

Throttle Position Sensor (TP)

REMOVAL & INSTALLATION

◆ See Figure 82



1. Open the engine compartment/hatch and disconnect the battery cables.
2. On the 1998 7.4Gi, remove the starboard high-rise exhaust elbow.
3. Remove the flame arrestor. Although not absolutely necessary, you may find it beneficial to remove the throttle body for better access to the sensor—although you must remove it on the 1998 7.4Gi.
4. Tag and disconnect the electrical connector at the sensor and move it out of the way.

□ Please refer to the Component Locations section.

5. Unscrew the 2 mounting screws and remove the sensor. Clean the sensor with a dry cloth; make sure that the sensor is in good condition (no wear, cracks or damage), if not replace it.

If replacing the sensor with a new one, make sure to use the two new screws that came with the package.

6. Position the sensor seal or O-ring over the throttle shaft.
7. With the throttle valve closed, install the sensor so it is positioned on the throttle shaft and tighten the screws to 18 inch lbs. (2 Nm). Coat the threads with Loctite® 242 (TBI engines) and don't forget the washers!
8. Install the throttle body and exhaust elbow if removed.
9. Connect the electrical lead. Connect the battery cables
10. Start the engine and check the sensor output voltage. It should be approximately 0.7V at idle and 5.0V at wide open throttle.
11. Install the flame arrestor.

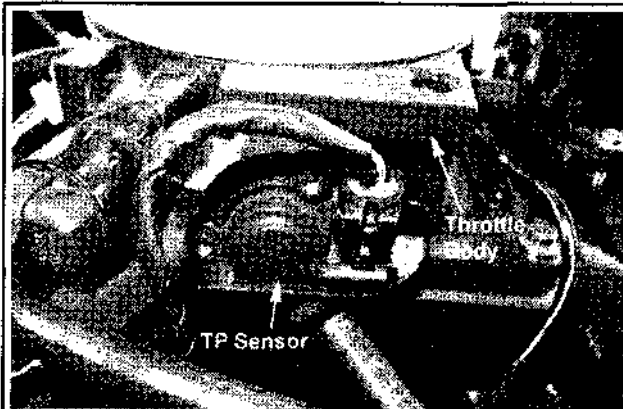


Fig. 82 The TP sensor is located on the lower edge of the throttle body

Vapor Separator Tank/Fuel Reservoir

REMOVAL & INSTALLATION

◆ See Figure 66



□ Certain early engines may not utilize this system.

Always have a fire extinguisher handy when working on any part of the fuel system. Remember, a very small amount of fuel vapor in the bilge, has the tremendous potential explosive power.

1. Open or remove the engine hatchcover and relieve the fuel system pressure as detailed previously. Disconnect the battery cable.
2. Loosen the hose clamps and then remove the water inlet and outlet hoses from the tank.
3. Remove the power steering cooler retaining bracket nut and position the cooler out of the way. There is a special flat washer behind the cooler bracket—don't lose it when lifting off the assembly.

4. Clip the plastic tie securing the pump harness to the pump and then unplug the connector and move the harness out of the way.
5. Remove the small clamp and wiggle the vent hose from the nipple at the rear of the reservoir. Position it out of the way.
6. Remove the fuel inlet line coming from the low pressure pump. Remove the line running between the reservoir and pressure regulator. Remove the high pressure pump outlet line. Please refer to the Fuel Pump procedures for specific details on removing the fuel lines.
7. Loosen the clamp and remove the cooling outlet line (running to the thermostat housing) connected to the elbow on the Starboard side of the reservoir.

8. Remove the 2 mounting bolts at the bottom of the reservoir and lift off the assembly. The Port side mounting bolt may have a nut on the back of the bracket.

To Install:

9. Adjust the float level as detailed later in this section.
10. Position the reservoir onto the engine and tighten the mounting bolts to 28-36 ft. lbs. (38-49 Nm).
11. Reattach the coolant line to the elbow on the reservoir and tighten the clamp securely.
12. Connect the three fuel lines to the pump and reservoir as detailed in the Fuel Pump section.
13. Connect the vent line running from the upper manifold and tighten the clamp securely, but not so tight as to pinch the hose.
14. Coat the terminals on the fuel pump and pump harness connector with Terminal Grease and plug the connector into the pump. Secure the harness to the pump body with a new plastic tie.
15. Slide the flay washer over the mounting stud on the rear of the reservoir and then install the power steering cooler. Tighten the lock nut to 20-25 ft. lbs. (27-34 Nm).
16. Reconnect the cooling hoses and tighten their hose clamps securely.
17. Connect the battery cables. Turn the ignition key to the ON position so that the fuel pumps are energized and check for any fuel leaks. Do not actually start the engine until confirming that there are no leaks at the throttle body or fuel lines. Install the flame arrestor.
18. Start the engine and check for fuel leakage.

FLOAT LEVEL

◆ See Figure 83



1. Disconnect all fuel lines and remove the high pressure fuel pump.
2. Remove the 8 reservoir cover retaining screws and lift off the cover and pump brackets. Discard the gasket.
3. Flip the cover assembly over and allow the float to drop down until it seats the float needle.
4. Measure the distance between the bottom edge of the inverted float (actually the top edge when installed in the reservoir) and the inner mounting surface of the reservoir cover.
5. Bend the float adjustment tab very carefully until the gap is 3/16 in. (4.76mm). Rotate the assembly once or twice and check that the float moves freely and that the gap has not changed.

Never force the float needle tip against the seat or you will damage the special tip.

6. Position a new cover gasket onto the reservoir and then carefully install the cover assembly. Tighten the retaining screws to 25-35 inch lbs. (2.8-4.0 Nm).
7. Install the fuel pump and reconnect the fuel lines.

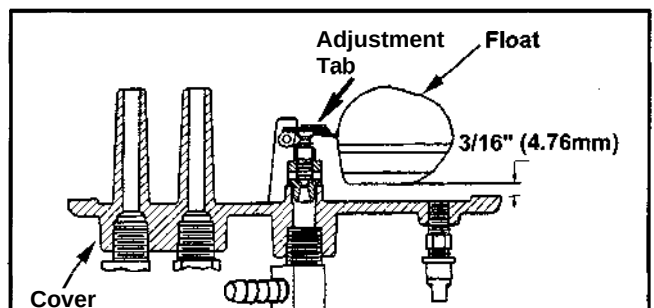


Fig. 83 Adjust the float level with the reservoir cover inverted

SYSTEM DIAGNOSIS

◆ See Figure 84

Prior to performing any diagnostics on the EFI system, a diagnostic circuit check must first be completed. This is an organized approach to identifying a problem created by a malfunction in the electronic engine control management system and can only be performed with the correct scan tool—although most tests can be accomplished with a less expensive code tool (CodeMate) and a digital multi-meter (DVOM). After hooking the tool up properly and finding that the on-board diagnostic system is functioning correctly and there are no codes displayed, the accompanying table should be used as a reference for what a normally functioning system should display. Use only the parameters listed in the chart.

If codes are displayed, move on to the next section.

PRECAUTIONS

◆ See Figures 85 and 86

Good shop practice, as well as good judgment requires all the following practices be observed.

1. The negative battery cable must be disconnected before any ECM system component is removed.
2. Always check to be sure the battery cables are securely connected, before starting the engine.
3. Never separate the battery from the on-board electrical system while the engine is operating.
4. Never separate the battery feed wire from the charging system while the engine is operating.
5. Disconnect the battery from the boat electrical system before starting to charge the battery.
6. Check to be sure all cable harnesses are securely connected and the battery terminals are clean and the cables securely connected.
7. Never connect or disconnect the wiring harness at the ECM when the ignition switch is in the on position.
8. Before any electric arc welding is attempted, disconnect the battery leads and the ECM connectors.
9. Never direct a steam-cleaning nozzle at ECM components. Such action will cause damage or corrosion the component terminals.
10. Do not use any test equipment not specified in the diagnostic charts. Such equipment may give an incorrect reading and/or may actually damage good components.

Scan Position	Units	Data Value
BARO	Volts	3-5
Battery	Volts	12-14.5
Coolant Temperature	Deg. F/C	150-170 (66-77)
Engine Overtemp	OK/Overheat	OK
Fuel Consumption	GPH	1 to 2
Idle Air Control Valve		
Follower	Counts (Steps)	0
Minimum	Counts (Steps)	0-40
Normal	Counts (Steps)	0-40
Injector		
On Time Cranking	Msec	2.5-3.5
Pulse Width	Msec	2-3
Knock Retard	Deg.	0
Lanyard Stop Mode	OFF/ON	OFF
Manifold Air Temperature	Deg. F/C	Varies w/ambient
MAP	Volts	1-3
Memory Calibration Check	Sum of Check	Varies
Oil Pressure		
I/O	OK/LOW	OK
Transmission	OK/LOW	OK
Rpm		
Desired	Rpm	600-700
Normal	Rpm	600-650
Spark Advance	Deg.	10-30
Throttle		
Angle	0-100%	0-1
Position	Volts	0.4-0.8

Fig. 84 Normal specifications for a scan tool

11. A digital voltmeter with a rating of 10 megohms input impedance must be used when taking any voltage measurements.

12. A "low-ampere rated" test light must be used when a test light is specified for a test. Never use a high-ampere rated test light. Power the setup with the boat battery. If the ammeter indicates less than 3110 amp current flow, the test light is safe to use.

A final word here. If a test light with 100 mA or less is used, a faint glow may show, when the test actually states "no light".

General Diagnostic Tests

□ Please refer to wiring schematics at the end of this section for correct pin and circuit locations.

ON-BOARD DIAGNOSTIC SYSTEM CHECK



1. Connect the tester to the diagnostic link connector (DLC)—either at the front of the engine near the thermostat housing, or on the Starboard side near the ECM bracket. Switch it to the OFF position.
2. With the ignition switch in the ON position and the engine OFF, the tester light should come on; if not, please refer to the following procedure for "No Code Tool Light or Data".
3. If the tester flashes a Code 12, check terminal B on the DLC for a short to ground—if no short is evident, the ECM will require replacement.
4. Switch the tester to the ON position and confirm that it flashes Code 12. If it doesn't, check the "Code Tester Light on Steady..." procedure following.
5. If DTC 51 is also present, proceed to that test. Otherwise, turn the tester OFF and see if the engine will start.
6. If the engine continues to run, move to the next step; if it won't run, move to the "Engine Cranks But Won't Run" procedure.
7. Turn off the engine but leave the ignition switch in the ON position. Switch the tester back to ON and check for any stored codes. Refer to the DTC charts at the end of this section.

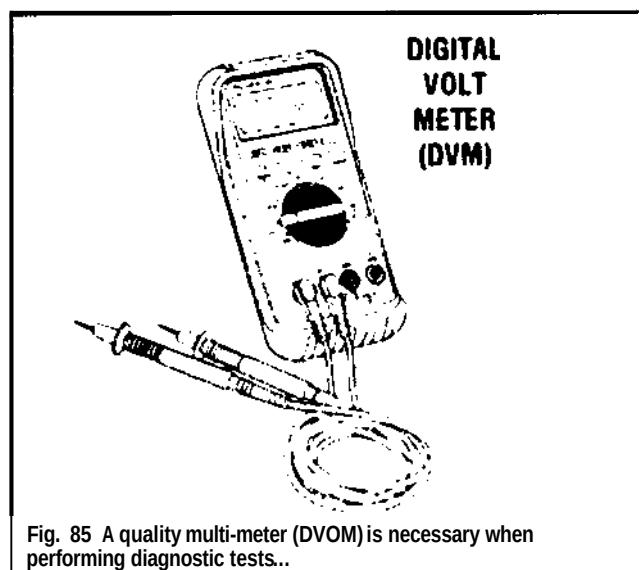


Fig. 85 A quality multi-meter (DVOM) is necessary when performing diagnostic tests..

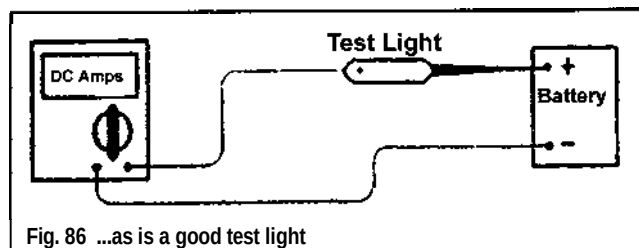


Fig. 86 ...as is a good test light

NO CT LIGHT OR NO DLC DATA



4 See Figure 88

When a tester is connected to the DLC it should receive voltage via the circuit on terminal F and be grounded through the circuit on terminal E. There should always be a steady tester light when the ignition is **ON** (engine stopped). Obviously, always check for bad connections or frayed wires. It's also a good idea to check that the indicator bulb is not burned

■ Please refer to wiring schematics for Tests A-1/A-2 in the Diagnostic Test Schematic section for correct pin and circuit locations.

If The Engine Starts

1. Remove the Code Tool tester and turn the ignition switch to the **ON** position (engine OFF). Connect a test light to ground and touch the probe to terminal **F** of the DLC. If the light goes on move to Step 2; if it does not come on, the circuit between J1-32/J1-16 on the ECM and terminal **F** on the DLC is open or has a short to ground.

2. Now connect the test light to the battery positive and touch the probe to terminal **E** of the DLC. If the light goes on, move to the next step; if it does not come on, turn the ignition switch to the **OFF** position. Disconnect the J2 connector at the ECM and check the resistance between J2-31 and terminal **E** at the DLC. If close to 0 ohms, check the ECM connections or replace the ECM; otherwise, repair the open circuit.

3. Connect a test light between DLC terminals **F** and **E**. If the light goes on, replace the tool.

If The Engine Does Not Start

1. Check the ECM circuit breaker and replace if necessary. If the breaker is functioning properly, move to the next step.

2. With the ignition **OFF**, connect a test light to ground and probe J1-16 and J1-32 on the ECM connector. If the light goes on for each circuit, move to the next step. If it does not light, repair the open in that circuit.

3. Turn the ignition switch to the **ON** position (engine not running). Connect a test light to ground and probe ECM connector pin J1-11. If the light goes on, check the ECM grounds and then replace the ECM if they are OK. If it does not light, check the ECM/INJ circuit breaker. If it is OK, check the ECM/INJ relay. Otherwise, find and repair the ground in the J1-11 to breaker circuit.

CT LIGHT ON STEADY—WILL NOT FLASH DTC 12



4 See Figure 88

When the Code Tool tester is installed, it receives voltage through terminal **F** and is grounded through terminal **E**. When the ignition is **ON** and the engine OFF, there should always be a steady MIL. Obviously, always check for bad connections or frayed wires. It's also a good idea to check that the indicator bulb is not burned out.

□ Please refer to wiring schematics for Tests A-1/A-2 in the Diagnostic Test Schematic section for correct pin and circuit locations.

1. With the ignition switch in the **ON** position and the engine OFF, switch the tester ON. If the CT flashes DTC 12, look for bad connections in the circuit; if DTC 12 does not flash, go to Step 2.

2. Turn the ignition **OFF** and disconnect the J2 connector at the ECM. Turn the ignition switch back to the **ON** position. If the CT light comes ON, there is a short to ground between J2-31 and terminal **E** on the DLC connector; if the light does not come on, go to Step 3.

3. Turn the ignition **OFF**, disconnect the J1 connector at the ECM and connect a jumper wire between terminals **A** and **B** at the DLC. Connect a test light between terminal J1-7 and battery positive (**B+**). If the light goes ON, you'll need to verify that the tester is working properly by hooking it up to a known good system—we know it's unlikely that you have another engine available, so all we can suggest is running down to your local dealer and asking them to confirm it is OK. If the light does not go on, check for an open circuit between terminal **A** on the DLC and ground; or between terminal **B** and J1-7 at the ECM

ENGINE CRANKS BUT WILL NOT RUN

The distributor ignition system and the fuel injector circuit are both supplied voltage via the EFI system relay. From the relay, circuit 902 delivers voltage to the injector/ECM fuse and to the coil. The following test assumes a properly functioning battery and adequate fuel supply. Is also a good idea to check all connections and wires before hand.

1994-96 Engines



1. Perform the On-Board Diagnostic System Check. Disconnect the I/P sensor and attempt to start the engine. If it starts, replace the sensor, otherwise move to the next step.

2. Ensure that the ignition has been in the **OFF** position for at least 10 seconds and then switch it **ON**. If the fuel pumps run for 2 seconds and then stop, go to Step 3; if not, move on to the "Fuel System Diagnosis" procedure following.

3. Crank the engine for 3 second and listen for the fuel pumps to run while the engine is cranking. If they run, go to Step 5; if they do not run, go to Step 4.

4. Disconnect the connector at the ESA module and probe terminal **B** in the distributor harness connector while cranking the engine. If the meter needle fluctuates, go to the next step; if it does-not, replace the IC module

5. Install a fuel pressure gauge to the pressure valve on the high pressure fuel pump; as per the manufacturer's instructions. Turn the ignition switch to the **ON** position. Check the fuel pressure while the pump is running. If 9-13 psi shows on TBI engines or 36-42 psi on MFI engines, move to the next step; if not, move on to the "Fuel System Diagnosis" procedure.

6. Check the secondary spark output. If spark strength and output are ok, move to the next step. Otherwise, disconnect the ESA module and try to start the engine. If it starts, replace the module; if it doesn't, perform the Ignition System diagnostic tests.

7. Disconnect the J1 connector at the ECM. Connect a DVOM and check for battery voltage (**B+**) at J1-16 and J1-32. If voltage is present at both terminals, move to the next step. If no voltage is present, check the 12.5 amp ignition circuit breaker. If the breaker is functioning properly and there is battery voltage present, repair the circuit between the two pins and the breaker; if not replace the breaker.

8. Turn the ignition switch to the **ON** position and use the DVOM to check for switched battery voltage at J1-11. If present, go to Step 11, if not, go to the next step.

9. Remove the ignition relay and check for battery voltage at the Red/Purple wire terminal. Turn the ignition switch **ON** and check for switched voltage at the Purple wire terminal. Check the relay ground circuit for continuity. If all three check out OK, replace the relay and check J1-11 again. If there is still no switched battery power, check the circuit between it and the relay.

10. In the previous step, if there was no battery voltage, there is a fault in the circuit going to the 12.5 amp circuit breaker. If there was no switched battery voltage, there is a fault in the circuit going to the ignition switch. If the there was a bad ground, fix it.

11. Disconnect one injector from each bank, turn the ignition switch **ON** and connect a DVOM. Probe the Pink/White wire terminal in each connector. If battery voltage is present, go to the next step; if not, check the circuit between the ignition relay and the injector.

□ The ignition relay also supplies switched battery voltage to the knock sensor module—disconnect the module and try to start the engine, if it starts now, replace the module.

12. Connect an injector test light to each of the injectors disconnected previously and then crank the engine. If both test lights blink brightly, the system is OK. If one (or both) lights stay on steadily, go to the next step. If they do not come on at all, go to Step 14.

13. Turn the ignition **OFF** and check the driver circuits for a short to ground. Disconnect the 2-pin connector at the ignition coil and then disconnect the J2 connector at the ECM. Attach a test light to the battery and probe terminals J2-5 and J2-21. If the light goes ON at either terminal, check for a fault in the ground circuit. If the light does not come ON, replace the ECM.

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14. Turn OFF the ignition and check the ECM ground circuits. Disconnect both ECM connectors, connect a test light to the battery and then probe the following connectors: J2-15, J2-20, J1-14 and J1-30. If the light does not come ON, look for and repair a bad ground in the individual circuit. If it does come ON, turn off the ignition and check for an open in the driver circuits between the injectors and J2-15 or J2-21. If they check out OK, move to the next step; otherwise, repair the bad circuit.

15. Check the injectors for an open circuit—resistance across the injector terminals should be greater than 10 ohms. If it is, the injectors are OK and you will need to replace the ECM. If resistance is out of range, replace the injector.

1997-98 Engines



† See Figures 89, 90 and 91

■ Please refer to wiring schematics for Test A-3 in the Diagnostic Test Schematic section for correct pin and circuit locations.

1. Perform the On-Board Diagnostic System Check. Disconnect the TP sensor and attempt to start the engine. If it starts, replace the sensor, otherwise move to the next step.

2. Ensure that the ignition has been in the **OFF** position for at least 10 seconds and then switch it **ON**. If the fuel pumps run for 2 seconds and then stop, go to Step 3; if not, move on to the "Fuel System Diagnosis" procedure following.

3. Crank the engine for 3 seconds and listen for the fuel pumps to run. If they run, go to Step 5; if they do not run, go to Step 4.

4. With the ignition switch in the **OFF** position, disconnect the J2 connector at the ECM. Connect a DVOM to ground and probe the J2-8 pin while cranking the engine. If the DVOM reads 1-2V, confirm all ECM connections are good and then replace the ECM. If it does not read 1-2V, J2-8 is shorted to ground or the ignition module is bad.

5. Install a fuel pressure gauge to the pressure valve on the high pressure fuel pump; as per the manufacturer's instructions. Turn the ignition switch to the **ON** position. Check the fuel pressure while the pump is running. If 9-13 psi on 4.3L engines, 28-32 psi on V8 engines or 36-42 psi on 7.4L/8.2L engines, move to the next step; if not, move on to the "Fuel System Diagnosis" procedure.

6. Check the secondary spark output. If spark strength and output are ok, move to the next step. Otherwise, perform ignition system diagnostics.

7. Disconnect the J1 connector at the ECM. Connect a DVOM and check for battery voltage (B+) at J1-16 and J1-32. If voltage is present at both terminals, move to the next step. If no voltage is present, check the 12.5 amp ignition circuit breaker. If the breaker is functioning properly and there is battery voltage present, repair the circuit between the two pins and the breaker; if not replace the breaker.

8. Turn the ignition switch to the **ON** position and use the DVOM to check for switched battery voltage at J1-11. If present, go to Step 11, if not, go to the next step.

9. Remove the ignition relay and check for battery voltage at the Red/Purple wire terminal. Turn the ignition switch **ON** and check for switched voltage at the Purple wire terminal. Check the relay ground circuit for continuity. If all three check out OK, replace the relay and check J1-11 again. If there is still no switched battery power, check the circuit between it and the relay.

10. In the previous step, if there was no battery voltage, there is a fault in the circuit going to the 12.5 amp circuit breaker. If there was no switched battery voltage, there is a fault in the circuit going to the ignition switch. If there was a bad ground, fix it.

11. Disconnect one injector from each bank, turn the ignition switch **ON** and connect a DVOM. Probe the Pink/White wire terminal in each connector. If battery voltage is present, go to the next step; if not, check the circuit between the ignition relay and the injector.

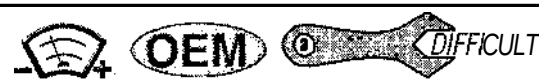
12. Connect an injector test light to each of the injectors disconnected previously and then crank the engine. If both test lights blink brightly, the system is OK. If one (or both) lights stay on steadily, go to the next step. If they do not come on at all, go to Step 14.

13. Turn the ignition **OFF** and check the driver circuits for a short to ground. Disconnect the 2-pin connector at the ignition coil and then disconnect the J2 connector at the ECM. Attach a test light to the battery and probe terminals J2-5 and J2-21. If the light goes ON at either terminal, check for a fault in the ground circuit. If the light does not come ON, replace the ECM.

14. Turn OFF the ignition and check the ECM ground circuits. Disconnect both ECM connectors, connect a test light to the battery and then probe the following connectors: J2-15, J2-20, J1-14 and J1-30. If the light does not come ON, look for and repair a bad ground in the individual circuit. If it does come ON, turn off the ignition and check for an open in the driver circuits between the injectors and J2-15 or J2-21. If they check out OK, move to the next step; otherwise, repair the bad circuit.

15. Check that the resistance across the injector terminals is less than 1.25-1.27 ohms. If it is, the injectors are OK and you will need to replace the ECM. If resistance is out of range, replace the injector.

FUEL SYSTEM DIAGNOSIS—TBI ENGINES



1. Connect a pressure gauge to the check valve for the high pressure pump. Turn the ignition switch **ON**. The pumps should run for 2 seconds and then shut off; while running the pressure should be 9-13 psi (27-31 psi on the 1998 5.7GSI). If it is, go to the next step. If below 9 psi (or 27), go to Step 6. If over 13 psi (or 31), go to Step 10.

2. Start the engine and allow it to idle until it reaches normal operating temperature. The fuel pressure should be within 1 psi of the previous reading. If it is, the system is OK; if not, go to the next step.

3. Check the fuel lines and filter for restrictions and repair or replace as necessary. If they are OK, go to the next step.

4. Disconnect the fuel line at the high pressure pump outlet and connect the pressure gauge to the pump (not the check valve). Turn the ignition **ON** and check that the pressure holds for 15-20 seconds after the pumps stop running. If pressure holds, go to the next step. If not, check for leaks; replacing the fuel pump if there are none found.

5. Disconnect the pressure gauge and reconnect the fuel line. Reconnect the gauge to the check valve. Disconnect the fuel return line at the vapor separator and connect another gauge to the line--do not reconnect the return line to the tank. Turn the ignition **ON** and confirm that the high pressure gauge reads 9-13 psi after the pumps stop, or 27-32 psi on the 1998 5.7GSI. If it does, the system is OK. If not, check both gauges; if equal, replace the regulator. If the high pressure gauge has dropped to near 0 psi and there is still pressure showing on the other gauge, check for a leaking injector or regulator.

6. If the fuel pressure in Step 1 was less than 9 psi (or 27 psi), check for any external fuel leaks. If any are found, fix them and go back to Step 1. If none are found, check that the battery is fully charged. Go to the next step if it is, otherwise charge it.

