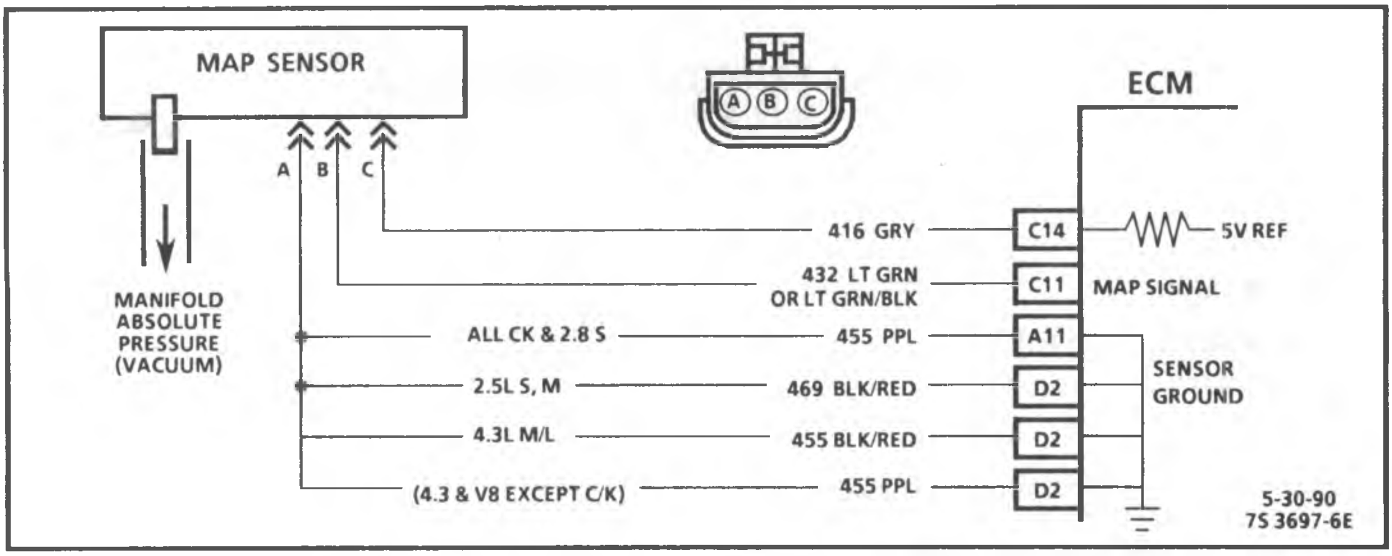


DIAGNOSIS:

1. With the engine idling at normal operating temperature, observe the exhaust system backpressure reading on the gage. Reading should not exceed 8.6 kPa (1.25 psi).
2. Increase engine speed to 2000 rpm and observe gage. Reading should not exceed 20.7 kPa (3 psi).
3. If the backpressure at either speed exceeds specification, a restricted exhaust system is indicated.
4. Inspect the entire exhaust system for a collapsed pipe, heat distress, or possible internal muffler failure.
5. If there are no obvious reasons for the excessive backpressure, the catalytic converter is suspected to be restricted and should be replaced using current recommended procedures.

7-18-90
7S 3340-6E

Figure 3-17 - Exhaust System Check



MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK

ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

Circuit Description:

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load (intake manifold vacuum) and rpm changes; and converts these into a voltage output. The ECM sends a 5 volt reference voltage to the MAP sensor. As the manifold pressure changes, the output voltage of the sensor also changes. By monitoring the sensor output voltage, the ECM knows the manifold pressure. At lower pressure output voltage will be about 1 to 2 volts at idle. While at higher pressure or at Wide Open Throttle (WOT) output voltage will be about 4 to 4.8 volts. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the ECM to make adjustments for different altitudes. The ECM uses the MAP sensor to control fuel delivery and ignition timing.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

Important

- Be sure to use the same Diagnostic Test Equipment for all measurements.

1. Checks MAP sensor output voltage to the ECM. This voltage, without engine running, represents a barometer reading to the ECM.
   - When comparing "Scan" readings to a known good vehicle, it is important to compare vehicles that use a MAP sensor having the same color insert or having the same "Hot Stamped" number. See figures on facing page.
2. Applying 34 kPa (10" Hg) vacuum to the MAP sensor should cause the voltage to change. Subtract second reading from the first. Voltage value should be greater than 1.5 volts. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.
3. Check vacuum hose to sensor for leaking or restriction. Be sure that no other vacuum devices are connected to the MAP hose.

   NOTE: Make sure electrical connector remains securely fastened.
4. Disconnect sensor from bracket and twist sensor by hand (only) to check for intermittent connection. Output changes greater than .1 volt indicate a bad connector or connection. If OK, replace sensor.

MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK

ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION

NOTE: THIS CHART ONLY APPLIES TO MAP SENSORS HAVING GREEN OR BLACK COLOR KEY INSERT (SEE BELOW).

1
- IGNITION "ON," ENGINE "OFF."
- TECH 1 SHOULD INDICATE A MAP SENSOR VOLTAGE.
- COMPARE THIS READING WITH THE READING OF A KNOWN GOOD VEHICLE. SEE FACING PAGE TEST DESCRIPTION, STEP 1.
- VOLTAGE READING SHOULD BE WITHIN, ± .4 VOLT.

IS IT?

YES → 2

NO → REPLACE SENSOR.

2
- DISCONNECT AND PLUG VACUUM SOURCE TO MAP SENSOR.
- CONNECT A HAND VACUUM PUMP TO MAP SENSOR.
- START ENGINE.
- NOTE MAP SENSOR VOLTAGE.
- APPLY 34 kPa (10" Hg) OF VACUUM AND NOTE VOLTAGE CHANGE. SUBTRACT SECOND READING FROM THE FIRST. VOLTAGE VALUE SHOULD BE GREATER THAN 1.5 VOLTS.

IS IT?

YES → 3 NO TROUBLE FOUND. CHECK SENSOR VACUUM SOURCE FOR LEAKAGE OR RESTRICTION. BE SURE THIS SOURCE SUPPLIES VACUUM TO MAP SENSOR ONLY.

NO → 4 CHECK SENSOR CONNECTION. IF OK, REPLACE SENSOR.

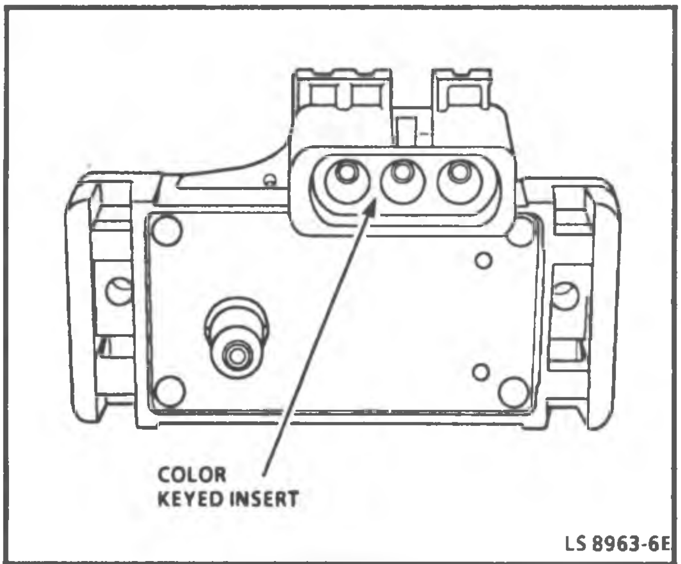


Figure 1 - Color Key Insert

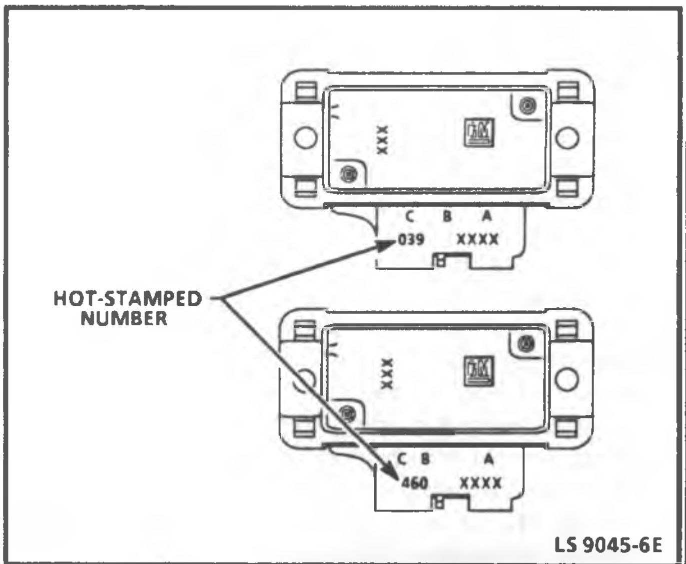
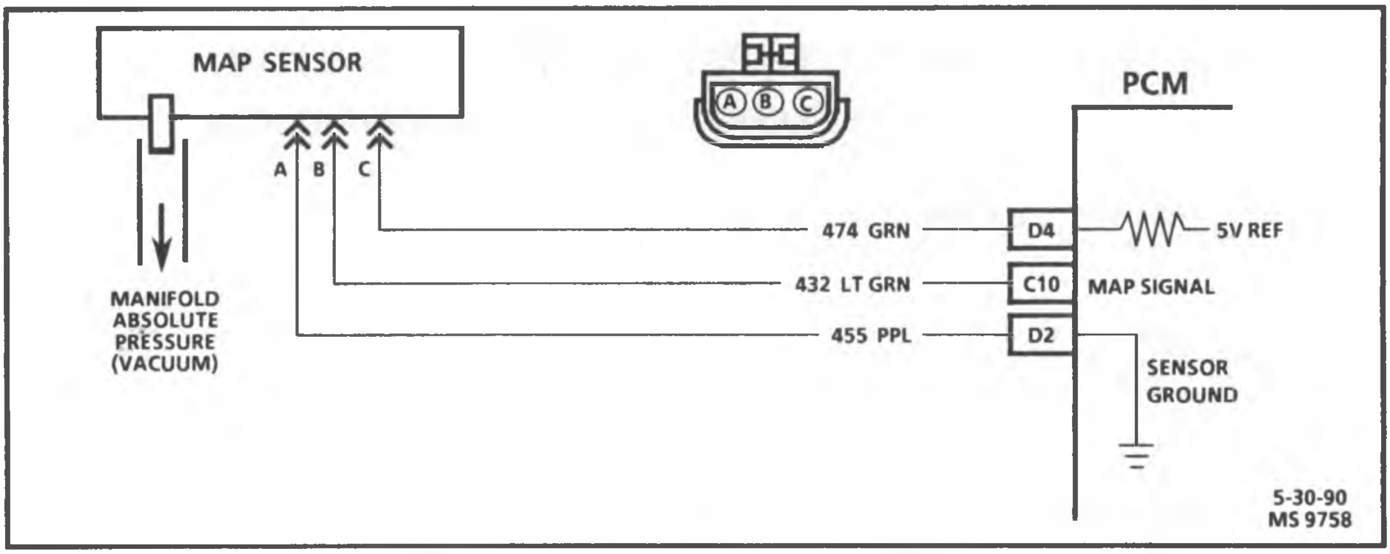


Figure 2 - Hot-Stamped Number

""*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.



MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK

ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load (intake manifold vacuum) and rpm changes; and converts these into a voltage output. The PCM sends a 5 volt reference voltage to the MAP sensor. As the manifold pressure changes, the output voltage of the sensor also changes. By monitoring the sensor output voltage, the PCM knows the manifold pressure. At lower pressure output voltage will be about 1 to 2 volts at idle. While at higher pressure or at Wide Open Throttle (WOT) output voltage will be about 4 to 4.8 volts. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the PCM to make adjustments for different altitudes. The PCM uses the MAP sensor to control fuel delivery and ignition timing.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

Important

- Be sure to use the same Diagnostic Test Equipment for all measurements.

1. Checks MAP sensor output voltage to the PCM. This voltage, without engine running, represents a barometer reading to the PCM.
   - When comparing "Scan" readings to a known good vehicle, it is important to compare vehicles that use a MAP sensor having the same color insert or having the same "Hot Stamped" number. See figures on facing page.
2. Applying 34 kPa (10" Hg) vacuum to the MAP sensor should cause the voltage to change. Subtract second reading from the first. Voltage value should be greater than 1.5 volts. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.
3. Check vacuum hose to sensor for leaking or restriction. Be sure that no other vacuum devices are connected to the MAP hose.

   NOTE: Make sure electrical connector remains securely fastened.

4. Disconnect sensor from bracket and twist sensor by hand (only) to check for intermittent connection. Output changes greater than .1 volt indicate a bad connector or connection. If OK, replace sensor.

MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK

ALL VEHICLES WITH 4L80-E TRANSMISSION

NOTE: THIS CHART ONLY APPLIES TO MAP SENSORS HAVING GREEN OR BLACK COLOR KEY INSERT (SEE BELOW).

1
- IGNITION "ON," ENGINE "OFF."
- TECH 1 SHOULD INDICATE A MAP SENSOR VOLTAGE.
- COMPARE THIS READING WITH THE READING OF A KNOWN GOOD VEHICLE. SEE FACING PAGE TEST DESCRIPTION, STEP 1.
- VOLTAGE READING SHOULD BE WITHIN, ± .4 VOLT.

IS IT?

YES → 2

NO → REPLACE SENSOR.

2
- DISCONNECT AND PLUG VACUUM SOURCE TO MAP SENSOR.
- CONNECT A HAND VACUUM PUMP TO MAP SENSOR.
- START ENGINE.
- NOTE MAP SENSOR VOLTAGE.
- APPLY 34 kPa (10" Hg) OF VACUUM AND NOTE VOLTAGE CHANGE. SUBTRACT SECOND READING FROM THE FIRST. VOLTAGE VALUE SHOULD BE GREATER THAN 1.5 VOLTS.

IS IT?

YES → 3

NO → 4

3 NO TROUBLE FOUND. CHECK SENSOR VACUUM SOURCE FOR LEAKAGE OR RESTRICTION. BE SURE THIS SOURCE SUPPLIES VACUUM TO MAP SENSOR ONLY.

4 CHECK SENSOR CONNECTION. IF OK, REPLACE SENSOR.

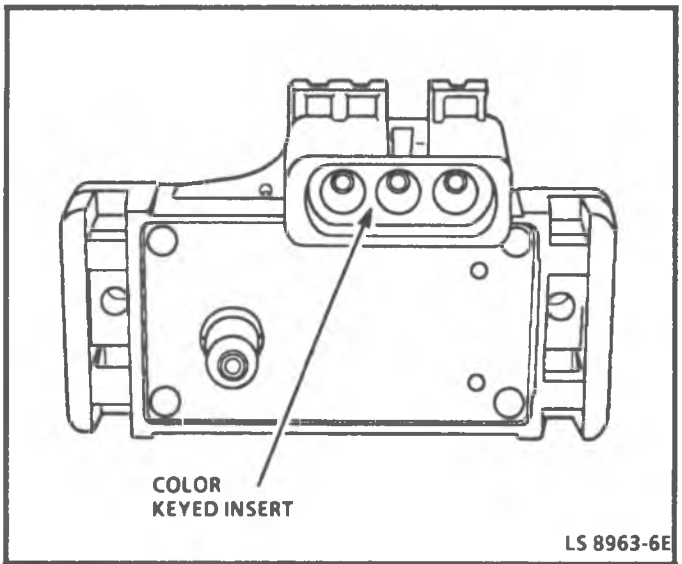


Figure 1 - Color Key Insert

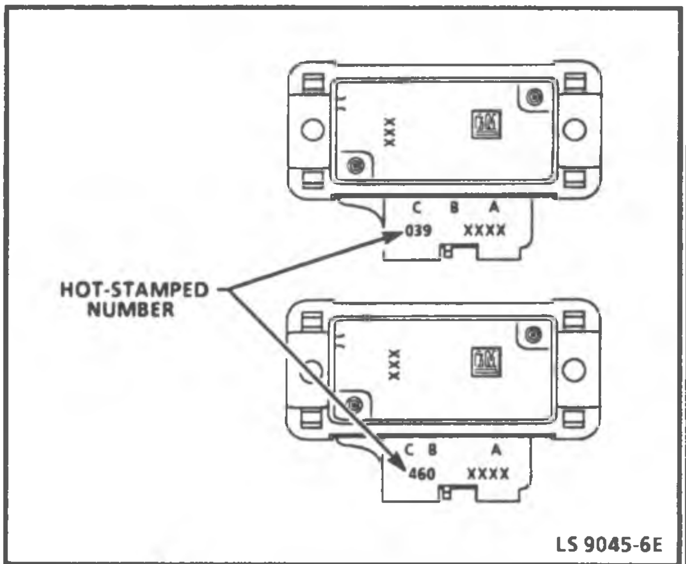
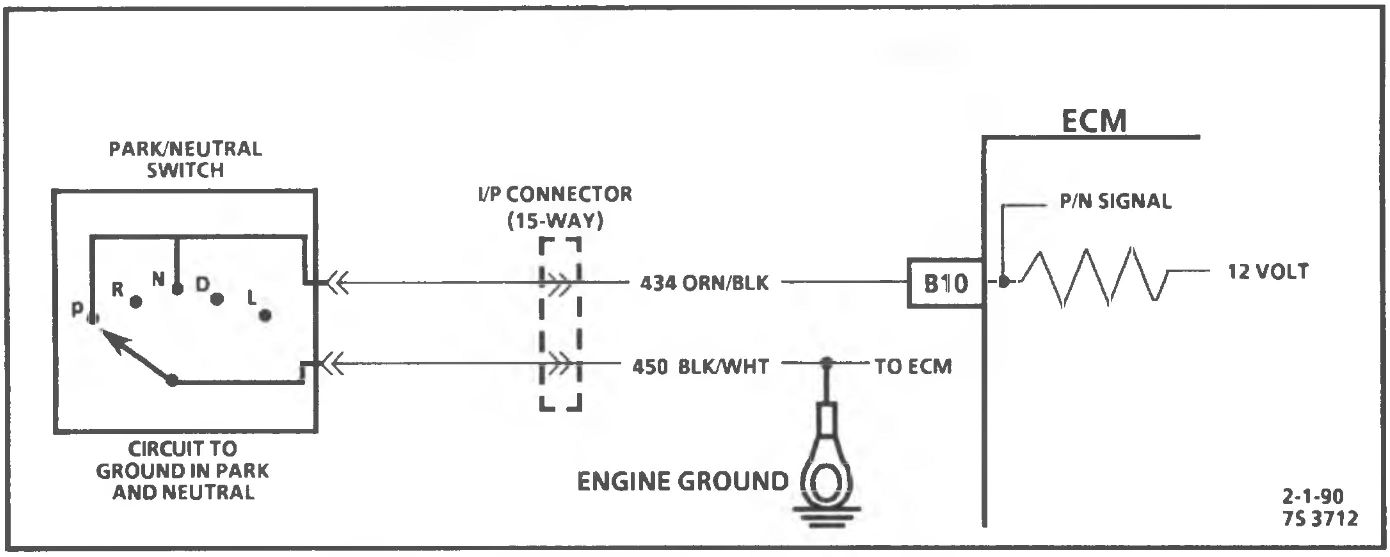


Figure 2 - Hot-Stamped Number

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.



PARK/NEUTRAL (P/N) SWITCH DIAGNOSIS

ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION AUTO TRANSMISSION ONLY

Circuit Description:

The Park/Neutral (P/N) switch contacts are closed to ground in park or neutral and open in drive ranges.

The ECM supplies ignition voltage, through a current limiting resistor, to CKT 434 and senses a closed switch, when the voltage on CKT 434 drops to less than one volt.

The ECM uses the P/N signal as one of the inputs to control:

- Idle Air Control (IAC).
- Vehicle Speed Sensor (VSS) Diagnostics.

Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart.

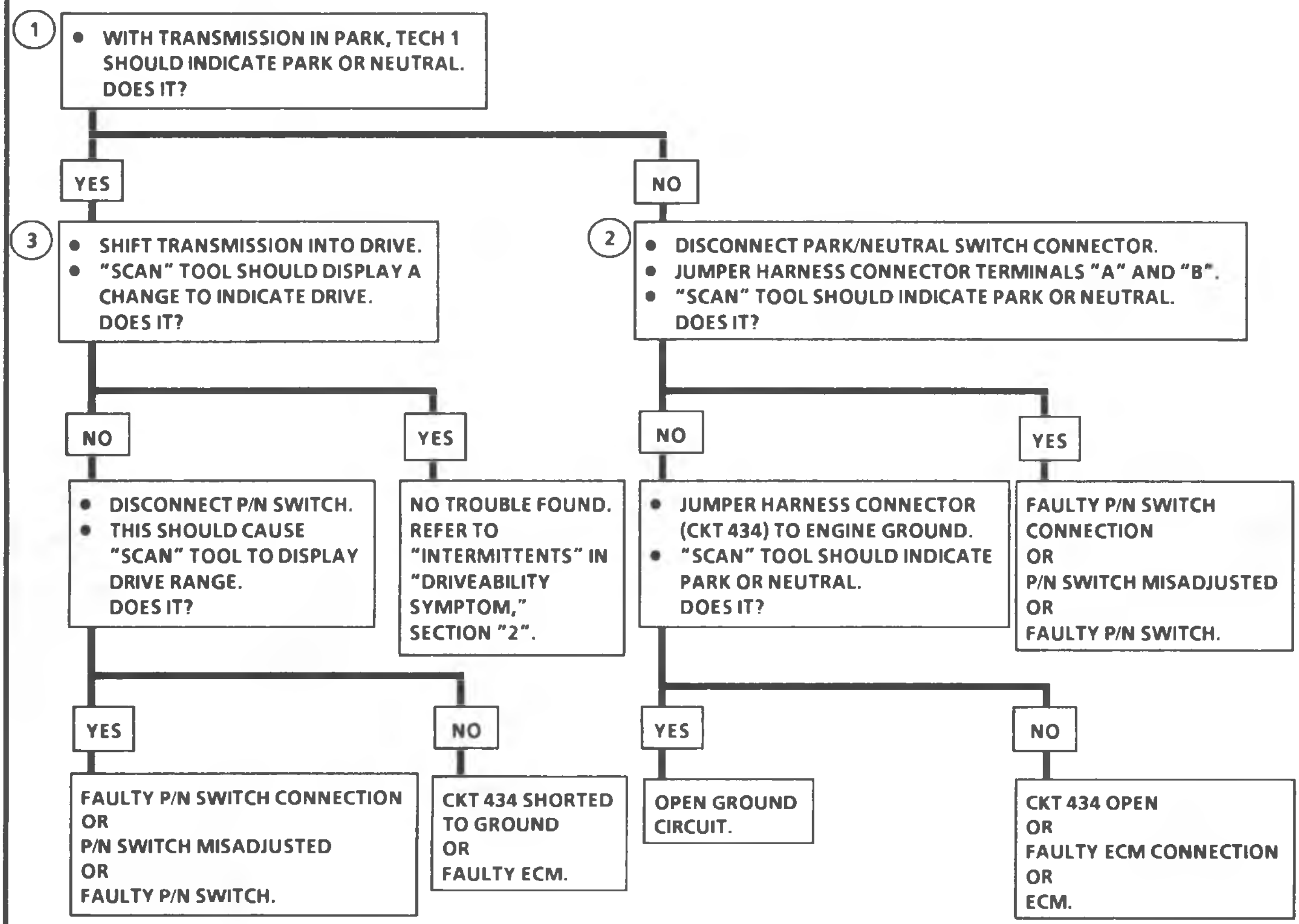
1. Checks for a closed switch to ground in park position. Different makes of "Scan" tools will read P/N differently. Refer to operators manual for type of display used for a specific tool.
2. Checks for an open switch in drive or reverse range.
3. Be sure "Scan" indicates drive, even while wiggling shifter to test for an intermittent or misadjusted switch in drive range.

Diagnostic Aids:

If CKT 434 always indicates drive (open), a drop in the idle may exist when the gear selector is moved into drive range.

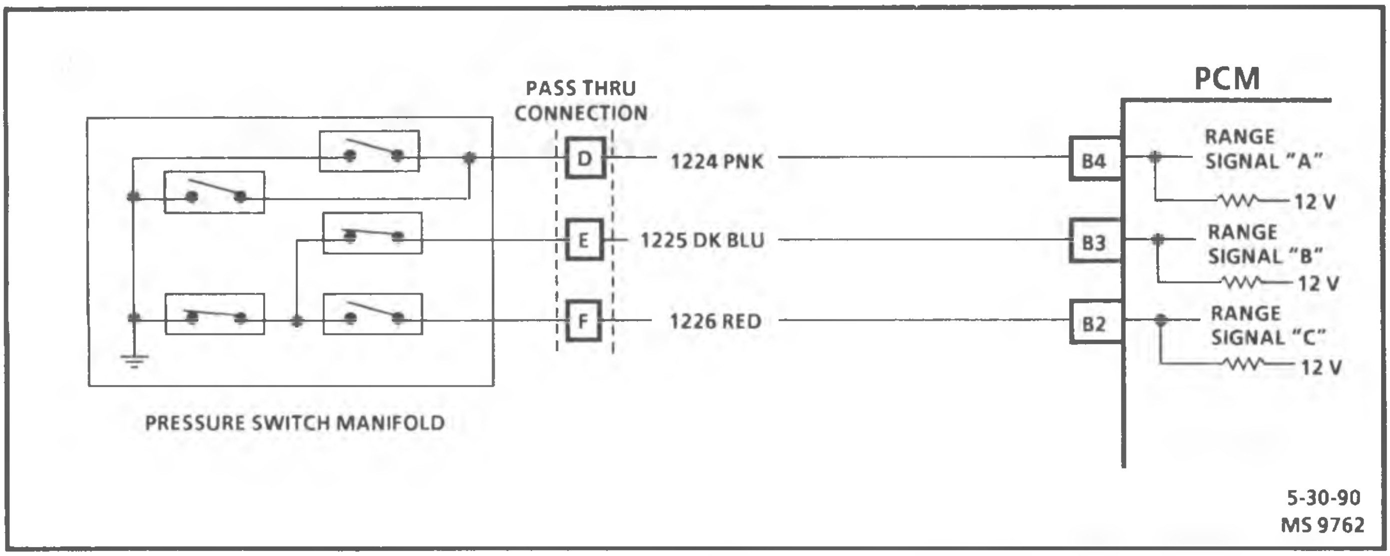
PARK/NEUTRAL (P/N) SWITCH DIAGNOSIS

ALL VEHICLES EXCEPT WITH 4L80-E TRANSMISSION
AUTOMATIC TRANSMISSION ONLY



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

7-17-90
7S 3161-6E



PRESSURE SWITCH MANIFOLD (PSM) CHECK

ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The Pressure Switch Manifold (PSM) is actually five pressure switches combined into one unit and mounted on the valve body. The PCM supplies battery voltage to the PSM on three separate wires. By grounding one or more of these circuits through various combinations of the pressure switches inside the pressure switch manifold the PCM detects what gear range has been selected by the vehicle operator.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test compares the indicated range to the range actually selected.
2. This test checks for correct voltage from the PCM to the transmission pass-thru connector.
3. This final test will detect a short to ground in any one of the three PSM range circuits.

Diagnostic Aids:

Code 28 will set if the PCM detects one of two "illegal" **psm** combinations.

See accompanying chart for various combinations. Be sure to check pass-thru connector for good contact.

	A	B	C
Park	12	0	12
Rev	0	0	12
Neutral	12	0	12
4th	12	0	0
3rd	12	12	0
2nd	12	12	12
1st	0	12	12
Illegal Illegal	0 0	12 0	0 0

Expected Voltage Readings

PRESSURE SWITCH MANIFOLD (PSM) CHECK

ALL VEHICLES WITH 4L80-E TRANSMISSION

1
- CLEAR CODES.
- RAISE DRIVE WHEELS.
- WITH ENGINE IDLING - PLACE TRANSMISSION IN MANUAL LOW, THEN MOVE ON TO EACH PROGRESSIVELY HIGHER RANGE. "SCAN" SHOULD MATCH SELECTED RANGE. DOES IT?

NO

- IGNITION "OFF."
- DISCONNECT TRANSMISSION PASS-THRU CONNECTOR.
- IGNITION "ON."
- WITH A VOLTMETER, CHECK VOLTAGE AT HARNESS CONNECTOR TERMINALS "D", "E" AND "F".
- IS THERE SYSTEM VOLTAGE ON ALL PINS?

YES

PROBLEM IS INTERMITTENT, SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

NO

2
- IGNITION STILL "ON."
- DVM SELECTION SWITCH SET ON 20 VDC SCALE.
- BACKPROBE PCM/TCM HARNESS CONNECTOR RANGE CIRCUITS THAT HAD LOW OR NO VOLTAGE.
- IS THERE SYSTEM VOLTAGE?

YES

CHECK TRANSMISSION INTERNAL HARNESS FOR OPEN OR SHORT TO GROUND.

HARNESS OK

FAULTY PRESSURE SWITCH MANIFOLD

NO

3
- IGNITION "OFF."
- DISCONNECT PCM A-B CONNECTOR.
- WITH A TEST LIGHT CONNECTED TO 12 VOLTS, PROBE SAME PCM HARNESS CONNECTOR TERMINALS.

YES

OPEN RANGE CIRCUIT FROM PCM TO TRANSMISSION PASS-THRU CONNECTOR.

LIGHT "OFF"

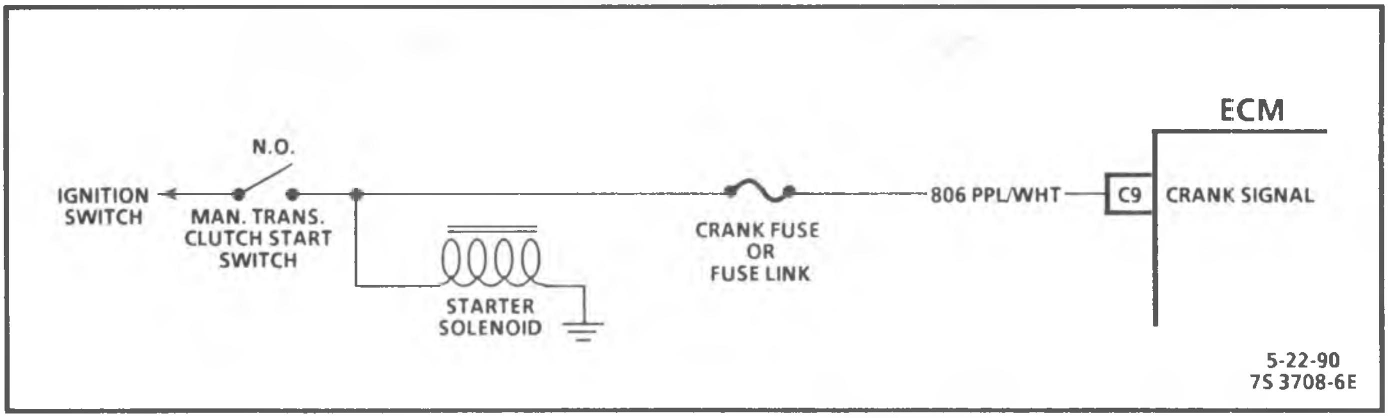
PROBLEM IS FAULTY CONNECTION AT PCM.
OR
PCM.

LIGHT "ON"

RANGE CIRCUIT SHORTED TO GROUND BETWEEN PCM AND TRANSMISSION.

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

6-4-90
MS 9974-6E



CRANK SIGNAL DIAGNOSIS

ALL VEHICLES

Circuit Description:

Crank signal is a 12 volt signal to the ECM during cranking to allow enrichment and cancel diagnostics until engine is running or 12 volts is no longer on circuit.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks for normal (cranking) voltage to terminal "C9" of ECM. Test light should be "ON" during cranking and then go "OFF" when engine is running.
2. Checks to determine if source of open fuse or fuse link was a faulty ECM.

CRANK SIGNAL DIAGNOSIS
ALL VEHICLES

1
- PROBE ECM CONNECTOR CKT 806 WITH TEST LIGHT TO GROUND.
- CRANK ENGINE.
- TEST LIGHT SHOULD ILLUMINATE. DOES IT?

NO

CHECK FUSE OR FUSE LINK

YES

CRANK SIGNAL CIRCUIT OK IF LIGHT GOES OUT WITH ENGINE RUNNING.

NOT OK

2
CHECK WIRE FROM FUSE OR FUSE LINK TO ECM FOR SHORT TO GROUND.

OK

REPAIR OPEN IN WIRE FROM ECM TO IGNITION SWITCH.

OK

- REPLACE FUSE/FUSE LINK.
- CRANK ENGINE.
- RECHECK FUSE/FUSE LINK.

NOT OK

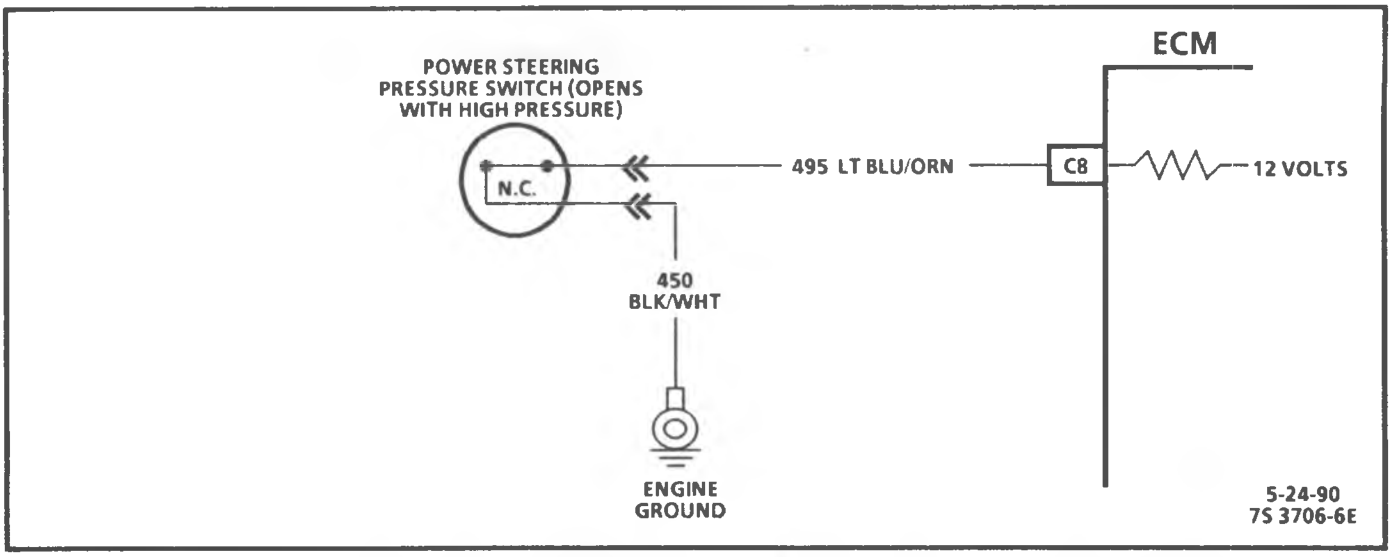
REPLACE ECM

OK

DEFECTIVE FUSE.
CRANK CIRCUIT OK.

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

2-1-90
7S 3709-6E



POWER STEERING PRESSURE SWITCH (PSPS) CHECK

2.5L ENGINE

Circuit Description:

The Power Steering Pressure Switch (PSPS) is normally open to ground, and CKT 495 will be near battery voltage.

Turning the steering wheel increases power steering oil pressure and its load on an idling engine. The pressure switch will close before the load can cause an idle problem.

Closing the switch causes CKT 495 to read less than 1 volt. The ECM will increase the idle speed and retard the timing.

Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks for ECM signal voltage on CKT 495 and confirms that ground CKT 450 is OK.
2. Maximum resistance, or infinity, indicates an open switch.
3. Less than 1 ohm indicates that the switch is closed when the power steering pressure is high. Switch is OK.

Diagnostic Aids:

A pressure switch that will not close, or an open CKT 495 or 450, may cause the engine to stop when power steering loads are high.

A switch that will not open, or CKT 495 shorted to ground, will cause timing to retard at idle, and may affect idle quality.

POWER STEERING PRESSURE SWITCH (PSPS) CHECK
2.5L ENGINE

1
- DISCONNECT P/S PRESSURE SWITCH CONNECTOR.
- IGNITION "ON" AND ENGINE STOPPED.
- CHECK VOLTAGE BETWEEN HARNESS TERMINALS, CKTS 450 AND 495. SHOULD READ BATTERY VOLTAGE. DOES IT?

YES

2
- CONNECT OHMMETER BETWEEN SWITCH TERMINALS. RESISTANCE SHOULD BE HIGH (OPEN SWITCH). IS IT?

YES

3
- START AND IDLE ENGINE.
- TURN STEERING AND HOLD MOMENTARILY AGAINST STOP. OHMMETER SHOULD INDICATE LOW RESISTANCE (CLOSED SWITCH). DOES IT?

YES

NO TROUBLE FOUND. RECONNECT P/S SWITCH CONNECTOR AND REVIEW SYMPTOMS.

NO

FAULTY POWER STEERING SWITCH.

NO

FAULTY POWER STEERING SWITCH.

NO

- PROBE BOTH TERMINALS WITH A VOLTMETER TO GROUND.
- NOTE VOLTAGE.

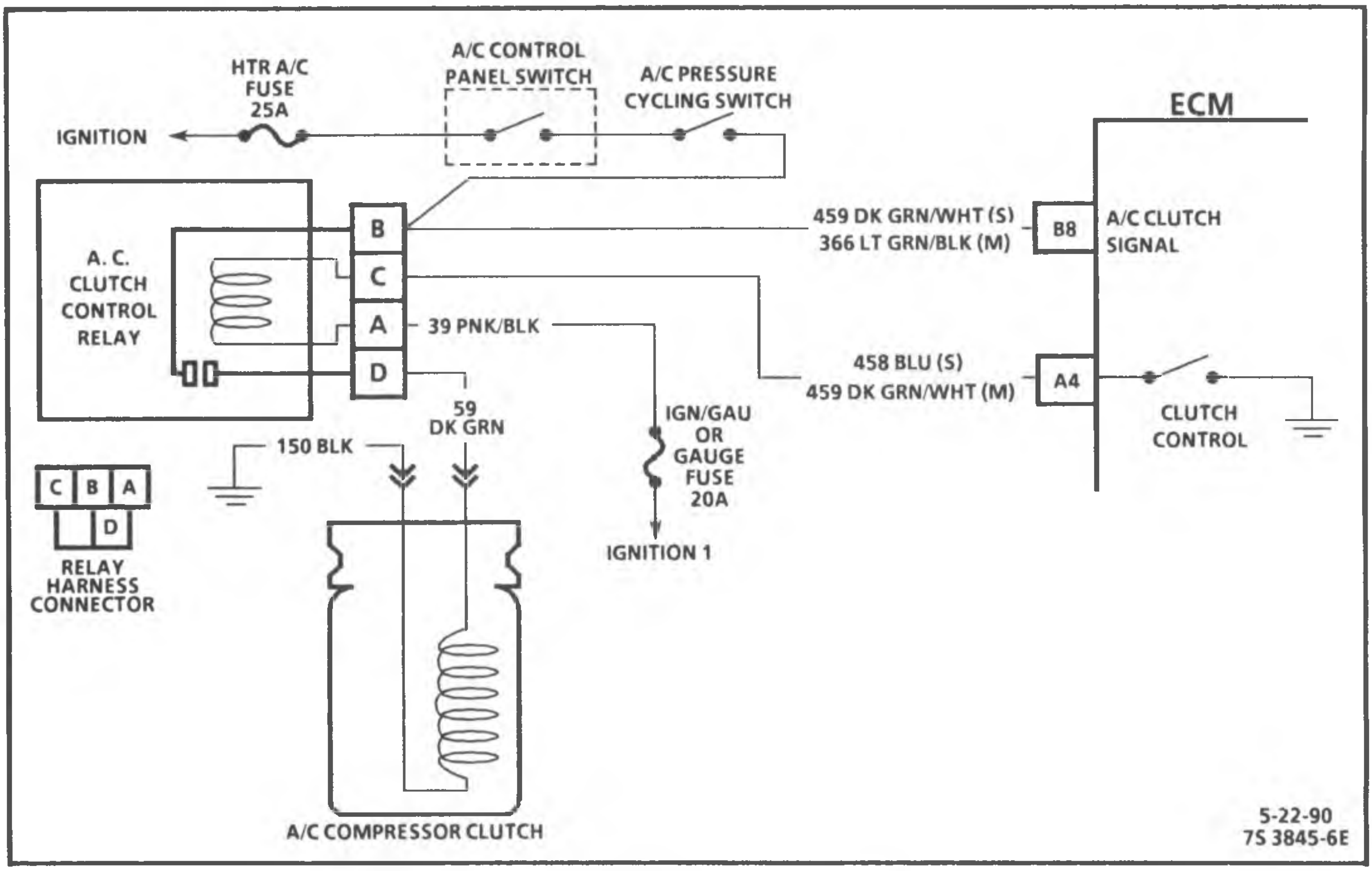
BATTERY VOLTAGE ONE TERMINAL.

REPAIR GROUND CKT 450.

NO BATTERY VOLTAGE.

DISCONNECT C-D ECM CONNECTOR. CHECK FOR OPEN OR SHORT TO GROUND IN CKT 495. IF OK, IT IS FAULTY ECM CONNECTOR TERMINAL C8 OR ECM.

"*AFTER REPAIRS,*" CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.



A/C CLUTCH CONTROL DIAGNOSIS

(Page 1 of 2)
2.5L ENGINE

Circuit Description:

ECM control of the A/C clutch improves idle quality and performance by;

- Delaying clutch apply until the idle speed is increased.
- Releasing clutch when idle speed is too low.
- Smooths cycling of the compressor by providing additional fuel at the instant clutch is applied.

Turning on air conditioning supplies CKT 459/366 battery voltage to the clutch control relay and terminal "B8." After a time delay of about 1/2 second the ECM will ground terminal "A4," CKT 458/459, and close the control relay. A/C compressor clutch will engage.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks for low refrigerant as cause for no A/C.
2. This and following tests check for faulty A/C control relay.

A/C CLUTCH CONTROL DIAGNOSIS

(Page 1 of 2)

2.5L ENGINE

- BE SURE THESE SYSTEMS ARE OK BEFORE USING THIS CHART.
  - ENGINE IDLE SPEED NORMAL. IF IDLE IS TOO LOW IT WILL SHUT OFF THE COMPRESSOR.
- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
- TURN A/C "ON" AND "OFF" AND NOTE A/C CLUTCH. SHOULD CYCLE "ON" AND "OFF."

NOT OK

- CHECK A/C FUSE

OK

CLUTCH CONTROL CIRCUIT OK - BASIC A/C SYSTEM PROBLEM SEE SECTION "1B".

OK

1
- ENGINE IDLING.
- A/C "ON."
- DISCONNECT A/C CYCLING SWITCH AND JUMPER BETWEEN HARNESS CONNECTOR TERMS. A/C CLUTCH SHOULD ENGAGE.

NOT OK

- DISCONNECT A/C RELAY.
- PROBE RELAY HARNESS TERMINAL "B" WITH A TEST LIGHT TO 12 VOLTS.

LIGHT "ON"

REPAIR SHORT TO GROUND CKT 459/366 TO RELAY.

LIGHT "OFF"

CHECK FOR SHORT TO GROUND IN CKT 59. IF OK IT IS SHORTED RELAY OR DEFECTIVE FUSE.

NOT OK

2
- IGNITION "ON" ENGINE STOPPED.
- A/C "OFF."
- DISCONNECT A/C RELAY AND CONNECT TEST LIGHT BETWEEN HARNESS TERMINALS "A & C".

OK

BASIC A/C SEALED SYSTEM PROBLEM OR FAULTY CYCLING SWITCH.

LIGHT "OFF"

- GROUND DIAGNOSTIC TERMINAL AND REPEAT TEST.

LIGHT "ON"

CHECK FOR GROUND IN CKT 458/459. IF CKT 458/459 IS NOT GROUNDED REPLACE ECM.

LIGHT "ON"

- A/C "ON."
- REMOVE GROUND FROM DIAGNOSTIC TERMINAL.
- REPEAT TEST WITH ENGINE IDLING.

SEE A/C CLUTCH CONTROL DIAGNOSIS CHART (2 OF 2).

LIGHT "OFF"

- PROBE HARNESS CONNECTOR TERMINAL "A" WITH TEST LIGHT TO GROUND.

LIGHT "ON"

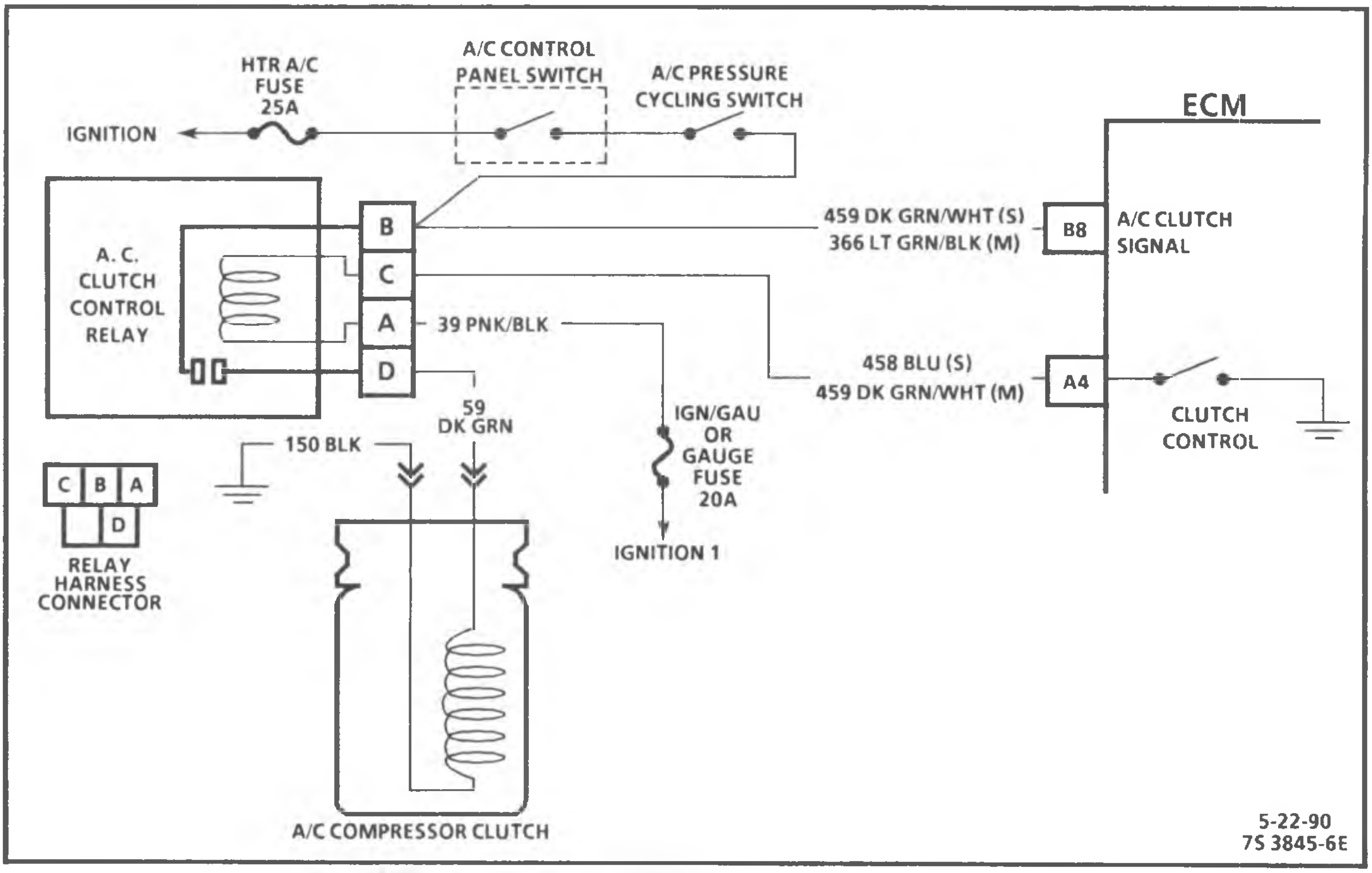
DISCONNECT A-B CONNECTOR AND CHECK FOR OPEN CKT 458/459. IF OK, IT IS FAULTY ECM CONNECTOR TERMINAL "A4" OR ECM.

LIGHT "OFF"

REPAIR OPEN CKT 39.

"*AFTER REPAIRS,*" CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

5-31-90
7S 3849-6E



A/C CLUTCH CONTROL DIAGNOSIS

(Page 2 of 2)

2.5L ENGINE

Circuit Description:

ECM control of the A/C clutch improves idle quality and performance by;

- Delaying clutch apply until the idle speed is increased.
- Releasing clutch when idle speed is too low.
- Smooths cycling of the compressor by providing additional fuel at the instant clutch is applied.

Turning on air conditioning supplies CKT 459/366 battery voltage to the clutch control relay and terminal "B8". After a time delay of about 1/2 second, the ECM will ground terminal "A4", CKT 458/459, and close the control relay. A/C compressor clutch will engage.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

3. Checks for faulty cycling switch.
   - Solenoids and relays are turned "ON" or "OFF" by the ECM, using internal electronic switches called "drivers." Each driver is part of a group of four, called Quad-Drivers. Failure of one driver can damage any other driver in the set.

     Solenoid and relay coil resistance must measure more than 20 ohms. Less resistance will cause early failure of the ECM "driver." Using an ohmmeter, check the coil resistance of the A/C relay before replacing the ECM.

Diagnostic Aids:

Before replacing ECM, use ohmmeter and check resistance of each ECM controlled relay or solenoid coil. See "ECM Wiring Diagram" for coil terminal identification for solenoids(s) and relay(s) to be checked.

Replace any relay or solenoid that measures less than 20 ohms.

A/C CLUTCH CONTROL DIAGNOSIS

(Page 2 of 2)

2.5L ENGINE

FROM A/C CLUTCH CONTROL DIAGNOSIS CHART (1 OF 2)

LIGHT "OFF"

- PROBE HARNESS CONNECTOR TERMINAL "B" WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

- JUMPER BETWEEN HARNESS TERMINALS "B & D". A/C CLUTCH SHOULD ENGAGE.

NOT OK

CHECK:
- OPEN CKT 59 TO CLUTCH
- OPEN CLUTCH COIL
- OPEN HI PRESSURE SWITCH
- FAULTY GROUND

OK

FAULTY A/C RELAY

LIGHT "OFF"

(3)
- DISCONNECT A/C PRESSURE CYCLING SWITCH.
- PROBE BOTH HARNESS TERMINALS WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

- DISCONNECT A-B ECM CONNECTOR.
- PROBE TERMINAL "B8" WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

FAULTY ECM CONNECTOR TERMINAL OR ECM. SEE FACING PAGE "DIAGNOSTIC AIDS."

LIGHT "OFF"

REPAIR OPEN IN CKT 459/366 TO RELAY.

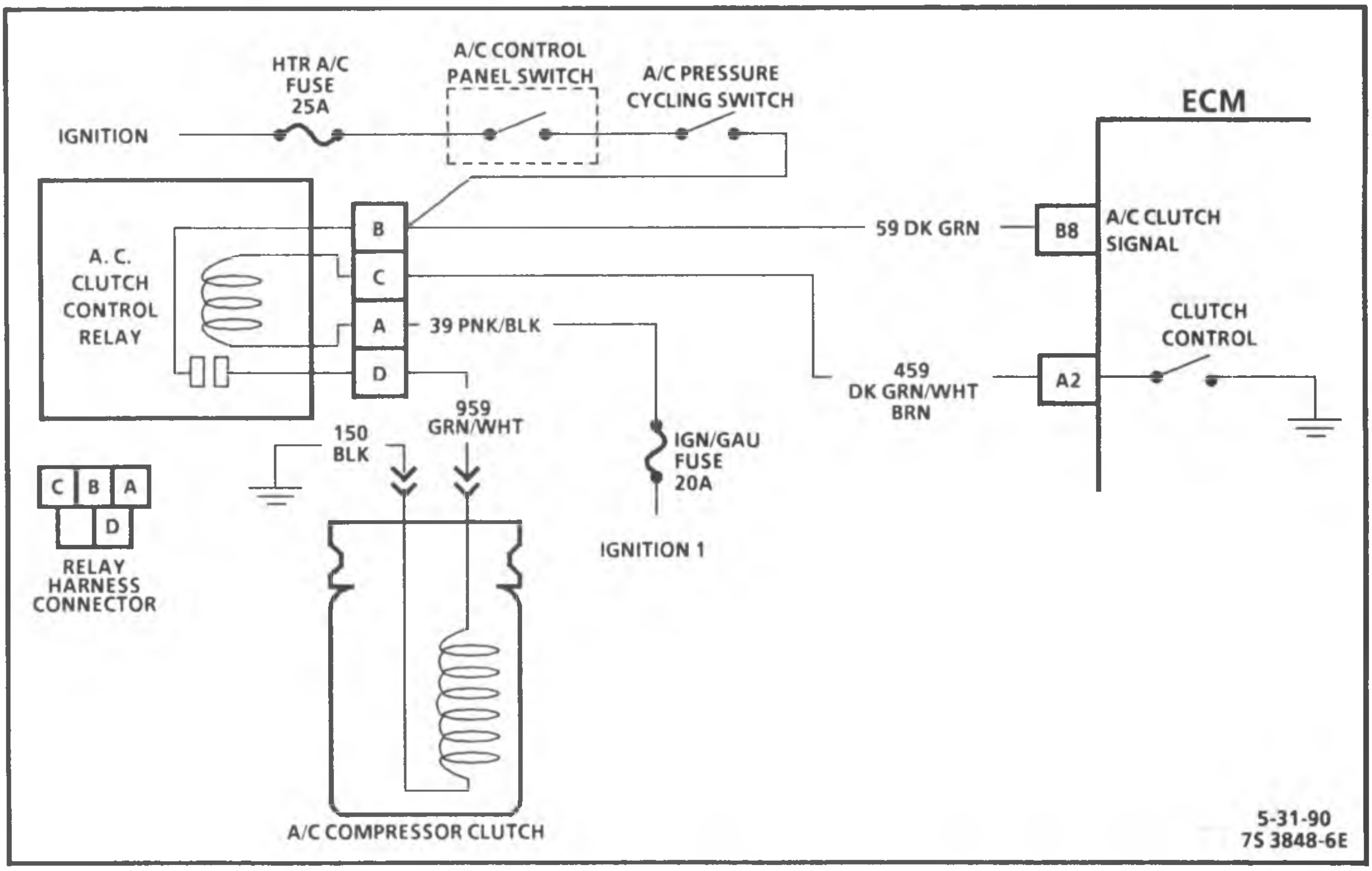
LIGHT "ON" ONE TERMINAL

CHECK FOR OPEN CKT 459/366 FROM CYCLING SWITCH TO RELAY. IF OK IT IS A FAULTY CYCLING SWITCH.

NO LIGHT EITHER TERMINAL

CHECK FOR OPEN CKT 459/366 TO A/C CONTROL SWITCH OR FAULTY A/C SWITCH.

"*AFTER REPAIRS,*" CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.



A/C CLUTCH CONTROL DIAGNOSIS

(Page 1 of 2)

2.8L ENGINE & 4.3L (S/T) AUTOMATIC

Circuit Description:

ECM control of the A/C clutch improves idle quality and performance by:

- Delaying clutch apply until the idle speed is increased.
- Releasing clutch when idle speed is too low.
- Releasing clutch at Wide Open Throttle.
- Smooths cycling of the compressor by providing additional fuel at the instant clutch is applied.

Turning on air conditioning supplies CKT 59 battery voltage to the clutch control relay and terminal "B8" of the ECM connector. After a time delay of about 1/2 second the ECM will ground terminal "A2" of the ECM connector, CKT 459, and close the control relay. A/C compressor clutch will engage.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks for low refrigerant as cause for no A/C.
2. This and following tests check for faulty A/C control relay.

A/C CLUTCH CONTROL DIAGNOSIS

(Page 1 of 2)

2.8L ENGINE & 4.3L (S/T) AUTOMATIC

- BE SURE THESE SYSTEMS ARE OK BEFORE USING THIS CHART.
  - ENGINE IDLE SPEED NORMAL. IF IDLE IS TOO LOW IT WILL SHUT OFF THE COMPRESSOR.
  - ENGINE COOLING FAN RUNS WHEN A/C IS ON.
- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
- TURN A/C ON AND OFF AND NOTE A/C CLUTCH. SHOULD CYCLE ON AND OFF.

OK

CLUTCH CONTROL CIRCUIT OK - BASIC A/C SYSTEM PROBLEM SEE SECTION 1B.

NOT OK

- CHECK A/C FUSE

NOT OK

- DISCONNECT A/C RELAY
- PROBE RELAY HARNESS TERMINAL "B" WITH A TEST LIGHT TO 12 VOLTS.

LIGHT ON

REPAIR SHORT TO GROUND CKT 59 TO RELAY.

LIGHT OFF

CHECK FOR SHORT TO GROUND IN CKT 959. IF OK IT IS SHORTED RELAY OR DEFECTIVE FUSE.

OK

1

- ENGINE IDLING
- A/C ON
- DISCONNECT A/C CYCLING SWITCH AND JUMPER BETWEEN HARNESS CONNECTOR TERMS. A/C CLUTCH SHOULD ENGAGE.

OK

BASIC A/C SEALED SYSTEM PROBLEM OR FAULTY CYCLING SWITCH.

NOT OK

2

- IGNITION ON ENGINE STOPPED.
- A/C OFF.
- DISCONNECT A/C RELAY AND CONNECT TEST LIGHT BETWEEN HARNESS TERMINALS "A & C".

LIGHT ON

CHECK FOR GROUND IN CKT 459. IF CKT 459 IS NOT GROUNDED REPLACE ECM.

LIGHT OFF

- GROUND DIAGNOSTIC TERMINAL AND REPEAT TEST.

LIGHT OFF

- PROBE HARNESS CONNECTOR TERMINAL "A" WITH TEST LIGHT TO GROUND.

LIGHT ON

DISCONNECT ECM A-B CONNECTOR AND CHECK FOR OPEN CKT 459. IF OK, IT IS FAULTY ECM CONNECTOR TERMINAL A2 OR ECM. BEFORE REPLACING THE ECM, REFER TO THE ECM QDR CHECK CHART.

LIGHT OFF

REPAIR OPEN CKT 39.

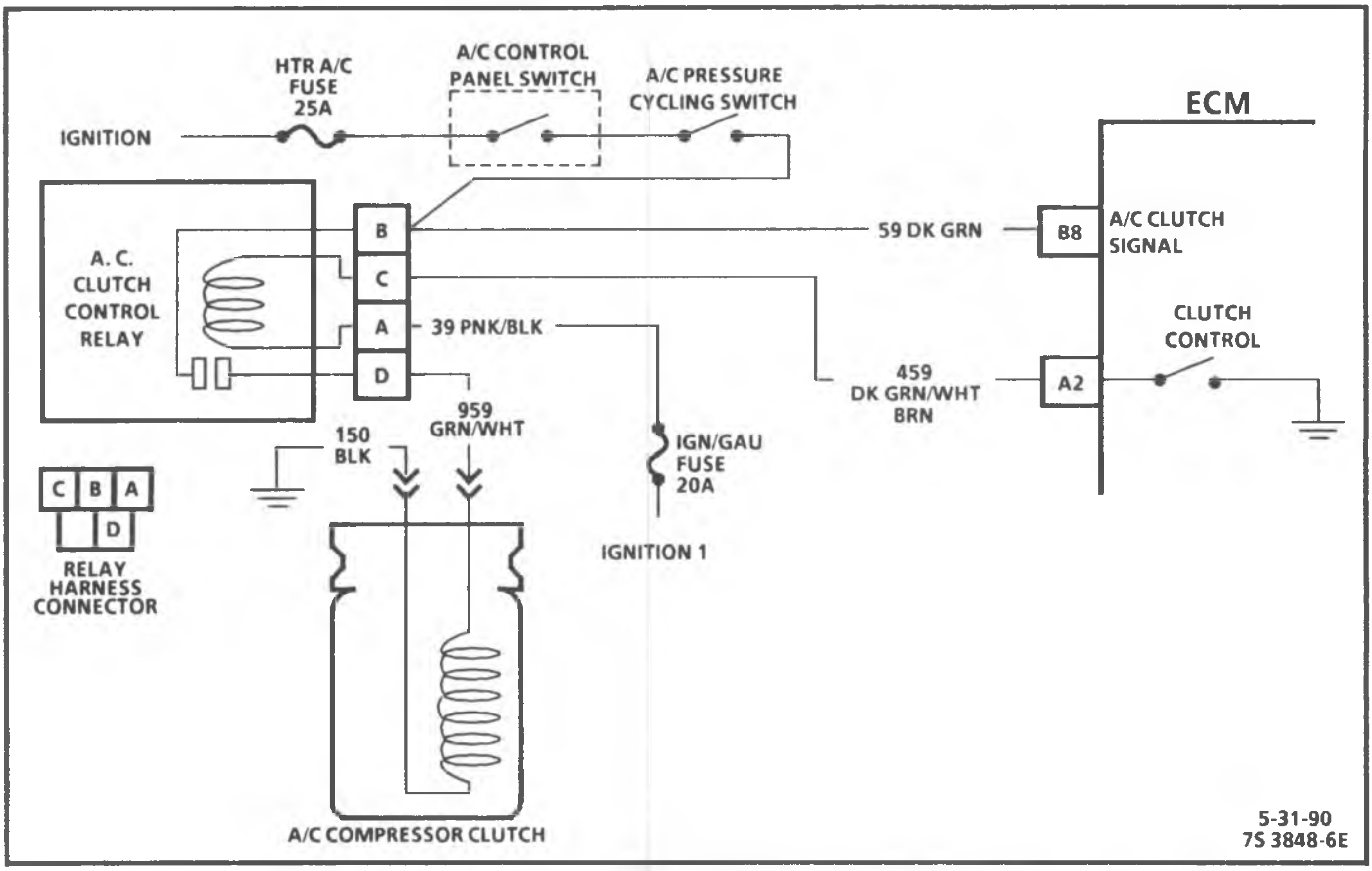
LIGHT ON

- A/C ON.
- REMOVE GROUND FROM DIAGNOSTIC TERMINAL.
- REPEAT TEST WITH ENGINE IDLING.

SEE A/C CLUTCH CONTROL DIAGNOSIS CHART (2 of 2)

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

1-30-90
6S 2851-6E



A/C CLUTCH CONTROL DIAGNOSIS

(Page 2 of 2)
2.8L ENGINE & 4.3L (S/T) AUTOMATIC

Circuit Description:

ECM control of the A/C clutch improves idle quality and performance by;

- Delaying clutch apply until the idle speed is increased.
- Releasing clutch when idle speed is too low.
- Releasing clutch at Wide Open Throttle (WOT).
- Smooths cycling of the compressor by providing additional fuel at the instant clutch is applied.

Turning on air conditioning supplies CKT 59 battery voltage to the clutch control relay and terminal "B8" of the ECM connector. After a time delay of about 1/2 second the ECM will ground terminal "A2" of the ECM connector, CKT 459, and close the control relay. A/C compressor clutch will engage.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

3. Checks for faulty cycling switch.
   - Solenoids and relays are turned "ON" or "OFF" by the ECM, using internal electronic switches called "drivers." Each driver is part of a group of four, called Quad-Drivers. Failure of one driver can damage any other driver in the set.

     Solenoid and relay coil resistance must measure more than 20 ohms. Less resistance will cause early failure of the ECM "driver." Using an ohmmeter, check the coil resistance of the A/C relay before replacing the ECM.

Diagnostic Aids:

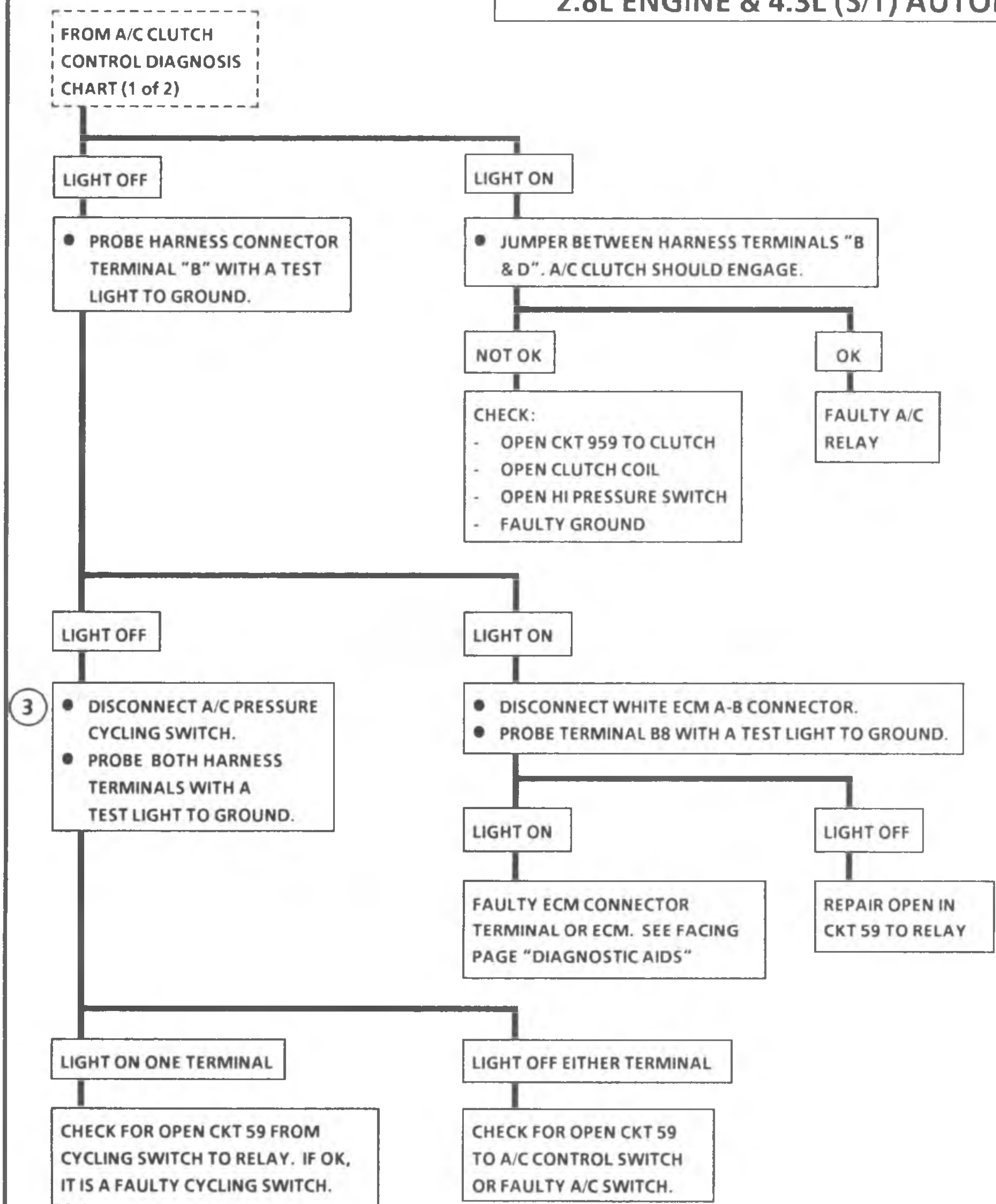
Before replacing ECM, use ohmmeter and check resistance of each ECM controlled relay or solenoid coil. Refer to "ECM QDR Check" (Figure 3-18). See ECM wiring diagram for coil terminal identification for solenoid(s) and relay(s) to be checked.

Replace any relay or solenoid that measures less than 20 ohms.

A/C CLUTCH CONTROL DIAGNOSIS

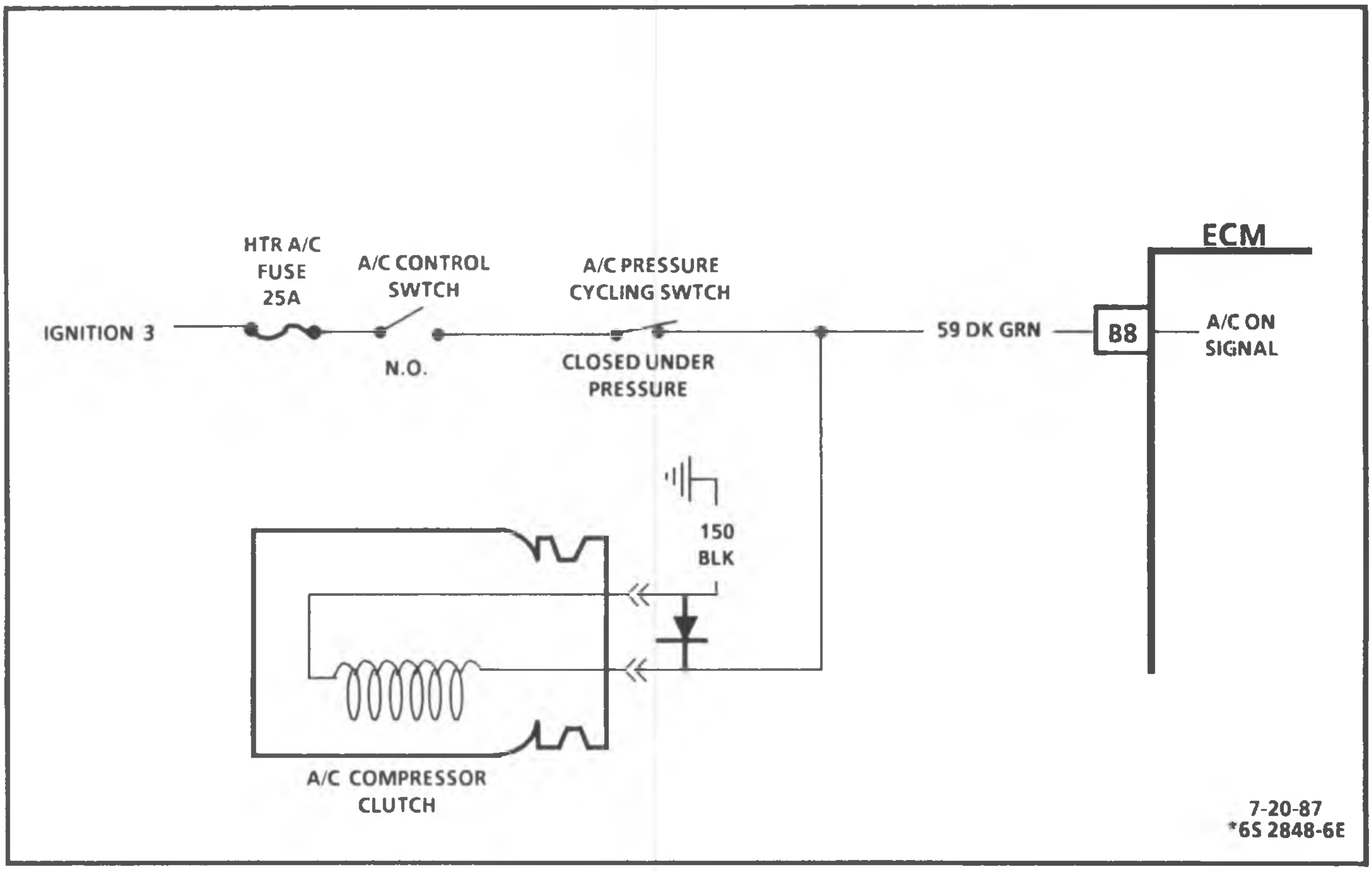
(Page2 of 2)

2.8L ENGINE & 4.3L (S/T) AUTOMATIC



"*AFTER REPAIRS,*" CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

2-2-90
7S 3851-6E



A/C "ON" SIGNAL DIAGNOSIS

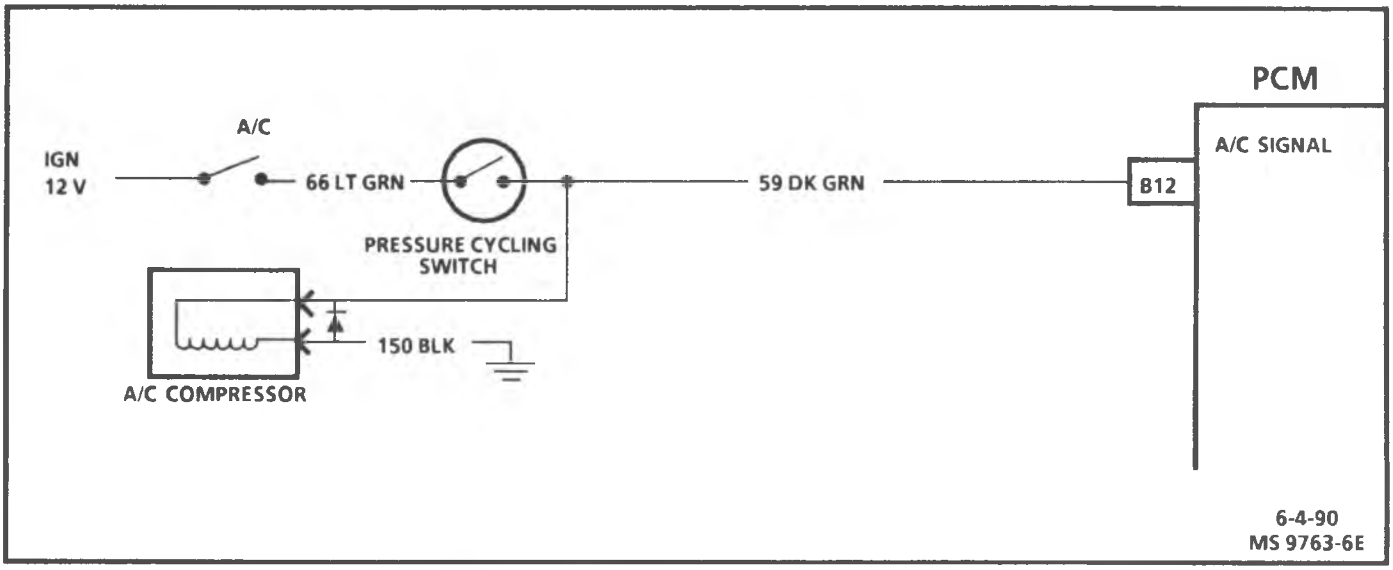
4.3L (S/T) MANUAL TRANSMISSION, 4.3L & V8 ENGINE EXCEPT WITH 4L80-E TRANSMISSION

Circuit And Test Description:

Turning "ON" the air conditioning supplies CKT 59 battery voltage to the A/C compressor clutch and to terminal "B8" of the ECM connector to increase and maintain idle speed.

The ECM does not control the A/C compressor clutch, therefore, if A/C does not function, refer to the A/C section of the service manual for diagnosis of the system.

If A/C is operating properly and idle speed dips too low when the A/C compressor turns "ON" or flares too high when the A/C compressor turns "OFF," check for an open CKT 59 to the ECM. If circuits are OK, it is a faulty ECM connector terminal "B8" or ECM.



A/C "ON" SIGNAL DIAGNOSIS

ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit and Test Description:

Turning "ON" the air conditioning supplies CKT 59 battery voltage to the A/C compressor clutch and to terminal "B8" of the PCM connector to increase and maintain idle speed.

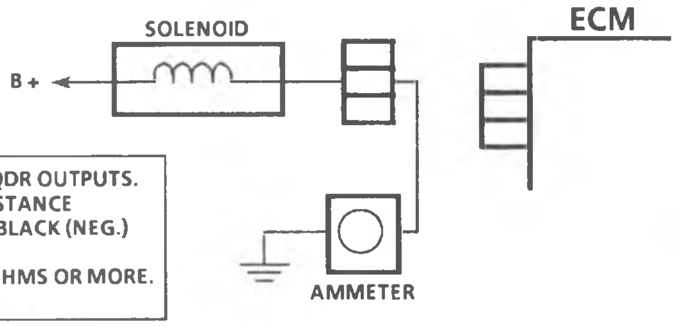
The PCM does not control the A/C compressor clutch, therefore, if A/C does not function, refer to the A/C section of the service manual for diagnosis of the system.

If A/C is operating properly and idle speed dips too low when the A/C compressor turns "ON" or flares too high when the A/C compressor turns "OFF," check for an open CKT 59 to the PCM. If circuits are OK, it is a faulty PCM connector terminal "B8" or PCM.

ECM QDR CHECK PROCEDURE

V6 OR V8 ENGINE EXCEPT WITH 4L80-E TRANSMISSION

USE THIS CHECK PROCEDURE ONLY AFTER OTHER DIAGNOSTIC CHARTS IN THE SERVICE MANUAL HAVE DETERMINED THAT THERE WAS AN ECM FAILURE.



- REMOVE THE ECM FROM THE VEHICLE.

- REFER TO LIST BELOW OF THE ECM TERMINALS WHICH ARE QDR OUTPUTS.
- USING THE 100/200 K OHM SCALE ON DVM*, MEASURE RESISTANCE BETWEEN THE ECM CASE AND EACH ECM TERMINAL LISTED, BLACK (NEG.) LEAD TO CASE AND RED (POS.) LEAD TO ECM TERMINAL.
- ALL TERMINALS LISTED SHOULD HAVE RESISTANCE OF 50K OHMS OR MORE. DO THEY?

NO

THE PRIOR TEST HAS DETERMINED THAT A QDR IN THE ECM HAS BEEN DAMAGED. IT IS MOST IMPORTANT TO LOCATE AND REPAIR THE CIRCUIT OR COMPONENT THAT CAUSED THE DAMAGE. FAILURE TO DO SO WILL RESULT IN ANOTHER FAILURE OF THE NEWLY REPLACED ECM.
ANY TERMINAL WITH LESS THAN 50K OHMS RESISTANCE IS CONNECTED TO A DEFECTIVE QDR. THE ECM TERMINAL WITH THE LOWEST RESISTANCE WAS CONNECTED TO THE VEHICLE CIRCUIT MOST LIKELY TO HAVE CAUSED THE QDR FAILURE.

- DISCONNECT THE COMPONENT IN THAT VEHICLE CIRCUIT AND CHECK FOR A SHORT TO VOLTAGE. IF THE CIRCUIT IS NOT SHORTED TO VOLTAGE, REPLACE THE COMPONENT IN THAT CIRCUIT AND THE ECM.

YES

- KEY "ON," ENGINE NOT RUNNING.
- USE A FUSED AMMETER CAPABLE OF MEASURING AT LEAST 2 AMPS (J 34029-A OR EQUIVALENT).
- CONNECT ONE LEAD OF THE AMMETER TO CHASSIS GROUND.
- CONNECT THE REMAINING LEAD TO EACH VEHICLE CIRCUIT WHICH WAS LISTED ABOVE.
- MEASURE SUSTAINED CURRENT FLOW THROUGH EACH CIRCUIT FOR 2 MINUTES EACH (IN MOST CASES, THE TCC SOLENOID CANNOT BE EASILY TESTED FOR CURRENT DRAW).
- NOTE AMPERAGE.

IF A CIRCUIT(S) HAS MORE THAN 0.75 AMPS CURRENT DRAW.

- CHECK FOR A SHORT TO VOLTAGE IN EXCESSIVE CURRENT DRAW CIRCUIT.
- IF NO SHORT TO VOLTAGE, REPLACE RELATED SOLENOID OR RELAY.

IF NO CIRCUIT HAS MORE THAN 0.75 AMPS CURRENT DRAW.

- REPLACE ECM.

V6 or V8

QDR NUMBER	ECM OUTPUT TERMINAL	CIRCUIT
1	A2	A/C RELAY
	A3	NOT USED
	C1	NOT USED
	C2	EAC SOLENOID
2	A4	EGR OR EVRV SOLENOID
	A5	SES LIGHT
	A7	TCC SOLENOID OR SHIFT LIGHT

2.5L

QDR NUMBER	ECM OUTPUT TERMINAL	CIRCUIT
1	A5	SES LIGHT
	A4	AC
	A2	T.C.C. OR SHIFT LIGHT
	C1	NOT USED
2	A3	EGR
	D12	NOT USED
	C2	NOT USED
	A7	NOT USED

* USE DVM J 34029-A OR EQUIVALENT

7-15-90
8S 4335-6E

Figure 3-18 - ECM QDR Check Procedure (V6 or V8)

PCM QDR CHECK PROCEDURE

V6 OR V8 ENGINE WITH 4L80-E TRANSMISSION

USE THIS CHECK PROCEDURE ONLY AFTER OTHER DIAGNOSTIC CHARTS IN THE SERVICE MANUAL HAVE DETERMINED THAT THERE WAS AN ECM FAILURE.

- REMOVE THE PCM FROM THE VEHICLE.

- REFER TO LIST BELOW OF THE PCM TERMINALS WHICH ARE QDR OUTPUTS.
- USING THE 100/200 K OHM SCALE ON DVM*, MEASURE RESISTANCE BETWEEN THE PCM CASE AND EACH PCM TERMINAL LISTED, BLACK (NEGATIVE) LEAD TO CASE AND RED (POSITIVE) LEAD TO PCM TERMINAL.
- ALL TERMINALS LISTED SHOULD HAVE RESISTANCE OF 50K OHMS OR MORE.
- DO THEY?

NO

THE PRIOR TEST HAS DETERMINED THAT A QDR IN THE PCM HAS BEEN DAMAGED. IT IS MOST IMPORTANT TO LOCATE AND REPAIR THE CIRCUIT OR COMPONENT THAT CAUSED THE DAMAGE. FAILURE TO DO SO WILL RESULT IN ANOTHER FAILURE OF THE NEWLY REPLACED PCM. ANY TERMINAL WITH LESS THAN 50K OHMS RESISTANCE IS CONNECTED TO A DEFECTIVE QDR. THE PCM TERMINAL WITH THE LOWEST RESISTANCE WAS CONNECTED TO THE VEHICLE CIRCUIT MOST LIKELY TO HAVE CAUSED THE QDR FAILURE.

- DISCONNECT THE COMPONENT IN THAT VEHICLE CIRCUIT AND CHECK FOR A SHORT TO VOLTAGE. IF THE CIRCUIT IS NOT SHORTED TO VOLTAGE, REPLACE THE COMPONENT IN THAT CIRCUIT AND THE PCM.

YES

- KEY "ON," ENGINE NOT RUNNING.
- USE A FUSED AMMETER CAPABLE OF MEASURING AT LEAST 2 AMPS (J 34029-A OR EQUIVALENT).
- CONNECT ONE LEAD OF THE AMMETER TO CHASSIS GROUND.
- CONNECT THE REMAINING LEAD TO EACH VEHICLE CIRCUIT WHICH WAS LISTED ABOVE.
- MEASURE SUSTAINED CURRENT FLOW THROUGH EACH CIRCUIT FOR 2 MINUTES EACH (IN MOST CASES, THE TCC SOLENOID CANNOT BE EASILY TESTED FOR CURRENT DRAW).
- NOTE AMPERAGE.

IF A CIRCUIT(S) HAS MORE THAN 0.75 AMPS CURRENT DRAW.

- CHECK FOR A SHORT TO VOLTAGE IN EXCESSIVE CURRENT DRAW CIRCUIT.
- IF NO SHORT TO VOLTAGE, REPLACE RELATED SOLENOID OR RELAY.

IF NO CIRCUIT HAS MORE THAN 0.75 AMPS CURRENT DRAW.

- REPLACE PCM.

ALL VEHICLES WITH 4L80-E TRANSMISSION

QDM NUMBER	PCM OUTPUT TERMINAL	CIRCUIT
1	A4	TCC
	A3	SHIFT SOLENOID A
	A2	SHIFT SOLENOID B
2	A7	CHECK ENGINE LIGHT
3	A11	EGR OR EVRV SOLENOID

* USE DVM J 34029-A OR EQUIVALENT

7-16-90
MS 9952-6E

Figure 3-19 - PCM QDR Check Procedure (V6 or V8)

ON-VEHICLE SERVICE

WIRE HARNESS

The ECM/PCM harness electrically connects the ECM/PCM to the various solenoids, switches, and sensors in vehicle engine and passenger compartment.

Wire harnesses should be replaced with proper part number harnesses. When signal wires are spliced, into a harness, use wire with high temperature insulation only.

With the low current and voltage levels found in the system, it is important that the best possible bond at all wire splices be made by soldering the splices, as shown in Figure 3-20.

Molded on connectors require complete replacement of the connector. This means splicing a new connector assembly into the harness.

Refer to Figures 3-20 for wiring diagrams.

Replacement connectors and terminals are listed in Group 8.965, of the Standard Parts Catalog.

CONNECTORS AND TERMINALS

Use care, when probing a connector or replacing terminals in them. It is possible to short between opposite terminals. If this happens, to the wrong terminal pair, it is possible to damage certain components. Always use jumper wires between connectors, for circuit checking. NEVER probe through the Weather-Pack seals. Use tachometer adapter J 35812, or equivalent, which provides an easy hook up of the tach. lead. The connector test adapter kit J 35616, or equivalent, contains an assortment of flexible connectors, used to probe terminals during diagnosis. Fuse remover and test tool BT 8616, or equivalent, is used for removing a fuse and to adapt fuse holder, with a meter, for diagnosis.

When diagnosing, open circuits are often difficult to locate by sight, because oxidation, or terminal mis-alignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may correct the open circuit condition. This should always be considered, when an open circuit, or failed sensor is indicated. Intermittent problems may, also, be caused by oxidized or loose connections.

Before making a connector repair, be certain of the type of connector. Weather-Pack and Compact Three connectors look similar, but are serviced differently.

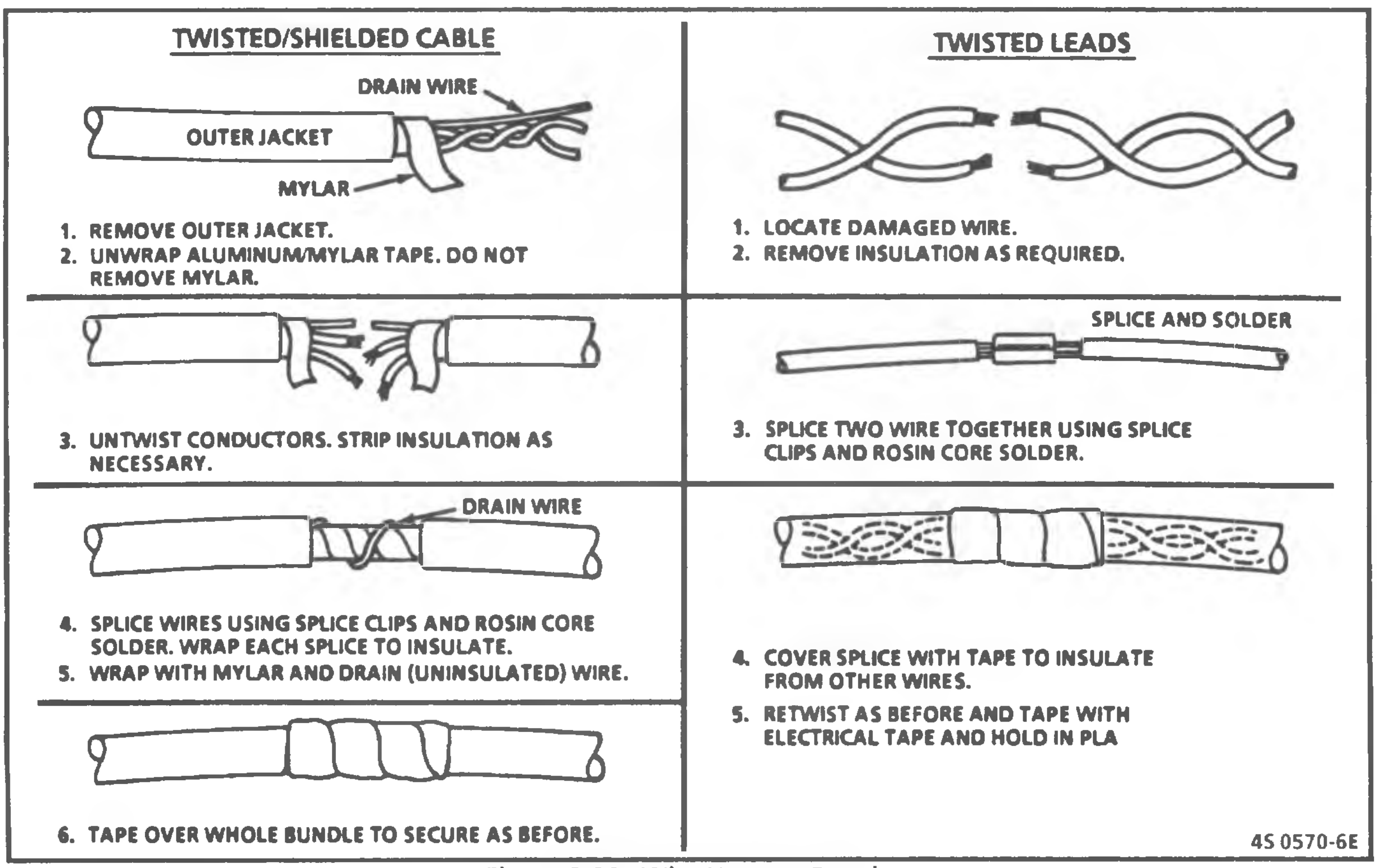


Figure 3-20 - Wire Harness Repair

Micro-Pack

Refer to Figure 3-21 and repair procedure for replacement of a Micro-Pack terminal.

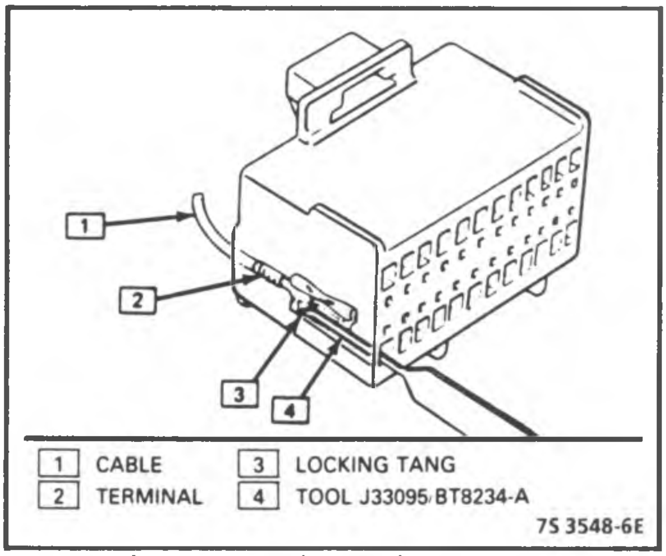


Figure 3-21 - Micro-Pack Connector

Metri-Pack

Some connectors use terminals called Metri-Pack Series 150. (Figure 3-22). These may be used at the coolant sensor, as well as TBI units.

They are also called "Pull-To-Seat" terminals, because, to install a terminal on a wire, the wire is first inserted through the seal (5) and connector (4). The terminal is then crimped on the wire and the terminal pulled back into the connector to seat it in place.

To remove a terminal:

1. Slide the seal back on the wire.
2. Insert tool (3) BT-8518, or J 35689, or equivalent, as shown in insert "A" and "B," to release the terminal locking tab (2).
3. Push the wire and terminal out through the connector.

If reusing the terminal, reshape the locking tang (2).

Weather-Pack

A Weather-Pack connector can be identified by a rubber seal, at the rear of the connector. This connector, which is used in the engine compartment, protects against moisture and dirt, which could create oxidation and deposits on the terminals. This protection is important, because of the very low voltage and current levels found in the electronic system.

Repair of a Weather-Pack terminal is shown in Figure 3-23. Use tool J M28742, or BT8234-A to remove the pin and sleeve terminals.

If removal is attempted with an ordinary pick, there is a good chance that the terminal will be bent, or deformed. Unlike standard blade type terminals, these terminals cannot be straightened once they are bent.

Make certain that the connectors are properly seated and all of the sealing rings in place, when connecting leads. The hinge type flap provides a backup, or secondary locking feature for the connector. They are used to improve the connector reliability by retaining the terminals, if the small terminal lock tangs are not positioned properly.

Weather-Pack connections cannot be replaced with standard connections. Instructions are provided with Weather-Pack connector and terminal packages.

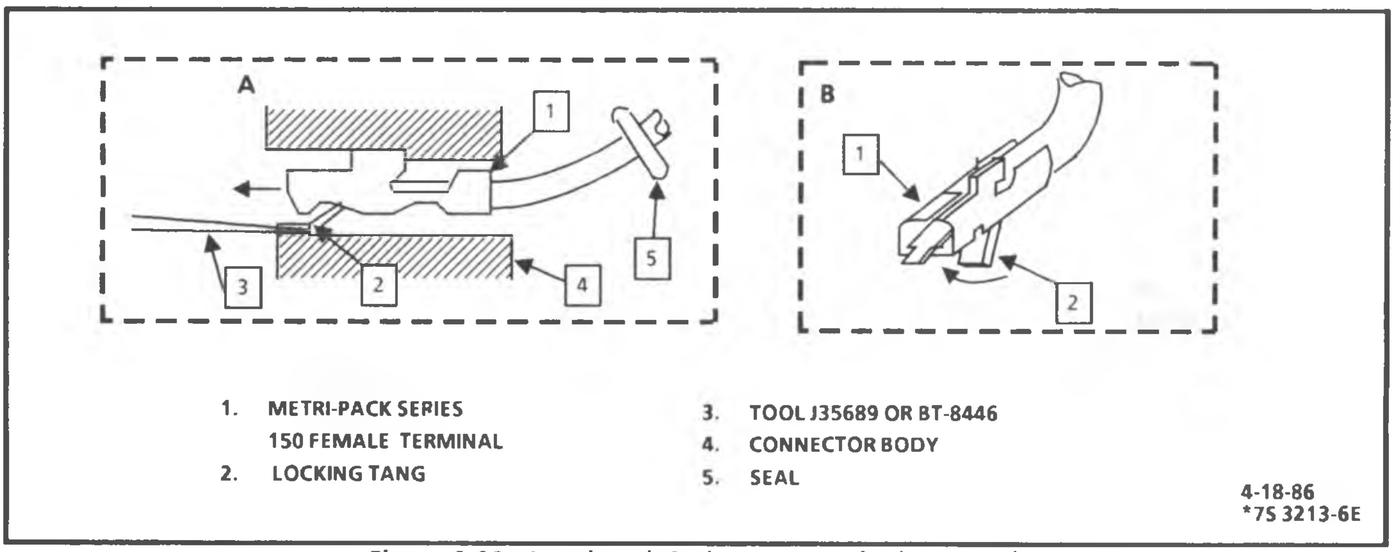


Figure 3-22 - Metri-Pack Series 150 Terminal Removal

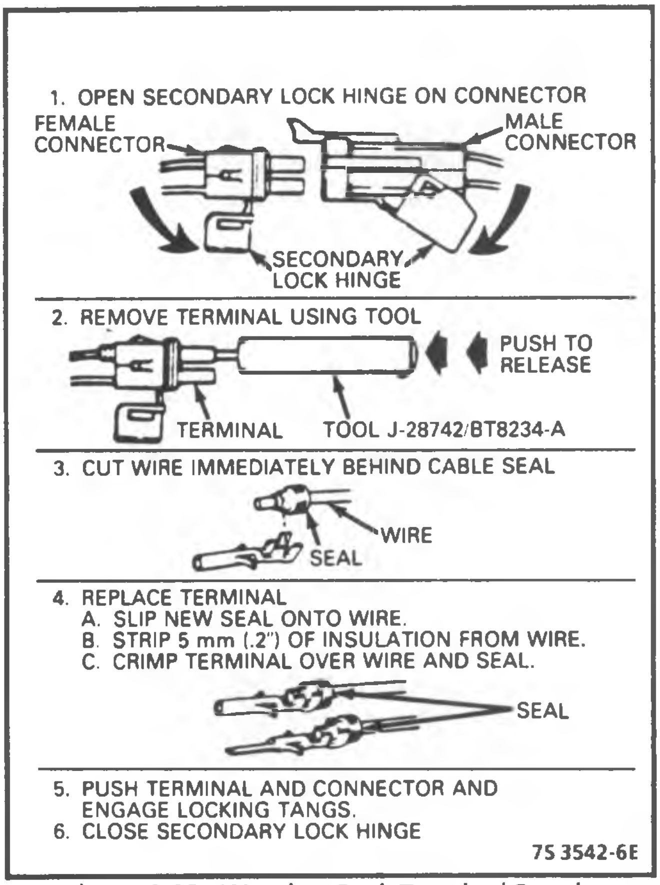


Figure 3-23 - Weather-Pack Terminal Repair

Compact Three

The Compact Three connector, which looks similar to a Weather-Pack connector, is not sealed and is used where resistance to the environment is not required. This type of connector, most likely, is used at the air control solenoid. Use the standard method, when repairing a terminal. Do not use the Weather-Pack terminal tool J 28742, or BT-8234-A, as these will damage the terminals.

ELECTRONIC/POWERTRAIN CONTROL MODULE

Replacement of the Electronic/Powertrain Control Module (ECM/PCM) consists of a service controller, without a PROM/CAL-PAK, or MEM-CAL.

If the diagnostic procedures require the ECM/PCM to be replaced, the ECM/PCM, PROM, CAL-PAK, and MEM-CAL should be checked for the correct part number. If they are correct, remove the PROM and CAL-PAK, or MEM-CAL, and install them in the service controller. The service controller will not contain a PROM/CAL-PAK, or MEM-CAL.

Important

- When replacing a production ECM/PCM with a service controller, transfer the broadcast code and production ECM/PCM part number to the controller label. Do not record information on the access cover

NOTICE: The ignition must be "OFF," when disconnecting or reconnecting the ECM/PCM connector, to prevent internal damage to the ECM/PCM.

NOTICE: To prevent possible Electrostatic Discharge damage to the ECM/PCM, Do Not touch the connector pins or soldered components on the circuit board.

ECM/PCM Connector Terminal Voltages

Refer to Figure 3-60 through 3-73, for voltage charts to aid in diagnosis.

ECM/PCM Replacement - with MEM-CAL (2.5L) and Vehicles with 4L80-E Transmission *Figures 3-74, 3-76 and 3-77*

Remove or Disconnect

1. Negative battery cable.
2. Connectors from ECM/PCM.
3. ECM/PCM mounting hardware.
4. ECM/PCM from passenger compartment.
5. ECM/PCM access cover (Figure 3-3).
6. MEM-CAL removal (Figure 3-82).

Important

- Replacement ECM/PCM is supplied without a MEM-CAL, so care should be used when removing it from the defective ECM/PCM, because it will be reused in the new ECM/PCM.

Using two fingers, push both retaining clips back away from the MEM-CAL. At the same time, grasp it at both ends and lift it up out of the socket. Do not remove the cover of the MEM-CAL. Use of unapproved MEM-CAL removal methods may cause damage to the MEM-CAL or socket.

Inspect

Figure 3-77

- For alignment notches of the MEM-CAL and carefully set it aside. Do not open the MEM-CAL.

