EMISSION CONTROLS

CRANKCASE VENTILATION SYSTEM

OPERATION

The Positive Crankcase Ventilation (PCV) system is used to control crankcase blow-by vapors. As the engine is running, clean, filtered air is drawn through the air filter and into the crankcase. As the air passes through the crankcase, it picks up the combustion gases and carries them out of the crankcase, through the PCV valve, and into the induction system. As they enter the intake manifold, they are drawn into the combustion chamber where they are reburned.

The most critical component in the system is the PCV valve. This valve controls the amount of gases which are recycled into the combustion chamber. At low engine speeds, the valve is partially closed, limiting the flow of gases into the intake manifold. As engine speed increases, the valve opens to admit greater quantities of gases into the intake manifold. If the PCV valve becomes clogged, the system is designed to allow excessive amounts of blow-by gases to back flow through the crankcase tube into the air cleaner to be consumed by normal combustion.

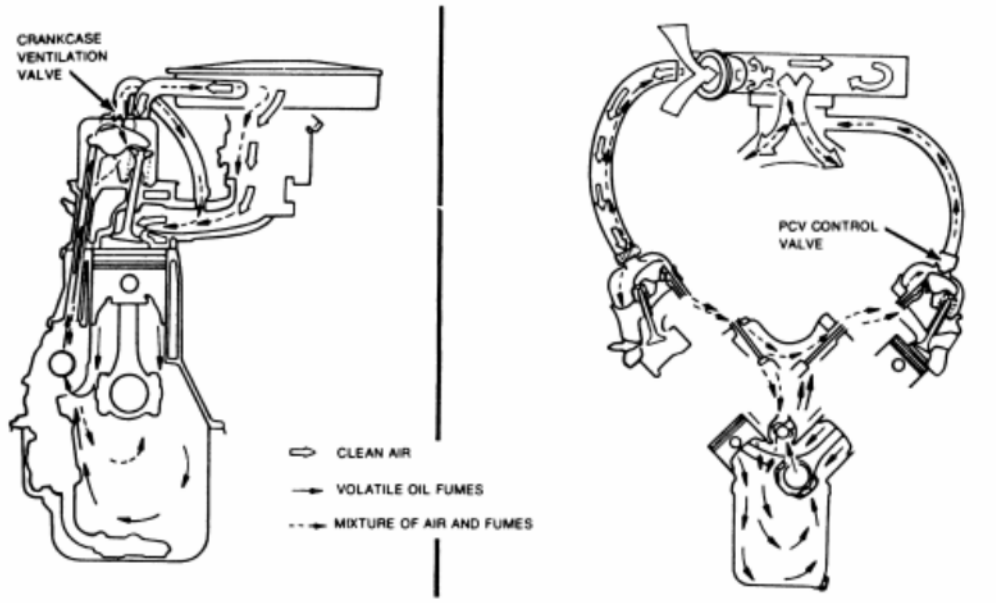


Fig. 1: PCV flow on 4, 6 and 8cylinder engines

SERVICE

Inspect the PCV system hose and connections at each tune-up and replace any deteriorated hoses. Check the PCV valve at every tune-up and replace it at 30,000 mile intervals.

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TESTING

1. Remove the PCV valve from the intake manifold or valve cover.
2. Run the engine at idle.
3. Place your thumb over the end of the valve. Check for vacuum. If there is no vacuum at the valve, check for plugged valve or vacuum lines.

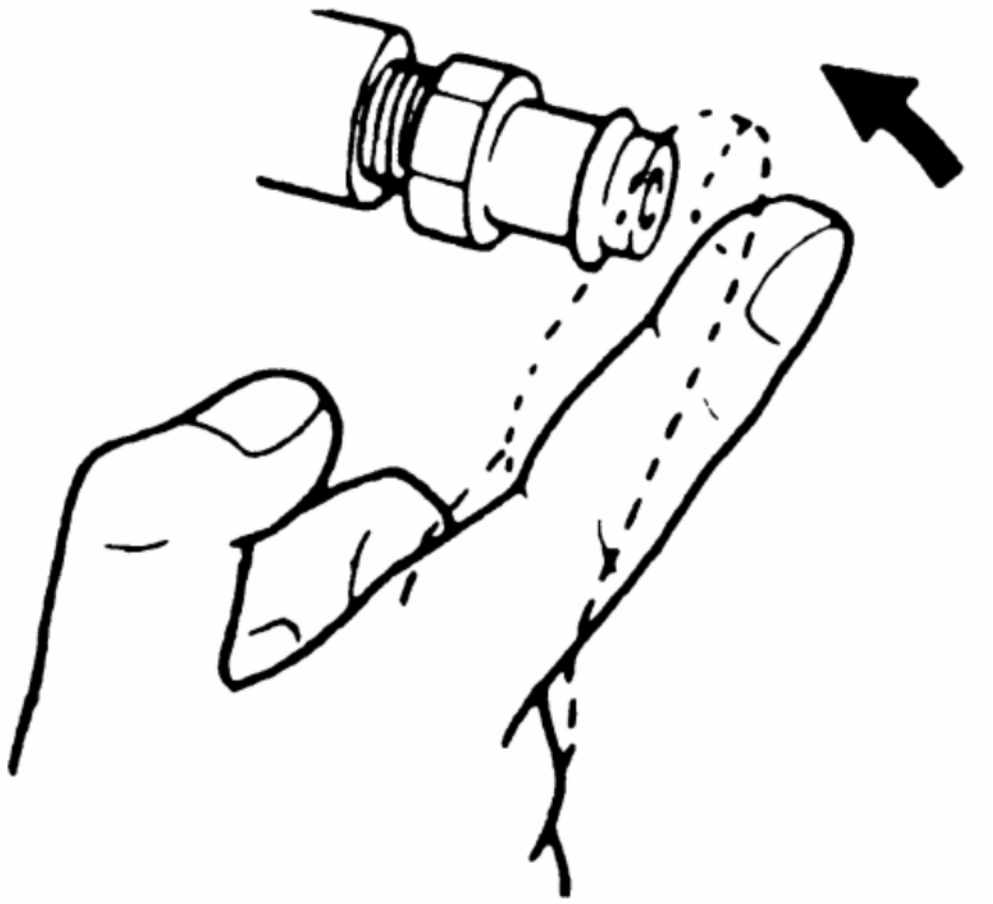


Fig. 2: Check the PCV valve for vacuum at idle

4. Shut off the engine. Shake the valve and listen for the rattle. If valve doesn't rattle, replace it.

REMOVAL & INSTALLATION

PCV SYSTEM FILTER

1. To replace the PCV filter disconnect the hose, if equipped, attached to the filter at the air cleaner and remove the air cleaner cover. Slide the spring clamp off of the filter and remove it from the air cleaner.
2. Inspect the rubber grommet in the valve cover and the hose for signs of deterioration, brittleness and cracking. Replace as necessary.
3. Installation is the reverse of removal.

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PCV VALVE

1. Disconnect the hose or pipe from the PCV valve.
2. Gently pull the PCV valve out of the grommet in the valve cover or intake manifold.
3. Installation is the reverse of removal.

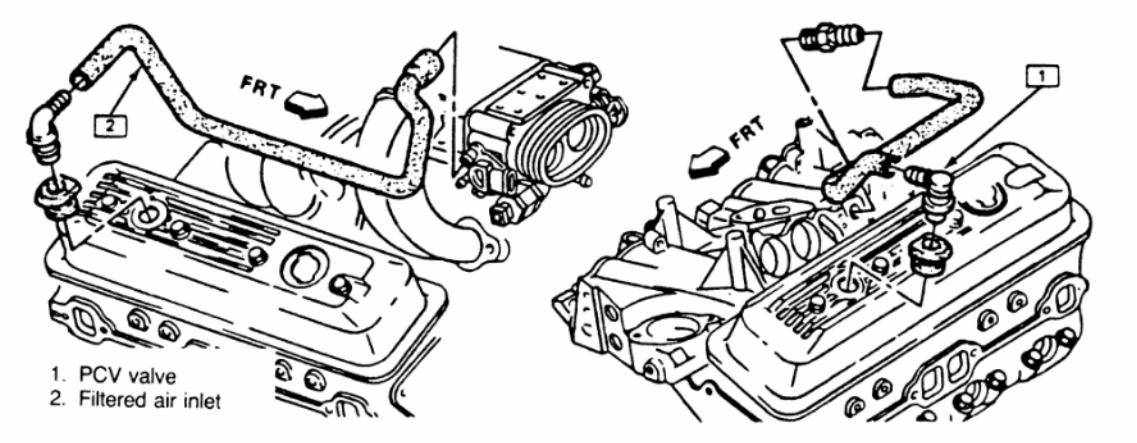


Fig. 3: PCV system on Tuned Port Injection equipped engines

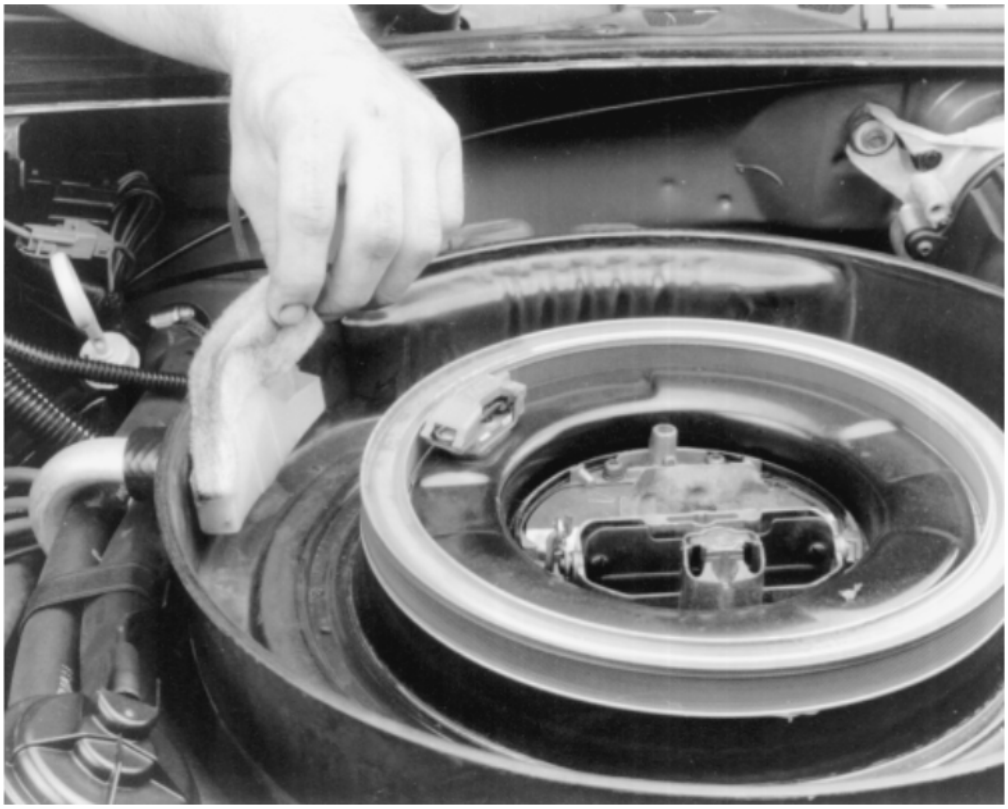


Fig. 4: PCV filter location on most carbureted and throttle body injected engines

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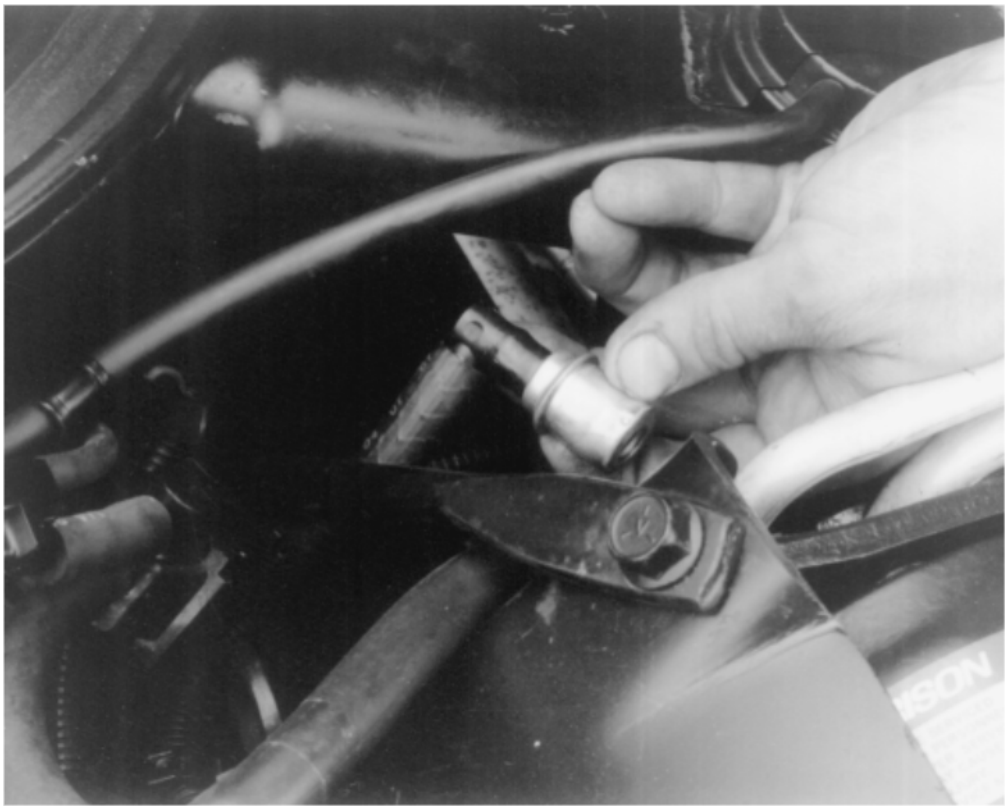