7. Check the fuel lines and filter for restrictions and water. Fix any problems you find, otherwise go to the next step.

8. Connect a pressure gauge to the low pressure check valve on the separator, turn the ignition **ON** and check that the pressure is 4-8 psi. If it is, go to the next step, otherwise replace the low pressure pump.

9. Disconnect the vent vacuum line at the separator and splice in a clear plastic hose between the end of the line and the tank. Turn the ignition **ON**. If fuel appears in the line, replace the vent valve in the tank. If none appears, check for leaking injectors and/or replace the regulator.

10. If the fuel pressure in Step 1 was greater than 13 psi (or 31 psi), disconnect the fuel return line at the separator tank and connect a pressure gauge between the line and the tank. Reconnect the line and turn the ignition **ON**. Check the pressure while the pumps are still running. If above 13 psi (or 31 psi), go to the next step, otherwise the system is OK.

11. Check the supply line from the filter back to the fuel tank to see if there has been another pump installed (or something producing pressure). If nothing is there, check for a restriction in the line between the regulator and the separator tank. Replace the regulator if nothing is found. If there is some sort of device installed between the filter and tank, remove it.

FUEL SYSTEM DIAGNOSIS—MFI ENGINES



◆ See Figure 92

Please refer to wiring schematics for Test A-5 in the Diagnostic Test Schematic section for correct pin and circuit locations.

1. Turn the ignition switch OFF. Install a fuel pressure gauge to the check valve for the high pressure pump. Turn the ignition switch to the ON position. The fuel pump should run for about 2 seconds and then shut off. Check the pressure while the pump is running and then after it stops; it should hold steady after the pump stops for at least 15-20 seconds. If the fuel pressure is 36-42 psi, go to Step 2.

If the pressure drops immediately to 0 psi after the pump shuts off, check the vacuum line at the pressure regulator for fuel—if fuel in line, replace the regulator, if no fuel in line, go to Step 4.

If the pressure was below 36 psi, go to Step 6; if above 42 psi, go to Step 11; if there was no pressure, or the pumps did not turn on, go to Step 13.

2. Start the engine and allow it to idle until it reaches normal operating temperature. If the fuel pressure is within 3-10 psi of the reading taken previously, the system is OK; if not, go to Step 3.

3. With the engine still idling, connect a vacuum gauge to the pressure regulator and apply 10 in. of vacuum to the pressure regulator. If the pressure drops by 3-10 psi, you have a vacuum leak at the regulator; if it doesn't drop by the above spec, replace the fuel pressure regulator.

4. Turn the ignition OFF, disconnect the fuel line at the high pressure pump outlet fitting and then connect a pressure gauge directly to the pump. Turn the ignition switch to the ON position. If the pressure holds for 15-20 seconds after the pump stops running, go to the next step; otherwise, check for leaks and then replace the pump.

5. With the ignition OFF, connect a pressure gauge to the high pressure pump test valve. Disconnect the fuel return line at the vapor separator and connect another pressure gauge directly to the line—do not reconnect the return line to the separator tank. Turn the ignition switch to the ON position. If the gauge connected to the high pressure test point holds at 36-42 psi, the system is OK.

If it doesn't hold, check both gauges. If they are each showing the same pressure (approximately), replace the regulator. If the high pressure gauge has dropped to 0 psi (or near 0) and there is still pressure left on the other gauge, check for leaking injector(s).

6. If the fuel pressure reading in Step 1 was less than 36 psi, check for fuel leaks. If leaks are found, repair them and restart the test. If no leaks are found, check that the battery is fully charged and then move to the next step.

7. Check to see if the fuel lines or filter are clogged. Look for water in the filter. Repair or replace any problems if found, otherwise, go to the next step.

8. Connect a pressure gauge to the low pressure test valve on the vapor separator tank. Turn the ignition switch to the ON position and check the fuel pressure. If 4-8 psi, go to the next step; otherwise, replace the low pressure fuel pump.

9. Disconnect the vacuum line at the pressure regulator. Connect a piece of clear plastic hose between the line and the regulator and then turn the ignition ON. If fuel appears in the hose, replace the regulator; otherwise, go to the next step.

10. Disconnect the vacuum line at the vapor separator. Connect a piece of clear plastic hose between the line and the separator and then turn the ignition ON. If fuel appears in the hose, replace the vent valve in the separator; otherwise, check for leaking fuel injectors and/or replace the pressure regulator.

11. If the pressure reading in Step 1 was over 42 psi, disconnect the fuel return line at the vapor separator and connect a pressure gauge between the line and tank. Turn the ignition ON and observe the pressure while the pumps are running. If above 42 psi, the system is OK; otherwise, move to the next step.

12. Check the supply line from the filter back to the fuel tank to see if there has been another pump installed (or something producing pressure). If nothing is there, check for a restriction in the line between the regulator and the separator tank. Replace the regulator if nothing is found. If there is some sort of device installed between the filter and tank, remove it.

13. If there was no pressure when the reading was taken in Step 1, perform the On-Board Diagnostic System Check.

14. Check the 20 amp circuit breaker at the fuel pump. Reset if necessary. Confirm that battery voltage is present at the breaker and then move to the next step. If no voltage is present, repair the open or ground in the circuit between the breaker and the battery.

15. Remove the fuel pump relay. Connect a test light to ground and probe terminals 30 and 87. If the light comes ON, go to the next step; otherwise, check for an open circuit or bad connection back to the circuit breaker.

16. Connect a test light to the battery positive (Bt) and probe terminal 85 on the relay socket while switching the ignition switch to the ON position. If the light comes ON for 2 seconds and then goes OFF, move to the next step; otherwise, go to Step 20.

17. Install a fused jumper wire between terminals 30 and 87 on the relay socket. If the fuel pumps run, replace the relay; otherwise, go to the next step.

18. Connect a test light to ground and then probe the terminal for the yellow/green wire on the fuel pump connector. If the light comes ON, go to the next step; otherwise, look for an open circuit or bad connection between the connector and terminal 87 on the relay socket. Remove the jumper and reinstall the relay.

19. Now connect the test light to power and probe the pump connector terminals with the black wire. If the light comes ON, replace BOTH fuel pumps; otherwise, look for an open or bad connection in the fuel pump ground circuits.

20. Disconnect the negative battery cable and then the J1 connector at the ECM. Connect an ohmmeter and check the continuity between terminal J1-23 and terminal 85 on the pump relay socket. If no continuity (0 ohms), replace the ECM; otherwise, look for an open circuit or bad connection.

IGNITION SYSTEM CHECK

Please refer to Section 10 for complete testing on the ignition system.

IDLE AIR CONTROL (IAC) VALVE FUNCTIONAL TEST



◆ See Figure 93

□ Please refer to wiring schematics for Test A-7 in the Diagnostic Test Schematic section for correct pin and circuit locations.

The ECM controls idle speed to a pre-set, desired rpm based on input from sensors and the actual engine rpm. Four separate circuits are used to move the IAC valve; said movement varying the amount of air allowed to bypass the throttle plates. Idle speed then is controlled, via the ECM, by the position of the IAC valve.

1. With the engine at normal operating temperature, turn it off, connect a tachometer and then restart it and allow the idle to stabilize. Record the idle speed and turn off the engine for 10 seconds. Disconnect the IAC harness connector, restart the engine and check the rpm. If the second recorded idle speed is higher than the first by 200 rpm or more, go to Step 2; if not, go to Step 3.

2. Reconnect the IAC harness. If the idle speed returns to within 75 rpm of the originally recorded speed in Step 1 within 30 seconds, the IAC circuit is functioning properly; if it does not, go to the next step.

3. Turn off the ignition for 10 seconds. Disconnect the IAC again and restart the engine. Connect a test light to ground and then touch the probe to each of the four IAC harness terminals. If the light blinks on each terminal, check for a bad IAC connection somewhere in the circuit, otherwise replace the valve; if it doesn't blink, look for an open or shorted circuit on the terminal(s) that didn't blink. Also, check for any bad connections at the ECM.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR OUTPUT CHECK



◆ See Figures 87, 94 and 102

□ Please refer to wiring schematics for Test A-8 in the Diagnostic Test Schematic section for correct pin and circuit locations.

The MAP sensor measures the change in intake manifold pressure resulting from engine load and rpm changes; converting these inputs into a voltage output. The ECM supplies the MAP sensor with a 5V reference signal—as manifold pressure changes so to does the output voltage at the sensor.

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1. Turn the ignition switch to the ON position and install the code tool to check for DTCs. If Code 33 is present, follow the procedures for Code 33 later in this section. If no Code 33 is present, check the MAP sensor voltage and compare this with that of a "known good" sensor; make sure they have the same color insert and 'hot stamp'. If the two voltage measurements are within 0.4V of each other, go to the next step; otherwise replace the sensor.

2. Remove the MAP sensor and then plug the vacuum port on the intake manifold.

3. Connect a hand vacuum pump to the port on the sensor, start the engine and note the sensor voltage.

4. Apply 10 inch Hg. (34 kPa) with the pump and note the change in voltage.

5. Subtract the second reading from the first. If greater than 1.5V, the sensor is OK and you should check the sensor port for a restriction or leaking seal. If less than 1.5V, check the sensor connection, replacing the sensor if the connection is OK.

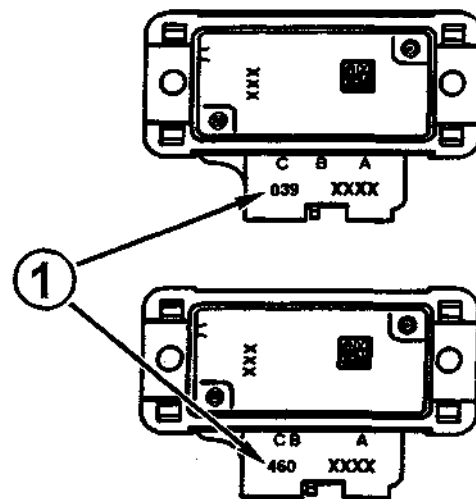


Fig. 87 if the hot stamp number is different, you need to find another sensor for comparison