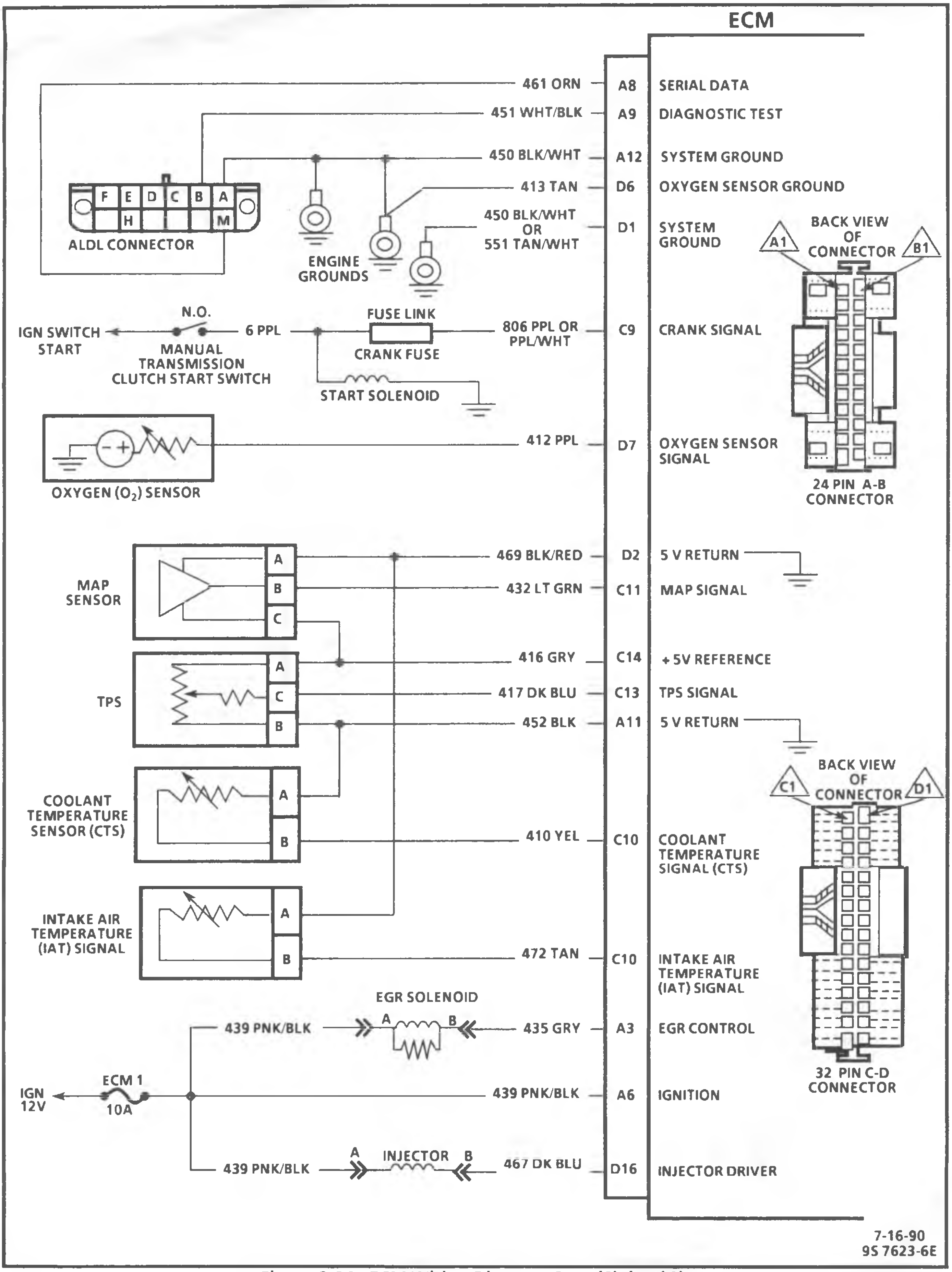


Figure 3-24 - ECM Wiring Diagram 2.5L (S) (1 of 3)

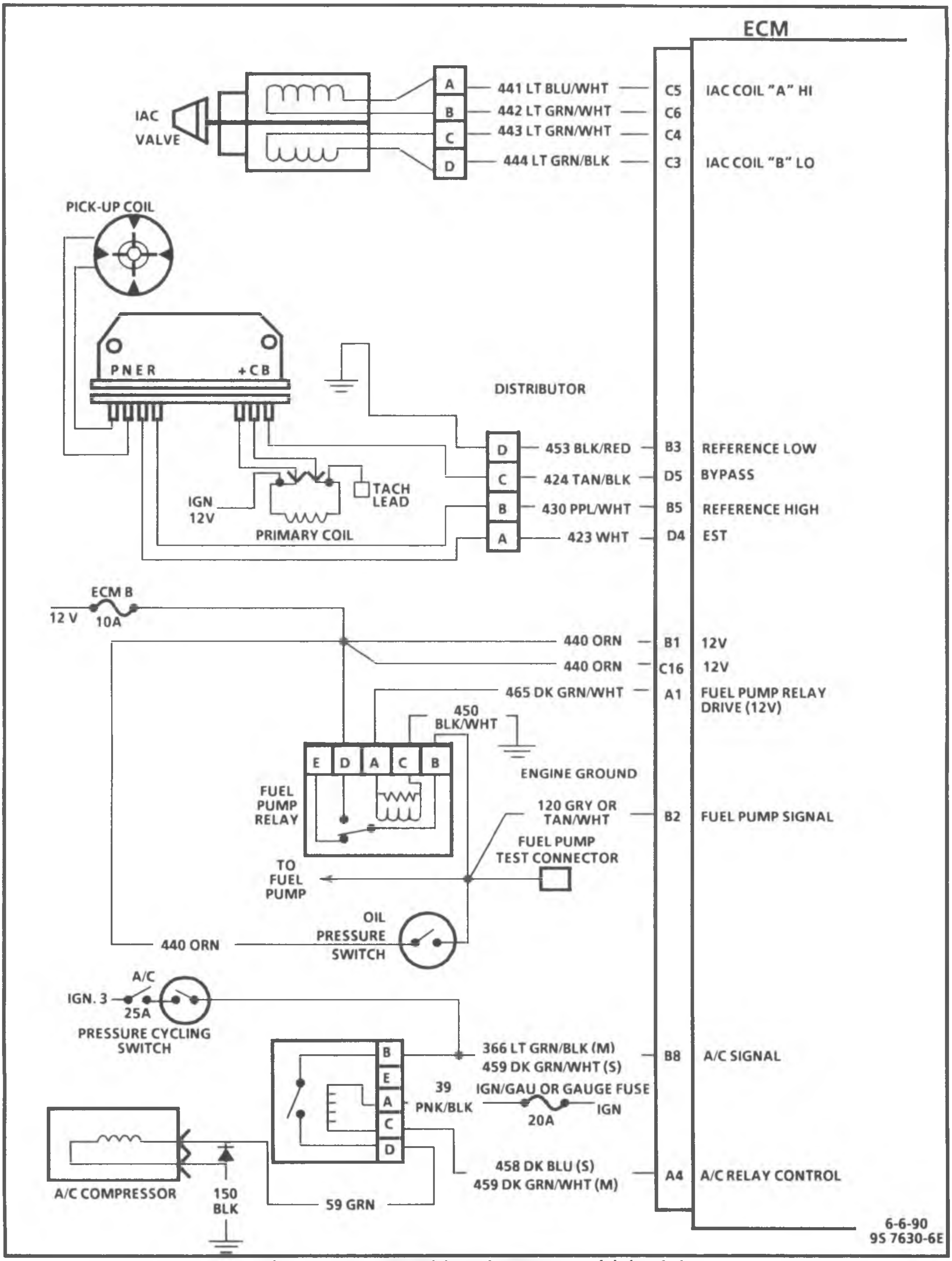


Figure 3-25 - ECM Wiring Diagram 2.5L (S) (2 of 3)

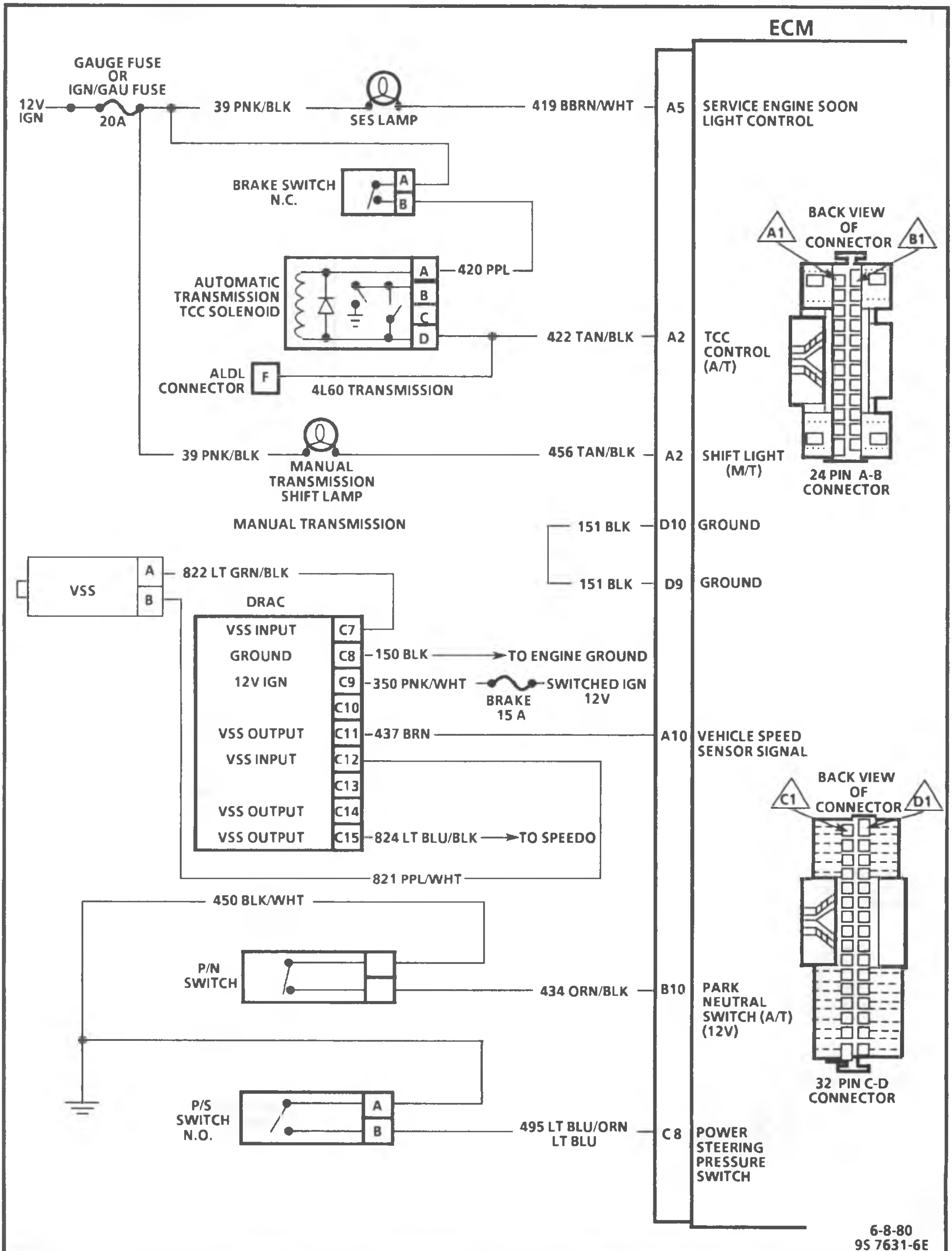


Figure 3-26 - ECM Wiring Diagram 2.5L (S) (3 of 3)

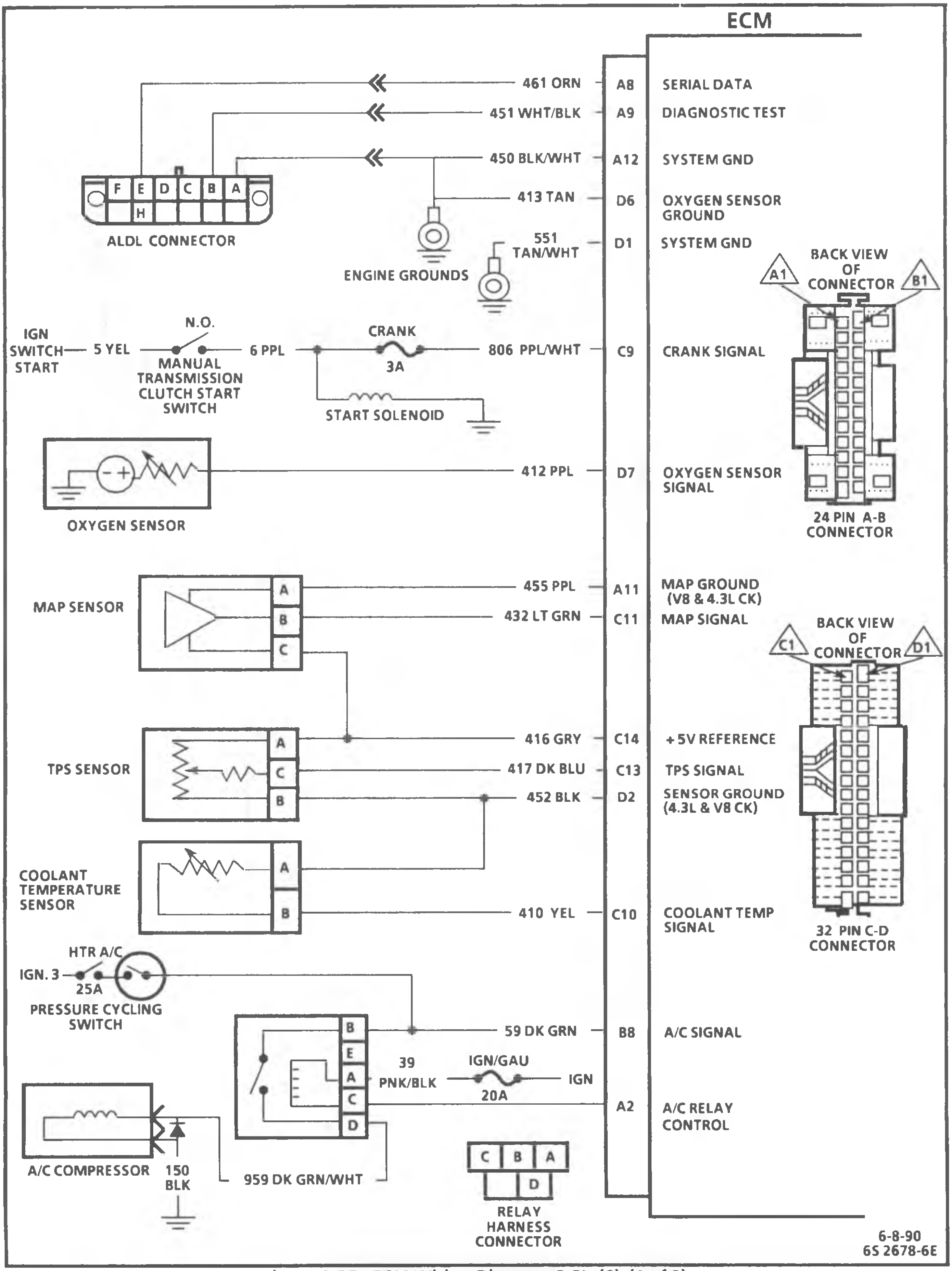


Figure 3-27 - ECM Wiring Diagram 2.8L (S) (1 of 3)

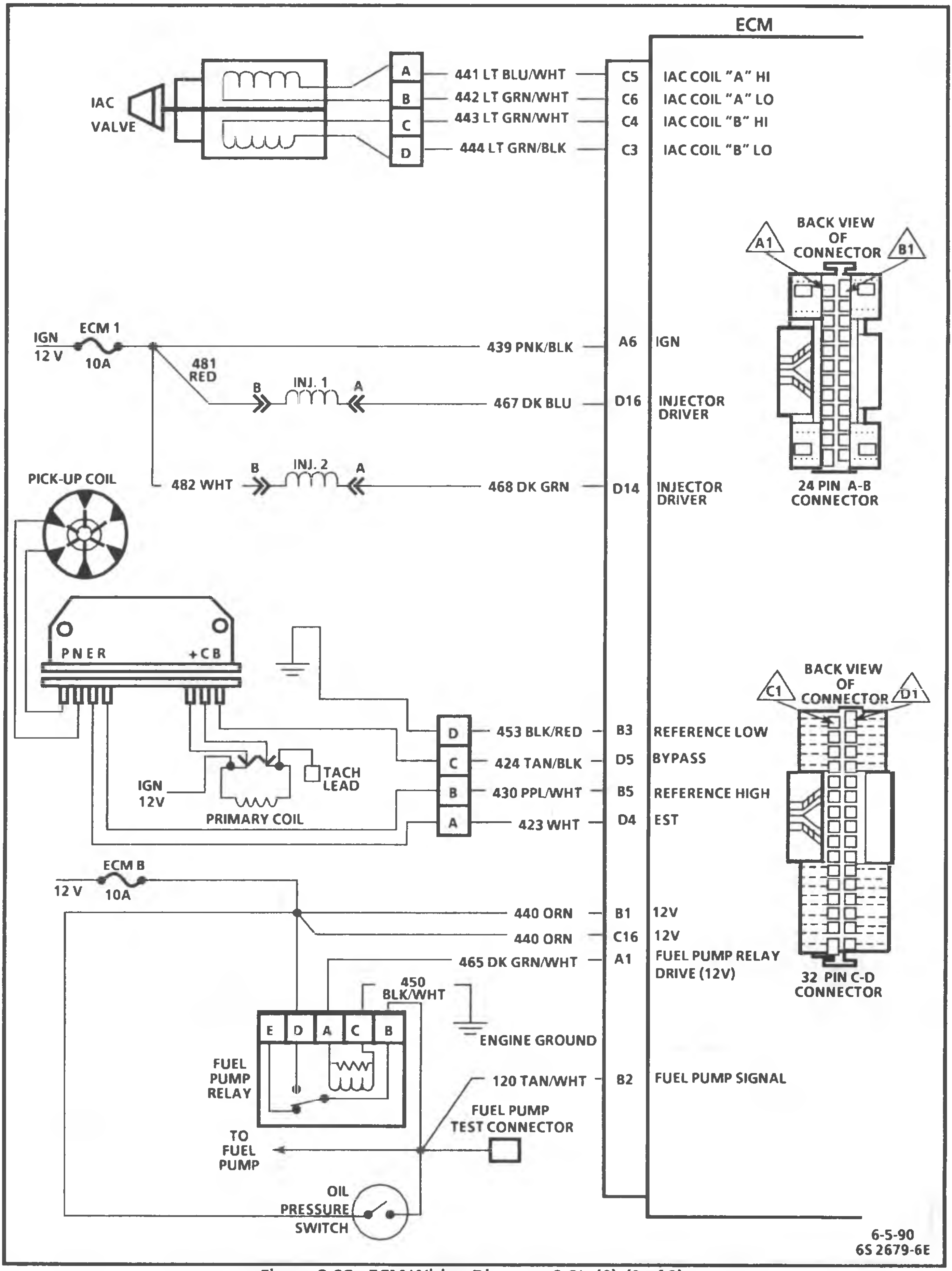


Figure 3-28 - ECM Wiring Diagram 2.8L (S) (2 of 3)

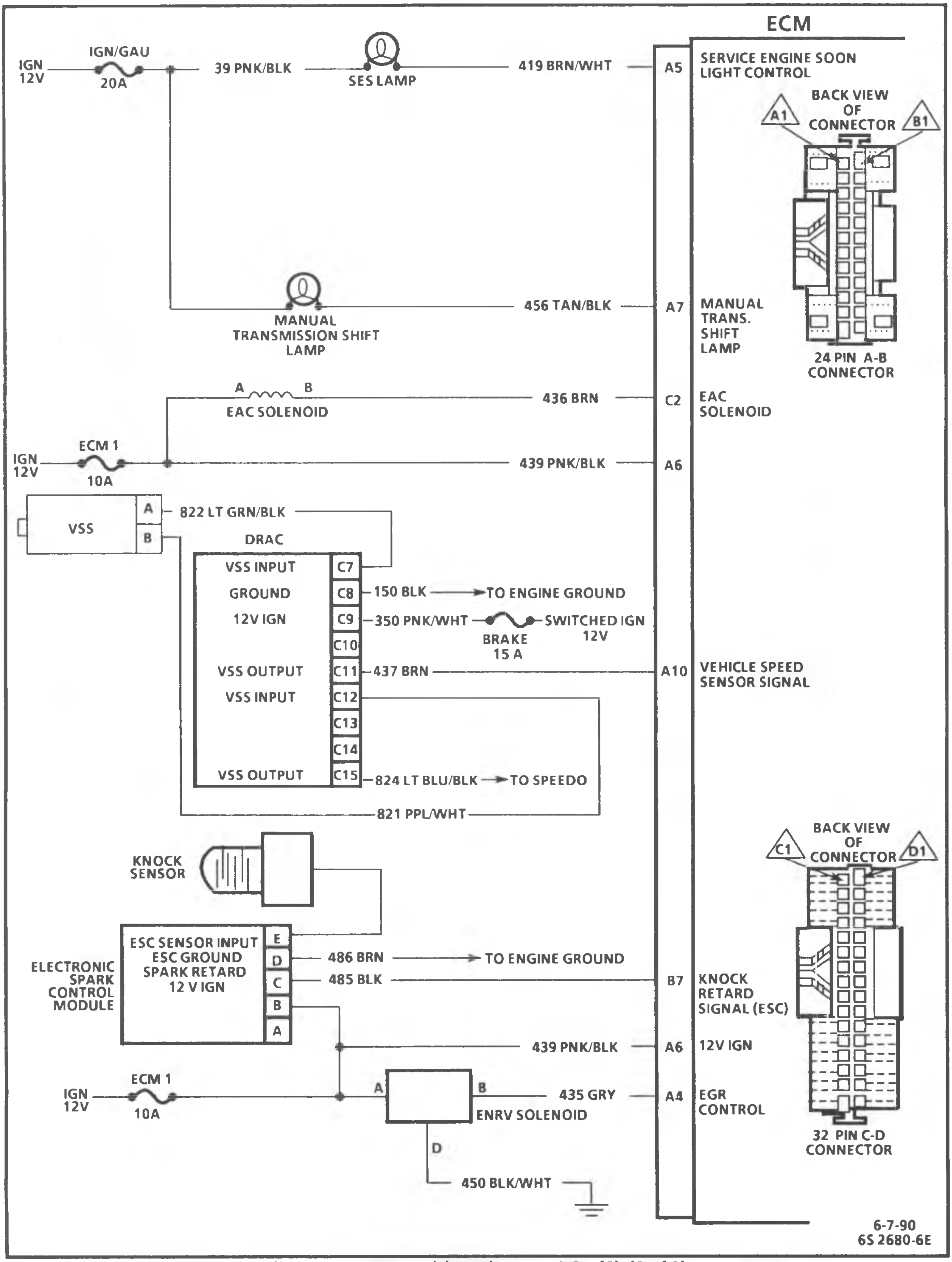


Figure 3-29 - ECM Wiring Diagram 2.8L (S) (3 of 3)

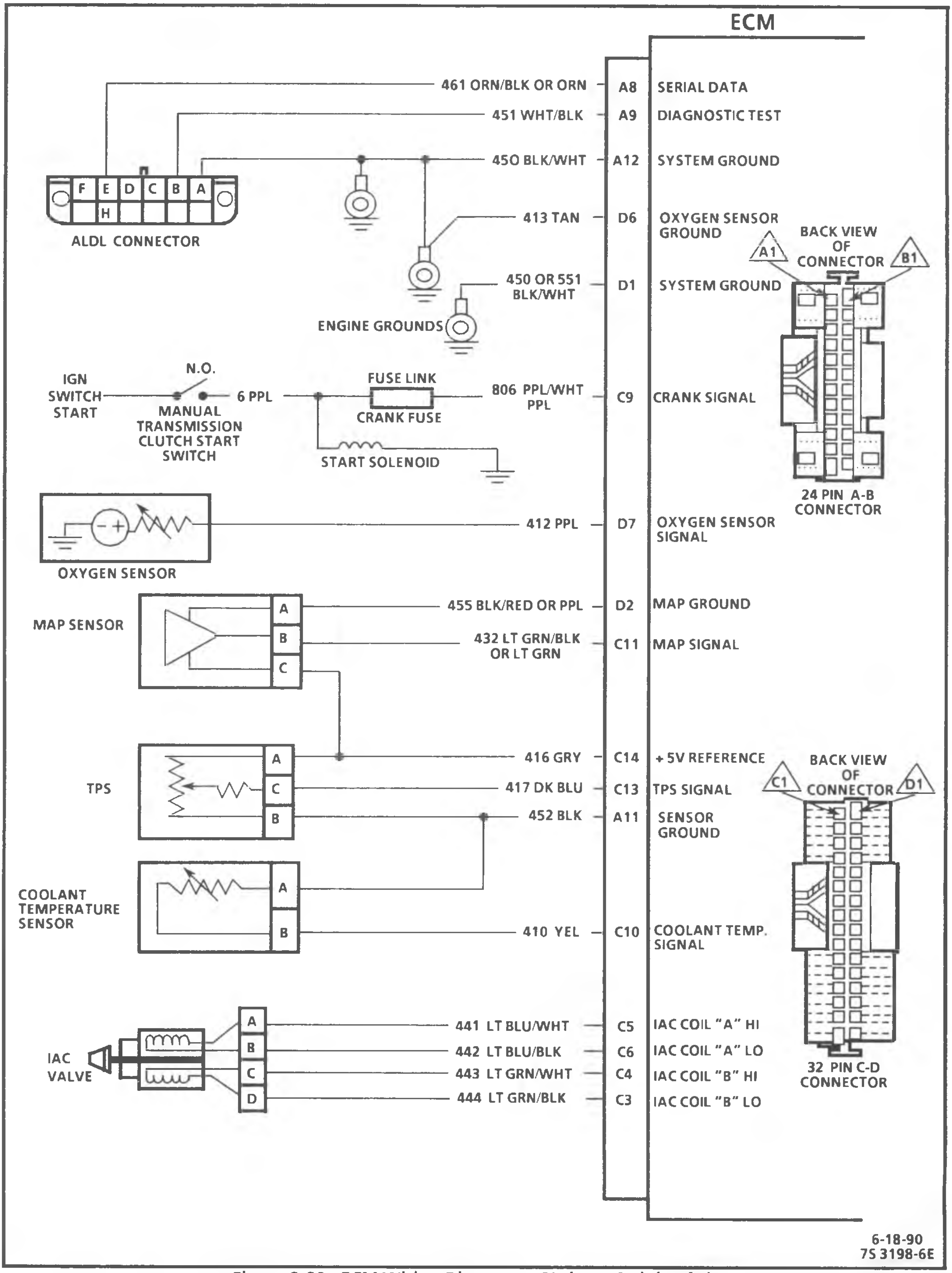


Figure 3-30 - ECM Wiring Diagram 4.3L (M/L, S/T) (1 of 4)

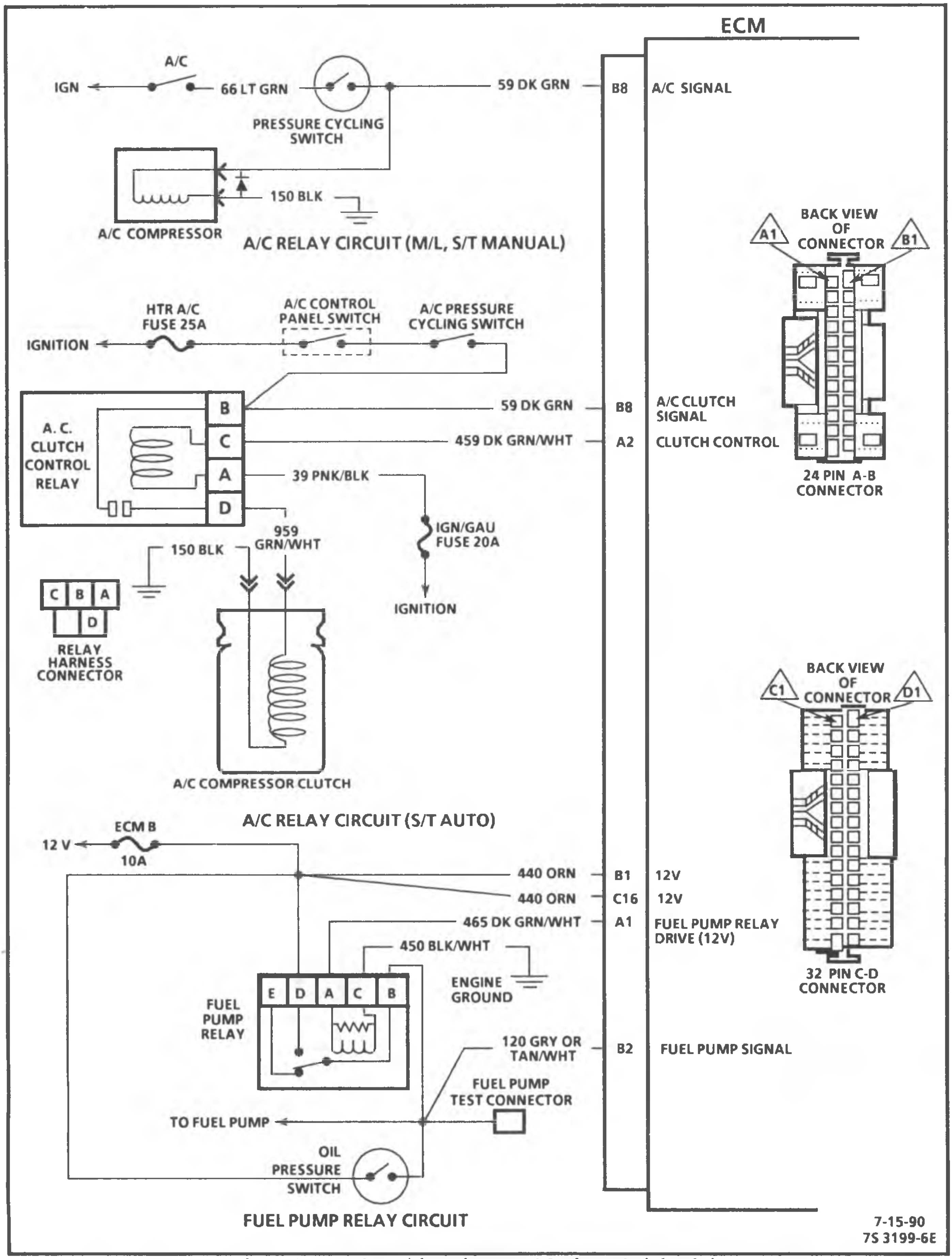


Figure 3-31 - ECM Wiring Diagram 4.3L (M/L, S/T) (2 of 4)

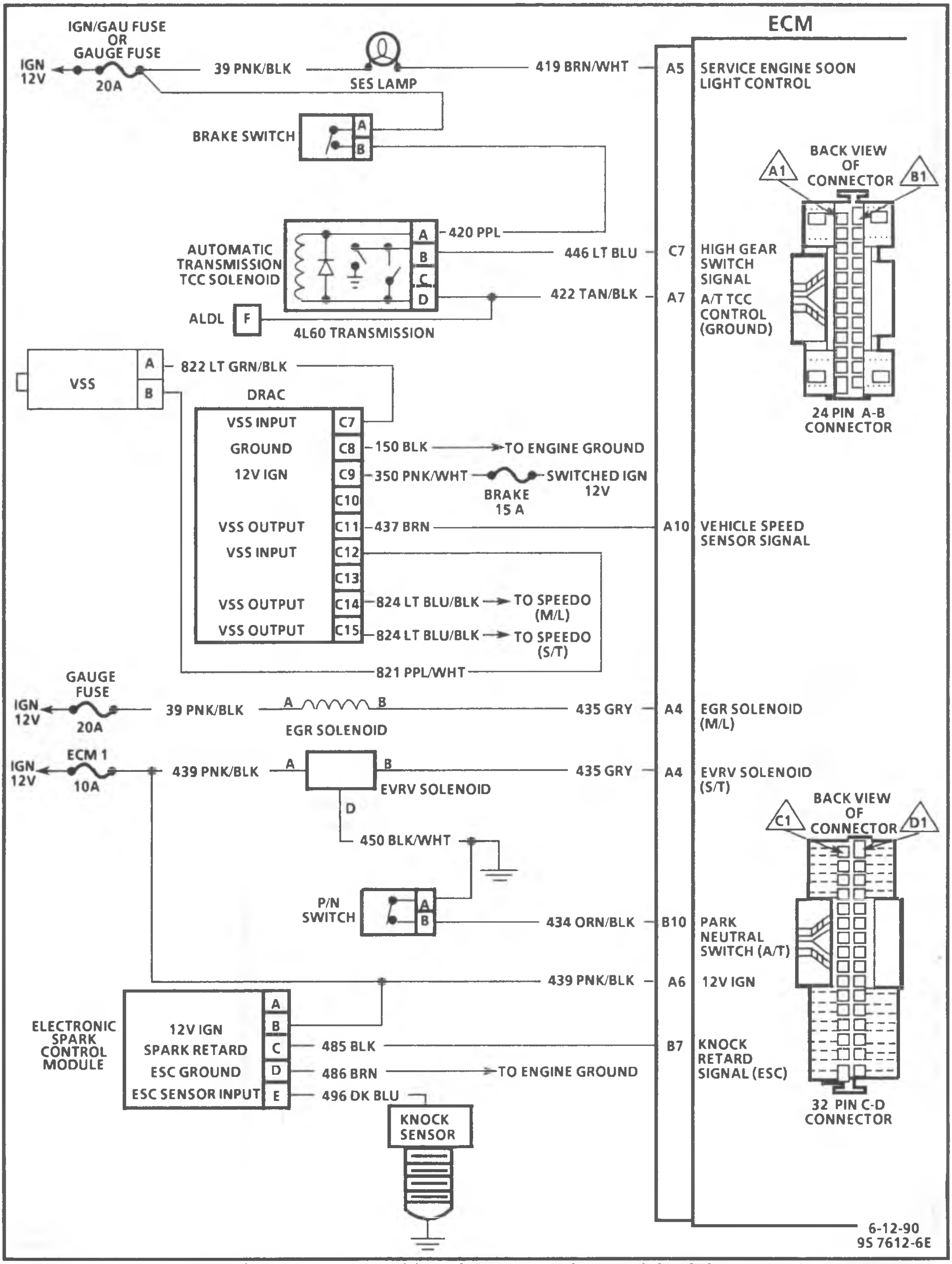


Figure 3-32 - ECM Wiring Diagram 4.3L (M/L, S/T) (3 of 4)

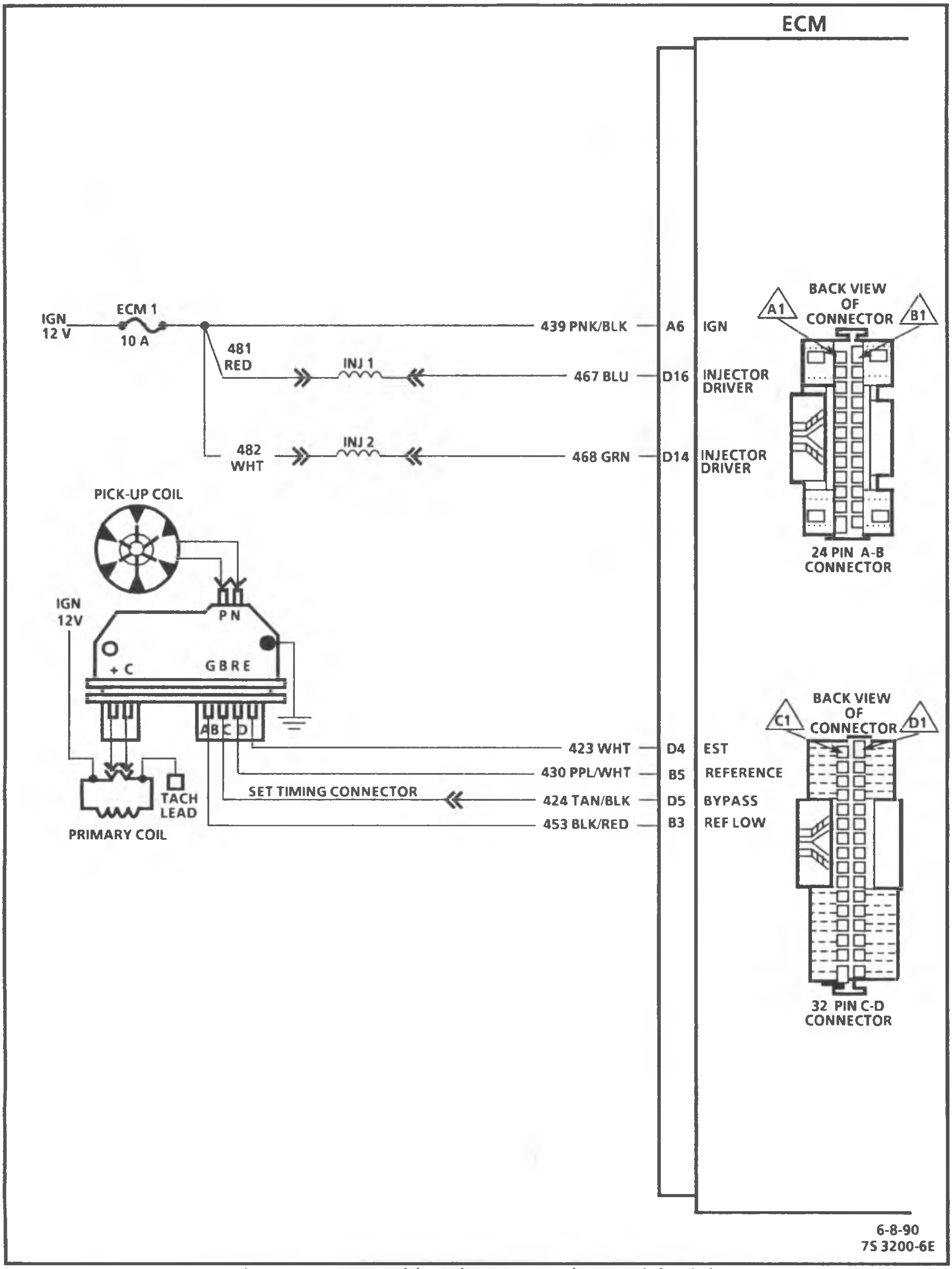


Figure 3-33 - ECM Wiring Diagram 4.3L (M/L, S/T) (4 of 4)

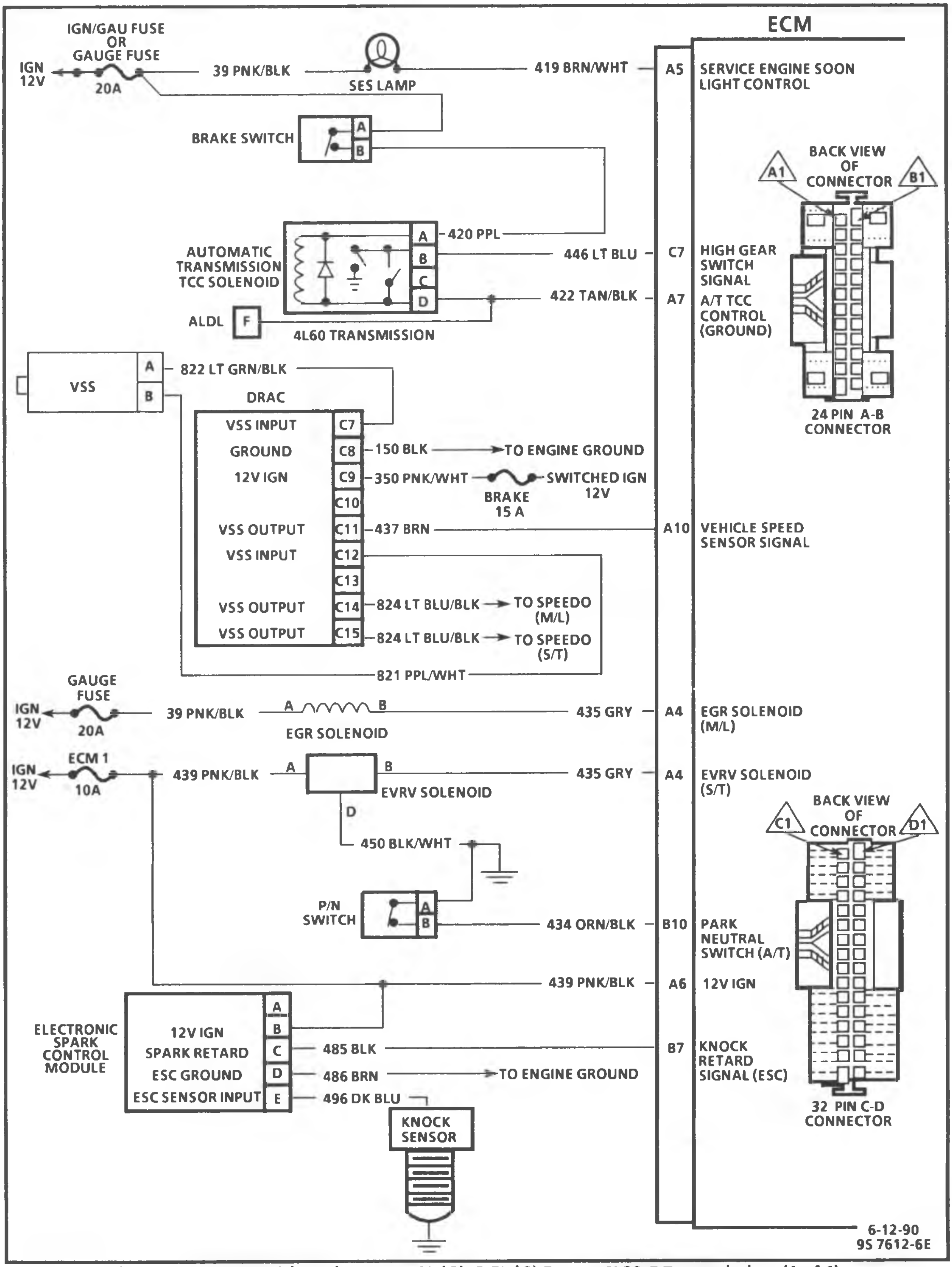


Figure 3-34 - ECM Wiring Diagram 4.3L (G), 5.7L (G) Except 4L80-E Transmission (1 of 4)

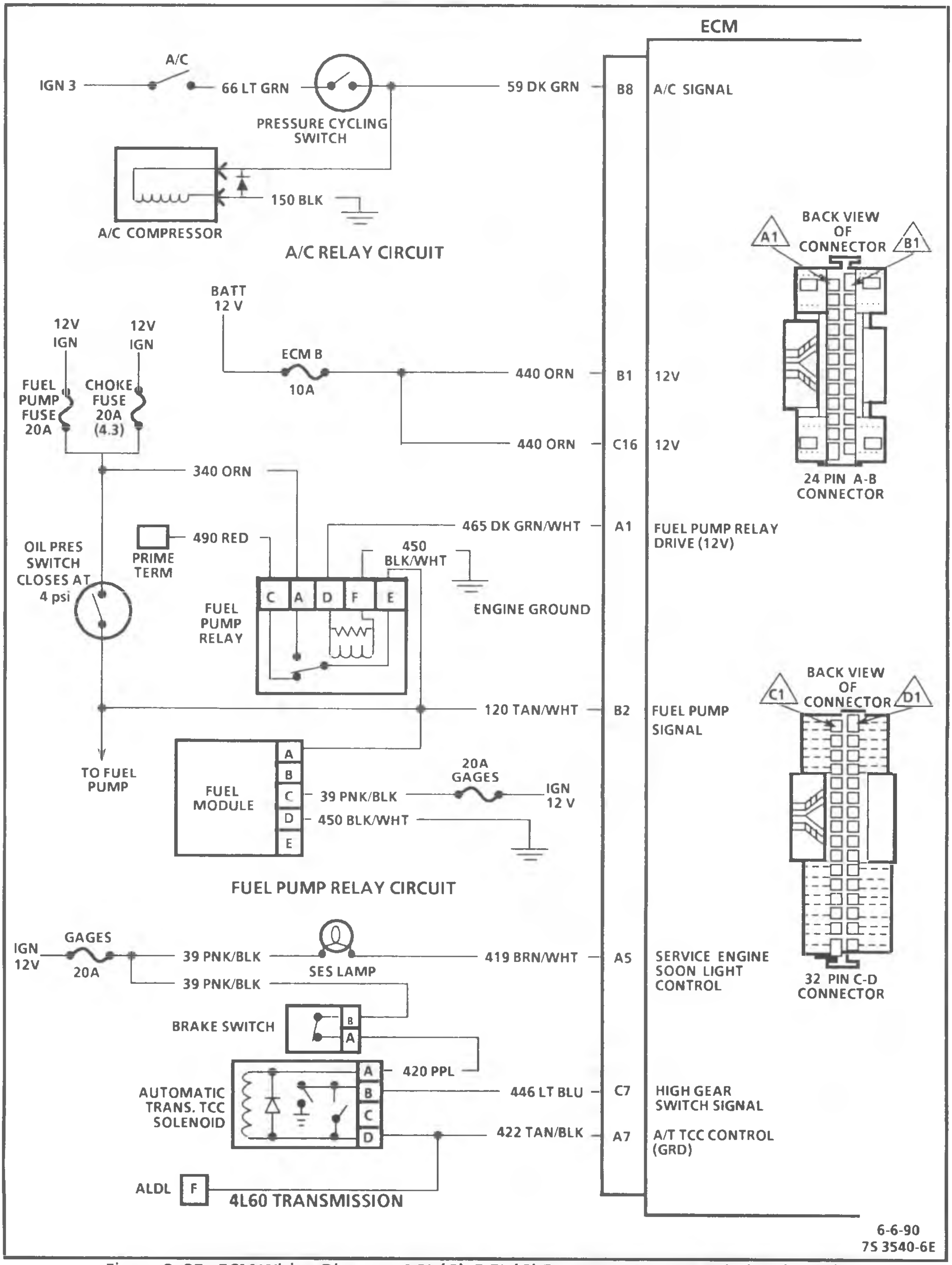


Figure 3 -35 - ECM Wiring Diagram 4.3L (G), 5.7L (G) Except 4L80-E Transmission (2 of 4)

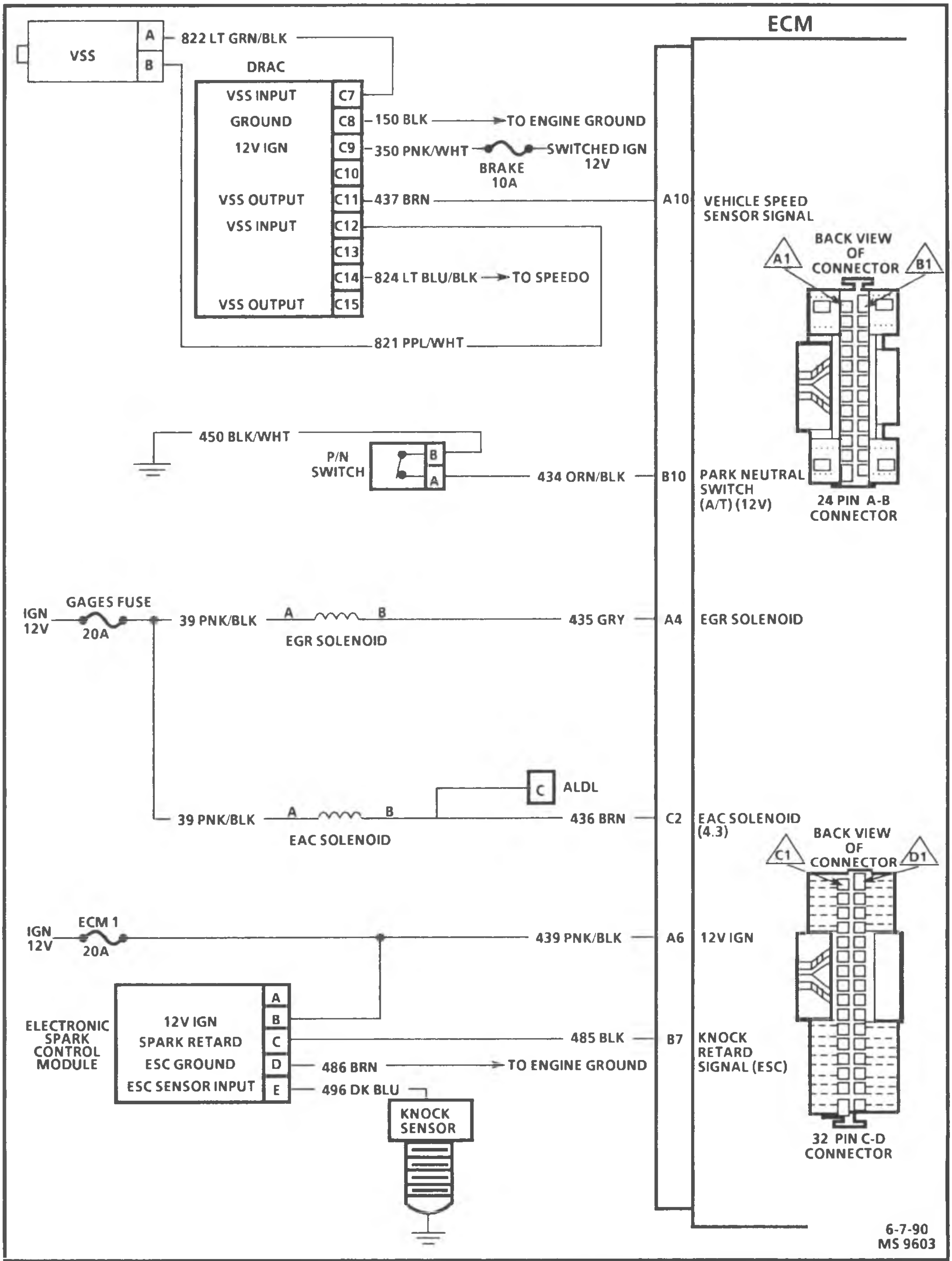


Figure 3-36 - ECM Wiring Diagram 4.3L (G), 5.7L (G) Except 4L80-E Transmission (3 of 4)

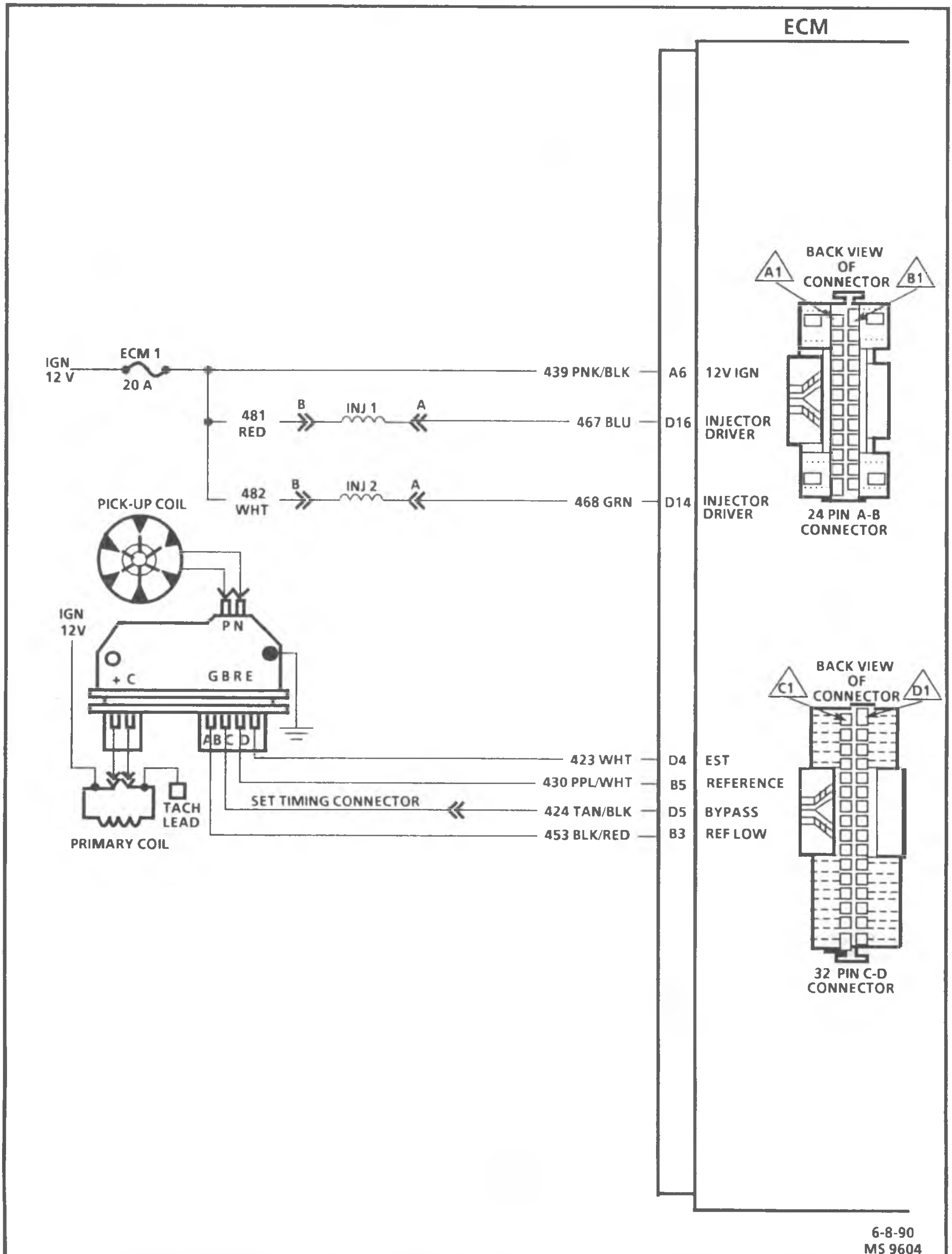


Figure 3-37 - ECM Wiring Diagram 4.3L (G), 5.7L (G) Except 4L80-E Transmission (4 of 4)

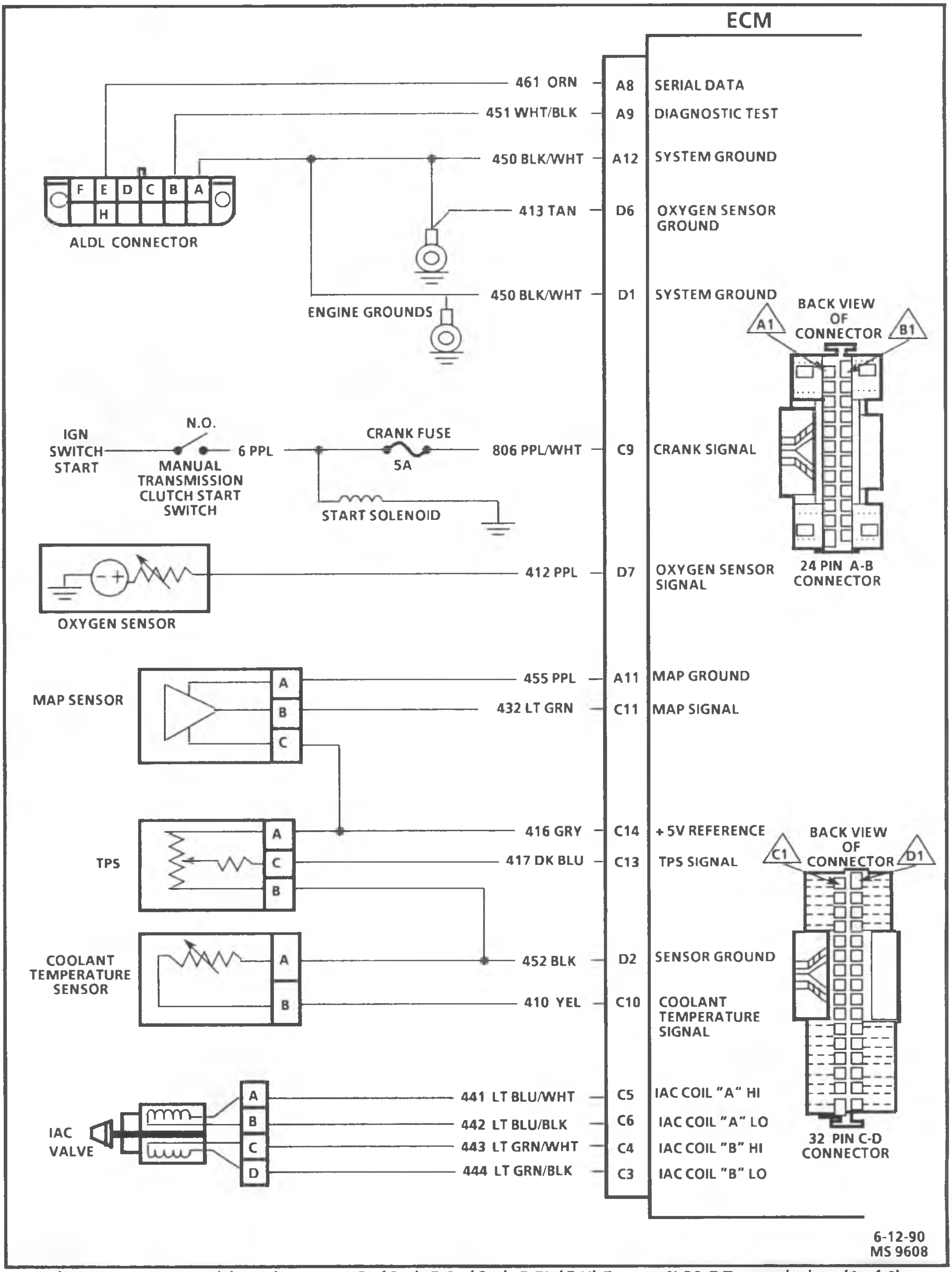


Figure 3-38 - ECM Wiring Diagram 4.3L (C/K), 5.0L (C/K), 5.7L (C/K) Except 4L80-E Transmission (1 of 4)

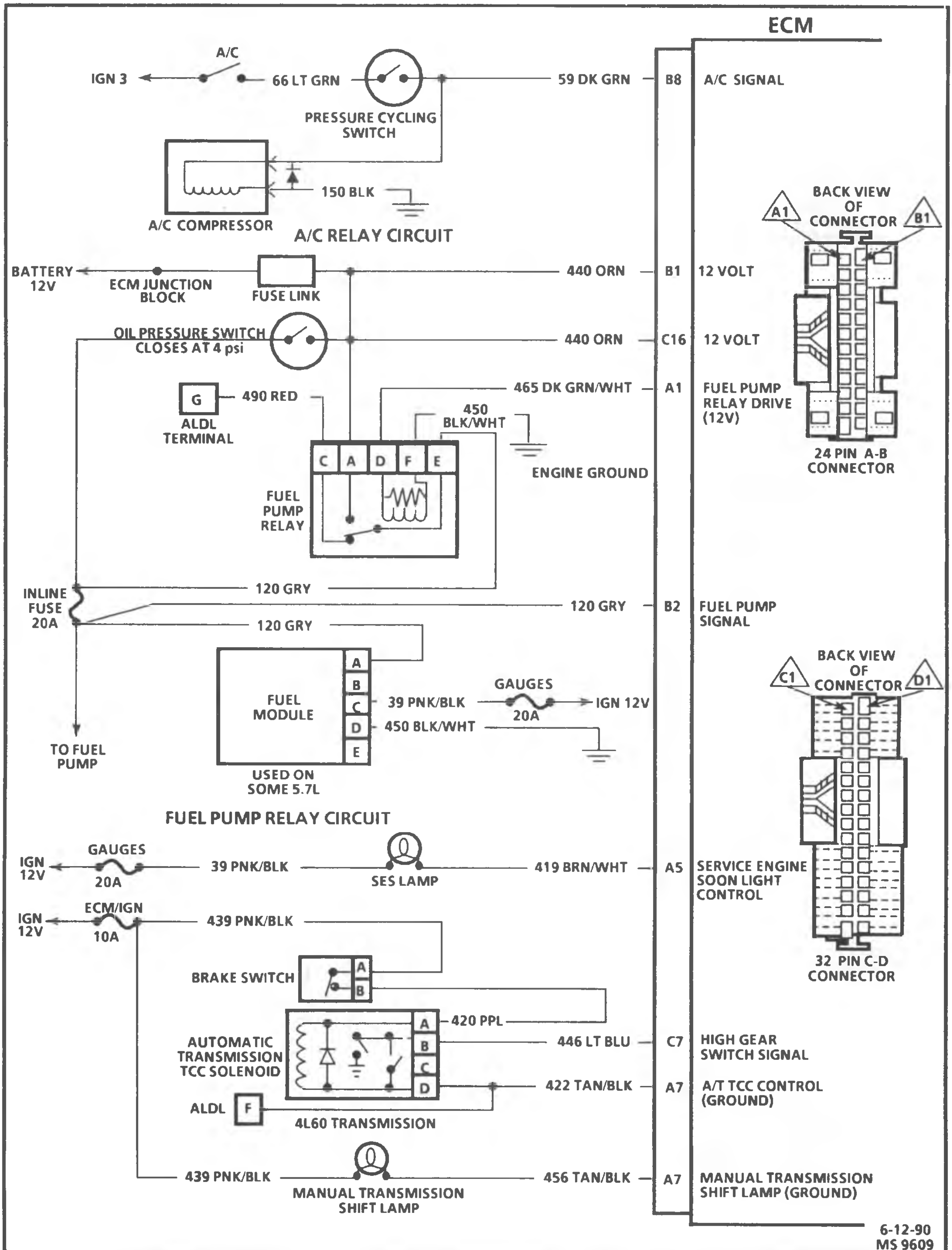


Figure 3-39 - ECM Wiring Diagram 4.3L (C/K), 5.0L (C/K), 5.7L (C/K) Except 4L80-E Transmission (2 of 4)

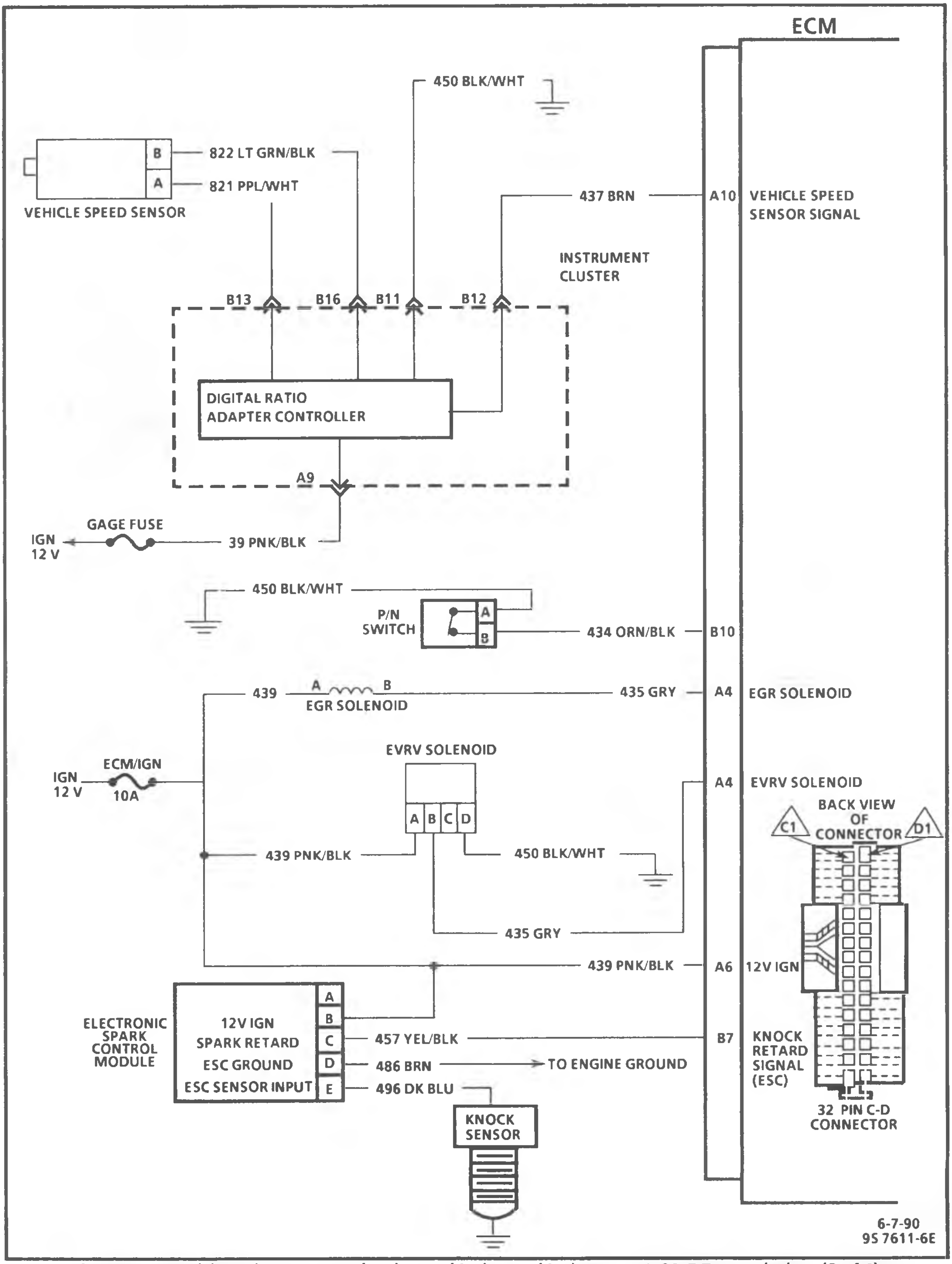


Figure 3-40 - Wiring Diagram 4.3L (C/K), 5.0L (C/K), 5.7L (C/K) Except 4L80-E Transmission (3 of 4)

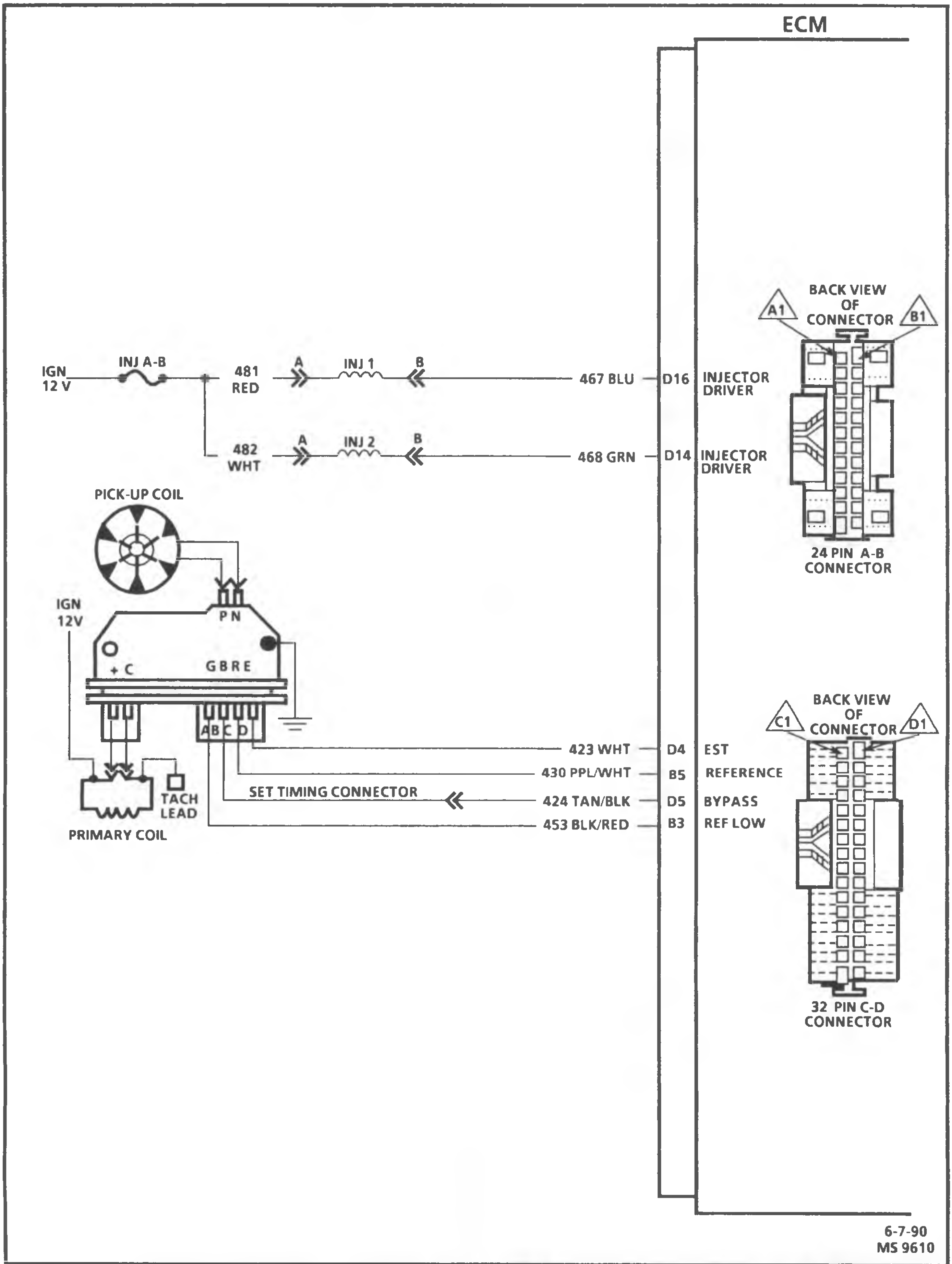


Figure 3-41 - ECM Wiring Diagram 4.3L (C/K), 5.0L (C/K), 5.7L (C/K) Except 4L80-E Transmission (4 of 4)

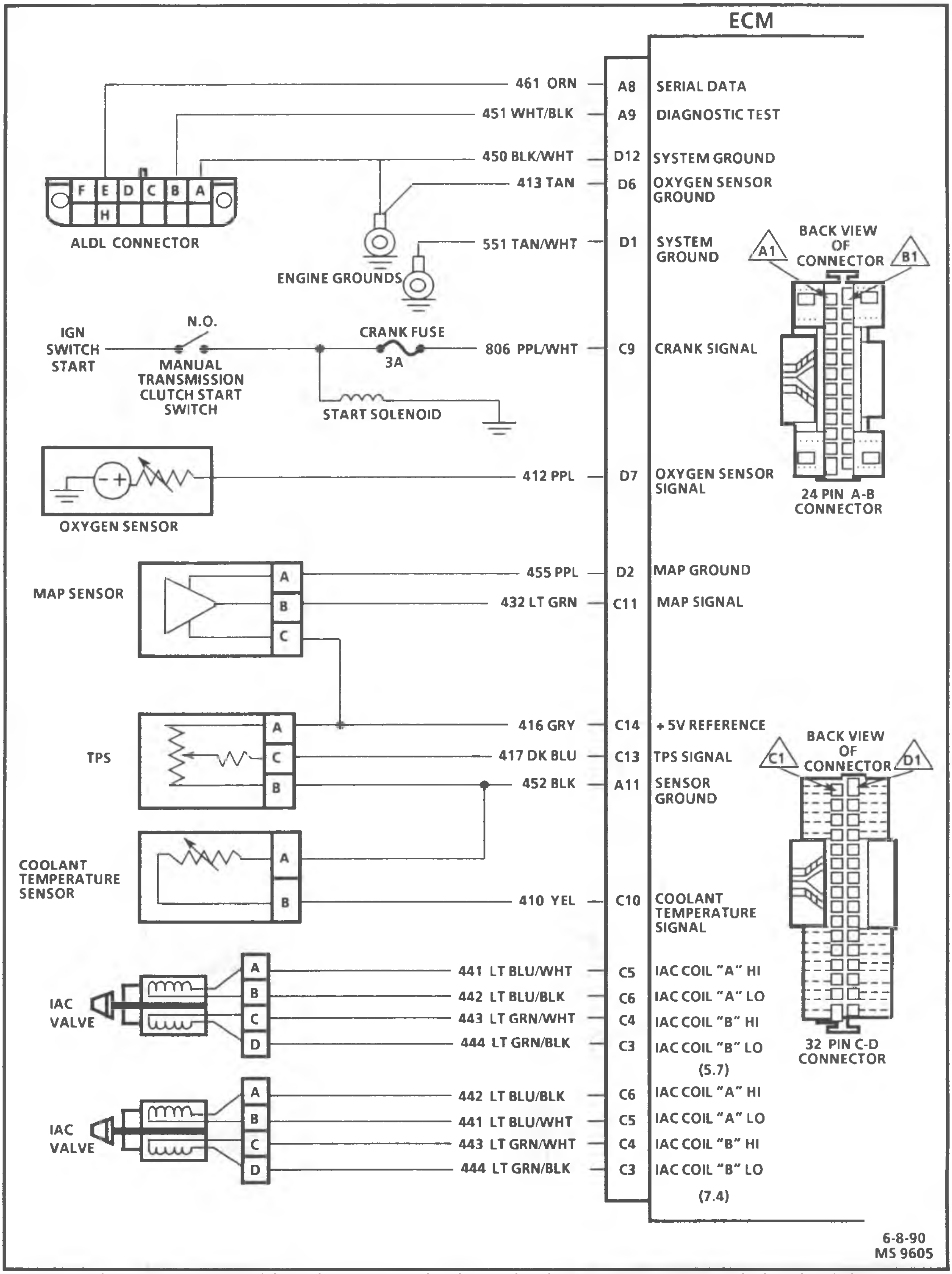


Figure 3-42 - ECM Wiring Diagram 5.7L (R/V), 7.4L (R/V) Except 4L80-E Transmission (1 of 3)

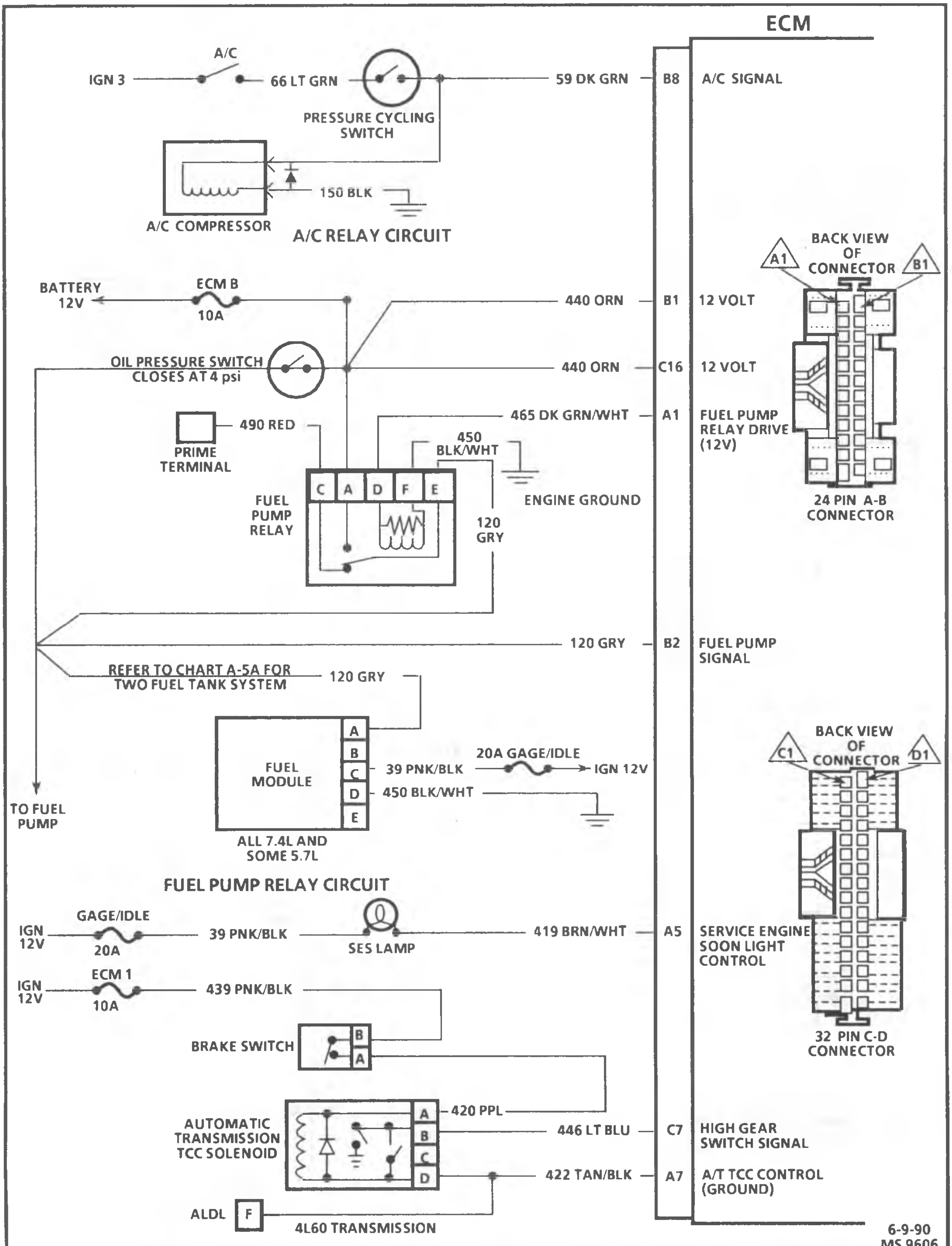


Figure 3-43 - ECM Wiring Diagram 5.7L (R/V), 7.4L (R/V) Except 4L80-E Transmission (2 of 3)

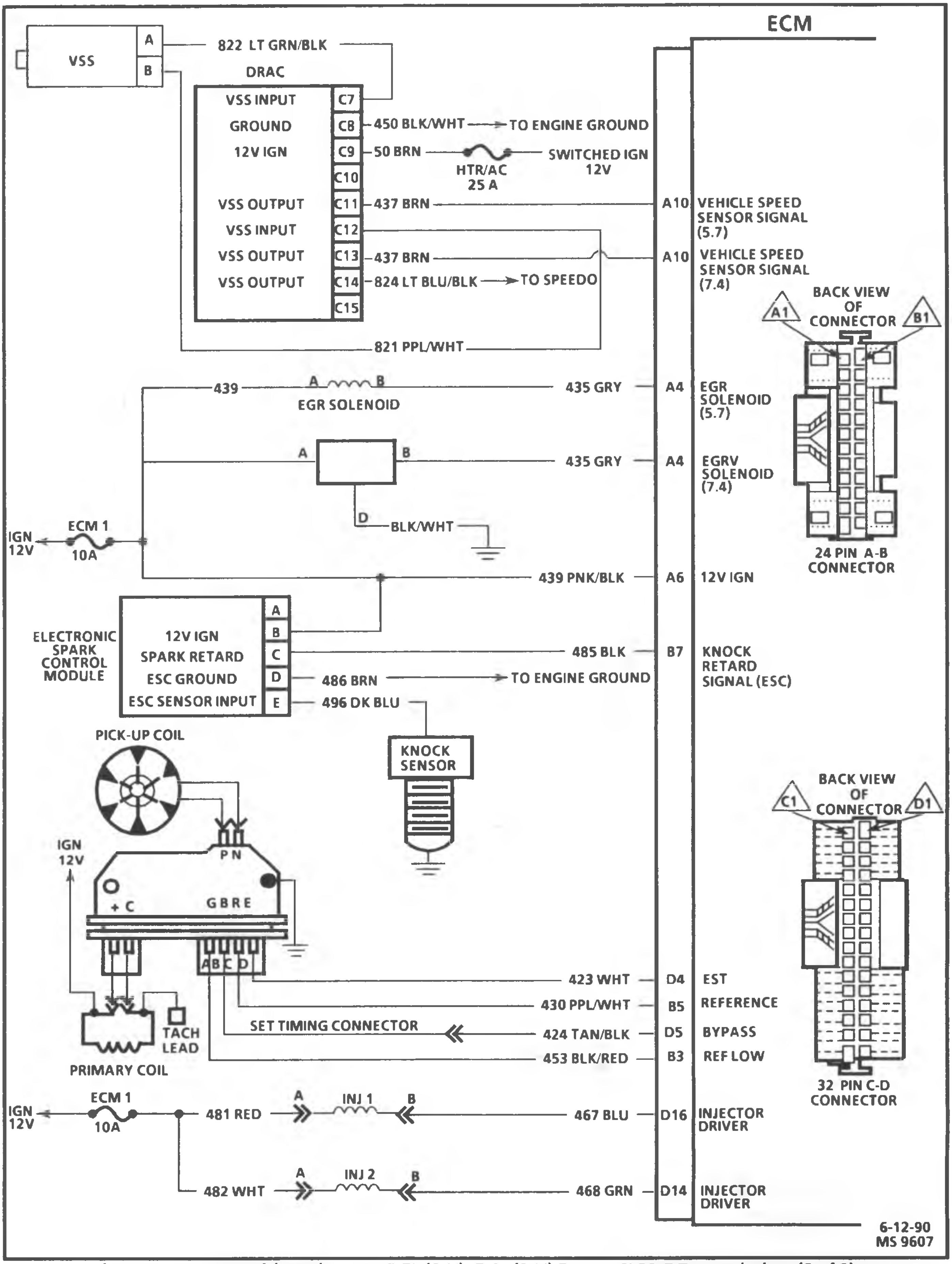


Figure 3-44 - ECM Wiring Diagram 5.7L (R/V), 7.4L (R/V) Except 4L80-E Transmission (3 of 3)

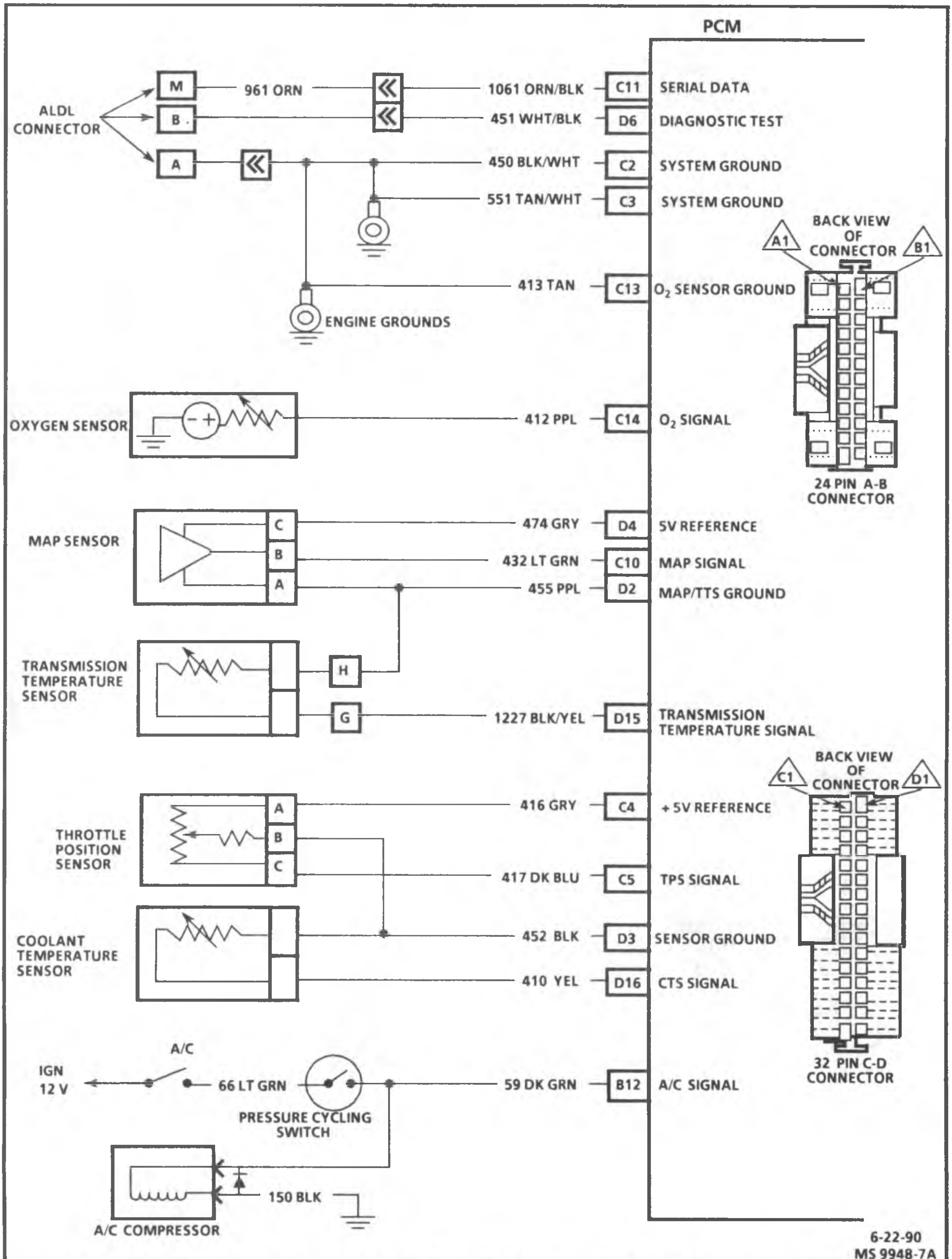


Figure 3-45 - PCM Wiring Diagram 5.7L (G), 7.4L (G) Equipped with 4L80-E Transmission (1 of 5)

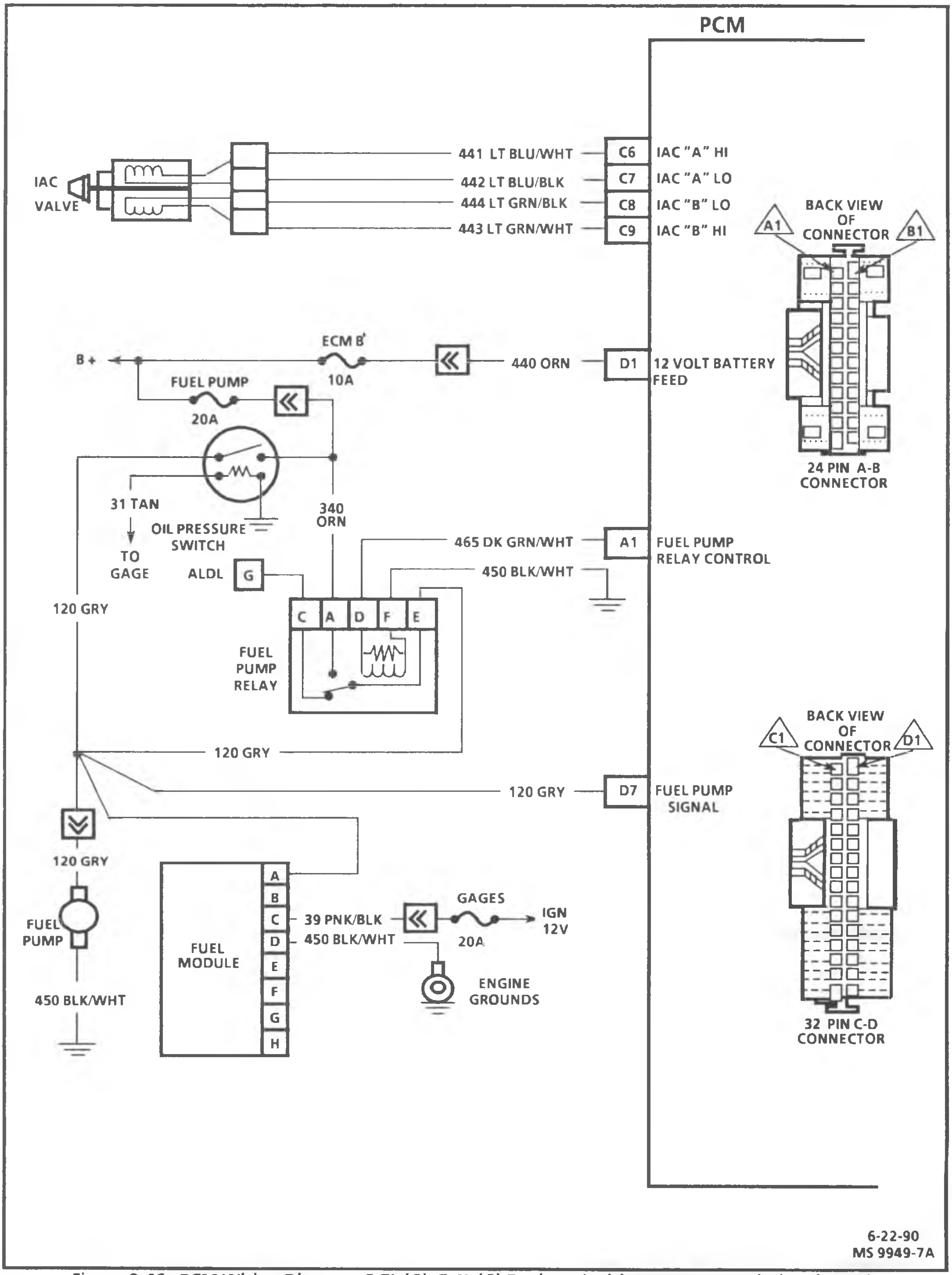


Figure 3-46 - PCM Wiring Diagram 5.7L (G), 7.4L (G) Equipped with 4L80-E Transmission (2 of 5)

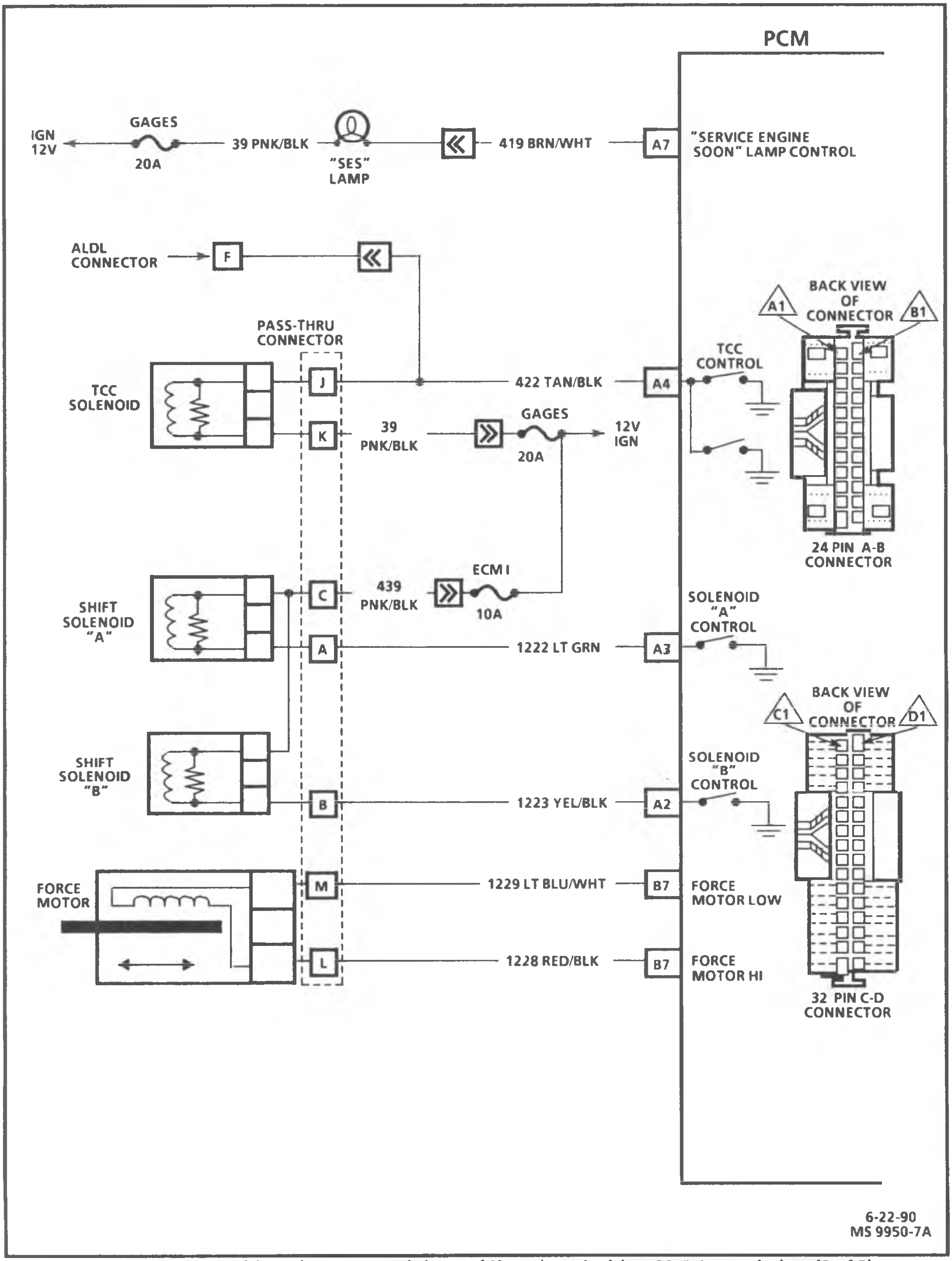


Figure 3-47 - PCM Wiring Diagram 5.7L (G), 7.4L (G) Equipped with 4L80-E Transmission (3 of 5)

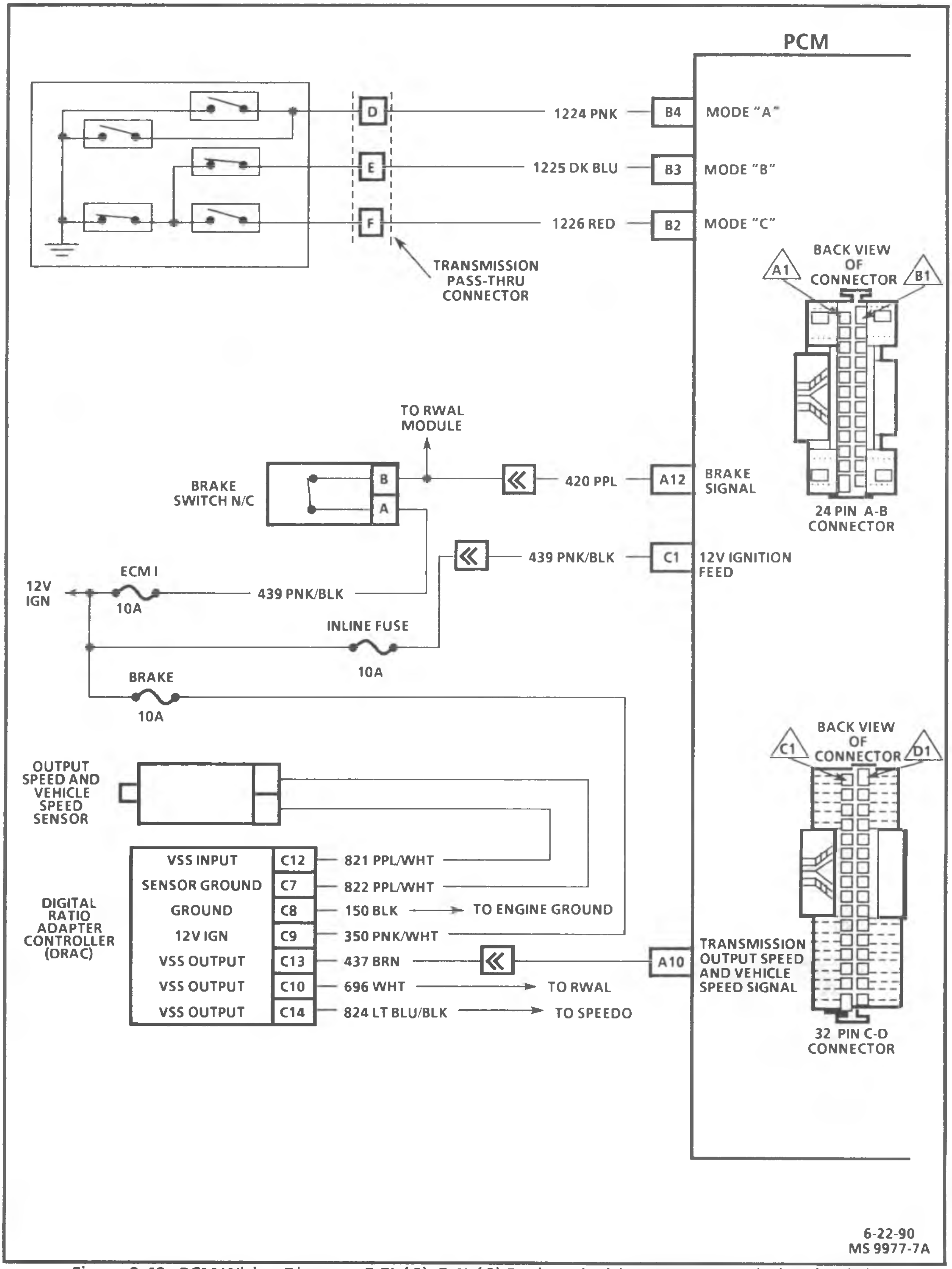


Figure 3-48 - PCM Wiring Diagram 5.7L (G), 7.4L (G) Equipped with 4L80-E Transmission (4 of 5)

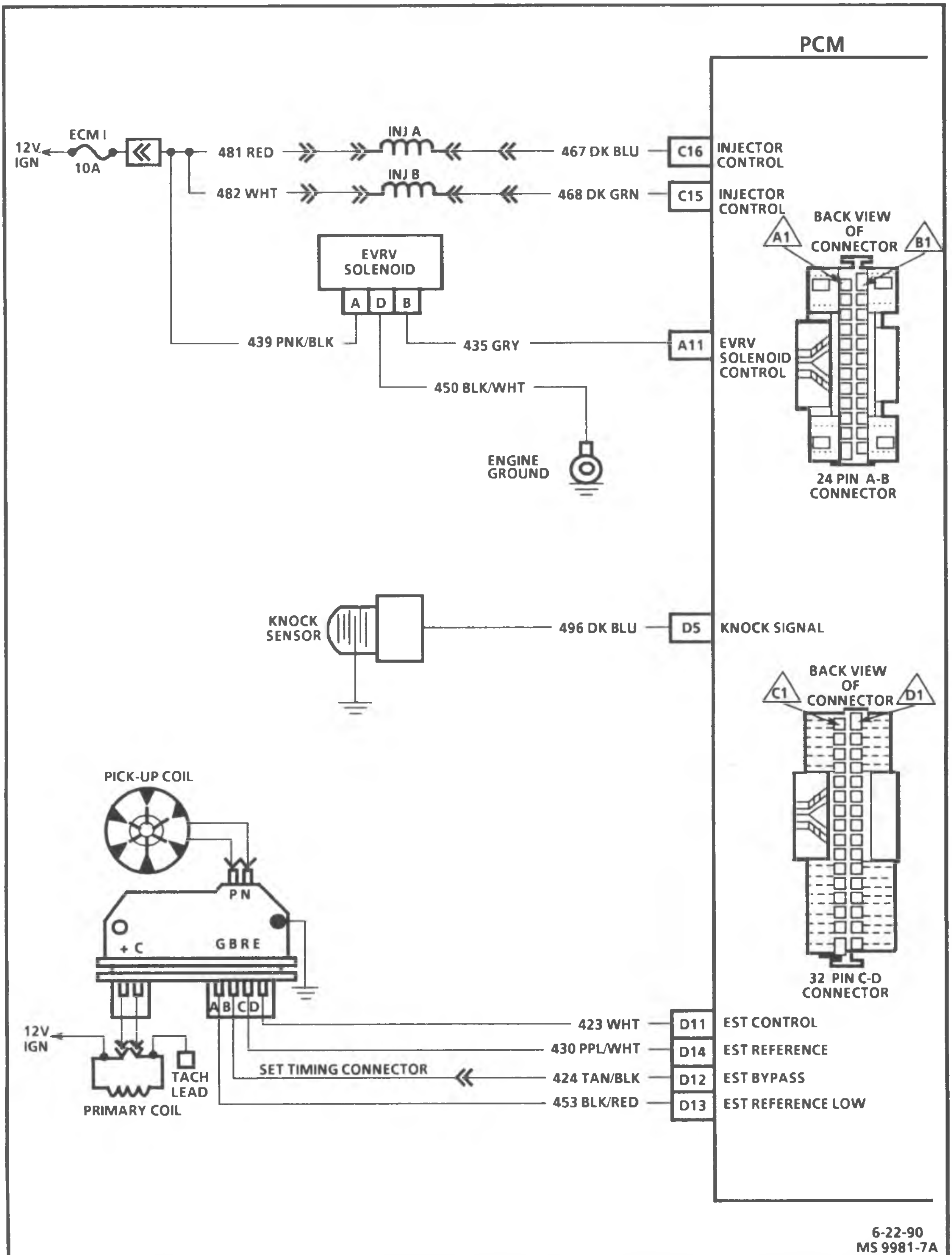


Figure 3-49 - PCM Wiring Diagram 5.7L (G), 7.4L (G) Equipped with 4L80-E Transmission (5 of 5)

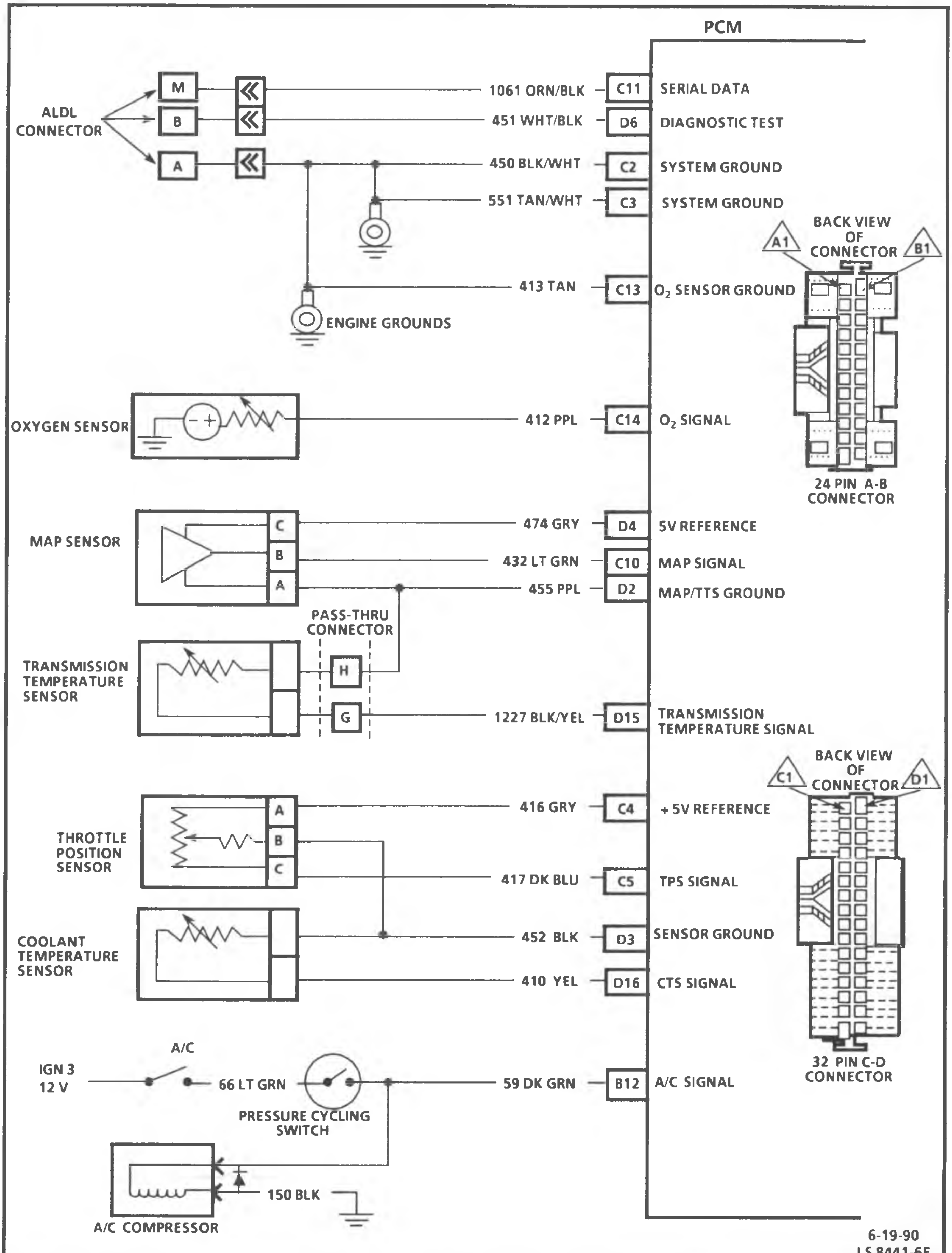


Figure 3-50 - PCM Wiring Diagram 4.3L (C/K), 5.7L (C/K), 7.4L (C/K) Equipped with 4L80-E Transmission (1 of 5)

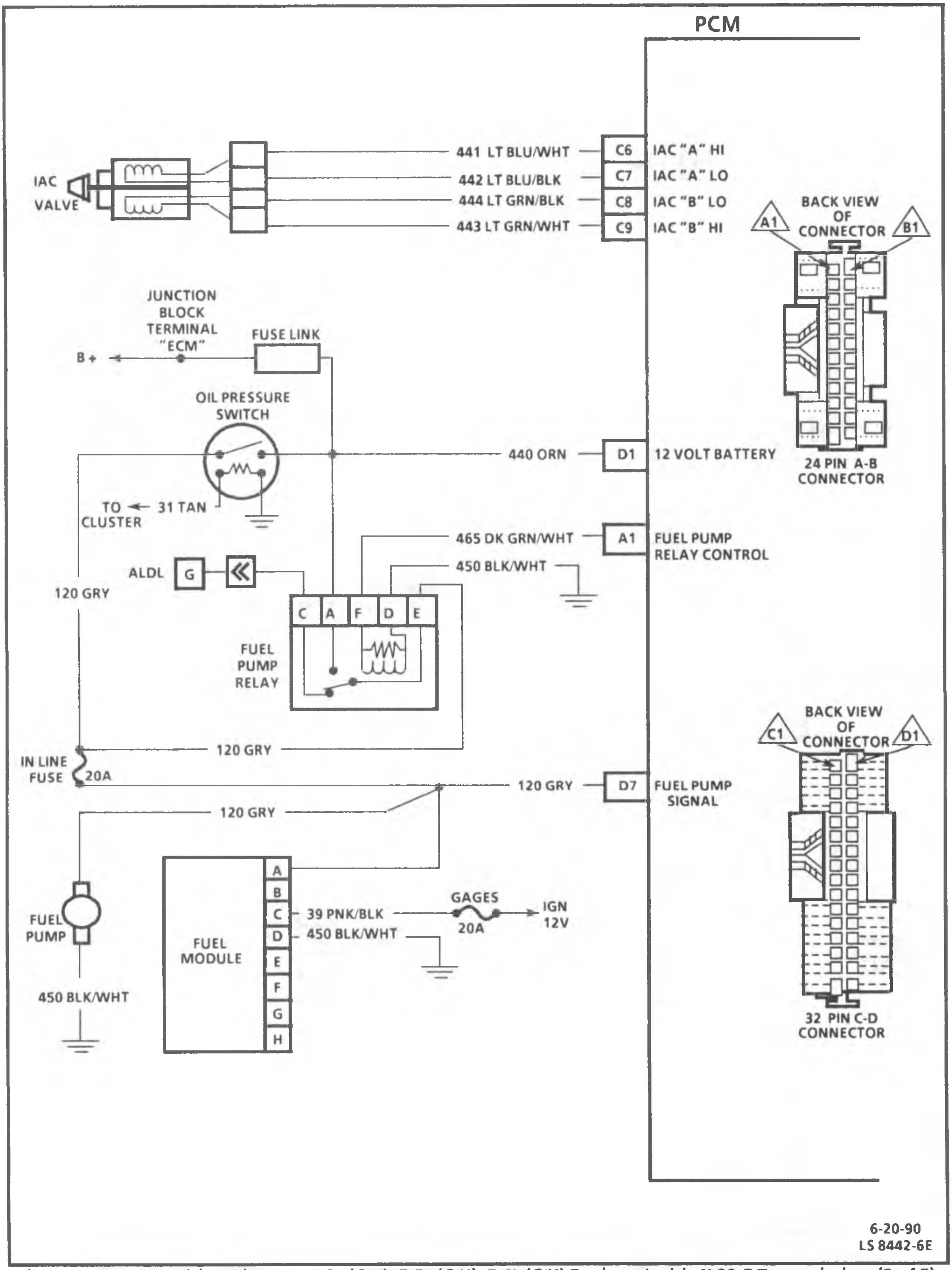


Figure 3-51 - PCM Wiring Diagram 4.3L (C/K), 5.7L (C/K), 7.4L (C/K) Equipped with 4L80-E Transmission (2 of 5)

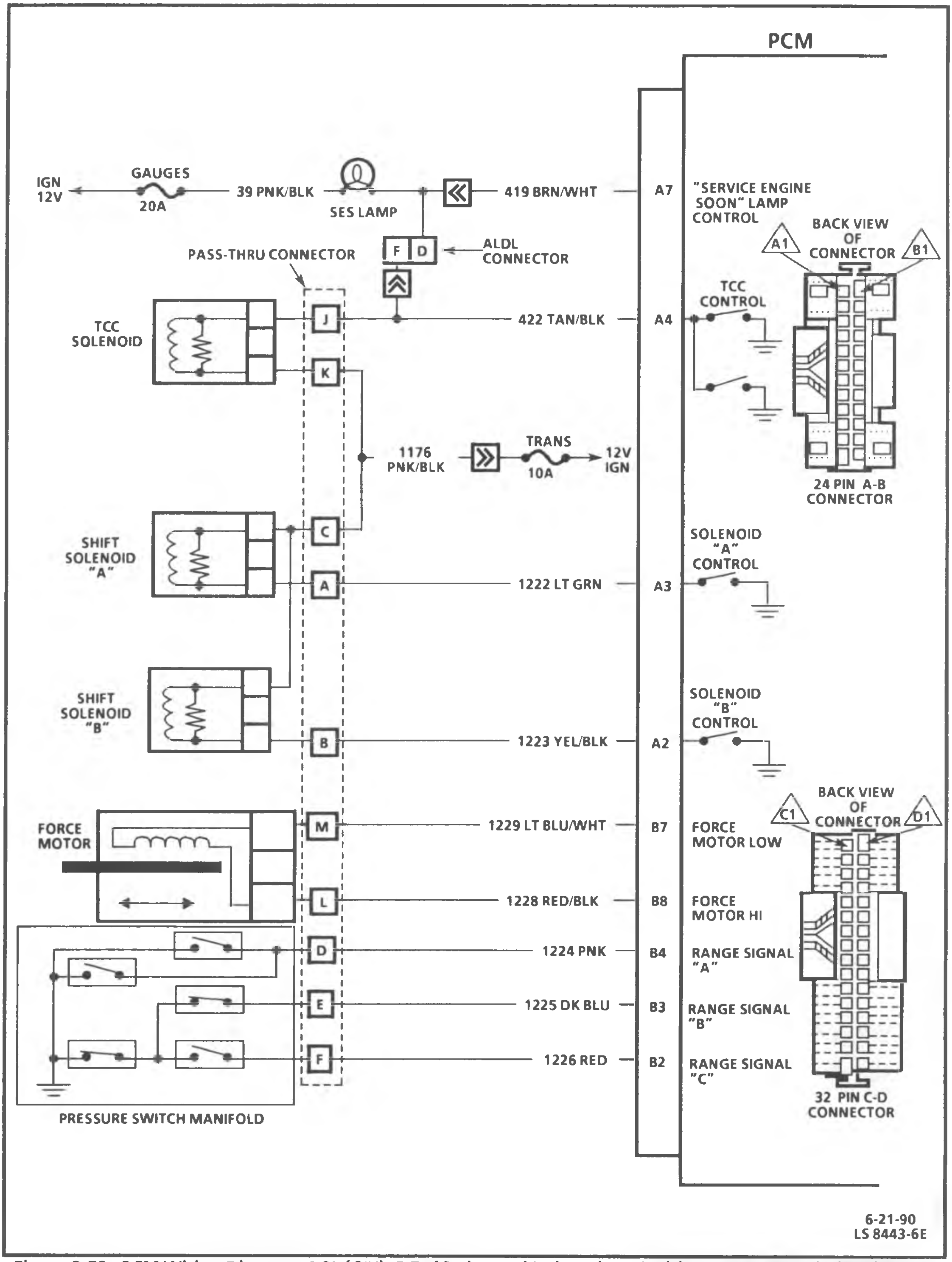


Figure 3-52 - PCM Wiring Diagram 4.3L (C/K), 5.7L (C/K), 7.4L (C/K) Equipped with 4L80-E Transmission (3 of 5)

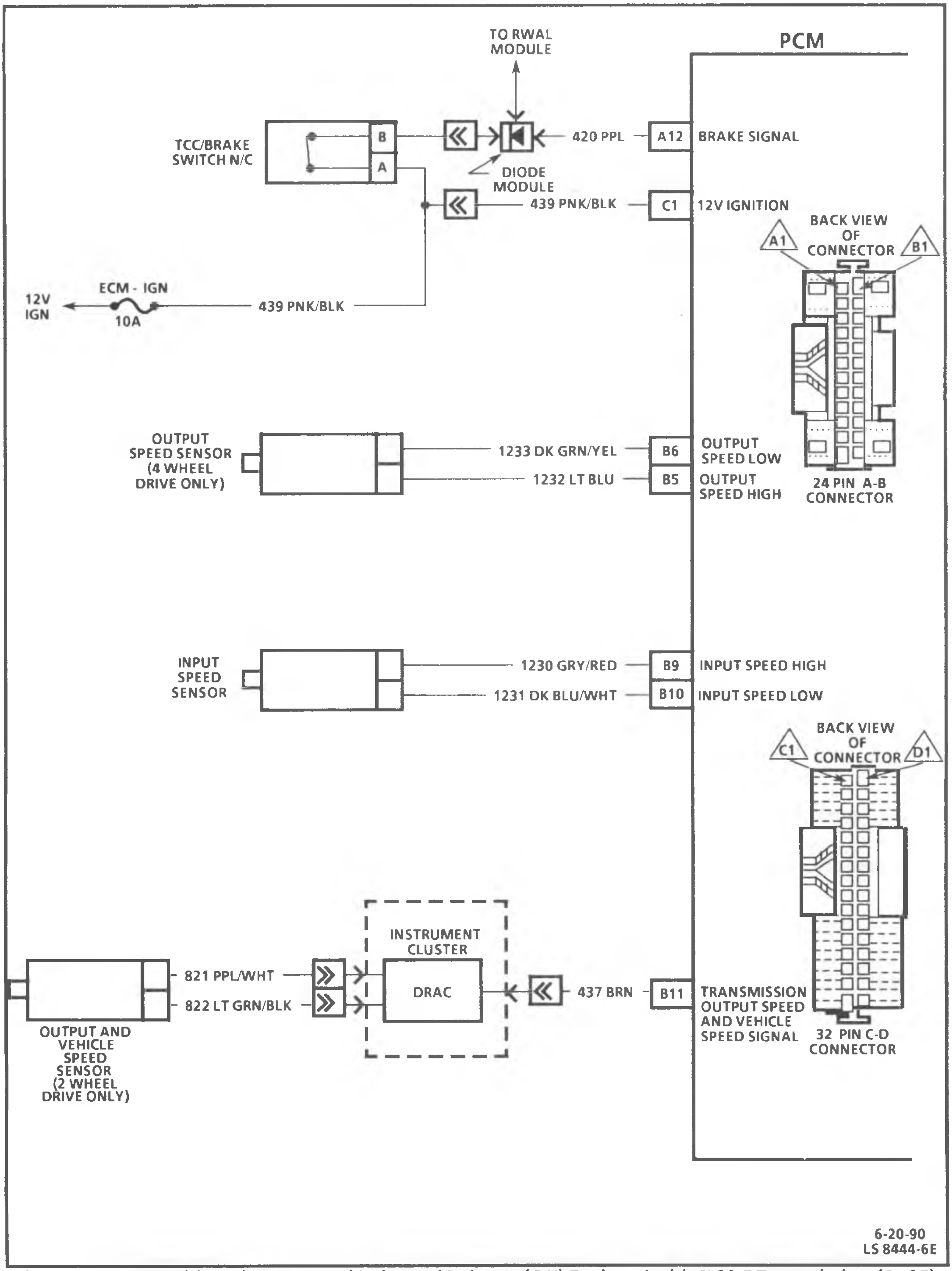


Figure 3-53 - PCM Wiring Diagram 4.3L (C/K), 5.7L (C/K), 7.4L (C/K) Equipped with 4L80-E Transmission (4 of 5)