Fig. 5: Most PCV valves are located in the rocker arm covers

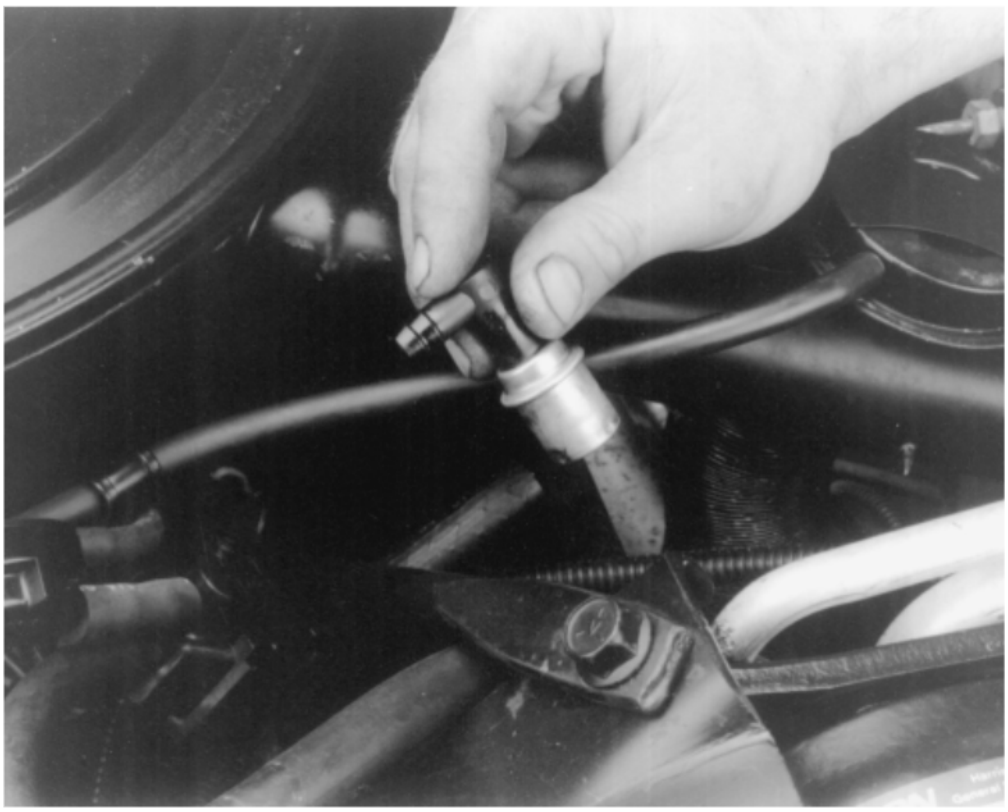


Fig. 6: Once the valve has been withdrawn from the rocker cover, it can be removed from the hose and replaced

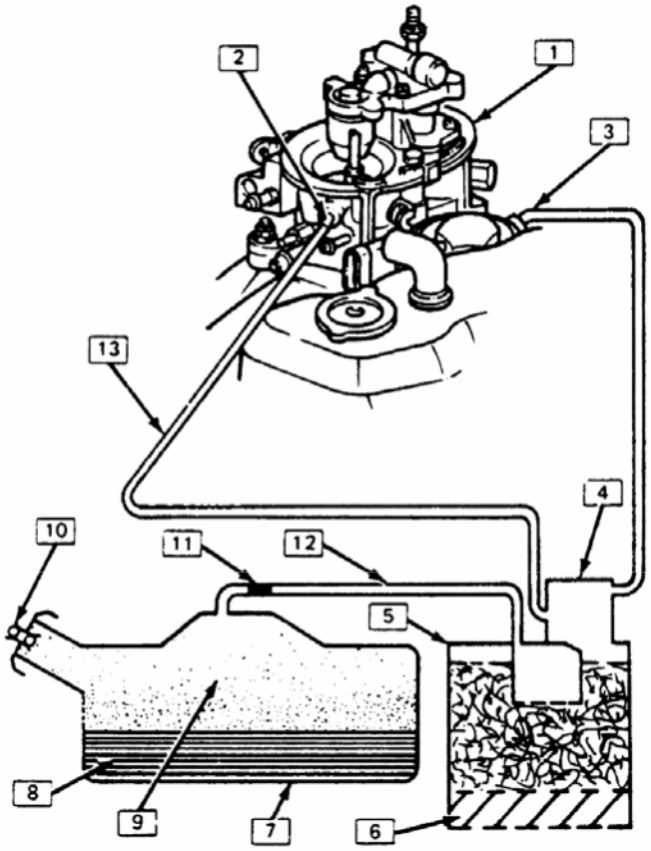
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EVAPORATIVE EMISSION CONTROLS

OPERATION

This system reduces the amount of gasoline vapors escaping into the atmosphere. Some models employ a purge control solenoid which is controlled by the ECM, to open and close the EEC system. Other models use a canister mounted vacuum purge valve; when the engine vacuum reaches a certain pressure, the valve opens allowing the gas vapors to be drawn off to the carburetor for burning.

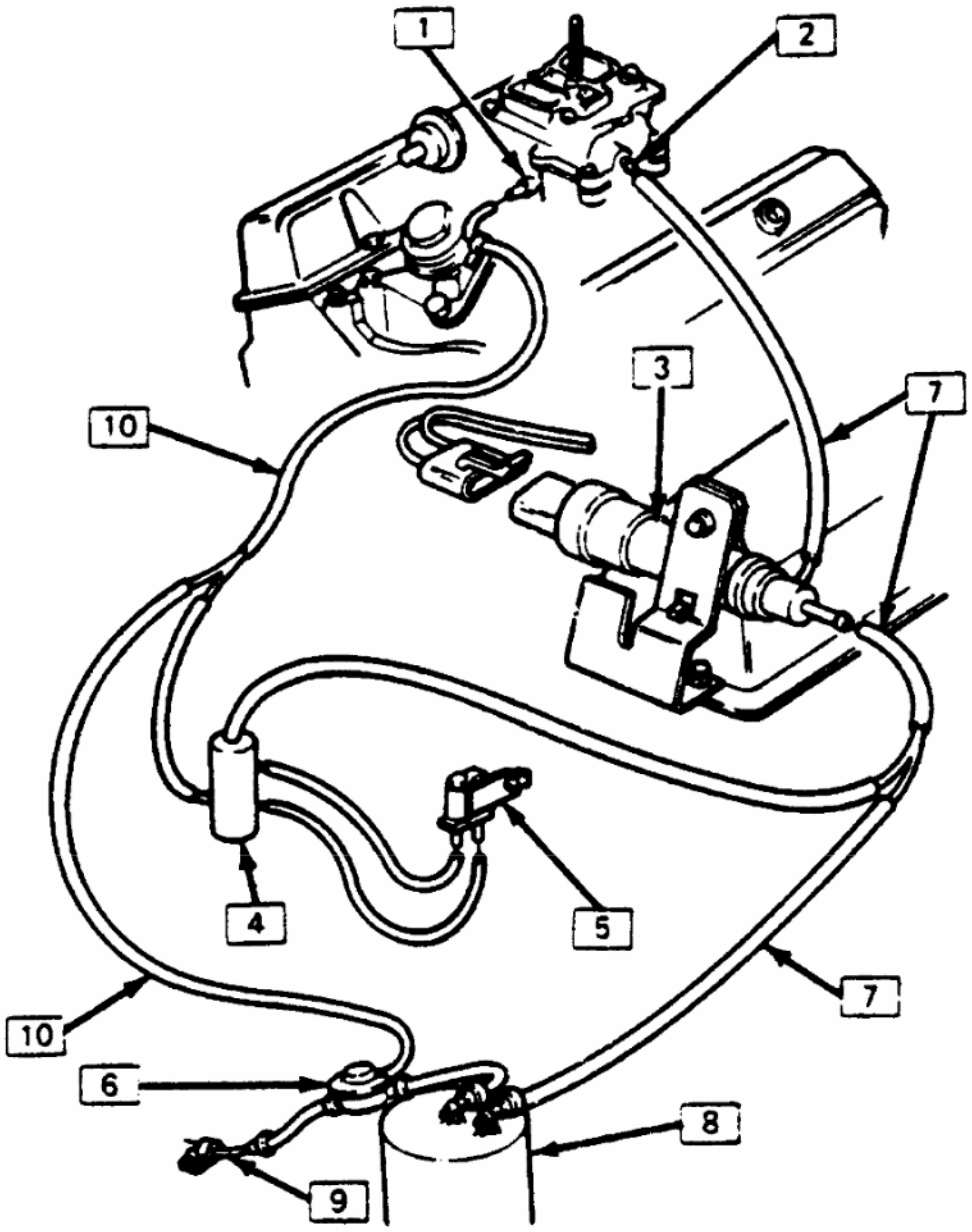
Carbureted models use an exhaust tube from the float bowl to the charcoal canister; fuel injected models eliminate the fuel bowl tube (as no float bowl is used on fuel injection systems). Fuel vapors from the gas tank travel from the tank to the vapor canister, where they are collected. Although the system varies from vehicle-to-vehicle, the operations are basically the same.



1. TBI
2. Canister purge port
3. Vacuum signal
4. Purge valve
5. Vapor storage canister
6. Purge air
7. Fuel tank
8. Fuel
9. Vapor
10. Pressure-vacuum relief gas cap
11. Vent restrictor
12. Fuel tank vent
13. Purge line

Fig. 1: Evaporative Emission Control (EEC) System - 2.5L engines

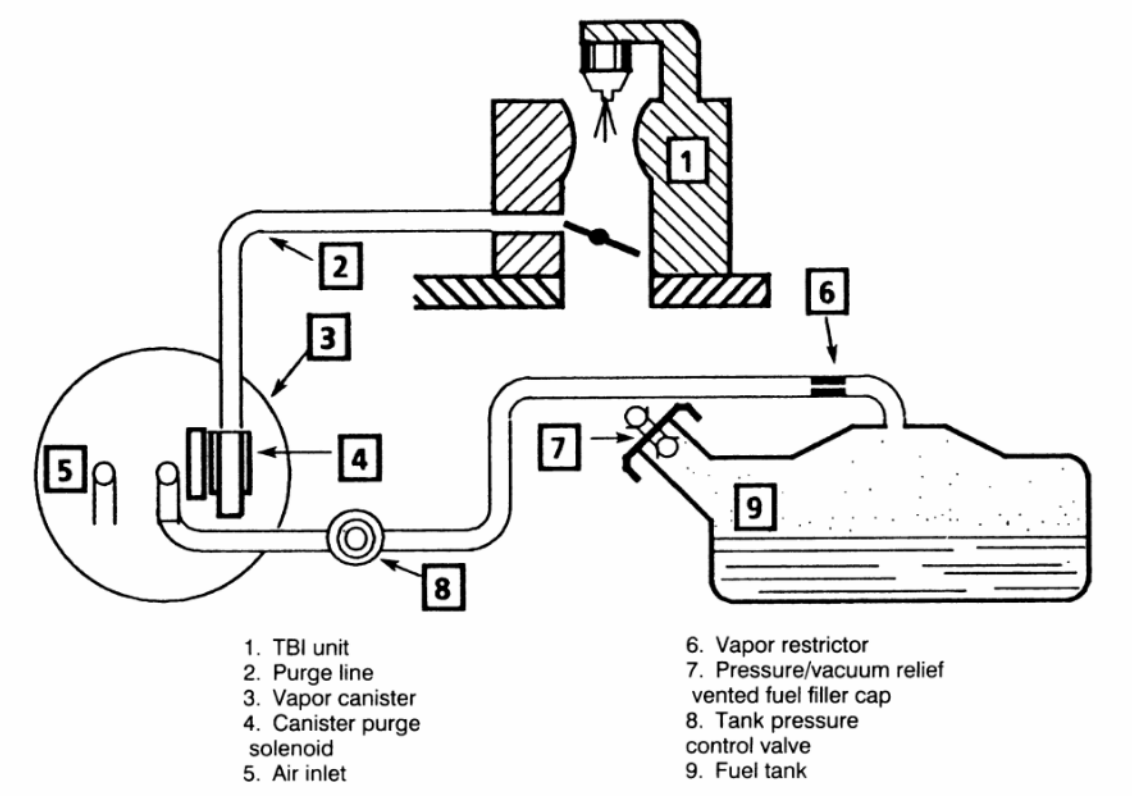
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1. Port "B" ported vacuum
2. Port "F" bowl vent
3. Fuel bowl vent solenoid
4. Fuel vapor connector
5. Fuel vapor purge solenoid
6. Tank pressure control valve
7. Vent/purge hose
8. Canister
9. Tank vapor vent pipe
10. Ported vacuum line

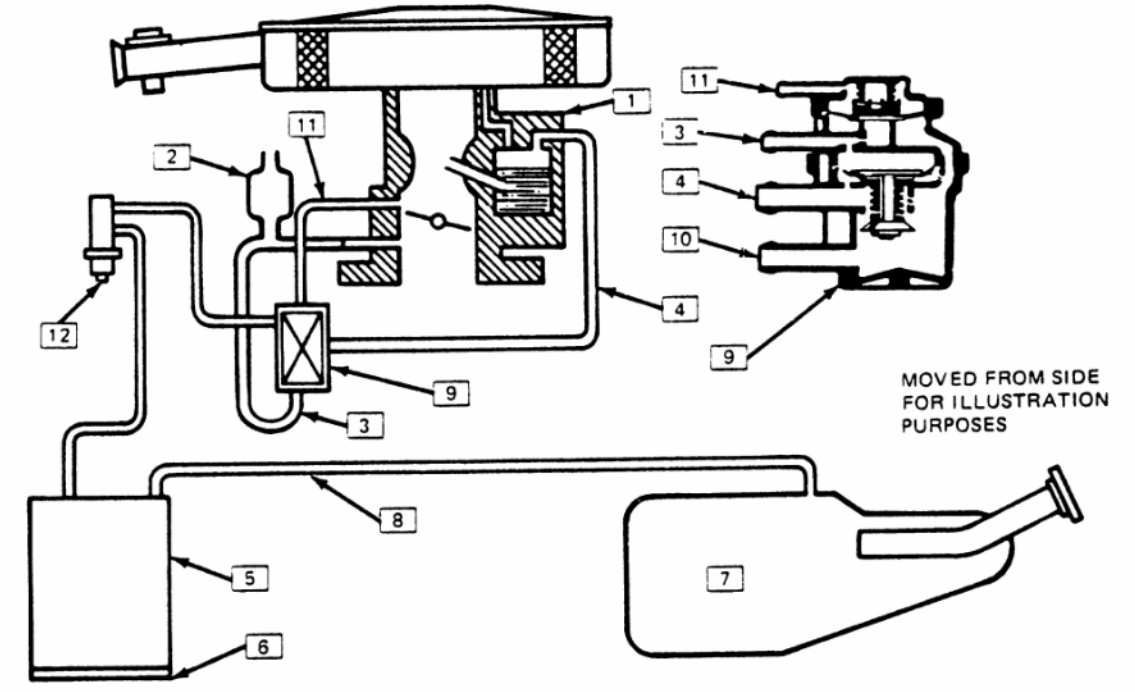
Fig. 2: EEC system - 2.8L carbureted engines

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1. TBI unit
2. Purge line
3. Vapor canister
4. Canister purge solenoid
5. Air inlet
6. Vapor restrictor
7. Pressure/vacuum relief vented fuel filler cap
8. Tank pressure control valve
9. Fuel tank

Fig. 3: EEC system on TPI and TBI V6/V8 engines



1. Carburetor
2. PCV valve
3. Manifold vacuum from PCV
4. Carburetor bowl tube
5. Vapor storage canister
6. Purge air
7. Fuel tank
8. Fuel tank vent pipe
9. Canister control valve
10. Canister tube
11. Tube control vacuum
12. T.V.S. switch

Fig. 4: EEC system on carbureted V8 engines

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TESTING

TANK PRESSURE CONTROL VALVE

1. Using a hand-held vacuum pump, apply a vacuum of 15 in. Hg. (51 kPa) through the control vacuum signal tube to the purge valve diaphragm. If the diaphragm does not hold 5 in. Hg. at least for 10 seconds, the diaphragm is leaking. Replace the control valve.
2. With the vacuum still applied to the control vacuum tube, attach a short piece of hose to the valve's tank tube side and blow into the hose. Air should pass through the valve. If it does not, replace the control valve.