Diagnostic Test Schematics

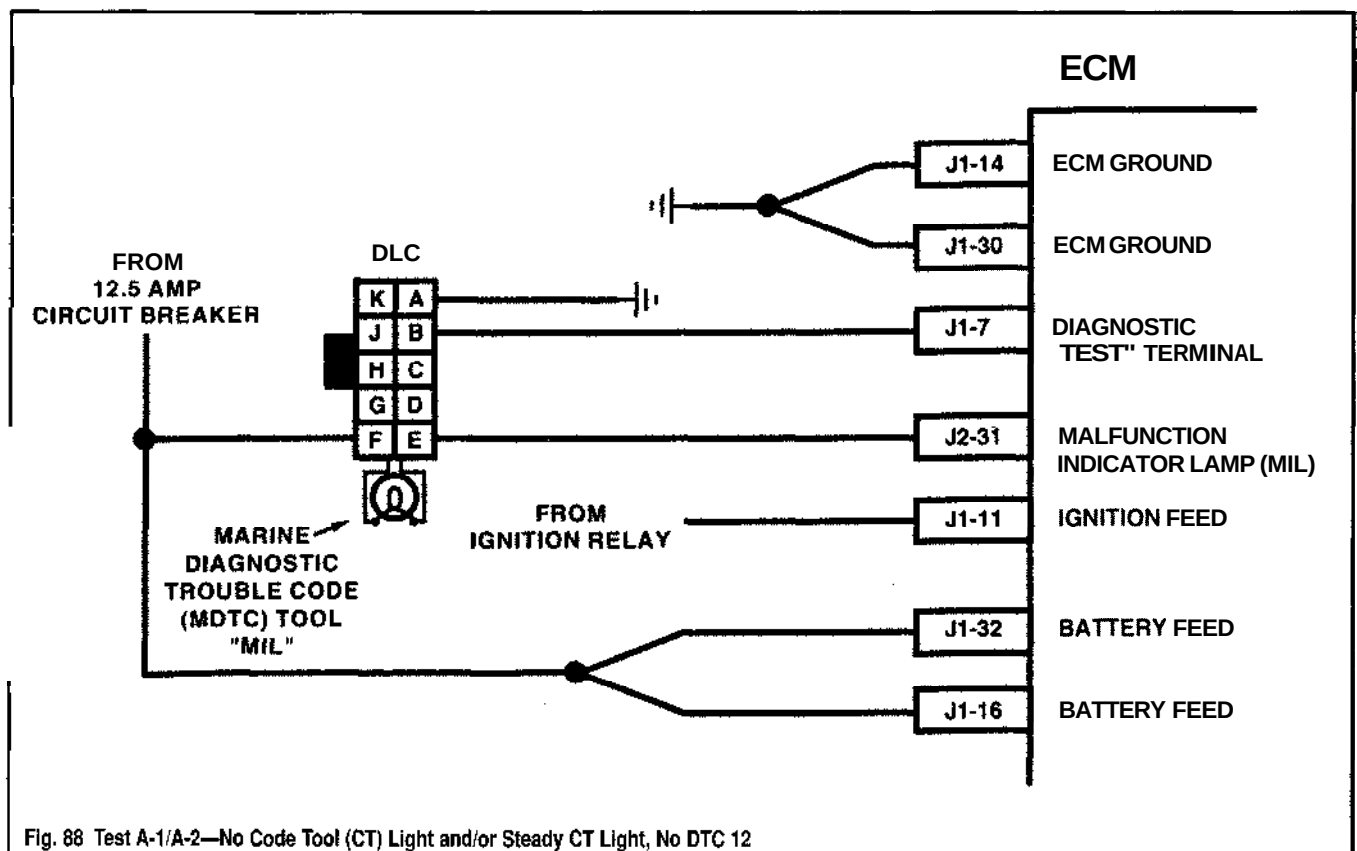


Fig. 88 Test A-1/A-2—No Code Tool (CT) Light and/or Steady CT Light, No DTC 12

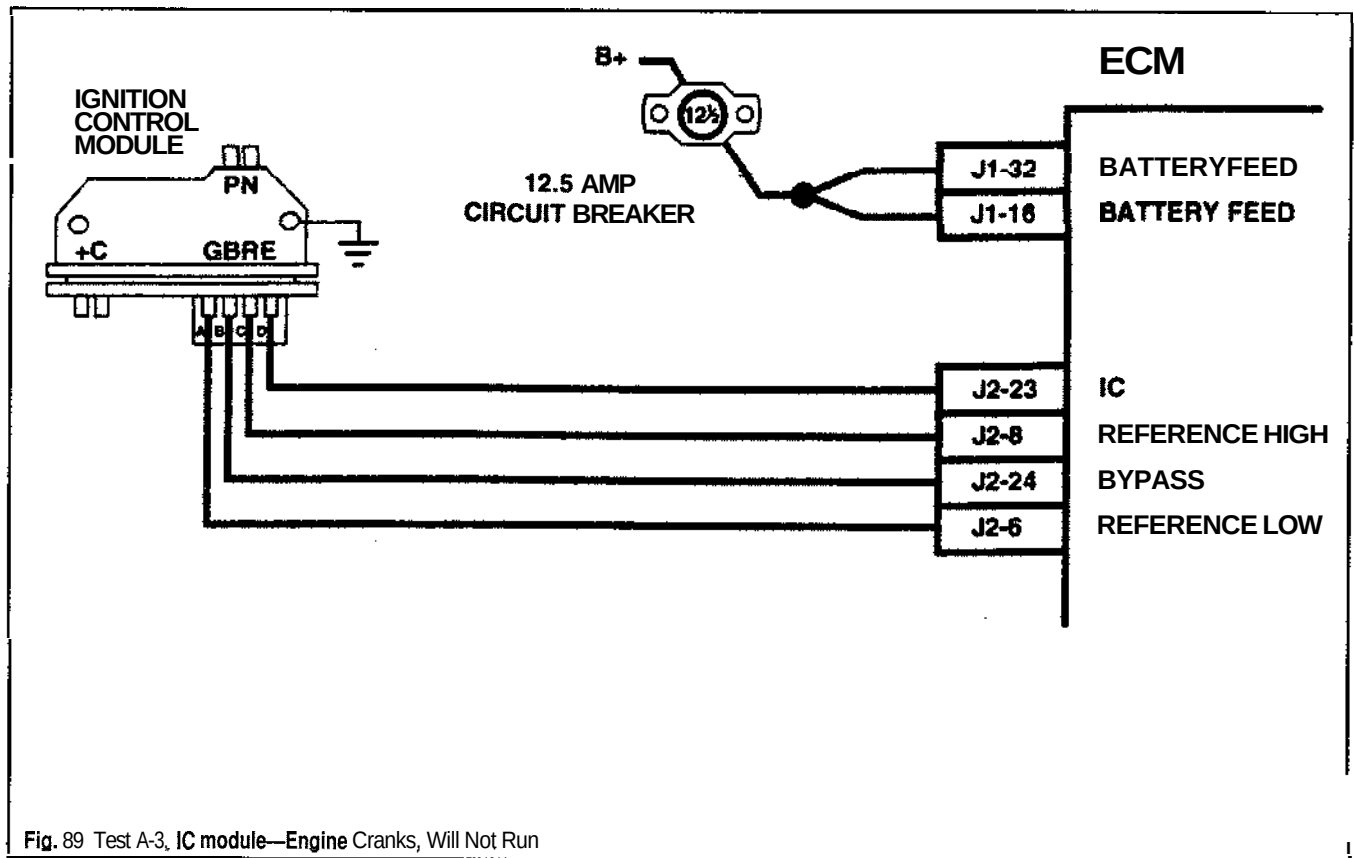


Fig. 89 Test A-3, IC module—Engine Cranks, Will Not Run

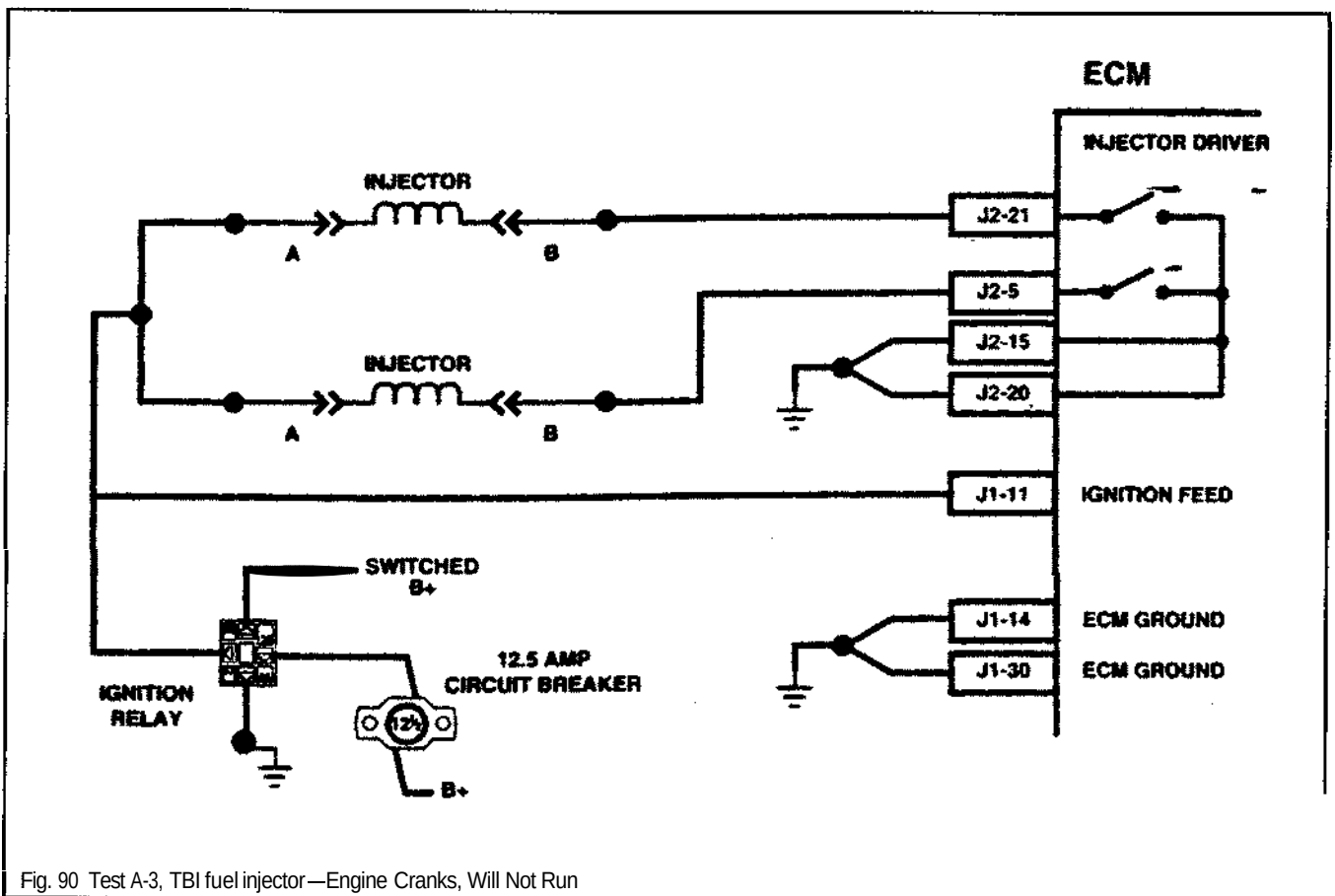


Fig. 90 Test A-3, TBI fuel injector—Engine Cranks, Will Not Run

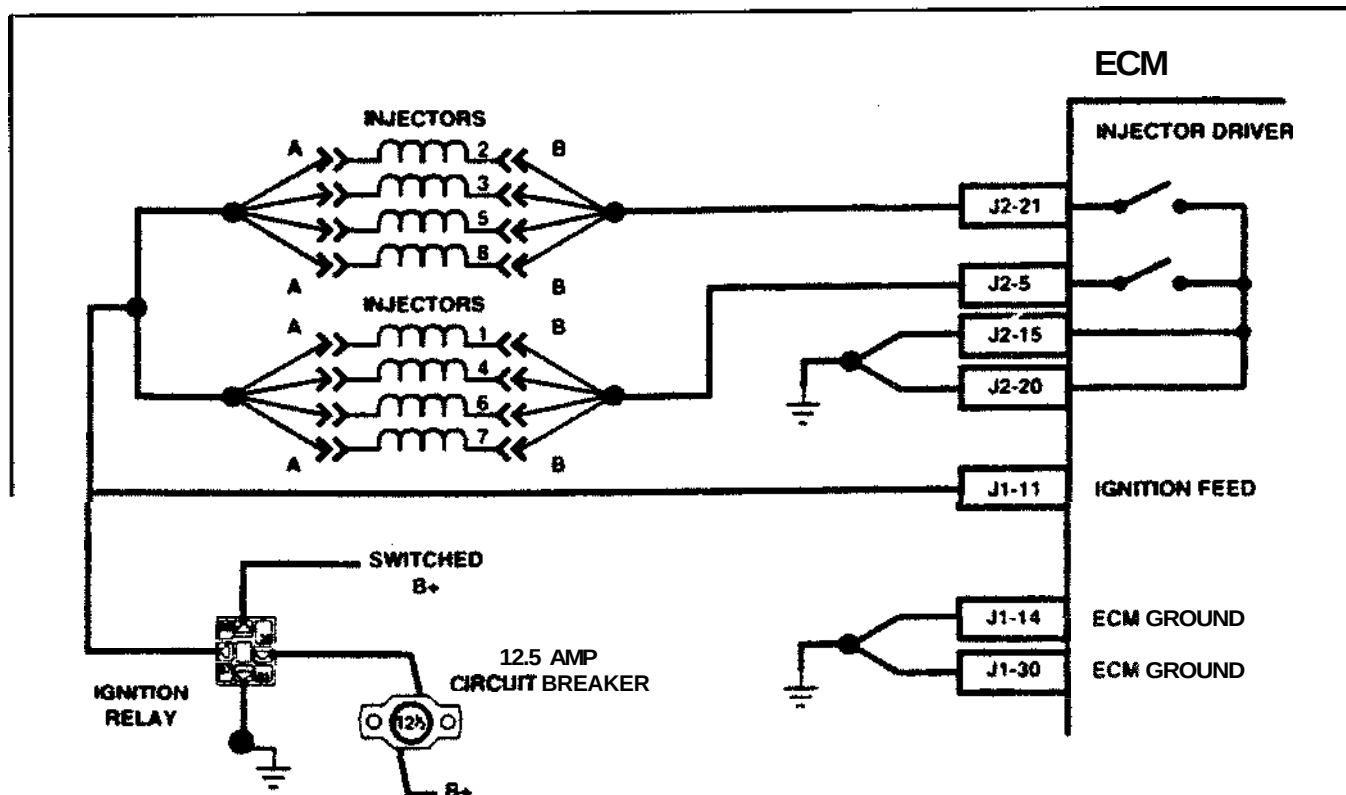


Fig. 91 Test A-3, MFI fuel injector—Engine Cranks, Will Not Run

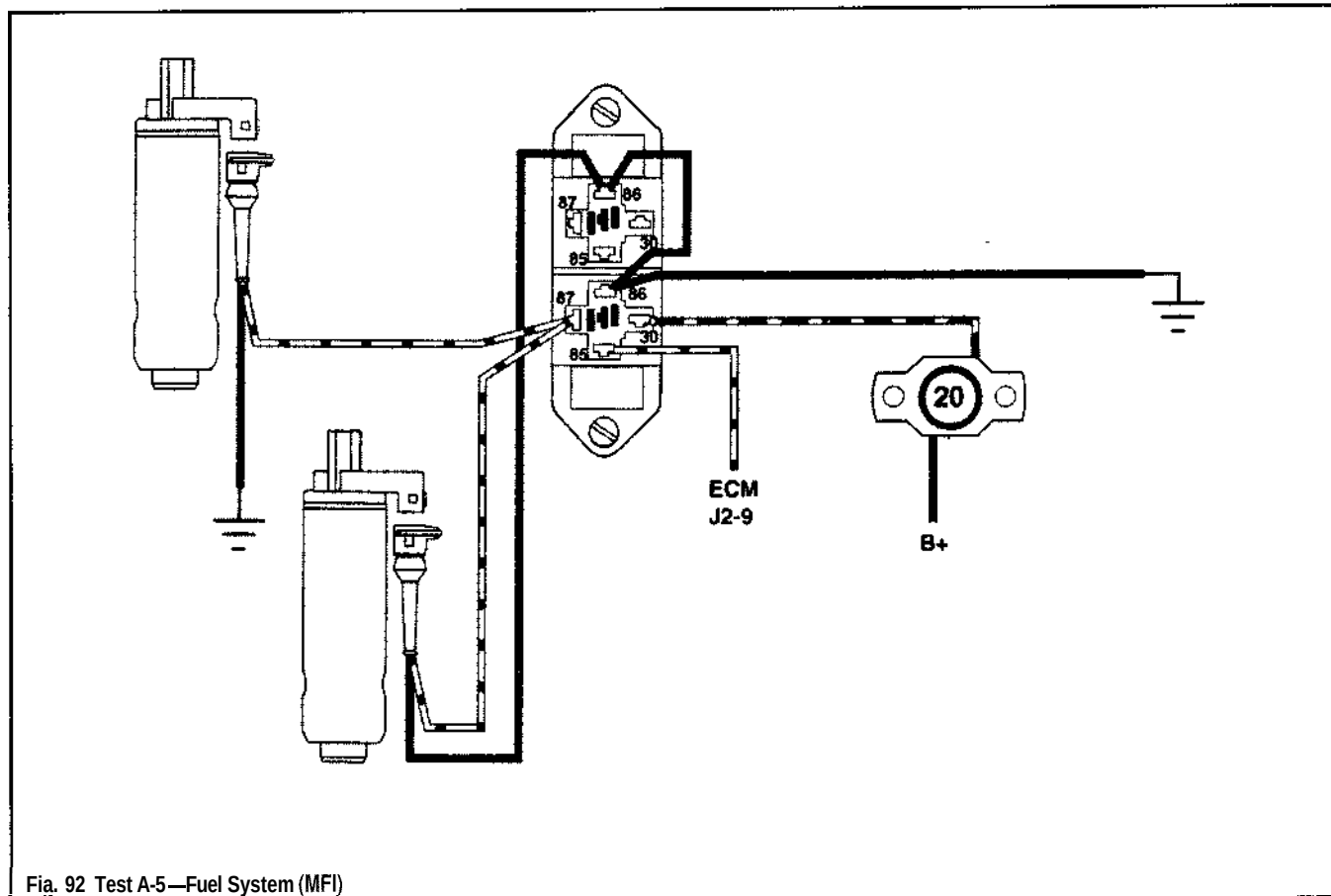
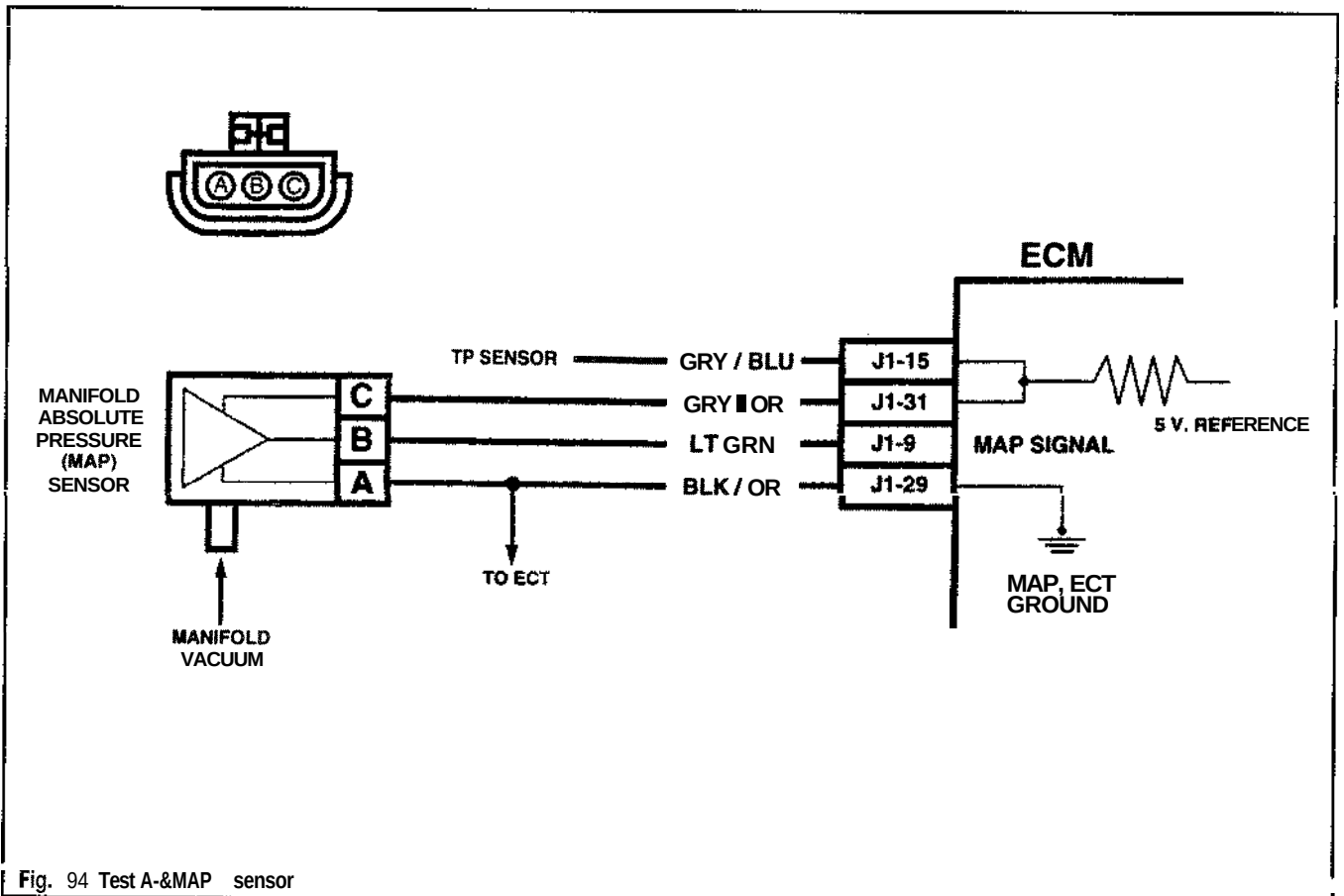
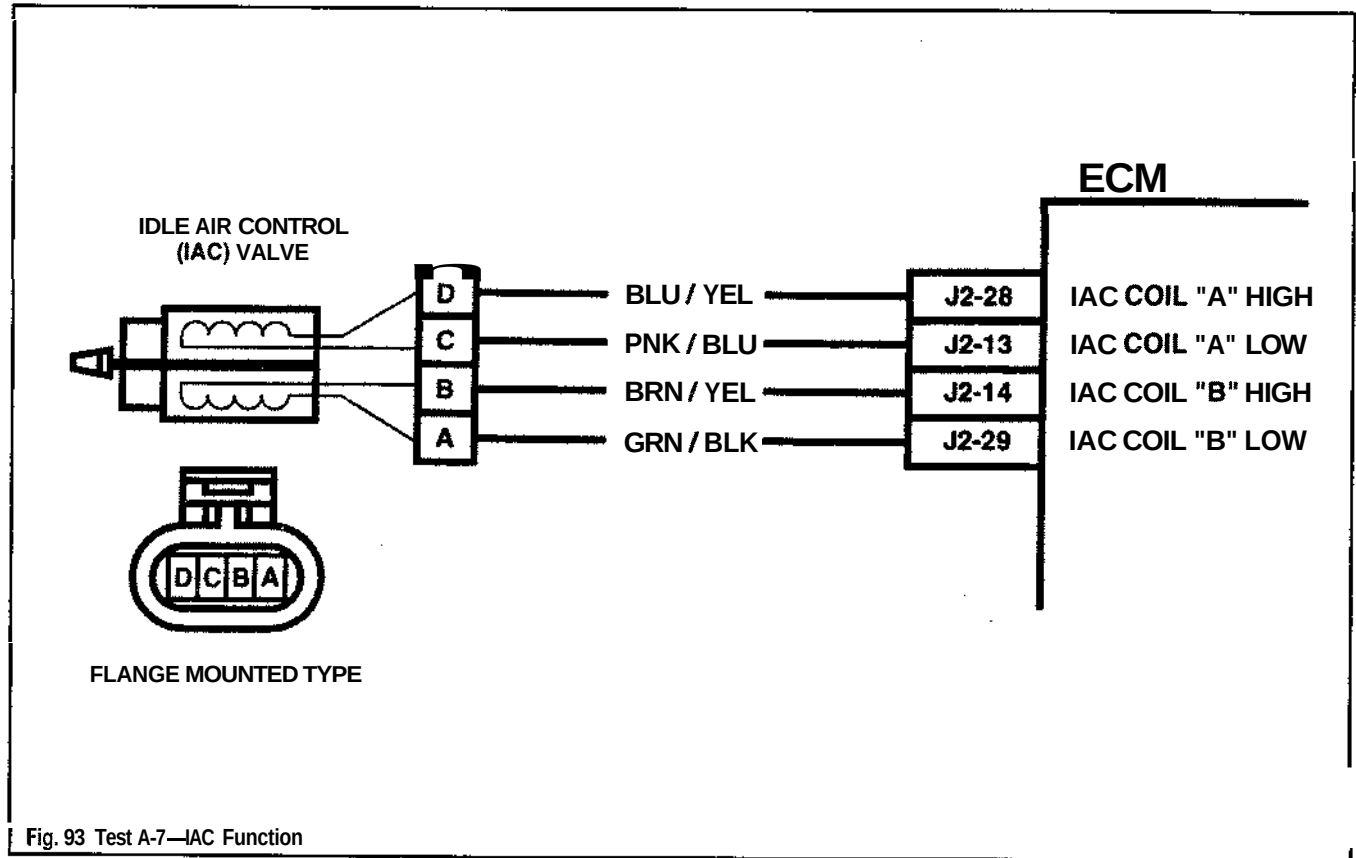


Fig. 92 Test A-5—Fuel System (MFI)



9-48 FUEL SYSTEMS – FUEL INJECTION

Diagnostic Trouble Codes (DTC)

◆ See Figures 95, 96 and 97

Operational problems during everyday engine operation are recognized by the ECM and a diagnostic trouble code is created to identify the particular problem. The ECM will retain this code, or a combination thereof, in its memory until such a time as you access it, read it and then clear it. If the reason for the code has not been repaired prior to clearing the code it will reset itself again shortly after the engine begins to operate.

Remember that DTCs do not necessarily indicate the specific problem or component, merely the area from which the problem is originating. Code charts for your particular engine can be found at the end of this section; while fault and function tests for each code are also found following the section on reading and clearing codes. You will find that more times than not, the source of the problem is a bad connection or frayed wire—particularly where intermittent codes are seen. Follow the steps in the tests carefully and you will find that diagnostics is not always as difficult as you may have thought.

Wiring schematics for all individual components or systems can be found with the fault/function test procedures. Complete system schematics and ECM symptoms charts can be found at the end of this section, while ECM connector pin locations are detailed here; remember there are two ECM harness connectors, J1 and J2.

READING CODES



All trouble codes stored in the ECM are displayed by means of a series of flashes and pauses; the number of flashes represents the number of the code, with the first and second digits being separated by a short pause. Each code will be flashed three times with a long pause separating the repeat of the code each time. For instance, DTC 12 would be represented as "flash, pause, flash-flash, long pause; and then it would repeat this cycle two more times. Count the number of flashes you observe and determine your DTC. Diagnostic trouble codes can be pulled with either a Scan tool or a Code Tool tester. When using a scan tool, simply follow the manufacturer's instructions. If you are using a code tool:

1. With the ignition switch in the ON position and the engine OFF, connect the tester to the diagnostic link connector (DLC) and switch it to the OFF mode.
2. Turn the ignition switch to the ON position without starting the engine and confirm that the CT light is on steady.
3. Move the CT switch to the ON position. The CT lamp should come on and flash a Code 12 (3 times), indicating the diagnostic system is operating properly. If Code 12 is not displayed, please refer to the following procedure for "No CT Light or DLC Data".
4. Shortly after displaying Code 12, the system will flash any stored codes from the system; three times each and in ascending order if more than one code has been stored. If Code 12 continues being displayed then you have no stored codes (or an intermittent one).

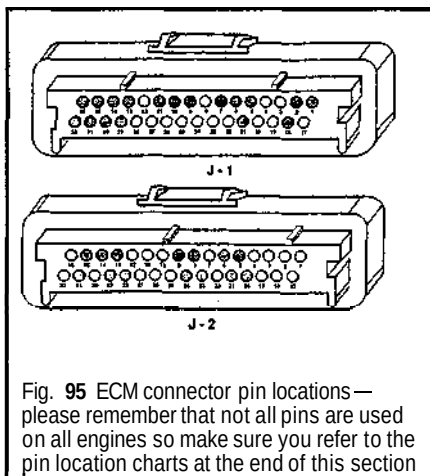


Fig. 95 ECM connector pin locations—please remember that not all pins are used on all engines so make sure you refer to the pin location charts at the end of this section



Fig. 96 Data Link Connector (DLC)...

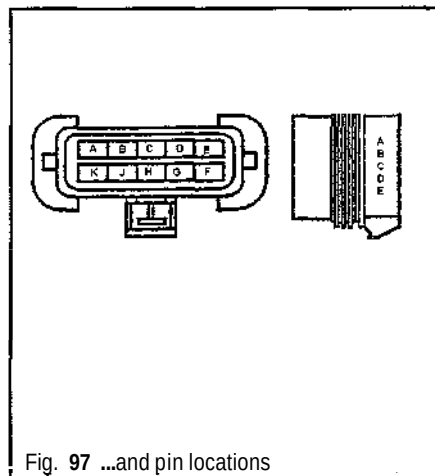


Fig. 97 ...and pin locations

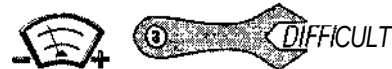
CLEARING CODES



Once again, if using a scan tool, follow the tool manufacturer's instructions. If using a Code Tool tester:

1. Ensure that the battery is fully charged.
2. Connect the tester to the DLC and switch the ignition key to the ON position without starting the engine.
3. Select the ON position on the tester, disengage the remote controls shift function and then move the throttle through its full range, from idle to full throttle and then back to idle.
4. Turn the ignition switch to OFF for 20 seconds.
5. Switch the tester to the OFF position, start the engine and let it run for 20 seconds.
6. Turn the ignition switch to OFF for 20 seconds.
7. Turn the ignition switch to ON again (but do not start the engine). Switch the tester back to the ON position and confirm that the only code present is DTC 12. Remove the tool.
8. If there are codes present, check the battery again and then perform the procedure one more time. If codes are still apparent at the end of the second go-around (we're assuming that you fixed the code's problem before attempting to clear it!), refer to the appropriate troubleshooting or diagnostic charts. If the battery is not at full charge, you should hear the audio warning buzzer come on after engine start-up.

CODE 14—ENGINE COOLANT TEMPERATURE SENSOR (ECT)



◆ See Figure 98

The ECT sensor utilizes a thermistor to control the signal voltage being sent to the ECM. The ECM then applies specified voltage back through the B terminal to the sensor. When the coolant is cold, the sensor resistance is high. As the coolant warms, resistance lessens and voltage drops.

■ Please refer to wiring schematics for Code 14 in the Diagnostic Trouble Code Schematics section for correct pin and circuit locations.

1. The ECT and MAP sensor share a common circuit--disconnect the MAP sensor and see if the problem went away. If it did, move to the MAP sensor test; if it did not, go to the next step.
2. With the ignition OFF, disconnect the ECT sensor harness connector. Turn the ignition ON (but don't start the engine) and then connect a multi-meter (DVOM) across the A and B sensor harness terminals.
3. If the voltage is above 4 volts, look for a bad electrical connection or replace the sensor.
4. If the voltage is below 4 volts, connect the positive lead on the multi-meter to terminal B and the negative lead to a good ground.
5. If voltage is now above 4 volts, you've got a bad ground somewhere between J1-29 and terminal A or a bad connection at the ECM. If these are OK, replace the ECM

6. If the voltage is not above 4 volts, remove the multi-meter and turn the ignition **ON**. Connect a test light to the positive battery terminal and then touch terminal B. If the light does not go ON, check for an open connection on the 5V circuit back to J1-2 or a bad connection at the ECM. If these are OK, replace the ECM.

7. If the light goes ON (1995-97), disconnect the J1/J2 connectors at the ECM. If the light stays ON, you've got a shorted circuit back to J1-2. If it goes out, circuit J1-2 is shorted to J1-29; otherwise, replace the ECM.

8. If the light goes ON (1998), disconnect the J1 connectors at the ECM and touch terminal B again. If the light stays ON, you've got a shorted circuit back to J1-2. If it goes out, disconnect the harness at the ECM and the sensor and check for continuity on both circuits between the sensor and the ECM. Each circuit should show continuity to its respective connector terminal only—i.e. J1-2 to terminal B should show zero resistance, while J1-2 to terminal A should show infinity. If continuity readings on both circuits is correct, replace the ECM. If not, the circuit is shorted and should be repaired.

CODE 21—THROTTLE POSITION SENSOR (TP)



The TP sensor is a potentiometer and provides a voltage signal to the ECM that varies with the opening and closing of the throttles. Signal voltage will vary from approximately 0.7V (0.4-0.5V - 1998) at idle to slightly less than 4.9V at wide open throttle.

☐ Please refer to wiring schematics for Code 21 in the Diagnostic Trouble Code Schematics section for correct pin and circuit locations.

9. The TP and MAP sensor share a common circuit—disconnect the MAP sensor and see if the problem went away. If it did, move to the MAP sensor test; if it did not, go to the next step.

10. With the ignition switch **OFF**, disconnect the TP sensor harness connector and then turn the ignition **ON** but do not start the engine. Connect a multi-meter (DVOM) between the A and B harness terminals.

11. If the reading in Step 2 is less than 4 volts, connect a multi-meter between harness connector A and a good engine ground. If the reading is over 4 volts, the circuit between J1-13 and terminal B is open to ground or you have a bad connection at the ECM; if both are OK, replace the ECM. If less than 4 volts, the 5V circuit for J1-15 is open or shorted to ground, or you have a bad connection at the ECM, or the MAP sensor 5V circuit from J1-31 is grounded; replace the ECM if they all check out OK.

12. If the reading in Step 2 is over 4 volts, connect the multi-meter between harness terminals A and C.

13. If the reading is under 4 volts, connect the multi-meter between terminal C and an engine ground. If the reading is over 4 volts, signal circuit J1-10 is shorted to circuit J1-15 or J1-31. If the reading is less than 4 volts, J1-10 is an open circuit or you have a bad connection at the ECM. If all are OK, replace the ECM.

14. If the reading is over 4 volts, turn the ignition **OFF**, remove the DVOM and connect a test light to the positive battery cable. Touch the probe to the C harness terminal. If the light doesn't come ON, replace the TP sensor. If the light comes on, disconnect the ECM and touch the harness terminal C with the probe. If the light comes ON, the circuit from J1-10 is shorted to ground; if the light doesn't come ON, replaced the ECM on 1995-97 engines. On 1998 engines, go to the next step.

15. Disconnect the harness at the ECM and the sensor and then check continuity on all three circuits between the TP and the ECM. Each circuit should only show continuity to its respective connector terminal—i.e. J1-13 to terminal B should show zero resistance, while J1-13 to terminals A and C should show infinity.

16. If all three circuits showed the correct continuity, replace the ECM. If not, check for shorts in each circuit.

CODE 23—INTAKE AIR TEMPERATURE (IAT) SENSOR

◆ See Figure 100



The IAT sensor, used only on MFI engines, utilizes a thermistor to control a voltage signal to the ECM. Resistance is high when intake air is cold so the ECM will see a high voltage. As the air warms, resistance lessens and voltage drops.

☐ Please refer to wiring schematics for Code 23 in the Diagnostic Trouble Code Schematics section for correct pin and circuit locations.

1. Disconnect the IAT sensor and turn the ignition **ON** without starting the engine. Connect a multi-meter (DVOM) and check voltage across the sensor harness terminals. If over 4 volts, go to Step 2; if under 4 volts, go to Step 3.

2. Now check the resistance across the terminals. If less than 25,000 ohms, check the signal circuit for shorting to voltage; otherwise, check all circuits for bad connections or frayed wires. If over 25,000 ohms, replace the sensor.

3. Check the voltage between the harness connector signal circuit terminal A and ground. If above 4 volts, check for a bad sensor ground circuit (J1-13) or bad connections in the circuit; if OK, replace the ECM. If under 4 volts on 1995-97 engines, look for an open signal circuit or bad connections in the circuit; if OK, replace the ECM. If the reading is under 4 volts on 1998 engines, go to the next step.

4. Turn the ignition **OFF** and remove the DVOM. Connect a test light to B+ power source and then touch the probe to connector terminal A. If the light does not come ON, check for an open 5V circuit back to J1-24 or a bad connection at the ECM. If both are OK, replace the ECM. If the light comes ON, move to the next step.

5. Disconnect the ECM and then touch the test light probe to terminal A again. If the light comes ON, the 5V circuit to J1-24 is shorted to ground. If it doesn't come ON, go to the next step.

6. Disconnect the harness at the ECM and the sensor and then check continuity on both circuits between the IAT and ECM. Each circuit should show continuity to its respective connector terminal only—the circuit between J1-24 and terminal A should show zero resistance, while J1-24 to terminal B should show infinity. If the continuity on both circuits is correct, replace the ECM. If not, check for shorts in each circuit.

CODE 33—MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP)



◆ See Figure 101

Please refer to wiring schematics for Code 33 in the Diagnostic Trouble Code Schematics section for correct pin and circuit locations.

The MAP sensor responds to changes in pressure in the manifold (vacuum). This information is sent to the ECM as signal voltage and will vary from 1.0-1.5 volts at idle to about 4.0-4.5 volts at full throttle. The ECM compensates for a failing Map sensor by defaulting to a MAP value program that varies with rpm. Circuit J1-31 provides a reference value of about 5 volts to the MAP sensor, while J1-29 is the ground. Circuit J1-9 carries the signal to the ECM.

1. With the ignition **OFF**, install a vacuum gauge to the vacuum port on the throttle body, start the engine and increase the idle to 1000 rpm. If the gauge reads steady at 14 in. Hg. or higher, go to Step 2; if it fluctuates or is lower, you have vacuum leak somewhere.

☐ On 1998 PFI engines, tee a vacuum gauge into the vacuum line running to the pressure regulator.

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2. Turn off the engine and remove the gauge. Disconnect the sensor electrical lead and connect a multi-meter (DVOM) between harness terminals A and C. Turn the ignition ON without starting the engine. If the reading is over 4 volts, go to Step 4. If under 4 volts, go to Step 3.

3. Connect the meter between harness terminal C and an engine ground. If the reading is over 4 volts, check circuit for an open or bad connection at the ECM or check if the ground circuit to J1-29 is open. If both are OK, replace the ECM. If under 4 volts, check circuit J1-31 for an open or short to ground, or bad connections at the ECM. If both are OK, replace the ECM.

4. Connect the meter between harness terminals B and C and then turn the ignition **ON** without starting the engine. If the reading is over 4 volts, go to Step 6 for 1995-97 engines or Step 7 for 1998 engines; if under 4 volts, go to Step 5.

5. Connect the meter between terminal B and an engine ground. If the reading is over 4 volts, circuit J1-9 is shorted to 5V circuits J1-15 or J1-31. If under 4 volts, circuit J1-9 is open or there's a bad connection at the ECM. If both are OK, replace the ECM.

6. Disconnect the terminals at the ECM and connect a test light to battery power (Bt). Touch the probe to harness terminal B. If the light goes on, circuit J1-9 is shorted to ground. If not, replace the ECM.

7. With the ignition **OFF** and the DVOM removed, connect a test light to the battery positive (B+) source. Touch the probe to harness terminal B. If the light goes on, move to the next step. If it doesn't light, replace the sensor.

8. Disconnect the terminals at the ECM and touch the probe to harness terminal B again. If the light goes on, circuit J1-9 is shorted to ground. If not, move to the next step.

9. Disconnect the harness at the ECM and the sensor and then check continuity on all three circuits between the MAP and ECM. Each circuit should show continuity to its respective connector terminal only—the circuit between J1-15 and terminal C should show zero resistance, while J1-15 to terminals A and B should show infinity. If the continuity on all circuits is correct, replace the ECM. If not, check for shorts in each circuit.

CODE 42—IGNITION CONTROL (IC) CIRCUIT



◆ See Figure 102

Please refer to wiring schematics for Code 42 in the Diagnostic Trouble Code Schematics section for correct pin and circuit locations.

When the idle speed reaches the necessary rpm for IC and voltage is applied to circuit J2-24, circuit J2-23 should no longer be grounded. If J2-24 is open or grounded the module will not switch to IC mode, J2-23 voltage will be low and code 42 will then be set.