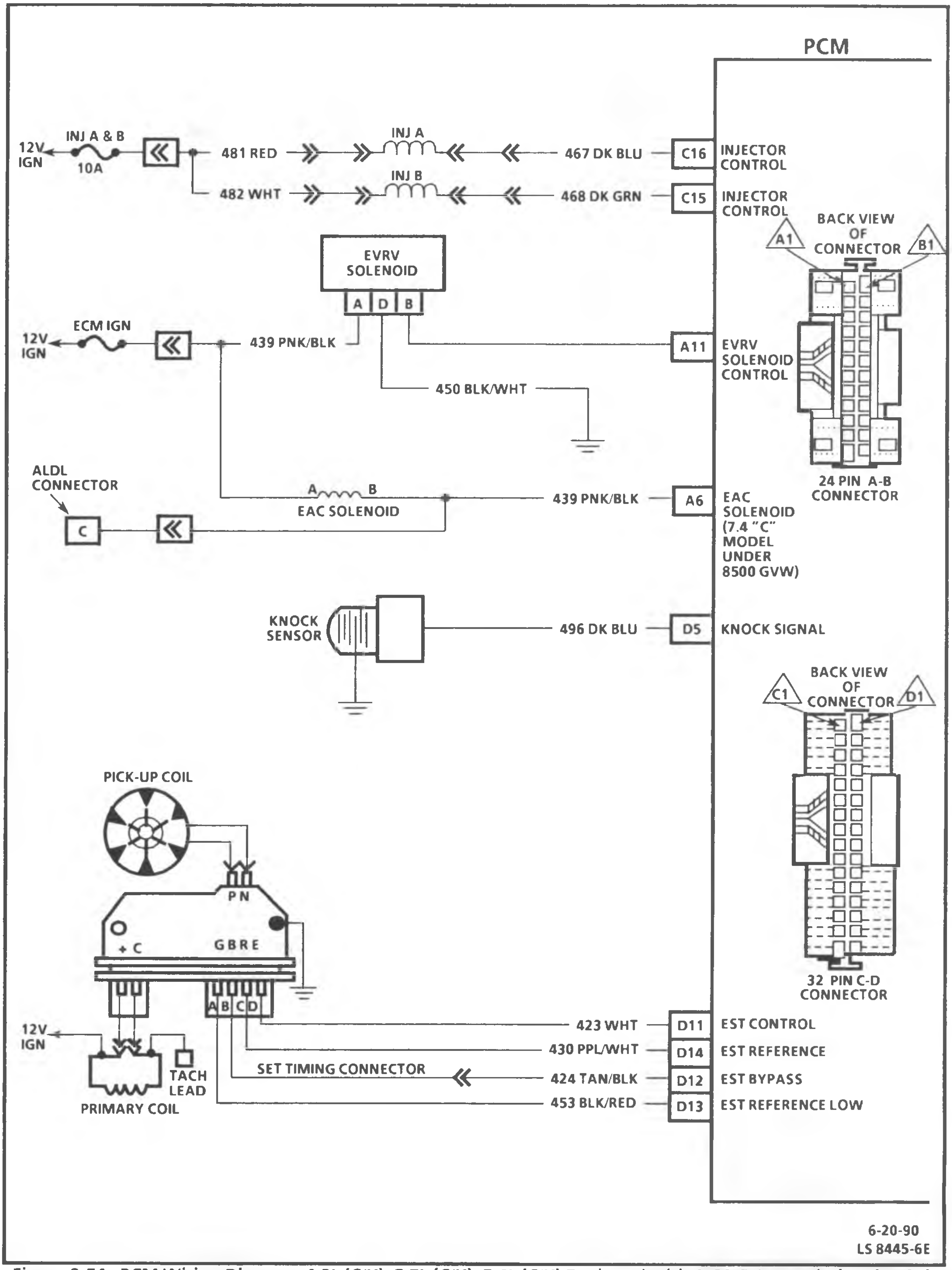


Figure 3-54 - PCM Wiring Diagram 4.3L (C/K), 5.7L (C/K), 7.4L (C/K) Equipped with 4L80-E Transmission (5 of 5)

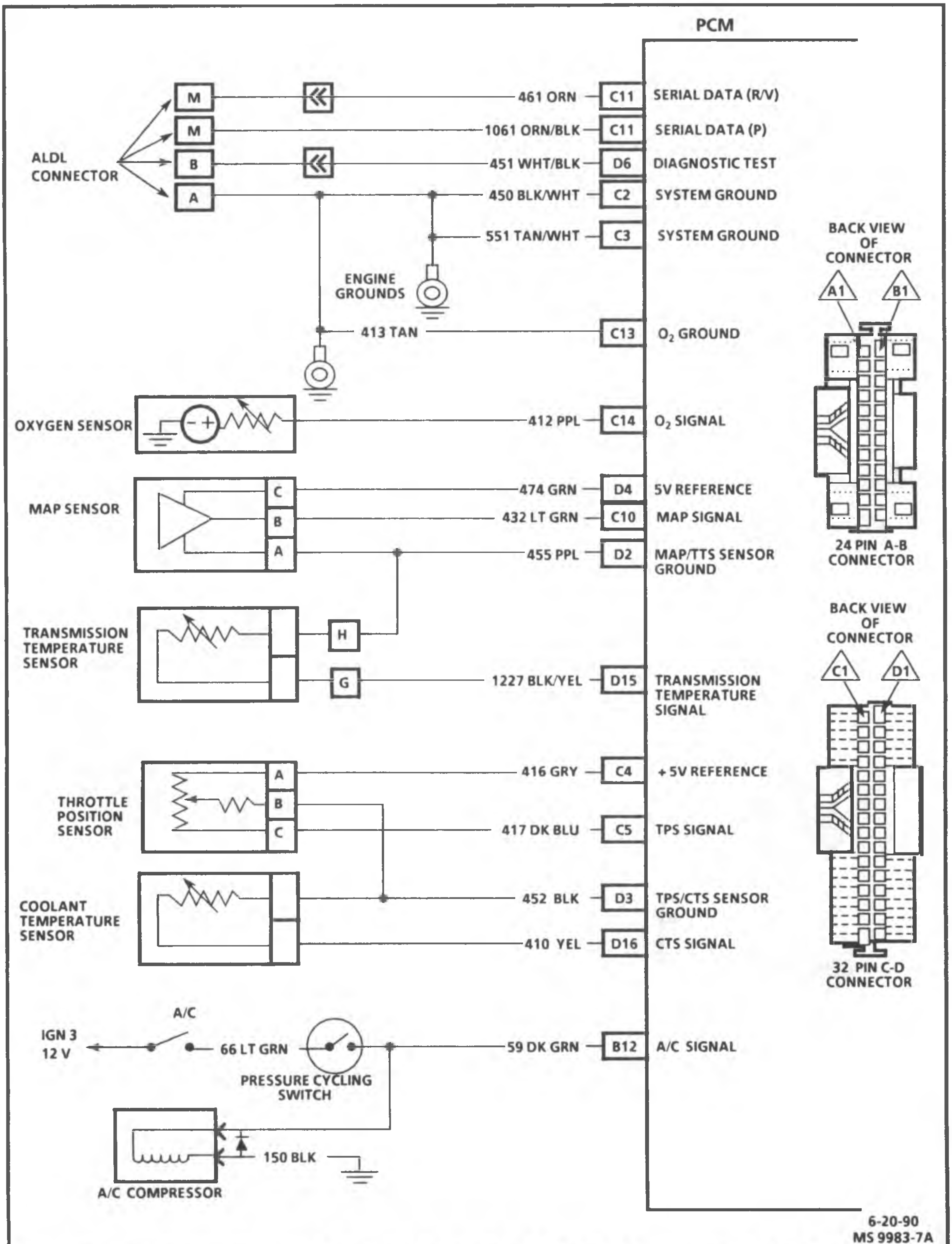


Figure 3-55 - PCM Wiring Diagram 4.3L (R/V, P), 5.7L (R/V, P), 7.4L (R/V, P) Equipped with 4L80-E Transmission (1 of 5)

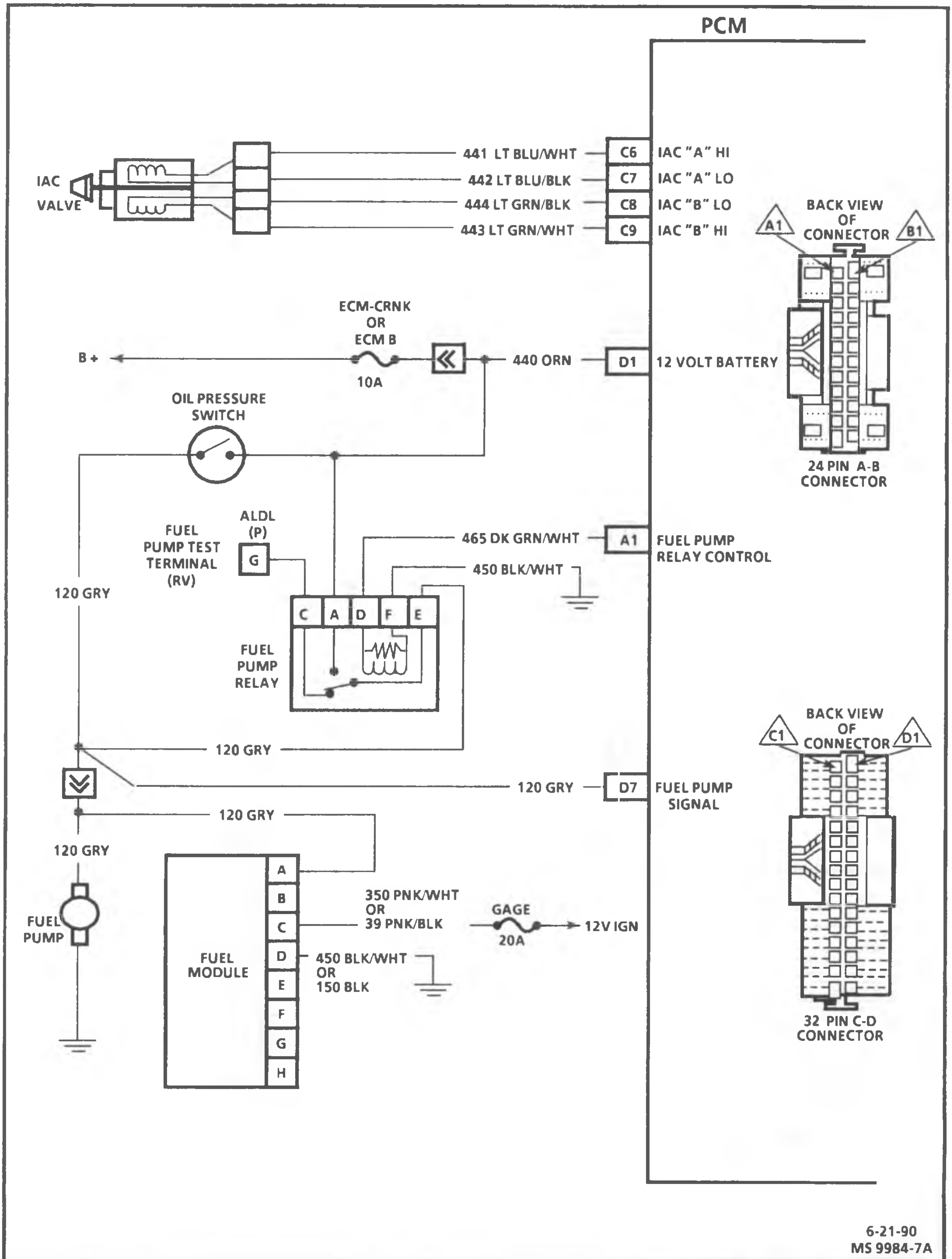


Figure 3-56 - PCM Wiring Diagram 4.3L (R/V, P), 5.7L (R/V, P), 7.4L (R/V, P) Equipped with 4L80-E Transmission (2 of 5)

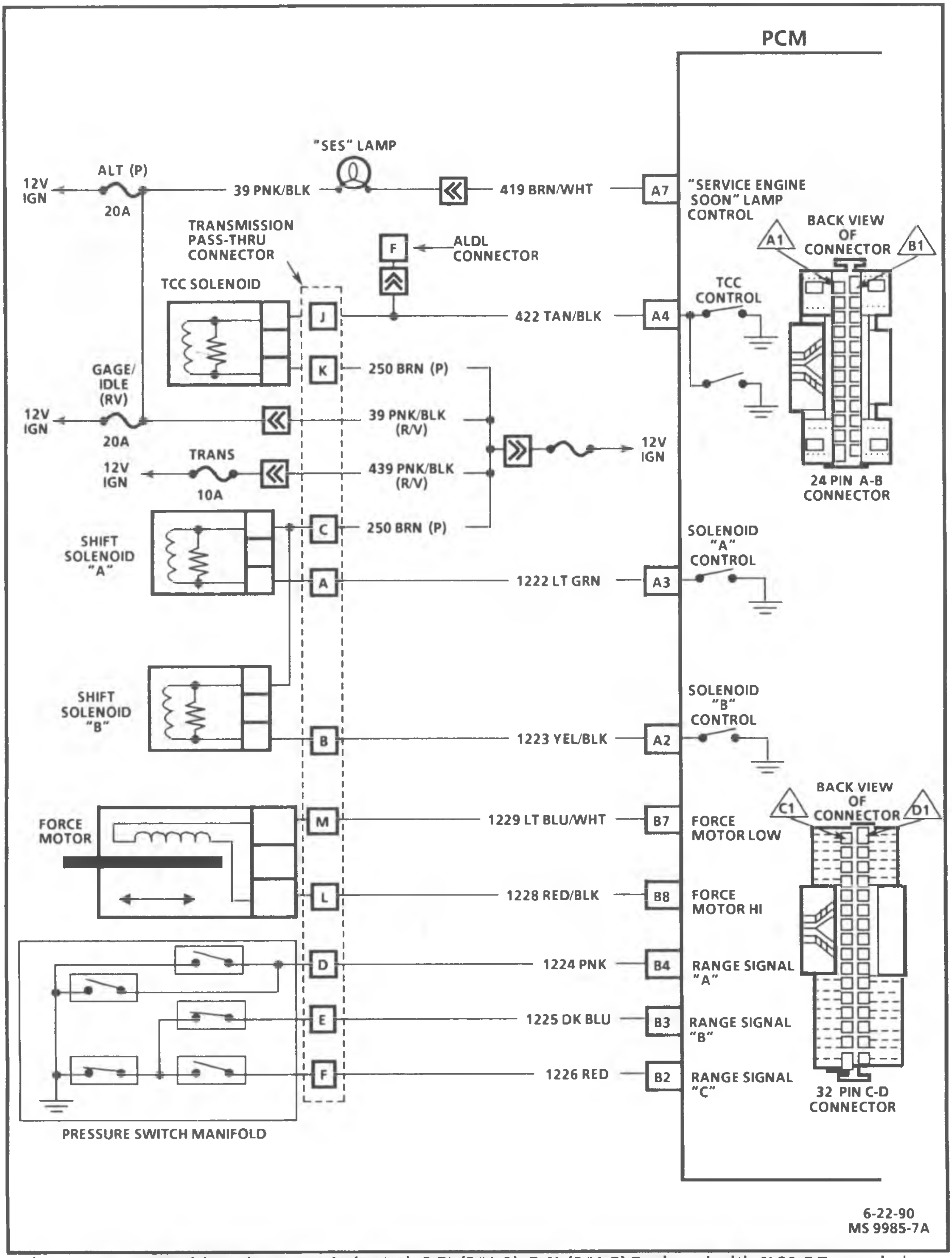


Figure 3-57 - PCM Wiring Diagram 4.3L (R/V, P), 5.7L (R/V, P), 7.4L (R/V, P) Equipped with 4L80-E Transmission (3 of 5)

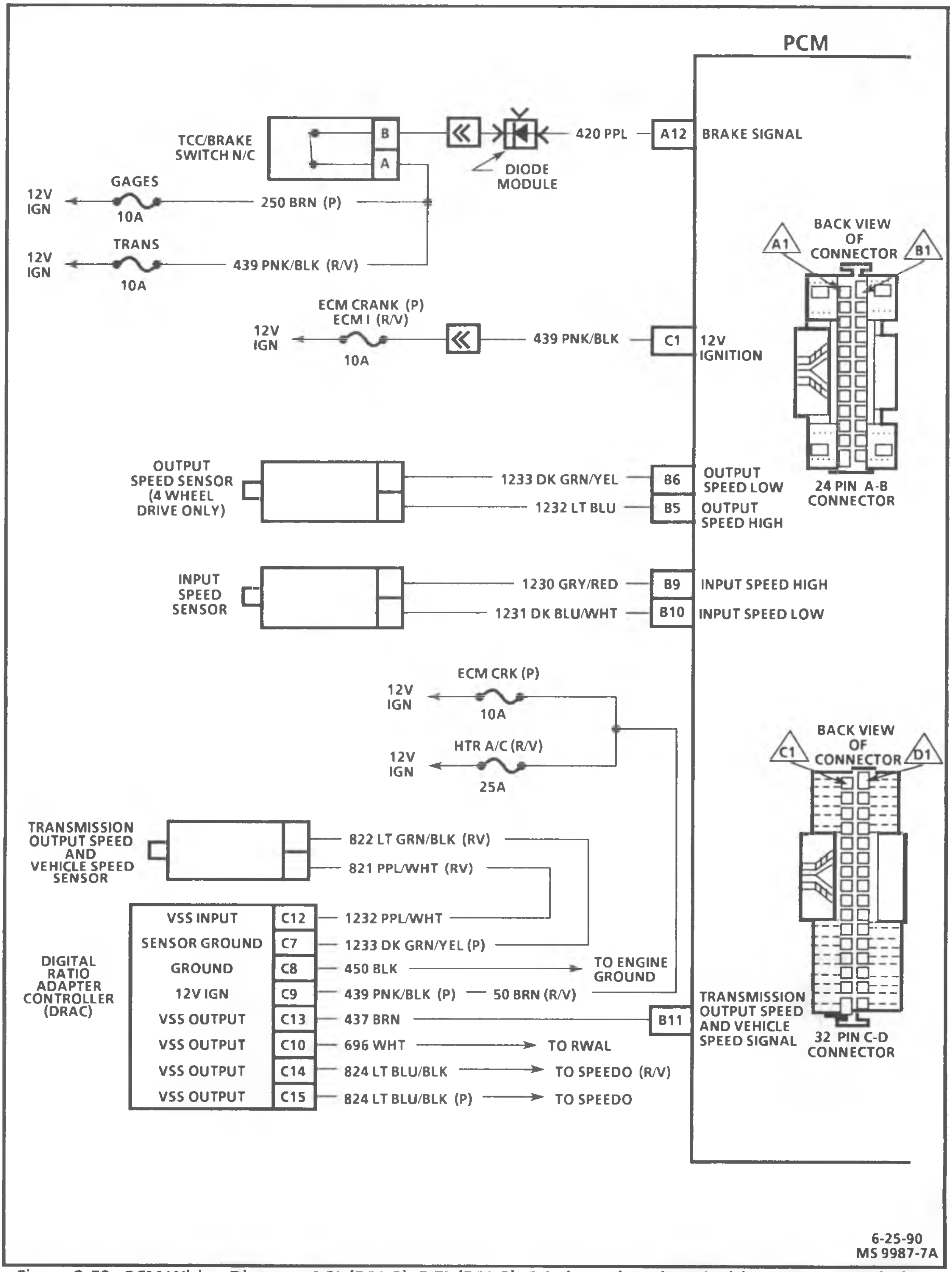


Figure 3-58 - PCM Wiring Diagram 4.3L (R/V, P), 5.7L (R/V, P), 7.4L (R/V, P) Equipped with 4L80-E Transmission (4 of 5)

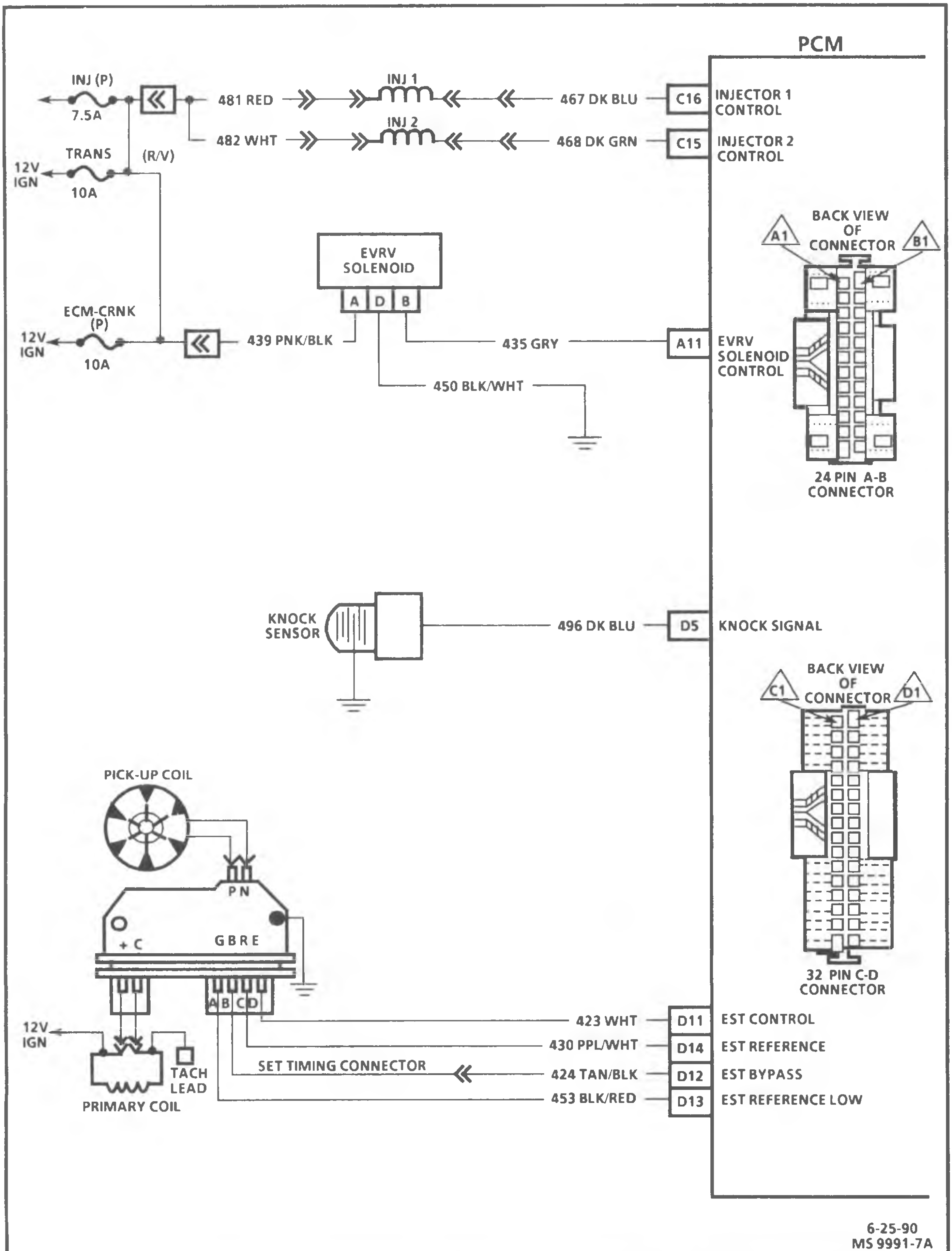


Figure 3-59 - PCM Wiring Diagram 4.3L (R/V, P), 5.7L (R/V, P), 7.4L (R/V, P) Equipped with 4L80-E Transmission (5 of 5)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

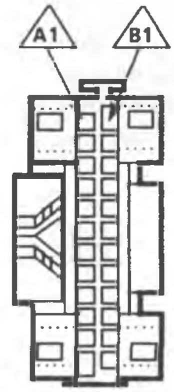
PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE	
				KEY "ON"	ENG RUN
A1	FUEL PUMP RELAY DRIVE	465	DK GRN/ WHT	(1)	14
A2	SHIFT LIGHT (MT) TCC CONTROL (AT)	456 422	TAN/BLK	12	14
A3	EGR SOLENOID CONTROL	435	GRY	12	0
A4	A/C RELAY CONTROL	458 459	DK BLU BLU/WHT	(8)	(8)
A5	"SERVICE ENGINE SOON" LIGHT CONTROL	419	BRN/WHT	0	14
A6	IGN-ECM FUSE	439	PNK/BLK	12	14
A7	NOT USED				
A8	SERIAL DATA	461	ORN	(2)	(2)
A9	DIAGNOSTIC TEST TERMINAL	451	WHT/BLK	5	5
A10	SPEED SENSOR SIGNAL	437	BRN	(3)	(3)
A11	CTS & TPS SENSOR GROUND	452	BLK	0	0
A12	SYSTEM GROUND	450	BLK/WHT	0	0

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE	
				KEY "ON"	ENG RUN
B1	BATTERY 12 VOLTS	440	ORN	12	14
B2	FUEL PUMP SIGNAL	120	GRY TAN/WHT	(1)	14
B3	EST REFERENCE LOW	453	BLK/RED	0	0
B4	NOT USED				
B5	EST REFERENCE HIGH	430	PPL/WHT	0	1.6
B6	NOT USED				
B7	NOT USED				
B8	A/C SIGNAL	366 459	GRN/BLK GRN/WHT	(4)	(4)
B9	NOT USED				
B10	PARK/NEUTRAL SWITCH SIGNAL	434	ORN/BLK	(5)	(5)
B11	NOT USED				
B12	NOT USED				

(1) Battery voltage first two seconds
(2) Varies from 2 volts to 5 volts
(3) Varies from 0 to battery voltage depending on position of drive wheels.
(4) 0 volts A/C "OFF" battery voltage A/C "ON."
(5) 0 volts in neutral, battery voltage in gear
(6) Varies with temperature
(7) Varies
(8) 0 volts A/C "ON," battery voltage A/C "OFF"

ENGINE: 2.5L
VEHICLE: S TRUCK
1991

BACK VIEW OF CONNECTOR



24 PIN A-B CONNECTOR

6-13-90
9S 7632-6E

Figure 3-60 - ECM Connector Terminal End View 2.5L (S) (1 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

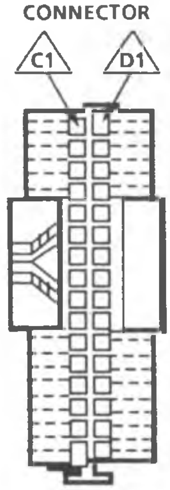
PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE KEY "ON"	NORMAL VOLTAGE ENG RUN
C1	NOT USED				
C2	NOT USED				
C3	IAC "B" LOW	444	LT GRN/ BLK	NOT	USABLE
C4	IAC "B" HIGH	443	LT GRN/ WHT	NOT	USABLE
C5	IAC "A" HIGH	441	LT BLU/ WHT	NOT	USABLE
C6	IAC "A" LOW	442	LT BLU/ BLK	NOT	USABLE
C7	NOT USED				
C8	P/S SWITCH	495	BLU/ORN LT BLU	12 3	14 0
C9	CRANK SIGNAL	806	PPL PPL/WHT	(1)	0
C10	COOLANT TEMP SIGNAL	410	YEL	(2)	(2)
C11	MAP SIGNAL	432	LT GRN	4.7	1 0
C12	MAT SIGNAL	472	TAN	(2)	(2)
C13	TPS SIGNAL	417	DK BLU	(3)	6
C14	5 VOLT REF MAP & TPS	416	GRY	5	5
C15	NOT USED				
C16	BATTERY 12 VOLTS	440	ORN	12	14

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE KEY "ON"	NORMAL VOLTAGE ENG RUN
D1	SYSTEM GROUND	450 551	BLK/WHT TAN/WHT	0	0
D2	MAP,MAT SENSOR GROUND	469	BLK/RED	0	0
D3	NOT USED				
D4	EST CONTROL	423	WHT	*	1.0
D5	EST BYPASS	424	TAN/BLK	*	4.75
D6	OXYGEN SENSOR GROUND	413	TAN	*	*
D7	OXYGEN SENSOR SIGNAL	412	PPL	(4)	(5)
D8	NOT USED				
D9	GROUND	151	BLK	0	0
D10	GROUND	151	BLK	0	0
D11	NOT USED				
D12	NOT USED				
D13	NOT USED				
D14	NOT USED				
D15	NOT USED				
D16	INJECTOR A	467	DK BLU	12	14

(1) Battery voltage when cranking
(2) About 1.0 volt, varies with temperature
(3) .6 volt to about 4.8 volts at Wide Open Throttle (WOT)
(4) .26 to .46 volts
(5) Varies from .1 volt to .9 volt
* Less than .5 volt

ENGINE: 2.5L
VEHICLE: S TRUCK
1991

BACK VIEW OF CONNECTOR



32 PIN C-D CONNECTOR

6-14-90
MS 9205

Figure 3-61 - ECM Connector Terminal End View 2.5L (S) (2 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

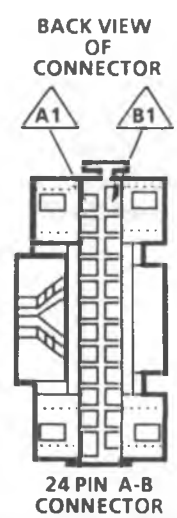
- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE	
				KEY "ON"	ENG RUN
A1	FUEL PUMP RELAY DRIVE	465	BLK/WHT TAN/WHT	(1)	14
A2	A/C RELAY CONTROL	459	BRN	(8)	(8)
A3	NOT USED				
A4	EGR CONTROL	435	GRY	12	14
A5	"SERVICE ENGINE SOON" LIGHT CONTROL	419	BRN/WHT	0	14
A6	IGN-ECM FUSE	439	PNK/BLK	12	14
A7	MANUAL TRANS SHIFT LAMP	456	TAN/BLK	12	14
A8	SERIAL DATA	461	ORN	(2)	(2)
A9	DIAGNOSTIC TEST TERMINAL	451	WHT/BLK	5	5
A10	VEHICLE SPEED SENSOR SIGNAL	437	BRN	(3)	(3)
A11	MAP SENSOR GROUND	455	PPL	0	0
A12	SYSTEM GROUND	450	BLK/WHT	0	0

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE	
				KEY "ON"	ENG RUN
B1	BATTERY 12 VOLTS	440	ORN	12	14
B2	FUEL PUMP SIGNAL	120	TAN/WHT	(1)	14
B3	EST REFERENCE "LOW"	453	BLK/RED	0	0
B4	NOT USED				
B5	EST REFERENCE "HIGH"	430	PPL/WHT	0	1.6
B6	NOT USED				
B7	ESC SIGNAL	485	BLK	9	9
B8	A/C SIGNAL	59	DK GRN	(4)	(4)
B9	NOT USED				
B10	NOT USED				
B11	NOT USED				
B12	NOT USED				

(1) Battery voltage first two seconds
(2) Varies from 2 volts to 5 volts
(3) Varies from 0 to battery voltage depending on position of drive wheels.
(4) 0 volts A/C "OFF" battery voltage A/C "ON."
(5) 0 volts in neutral, battery voltage in gear
(6) Varies with temperature
(7) Varies
(8) 0 volts A/C "ON," battery voltage A/C "OFF"

ENGINE: 2.8L
VEHICLE: S TRUCK
1991



6-13-90
2819-6E

Figure 3-62 - ECM Connector Terminal End View 2.8L (S) (1 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

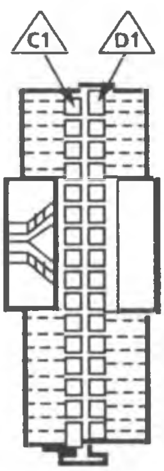
PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE KEY "ON"	NORMAL VOLTAGE ENG RUN
C1	NOT USED				
C2	ELECTRONIC AIR CONTROL SOLENOID	436	BRN	12	14
C3	IAC "B" LOW	444	LT GRN/ BLK	NOT	USABLE
C4	IAC "B" HIGH	443	LT GRN/ WHT	NOT	USABLE
C5	IAC "A" HIGH	441	LT BLU/ WHT	NOT	USABLE
C6	IAC "A" LOW	442	LT BLU/ BLK	NOT	USABLE
C7	NOT USED				
C8	NOT USED				
C9	CRANK SIGNAL	806	PPL/WHT	(1)	0
C10	COOLANT TEMP SIGNAL	410	YEL	(2)	(2)
C11	MAP SIGNAL	432	LT GRN	4.8	1.0
C12	NOT USED				
C13	TPS SIGNAL	417	DK BLU	(3)	.6
C14	5 VOLT REF MAP & TPS	416	GRY	5	5
C15	NOT USED				
C16	BATTERY 12 VOLTS	440	ORN	12	14

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE KEY "ON"	NORMAL VOLTAGE ENG RUN
D1	SYSTEM GROUND	551	TAN/WHT	0	0
D2	TPS, CTS SENSOR GROUND	452	BLK	0	0
D3	NOT USED				
D4	EST CONTROL	423	WHT	*	1.0
D5	EST BYPASS	424	TAN/BLK	*	4.75
D6	OXYGEN SENSOR GROUND	413	TAN	*	*
D7	OXYGEN SENSOR SIGNAL	412	PPL	(4)	(5)
D8	NOT USED				
D9	NOT USED				
D10	NOT USED				
D11	NOT USED				
D12	NOT USED				
D13	NOT USED				
D14	INJECTOR B	468	DK GRN	12	14
D15	NOT USED				
D16	INJECTOR A	467	DK BLU	12	14

(1) Battery voltage when cranking
(2) About 1.0 volt, varies with temperature
(3) .6 volt to about 4.8 volts at Wide Open Throttle (WOT)
(4) .26 to .46 volts
(5) Varies from .1 volt to .9 volt
* Less than .5 volt

ENGINE: 2.8L
VEHICLE: S TRUCK
1991

BACK VIEW OF CONNECTOR



32 PIN C-D CONNECTOR

6-13-90
MS 9904

Figure 3-63 - ECM Connector Terminal End View 2.8L (S) (2 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

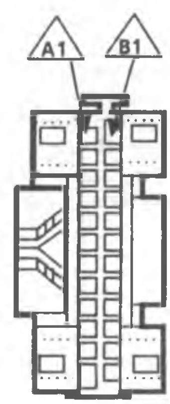
- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES	
				KEY "ON"	ENG RUN
A1	FUEL PUMP RELAY DRIVE	465	DK GRN/ WHT	①	14
A2	A/C CLUTCH CONTROL	459	DK GRN/ WHT	⑦	⑦
A3	NOT USED	–	–	–	–
A4	EGR CONTROL	435	GRY	12	14
A5	"SERVICE ENGINE SOON" LIGHT CONTROL	419	BRN/WHT	0	14
A6	IGN-ECM FUSED	439	PNK/BLK	12	14
A7	TCC CONTROL	422	TAN/BLK	12	14
A8	SERIAL DATA	461	ORN/BLK ORN	②	②
A9	DIAGNOSTIC TEST TERMINAL	451	WHT/BLK	5	5
A10	VEHICLE SPEED SENSOR SIGNAL	437	BRN	③	③
A11	TPS, CTS SENSOR GROUND	452	BLK	0	0
A12	SYSTEM GROUND	450	BLK/WHT	0	0

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES	
				KEY "ON"	ENG RUN
B1	BATTERY 12 VOLT	440	ORN	12	14
B2	FUEL PUMP SIGNAL	120	GRY TAN/WHT	①	14
B3	EST REFERENCE LOW	453	BLK/RED	0	0
B4	NOT USED	–	–	–	–
B5	EST REFERENCE HIGH	430	PPL/WHT	0	1.6
B6	NOT USED	–	–	–	–
B7	ESC SIGNAL	485	BLK	9	9
B8	A/C SIGNAL	59	DK GRN	④	④
B9	NOT USED	–	–	–	–
B10	PARK/NUETRAL SWITCH SIGNAL	434	ORN/BLK	⑤	⑤
B11	NOT USED	–	–	–	–
B12	NOT USED	–	–	–	–

① Battery voltage first 2 seconds.
② Varies
③ Varies from .01 to battery voltage depending on position of drive wheels.
④ 0 volts A/C "OFF" battery voltage A/C "ON."
⑤ 0 volts in neutral, battery voltage in gear.
⑥ Varies with temperature
⑦ 0 Volts A/C "ON."
Battery voltage A/C "OFF."

BACK VIEW OF CONNECTOR



24 PIN A-B CONNECTOR

ENGINE 4.3L
VEHICLE S/T TRUCK M/L VAN

1991

6-5-90
9S 9908-6E

Figure 3-64 - ECM Connector Terminal End View 4.3L (S/T, M/L) (1 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES	
				KEY "ON"	ENG RUN
C1	NOT USED	–	–	–	–
C2	NOT USED	–	–	–	–
C3	IAC "B" LOW	444	LT GRN/ BLK	NOT	USABLE
C4	IAC "B" HIGH	443	LT GRN/ WHT	NOT	USABLE
C5	IAC "A" HIGH	441	LT BLU/ WHT	NOT	USABLE
C6	IAC "A" LOW	442	LT BLU/ BLK	NOT	USABLE
C7	HIGH GEAR SWITCH SIGNAL	446	LT BLU	12	14
C8	NOT USED	–	–	–	–
C9	CRANK SIGNAL	806	PPL PPL/WHT	①	0
C10	CTS SIGNAL	410	YEL	②	②
C11	MAP SENSOR SIGNAL	432	LT GRN LT GRN/BLK	4.8	1.0
C12	NOT USED	–	–	–	–
C13	TPS SIGNAL	417	DK BLU	③	.6
C14	MAP, TPS 5 VOLT REF.	416	GRY	5	5
C15	NOT USED	–	–	–	–
C16	BATTERY 12 VOLT	440	ORN	12	14

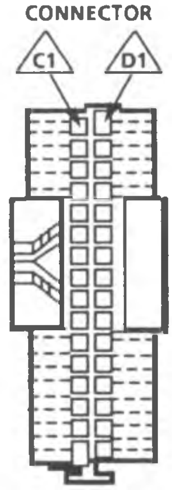
PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES	
				KEY "ON"	ENG RUN
D1	SYSTEM GROUND	450 551	BLK/WHT	0	0
D2	MAP SENSOR GROUND	455	PPL BLK/RED	0	0
D3	NOT USED	–	–	–	–
D4	EST	423	WHT	*	1.0
D5	EST BYPASS	424	TAN/BLK	*	4.75
D6	OXYGEN SENSOR GROUND	413	TAN	*	*
D7	OXYGEN SENSOR SIGNAL	412	PPL	④	⑤
D8	NOT USED	–	–	–	–
D9	NOT USED	–	–	–	–
D10	NOT USED	–	–	–	–
D11	NOT USED	–	–	–	–
D12	NOT USED	–	–	–	–
D13	NOT USED	–	–	–	–
D14	INJECTOR 2 DRIVER CONTROL	468	GRN	12	14
D15	NOT USED	–	–	–	–
D16	INJECTOR 1 DRIVER CONTROL	467	BLU	12	14

① Battery voltage when cranking
② About 1.0 volt, varies with temperature
③ .6 Volt to about 4.8 volt at Wide Open Throttle (WOT)
④ .26 to .46 volt
⑤ Varies from .1 volt to .9 volt
* Less then .5 volt

ENGINE 4.3L
VEHICLE S/T TRUCK M/L VAN

1991

BACK VIEW OF CONNECTOR



32 PIN C-D CONNECTOR

6-6-90
MS 9909-6E

Figure 3-65 - ECM Connector Terminal End View 4.3L (S/T, M/L) (2 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

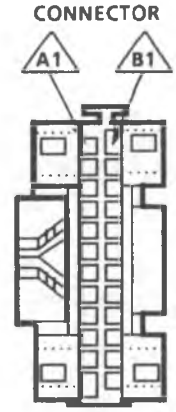
- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE	
				KEY "ON"	ENG RUN
A1	FUEL PUMP RELAY DRIVE	465	DK GRN/ WHT	(1)	14
A2	NOT USED				
A3	NOT USED				
A4	EGR CONTROL	435	GRY	12	14
A5	"SERVICE ENGINE SOON" LIGHT CONTROL	419	BRN	0	14
A6	IGN-ECM FUSED	439	PNK/BLK	12	14
A7	TCC CONTROL	422	TAN/BLK	12	14
A8	SERIAL DATA	461	ORN	(2)	(2)
A9	DIAGNOSTIC TEST TERMINAL	451	BLK/WHT	5	5
A10	VEHICLE SPEED SENSOR SIGNAL	437	BRN	(3)	(3)
A11	CTS & TPS SENSOR GROUND	452	BLK	0	0
A12	SYSTEM GROUND	450	BLK/WHT	0	0

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE	
				KEY "ON"	ENG RUN
B1	BATTERY 12 VOLTS	440	ORN	12	14
B2	FUEL PUMP SIGNAL	120	TAN/WHT	(1)	14
B3	EST REFERENCE "LOW"	453	BLK/RED	0	0
B4	NOT USED				
B5	EST REFERENCE "HIGH"	430	PPL/WHT	0	1.6
B6	NOT USED				
B7	ESC SIGNAL	485	BLK	9	9
B8	A/C SIGNAL	59	DK GRN	(4)	(4)
B9	NOT USED				
B10	PARK/NEUTRAL SWITCH SIGNAL	434	ORN/BLK	(5)	(5)
B11	NOT USED				
B12	NOT USED				

(1) Battery voltage first two seconds
(2) Varies
(3) Varies from 0 to battery voltage depending on position of drive wheels.
(4) 0 volts A/C "OFF" battery voltage A/C "ON."
(5) 0 volts in neutral, battery voltage in gear
(6) Varies with temperature

BACK VIEW OF CONNECTOR



24 PIN A-B CONNECTOR

ENGINE 4.3L, 5.7L
VEHICLE G VAN
1991

6-13-90
7S 3582-6E

Figure 3-66 - ECM Connector Terminal End View 4.3L, 5.7L (G) Except 4L80-E Transmission (1 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

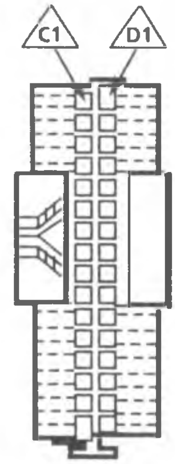
PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE KEY "ON"	NORMAL VOLTAGE ENG RUN
C1	NOT USED				
C2	ELECTRONIC AIR CONTROL SOLENOID	436	BRN	12	14
C3	IAC "B" LOW	444	LT GRN/BLK	NOT	USABLE
C4	IAC "B" HIGH	443	LT GRN/WHT	NOT	USABLE
C5	IAC "A" HIGH	441	LT BLU/WHT	NOT	USABLE
C6	IAC "A" LOW	442	LT BLU/BLK	NOT	USABLE
C7	HIGH GEAR SWITCH SIGNAL	446	LT BLU	12	14
C8	NOT USED				
C9	CRANK SIGNAL	806	PPL	(1)	0
C10	COOLANT TEMP SIGNAL	410	YEL	(2)	(2)
C11	MAP SIGNAL	432	LT GRN	4.8	1.0
C12	NOT USED				
C13	TPS SIGNAL	417	DK BLU	(3)	6
C14	5 VOLT REF MAP & TPS	416	GRY	5	5
C15	NOT USED				
C16	BATTERY 12 VOLT	440	ORN	12	14

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGE KEY "ON"	NORMAL VOLTAGE ENG RUN
D1	SYSTEM GROUND	450	BLK/WHT	0	0
D2	MAP SENSOR GROUND	455	PPL	0	0
D3	NOT USED				
D4	EST CONTROL	423	WHT	*	1.0
D5	EST BYPASS	424	TAN/BLK	*	4.75
D6	OXYGEN SENSOR GROUND	413	TAN	*	*
D7	OXYGEN SENSOR SIGNAL	412	PPL	(4)	(5)
D8	NOT USED				
D9	NOT USED				
D10	NOT USED				
D11	NOT USED				
D12	NOT USED				
D13	NOT USED				
D14	INJECTOR 2 DRIVER	468	GRN	12	14
D15	NOT USED				
D16	INJECTOR 1 DRIVER	467	BLU	12	14

(1) Battery voltage when cranking
(2) About 1.0 volt, varies with temperature
(3) .6 volt to about 4.8 volts at Wide Open Throttle (WOT)
(4) .26 to .46 volts
(5) Varies from .1 volt to .9 volt
* Less than .5 volt

ENGINE: 4.3L, 5.7L
VEHICLE G VAN
1991

BACK VIEW OF CONNECTOR



32 PIN C-D CONNECTOR

6-13-90
MS 9905

Figure 3-67 - ECM Connector Terminal End View 4.3L, 5.7L (G) Except 4L80-E Transmission (2 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

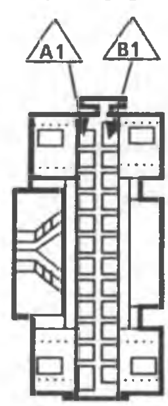
- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES KEY "ON"	NORMAL VOLTAGES ENG RUN
A1	FUEL PUMP RELAY DRIVE	465	DK GRN/ WHT	①	14
A2	NOT USED	–	–	–	–
A3	NOT USED	–	–	–	–
A4	EGR CONTROL	435	GRY	12	14
A5	"SERVICE ENGINE SOON" LIGHT CONTROL	419	BRN	0	14
A6	IGN ECM FUSED	439	PNK/BLK	12	14
A7	TCC CONTROL	422	TAN/BLK	12	14
A8	SERIAL DATA	461	ORN	②	②
A9	DIAGNOSTIC TEST TERMINAL	451	WHT/BLK	5	5
A10	VEHICLE SPEED SENSOR SIGNAL	437	BRN	③	③
A11	MAP SENSOR GROUND	455	PPL	0	0
A12	SYSTEM GROUND	450	BLK/WHT	0	0

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES KEY "ON"	NORMAL VOLTAGES ENG RUN
B1	BATTERY 12 VOLT	440	ORN	12	14
B2	FUEL PUMP SIGNAL	120	GRY	①	14
B3	EST REFERENCE LOW	453	BLK/RED	0	0
B4	NOT USED	–	–	–	–
B5	EST REFERENCE HIGH	430	PPL/WHT	0	1.6
B6	NOT USED	–	–	–	–
B7	ESC SIGNAL	457	YEL/BLK	9	9
B8	A/C SIGNAL	59	DK GRN	④	④
B9	NOT USED	–	–	–	–
B10	PARK/NEUTRAL SWITCH SIGNAL	434	ORN/BLK	⑤	⑤
B11	NOT USED	–	–	–	–
B12	NOT USED	–	–	–	–

① Battery voltage first 2 seconds.
② Varies
③ Varies from .01 to battery voltage depending on position of drive wheels.
④ 0 volts A/C "OFF" battery voltage A/C "ON."
⑤ 0 volts in neutral, battery voltage in gear.
⑥ Varies with temperature.

BACK VIEW OF CONNECTOR



24 PIN A-B CONNECTOR

ENGINE 4.3L, 5.0L, 5.7L
VEHICLE C/K TRUCK
UNDER 8600 GVW

1991

6-6-90
MS 9910

Figure 3-68 - ECM Connector Terminal End View 4.3L, 5.0L, 5.7L (C/K) Except 4L80-E Transmission (1 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

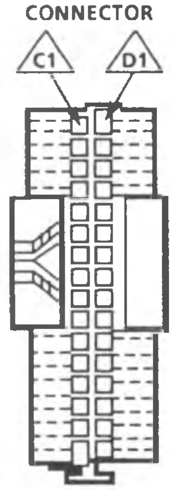
THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES	
				KEY "ON"	ENG RUN
C1	NOT USED	–	–	–	–
C2	NOT USED	–	–	–	–
C3	IAC "B" LOW	444	LT GRN/ BLK	NOT	USABLE
C4	IAC "B" HIGH	443	LT GRN/ WHT	NOT	USABLE
C5	IAC "A" HIGH	441	LT BLU/ WHT	NOT	USABLE
C6	IAC "A" LOW	442	LT BLU/ BLK	NOT	USABLE
C7	HIGH GEAR SWITCH SIGNAL	446	LT BLU	12	14
C8	NOT USED	–	–	–	–
C9	CRANK SIGNAL	806	PPL/WHT	①	0
C10	CTS SIGNAL	410	YEL	②	②
C11	MAP SIGNAL	432	LT GRN	4.8	1.0
C12	NOT USED	–	–	–	–
C13	TPS SIGNAL	417	DK BLU	③	.6
C14	MAP & TPS 5 VOLT REF.	416	GRY	5	5
C15	NOT USED	–	–	–	–
C16	BATTERY 12 VOLT	440	ORN	12	14

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES	
				KEY "ON"	ENG RUN
D1	SYSTEM GROUND	450	BLK/WHT	0	0
D2	TPS & CTS SENSOR GROUND	452	BLK	0	0
D3	NOT USED	–	–	–	–
D4	EST	423	WHT	*	1.0
D5	EST BYPASS	424	TAN/BLK	*	4.75
D6	OXYGEN SENSOR GROUND	413	TAN	*	*
D7	OXYGEN SENSOR SIGNAL	412	PPL	④	⑤
D8	NOT USED	–	–	–	–
D9	NOT USED	–	–	–	–
D10	NOT USED	–	–	–	–
D11	NOT USED	–	–	–	–
D12	NOT USED	–	–	–	–
D13	NOT USED	–	–	–	–
D14	INJECTOR 2 DRIVER	468	GRN	12	14
D15	NOT USED	–	–	–	–
D16	INJECTOR 1 DRIVER	467	BLU	12	14

BACK VIEW OF CONNECTOR



32 PIN C-D CONNECTOR

① Battery voltage when cranking
② About 1.0 volt, varies with temperature
③ .6 Volt to about 4.8 volt at Wide Open Throttle (WOT)
④ .26 to .46 volt
⑤ Varies from .1 volt to .9 volt
* Less than .5 volt

ENGINE 4.3L, 5.0L, 5.7L
VEHICLE C/K TRUCK

1991

6-6-90
MS 9911

Figure 3-69 - ECM Connector Terminal End View 4.3L, 5.0L, 5.7L (C/K) Except 4L80-E Transmission (2 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES KEY "ON"	NORMAL VOLTAGES ENG RUN
A1	FUEL PUMP RELAY DRIVE	465	DR GRN/ WHT	①	14
A2	NOT USED	–	–	–	–
A3	NOT USED	–	–	–	–
A4	EGR CONTROL	435	GRY	12	14
A5	"SERVICE ENGINE SOON" LIGHT CONTROL	419	BRN/WHT	0	14
A6	IGNITION - ECM FUSED	439	PNK/BLK	12	14
A7	TCC CONTROL	422	TAN/BLK	12	14
A8	SERIAL DATA	461	ORN	②	②
A9	DIAGNOSTIC TEST TERMINAL	451	WHT/BLK	5	5
A10	VEHICLE SPEED SENSOR SIGNAL	437	BRN	③	③
A11	TPS AND CTS SENSOR GROUND	452	BLK	0	0
A12	SYSTEM GROUND	450	BLK/WHT	0	0

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES KEY "ON"	NORMAL VOLTAGES ENG RUN
B1	BATTERY 12 VOLT	440	ORN	12	14
B2	FUEL PUMP SIGNAL	120	GRY	①	14
B3	EST REFERENCE LOW	453	BLK/RED	0	0
B4	NOT USED	–	–	–	–
B5	EST REFERENCE HIGH	430	PPL/WHT	0	1.6
B6	NOT USED	–	–	–	–
B7	ESC SIGNAL	485	BLK	9	9
B8	A/C SIGNAL	59	DK GRN	④	④
B9	NOT USED	–	–	–	–
B10	NOT USED	–	–	–	–
B11	NOT USED	–	–	–	–
B12	NOT USED	–	–	–	–

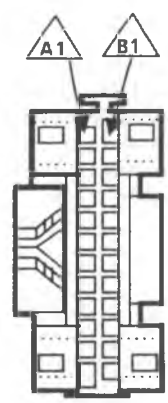
① Battery voltage first 2 seconds.
② Varies
③ Varies from 0 to battery voltage depending on position of drive wheels.
④ 0 volts A/C "OFF" battery voltage A/C "ON".
⑤ 0 volts in neutral, battery voltage in gear.
⑥ Varies with temperature.

ENGINE 5.7L & 7.4L

VEHICLE R/V TRUCK
UNDER 8600 GVW

1991

BACK VIEW OF CONNECTOR



24 PIN A-B CONNECTOR

5-31-90
MS 9906

Figure 3-70 - ECM Connector Terminal End View 5.7L, 7.4L (R/V) Except 4L80-E Transmission (1 of 2)

TBI FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling in closed loop (for "Engine Run" column)
- Diagnostic terminal not grounded
- Tech 1 in open/road test mode

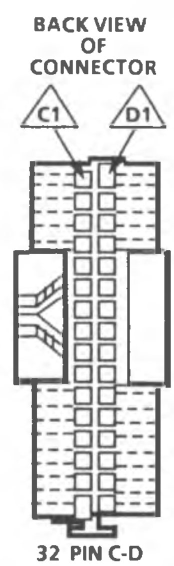
PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES	
				KEY "ON"	ENG RUN
C1	NOT USED	–	–	–	–
C2	NOT USED	–	–	–	–
C3	IAC "B" LOW	444	LT GRN/ BLK	NOT	USABLE
C4	IAC "B" HIGH	443	LT GRN/ WHT	NOT	USABLE
C5	IAC "A" HIGH	441	LT BLU/ WHT	NOT	USABLE
C6	IAC "A" LOW	442	LT BLU/ BLK	NOT	USABLE
C7	HIGH GEAR SWITCH SIGNAL	446	LT BLU	12	14
C8	NOT USED	–	–	–	–
C9	CRANK SIGNAL	806	PPL/WHT	①	0
C10	CTS SIGNAL	410	YEL	②	②
C11	MAP SIGNAL	432	LT GRN	4.8	1.0
C12	NOT USED	–	–	–	–
C13	TPS SIGNAL	417	DK BLU	③	.6
C14	MAP & TPS 5 VOLT REF.	416	GRY	5	5
C15	NOT USED	–	–	–	–
C16	BATTERY 12 VOLT	440	ORN	12	14

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES	
				KEY "ON"	ENG RUN
D1	SYSTEM GROUND	551	TAN/WHT	0	0
D2	MAP GROUND	455	PPL	0	0
D3	NOT USED	–	–	–	–
D4	EST SIGNAL	423	WHT	*	1.0
D5	EST BYPASS	424	TAN/BLK	*	4.75
D6	OXYGEN SENSOR GROUND	413	TAN	*	*
D7	OXYGEN SENSOR SIGNAL	412	PPL	④	⑤
D8	NOT USED	–	–	–	–
D9	NOT USED	–	–	–	–
D10	NOT USED	–	–	–	–
D11	NOT USED	–	–	–	–
D12	NOT USED	–	–	–	–
D13	NOT USED	–	–	–	–
D14	INJECTOR 2 DRIVER	468	GRN	12	14
D15	NOT USED	–	–	–	–
D16	INJECTOR 1 DRIVER	467	BLU	12	14

① Battery voltage when cranking
② About 1.0 volt, varies with temperature
③ .6 Volt to about 4.8 volt at Wide Open Throttle (WOT)
④ .26 to .46 volt
⑤ Varies from .1 volt to .9 volt
* Less than .5 volt

ENGINE 5.7L, 7.4L
VEHICLE R/V TRUCK
UNDER 8600 GVW

1991



6-6-90
MS 9907-6E

Figure 3-71 - ECM Connector Terminal End View 5.7L, 7.4L (R/V) Except 4L80-E Transmission (2 of 2)

PCM CONNECTOR IDENTIFICATION

This PCM voltage chart is for use with a digital voltmeter to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

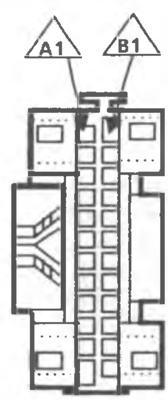
- Engine at operating temperature
- Closed Loop
- Engine idling (for "Engine Run" column)
- Test terminal not grounded
- Tech 1 not installed
- Tech 1 in open/road test mode

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES	
				KEY "ON"	ENG RUN
A1	FUEL PUMP RELAY CONTROL	465	DK GRN/WHT	(1)	14
A2	SHIFT SOLENOID "B" CONTROL	1223	YEL/BLK	12	14
A3	SHIFT SOLENOID "A" CONTROL	1222	LT GRN	*	*
A4	TCC SOLENOID CONTROL	422	TAN/BLK	12	14
A5	NOT USED	–	–	–	–
A6	EAC CONTROL (7.4L UNDER 8500 GVW)	436	BRN	12	14
A7	"SERVICE ENGINE SOON" LAMP CONTROL	419	BRN/WHT	0	14
A8	NOT USED	–	–	–	–
A9	NOT USED	–	–	–	–
A10	NOT USED	–	–	–	–
A11	EVRV (EGR) CONTROL	435	GRY	11	12
A12	BRAKE SIGNAL	420	PPL	(2)	(2)

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES	
				KEY "ON"	ENG RUN
B1	NOT USED	–	–	–	–
B2	RANGE "C" SIGNAL	1226	RED	12	14
B3	RANGE "B" SIGNAL	1225	DK BLU	0	*
B4	RANGE "A" SIGNAL	1224	PNK	12	14
B5	TRANSMISSION OUTPUT SPEED SIGNAL (4WD)	1232	LT BLU	5	5
B6	TRANSMISSION OUTPUT SPEED SENSOR GROUND	1233	DK GRN/YEL	0	0
B7	FORCE MOTOR LOW	1229	LT BLU/WHT	0	.85
B8	FORCE MOTOR HIGH	1228	RED/BLK	0	4.50
B9	TRANSMISSION INPUT SPEED SIGNAL	1230	GRY/RED	0	*
B10	TRANSMISSION INPUT SPEED SENSOR GROUND	1231	DK BLU/WHT	0	0
B11	VEHICLE SPEED AND TRANSMISSION OUTPUT SPEED SIGNAL (2WD)	437	BRN	0	0
B12	A/C SIGNAL	59	DK GRN	(3)	(3)

(1) Battery voltage first 20 seconds
(2) Battery voltage brakes "OFF."
0 volts brakes "ON."
(3) 0 volts A/C "OFF" battery voltage A/C "ON."
* Less than .50 volt.

BACK VIEW OF CONNECTOR



24 PIN A-B CONNECTOR

ENGINE 4.3L, 5.7L, 7.4L AND 4L80-E TRANSMISSION

1991

6-25-90
MS 10033-7A

Figure 3-72 - PCM Connector Terminal End View 4.3L, 5.7L, 7.4L Equipped with 4L80-E Transmission (All Series) (1 of 2)

PCM CONNECTOR IDENTIFICATION

This PCM voltage chart is for use with a digital voltmeter to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

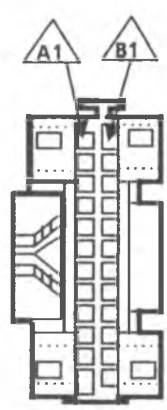
- Engine at operating temperature
- Closed Loop
- Engine idling (for "Engine Run" column)
- Test terminal not grounded
- Tech 1 not installed
- Tech 1 in open/road test mode

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES KEY "ON"	NORMAL VOLTAGES ENG RUN
C1	FUSED IGNITION FEED	439	PNK/BLK	12	14
C2	SYSTEM GROUND	450	BLK/WHT	*	*
C3	SYSTEM GROUND	551	TAN/WHT	*	*
C4	TPS REFERENCE VOLTAGE	416	GRY	5	5
C5	TPS SIGNAL	417	DK BLU	.60	(2)
C6	IAC COIL "A" HIGH	441	LT BLU/WHT	NOT	USE-ABLE
C7	IAC COIL "A" LOW	442	LT BLU/BLK	NOT	USE-ABLE
C8	IAC COIL "B" LOW	444	LT GRY/BLK	NOT	USE-ABLE
C9	IAC COIL "B" HIGH	443	LT GRN/WHT	NOT	USE-ABLE
C10	MAP SIGNAL	432	LT GRN	4.77	1.45
C11	SERIAL DATA	(1)	(1)	(1)	(1)
C12	NOT USED	–	–	–	–
C13	O_2 SENSOR GROUND	413	TAN	0	*
C14	O_2 SIGNAL	412	PPL	(3)	(4)
C15	INJECTOR #2 CONTROL	468	DK GRN	12	14
C16	INJECTOR #1 CONTROL	467	DK BLU	12	14

PIN	PIN FUNCTION	CKT #	WIRE COLOR	NORMAL VOLTAGES KEY "ON"	NORMAL VOLTAGES ENG RUN
D1	BATTERY VOLTAGE FEED	440	ORN	12	14
D2	MAP/TTS SENSOR GROUND	455	PPL	0	0
D3	TPS/CTS SENSOR GROUND	452	BLK	0	0
D4	MAP REFERENCE VOLTAGE	474	GRY	5.0	5.0
D5	ESC (KNOCK) SIGNAL	496	DK BLU	4.7	4.7
D6	DIAGNOSTIC TEST TERMINAL	451	WHT/BLK	5	5
D7	FUEL PUMP SIGNAL	120	GRY		
D8	NOT USED	–	–	–	–
D9	NOT USED	–	–	–	–
D10	NOT USED	–	–	–	–
D11	EST CONTROL	423	WHT	0	1.0
D12	EST BYPASS	424	TAN/BLK	0	4.64
D13	EST REFERENCE LOW	453	BLK/RED	0	0
D14	EST REFERENCE HIGH	430	PPL/WHT	0	1.5
D15	TRANSMISSION TEMPERATURE SIGNAL	1227	BLK/YEL	2.24	2.0
D16	COOLANT TEMPERATURE SIGNAL	410	YEL	1.5	1.69

(1) 1061 ORN/BLK or 461 ORN or 488 from 2 volts to 5 volts.
(2) .70 volts measured between terminals "C5" and "D2" 4.26v W.O.T.
(3) .26 volt to .46 volt
(4) Varies (toggles) .1 volt to .9 volt.
(5) 12 volts first 20 seconds.
* Less than .50 volt.

BACK VIEW OF CONNECTOR



24 PIN A-B CONNECTOR

ENGINE 4.3L, 5.7L, 7.4L AND 4L80-E TRANSMISSION

1991

6-25-90
MS 10038-7A

Figure 3-73 - PCM Connector Terminal End View 4.3L, 5.7L, 7.4L Equipped with 4L80-E Transmission (All Series) (2 of 2)

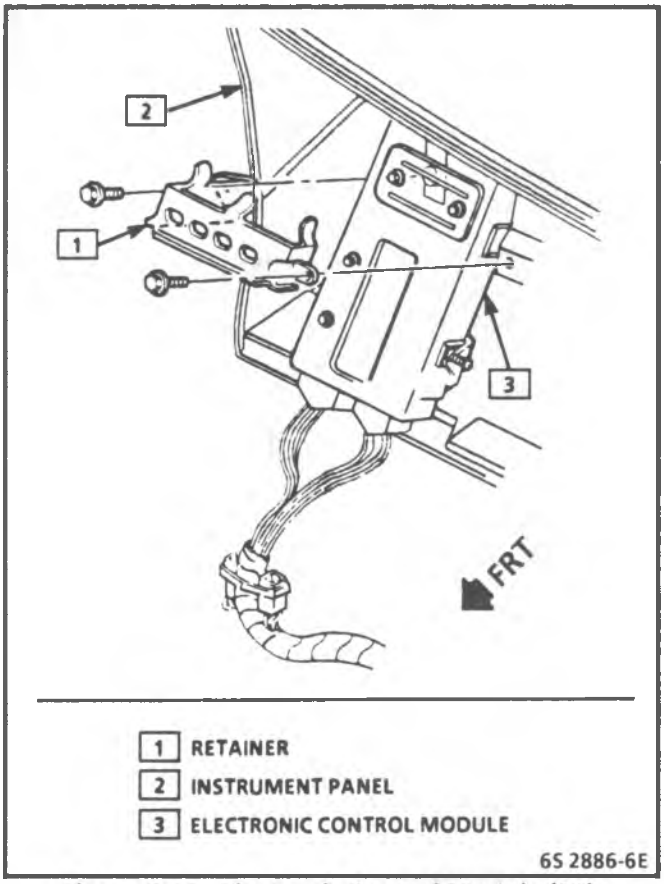


Figure 3-74 - Electronic Control Module (ST)

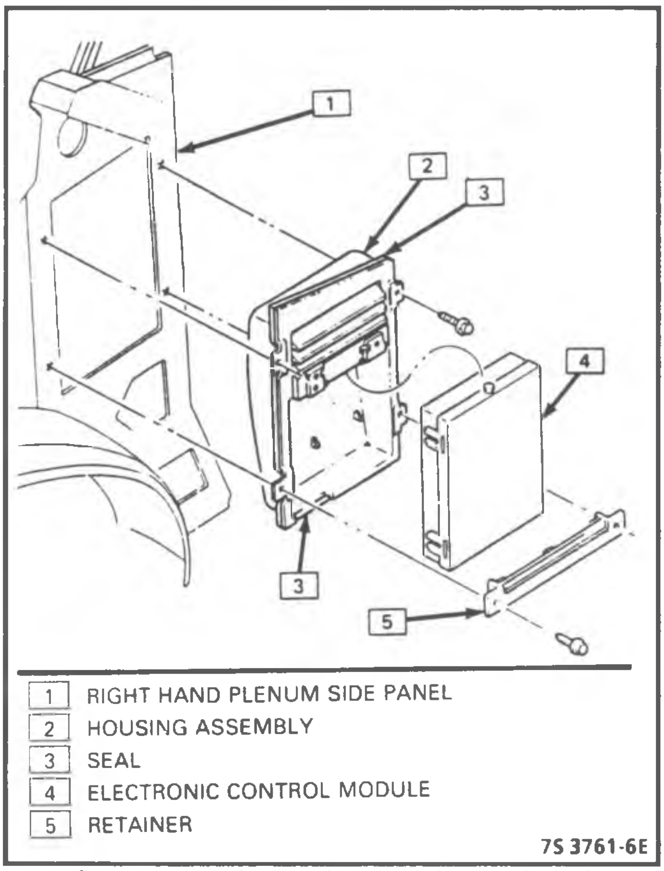


Figure 3-75 - Electronic Control Module (M)

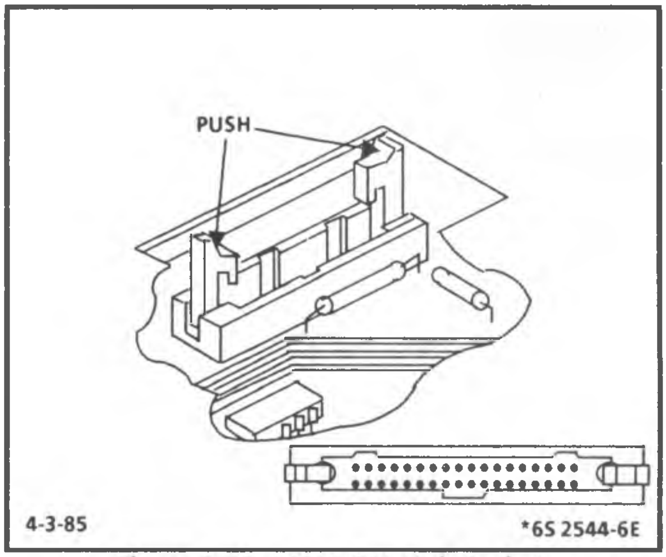


Figure 3-76 - MEM-CAL Unit Socket

IF ECM (2.5L)/PCM IS BEING REPLACED:

Remove or Disconnect

1. New ECM/PCM from its packaging and check the service number to make sure it is the same as the defective ECM/PCM.
2. Access cover.

Install or Connect

1. MEM-CAL in MEM-CAL socket.

Important

- Press only on the ends of the MEM-CAL. Small notches in the MEM-CAL must be aligned with the small notches in the MEM-CAL socket. Press on the ends of the MEM-CAL, until the retaining clips snap into the ends of the MEM-CAL. Do not press on the middle of the MEM-CAL, only the ends.

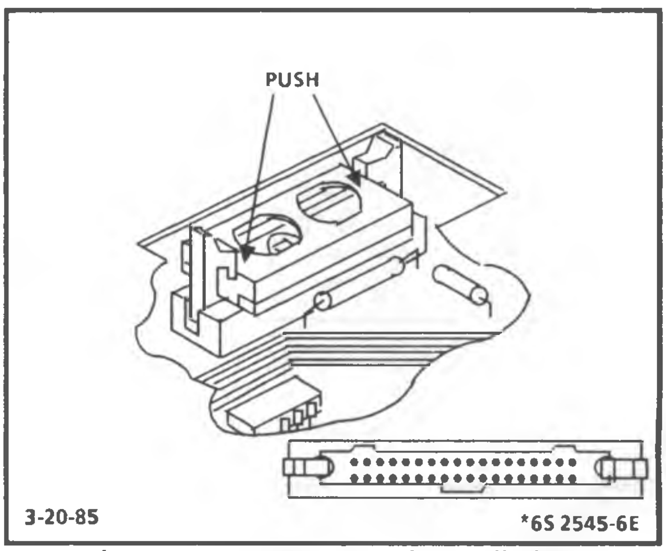


Figure 3-77 - MEM-CAL Unit Installation

2. Access cover on ECM/PCM.
3. ECM/PCM in passenger compartment.
4. Connectors to ECM/PCM.

Functional Check

1. Turn ignition "ON."
2. Enter diagnostics.
   A. Code 12 should flash four times (if no other codes are present). This indicates the MEM-CAL is installed properly, and the ECM/PCM is functioning.
   B. If trouble Code 51 occurs, or if the "Service Engine Soon" light is "ON" constantly with no codes, the MEM-CAL is not fully seated or is defective.
      - If not fully seated, press firmly on the ends of the MEM-CAL.
      - If it is necessary to remove the MEM-CAL, follow the previous removal instructions.

ECM Replacement - With PROM & CAL-PAK (V6 & V8)

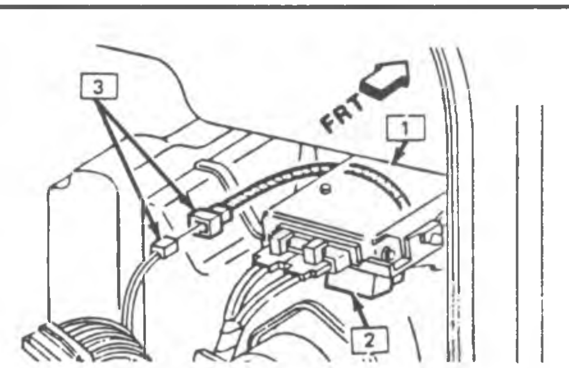
Figures 3-74 and 3-75; 3-78 through 3-81 and 3-83

Remove or Disconnect

1. Negative battery cable or ECM B fuse
2. Connectors from the ECM.
3. ECM. Refer to Figure 3-75 for servicing the ECM.

Install or Connect

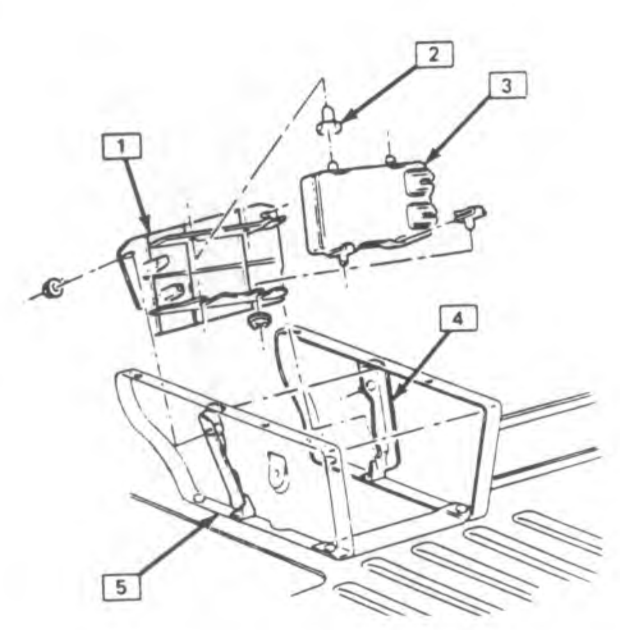
1. ECM into vehicle.
2. Connector to the ECM.
3. Negative battery cable or ECM B fuse.
4. Perform system check.



1 ELECTRONIC CONTROL MODULE
2 FUEL MODULE
3 ELECTRONIC CONNECTOR

8S 4613-6E

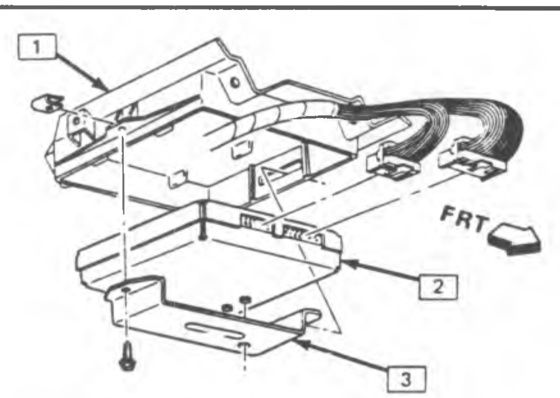
Figure 3-78 - Electronic Control Module (CK)



1 ECM HOUSING
2 RETAINER
3 ELECTRONIC CONTROL MODULE
4 BRACKET
5 SEAT RISER

7S 3765-6E

Figure 3-79 - Electronic Control Module (G)



1 ECM HOUSING (BEHIND GLOVE BOX)
2 ELECTRONIC CONTROL MODULE
3 RETAINER

7S 3762-6E

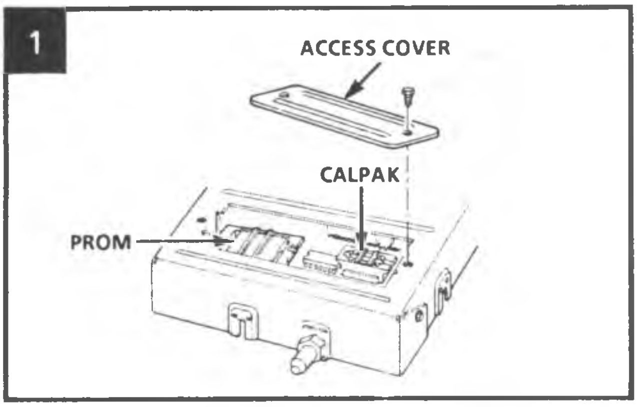
Figure 3-80 - Electronic Control Module (RV)

PROM

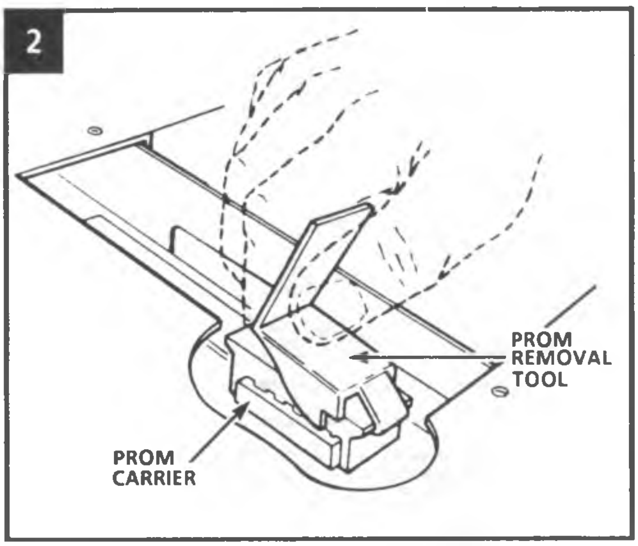
Refer to Figure 3-81, for removal and installation of a PROM.

NOTICE: To prevent possible Electrostatic Discharge damage to the PROM, CAL-PAK or MEM-CAL, Do Not touch the component leads, and Do Not remove integrated circuit from carrier.

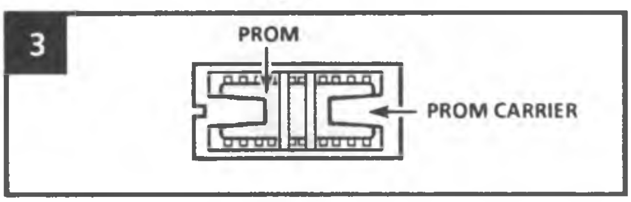
1. Remove ECM access cover.



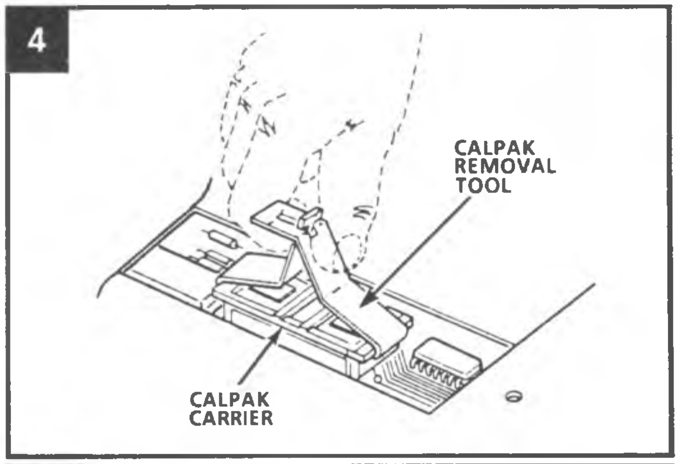
2. Remove PROM using the rocker-type PROM removal tool shown. Engage one end of the PROM carrier with the hook end of the tool. Press on the vertical bar end of the tool and rock the engaged end of the PROM carrier up as far as possible. Engage the opposite end of the PROM carrier in the same manner and rock this end up as far as possible. Repeat this process until the PROM carrier and PROM are free of the PROM socket. The PROM carrier with PROM in it should lift off of the PROM socket easily.

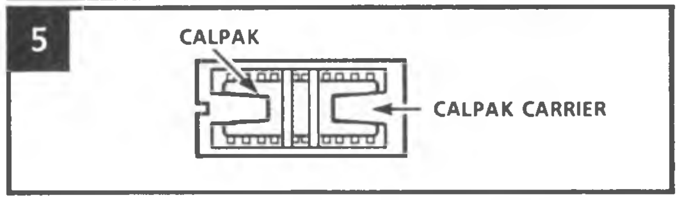


3. Inspect reference end of the PROM carrier and carefully set aside. Do not remove PROM from the carrier to confirm PROM correctness. Notch in PROM referenced to small notch in carrier and the 1.

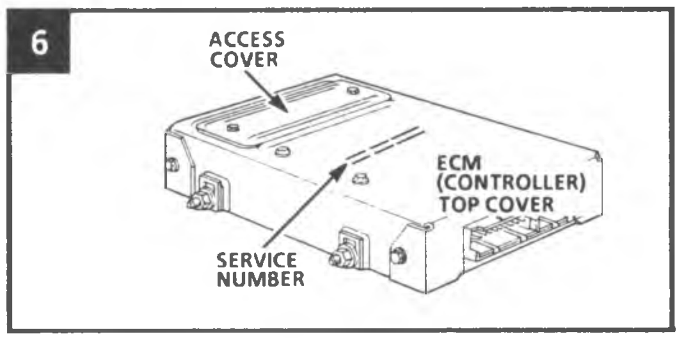


4. Remove CALPAK (if used) using removal tool shown. Grasp the CALPAK carrier of the narrow ends only. Gently rock the carrier from end to end while applying a firm upward force.
5. Inspect reference end of the CALPAK carrier and carefully set aside. Do not remove CALPAK from carrier to confirm CALPAK correctness. Notch in CALPAK reference to samll notch in carrier and the 1.





6. If a service controller is being installed, check the service number on the controller to make sure it is the same as the removed ECM. Remove access cover.



7. Install PROM and CALPAK (if used). If a service PROM or CALPAK is being installed, make sure they have the same part number as the removed PROM or CALPAK.

Important (Before installing PROM)

ANY TIME THE PROM IS INSTALLED BACKWARDS AND THE IGNITION SWITCH TURNED ON, THE PROM IS DESTROYED.

Important

DO NOT press on PROM or CALPAK - ONLY CARRIER.

Small notch of carrier must be aligned with small notch in socket. Press on PROM or CALPAK carrier until it is firmly seated in the socket. Do not press on PROM or CALPAK, only carrier

8. Install ECM access cover.
9. Install ECM in passenger compartment and perform a "DIAGNOSTIC CIRCUIT CHECK" to confirm proper installation.

8-10-88
6S 2511-6E

Figure 3-81 - Servicing ECM - Except 2.5L

Remove or Disconnect (Figures 1 and 2)

1. ECM access cover

Important
DO NOT remove any of the other screws.

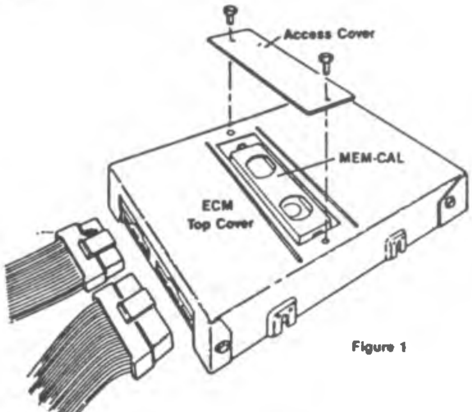


Figure 1

2. MEM-CAL removal

Important
Replacement Electronic Control Module (ECM) is supplied without a Memory-Calibration unit (MEM-CAL) so care should be taken when removing the MEM-CAL from the defective ECM as it will be reused in the new ECM.

Using two fingers, push both retaining clips back away from the MEM-CAL at the same time. Grasp the MEM-CAL at both ends and lift up out of the MEM-CAL socket. Do not remove the cover of the MEM-CAL. Use of unapproved MEM-CAL removal methods will cause damage to the MEM-CAL or MEM-CAL socket.

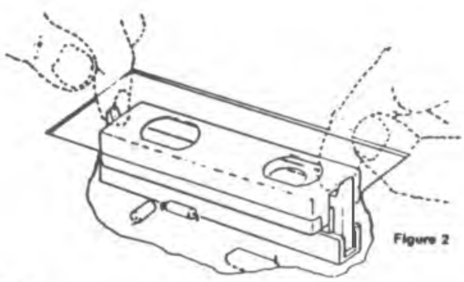


Figure 2

Inspect (Figure 3)

For alignment notches of the MEM-CAL and carefully set aside. Do not open the MEM-CAL.

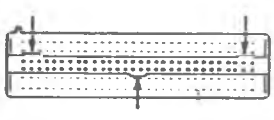


Figure 3

Remove or Disconnect (Figure 1)

1. New Electronic Control Module (ECM) from its packaging and check the service number to make sure it is the same as the defective ECM.
2. Access cover

Install or Connect (Figures 4, 5, 6, 7 and 8)

1. MEM-CAL in MEM-CAL socket

Inspect

Type of clips used on the MEM-CAL sockets

There are two types of clips used on the MEM-CAL sockets. A "solid" type is used on the early production models and a "hollow" type is used on later production models. See Figure 3.

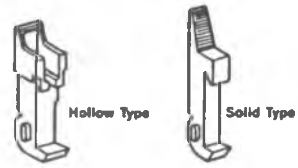


Figure 4

Important

Press only on the ends of the MEM-CAL.

Small notches in the MEM-CAL must be aligned with the small notches in the MEM-CAL socket.

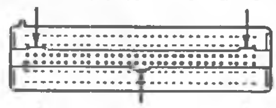


Figure 5


Figure 6

Installing MEM-CAL with "solid" clips

Press on the ends of the MEM-CAL until the retaining clips snap into the ends of the MEM-CAL. Press the clips into the side of the MEM-CAL until they snap into place. Listen for the click. Do not press on the middle of the MEM-CAL; only on the ends.

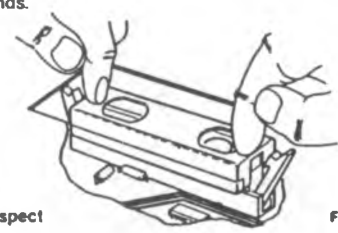


Figure 7

Inspect

Retaining clips have snapped into place.

Installing MEM-CAL with "hollow" clips.

Press down on the ends of the MEM-CAL until the clips are against the side of the MEM-CAL. Press inward on the clips until they snap into place. Listen for the click.

Important

Do not press on the ends of the MEM-CAL until the clips snap into place because the clips may be damaged.

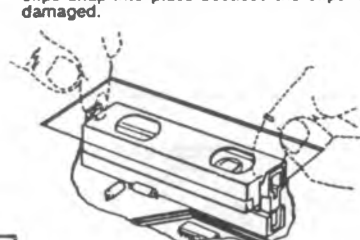


Figure 8

Inspect

Retaining clips have snapped into place.

Install or Connect (Figure 1)

1. Access cover on ECM
2. ECM in passenger compartment and perform "System Check" to confirm proper installation

8S 4697-6E

Figure 3-82 - Servicing ECM/PCM 2.5L and V6, V8 with 4L80-E Transmission

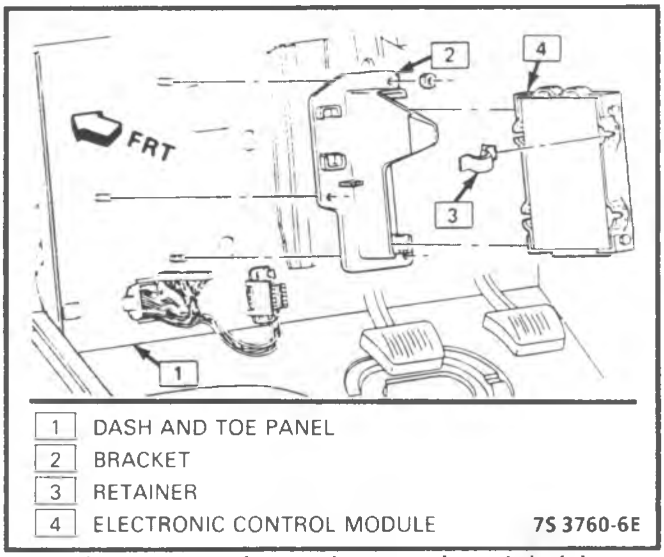


Figure 3-83 - Electronic Control Module (P)

CALPAK

Refer to Figure 3-81, for removal and installation of a CAL-PAK. Some CAL-PAK's are soldered in and, therefore, non-replaceable.

NOTICE: To prevent possible Electrostatic Discharge damage to the PROM, CAL-PAK or MEM-CAL, Do Not touch the component leads, and Do Not remove integrated circuit from carrier.

COOLANT TEMPERATURE SENSOR
Figure 3-84

NOTICE: Care must be taken, when handling coolant sensor. Damage to coolant sensor will affect proper operation of the fuel control system.

Remove or Disconnect

1. Negative battery cable.
2. Drain cooling system below level of sensor.
3. Electrical connector releasing locking tab.
4. Coolant sensor.

Install or Connect

1. Sensor in engine.
2. Electrical connector.
3. Refill coolant system.
4. Negative battery cable.

MAP SENSOR
Figures 3-85 through 3-89

Other than checking for loose hoses and electrical connections, the only service possible is unit replacement, if diagnosis shows sensor to be faulty.

Remove or Disconnect

1. Negative battery cable.

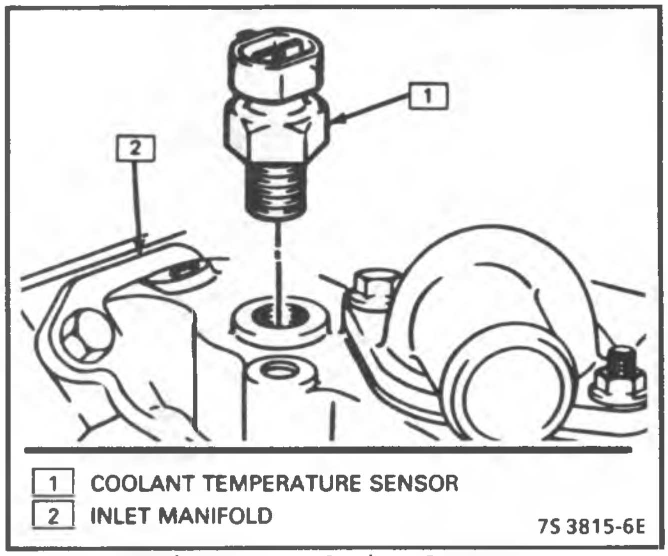


Figure 3-84 - Coolant Sensor

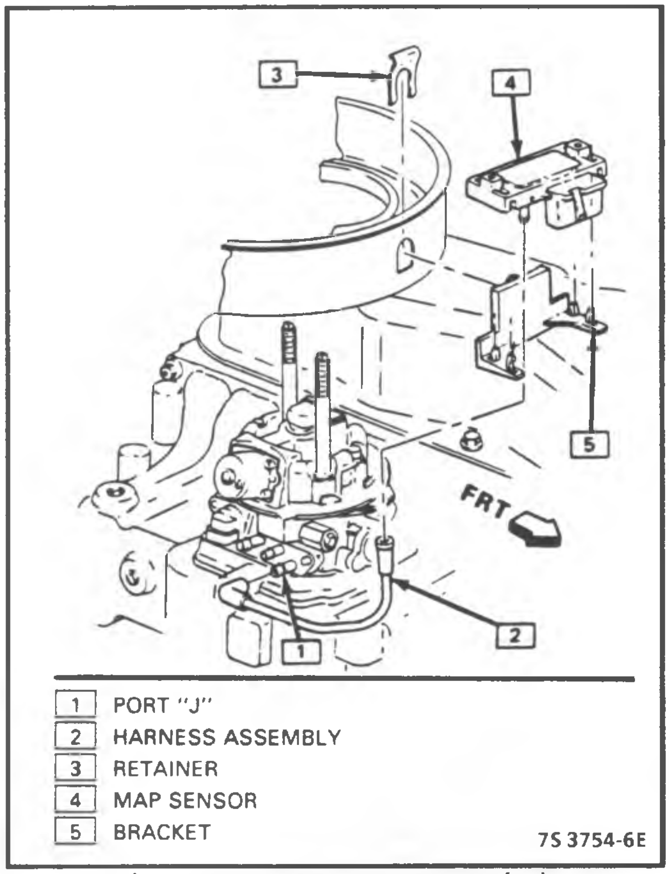
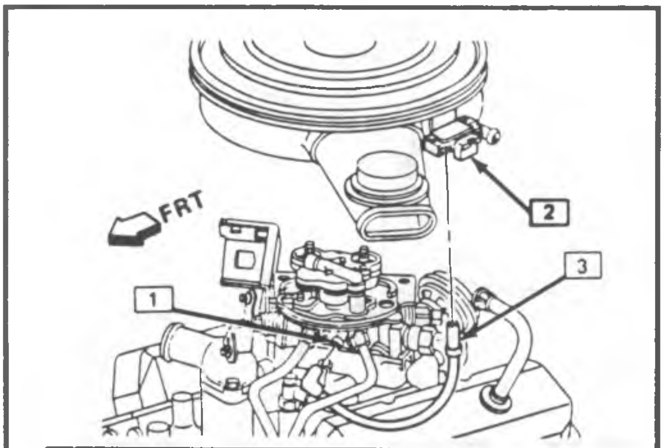


Figure 3-85 - MAP Sensor - 2.5L (ST)

2. Vacuum harness assembly.
3. Electrical connector releasing locking tab.
4. Bolts or release lock tabs and remove sensor.

Install or Connect

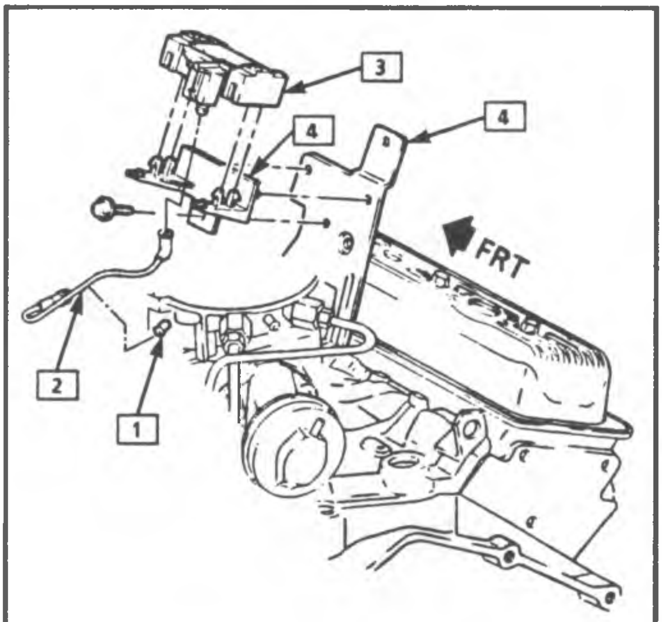
1. Bolts or snap sensor on bracket.
2. Electrical connector.
3. Vacuum harness.
4. Negative battery cable.



1 PORT "F"
2 MAP SENSOR
3 HARNESS ASSEMBLY

7S 3764-6E

Figure 3-86 - MAP Sensor 2.8L (S)



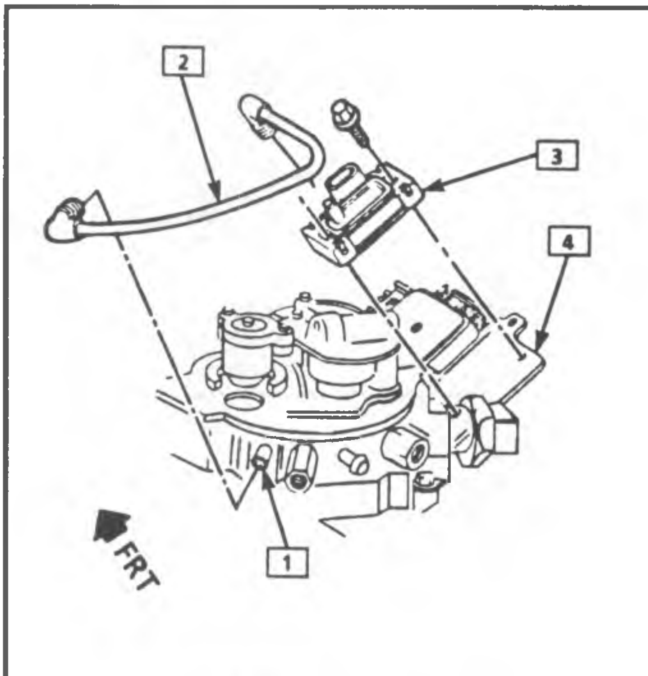
1 PORT "F"
2 HARNESS ASSEMBLY
3 MAP SENSOR
4 BRACKET

9S 5607-6E

Figure 3-87 - MAP Sensor 4.3L (S/T, M/L, P)

OXYGEN (O_2) SENSOR
Figure 3-90 through 3-94

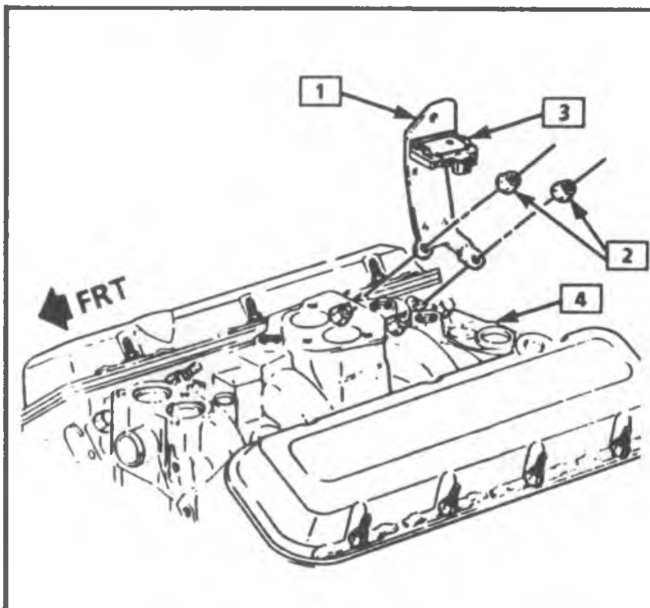
NOTICE: The Oxygen (O_2) sensor uses a permanently attached pigtail and connector. This pigtail should not be removed from the Oxygen (O_2) sensor. Damage or removal of the pigtail or connector could affect proper operation of the oxygen sensor.



1 PORT "F"
2 HARNESS ASSEMBLY
3 MAP SENSOR
4 BRACKET

7S 3750-6E

Figure 3-88 - MAP Sensor 4.3L (G)



1 BRACKET ASSEMBLY - MAP SENSOR
2 NUT - TIGHTEN TO 20-30 lb. ft.
3 MAP SENSOR ASSEMBLY
4 INTAKE MANIFOLD

MS 10026

Figure 3-89 - MAP Sensor 5.0L & 5.7L (C/K, R/V, P, G) 7.4L (C/K, R/V, P, G)

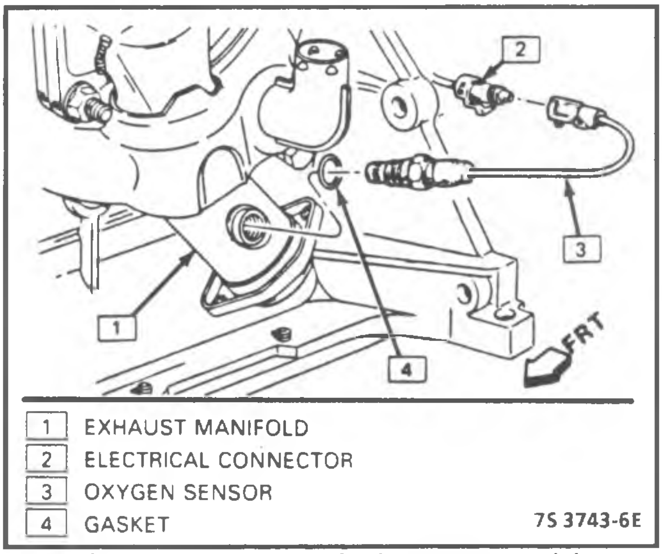


Figure 3-90 - Oxygen (O_2) Sensor 2.5L (S)

Take care when handling the Oxygen (O_2)sensor. The in-line electrical connector and louvered end must be kept free of grease, dirt, or other contaminants. Also, avoid using cleaning solvents of any type. Do not drop or roughly handle the oxygen sensor.

Remove or Disconnect

- The Oxygen (O_2) sensor may be difficult to remove, when engine temperature is below 48°C (120°F). Excessive force may damage threads in exhaust manifold or exhaust pipe.

1. Negative battery cable.
2. Electrical connector releasing locking tab.
3. Carefully back out oxygen sensor.

Install or Connect

Important

- A special anti-seize compound is used on the Oxygen (O_2) sensor threads. The compound consists of liquid graphite and glass beads. The graphite will tend to burn away, but the glass beads will remain, making the sensor easier to remove.

New, or service replacement sensors will already have the compound applied to the threads. If a sensor is removed from an engine, and if for any reason it is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

1. Coat threads of oxygen sensor with anti-seize compound P/N 5613695 or equivalent, if necessary.
2. Sensor, and torque to 41 N·m (30 ft. lb.).
3. Electrical connector.
4. Negative battery cable.

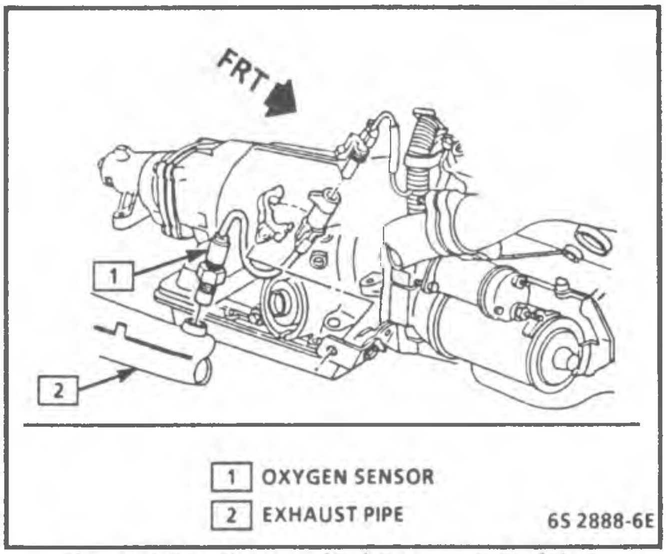


Figure 3-91 - Oxygen (O_2) Sensor 2.8L (S) & 4.3L (S/T, C/K, M/L, P, G)

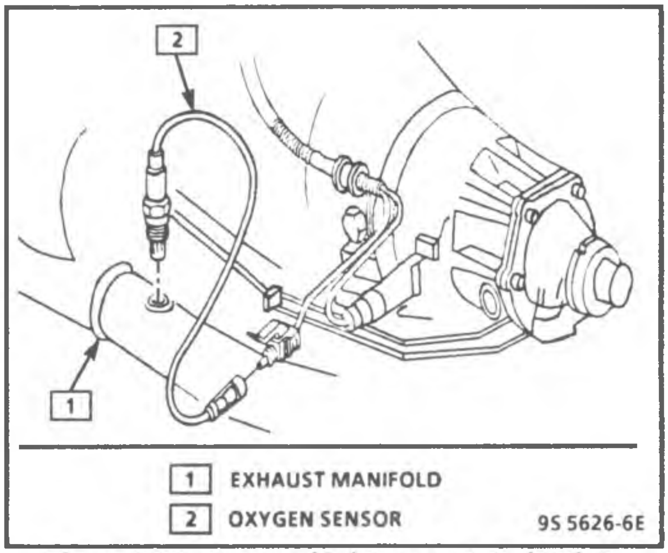


Figure 3-92 - Oxygen (O_2) Sensor 5.7L (C/K) & 7.4L (C/K, P, G)

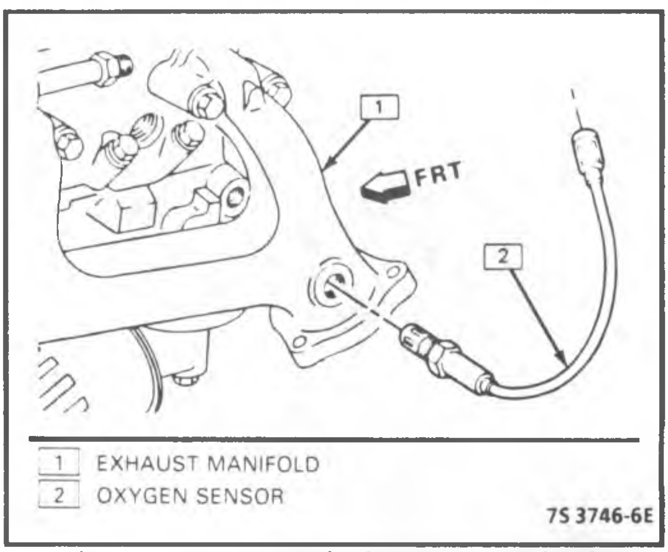


Figure 3-93 - Oxygen (O_2) Sensor 5.0L (C/K)

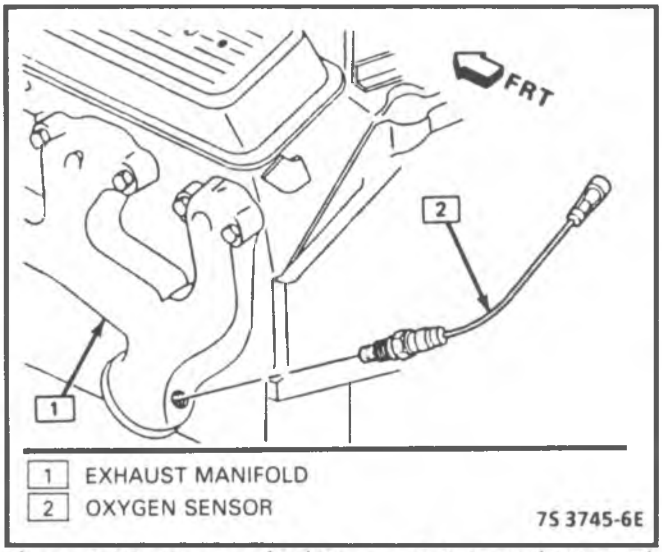


Figure 3-94 - Oxygen (O_2) Sensor 5.0L/5.7L (R/V, P, G)

THROTTLE POSITION SENSOR
Replacement - TBI 700
Figure 3-95

NOTICE: The TPS is an electrical component and must not be soaked in any liquid cleaner or solvent, as damage may result.

Remove or Disconnect

1. Air cleaner and gasket. Discard gasket.
2. Electrical connector releasing locking tab.
3. Two TPS attaching screw assemblies.
4. TPS from throttle body assembly.

Install or Connect

1. With throttle valve closed, install TPS on throttle shaft. Rotate counter-clockwise, to align mounting holes.
2. Two TPS attaching screw assemblies.

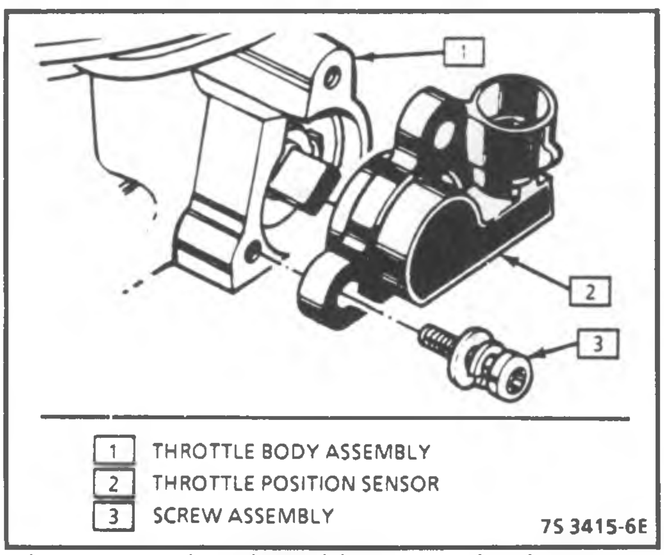


Figure 3-95 - Throttle Position Sensor (TPS) - TBI 700

Tighten

- Screw assemblies to 2.0 N·m (18.0 in. lb.).

3. Electrical connector.
4. Air cleaner and new gasket.

Replacement - TBI 220
Figure 3-96

Remove or Disconnect

1. Air cleaner, adapter, and gaskets. Discard gaskets.
2. Electrical connector releasing locking tab.
3. Two TPS attaching screw assemblies.
4. TPS from throttle body assembly.

NOTICE: The TPS is an electrical component and must not be soaked in any liquid cleaner, or solvent, as damage may result.