REMOVAL & INSTALLATION

CANISTER

1. Disconnect the negative battery cable.
2. Loosen the screw holding the canister retaining bracket.
3. Remove the canister.
4. Tag and disconnect the hoses leading from the canister.

To install:

5. Connect the hoses to the canister according to the tags.
6. Install the canister into the retaining bracket.
7. Tighten the screw holding the canister retaining bracket.
8. Reconnect the negative battery cable.

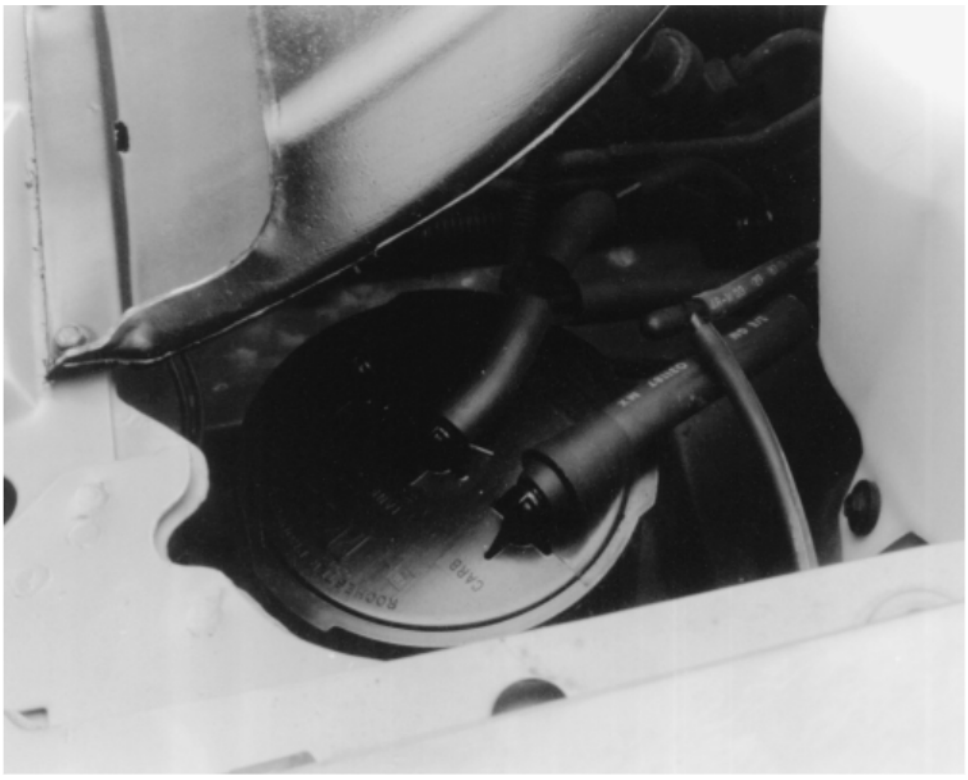


Fig. 5: A common EEC canister location

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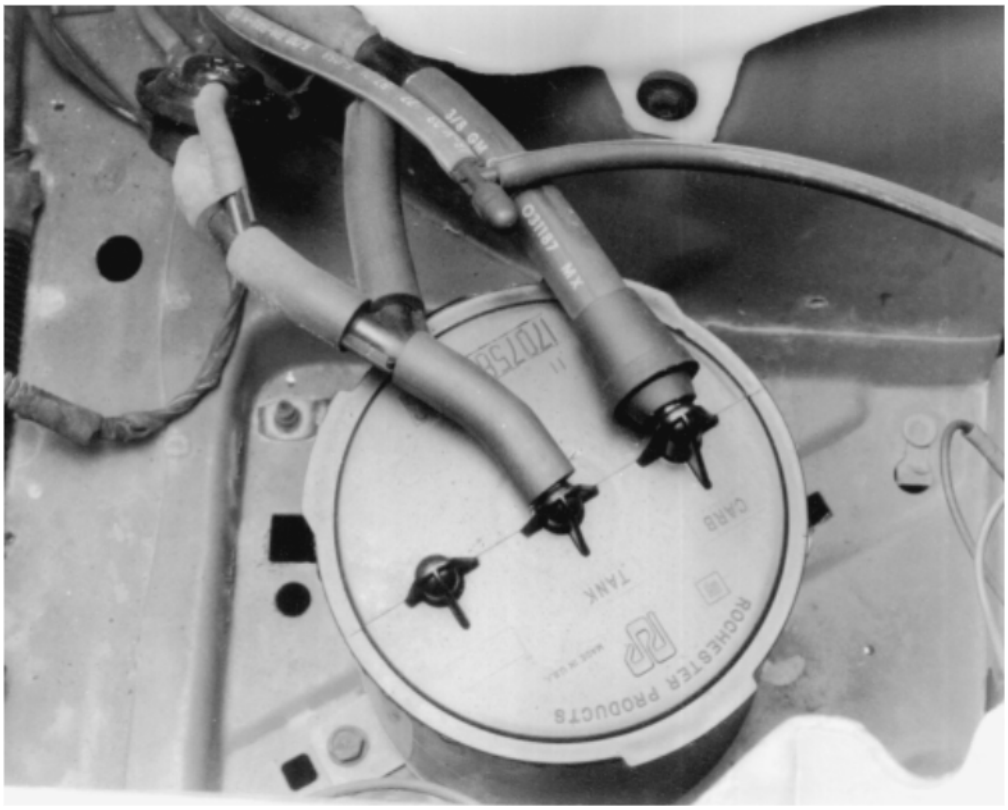


Fig. 6: Be sure to label the hoses before disconnecting them to avoid confusion later

FILTER

Not all models use canisters with replaceable filters.

1. Remove the vapor canister.
2. Pull the filter out from the bottom of the canister.
3. Install a new filter and then replace the canister.

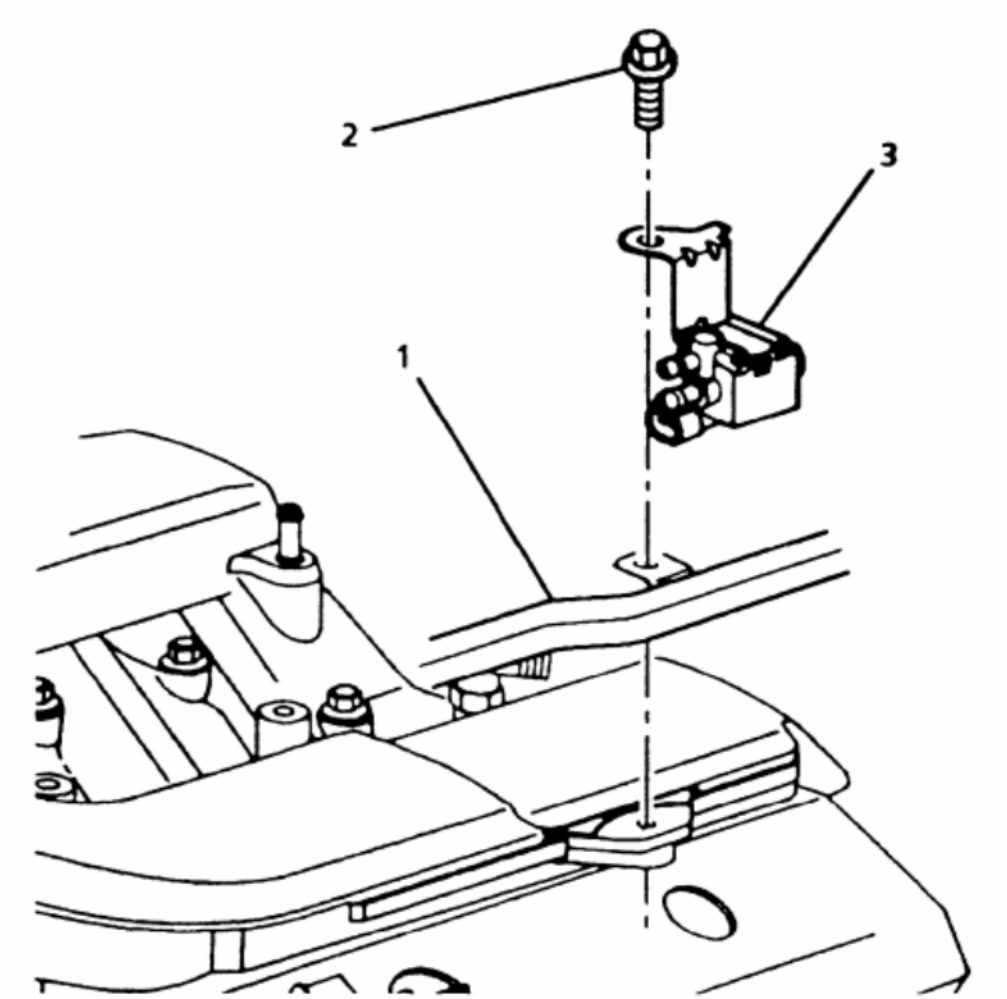
CANISTER PURGE SOLENOID

1. Disconnect the negative battery cable.
2. Remove the bolt, cover and solenoid.
3. Disconnect the electrical wiring and hoses from the solenoid.
4. Remove the solenoid.

To install:

5. Install the solenoid, cover and bolt.
6. Connect the hoses and electrical wiring solenoid.
7. Connect the negative battery cable.

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1 FUEL FEED AND RETURN PIPE ASSEMBLY

2 BOLT/SCREW

3 EVAPORATIVE EMISSION CANISTER PURGE SOLENOID VALVE

Fig. 7: A common canister purge solenoid location

TANK PRESSURE CONTROL VALVE

1. Disconnect the hoses from the control valve.
2. Remove the mounting hardware.
3. Remove the control valve from the vehicle.
4. Installation is the reverse of the removal procedure. Refer to the Vehicle Emission Control Information (VECI) label, located in the engine compartment (if present) or the diagrams found later in this section, for proper routing of the vacuum hoses.

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EXHAUST GAS RECIRCULATION (EGR) SYSTEM

OPERATION

All models are equipped with this system, which consists of a metering valve, a vacuum line to the carburetor or intake manifold, and cast-in exhaust passages in the intake manifold. The EGR valve is controlled by vacuum, which opens and closes in response to the vacuum signals to admit exhaust gases into the air/fuel mixture. The exhaust gases lower peak combustion temperatures, reducing the formation of NOx. The valve is closed at idle and wide open throttle, but is open between the two extreme positions.

There are actually four types of EGR systems: Ported, Positive Back-Pressure, Negative Backpressure and Digital. The principle of all the systems are the same; the only difference is in the method used to control how the EGR valve opens.

Too much EGR flow at idle, cruise or during cold operation may result in the engine stalling after cold start, the engine stalling at idle after deceleration, vehicle surge during cruise and rough idle. If the EGR valve is always open, the vehicle may not idle. Too little or no EGR flow allows combustion temperatures to rise, which could result in spark knock (detonation), engine overheating and/or emission test failure.

A Thermal Vacuum Switch (TVS) or vacuum control solenoid may sometimes be used in combination with the EGR valve. The TVS will close off vacuum during cold operation. A vacuum control solenoid uses Pulse Width Modulation (PWM) to turn the solenoid ON and OFF numerous times a second and varies the amount of ON time (pulse width) to vary the amount of ported vacuum supplied the EGR valve.

PORTED VALVE

In the ported system, the amount of exhaust gas admitted into the intake manifold depends on a ported vacuum signal. A ported vacuum signal is one taken from the carburetor above the throttle plates; thus, the vacuum signal (amount of vacuum) is dependent on how far the throttle plates are opened. When the throttle is closed (idle or deceleration) there is no vacuum signal. Thus, the EGR valve is closed, and no exhaust gas enters the intake manifold. As the throttle is opened, a vacuum is produced, which opens the EGR valve, admitting exhaust gas into the intake manifold.

POSITIVE BACKPRESSURE VALVE

This valve operates the same as the ported, except, it has an internal air bleed that acts as a vacuum regulator. The bleed valve controls the amount of vacuum inside the vacuum chamber during operation. When the valve receives sufficient exhaust backpressure through the hollow shaft, it closes the bleed; at this point the EGR valve opens.

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This valve will not open, with vacuum applied to it, while the engine is idling or stopped.