1. Clear all codes as detailed in this section. Start the engine and allow it to idle for 1 minute or until the MIL comes on. Turn off the engine but leave the ignition switch in the **ON** position. Switch the tester to Service mode and see if DTC 42 resets itself. If you get DTC 42, go to the next step; if no code, check the system circuits for bad connections or frayed wires.

2. Turn the ignition **OFF** and disconnect both ECM connectors. Connect a multi-meter (DVOM), set it to the Ohms scale and then check the circuit between J2-23 and ground. If resistance is 3000-6000 ohms, go to the next step; if under not in range, circuit J2-23 is open, grounded or there is a bad connection at the ignition module. If both are OK, replace the module.

3. With the DVOM still connected and grounding J2-23, connect a test light to the positive battery cable (Bt) and touch the probe to circuit J2-24. The resistance should switch from over 3000 ohms to under 1000 ohms as the probe makes contact. If it does, go to the next step; if it doesn't drop, go to Step 5.

4. Reconnect the ECM connectors, start the engine and allow it to idle for 1 minute or until the MIL comes on. If it comes on and shows DTC 42, replace the ECM. If it doesn't come on, check the system circuits for bad connections or frayed wires, or a short to ground in circuits J2-23 or J2-24.

5. Connect a test light to a Bt battery power source and touch the probe to ECM harness terminal J2-24. If the light comes ON, go to the next step. If it doesn't come ON, check for poor connections or an open in circuit J2-24; if OK, replace the IC module.

6. Disconnect the 4-wire connector at the IC module and touch the test light probe to terminal J2-24. If the light comes ON, circuit J2-24 is shorted to ground. If it does not come ON, replace the IC module.

CODE 43—KNOCK SENSOR (KS)



◆ See Figure 103

Please refer to wiring schematics for Code 43 in the Diagnostic Trouble Code Schematics section for correct pin and circuit locations.

Detonation or spark knock is sensed by the module which sends a voltage signal to the ECM. As the sensor detects knock, the voltage drops, signaling the ECM to begin retarding timing. The ECM will retard timing whenever knock is detected, and rpm and idle speed are above a specified level.

1. Disconnect the 5-wire KS module connector. Connect a multi-meter (DVOM) and measure the resistance between terminal E and ground. If resistance is 99,500-100,500 ohms on the 1997-98 4.3L or 3300-4500 ohms on all other engines, go to Step 2. If not, the circuit between terminal E and the sensor is either open or shorted. If it's OK, replace the sensor.

2. Reconnect the 5-wire connector at the module and disconnect the connector at the sensor. Connect a test light to B+ battery power source and start the engine. Hold idle steady at 2500 rpm while touching the probe to the sensor harness terminal a few times. If you detect a noticeable drop in rpm, check the sensor terminal contacts and sensor threads, if they're OK, replace the sensor. If no drop in engine speed is noticeable, go to Step 3.

3. Turn the ignition **OFF** and disconnect the J1 connector at the ECM. Turn the ignition back **ON** and connect a multi-meter (DVOM) between harness terminal J1-1 and ground. If 8-10 volts are present, go to Step 4. If not, go to Step 6.

4. Allow voltage to stabilize and touch the test light probe to the harness connector terminal for the sensor. If the voltage changes, replace the ECM. If no change, go to the next step.

5. Disconnect the module connector again and touch the probe to its terminal D. If it lights, replace the sensor module. If it doesn't light, look for an open on the ground circuit for terminal D.

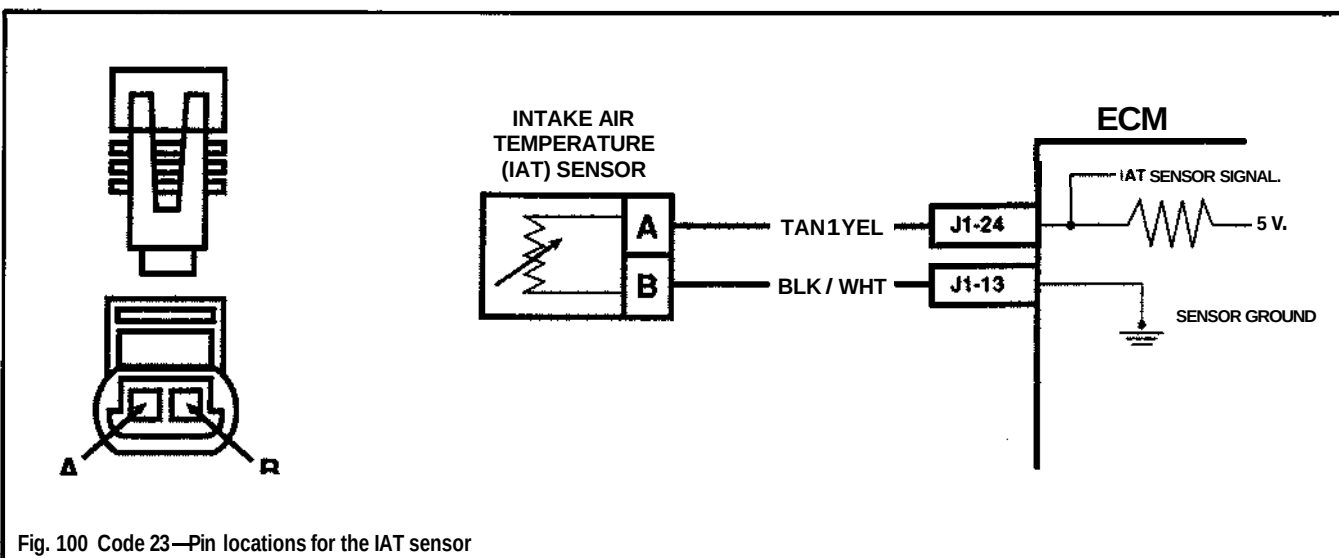
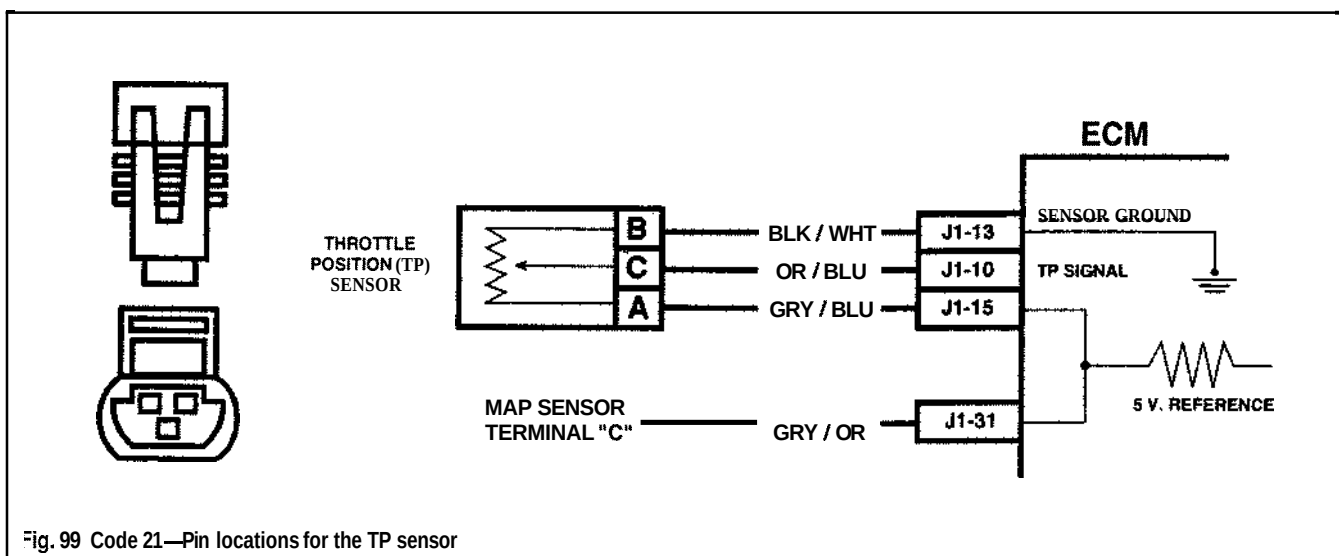
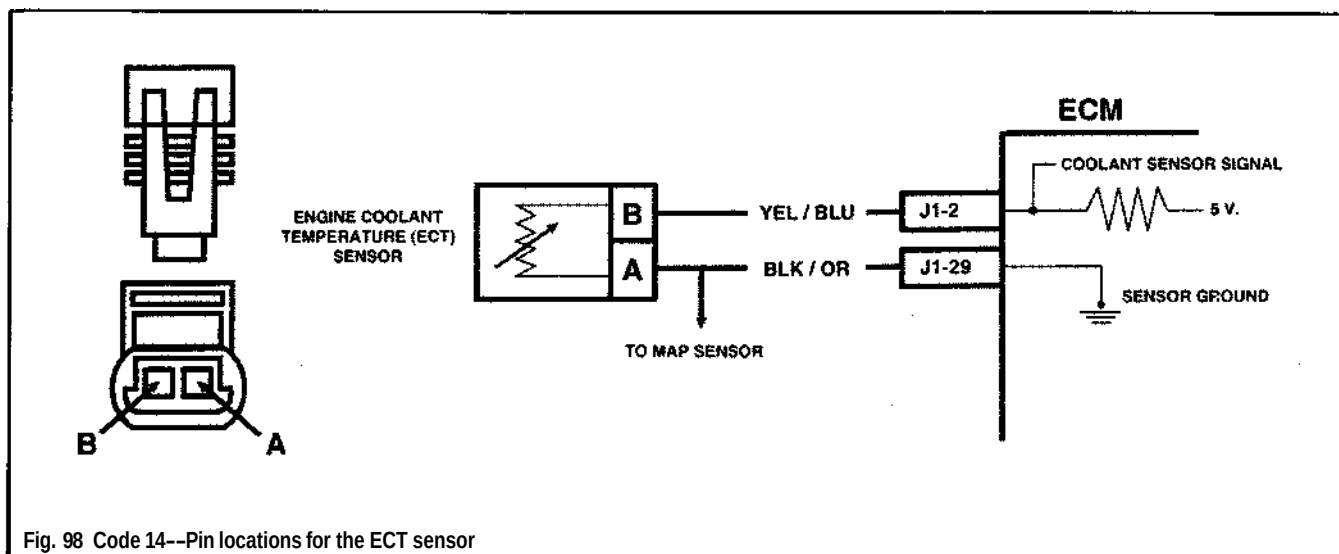
6. Connect a test light to ground, disconnect the 5-wire connector at the module and touch the probe to terminal B. If the light goes ON, circuit J1-1 is either open or shorted to ground. If OK, replace the KS module. If it doesn't go ON, the 12V circuit from the module to the ignition/injector relay is open or grounded.

CODE 51—ELECTRONIC CONTROL MODULE (ECM) CALIBRATION MEMORY FAILURE

If DTC 51 has shown more than once but is intermittent, replace the ECM.

Turn the ignition switch **ON** and clear the codes as detailed in this section. If the code resets itself, replace the ECM; if not, check all system circuits for bad connections and/or frayed wires.

Diagnostic Trouble Code Schematics



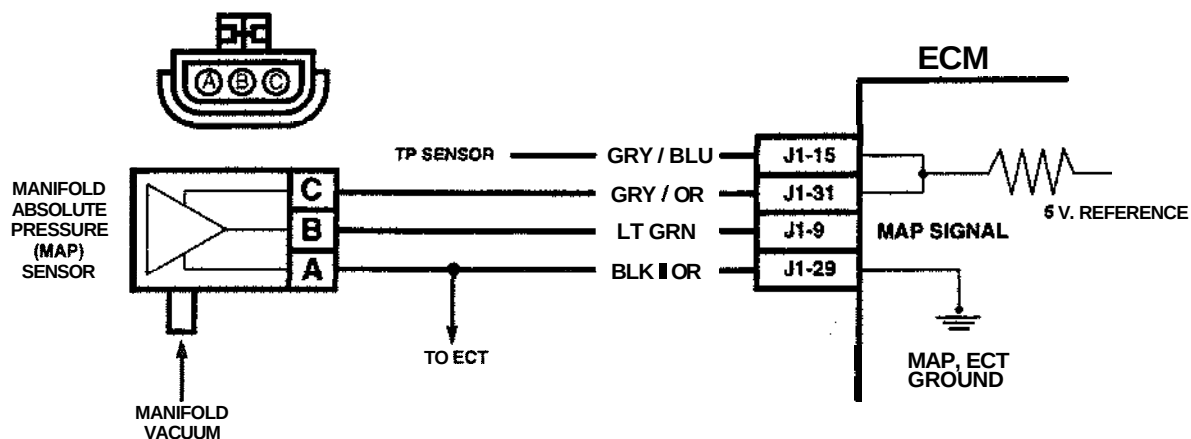


Fig. 101 Code 33—Pin locations for the MAP sensor

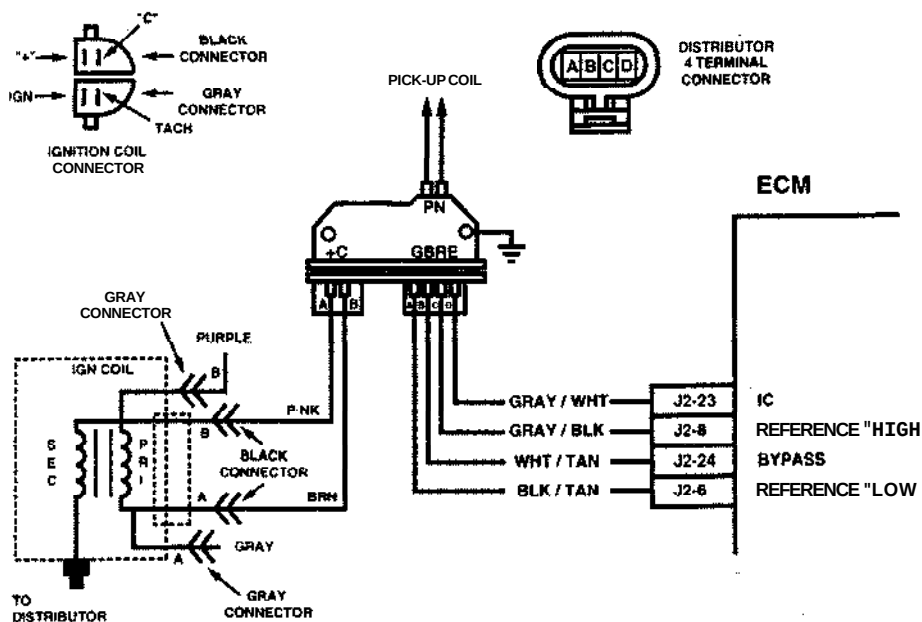


Fig. 102 Code 42—Pin locations for the IC circuit

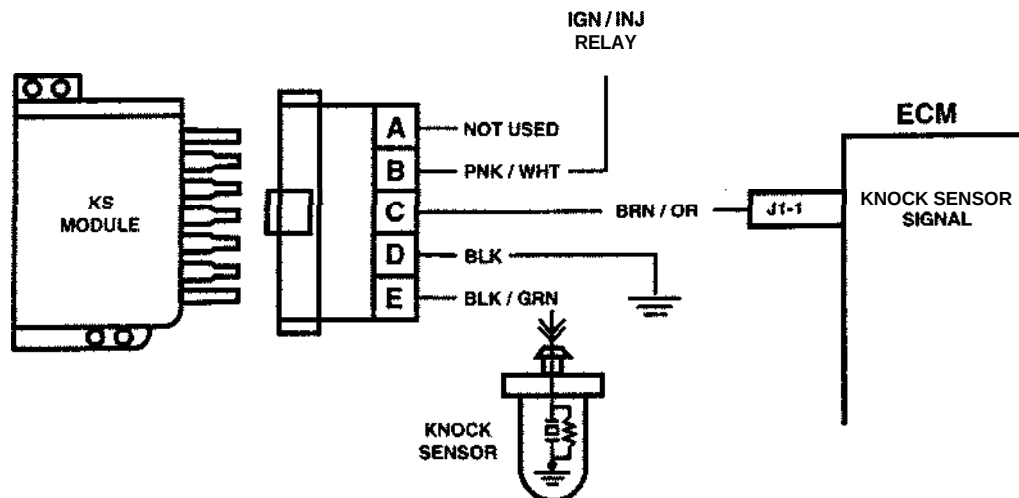


Fig. 103 Code 43—Pin locations for the KS sensor

WIRING SCHEMATICS

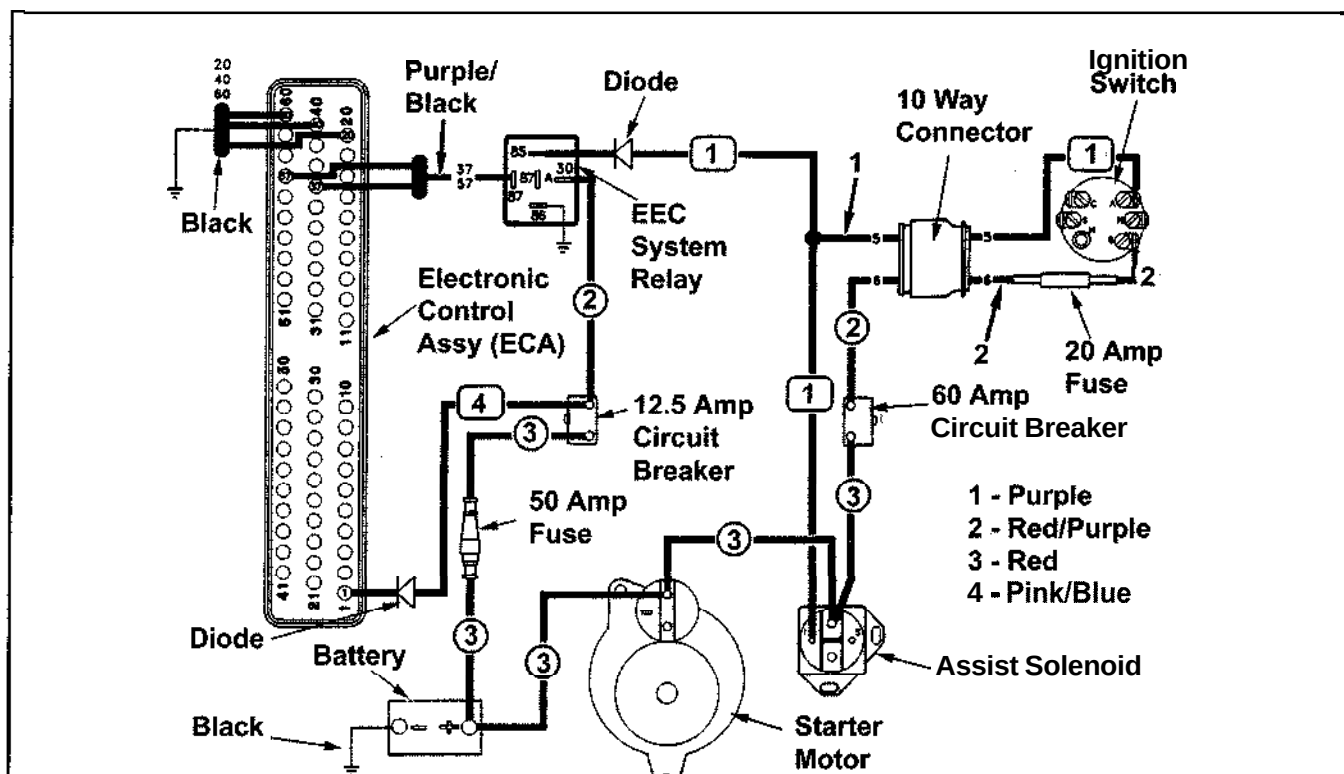


Fig. 104 EEC Power and Keep Alive circuits—Ford engines

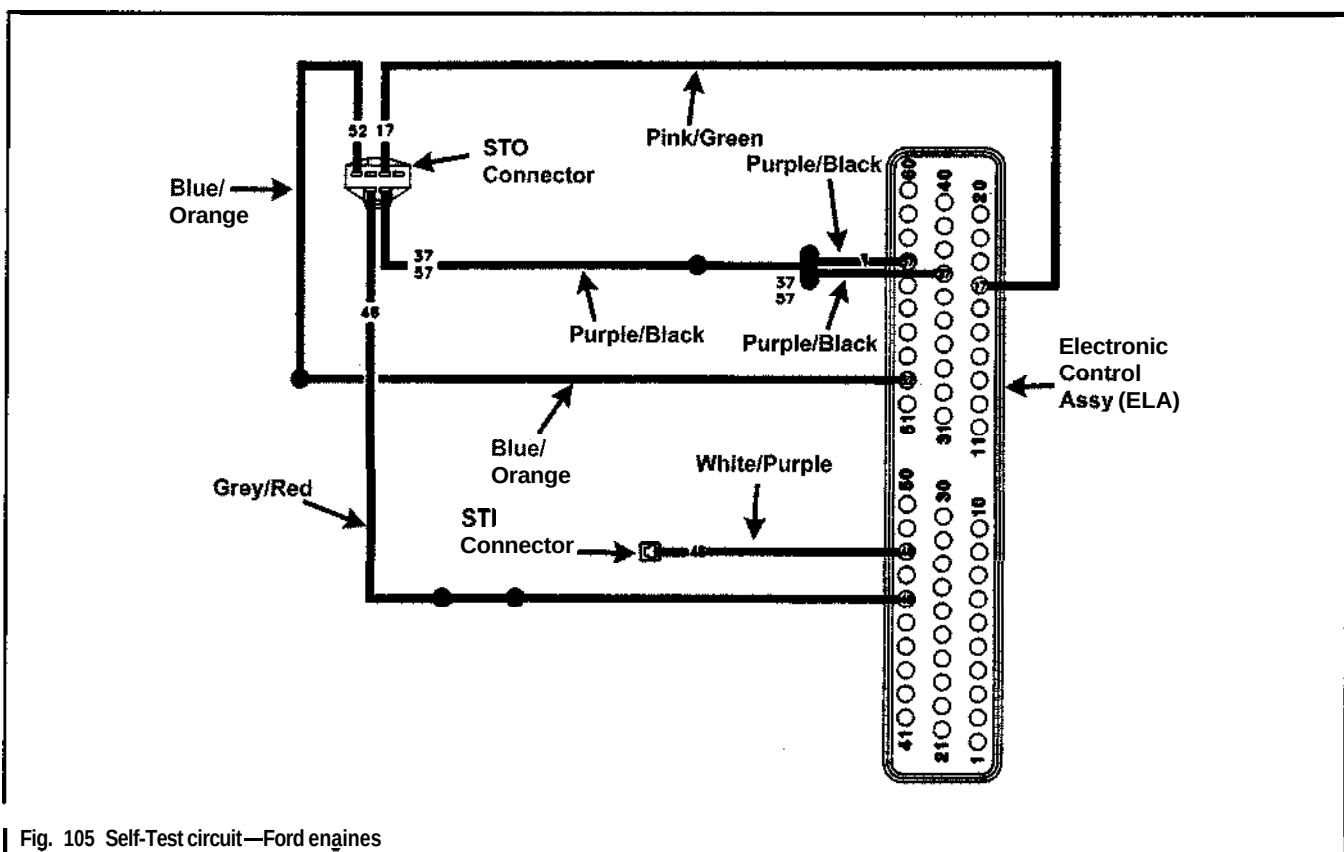


Fig. 105 Self-Test circuit—Ford engines

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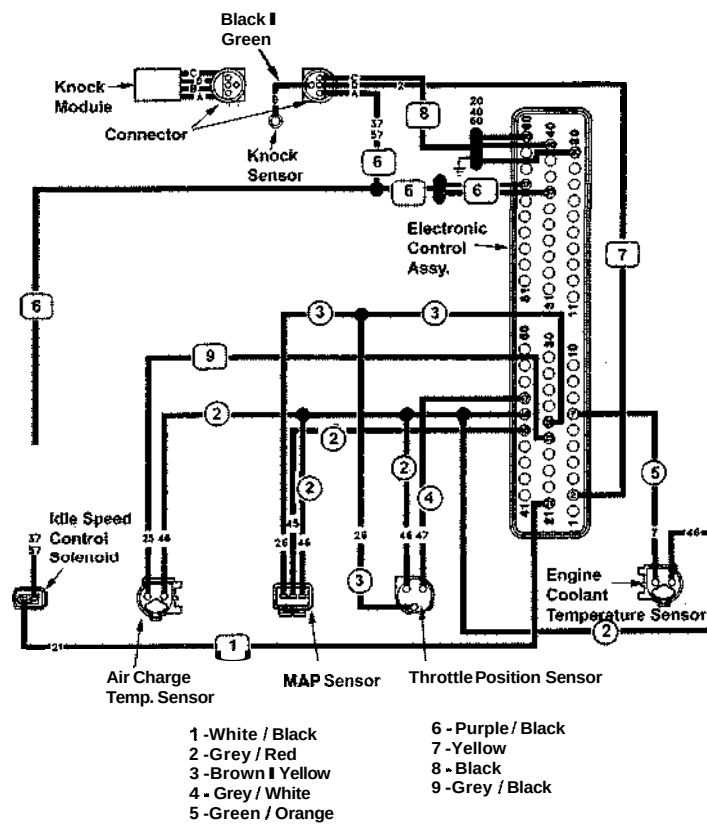