Install or Connect

1. TPS on throttle body assembly, while lining up TPS lever with TPS drive lever on throttle body.
2. Two TPS attaching screw assemblies.

Tighten

- Screw assemblies to 2.0 N·m (18.0 in. lb.).

3. Electrical connector.
4. Air cleaner, adapter, and new gaskets.

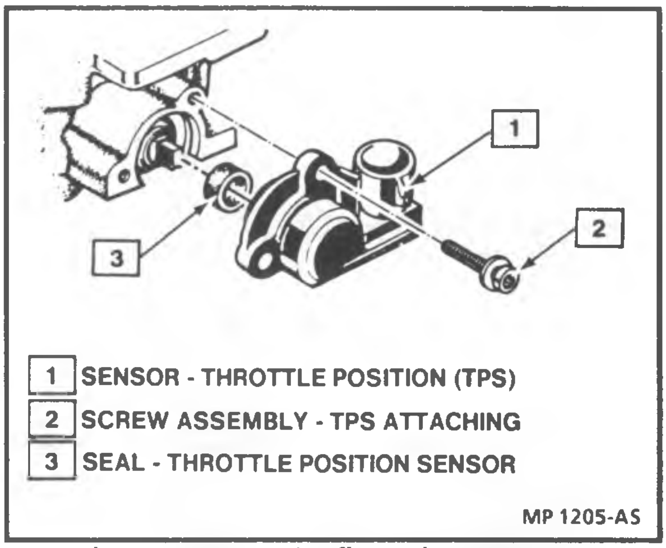


Figure 3-96 - TPS Configurations - TBI 220

INTAKE AIR TEMPERATURE (IAT) SENSOR
Figure 3-97

Remove or Disconnect

1. Negative battery cable.
2. Electrical connector releasing locking tab.
3. IAT sensor.

Install or Connect

1. IAT sensor.
2. Electrical connector.
3. Negative battery cable.

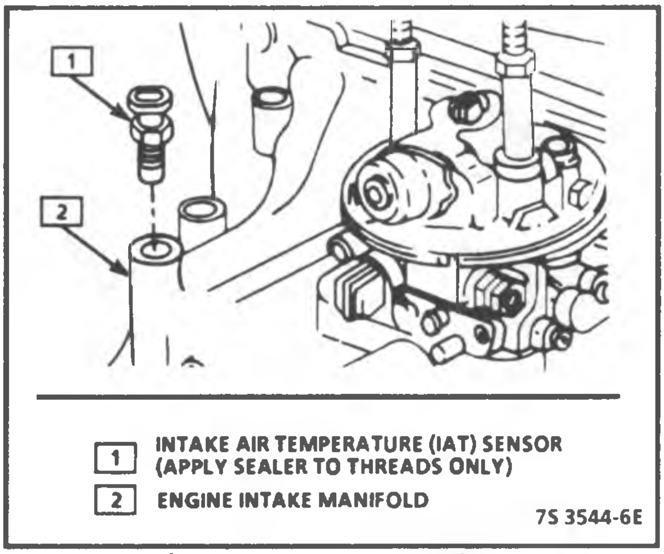


Figure 3-97 - IAT Sensor 2.5L

KNOCK SENSOR

Refer to "Electronic Spark Control," Section "7" for replacement of the knock sensor.

VEHICLE SPEED SENSOR (VSS)
Figure 3-98 through 3-100

Refer to INSTRUMENT PANEL AND GAGES (SECTION 8C), in Service Manual, for Vehicle Speed Sensor (VSS) service, which is located on the transmission.

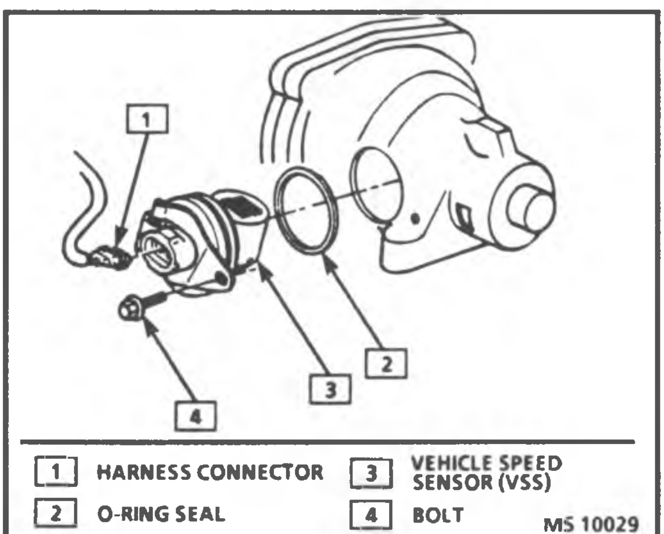


Figure 3-98 - Vehicle Speed Sensor (VSS)

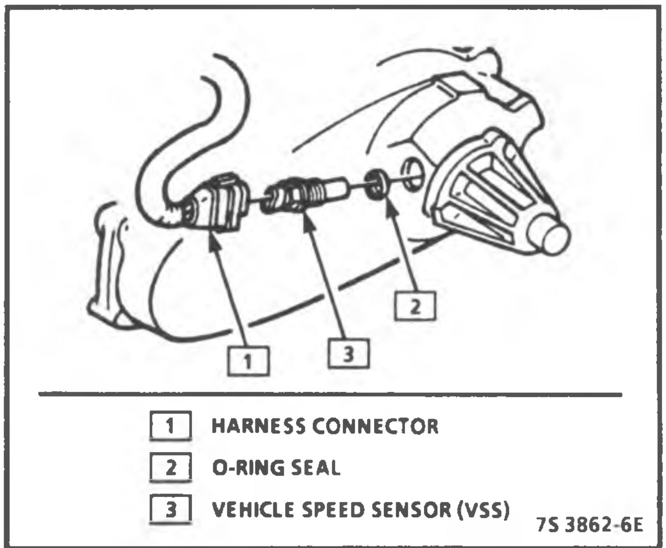


Figure 3-99 - Vehicle Speed Sensor (VSS)

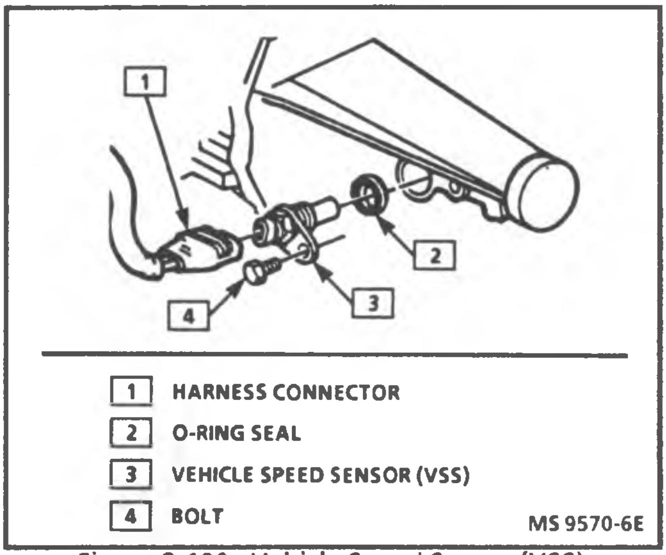


Figure 3-100 - Vehicle Speed Sensor (VSS)

DIGITAL RATIO ADAPTER CONTROLLER
Figures 3-101 to 3-105

Refer to INSTRUMENT PANEL AND GAGES (SECTION 8C), in the appropriate service manual for digital ratio adapter controller service.

The DRAC module is located on the right hand side of steering column, attached to the instrument panel on models M/L, R/V, P, and located on the left hand side of instrument panel on the parking brake lever assembly on the "G" VAN model. On the S/T model, it is located on the right hand side of the instrument panel attached to the ECM bracket. On the C/K model the DRAC is located in the instrument cluster.

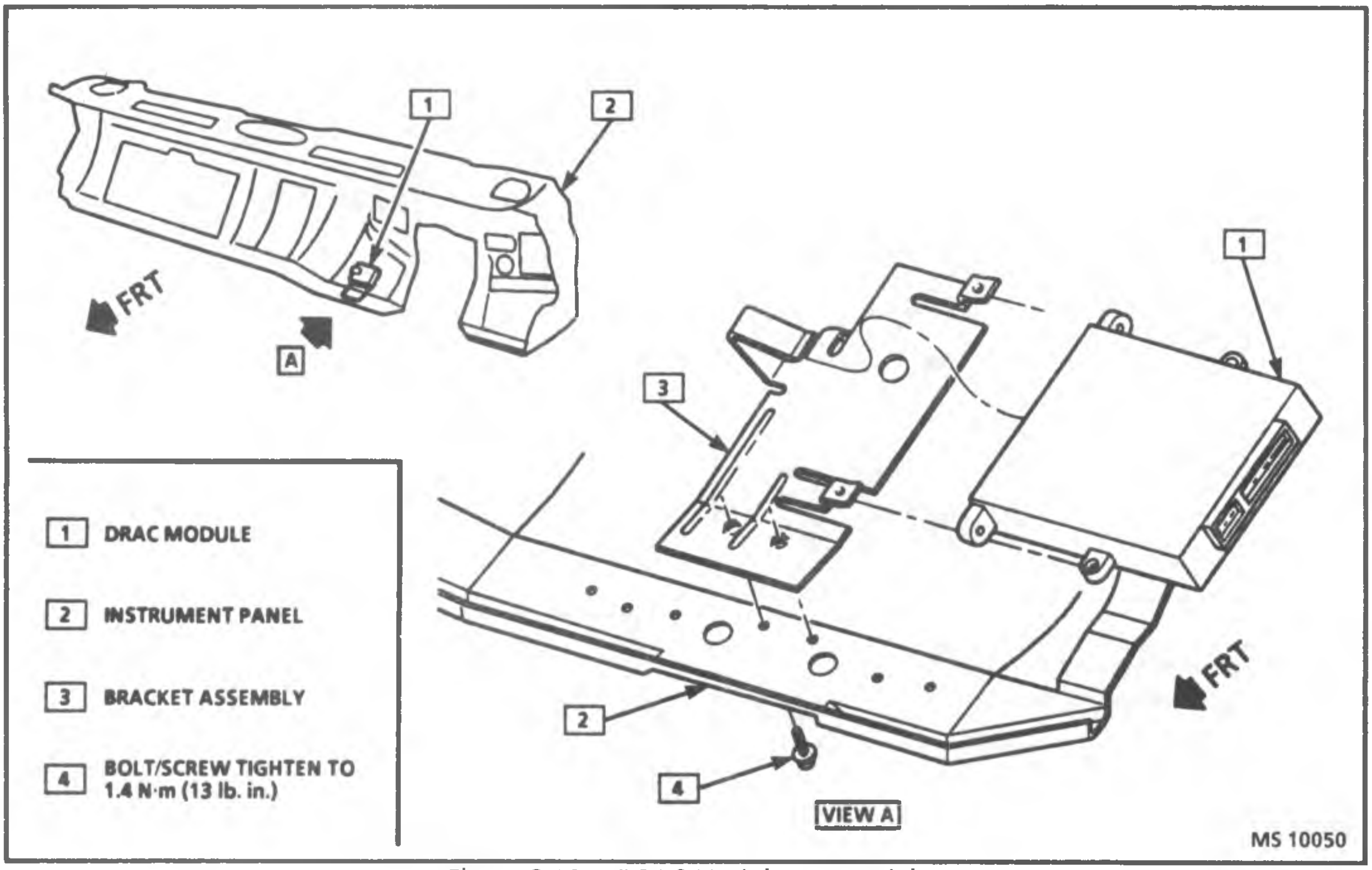


Figure 3-101 - DRAC Module R/V Model

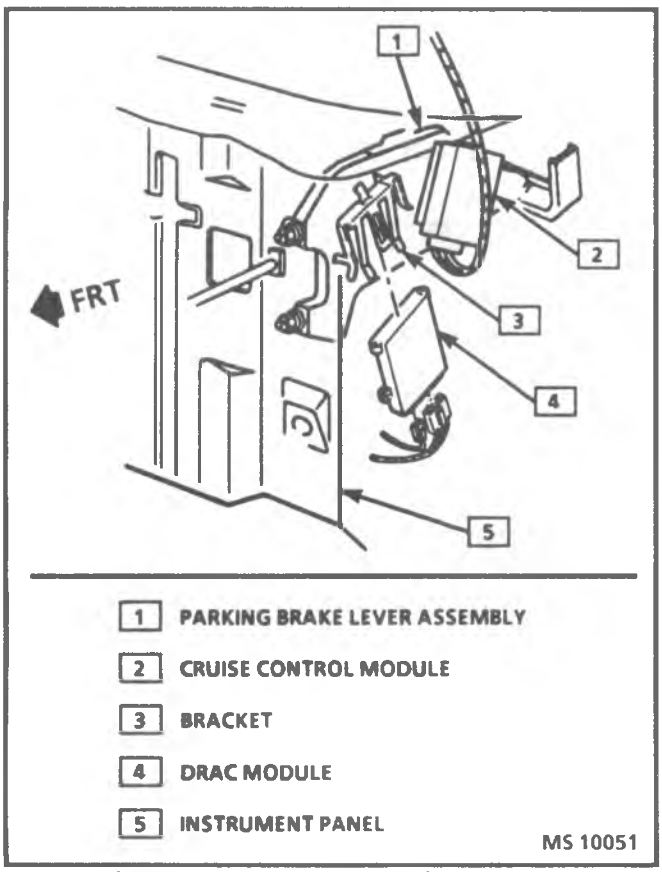


Figure 3-102 - DRAC Module G Model

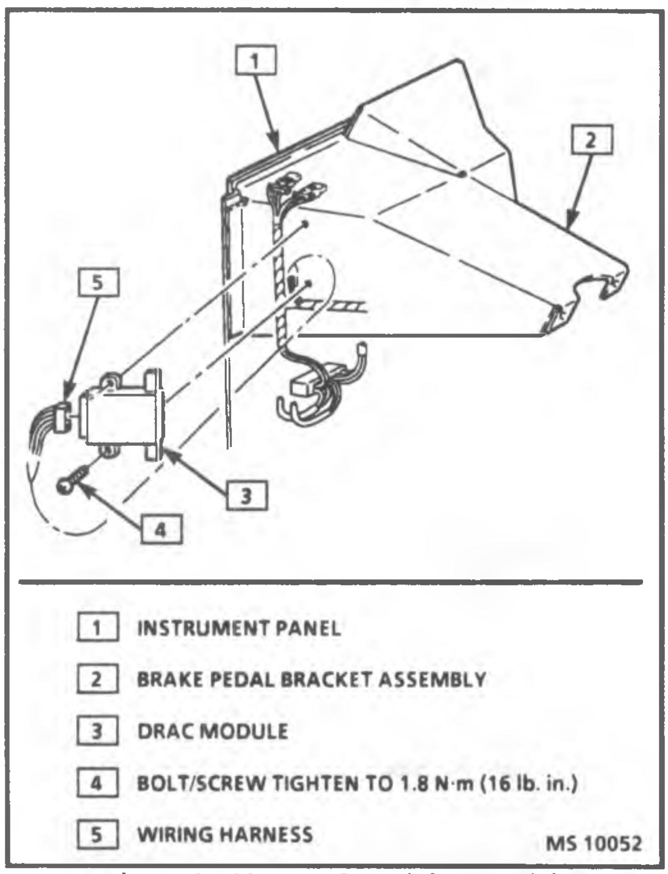


Figure 3-103 - DRAC Module P Model

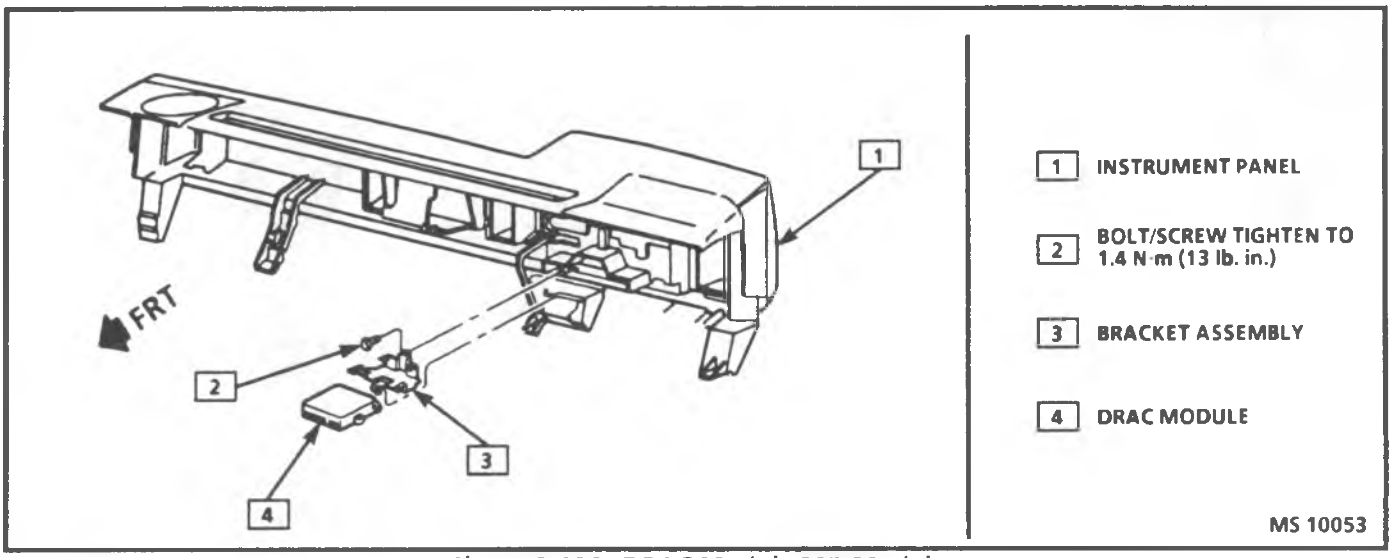


Figure 3-104 - DRAC Module M/L Model

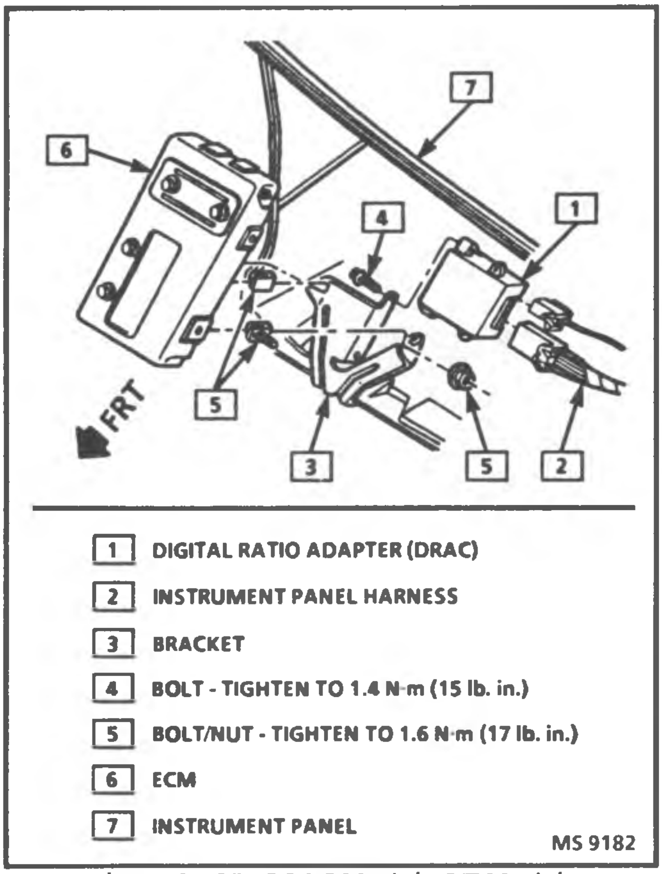


Figure 3-105 - DRAC Module S/T Model

PARK/NEUTRAL (P/N) SWITCH

The Park/Neutral (P/N) switch is located on the steering column.

PRESSURE SWITCH MANIFOLD

The pressure switch manifold is located on the 4L80-E transmission. Refer to 4L80-E AUTOMATIC TRANSMISSION (SECTION 7A2) in the appropriate service manual.

Adjustment

1. Move the switch housing all the way toward "low gear" position.
2. Move gear selector to "park" position. The main housing and housing back should ratchet, providing proper switch adjustment.

Remove or Disconnect

1. Place gear selector in "neutral."
2. Electrical connectors.
3. Spread tangs on housing and pull switch.

Install and Connect

1. Align actuator on switch, with hole in shift tube.
2. Position rearward portion of the switch (connector side) to fit into cutout in lower jacket.
3. Push down on front of switch to engage the two tangs.
4. Move gear selection to "park" and switch is adjusted.
5. Electrical connectors.

POWER STEERING PRESSURE SWITCH (PSPS) Figures 3-106

The switch is located in the inlet pipe of the power steering gear.

Remove or Disconnect

1. Electrical connector releasing locking tab.
2. Power Steering Pressure Switch (PSPS).

Install and Connect

1. Power Steering Pressure Switch (PSPS).
2. Electrical connector.

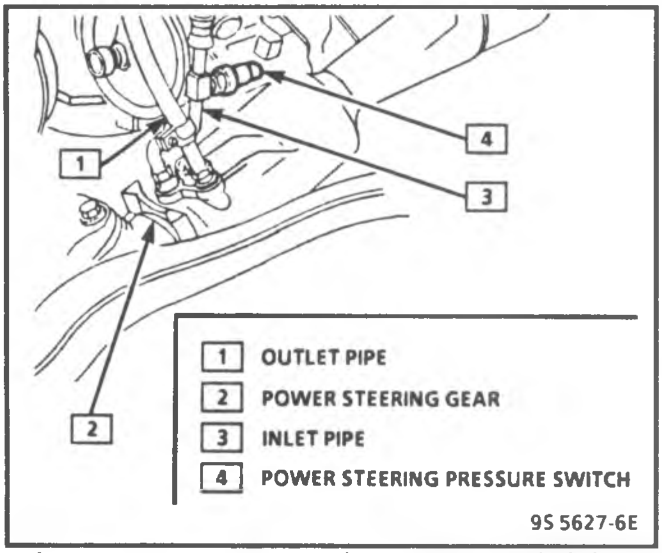


Figure 3-106 - Power Steering Pressure Switch (ST)

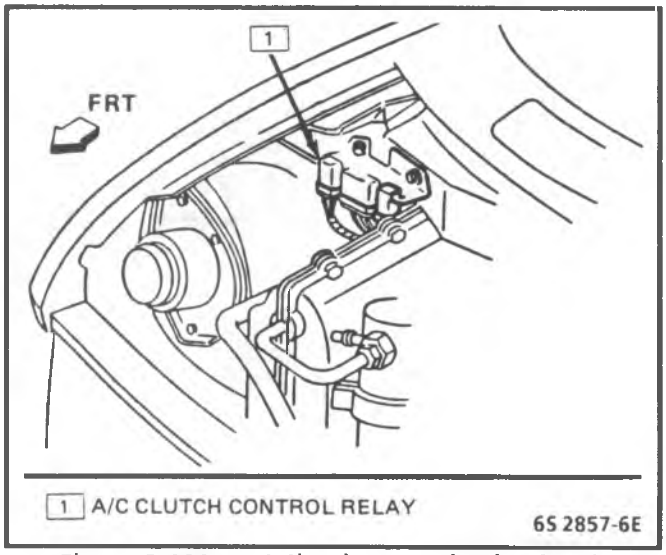


Figure 3-108 - A/C Clutch Control Relay (M/L)

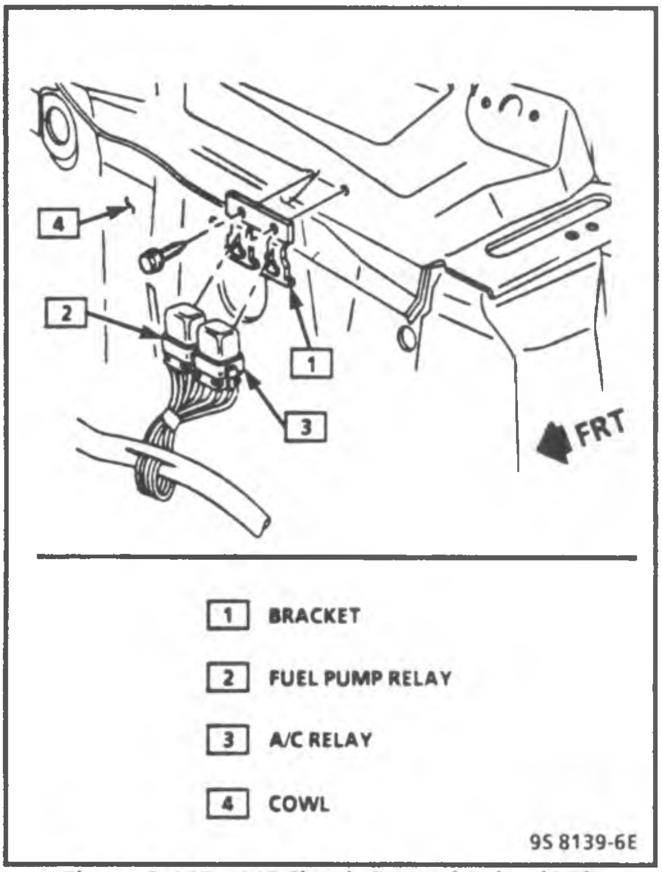


Figure 3-107 - A/C Clutch Control Relay (S/T)

A/C CONTROL

Refer to Figure 3-107 and 3-108, for replacement of the A/C clutch control relay on S/T Truck and M/L Van.

PARTS INFORMATION

PART NAME	GROUP
Controller, ECM/PCM	3.670
Calibrator, PROM	3.670
Sensor, Coolant Temp.	3.682
Sensor, Exhaust Oxygen	3.682
Sensor, MAP	3.682
Sensor, Throttle Position: Part of Sensor Kit, Throttle Position	3.440
Switch, Neu. St. & Backing LP	2.698

SECTION 4

FUEL CONTROL SYSTEM

TBI MODEL 220 - V6 OR V8 ENGINE
TBI MODEL 700 - L4 ENGINE

CONTENTS

GENERAL DESCRIPTION

PURPOSE

The fuel control system is controlled by an Electronic Control Module (ECM) or Powertrain Control Module (PCM) located in the passenger compartment. The ECM/PCM is the control center of the computer command control system found in "Computer Command Control, "Section "3" which provides additional information about fuel control and delivery.

The basic function of the fuel control system is to control fuel delivery to the engine. Fuel is delivered to the engine by a Throttle Body Injection (TBI) unit.

The main control sensor is the Oxygen (O_2) sensor, which is located in the exhaust manifold. The O_2 sensor tells the ECM/PCM the amount of oxygen in the exhaust gas, and the ECM/PCM changes the air/fuel ratio to the engine by controlling the fuel injector. A 14.7:1 air/fuel ratio is required for efficient catalytic converter operation. Because the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a "Closed Loop" system (Figure 4-1).

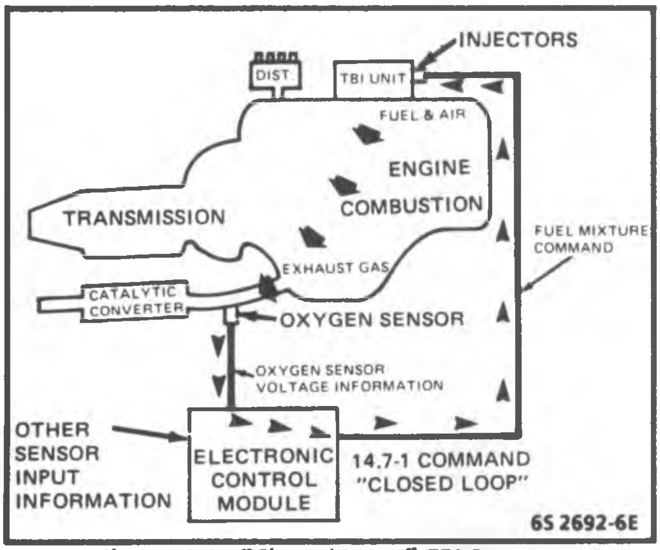


Figure 4-1 - "Closed Loop" TBI System

MODES OF OPERATION

The ECM/PCM monitors voltages from several sensors to determine how much fuel to give the engine. The fuel is delivered under one of several conditions called "modes." All the modes are controlled by the ECM/PCM.

Starting Mode

When the key is first turned "ON," the ECM/PCM turns on the fuel pump relay for two seconds, and the fuel pump builds up pressure to the TBI unit. The ECM/PCM checks the Coolant Temperature Sensor (CTS), Throttle Position Sensor (TPS), Manifold Absolute Pressure (MAP) sensor, and crank signal, then determines the proper air/fuel ratio for starting. This ranges from 1.5:1 at -36°C (-33°F) to 14.7:1, at 94°C (201°F) running temperature.

The ECM/PCM controls the amount of fuel delivered in the starting mode by changing how long the injector is turned "ON" and "OFF." This is done by "pulsing" the injector for very short times.

Clear Flood Mode

If the engine floods, clear it by pushing the accelerator pedal down all the way. The ECM/PCM then pulses the injector at a 16.5:1 air/fuel ratio, and holds this injector rate as long as the throttle stays wide open, and the engine is below 600 rpm. If the throttle position becomes less than 65%, the ECM/PCM returns to the starting mode.

Run Mode

The Run mode has two conditions called "Open Loop" and "Closed Loop."

Open Loop

When the engine is first started, and it is above 400 rpm, the system goes into "Open Loop" operation. In "Open Loop," the ECM/PCM ignores the signal from the O_2 sensor, and calculates the air/fuel ratio based on inputs from the coolant temperature and MAP sensors.

The system stays in "Open Loop" until the following conditions are met:

1. The O_2 sensor has varying voltage output, showing that it is hot enough to operate properly. (This depends on temperature.)
2. The Coolant Temperature Sensor (CTS) is above a specified temperature.
3. A specific amount of time has elapsed after starting the engine.

The 7.4L engine is designed to operate "Open Loop" at idle. The system will go to "Closed Loop" when the rpm is increased and all conditions above are met.

A normal functioning system may go into "Open Loop" at idle if O_2 sensor temperature drops below the minimum requirement to produce voltage fluxuation.

Closed Loop

The specific values for the above conditions vary with different engines, and are stored in the Programmable Read Only Memory (PROM). When these conditions are met, the systems goes into "Closed Loop" operation. In "Closed Loop," the ECM/PCM calculates the air/fuel ratio (injector on-time) based on the signal from the O_2 sensor. This allows the air/fuel ratio to stay very close to 14.7:1.

Acceleration Mode

The ECM/PCM looks at rapid changes in throttle position and manifold pressure, and provides extra fuel.

Deceleration Mode

When deceleration occurs, the fuel remaining in the intake manifold can cause excessive emissions and backfiring. Again, the ECM/PCM looks at changes in throttle position and manifold pressure and reduces the amount of fuel. When deceleration is very fast, the ECM/PCM can cut off fuel completely for short periods.

Battery Voltage Correction Mode

When battery voltage is low, the ECM/PCM can compensate for a weak spark delivered to the distributor by:
- Increasing injector on time
- Increasing the idle rpm
- Increasing ignition dwell time

Fuel Cutoff Mode

No fuel is delivered by the injectors when the ignition is "OFF." This prevents dieseling. Also, fuel is not delivered if no reference pulses are seen from the distributor, which means the engine is not running. Fuel cutoff also occurs at high engine rpm, to protect internal engine components from damage.

FUEL CONTROL OPERATION

The fuel control system (Figure 4-2) consists of the following components:
- Throttle Body Injection (TBI) unit
- Fuel pump
- Fuel pump relay
- Fuel tank
- Accelerator control
- Fuel lines
- Fuel filters
- Evaporative emission control system

The fuel control system has an electric fuel pump, located in the fuel tank on the gage sending unit. It pumps fuel to the throttle body through an in-line fuel filter and fuel supply line. The pump is designed to provide pressurized fuel at about 125 kPa (18 psi). On vehicles with two fuel tanks, there is an electric fuel pump and gage sending unit in each fuel tank.

A pressure regulator in the TBI keeps fuel available to the injectors at a constant pressure between 62 and 90 kPa (9 to 13 psi). Fuel in excess of injector needs is returned to the fuel tank by a separate line.

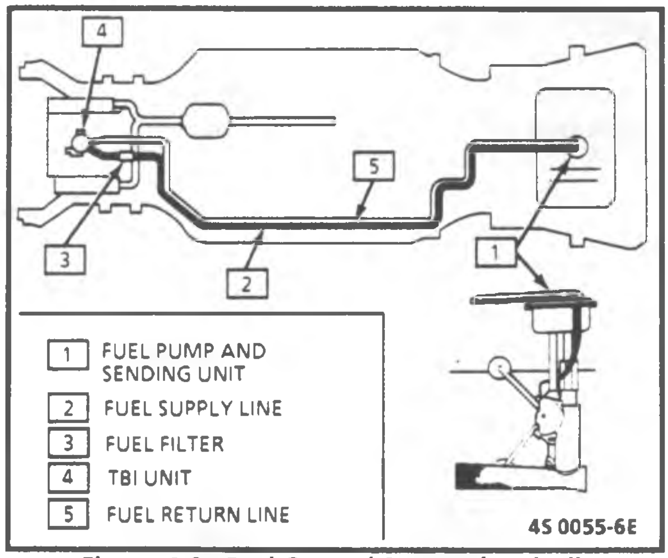


Figure 4-2 - Fuel Control System (Typical)

The ECM/PCM controls the injectors that are located in the fuel meter body assembly of the TBI. The injectors deliver fuel in one of several modes, described above.

In order to properly control the fuel supply, the fuel pump is operated by the ECM/PCM through the fuel pump relay and oil pressure switch (see "Fuel Pump Electrical Circuit").

MODEL 220 TBI UNIT

Model 220, used on V6 and V8 engines (Figure 4-3), consists of three major casting assemblies:
- Fuel meter cover with:
  - Pressure regulator
- Fuel meter body with:
  - Fuel injectors
- Throttle body with:
  - Idle Air Control (IAC) valve
  - Throttle Position Sensor (TPS)

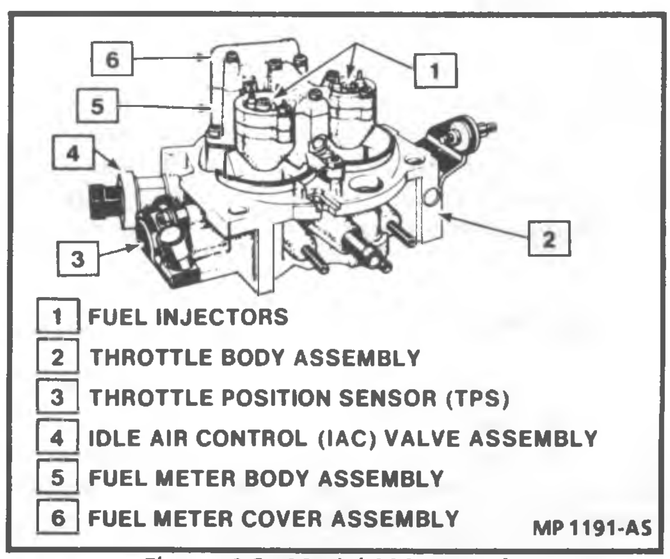
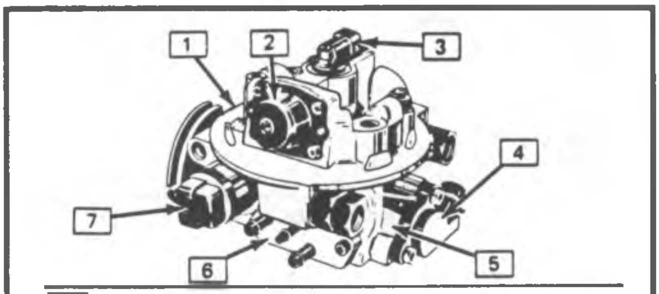


Figure 4-3 - Model 220 TBI Unit

MODEL 700 TBI UNIT

Model 700, used on the L4 engine (Figure 4-4), is made up of two major casting assemblies:

- Fuel meter assembly with:
  - Pressure regulator
  - Fuel injector
- Throttle body with:
  - Idle Air Control (IAC)
  - Throttle Position Sensor (TPS)



1 FUEL METER ASSEMBLY
2 PRESSURE REGULATOR COVER ASSEMBLY
3 FUEL INJECTOR ASSEMBLY
4 THROTTLE POSITION SENSOR (TPS)
5 THROTTLE BODY ASSEMBLY
6 TUBE MODULE ASSEMBLY
7 IDLE AIR CONTROL (IAC) VALVE

8S 4698-6E

Figure 4-4 - Model 700 TBI Unit

Vacuum Ports

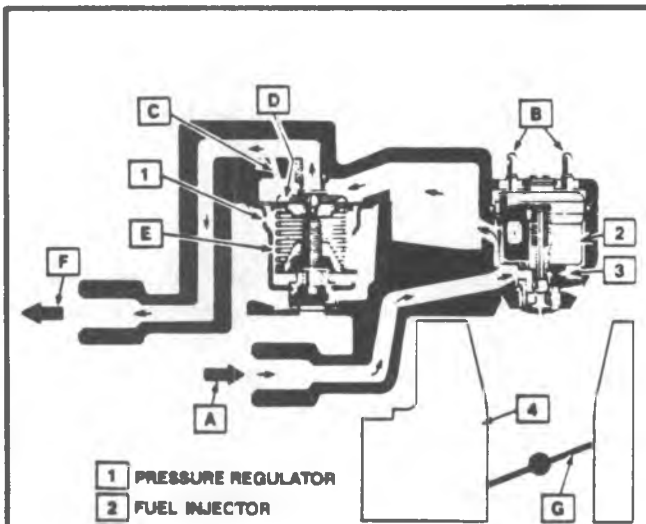
The throttle body portion of both TBI units may contain ports located above, or below the throttle valve. These ports generate the vacuum signals for the Exhaust Gas Recirculation (EGR) valve, MAP sensor, and the canister purge system.

Fuel Injector(s)

The fuel injectors (Figure 4-5 and 4-6) are solenoid-operated devices, controlled by the ECM/PCM. The ECM/PCM turns on the solenoid, which lifts a normally closed ball valve off a seat. Fuel, under pressure, is injected in a conical spray pattern at the walls of the throttle body bore above the throttle valve. The fuel which is not used by the injectors passes through the pressure regulator before being returned to the fuel tank.

Pressure Regulator

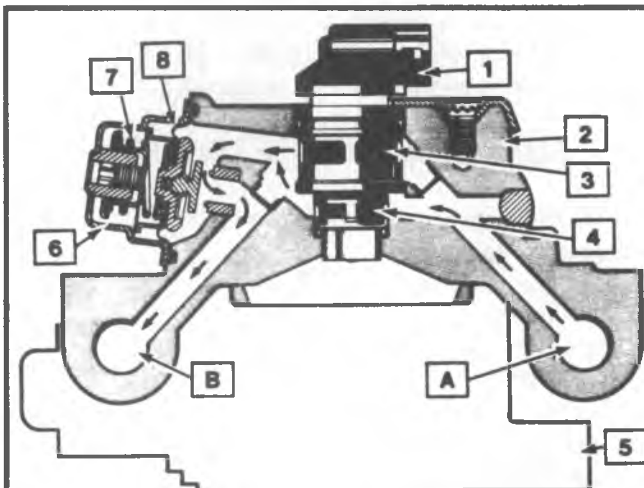
The pressure regulator (see Figure 4-5 and 4-6) is a diaphragm-operated relief valve with injector pressure on one side and air cleaner pressure on the other. The function of the regulator is to maintain a constant pressure at the injectors at all times, by controlling the flow in the return line (by means of a calibrated bypass).



1 PRESSURE REGULATOR
2 FUEL INJECTOR
3 FUEL INJECTOR INLET FILTER
4 THROTTLE BODY ASSEMBLY
A FUEL FROM PUMP
B INJECTOR ELECTRICAL TERMINALS
C CONSTANT BLEED - (SOME MODELS)
D PRESSURE REGULATOR DIAPHRAGM ASSEMBLY
E PRESSURE REGULATOR SPRING
F FUEL RETURN TO TANK
G THROTTLE VALVE

8P 0320-SY

Figure 4-5 - TBI 220 Unit Operation



1 FUEL INJECTOR
2 FUEL METER ASSEMBLY
3 PURGE FILTER
4 INLET FILTER
5 THROTTLE BODY ASSEMBLY
6 PRESSURE REGULATOR COVER ASSEMBLY
7 PRESSURE REGULATOR SPRING
8 PRESSURE REGULATOR DIAPHRAGM ASSEMBLY
A FUEL INLET
B FUEL OUTLET

9P 0415-SY

Figure 4-6 - TBI 700 Unit Operation

The pressure regulator on a TBI 220 unit is serviced as part of the fuel meter cover and should not be disassembled.

The pressure regulator on a TBI 700 unit is serviced as part of the fuel meter assembly and can be disassembled.

Idle Air Control System

All engine idle speeds are controlled by the ECM/PCM through the Idle Air Control (IAC) valve mounted on the throttle body (Figures 4-7 or 4-8). The ECM/PCM sends voltage pulses to the IAC motor windings causing the IAC motor shaft and pintle to move "IN" or "OUT" a given distance (number of steps) for each pulse, (called counts).

This movement controls airflow around the throttle plate, which in turn, controls engine idle speed, either cold or hot. IAC valve pintle position counts can be seen using a "Scan" tool. 0 counts correspond to a fully closed passage, while 140 counts or more (depending on the application) corresponds to full flow.

- Actual or "controlled" idle speed is obtained by the ECM/PCM positioning the IAC valve pintle. Resulting idle speed is generated from the total idle air flow (IAC/passage + PCV + throttle valve + vacuum leaks).
- Controlled idle speed is always specified for normal operating conditions. Normal operating condition is coolant temperature in operating range, the A/C is "OFF," manual transmission is in neutral or automatic transmission in drive with proper Park/Neutral (P/N) switch adjustment. A high or low coolant temperature, or A/C clutch engagement may signal the ECM/PCM to change the IAC counts.
- The minimum idle speed is set at the factory with a stop screw. This setting allows enough air flow by the throttle valves to cause the IAC valve pintle to be positioned a calibrated number of steps (counts) from the seat during normal controlled idle operation. The IAC counts will be higher than normal on an engine with less than 500 miles, or an engine operating at high altitude or an engine with an accessory load such as the alternator, A/C, power steering or hydra-boost brakes activated.

Throttle Position Sensor (TPS)

The Throttle Position Sensor (TPS), is mounted on the side of the throttle body opposite the throttle lever assembly. Its function is to sense the current throttle valve position and relay that information to the ECM/PCM (see Figure 4-11). Throttle position information allows the ECM/PCM to generate the required injector control signals (base pulse).

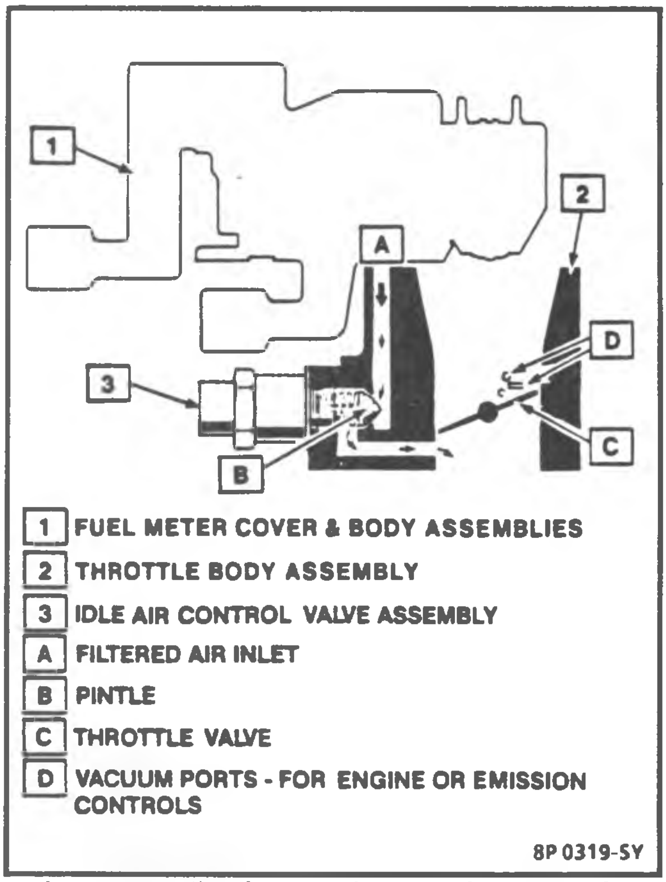


Figure 4-7 - Idle Air Control System (TBI 220 Unit)

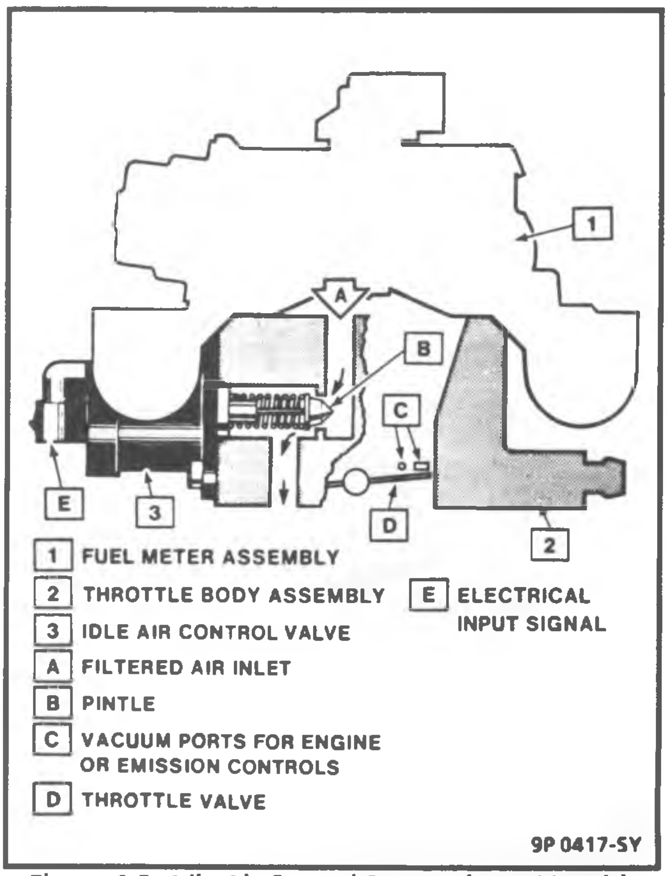


Figure 4-8 - Idle Air Control SYstem (TBI 700 Unit)

If the TPS senses a Wide Open Throttle (WOT), a voltage signal indicating this condition is sent to the ECM/PCM. The ECM/PCM then increases the injector base pulse width, permitting increased fuel flow.

As the throttle valve rotates in response to movement of the accelerator pedal, the throttle shaft transfers this rotation movement to the TPS. A potentiometer (variable resistor) within the TPS assembly changes its resistance (and voltage drop) in proportion to throttle movement.

By applying a reference voltage (5.0 volts) to the TPS input, a varying voltage (reflecting throttle position) is available at the TPS output. For example, approximately 2.5 volts results from a 50% throttle valve opening (depending on TPS calibration). The voltage output from the TPS assembly is routed to the ECM/PCM for use in determining throttle position.

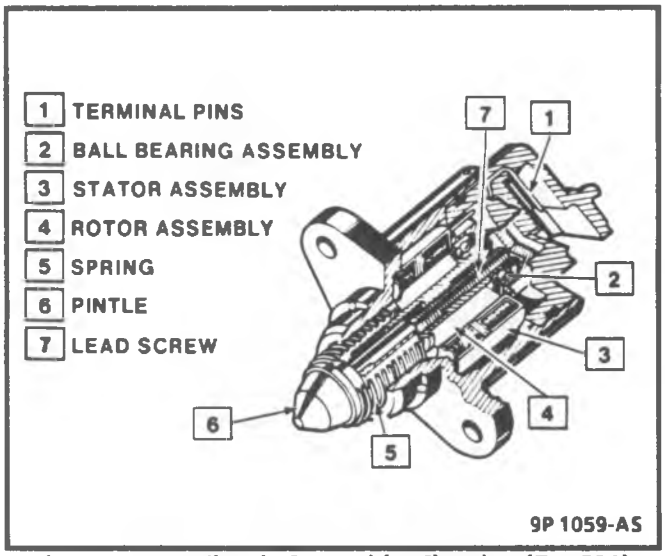


Figure 4-10 - Idle Air Control (IAC) Valve (TBI 700)

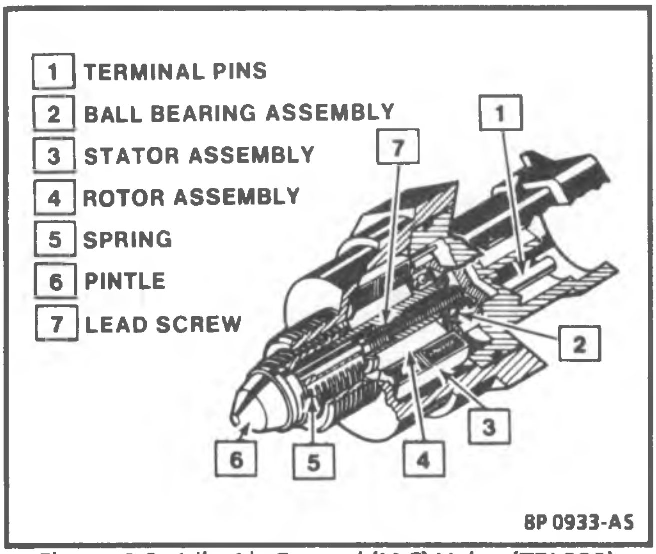


Figure 4-9 - Idle Air Control (IAC) Valve (TBI 220)

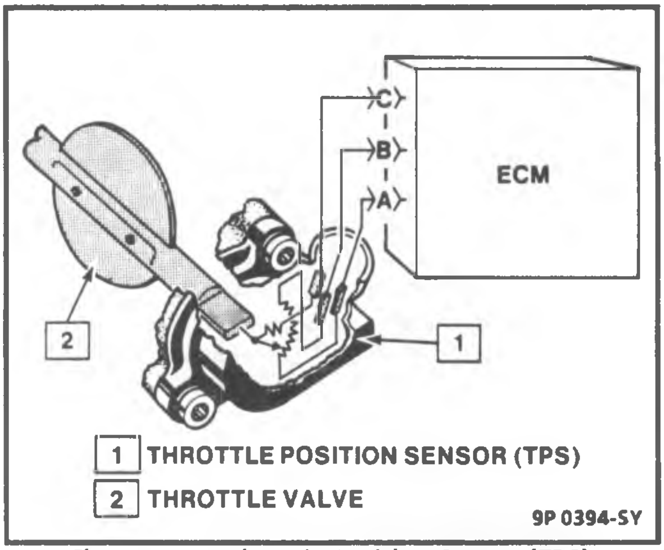


Figure 4-11 - Throttle Position Sensor (TPS)

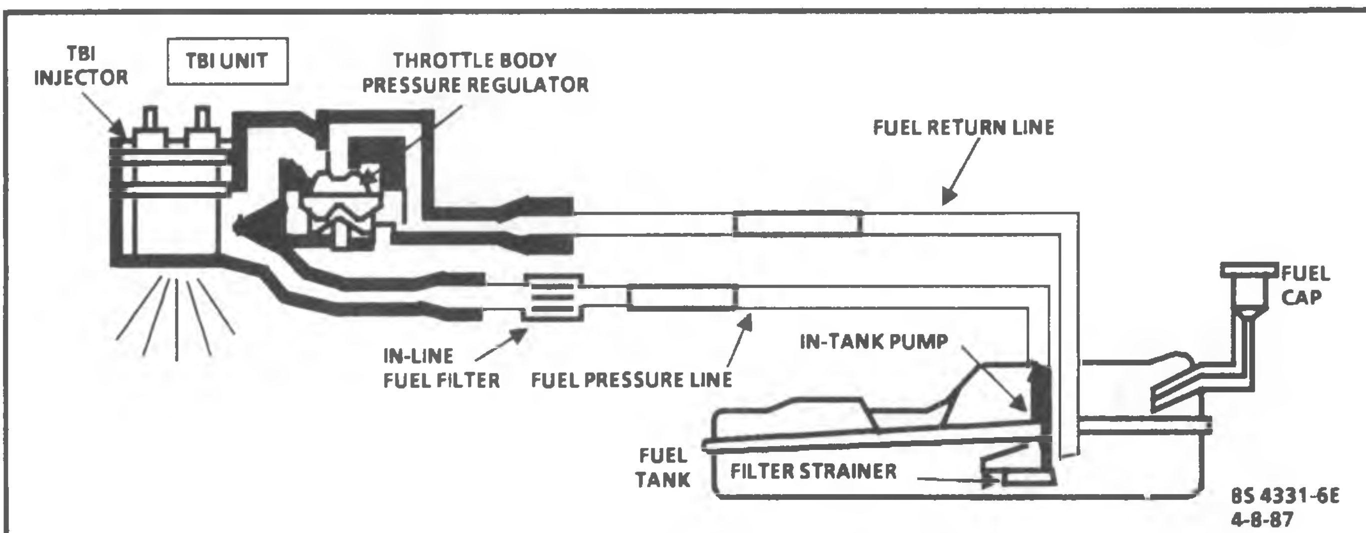


Figure 4-12 - TBI Fuel Supply System (Typical)

FUEL PUMP CIRCUIT

The fuel pump is a turbine type, low pressure electric pump, mounted in the fuel tank. Fuel is pumped at a positive pressure (above 62 kPa or 9 psi) from the fuel pump through the in-line filter to the pressure regulator in the TBI unit (see Figure 4-13). Excess fuel is returned to the fuel tank through the fuel return line.

The fuel pump is attached to the fuel gage sender assembly. A fuel strainer is attached to the fuel pump inlet line and prevents dirt particles from entering the fuel line and tends to separate water from the fuel.

On vehicles with two fuel tanks, there is an electric fuel pump and gage sending unit in each tank.

Vapor lock problems are reduced when using an electric pump because the fuel is pushed from the tank under pressure rather than being pulled under vacuum, a condition that produces vapor.

When the key is first turned "ON" without the engine running, the ECM/PCM turns a fuel pump relay "ON" for two seconds. This builds up the fuel pressure quickly. If the engine is not started within two seconds, the ECM/PCM shuts the fuel pump "OFF" and waits until the engine starts. As soon as the engine is cranked, the ECM/PCM turns the relay "ON" and runs the fuel pump.

On the 5.7L engine in the G van and all other 5.7L and 7.4L engines in vehicles over 8500 GVW, a fuel module will override the ECM/PCM and the fuel pump will run for approximately twenty seconds. The fuel module corrects a prolonged hot restart (vapor lock) during high ambient conditions.

When the engine is cranking or running, the ECM/PCM receives distributor reference pulses which in turn energize the fuel injectors.

As a backup system to the fuel pump relay, the fuel pump is also turned on by an oil pressure switch. When the engine oil pressure reaches about 28 kPa (4psi), through cranking the oil pressure switch will close to complete the circuit to the fuel pump.

An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold. The oil pressure switch will turn on the fuel pump as soon as oil pressure reaches about 28 kPa (4 psi).

FUEL FILTER

In-line Filter

CAUTION: To reduce the risk of fire and personal injury, it is necessary to allow fuel pressure to bleed off before servicing fuel system components. (See "Fuel System Pressure Relief Procedure.")

The in-line filter is located in the fuel feed line. It prevents dirt from entering the TBI unit.

In-Tank Filter

A woven plastic filter is located on the lower end of the fuel pickup tube in the fuel tank. The filter prevents dirt from entering the fuel line and, also, stops water, unless the filter becomes completely submerged in water. This filter is self-cleaning and normally requires no maintenance. Fuel stoppage, at this point, indicates that the fuel tank contains an abnormal amount of sediment or water; the tank should, therefore, be thoroughly cleaned.

FUEL AND VAPOR PIPES

The fuel feed and return pipes and hoses extend from the fuel pump and sender to the TBI unit. They are secured with clamps and are routed along the frame side member.

The vapor pipe and hoses extend from fuel pump and sender unit to the evaporative emission control vapor canister.

FUEL TANK

The fuel tank, at the rear of the underbody, is held in place by two metal straps. Anti-squeak pieces are used on top of the tank to reduce rattles.

Filler Neck

To help prevent refueling with leaded gasoline, the fuel filler neck on a gasoline engine vehicles has a built-in restrictor and deflector. The opening in the restrictor will only admit the smaller unleaded gas nozzle spout, which must be fully inserted to bypass the deflector. Attempted refueling with a leaded gas nozzle, or failure to fully insert the unleaded gas nozzle, will result in gasoline splashing back out of the filler neck.

Fuel Filler Cap

The fuel tank filler neck is equipped with a screw-type cap. The threaded part of the cap requires several turns counterclockwise to remove. The long threaded area was designed to allow any remaining fuel tank pressure to escape, while the cap was being removed. A built-in torque-limiting device prevents overtightening. To install, turn the cap clockwise until a clicking noise is heard. This signals that the correct torque has been reached and the cap is fully seated.

ACCELERATOR CONTROL

The accelerator control system is a control cable type, attached to an accelerator pedal assembly.

EVAPORATIVE EMISSION CONTROL

The system transfers fuel vapors from the fuel tank into a vapor canister and then vapors are purged into the intake manifold air flow and consumed in combustion. Refer to "Evaporative Emission Control," Section "5" for additional information, diagnosis, and On-Vehicle service.

DIAGNOSIS

ALCOHOL-IN-FUEL

Alcohol-in-fuel can be detrimental to fuel system components and may cause driveability problems such as hesitation, lack of power, stall, no start, etc.

The problems may be due to fuel system corrosion and subsequent fuel filter plugging, deterioration or rubber components and/or air fuel mixture leaning.

Various types and concentrations of alcohol are used in commercial fuel. Some alcohol is more detrimental to fuel system components than others. If an excessive amount of alcohol in the fuel is suspected as the cause of a driveability condition, the following procedure may be used to detect the presence of alcohol in the fuel. In this procedure, water is used to extract the alcohol from the fuel.

Testing Procedure

The fuel sample should be drawn form the bottom of the tank so that any water present in the tank will be detected. The sample should be bright and clear. If the sample appears cloudy, or contaminated with water (as indicated by a water layer at the bottom of the sample), this procedure should not be used and the fuel system should be cleaned (see "Fuel System Cleaning").

1. Using a 100 ml cylinder with 1 ml graduation marks, fill with fuel to the 90 ml mark.
2. Add 10 ml of water to bring the total fluid volume to 100 ml and install a stopper.
3. Shake vigorously for 10 to 15 seconds.
4. Carefully loosen the stopper to release pressure.
5. Close the stopper and shake vigorously again for 10 to 15 seconds.
6. Put the graduated cylinder on a level surface for approximately 5 minutes to allow adequate liquid separation.

If alcohol is resent in the fuel, the volume of the lower layer (which would now contain both alcohol and water) will be greater than 10 ml.

For example, if the volume of the lower layer is increase to 15 ml, it will indicate at least 5 percent alcohol in fuel. The actual amount of alcohol may be somewhat greater because this procedure does not extract all of the alcohol from the fuel.

FUEL CONTROL

The diagnosis of fuel control and the TBI unit is in "Computer Command Control," Section "3", because the computer command control system controls fuel delivery. This system has a built in diagnostic system in the ECM/PCM to indicate a failed circuit. This section will explain the system check and the codes related to fuel control.

The fuel control can be the reason that the engine cranks, but will not run and the diagnosis is, also, in "Computer Command Control," Section "3". If diagnosis indicates that the engine will not run because there is a fuel delivery problem, the diagnosis of the fuel system is, also, included in "Computer Command Control," Section "3".

Fuel Injectors

Testing the fuel injector circuit is in CHART A-3 and additional diagnosis in CHART A-4 in "Computer Command Control," Section "3".

A fuel injector which does not open may cause a no-start condition. An injector which is stuck partly open, could cause loss of pressure after sitting, so long crank times would be noticed on some engines. Also, dieseling could occur because some fuel could be delivered to the engine after the key is turned "OFF."

Pressure Regulator

Testing the pressure regulator circuit is in CHART A-3 and A-4, in "Computer Command Control," Section "3".

If the pressure regulator in the TBI supplies pressure which is too low (below 62 kPa or 9 psi), poor performance could result. If the pressure is too high, excess emissions and unpleasant exhaust odor may result.

Idle Air Control

The diagnosis of idle air control can be found in Code 35, "Computer Command Control," Section "3", for the 2.5L engine and in this section for all other engines.

If the IAC valve is disconnected or connected with the engine running, the idle rpm may be wrong. In this case, the IAC valve may be reset by turning the engine "OFF" for ten seconds and then re-starting the engine.

The IAC valve affects only the idle characteristics of the engine. If it is open fully, too much air will be allowed to the manifold and idle speed will be high. If it is stuck closed, too little air will be allowed in the manifold, and idle speed will be too low. If it is stuck part way open, the idle may be rough, and will not respond to engine load changes.

The minimum idle speed is set at the factory with a stop screw. The stop screw should not be adjusted.

Vacuum leaks will cause the IAC valve pintle to be "stepped" closer to the seat or to be closed against its seat in an attempt to maintain controlled idle speed.

Throttle Position Sensor (TPS)

Refer to "Computer Command Control," Section "3," for diagnosis of the throttle position sensor.

Driveability Symptoms

Refer to "Driveability Symptoms," Section "2," for additional fuel control diagnosis.

FUEL PUMP CIRCUIT

Refer to system diagnosis in "Computer Command Control," Section "3," for fuel pump diagnosis.

An inoperative fuel pump would cause a no start condition. A fuel pump which does not provide enough pressure can result in poor performance. (See "Fuel System Pressure Test" procedure).

Fuel Pump Relay

Refer to fuel pump relay circuit check in "Computer Command Control," Section "3," for fuel pump relay diagnosis.

An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold. The oil pressure switch will turn on the fuel pump as soon as oil pressure reaches about 28 kPa (4psi).

Oil Pressure Switch

Refer to fuel pump relay circuit check in "Computer Command Control," Section "3," for oil pressure switch diagnosis.

Fuel Module

Refer to the diagnosis section in "Computer Command Control," Section "3," for fuel module check.

Fuel Filter

The diagnosis of the fuel filter is covered in "Computer Command Control," Section "3," as part of the fuel system diagnosis.

A plugged fuel filter may cause a restricted fuel delivery, or a no start condition.

Fuel Pipes and Hoses

The diagnosis of gasoline odor may be a condition of a leaking fuel feed, or return pipe or hose. Fuel pipes that are pinched, plugged, or mis-routed may cause restricted fuel delivery.

Fuel Tank

The diagnosis of gasoline odor may be a condition of leaking fuel tank, filler neck, or filler cap.

A defective filler cap, a plugged or pinched vapor pipe can cause a collapsed fuel tank.

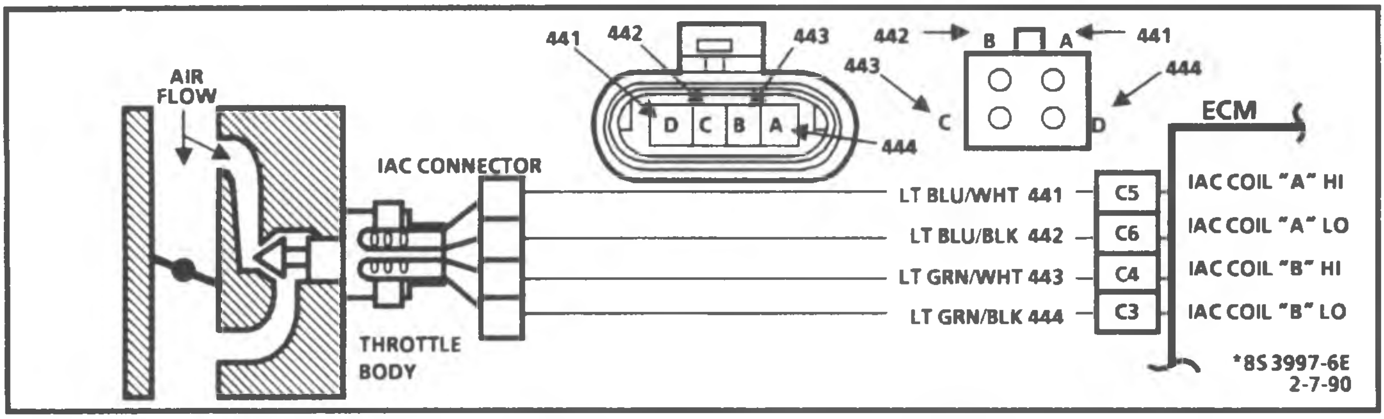
Loose mounting straps, or foreign material in tank, may be the cause of a rattle at the fuel tank.

ACCELERATOR CONTROL

Check for correct cable routing, or binding, and correct as necessary.

EVAPORATIVE EMISSION CONTROL

Refer to "Evaporative Emission Control," Section "5", for diagnosis of the Evaporative Emission Control System.



IDLE AIR CONTROL (IAC) SYSTEM CHECK

ALL ENGINES EXCEPT 2.5L AND VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The ECM controls engine idle speed with the IAC valve. To increase idle speed, the ECM retracts the IAC valve pintle away from it's seat, allowing more air to pass by the throttle bore. To decrease idle speed, it extends the IAC valve pintle towards it's seat, reducing bypass air flow. A "Scan" tool will read the ECM commands to the IAC valve in counts. Higher the counts indicate more air bypass (higher idle). The lower the counts indicate less air is allowed to bypass (lower idle).

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. The IAC tester is used to extend and retract the IAC valve. Valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be retested when removed from the throttle body.
2. This step checks the quality of the IAC movement in Step 1. Between 700 rpm and about 1500 rpm the engine speed should change smoothly with each flash of the tester light in both extend and retract. If the IAC valve is retracted beyond the control range (about 1500 rpm), it may take many flashes in the extend position before engine speed will begin to drop. This is normal on certain engines, fully extending IAC may cause engine stall. This may be normal.
3. Steps 1 and 2 verified proper IAC valve operation while this step checks the IAC circuits. each lamp on the node light should flash Red and Green while the IAC valve is cycled. While the sequence of color is not important if either light is "OFF" or does not flash Red and Green, check the circuits for faults, beginning with poor terminal contacts.

IAC Valve Reset Procedure

- Ignition "OFF" for 10 seconds
- Start and run engine for 5 seconds
- Ignition "OFF" for 10 seconds

Diagnostic Aids:

A slow, unstable, or fast idle may be caused by a non-IAC system problem that cannot be overcome by the IAC valve. Out of control range IAC "Scan" tool counts will be above 60 if idle is too low, and zero counts if idle is too high The following checks should be made to repair a non-IAC system problem.

- Vacuum Leak (High Idle) - If idle is too high, stop the engine. Fully extend (low) IAC with tester. Start engine. If idle speed is above 800 rpm, locate and correct vacuum leak including PCV system. Also, check for binding of throttle blade or linkage.
- System too rich (Low Air/Fuel Ratio) - The idle speed will be too low. "Scan" tool IAC counts will usually be above 80. System is obviously rich and may exhibit black smoke in exhaust.
  "Scan" tool O_2 voltage will be fixed above 800 mV (.8 volt).
  Check for high fuel pressure, leaking or sticking injector. Silicone contaminated O_2 sensors "Scan" voltage will be slow to respond.
- Throttle body - Remove IAC valve and inspect bore for foreign material.
- IAC Valve Electrical Connections - IAC valve connections should be carefully checked for proper contact.
- PCV Valve - An incorrect or faulty PCV valve may result in an incorrect idle speed.
- Refer to "Rough, Unstable, Incorrect Idle or Stalling" in "Drivability Symptom," Section "2."
- If intermittent poor drivability or idle symptoms are resolved by disconnecting the IAC, carefully recheck connections, valve terminal resistance or replace IAC.
- A/C Compressor or relay failure - See A/C diagnosis if circuit is shorted to ground. If the relay is faulty, idle problem may exist.
- Refer to "Rough, Unstable, Incorrect Idle or Stalling," in Section "2".

IDLE AIR CONTROL (IAC) SYSTEM CHECK

ALL ENGINES EXCEPT 2.5L AND VEHICLES WITH 4L80-E TRANSMISSION

NOTE: IF A REPAIR HAS BEEN MADE REFER TO THE IAC RESET PROCEDURE ON THE FACING PAGE BEFORE RETESTING.

1
- IGNITION "OFF," CONNECT IAC DRIVER * TO IAC VALVE.
- SET PARK BRAKE, BLOCK WHEELS, A/C "OFF."
- IDLE ENGINE IN PARK (A/T) OR NEUTRAL (M/T).
- INSTALL "SCAN" TOOL AND DISPLAY RPM.
- WITH IAC DRIVER, EXTEND AND RETRACT IAC VALVE.
- ENGINE RPM SHOULD DECREASE AND INCREASE AS IAC IS CYCLED.

RPM CHANGES

2
- RPM SHOULD CHANGE SMOOTHLY WITH EACH FLASH OF THE IAC DRIVER LIGHT FROM 700 RPM TO ABOUT 1500 RPM. DOES IT?

NO RPM CHANGES
- CHECK IAC PASSAGES.
- IF OK, REPLACE IAC.

YES

3
- INSTALL APPROPRIATE IAC NODE LIGHT * IN ECM HARNESS.
- CYCLE IAC DRIVER AND NOTE LIGHTS.
- BOTH LIGHTS SHOULD CYCLE RED AND GREEN BUT NEVER "OFF" AS RPM IS CHANGED OVER ITS RANGE. DO THEY?

NO
- CHECK IAC PASSAGES.
- IF OK, REPLACE IAC.

NO

IF CIRCUIT(S) DID NOT TEST GREEN AND RED, CHECK FOR:
- FAULTY CONNECTOR TERMINAL CONTACTS.
- OPEN CIRCUITS INCLUDING CONNECTIONS.
- CIRCUITS SHORTENED TO GROUND OR VOLTAGE.
- FAULTY ECM CONNECTION OR ECM.

REPAIR AS NECESSARY AND RETEST.

YES
- USING THE OTHER CONNECTOR ON THE IAC DRIVER PIGTAIL, CHECK RESISTANCE ACROSS IAC COILS.
- SHOULD BE 40 TO 80 OHMS BETWEEN IAC TERMINALS "A" TO "B" AND "C" TO "D".

OK
- CHECK RESISTANCE BETWEEN IAC TERMINALS "B" AND "C" AND "A" AND "D".
- SHOULD BE INFINITE.

NOT OK
- REPLACE VALVE AND RETEST.

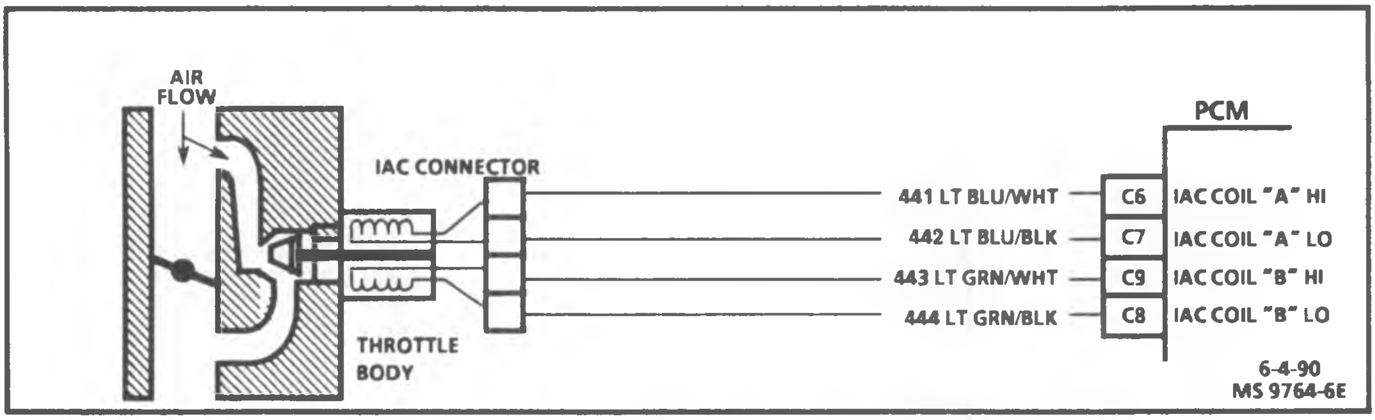
OK
- IDLE AIR CONTROL VALVE AND CIRCUIT OK. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NOT OK
- REPLACE VALVE AND RETEST.

* IAC DRIVER AND NODE LIGHT REQUIRED KIT 222-L FROM: CONCEPT TECHNOLOGY, INC. J 37027 FROM: KENT-MOORE, INC.

CLEAR CODES, CONFIRM "CLOSED LOOP" OPERATION, NO "SERVICE ENGINE SOON" LIGHT, PERFORM IAC RESET PROCEDURE AND VERIFY CONTROLLED IDLE SPEED IS CORRECT.

7-17-90
8S 4652-6E



IDLE AIR CONTROL (IAC) SYSTEM CHECK

ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The PCM controls engine idle speed with the IAC valve. To increase idle speed, the PCM retracts the IAC valve pintle away from it's seat, allowing more air to pass by the throttle bore. To decrease idle speed, it extends the IAC valve pintle towards it's seat, reducing bypass air flow. A "Scan" tool will read the PCM commands to the IAC valve in counts. Higher the counts indicate more air bypass (higher idle). The lower the counts indicate less air is allowed to bypass (lower idle).

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. The IAC tester is used to extend and retract the IAC valve. Valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be retested when removed from the throttle body.
2. This step checks the quality of the IAC movement in Step 1. Between 700 rpm and about 1500 rpm the engine speed should change smoothly with each flash of the tester light in both extend and retract. If the IAC valve is retracted beyond the control range (about 1500 rpm), it may take many flashes in the extend position before engine speed will begin to drop. This is normal on certain engines, fully extending IAC may cause engine stall. This may be normal.
3. Steps 1 and 2 verified proper IAC valve operation while this step checks the IAC circuits. each lamp on the node light should flash Red and Green while the IAC valve is cycled. While the sequence of color is not important if either light is "OFF" or does not flash Red and Green, check the circuits for faults, beginning with poor terminal contacts.

IAC Valve Reset Procedure

- Ignition "OFF" for 10 seconds
- Start and run engine for 5 seconds
- Ignition "OFF" for 10 seconds

Diagnostic Aids:

A slow, unstable, or fast idle may be caused by a non-IAC system problem that cannot be overcome by the IAC valve. Out of control range IAC "Scan" tool counts will be above 60 if idle is too low, and zero counts if idle is too high The following checks should be made to repair a non-IAC system problem.

- Vacuum Leak (High Idle) - If idle is too high, stop the engine. Fully extend (low) IAC with tester. Start engine. If idle speed is above 800 rpm, locate and correct vacuum leak including PCV system. Also, check for binding of throttle blade or linkage.
- System too rich (Low Air/Fuel Ratio) - The idle speed will be too low. "Scan" tool IAC counts will usually be above 80. System is obviously rich and may exhibit black smoke in exhaust.
  "Scan" tool O_2 voltage will be fixed above 800 mV (.8 volt).
  Check for high fuel pressure, leaking or sticking injector. Silicone contaminated O_2 sensors "Scan" voltage will be slow to respond.
- Throttle body - Remove IAC valve and inspect bore for foreign material.
- IAC Valve Electrical Connections - IAC valve connections should be carefully checked for proper contact.
- PCV Valve - An incorrect or faulty PCV valve may result in an incorrect idle speed.
- Refer to "Rough, Unstable, Incorrect Idle or Stalling" in "Drivability Symptom," Section "2."
- If intermittent poor drivability or idle symptoms are resolved by disconnecting the IAC, carefully recheck connections, valve terminal resistance or replace IAC.
- A/C Compressor or relay failure - See A/C diagnosis if circuit is shorted to ground. If the relay is faulty, idle problem may exist.
- Refer to "Rough, Unstable, Incorrect Idle or Stalling," in Section "2".

IDLE AIR CONTROL (IAC) SYSTEM CHECK

ALL VEHICLES WITH 4L80-E TRANSMISSION

1
- IGNITION "OFF," CONNECT IAC DRIVER * TO IAC VALVE.
- SET PARKING BRAKE, BLOCK WHEELS, A/C "OFF."
- IDLE ENGINE IN PARK (A/T) OR NEUTRAL (M/T).
- INSTALL "SCAN" TOOL AND DISPLAY RPM.
- WITH IAC DRIVER, EXTEND AND RETRACT IAC VALVE.
- ENGINE RPM SHOULD DECREASE AND INCREASE AS IAC IS CYCLED.

NOTE: IF A REPAIR HAS BEEN MADE REFER TO THE IAC RESET PROCEDURE ON THE FACING PAGE BEFORE RETESTING.

RPM CHANGES

2
- RPM SHOULD CHANGE SMOOTHLY WITH EACH FLASH OF THE IAC DRIVER LIGHT FROM 700 RPM TO ABOUT 1500 RPM.
  DOES IT?

YES

3
- INSTALL APPROPRIATE IAC NODE LIGHT * IN PCM HARNESS.
- CYCLE IAC DRIVER AND NOTE LIGHTS.
- BOTH LIGHTS SHOULD CYCLE RED AND GREEN BUT NEVER "OFF" AS RPM IS CHANGED OVER ITS RANGE.
  DO THEY?

NO

IF CIRCUIT(S) DID NOT TEST GREEN AND RED, CHECK FOR:
- FAULTY CONNECTOR TERMINAL CONTACTS.
- OPEN CIRCUITS INCLUDING CONNECTIONS.
- CIRCUITS SHORTED TO GROUND OR VOLTAGE.
- FAULTY PCM CONNECTION OR PCM.
  REPAIR AS NECESSARY AND RETEST.

YES

- USING THE OTHER CONNECTOR ON THE IAC DRIVER PIGTAIL, CHECK RESISTANCE ACROSS IAC COILS.
- SHOULD BE 40 TO 80 OHMS BETWEEN IAC TERMINALS "A" TO "B" AND "C" TO "D".

OK

- CHECK RESISTANCE BETWEEN IAC TERMINALS "B" AND "C" AND "A" AND "D".
- SHOULD BE INFINITE.

OK

IDLE AIR CONTROL VALVE AND CIRCUIT OK. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NOT OK

REPLACE IAC VALVE AND RETEST.

NOT OK

REPLACE IAC VALVE AND RETEST.

NO

- CHECK IAC PASSAGES.
- IF OK, REPLACE IAC.

NO RPM CHANGE

- CHECK IAC PASSAGES.
- IF OK, REPLACE IAC.

* IAC DRIVER AND NODE LIGHT REQUIRED KIT
222-L FROM: CONCEPT TECHNOLOGY, INC.
J 37027 FROM: KENT-MOORE, INC.

6-6-90
MS 9953-6E

ON-VEHICLE SERVICE

GENERAL SERVICE MANUAL

CAUTION:

• To prevent personal injury or damage to the vehicle as the result of an accidental start, disconnect and reconnect the negative battery cable before and after service is performed (except for those tests where battery voltage is required).

• To minimize the risk of fire, and personal injury, disconnect negative battery cable and relieve the fuel system pressure (where applicable) before servicing the fuel system. (See "Fuel Pressure Relief Procedure," below.)

• Also, catch any fuel that leaks out when disconnecting the fuel lines by covering the fittings with a shop cloth. Place the cloth in an approved container when work is complete.

The following is general information required when working on the fuel system:

- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Fuel pipe fittings require new O-rings when assembling.
- All fuel pipe must meet the GM Specification 124-M, or its equivalent.
- All fuel hose must meet GM Specification 6163-M or its equivalent.
- Do not replace fuel pipe with fuel hose.
- Always allow fuel pressure to bleed off before servicing any fuel system components.
- Do not do any repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.
- Observe all Notices and Cautions.

All gasoline engines are designed to use only unleaded gasoline to maintain proper emission control system operation. Its use will also minimize spark plug fouling and extend engine oil life. Using leaded gasoline can damage the emission control system and could result in loss of emission warranty coverage.

All vehicles covered in the manual are equipped with and evaporative emission system. The purpose of the system is to minimize the escape of fuel vapors to the atmosphere. Information on this system will be found in "Evaporative Emission Control," Section "5."

TBI SERVICE INFORMATION

The TBI unit repair procedures cover component replacement with the unit on the vehicle. However, throttle body replacement requires that the complete unit be removed from the engine.

An eight digit part identification number is stamped on the throttle body (Figures 13 and 14). Refer to this number if servicing or part replacement is required

Refer to the disassembled views (Figures 4-15 and 4-16) for identification of parts during repair procedures. Service repair of individual components is performed without removing the TBI unit from the engine. If removed, it is essential that care is taken to prevent damage to the throttle valve or sealing surface while performing any service.

Whenever service is performed on a TBI or any of its components, first remove the air cleaner, adapter (if applicable), and air cleaner gaskets. Discard the gaskets and replace them with new ones before replacing the air cleaner after service is complete.

When disconnecting the fuel lines, be sure to use a backup wrench (J 29698-A, or BT-8251-A, or equivalent) to keep the TBI nuts from turning.

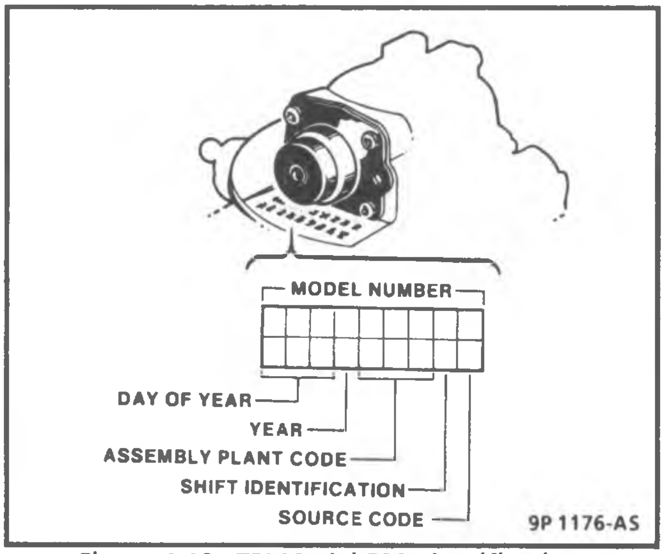


Figure 4-13 - TBI Model 700 Identification

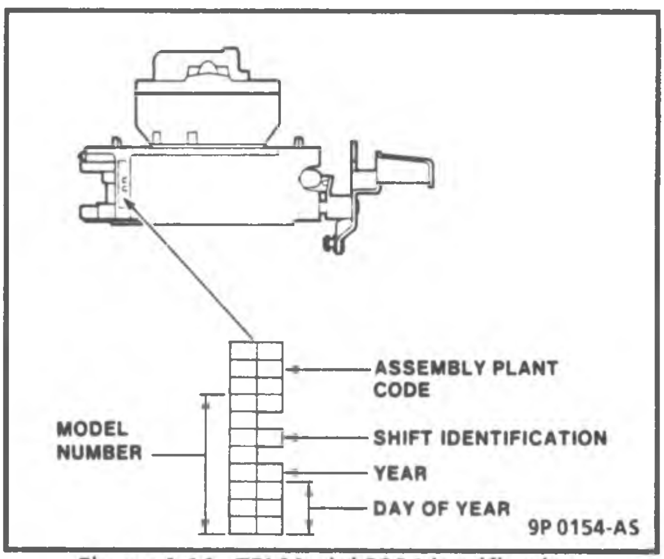
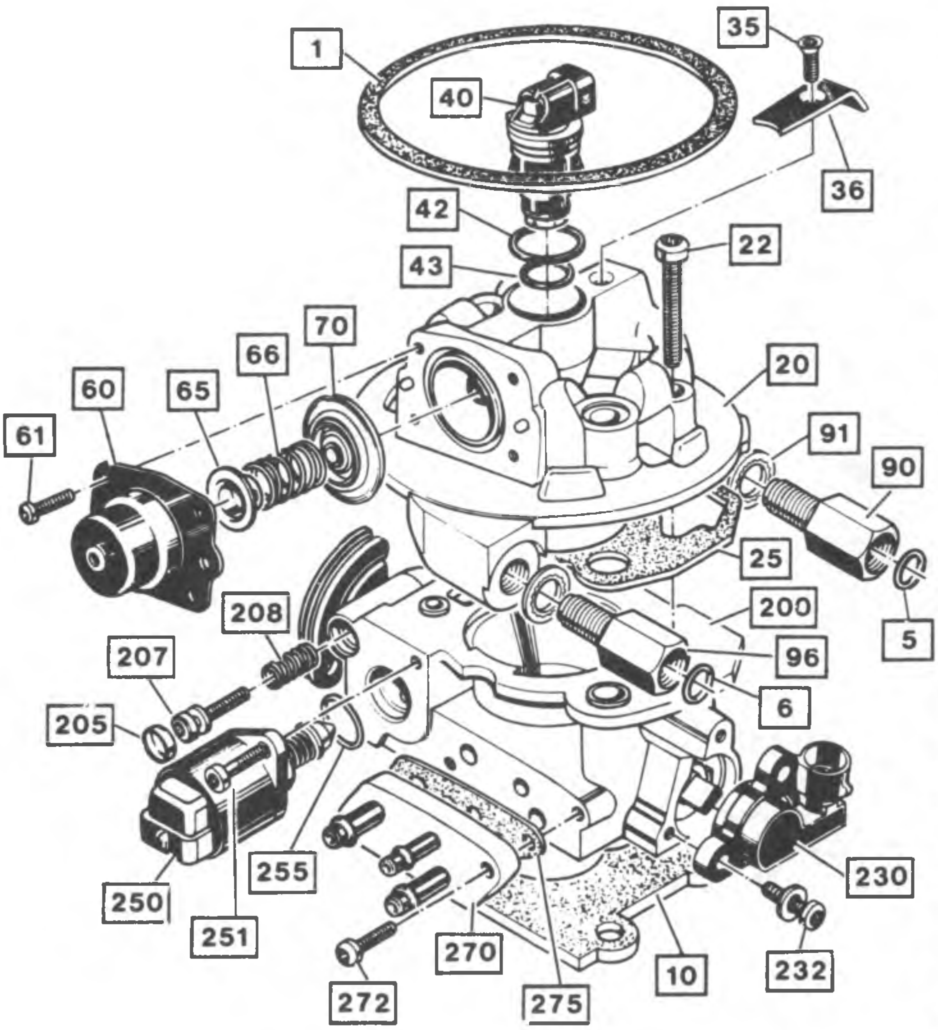


Figure 4-14 - TBI Model 220 Identification

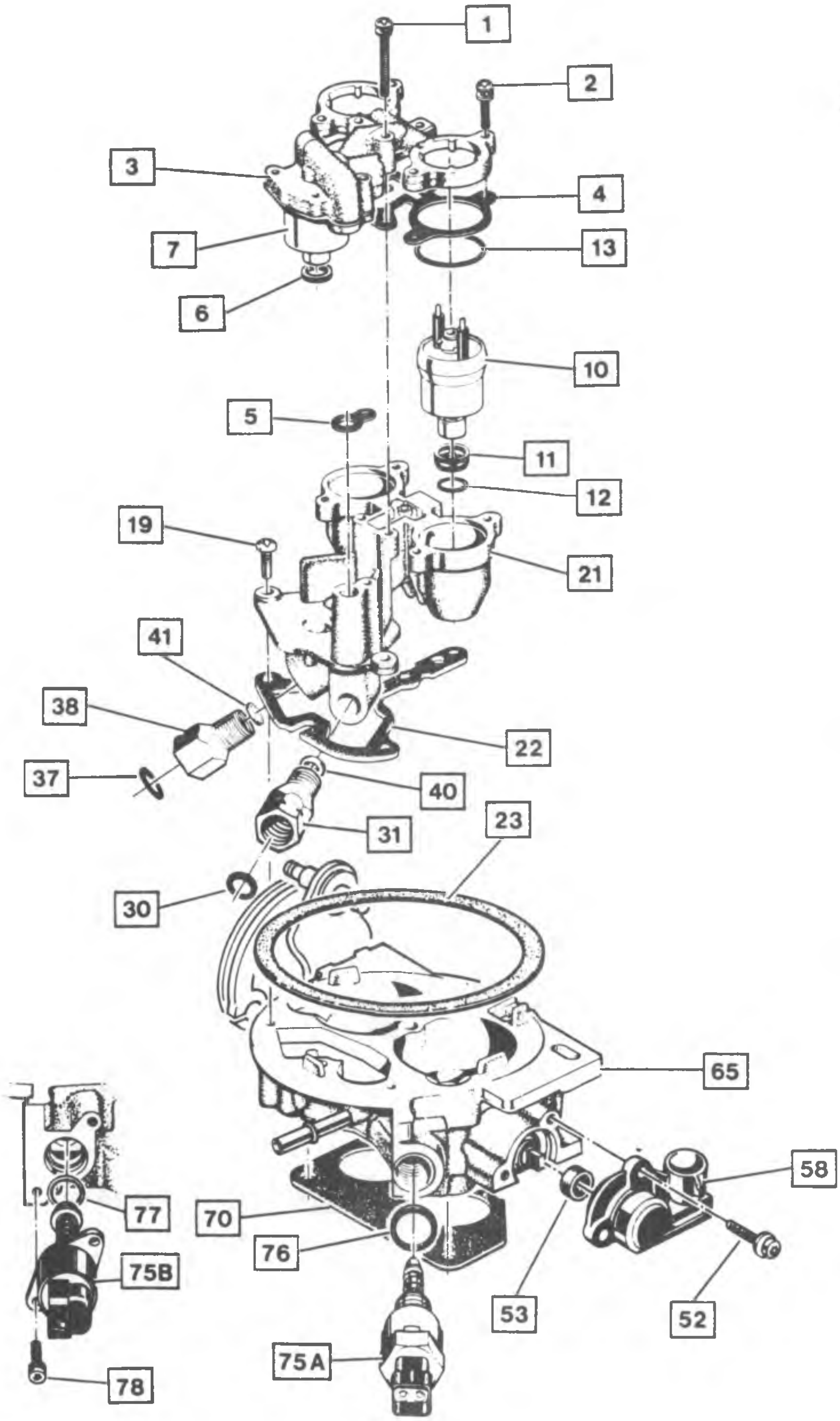


Part Names

1	Gasket - Air Cleaner
5	O-ring - Fuel Line Inlet Nut
6	O-ring - Fuel Line Outlet Nut
10	Gasket - Flange
20	Fuel Meter Body Assembly
22	Screw - Fuel Meter Body - Throttle Body Attaching
25	Gasket - Fuel Meter Body to Throttle Body
35	Screw - Injector Retainer Attaching
36	Retainer - Injector
40	TBI Injector Assembly
42	O-ring - Fuel Injector - Upper
43	O-ring - Fuel Injector - Lower
60	Pressure Regulator Cover Assembly
61	Screw - Pressure Regulator Attaching
65	Seat - Pressure Regulator Spring
66	Spring - Pressure Regulator
70	Pressure Regulator Diaphragm Assembly
90	Fitting - Fuel Inlet
91	Seal - Fuel Fitting
96	Fitting - Fuel Outlet
200	Throttle Body Assembly
205	Plug - Idle Stop Screw
207	Idle Stop Screw Assembly
208	Spring - Idle Stop Screw
230	Sensor - Throttle Position (TPS)
232	Screw Assembly - TPS Attaching
250	Idle Air Control (IAC) Valve Assembly
251	Screw - IAC Valve Attaching
255	O-ring - IAC Valve
270	Tube Module Assembly
272	Screw - Tube Module Assembly Attaching
275	Gasket - Tube Module Assembly

9P 0156-XV

Figure 4-15 - Model 700 TBI Parts Identification (L-4 Engine)



Part Names

1	Screw Assembly - Fuel Meter Cover Attaching - Long
2	Screw Assembly - Fuel Meter Cover Attaching - Short
3	Fuel Meter Cover Assembly
4	Gasket - Fuel Meter Cover
5	Gasket - Fuel Meter Outlet
6	Seal - Pressure Regulator
7	Pressure Regulator
10	TBI Fuel Injector Assembly
11	Filter - Fuel Injector Inlet
12	O-ring - Fuel Injector - Lower
13	O-ring - Fuel Injector - Upper
19	Screw - Fuel Meter Body - Throttle Body Attaching
21	Fuel Meter Body Assembly
22	Gasket - Throttle Body to Fuel Meter Body
23	Gasket - Air Cleaner
30	O-ring - Fuel Return Line
31	Nut - Fuel Outlet
37	O-ring - Fuel Inlet Line
38	Nut - Fuel Inlet
40	Gasket - Fuel Outlet Nut
41	Gasket - Fuel Inlet Nut
52	Screw Assembly - TPS Attaching
53	Seal - Throttle Position Sensor
58	Sensor -Throttle Position (TPS)
65	Throttle Body Assembly
70	Gasket - Flange
75	Idle Air Control Valve Assembly: A. Thread Mounted B. Flange Mounted
76	Gasket - Idle Air Control Valve Assembly
77	O-ring - Idle Air Control Valve
78	Screw Assembly - Idle Air Control Valve Attaching

MP 0171-6E

Figure 4-16 - Model 220 TBI Parts Identification (V-6 and V-8 Engine)

Fuel Pressure Relief Procedure

The TBI Model 200 for V6 and V8 engines contains a constant bleed feature in the pressure regulator that relieves pressure.

However, on L4 engines, the TBI Model 700 does not contain a constant bleed feature to relieve pressure.

TBI MODEL 700

1. Place transmission selector in park (neutral on manual transmissions), set parking brake, and block drive wheels.
2. Loosen fuel filler cap to relieve tank pressure.
3. Disconnect three terminal electrical connector at fuel tank.
4. Start engine and allow to run a few seconds until it stops from lack of fuel.
5. Engage starter for three seconds to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
6. Disconnect negative battery terminal to avoid possible fuel discharge if an accidental attempt is made to start the engine.
7. After service, reconnect connector at fuel tank, tighten fuel filler cap and reinstall negative battery cable.

TBI MODEL 220

1. Disconnect negative battery terminal to avoid possible fuel discharge if an accidental attempt is made to start the engine.
2. Loosen fuel filler cap to relieve tank vapor pressure.
3. The internal constant bleed feature of TBI Model 220 relieves fuel pump system pressure when the engine is turned "OFF." Therefore, no further pressure relief procedure is required.

Fuel System Pressure Test

A fuel system pressure test is part of several of the Diagnostic Charts and Symptom checks. To perform this test, follow this procedure:

1. Turn engine "OFF" and relieve fuel pressure following above procedure.
2. Plug THERMAC vacuum port if required on TBI.
3. Uncouple fuel supply flexible hose in engine compartment. Instal fuel pressure gage J29658A/BT-8205 and adapter J 2968A-85 between steel line and flexible hose.
4. Tighten gage in line to ensure no leaks occur during testing.
5. Connect negative battery terminal.
6. Start engine and observe fuel pressure reading. It should be 62-90 kPa (9-13 psi). If not, refer to CHART A-6 in "Computer Command Control," Section "3" diagnosis.
7. Relieve fuel pressure.
8. Remove fuel pressure gage.
9. Install new O-ring on fuel feed line.
10. Reinstall fuel line.
11. Reconnect negative battery terminal.
12. Start engine and check for fuel leaks.
13. Remove plug from vacuum port if installed, and install air cleaner with new gasket.

Cleaning and Inspection

- All TBI component parts, with the exception of those noted below, should be cleaned in a cold immersion cleaner such as Carbon X (X-55) or equivalent.

NOTICE: The Throttle Position (TPS), sensor Idle Air Control (IAC) valve, pressure regulator diaphragm assembly, fuel injectors or other components containing rubber, should NOT be placed in a solvent or cleaner bath. A chemical reaction will cause these parts to swell, harden or distort. Do not soak the throttle body with the above parts attached. If the throttle body assembly requires cleaning, soak time in the cleaner should be kept to a minimum. Some models have hidden throttle shaft dust seals that could lose their effectiveness by extended soaking.

1. Clean all metal parts thoroughly and blow dry with shop air. Be sure that all fuel and air passages are free of dirt or burrs.
2. Inspect mating casting surfaces for damage that could affect gasket sealing.

Thread Locking Compound

Service repair kits are supplied with a small vial of thread locking compound with directions for use. If material is not available, use Loctite 262, or GM part number 10522624, or equivalent.

NOTICE: In precoating screws, do not use a higher strength locking compound than recommended, since to do so could make removing the screw extremely difficult, or result in damaging the screw head.

MODEL 220 AND 700 TBI UNITS Replacement
Figures 4-17 through 4-21

Remove or Disconnect

1. THERMAC hose from engine fitting (S/T Series).
2. Air cleaner, adapter, and gaskets. Discard gasket.

3. Electrical connectors - idle air control valve, throttle position sensor, and fuel injectors. (On TBI 220 units, squeeze plastic tabs on injectors and pull straight up.)
4. Grommet with wires from throttle body.
5. Throttle linkage, return springs(s), transmission control cable, and cruise control (wherever applicable).
6. Vacuum hoses, noting positions of hoses.
7. Inlet and outlet fuel line nuts, using back-up wrench J 29698-A or BT-8251-A.

CAUTION: Refer to "Fuel Pressure Relief Procedure" (above), before disconnecting fuel lines.

8. Fuel line O-rings from nuts and discard.
9. TBI mounting hardware.
10. TBI unit from intake manifold.

NOTICE: To prevent damage to the throttle valve, it is essential that the unit be placed on a holding fixture, before performing service.

11. TBI flange (Manifold mounting) gasket.

NOTICE: Stuff the manifold opening with a rag, to prevent material from entering the engine, and remove the old gasket material from surface of intake manifold.

Inspect

- Manifold bore for loose parts and foreign material.
- Intake manifold sealing surface for cleanliness.

Install or Connect

1. New TBI flange (Manifold mounting) gasket.
2. TBI with mounting hardware.

Tighten

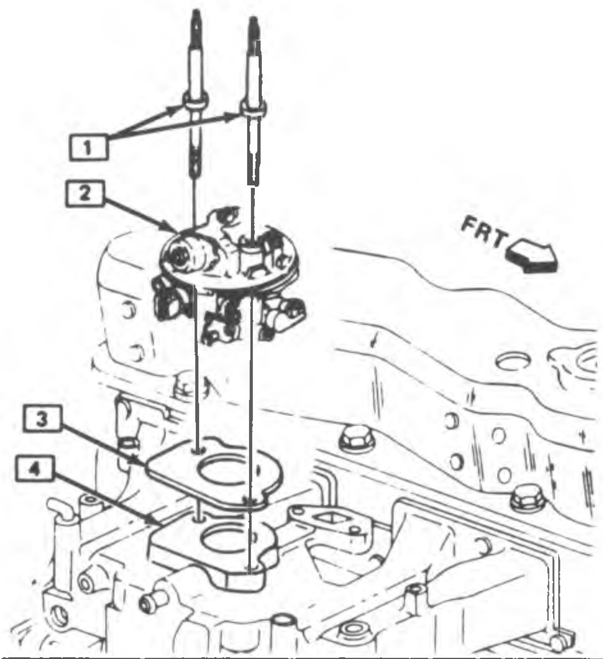
- Hardware on 2.5L engine, 17.0 N·m (12.5 lb. ft.).
- Hardware on 2.8L engine, 25.0 N·m (18.0 lb. ft.).
- Hardware on 4.3L, 5.0L, 5.7L, and 7.4L engines, 16.0 N·m (12.0 lb. ft.).

3. New O-rings on fuel line nuts.
4. Fuel line inlet and outlet nuts by hand.

Tighten

- Fuel line nut to 26.0 N·m (20.0 lb. ft). (Use back-up wrench to prevent TBI nuts from turning,)

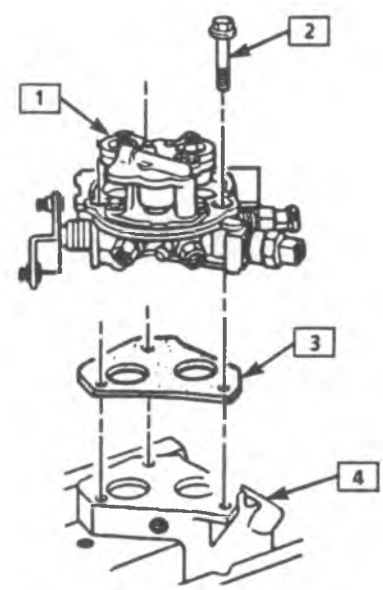
5. Vacuum hoses and bracket.



1 STUD - TIGHTEN TO 17 N·m (12 FT. LBS.)
2 TBI UNIT
3 GASKET
4 ENGINE INTAKE MANIFOLD

7S 3546-6E

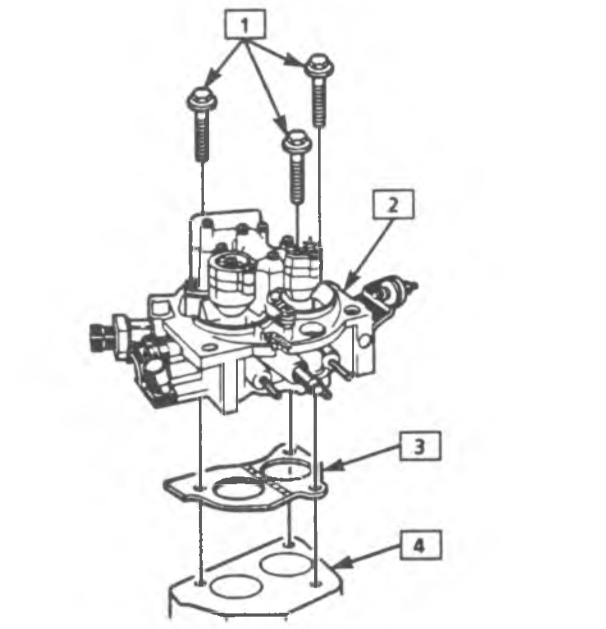
Figure 4-17 - Replacing TBI 700 Unit - 2.5L Engine



1 TBI UNIT
2 BOLT – TIGHTEN TO 25 N·m (18 lb. ft.)
3 GASKET
4 ENGINE INTAKE MANIFOLD

6S 2797-6E

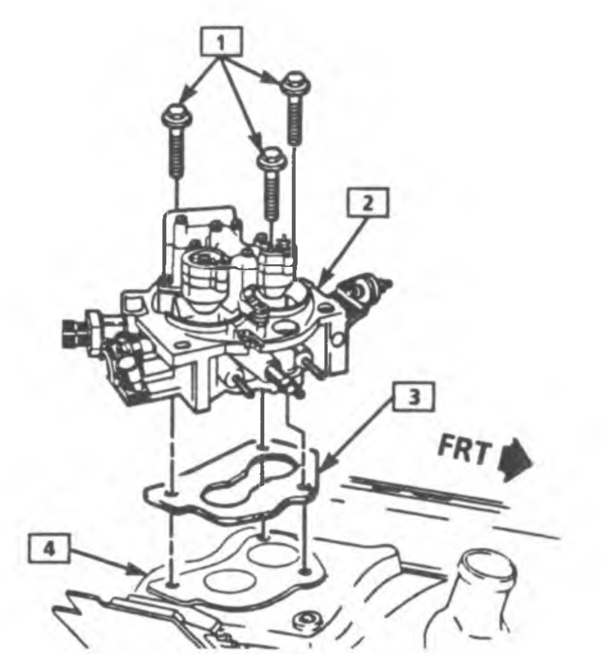
Figure 4-18 - Replacing TBI 220 Unit - 2.8L Engine



1 BOLT
2 TBI UNIT
3 GASKET (MUST BE INSTALLED WITH STRIPE FACING UP)
4 ENGINE INTAKE MANIFOLD

6S 2799-6E

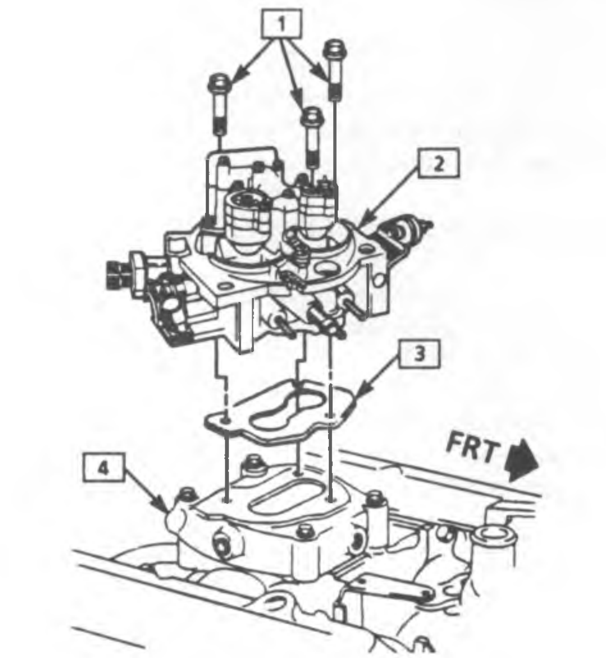
Figure 4-19 - Replacing TBI 220 Unit - 4.3L Engine



1 BOLT - TIGHTEN TO 16 N·m (12 lb. ft.)
2 TBI UNIT
3 GASKET
4 ENGINE INLET MANIFOLD

7S 3547-6E

Figure 4-20 - Replacing TBI 220 Unit - 5.0L/5.7L Engine



1 BOLT - TIGHTEN TO 16 N·m (12 lb. ft.)
2 TBI UNIT
3 GASKET
4 HEATER

7S 3543-6E

Figure 4-21 - Replacing TBI 220 Unit - 7.4L Engine

6. Throttle linkage, return springs(s), transmission control cable, and cruise control (wherever applicable).
7. Grommet, with wire harness, to throttle body.
8. Electrical connectors, making sure connectors are fully seated and latched.
9. Check to see if accelerator pedal is free, by depressing pedal to the floor and releasing, while engine is "OFF."
10. With engine "OFF," and ignition "ON," check for leaks around fuel line nuts.
11. Air cleaner, adapter, and new gaskets.
12. Start engine and check again for fuel leaks.

Controlled Idle Speed Check

Before performing this check, there should be no codes displayed, idle air control system has been checked and ignition timing correct.

1. Set parking brake and block drive wheels.
2. Connect a "Scan" tool to the ALDL connector with tool in Open Mode.
3. Start engine and bring it to normal operating temperature.
4. Check for correct state of Park/Neutral switch on "Scan" tool.
5. Check specifications chart at the end of this section for controlled idle speed and IAC valve pintle position (counts).

6. If within specifications, the idle speed is being correctly controlled by the ECM.
7. If not within specifications, refer to "Rough, Unstable or Incorrect Idle, Stalling" in "Driveability Symptom," Section "2" and review information at the beginning of this check.