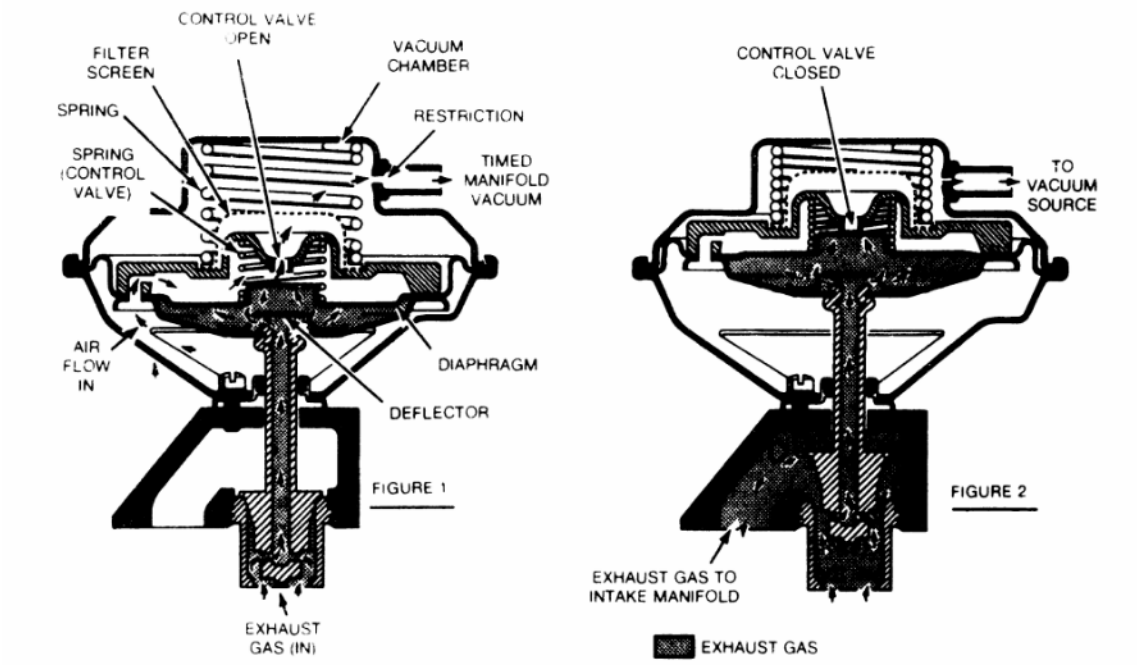


Fig. 1: Positive backpressure EGR valve

NEGATIVE BACKPRESSURE VALVE

This valve is similar to the positive backpressure type, except, the bleed valve spring is moved from above the diaphragm to below it. The bleed valve is normally closed.

At certain manifold pressures, the EGR valve will open. When the manifold vacuum combines with the negative exhaust backpressure, the bleed hole opens and the EGR valve closes.

This valve will open when vacuum is applied and the engine is not running.

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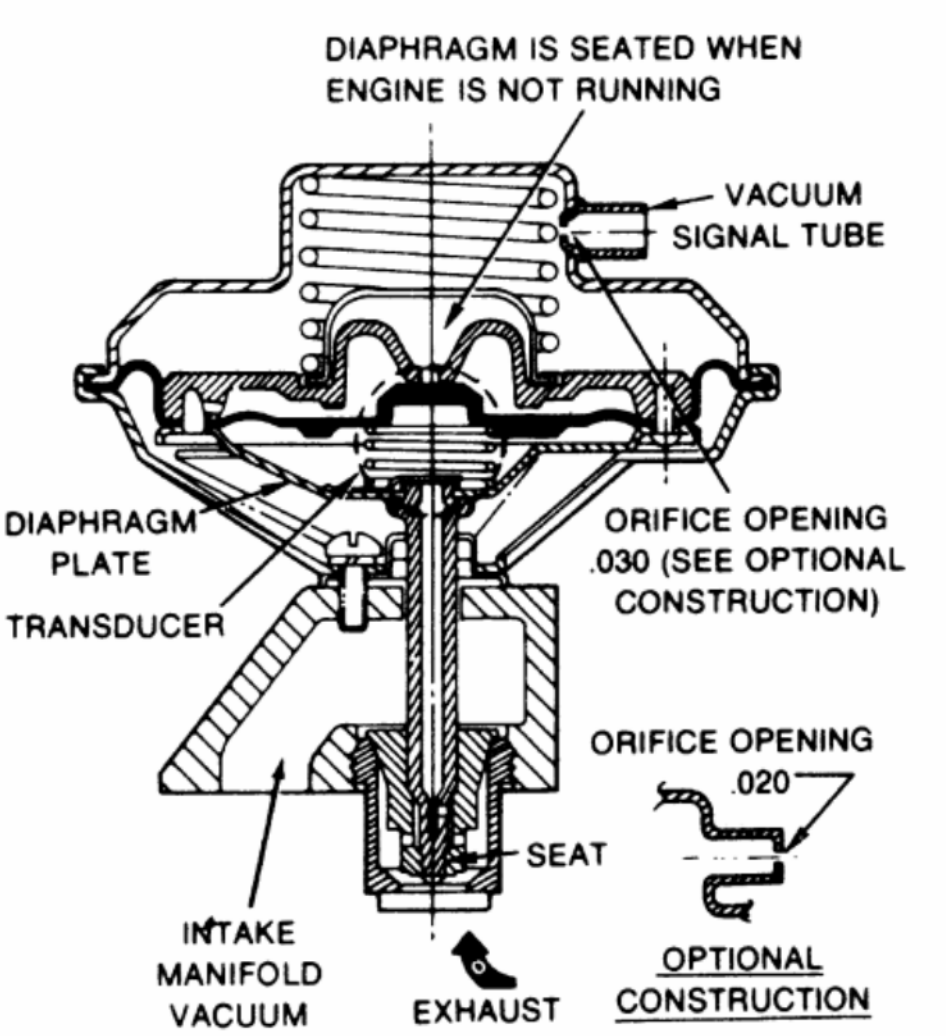


Fig. 2: Negative backpressure EGR valve

DIGITAL EGR VALVE

The digital EGR valve, used on 3.1L (VIN T) engines, is designed to control the flow of EGR independent of intake manifold vacuum. The valve controls EGR flow through 3 solenoid-opened orifices, which increase in size, to produce 7 possible combinations. When a solenoid is energized, the armature with attached shaft and swivel pintle, is lifted, opening the orifice.

The digital EGR valve is opened by the ECM "quad-driver" (QDR), grounding each solenoid circuit individually. The flow of EGR is regulated by the ECM which uses information from the Coolant Temperature Sensor (CTS), Throttle Position Sensor (TPS) and the Manifold Absolute Pressure (MAP) sensor to determine the appropriate rate of flow for a particular engine operating condition.

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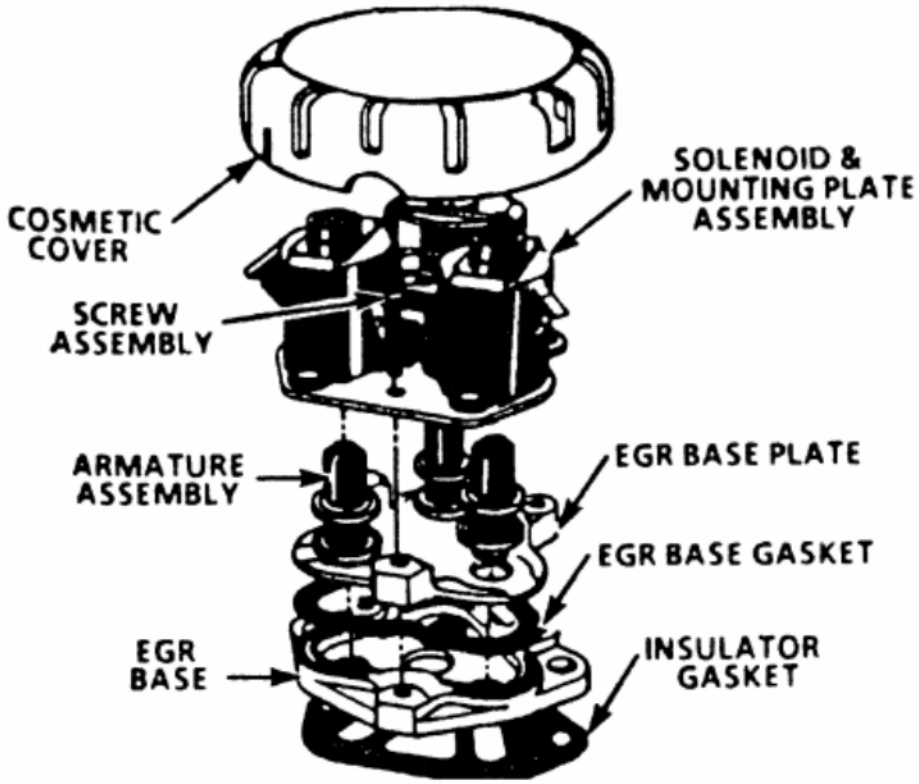
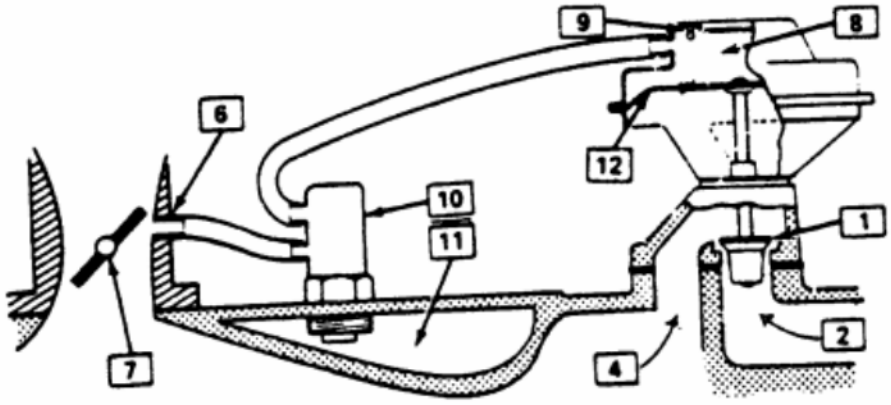


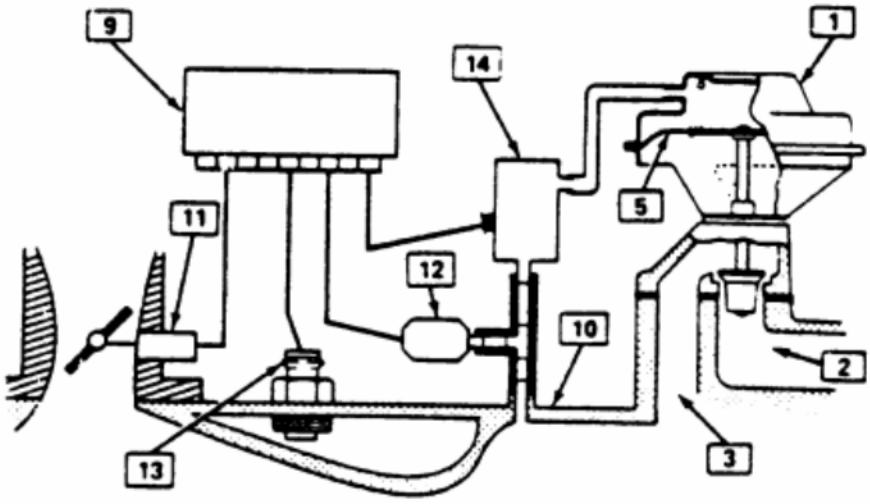
Fig. 3: Digital EGR valve used on 3.1L engines



1. EGR valve
2. Exhaust gas
4. Intake flow
6. Vacuum port
7. Throttle valve
8. Vacuum chamber
9. Valve return spring
10. Thermal vacuum switch
11. Coolant
12. Diaphragm

Fig. 4: Thermostatic Vacuum Switch (TVS) controlled EGR system

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1. EGR valve
2. Exhaust gas
3. Intake air
5. Diaphragm
9. Electronic control module
10. Manifold vacuum
12. Manifold pressure sensor
13. Coolant temperature sensor
14. EGR control solenoid

Fig. 5: Solenoid controlled EGR system

IDENTIFICATION

- Positive backpressure EGR valves will have a "P" stamped on the top side of the valve below the date built
- Negative backpressure EGR valves will have a "N" stamped on the top side of the valve below the date built
- Port EGR valves have no identification stamped below the date built

SERVICE

1. Check to see if the EGR valve diaphragm moves freely. Use your finger to reach up under the valve and push on the diaphragm. If it doesn't move freely, the valve should be replaced. The use of a mirror will aid the inspection process.

CAUTION - If the engine is hot, wear a glove to protect your hand.

2. Install a vacuum gauge into the vacuum line between the EGR valve and the vacuum source. Start the engine and allow it to reach operating temperature.

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Fig. 6: Some EGR valves may be tested using a vacuum pump by watching for diaphragm movement

3. With the car in either *P* or *N*, increase the engine speed until at least 5 in. Hg is showing on the gauge.
4. Remove the vacuum hose from the EGR valve. The diaphragm should move downward (valve closed). The engine speed should increase.
5. Install the vacuum hose and watch for the EGR valve to open (diaphragm moving upward). The engine speed should decrease to its former level, indicating exhaust recirculation.
6. If the diaphragm doesn't move, check engine vacuum; it should be at least 5 in. Hg with the throttle open and engine running.
7. Check to see that the engine is at normal operating temperature.
8. Check for vacuum at the EGR hose. If no vacuum is present, check the hose for leaks, breaks, kinks, improper connections, etc., and replace as necessary.
9. If the diaphragm moves, but the engine speed doesn't change, check the EGR passages in the intake manifold for blockage.

REMOVAL & INSTALLATION

EGR VALVE

EXCEPT 3.1L ENGINE

1. Disconnect the negative battery cable.
2. Remove the air cleaner assembly, if necessary.

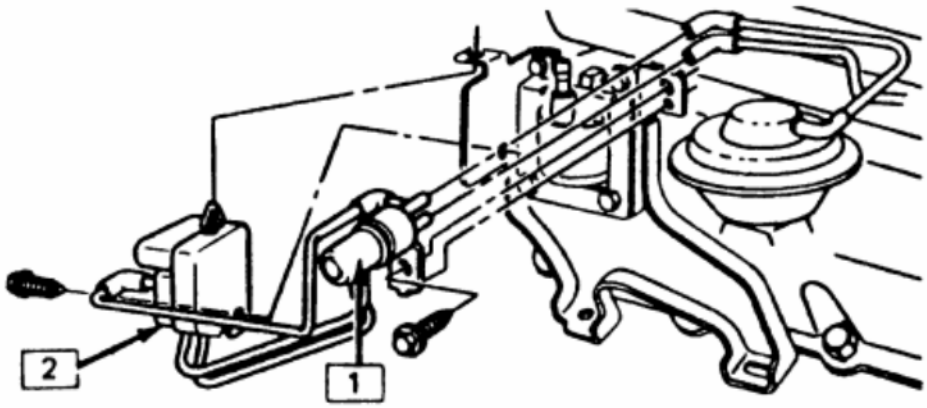
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If equipped with the 5.0L (VIN F) and 5.7L (VIN 8) engines with Tuned Port Injection (TPI), it will be necessary to remove the intake plenum to gain access to the EGR valve.

3. Tag and disconnect the necessary hoses and wiring to gain access to the EGR valve.
4. Remove the EGR valve retaining bolts.
5. Remove the EGR valve. Discard the gasket.
6. Buff the exhaust deposits from the mounting surface and around the valve using a wire wheel.
7. Remove deposits from the valve outlet.
8. Clean the mounting surfaces of the intake manifold and valve assembly.