Fig. 106 Sensor and actuator circuits—Ford engines

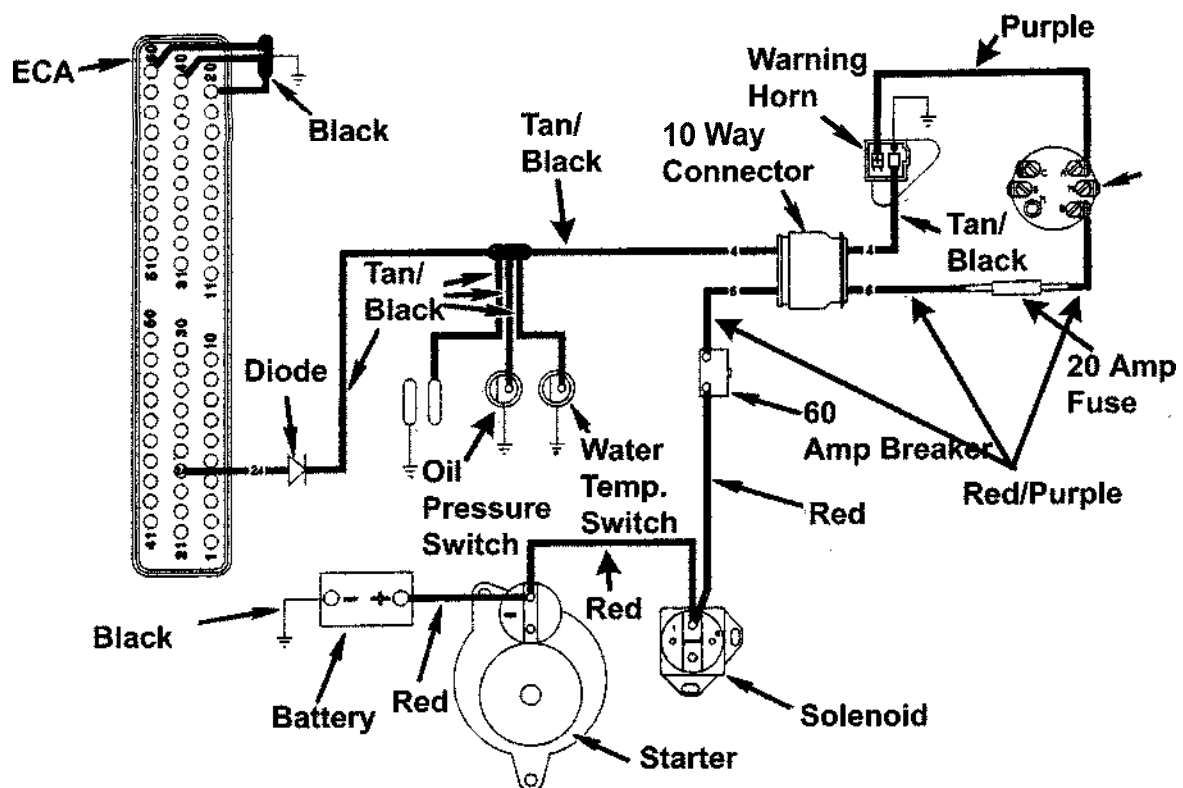


Fig. 107 SLOW circuit—Ford engines

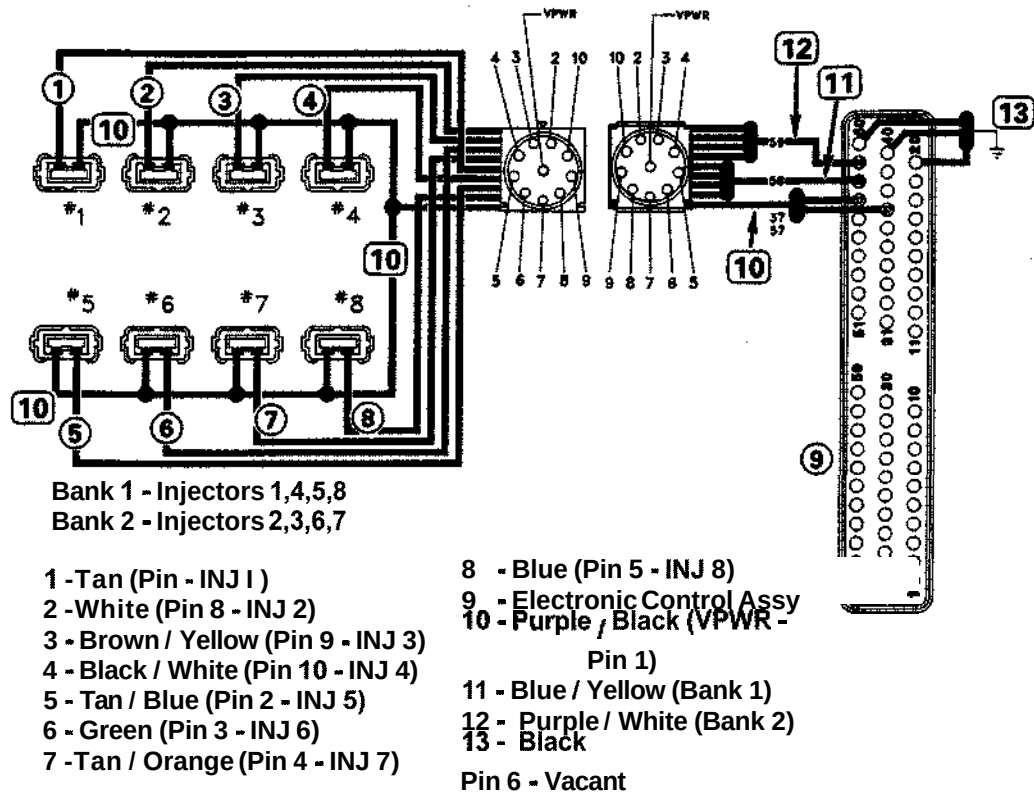


Fig. 108 Fuel injector circuits—Ford engines

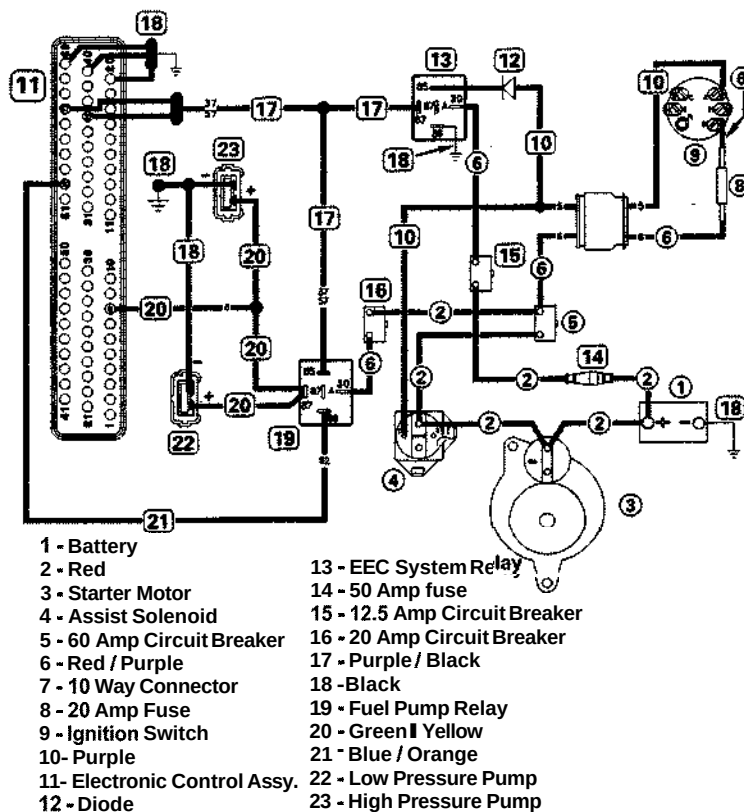


Fig. 109 Fuel pump circuits—Ford engines

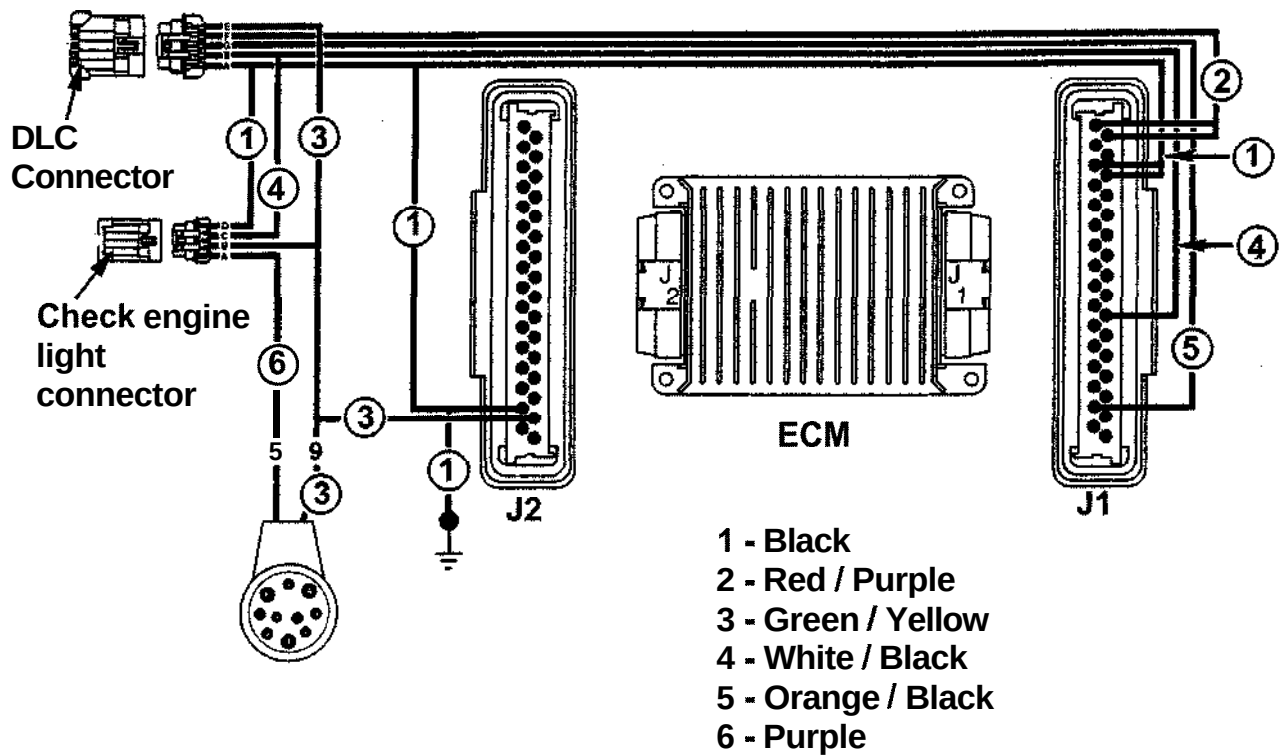


Fig. 110 Diagnostic circuit—1995-96 GM engines

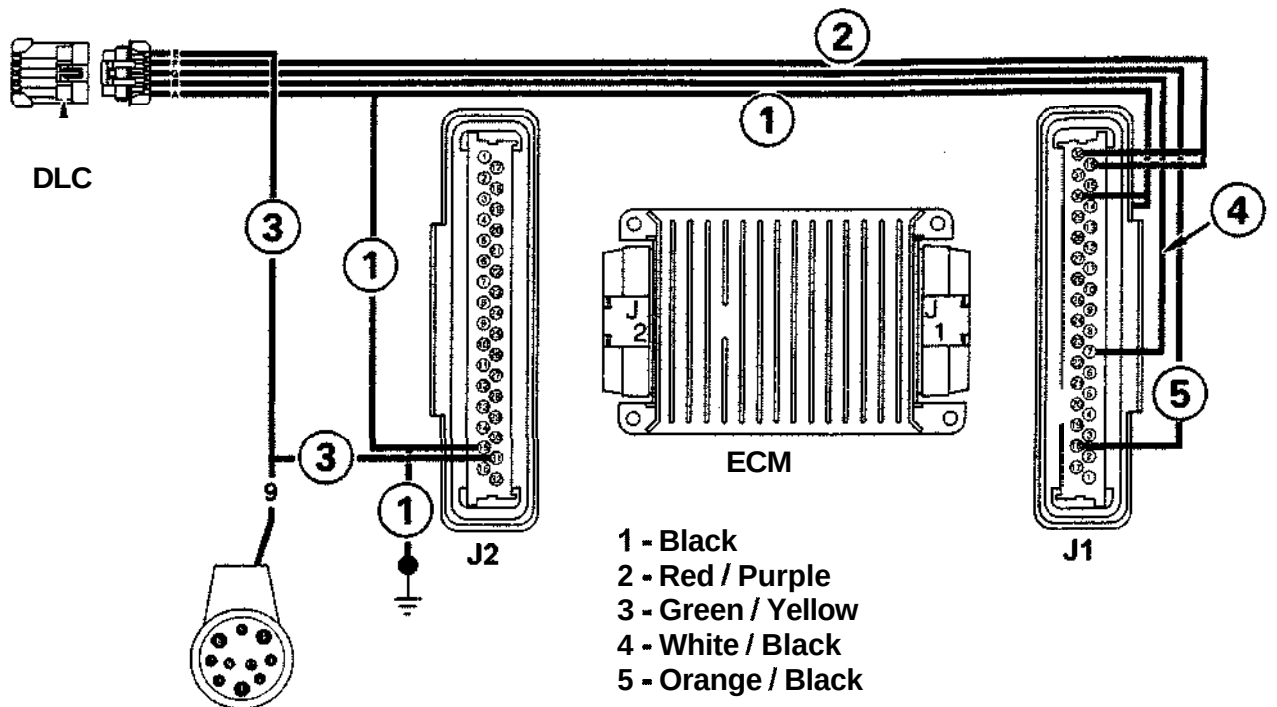


Fig. 111 Diagnostic circuit—1997-98 GM engines

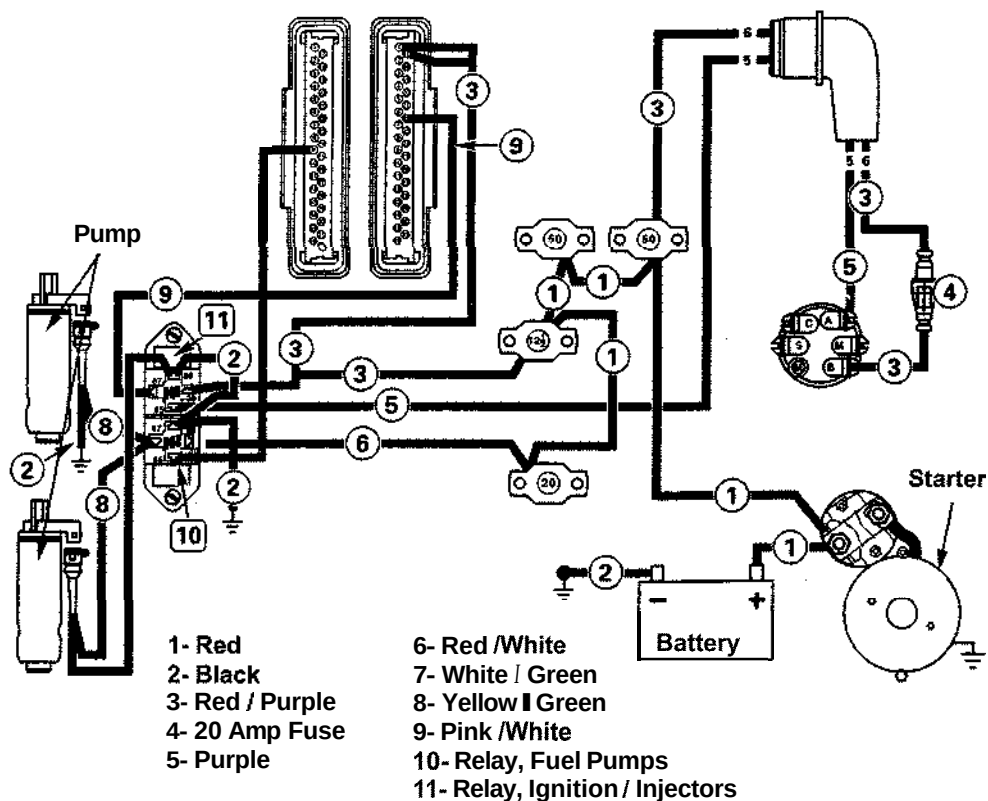


Fig. 112 Fuel pump circuits—GM MFI and TBI engines

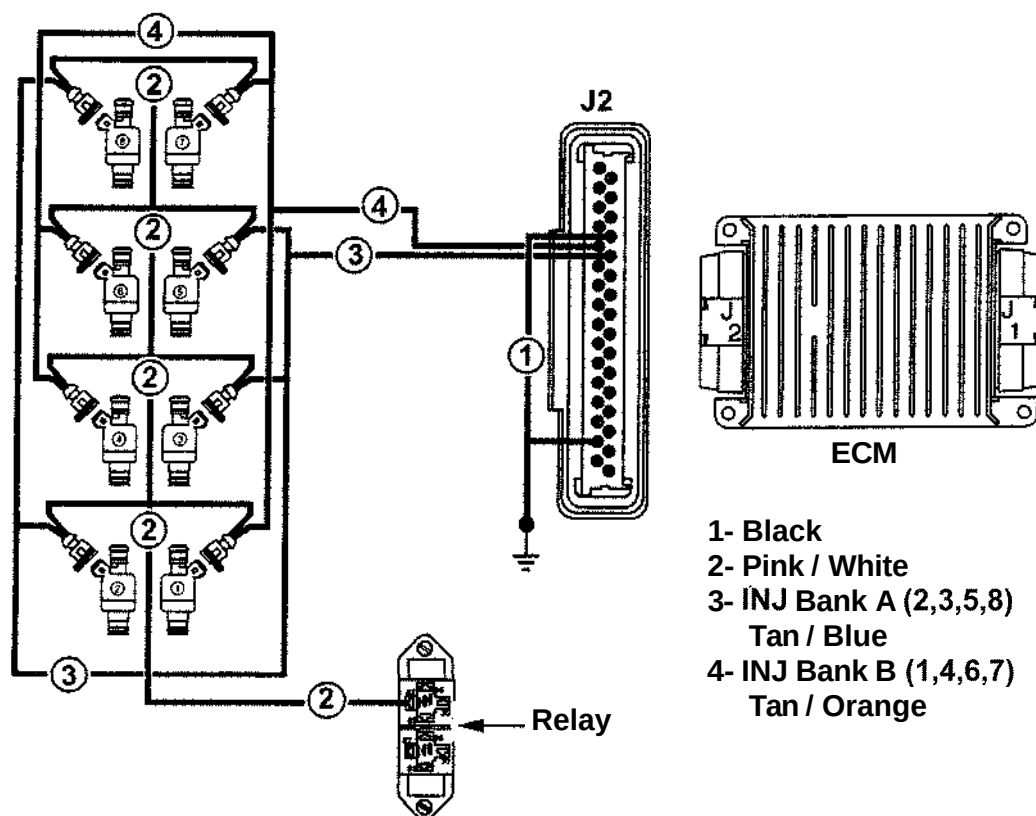


Fig. 113 Fuel injector circuits—GM MFI engines except 1998 7.4Gi

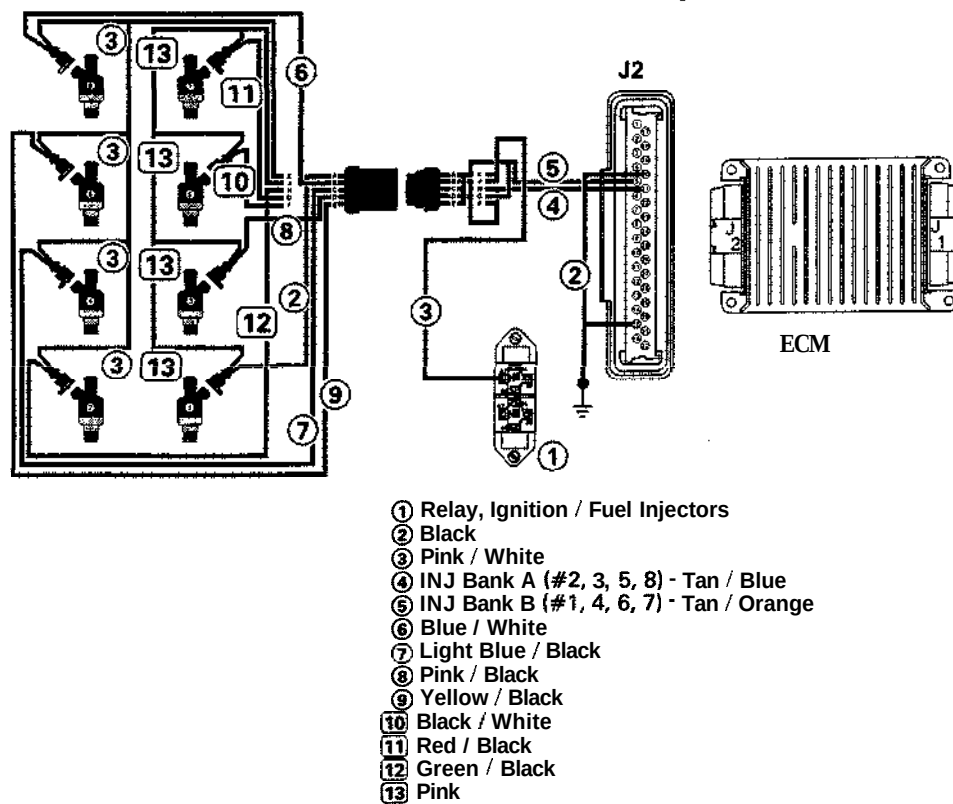


Fig. 114 Fuel injector circuits—1998 7.4Gi engines

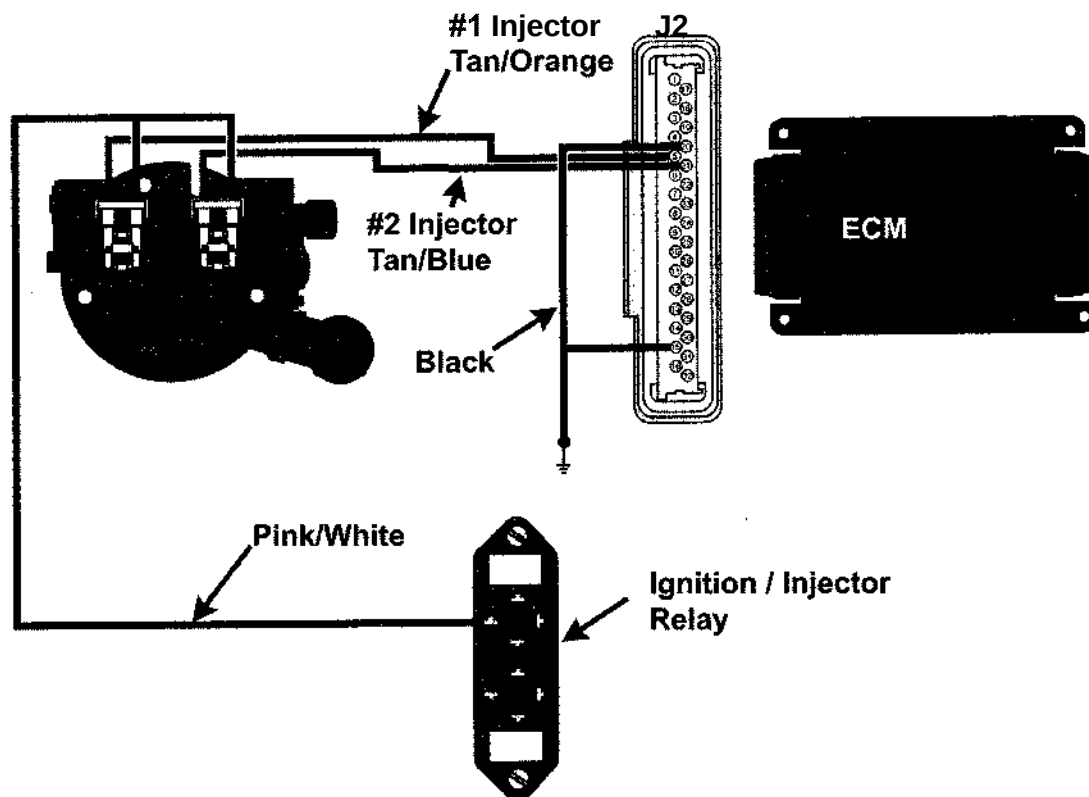


Fig. 115 Fuel injector circuits—GM TBI engines

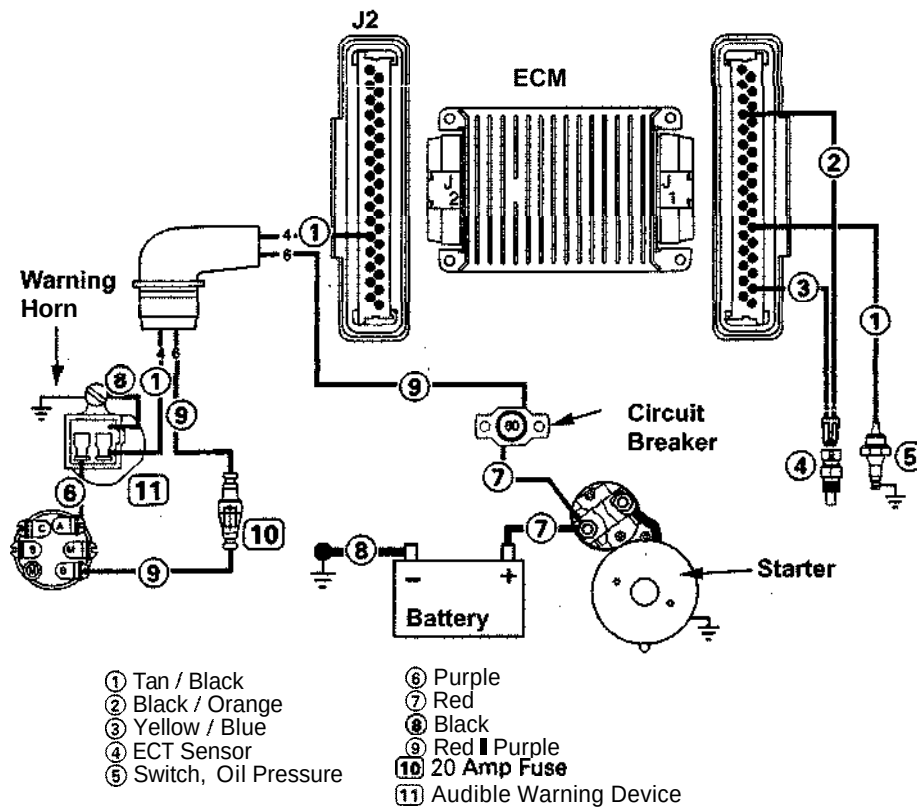


Fig. 116 SLOW circuit—GM engines, 1998 engines use a 50 amp circuit breaker

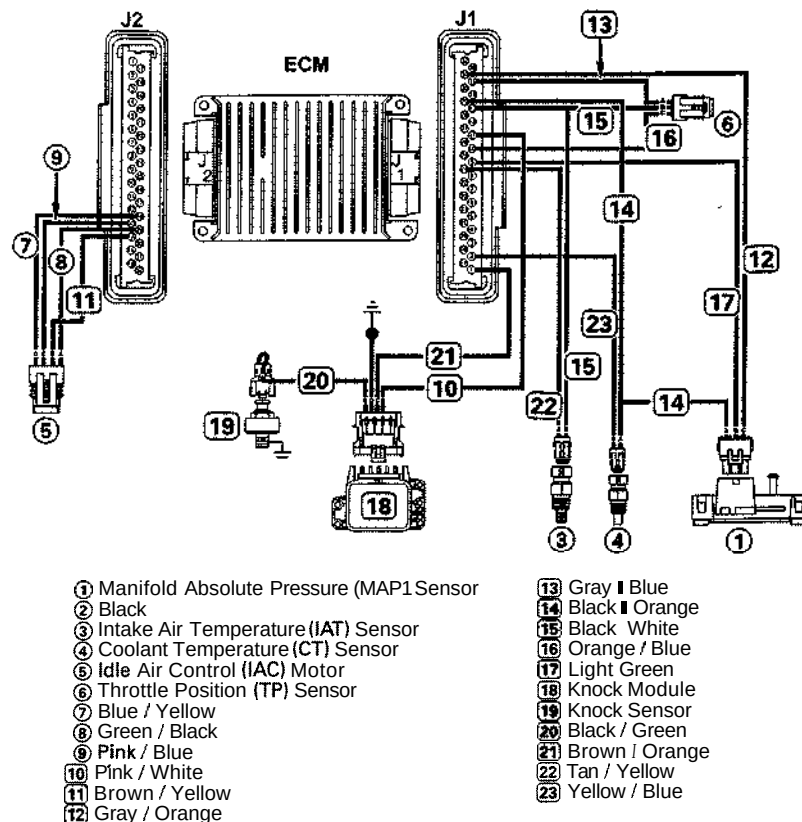


Fig. 117 Sensor and actuator circuits—GM MFI and TBI engines

ECM J1 32-Pin Connector

J1 Pin No.	Circuit Description	Wire Color
1	Spark Retard Signal (ESC)	Brown/Orange
2	ECT Sensor	Yellow/Blue
3	Blank	
4	Blank	
5	Master/Slave (ECM) Twin Engine Only	Yellow/Gray
6	Oil Pressure Switch - S.L.O.W.	Tan/Black
7	Diagnostic "Test" (Service Mode)	White/Black
8	Blank	
9	MAP Sensor Signal	Light Green
10	TP Sensor Signal	Orange/Blue
11	Ignition 12V	Pink/White
12	Blank	
13	IAT and TP Sensor Ground	Black/White
14	ECM Ground	Black
15	TP 5 Volt Reference	Gray/Blue
16	Battery 12V	Red/Purple
17	Blank	
18	Serial Data (Scan Tool Communication)	Orange/Black
19	Blank	
20	Blank	
21	Not Used	Pink
22	Blank	
23	Blank	
24	IAT Sensor Signal	Tan/Yellow
25	Blank	
26	Blank	
27	Blank	
28	Blank	
29	MAP and ECT Sensor Ground	Black/Orange
30	ECM Ground	Black
31	MAP Sensor 5V Reference	Gray/Orange
32	Battery 12V	Red/Purple

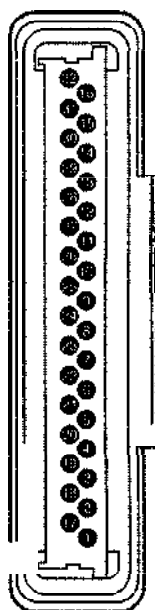


Fig. 118 J1 pin locations—1995 engines

ECM J2 32-Pin Connector

J2 Pin No.	Circuit Description	Wire Color
1	Blank	
2	Blank	
3	Blank	
4	Blank	
5	Cyl. 1-7-4-6 Injector Driver	Tan/Orange
6	Distributor Low Reference and ESA	Black/Tan
7	Fuel Injector Jumper	Purple/White
8	Distributor High Reference and ESA	Gray/Black
9	Fuel Pump Relay Driver	White/Green
10	Blank	
11	Blank	
12	S.L.O.W. Warning Horn	Tan/Black
13	IAC Coil "A" Low	Pink/Blue
14	IAC Coil "B" High	Brown/Yellow
15	Ground	Black
16	Blank	
17	Blank	
18	Blank	
19	Blank	
20	Ground	Black
21	Cyl. 2-8-3-5 Injector Driver	Tan/Blue
22	Fuel Injector Jumper	Purple/White
23	(ESA) Electronic Shift Assist and (IC) Electronic Spark Timing	White
24	IC Bypass	White/Tan
25	Blank	
26	Blank	
27	Blank	
28	IAC Coil "A" High	Blue/Yellow
29	IAC Coil "B" Low	Green/Black
30	Blank	
31	MIL / Check Engine Lamp Output	Green/Yellow
32	Blank	

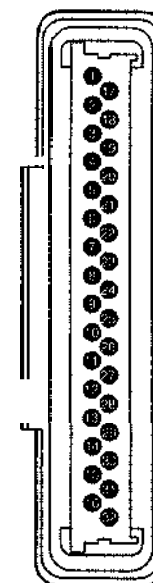


Fig. 119 J2 pin locations—1995 engines

ECM J1 32-Pin Connector

J1 Pin No.	Circuit Description	Wire Color
1	Spark Retard Signal (ESC)	Brown/Orange
2	ECT Sensor, <i>S.L.O.W.</i>	Yellow/Blue
3	Blank	
4	Blank	
5	ECM Master/Slave (not used)	Yellow/Gray
6	Oil Pressure Switch * <i>S.L.O.W.</i>	Tan/Black
7	Diagnostic "Test" (Service Mode)	White/Black
8	Blank	
9	MAP Sensor Signal	Light Green
10	TP Sensor Signal	Orange/Blue
11	Ignition 12V	Pink/White
12	Blank	
13	IAT* and TP Sensor Ground	Black/White
14	ECM Ground	Black
15	TP 5 Volt Reference	Gray/Blue
16	Battery 12V	Red/Purple
17	Blank	
18	DLC, Master/Slave Communication	Orange/Black
19	Blank	
20	Blank	
21	Blank	
22	Blank	
23	Blank	
24	IAT Sensor* Signal	Tan/Yellow
25	Blank	
26	Blank	
27	Blank	
28	Blank	
29	MAP and ECT Sensor Ground, <i>S.L.O.W.</i>	Black/Orange
30	ECM Ground	Black
31	MAP Sensor 5V Reference	Gray/Orange
32	Battery 12V	Red/Purple

* MFI models only; not used on TBI models

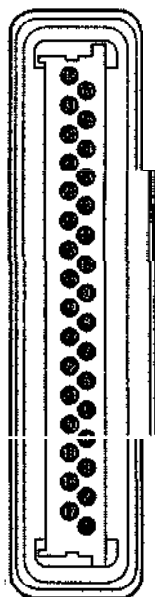


Fig. 120 J1 pin locations—1996-97 engines

ECM J2 32-Pin Connector

J2 Pin No.	Circuit Description	Wire Color
1	Blank	
2	Blank	
3	Blank	
4	Blank	
5	Cyl. 1-7-4-6 Injector Driver	Tan/Orange
6	Distributor Low Reference	Black/Tan
7	Fuel injector Jumper*	Purple/White
8	Distributor High Reference	Gray/Black
9	Fuel Pump Relay Driver	White/Green
10	Blank	
11	Blank	
12	<i>S.L.O.W.</i> Warning Horn	Tan/Black
13	IAC Coil "A" Low	Pink/Blue
14	IAC Coil "B" High	Brown/Yellow
15	Fuel Injector Ground	Black
16	Blank	
17	Blank	
18	Blank	
19	Blank	
20	Fuel Injector Ground	Black
21	Cyl. 2-8-3-5 Injector Driver	Tan/Blue
22	Fuel Injector Jumper*	Purple/White
23	(IC) Electronic Spark Timing	White
24	IC Bypass	White/Tan
25	Blank	
26	Blank	
27	Blank	
28	IAC Coil "A" High	Blue/Yellow
29	IAC Coil "B" Low	Green/Black
30	Blank	
31	Data Link Connector	Green/Yellow
32	Blank	

* MFI models only; not used on TBI models

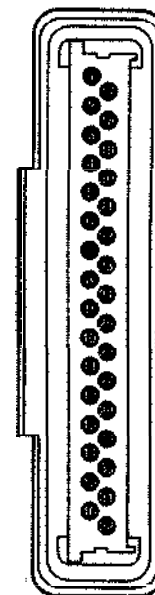


Fig. 121 J2 pin locations—1996-97 engines

ECM J2 32-Pin Connector

J2 Pin No.	Circuit Description	Wire Color
1	Blank	
2	Blank	
3	Blank	
4	Blank	
5	Injector Driver #	Tan/Orange
6	IC Reference "LOW"	Black/Tan
7	Fuel Injector Jumper*	Purple/White
8	IC Reference "HIGH"	Gray/Black
9	Fuel Pump Relay Driver	White/Green
10	Blank	
11	Blank	
12	S.L.O.W.™ Warning Horn	Tan/Black
13	IAC Coil "A" Low	Pink/Blue
14	IAC Coil "B" High	Brown/Yellow
15	Fuel Injector Ground	Black
16	Blank	
17	Blank	
18	Blank	
19	Blank	
20	Fuel Injector Ground	Black
21	Injector Driver +	Tan/Blue
22	Fuel Injector Jumper*	Purple/White
23	IC Signal	White
24	IC Bypass	White/Tan
25	Blank	
26	Blank	
27	Blank	
28	IAC Coil "A" High	Blue/Yellow
29	IAC Coil "B" Low	Green/Black
30	Blank	
31	Data Link Connector	Green/Yellow
32	Blank	

MFI models only; not used on TBI models

* MFI models: Cylinders 1-4-6-7 TBI models: Injector No. 1

- MFI models: Cylinders 2-3-5-8 TBI models: Injector No. 2

ECM J1 32-Pin Connector

J1 Pin No.	Circuit Description	Wire Color
1	Spark Retard Signal (ESC)	Brown/Orange
2	ECT Sensor, S.L.O.W.™	Yellow/Blue
3	Blank	
4	Blank	
5	ECM Master/Slave (not used)	Yellow/Gray
6	Oil Pressure Switch - S.L.O.W.™	Tan/Black
7	Diagnostic "Test" (Service Mode)	White/Black
8	Blank	
9	MAP Sensor Signal	Light Green
10	TP Sensor Signal	Orange/Blue
11	Ignition 12V	Pink/White
12	Blank	
13	IAT* and TP Sensor Ground	Black/White
14	ECM Ground	Black
15	TP 5 Volt Reference	Gray/Blue
16	Battery 12V	Red/Purple
17	Blank	
18	DLC, Master/Slave Communication	Orange/Black
19	Blank	
20	Blank	
21	Blank	
22	Blank	
23	Blank	
24	IAT Sensor* Signal	Tan/Yellow
25	Blank	
26	Blank	
27	Blank	
28	Blank	
29	MAP and ECT Sensor Ground, S.L.O.W.™	Black/Orange
30	ECM Ground	Black
31	MAP Sensor 5V Reference	Gray/Orange
32	Battery 12V	Red/Purple

* MFI models only; not used on TBI models

Fig. 123 J2 pin locations—1998 engines

Fig. 122 J1 pin locations—1998 engines

ECM J1 Input Connector and Symptoms Identification

This chart is to further aid in diagnosis of symptoms. These voltages were derived from a known good system completely hooked up and operational. The voltages are to help identify what voltage is needed to operate the different circuits. **NEVER ATTEMPT TO OBTAIN THESE VOLTAGES BY PROBING WIRES OR CONNECTORS.** Serious damage could result to wiring, or connectors, with the loss of engine operation. The voltages you may get may vary due to low battery charge or other reasons, but they should be close.

The "B+" symbol indicates a system voltage.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine operating temperature
- Engine idling (for "Engine Operating" column)
- Test terminal not grounded

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
1	KS SIGNAL	BROWN/ ORANGE	KNOCK SENSOR	9.5V	9.5V	43	POOR FUEL ECONOMY, POOR PERFORMANCE, DETONATION
2	ECT SIGNAL	BLUE	ECT SENSOR	1.95V (2)	1.95V (2)	14	POOR PERFORMANCE, EXHAUST ODOR, ROUGH IDLE, RPM REDUCTION
3	NOT USED	-	-	-	-	-	-
4	NOT USED	-	-	-	-	-	-
5	MASTER SLAVE	YELLOW/ GRAY	IN-LINE BOAT HARNESS	B+	B+	NONE	LACK OF DATA FROM OTHER ENGINE
6	OIL PRESSURE SWITCH	TAN/ BLACK	10 PIN CONNECTOR	(5)	B+	NONE	RPM REDUCTION MODE
7	DIAGNOSIS TEST TERMINAL	WHITE/ BLACK	DLC	B+	B+	NONE	INCORRECT IDLE, POOR PERFORMANCE
8	NOT USED	-	-	-	-	-	-
9	MAP SIGNAL	LIGHT GREEN	MAP SENSOR	4.9V	1.46V (3)	33	POOR PERFORMANCE, SURGE, POOR FUEL ECONOMY, EXHAUST ODOR
10	TP SIGNAL	ORANGE/ BWE	TP SENSOR	0.62V (4)	0.62V (4)	21	POOR PERFORMANCE AND ACCELERATION, INCORRECT IDLE
11	IGNITION FUSED	PINK/ WHITE	SPUCE	B+	B+	NONE	CT INOPERABLE, NO START
12	NOT USED	-	-	-	-	-	-
13	TP & IAT GROUND	BLACK/ WHITE	TP SENSOR	(5)	(5)	2	HIGH IDLE, ROUGH IDLE, POOR PERFORMANCE
14	ECM GROUND	BLACK	ENGINE BLOCK	(5)	(5)	NONE	NO CHANGE
15	TP 5V REF	GRAY/ BWE	TP MAP SENSOR	5V	5V	21, 33	LACK OF POWER, IDLE HIGH