Minimum Idle Speed Check (7.4L Only)

1. Check controlled idle speed and perform idle speed control system check first.
2. Set parking brake and block drive wheels.
3. Start engine and bring it to normal operating temperature (85°-100°C). Turn engine "OFF."
4. Remove air cleaner, adapter and gaskets. On ST Series vehicle, leave THERMAC hose connected. Check that the throttle lever is not being bound by the throttle, TV or cruise control cables.
5. With IAC valve connected, ground the diagnostic terminal (ALDL connector).
6. Turn "ON" ignition, do not start engine. Wait at least 10 seconds (this allows IAC valve pintle to extend and seat in throttle body).
7. With ignition "ON," engine stopped, test terminal still grounded, disconnect IAC valve electrical connector. (This disables IAC valve in seated position). Care should be taken to pull the connector straight out so that the moment of electrical disconnect is the same for all the pins. Otherwise the pintle may move as the connector is removed. Remove ground from diagnostic terminal.
8. Connect a "Scan" tool to the ALDL connector and place in open mode.
9. Start engine. With transmission in neutral, allow engine rpm to stabilize.
10. Check rpm against specifications at the end of this section. Disregard IAC counts on "Scan" tool with the IAC disconnected. If the engine has less than 500 miles or is checked at altitudes above 1500 feet, the idle rpm with a seated IAC valve should be lower than values above.
11. If the minimum idle speed is within specifications, no further check is required.
12. If the minimum idle speed is not within specifications, perform the following procedures:
13. If present, remove stop screw plug by piercing it with an awl, then applying leverage (see Figure 4-22). The screw is covered to discourage unauthorized adjustments.
14. With engine at normal operating temperature (85°-100°C), adjust stop screw to obtain nominal rpm per specifications with seated IAC valve.
15. Turn ignition "OFF" and reconnect IAC valve electrical connector.
16. Disconnect "Scan" tool or tachometer.
17. Use silicon sealant or equivalent to cover stop screw hole.

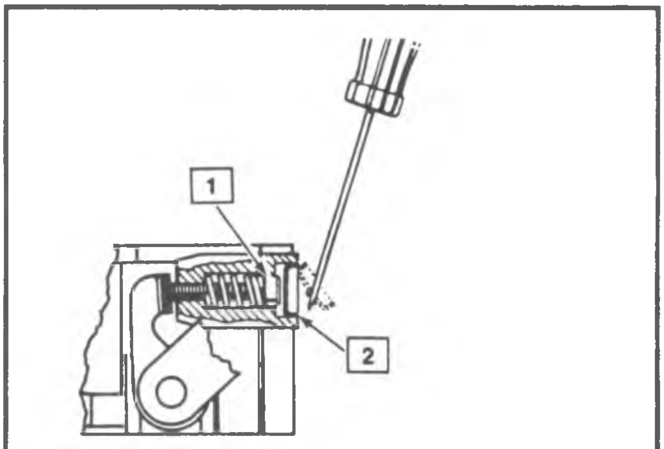


Figure 4-22 - Removing Stop Screw Plug 7.4L

18. Install air cleaner, adapter and gasket.
19. Reset IAC valve. Refer to "Idle Air Control Valve" in "Fuel Control," Section "4".

TBI 220 COMPONENT SERVICE
FUEL METER COVER ASSEMBLY - TBI 220
Figure 4-23

The fuel meter cover assembly contains the fuel pressure regulator assembly. The regulator has been adjusted at the factory and should only be serviced as a complete preset assembly.

CAUTION: DO NOT remove the four screws securing the pressure regulator to the fuel meter cover. The fuel pressure regulator includes a large spring under heavy compression which, if accidentally released, could cause personal injury. Disassembly might also result in a fuel leak between the diaphragm and the regulator container.

←→ Remove or Disconnect

1. Electrical connectors to fuel injectors. (Squeeze plastic tabs and pull straight up.)
2. Long and short fuel meter cover screw assemblies.
3. Fuel meter cover assembly.

NOTICE: DO NOT immerse the fuel meter cover (with pressure regulator) in cleaner, as damage to the regulator diaphragm and gasket could occur.

4. Fuel meter outlet gasket and pressure regulator seal. Discard gaskets and seal.

Inspect

- For dirt, foreign material and casting warpage.

Install or Connect

1. New pressure regulator seal, fuel meter outlet passage gasket, and cover gasket.
2. Fuel meter cover assembly.
3. Attaching screw assemblies, precoated with appropriate locking compound to threads. (Short screws are next to injectors.)

Tighten

- Screw assemblies to 3.0 N·m (28.0 lb. in.).

4. Electrical connectors to fuel injectors.
5. With engine "OFF," and ignition "ON," check for leaks around gasket and fuel line couplings.

FUEL INJECTOR ASSEMBLY - TBI 220
Figures 4-22 to 4-26

Each fuel injector (see Figure 4-23) is serviced as a complete assembly only.

NOTICE: Use care in removing the fuel injectors to prevent damage to the electrical connector terminals, the injector filter, and the fuel nozzle. The fuel injector is serviced as a complete assembly only. Also, since the injectors are electrical components, they should not be immersed in any type of liquid solvent or cleaner as damage may occur.

Remove or Disconnect

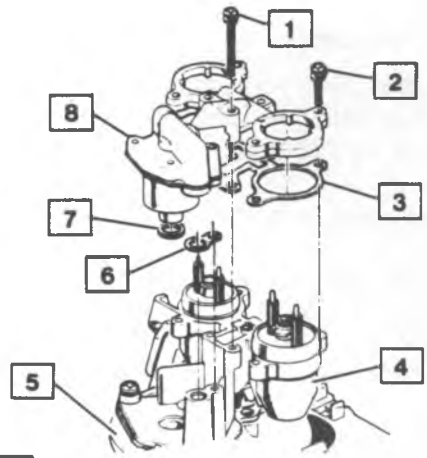
1. Electrical connectors to fuel injectors. (Squeeze plastic tabs and pull straight up.)
2. Fuel meter cover assembly, following above procedure.
3. With fuel meter cover gasket in place to prevent damage to casting, use a screwdriver and fulcrum to carefully lift out each injector (Figure 4-25).
4. Lower (small) O-rings from nozzle of injectors and discard.
5. Fuel meter cover gasket and discard.
6. Upper (large) O-rings and steel backup washers from top of fuel injector cavity and discard.

Inspect

- Fuel injector filter for evidence of dirt and contamination. If present, check for presence of dirt in fuel lines and fuel tank.

Important

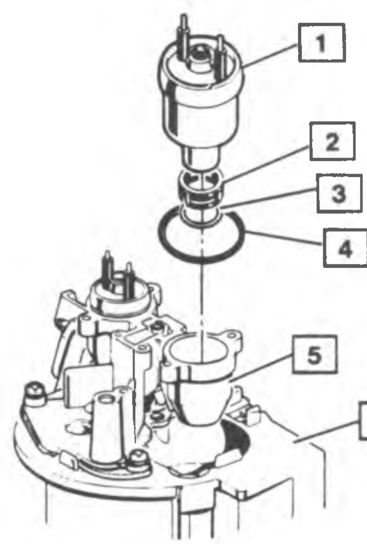
- Be sure to replace the injector with one having an identical part number. Injectors from other models can also fit in TBI model 220, but are calibrated for different flow rates. (See Figure 4-26 for part number location).



1 FUEL METER COVER ATTACHING SCREW ASSEMBLY - LONG
2 FUEL METER COVER ATTACHING SCREW ASSEMBLY - SHORT
3 FUEL METER COVER GASKET
4 FUEL METER BODY ASSEMBLY
5 THROTTLE BODY ASSEMBLY
6 FUEL METER OUTLET GASKET
7 PRESSURE REGULATOR SEAL
8 FUEL METER COVER ASSEMBLY

8P 0924-AS

Figure 4-23 - Replacing Model 220 Fuel Meter Cover



1 FUEL INJECTOR ASSEMBLY
2 FUEL INJECTOR INLET FILTER
3 FUEL INJECTOR LOWER "O" RING
4 FUEL INJECTOR UPPER "O" RING
5 FUEL METER BODY ASSEMBLY
6 THROTTLE BODY ASSEMBLY

MP 1200-AS

Figure 4-24 - Model TBI 220 Fuel Injector Parts

Install or Connect

1. Lubricate new lower (small) O-rings with automatic transmission fluid and push on nozzle end of injector until it presses against injector fuel filter.
2. Steel injector backup washer in counterbore of fuel meter body.
3. Lubricate new upper (large) O-ring with automatic transmission fluid and install directly over the backup washer. Be sure O-ring is seated properly and is flush with top of fuel meter body surface.

   NOTICE: Backup washers and O-rings must be installed before injectors, or improper seating of large O-ring could cause fuel to leak.

4. Injector, aligning raised lug on each injector base with notch in fuel meter body cavity. Push down on injector until it is fully seated in fuel meter body (Figure 4-28). (Electrical terminals of injector should be parallel with throttle shaft).

Important

- Be sure to install the injectors in their proper location.

5. Fuel meter cover gasket.
6. Fuel Meter cover, following above procedure.
7. Electrical connectors to fuel injectors.
8. With engine "OFF" and ignition "ON," check for fuel leaks.

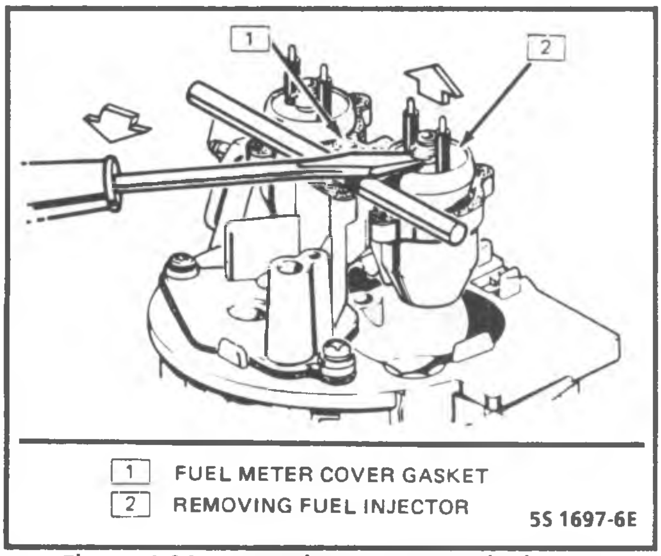


Figure 4-25 - Removing TBI 220 Fuel Injector

FUEL METER BODY ASSEMBLY - TBI 220
Figure 4-29

Remove or Disconnect

1. Electrical connections to fuel injectors. (Squeeze plastic tabs and pull straight up.)

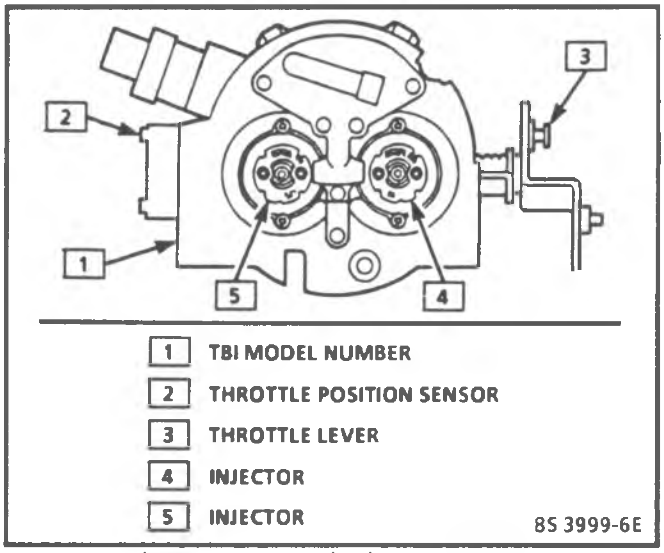


Figure 4-26 - Fuel Injector TBI 220

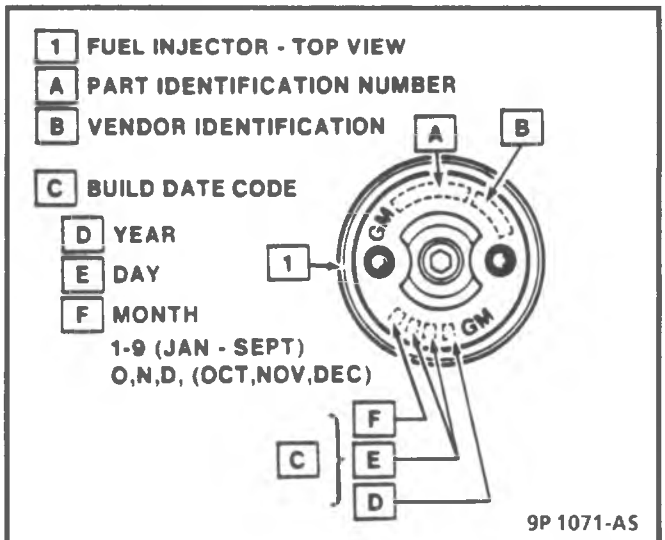


Figure 4-27 - Fuel Injector Part Number Location TBI 220

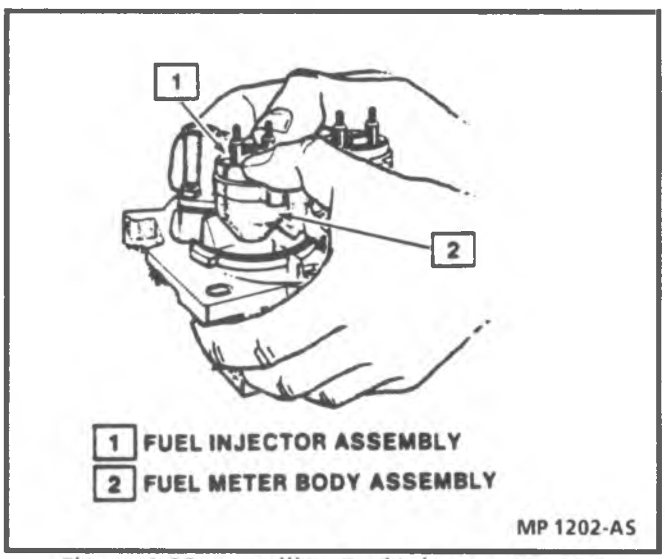


Figure 4-28 - Installing Fuel Injector - TBI 220

2. Fuel meter cover assembly, (See previous procedure).
3. Fuel meter cover assembly, following above procedure.
4. Fuel injectors, following above procedure.
5. Fuel inlet and return lines. Discard O-rings.
6. Fuel inlet and outlet nuts and gaskets from the fuel meter body assembly. Discard gaskets.

Important

- Note locations of nuts, for proper reassembly later. Inlet nut has a larger passage than outlet nut.

7. Fuel meter body to throttle body attaching screw assemblies.
8. Fuel meter body assembly from throttle body assembly.
9. Throttle body to fuel meter body gasket and discard.

Install or Connect

1. New throttle body to fuel meter body gasket. Match cut-out portions in gasket with openings in throttle body.
2. Fuel meter body assembly on throttle body assembly.
3. Fuel meter body-to-throttle body attaching screw assemblies, precoated with appropriate locking compound.

Tighten

- Screw assemblies to 4.0 N·m (30.0 lb. in.)

4. Fuel inlet and outlet nuts with new gaskets to fuel meter body assembly.

Tighten

- Inlet nut to 40.0 N·m (30.0 lb. ft).
- Outlet nut to 29.0 N·m (21.0 lb. ft).

5. Fuel inlet and return lines and new O-rings. (Use back-up wrench J 29698-A or BT-8251-A to keep TBI nuts from turning.)

Tighten

- Fuel lines to 23 N·m (17 lb. ft.).

6. Injectors, with new upper and lower O-rings in fuel meter body assembly.
7. Fuel meter cover gasket, fuel meter outlet gasket, and pressure regulator seal.
8. Fuel meter cover assembly.
9. Long and short fuel meter cover attaching screw assemblies, coated with appropriate thread locking compound.

Tighten

- Screw assemblies to 3.0 N·m (27.0 lb. in.)

10. Electrical connectors to fuel injectors.

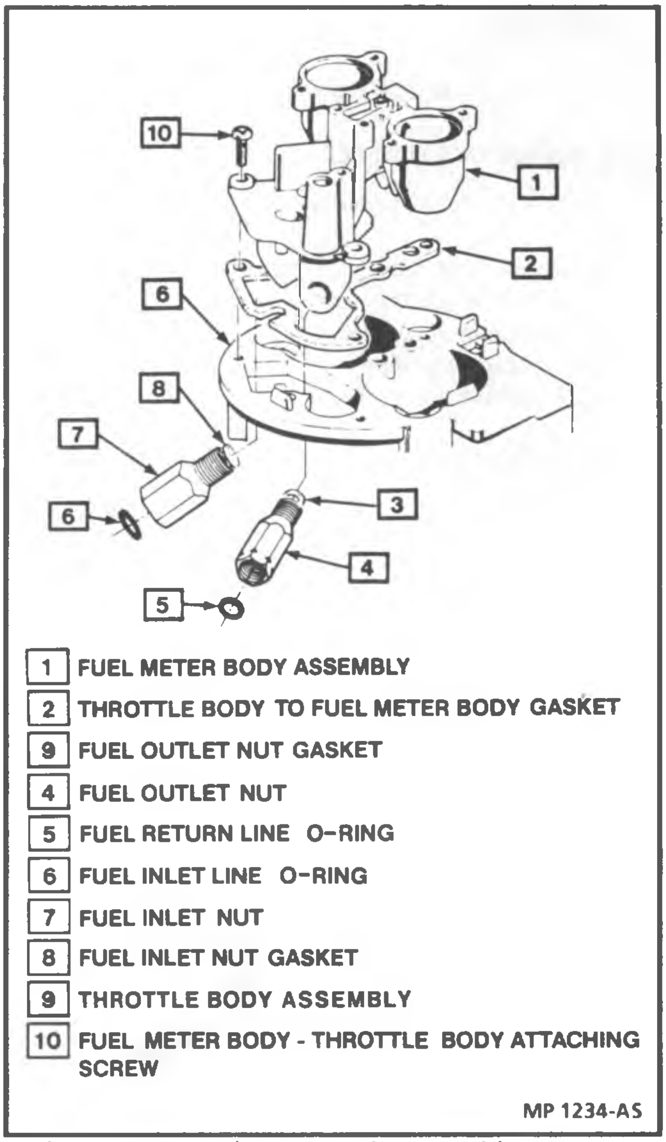


Figure 4-29 - Fuel Meter Body Assembly - TBI 220

11. With engine "OFF," and ignition "ON," check for leaks around fuel meter body, gasket and around fuel line nuts.

THROTTLE POSITION SENSOR (TPS) - TBI 220
Figure 4-30

Important

- Since TPS configurations can be mounted interchangeable, be sure to order the correct one for your engine with the identical part number of the one being replaced.

Remove or Disconnect

1. Electrical connector.
2. Two TPS attaching screw assemblies.
3. TPS from throttle body assembly.
4. TPS seal.

NOTICE: The TPS is an electrical component and must not be soaked in any liquid cleaner or solvent, as damage may result.

Install or Connect

1. TPS seal over throttle shaft as shown in Figure 4-29.
2. With throttle valve in normally closed position, install TPS on throttle shaft and rotate counter clockwise to align mounting hole.
3. TPS attaching screw assemblies, precoated with appropriate thread-locking compound.

Tighten

- Screw assemblies to 2.0 N·m (18.0 lb. in).

4. Electrical connector.
5. Check for TPS output as follows:
   - Connect ALDL scanner to read TPS output voltage.
   - With ignition "ON" and engine stopped, TPS voltage should be less than 1.25 volts. If more than 1.25 volts, replace TPS.

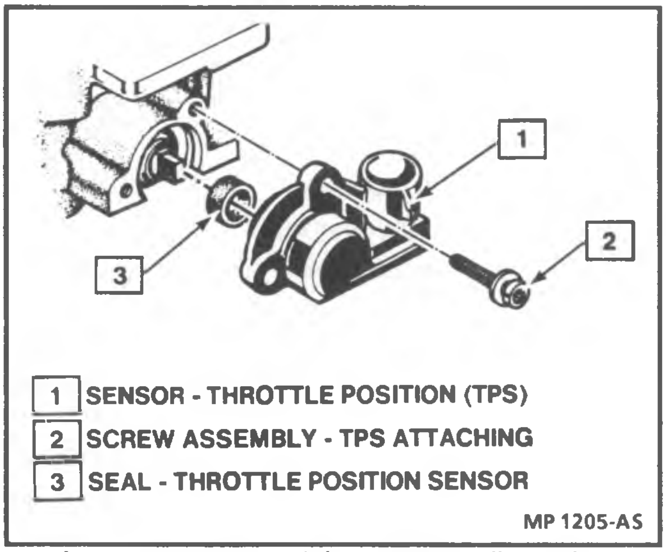


Figure 4-30 - TBI Model 220 TPS Configuration

IDLE AIR CONTROL (IAC) VALVE-TBI 220
Figures 4-31 and 4-32

NOTICE: The IAC valve is an electrical component and must not be soaked in any liquid cleaner or solvent. Otherwise damage could result.

Important

- All IAC valves on TBI Model 220 units (except those on the 7.4L engine) are thread-mounted and have a dual taper, 10 mm diameter, pintle. On the 7.4L engine, the IAC valve is flange-mounted and has a 12mm diameter, dual taper pintle.

Any replacement of an IAC valve must have the correct part number, with the appropriate pintle taper and diameter for proper seating of the valve in the throttle body.

Remove or Disconnect

1. Electrical connector.
2. IAC valve.
   - On thread mounted units, use a 32 mm ($1\frac{1}{4}$") wrench (Figure 4-31).
   - On flange-mounted units, remove screw assemblies (Figure 4-32)
3. IAC valve gasket or O-ring and discard.

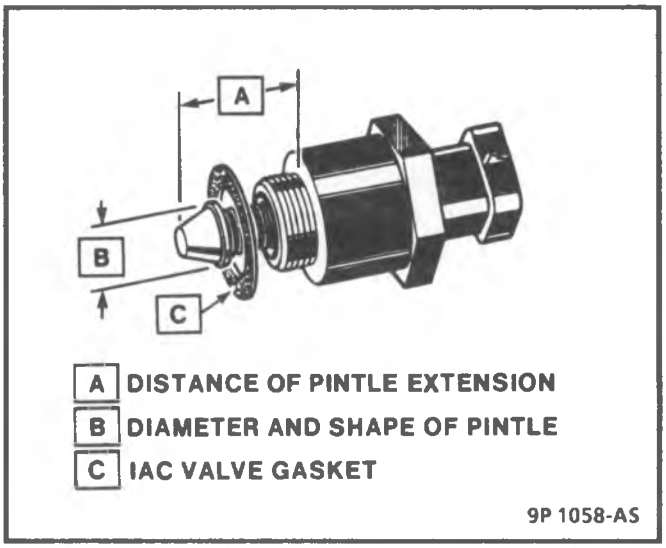


Figure 4-31 - Thread Mounted Type IAC Valve

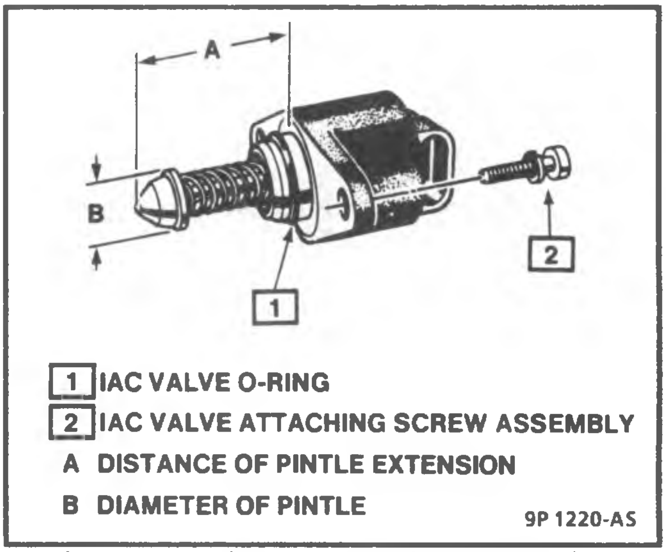


Figure 4-32 - Flange Mounted Type IAC Valve

Clean

- Thread mounted valve - Old gasket material from surface of throttle body assembly to insure proper seal of new gasket.
- Flange-mounted valve - IAC valve surfaces on throttle body to assure proper seal of new O-ring and contact of IAC valve flange.

NOTICE: If the IAC valve was removed during service, it's operation may be tested electrically with the IAC/ISC Motor Tester (J 37027 or BT-8256K). However, if the valve pintle is extended electrically, it must also be retracted electrically. Before installing an IAC valve, measure the distance between the tip of the valve pintle and the mounting surface.If the dimension is greater than 28 mm (1.10"), it must be reduced to prevent damage to the valve. This may be done electrically using an IAC/ISC motor tester (J 37027 or BT-8256K).

Measure (If Installing a New IAC Valve)

Figures 4-31 and 4-32

- Distance between tip of IAC valve pintle and mounting flange.
  - If greater than 28 mm, use finger pressure to slowly retract the pintle, The force required to retract the pintle of a new valve will not cause damage to the valve.

Important

- No physical adjustment of the IAC valve assembly is required after installation. The IAC valve pintle is reset by the ECM/PCM which causes the valve pintle to seat in the throttle body. The ECM/PCM then has a reset procedure to set the correct pintle position. Proper idle regulation should result.
  No physical adjustment of the IAC valve assembly is required after installation. The IAC valve pintle is reset by turning the ignition "ON" for ten seconds and then "OFF." The ECM/PCM then resets the pintle to the correct position. Proper idle regulation should result.

Install or Connect

1. IAC valve into throttle body as follows:
   - Thread-mounted valve - Install with new gasket.
   - Flange-mounted valve - Install with new lubricated O-ring, using attaching screw assemblies.

NOTICE: New IAC valves have been reset at the factory and should be installed in the throttle body in an "as is" condition, without any adjustment.

Tighten

- Thread-mounted IAC valve assembly to 18.0 N·m (13.0 lb. ft.) with 32 mm (1 - $\frac{1}{4}$") wrench.
- Flange-mounted attaching screw assemblies to 3.2 N·m (28.0 lb. in.)

2. Electrical connector to IAC valve.
3. Reset IAC valve pintle position:
   a. Turn ignition "ON" for five seconds.
   b. Turn ignition "OFF" for ten seconds.
   c. Start engine and check for proper idle operation.

THROTTLE BODY ASSEMBLY-TBI 220

Remove or Disconnect

1. TBI unit, as described above.
2. Fuel meter body-to-throttle body attaching screw assemblies.
3. Fuel meter body assembly.
4. Throttle body-to-fuel meter body gasket and discard.

Disassemble

- TPS from old throttle body, according to previous instructions, for reuse on new throttle body. (The IAC valve does not have to be removed, since a new one comes with replacement throttle body.)

Assemble

- TPS onto replacement throttle body assembly, according to previous instructions.

Install or Connect

1. New throttle body-to-fuel meter body gasket.
2. Fuel meter body assembly on throttle body assembly.
3. Fuel meter body-throttle attaching screw assemblies that have been coated with locking compound.

   #### Tighten

   - Attaching screw assemblies to 4.0 N·m (3.50 lb. in.)
4. TBI unit onto intake manifold, as previously described.

TBI 700 COMPONENT SERVICE

FUEL INJECTOR ASSEMBLY-TBI 700
Figures 4-33 through 4-35

The fuel injector (see Figure 4-33) is serviced only as a complete assembly.

NOTICE: Use care in removing injector, to prevent damage to the electrical connector on top of the injector, and nozzle. Also, because the fuel injector is an electrical component, it should not be immersed in any type of liquid solvent or cleaner, as damage may occur.

Remove or Disconnect

1. Electrical connector to fuel injector.
2. Injector retainer screw and retainer.
3. Using a fulcrum, place a screwdriver blade under ridge opposite connector end and carefully pry injector out (see Figure 4-33).
4. Remove upper and lower O-rings from injector and in fuel injector cavity and discard.

Inspect

- Fuel injector filter for evidence of dirt and contamination. If present, check for presence of dirt in fuel lines and fuel tank.

Important

- Be sure to replace the injector with an identical part. Injectors from other models can fit in the Model 700 TBI, but are calibrated for different flow rates. (See Figure 4-35 for part number location.)

Install or Connect

1. Lubricate new upper and lower O-rings with automatic transmission fluid and place them on injector. (Make sure upper O-ring is in groove and lower one is flush up against filter.)

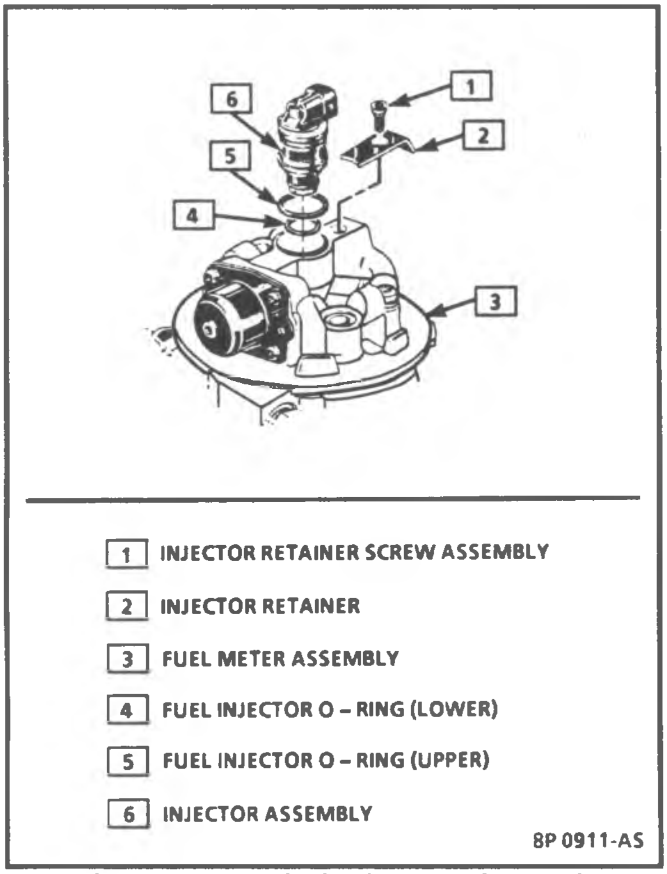


Figure 4-33 - Fuel Injection Parts (TBI 700)

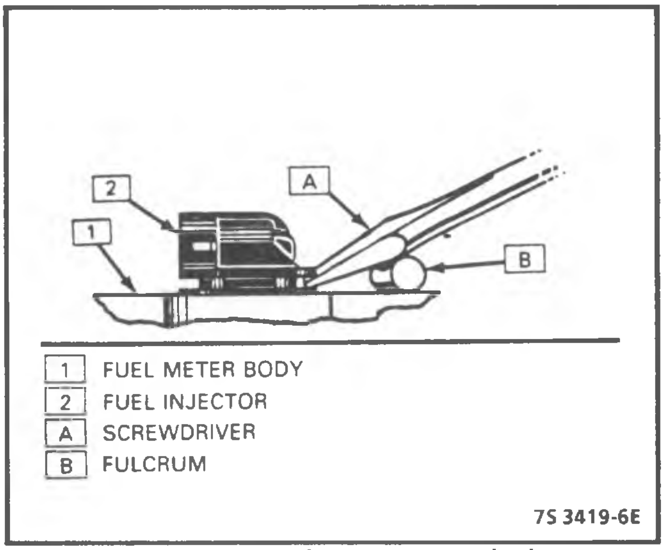


Figure 4-34 - Removing TBI 700 Fuel Injector

2. Injector assembly, pushing it straight into fuel injector cavity.

Important

- Be sure the electrical connector end on the injector is parallel to casting support rib and facing in the general direction of the cut-out in the fuel meter body for the wire grommet.

3. Injector retainer, using appropriate thread locking compound on retainer attaching screw.
4. Electrical connect or to fuel injector.

Tighten

- Injector retainer attaching screw to 3.0 N·m (27.0 lb. in.).

5. With engine "OFF" and ignition "ON," check for fuel leaks.

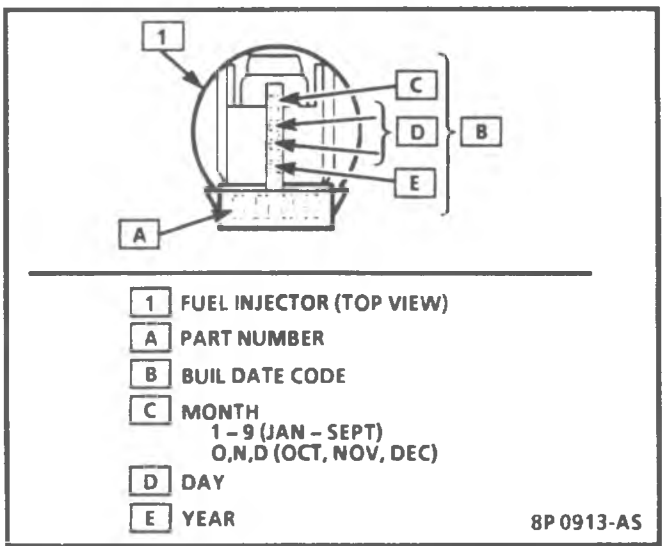


Figure 4-35 - Fuel Injector Part Number Location TBI 700

PRESSURE REGULATOR ASSEMBLY
Figure 4-36

NOTICE: To prevent leaks, the pressure regulator diaphragm assembly must be replaced whenever the cover is removed.

Remove or Disconnect

1. Four pressure regulator attaching screws, while keeping pressure regulator compressed.

CAUTION: The pressure regulator contains a large spring under heavy compression. Use care when removing the screws to prevent personal injury.

2. Pressure regulator cover assembly.
3. Pressure regulator spring.
4. Spring seat.
5. Pressure regulator diaphragm assembly.

Inspect

- Pressure regulator seat in fuel meter body cavity for pitting, nicks, or irregularities. (Use magnifying glass if necessary.) If any of above is present, the whole fuel body casting must be replaced.

Install or Connect

1. New pressure regulator diaphragm assembly, making sure it is seated in groove in fuel meter body.
2. Regulator spring seat and spring into cover assembly.
3. Cover assembly over diaphragm, while aligning mounting holes.

NOTICE: Use care while installing the pressure regulator to prevent misalignment of diaphragm and possible leaks.

4. Four screw assemblies that have been coated with appropriate thread locking compound, while maintaining pressure on regulator spring.

Tighten

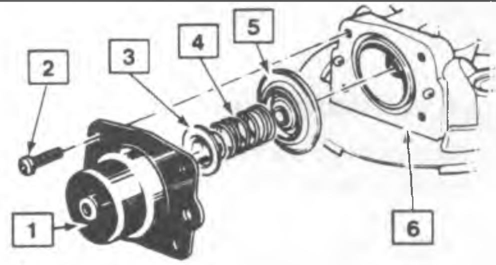
- Attaching screw assemblies to 2.5 N·m (22.0 lb. in.).

5. With engine "OFF" and ignition "ON," check for fuel leaks.

FUEL METER ASSEMBLY
Figure 4-15

Remove or Disconnect

1. Electrical connector from fuel injector.



1 PRESSURE REGULATOR COVER ASSEMBLY
2 PRESSURE REGULATOR ATTACHING SCREW
3 SPRING SEAT
4 PRESSURE REGULATOR SPRING
5 DIAPHRAGM ASSEMBLY
6 FUEL METER ASSEMBLY

9P 1171-AS

Figure 4-36 - TBI 700 Pressure Regulator

2. Grommet with wires from fuel meter assembly.
3. Inlet and outlet fuel line nuts, using backup wrench J 29698-A, or BT-8251-A.
4. Fuel line O-rings from nuts and discard.
5. TBI mounting hardware.
6. Two fuel meter body attaching screws.
7. Fuel meter assembly from throttle body assembly.
8. Fuel meter body to throttle body gasket and discard.

Install or Connect

1. New fuel meter body to throttle body gasket. Match cut-out portions of gasket with openings in throttle body assembly.
2. Fuel meter assembly.
3. Two fuel meter body attaching screws that have been coated with appropriate locking compound.

Tighten

- Attaching screws to 6.0 N·m (53 lb. in.).

4. Throttle body injection unit mounting hardware.

Tighten

- Mounting hardware to 17 N·m (12 lb. ft.).

5. New O-rings on fuel line nuts.
6. Fuel line inlet and outlet nuts by hand.

Tighten

- Inlet and outlet nuts to 27 N·m (20 lb. ft.). (Use back-up wrench J 29698-A, or BT-8251-A to keep TBI nuts from turning.)

7. Grommet with wires to fuel meter assembly.
8. Electrical connector to fuel injector, making sure it is fully seated and latched.
9. With engine "OFF" and ignition "ON," check for leaks around fuel line nuts.

THROTTLE POSITION SENSOR
Figure 4-37

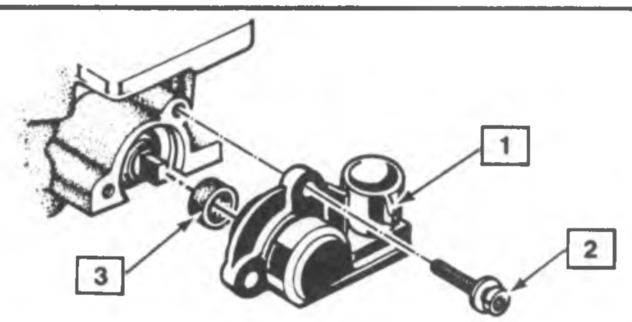
Remove or Disconnect
1. Electrical connector from TPS.
2. Screw assemblies and TPS.

NOTICE: The Throttle Position Sensor (TPS) is an electrical component, and should not be immersed in any type of liquid solvent or cleaner, as damage may result.

Install or Connect
1. With throttle valve in normally closed position, install TPS on throttle shaft and rotate counterclockwise to align mounting holes.
2. Attaching screw and washer assemblies.

Tighten
- Screw assemblies to 2.0 N·m (18.0 lb. in.)

3. Electrical connector to TPS.
4. Check for TPS output as follows:
   - Connect ALDL scanner to read TPS output voltage.
   - With ignition "ON" and engine stopped, TPS voltage should be less than 1.25 volts. If more than 1.25 volts, replace TPS.



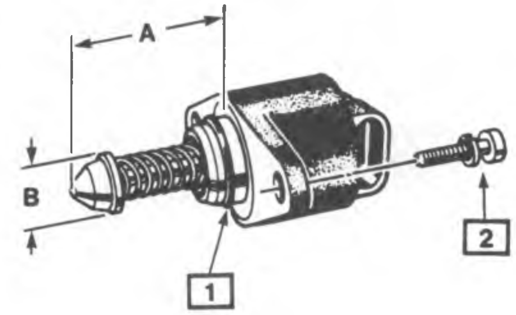
1 SENSOR - THROTTLE POSITION (TPS)
2 SCREW ASSEMBLY - TPS ATTACHING
3 SEAL - THROTTLE POSITION SENSOR

MP 1205-AS

Figure 4-37 - Throttle Position Sensor (TPS) - TBI 700

IDLE AIR CONTROL (IAC) VALVE
Figure 4-38

NOTICE: The IAC valve is an electrical component and must not be soaked in any liquid cleaner or solvent. Otherwise damage could result. On IAC valves that have been in service: Do Not push or pull on the IAC vale pintle. The force required to move the pintle may damage the threads on the worm drive.



1 IAC VALVE O-RING
2 IAC VALVE ATTACHING SCREW ASSEMBLY
A DISTANCE OF PINTLE EXTENSION
B DIAMETER OF PINTLE

MS 1220-6E

Figure 4-38 - Flange-Mount IAC Valve - TBI 700

Important
- On TBI Model 700, the IAC valve is flange-mounted, with dual taper, 10 mm diameter pintle. If replacement is necessary, only an IAC valve identified with the correct part number (having the appropriate pintle shape and diameter) should be used.

Remove or Disconnect
1. Electrical connector from IAC valve.
2. Screw assemblies and IAC valve.
3. IAC valve O-ring and discard.

Cleaning and Inspection
- Both original and replacement IAC valves have a special factory applied thread-locking compound applied to the screw threads. If the valve removed from the throttle body is being reinstalled, Do Not remove thread-locking compound that may remain on the threads.
- Clean IAC valve gasket sealing surface, pintle valve seat and air passage.
  - Use carburetor cleaner to remove carbon deposits. Do Not use a cleaner that contains methyl ethyl keytone, an extremely strong solvent, and not necessary for this type of deposit.
  - Shiny spots on the pintle or seat are normal, and do not indicate misalignment or a bent pintle shaft.
  - If air passage has heavy deposits, remove throttle body for complete cleaning.

Important
- No physical adjustment of the IAC valve assembly is required after installation. The IAC valve pintle is reset by the ECM which causes the valve pintle to seat in the throttle body. The ECM then has a reset procedure to set the correct pintle position. Proper idle regulation should result.

Measure (If Installing a New IAC Valve)

Figure C2-18

- Distance between tip of IAC valve pintle and mounting surface.
  - If greater than 28 mm, use finger pressure to slowly retract the pintle. The force required to retract the pintle of a new valve will not cause damage to the valve. This can be done electrically, using an IAC/ISC Motor Tester (J37027 or BT-8256K) on valves that have been removed during service.

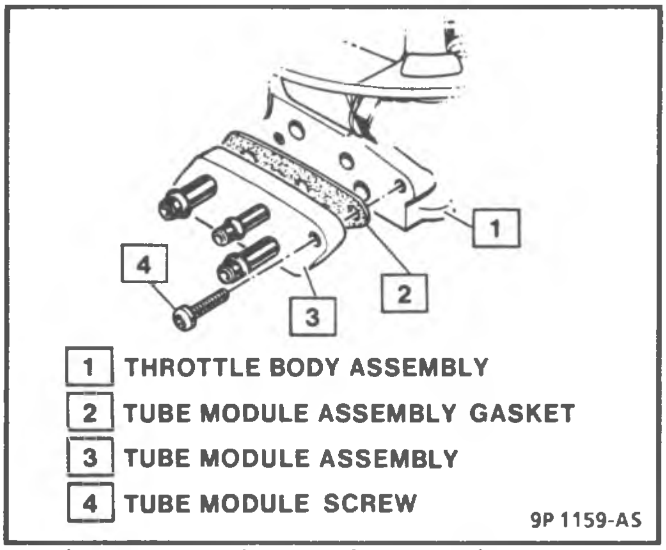


Figure 4-39 - Tube Module Assembly - TBI 700

Install or Connect

1. Lubricate new O-ring with transmission fluid and install on IAC valve.
2. IAC valve to throttle body.
3. IAC valve attaching screw assemblies that have been coated with appropriate thread locking compound.

Tighten

- Screw assemblies to 3.2 N·m (28.0 lb. in.).

4. Electrical connector to idle air control valve.
5. Reset IAC valve pintle position:
   a. Depress accelerator pedal slightly.
   b. Start and run engine for five seconds.
   c. Turn ignition "OFF" for ten seconds.
   d. Restart engine and check for proper idle operation.

TUBE MODULE ASSEMBLY
Figure 4-40

Remove or Disconnect

1. Tube module assembly attaching screws.
2. Tube module assembly.
3. Tube module assembly gasket and discard.

Clean

- Old gasket material from surface of throttle body assembly to insure proper seal of new gasket.

Install or Connect

1. New tube module assembly gasket.
2. Tube module assembly.
3. Tube module assembly attaching screws that have been coated with appropriate threadlocking compund.

Tighten

- Screw assemblies to 3.0 N·m (28.0 lb. in.).

THROTTLE BODY ASSEMBLY
Figure 4-15

NOTICE: Procedures related to replacement of the individual components below have been described previously and should be followed, or damage could occur.

Remove or Disconnect

1. Throttle Body Injection (TBI) unit, as described below.
2. Fuel meter body-to-throttle body attaching screw and washer assemblies.
3. Fuel meter assembly.
4. Fuel meter body to throttle body gasket and discard.

Disassemble

- TPS, IAC valve and tube module assembly from old throttle body assembly, according to previous instructions.

Assemble

- TPS, IAC valve, and tube module assembly onto replacement throttle body assembly, according to previous instructions.

Install or Connect

1. New fuel meter body to throttle body gasket.
2. Fuel meter assembly on throttle body assembly.
3. Fuel meter body-to-throttle body attaching screws coated with appropriate thread-locking compound.

Tighten

- Screws to 6.0 N·m (53 lb. in.)

4. TBI unit onto engine, as described below.

FUEL PUMP
Figure 4-40

Remove or Disconnect

1. Relieve full system pressure (2.5L Engine only).

2. Raise the vehicle on a hoist.
3. Negative battery cable.
4. Fuel tank.
5. Sender unit and pump by turning the cam lock counterclockwise using tool J 36608 or J 24187.
6. Fuel pump from the sending unit.
   - Pull the fuel pump up into the attaching hose while pulling outward from the bottom support.
   - Do not damage the rubber insulator or the strainer.

Inspect

1. Fuel pump attaching hose for signs of deterioration.
2. Rubber sound insulation at the bottom of the pump.

Install or Connect

1. Fuel pump assembly into the attaching hose.

   NOTICE: Care should be taken not to fold over or twist the strainer, when installing the sending unit as this will restrict fuel flow.

2. Sending unit and fuel pump assembly into the fuel tank.
   - Use a new O-ring seal.
3. Cam lock assembly.
   - Turn the cam lock clockwise to lock it.
4. Fuel tank.
5. Negative battery cable.

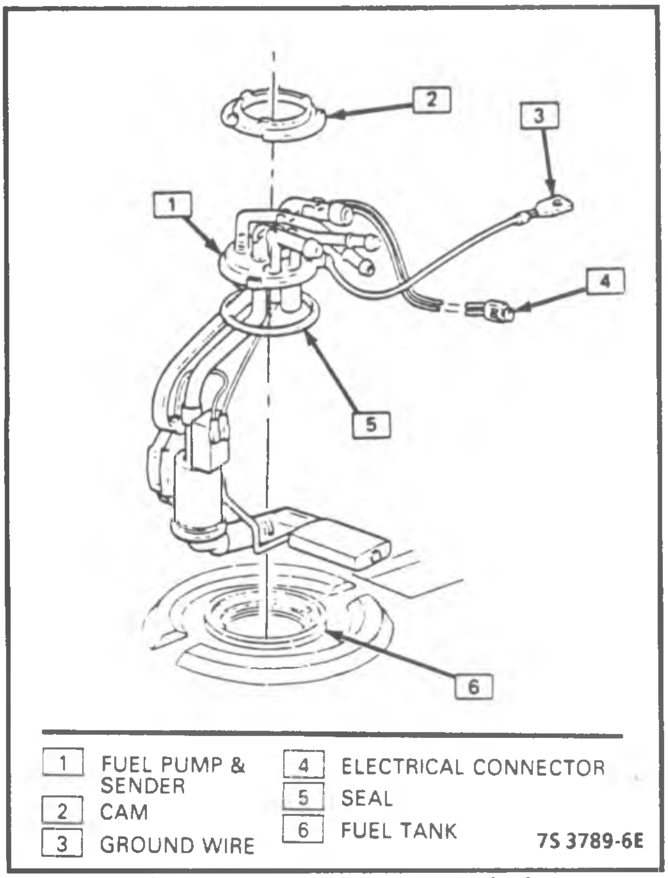


Figure 4-40 - Fuel Pump - Typical

FUEL PUMP RELAY

Figure 4-41 through 4-46

Remove or Disconnect

1. Protective cover (C/K).
2. Retainer, if installed.
3. Electrical connector.
4. Relay by depressing bracket clip at rear of relay, or removing bolts from retaining bracket.

Install or Connect

1. Relay.
2. Electrical connector.
3. Retainer.
4. Protective cover (C/K).

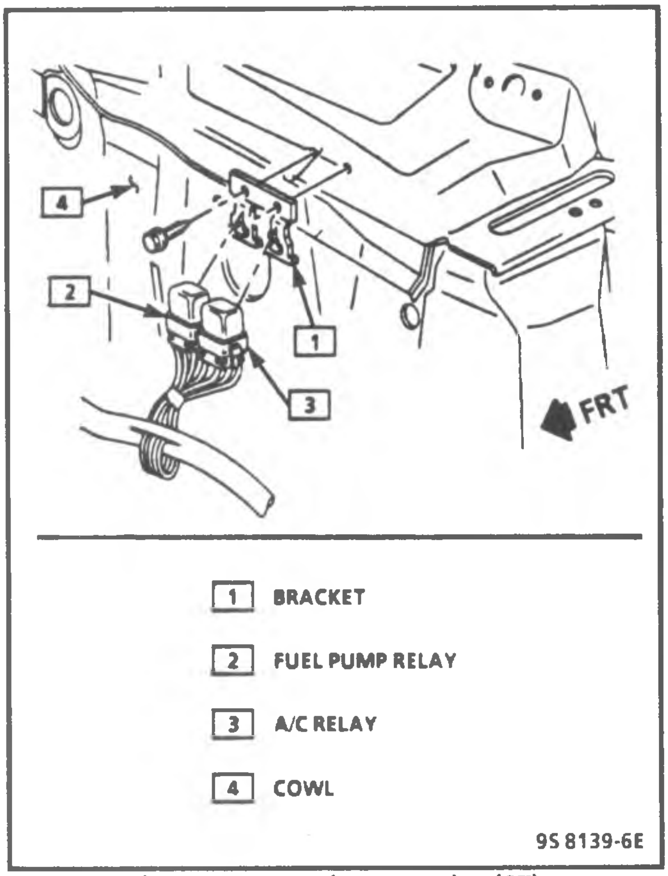


Figure 4-41 - Fuel Pump Relay (ST)

FUEL MODULE

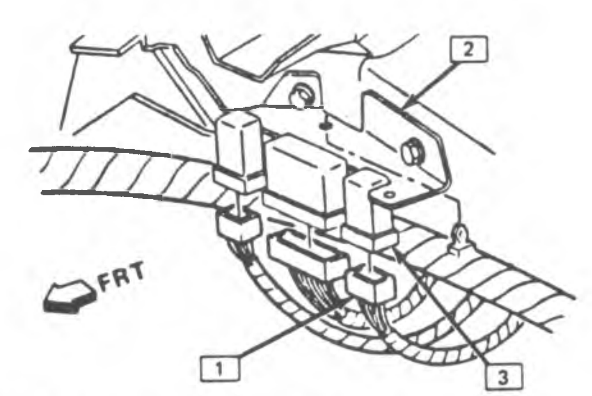
Figures 4-47 through 4-49

Remove or Disconnect

1. Fuel module housing.
2. Open housing cover.
3. Fuel module board.

Install or Connect

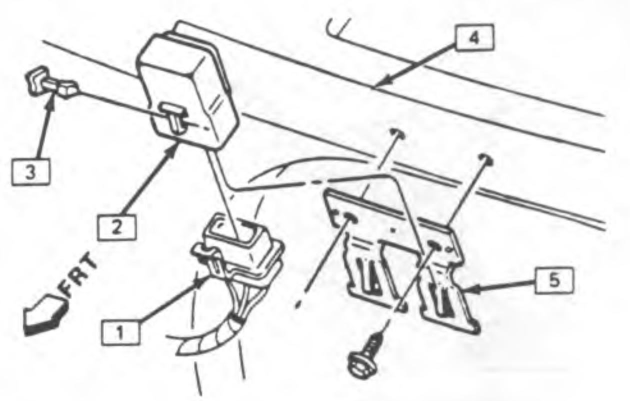
1. Fuel module board.
2. Close cover.
3. Fuel module housing.



1 ELECTRICAL CONNECTOR
2 BRACKET
3 FUEL PUMP RELAY

7S 3755-6E

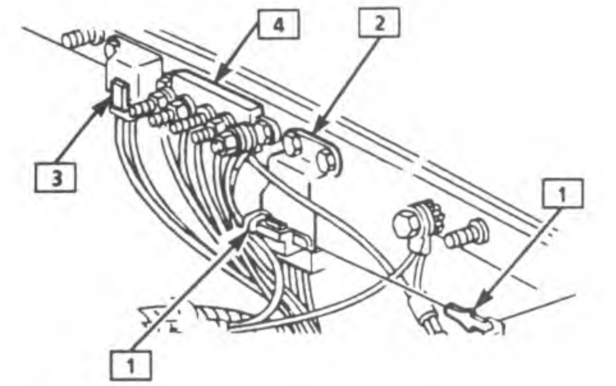
Figure 4-42 - Fuel Pump Relay (M/L)



1 ELECTRICAL CONNECTOR
2 FUEL PUMP RELAY
3 RETAINER
4 PLENUM PANEL
5 BRACKET

7S 3757-6E

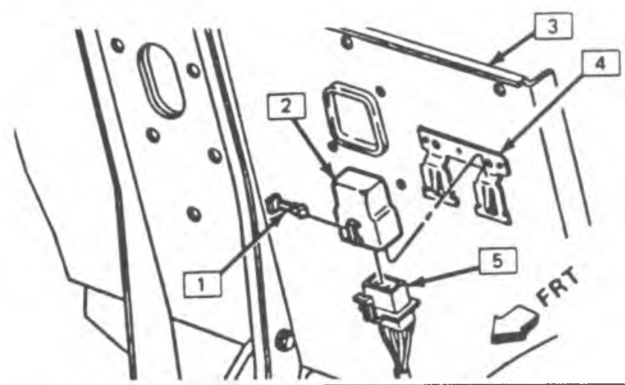
Figure 4-45 - Fuel Pump Relay (G)



1 RETAINER
2 FUEL PUMP RELAY
3 FUEL PUMP FUSE
4 DASH PANEL

7S 3756-6E

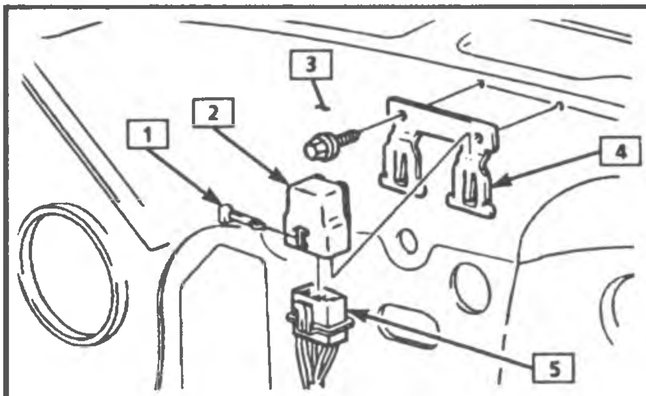
Figure 4-43 - Fuel Pump Relay (C/K)



1 RETAINER
2 FUEL PUMP RELAY
3 DASH AND TOE PANEL
4 BRACKET
5 ELECTRICAL CONNECTOR

7S 3758-6E

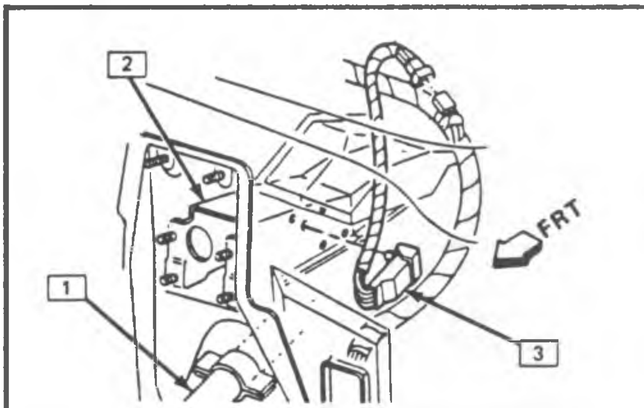
Figure 4-46 - Fuel Pump Relay (P)



1 RETAINER
2 FUEL PUMP RELAY
3 PLENUM PANEL
4 BRACKET
5 ELECTRICAL CONNECTOR

7S 3759 -6E

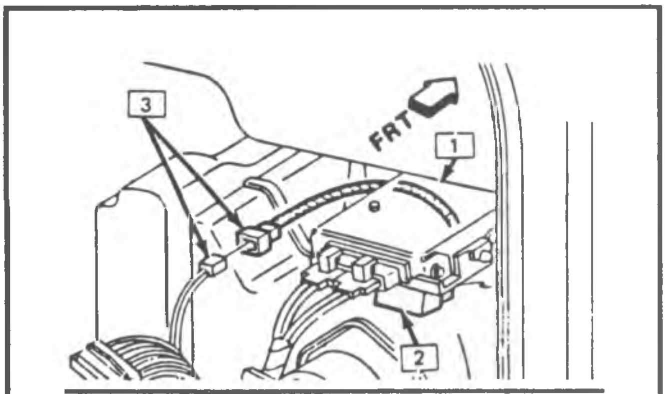
Figure 4-44 - Fuel Pump Relay (R/V)



1 STEERING COLUMN
2 BRAKE PEDAL BRACKET
3 FUEL MODULE

7S 3790-6E

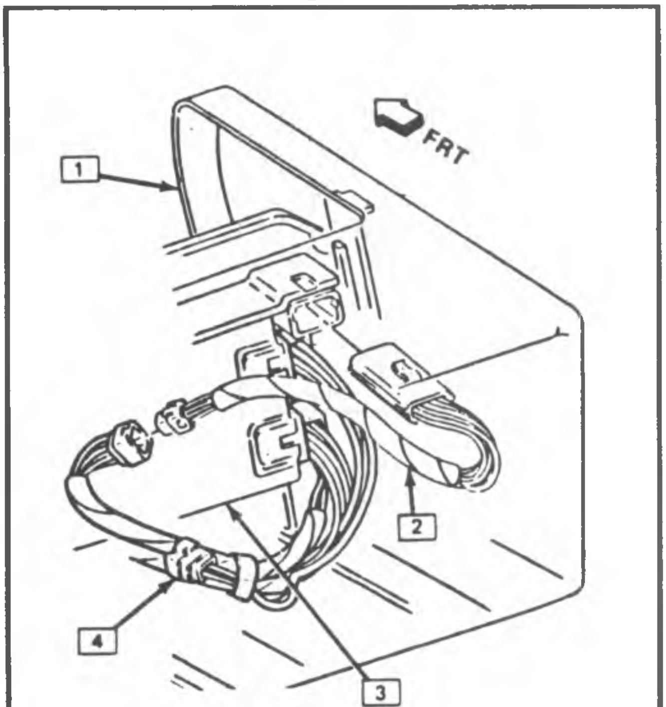
Figure 4-47 - Fuel Module (R/V)



1 ELECTRONIC CONTROL MODULE
2 FUEL MODULE
3 ELECTRONIC CONNECTOR

8S 4613-6E

Figure 4-48 - Fuel Module (C/K) 5.7L, 7.4L over 8500 GVW



1 SEAT RISER
2 FUEL MODULE
3 ELECTRONIC CONTROL MODULE
4 ALDL CONNECTOR

7S 3786-6E

Figure 49 - Fuel Module (G)

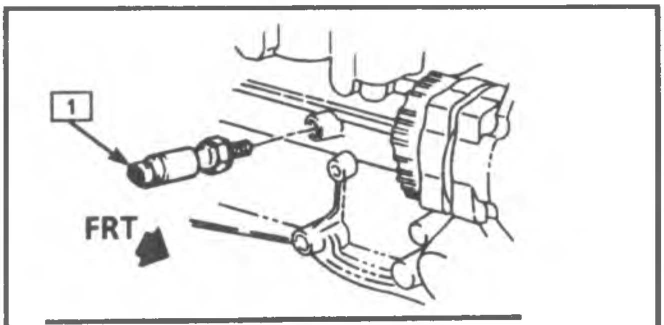
OIL PRESSURE SWITCH
Figures 4-50 through 4-53

Remove or Disconnect

1. Electrical connector.
2. Oil pressure switch using wrench J 28687-A or BT-8220 if required.

Install or Connect

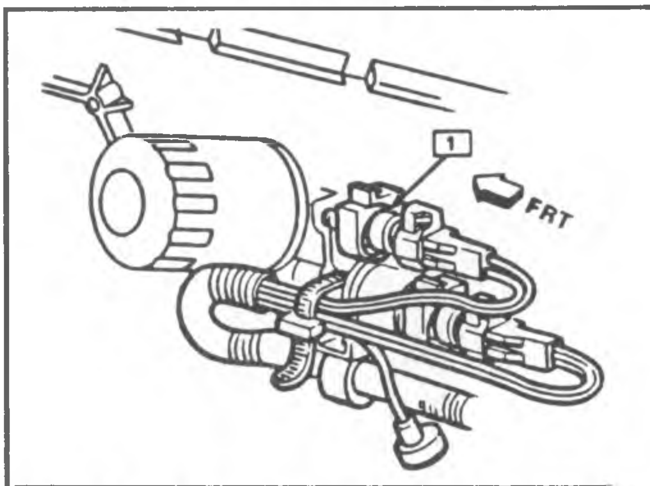
1. Oil pressure switch.
2. Electrical connector.



1 FUEL PUMP/OIL PRESSURE SWITCH

6S 2801-6E

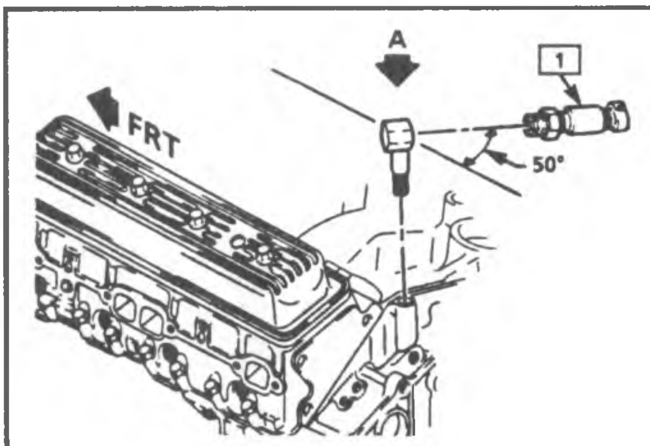
Figure 4-50 - Oil Pressure Switch (2.5L)



1 FUEL PUMP/OIL PRESSURE SWITCH

6S 2935-6E

Figure 4-51 - Oil Pressure Switch (2.8L)



1 OIL PRESSURE/FUEL PUMP SWITCH ASSEMBLY

9S 7663-6E

Figure 4-52 - Oil Pressure Switch (4.3L, 5.0, 5.7)

FUEL FILTER

In-Line Filter Replacement
Figures 4-54 through 4-60

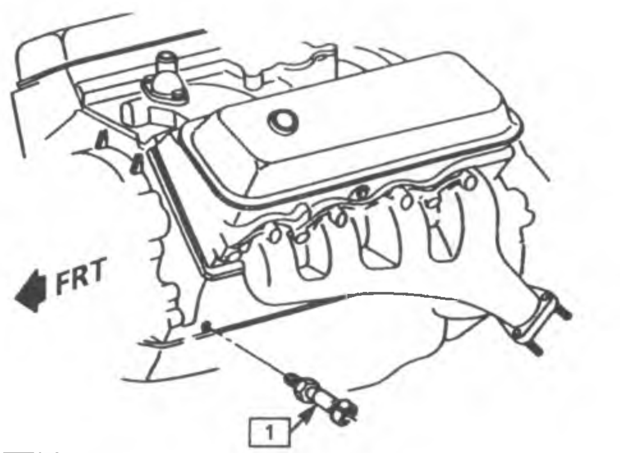
Remove or Disconnect

- On 2.5L engine, relieve fuel system pressure.

1. Fuel filler cap.
2. Fuel feed nuts.
3. Clamp bolt.
4. Filter and clamp.
5. Clamp from filter.

→← Install or connect

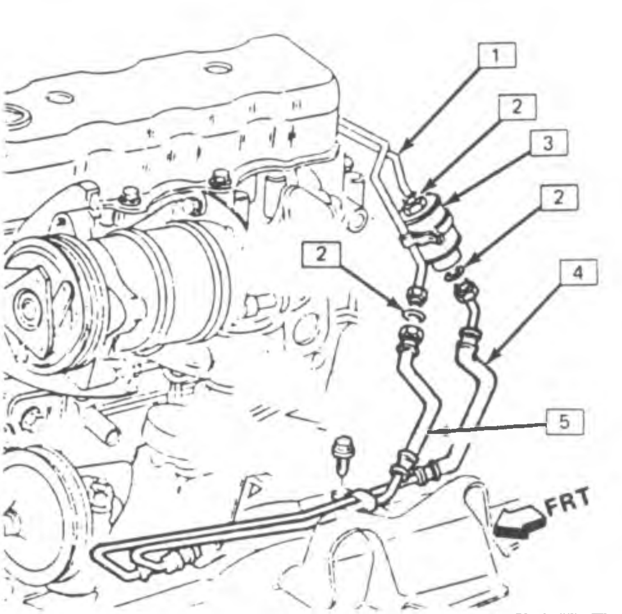
1. Clamp to filter.
2. Clamp bolt.
3. Fuel feed nuts.
4. Fuel filler cap.



[1] OIL PRESSURE/FUEL PUMP SWITCH ASM

9S 7763-6E

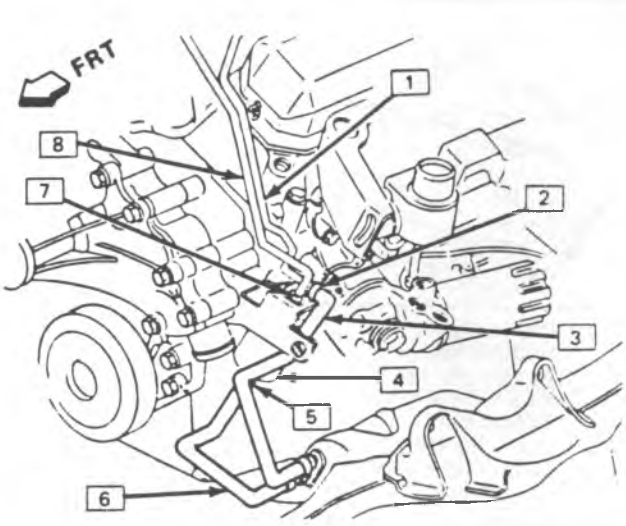
Figure 4-53 - Oil Pressure Switch (7.4)



[1] FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
[2] O-RING
[3] IN-LINE FUEL FILTER
[4] FUEL FEED HOSE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
[5] FUEL RETURN HOSE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)

7S 3645-6E

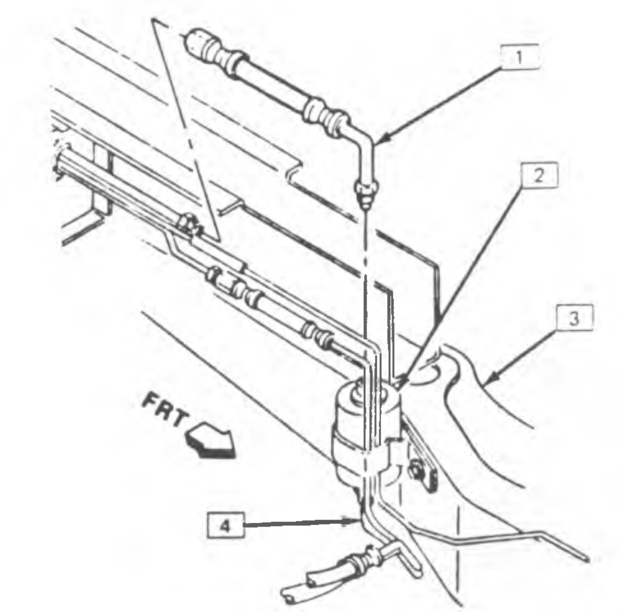
Figure 4-54 - Fuel Filter - 2.5L



[1] FUEL RETURN PIPE
[2] CLAMP
[3] FUEL RETURN HOSE
[4] IN-LINE FUEL FILTER
[5] CLAMP (DOUBLE)
[6] FUEL FEED HOSE
[7] O-RING
[8] FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)

7S 3646-6E

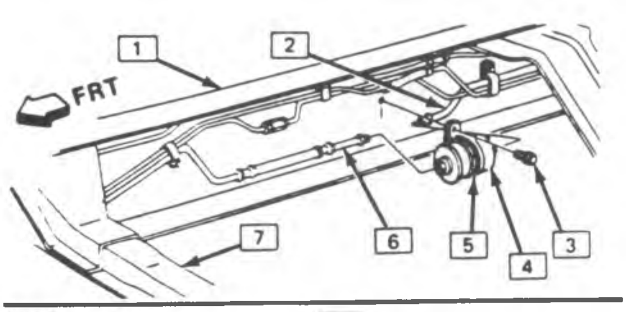
Figure 4-55 - Fuel Filter 2.8L (ST)



[1] FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
[2] IN-LINE FUEL FILTER
[3] LEFT FRAME SIDE MEMBER
[4] FRONT FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)

7S 3647-6E

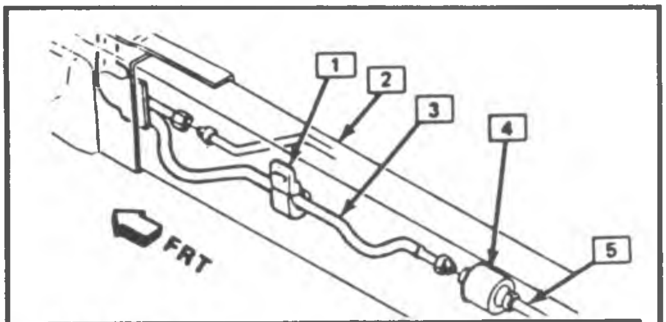
Figure 4-56 - Fuel Filter 4.3L (M/L)



1 RIGHT FRAME SIDE MEMBER
2 REAR FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
3 BOLT-TIGHTEN TO 16 N·m (24 FT. LBS.)
4 IN-LINE FUEL FILTER
5 CLAMP
6 INTERMEDIATE FUEL FEED PIPE-TIGHTEN NUT TO 26N·m (20 FT. LBS.)
7 TRANSMISSION SUPPORT

7S 3644-6E

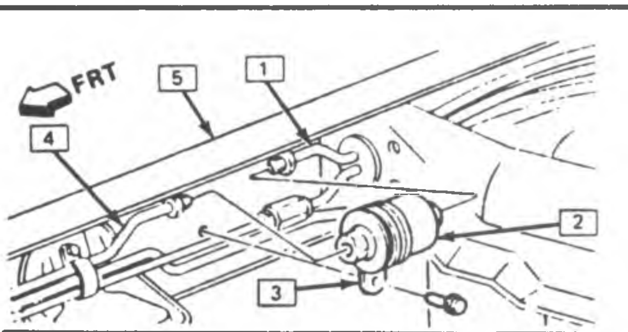
Figure 4-57 - Fuel Filter (R/V)



1 CLIP
2 LEFT FRAME SIDE MEMBER
3 FRONT FUEL FEED HOSE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
4 IN-LINE FUEL FILTER
5 REAR FUEL FEED HOSE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)

7S 3650-6E

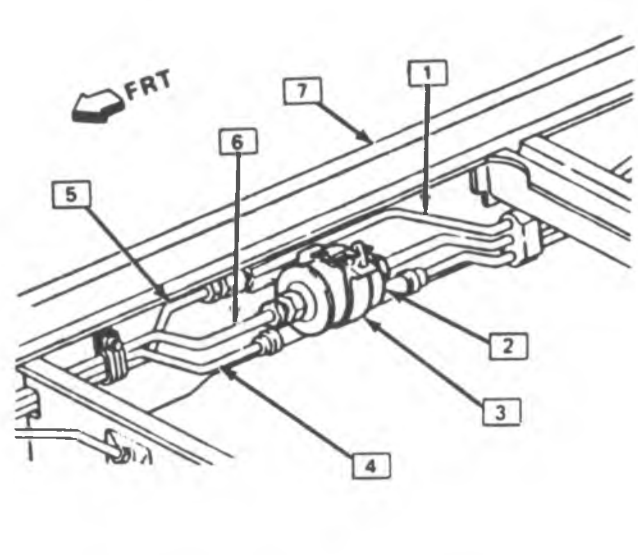
Figure 4-58 Fuel Filter (C/K)



1 REAR FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
2 IN-LINE FUEL FILTER
3 CLAMP
4 INTERMEDIATE FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
5 RIGHT FRAME SIDE MEMBER

7S 3649-6E

Figure 4-59 - Fuel Filter (P)



1 REAR FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
2 IN-LINE FUEL FILTER
3 BRACKET
4 VAPOR PIPE
5 FUEL RETURN PIPE
6 INTERMEDIATE FUEL FEED PIPE-TIGHTEN NUT TO 26 N·m (20 FT. LBS.)
7 RIGHT FRAME SIDE MEMBER

7S 3648-6E

Figure 4-60 - Fuel Filter (G)

In-Tank Filter Replacement

Refer to fuel pump replacement, if the in-tank filter required service.

AUXILIARY FUEL TANK CONTROL

The auxiliary fuel tank is controlled by a selector valve and meter switch and selector switch. The diagnosis of these components are part of the fuel pump circuit diagnosis and can be found in "Computer Command Control," Section "3".

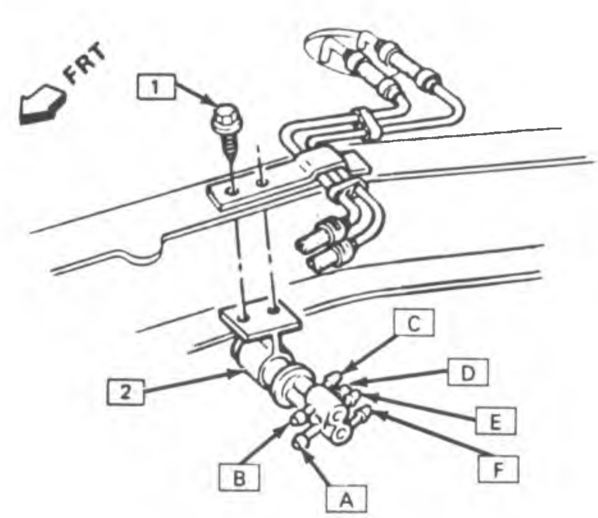
Selector Valve and Meter Switch *Figure 4-61*

←→ Remove or Disconnect

1. Battery.
2. Hose shield, if required.
3. Electrical connector from valve and switch.
4. Fuel feed and return hose. Note position and color of hoses.
5. Selector valve and meter switch from frame.

→← Install and Connect

1. Selector valve and meter switch.
2. Fuel feed and return hoses.
3. Electrical connector.
4. Hose shield.
5. Battery.



1 BOLT — TIGHTEN TO 18 N·m (12 LBS. FT.)
2 FUEL TANK SELECTOR VALVE
A FUEL FEED
B FUEL RETURN
C RH FUEL RETURN — PINK
D RH FUEL FEED — ORANGE
E LH FUEL RETURN — BLUE
F LH FUEL FEED — YELLOW

7S 3843-6E

Figure 4-61 - Selector Valve - (R/V)

FUEL HOSE AND PIPE ASSEMBLIES

Materials

Fuel Lines - These are welded steel tubes, meeting GM Specifications 124-M, or its equivalent. The fuel feed line is 3/8" diameter and the fuel return line is 5/16" diameter. Do not use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory durability to withstand normal vehicle vibration.

Coupled hose - These are not to be repaired and are replaced only as an assembly.

Uncoupled Hose - Use only reinforced furl resistant hose, made of "Fluoroelastomer" material. Do not use a hose within 4" (100 mm) of any part of the exhaust system, or within 10" (254 mm) of the catalytic converter. The hose's inside diameter must match the outside diameter of the steel tubing.

Clamps - These are stainless steel, screw bank-type clamps, #2494772, or equivalent.

Fuel Line Repair

1. Cut a piece of fuel hose 4" (100 mm) longer than the section of line to be removed. If more than 6" (152 mm) is to be removed, use a combination of steel pipe and hose. The hose length should not be more than 10" total.
2. Cut a section of the pipe to be replaced with a tube cutter. Use the first step of a double flaring tool to form a bead on the ends of the pipe and, also, on the new section of pipe, if used.
3. Slide the hose clamps onto the pipe and push the hose 2" (51 mm) onto each portion of the fuel pipe. Tighten a clamp on each side of the repair.
4. Secure fuel line to the frame.

FUEL TANK

Draining

1. Disconnect the negative battery cable.
   - Have a dry chemical (Class B) fire extinguisher nearby.

CAUTION: Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion.

2. Use a hand operated pump device to drain as much fuel as possible through the filler neck. On some fuel tank installations, the filler neck is too long to gain access to the fuel. If the tank is not full, disconnect filler neck nose, at the fuel tank, to gain access to the fuel.
   Alternate method:
   a. Disconnect fuel feed pipe and attach a hand operated pump device.
   b. Energize the fuel pump relay.
   c. With fuel pump running, operate hand pump to remove fuel.
3. After servicing fuel tank, install removed hose, lines, and fuel filler cap.

Replacement
Figures 4-62 through 4-79

←→ Remove or Disconnect

1. Fuel from the fuel tank.
2. Clamps from filler neck hose and vent line.
3. Fuel tank retaining straps.
   - Support the fuel tank.
4. Sender unit wires, hoses, and ground strap.
   - Lower the fuel tank to gain access.
5. Fuel tank from the vehicle.
6. Fuel sender and pump from the fuel tank.
7. Purge tank, if being repaired.

→← Install or Connect

1. Fuel sender and pump into fuel tank.
2. Fuel tank into the vehicle.
3. Sender unit wires, hoses, and ground straps.
4. Fuel tank retaining straps with insulator strips in place.
5. Clamp to filler neck hose and vent line.
6. Bolts and nuts.

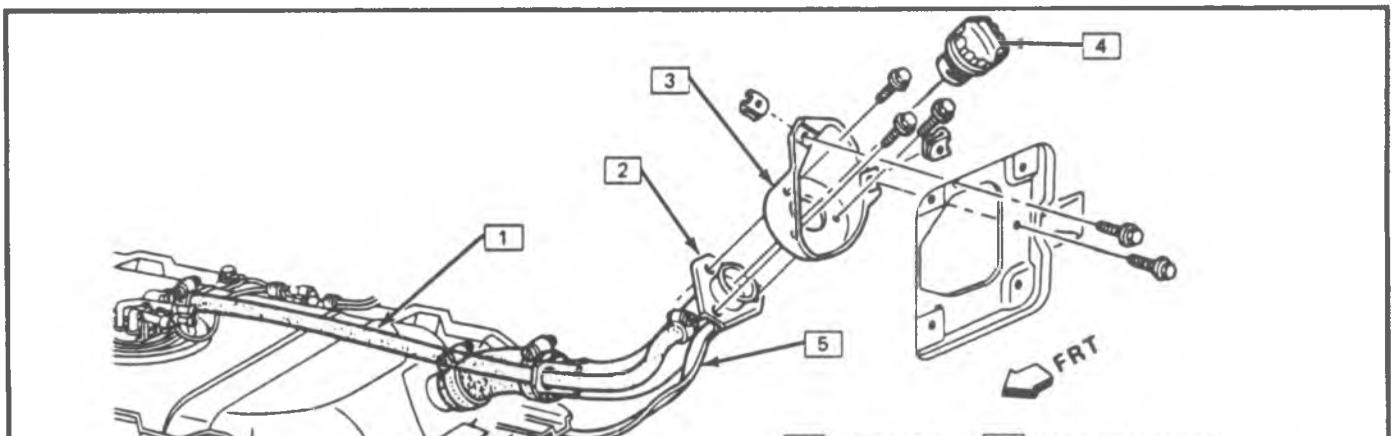


Figure 4-62 - Filler Neck - ST Utility

Tighten

- Bolts, as shown in the illustrations.

Purging

The fuel tank should be purged, before being repaired.

Remove or Disconnect

1. Fuel tank from the vehicle.
2. Fuel gage sending and pump unit.
3. All remaining fuel from the tank.

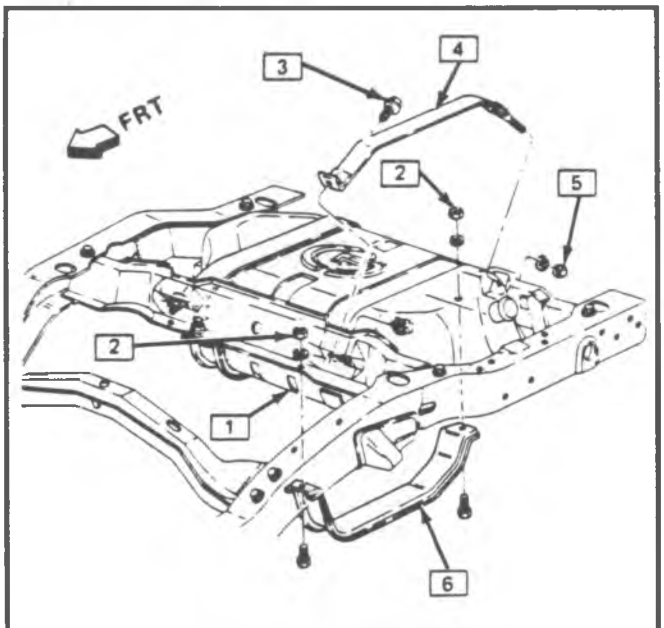


Figure 4-63 - Fuel Tank - S/T Utility

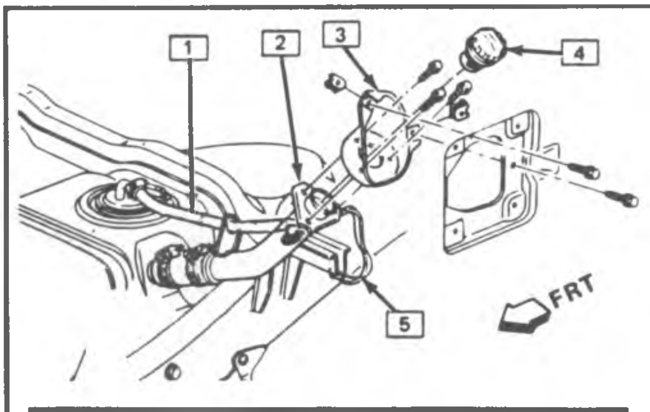


Figure 4-64 - Filler Neck - S/T Pickup

Inspect

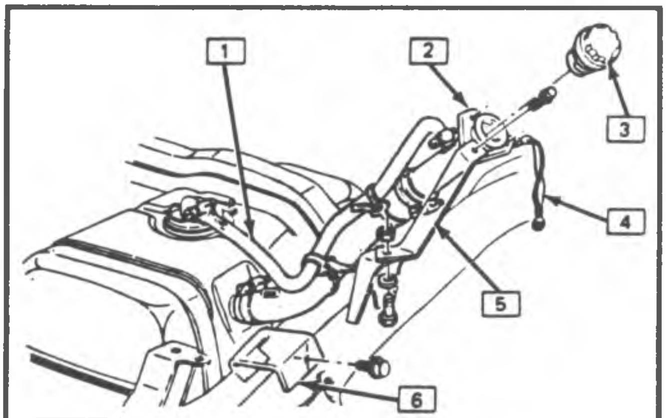
- Fuel tank for any remaining fuel.

Install or Connect

1. Tap water into the tank,
   - Move the tank to the flushing area (wash rack.)
   - Agitate the water vigorously and then drain it.
2. Gasoline emulsifying agent into the tank.
   - Use an available emulsifying agent, such as Product-Sol No. 913, or equivalent.
3. Water to the fuel tank.
   - Refer to the emulsifying agent specifications for the mixture ratio.
   - Agitate the mixture for ten minutes.
   - Drain the tank completely.
   - Fill the tank with water, until it overflows.
   - Completely flush out any remaining mixture.
   - Drain the fuel tank.

- Use an explosion meter (if available) to check for a negative reading.
- Perform the required service work.

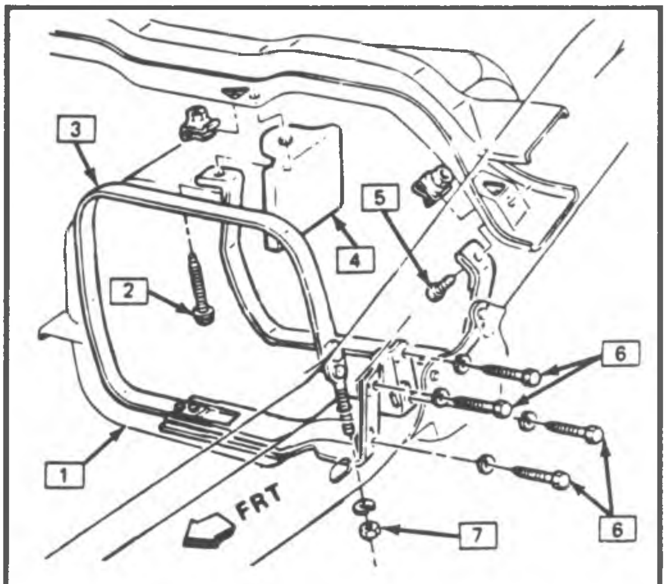
4. Repair fuel tank.
5. Fuel gage sending and pump unit.
6. Fuel tank into vehicle.



1 VENT PIPE
2 FILLER PIPE
3 FUEL FILLER PIPE
4 GROUND STRAP
5 SUPPORT
6 SHIELD

7S 3825-6E

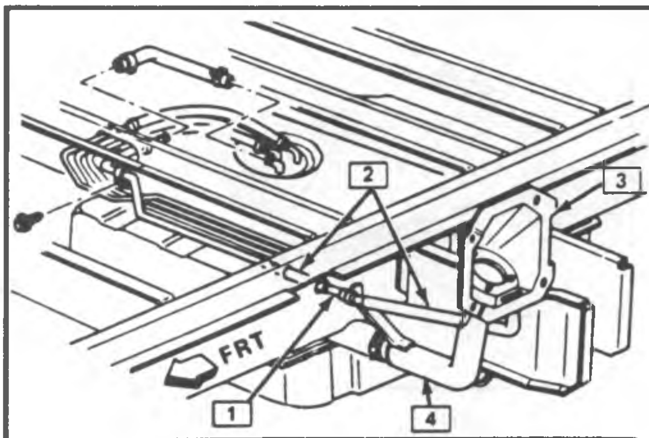
Figure 4-65 - Filler Neck (S/T) Chassis Cab



1 FUEL TANK
2 BOLT — TIGHTEN TO 18 N·m (13 FT. LBS.)
3 STRAP
4 PROTECTOR
5 BOLT — TIGHTEN TO 35 N·m (26 FT. LBS.)
6 BOLT — TIGHTEN TO 35 N·m (26 FT. LBS.)
7 NUT — TIGHTEN TO 7 N·m (5 FT. LBS.)

7S 3820-6E

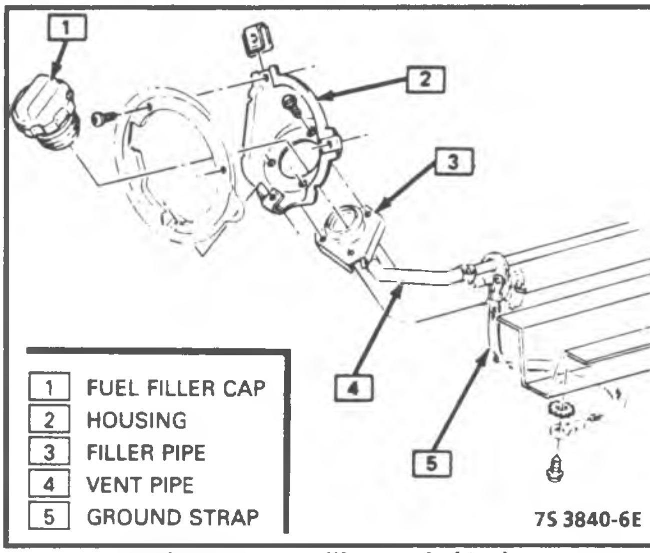
Figure 4-66 - Fuel Tank (S/T) (except Utility)



1 VENT PIPE
2 INSULATOR
3 HOUSING
4 FILLER PIPE

7S 3822-6E

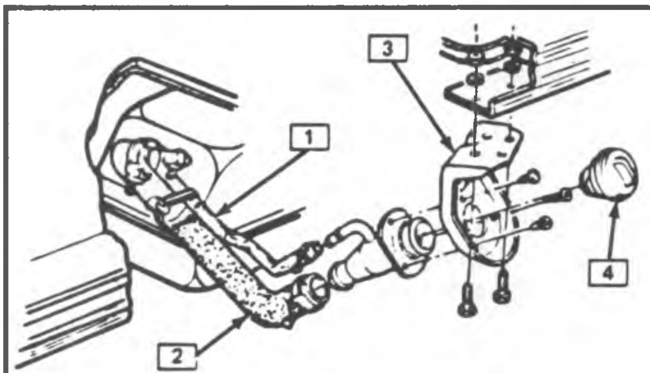
Figure 4-67 - Filler Neck (M/L)



1 FUEL FILLER CAP
2 HOUSING
3 FILLER PIPE
4 VENT PIPE
5 GROUND STRAP

7S 3840-6E

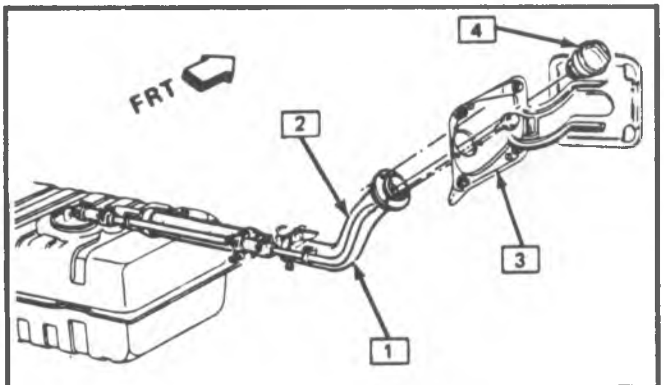
Figure 4-68 - Filler Neck (C/K)



1 VENT TUBE
2 FILLER NECK
3 HOUSING
4 FUEL FILLER CAP

7S 3828-6E

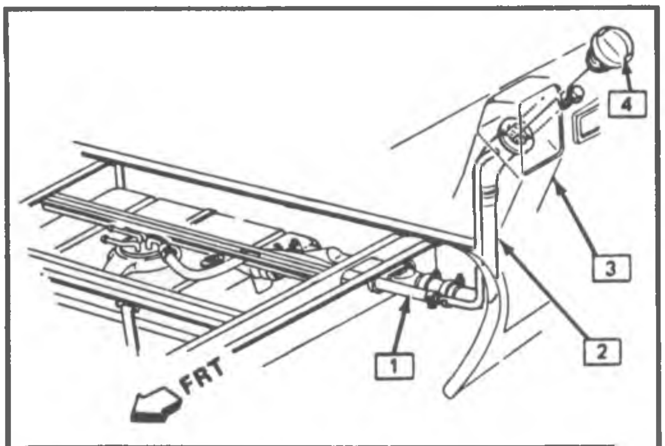
Figure 4-69 - Filler Neck (R/V) Chassis Cab



1 VENT PIPE
2 FILLER NECK
3 HOUSING
4 FUEL FILLER CAP

7S 3827-6E

Figure 4-70 - Filler Neck - R/V Utility & Suburban



1	VENT PIPE	3	HOUSING
2	FILLER PIPE	4	FUEL FILLER CAP

7S 3826-6E

Figure 4-71 - Filler Neck (G)

FUEL SYSTEM CLEANING

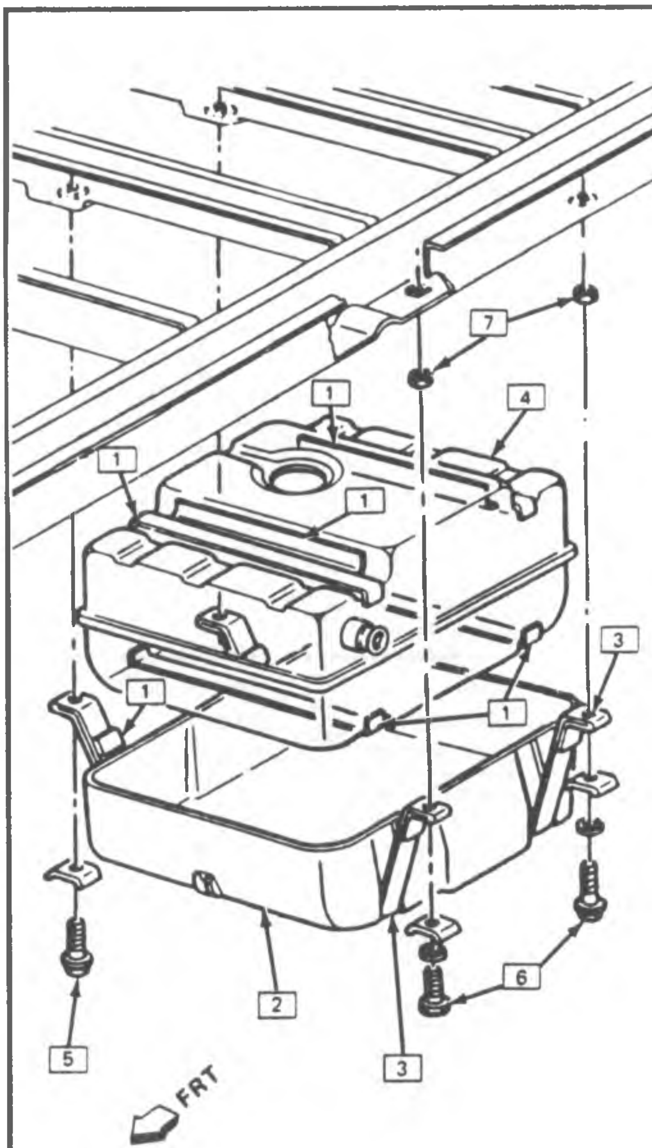
Remove or Disconnect

1. Negative battery cable.
2. Engine harness connector on the distributor.
   - Have a dry chemical (Class B) fire extinguisher near the work area.
3. Fuel system pressure (2.5L engine only)
4. Fuel from the fuel tank.
5. Fuel tank.
6. Fuel gage sending and pump unit.
7. Purge fuel tank.

In-Line Fuel Filter

Inspect

- In-Line fuel filter, for contamination.
- Replace the filter, if it is plugged.



COMPLETELY INSTALL ONE STRAP PRIOR TO INSTALLATION OF THE SECOND STRAP, HOWEVER, THE TANK MUST REMAIN SUPPORTED UNTIL ALL FOUR BOLTS ARE TORQUED TO SPECIFICATIONS.

1 INSULATOR
2 LOWER SHIELD
3 STRAP
4 FUEL TANK

INSTALLATION SEQUENCE

5 BOLT — TIGHTEN TO 35 N·m (26 FT. LBS.)
6 BOLT — TIGHTEN TO 3.4 N·m (30 IN. LBS.)
7 NUT — TIGHTEN TO 35 N·m (26 FT. LBS.)

7S 3819-6E

Figure 4-72 - Fuel Tank (M/L)

Clean

- Fuel lines, by applying air pressure in the opposite direction of fuel flow.

Install or Connect

1. New strainer (if necessary) on the fuel gage sending and pump unit.

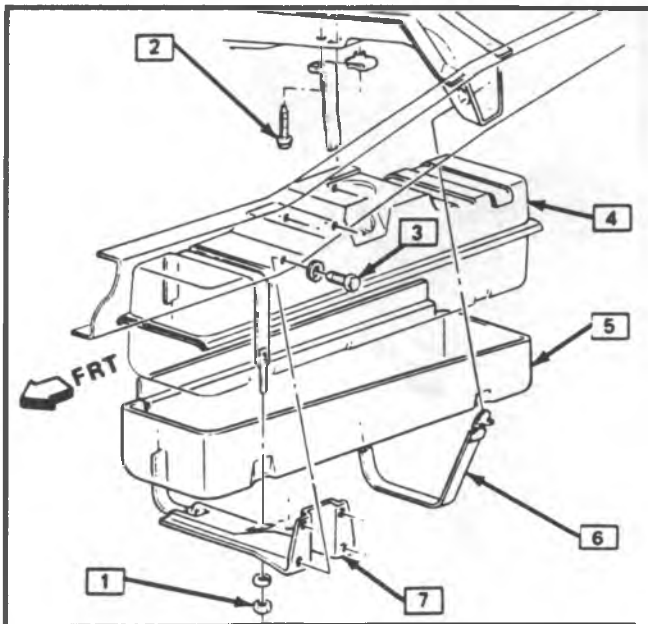
   NOTICE: Care should be taken not to fold over or twist the strainer, when installing the sending unit, as this will restrict fuel flow.

2. Fuel gage sender and pump unit, with a new seal into the fuel tank.
3. Fuel tank.
4. Disconnect the fuel feed line at the front of the vehicle.
5. Hose to the fuel feed line at the front of the vehicle and insert the other end of the hose into a 3.8 liter (one gallon) fuel can.
6. Negative battery cable.
7. Twenty three liters (six gallons) of clean fuel into the fuel tank.
8. Energize fuel pump relay, to operate the fuel pump, until two liters (1/2 gallon) of fuel flows into the fuel can. this will purge the fuel pump.
9. Fuel line, at the front of the vehicle.
10. Engine harness connector to the distributor.
    - Check all connections, for leaks, and tighten all hose clamps.

Leak Test

If fuel is leaking, from the tank, the tank should be replaced. Make sure that the fuel lines are not leaking onto the tank.

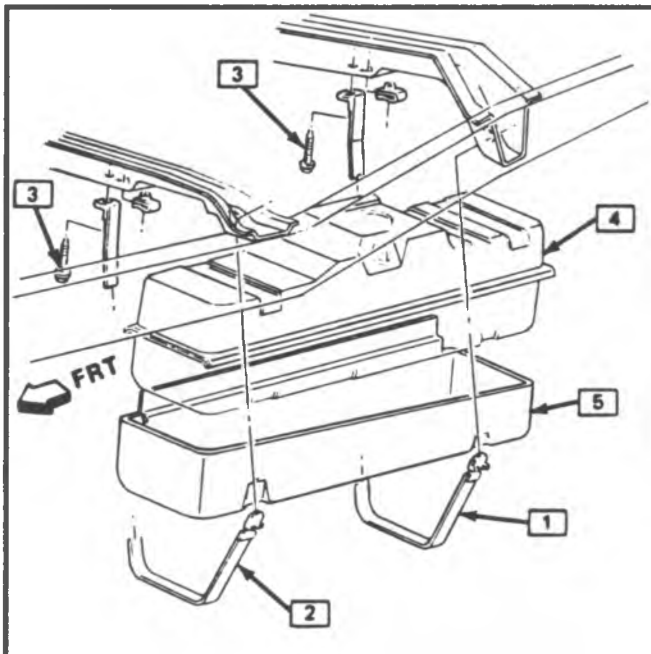
1. Remove the fuel tank.
2. Drain the tank.
3. Plug all of the outlets.
4. Apply 7 to 10 kPa (1 to $1\frac{1}{2}$ psi) air pressure through the vent tube.
5. Test for leaks, with a soap solution, or by submersion.
6. Replace the tank, if a leak is found.



1 NUT — TIGHTEN TO 12 N·m (10 FT. LBS.)
2 BOLT — TIGHTEN TO 12 N·m (10 FT. LBS.)
3 BOLT — TIGHTEN TO 33 N·m (24 FT. LBS.)
4 FUEL TANK
5 SHIELD
6 REAR STRAP
7 FRONT STRAP

7S 3829-6E

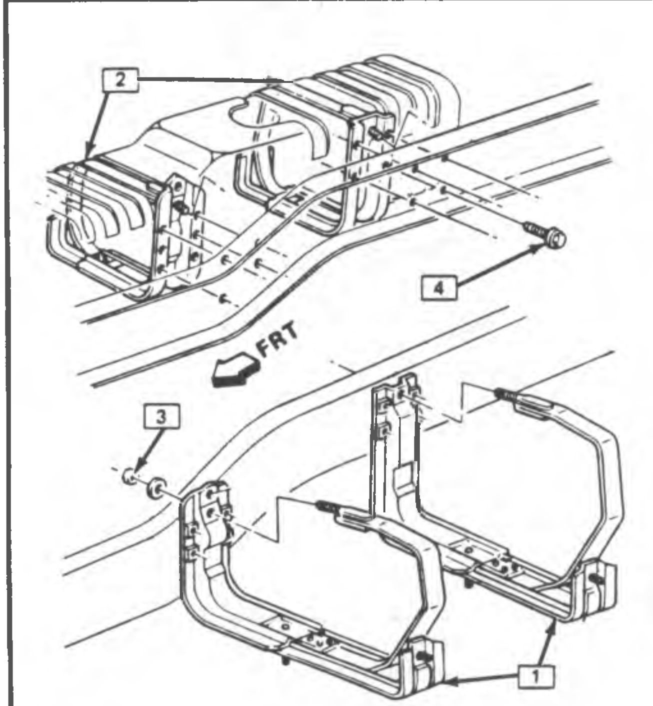
Figure 4-73 - Fuel Tank (C/K) Chassis Cab



1 REAR STRAP
2 FRONT STRAP
3 BOLT — TIGHTEN TO 12 N·m (10 FT. LBS.)
4 FUEL TANK
5 SHIELD

7S 3830-6E

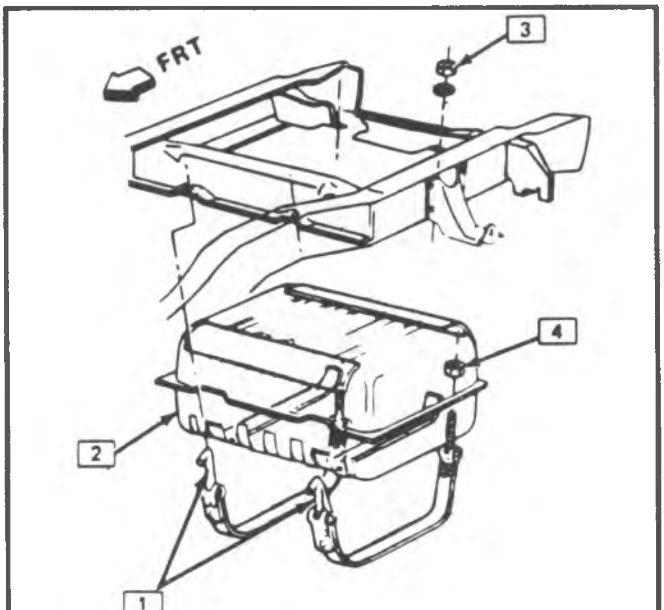
Figure 4-74 - Fuel Tank (C/K) (except Chassis Cab)



1 SUPPORT—BASE (LEFT) FUEL TANK LOCATION
2 SUPPORT—AUXILIARY (RIGHT) FUEL TANK LOCATION
3 NUT—TIGHTEN TO 7 N·m (60 IN. LBS.)
4 BOLT—TIGHTEN TO 33 N·m (22 FT. LBS.)

7S 3817-6E

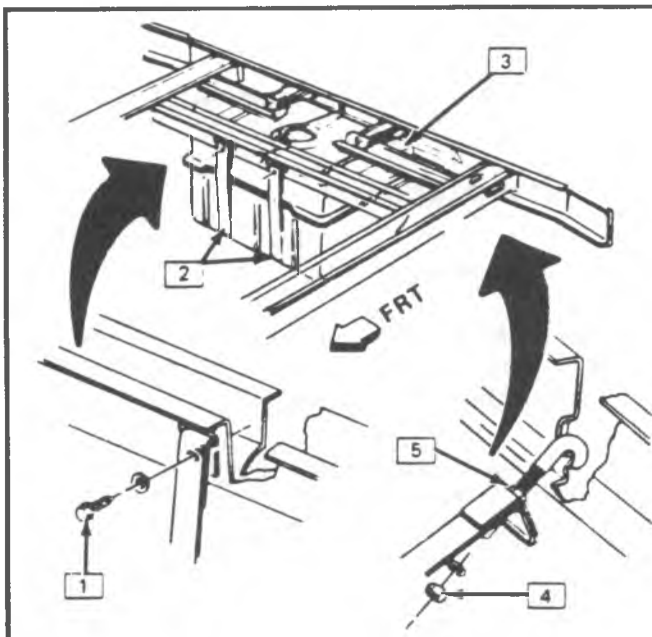
Figure 4-75 - Fuel Tank - R/V Pickup



1 STRAP — HOOK MUST FACE FORWARD
2 FUEL TANK
3 UPPER NUT — TIGHTEN TO 14 N·m (10 FT. LBS.) AND THEN TIGHTEN LOWER NUT 4 TO 14 N·m (10 FT. LBS.)

7S 3818-6E

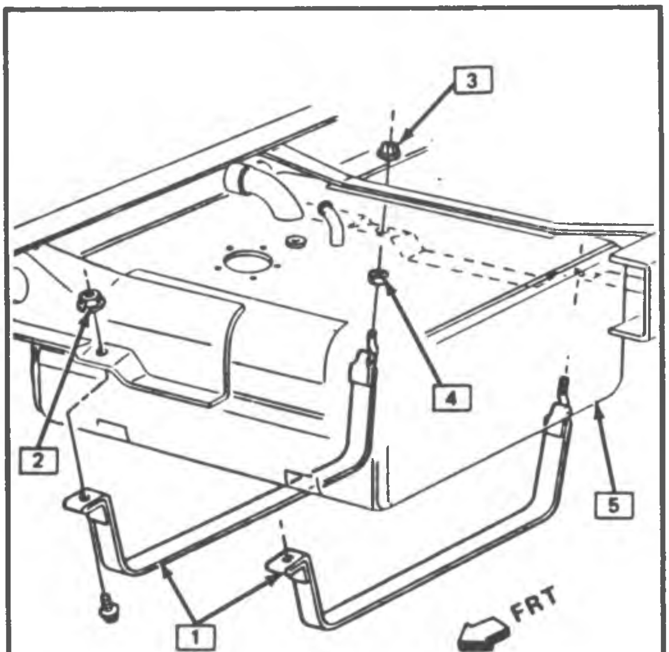
Figure 4-76 - Fuel Tank - R/V Utility & Suburban



1 BOLT — TIGHTEN TO 9.5 N·m (85 IN. LBS.)
2 STRAP
3 FUEL TANK
4 LOWER NUT — TIGHTEN TO 14 N·m (10 FT. LBS.) AND THEN TIGHTEN UPPER NUT 5 TO 14 N·m (10 FT. LBS.)

7S 3816-6E

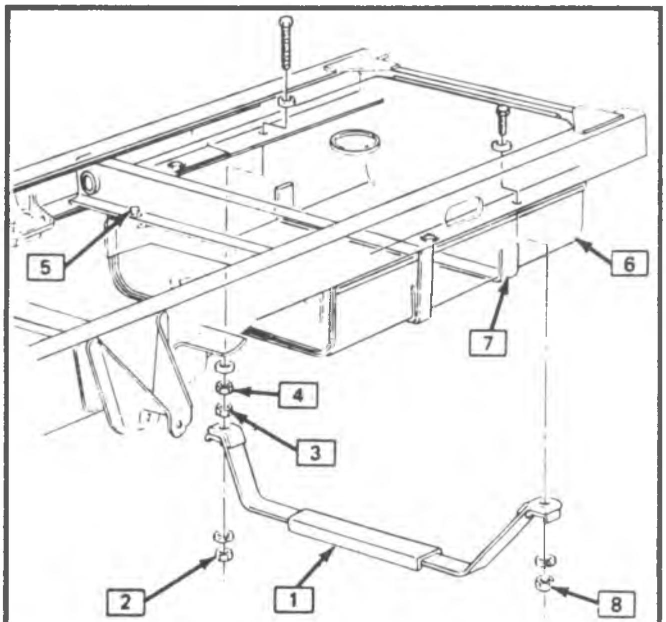
Figure 4-77 - Fuel Tank - G



1 STRAP
2 NUT TIGHTEN TO 12 N·m (10 FT. LBS.)
3 UPPER NUT — TIGHTEN TO 35 N·m (23 FT. LBS.) AND THEN TIGHTEN LOWER NUT 4 TO 35 N·m (25 FT. LBS.)
5 FUEL TANK

7S 3839-6E

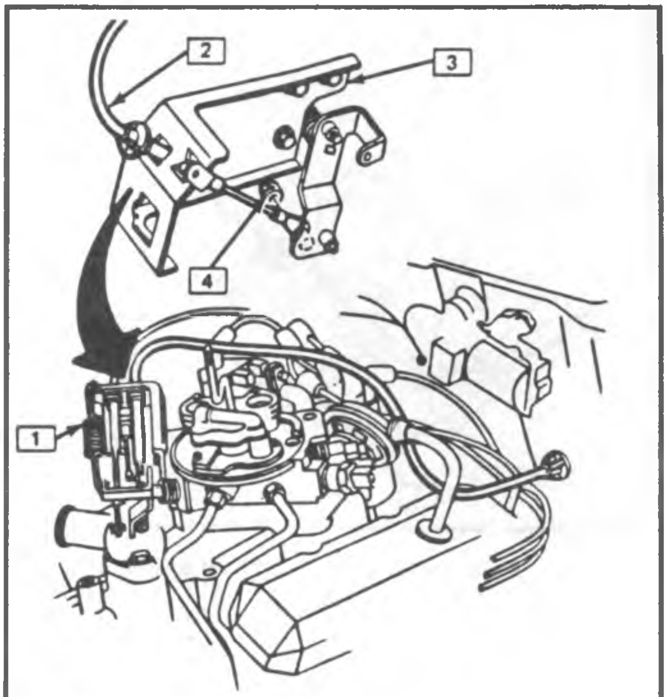
Figure 4-78 - Fuel Tank - P



1 STRAP
2 LOWER NUT — TIGHTEN TO 12 N·m (10 FT. LBS.), THEN TIGHTEN MIDDLE NUT 3 TO 58 N·m (42 FT. LBS.) AND THEN TIGHTEN LOWER AND UPPER NUT 4 TO 58 N·m (42 FT. LBS.)
5 NUT — TIGHTEN TO 58 N·m (42 FT. LBS.)
6 FUEL TANK
7 INSULATOR
8 NUT — TIGHTEN TO 58 N·m (42 FT. LBS.)