To install:

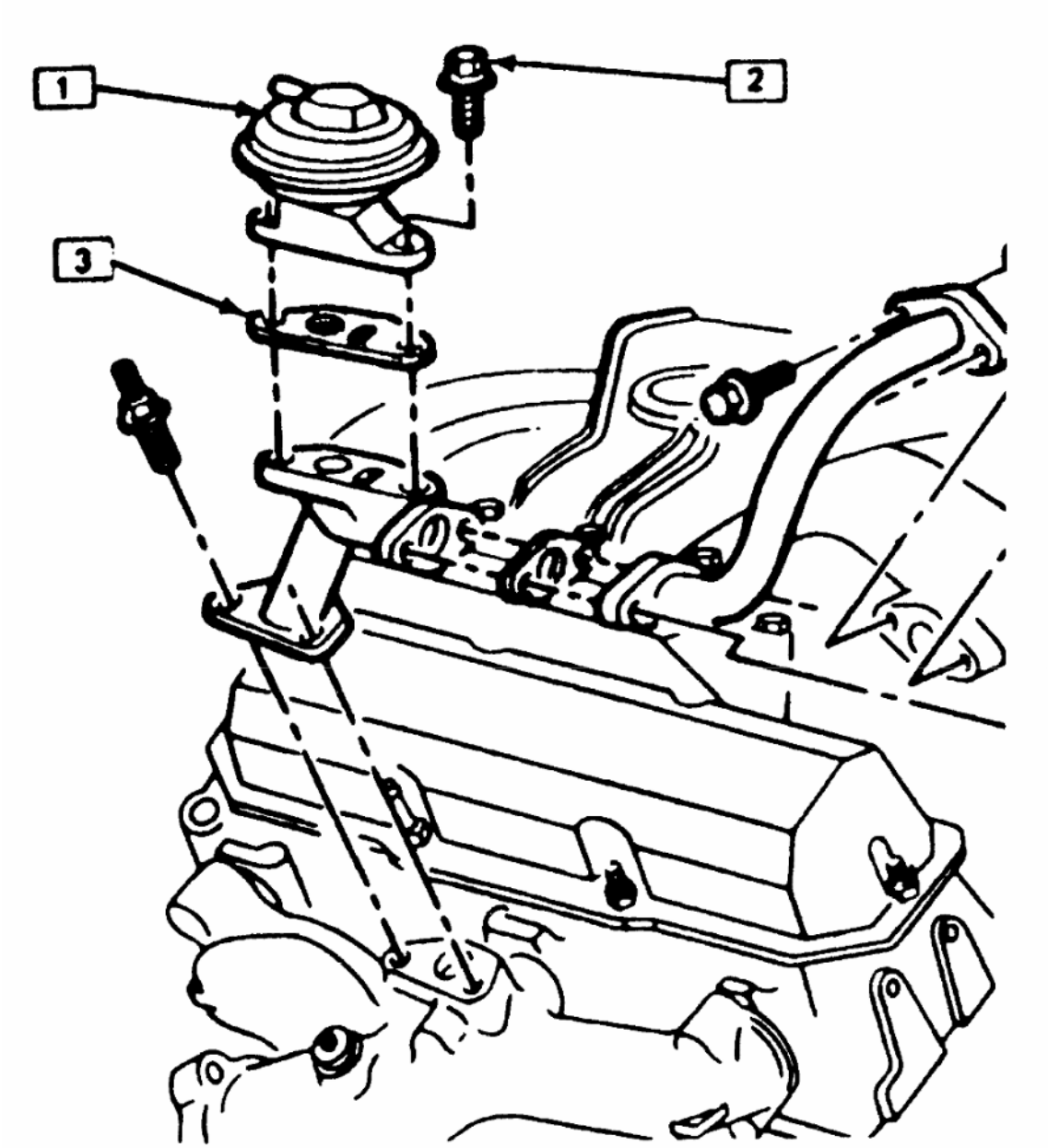
9. Install a new EGR gasket.
10. Install the EGR valve to the manifold.
11. Install the retaining bolts.
12. Connect the wiring and hoses.
13. Install the air cleaner assembly.
14. Connect the negative battery cable.



1. EGR control solenoid
2. EGR diagnostic vacuum switch

Fig. 7: EGR valve control solenoid on 2.8L engines

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1. EGR valve
2. Bolts 23 ft. lbs. (31 Nm)
3. Gasket

Fig. 8: EGR valve assembly on 2.8L engines

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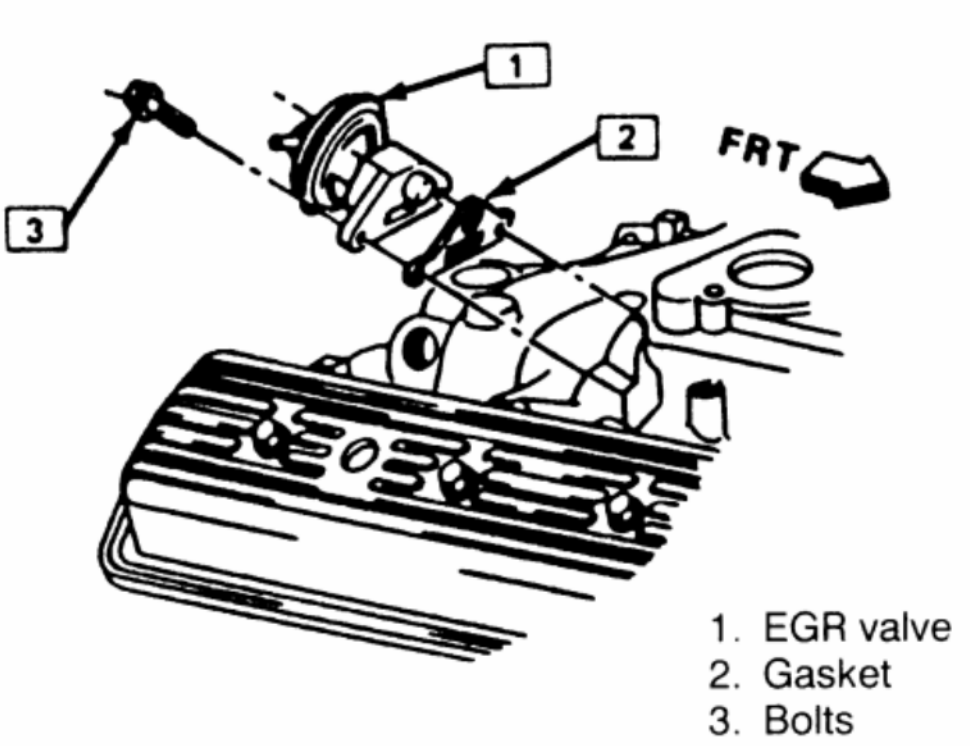
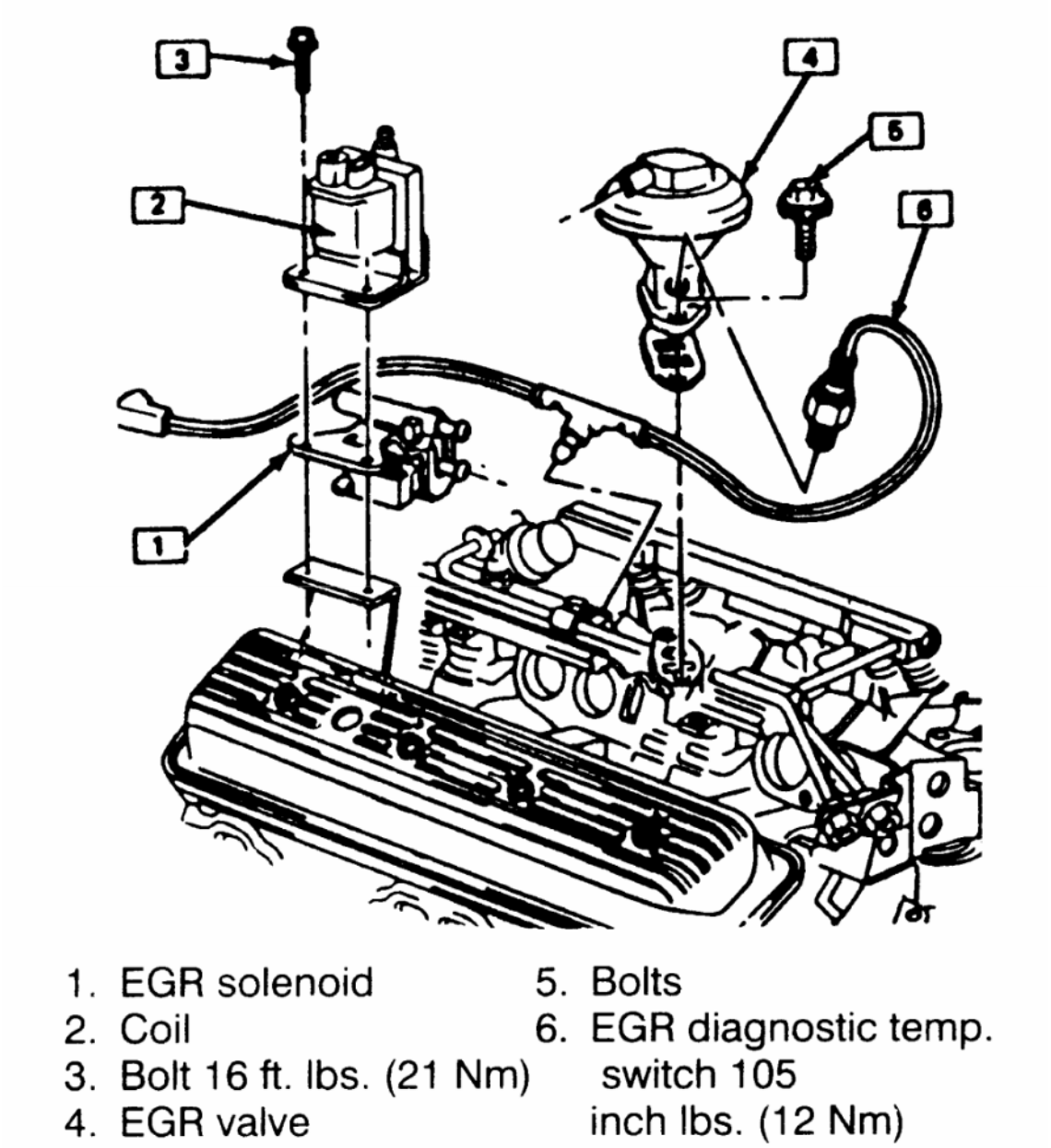


Fig. 9: EGR valve location on carbureted and throttle body injected V8 engines

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1. EGR solenoid
2. Coil
3. Bolt 16 ft. lbs. (21 Nm)
4. EGR valve
5. Bolts
6. EGR diagnostic temp. switch 105 inch lbs. (12 Nm)

Fig. 10: EGR valve and solenoid assembly on Tuned Port Injection engines

3.1L ENGINE

1. Disconnect the negative battery cable.
2. Disconnect the electrical wiring at the solenoid.
3. Remove the 2 base-to-flange bolts.
4. Remove the digital EGR valve.

To install:

5. Install the gasket with "UP" readable after positioning on the adapter.
6. Install the digital EGR valve.
7. Install the 2 base-to-flange bolts. Tighten the bolts to 11 ft. lbs (15 Nm) first, then torque to 22 ft. lbs. (30 Nm).
8. Connect the negative battery cable.

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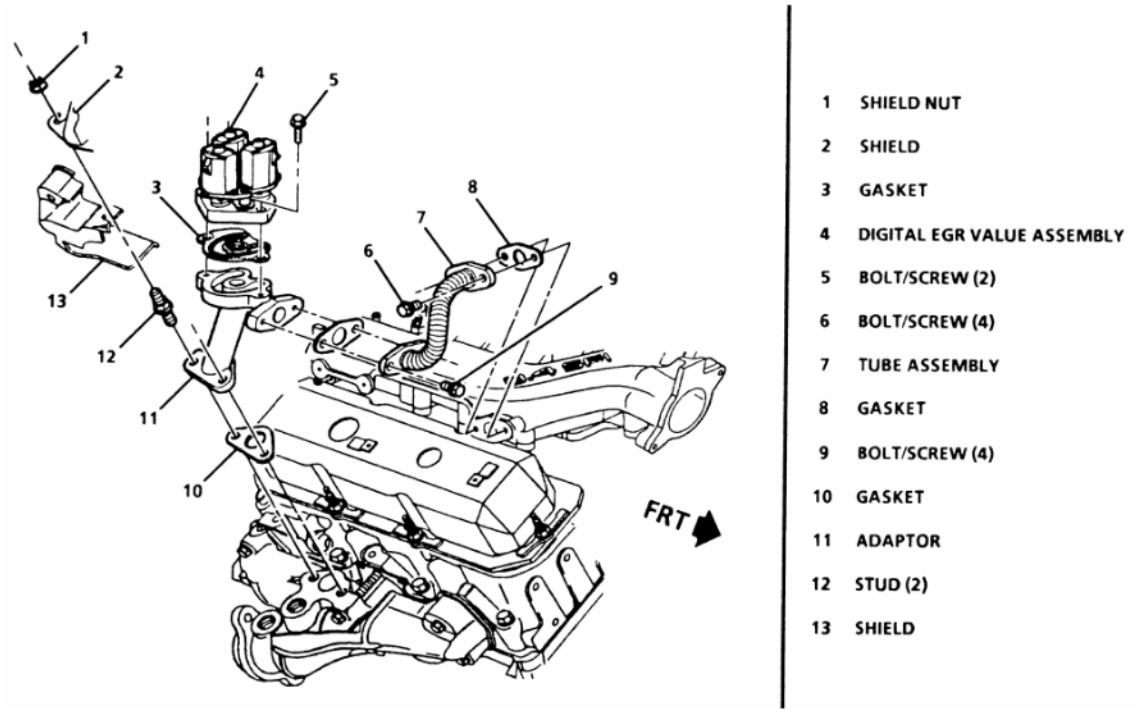


Fig. 11: Digital EGR valve assembly

EGR SOLENOID

1. Disconnect the negative battery cable.
2. Remove the air cleaner, as required.
3. Disconnect the electrical wiring at the solenoid.
4. Disconnect the vacuum hoses.
5. Remove the retaining bolts and the solenoid.
6. Remove the filter, as required.

To install:

7. If removed, install the filter.
8. Install the solenoid and retaining bolts.
9. Connect the vacuum hoses.
10. Connect the electrical wiring.
11. If removed, install the air cleaner.
12. Connect the negative battery cable.