16	BATTERY FEED	RED/ PURPLE	SPUCE	B+	B+	NONE	NO START

- (1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS
 (2) VARIES WITH TEMPERATURE
 (3) VARIES WITH MANIFOLD VACUUM

- (4) VARIES WITH THROTTLE MOVEMENT
 (5) LESS THAN 0.5 VOLT (500mV)

ECM J1 Input Connector and Symptoms Identification

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
17	NOT USED	-	-	-	-	-	-
18	SERIAL DATA	ORANGE/ BLACK	DLC	5V	5V	NONE	NO SERIAL DATA
19	NOT USED	-	-	-	-	-	-
20	NOT USED	-	-	-	-	-	-
21	E-STOP	PINK	BULLET CONNECTOR	B+	B+	NONE	RPM REDUCTION MODE
22	NOT USED	-	-	-	-	-	-
23	NOT USED	-	-	-	-	-	-
24	IAT SENSOR	TAN/ YELLOW	IAT SENSOR	3.2V (2)	3.2V (2)	23	ROUGH IDLE
25	NOT USED	-	-	-	-	-	-
26	NOT USED	-	-	-	-	-	-
27	NOT USED	-	-	-	-	-	-
28	NOT USED	-	-	-	-	-	-
29	MAP & ECT GROUND	BLACK/ ORANGE	MAP AND ECT SENSOR	(5)	(5)	14 & 33	LACK OF PERFORMANCE EXHAUST ODOR, STALL
30	ECM GROUND	BLACK	ENGINE BLOCK	(5)	(5)	NONE	NO CHANGE
31	MAP, 5V REFERENCE	GRAY/ ORANGE	MAP SENSOR	5V	5V	33	LACK OF POWER, SURGE, ROUGH IDLE, EXHAUST ODOR
32	BATTERY FEED	RED/ PURPLE	SPUCE	B+	B+	NONE	NO START

- (1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS
 (2) VARIES WITH TEMPERATURE
 (3) VARIES WITH MANIFOLD VACUUM

- (4) VARIES WITH THROTTLE MOVEMENT
 (5) LESS THAN 0.5 VOLT (500mV)

Fig.124 ECM connector and symptoms identification—1995 J1 (1 of 2)

Fig. 125 ECM connector and symptoms identification—1995 J1 (2 of 2)

ECM J2 Output Connector and Symptoms Identification

This chart is to further aid in diagnosis of symptoms. These voltages were derived from a known good engine. The voltages shown were done with the electrical system completely hooked up and operational. The voltages are to help identify what voltage is needed to operate the different circuits. **NEVER ATTEMPT TO OBTAIN THESE VOLTAGES BY PROBING WIRES OR CONNECTORS.** Serious damage could result to wiring, or connectors, with the loss of engine operation. The voltages you may get may vary due to low battery charge or other reasons, but they should be close.

The "B+" symbol indicates a system voltage.
THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine operating temperature ● Engine idling (for " Engine Operating" column)
- Test terminal not grounded

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
1	NOT USED	-	-	-	-	-	-
2	NOT USED	-	-	-	-	-	-
3	NOT USED	-	-	-	-	-	-
4	NOT USED	-	-	-	-	-	-
5	CYL 1-7-4-6 INJECTOR DRIVER	TAN/ ORANGE	INJECTOR	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STALL
6	IC REF LOW & ESA	BLACK/ TAN	IC MODULE	(5)	(5)	NONE	NO CHANGE
7	JUMPER	PURPLE/ WHITE	ECM	2.9V	2.9V	NONE	NO CHANGE
8	IC REF HIGH & ESA	GRAY/ BLACK	IC MODULE	5V	1.6V	NONE	NORESTART
9	FUEL PUMP RELAY DRIVER	WHITE/ GREEN	FUEL PUMP RELAY	(1)(5)	B+	NONE	NO START
10	NOT USED	-	-	-	-	-	-
11	NOT USED	-	-	-	-	-	-
RPM REDUCE WARNING HORN		BLACK	10 PIN CONNECTOR	(5)	(5)	NONE	LOSS OF RPM OVER 2500
13	IAC "A" LOW	PINK/ BLUE	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
14	IAC "B" HIGH	BROWN/ YELLOW	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
15	FUEL INJECTOR GROUND	BLACK	ENGINE GROUND	(5)	(5)	NONE	NO CHANGE
16	NOT USED	-	-	-	-	-	-

- (1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS
(2) VARIES WITH TEMPERATURE
(3) VARIES WITH MANIFOLD VACUUM

- (4) VARIES WITH THROTTLE MOVEMENT
(5) LESS THAN 0.5 VOLT (500mV)

ECM J2 Output Connector and Symptoms Identification

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
17	NOT USED	-	-	-	-	-	-
18	NOT USED	-	-	-	-	-	-
19	NOT USED	-	-	-	-	-	-
20	FUEL INJECTOR GROUND	BLACK	ENGINE GROUND	(5)	(5)	NONE	NO CHANGE
21	CYL 2-8-3-5 INJECTOR DRIVER	TAN/ BLUE	INJECTOR	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STALL
22	PIN 7	PURPLE/ WHITE	-	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STALL
23	IC or ESA SIGNAL	WHITE	IC MODULE	(5)	1.2V	42	STALL, WILL RESTART IN BYPASS MODE, LACK OF POWER
24	IC BYPASS	WHITE/ TAN	IC MODULE	(5)	4.5V	42	LACK OF POWER, FIXED TIMING
25	NOT USED	-	-	-	-	-	-
26	NOT USED	-	-	-	-	-	-
27	NOT USED	-	-	-	-	-	-
28	IAC "A" HIGH	BLUE/ YELLOW	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
29	IAC "B" LOW	GREEN/ BLACK	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
30	NOT USED	-	-	-	-	-	-
31	MALFUNCTION INDICATOR LAMP	GREEN/ YELLOW	DLC	(5)	(5)	NONE	LAMP INOPERABLE
32	NOT USED	-	-	-	-	-	-

- (1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS
(2) VARIES WITH TEMPERATURE
(3) VARIES WITH MANIFOLD VACUUM

- (4) VARIES WITH THROTTLE MOVEMENT
(5) LESS THAN 0.5 VOLT (500mV)

Fig. 126 ECM connector and symptoms identification—1995 J2 (1 of 2)

Fig. 127 ECM connector and symptoms identification—1995 J2 (2 of 2)

ECM J1 Connector and Symptoms Identification

This chart is to further aid in diagnosis of symptoms. These voltages were derived from a known good engine. The voltages shown were done with the electrical system completely hooked up and

↑ If voltages are to help identify what age is needed to operate ↓ different circuits.

NEVER - ~~ON~~ TO OBTAIN THESE VOLTAGES BY **PROBING W** OR **J** Serious damage could result to wiring, or connectors, with the loss of engine operation. The voltages you may get may vary due to low battery charge or other reasons, but they should be close.

The "B+" symbol indicates a system voltage.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling (for "Engine Operating" column)
- Test terminal not grounded

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
1	KS SIGNAL	BROWN/ ORANGE	KNOCK SENSOR	9.5V	9.5V	43	POOR FUEL ECONOMY, POOR PERFORMANCE, DETONATION
2	ECT SIGNAL S.L.O.W.	YELLOW/ BLUE	ECT SENSOR	1.95V (2)	1.95V (2)	14	POOR PERFORMANCE, EXHAUST ODOR, ROUGH IDLE, RPM REDUCTION
3	NOT USED						-
4	NOT USED						-
5	MASTER/SLAVE (not used)	YELLOW/ GRAY	IN-LINE BOAT HARNESS	B+	B+	NONE	LACK OF DATA FROM OTHER ENGINE
6	MILPRESSURE SWITCH, S.L.O.W.	TAN/ BLACK	10 PIN CONNECTOR	(5)	B+	NONE	RPM REDUCTION M O M
7	DATA UNK CONNECTOR	WHITE/ BLACK	DLC	B+	B+	NONE	INCORRECT IDLE, POOR PERFORMANCE
8	NOT USED						-
9	MAP SIGNAL	LIGHT GREEN	MAP SENSOR	4.9V	1.46V (3)	33	POOR PERFORMANCE SURGE, POOR FUEL ECONOMY, EXHAUST ODOR
10	TP SIGNAL	ORANGE/ BWE	TP SENSOR	0.62V (4)	0.62V (4)	21	POOR PERFORMANCE AND ACCELERATION, INCORRECT IDLE
11	ECM SWITCHED 12V	PINK/ WHITE	SPLICE	B+	B+	NONE	CT INOPERABLE, NO START
12	NOT USED						-
13	TP & IAT* GROUND	BLACK/ WHITE	TP, IAT SENSOR	(5)	(5)	21	HIGH IDLE, ROUGH IDLE, POOR PERFORMANCE
14	ECM GROUND	SLACK	ENGINE BLOCK	(5)	(5)	NONE	NO CHANGE
15	TP 5V REF	GRAY/ BLUE	TP, MAP SENSOR	5V	5V	21, 33	LACK OF POWER, IDLE HIGH
16	ECM B+	RED/ PURPLE	SPLICE	B+	B+	NONE	NO START

(1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS

(2) VARIES WITH TEMPERATURE

(3) VARIES WITH MANIFOLD VACUUM

* MFI models only; not used on **TBI** models

(4) VARIES WITH THROTTLE MOVEMENT

(5) LESS THAN 0.5 VOLT (500Mv)

ECM J1 Connector and Symptoms Identification

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
17	NOT USED			-	-	-	-
18	MASTER/SLAVE (not used)	ORANGE/BLACK	DLC, IN-LINE BOAT HARNESS	5V	5V	NONE	NO SERIALDATA
19	NONE	-	-	-	-	-	-
20	NOT USED	-	-	-	-	-	-
21	NONE	-	-	-	-	-	-
22	NOT USED	-	-	-	-	-	-
23	NOT USED	-	-	-	-	-	-
24	IAT SENSOR*	TAN/ YEUOW	IAT SENSOR*	3.2V (2)	3.2V (2)	23	ROUGH IDLE
25	NOT USED	-	-	-	-	-	-
26	NOT USED	-	-	-	-	-	-
27	NOT USED	-	-	-	-	-	-
28	NOT USED	-	-	-	-	-	-
29	MAP/ECT GROUND, S.L.O.W.	BLACK/ ORANGE	MAP AND ECT SENSOR	(5)	(5)	14 & 33	LACK OF PERFORMANCE EXHAUST ODOR, STALL
30	ECM GROUND	BLACK	ENGINE BLOCK	(5)	(5)	NONE	NO CHANGE
31	MAP, 5V REFERENCE	GREEN/ ORANGE	MAP SENSOR	5V	5V	33	LACK OF POWER, SURGE, ROUGH IDLE, EXHAUST ODOR
32	ECM B+	RED/ WRPLE	SPLICE	B+	B+	NONE	NO START

(1) BATTERY VOLTAGE FOR FIRST TWO SECONDS. THEN 0 VOLTS

(2) VARIES WITH TEMPERATURE

(3) VARIES WITH MANIFOLD VACUUM

(4) VARIES WITH THROTTLE MOVEMENT

(6) LESS THAN 0.5 VOLT (500Mv)

* MR models only; not used on **TBI** models

Fig. 128 ECM connector and symptoms identification—1996-97J1 (1 of 2)

Fig. 129 ECM connector and symptoms identification—1996-97J1 (2 of 2)

ECM J2 Connector and Symptoms Identification

This chart is to further aid in diagnosis of symptoms. These voltages were derived from a known good engine. The voltages shown were done with the electrical system completely hooked up and operational. The voltages are to help identify what voltage is needed to operate the different circuits. NEVER EMPT TO OBTAIN VOLTAGES BY PROBING WIF OR CTORS. Serious damage could result to wiring, or connectors, with the loss of engine operation. The voltages you may get may vary due to low battery charge or other reasons, but they should be close.