7S 3841-6E

Figure 4-79 - Fuel Tank - P (42)



1 SPRING
2 CABLE
3 SUPPORT
4 RETAINER

7S 3834-6E

Figure 4-80 - Control Cable - 2.8L

ACCELERATOR CONTROL

Accelerator Control Cable
Figures 4-80 through 4-82

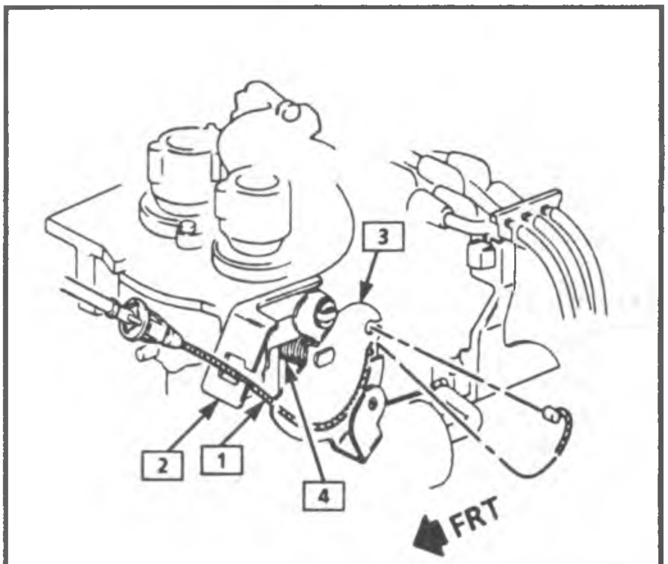
There are no linkage adjustments. The throttle cable must be replaced with an identical replacement part.

All linkages and cables must be checked, to assure free movement, with no rubbing, chafing, or binding.

The throttle must operate freely, without binding between full closed and side open throttle.

Observe the following, when performing service on the accelerator control cable.

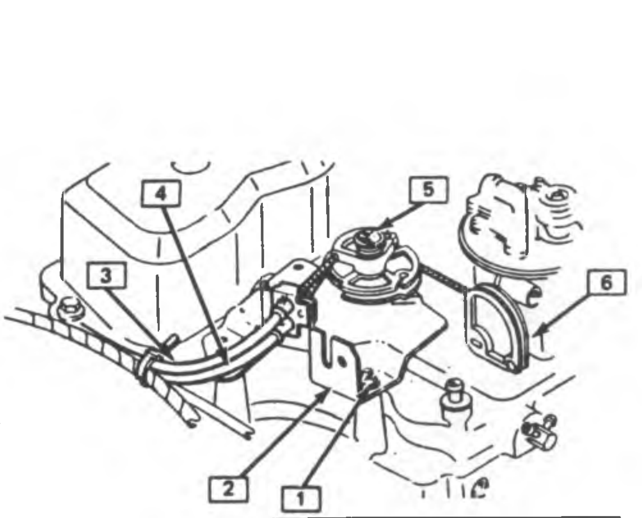
- The retainer must be installed with the tanks secured over the head of the stud.
- The conduit fitting, at both ends of the cable, must have the locking tanks expanded and locked into the attaching holes.
- The braided portion of the cable must not come into contact with the front of dash sealer during replacement.
- Flexible components (hoses, wires, conduit, etc.) must not be routed within 50 mm (2") of the moving parts of the accelerator linkage, unless routing is positively controlled.



1 CABLE
2 SUPPORT
3 PULLEY
4 SPRING

9S 8137-6E

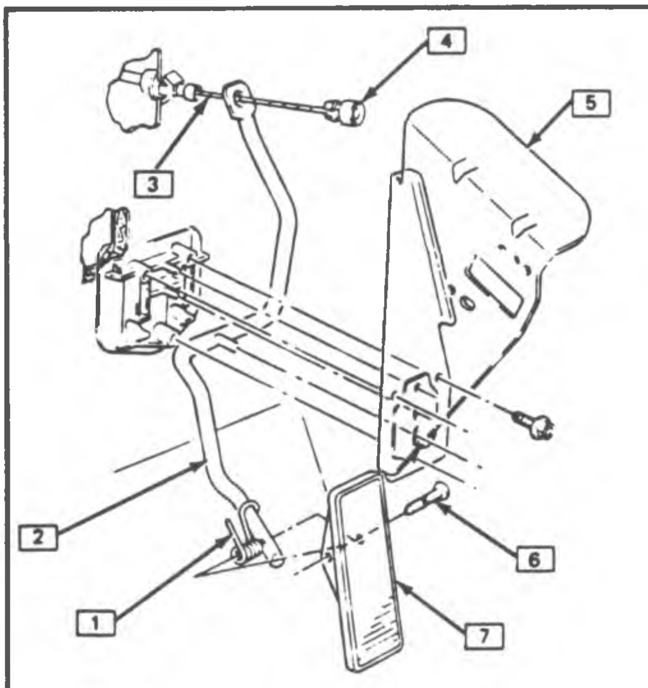
Figure 4-81 - Control Cable - 4.3L & V-8



1	NUT — TIGHTEN TO 27 N·m (20 FT. LBS.)	5	IDLER & CRUISE CAM
2	BRACKET AND PULLEY	6	PULLEY
3	CRUISE CABLE		
4	ACCELERATOR CABLE		

7S 3838-6E

Figure 4-82 - Control Cable - 2.5L



1	SPRING	5	PLATE
2	ROD	6	PIN
3	CABLE	7	PEDAL
4	RETAINER		

7S 3836 -6E

Figure 4-83 - Accelerator Pedal -S/T

Remove or Disconnect

1. Retainer from throttle lever stud or on 2.5L release cable from pulley.
2. Retainer locking tangs from support bracket.
3. Retainer from accelerator pedal rod or release cable from rod.
4. Retainer locking tanks from dash panel.

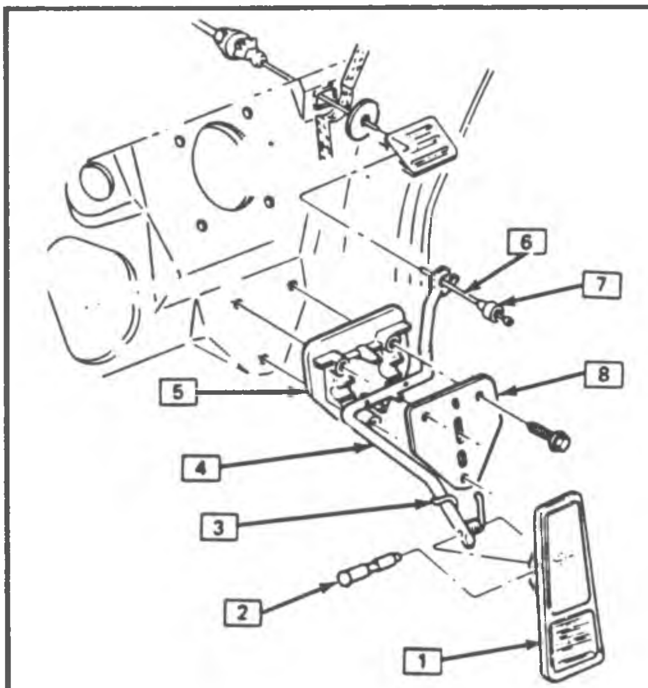
Install or Connect

1. Retainer to dash panel.
2. Retainer to accelerator pedal rod or connect cable in rod slot.
3. Retainer to support bracket.
4. Retainer to throttle lever stud or connect cable to pulley.

Accelerator Pedal
Figures 4-83 through 4-89

The accelerator pedal controls the throttle, through a cable. There are not linkage adjustment. The throttle cable must be replaced with an identical replacement part.

All linkages and cables must be checked, to assure free movement with no rubbing, chafing, or binding. The throttle must operate freely, without binding, between full closed and Wide Open Throttle (WOT).



1	PEDAL	5	SUPPORT
2	PIN	6	CABLE
3	SPRING	7	RETAINER
4	ROD	8	PLATE

7S 3837-6E

Figure 4-84 - Accelerator Pedal - M/L

Observe the following, when performing service on the accelerator pedal.

- The mounting surface between the support and the dash panel, must be free of insulation. The carpet and padding in the pedal and tunnel area must be positioned to lay flat and be free of wrinkles and bunches.
- Slip the accelerator control cable through the slot in the rod, before installing the retainer in the rod. Make sure it is seated properly. Use care in pressing retainer into the hole, so the cable if not kinked, or damaged.
- The linkage must operate freely, without binding, between closed throttle and full throttle.
- Wire, hoses, cable, and other flexible components, must not be placed within 13 mm (0.52") of the cable or rod, at any point, in their travel.

FUEL SPECIFICATIONS

ASTM Standard: D4814 (U.S.), CGSB 3.5-M87 (Canada).

Octane Requirements

Minimum Octane Requirement: 87 {(R -M)/2} (pump) octane. Where R = research octane number, and M = motor octane number.

Gasoline with Alcohol

NOTICE: Do not spill fuel containing alcohol on the vehicle. Alcohol can cause damage to the paint finish and trim.

Methyl Tertiary-butyl Ether (MTBE)

Fuel containing Methyl Tertiary-butyl Ether (MTBE) may be used, providing there is no more than 15% alcohol by volume.

Ethanol

Fuel containing ethanol (ethyl) or grain alcohol may be used, providing that there is no more than 10% ethanol alcohol by volume.

Methanol

Fuel containing methanol (methyl) or wood alcohol may be used, providing that there is no more than 5% methanol by volume.

NOTICE: Do not use fuel that contains more than 5% methanol. Use of a fuel (gasohol) that contains more than 5% of methanol can corrode metal fuel system components and damage plastic and rubber parts.

PARTS INFORMATION

PART NAME	GROUP
Cover, w/Regulator, Fuel Meter: Part of Meter Kit, Fuel	3.734
Injector, Fuel: Part of Pump, Fuel (In Tank)	3.774
Relay, Fuel Pump	3.990
Switch, Oil Press.	1.800
Throttle Body Injection Unit	3.725
Valve Asm, Idle Air Control: Part of Control Kit, Idle Air Valve	3.820

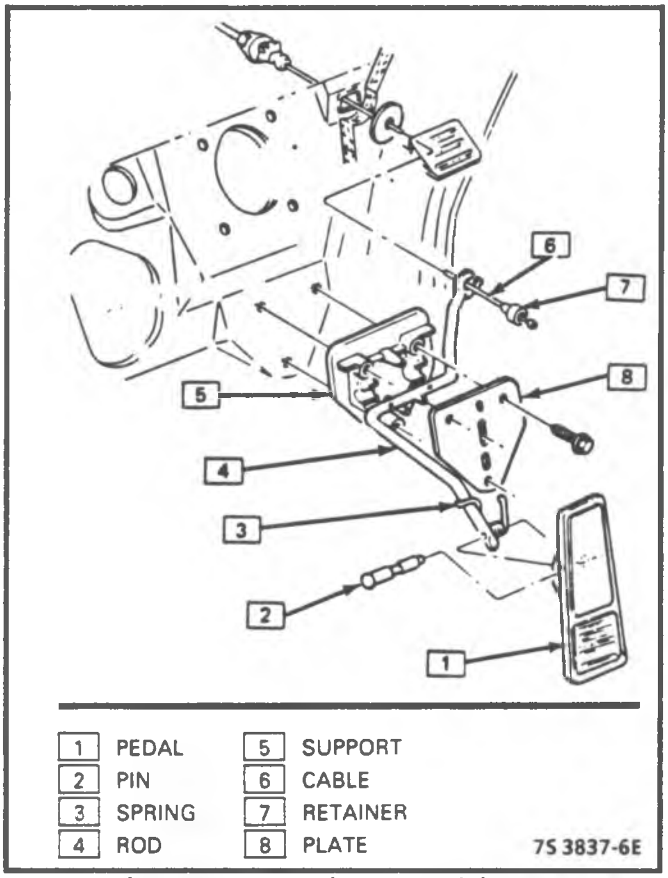
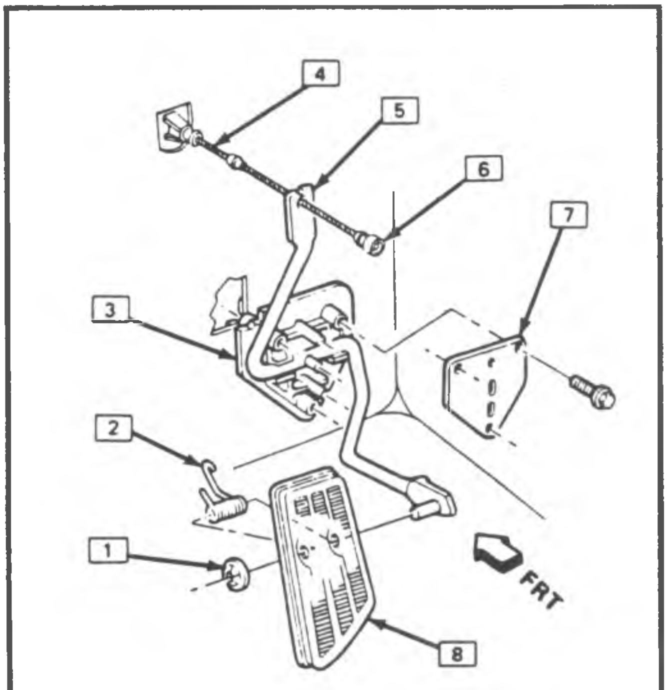


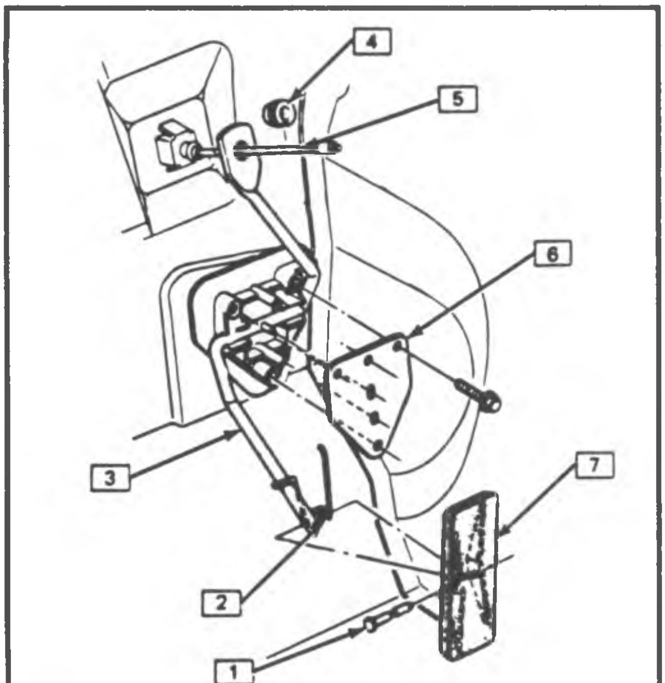
Figure 4-85 - Accelerator Pedal - R/V



1	RETAINER	5	ROD
2	SPRING	6	RETAINER
3	SUPPORT	7	PLATE
4	CABLE	8	PEDAL

7S 3788-6E

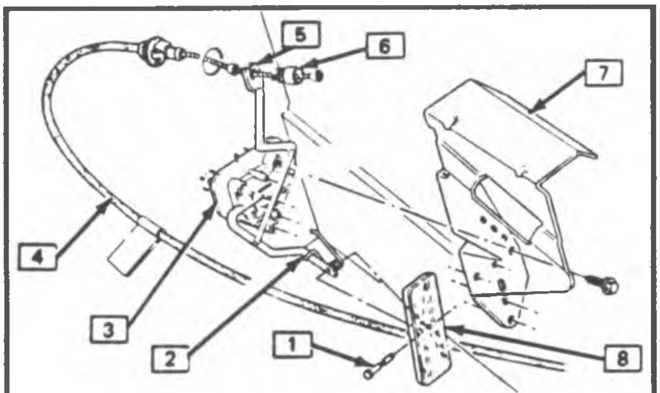
Figure 4-86 - Accelerator Pedal - C/K



1	PIN	5	CABLE
2	SPRING	6	REINFORCEMENT
3	ROD	7	PEDAL
4	RETAINER		

7S 3835-6E

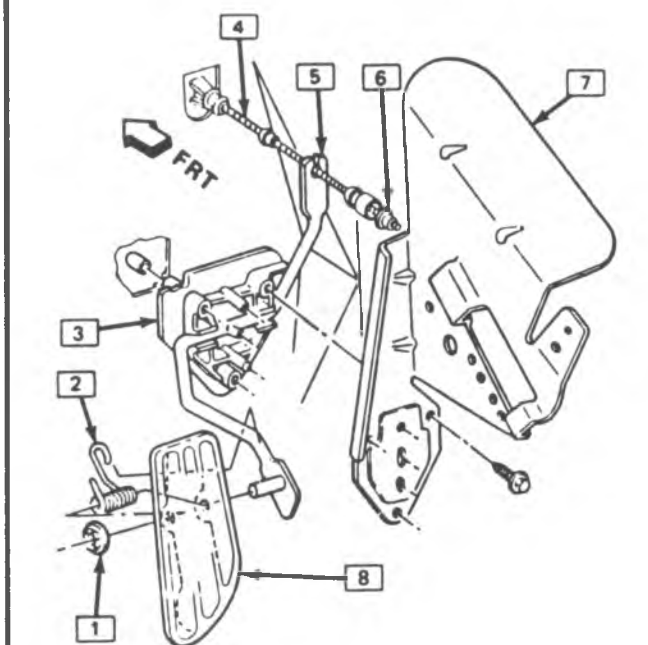
Figure 4-87 - Accelerator Pedal - G



1	PIN	5	ROD
2	SPRING	6	RETAINER
3	SUPPORT	7	PLATE
4	CABLE	8	PEDAL

7S 3832-6E

Figure 4-88 - Accelerator Pedal -P (42)



1	RETAINER	5	ROD
2	SPRING	6	RETAINER
3	SUPPORT	7	PLATE
4	CABLE	8	PEDAL

7S 3787-6E

Figure 4-89 - Accelerator Pedal -P (32)

1991 CONTROLLED IDLE SPEED

Engine	Transmission	Gear (D/N)	Idle Speed (RPM)	IAC Counts *	Open/Closed Loop **
2.5L	MAN	N	900(S) 800(M)	5-20	CL
	AUTO	D	800(S) 750(M)	15-40	CL
2.8L	MAN	N	800	5-20	OL
4.3L (under 8500 GVW)	MAN	N	550	2-20	CL
	AUTO	D	537	5-30	CL
	AUTO(1)	D	525	5-30	CL
	MAN (1)	N	600	3-30	CL
	AUTO (2)	D	588	5-30	CL
4.3L (over 8500 GVW)	MAN	N	650	5-30	CL
	AUTO	D	650	20-35	CL
5.0L	MAN	N	600	5-30	OL
	AUTO	D	500	5-30	OL
	AUTO(3)	D	500	5-30	CL
5.7L (under 8500 GVW)	MAN	N	600	5-30	OL
	AUTO	D	525	5-30	CL
5.7L (over 8500 GVW)	MAN		600	5-30	OL
	MAN(4)	N	600	5-30	CL ***
	AUTO	D	550	5-30	CL
7.4L	MAN	N	800	5-30	OL
	AUTO	D	750	5-30	OL

* Add 2 counts for engines with less than 500 miles. Add 2 counts for every 1000 ft. above sea level (4.3 L and V8). Add 1 count for every 1000 ft. above sea level (2.5L and 2.8 L).

** Let engine idle until proper fuel control status (open/closed loop) is reached.

*** Switches to "Open Loop" after 3 minutes

(1) 4.3 ST series only

(2) 4.3L high-output M Van Series only

(3) 3 speed auto in a C10 Pickup w/Fed. emissions and no AIR system.

(4) G van or Suburban with a single catalytic converter.

MINIMUM IDLE SPEED

Engine	Transmission	Gear (D/N)	Engine Speed (RPM) **	Open/Closed Loop *
7.4L	MAN	N	700 ± 25	OL
	AUTO	D	625 ± 25	OL

* Let engine idle until proper fuel control status (Open/Closed Loop)is reached.

** If the engine has less than 500 miles or is checked at altitudes above 1500 feet, the idle rpm with a seated IAC valve should be lower than valves above.

BLANK

SECTION 5
EVAPORATIVE EMISSION CONTROL SYSTEM (EECS)

CONTENTS

GENERAL DESCRIPTION

PURPOSE

The Evaporative Emission Control System (EECS) limits fuel vapor escape into the atmosphere. The system (EECS) transfers fuel vapor from a sealed fuel tank, through a single vapor pipe to an activated carbon (charcoal) storage device (vapor canister) to store the vapors when the vehicle is not operating. When the engine is running, the fuel vapor is purged from the carbon element by intake air flow and consumed in the normal combustion process.

The fuel tank has a fuel cap that is not normally vented to the atmosphere, but has a valve which allows both pressure and vacuum relief.

OPERATION

Evaporative System 2.5L, 2.8L & 4.3L (ST) *Figure 5-5*

Fuel vapors from the fuel tank are purged and flow into the vapor canister tube labeled "fuel tank" and are absorbed by the carbon. The canister (Figure 5-1) is purged when the engine is running above idle speed. A timed vacuum source is applied to the vapor canister tube labeled "canister purge" to draw fresh air through the bottom of the canister. The air mixes with vapor and the mixture is drawn into the intake manifold to be consumed in the normal combustion process.

2.8L Only *Figure 5-6*

This system has a thermostatic vacuum switch (TVS) installed in the intake manifold coolant passage to sense engine coolant temperature. This TVS has two ports and is located between the canister and the TBI unit.

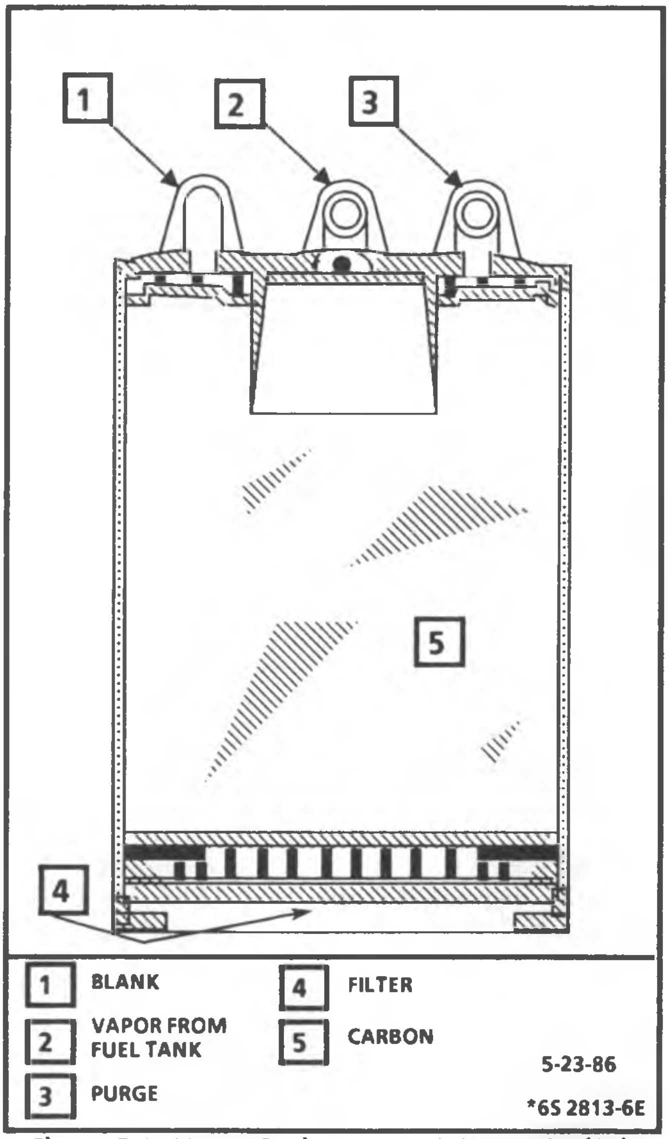


Figure 5-1 - Vapor Canister 2.5L, 2.8L & 4.3L (ST)

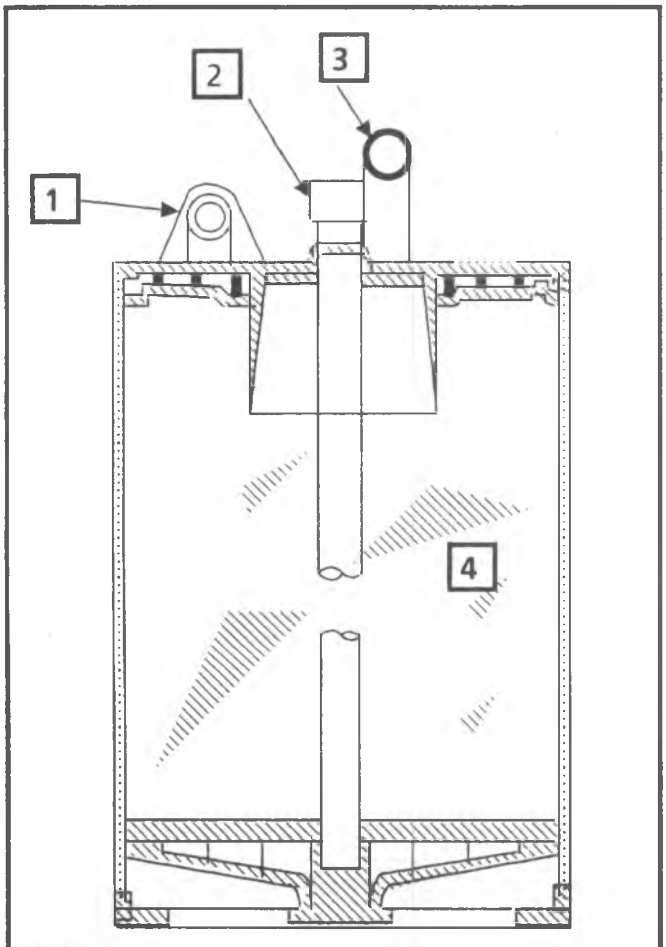


Figure 5-2 - Vapor Canister 4.3L & V8 Except Altitude

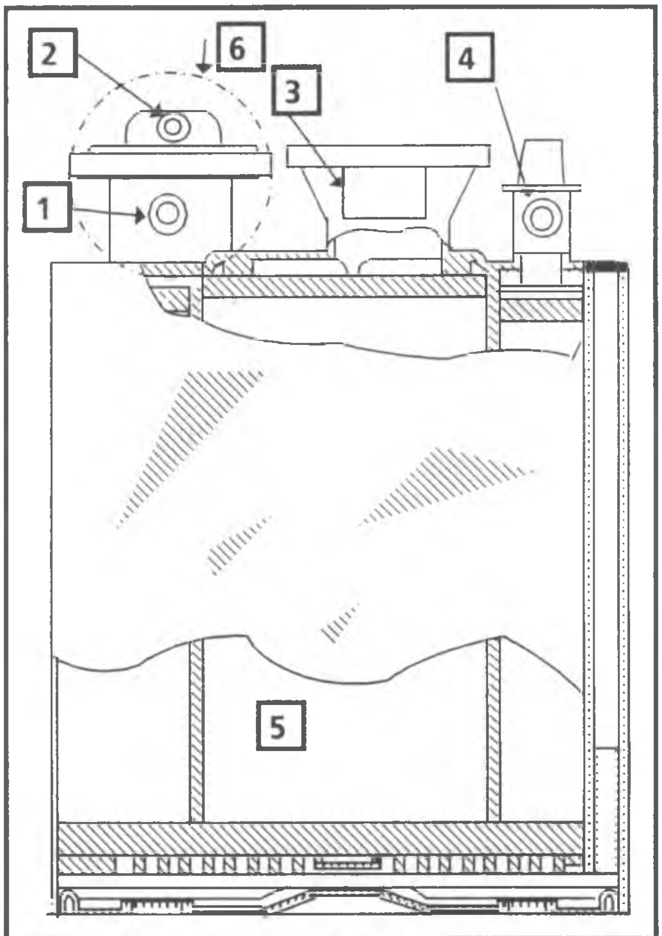


Figure 5-3 - Vapor Canister 4.3L & V8 - Altitude

When the engine is below 46°C (115°F), the TVS is closed preventing purge of the canister. When engine temperature is above 46°C (115°F), the TVS opens, allowing purge of the canister.

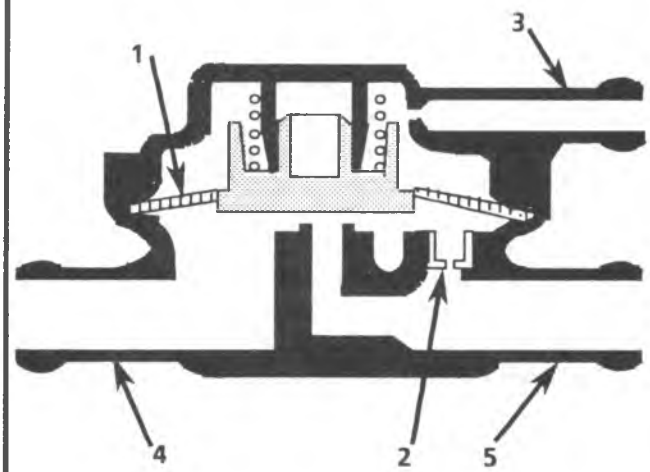
Evaporative System - Except Altitude 4.3L & V8 Figure 5-7

Fuel vapors from the fuel tank are purged and flow into the vapor canister tube labeled "fuel tank" and are absorbed by the carbon. The canister (Figure 5-2) is purged when the engine is running above idle speed. A timed vacuum source is applied to the vapor canister tube labeled "canister purge" to draw fresh air through the air inlet, at the top of the canister. This air flows through a tube to the bottom of the canister and forces the vapors out the purge line. The canister used on the 4.3L M application functions as described above, but has a 5/16" diameter "fuel tank" tube. All other applications have a canister with a 1/4' diameter "fuel tank" tube.

Evaporative System - Altitude 4.3L & V8 Figure 5-8

Fuel vapors from the fuel tank are purged and flow into the vapor canister tube labeled "fuel tank" and are absorbed by the carbon. When the canister (Figure 5-3) is purging, fresh air is drawn in through the air inlet, at the top of the canister. This air flows to the bottom of the canister and forces the vapors out the purge line.

The purge valve is an integral part of the canister. When the engine is running, full manifold vacuum is supplied to the top tube of the purge valve (control vacuum signal) which lifts the valve diaphragm and opens the valve. The lower tube on the purge valve is connected to a timed port above the TBI throttle valve. The rate of purge is controlled through this port by throttle valve location (throttle opening).



1 DIAPHRAGM
2 VENT RESTRICTION
3 TUBE TO MANIFOLD VACUUM
4 TUBE TO FUEL TANK
5 TUBE TO CANISTER

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Figure 5-4 - Fuel Tank Pressure Control Valve

Tank Pressure Control Valve

The tank pressure control valve (Figure 5-4), used only on altitude applications, allows vapors to flow from the fuel tank into the system. When fuel tank pressure exceeds the spring pressure on the valve diaphragm (4.3 kPa), the valve opens and allows vapors to enter the canister or go directly to the engine when purge is enabled. The tank pressure control valve is located in the engine compartment on C & K applications, and near the fuel tank on the others.

DIAGNOSIS

RESULTS OF INCORRECT OPERATION

- Poor idle, stalling and poor driveability can be caused by:
  - Damaged canister.
  - Hoses split, cracked and or, not connected to the proper tubes.
- Evidence of fuel loss or fuel vapor odor can be caused by:
  - Liquid fuel leaking from fuel lines or TBI unit.
  - Cracked or damaged vapor canister.
  - Disconnected, misrouted, kinked, deteriorated or damaged vapor pipe, or canister hoses.
  - Air cleaner or air cleaner gasket improperly seated.

VISUAL CHECK OF VAPOR CANISTER

- Replace vapor canister if cracked or damaged.
- Replace vapor canister if fuel is leaking from bottom and check operation of the total system.
- Replace filter at the bottom of the canister if dirty, plugged or damaged. (2.5L, 2.8L & 4.3L (ST) only).

FUNCTIONAL TESTS

Vapor Canister - Altitude Only

Apply a short length of hose to the lower tube of purge valve, and attempt to blow through it. Little or no air should pass into the canister. (A small amount of air will pass if the canister has a constant purge hole).

With hand vacuum pump, apply vacuum 38 cm Hg (15" Hg) to the control valve tube (upper tube). If the diaphragm does not hold vacuum for at least 20 seconds, the diaphragm is leaking, and the canister must be replaced.

If the diaphragm holds vacuum, again try to blow through the hose connected to the lower tube while vacuum is still being applied. An increased flow of air should be observed. If not, the canister must be replaced.

Tank Pressure Control Valve

With a hand vacuum pump, apply approximately 38 cm Hg (15" Hg) vacuum to the control vacuum tube. After ten seconds, there should be at least 13 cm Hg (5" Hg) vacuum remaining. (Be sure the and vacuum pump being used does not have an internal leak and the hose connections to the control vacuum tube and pump are secure.) If after ten seconds there is less than 13 cm Hg (5" Hg) vacuum, the valve must be replaced.

With 38 cm Hg (15" Hg) vacuum still applied to the control vacuum tube, attach a short piece of hose to the valve's tank tube side. Blow into the tube. You should feel the air pass through the valve, if air does not pass through, the valve must be replaced.

Thermostatic Vacuum Switch

With the engine temperature below 38°C (100°F), apply vacuum to manifold side of switch. Switch should hold vacuum.

Raise temperature of engine to above 50°C (122°F), vacuum should drop off.

If switch fails either test, replace it.

ON-VEHICLE SERVICE

VAPOR CANISTER

Remove or Disconnect

1. Hoses from canister. Mark hoses for installation on new canister.
2. Screw from bracket and canister.

Install or Connect

1. Canister and bracket screw.
2. Hoses to canister.

VAPOR CANISTER HOSES

Refer to "Vehicle Emission Control Information" label for routing of canister hoses. When replacing hoses, use hose identified with the word "Fluoroelastomer."

VAPOR PIPE

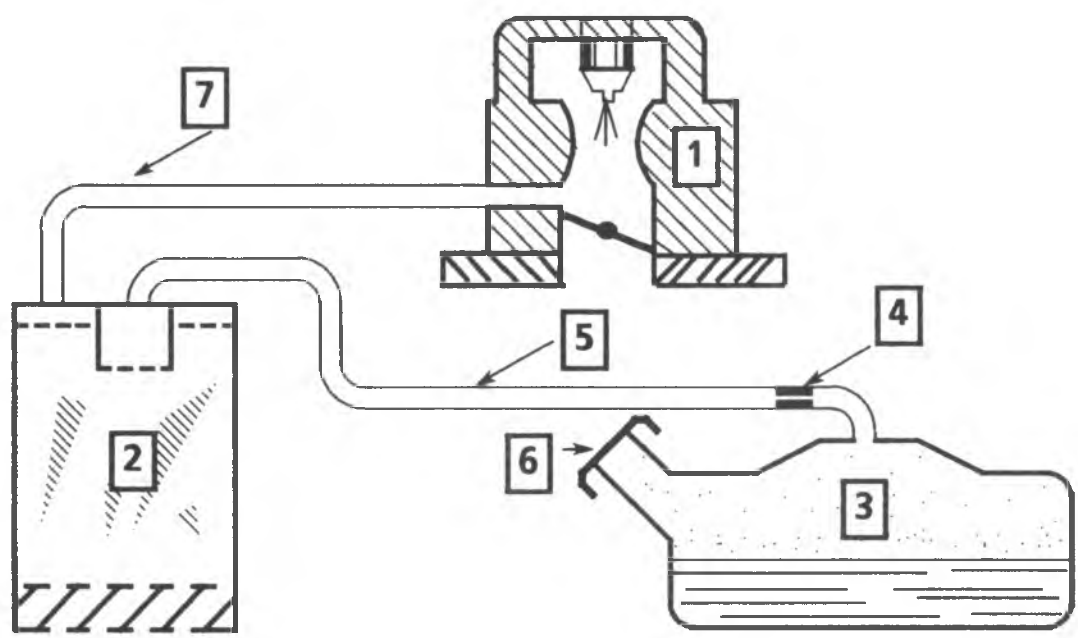
The vapor pipe is secured to the underbody with clamp and screw assemblies. Flexible hoses are connected at the fuel tank and the fuel vapor canister. The pipe should be inspected occasionally for leaks, kinks, or dents and repaired as required.

Vapor Pipe Repair

Repair vapor pipe in sections using brazed seamless steel tubing meeting GM Specification 123M or its equivalent or hose identified with the words "Fluoroelastomer." Hose not so marked could cause early failure or failure to meet emission standard.

- Do not use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory durability to withstand normal vehicle vibrations.
- Do not use rubber hose within 4" (100 mm) of any part of the exhaust system or within 10" (254 mm) of the catalytic converter. Hose inside diameter must match steel tubing outside diameter.

1. In repairable areas, cut a piece of fuel hose 4" (100 mm) longer than portion of the line removed.
   If more than a 6" (152 mm) length of pipe is removed, use a combination of steel tubing and hose so that hose lengths will not be more than 10 inches (254 mm).
2. Cut ends of pipe remaining on vehicle square with a tube cutter. Using the first step of a double flaring tool, form a bead on the end of both pipe sections. If pipe is too corroded to withstand bead operation without damage, the pipe should be replaced. If a new section of pipe is used, form a bead on both ends of it also.



1	TBI UNIT	3	FUEL TANK	5	VAPOR PIPE
2	VAPOR CANISTER	4	VAPOR RESTRICTION	6	FUEL CAP
				7	CANISTER HOSE

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Figure 5-5 - Evaporative Emissions Control System Schematic 2.5L & 4.3L (ST)

3. Use screw type hose clamp, part number 2494772 or equivalent. Slide clamps onto pipe and push hose 2″ (51 mm) onto each portion of fuel pipe. Tighten clamps on each side of repair.

FUEL CAP

If a fuel tank filler cap requires replacement, use only a cap with the same features. Failure to use the correct cap can result in a malfunctioning of the system.

THERMOSTATIC VACUUM SWITCH

Remove or Disconnect

1. Drain cooling system below level of switch.
2. Vacuum hoses from switch.
3. Thermostatic vacuum switch.

Install or Connect

1. Thermostatic vacuum switch using sealer on threads.
2. Vacuum hoses.
3. Refill cooling system.

PARTS INFORMATION

PART NAME	GROUP
Canister, Fuel Vapor	3.130
Valve, Tank Pressure Control	3.140

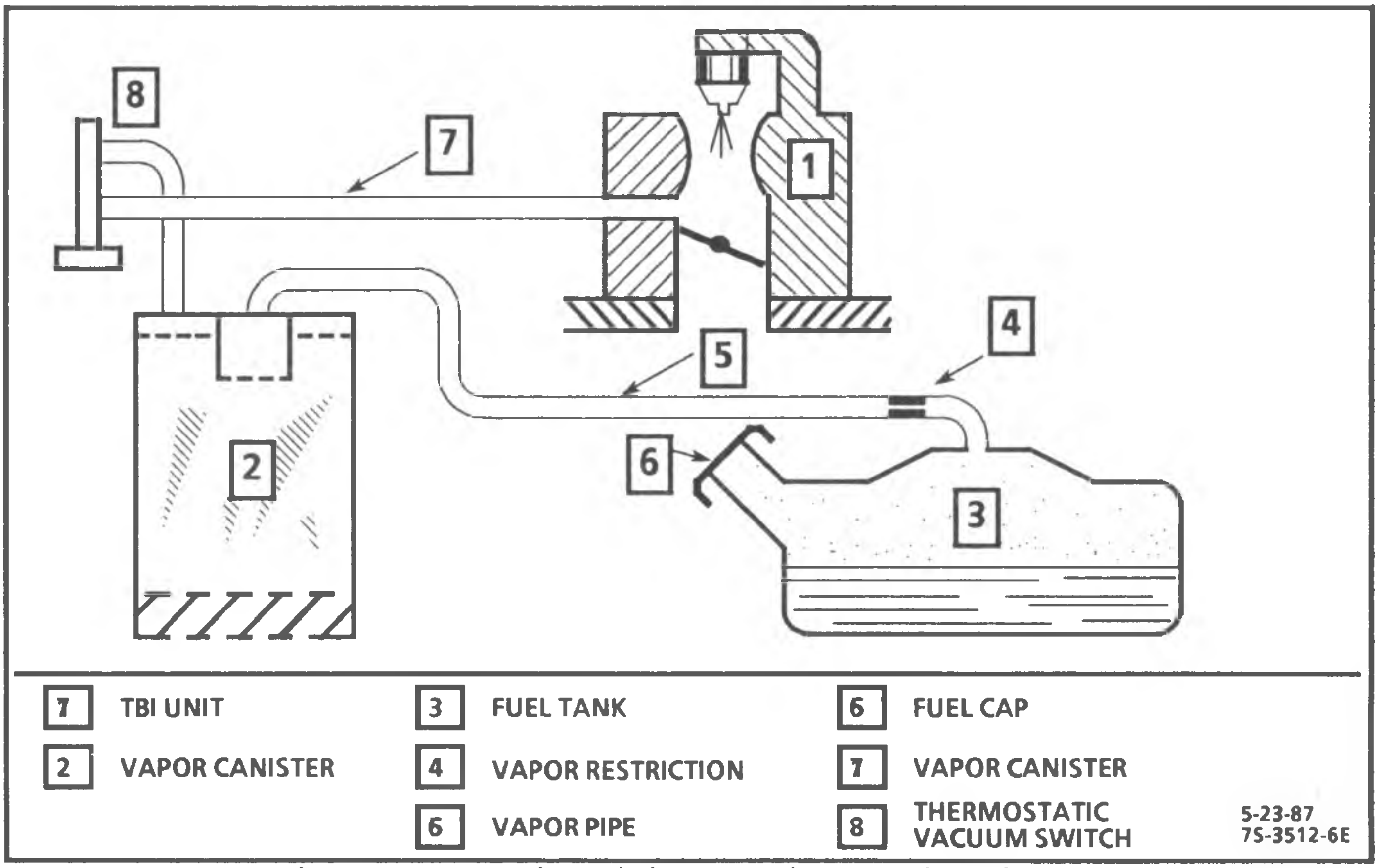
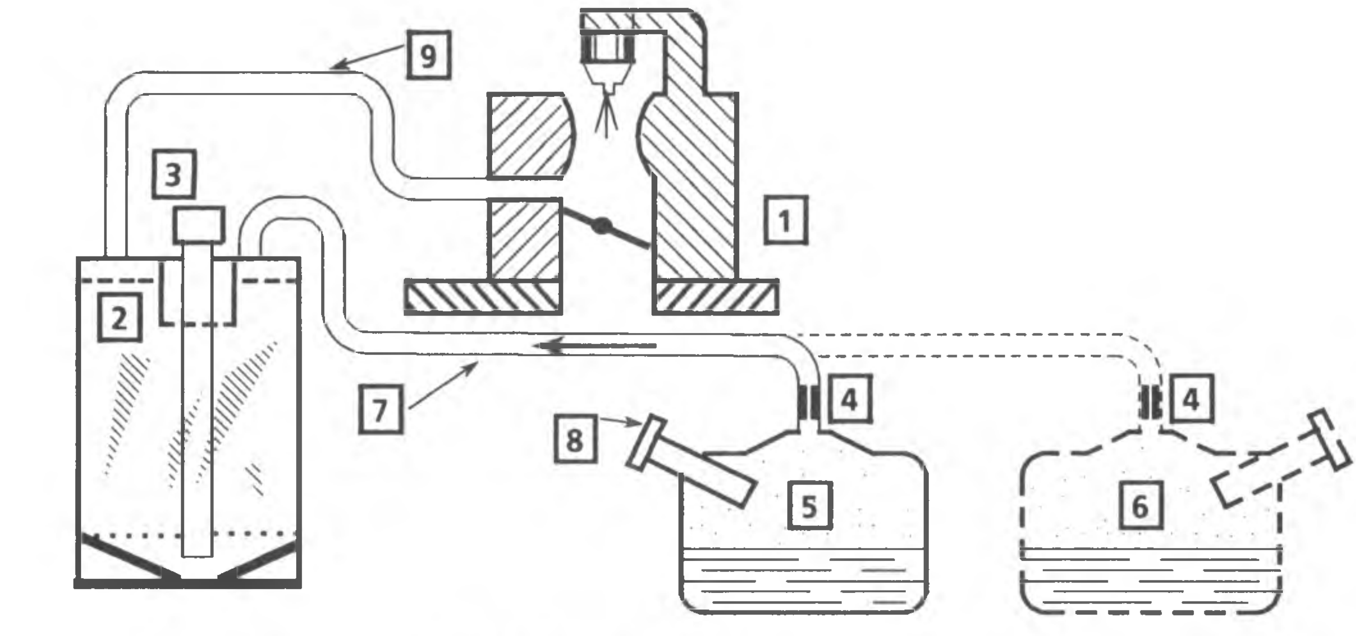


Figure 5-6 - Evaporative Emissions Control System Schematic 2.8L



1	TBI UNIT	4	VAPOR RESTRICTION	7	VAPOR PIPE
2	VAPOR CANISTER	5	FUEL TANK	8	FUEL CAP
3	AIR INLET	6	AUXILLIARY FUEL TANK (R & V SERIES ONLY)	9	CANISTER HOSE

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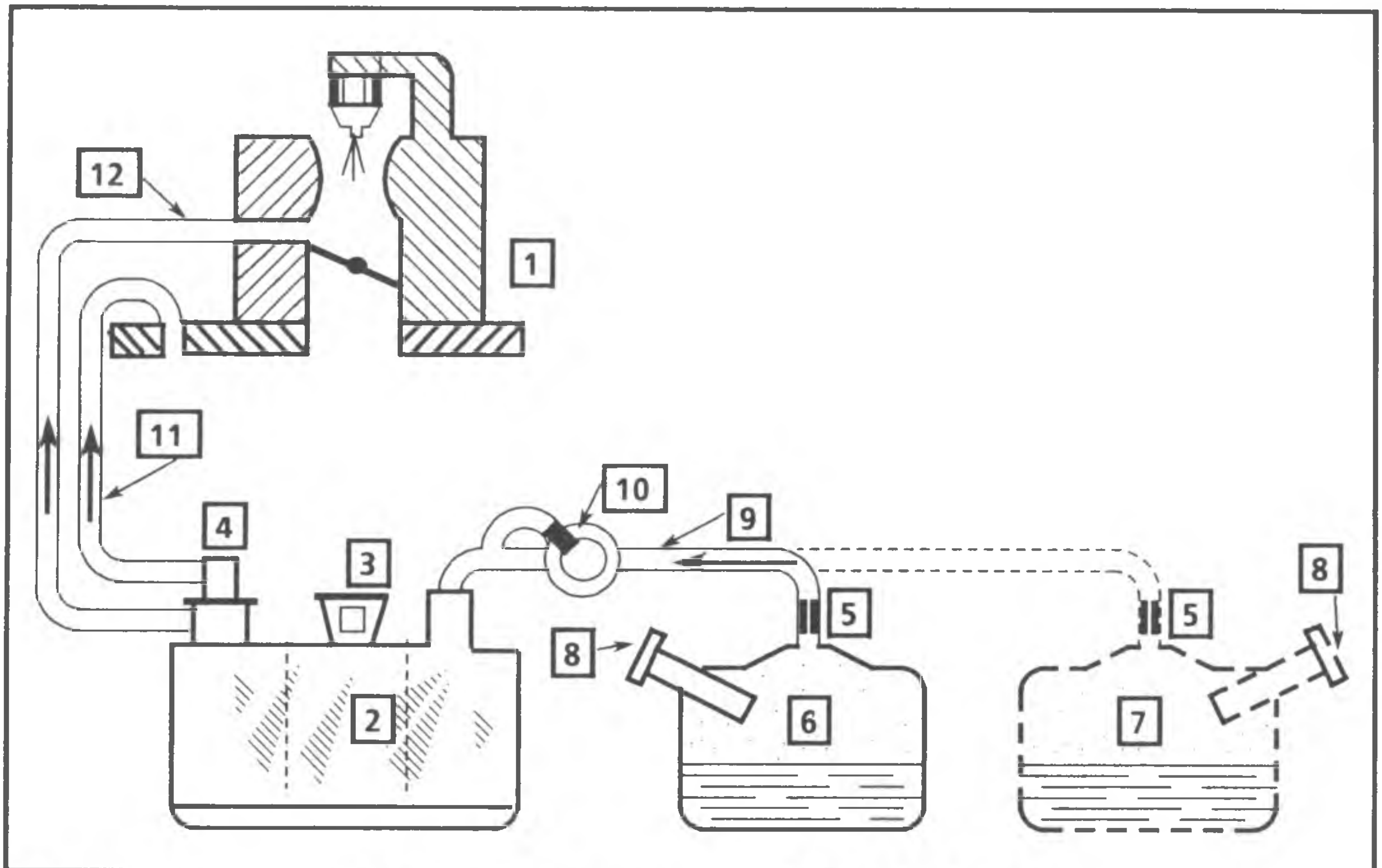
Figure 5-7 - Evaporative Emissions Control System Schematic 4.3L (Except S/T) & V8 - Except Altitude



1	TBI UNIT	5	VAPOR RESTRICTION	9	VAPOR PIPE
2	VAPOR CANISTER	6	FUEL TANK	10	TANK PRESSURE CONTROL VALVE
3	AIR INLET	7	AUXILLIARY FUEL TANK R & V SERIES ONLY	11	CANISTER CONTROL VACUUM HOSE (FULL MANIFOLD VACUUM)
4	CANISTER PURGE VALVE	8	FUEL CAP	12	CANISTER PURGE HOSE (PORTED VACUUM)

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7S 3515-6E

Figure 5-8 - Evaporative Emissions Control System Schematic 4.3L (Except S/T) & V8 - Altitude

BLANK

SECTION 6
IGNITION SYSTEM/EST
CONTENTS

GENERAL DESCRIPTION

PURPOSE

The ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide improved engine performance, fuel economy, and control of exhaust emissions, the ECM/PCM controls distributor spark advance (timing) with the Electronic Spark Timing (EST) system.

Only the EST system will be described here. Additional information on the ignition system is found in ENGINE ELECTRICAL (SECTION 6D).

OPERATION

The ignition system has a distributor module with four terminals for the EST system (Figure 6-1 and 6-2) that are connected by the ECM/PCM.

To properly control ignition/combustion timing, the ECM/PCM needs to know:

- Crankshaft position
- Engine speed (rpm)
- Engine load (manifold pressure or vacuum)
- Atmospheric (barometric) pressure
- Engine coolant temperature

All engines except 2.8L S Truck

The EST system consists of the distributor module, an ECM/PCM, and connecting wires. The four terminals for EST are lettered in the module.

The distributor four terminal connector is lettered A-B-C-D.

These circuits perform the following functions:

- Terminal "A" - Reference Ground Lo - This wire may be grounded in the distributor. It makes sure the ground circuit, between the module and ECM/PCM, has no voltage drop which could affect performance. If it is open, it may cause poor performance.

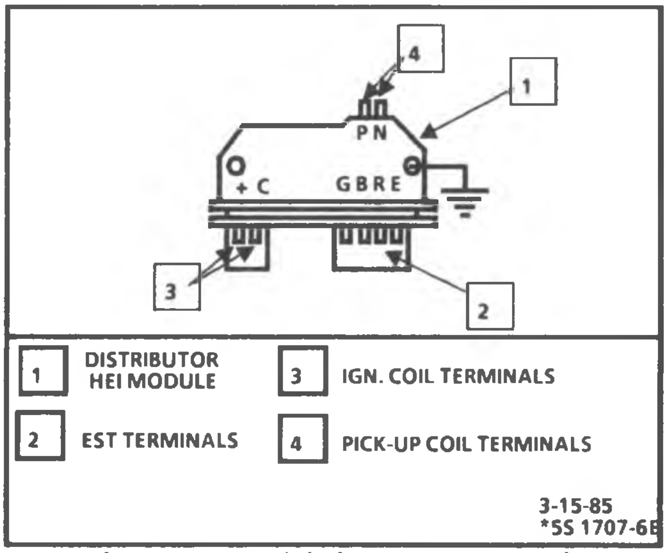


Figure 6-1 - Module (Except 2.5L & 2.8L)

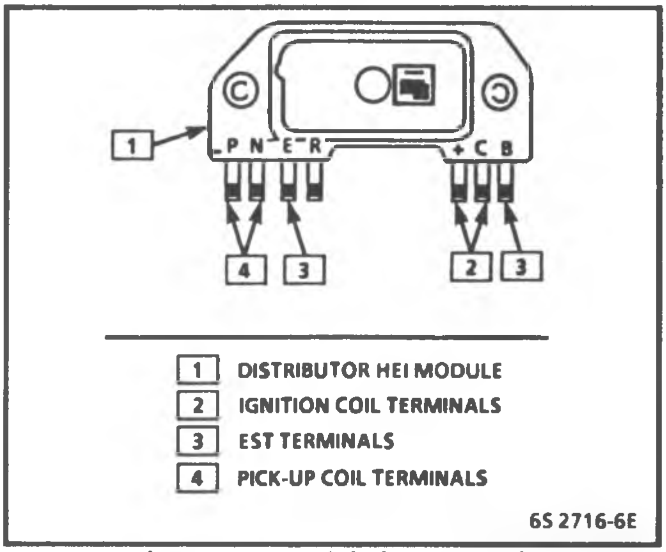


Figure 6-2 - Module (2.5L & 2.8L)

- Terminal "B" - Bypass - At about 400 rpm, the ECM/PCM applies 5 volts to this circuit to switch spark timing control from the module to the ECM/PCM. An open or grounded bypass circuit will set a Code 42 and the engine will run at base timing, plus a small amount of advance built into the module.
- Terminal "C" - Distributor Reference Hi - This provides the ECM/PCM with rpm and crankshaft position information.
- Terminal "D" - EST - This circuit triggers the module. The ECM/PCM does not know what the actual timing is, but it does know when it gets the reference signal. It then advances or retards the spark from that point. Therefore, if the base timing is set incorrectly, the engine spark curve will be incorrect.

S Truck with 2.8L

The EST system consists of a hall effect switch, the distributor module, an ECM, and connecting wires. The four terminal connector is lettered A-B-C-D.

These circuits perform the following functions:

- Terminal "A" - EST - This circuit triggers the module. The ECM does not know what the actual timing is, but it does know when it gets the reference signal. It then advances or retards the spark from that point. Therefore, if the base timing is set incorrectly, the engine spark curve will be incorrect.
- Terminal "B" - Distributor Reference Hi - This provides the ECM with rpm and crankshaft position information through the hall effect switch.
- Terminal "C" - Bypass - At about 400 rpm, the ECM applies 5 volts to this circuit to switch spark timing control from the module to the ECM. An open or grounded bypass circuit will set a Code 42 and the engine will run at base timing, plus a small amount of advance built into the module.
- Terminal "D" - Reference Ground Lo - This wire is grounded in the distributor and makes sure the ground circuit has no voltage drop which could affect performance. If it is open, it may cause poor performance.

DIAGNOSIS

The description and operation of the ignition system can be found in ENGINE ELECTRICAL (SECTION 6D).

Refer to charts in this section for ignition system check.

EST SYSTEM

Code 12 is used during the System Check in "Computer Command Control," Section "3" procedure to test the code display ability of the ECM/PCM. This code indicates that the ECM/PCM is not receiving the engine rpm (Reference) signal.

The "Reference" signal also triggers the fuel injection system. Without the "Reference" signal, the engine cannot run.

Results of Incorrect EST Operation

The ECM/PCM uses information from the MAP and coolant sensors in addition to rpm to calculate spark advance as follows:

Low MAP output voltage = More spark advance
Cold Engine = More spark advance
High MAP output voltage = Less spark advance
Hot engine = Less spark advance

Therefore, detonation could be caused by high MAP output or low resistance in the coolant sensor circuit.

Poor performance could be caused by high MAP output or low resistance in the coolant sensor circuit.

CODE 42

A fault in the EST system will usually set a Code 42, as diagnosed in "Computer Command Control," Section "3".

When the system is running on the distributor module, there is no voltage on the bypass line and the module grounds the EST signal. The ECM/PCM expects to see no voltage on the EST line during this condition. If it sees a voltage, it sets Code 42 and will not go into the EST mode.

When the rpm for EST is reached (about 400 rpm), the ECM/PCM applies 5 volts to the bypass line and the EST should no longer be grounded in the module, so the EST voltage should be varying.

If the bypass line is open, the module will not switch to test mode, so the EST voltage will be low and Code 42 will be set.

If the EST line is grounded, the module will switch to EST but, because the line is grounded, there will be no EST signal and the engine will not run. A Code 42 may or may not be set.

An open in the EST circuit will set a Code 42 and cause the engine to run on the distributor module timing. This will cause poor performance and poor fuel economy. A ground may set a Code 42, but the engine will not run.

EST PERFORMANCE CHECK

2.5L Engine

The ECM will set a specified value timing when the ALDL diagnostic terminal is grounded. To check the EST operation, record the timing at 2000 rpm with the diagnostic terminal not grounded. Then, ground the diagnostic terminal and the timing should change at 2000 rpm, indicating that EST is operating.

Except 2.5L Engine

To check EST operation, place the vehicle in "Park" or "Neutral" and block the drive wheels. Start the engine and accelerate to 2000 rpm. Note the ignition timing. Disconnect the "Set Timing" connector and again note the timing. The timing will change if the EST system is working.

ON-VEHICLE SERVICE

IGNITION SYSTEM

Refer to ENGINE ELECTRICAL (SECTION 6D) for On-Vehicle service of distributor, pick-up coil, distributor cap, ignition coil, hall effect switch, rotor, or distributor module.

SETTING TIMING

Set timing according to instructions on "Vehicle Emission Control Information" label under the hood.

Timing specifications for each engine are listed on the "Vehicle Emissions Control Information" label on the radiator support. When using a timing light, connect an adapter between the No. 1 spark plug and the No. 1 spark plug wire, or use an inductive type pickup. Do not pierce the plug lead. Once the insulation of the spark plug cable has been broken, voltage will jump to the nearest ground, and the spark plug will not fire properly. Always follow "Vehicle Emissions Control Information" label procedures when adjusting timing.

Some engines incorporate a magnetic timing probe hole for use with special electronic timing equipment. Consult manufacturer's instructions for use of this equipment.

Put the EST system in Bypass mode on the 2.5L engine by connecting terminal "B" to "A" at the ALDL connector. On the V6 and V8 engines, the system will go into Bypass mode by disconnecting the timing connector. This is a single wire sealed connector that has a tan with black stripe lead. On the 4.3L and V8 engine, this connector breaks out of the engine wiring harness conduit adjacent to the distributor. On V6 engines in S/T Truck, the connector breaks out of a taped section below the heater case in the passenger compartment (Figure 6-3).

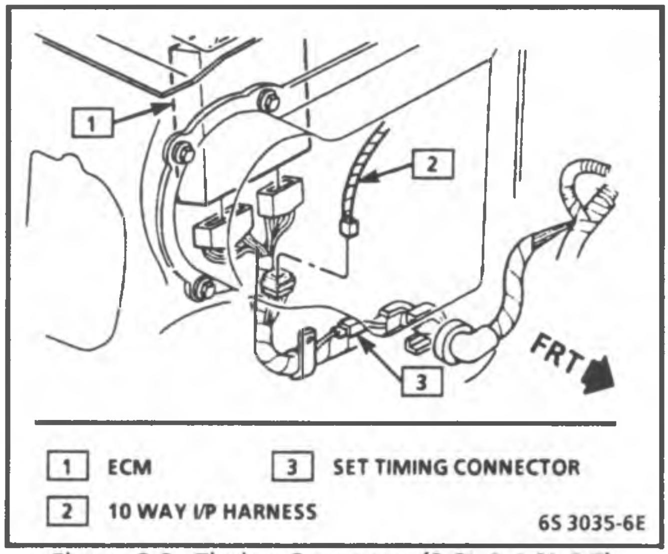
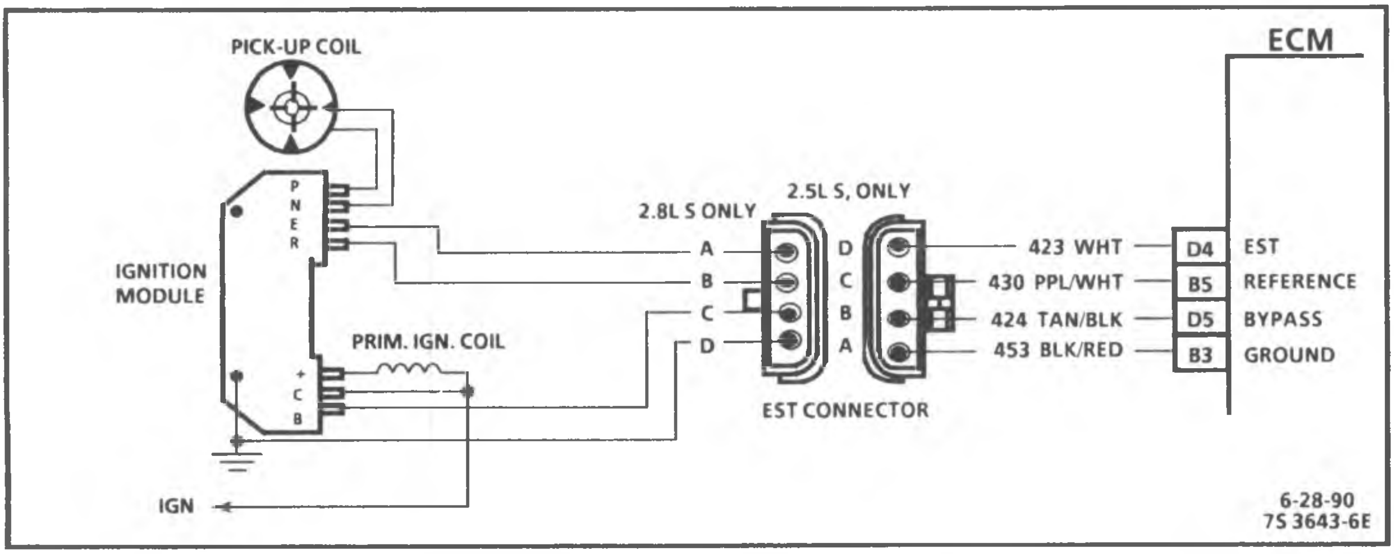


Figure 6-3 - Timing Connector (2.8L & 4.3L S/T)



IGNITION SYSTEM CHECK

(REMOTE COIL)
2.5L & 2.8L TRUCK

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Two wires are checked, to ensure that an open is not present in a spark plug wire.

1A. If spark occurs with 4 terminal distributor connector disconnected, pick-up coil output is too low for EST operation.

2. A spark indicates the problem must be the distributor cap or rotor.
3. Normally, there should be battery voltage at the "C" and "+" terminals. Low voltage would indicate an open or a high resistance circuit from the distributor to the coil or ignition switch. If "C" terminal voltage was low, but "+" terminal voltage is 10 volts or more, circuit from "C" terminal to ignition coil or ignition coil primary winding is open.
4. Checks for a shorted module or grounded circuit from the ignition coil to the module. The distributor module should be turned "OFF," so normal voltage should be about 12 volts.

   If the module is turned "ON," the voltage would be low, but above 1 volt. This could cause the ignition coil to fail from excessive heat.

   With an open ignition coil primary winding, a small amount of voltage will leak through the module from the "Batt" to the "tach" terminal.
5. Applying a voltage (1.5 to 8 volts) to module terminal "P" should turn the module "ON" and the "Tach." terminal voltage should drop to about 7-9 volts. This test will determine whether the module or coil is faulty or if the pick-up coil is not generating the proper signal to turn the module "ON." This test can be performed by using a DC battery with a rating of 1.5 to 8 volts. The use of the test light is mainly to allow the "P" terminal to be probed more easily.

   Some digital multi-meters can also be used to trigger the module by selecting ohms, usually the diode position. In this position, the meter may have a voltage across its terminals which can be used to trigger the module. The voltage in the ohm's position can be checked by using a second meter or by checking the manufacture's specification of the tool being used.
6. This should turn "OFF" the module and cause a spark. If no spark occurs, the fault is most likely in the ignition coil because most module problems would have been found before this point in the procedure. A module tester (J 24642) could determine which is at fault.

Diagnostic Aids:

The "Scan" tool does not have any ability to help diagnose a ignition system check.

Refer to "Driveability Symptoms," Section "2" for "ECM Intermittent Codes or Performance."

IGNITION SYSTEM CHECK

(REMOTE COIL) 2.5L & 2.8L TRUCK

1
- Perform System Check before proceeding with this test. (If a tachometer is connected to the Tach term., disconnect it before proceeding with the test).
- Check spark at plug with spark tester J-26792 or equivalent (ST-125) while cranking (if no spark on one wire, check a second wire) A few sparks and then nothing is considered no spark.

Spark: Check fuel, spark plugs, etc. See Section 2 symptoms.

No Spark:

1A
- Disconnect 4 term. distributor connector and check for spark.

Spark: Replace pick-up coil

No spark:

2
- Check for spark at coil wire with tester while cranking. (Leave spark tester connected to coil wire for Steps 3-6).

Spark: Inspect cap for water, cracks, etc. If OK, replace rotor.

No Spark:

3
- Disconnect distributor 2 term. "C / +" connector.
- Ignition switch "on", Engine stopped.
- Check volts at " + " and "C" term's. of dist. harn. conn.

Both term's. under 10 volts: Repair wire from module " + " term. to "B" term. of black Ign. coil connector or primary ckt. to ign. sw.

Under 10 volts "C" term. only: Check for open or gnd. in ckt. from "C" term. to ign. coil. If Ckt. is OK, fault is. ign. coil or conn.

Both term's. 10 volts or more:

4
- Reconnect dist. 2 term. conn.
- With ign. "ON", check voltage from tach. term. to gnd. (term. may be taped back in harness).

Under 1 volt: Repair open tach. lead or conn and repeat test #4.

1 to 10 volts: Replace module and check for spark from coil as in Step 6.
- **Spark:** System OK
- **No Spark:** Replace ign. coil, it too is faulty

Over10 volts:
- Connect test light from tach. term. to ground.
- Crank engine and observe light.

Light blinks: Replace ignition coil and recheck for spark with spark tester. If still no spark, re-install original coil and replace dist. module.

Light on steady:

5
- Disconnect distributor 4 term. connector.
- Remove dist. cap.
- Disconnect pick-up coil connector from module.
- Connect voltmeter from tach. term. to ground.
- Ignition on.
- Insulate a test light probe to 1/4" from tip and note voltage, as test light is momentarily connected from a voltage source (1.5 to 8V) to module term. "P". (Fig. 1).

No drop in voltage: Check module ground. If OK, replace module.

Voltage drops:

6
- Check for spark from coil wire with spark tester as test light is removed from module term.

No Spark:
- If no module tester (J24642) is available; Replace ign. coil and repeat Step 5.
  - **No Spark:** Ign. coil removed is OK, reinstall coil and check coil wire from dist. cap. if OK, replace dist. module.
  - **Spark:** System OK
- If module tester (J24642) is available: test module
  - **OK:** Check coil wire from cap to coil. If OK, replace coil.
  - **Not OK:** Replace module

Spark:
- Is rotating pole piece still magnetized?
  - **Yes:** Check pick-up coil or conns. (Coil resistance should be 500-1500 ohms and not grounded.)
  - **No:** Replace pole piece and shaft assy.

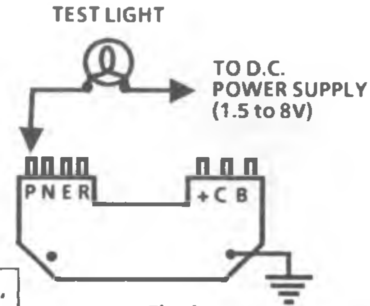


Fig. 1

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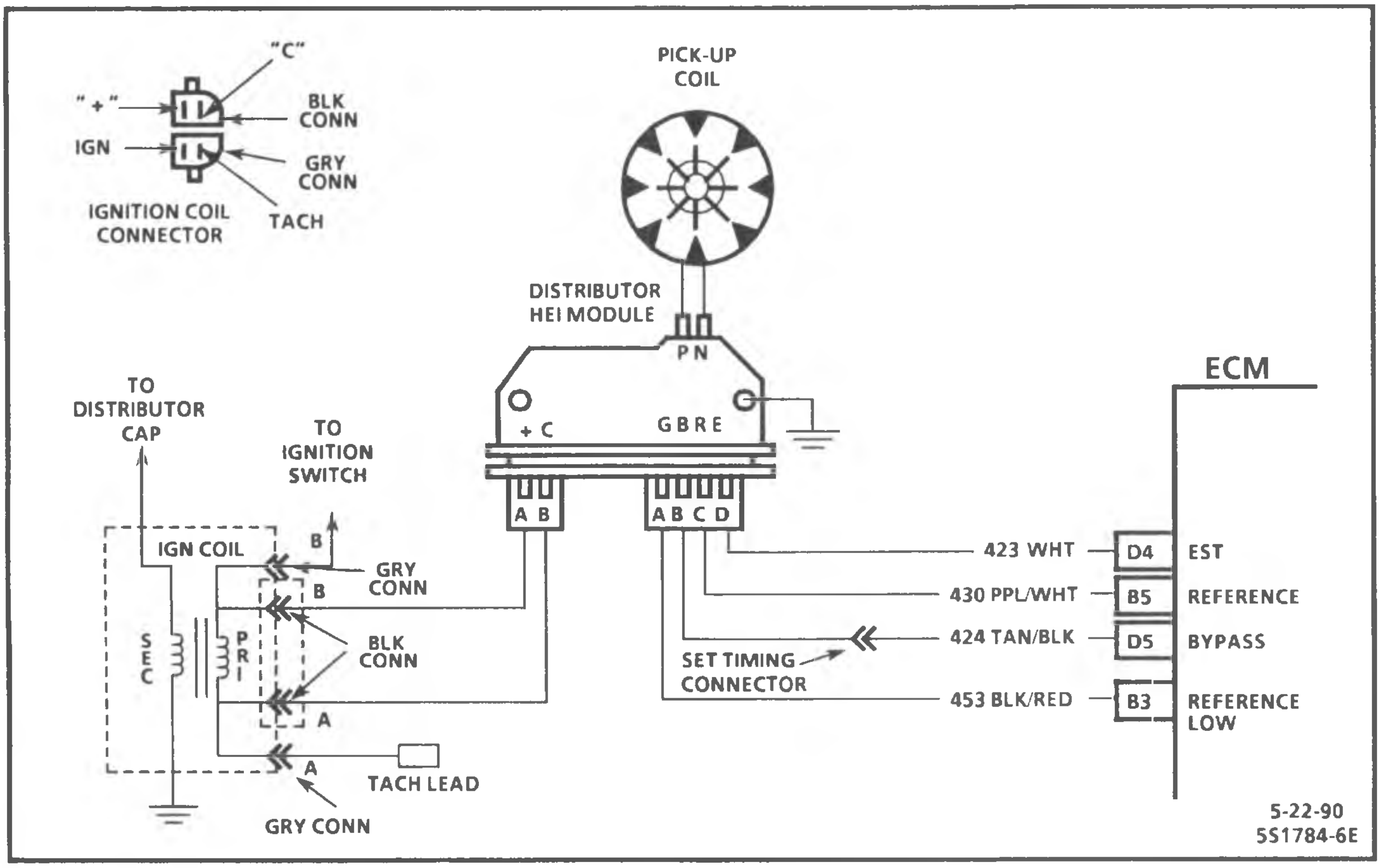


IGNITION SYSTEM CHECK

(REMOTE COIL/SEALED MODULE CONNECTOR DISTRIBUTOR) ALL ENGINES EXCEPT 2.5L & 2.8L TRUCK AND VEHICLES WITH 4L80-E TRANSMISSION

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Two wires are checked, to ensure that an open is not present in a spark plug wire.

1A. If spark occurs with EST connector disconnected, pick-up coil output is too low for EST operation.

2. A spark indicates the problem must be the distributor cap or rotor.
3. Normally, there should be battery voltage at the "C" and "+" terminals. Low voltage would indicate an open or a high resistance circuit from the distributor to the coil or ignition switch. If "C" terminal voltage was low, but "+" terminal voltage is 10 volts or more, circuit from "C" terminal to ignition coil or ignition coil primary winding is open.
4. Checks for a shorted module or grounded circuit from the ignition coil to the module. The distributor module should be turned "OFF", so normal voltage should be about 12 volts.

   If the module is turned "ON", the voltage would be low, but above 1 volt. This could cause the ignition coil to fail from excessive heat.

   With an open ignition coil primary winding, a small amount of voltage will leak through the module from the "Batt" to the "tach" terminal.
5. Applying a voltage (1.5 to 8 volts) to module terminal "P" should turn the module "ON" and the "tach" terminal voltage should drop to about 7-9 volts. This test will determine whether the module or coil is faulty or if the pick-up coil is not generating the proper signal to turn the module "ON." This test can be performed by using a DC battery with a rating of 1.5 to 8 volts. The use of the test light is mainly to allow the "P" terminal to be probed more easily. Some digital multi-meters can also be used to trigger the module by selecting ohms, usually the diode position. In this position the meter may have a voltage across it's terminals which can be used to trigger the module. The voltage in the ohm's position can be checked by using a second meter or by checking the manufacturer's specification of the tool being used.
6. This should turn "OFF" the module and cause a spark. If no spark occurs, the fault is most likely in the ignition coil because most module problems would have been found before this point in the procedure. A module tester could determine which is at fault.

IGNITION SYSTEM CHECK

(REMOTE COIL/SEALED MODULE CONNECTOR DISTRIBUTOR) ALL ENGINES EXCEPT 2.5L & 2.8L TRUCK AND VEHICLES WITH 4L80-E TRANSMISSION

(1)
- Perform System Check before proceeding with this test. (If a tachometer is connected to the Tach term., disconnect it before proceeding with the test).
- Check spark at plug with spark tester J-26792 or equivalent (ST-125) while cranking (if no spark on one wire, check a second wire) A few sparks and then nothing is considered no spark.

No Spark → (1A)

Spark → Check fuel,spark plugs, etc. See Section 2 symptoms.

(1A)
- Disconnect 4 term. distributor connector and check for spark.

No spark → (2)

Spark → Replace pick-up coil

(2)
- Check for spark at coil wire with tester while cranking. (Leave spark tester connected to coil wire for Steps 3-6).

No Spark → (3)

Spark → Inspect cap for water, cracks, etc. If OK, replace rotor.

(3)
- Disconnect distributor 2 term. "C / +" connector.
- Ignition switch "on", Engine stopped.
- Check volts at " + " and "C" term's. of dist. harn. conn.

Both term's. 10 volts or more → (4)

Both term's. under 10 volts → Repair wire from module " + " term. to "B" term. of black Ign. coil connector or primary ckt. to ign. sw.

Under 10 volts "C" term. only → Check for open or gnd. in ckt. from "C" term. to ign. coil. If Ckt. is OK, fault is. ign. coil or conn..

(4)
- Reconnect dist. 2 term. conn.
- With ign. "ON", check voltage from tach. term. to gnd. (term. may be taped back in harness).

Over10 volts →
- Connect test light from tach. term. to ground.
- Crank engine and observe light.

Under 1 volt → Repair open tach. lead or conn and repeat test #4.

1 to 10 volts → Replace module and check for spark from coil as in Step 6.
- Spark → System OK
- No Spark → Replace ign. coil, it too is faulty

Light on steady → (5)

Light blinks → Replace ignition coil and recheck for spark with spark tester. If still no spark, re-install original coil and replace dist. module..

(5)
- Disconnect distributor 4 term. connector.
- Remove dist. cap.
- Disconnect pick-up coil connector from module.
- Connect voltmeter from tach. term. to ground.
- Ignition on.
- Insulate a test light probe to 1/4" from tip and note voltage, as test light is momentarily connected from a voltage source (1.5 to 8V) to module term. "P". (Fig. 1).

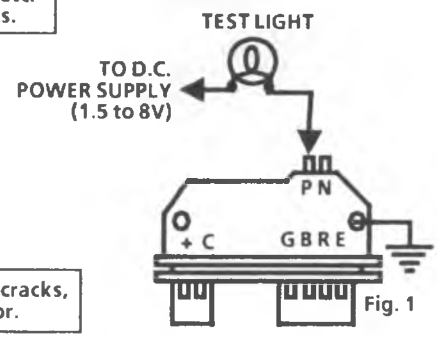


Fig. 1

Voltage drops → (6)

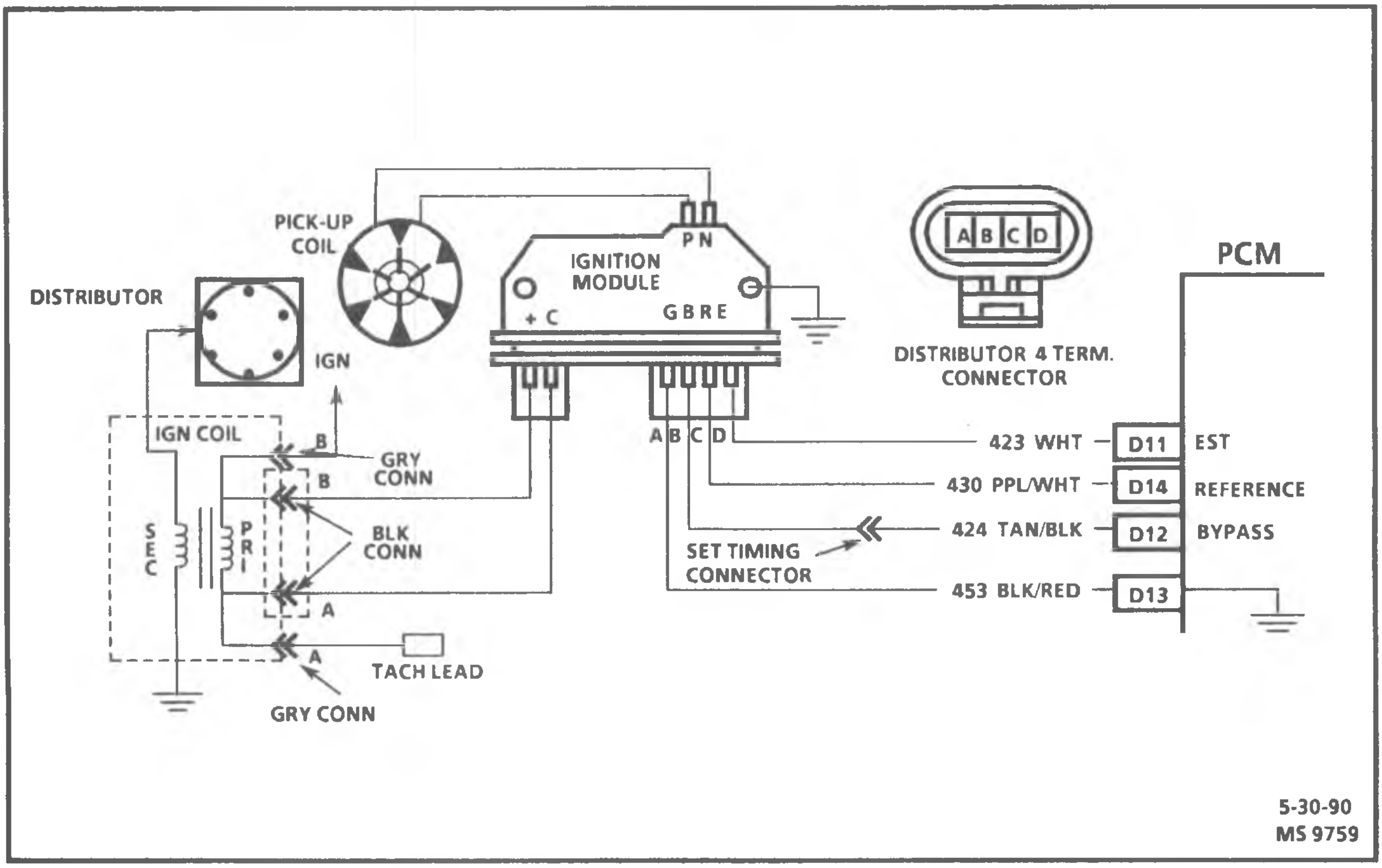
No drop in voltage → Check module ground. If OK, replace module.

(6)
- Check for spark from coil wire with spark tester as test light is removed from module term.

No Spark →
- If no module tester (J24642) is available; Replace ign. coil and repeat Step 5.
  - No Spark → Ign. coil removed is OK, reinstall coil and check coil wire from dist. cap. if OK, replace dist. module.
  - Spark → System OK
- If module tester (J24642) is available: test module
  - OK → Check coil wire from cap to coil. If OK, replace coil.
  - Not OK → Replace module

Spark →
- Is rotating pole piece still magnetized?
  - Yes → Check pick-up coil conns. Check pick-up coil (Coil resistance should be 500-1500 ohms and not grounded).
  - No → Replace pole piece and shaft assy.

2-1-90
7S 3660



IGNITION SYSTEM CHECK

(REMOTE COIL/SEALED MODULE CONNECTOR DISTRIBUTOR)
ALL VEHICLES WITH 4L80-E TRANSMISSION

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Two wires are checked, to ensure that an open is not present in a spark plug wire.

1A. If spark occurs with EST connector disconnected, pick-up coil output is too low for EST operation.

2. A spark indicates the problem must be the distributor cap or rotor.
3. Normally, there should be battery voltage at the "C" and "+" terminals. Low voltage would indicate an open or a high resistance circuit from the distributor to the coil or ignition switch. If "C" terminal voltage was low, but "+" terminal voltage is 10 volts or more, circuit from "C" terminal to ignition coil or ignition coil primary winding is open.
4. Checks for a shorted module or grounded circuit from the ignition coil to the module. The distributor module should be turned "OFF", so normal voltage should be about 12 volts.
   If the module is turned "ON", the voltage would be low, but above 1 volt. This could cause the ignition coil to fail from excessive heat.
   With an open ignition coil primary winding, a small amount of voltage will leak through the module from the "Batt" to the "tach" terminal.
5. Applying a voltage (1.5 to 8 volts) to module terminal "P" should turn the module "ON" and the "tach" terminal voltage should drop to about 7-9 volts. This test will determine whether the module or coil is faulty or if the pick-up coil is not generating the proper signal to turn the module "ON." This test can be performed by using a DC battery with a rating of 1.5 to 8 volts. The use of the test light is mainly to allow the "P" terminal to be probed more easily. Some digital multi-meters can also be used to trigger the module by selecting ohms, usually the diode position. In this position the meter may have a voltage across it's terminals which can be used to trigger the module. The voltage in the ohm's position can be checked by using a second meter or by checking the manufacturer's specification of the tool being used.
6. This should turn "OFF" the module and cause a spark. If no spark occurs, the fault is most likely in the ignition coil because most module problems would have been found before this point in the procedure. A module tester could determine which is at fault.

IGNITION SYSTEM CHECK

(REMOTE COIL/SEALED MODULE CONNECTOR DISTRIBUTOR) ALL VEHICLES WITH 4L80-E TRANSMISSION

1
- Perform System Check before proceeding with this test. (If a tachometer is connected to the Tach term., disconnect it before proceeding with the test).
- Check spark at plug with spark tester J-26792 or equivalent (ST-125) while cranking (if no spark on one wire, check a second wire) A few sparks and then nothing is considered no spark.

No Spark → **1A**
- Disconnect 4 term. distributor connector and check for spark.

Spark → Check fuel,spark plugs, etc. See Section 2 symptoms.

(1A) **No spark** → **2**
- Check for spark at coil wire with tester while cranking. (Leave spark tester connected to coil wire for Steps 3-6).

(1A) **Spark** → Replace pick-up coil

(2) **No Spark** → **3**
- Disconnect distributor 2 term. "C / + " connector.
- Ignition switch "on", Engine stopped.
- Check volts at " + " and "C" term's. of dist. harn. conn.

(2) **Spark** → Inspect cap for water, cracks, etc. If OK, replace rotor.

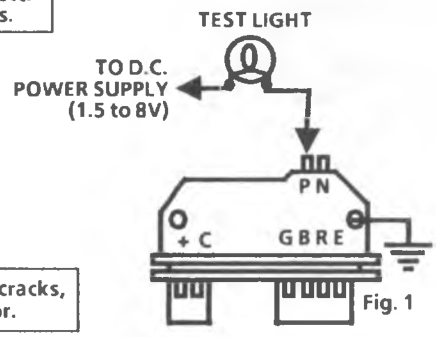


Fig. 1

(3) **Both term's. 10 volts or more** → **4**
- Reconnect dist. 2 term. conn.
- With ign. "ON", check voltage from tach. term. to gnd. (term. may be taped back in harness).

(3) **Both term's. under 10 volts** → Repair wire from module " + " term. to "B" term. of black Ign. coil connector or primary ckt. to ign. sw.

(3) **Under 10 volts "C" term. only** → Check for open or gnd. in ckt. from "C" term. to ign. coil. If Ckt. is OK, fault is. ign. coil or conn..

(4) **Over10 volts**
- Connect test light from tach. term. to ground.
- Crank engine and observe light.

(4) **Under 1 volt** → Repair open tach. lead or conn and repeat test #4.

(4) **1 to 10 volts** → Replace module and check for spark from coil as in Step 6.
- **Spark** → System OK
- **No Spark** → Replace ign. coil, it too is faulty

Light on steady → **5**
- Disconnect distributor 4 term. connector.
- Remove dist. cap.
- Disconnect pick-up coil connector from module.
- Connect voltmeter from tach. term. to ground.
- Ignition on.
- Insulate a test light probe to 1/4" from tip and note voltage, as test light is momentarily connected from a voltage source (1.5 to 8V) to module term. "P". (Fig. 1).

Light blinks → Replace ignition coil and recheck for spark with spark tester. If still no spark, re-install original coil and replace dist. module..

(5) **Voltage drops** → **6**
- Check for spark from coil wire with spark tester as test light is removed from module term.

(5) **No drop in voltage** → Check module ground. If OK, replace module.

(6) **No Spark**
- If no module tester (J24642) is available; Replace ign. coil and repeat Step 5.
  - **No Spark** → Ign. coil removed is OK, reinstall coil and check coil wire from dist. cap. if OK, replace dist. module.
  - **Spark** → System OK
- If module tester (J24642) is available: test module
  - **OK** → Check coil wire from cap to coil. If OK, replace coil.
  - **Not OK** → Replace module

(6) **Spark**
- Is rotating pole piece still magnetized?
  - **Yes** → Check pick-up coil conns. Check pick-up coil (Coil resistance should be 500-1500 ohms and not grounded).
  - **No** → Replace pole piece and shaft assy.

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EST SYSTEM

Refer to ENGINE ELECTRICAL (SECTION 6D) for replacement of the distributor module.

Refer to "Computer Command Control," Section "3" for repair of the EST wires or connectors.

Refer to "Computer Command Control," Section "3" for replacement of the ECM.

PARTS INFORMATION

PART NAME	GROUP
Distributor	2.361
Module, Distr	2.383
Coil, Distr	2.170

SECTION 7

ELECTRONIC SPARK CONTROL (ESC)

ALL ENGINES EXCEPT 2.5L

CONTENTS

GENERAL DESCRIPTION

PURPOSE

The Electronic Spark Control (ESC) system is designed to retard spark timing up to 10° - 20° to reduce spark knock (detonation) in the engine. This allows the engine to use maximum spark advance to improve driveability and fuel economy.

Varying octane levels in today's gasoline can cause detonation in an engine. Detonation is called spark knock.

OPERATION
All Except Vehicles With 4L80-E Transmission

The ESC system has three components:

- ESC Module
- ESC Knock Sensor
- ECM

The ESC knock sensor (Figure 7-1) detects abnormal vibration (spark knocking) in the engine. The sensor is mounted in the engine block near the cylinders (Figures 7-2 or 7-3). The ESC module receives the knock sensor information and sends a signal to the ECM. The ECM then adjusts the Electronic Spark Timing (EST) to reduce spark knocking.

The ESC module (Figures 7-4 through 7-6) sends a voltage signal (8 to 10 volts) to the ECM when no spark knocking is detected by the ESC knock sensor, and the ECM provides normal spark advance.

When the knock sensor detects spark knock, the module turns "OFF" the circuit to the ECM. The ECM then retards EST to reduce spark knock.

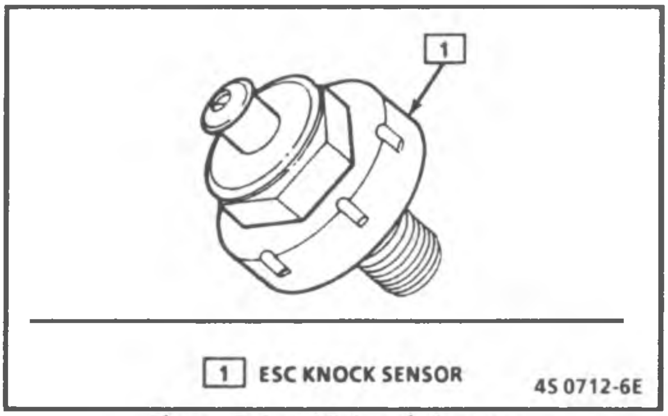


Figure 7-1 - ESC Knock Sensor

OPERATION
Vehicles With 4L80-E Transmission

On vehicles equipped with the 4L80-E transmission, a Powertrain Control Module (PCM) is used. The PCM has an integrated ESC module, so on this system there are only three components. Those components are the knock sensor, powertrain control module, and the wire inbetween.

A 5 volt reference is applied to the knock sensor which has an internal resistance of about 3500 ohms. This resistance will lower the applied voltage to about half or 2.5 volts. When a knock is present, a small AC voltage is produced by the knock sensor and transmitted to the PCM riding on top of the already existing 2.5 volts. An AC voltage monitor inside the PCM will detect the knock and trigger the PCM to start retarding the spark incrementally.

DIAGNOSIS

All Except Vehicles With 4L80-E Transmission

Loss of the ESC knock sensor signal or loss of ground at ESC module would cause the signal to the ECM to remain high. This condition would cause the ECM to control EST as if there was no spark knock. No retard would occur, and spark knocking could become severe under heavy engine load conditions.

Spark retard without the knock sensor connected could indicate a noise signal on the wire to the ECM or a malfunctioning ESC module.

Loss of the ESC signal to the ECM would cause the ECM to constantly retard EST. This could result in sluggish performance and cause a Code 43 to be set.

When no Code 43 is present but the ESC system is a possible cause of excessive spark knock, refer to diagnosis chart for ESC system check.

DIAGNOSIS

All Vehicles With 4L80-E Transmission

Two separate diagnostic checks are performed by the PCM. The first check merely monitors the voltage on the ESC circuit and if the voltage is below about .04 or over about 4.6 volts, Code 43 will be set. The second check, is a system performance check. During the course of operation, the PCM will begin advancing the timing in increments while anticipating a knock signal. If no knock signal appears after the self check has been performed twice, Code 43 will be set.

CODE 43
All Except Vehicles with 4L80-E Transmission

Code 43 indicates that the ECM is receiving less than 6 volts for a 4 second period with the engine running. If code is present, refer to Code 43 chart in "Computer Command Control," Section "3".

CODE 43
All Vehicles with 4L80-E Transmission

Code 43 means that either voltage on CKT 496 is too high or too low or that the ESC system has failed the self check at least twice.

ON-VEHICLE SERVICE

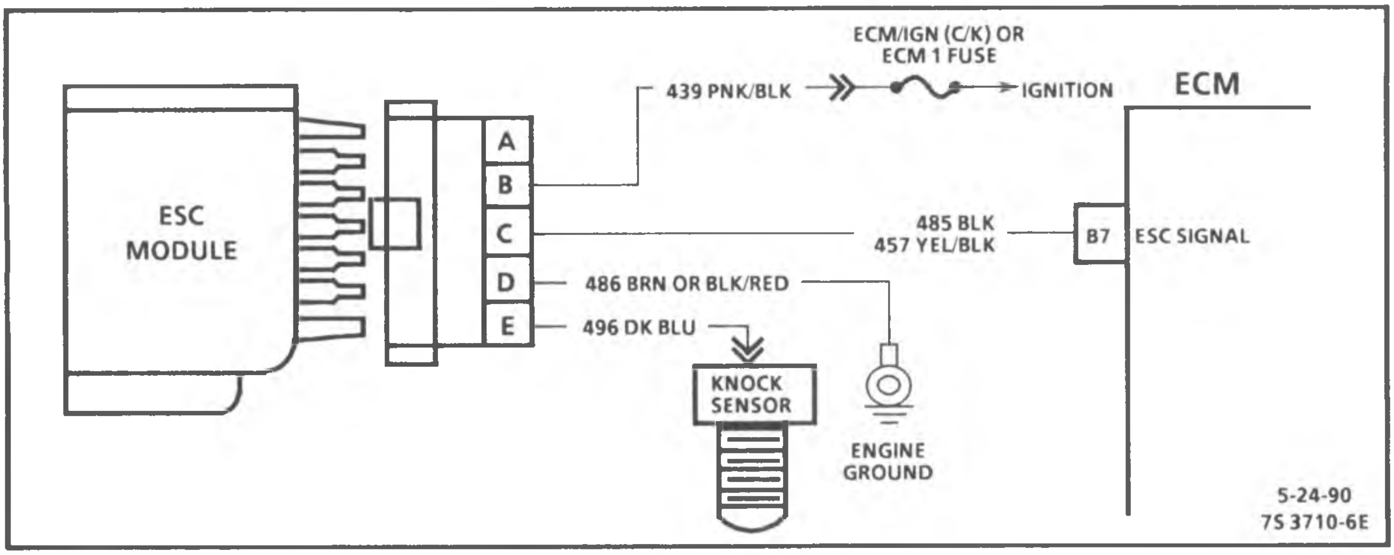
ESC KNOCK SENSOR
Figures 7-2 or 7-3

The ESC knock sensor is located on the left side of the engine block, below the spark plugs for the 4.3L except S/T Series, which is located on the top left rear of the transmission mounting flange, and the right side of the engine block for the 2.8L, 5.0L, 5.7L and 7.4L engines.

↔ Remove or Disconnect

1. Negative battery cable.
2. Wiring harness connector from ESC knock sensor.
3. ESC knock sensor from engine block.

BLANK



ELECTRONIC SPARK CONTROL (ESC) SYSTEM CHECK

ALL ENGINES EXCEPT 2.5L AND VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

Electronic Spark Control (ESC) is accomplished with a module that sends a voltage signal to the ECM. As the knock sensor detects engine knock, the voltage from the ESC module to the ECM is shut "OFF" and this signals the ECM to retard timing, if engine rpm is over about 900.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. If a Code 43 is not set, but a knock signal is indicated while running at 1500 rpm, listen for an internal engine noise. Under a no load condition there should not be any detonation, and if knock is indicated, an internal engine problem may exist.
2. Usually a knock signal can be generated by tapping on the right exhaust manifold. This test can also be performed at idle. Test Number 1 was run at 1500 rpm to determine if a constant knock signal was present, which would affect engine performance.
3. This tests whether the knock signal is due to the sensor, a basic engine problem, or the ESC module.
4. If the module ground circuit is faulty, the ESC module will not function correctly. The test light should light indicating the ground circuit is OK.
5. Contacting CKT 496, with a test light to 12 volts, should generate a knock signal to determine whether the knock sensor is faulty, or the ESC module can't recognize a knock signal.

Diagnostic Aids:

"Scan" tools may be used to diagnose the ESC system. The knock signal can be monitored to see if the knock sensor is detecting a knock condition and if the ESC module is functioning, knock signal should display "YES," whenever detonation is present. For 2.5L engines, the knock retard position on the "Scan" displays the amount of spark retard the ECM is commanding. The ECM can retard the timing up to 20 degrees.

If the ESC system checks OK, but detonation is the complaint, refer to "Detonation/Spark Knock" in "Driveability Symptoms," Section "2".

This check should be used after other causes of spark knock have been checked such as engine timing, EGR systems, engine temperature or excessive engine noise.

ELECTRONIC SPARK CONTROL (ESC) SYSTEM CHECK

ALL ENGINES EXCEPT 2.5L AND VEHICLES WITH 4L80-E TRANSMISSION

1
- THIS CHART ASSUMES CODE 43 IS NOT PRESENT. IF A CODE 43 WAS SET, USE THAT CHART FIRST.
- "SCAN" TOOL SET ON KNOCK SIGNAL.
- ENGINE RUNNING AT ABOUT 1500 RPM.
- IS THERE A KNOCK SIGNAL INDICATED?

NO

2
- ENGINE RUNNING AT 1500 RPM.
- TAP ENGINE BLOCK IN AREA OF KNOCK SENSOR.
- DOES "SCAN" INDICATE A KNOCK SIGNAL WHILE TAPPING ON ENGINE?

YES

3
- DISCONNECT KNOCK SENSOR.
- REPEAT TEST.
- IS THERE A KNOCK SIGNAL INDICATED?

YES

CHECK FOR ROUTING OF WIRE FROM KNOCK SENSOR TO ESC MODULE FOR PICKING UP FALSE KNOCK SIGNALS FROM AN ADJACENT WIRE. REROUTE AS NECESSARY. IF ROUTING IS CORRECT, REPLACE ESC MODULE.

NO

INTERNAL ENGINE KNOCK OR FAULTY SENSOR.

NO

4
- DISCONNECT ESC MODULE.
- PROBE HARNESS TERM. "D" (CKT 486) WITH A TEST LIGHT TO 12 V.

YES

ESC SYSTEM OK.

LIGHT "ON"

5
- RECONNECT ESC MODULE.
- DISCONNECT KNOCK SENSOR.
- ENGINE IDLING.
- MOMENTARILY TOUCH KNOCK SENSOR HARNESS (CKT 496) WITH A TEST LIGHT TO 12V.
- EACH TIME THE TEST LIGHT CONTACTS CKT 496, A KNOCK SIGNAL SHOULD BE GENERATED.
- IS A KNOCK SIGNAL INDICATED WITH "SCAN"?

LIGHT "OFF"

REPAIR OPEN GND CKT 486.

YES

FAULTY CONNECTION AT SENSOR OR FAULTY KNOCK SENSOR.

NO

CKT 496 OPEN, SHORTED TO GROUND, FAULTY CONNECTION AT ESC MODULE, OR FAULTY ESC MODULE.

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

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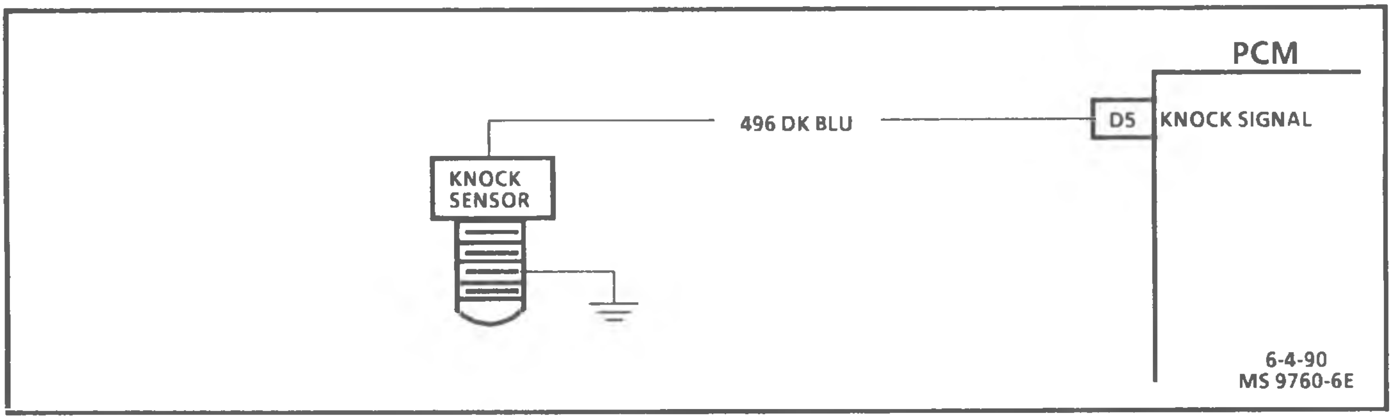
7S 3711



ELECTRONIC SPARK CONTROL (ESC) SYSTEM CHECK

ALL VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The Code 43 circuit consists of a knock sensor with one wire that goes directly to the PCM. There are two Code 43 checks performed by the PCM. One check consists of monitoring CKT 496 for a voltage that is more than .04 volt and less than 4.6 volts.

If voltage is either too high or too low for 16 or more seconds, Code 43 will set. Once engine temperature reaches 87.5°C or more but not over 104°C, and MAP and engine speed are below 81 kPa and 3200 rpm respectively, the PCM will perform a self check by advancing the timing incrementally while anticipating a knock signal. If no knock signal is received during two consecutive tests, Code 43 will be set.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. The first test is to determine if the system is functioning at the present time.
2. Test two determines the state of the 5 volt reference voltage applied to the knock sensor circuit.

Diagnostic Aids:

The PCM applies 5 volts to CKT 496. A 3500 ohm resistor in the knock sensor reduces the voltage to about 2.5 volts. When knock occurs, the knock sensor produces a small AC voltage that rides on top of the 2.5 volts already applied. An AC voltage monitor, in the PCM, is able to read this signal as knock and incrementally retard spark.

For further information, refer to "Driveability Symptoms," Section "2," "PCM/ECM Intermittent Codes or Performance."

ELECTRONIC SPARK CONTROL (ESC) SYSTEM CHECK

ALL VEHICLES WITH 4L80-E TRANSMISSION

1
- ENGINE IDLING.
- ENGINE TEMP ABOVE 70°.
- SCAN ON KNOCK SIGNAL.
- TAP ON ENGINE NEAR KNOCK SENSOR.

IS THERE A KNOCK SIGNAL?

NO

2
- ENGINE IDLING.
- WITH A DVOM MEASURE VOLTAGE FROM PCM CKT 496 AT PCM TO GROUND.

5.0 VOLTS

- REMOVE KNOCK SENSOR CONNECTOR.
- WITH AN OHMMETER, CHECK RESISTANCE BETWEEN KNOCK SENSOR TERMINAL AND ENGINE BLOCK.

SHOULD BE 3300 TO 4500 Ω.
IS IT?

YES

FAULTY CONNECTION AT KNOCK SENSOR OR OPEN CKT 496.

NO

FAULTY KNOCK SENSOR.

2.3 - 2.8 VOLTS

REMOVE KNOCK SENSOR CONNECTOR WITH AN OHMMETER CHECK RESISTANCE FROM KNOCK SENSOR TERMINAL TO ENGINE BLOCK.
SHOULD BE 3300 TO 4500 OHMS.
IS IT?

YES

FAULTY MEM-CAL OR PCM.

NO

REPLACE KNOCK SENSOR.

.4 VOLT OR LESS

REMOVE KNOCK SENSOR CONNECTOR.
DOES VOLTAGE GO UP TO 5V?

NO

SHORTED CKT 496 OR FAULTY PCM.

YES

FAULTY KNOCK SENSOR.

YES

PROBLEM IS INTERMITTENT. SEE "DIAGNOSTIC AIDS" ON FACING PAGE..

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

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MS 10044-6E

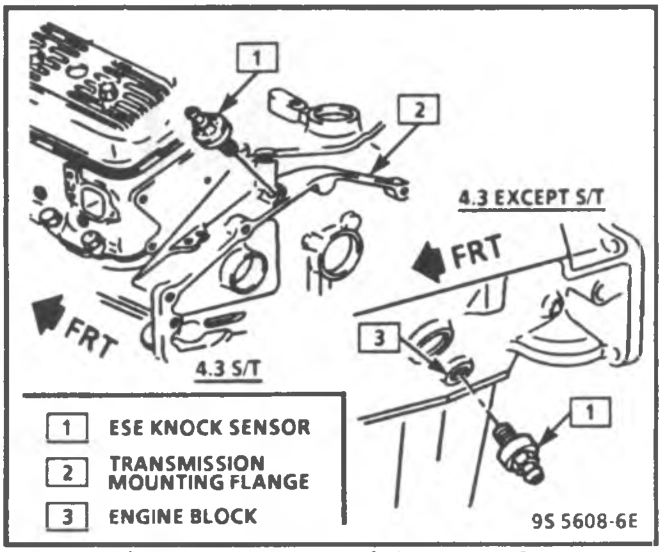


Figure 7-2 - ESE Knock Sensor - 4.3L

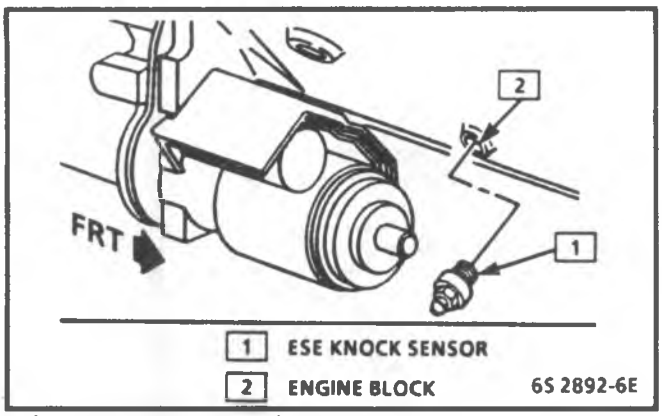


Figure 7-3 - ESC Knock Sensor - 2.8L, 5.0L, 5.7L, 7.4L

Install or Connect

1. Knock sensor into engine block. Apply water base caulk to sensor threads. Do not use silicon tape as this will insulate sensor from the engine block.
   - Tighten to 19 N·m (14 lb. ft.)
2. ESC wiring harness connector to the ESC knock sensor.
3. Negative battery cable.