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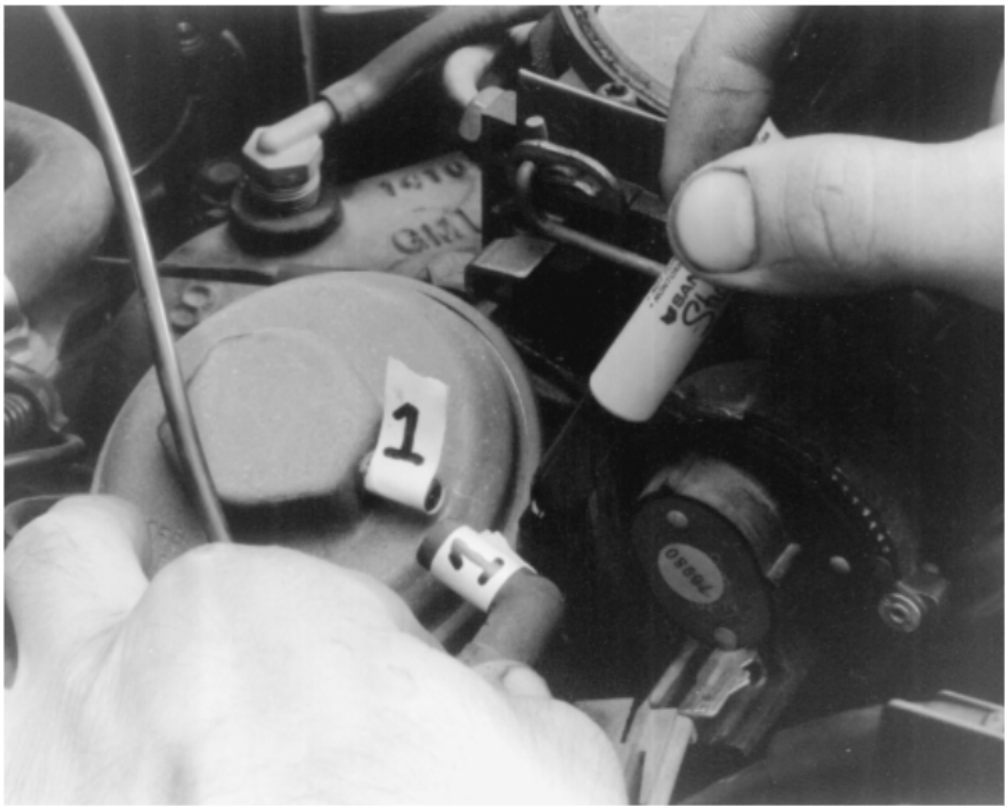
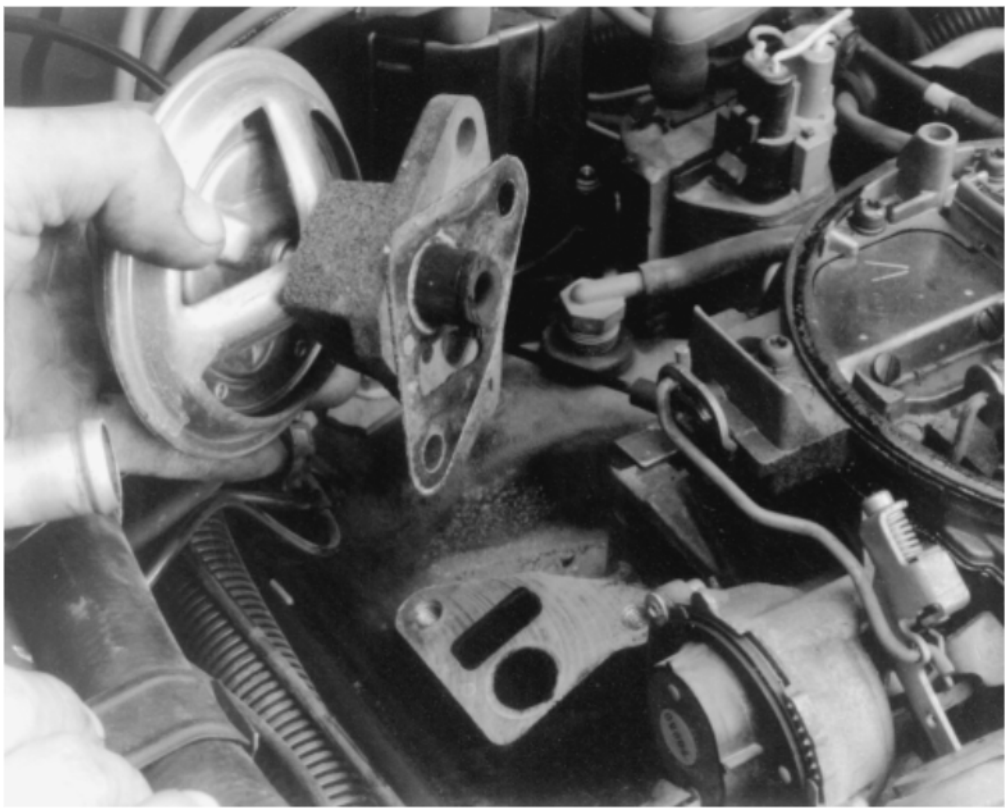


Fig. 12: Disconnect and label the EGR valve vacuum hose


Fig. 13: Removing the EGR valve from the engine

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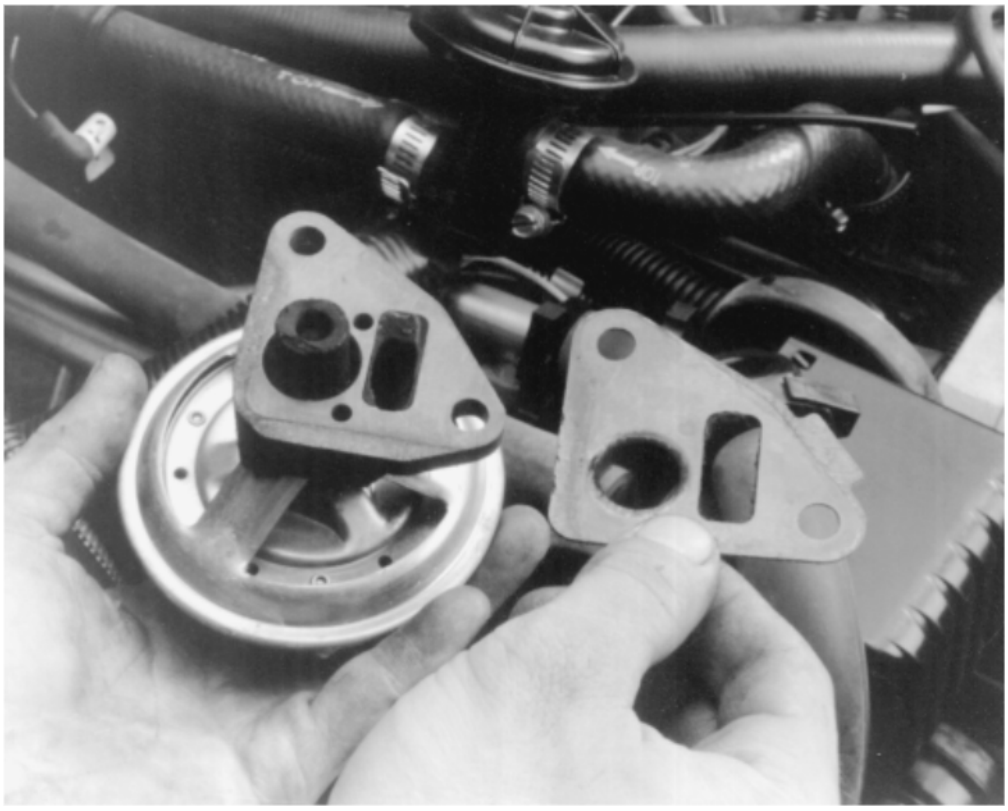


Fig. 14: Discard the old gasket. Be sure the remove all carbon deposits from the ports on the EGR valve and the mounting surface

THERMOSTATIC AIR CLEANER (THERMAC)

OPERATION

This system is designed to warm the air entering the carburetor when underhood temperatures are low, and to maintain a controlled air temperature into the carburetor or throttle body at all times. By allowing preheated air to enter, the amount of time the choke is on is reduced, resulting in better fuel economy and lower emissions. Engine warm-up time is also reduced.

The THERMAC system is composed of the air cleaner body, a filter, sensor unit, vacuum diaphragm, damper door, associated hoses and connections. Heat radiating from the exhaust manifold is trapped by a heat stove and is ducted to the air cleaner to supply heated air to the carburetor or throttle body. A movable door in the air cleaner case snorkel allows air to be drawn in from the heat stove (cold operation). The door position is controlled by the vacuum motor, which receives intake manifold vacuum as modulated by the temperature sensor.

A vacuum door which remains open can cause carburetor icing or poor cold driveability. A door which remains closed during normal engine operating temperatures can cause sluggishness, engine knocking and overheating.

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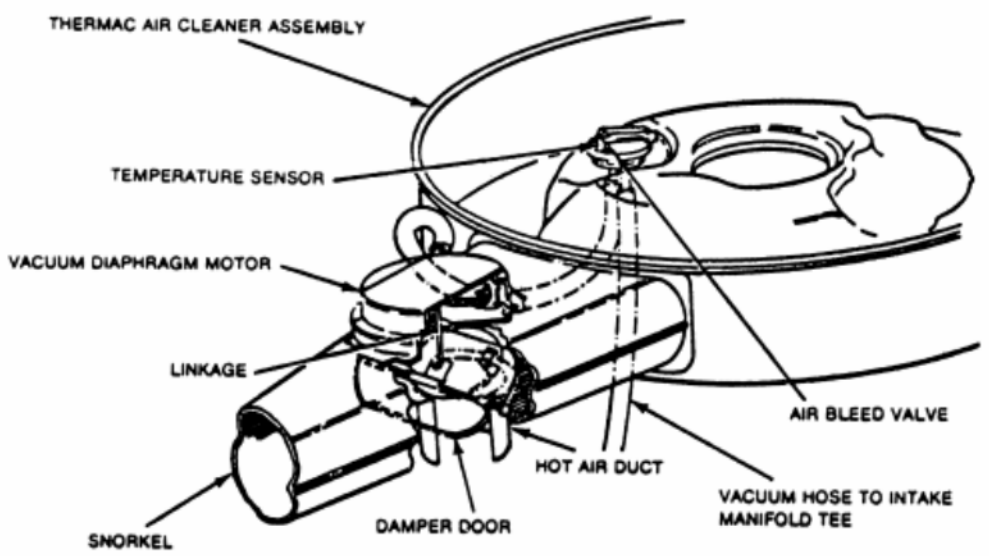


Fig. 1: A common THERMAC air cleaner and components

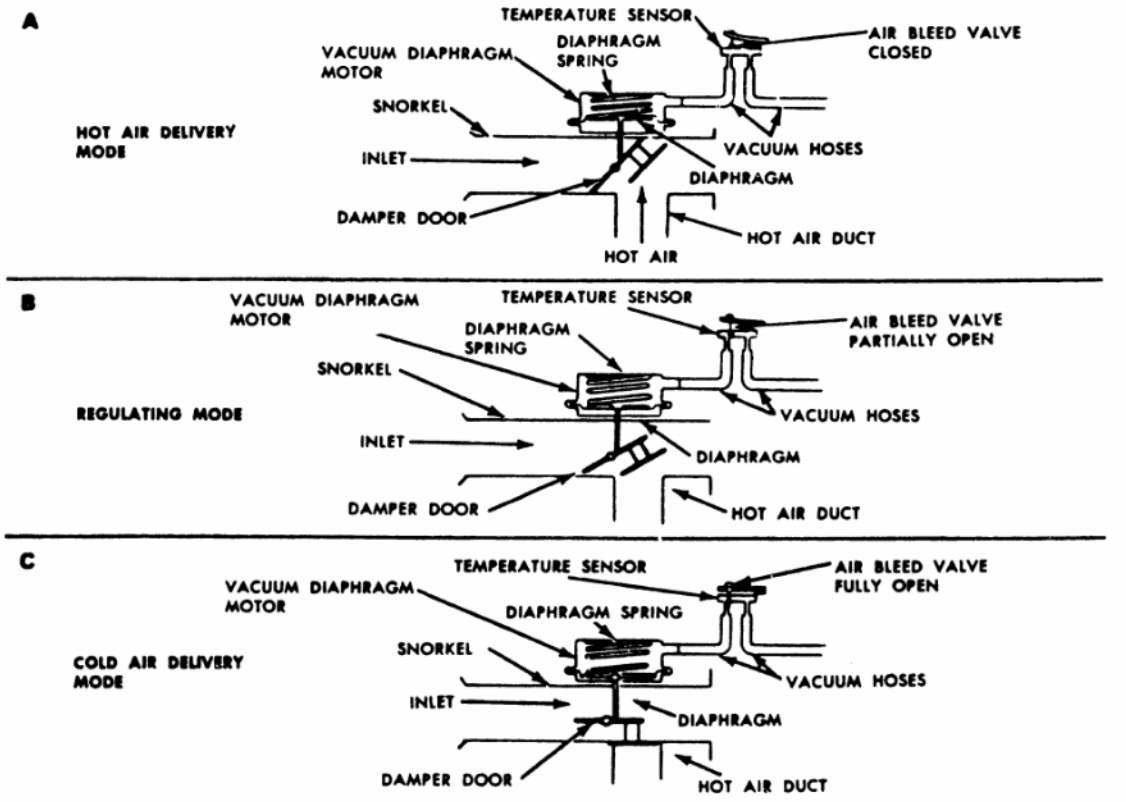


Fig. 2: THERMAC vacuum motor modes of operation

SERVICE

1. Check the vacuum hoses for leaks, kinks, breaks, or improper connections and correct any defects.
2. With the engine off, check the position of the damper door within the snorkel. A mirror can be used to make this job easier. The damper door should be open to admit outside air.

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3. Apply at least 7 in. Hg of vacuum to the damper diaphragm unit. The door should close. If it doesn't, check the diaphragm linkage for binding and correct hookup.
4. With the vacuum still applied and the door closed, clamp the tube to trap the vacuum. If the door doesn't remain closed, there is a leak in the diaphragm assembly.

REMOVAL & INSTALLATION

VACUUM MOTOR

1. Remove the air cleaner.
2. Disconnect the vacuum hose from the motor.
3. Drill out the spot welds with a $^{1}/_{8}$ inch (3mm) bit, then enlarge as necessary to remove the retaining strap.
4. Remove the retaining strap.
5. Lift up the motor and cock it to one side to unhook the motor linkage at the control damper assembly.