The "B+" symbol indicates a system voltage.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling (for "Engine Operating" column)
- Test terminal not grounded

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
1	NOT USED	-	-	-	-	-	
2	NOT USED	-	-	-	-	-	
3	NOT USED	-	-	-	-	-	
4	NOT USED	-	-	-	-	-	
5	INJECTOR DRIVER BANK B	TAN/ORANGE	INJECTOR	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STAU
6	IC REF LOW	BLACK/TAN	IC MODULE	(5)	(5)	NONE	NO CHANGE
7	INJECTOR JUMPER	PURPLE/WHITE	ECM	2.9V	2.9V	NONE	NO CHANGE
8	IC REF HIGH	GRAY/BLACK	IC MODULE	5V	1.6V	NONE	NO RESTART
9	FUEL PUMP RELAY DRIVER	WHITE/GREEN	FUEL PUMP RELAY	(1)(5)	B+	NONE	NO START
10	NOT USED	-	-	-	-	-	
11	NOT USED	-	-	-	-	-	
12	S.L.O.W. WARNING HORN	TAN/BLACK	10 PIN CONNECTOR	(5)	(5)	NONE	LOSS OF R W OVER 2500
13	IAC "A" LOW	PINK/BLUE	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
14	IAC "B" HIGH	BROWN/YELLOW	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
15	FUEL INJECTOR GROUND	BLACK	ENGINE GROUND	(5)	(5)	NONE	NO CHANGE
16	NOT USED	-	-	-	-	-	-

- (1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS
 (2) VARIES WITH TEMPERATURE
 (3) VARIES WITH MANIFOLD VACUUM

- (4) VARIES WITH THROTTLE MOVEMENT
 (5) LESS THAN 0.5 VOLT (500Mv)

* MFI models only; not used on TBI models

ECM J2 Connector and Symptoms Identification

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
17	NOT USED	-	-	-	-	-	
18	NOT USED	-	-	-	-	-	
19	NOT USED	-	-	-	-	-	
20	FUEL INJECTOR GROUND	BLACK	ENGINE GROUND	(5)	(5)	NONE	NO CHANGE
21	INJECTOR DRIVER BANK A	TAN/BLUE	INJECTOR	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STAU
22	INJECTOR JUMPER	PURPLE/WHITE	ECM	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STAU
23	IC SIGNAL	WHITE	IC MODULE	(5)	1.2V	42	STAU, WILL RESTART IN BYPASS MODE, LACK OF POWER
24	IC BYPASS	WHITE/TAN	IC MODULE	(5)	4.5V	42	LACK OF POWER, FIXED TIMING
25	NOT USED	-	-	-	-	-	
26	NOT USED	-	-	-	-	-	
27	NOT USED	-	-	-	-	-	
28	IAC "A" HIGH	BLUE/YELLOW	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
29	IAC "B" LOW	GREEN/BLACK	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
30	NOT USED	-	-	-	-	-	
31	DLC	GREEN/YELLOW	DLC	(5)	(5)	NONE	-
32	NOT USED	-	-	-	-	-	-

- (1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS
 (2) VARIES WITH TEMPERATURE
 (3) VARIES WITH MANIFOLD VACUUM

- (4) VARIES WITH THROTTLE MOVEMENT
 (5) LESS THAN 0.5 VOLT (500Mv)

* MFI models only; not used on TBI models

Fig. 130 ECM connector and symptoms identification—1996-97 J2 (1 of 2)

Fig. 131 ECM connector and symptoms identification—1996-97 J2 (2 of 2)

ECM J2 Connector and Symptoms Identification

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
17	NOT USED	-	-	-	-	-	-
18	NOT USED	-	-	-	-	-	-
19	NOT USED	-	-	-	-	-	-
20	FUEL INJECTOR GROUND	BLACK	ENGINE GROUND	(5)	(5)	NONE	NO CHANGE
21	INJECTOR DRIVER BANK A	TAN/BLUE	INJECTOR	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STALL
22	INJECTOR JUMPER*	PURPLE/WHITE	ECM	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STALL
23	IC SIGNAL	WHITE	IC MODULE	(5)	1.2V	42	STALL, WILL RESTART IN BYPASS MODE, LACK OF POWER
24	IC BYPASS	WHITE/TAN	IC MODULE	(5)	4.5V	42	LACK OF POWER, FIXED TIMING
25	NOT USED	-	-	-	-	-	-
26	NOT USED	-	-	-	-	-	-
27	NOT USED	-	-	-	-	-	-
28	IAC "A" HIGH	BLUE/YELLOW	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
29	IAC "B" LOW	GREEN/BLACK	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
30	NOT USED	-	-	-	-	-	-
31	DLC	GREEN/YELLOW	DLC	(5)	(5)	NONE	-
32	NOT USED	-	-	-	-	-	-

(1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS

(2) VARIES WITH TEMPERATURE

(3) VARIES WITH MANIFOLD VACUUM

(4) VARIES WITH THROTTLE MOVEMENT

(5) LESS THAN 0.5 VOLT (500mV)

* MFI models only; not used on TBI models

ECM J1 Connector and Symptoms Identification

This chart is to further aid in diagnosis of symptoms. These voltages were derived from a known good engine. The voltages shown were done with the electrical system completely hooked up and operational. The voltages are to help identify what voltage is needed to operate the different circuits. NEVER ATTEMPT TO OBTAIN THESE VOLTAGES BY PROBING WIRES OR CONNECTORS. Serious damage could result to wiring, or connectors, with the loss of engine operation. The voltages you may get may vary due to low battery charge or other reasons, but they should be close.

The "B+" symbol indicates a system voltage.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling (for "Engine Operating" column)
- Test terminal not grounded

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
1	KS SIGNAL	BROWN/ORANGE	KNOCK SENSOR	9.5V	9.5V	43	POOR FUEL ECONOMY, POOR PERFORMANCE, DETONATION
2	ECT SIGNAL S.L.O.W.*	YELLOW/BLUE	ECT SENSOR	1.95V (2)	1.95V (2)	14	POOR PERFORMANCE, EXHAUST ODOR, ROUGH IDLE, RPM REDUCTION
3	NOT USED	-	-	-	-	-	-
4	NOT USED	-	-	-	-	-	-
5	MASTER/SLAVE (not used)	YELLOW/GRAY	IN-LINE BOAT HARNESS	B+	B+	NONE	LACK OF DATA FROM OTHER ENGINE
6	OIL PRESSURE SWITCH S.L.O.W.*	TAN/BLACK	10 PIN CONNECTOR	(5)	B+	NONE	RPM REDUCTION MODE
7	DATA LINK CONNECTOR	WHITE/BLACK	DLC	B+	B+	NONE	INCORRECT IDLE, POOR PERFORMANCE
8	NOT USED	-	-	-	-	-	-
9	MAP SIGNAL	LIGHT GREEN	MAP SENSOR	4.9V	1.46V (3)	33	POOR PERFORMANCE, SURGE, POOR FUEL ECONOMY, EXHAUST ODOR
10	TP SIGNAL	ORANGE/BLUE	TP SENSOR	0.4-0.5V (4)	0.4-0.5V (4)	21	POOR PERFORMANCE AND ACCELERATION, INCORRECT IDLE
11	ECM SWITCHED 12V	PINK/WHITE	SPUCE	B+	B+	NONE	CTINOPERABLE, NO START
12	NOT USED	-	-	-	-	-	-
13	TP & IAT* GROUND	BLACK/WHITE	TP, IAT SENSOR	(5)	(5)	21	HIGH IDLE, ROUGH IDLE, POOR PERFORMANCE
14	ECM GROUND	BLACK	ENGINE BLOCK	(5)	(5)	NONE	NO CHANGE
15	TP 5V REF	GRAY/BLUE	TP, MAP SENSOR	5V	5V	21, 33	LACK OF POWER, IDLE HIGH
18	ECM B+	RED/PURPLE	WUCE	B+	B+	NONE	NO START

(1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS

(2) VARIES WITH TEMPERATURE

(3) VARIES WITH MANIFOLD VACUUM

(4) VARIES WITH THROTTLE MOVEMENT

(5) LESS THAN 0.5 VOLT (500mV)

* MFI models only; not used on TBI models

Fig. 131 ECM connector and symptoms identification—1996-97 J2 (2 of 2)

Fig. 132 ECM connector and symptoms identification—1998 J1 (1 of 2)

ECM J1 Connector and Symptoms Identification

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
17	NOT USED						
18	MASTER/SLAVE (not used)	ORANGE/BLACK	DLC, IN-UNE BOAT HARNESS	5V	5V	NONE	NO SERIAL DATA
19	NONE	-	-	-	-	-	
20	NOT USED						
21	NONE						
22	NOT USED						
23	NOT USED					-	
24	IAT SENSOR*	TAN/YELLOW	IAT SENSOR*	3.2V (2)	3.2V (2)	23	ROUGH IDLE
25	NOT USED						
26	NOT USED						
27	NOT USED				-		
28	NOT USED						
29	MAP/ECT GROUND, S.L.O.W.	BLACK/ ORANGE	MAP AND ECT SENSOR	(5)	(5)	14 & 33	LACK OF PERFORMANCE EXHAUST ODOR, STALL
30	ECM GROUND	BLACK	ENGINE BLOCK	(5)	(5)	NONE	NO CHANGE
31	MAP, 5V REFERENCE	GRAY/ ORANGE	MAP SENSOR	5V	5V	33	LACK OF POWER, SURGE, ROUGH IDLE, EXHAUST O/W
32	ECM B+	RED/ PURPLE	SPLICE	B+	B+	NONE	NO START

(1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS

(2) VARIES WITH TEMPERATURE

(3) VARIES WITH MANIFOLD VACUUM

* MFI models only; not used on TBI models

(4) VARIES WITH THROTTLE MOVEMENT

(5) LESS THAN 0.5 VOLT (500mV)

ECM J2 Connector and Symptoms Identification

This chart is to further aid in diagnosis of symptoms. These voltages were derived from a known good engine. The voltages shown were done with the electrical system completely hooked up and operational. The voltages are to help identify what voltage is needed to operate the different circuits. NEVER ATTEMPT TO TEST THESE VOLTS BY PROBING WIRES OR CONNECTORS. If the voltages are not correct, damage could result to wiring, or connectors, with the loss of engine operation. The voltages you may get may vary due to low battery charge or other reasons, but they should be close.

The "B+" symbol indicates a system voltage.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling (for "Engine Operating" column)
- Test terminal not grounded

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
1	NOT USED						
2	NOT USED						
3	NOT USED						
4	NOT USED					-	
5	INJECTOR DRIVER BANK B	TAN/ ORANGE	INJECTOR	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STALL
6	IC REF LOW	BLACK/ TAN	IC MODULE	(5)	(5)	NONE	NO CHANGE
7	INJECTOR JUMPER	PURPLE/ WHITE	ECM	2.9V	2.9V	NONE	NO CHANGE
8	IC REF HIGH	GRAY/ BLACK	IC MODULE	5V	1.6V	NONE	NO RESTART
9	FUEL PUMP RELAY DRIVER	WHITE/ GREEN	FUEL PUMP RELAY	(1)(5)	B+	NONE	NO START
10	NOT USED						-
11	NOT USED						-
12	S.L.O.W.™ WARNING HORN	TAN/ BLACK	10 PIN CONNECTOR	(5)	(5)	NONE	LOSS OF RPM OVER 2500
13	IAC "A" LOW	PINK/ BLUE	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
14	IAC "B" HIGH	BROWN/ YELLOW	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
15	FUEL INJECTOR GROUND	BLACK	ENGINE GROUND	(5)	(5)	NONE	NO CHANGE
16	NOT USED	-	-	-	-	-	

(1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS

(2) VARIES WITH TEMPERATURE

(3) VARIES WITH MANIFOLD VAC

(4) VARIES WITH THROTTLE MOVEMENT

(5) LESS THAN 0.5 VOLT (500mV)

* MFI models only; not used on TBI models

Fig. 133 ECM connector and symptoms identification—1998 J1 (2 of 2)

Fig. 134 ECM connector and symptoms identification—1998 J2 (1 of 2)

ECM J2 Connector and Symptoms Identification

PIN	PIN FUNCTION	WIRE COLOR	COMPONENT CONNECTOR	NORMAL VOLTAGE		DTC(s) AFFECTED	POSSIBLE SYMPTOMS
				IGNITION "ON"	ENGINE OPERATING		
17	NOT USED	–	–	–	–	–	–
18	NOT USED	–	–	–	–	–	–
19	NOT USED	–	–	–	–	–	–
20	FUEL INJECTOR GROUND	BLACK	ENGINE GROUND	(5)	(5)	NONE	NO CHANGE
21	INJECTOR DRIVER BANK A	TAN/BLUE	INJECTOR	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STALL
22	INJECTOR JUMPER*	PURPLE/WHITE	ECM	B+	B+	NONE	ROUGH IDLE, LACK OF POWER, STALL
23	IC SIGNAL	WHITE	IC MODULE	(5)	1.2V	42	STALL, WILL RESTART IN BYPASS MODE, LACK OF POWER
24	IC BYPASS	WHITE/TAN	IC MODULE	(5)	4.5V	42	LACK OF POWER, FIXED TIMING
25	NOT USED	–	–	–	–	–	–
26	NOT USED	–	–	–	–	–	–
27	NOT USED	–	–	–	–	–	–
28	IAC "A" HIGH	BLUE/YELLOW	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
29	IAC "B" LOW	GREEN/BLACK	IAC VALVE	NOT USABLE	NOT USABLE	NONE	ROUGH UNSTABLE OR INCORRECT IDLE
30	NOT USED	–	–	–	–	–	–
31	DLC	GREEN/YELLOW	DLC	(5)	(5)	NONE	–
32	NOT USED	–	–	–	–	–	–

(1) BATTERY VOLTAGE FOR FIRST TWO SECONDS, THEN 0 VOLTS

(2) VARIES WITH TEMPERATURE

(3) VARIES WITH MANIFOLD VACUUM

(4) VARIES WITH THROTTLE MOVEMENT

(5) LESS THAN 0.5 VOLT (500Mv)

* MFI models only; not used on TBI models

DIAGNOSTIC TROUBLE CODE (DTC) CHARTS

DTC CHART

Ford MFI

Code	Description
No Code	Loss of VREF
10	Vapor Separator
11	System Pass
12	RPM outside Self-Test upper band limit
13	RPM outside Self-Test lower band limit
14	PIP circuit fault
15	ROM test failed/KAM power in continuous (1993)
15	ROM test failed/KAM power interrupt (1994-96)
18	Loss of TACH input to ECA/SPOUT circuit grounded
19	Failure in EEC reference voltage
21	ECT out of Self-test range
22	MAP out of Self-test range
23	TP out of Self-test range
24	ACT out of Self-test range
25	Inactive – Ignore
51	-40 deg. indicated. ECT sensor circuit open
52	Shift assist circuit
53	TP circuit above maximum voltage
54	-40 deg. indicated. ACT sensor circuit open
61	254 deg. indicated. ECT sensor circuit grounded
63	TP circuit below minimum voltage
64	254 deg. indicated. ACT sensor circuit grounded
67	NDS circuit open
72	Insufficient MAP change - DYN RSP test
73	Insufficient TP change - DYN RSP test
77	Operator error - DYN RSP test
87	Fuel pump circuit failure
95	Fuel pump circuit open – ECA-to-motor ground
96	Fuel pump circuit open – BAT-to-relay
98	FMEM failure

DTC CHART

GM Engines

Code	Description
14	Engine coolant temperature (ECT) sensor circuit
21	Throttle position (TP) sensor circuit
33	Manifold absolute pressure (MAP) sensor circuit
42	Ignition control (IC) system
43	Knock sensor (KS) circuit
51	ECM EEPROM fault

FUEL FLOW DIAGRAMS

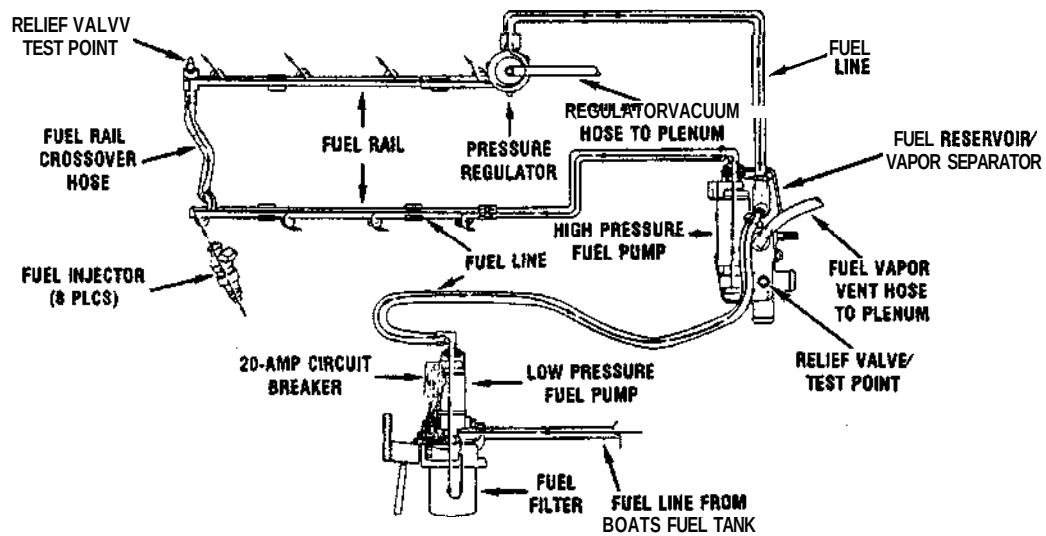


Fig. 138 Fuel flow diagram—Ford engines

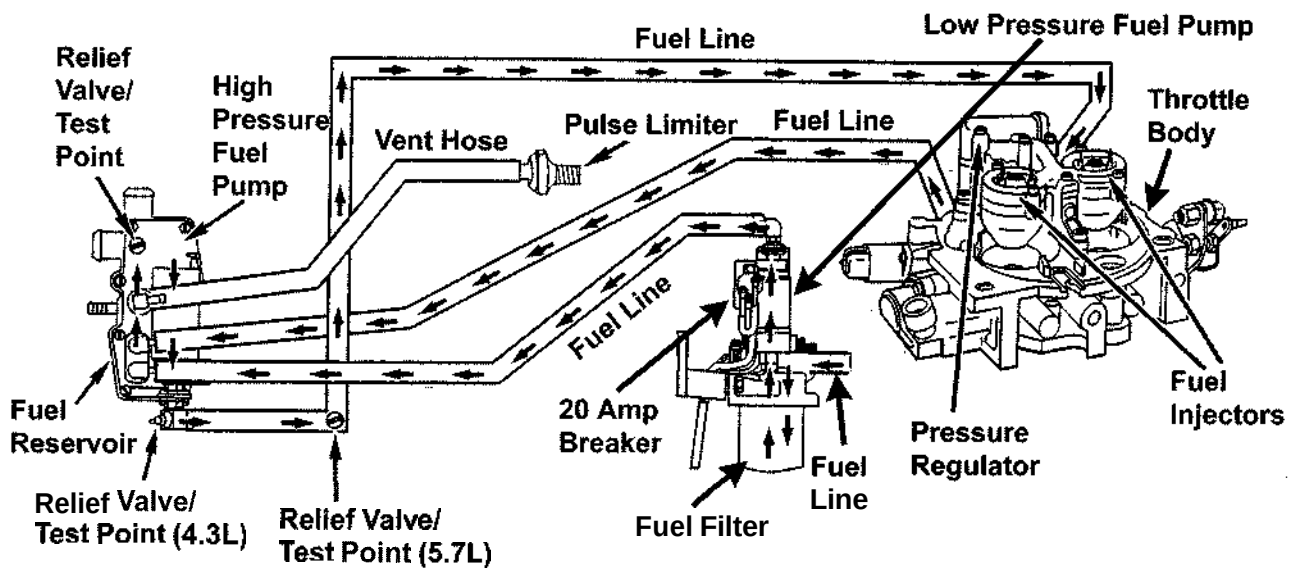


Fig. 139 Fuel flow diagram—GM TBI engines

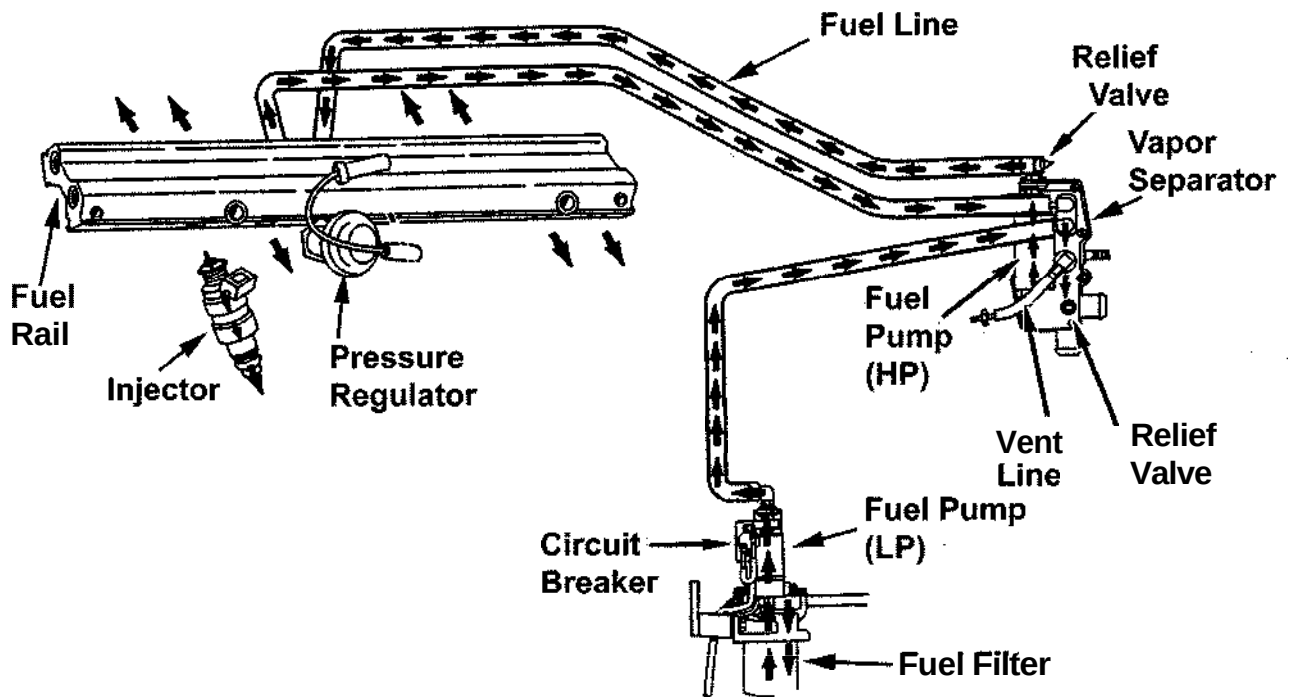


Fig. 140 Fuel flow diagram—GM MFI engines (except 1998 7.4Gi)