ESC MODULE AND BRACKET
Figures 7-4 through 7-6

Remove or Disconnect

1. ESC module connector.
2. Attaching screws.
3. ESC module.

Install or Connect

1. ESC module.
2. Attaching screws.
3. ESC module connector.

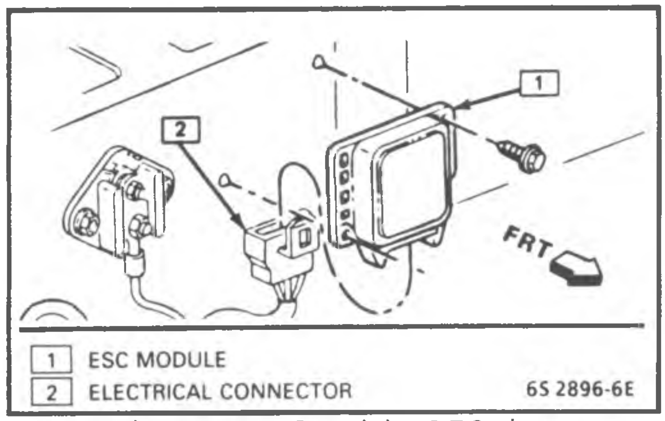


Figure 7-4 - ESC Module - S/T Series

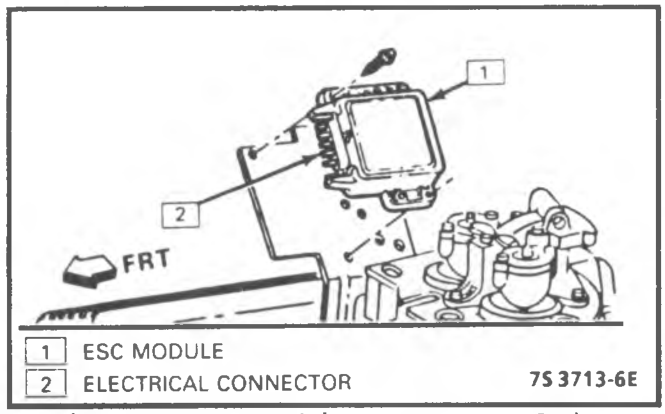


Figure 7-5 - ESC Module - C/K, R/V, M, P Series

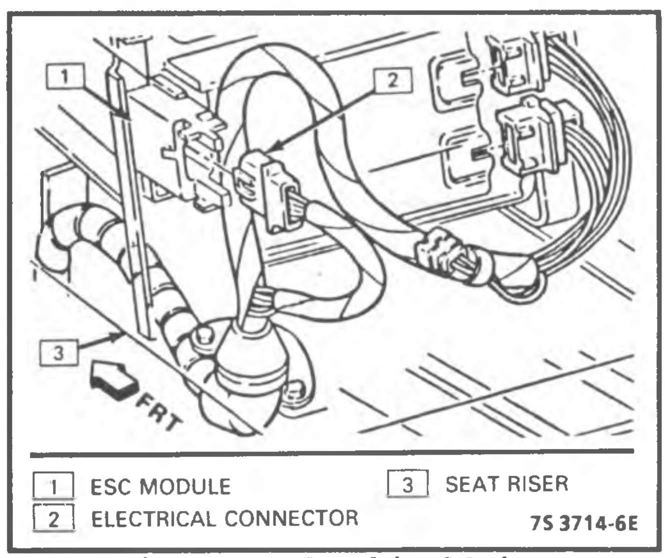


Figure 7-6 - ESC Module - G Series

PARTS INFORMATION

PART NAME	GROUP
Sensor, ESC Knock	3.682
Module, Elek Spark Cont	2.383
Bracket, Elek Spark Cont Md	2.383
Shield, Elek Spark Cont Knock	2.383

SECTION 8
AIR MANAGEMENT SYSTEM

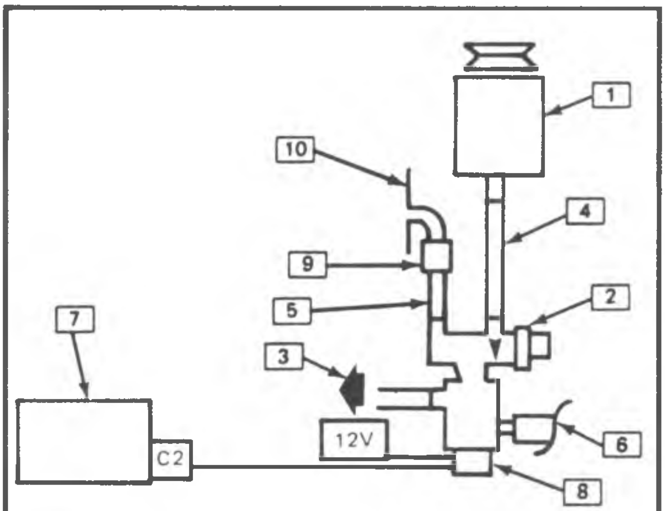
CONTENTS

GENERAL DESCRIPTION

PURPOSE

The air management system is used on some engines to reduce carbon monoxide and hydrocarbon emissions on some engines.

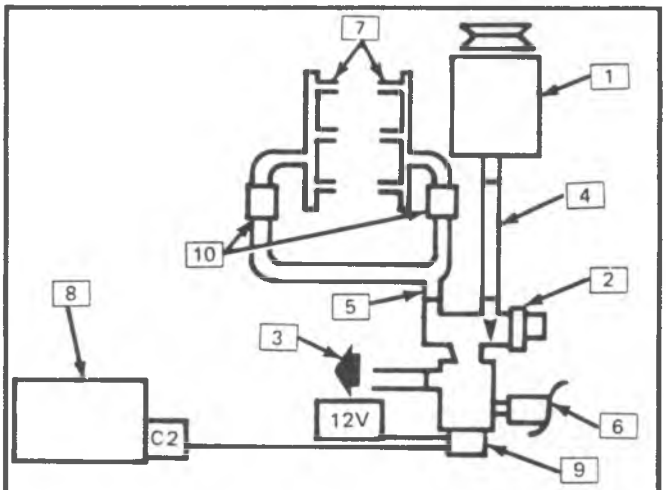
This system, Air Injection Reaction (AIR), under certain conditions, adds air (Oxygen) to the exhaust manifold to continue oxidation after the exhaust gases leave the combustion chamber. The heat from this reaction brings the catalytic converter up to operating temperature more quickly when the engine is cold.



1 AIR PUMP
2 EAC VALVE
3 AIR TO AIR CLEANER
4 AIR TO EAC VALVE
5 AIR TO EXHAUST PORT
6 MANIFOLD VACUUM SIGNAL
7 ECM
8 EAC SOLENOID
9 CHECK VALVE
10 EXHAUST MANIFOLD

6S 3040-6E

Figure 8-1 - AIR System 2.8L



1 AIR PUMP
2 EAC VALVE
3 AIR TO AIR CLEANER
4 AIR TO EAC VALVE
5 AIR TO EXHAUST PORTS
6 MANIFOLD VACUUM SIGNAL
7 AIR INJECTION PIPES (7.4L SHOWN. 4.3L, 5.0L AND 5.7L HAVE ONE INLET PIPE AT THE FRONT OF EACH MANIFOLD)
8 ECM
9 EAC SOLENOID
10 CHECK VALVES

6S 2714 -6E

Figure 8-2 - AIR System 4.3L & V8

AIR SYSTEM OPERATION

This system consists of an air pump, an (electric) air control valve with solenoid, check valve(s), and necessary plumbing.

A belt driven air pump supplies air through a centrifugal filter fan to the Electric Air Control (EAC) valve 2.8L (Figure 8-3) or an electric air control valve with relief tube (ECT) 4.3L and V8 (Figure 8-4). The shape of the centrifugal filter fan blades and the direction of fan rotation prevents foreign material from entering the pump with the incoming air. The EAC or ECT valve, directs the air to either the engine exhaust manifold ports or to the air cleaner.

When the engine is started with a coolant temperature above approximately 15°C, the ECM energizes the solenoid on the Air Control Valve which directs air to the exhaust manifold ports.

At higher engine speeds, air can be redirected to the air cleaner b the pressure relief valve even though the solenoid is energized.

Air can also be directed to the air cleaner because of:

- Low manifold pressure (overrun)
  OR
- Quick vacuum rise (rapid decel)
  OR
- Rich engine condition

The solenoid id de-energized and air is directed to the air cleaner, under the following conditions:

- If the engine coolant temperature is too low
  OR
- If the throttle si opened to power enrichment for more than a short time
  OR
- If the system is in "Closed Loop" mode
  OR
- If the "Service Engine Soon" lamp is "ON"

Some applications will switch air to the ports for a short time when entering power enrichment. Also, note:

- Some applications have a "Closed Loop" idle with air directed to the air cleaner.
- Some applications idle with air directed to the exhaust port (S).

The air cleaner acts as a silencer for diverted air. The check valve, on the air injection pipe, prevents back flow of the exhaust gases into the air pump.

DIAGNOSIS

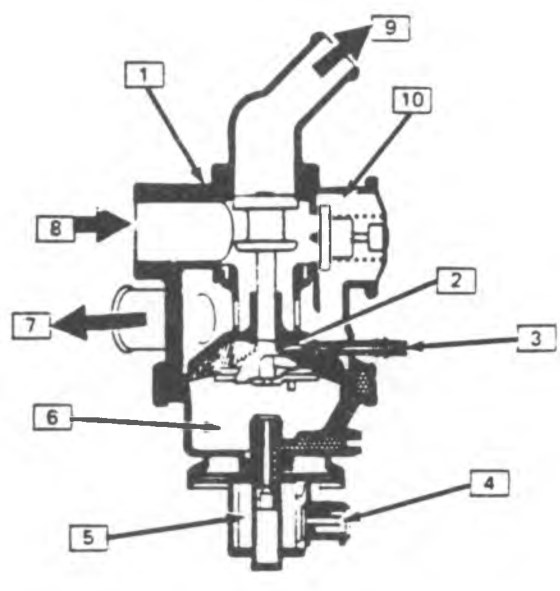
AIR SYSTEM

Refer to "Air Management Check" chart for the diagnosis of the AIR system.

> **NOTICE:** If the engine or underhood compartment is to be cleaned with steam or high-pressure detergent, the centrifugal filter fan should be masked off to prevent liquids from entering the pump.

Air flowing to the exhaust ports at wrong times could cause a false lean O_2 indication and cause the ECM to add extra fuel. This will result in increased catalytic converter temperature, because more fuel and air will be oxidizing in the converted.

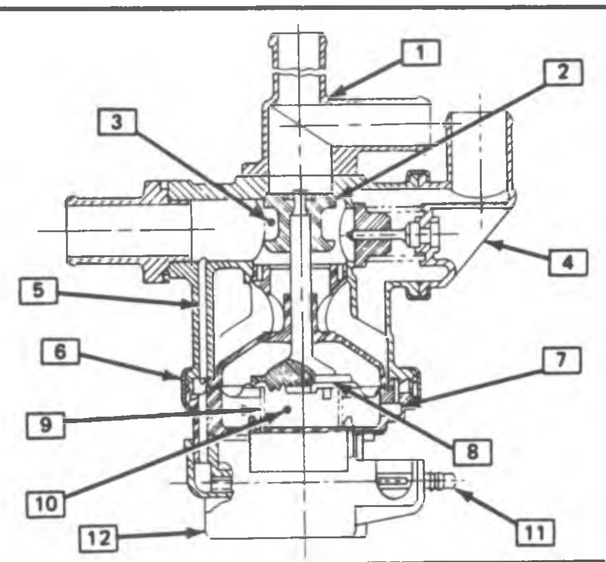
The AIR system is not completely noiseless. Under normal conditions, noise rises in pitch as engine speed increases.



1 ELECTRIC AIR CONTROL (EAC) VALVE
2 DECEL TIMING ASSEMBLY
3 MANIFOLD VACUUM SIGNAL TUBE
4 ELECTRICAL TERMINAL
5 EAC SOLENOID
6 DECEL TIMING CHAMBER
7 AIR TO AIR CLEANER
8 AIR FROM AIR PUMP
9 AIR TO EXHAUST PORTS OR MANIFOLD
10 PRESSURE RELIEF ASSEMBLY

6S 2609-6E

Figure 8-3 - EAC Valve



1 ELECTRIC AIR CONTROL VALVE WITH RELIEF TUBE
2 OUTLET SEAT
3 METERING VALVE CHAMBER
4 RELIEF VALVE & BODY ASM
5 PRESSURE PASSAGE
6 BAND — CLAMP
7 DIVERT ASSIST ORIFICE
8 DIAPHRAGM & GUIDE ASSEMBLY
9 DIAPHRAGM SPRING
10 VACUUM CHAMBER
11 MANIFOLD VACUUM SIGNAL TUBE
12 DIAPHRAGM COVER ASSEMBLY

7S 3613-6E

Figure 8-4 - ECT Valve

If noise is caused by the AIR system, check for:

- A seized air pump.
- Proper mounting and bolt torque of pump.
- Proper routing and connections of hoses.

NOTICE: Do Not oil air pump.

- Replace pump if there is excessive noise.

Air Pump

The air pump is a positive displacement vane type which is permanently lubricated and requires no periodic maintenance.

Accelerate engine to approximately 1500 rpm and observe air flow from hose. If air flow increases as engine is accelerated, pump is operating satisfactorily. If air flow does not increase or is not present, proceed as follows:

Inspect

1. For proper drive belt tension.
2. For a leaky pressure relief valve. Air may be heard leaking with the pump running.

Check Valve

Inspect

1. A check valve should be inspected whenever the hose is disconnected from it or whenever check valve failure is suspected (A pump that had become inoperative and had shown indications of having exhaust gases in the pump would indicate check valve failure).
2. Remove the check valve.
3. Blow through the check valve toward the exhaust manifold side. Air should pass freely. Turn the valve around and attempt to blow through the valve toward the air pump side. No air should pass through the valve.
4. Replace valve which does not operate properly.

Hoses and Pipes

Inspect

1. Hose or pipe for deterioration or holes.
2. All hoses or pipe connections, and clamp tightness.
3. Hose or pipe routing. Interference may cause wear.
4. If a leak is suspected on the pressure side of the system, or if a hose or pipe has been disconnected on the pressure side, the connections should be checked for leaks with a soapy water solution. With the pump running, bubbles will form if a leak exists.

ON-VEHICLE SERVICE

DRIVE BELT

Remove or Disconnect

- Refer to ENGINE COOLING (SECTION 6B1) of the appropriate service manual.

PUMP CENTRIFUGAL FILTER FAN

The centrifugal filter fan should not be cleaned, either with compressed air or solvents.

CAUTION: Centrifugal fan should not be removed from pump unless it is damaged, as removal will destroy the fan.

Before removing fan, note the following:

- Do not allow any filter fragments to enter the air pump intake hole.
- Do not remove filter fan by inserting a screwdriver between pump and filter fan. Damage to pump sealing lip will result.
- Do not remove metal drive hub from filter fan.
- It is seldom possible to remove the filter fan without destroying it.

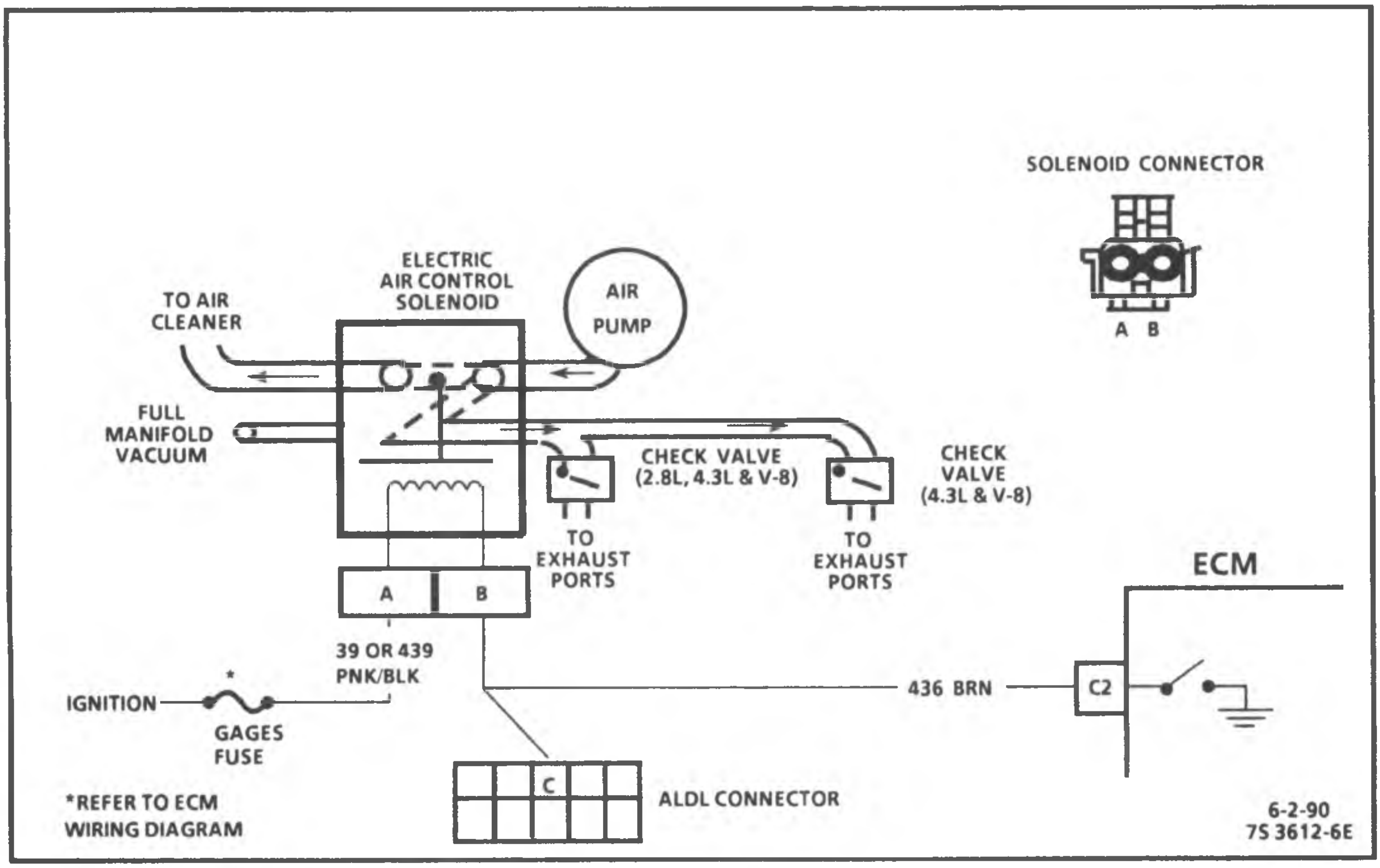
Remove or Disconnect

Figure 8-5

1. Air pump.
2. Pump pulley.
3. Insert needle nose pliers and pull filter fan from pump hub.

Install or Connect

1. New filter fan on pump hub.
2. Spacer and pump pulley against centrifugal filter fan.
3. Pump pulley bolts and tighten equal to torque specifications in Figure 8-6. This will compress the centrifugal filter fan onto the pump hole. Do not drive filter fan on with a hammer. A slight amount of interference with the housing bore is normal. After a new filter fan has been installed, it may squeal upon initial operation or until O.D. of sealing lip has worn in. This may require a short period of pump operation at various engine speeds.
4. Air pump.



AIR MANAGEMENT CHECK

(ELECTRONIC AIR CONTROL VALVE)

Circuit Description:

An electric air control valve solenoid directs air into the exhaust ports or the air cleaner. During cold start the ECM completes the ground circuit, the solenoid is energized, and air is directed to the exhaust ports. As the system goes to "Closed Loop," the ECM opens the ground circuit, the solenoid is de-energized, and air goes to the air cleaner.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This is a system performance test, to be performed if a malfunction is suspected or observed. When the vehicle goes to "Closed Loop," air will switch from the ports and divert to the air cleaner. (Under normal, steady-state condition, and vehicle not at idle.)
2. Tests for a grounded electric divert circuit. Normal system light will be "OFF."
3. Checks for an open control circuit. Grounding diagnostic terminal will energize the solenoid, if ECM and circuits are normal. In this step, if test light is "ON," circuits are normal and fault is in valve connections or valve.
4. Checks for voltage from battery through a fuse to the solenoid.

AIR MANAGEMENT CHECK
(ELECTRONIC AIR CONTROL VALVE)

ASSUMES MANIFOLD VACUUM SIGNAL AT VALVE WITH ENGINE IDLING, AND VOLTAGE ON PIN A WITH IGNITION ON.

1

- IGNITION OFF. DIAGNOSTIC TERMINAL NOT GROUNDED.
- TRANSMISSION IN PARK OR NEUTRAL.
- PARKING BRAKE ENGAGED.
- COOLANT AT NORMAL OPERATING TEMPERATURE (ABOVE 15°.
- DISCONNECT HOSE TO AIR CLEANER. START ENGINE.
- LET VEHICLE IDLE. AIR SHOULD GO TO EXHAUST PORTS.
- RUN AT PART THROTTLE TO WARM UP 02 SENSOR, UNTIL ENGINE GOES CLOSED LOOP. (USE SCAN TOOL TO VERIFY CLOSED LOOP)
- AFTER VEHICLE HAS BEEN IN CLOSED LOOP STATUS FOR AT LEAST 10 SECONDS, MAINTAIN A PART THROTTLE (APPROX. 1500 RPM CONDITION FOR AT LEAST 10 SEC.
- DOES AIR GO TO CLEANER

YES

- AIR MANAGEMENT SYSTEM IS OPERATING PROPERLY.

NO

2

- CONNECT HOSE TO AIR CLEANER.
- DIAGNOSTIC TERMINAL NOT GROUNDED.
- IGNITION "ON" AND ENGINE STOPPED.
- DISCONNECT CONNECTOR FROM VALVE SOLENOID AND CONNECT A TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS. IS THE TEST LIGHT "ON"?

YES

- CHECK FOR GROUNDED WIRE FROM SOLENOID TO ECM.
- IF NOT GROUNDED, REPLACE ECM.

NO

3

- GROUND DIAGNOSTIC TERMINAL.
- IS THE TEST LIGHT "ON"?

YES

- IT IS A FAULTY VALVE SOLENOID CONNECTOR OR SOLENOID. REPLACE EAC VALVE.

NO

4

- CONNECT TEST LIGHT BETWEEN HARNESS TERMINAL "A" TO GROUND.
- IS THE TEST LIGHT "ON"?

NO

- CHECK FOR OPEN FUSE OR OPEN IN WIRE TO IGNITION

YES

- CHECK FOR AN OPEN IN WIRE FROM SOLENOID TO ECM.
- IF OK, CHECK RESISTANCE OF SOLENOID WINDINGS.
- IF UNDER 20 OHMS, REPLACE EAC VALVE AND PERFORM ECM QDR CHECK IN SECTION "3".
- IF OVER 20 OHMS, REPLACE ECM ONLY.

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*6S 2839-6EB

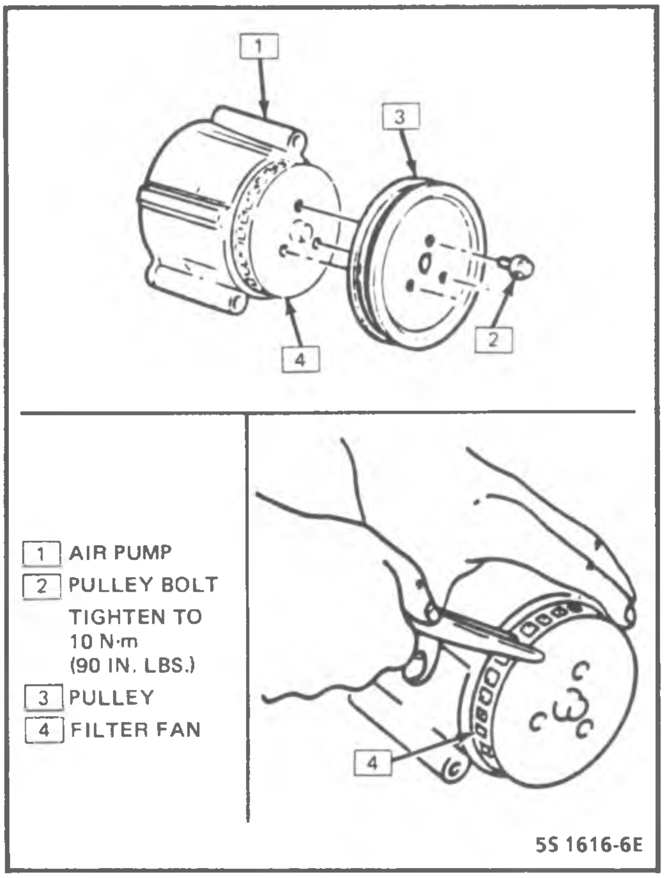


Figure 8-5 - Pump Filter Fan Service

AIR PUMP *Figure 8-6*

Remove or Disconnect

1. Hold pump pulley from turning by compressing drive belt, then loosen pump pulley bolts.
2. Loosen bolt, holding pump to mounting brackets, release tension on drive belts.
3. Move belts out of the way, then remove pump hoses, vacuum and electrical connections, and control valve.
4. Pulley, then pump.
5. If required, insert needle nose pliers and pull filter fan from hub (see Figure 8-5).

Install or Connect

1. Air pump assembly, and tighten mounting bolts.
2. Hose.
3. New filter fan on pump hub.
4. Spacer and pump pulley against centrifugal filter fan.
5. Pump pulley bolts and tighten equally to torque specifications in Figure 8-6. This will compress the centrifugal filter fan onto the pump hole. Do not drive filter fan on with a hammer. A slight amount of interference with the housing bore is normal. After a new filter fan has been installed, it may squeal upon initial operation or until O.D. sealing lip has worn in. This may require a short period of pump operation at various engine speeds.
6. Pump drive belt and adjust.
7. Check air management system for proper operation (see "Air Management Check" chart).

AIR CONTROL VALVE
Figures 8-7 thru 8-10

Remove or Disconnect

1. Battery ground cable.
2. Electrical connector on control valve.
3. Manifold vacuum signal hose.
4. Air inlet and outlet hoses from valve.
5. Control valve.

Install or Connect

1. Control valve.
2. Air inlet and outlet hoses to valve.
3. Manifold vacuum signal hose.
4. Electrical connector on control valve.
5. Battery ground cable.
6. Check system operation (See "Air Management Check" chart).

CHECK VALVE
Figures 8-7 thru 8-10

Remove or Disconnect

1. Any parts required for access.
2. Release clamp and disconnect air hoses from check valve.
3. Unscrew check valve from air injection pipe.

Install or Connect

1. Screw check valve onto air injection pipe.
2. Position air hose on check valve and secure with clamp.
3. Any parts removed for access.

AIR INJECTION PIPE ASSEMBLY

Remove or Disconnect

1. Hose.
2. Check valve.
3. Nuts attaching pipes-to-manifold.
4. Pipe assembly.

Install or Connect

1. Nuts attaching pipes-to-manifold.
2. Check Valve.
3. Hose.

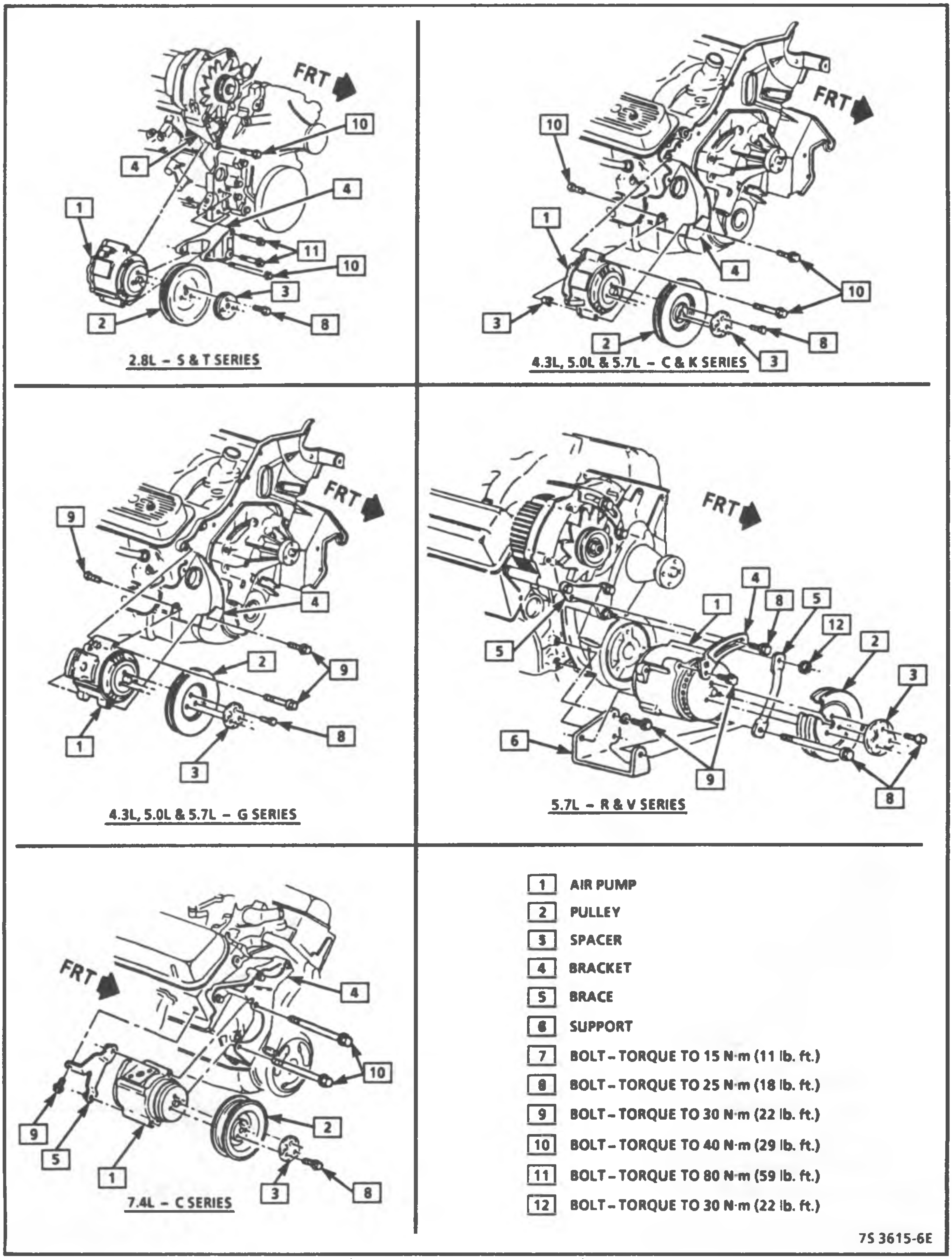
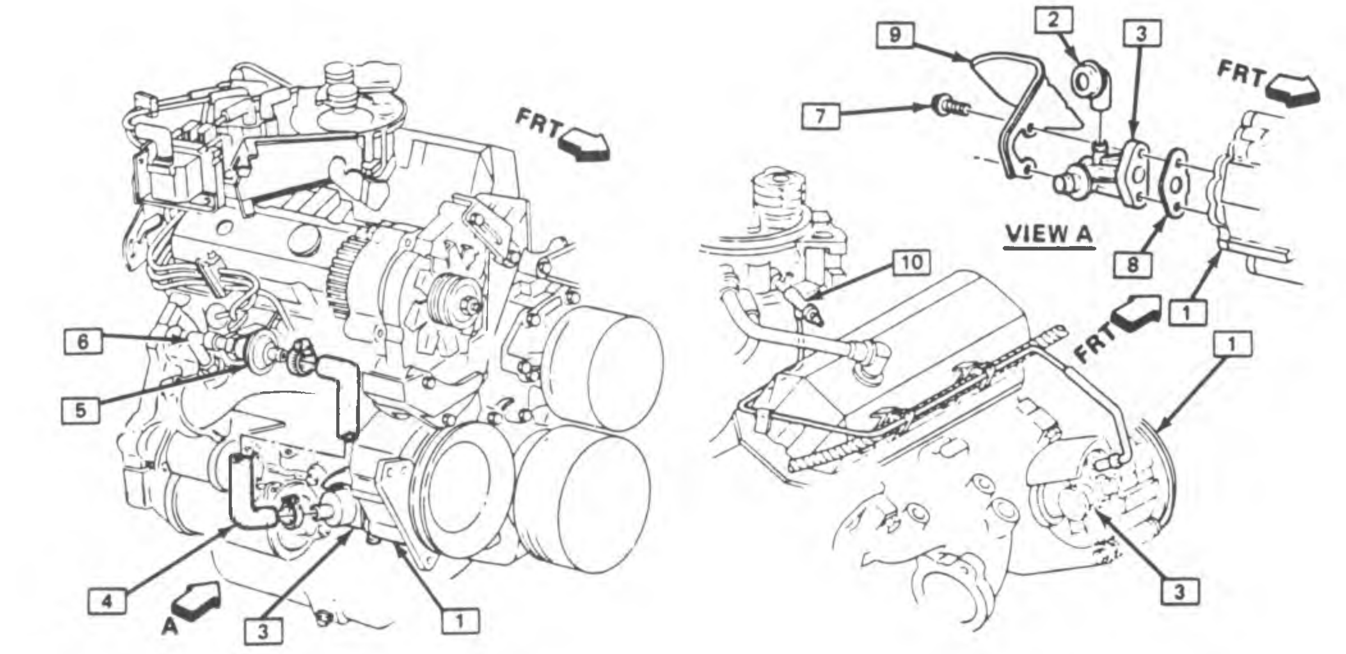


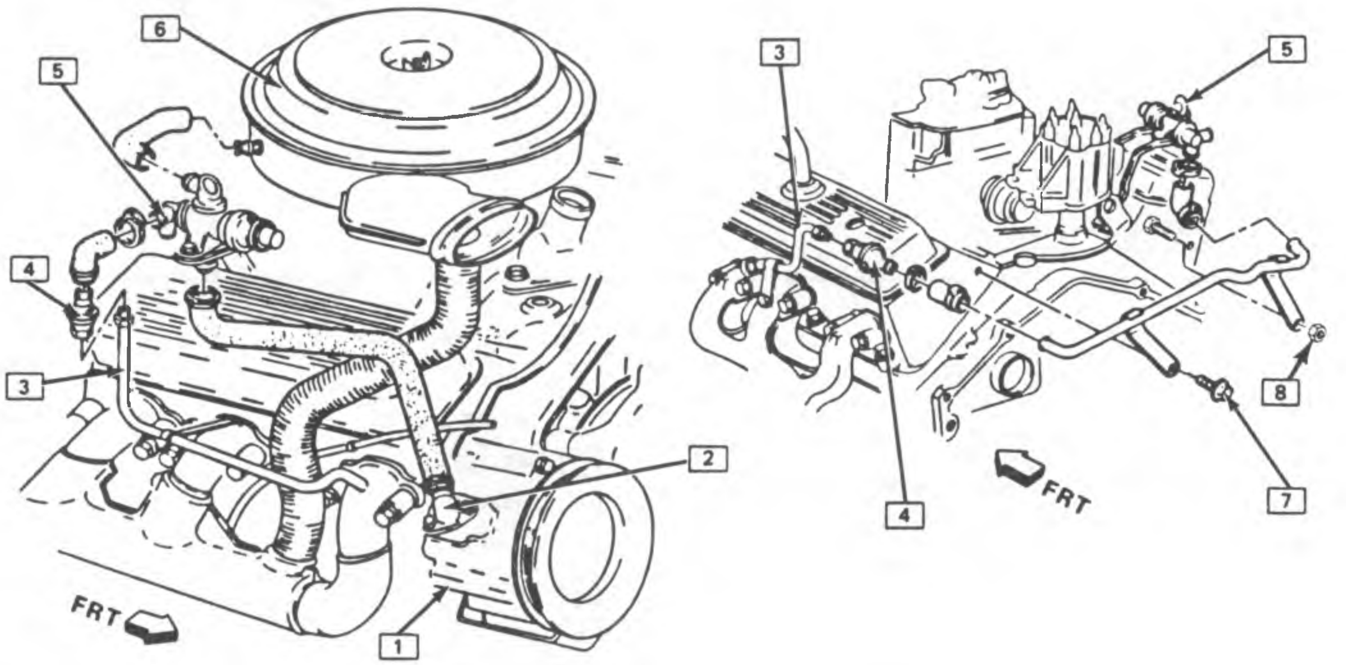
Figure 8-6 - AIR Pump Mounting



1 AIR PUMP	6 AIR INJECTION PIPE — TIGHTEN NUTS TO 28 N·m (20 FT. LBS.)
2 SILENCER	7 BOLT — TIGHTEN TO 15 N·m (11 FT. LBS.)
3 EAC VALVE	8 GASKET
4 HOSE	9 SHIELD
5 CHECK VALVE — TIGHTEN TO 85 N·m (26 FT. LBS.)	10 PORT VACUUM HARNESS

6S 2897-6E

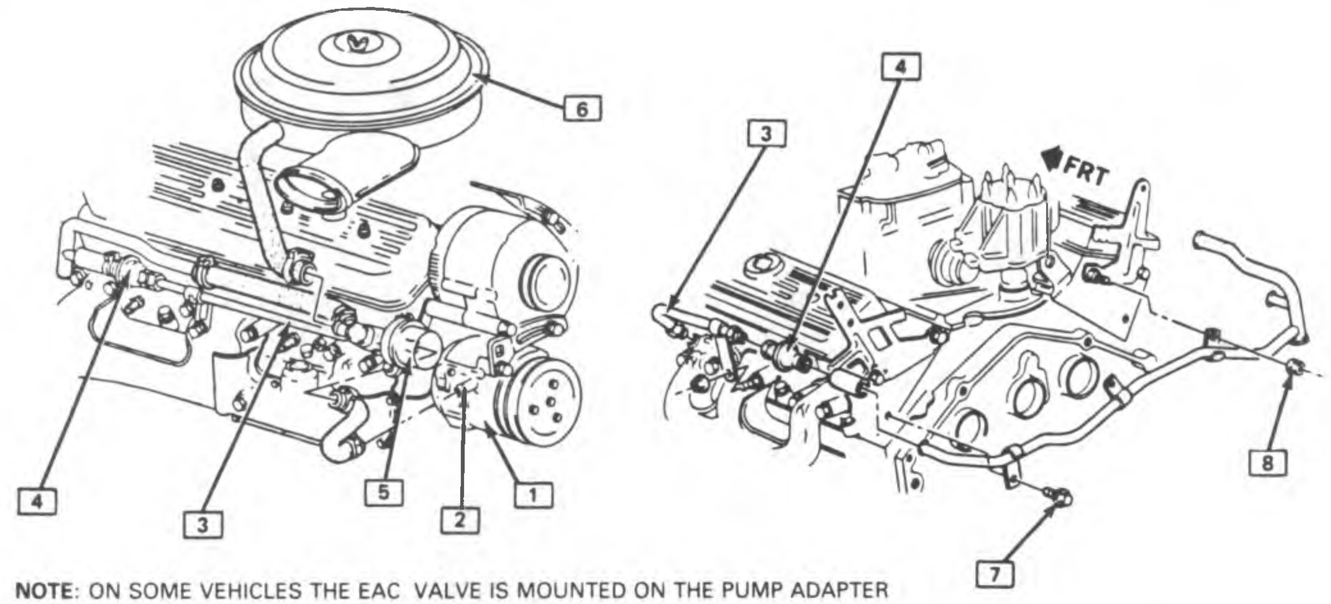
Figure 8-7 - A I R System - 2.8L



1 AIR PUMP	5 DIVERTER VALVE OR EAC VALVE
2 ADAPTER AND SEAL - TIGHTEN SCREWS TO 25 N·m (18 FT. LBS.)	6 AIR CLEANER
3 AIR INJECTION PIPE — TIGHTEN NUTS TO 28 N·m (20 FT. LBS.)	7 BOLT - TIGHTEN TO 34 N·m (25 FT. LBS.)
4 CHECK VALVE - TIGHTEN TO 25 N·m (18 FT. LBS.)	8 NUT-TIGHTEN TO 34 N·m (25 FT. LBS.)

7S 3309-6E

Figure 8-8 - A I R System - 4.3L - G & M Series



NOTE: ON SOME VEHICLES THE EAC VALVE IS MOUNTED ON THE PUMP ADAPTER

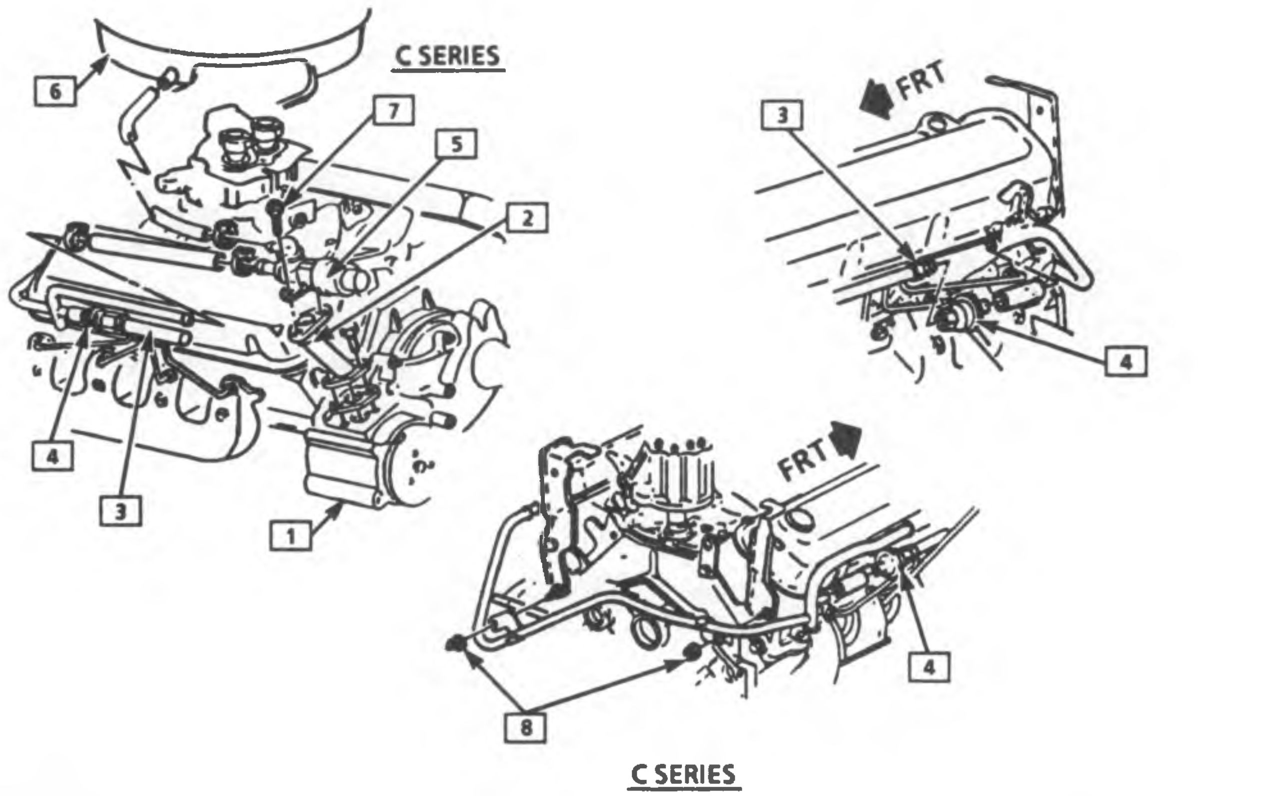
1	AIR PUMP	5	DIVERTER VALVE OR EAC VALVE
2	ADAPTER AND SEAL - TIGHTEN SCREWS TO 25 N·m (18 FT. LBS.)	6	AIR CLEANER
3	AIR INJECTION PIPE — TIGHTEN NUTS TO 28 N·m (20 FT. LBS.)	7	BOLT - TIGHTEN TO 34 N·m (25 FT. LBS.)
4	CHECK VALVE - TIGHTEN TO 35 N·m (26 FT. LBS.)	8	NUT - TIGHTEN TO 34 N·m (25 FT. LBS.)

7S 3412-6E

Figure 8-9 - A I R System - 4.3L, 5.7L - C/K Series

PARTS INFORMATION

PART NAME	GROUP
Adapter, AIR Inj Cont Vlv	3.675
Bracket, AIR Inj Pump Supt	3.655
Bracket, AIR Inj Pump	3.655
Fan, AIR Pump	3.665
Gasket, AIR Inj Dvtr Vlv El	3.680
Harness, AIR Inj Cont Vlv Vac	3.675
Hose, AIR Inj Cont Vlv	3.675
Hose, AIR Inj Cont Vlv Dvtr	3.675
Pulley, AIR Inj Pump	3.650
Pump, AIR Inj	3.660
Valve, AIR Inj Cont	3.670
Valve, AIR Inj Eng Chk	3.670
Valve, AIR Inj Control (Divert)	3.670
Valve, AIR Inj Switching	3.670



1 AIR PUMP

2 ADAPTER AND SEAL – TIGHTEN SCREWS TO 10 N·m (88 lb. in.)

3 AIR INJECTION PIPE – TIGHTEN NUTS TO 28 N·m (20 lb. in.)

4 CHECK VALVE – TIGHTEN TO 25 N·m (18 lb. in.)

5 DIVERTER VALVE OR EAC VALVE

6 AIR CLEANER

7 BOLT – TIGHTEN TO 10 N·m (88 lb. in.)

8 NUT – TIGHTEN TO 34 N·m (5 lb. in.)

7S 3413-6E

Figure 8-10 - A I R System - 7.4L All Series

SECTION 9

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

CONTENTS

GENERAL DESCRIPTION

PURPOSE

The EGR system is used to lower NOx (oxides of nitrogen) emission levels caused by high combustion temperatures. The EGR valve feeds small amounts of exhaust gas back into the combustion chamber to decrease combustion temperature.

The main element of the system is an EGR valve operated by vacuum, and mounted on the intake manifold.

OPERATION

The EGR valve is opened by vacuum to let exhaust gas flow into the intake manifold. The exhaust gas then moves with the air/fuel mixture into the combustion chamber. If too much exhaust gas enters, combustion will not occur. For this reason, very little exhaust gas is allowed to pass through the valve, especially at idle. The EGR valve is usually open under the following conditions:

- Warm engine operation
- Above idle speed

EGR CONTROL

Solenoid 2.5L, 4.3L (M/L, C/K, G, P), 5.0L (C/K), 5.7L (C/K, R/V, G) under 8600 GVW

To regulate EGR flow an ECM controlled solenoid is used in the vacuum line. This is a normally closed solenoid vacuum valve which is opened when the ECM completes the ground. The ECM will energize the EGR solenoid (EGR "ON") when the engine is warm and above idle. There is little EGR flow at wide open throttle due to lack of vacuum.

2.5L only

On cold engine start-up the ECM receives input from the IAT sensor (manifold air temperature), and if the IAT reading is less than 12°C (57°F) the EGR solenoid is "OFF" until the coolant warms to 80°C (176°F). If there is a malfunction of the IAT sensor then the ECM receives input from the coolant sensor.

EVRV 2.8L, 4.3L (S/T), 4.3L, 5.7L (C/K, R/V, P, G) over 8500 GVW, 7.4L (C/K, R/V, P, G)

To regulate EGR flow, an ECM controlled Electronic Vacuum Regulator Valve (EVRV) solenoid is used in the vacuum line. The ECM uses information from the following sensors to regulate the solenoid:

- Coolant Temperature Sensor (CTS)
- Throttle Position Sensor (TPS)
- Park/Neutral (P/N) switch
- Distributor (rpm Signal)

The EGR vacuum control has an EVRV solenoid that uses "pulse width modulation." This means the ECM turns the solenoid "ON" and "OFF" many times a second and varies the amount of "ON" time ("pulse width") to vary the amount of EGR.

TYPES OF EGR VALVES

Two types of EGR valves are used on these engines:

- Port (2.8L, 4.3L, 7.4L & 5.7L over 8500 GVW)
- Negative backpressure (2.5L, 5.0L & 5.7L under 8500 GVW).

Negative Backpressure EGR Valve
Figure 9-1

The negative backpressure EGR valve has the bleed valve spring below the diaphragm, and the valve is normally closed. The negative backpressure valve varies the amount of exhaust gas flow into the manifold depending on manifold vacuum and variations in exhaust back pressure.

The diaphragm on this valve has an internal air bleed hole which is held closed by a small spring when there is no exhaust backpressure.

Engine vacuum opens the EGR valve against the pressure of a large spring. When manifold vacuum combines with negative exhaust backpressure, the vacuum bleed hole opens and the EGR valve closes.

This valve will open if vacuum is applied with the engine not running.

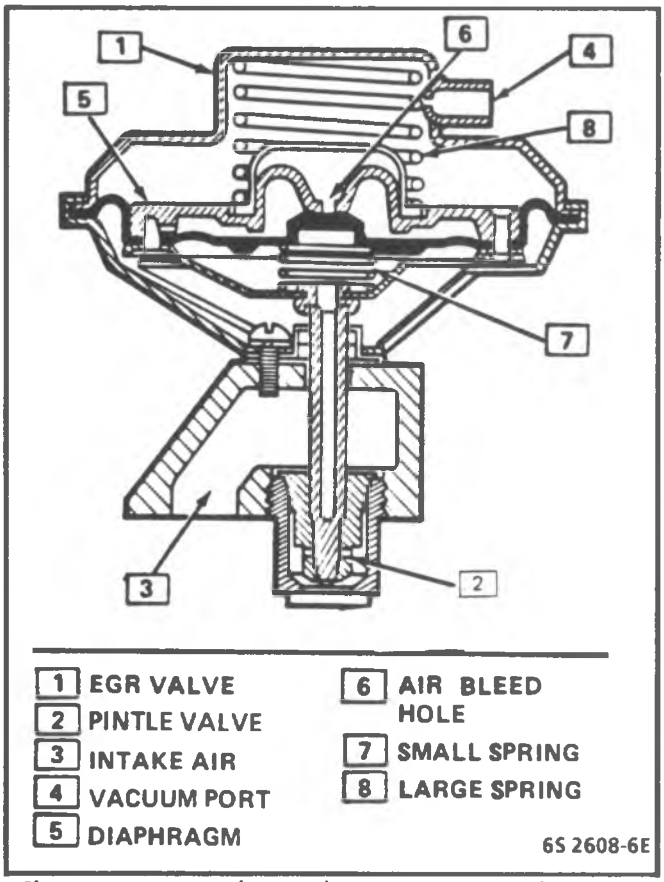


Figure 9-1 - Negative Backpressure EGR Valve 2.5L, 5.0L & 5.7L (under 8600 GVW)

Port EGR Valve
Figure 9-2

This valve is controlled by a flexible diaphragm which is spring loaded to hold the valve closed. Vacuum applied to the top side of the diaphragm overcomes the spring pressure and opens the valve in the exhaust gas port. This allows exhaust gas to be pulled into the intake manifold and enter the engine cylinders.

EGR VALVE IDENTIFICATION
Figure 9-4

- Positive backpressure EGR valves will have a "P" stamped on the top side of the valve after the part number.

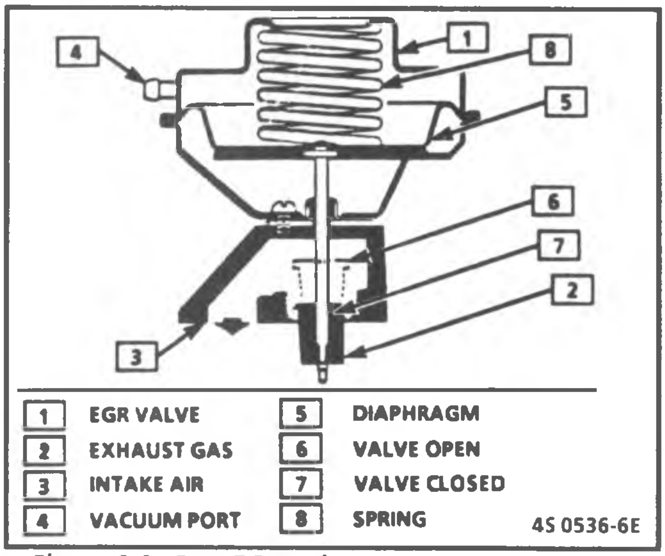


Figure 9-2 - Port EGR Valve 2.8L, 4.3L, 7.4L & 5.7L (over 8500 GVW)

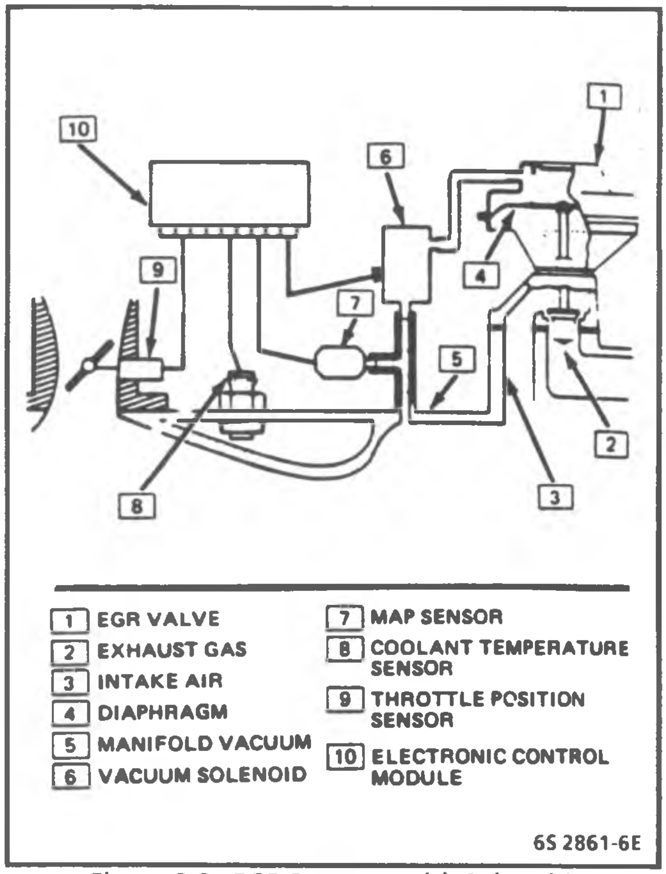


Figure 9-3 - EGR System - with Solenoid

- Negative backpressure EGR valves will have a "N" stamped on the top side of the valve after the part number.
- Port EGR valves have no identification stamped after the part number.

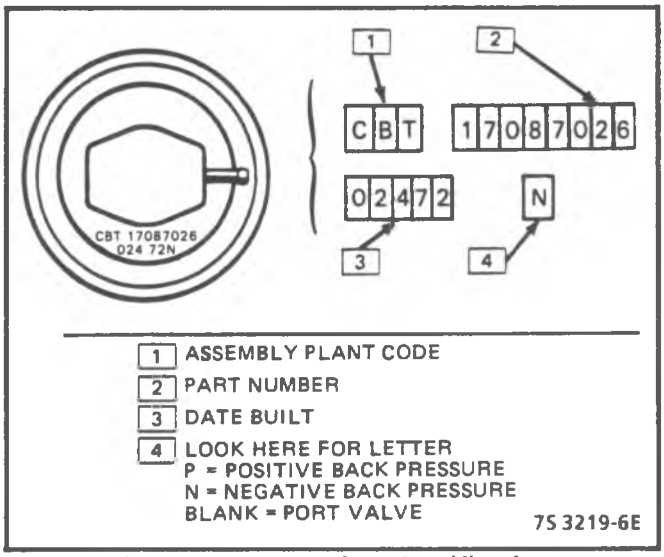


Figure 9-4 - EGR Valve Identification

DIAGNOSIS

RESULTS OF INCORRECT OPERATION

With too much EGR flow at idle, cruise, or cold operation, any of the following conditions may occur:

- Engine stops after cold start.
- Engine stops at idle after deceleration.
- Vehicle surges during cruise.
- Rough idle.

If the EGR valve should stay open all of the time, the engine may not idle.

Too little or no EGR flow allows combustion temperatures to get too high during acceleration and load conditions. This could cause:

- Spark knock (detonation).
- Engine overheating.

SYSTEM CHECK

Diagnosis of the EGR system is covered in the following charts. These charts begin on page 9-4.

ON-VEHICLE SERVICE

EGR VALVE

Remove or Disconnect

1. Air cleaner.
2. EGR valve vacuum tube at valve. (Figure 9-5 to 9-10).
3. Bolts or nuts.
4. EGR valve and gasket from manifold (Figures 9-10 to 9-15). Discard gasket.

Important

- Do Not wash EGR valve in solvents or degreaser - permanent damage to valve diaphragm may result. Also, sand blasting of the valve is not recommended since this can affect the operation of the valve.

EGR Manifold Passage

Inspect

- If EGR passage indicates excessive build-up of deposits, the passage should be cleaned. Care should be taken to ensure that all loose particles are completely removed to prevent them from clogging the EGR valve or from being ingested into the engine.

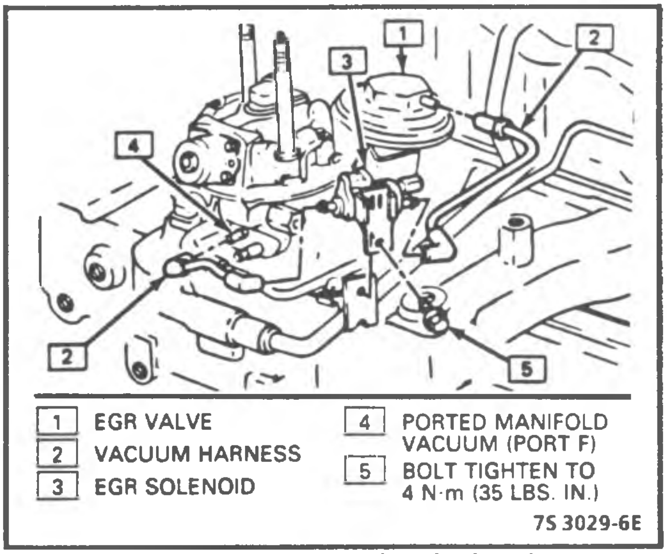


Figure 9-5 - EGR & Solenoid (2.5L)

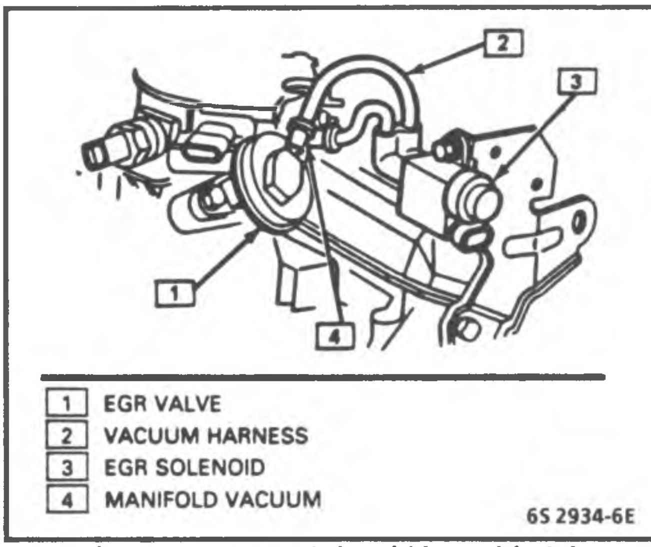
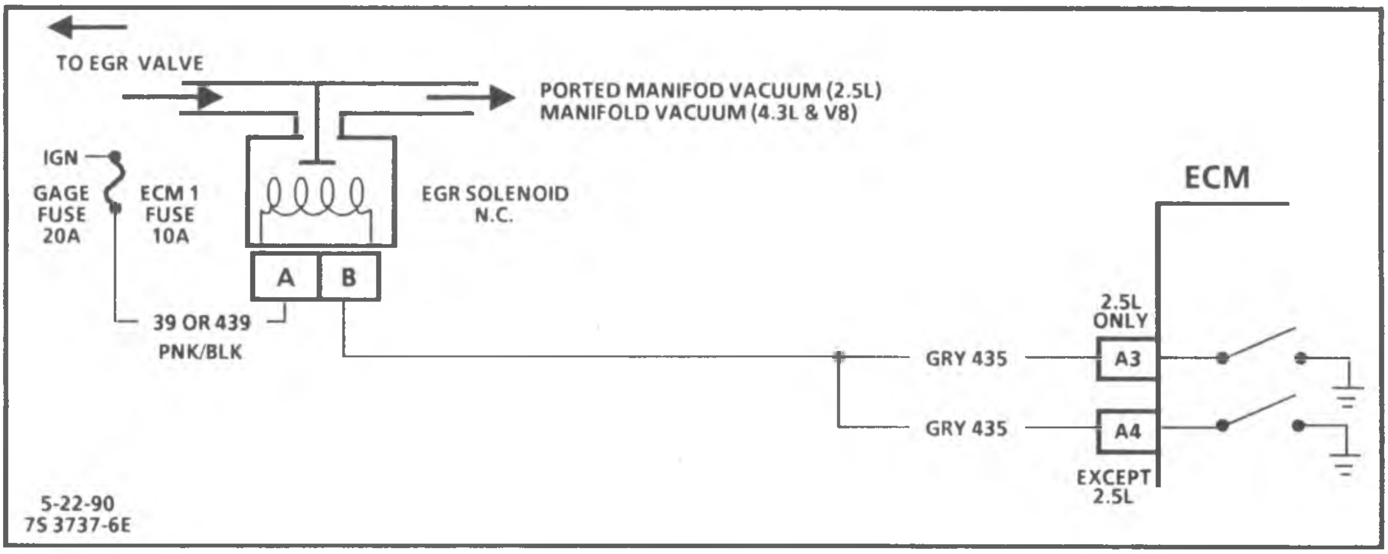


Figure 9-6 - EGR & Solenoid (EVRV) (2.8L)



EGR SYSTEM CHECK

2.5L (S), 4.3L (M/L, C/K, G), 5.0L (C/K), 5.7L (C/K, R/V, G) EXCEPT VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The ECM operates a solenoid to control the exhaust gas recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the ECM energizes the solenoid which then allows vacuum to pass to the EGR valve. The ECM control of the EGR is based on the following inputs:

- Engine coolant temperature - above 25°C.
- TPS - "OFF" idle
- MAP

If Code 24 is stored, use that chart first.

Code 32 will detect a faulty solenoid, vacuum supply, EGR valve or plugged passage. This chart checks for plugged EGR passages, a sticking EGR valve, or a stuck open or inoperative solenoid.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks for solenoid stuck open.
2. Checks for solenoid always being energized.
3. Grounding test terminal should energize solenoid and vacuum should drop.
4. Negative backpressure valve should hold vacuum with engine "OFF."
5. When engine is started, exhaust backpressure should cause vacuum to bleed off and valve to fully close.

Diagnostic Aids:

- Before replacing ECM, use an ohmmeter and check the resistance of each ECM controlled relay and solenoid coil. Refer to "ECM QDR Check" procedure in "Computer Command Control," Section "3". See ECM wiring diagram for coil terminal ID of solenoid(s) and relay(s) to be checked. Replace any solenoid where resistance measures less than 20 ohms.

EGR SYSTEM CHECK

2.5L, 4.3L (M/L, C/K, G), 5.0L (C/K), 5.7L (C/K, R/V, G) EXCEPT VEHICLES WITH 4L80-E TRANSMISSION

ASSUMES NO CODE 24 OR 32 IS STORED

NOTICE: DISCONNECT TECH 1 WHEN USING THIS CHART.

1
- CHECK VACUUM SOURCE TO EGR SOLENOID (IF NOT OK, REPAIR).
- IGNITION "OFF."
- DISCONNECT EGR SOLENOID VACUUM HARNESS.
- INSTALL HAND HELD VACUUM PUMP ON MANIFOLD SIDE OF SOLENOID.
- APPLY VACUUM.

DOES SOLENOID HOLD VACUUM?

YES → 2

NO → FAULTY SOLENOID.

2
- IGNITION "ON," ENGINE STOPPED.
- DOES VACUUM DROP?

NO → 3

YES → CKT 435 SHORTED TO GROUND OR FAULTY ECM. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

3
- GROUND DIAGNOSTIC "TEST" TERMINAL.

DOES VACUUM DROP?

YES → 4

YES → DISCONNECT SOLENOID ELECTRICAL CONNECTOR. PROBE CKT 439 WITH A TEST LIGHT TO GROUND.

- LIGHT "ON" → CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS.
  - LIGHT "ON" → FAULTY SOLENOID.
  - LIGHT "OFF" → OPEN CKT 435, SHORT TO VOLTAGE OR FAULTY ECM. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.
- LIGHT "OFF" → OPEN CKT 439.

4
- REMOVE GROUND FROM DIAGNOSTIC TEST TERMINAL.
- IGNITION "OFF."
- CONNECT A VACUUM PUMP TO EGR SIDE OF VACUUM HARNESS.
- USING A MIRROR, OBSERVE EGR DIAPHRAGM WHILE APPLYING VACUUM
- DIAPHRAGM SHOULD MOVE FREELY AND HOLD VACUUM FOR AT LEAST 20 SECONDS.

OK → 5

NOT OK → CHECK FOR RESTRICTION IN VACUUM LINE TO VALVE OR IN VALVE VACUUM PORT ORIFACE. IF OK, REPLACE EGR VALVE.

5
- APPLY VACUUM TO EGR VALVE.
- START ENGINE AND IMMEDIATELY OBSERVE VACUUM AND VALVE POSITION.
- VALVE IS GOOD IF VALVE MOVES TO SEATED POSITION (VALVE CLOSED) AND VACUUM DROPPED WHILE STARTING ENGINE.

OK → A/T CHECK P/N SWITCH.

- OK → NO TROUBLE FOUND.
- NOT OK → REPAIR AS NECESSARY.

NOT OK →
- REMOVE EGR VALVE AND CHECK PASSAGES FOR BEING PLUGGED.
- IF NOT PLUGGED REPLACE EGR VALVE.

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

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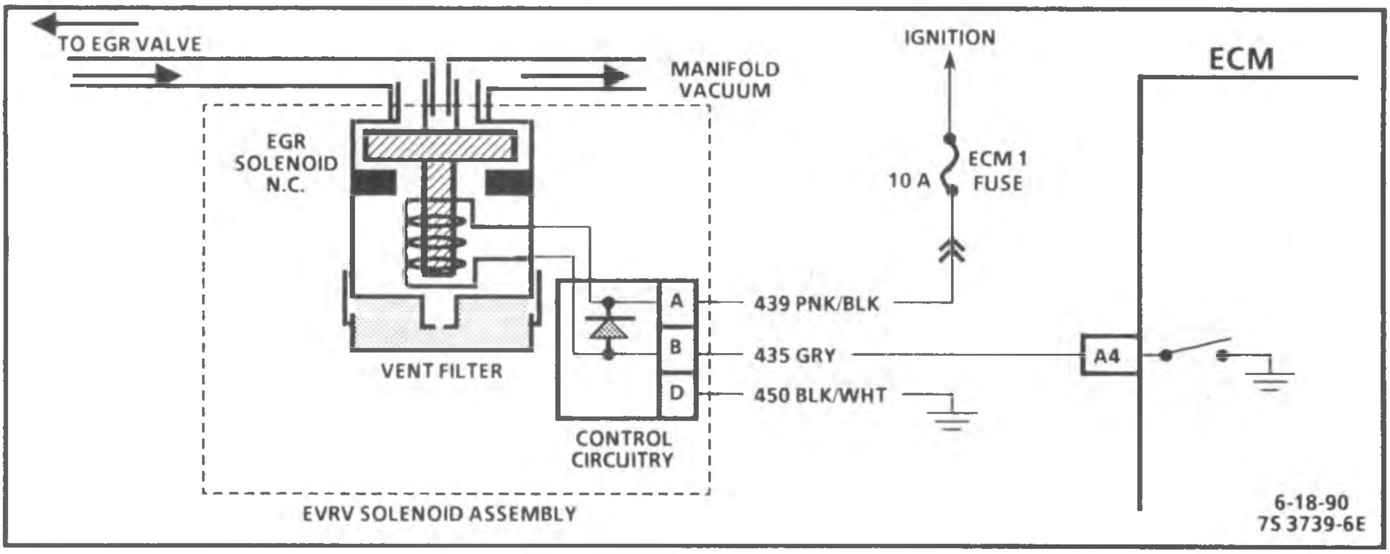


EGR SYSTEM CHECK (EVRV)

2.8L (S), 4.3L (S/T) & 7.4L (C) (WITH MANUAL TRANSMISSION) EXCEPT VEHICLES WITH 4L80-E TRANSMISSION

Circuit Description:

The EGR valve is controlled by a normally closed solenoid (allows a vacuum to pass when energized). The ECM pulses the solenoid to turn "ON" and regulate the EGR. The ECM diagnoses the system using an internal EGR test procedure. The ECM control of the EGR is based on the following inputs:

- Engine coolant temperature - above 25°C.
- TPS - "OFF" idle
- MAP

If Code 24 is stored, use that chart first.

Code 32 will detect a faulty solenoid, vacuum supply, EGR valve or plugged passage. This chart checks for plugged EGR passages, a sticking EGR valve, or a stuck open or inoperative solenoid.

Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart.

1. With the ignition "ON", engine stopped, the solenoid should not be energized and vacuum should not pass to the EGR valve.
2. Grounding the diagnostic terminal will energize the solenoid and allow vacuum to pass to the valve.
3. Checks for plugged EGR passages. If passages are plugged, the engine may have severe detonation on acceleration.
4. The vehicle must be driven during this test in order to produce sufficient engine load to operate the EGR. Lightly accelerating (approximately 1/4 throttle) will produce a large and stable enough reading to determine if the ECM is commanding the system "ON."

Diagnostic Aids:

- Before replacing ECM, use ohmmeter and check resistance of each ECM controlled relay and solenoid coil. Refer to "ECM QDR Check" in "Computer Command Control," Section "3".
  See ECM wiring diagram for coil terminal identification of solenoid(s) and relay(s) to be checked. Replace any relay or solenoid if the coil resistance measures less than 20 ohms.

EGR SYSTEM CHECK (EVRV)

2.8L (S), 4.3L (S/T) & 7.4L (C) (WITH MANUAL TRANSMISSION) EXCEPT VEHICLES WITH 4L80-E TRANSMISSION

ASSUMES NO CODE 24 OR 32 IS STORED

1
- DISCONNECT EGR SOLENOID VACUUM HOSE (MANIFOLD SIDE)
- CHECK VACUUM SOURCE TO SOLENOID (IF NOT OK , REPAIR) .
- INSTALL A HAND HELD VACUUM PUMP WITH GAGE ON MANIFOLD SIDE OF EGR SOLENOID .
- IGNITION "ON" ENGINE STOPPED .
- DIAGNOSTIC TERMINAL NOT GROUNDED .
- APPLY VACUUM .
- OSBSERVE EGR VALVE .
- VALVE SHOULD NOT MOVE . DOES IT?

NO

2
- GROUND DIAGNOSTIC TERMINAL .
- REPEAT TEST . DOES VALVE MOVE?

YES

3
- START AND IDLE ENGINE .
- LIFT UP ON EGR VALVE AND OBSERVE IDLE .

NO

- INSTALL A VACUUM GAGE IN VACUUM LINE AT VALVE.
- REPEAT TEST.
- DOES GAGE INDICATE VACUUM.

YES

CHECK EGR VALVE VACUUM PORT ORIFACE FOR BEING PLUGGED. IF NOT PLUGGED. REPLACE EGR VALVE.

NO

SEE CODE 32 CHART TO DIAGNOSE SOLENOID.

YES

- DISCONNECT EGR SOLENOID ELECTRICAL CONNECTOR .
- REPEAT TEST . DOES VALVE MOVE?

YES

REPLACE SOLENOID

NO

CHECK CKT 435 FOR SHORT TO GROUND . IF NOT SHORTED IT IS A FAULTY ECM . SEE "DIAGNOSTIC AIDS."

IDLE ROUGHENS

4
- RECONNECT EGR SOLENOID .
- CONNECT VACUUM GAGE TO VACUUM HOSE AT EGR VALVE .
- ENGINE AT NORMAL OPERATING TEMP.
- PUT TRANSMISSION IN GEAR.
- LIGHTLY ACCELERATE FROM A STOP.
- OBSERVE VACUUM GAGE, SHOULD BE LESS THAN 10".

OK

NO TROUBLE FOUND. EGR SYSTEM OK

NOT OK

OVER 10" VACUUM

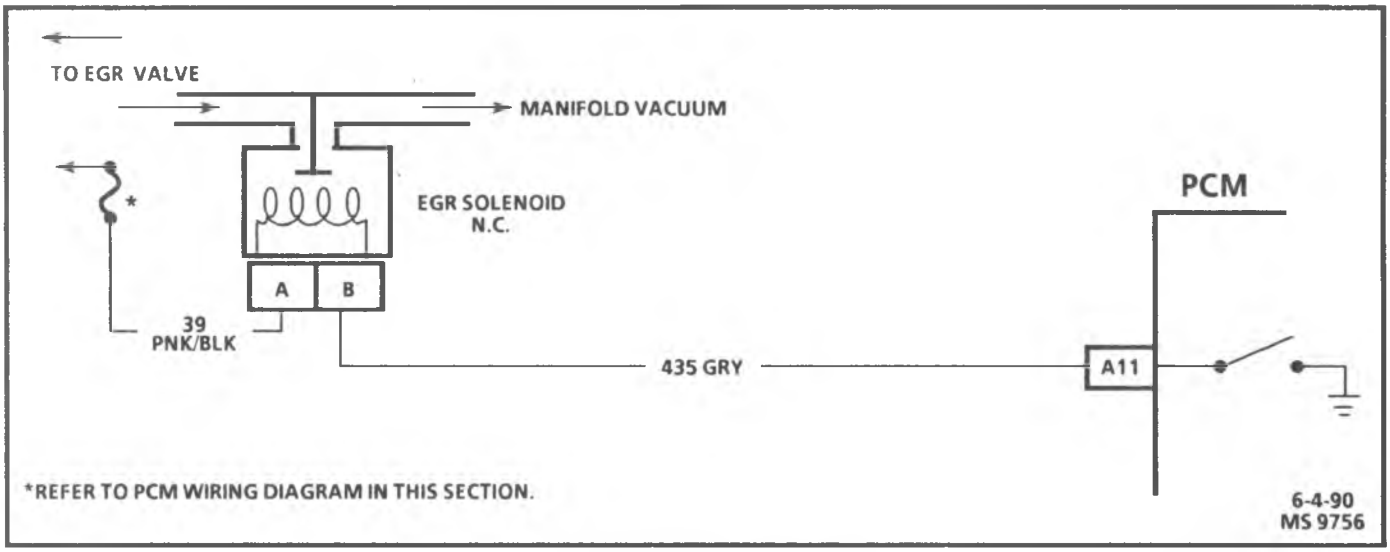
CLEAN OR REPLACE EVRV FILTER .

NO CHANGE

- REMOVE EGR VALVE .
- CHECK PASSAGES FOR BEING PLUGGED . IF NOT PLUGGED REPLACE EGR VALVE .

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

2-1-90
7S 3740



EGR SYSTEM CHECK

"C/K", "G" & "P" MODEL WITH 4.3L ENGINE AND 4L80-E TRANSMISSION

Circuit Description:

The PCM operates a solenoid to control the Exhaust Gas Recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the ECM energizes the solenoid which then allows vacuum to pass to the EGR valve.

The PCM monitors EGR effectiveness by de-energizing the EGR control solenoid, thereby, shutting off vacuum to the EGR valve diaphragm. With the EGR valve closed and O_2 sensor fluctuating normally, fuel integrator counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, a Code 32 will be set.

The PCM will check EGR operation when:

- Engine speed is above 2000 rpm.
- Engine vacuum is between 8 and 30 kPa.
- No change in throttle position while test is being run.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. By grounding the diagnostic terminal, the EGR solenoid should be energized and allow vacuum to be applied to the EGR valve and the vacuum should hold.
2. When the diagnostic terminal is ungrounded, the vacuum to the EGR valve should bleed off through a vent in the solenoid and the valve should close. The gage amy or may not bleed off but this does not indicate a problem.
3. This test will determine if the electrical control part of the system is at fault or if the connector or solenoid is at fault.
4. This system uses a negative backpressure valve which should hold vacuum with engine "OFF."
5. when engine is started, exhaust backpressure should cause vacuum to bleed off and valve should fully close.

Diagnostic Aids:

Before replacing PCM, use ohmmeter and check resistance of each PCM controlled relay and solenoid coil.

See "PCM Wiring Diagram" for coil terminal identification of solenoid(s) and relay(s) to be checked. Replace any relay or solenoid if the coil resistance measures less than 20 ohms.

EGR SYSTEM CHECK

"C/K", & "G" "P" MODEL WITH 4.3L ENGINE AND 4L80-E TRANSMISSION

BEFORE USING THIS CHART, CHECK VACUUM SOURCE TO EGR SOLENOID, ALSO CHECK HOSES FOR LEAKS OR RESTRICTIONS. SHOULD BE AT LEAST (7") HG VACUUM AT 2000 RPM.

(1)
- DISCONNECT EGR SOLENOID VACUUM LINE FROM THROTTLE BODY.
- IGNITION "ON," ENGINE STOPPED.
- INSTALL A HAND HELD VACUUM PUMP WITH GAGE TO THROTTLE BODY SIDE OF EGR SOLENOID.
- APPLY VACUUM AND OBSERVE EGR VALVE DIAPHRAGM.
- VALVE SHOULD MOVE.

DOES IT?

YES

(2)
- WITH THE TECH 1, COMMAND EGR SOLENOID "OFF."
- VACUUM SHOULD BLEED OFF AND VALVE SHOULD CLOSE.

DOES IT?

YES

(4)
- IGNITION "OFF."
- CONNECT A VACUUM PUMP TO EGR VALVE.
- USING A MIRROR, OBSERVE EGR DIAPHRAGM WHILE APPLYING VACUUM.
- DIAPHRAGM SHOULD MOVE FREELY AND HOLD VACUUM FOR AT LEAST 20 SECONDS.

DOES IT?

YES

(5)
- APPLY VACUUM TO EGR VALVE.
- START ENGINE AND IMMEDIATELY OBSERVE VACUUM GAGE ON VACUUM PUMP.
- VALVE IS GOOD IF DIAPHRAGM HAS MOVED TO SEATED POSITION (VALVE CLOSED) AND VACUUM DROPPED WHILE STARTING ENGINE.

VACUUM DROPPED

BE SURE VACUUM HOSE BETWEEN SOLENOID AND EGR VALVE IS OK. (NO LEAKS OR RESTRICTIONS) IF NO PROBLEM IS FOUND, THE EGR CIRCUIT IS OK.

NO VACUUM DROP

- REMOVE EGR VALVE.
- CHECK PASSAGES FOR BEING PLUGGED. IF NOT PLUGGED, REPLACE VALVE.

NO (4)

REPLACE EGR VALVE.

NO (2)

(3)
- DISCONNECT SOLENOID ELECTRICAL CONNECTOR.

DOES VACUUM BLEED OFF?

YES

CKT 435 SHORTED TO GROUND OR FAULTY PCM. **

NO

REPLACE SOLENOID.

NO (1)

- CONNECT VACUUM PUMP TO EGR VALVE SIDE OF HARNESS.
- APPLY VACUUM AND OBSERVE VALVE.
- VALVE SHOULD MOVE.

DOES IT?

YES

- DISCONNECT EGR ELECTRICAL CONNECTOR.
- CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS.
- IGNITION "ON," ENGINE "OFF."
- TEST LIGHT SHOULD LIGHT.

DOES IT?

NO

CONNECT TEST LIGHT BETWEEN HARNESS TERMINAL "A" AND GROUND.

NO LIGHT

REPAIR OPEN CKT 439.

LIGHT

REPAIR OPEN CKT 435. IF NOT OPEN, IT IS A FAULTY PCM. **

YES

FAULTY SOLENOID CONNECTION OR FAULTY SOLENOID.

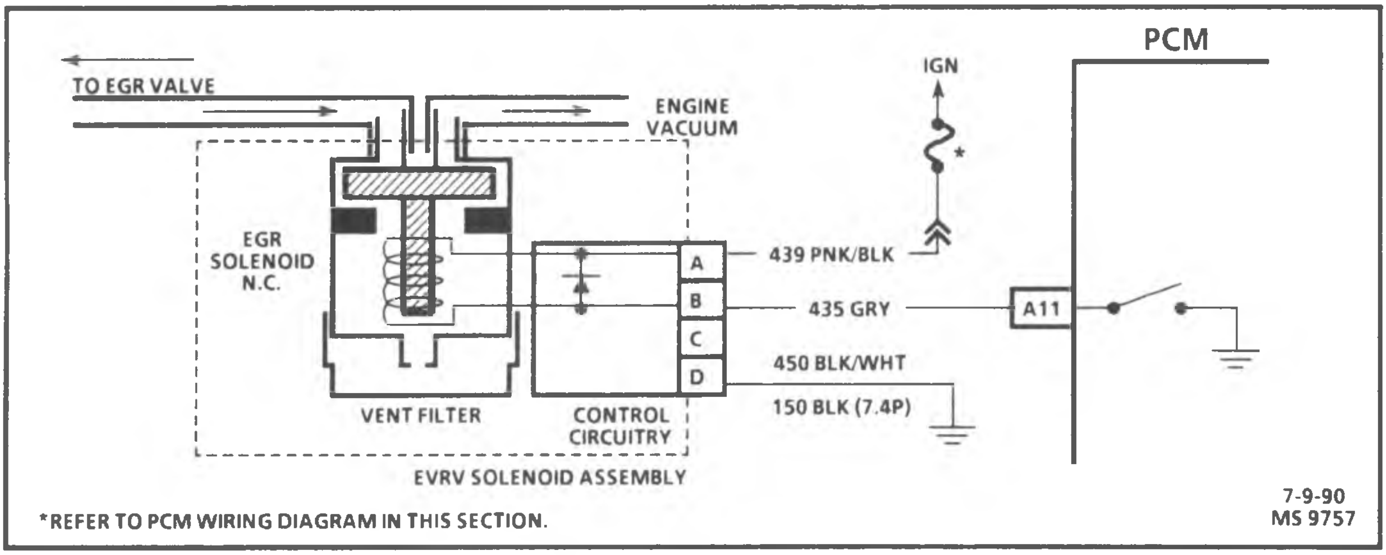
NO

- FAULTY VACUUM HOSE TO EGR VALVE OR FAULTY VALVE.

** BEFORE REPLACING PCM, REFER TO PCM QDR CHECK PROCEDURE.
REPLACE ANY RELAY OR SOLENOID IF THE COIL RESISTANCE MEASURES LESS THAN 20 OHMS.

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

7-20-90
MS 9961-6E



EGR SYSTEM CHECK

ALL VEHICLES WITH 4L80-E TRANSMISSION EXCEPT 4.3L (C/K, G, P) MODEL

Circuit Description:

The PCM operates a solenoid to control the Exhaust Gas Recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the PCM energizes the solenoid which then allows vacuum to pass the EGR valve.

The PCM monitors EGR effectiveness by de-energizing the EGR control solenoid, thereby, shutting off vacuum to the EGR vale diaphragm. With the EGR valve closed and O_2 sensor fluctuating normally, fuel integrator counts will be greater than they were during normal EGR operation. If the change is not within the calibrated window, a Code 32 will be set.

The ECM will check EGR operation when:

- Engine speed is greater than 1600 rpm.
- Engine vacuum is between 20 and 60 kPa.
- No change in throttle position while test is being run.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. With the ignition "ON," engine stopped, the solenoid should not be energized and vacuum should not pass to the EGR valve. The solenoid will allow vacuum to pass to the energizing valve.
2. Checks for plugged EGR passages. If passages are plugged, the engine may have severe detonation on acceleration.
3. The vehicle must be driven during this test in order to produce sufficient engine load to operate the EGR. Lightly accelerating (approximately 1/4 throttle) will produce a large and stable enough reading to determine if the ECM is commanding the system "ON."

Diagnostic Aids:

Before replacing ECM, use ohmmeter and check resistance of each ECM controlled relay and solenoid coil.

See "ECM Wiring Diagram" for coil terminal identification of solenoid(s) and relay(s) to be checked. Replace any relay or solenoid if the coil resistance measures less than 20 ohms.

EGR SYSTEM CHECK

ALL VEHICLES WITH 4L80-E TRANSMISSIONS
EXCEPT 4.3L (C/K, G, P) MODEL

IF ANY OTHER CODES ARE STORED, DIAGNOSE THEM FIRST.
IF VEHICLE EXHIBITS A ROUGH OR INCORRECT IDLE, REPAIR IDLE COMPLAINT FIRST. SEE SECTION "2".

1
- DISCONNECT EGR SOLENOID VACUUM HOSE (MANIFOLD SIDE).
- CHECK VACUUM SOURCE TO SOLENOID (IF NOT OK, REPAIR).
- CHECK VACUUM HOSE BETWEEN SOLENOID AND VALVE FOR RESTRICTIONS.
- INSTALL A HAND HELD VACUUM PUMP WITH GAGE ON MANIFOLD SIDE OF EGR SOLENOID.
- IGNITION "ON," ENGINE STOPPED.
- WITH TECH 1 COMMAND EGR SOLENOID "ON."
- APPLY VACUUM.
- OBSERVE EGR VALVE.
- VALVE SHOULD MOVE. DOES IT?

NO

- INSTALL A VACUUM GAGE IN VACUUM LINE AT VALVE.
- REPEAT TEST.
- DOES GAGE INDICATE VACUUM?

NO

- DISCONNECT SOLENOID CONNECTOR.
- PROBE HARNESS CONNECTOR TERMINAL "A" WITH A TEST LIGHT TO GROUND.

LIGHT "ON"

CONNECT A TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS "A" & "D".

LIGHT "ON"

- CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS "A" & "B".
- WITH TECH 1 COMMAND EGR SOLENOID ON.

LIGHT "ON"

REPLACE SOLENOID.

LIGHT

OPEN CKT 435 OR FAULTY ECM. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

LIGHT "OFF"

REPAIR OPEN IN GROUND CIRCUIT.

LIGHT "OFF"

REPAIR OPEN IN CKT 439.

YES

REPLACE EGR VALVE.

YES

2
- PLUG VACUUM HOSE FROM THROTTLE BODY.
- EGR SOLENOID IN NORMALLY CLOSED POSITION.
- START AND IDLE ENGINE.
- LIFT UP ON EGR VALVE AND OBSERVE IDLE.

IDLE ROUGHENS

3
- RECONNECT EGR SOLENOID.
- CONNECT VACUUM GAGE TO VACUUM HOSE AT EGR VALVE,
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- PUT TRANSMISSION IN GEAR.
- LIGHTLY ACCELERATE FROM A STOP.
- OBSERVE VACUUM GAGE, SHOULD BE LESS THAN 10" VACUUM.

OK

NO TROUBLE FOUND. SEE INTERMITTENTS IN SECTION "2".

NOT OK

OVER 10" VACUUM

REPLACE EGR FILTER.

NO CHANGE

- REMOVE EGR VALVE.
- CHECK PASSAGES FOR BEING PLUGGED. IF NOT PLUGGED REPLACE EGR VALVE.

"*AFTER REPAIRS,*" CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

6-6-90
MS 9960-6E

Clean

1. With a wire wheel, buff the exhaust deposits from the mounting surface and around the valve.
2. Look for exhaust deposits in the valve outlet. Remove deposit build-up with a screwdriver.
3. Clean mounting surfaces of intake manifold and valve assembly.

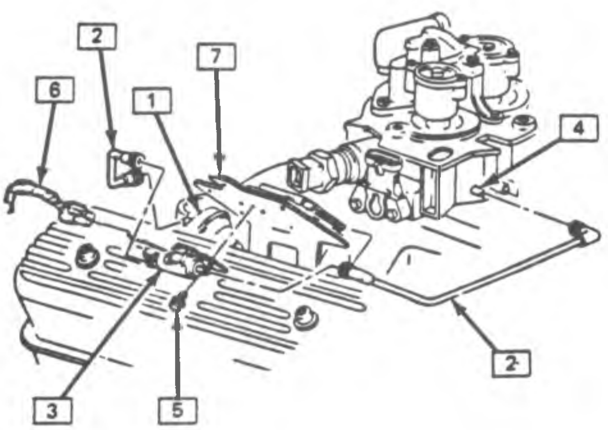
Install or Connect

1. New EGR gasket.
2. EGR valve to manifold.
3. Bolts or nuts.
4. Vacuum tube to valve.
5. Air cleaner.

SYSTEM HOSES

Refer to "Vehicle Emission Control Information" label for routing of system hoses.

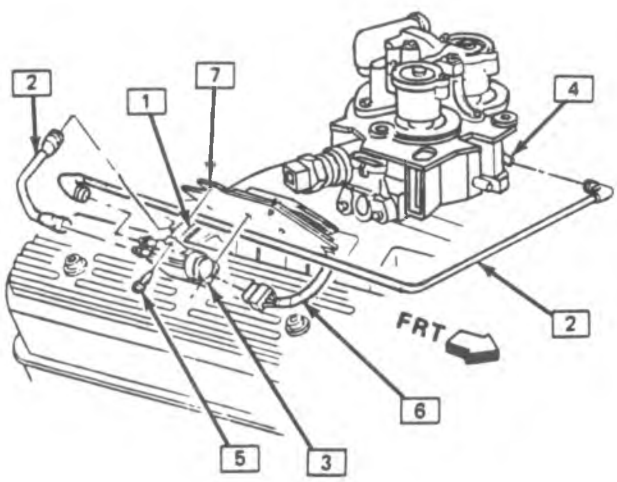
When replacing hoses, use hose identified with the word "Fluoroelastomer."



1 EGR VALVE
2 VACUUM HARNESS
3 EGR SOLENOID (MOUNTED ON TOP SIDE OF BRACKET ON G-SERIES)
4 MANIFOLD VACUUM (PORT-J)
5 BOLT—TIGHTEN TO 2 N·m (18 IN. LBS.)
6 HARNESS CONNECTOR
7 BRACKET

7S 3460-6E

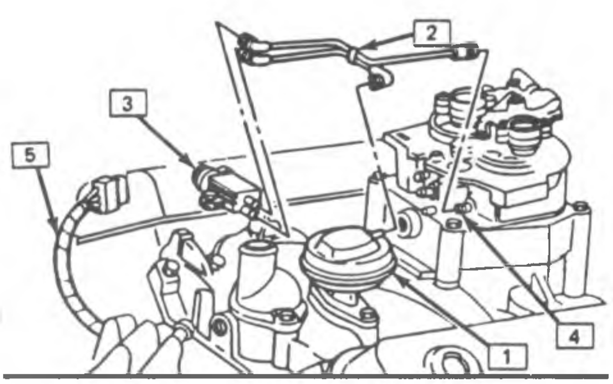
Figure 9-7 - EGR & Solenoid 2.5L, 4.3L (M/L, C/K, G, P), 5.0L (C/K), 5.7L (C/K, R/V, G)



1 EGR VALVE
2 VACUUM HARNESS
3 EGR SOLENOID (MOUNTED ON TOP SIDE OF BRACKET ON G-SERIES)
4 MANIFOLD VACUUM (PORT-S)
5 BOLT—TIGHTEN TO 4 N·m (35 LBS. IN.)
6 HARNESS CONNECTOR
7 BRACKET

7S 3461-6E

Figure 9-8 - EGR & Solenoid (EVRV) 2.8L, 4.3L (S/T), 5.7L (C/K, R/V, P, G) over 8500 GVW



1 EGR VALVE
2 VACUUM HARNESS
3 EGR SOLENOID
4 MANIFOLD VACUUM (PORT-S)
5 HARNESS CONNECTOR

7S 3462-6E

Figure 9-9 - EGR & Solenoid (EVRV) (7.4L)

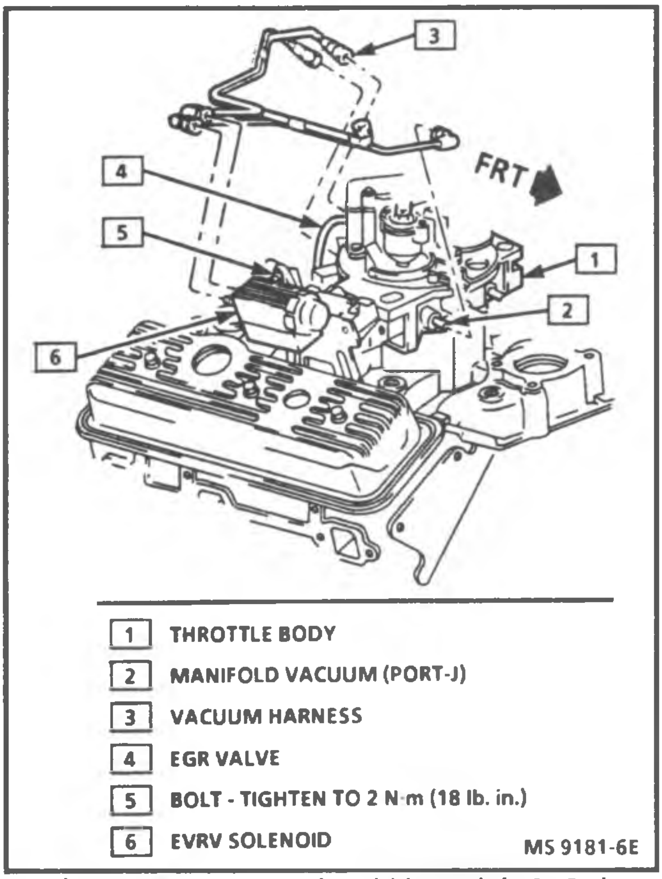


Figure 9-10 - EGR & Solenoid (EVRV) (4.3L S/T)

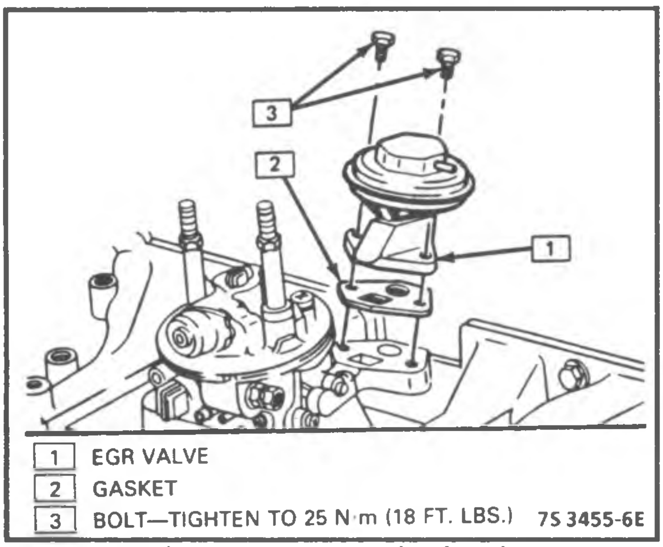


Figure 9-11 - EGR Valve (2.5L)

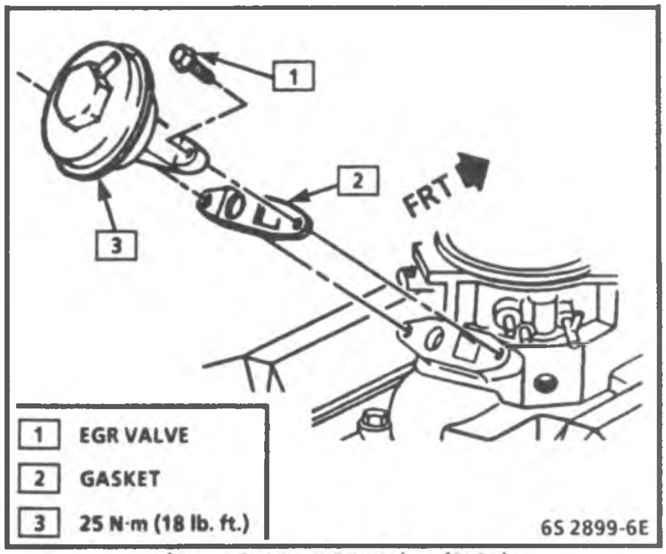


Figure 9-12 - EGR Valve (2.8L)

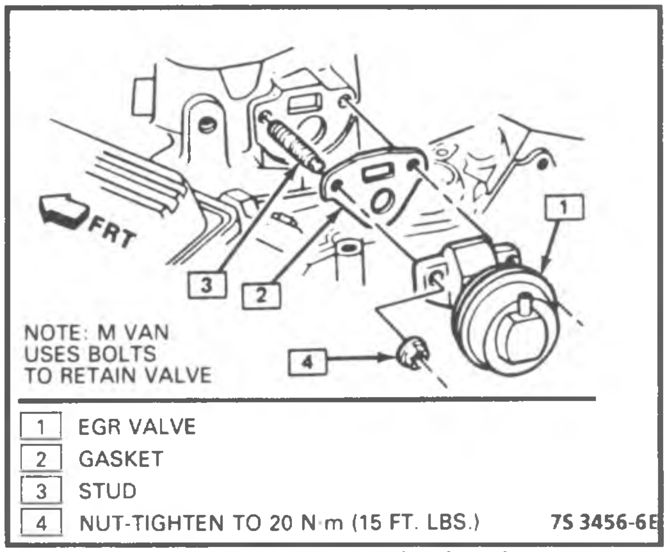


Figure 9-13 - EGR Valve (4.3L)

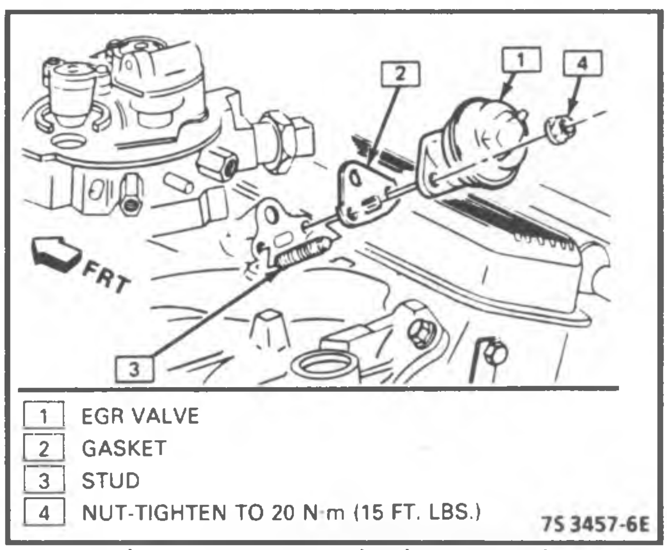
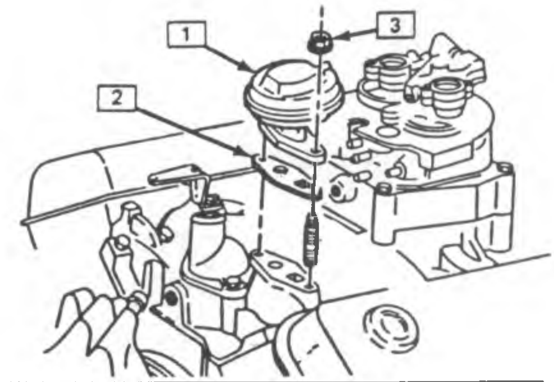


Figure 9-14 - EGR Valve (5.0L & 5.7L)



1 EGR VALVE
2 GASKET
3 NUT—TIGHTEN TO 20 N·m (15 LBS. FT.) 7S 3458-6E

Figure 9-15 - EGR Valve (7.4L)

EGR SOLENOID (EVRV)
2.8L (S), 4.3L (S/T), 5.7L (C/K, R/V, P, G) over 8500 GVW, 7.4L (C/K, R/V, P, G)
Figure 9-16

Remove or Disconnect

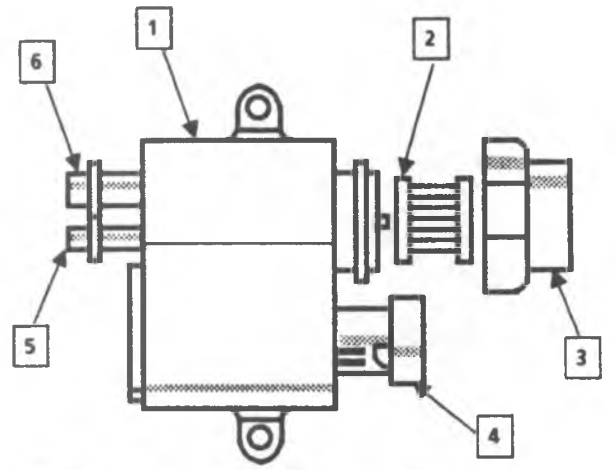
1. Negative battery cable.
2. Air cleaner, if necessary.
3. Electrical connector at solenoid.
4. Vacuum hoses.
5. Bolt(s) and solenoid.
6. Filter, if required.

Install or Connect

1. Filter, if required.
2. Solenoid. Tighten bolts to 24 N·m (17 lb. ft.).
3. Vacuum hoses.
4. Electrical connector.
5. Air cleaner, if removed.
6. Negative battery cable.

EGR FILTER CLEANING/REPLACEMENT

1. Grasp and pull filter off with a rocking motion.
2. Push new filter on making sure cut-out for wires is properly aligned.



1 EGR CONTROL SOLENOID ASSEMBLY
2 FILTER
3 COVER
4 ELECTRICAL CONNECTOR
5 VACUUM CONNECTOR FROM SOURCE
6 VACUUM CONNECTOR TO EGR VALVE

6S 2687-6E

Figure 9-16 - EGR Control Solenoid (EVRV)

EGR VACUUM SOLENOID
2.5L (S), 4.3L (M/L, C/K, G, P), 5.0L (C/K), 5.7L (C/K, R/V, G)
Figure 9-17

Remove or Disconnect

1. Negative battery cable.
2. Electrical connector at solenoid.
3. Vacuum hoses.
4. Bolt(s) and solenoid.

Install or Connect

1. Solenoid. See Figures 9-5 thru 9-9 for torque specification.
2. Vacuum hoses
3. Electrical connector.
4. Negative battery cable.

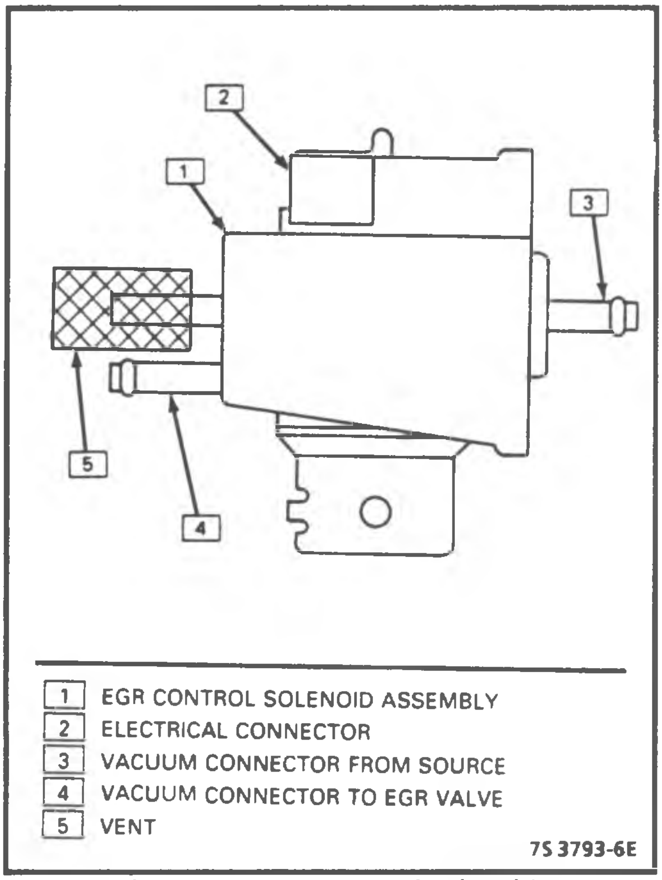


Figure 9-17 - EGR Control Solenoid

PARTS INFORMATION

PARTS NAME	GROUP
Valve, EGR	3.670
Valve, Elect Vac Reg	3.670
Solenoid, EGR Cont	3.670
Gasket, EGR Valve	3.680

BLANK

SECTION 10

AUTOMATIC AND MANUAL TRANSMISSION CONTROLS

CONTENTS

GENERAL DESCRIPTION

AUTOMATIC TRANSMISSION

TCC System

The Torque Converter Clutch (TCC) system, used on a Hydramatic 4L60 transmission, uses a solenoid operated valve, to couple the engine flywheel to the output shaft of the transmission through the torque converter. This reduces the slippage losses in the converter, which increases fuel economy.

Refer to ELECTRONIC TRANSMISSION CONTROL (SECTION 7A4), in appropriate service manual for diagnosis of 4L80-E transmission.

Operation

For the converter clutch to apply, two conditions must be met:

- Internal transmission fluid pressure must be correct. For information on internal transmission operation, see AUTOMATIC TRANSMISSION (SECTION 7A). This section will cover only the electrical operation of the TCC system.
- The ECM completes a ground circuit to energize a TCC apply solenoid in the transmission which moves a check ball in a fluid line (Figure 10-1). This allows the converter clutch to apply, if the hydraulic pressure is correct, as described above.

The ECM controls the TCC apply solenoid by looking at several sensors:

- Coolant Temperature Sensor (CTS). Engine must be warmed up, before clutch can apply.
- Throttle Position Sensor (TPS). After the converter clutch applies, the ECM uses the information from the TPS to release the clutch, when the vehicle is accelerating, or decelerating at a certain rate.
- Brake Switch. This switch in the TCC circuit opens, when the brake pedal is depressed. This de-energizes the TCC solenoid.
- Pulse switch. This is a downshift 4-3 pulse switch, which opens the TCC solenoid circuit, momentarily, during a downshift.
- Vehicle Speed Sensor (VSS). The VSS signals vehicle's speed to ECM.

MANUAL TRANSMISSION

Shift Light System

A vehicle, with manual transmission, has a shift light, on the instrument panel, to indicate the best shift point for maximum fuel economy. The light is controlled by the ECM and is turned "ON" by grounding CKT 456.