To install:

6. In order to install the new vacuum motor, drill a $^{7}/_{64}$ inch (2.8mm) hole in the snorkel tube as the center of the vacuum motor retaining strap.
7. Insert the vacuum motor linkage into the control damper assembly.
8. Use the motor retaining strap and a sheet metal screw to secure the retaining strap and motor to the snorkel tube.

Make sure the screw does not interfere with the operation of the damper assembly. Shorten the screw if necessary.

TEMPERATURE SENSOR

1. Remove the air cleaner.
2. Disconnect the hoses at the air cleaner.
3. Pry up the tabs on the sensor retaining clip and remove the clip and sensor from the air cleaner.

To install:

4. Position sensor into air cleaner.
5. Install retaining clip.
6. Connect the hoses to the air cleaner.
7. Install the air cleaner.

AIR INJECTION REACTION (AIR) SYSTEM

OPERATION

The AIR management system is used to provide additional oxygen to continue the combustion process after the exhaust gases leave the combustion chamber.

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Air is injected into either the exhaust port(s), the exhaust manifold(s) or the catalytic converter by an engine driven air pump. The system is in operation at all times and will bypass air only momentarily during deceleration and at high speeds. The bypass function is performed by the air control valve, while the check valve protects the air pump by preventing any backflow of exhaust gases.

The AIR system helps reduce HC and CO content in the exhaust gases by injecting air into the exhaust ports during cold engine operation. This air injection also helps the catalytic converter to reach the proper temperature quicker during warmup. When the engine is warm (Closed Loop), the AIR system injects air into the beds of a three-way converter to lower the HC and the CO content in the exhaust.

The system utilizes the following components:

1. An engine driven AIR pump.
2. AIR Control valves (Air Control, Air Switching).
3. Air flow and control hoses.
4. Check valves.
5. A dual-bed, three-way catalytic converter.
6. A deceleration back-fire control valve - 2.8L engine only.

The belt driven, vane-type air pump is located at the front of the engine and supplies clean air to the AIR system for purposes already stated. When the engine is cold, the Electronic Control Module (ECM) energizes an AIR control solenoid. This allows air to flow to the AIR switching valve. The AIR switching valve is then energized to direct air to the exhaust ports.

When the engine is warm, the ECM de-energizes the AIR switching valve, thus directing the air between the beds of the catalytic converter. This provides additional oxygen for the oxidizing catalyst in the second bed to decrease HC and CO, while at the same time keeping oxygen levels low in the first bed, enabling the reducing catalyst to effectively decrease the levels of NOx.

If the AIR control valve detects a rapid increase in manifold vacuum (deceleration), certain operating modes (wide open throttle, etc.) or if the ECM self-diagnostic system detects any problem in the system, air is diverted to the air cleaner or directly into the atmosphere.

The primary purpose of the ECM's divert mode is to prevent backfiring. Throttle closure at the beginning of deceleration will temporarily create air/fuel mixtures which are too rich to burn completely. These mixtures become burnable when they reach the exhaust if combined with the injection air. The next firing of the engine will ignite this mixture causing an exhaust backfire. Momentary diverting of the injection air from the exhaust prevents this.

The AIR system check valves and hoses should be checked periodically for any leaks, cracks or deterioration.

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On the 2.8L engine only, an anti-backfire (gulp) valve is used to allow air flow into the intake manifold. This is used to help prevent backfire during high vacuum deceleration conditions. The extra air enters the intake system to lean the rich air/fuel mixture. The valve is operated by the intake manifold vacuum to allow air from the air filter to flow into the intake manifold.

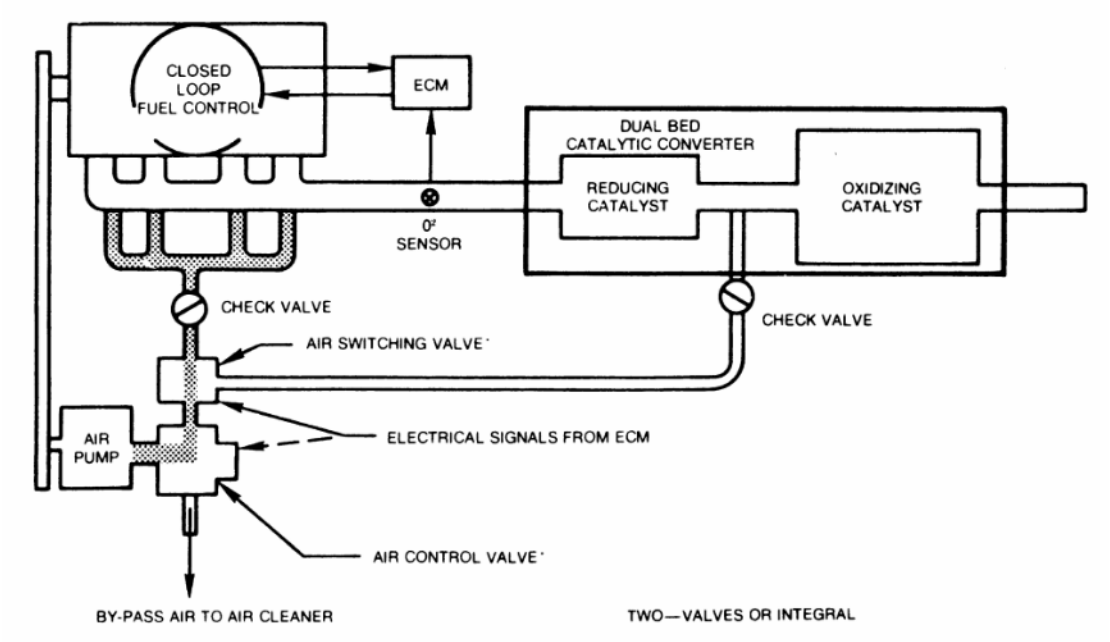


Fig. 1: AIR system operation - cold engine

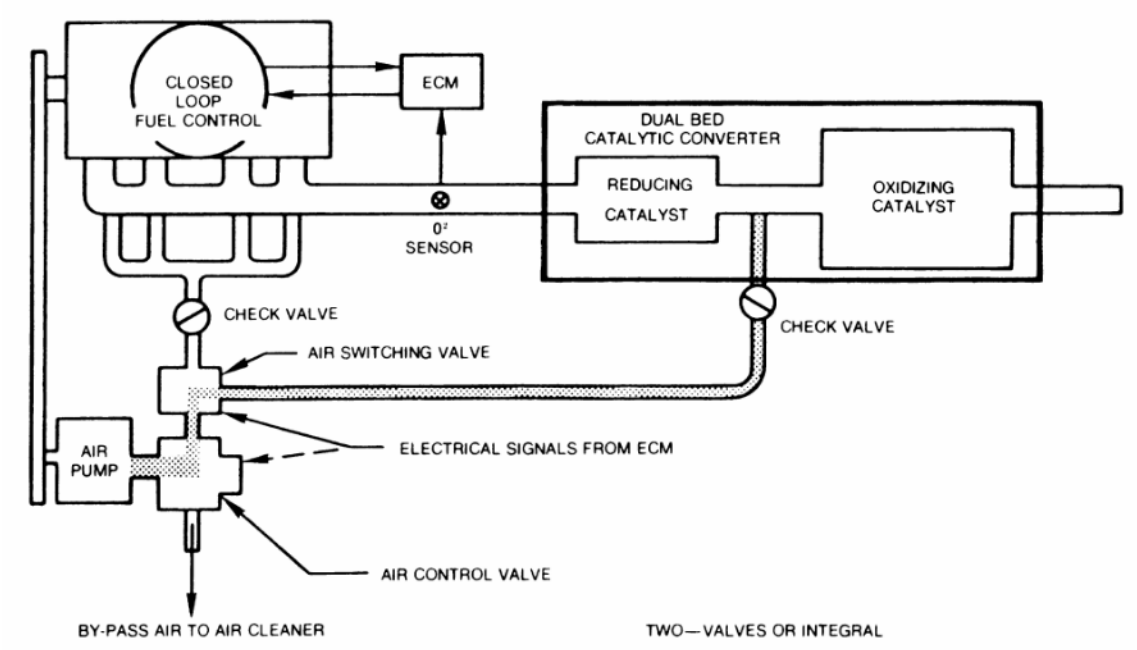
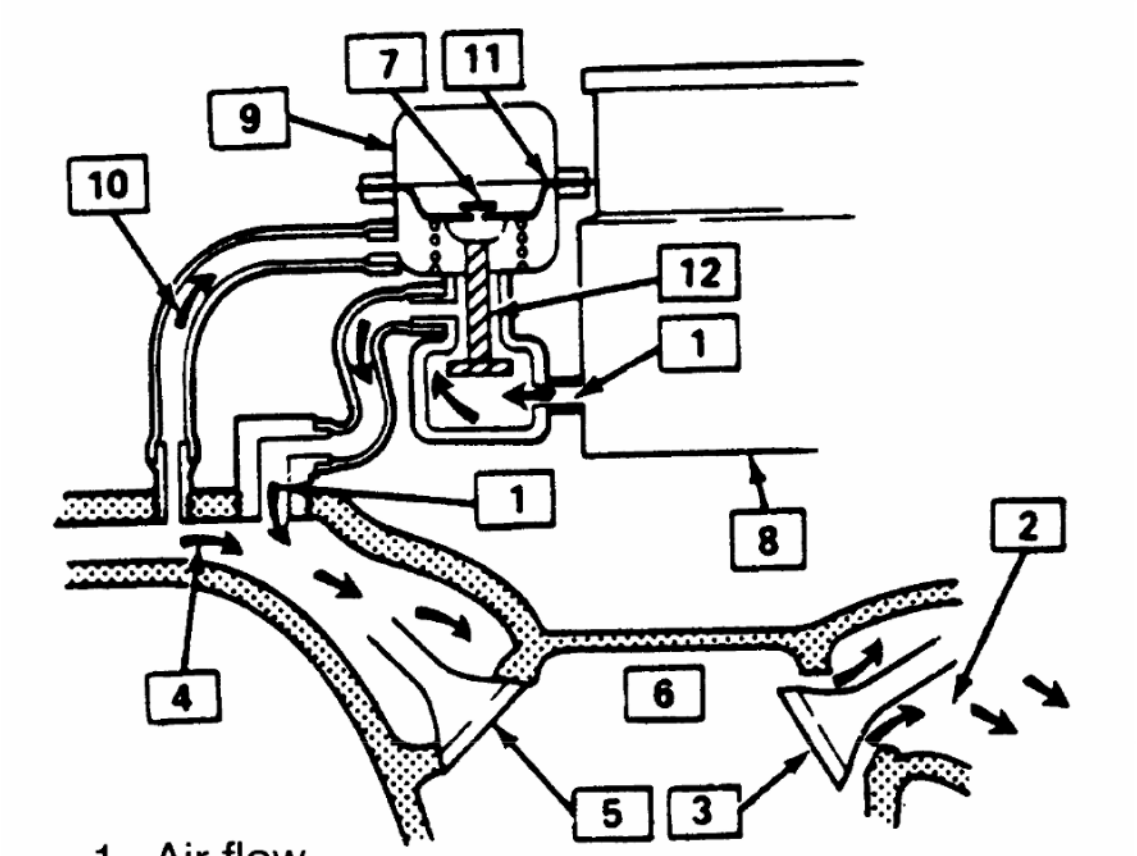


Fig. 2: AIR system operation - warm engine

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1. Air flow
2. Exhaust gas
3. Exhaust valve
4. Intake flow
5. Intake valve
6. Combustion chamber
7. Vacuum bleed valve
8. Air cleaner
9. Deceleration valve
10. Manifold vacuum
11. Diaphragm
12. Valve

Fig. 3: Anti-backfire valve used on 2.8L engines

TESTING

ANTI-BACKFIRE VALVE

1. Remove the air cleaner and plug the air cleaner vacuum source. Connect a tachometer to the engine.
2. With the engine idling, remove the vacuum signal hose from the intake manifold.

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3. Reconnect the signal hose and listen for air flow through the ventilation tube into the anti-backfire valve. A speed drop should be noticed when the hose is reconnected.
4. If these conditions are not found, check hoses for restrictions or leaks. If hoses are OK, replace the anti-backfire valve.

AIR PUMP

1. Check the drive belt tension.
2. Increase the engine speed and observe an increase in air flow. If air flow does not increase, replace the air pump.

CONTROL VALVE

1. Remove the hoses. Blow through the valve (toward the cylinder head).
2. Then, suck through the valve (or blow through the other side). If air flows in one direction, the valve is operative. If not, replace the control valve.