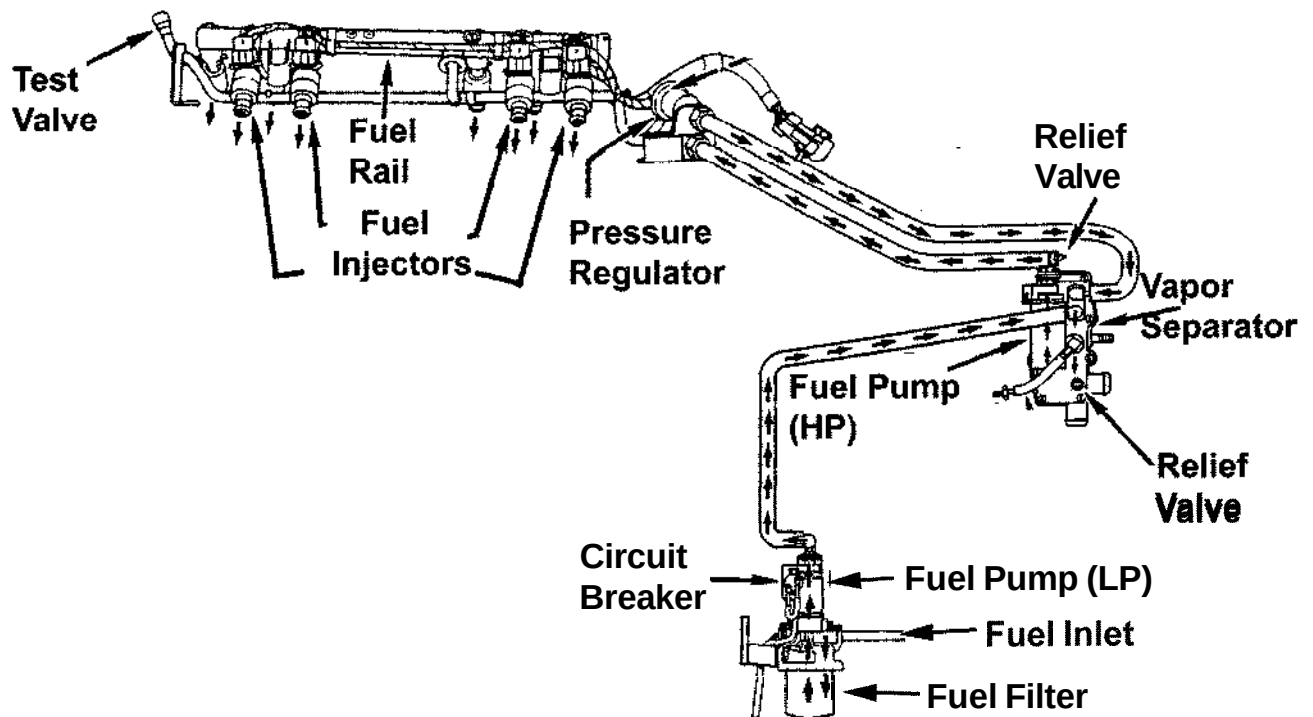


Fig. 141 Fuel flow diagram—1998 7.4Gi

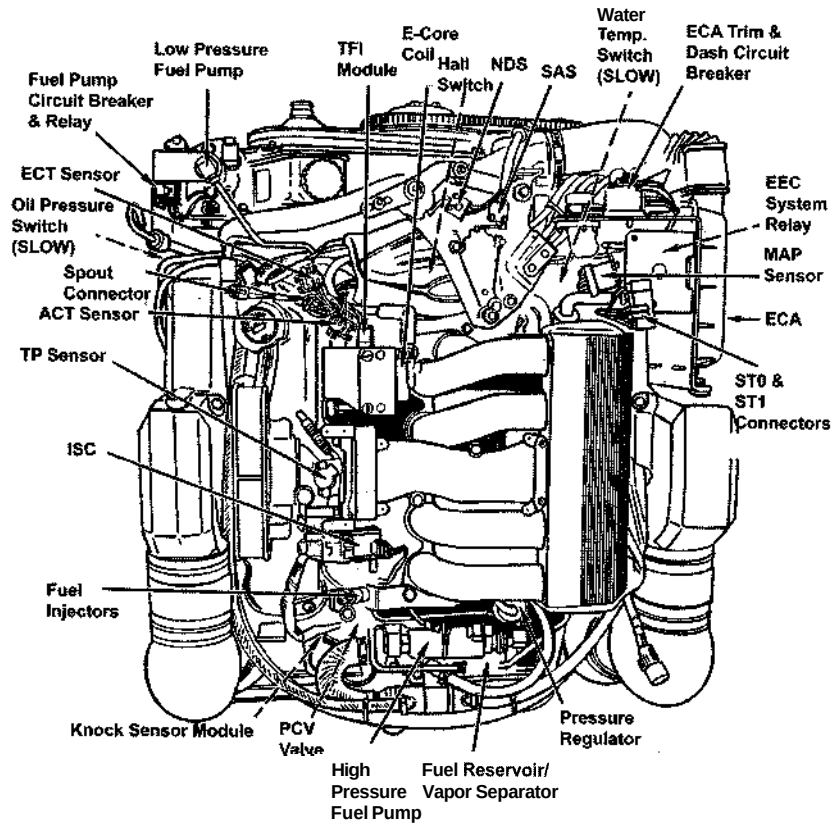


Fig. 142 Component locations—1993-94 Ford MFI engines

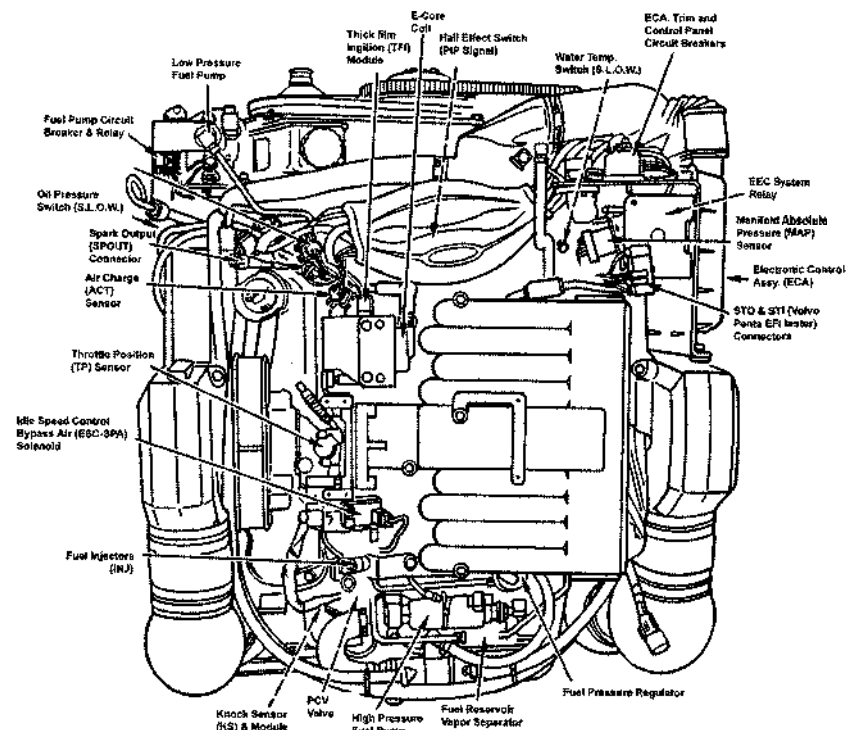


Fig. 143 Component locations—1995-96 Ford MFI engines

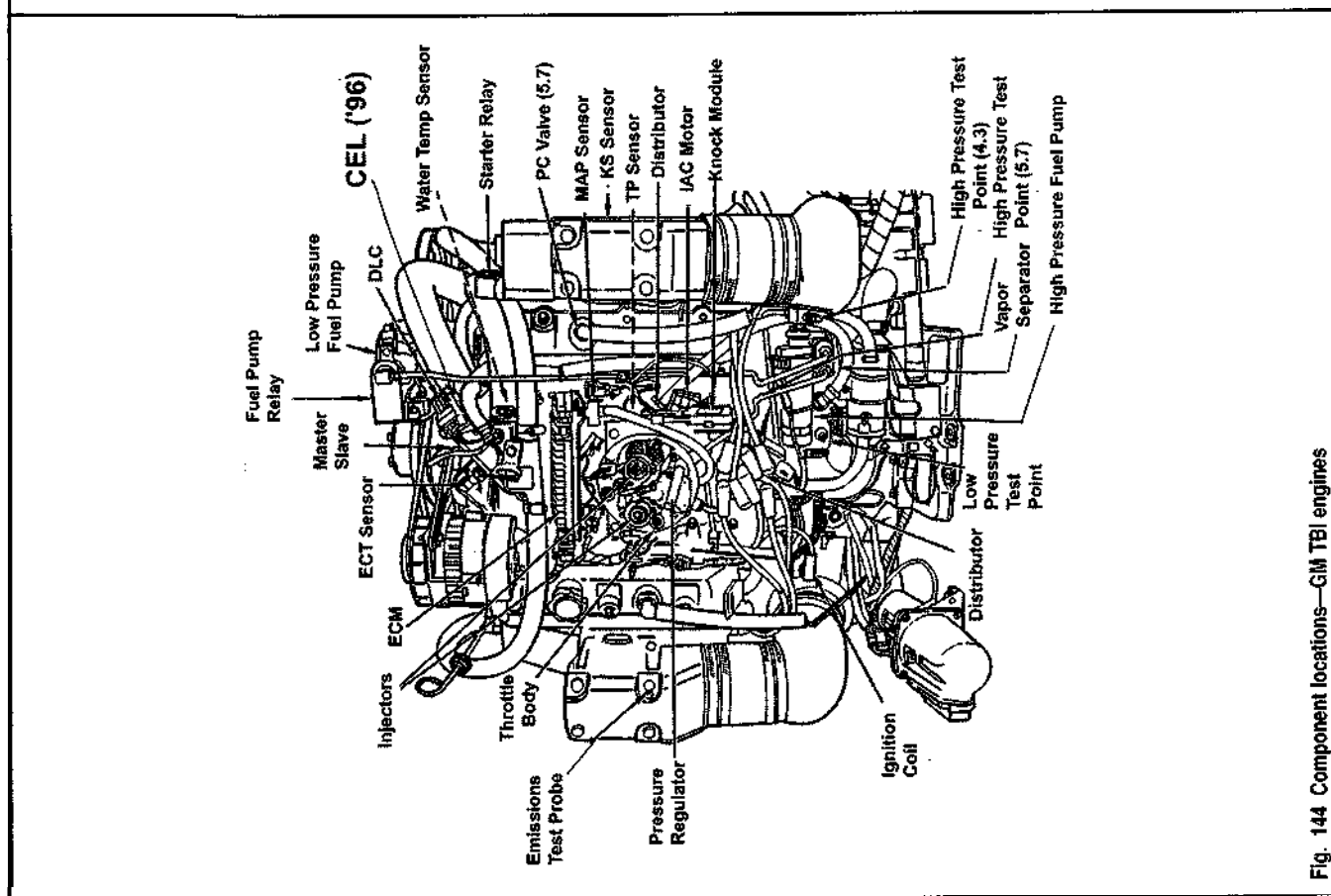


Fig. 144 Component locations—GM TBI engines

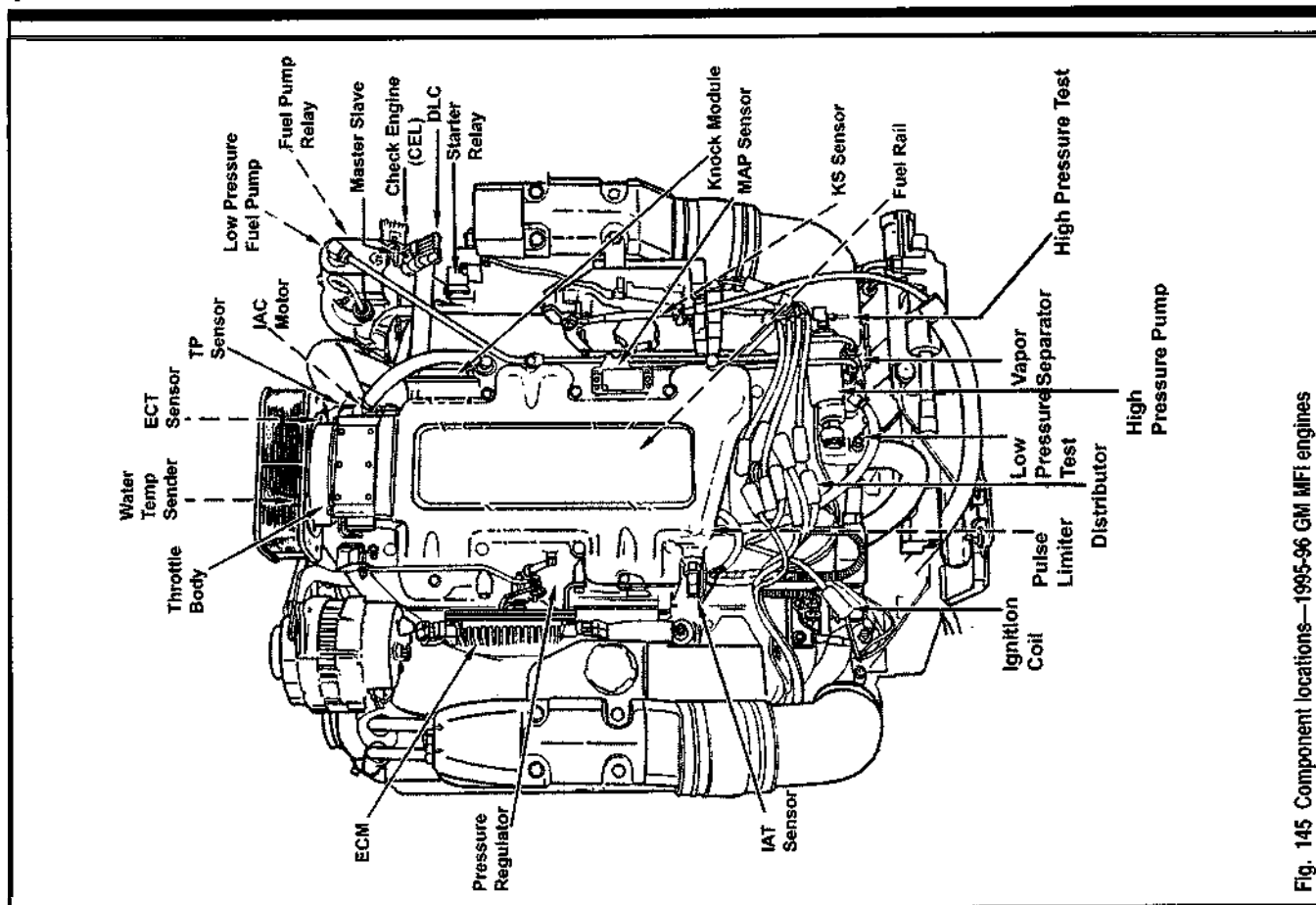


Fig. 145 Component locations—1995-96 GM MFI engines

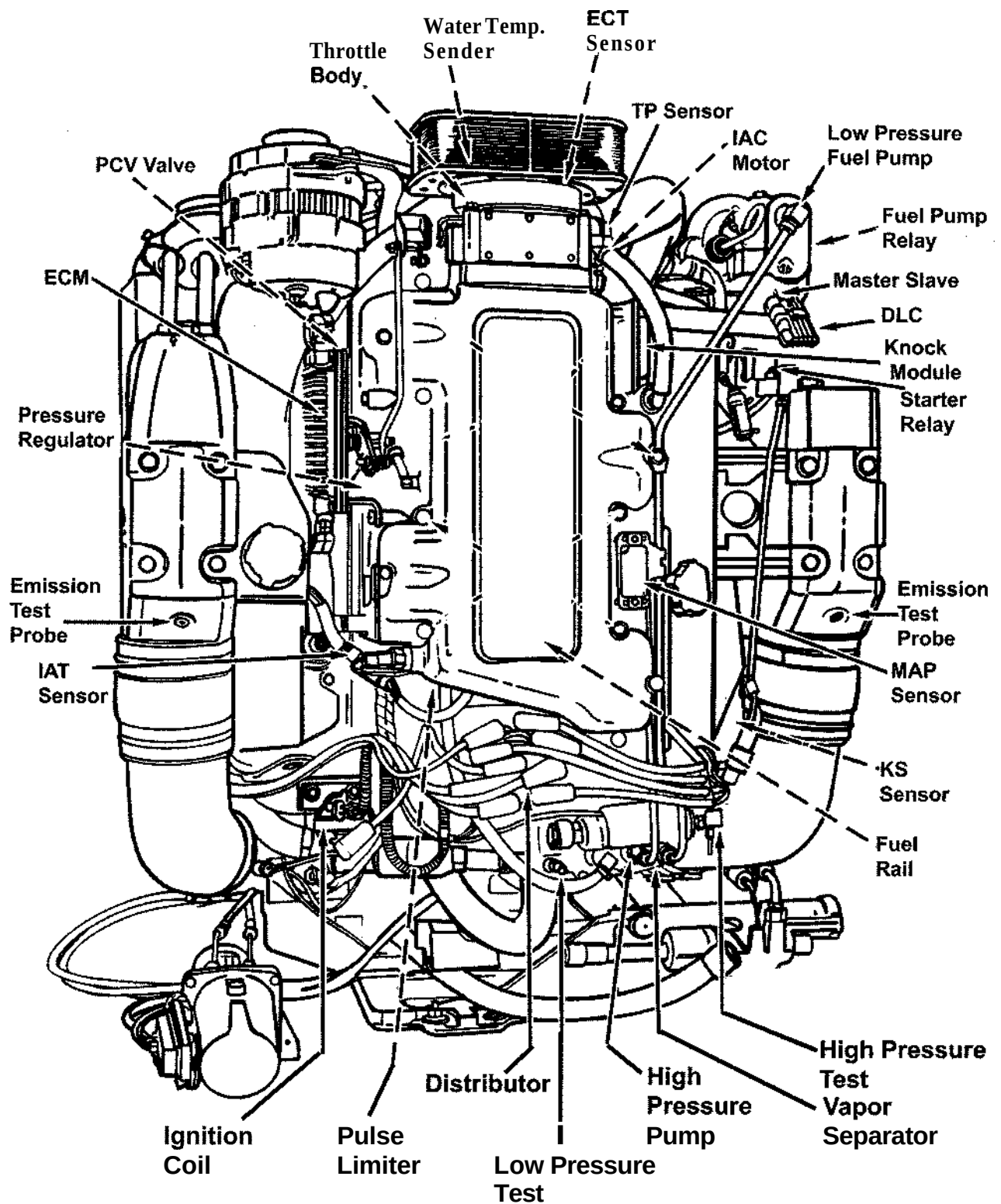


Fig. 46 Component locations—1997-98 GM MFI engines (except 1998 7.4Gi)

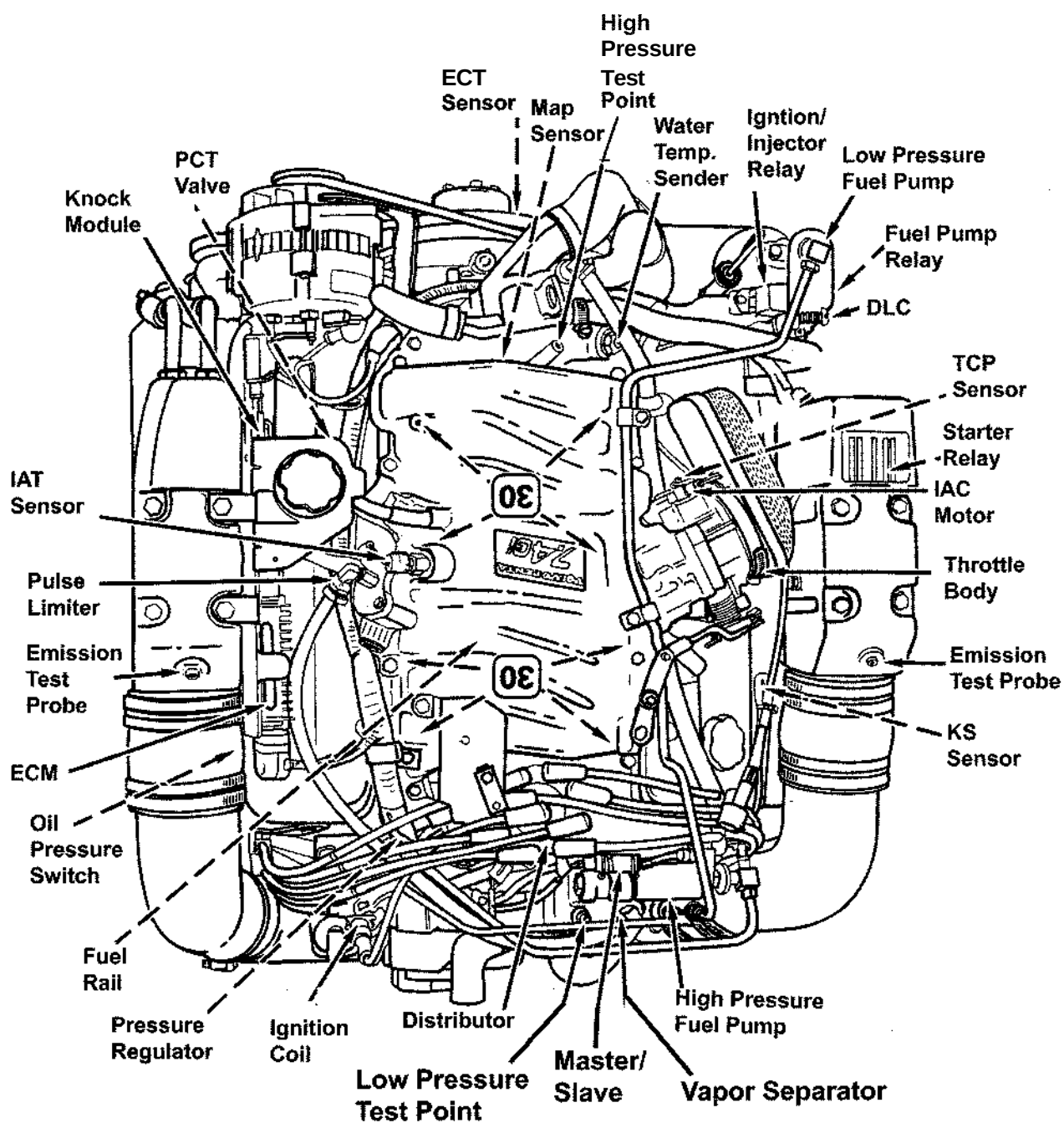


Fig. 47 Component locations—1998 7.4Gi

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS
Ford Multi-Point Fuel Injection (MFI)

Component	ft. lbs.	inch lbs.	Nm	
ACT Sensor	12-18	-	16-24	
Circuit Brreaker	-	20-25	2.3-2.8	
ECA Bracket-to-Engine	-	60-84	7-10	
ECA Cover	-	24-36	2.7-4.1	
ECA Module-to-Bracket	-	24-36	2.7-4.1	
ECA Connector (60 Pin)	-	46-64	5-7	
ECT Sensor	10-15	-	13.6-20.3	
EEC Relay-to-Bracket	-	24-36	2.7-4.1	
Elbow Lock Nut	-	60-84	7-10	
Flame Arrestor	-	24-48	2.7-5.4	
Fuel Line Fittings	10-12	-	13.6-16.3	
Fuel Pressure Regulator	-	27-40	3.0-4.5	
Fuel Pump (Lower) Adapter	8-10	-	11-14	
Fuel Pump Banjo Nut	18-22	-	24.4-29.8	
Fuel Pump (Lower) Bracket	20-25	-	27-34	
Fuel Rail-to-Manifold	-	70-105	7.9-11.7	
Fuel Reservoir Cover	-	25-35	2.8-4.0	
Fuel Reservoir-to-Engine	24-36	-	38-49	
ISC Solenoid	-	71-102	8-11	
ISC Solenoid-to-Adaptor	-	71-102	8-11	
Knock Sensor	7-10	-	9.5-13.5	
MAP Sensor	-	24-36	2.7-4.1	
Power Steering Cooler-to-Engine	20-25	-	27-34	
Shift Bracket				
	Large Nut	20-25	-	27-34
	Small Nut	-	60-84	7-10
Throttle Body Adaptor	-	71-102	8-11	
Throttle Body-to-Manifold	12-18	-	16-24	
Throttle Position Sensor (TPS)	-	18-26	2-3	
Upper-to-Lower Manifold	12-18	-	16-24	

TORQUE SPECIFICATIONS GM Fuel injection (MFI/TBI)

Component		ft. lbs.	inch lbs.	Nm
Circuit Breaker	Nut		20-25	2.3-2.8
	Screw		20-25	2.3-2.8
Coolant Cover (MFI Only)			28	3.2
ECM		-	88-124	10-14
ECT Sensor			108	12
Filter Bracket Inlet Elbow (MFI Only)		12	-	16
Fuel Filter Bracket (MFI Only)		20-25		27-34
Fuel Line Nuts	MFI	10-12		13.6-16.3
	TBI	17	-	23
Fuel Meter Body (TBI Only)			30	4
Fuel Meter Cover (TBI Only)		-	28	3
Fuel Meter Inlet Nut (TBI Only)		30	-	40
Fuel Meter Outlet Nut (TBI Only)		21	-	29
Fuel Pressure Regulator (MFI Only)		-	84	9.5
Fuel Pump (LP) Adapter (MFI Only)		8-10	-	11-14
Fuel Pump (LP) End Cap (MFI Only)		-	60-84	6.8-9.5
Fuel Pump (HP) Bracket (MFI Only)			27-35	2.8-4.0
Fuel Pump Banjo Nut (MFI Only)		18-22		24.7-29.8
Fuel Rail (MFI Only)		-	88	10
Fuel Reservoir	Cover	-	25-35	2.8-4.0
	To Block	28-36	-	38-49
IAC Valve			28	3.2
IAT Sensor (MFI Only)		11	-	15
Intake Plenum (MFI Only)		15		20
Knock Sensor		11-16	-	15-22
MAP Sensor	1998 7.4Gi	18	-	24
	All Others		44-62	5-7
Outlet Elbow (HP Pump)			60-84	6.8-9.5
Throttle Body	1998 7.4Gi		89	10
	All Other MFI	11	-	15
	All TBI	12		16
Throttle Body Adapter Plate (TBI Only)	V6	15	-	19
	1996-97 V8	30	-	40
	1998 V8	15	-	19
		-	18	2
Throttle Position Sensor (TP)		-	18	2