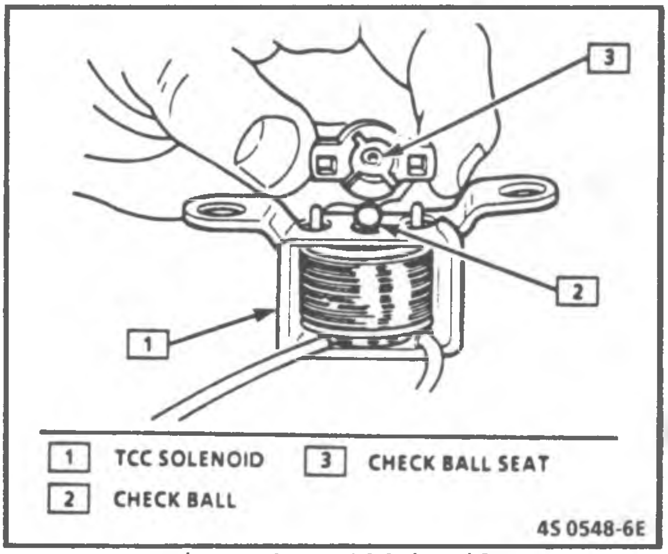
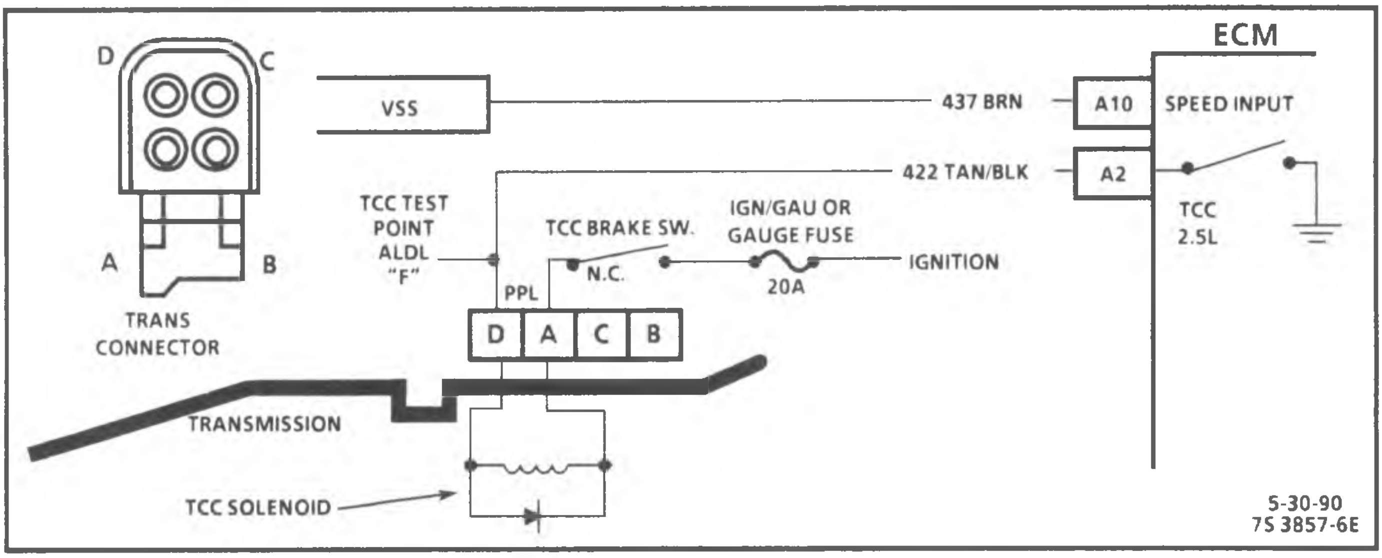


Figure 10-1 - TCC Solenoid



TORQUE CONVERTER CLUTCH (TCC)

(ELECTRICAL DIAGNOSIS)
2.5L ENGINES

Circuit Description:

The purpose of the automatic Torque Converter Clutch (TCC) feature is to eliminate the power loss of the torque converter stage when the vehicle is in a cruise condition. This allows the convenience of the automatic transmission and the fuel economy of a manual transmission.

Fused battery ignition is supplied to the TCC solenoid through the TCC brake switch.

The ECM will engage TCC by grounding CKT 422 to energize the solenoid.

TCC will engage when:

- Vehicle speed above 24 mph (39 km/h.)
- Engine at normal operating temperature (above 65°C) (149°F).
- Throttle position sensor output not changing, indicating a steady road speed.
- Brake switch closed.
- 3rd or 4th gears.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks continuity through brake switch and TCC solenoid.
2. Checks capability of ECM to energize solenoid. Grounding the diagnostic connector should energize the relay and cause the light to go out.
3. This test bypasses the TCC solenoid and checks for an open or short in CKT 422.

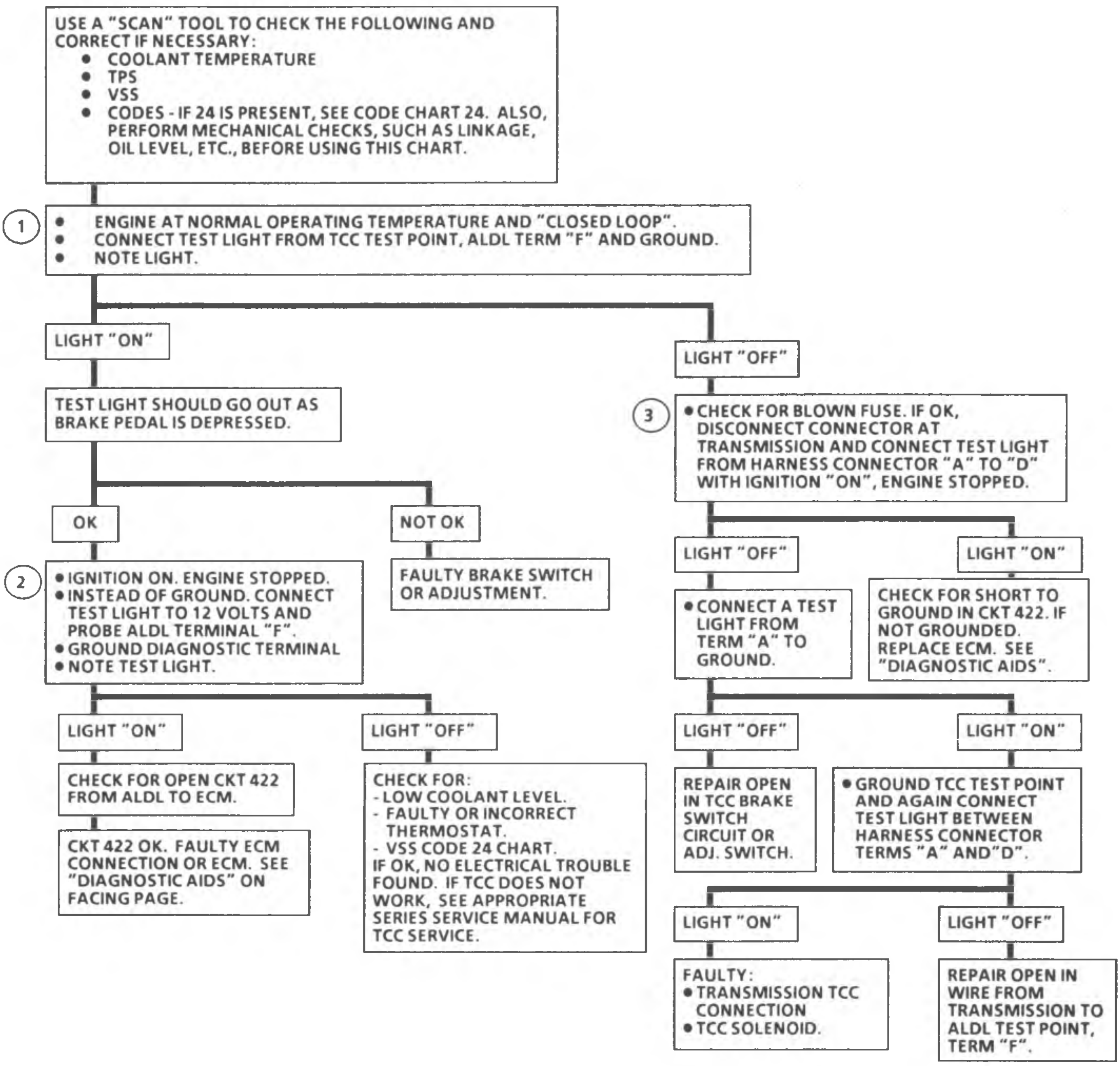
Diagnostic Aids:

Solenoid coil resistance must measure more than 20 ohms. Less resistance will cause early failure of the ECM "driver." Refer to "ECM QDR" check in "Computer Command Control," Section "3". Using an ohmmeter, check the solenoid coil resistance of all ECM controlled solenoids and relays, before installing a replacement ECM. Replace any solenoid, or relay, that measures less than 20 ohms resistance.

TORQUE CONVERTER CLUTCH (TCC)

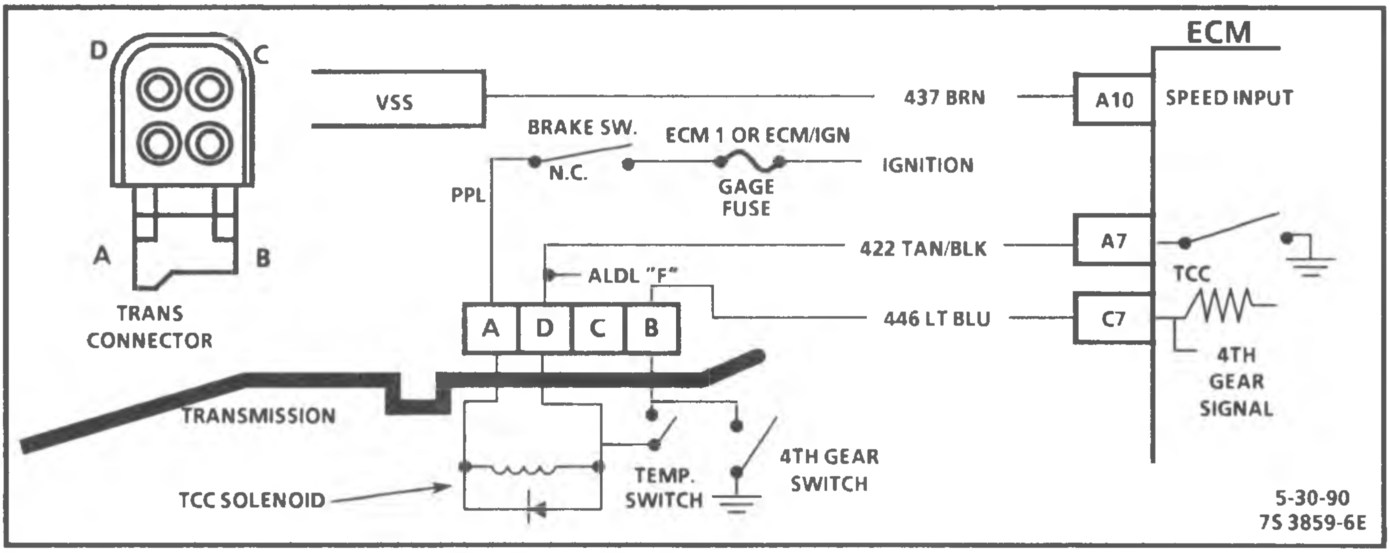
(ELECTRICAL DIAGNOSIS)

2.5L ENGINES



"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

2-2-90
7S 3858-6E



TORQUE CONVERTER CLUTCH (TCC)

(ELECTRICAL DIAGNOSIS)
4.3L, 5.0L AND 5.7L (UNDER 8500 GVW)

Circuit Description:

The purpose of the automatic transmission Torque Converter Clutch (TCC) feature is to eliminate the power loss of the torque converter stage when the vehicle is in a cruise condition. This allows the convenience of the automatic transmission and the fuel economy of a manual transmission.

Fused battery ignition is supplied to the TCC solenoid through the TCC brake switch.

The ECM will engage TCC by grounding CKT 422 to energize the solenoid.

TCC will engage when:

- Vehicle speed above 30 mph (48 km/h.)
- Engine at normal operating temperature (above 65°C) (149°F).
- Throttle position sensor output not changing, indicating a steady road speed.
- Brake switch closed.
- 3rd or 4th gears.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. A test light "ON" indicates battery voltage and continuity through the TCC solenoid is OK.
2. Checks for vehicle speed sensor signal to ECM using a "Scan" tool.
3. Checks for 4th gear signal to ECM. This signal will not prevent TCC engagement, but could cause a change in the engage and disengage speed points.

Diagnostic Aids:

Solenoid coil resistance must measure more than 20 ohms. Less resistance will cause early failure of the ECM "driver." Refer to "ECM QDR" check in "Computer Command Control," Section "3". Using an ohmmeter, check the solenoid coil resistance of all ECM controlled solenoids and relays before installing a replacement ECM. Replace any solenoid or relay that measures less than 20 ohms resistance.

To prevent TCC overheat condition, TCC temperature closes at 279°F ± 7° and reopens at 259°F ± 9°.

TORQUE CONVERTER CLUTCH (TCC)

(ELECTRICAL DIAGNOSIS)
4.3L, 5.0L AND 5.7L (UNDER 8500 GVW)

USE A "SCAN" TOOL TO CHECK THE FOLLOWING AND CORRECT IF NECESSARY:
- COOLANT TEMPERATURE
- TPS
- VSS
- CODES - IF 24 IS PRESENT, SEE CODE CHART 24. ALSO, PERFORM MECHANICAL CHECKS, SUCH AS LINKAGE, OIL LEVEL, ETC., BEFORE USING THIS CHART.

1
- ENGINE AT NORMAL OPERATING TEMPERATURE AND "CLOSED LOOP".
- CONNECT TEST LIGHT FROM TCC TEST POINT, ALDL TERM "F" TO GROUND.
- RAISE DRIVE WHEELS.
- START AND IDLE ENGINE IN PARK. DO NOT DEPRESS BRAKE PEDAL.
- NOTE LIGHT.

LIGHT "ON"

TEST LIGHT SHOULD GO OUT AS BRAKE PEDAL IS DEPRESSED.

OK

INCREASE SPEED TO 45 MPH (72 Km/h) HIGH GEAR, AND NOTE LIGHT.

LIGHT "OFF"

3
- IGNITION "ON", ENGINE STOPPED.
- BACK PROBE ECM TERM. C7 WITH A VOLTMETER TO GROUND.

OVER 6 VOLTS

- START ENGINE, TRANSMISSION IN DRIVE.
- INCREASE SPEED TO 55 MPH AND AGAIN NOTE VOLTAGE AT ECM TERMINAL C7.

UNDER 6 VOLTS

NO ELECTRICAL TROUBLE FOUND. IF TCC DOES NOT WORK, SEE APPROPRIATE SERIES SERVICE MANUAL.

OVER 6 VOLTS

FAULTY 4TH GEAR SWITCH IN TRANSMISSION.

UNDER 6 VOLTS

CHECK CKT 446 FOR OPEN. IF CKT NOT OPEN, IT IS FAULTY TRANSMISSION CONNECTION OR 4TH GEAR SWITCH.

LIGHT "ON"

2
- RAISE DRIVE WHEELS.
- ENGINE IDLING IN DRIVE.
- PLUG IN "SCAN" TOOL AND READ VEHICLE SPEED.
- DOES TOOL INDICATE VEHICLE SPEED?

YES

FAULTY ECM. SEE "DIAGNOSTIC AIDS".

NO

SEE CODE 24

NOT OK

FAULTY BRAKE SWITCH OR ADJUSTMENT.

LIGHT "OFF"

CHECK FOR BLOWN FUSE. IF OK, DISCONNECT CONNECTOR AT TRANS. AND CONNECT TEST LIGHT FROM HARNESS CONNECTOR "A" TO "D" WITH IGNITION "ON", ENGINE STOPPED.

LIGHT "OFF"

CONNECT A TEST LIGHT FROM TERM "A" TO GROUND.

LIGHT "ON"

GROUND TCC TEST POINT AND AGAIN CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMS "A" AND "D".

LIGHT "OFF"

REPAIR OPEN IN WIRE FROM TRANSMISSION TO ALDL TEST POINT. TERM "F".

LIGHT "ON"

FAULTY:
- TRANSMISSION TCC CONNECTOR
- TCC SOLENOID.

LIGHT "OFF"

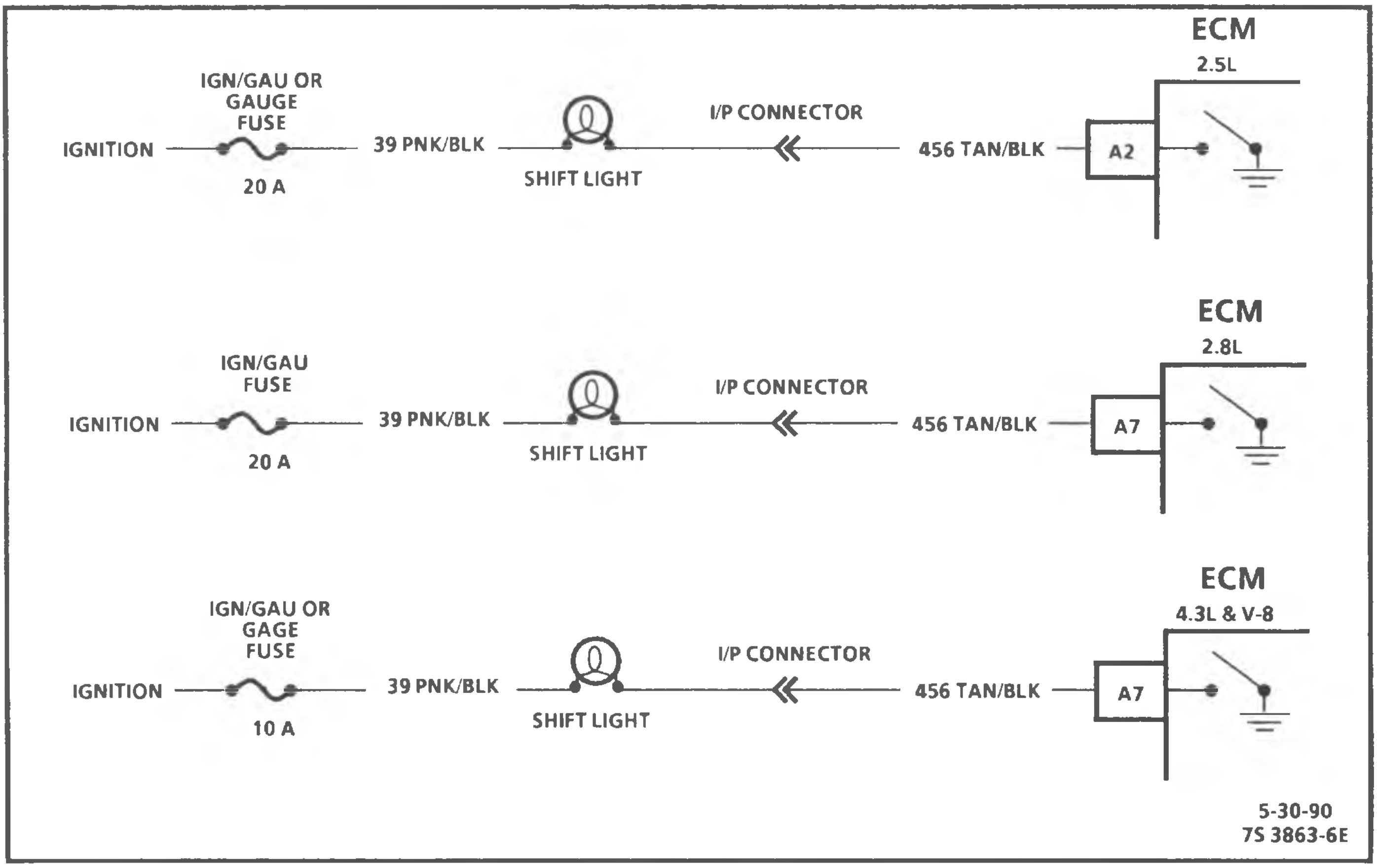
REPAIR OPEN IN TCC BRAKE SWITCH CIRCUIT OR ADJUST SWITCH.

LIGHT "ON"

CHECK FOR SHORT TO GROUND IN CKT 422. IF NOT GROUNDED. REPLACE ECM. SEE "DIAGNOSTIC AIDS".

"*AFTER REPAIRS*," CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

2-2-90
7S 3860-6E



MANUAL TRANSMISSION SHIFT LIGHT CHECK

VEHICLES BELOW 8500 GVW ONLY

Circuit Description:

The ECM uses information from the following inputs to control the shift light:

- Coolant Temperature Sensor (CTS)
- Throttle Position Sensor (TPS)
- Vehicle Speed Sensor (VSS)
- RPM

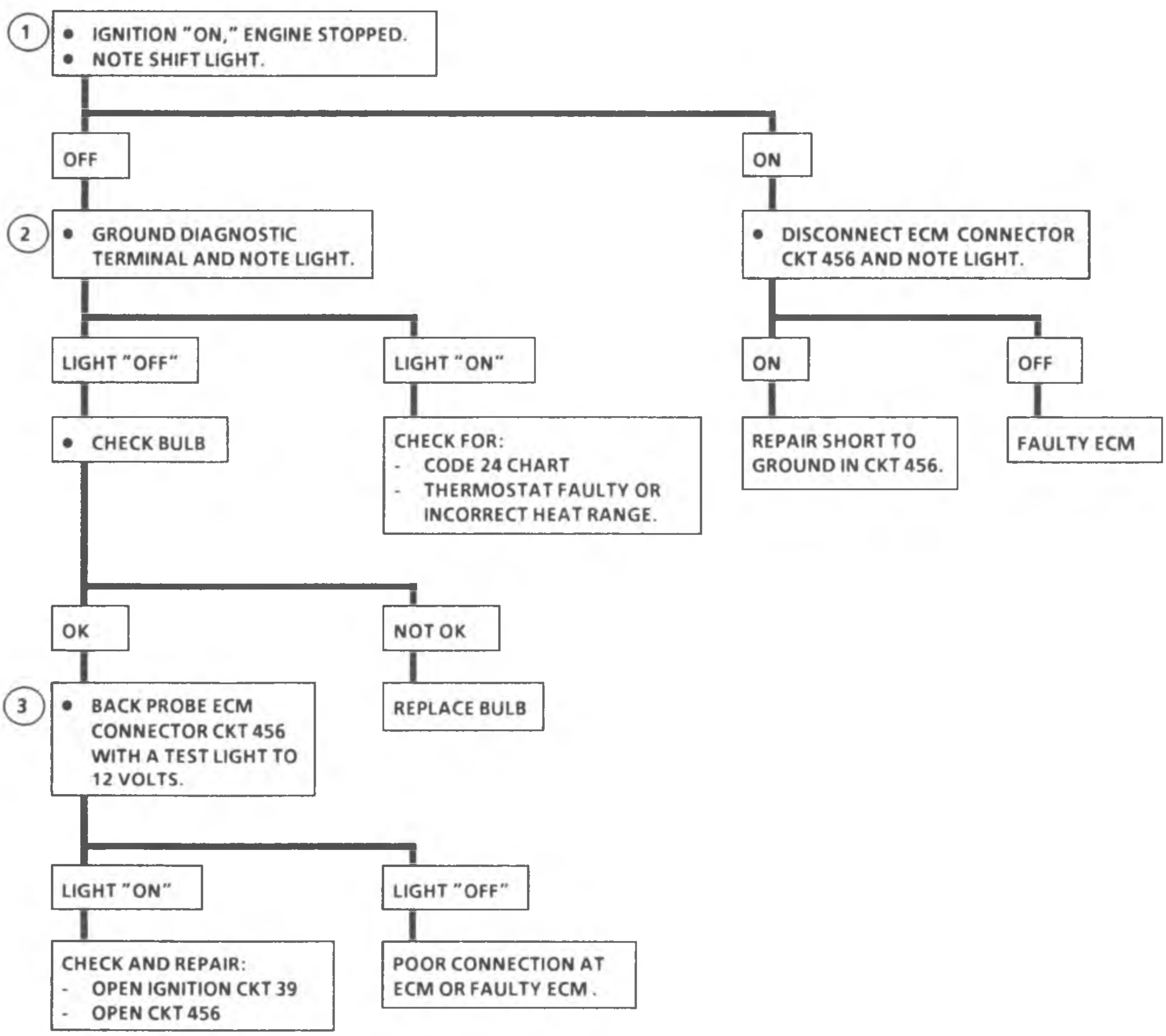
The ECM uses the measured rpm and the vehicle speed to calculate what gear the vehicle is in. Its this calculation that determines when the shift light should be turned "ON".

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This should not turn "ON" the shift light. If the light is "ON," there is a short to ground in CKT 456 wiring, or a fault in the ECM.
2. This should turn "ON" the shift light.
3. This checks for an open in the shift light circuit, or a faulty ECM.

MANUAL TRANSMISSION SHIFT LIGHT CHECK

VEHICLES BELOW 8500 GVW ONLY



5-24-90
7S 3864-6EA

DIAGNOSIS

TCC SYSTEM

If the converter clutch is applied at all times, the engine will stall immediately, just as in a manual transmission with the clutch applied.

If the converter clutch does not apply, fuel economy may be lower than expected. If the vehicle speed sensor fails, the TCC will not apply. If the 4th gear switch does not operate, the TCC will not apply at the right time.

The torque converter clutch (TCC) system has different operating characteristics than an automatic transmission without TCC. If the driver complains of a "chuggle" or "surge" condition, the vehicle should be road tested and compared to a similar vehicle to see if a real problem exists. The Owner's Manual section on TCC operation should be reviewed with the driver. Another TCC complaint may be a downshift felt when going up a grade, especially with cruise control. This may not be a downshift, but a clutch disengagement due to the change in TPS to maintain cruising speed.

The electrical diagnosis of the TCC system is covered in the appropriate "Torque Converter Clutch Electrical Diagnosis" chart.

If the ECM detects a problem in the VSS system, a Code 24 should set. In this case see Code 24 Chart.

SHIFT LIGHT SYSTEM

If the manual transmission shift light does not illuminate, or is "ON" all the time, while driving the vehicle, refer to "Manual Transmission Shift Light Check" chart.

ON-VEHICLE SERVICE

TCC SYSTEM

- Refer to "Computer Command Control," Section "3" for repair of wiring.
- Refer to "Computer Command Control," Section "3" for replacement of the ECM.
- For replacement of the TCC solenoid, vehicle speed sensor, or brake switch, refer to the appropriate series Service Manual, as listed in the "Forward."

SHIFT LIGHT SYSTEM

- Refer to "Computer Command Control," Section "3", for repair of wiring.
- Refer to "Computer Command Control," Section "3", for replacement of the ECM.

PARTS INFORMATION

PART NAME	GROUP
Sensor, VSS (1)	4.337
Valve, Clutch and Cruise Vac. Sw	3.885
Solenoid, TCC	4.122

SECTION 11

POSITIVE CRANKCASE VENTILATION (PCV)

CONTENTS

GENERAL DESCRIPTION

Except 2.5L

A Positive Crankcase Ventilation (PCV) system is used to provide more complete scavenging of crankcase vapors. Fresh air from the air cleaner through a filter is supplied to the crankcase, mixed with blow-by gases and then passed through a Positive Crankcase Ventilation (PCV) valve into the intake manifold (Figure 11-2).

The primary control is through the PCV valve (Figure 11-3), which meters the flow at a rate depending on manifold vacuum.

To maintain idle quality, the PCV valve restricts the flow when intake manifold vacuum is high. If abnormal operating conditions arise, the system is designed to allow excessive amounts of blow-by gases to back flow through the crankcase vent tube into the air cleaner to be consumed by normal combustion.

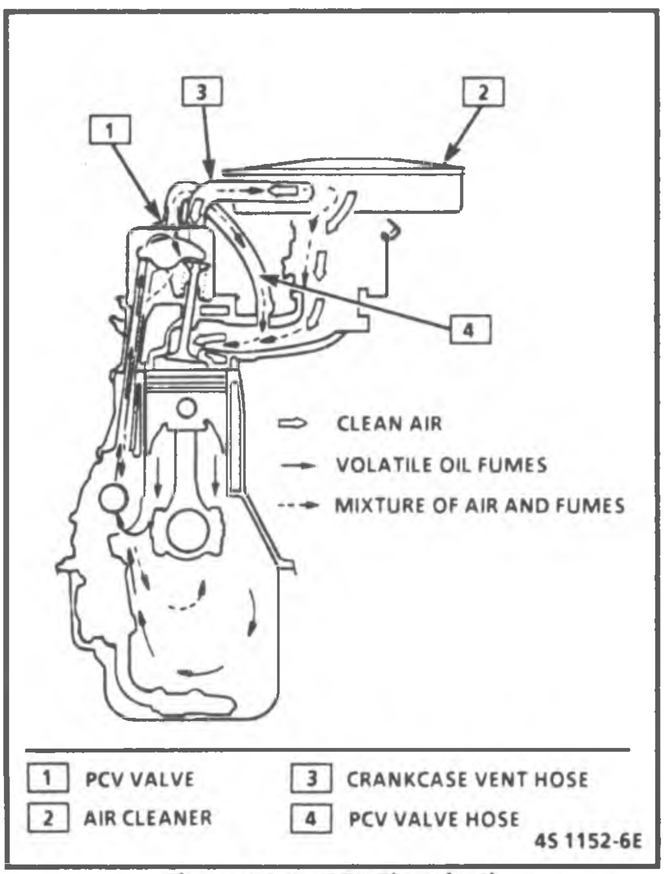


Figure 11-1 - PCV Flow (L-4)

2.5L

The Positive Crankcase Ventilation (PCV) system on this engine utilizes a constant bleed orifice in place of the PCV valve used in past model years. The orifice meters the vacuum applied to the crankcase, and is part of the crankcase vent tube assembly.

A Positive Crankcase Ventilation (PCV) system is used to provide more complete purging of crankcase vapors. Fresh air from the air cleaner is supplied to the crankcase, mixed with blow-by gases and then passed through the crankcase vent tube assembly into the intake manifold (Figure 11-1).

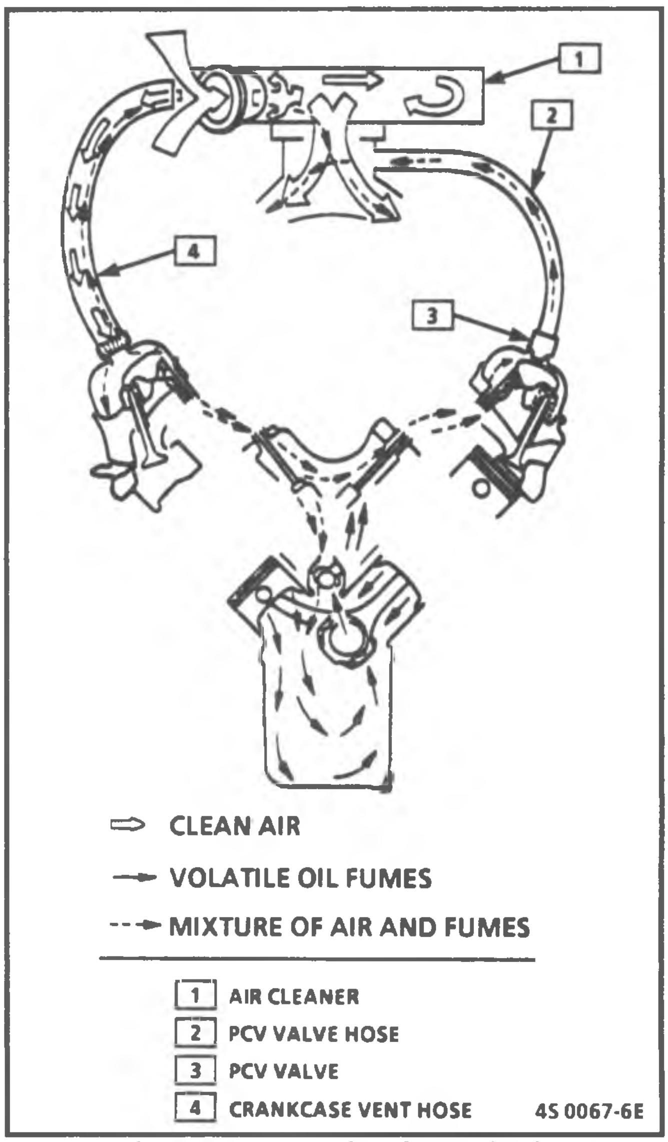


Figure 11-2 - PCV Flow (V6 and V8)

The primary control is through the PCV orifice (Figure 11-4), which meters the flow at a rate depending on manifold vacuum.

To maintain idle quality, the PCV orifice restricts the flow when intake manifold vacuum is high. If abnormal operating conditions arise, the system is designed to allow excessive amounts of blow-by gases to flow back through the crankcase vent hose into the air cleaner to be consumed by normal combustion.

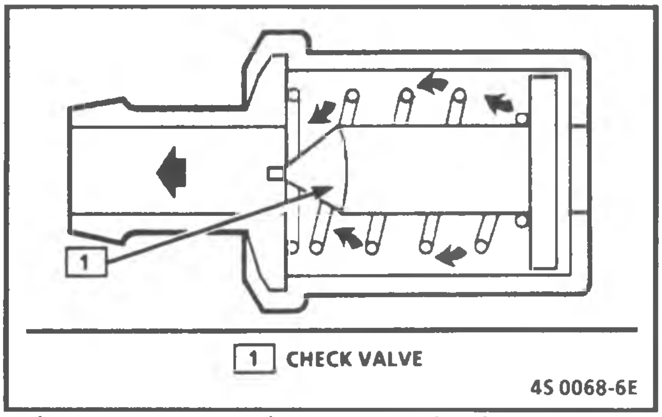


Figure 11-3 - PCV Valve Cross Section (Except 2.5L)

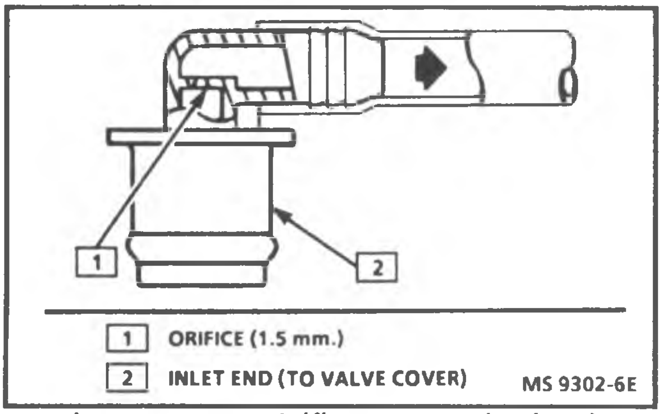


Figure 11-4 - PCV Orifice Cross Section (2.5L)

DIAGNOSIS

RESULTS OF INCORRECT OPERATION

Except 2.5L

- A plugged valve or hose may cause:
  - Rough idle
  - Stalling or slow idle speed
  - Oil leaks
  - Oil in air cleaner
  - Sludge in engine
- A leaking PCV valve or hose would cause:
  - Rough idle
  - Stalling
  - High idle speed

2.5L

- A plugged crankcase vent tube assembly 2.5L may cause:
  - Rough idle
  - Stalling or slow idle speed
  - Oil leaks
  - Oil in air cleaner
  - Sludge in engine
- A leaking crankcase vent tube assembly would cause:
  - Rough idle
  - Stalling
  - High idle speed

FUNCTIONAL CHECK

Except 2.5L

If an engine is idling rough, check for a clogged PCV valve, dirty vent filter or air cleaner element, or plugged hose. Replace as required. Use the following procedure:

1. Remove PCV valve from rocker arm cover.
2. Run the engine at idle.
3. Place your thumb over end of valve to check for vacuum. If there is no vacuum at valve, check for plugged hoses, manifold port at TBI unit, PCV valve. Replace plugged or deteriorated hoses, plugged PCV valve.
4. Turn "OFF" the engine and remove PCV valve. Shake valve and listen for the rattle of check needle inside the valve. If valve does not rattle, replace valve.

With this system, any blow-by in excess of the system capacity (from a badly-worn engine, sustained heavy load, etc.) is exhausted into the air cleaner and is drawn into the engine.

Proper operation of the PCV system is dependent upon a sealed engine. If oil sludging or dilution is noted and the PCV system is functioning properly, check engine for possible cause and correct to ensure that system will function as intended.

2.5L

If an engine is idling roughly, check for a clogged crankcase vent tube assembly. Replace as required. Use the following procedure:

1. Remove crankcase vent tube assembly from rocker arm cover.
2. Run the engine at idle.
3. Place thumb over inlet end to check for vacuum. If there is no vacuum at inlet end, check for plugged crankcase vent tube assembly and manifold port. If necessary, clean crankcase vent tube assembly with mineral spirits.

With this system, any blow-by in excess of the system capacity (from a badly-worn engine, sustained heavy load, etc.) is exhausted into the air cleaner and is drawn into the engine.

Proper operation of the PCV system is dependent upon a sealed engine. If oil sludging or dilution is noted and the PCV system is functioning properly, check engine for possible cause and correct to ensure that system will function as intended.

ON-VEHICLE SERVICE

Except 2.5L

An engine can be damaged if it is operated without crankcase ventilation (Figure 11-5). Therefore, it is important to perform the "Functional Check" at intervals shown in MAINTENANCE AND LUBRICATION (SECTION 0B) of the appropriate Service Manual or the vehicle's maintenance schedule.

Replace PCV components as diagnosis requires. The recommended replacement parts are listed in the "Specifications" section of the vehicle's owners manual.

Periodically, inspect the hoses and clamps and replace any showing signs of deterioration.

2.5L

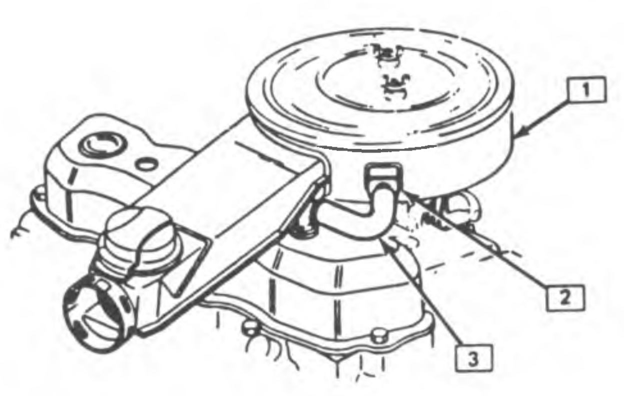
See Figure 11-6 for replacement of PCV system components.

An engine which is operated without any crankcase ventilation can be damaged (Figure 11-5). Therefore, it is important to replace the air inlet filter/separator at intervals shown in MAINTENANCE AND LUBRICATION (SECTION 0B).

Periodically, inspect the crankcase vent tube assembly and crankcase vent hose and replace any showing signs of deterioration.

PARTS INFORMATION

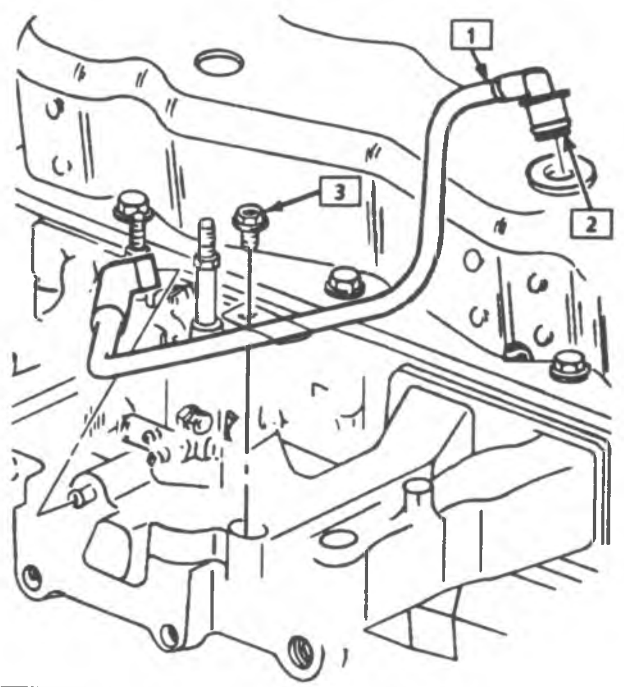
PART NAME	GROUP
Air Cleaner	3.402
Tube, C/Case Vent	1.762
Hose, C/Case Vent Vlv	1.762



1 AIR CLEANER
2 CRANKCASE VENT FILTER
3 HOSE

7S 3854-6E

Figure 11-5 - Crankcase Vent Filter



1 CRANKCASE VENT TUBE ASSEMBLY
2 INLET END
3 BOLT (1)

8S 4490-6E

Figure 11-6 - PCV System 2.5L

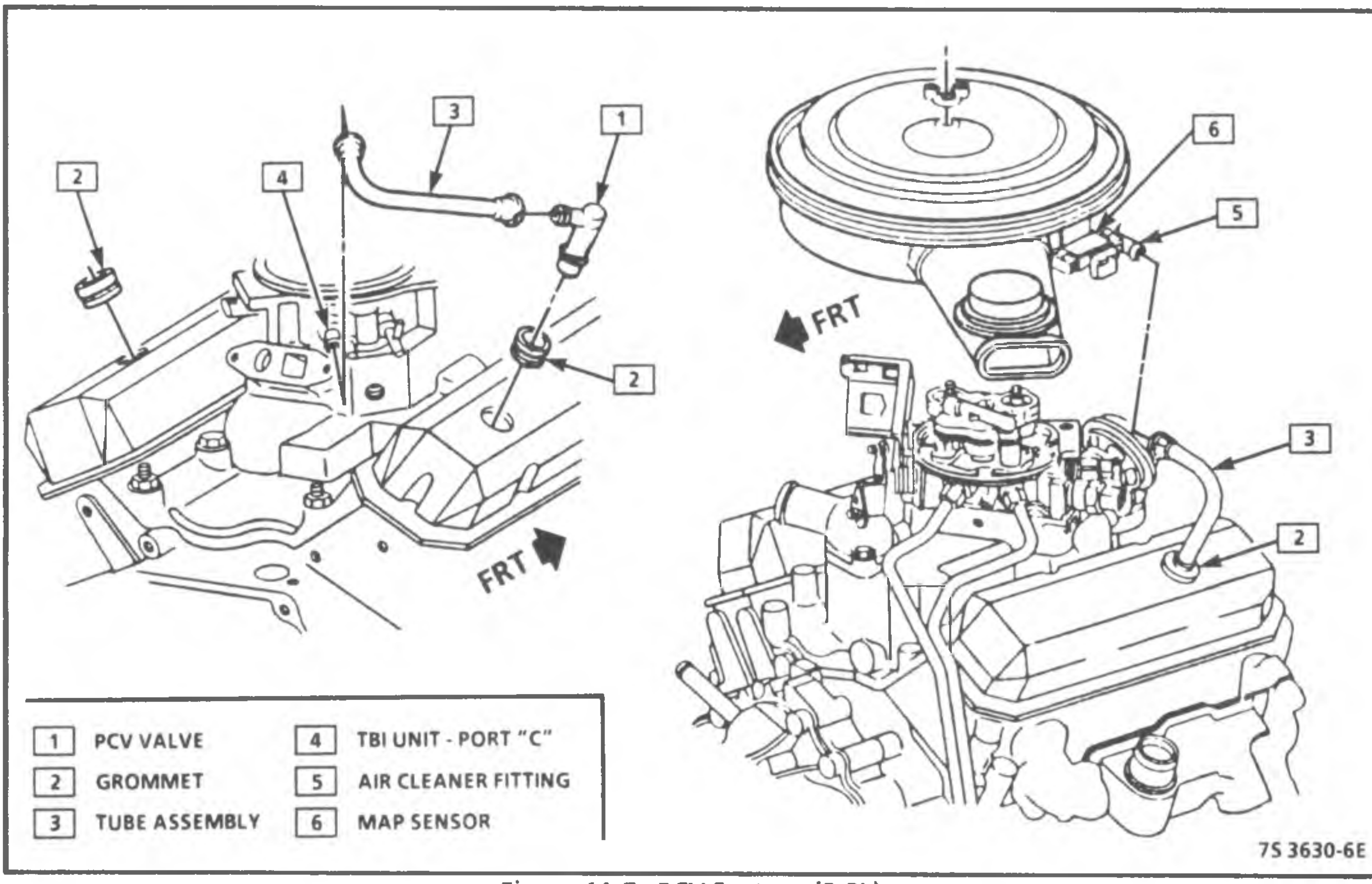


Figure 11-7 - PCV System (2.8L)

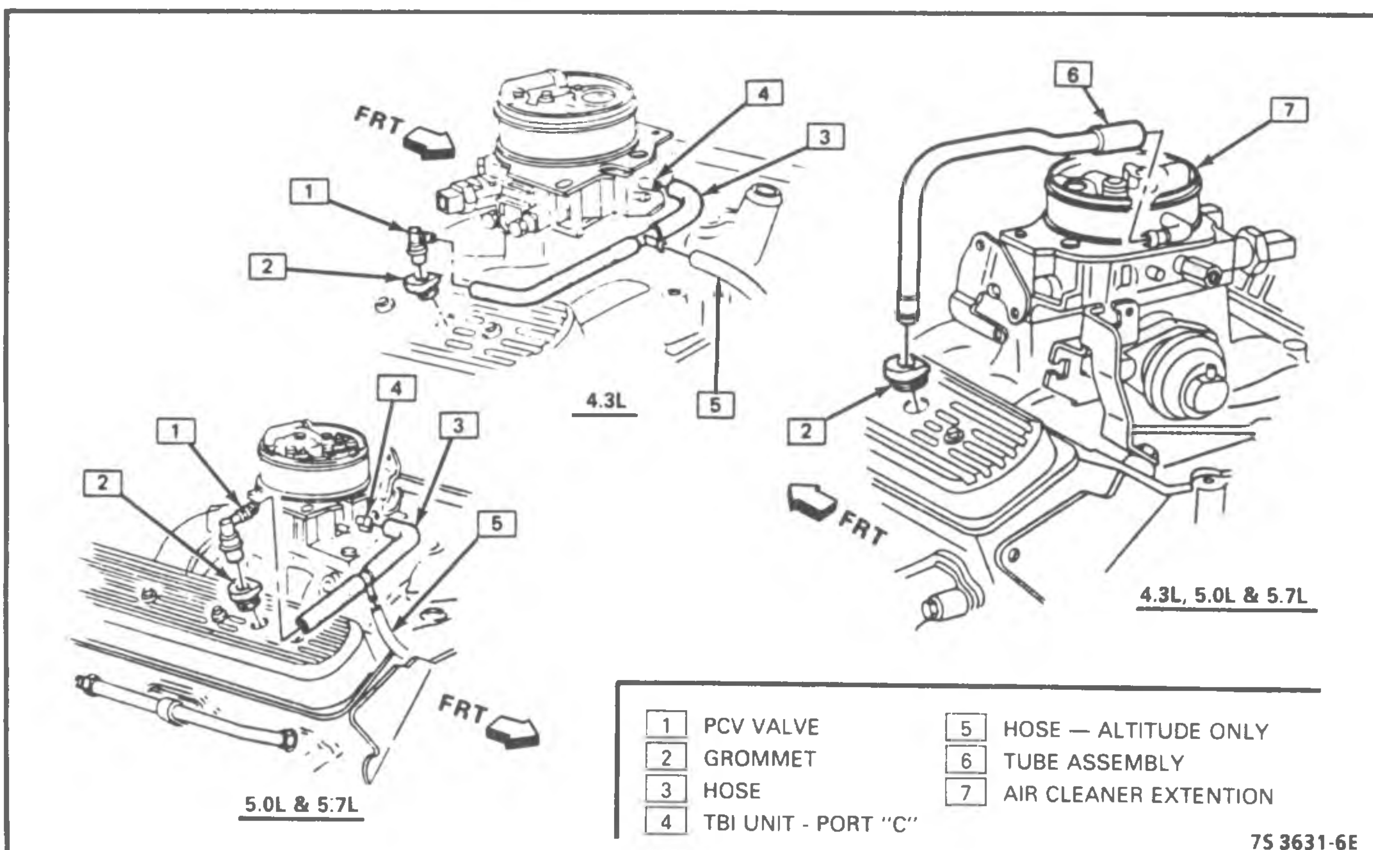


Figure 11-8 - PCV System (4.3L, 5.0L & 5.7L)

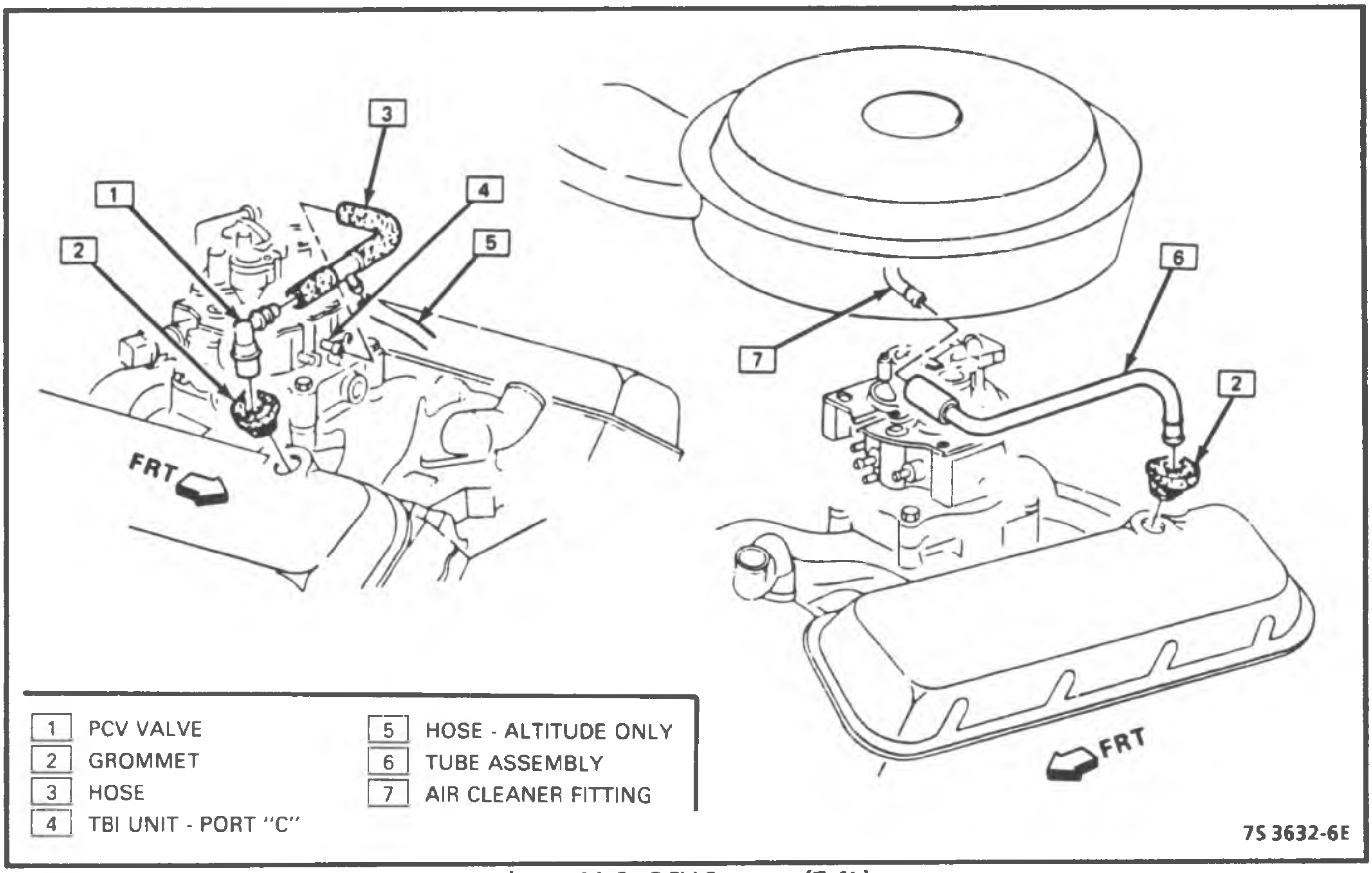


Figure 11-9 - PCV System (7.4L)

BLANK

SECTION 12
THERMOSTATIC AIR CLEANER (THERMAC)

CONTENTS

GENERAL DESCRIPTION

PURPOSE

A heated intake air system is used to give good driveability under varying climatic conditions. Having a uniform inlet air temperature improves fuel vaporization.

OPERATION

All Except 2.8L

The THERMAC system (Figure 12-1) regulates incoming air temperature without the use of vacuum. The air regulating damper is controlled by means of a self-contained, wax-pellet actuated assembly mounted in the air cleaner. When incoming air is cold, the wax material sealed in the actuator is in a solid (contracted) phase and the damper closes off the cold air inlet. This causes all incoming air to be heated by the exhaust manifold. As the incoming air warms, the wax material expands by changing to liquid phase which forces out a piston to reposition the damper allowing a cold and hot air mix or all cold air to enter the engine.

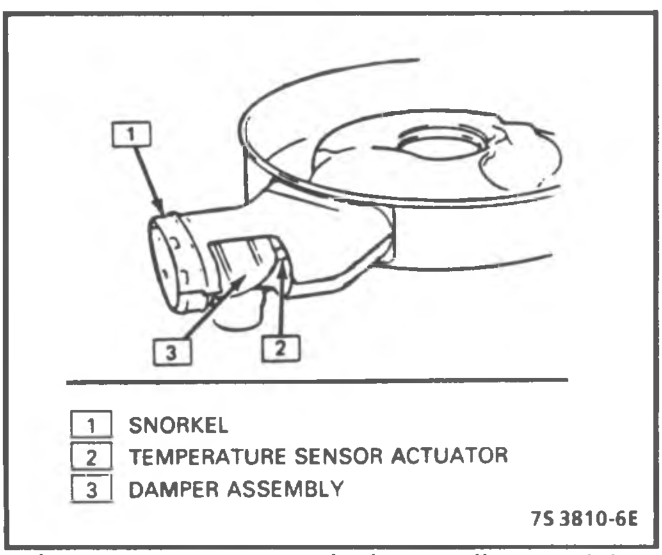


Figure 12-1 - THERMAC Air Cleaner All Except 2.8L

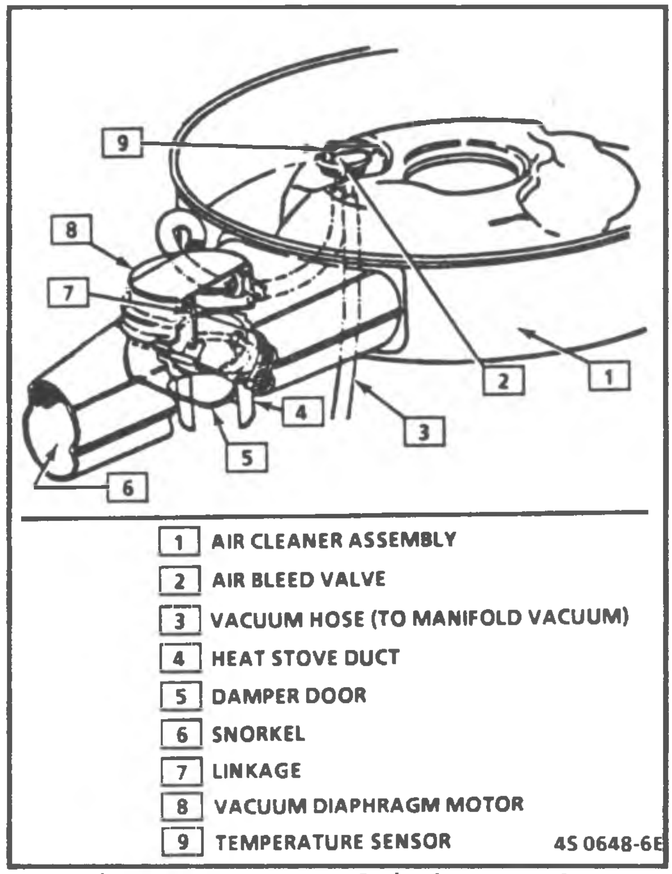


Figure 12-2 - THERMAC Air Cleaner - 2.8L

2.8L

The THERMAC system (Figure 12-2) uses a sensor, vacuum motor, and damper to regulate intake air temperature. The sensor monitors air temperature and controls the vacuum motor which in turn positions the damper. When the incoming air is cold, the sensor will apply manifold vacuum to the vacuum motor, cutting off the cold air supply. This causes all incoming air to be heated up by the exhaust manifold. As the incoming air warms up, the sensor will reduce the vacuum to the motor via an air bleed valve, thus re-positioning the damper to allow a cold and hot air mix or all cold air to enter the engine.

DIAGNOSIS

RESULTS OF INCORRECT OPERATION

All Except 2.8L

- Hesitation during warm-up can be caused by:
  - Heat stove tube disconnected.
  - Missing or damaged air cleaner-to-TBI gasket.
  - Loose air cleaner cover & air cleaner.
  - Missing air cleaner cover seal.
  - Damper door does not close.
- Lack of power, sluggish, or spongy (on a hot engine) can be caused by:
  - Damper door does not open to outside air.

2.8L

- Hesitation during warm-up can be caused by:
  - Heat stove tube disconnected.
  - Vacuum diaphragm motor inoperative (open to snorkel).
  - No manifold vacuum.
  - Damper door does not move.
  - Missing air cleaner to TBI seal.
  - Missing air cleaner cover seal or loose cover.
  - Loose air cleaner.
- Lack of power, sluggish, or spongy (on a hot engine) can be caused by:
  - Damper door does not open to outside air.
  - Temperature sensor doesn't bleed off vacuum.

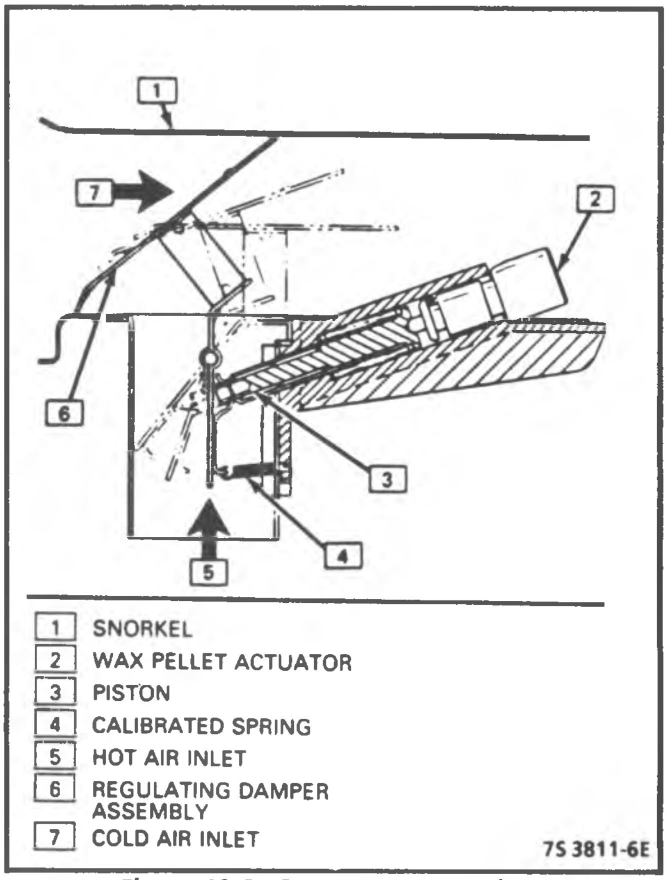


Figure 12-3 - THERMAC Operation
All Except 2.8L

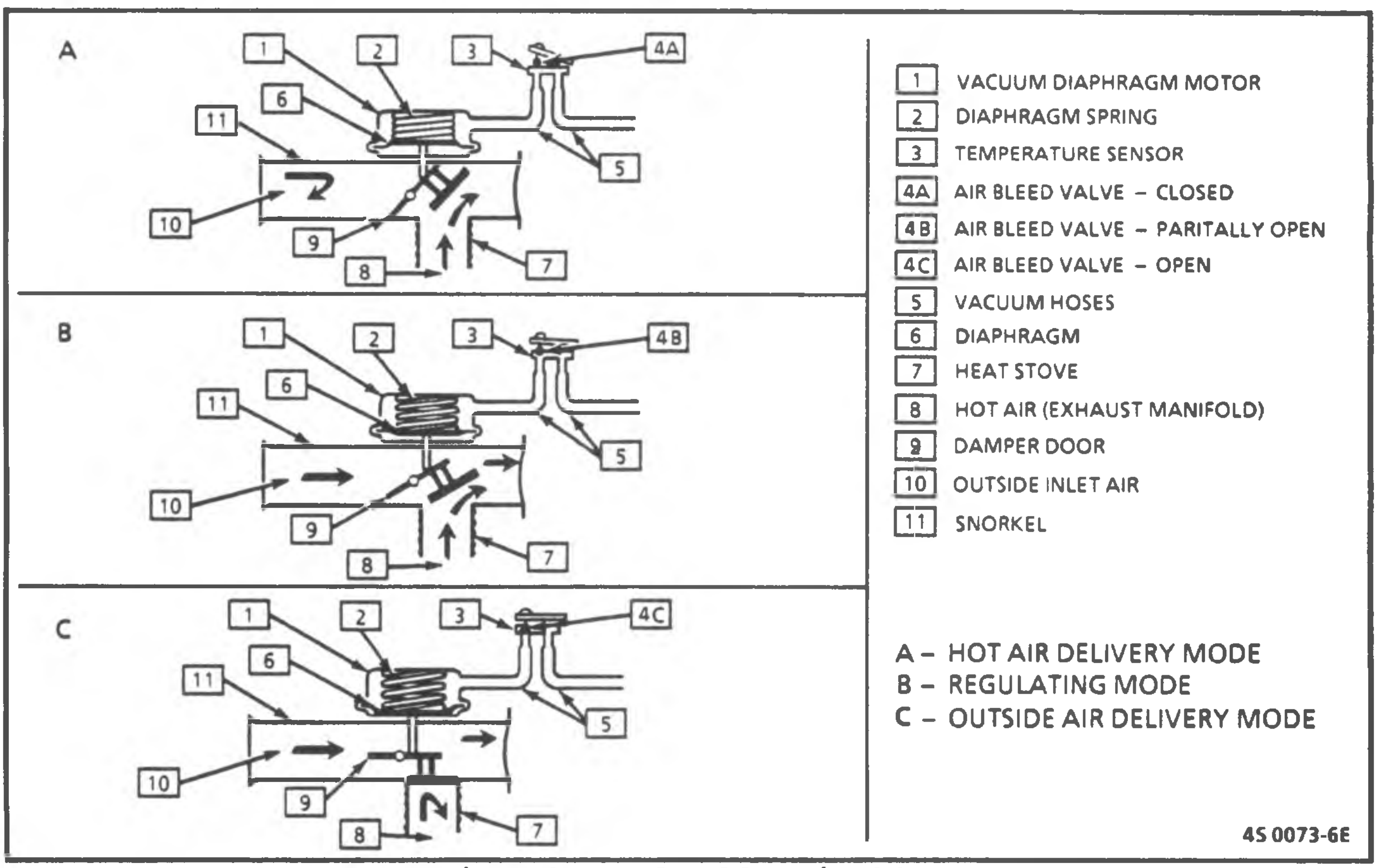


Figure 12-4 - THERMAC Operation 2.8L

THERMAC AIR CLEANER FUNCTIONAL CHECK

All Except 2.8L

1. Remove air cleaner assembly and cool to below 4°C (40°F). The damper door should be closed to outside air (cold air).
2. Check for presence and condition of air cleaner to throttle body gasket.
3. Reinstall air cleaner assembly and be sure heat stove tube is connected at air cleaner snorkel and exhaust manifold.
4. Start engine. Watch damper door in air cleaner snorkel. As air cleaner warms up, damper door should open slowly to outside air (cold air).
5. If air cleaner fails to operate as described, be sure calibrated spring is properly installed and damper is not binding. If OK, replace air cleaner assembly.

2.8L

1. Inspect system to be sure all hoses and heat stove tube are connected. Check for kinked, plugged or deteriorated hoses.
2. Check for presence and condition of air cleaner to throttle body gasket seal.
3. With air cleaner assembly installed, damper door should be open to outside air.
4. Start engine. Watch damper door in air cleaner snorkel. When engine is first started, damper door should move and close off outside air. As air cleaner warms up, damper door should open slowly to outside air.
5. If the air cleaner fails to operate as described above, perform vacuum motor check. If it operates, the door may not be moving at the right temperature. If the driveability problem is during warm-up, make the temperature sensor check below.

VACUUM MOTOR FUNCTIONAL CHECK

2.8L

1. With engine "OFF," disconnect vacuum hose at vacuum diaphragm motor.
2. Apply at least 23 kPa (7" Hg.) of vacuum to the vacuum diaphragm motor. Damper door should completely block off to outside air when vacuum is applied. If not, check to see if linkage is hooked up correctly.
3. With vacuum still applied, trap vacuum in vacuum diaphragm motor by bending hose. Damper door should remain closed. If not, replace vacuum diaphragm motor assembly. (Failure of the vacuum diaphragm motor assembly is more likely to be caused from binding linkage or a corroded snorkel than from a failed diaphragm. This should be checked first, before replacing the diaphragm.)
4. If vacuum motor checks OK, check vacuum hoses and connections. If OK, replace the temperature sensor.

TEMPERATURE SENSOR CHECK

2.8L

1. Start test with air cleaner temperature below 30°C (86°F). If engine has been run recently, remove air cleaner cover and place thermometer as close as possible to the sensor. Let air cleaner cool until thermometer reads below 30°C (86°F) about 5 to 10 minutes. Reinstall air cleaner on engine and continue to Step 2.
2. Start and idle engine. Damper door should move to close off outside air immediately, if engine is cool enough. When damper door starts to open (in a few minutes), remove air cleaner cover and read thermometer. It must read about 55°C (131°F).
3. If the damper door is not open to outside air at temperature indicated, temperature sensor is malfunctioning and must be replaced.

ON-VEHICLE SERVICE

AIR CLEANER ELEMENT

←→ Remove or Disconnect

1. Air cleaner cover.
2. Old element.
3. Clean housing.

→← Install or Connect

1. New element.
2. Air cleaner cover. Tighten securely 14 - 17 in/lb.

AIR CLEANER

Refer to Figures "12-8 to 12-11" for repair or replacement of air cleaner.

VACUUM DIAPHRAGM MOTOR

S/T Series
Figure 12-5

←→ Remove or Disconnect

1. Air cleaner.
2. Vacuum hose from motor.
3. Drill out the two spot welds initially with a 1.6mm (1/16") drill, then enlarge as required to remove the retaining strap. Do not damage the snorkel tube.
4. Motor retaining strap.
5. Lift up motor, cocking it to one side to unhook the motor linkage at the control damper assembly.

Install or Connect

1. Drill a 2.8 mm (7/64") hole in snorkel tube at center of vacuum motor retaining strap.
2. Vacuum motor linkage into control damper assembly.
3. Use the motor retaining strap and sheet metal screw provided in the motor service package to secure motor to the snorkel tube. Make sure the screw does not interfere with the operation of the damper assembly. Shorten screw if required.
4. Vacuum hose to motor and install air cleaner.

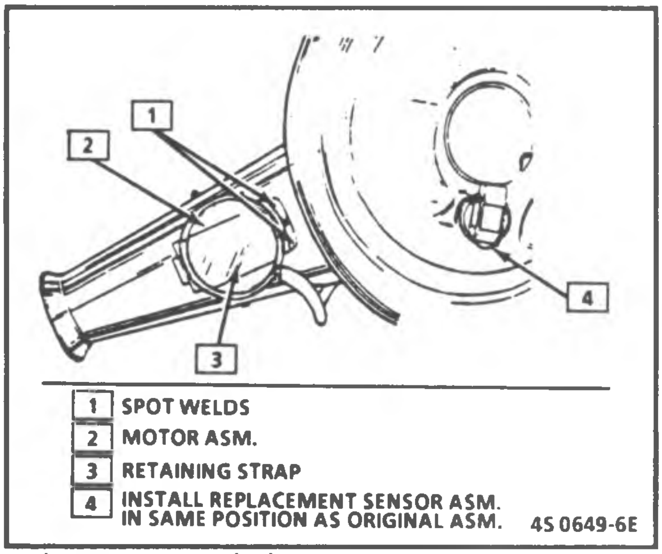


Figure 12-5 - Replacing THERMAC Vacuum Motor 2.8L

SENSOR

2.8L
Figure 12-6

Remove or Disconnect

1. Air cleaner.
2. Hoses at sensor.
3. Pry up tabs on sensor retaining clip. Remove clip and sensor from air cleaner. Note position of sensor for installation.

Install or Connect

1. Sensor and gasket assembly in original position.
2. Retainer clip on hose connectors.
3. Vacuum hoses and air cleaner on engine.

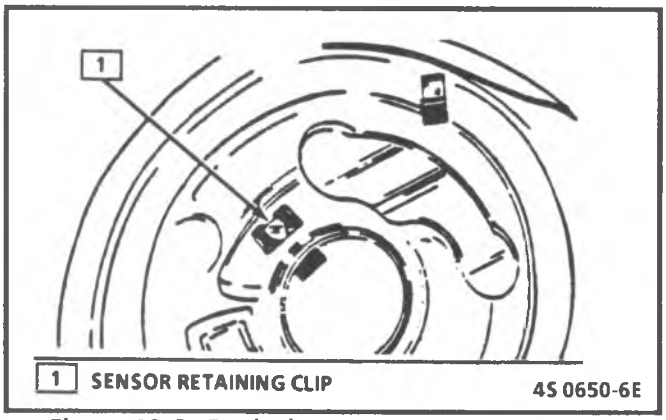


Figure 12-6 - Replacing THERMAC Sensor 2.8L

PARTS INFORMATION

PART NAME	GROUP
Air Cleaner	3.402
Element (Paper)	3.410
Nut, A/Cl	3.403
Seal, Air Cleaner	3.403
Sensor, A/Cl	3.415
Motor, A/Cl Vac Diaph	3.415
Tube, Eng Air Heat Stove	3.417
Stove, Eng Air Heat	3.417

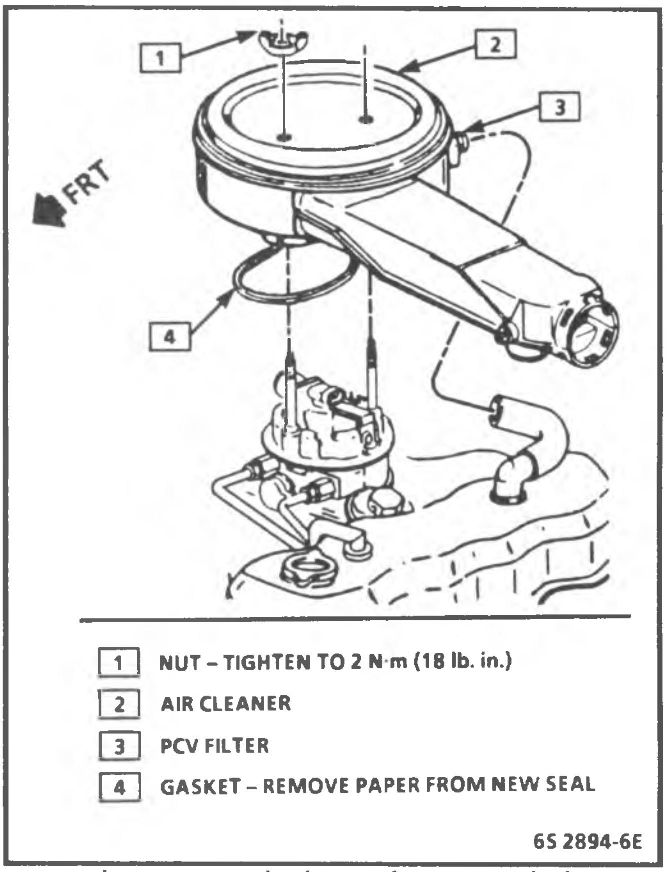
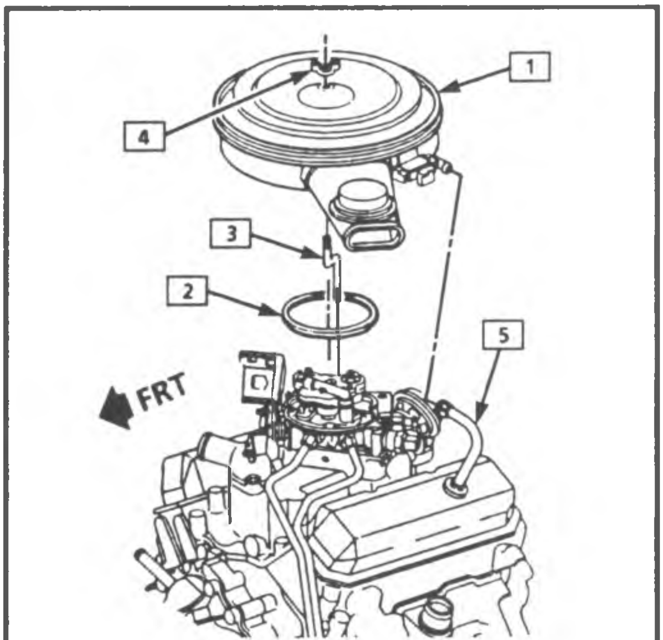


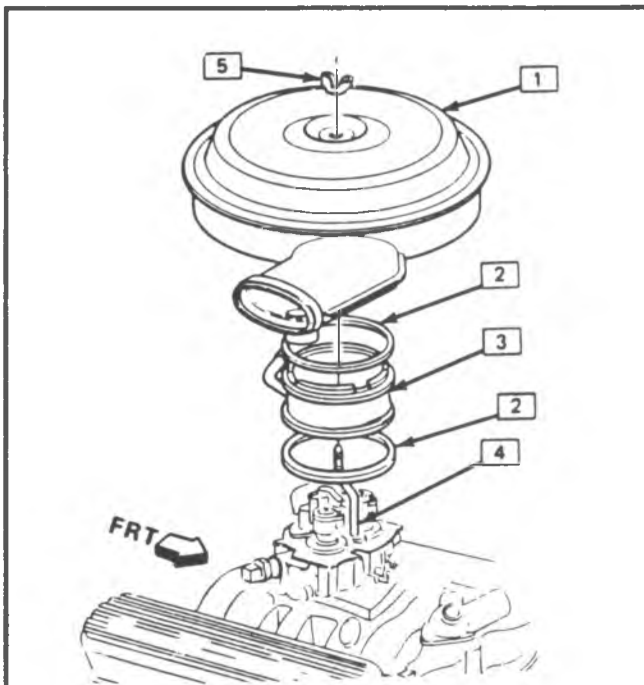
Figure 12-7 - Air Cleaner (2.5L - S Series)



1 AIR CLEANER ASSEMBLY
2 SEAL
3 STUD
4 NUT - TIGHTEN TO 2 N·m (18 lb. in.)
5 TUBE ASSEMBLY

7S 3702-6E

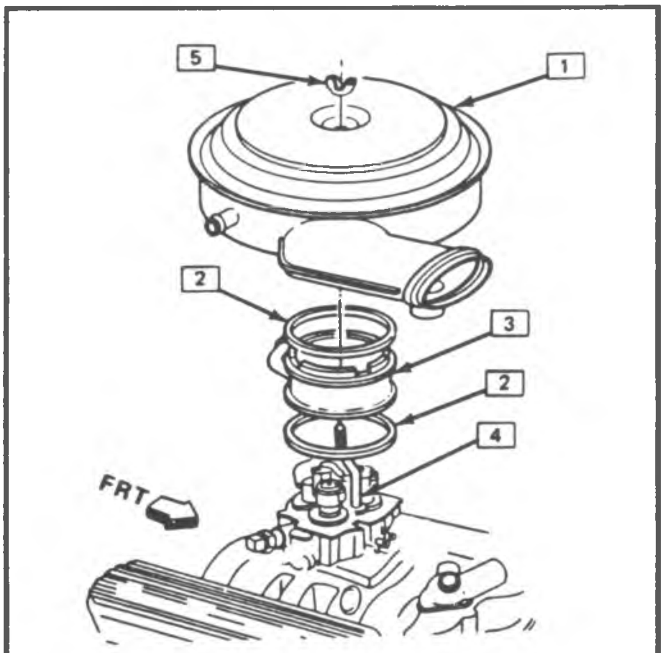
Figure 12-8 - Air Cleaner (2.8L - S Series)



1 AIR CLEANER ASSEMBLY
2 SEAL
3 EXTENSION
4 STUD
5 NUT-TIGHTEN TO 2 N·m (18 IN. LBS.)

7S 3704-6E

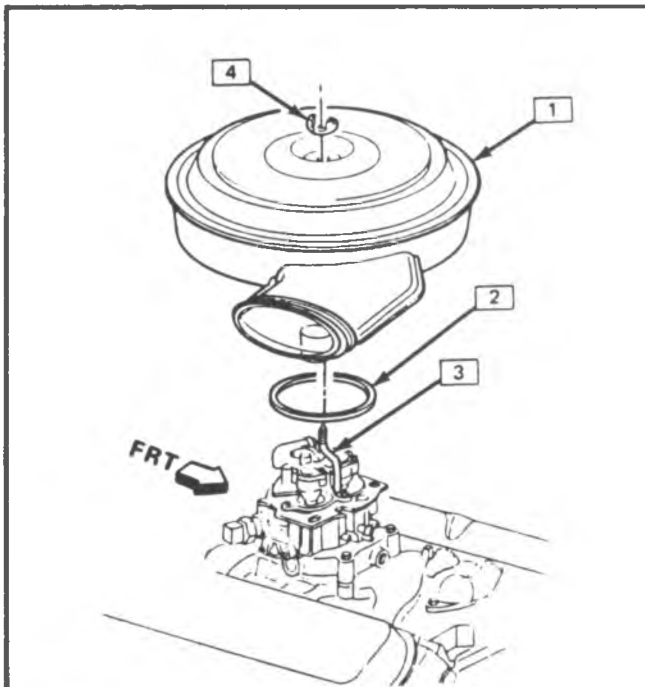
Figure 12-10 - Air Cleaner (4.3L, 5.0L & 5.7L - C/K, P, R/V Series)



1 AIR CLEANER ASSEMBLY
2 SEAL
3 EXTENSION
4 STUD
5 NUT-TIGHTEN TO 2 N·m (18 IN. LBS.)

7S 3703-6E

Figure 12-9 - Air Cleaner (4.3L, 5.0L & 5.7L - S/T, M/L & G Series)



1 AIR CLEANER ASSEMBLY
2 SEAL
3 STUD
4 NUT-TIGHTEN TO 2 N·m (18 IN. LBS.)

7S 3705-6E

Figure 12-11 - Air Cleaner (7.4L All)

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SECTION 13
SPECIAL TOOLS
CONTENTS

GENERAL

The special tools required to service the fuel and emission systems are illustrated in Figures 13-1 through 13-3.

You should know how to use a test light, how to connect and use a tachometer, and how to use jumper wires to bypass components to test circuits. A test light or voltmeter must be used when specified in the procedures. They must NOT be interchanged. Care should be taken to not deform terminals when testing.

You should be familiar with the Digital Volt-Ohm Meter, particularly essential tool J 29125-A, J 34029A or equivalent. You should be able to measure voltage, resistance, and current and know how to use the meter correctly.

"SCAN" TOOL

The Computer Command Control ALDL connector under the dash, has a variety of information available on serial data line terminal "E" or "M" (depending on engine). There are several "Scan" tools available for reading this information.

"Scan" tools do not make the use of diagnostic charts unnecessary. They do not tell exactly where a problem is in a given circuit. However, with an understanding of what each position on the equipment measures, and knowledge of the circuit involved, the tools can be very useful in getting information which would be more time consuming to get with other equipment.

In some cases, "Scan" tools will provide information that is either extremely difficult or impossible to get with other equipment.

A "SCAN" TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY "SCAN" TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.

Tree code charts incorporate diagnosis procedures using an ALDL "Scan" tool where possible.

Some electronic control modules have three modes for transmitting information but some only read data in the open mode.

The following information will describe each of the three modes where applicable and the affects they may cause.

"SCAN" TOOL MODES

Normal (Open) Mode

Not all systems will transmit information on the serial data line while in this mode.

On systems that can be monitored in the open mode, it allows certain parameters to be obtained without changing the engine operating characteristics.

The parameters capable of being read vary from engine family to engine family. Most "Scan" tools are programmed so that the system will go directly into the special mode if the "open" mode is not available.

ALDL (10K, or Special) Mode (not used on all engines)

In this mode, all information incorporated into a specific engine and ECM/PCM is obtainable. However, in this mode the system operating characteristics are modified as follows.

- "Closed Loop" timers in ECM/PCM are bypassed
- EST (spark) is advanced
- IAC will control engine idle to 1000 rpm ± 50 rpm (On 5.0L engine the control engine idle is 850 rpm ± 50 rpm.
- P/N restrict functions will be disabled

Factory Test (Back-up or 3.9 K) Mode

When in this mode, the ECM/PCM is operating on the fuel back-up logic and calibrated by the CAL-PAK/MEM-CAL. The CAL-PAK/MEM-CAL is used to control the fuel delivery if the ECM fails. This mode verifies that the back-up feature is OK. The parameters that can be read on a "Scan" tool in this mode are not of much use for service.

"SCAN" TOOL LIMITATIONS AND USE

The "Scan" tool allows a quick check of sensors and switches which are inputs to the ECM/PCM. However, on some applications the data update rate makes the tool not as effective as a voltmeter when trying to detect an intermittent which lasts for a very short time. However, the "Scan" tool allows manipulation of wiring harnesses or components under the hood while observing the "Scan" readout. This helps in locating intermittents with the engine not running.

Intermittent Conditions

The "Scan" tool is helpful in cases of intermittent operation. The tool can be plugged in and observed while driving the vehicle under the condition where the light comes "ON" momentarily, or the engine driveability is poor momentarily. If the problem seems to be related to certain areas that can be checked on the "Scan" tool, then those are the positions that should be checked while driving the vehicle. If there does not seem to be any correlation between the problem and any specific circuit, the "Scan" tool can be checked on each position, watching for a period of time to see if there is any change in the readings that indicates intermittent operation.

The "Scan" tool is also a useful and quick way of comparing operating parameters of a poorly operating engine with a known good one. For example; A sensor may shift in value but not set a code. Comparing with a known good vehicle may uncover the problem.

The "Scan" tool has the ability to save time in diagnosis and prevent the replacement of good parts. The key to using the "Scan" tool successfully for diagnosis lies in the technicians ability to understand the system he is trying to diagnose as well as an understanding of the "Scan" tool's limitations. Therefore, the technician should read the tool operating manual to become familiar with the tool. The following information will describe most of the "Scan" tool positions and how they can be helpful in diagnosis.

"SCAN" TOOL POSITIONS

The following positions may not be applicable to all engines:

A/C Clutch

Displays "ON" when the ECM has commanded the A/C clutch "ON."

A/C Request

Displays the state of the A/C signal line to the ECM/PCM. Should read "YES" whenever the A/C is requested.

Battery Voltage

This displays the battery voltage detected at the ECM/PCM ignition input.

Closed Loop/Open Loop

This position will indicate whether the engine control system is operating in "Open" or "Closed Loop." Most systems go "Closed Loop" after a certain amount of run time, when coolant temperature is high enough, and the oxygen sensor becomes active.

Block Learn Multiplier (BLM) Cell - or - Block Learn Memory (BLM)

There are up to sixteen different cells, corresponding to ranges of rpm and engine load (indicated by MAP signal), and other conditions, such as A/C or P/N switch "ON" or "OFF," etc. The ECM/PCM learns how much adjustment is needed in each cell, and retains it in memory, so that the adjustment will immediately be made when the engine operates in that cell (or rpm/load range). This parameter will display what cell the ECM/PCM is currently using for the fuel calculation.

Codes

Will display any code stored in the ECM/PCM memory.

Coolant Temperature

Engine coolant temperature is displayed in Celsius degrees. After engine is started the temperature should rise steadily to about 85-95°C then stabilize when the thermostat opens.

Desired RPM

Indicates the rpm to which the ECM/PCM is trying to control the idle.

EGR (Duty Cycle)

The EGR system uses a valve to feed a small amount of exhaust gas back into the intake manifold to control formation of NOx. Like all ECM/PCM outputs the "Scan" tool only indicates that the ECM/PCM has commanded the function and does not indicate that the function has really happened.

EGR Position

Indicates the position of the EGR pintle.

4th gear

Displays state of the 4th gear switch. "Yes" = 4th gear.

IAC (Idle Air Control)

This system is used to control engine idle speed to the desired rpm, for different operating conditions. In this mode, the numbers will indicate what position the ECM/PCM thinks the valve is in. The ECM/PCM moves the IAC in counts and these counts are what is displayed on a "Scan" tool.

Injector Pulse Width

In this position, the reading is given in milliseconds which is the on time that the ECM/PCM is commanding to the injector(s).

Integrator and Block Learn

Normal readings for these positions are around 128, if higher, it indicates that the ECM/PCM is adding fuel to the base fuel calculation because the system is lean, and if the numbers are below 128 the ECM/PCM is taking out fuel from the base calculation because the system is rich.

The integrator is short term corrective action while the block learn portion (which is a long term correction) will only change if the integrator has seen a condition which lasts for a calibrated period of time.

Knock Retard

Indicates the number of degrees the ECM/PCM is retarding the Electronic Spark Timing (EST).

Knock Signal

Displays a "YES" when knock is detected by the ECM/PCM and displays a "NO" when knock is not detected.

Intake Air Temperature (IAT) Sensor

Displays temperature of the intake intake air. Should read close to ambient air temperature when the engine is cold, and rise as underhood and engine temperature increases.

Manifold Absolute Pressure (MAP) Sensor

The MAP Sensor produces a low signal voltage when manifold pressure is low (high vacuum) and a high voltage when the pressure is high (low vacuum).

With the ignition "ON" and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM/PCM as an indication of vehicle altitude and is referred to as BARO. Comparison of this BARO reading with a known good vehicle with the same sensor ** is a good way to check accuracy of a "suspect" sensor. Readings should be the same ±.4 volt.

** A MAP Sensor has a colored plastic insert visible in the connector cavity. Sensors with the same insert color are identical in calibration. The harness electrical connector color should also be the same as the sensor insert color.

Mode

Check with the manufacturer to determine what the function of this mode is. In most cases it allows the user to place the ECM/PCM in different operating modes.

MPH

Displays vehicle speed. Useful in Checking TCC lock up speed or speedometer accuracy.

Oxygen (O_2) Sensor

The reading will be read out in millivolts (mV) with a range from 1 to 999 mV. If the reading is consistently below 350 (350 mV), the fuel system is running lean as seen by the ECM/PCM and if the reading is consistently above 550 (550 mV), the system is running rich.

Park/Neutral Switch or Pressure Switch Manifold (PSM)

The indication in this mode may vary with manufacturer so the type of reading for a particular tool should be checked in the operators manual. The important thing is that the the reading changes state (switches) when the gear selector is moved from park/neutral to drive or reverse.

Power Steering Pressure Switch (PSPS)

Displays the state of switch. This reading may vary with the tool used and the type of switch installed on the vehicle. The important thing is that the reading changes state (switches) when the steering is moved against the stops.

PROM ID

In this position, information is used for assembly verification only. PROM ID is useful only when the vehicle is equipped with the original ECM/PCM and PROM or MEM-CAL. Refer to "Parts Information" for correct PROM.

RPM

Displays engine rpm. Often useful if extra reference pulses are suspected. A sudden high rpm indication while at a steady throttle would indicate Electrical Interference (EMI) in the reference circuit. This interference is usually caused by ECM/PCM wires too close to ignition secondary wires or an open distributor ground circuit.

Shift Light

Displays "YES" when the ECM is commanding the shift light to turn "ON."

Throttle Angle

Displays in percent the amount the throttle is open. 0% is closed throttle and 100% is Wide Open Throttle (WOT).

Throttle Position Sensor (TPS)

Values read will be the voltage as seen by the ECM/PCM. The voltage should be the TPS specification with the throttle closed and go up to about 5 volts with Wide Open Throttle (WOT).

Torque Convertor Clutch (TCC)

In this position, the tool will indicate when the TCC has been commanded by the ECM to turn "ON." This does not necessarily mean that the clutch was engaged but only that the ECM grounded the circuit internally. The best way to determine if the clutch has engaged is to monitor engine RPM when the TCC comes "ON."

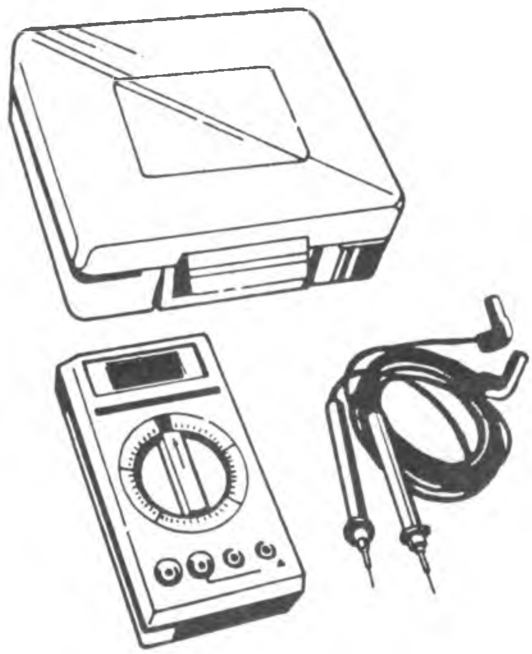
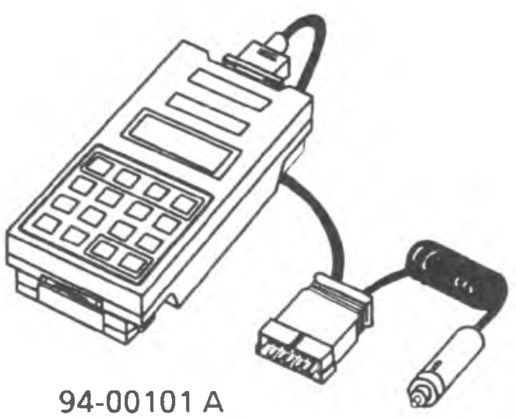
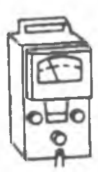
 HIGH IMPEDANCE MULTIMETER (DIGITAL VOLTMETER-DVM) J 34029-A	VOLTMETER - Voltage Position Measures amount of voltage. When connected in parallel to an existing circuit. A digital voltmeter with 10 megohm input impedance is used because some circuits require accurate low voltage readings, and some circuits in the ECM have a very high resistance. AMMETER - When used as ammeter, this meter also accurately measures extremely low current flow. Refer to meter instructions for more information. • Selector must be set properly for both function and range. DC is used for most automotive measurements. OHMMETER - Measures resistance of circuit directly in ohms. Refer to meter for more information. • OL Display in all ranges indicates open circuit. • Zero display in all ranges indicates a short circuit. • Intermittent connection in circuit may be indicated by digital reading that will not stabilize on circuit. • Range Switch. 200Ω – Reads ohms directly 2K,20K,200KΩ – Reads ohms in thousands 2M and 20MΩ - Reads ohms in millions
 94-00101 A	**TECH 1 DIAGNOSTIC COMPUTER** A hand-held "SCAN" tool used to analyze and diagnose fuel and emission system. Also can be used to analyze other computer system.
	**TACHOMETER** Use inductive trigger signal pickup type to check RPM.
 J 35616	**CONNECTOR TEST ADAPTER KIT** Used to make electrical test connections in current Weather Pack, Metri - Pack and Micro-Pack style terminals. 5-24-90 7S 3534-6E

Figure 13-1 - Special Tools (1 of 4)

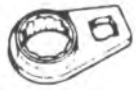
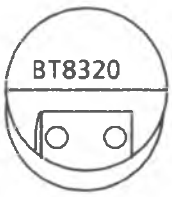
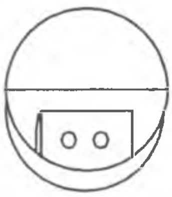
 J29533-A/BT8127	**OXYGEN SENSOR WRENCH** Used to remove or install the oxygen sensor.
 J33031/BT8130	**IDLE AIR CONTROL WRENCH** Used to remove or install IAC valve on throttle body.
 BT8320	**INJECTOR TEST LIGHT** Used to check electrical circuit to a TBI 220 fuel injector.
 J347302A/ BT8329A	**INJECTOR TEST LIGHT** Used to check electrical circuit to a TBI 700 fuel injector.
 J34636/BT8405	**CIRCUIT TESTER** Used to check all relays and solenoids before connecting them to a new ECM. Measures the circuit resistance and indicates pass or fail via green or red LED. Amber LED indicates current polarity. Can also be used as a non-powered continuity checker.
 J35689A	**METRI-PACK TERMINAL REMOVER** Used to remove 150 series Metri-Pack "pull-to-seat" terminals from connectors. Refer to wiring harness service in Section "3" for removal procedure.
 J28742-A	**WEATHER PACK TERMINAL REMOVER** Used to remove terminals from Weather Pack connectors. Refer to wiring harness service in Section 3 for removal procedure.
 J33095/BT8234-A	**ECM CONNECTOR TERMINAL REMOVER** Used to remove terminal from Micro-Pack connectors. Refer to wiring harness service in Section "6E" for removal procedure. 7-20-89 7S 3535-6E

Figure 13-2 - Special Tools (2 of 4)

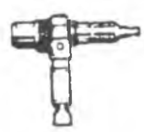
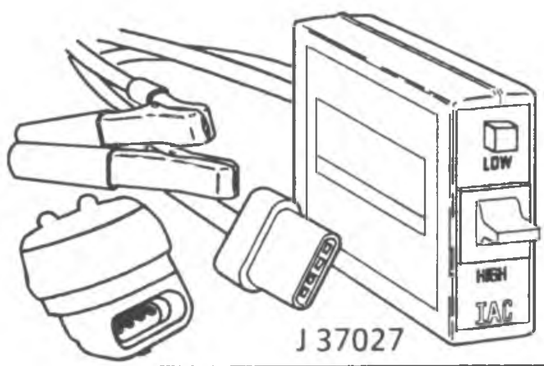
 J 26792/BT-7220-1	**SPARK TESTER** Used to check available secondary ignition voltage. Also called an ST125.
 J 29698-A/BT-8251	**FUEL LINE WRENCH** Used to disconnect or connect fuel lines at TBI unit by holding fuel nut at throttle body.
 J 33179-20	**MINIMUM IDLE SPEED ADJUSTING WRENCH** Used to adjust throttle stop screw on TBI unit.
 J 29658-B/BT-8205	**FUEL PRESSURE GAGE** Used to check and monitor fuel line pressure.
 J 37027	**IAC SYSTEM MONITOR** Used to test IAC motors for correct functioning and proper response to commands.
 J 36608(CK)/J 24178	**FUEL TANK SENDING AND PUMP UNIT** Used to remove and install cam lock nut on the fuel tank sending and pump unit in Section 4.
 J 24642-F/BT-7220	**IGNITION MODULE TESTER** Used to test ignition module in Section 6. 7-5-89 7S 3536-6E

Figure 13-3 - Special Tools (3 of 4)

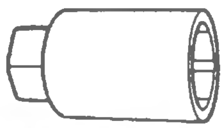
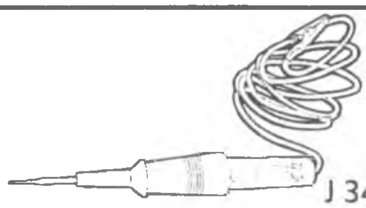
 J 35748	**OIL PRESSURE SENDING UNIT SOCKET** Used to remove and install oil pressure sending unit.
 J 35749	**OIL PRESSURE SWITCH SOCKET** Used to remove or install oil pressure switch.
 J 23738	**VACUUM PUMP (20 IN. HG. MINIMUM)** Use gage to monitor manifold engine vacuum and check vacuum sensors, solenoids and valves.
 J 34142-B	**UNPOWERED TEST LIGHT** Used to check wiring for complete circuit and short to ground or voltage. 5-24-90 9S-8140-AS

Figure 13-4 - Special Tools (4 of 4)

SPECIFICATIONS

SPECIFICATION	LOCATION OF INFORMATION
Engine Timing	Vehicle Emission Control Information label.
Idle Speed, ECM Controlled	Not adjustable. ECM controls idle.
Spark Plug Type	See Owner's Manual, Section "7."
Spark Plug Gap	Vehicle Emission Control Information label.
Engine Code	8th digit of VIN number. See Section "0A." Also Owner's Manual, Section "7."
Engine Family	Vehicle Emission Control Information label.
Filter Part Numbers	See Owner's Manual, Section "7."
Part Numbers of Major Components	GM SPO Parts Book.
Replacement of Vehicle Emission Control Information Label	GM SPO Standard Parts Catalog.

7-15-88
8S 4703-6E

SECTION 14

ABBREVIATIONS AND GLOSSARY OF TERMS

Abbreviations used in this manual are listed below in alphabetical order with an explanation of the abbreviation. There are some variations in the use of periods and in capitalization (as mph, m.p.h., Mph, and MPH) for abbreviations used in this section but all types are acceptable.

A/F - AIR/FUEL (A/F RATIO) - The amount of air-to-fuel for combustion of fuel. Ideal ration is 14.7 parts of air to 1 part of fuel.

AIR - AIR INJECTOR REACTION SYSTEM - Air flow from pump is directed into engine exhaust manifold and/or converter to reduce exhaust emissions.

ALDL - ASSEMBLY LINE DIAGNOSTIC LINK - Used at assembly to evaluate Computer Command Control and for service to flash the "Service Engine Soon" light if there are trouble codes. Also used by "Scan" tools to obtain ECM serial data.

ANALOG SIGNAL - An electrical signal that varies in voltage within a given parameter.

Bat + - Battery Positive Terminal (12 Volts)

BLOCK LEARN - ECM memory that adjusts the air/fuel ratio on a semipermanent basis.

CAPACITOR - An electrical device used to store a temporary charge.

CALPAK - A device used with fuel injection to allow fuel delivery in the event of a PROM or ECM malfunction.

CALIBRATOR - (PROM) - An electronic component which can be specifically programmed to meet engine operating requirements for each vehicle model. It plugs into the Engine Control Module (ECM).

CCC - COMPUTER COMMAND CONTROL - has an electronic control module to control air/fuel and emission systems.

CCP - CONTROLLED CANISTER PURGE - ECM controlled solenoid valve that permits manifold vacuum to purge the evaporative emissions from the charcoal canister.

CID - CUBIC INCH DISPLACEMENT - Used to describe engine size.

C/LOOP - CLOSED LOOP - Designed with feedback information to the ECM to maintain an optimum air/fuel ratio (14.7:1), output.

COOLANT TEMPERATURE SENSOR (CTS) - Device that senses the engine coolant temperature, and passes that information to the electronic control module.

CONVERTER - CATALYTIC CONVERTER - Containing platinum and palladium to speed up conversion of HC and CO.

CO - CARBON MONOXIDE - One of the pollutants found in engine exhaust.

CURRENT OR AMPERAGE - The rate of flow of electrons is similar to gallons of water per minute flowing in a water pipe.

DIAGNOSTIC CODE - Pair of numbers obtained from flashing "Service Engine Soon" light, or displaying on a "Scan" tool. This code can be used to determine the system malfunction.

DIAGNOSTIC TERMINAL - Grounding terminal "B" of ALDL connector will flash or display a code. When grounded with the engine running will enter the "Field Service Mode."

DIGITAL RATIO ADAPTER - DIGITAL SIGNAL - An electrical signal that is either "ON" or "OFF" with no in between.

DIODE - An electrical device that restricts current flow in one direction.

DRIVER - An electrical device, usually a power transistor, that operates like a switch; that is, it turns something "ON" or "OFF."

DVM (10 Meg.) - Digital Voltmeter with 10 Million ohms resistance - used for measurement in electronic systems.

EAC - ELECTRIC AIR CONTROL - Used on AIR system to direct air flow to Air Switching valve or atmosphere.

ECM - ELECTRONIC ENGINE CONTROL MODULE - A metal case (located in passenger compartment) containing electronic circuitry which electrically controls and monitors air/fuel and emission systems on Computer Command Control, and turns "ON" the "Service Engine Soon" light when a malfunction occurs in the system.

ECU - ENGINE CALIBRATION UNIT - An electronic component which can be specifically programmed to the design of each vehicle model to control the M/C solenoid. The ECU plugs into the Electronic Control Module (ECM). The ECU is usually called a PROM.

EFI - ELECTRONIC FUEL INJECTION - Computer Command Control using throttle body fuel injection.

EGR - EXHAUST GAS RECIRCULATION - Method of reducing NOx emission levels.

EECS - EVAPORATIVE EMISSIONS CONTROL SYSTEM - Used to prevent gasoline vapors in the fuel tank from entering the atmosphere.

EMI OR NOISE - An unwanted signal interfering with another needed signal; like an electrical razor upsets a television picture, or driving under high voltage power lines upsets the AM radio in a vehicle.

ENERGIZE/DE-ENERGIZE - When current is passed through a coil (energized) such as a solenoid, a plunger is pulled or pushed. When the voltage to the solenoid is turned off, (de-energized), a spring raises or lowers the plunger.

ESC - ELECTRONIC SPARK CONTROL - Used to sense detonation and retard spark advance when detonation occurs.

EST - ELECTRONIC SPARK TIMING - ECM controlled timing of ignition spark.

EVRV - ELECTRONIC VACUUM REGULATOR VALVE - Controls EGR vacuum.

FED - FEDERAL - Vehicle/Engine available in all states except California.

FI - FUEL INJECTION - Computer Command Control using throttle body fuel injection.

GROUND - A wire shorted to ground. A common return path for an electrical circuit. A reference point from which voltage measurements may be made.

HC - HYDROCARBONS - One of the pollutants found in engine exhaust. Hydrogen and carbon in gasoline.

HIGH - A voltage more than ground or 0, like the output wire of an oxygen sensor is called __voltage high, as compared to the ground, which is called voltage low. In digital signals, high is "ON" and low is "OFF."

HIGH IMPEDANCE VOLTMETER - Has high opposition to the flow of electrical current. Good for reading circuits with low current flow, such as found in electronic systems.

HEI - HIGH ENERGY IGNITION - A distributor that uses an electronic module and pick-up coil in place of contact points.

Hg - MERCURY - A calibration material used as a standard for vacuum measurement.

IAC - IDLE AIR CONTROL - Installed in the throttle body of a fuel injected system and controlled by the ECM to regulate idle speed.

IDEAL MIXTURE - The air/fuel ratio which provides the best performance, while maintaining maximum conversion of exhaust emissions, typically 14.7/1.

IGN - IGNITION - Refers to ignition switch and lock.

INPUTS - Information from sources (such as, coolant temperature sensors, exhaust oxygen sensor, etc.) that tell the ECM how the systems are performing.

INTERMITTENT - Occurs now and then; not continuously. In electrical circuits, refers to occasional open, short, or ground.

I/P. - INSTRUMENT PANEL - Contains instrument gages and indicator lights to indicate performance of the vehicle.

KM/H - KILOMETER PER HOUR - A metric unit measuring distance (1000 meters) in one hour.

L - LITER - A metric unit of capacity.

LOW - Operates the same as ground and may, or may not, be connected to chassis ground.

L4 - FOUR CYLINDER IN-LINE ENGINE

MALFUNCTION - A problem that causes the system to operate incorrectly. Typical malfunctions are; wiring harness opens or shorts, failed sensors, or circuit components.

MAP - MANIFOLD ABSOLUTE PRESSURE SENSOR - Reads pressure changes in intake manifold with reference to zero pressure. It puts out a voltage which is highest when the pressure is highest. The maximum voltage is between 4-5 volts.

MEM-CAL - Contains specific calibrations to meet the requirements of a specific engine..

MODE - A particular state of operation.

MPH - MILES PER HOUR - A unit measuring distance (5280 feet) in one hour.

N.C. - NORMALLY CLOSED - State of relay contacts or solenoid plunger when no voltage is applied.

N•m - NEWTON METERS (TORQUE) - A metric unit which measures force.

N.O. - NORMALLY OPEN - State of relay contacts or solenoid plunger when no voltage is applied.

NOx - NITROGEN, OXIDES OF - One of the pollutants found in engine exhaust. Nitrogen that combines with oxygen to form oxides of nitrogen.

O_2 - OXYGEN (O_2) (SENSOR) - Monitors the oxygen content of the exhaust system and generates a voltage signal to the ECM.

O LOOP - OPEN LOOP - Describes ECM fuel control without use of oxygen sensor information.

OUTPUT - Functions, typically solenoids, that are controlled by the ECM.

OXYGEN SENSOR, EXHAUST - Device that detects the amount of oxygen (O_2) in the exhaust stream.

POSITIVE CRANKCASE VENTILATION - Prevent fumes in crankcase from passing into atmosphere.

P/N - PARK/NEUTRAL - Refers to switch used to indicate to the ECM the position of the automatic transmission.

PORT - EXHAUST OR INTAKE PORT

PROM - PROGRAMMABLE READ ONLY MEMORY- an electronic term used to describe the engine calibration unit.

PULSE WIDTH MODULATED - A device operated by a digital signal that is controlled by the time duration the device is turned "ON" or "OFF."

QUAD DRIVER - A "chip" device that is capable of operating four separate outputs. Some have digital and some have pulse width modulated outputs.

RESISTANCE - The ability of a circuit to limit current flow; like a restriction in a water pipe.

RPM - REVOLUTIONS PER MINUTE - A measure of rotational speed.

SELF-DIAGNOSTIC CODE - The ECM can detect malfunctions in the system. If a malfunction occurs, the ECM turns "ON" the "Service Engine Soon" light. A diagnostic code can be obtained from the ECM through the "Service Engine Soon" light. This code will indicate the area of the malfunction.

SES - SERVICE ENGINE SOON LIGHT - Lights when a malfunction occurs in Computer Command Control system.

TACH - TACHOMETER - A device for indicating speed for rotation.

TBI - THROTTLE BODY INJECTION (UNIT) - Is controlled by the ECM to supply precise air/fuel mixture into the intake manifold.

TCC - TRANSMISSION / TRANSAXLE CONVERTER CLUTCH - ECM controlled solenoid in transmission which positively couples the transmission to the engine.

THERMAC - THERMOSTATIC AIR CLEANER - Provides preheated air to intake manifold to provide better driveability when engine is cold.

TPS - THROTTLE POSITION SENSOR - Device that tells the ECM the throttle position.

TVS - THERMAL VACUUM SWITCH - Used to control vacuum in relationship to engine temperature.

V - VOLT - A measurement of electrical pressure.

VOLTAGE - The pressure of force pushing the current in a circuit; like pressure in a water pipe.

V-6 - SIX CYLINDER ENGINE - Arranged in a "V".

V-8 - EIGHT CYLINDER ENGINE - Arranged in a "V".

VACUUM - Negative pressure; less than atmospheric pressure.

VACUUM, MANIFOLD - Vacuum source in manifold below throttle plate.

VACUUM, PORTED - A vacuum source above (atmospheric side) of closed throttle plate.

VIN - VEHICLE IDENTIFICATION NUMBER - Appears on a plate attached to the windshield pillar.

VSS - VEHICLE SPEED SENSOR - Sensor which sends vehicle speed information to the ECM.

WOT - WIDE OPEN THROTTLE - Refers to the throttle valve or accelerator pedal when fully open or depressed.

BLANK

GM

Automotive
Service
Educational
Program

TT

Transportation
Technician

ASE
CERTIFIED ®

We employ technicians certified by the
National Institute for

AUTOMOTIVE
SERVICE
EXCELLENCE

Let us show you their credentials

GMC
TRUCK

MEDIUM
TRUCK

PROFESSIONAL
TRUCK
ADVISORS
GUILD

These pre-addressed and prepaid reply cards are provided so that you may advise us of any errors you might find in this manual.

We also welcome your suggestions for improving our service manual coverage.

These reply cards are not to be used for ordering Service Manuals. Manuals may be ordered using a form provided in the Owner's Manual.

Name ____________ **Title** ____________
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State ____________ **Zip** ____________
Manual No. ____________ **Section and Page No.** ____________
Comments: ____________

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NO
POSTAGE STAMP
NECESSARY
IF MAILED IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 102 PONTIAC, MI

POSTAGE WILL BE PAID BY THE ADDRESSEE

GM TRUCK & BUS
ATTN: GRAHAM FISHWILD
MAIL CODE: 1607-06
31 JUDSON STREET
PONTIAC, MI 48342

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GMC TRUCK