REMOVAL & INSTALLATION

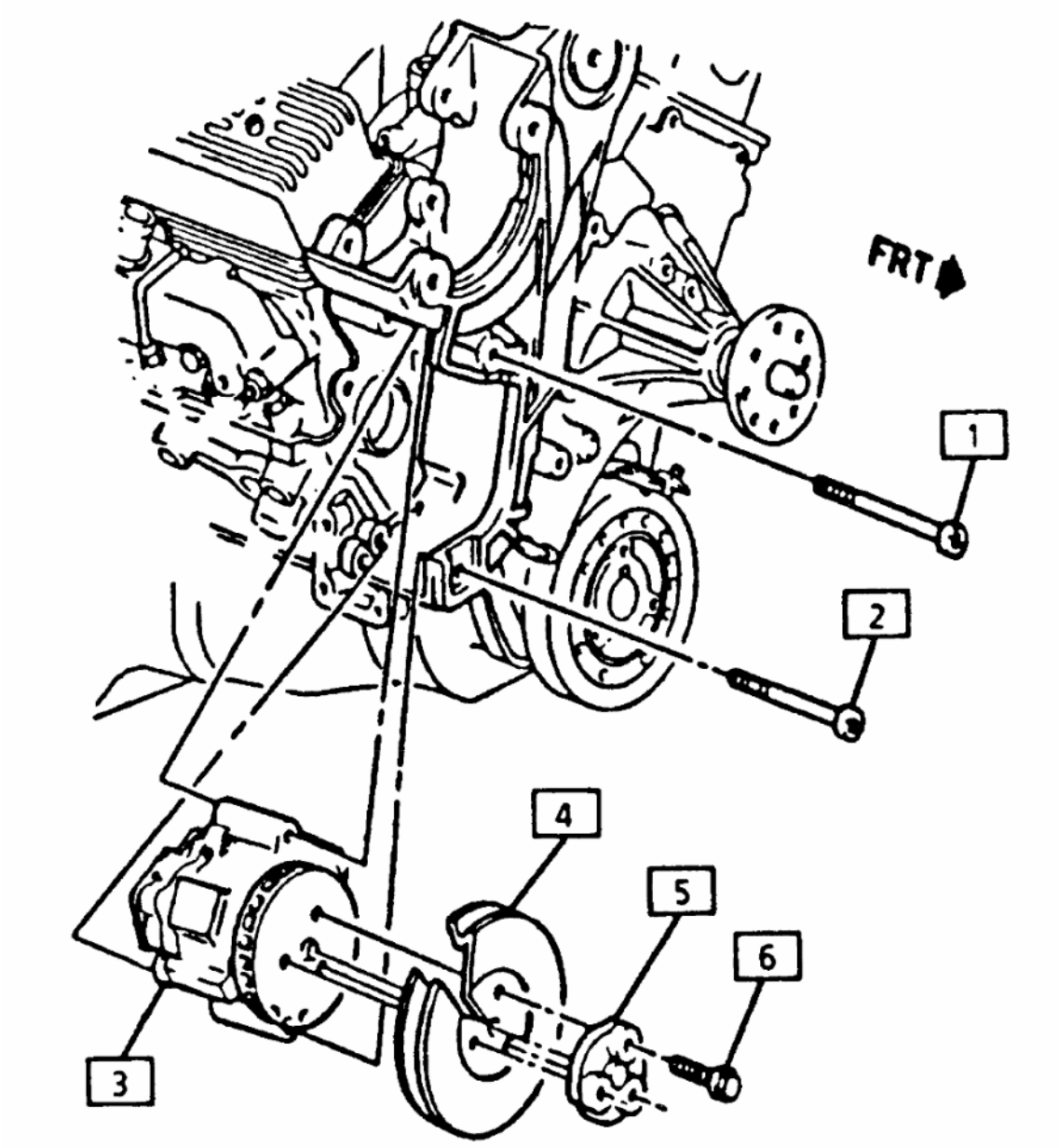
AIR PUMP

1. Remove the AIR control valves and/or adapter at the pump.
2. Loosen the air pump adjustment bolt and remove the drive belt.
3. Unscrew the pump mounting bolts and then remove the pump pulley.
4. Unscrew the pump mounting bolts and then remove the pump.

To install:

5. Position the pump into place and secure it with the mounting bolts.
6. Install the pump pulley.
7. Install the air pump drive belt and adjust pump belt with the pump adjustment bolt.
8. Install the AIR control valves and/or adapter.

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1. AIR pump upper bolt
2. AIR pump lower bolt
3. AIR injection pump
4. AIR pump pulley
5. AIR pump pulley spacer
6. Bolt

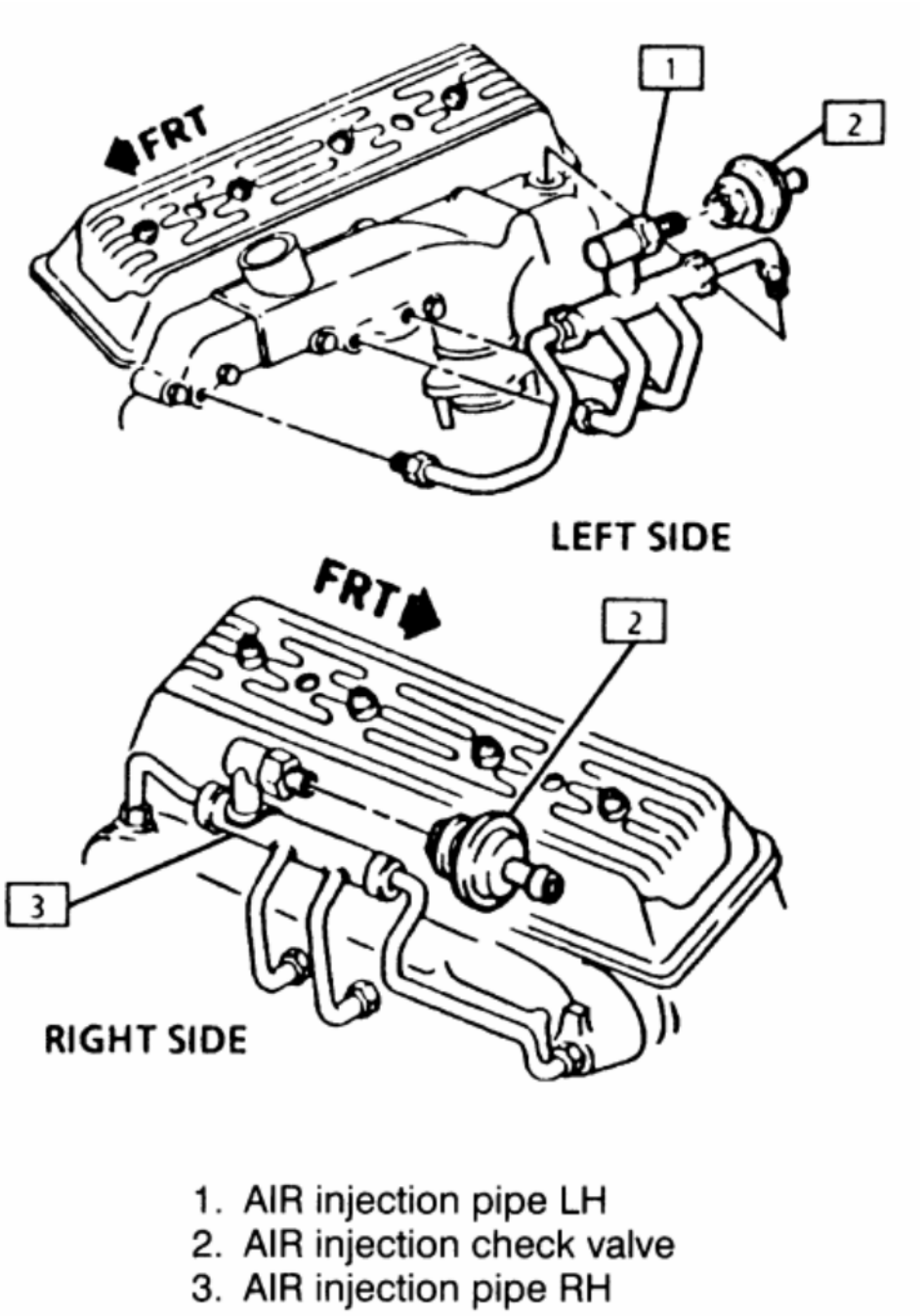
Fig. 4: A common air pump location and mounting

CHECK VALVE

1. Release the clamp and disconnect the air hoses from the valve.
2. Unscrew the check valve from the air injection pipe.

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3. Installation is in the reverse order of removal.



1. AIR injection pipe LH
2. AIR injection check valve
3. AIR injection pipe RH

Fig. 5: AIR pipe and check valve, all models similar

AIR CONTROL VALVE

1. Disconnect the negative battery cable.
2. Remove the air cleaner.
3. Tag and disconnect the vacuum hose from the valve.
4. Tag and disconnect the air outlet hoses from the valve.
5. Bend back the lock tabs and then remove the bolts holding the elbow to the valve.

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6. Tag and disconnect any electrical connections at the valve and then remove the valve from the elbow.

To install:

7. Position the valve into the elbow.
8. Connect any electrical connections at the valve.
9. Install the bolts holding the elbow to the valve and bend the lock tabs.
10. Connect the air outlet hoses to the valve.
11. Connect the vacuum hose to the valve.
12. Install the air cleaner.
13. Connect the negative battery cable.

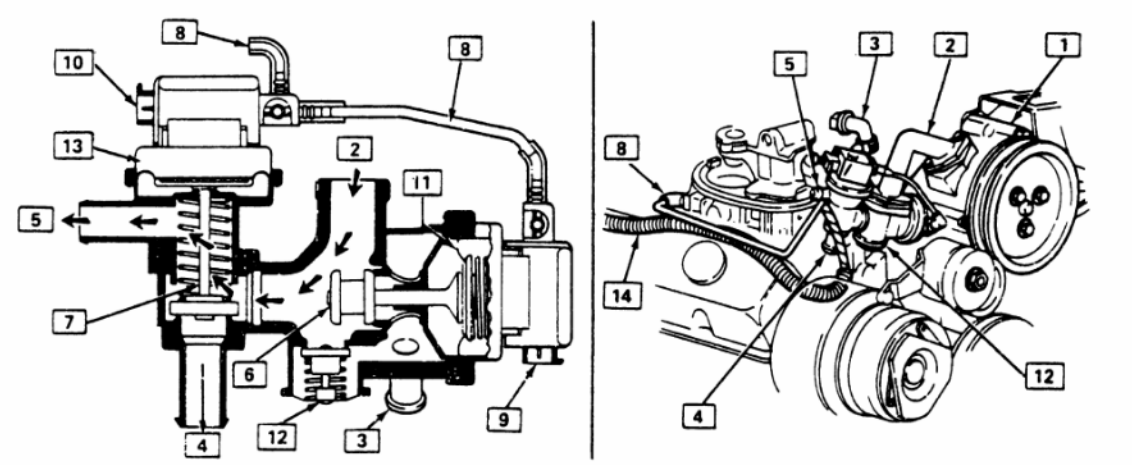
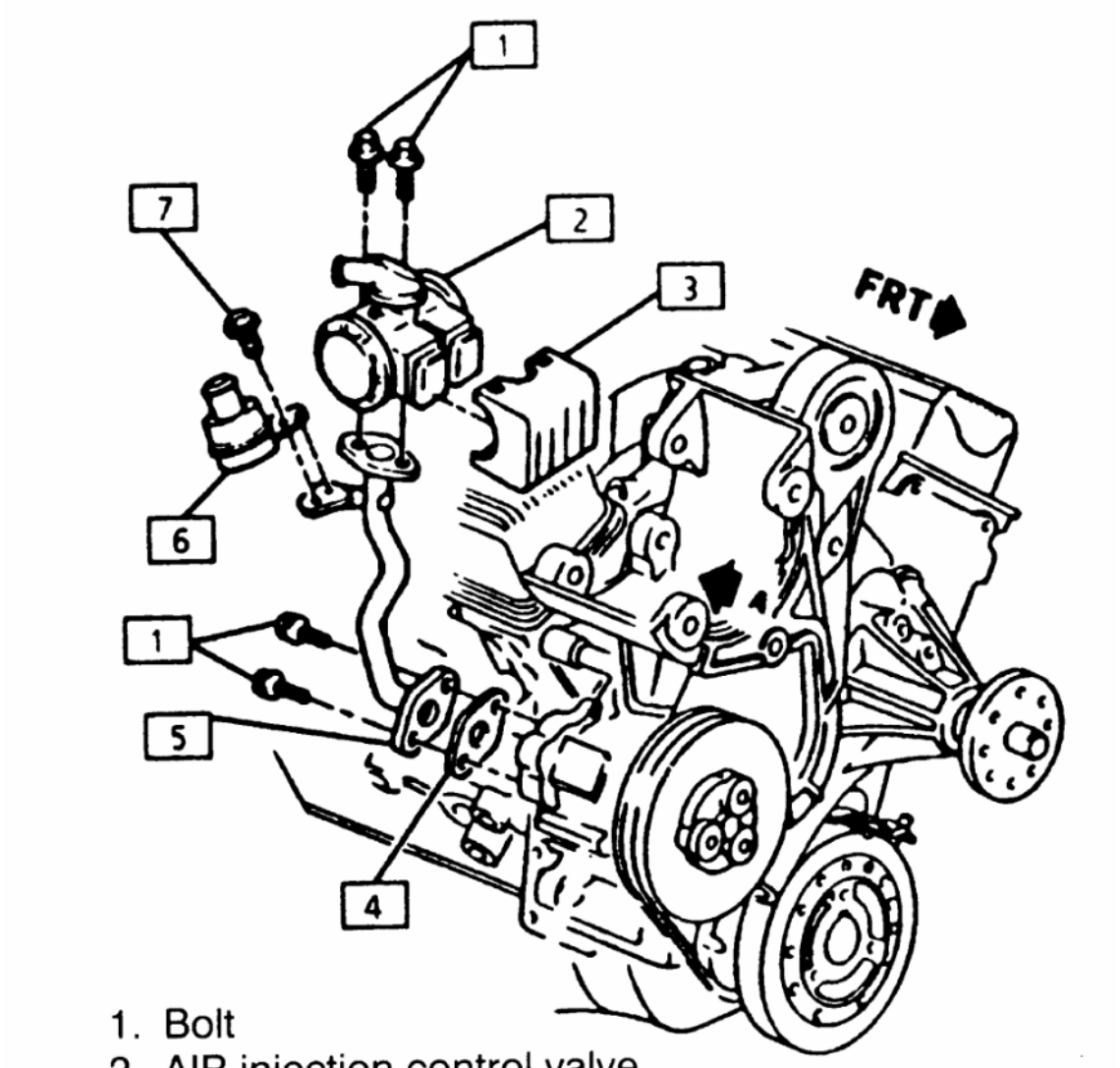


Fig. 6: AIR system control valve

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1. Bolt
2. AIR injection control valve
3. AIR injection control valve cover
4. AIR injection control valve adapter gasket
5. AIR injection control valve pipe
6. AIR injection control valve silencer
7. Screw

Fig. 7: AIR system control valve assembly; all models similar

EARLY FUEL EVAPORATION (EFE)

OPERATION

The EFE system is used on some of the engines to provide a source of rapid engine heat up during cold operations. It helps reduce the time that carburetor choking is required and helps reduce exhaust emissions.

There are two types of EFE systems. The vacuum servo type, consists of a valve located in the exhaust manifold, an actuator and a Thermal Vacuum

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Switch (TVS). The electrical type, consists of a ceramic grid located under the base of the carburetor.

A check of the operation should be made at regular maintenance intervals.

TESTING

VACUUM SERVO TYPE

1. With the engine cold, observe the position of the actuator arm. Start the engine. The arm should move toward the diaphragm (closing the valve).
2. If the arm does not move, remove the hose and check for vacuum. If still no vacuum, remove the top hose from the TVS switch and check for vacuum.
3. If vacuum is present in the top hose, replace the TVS switch.
4. If vacuum is present at the actuator and it does not move, try to free the valve. If the valve cannot be freed, it must be replaced.

ELECTRICAL TYPE

1. Turn the ignition *ON* with the engine cold and probe both terminals of the heater switch connector with a test light.
    - If 1 wire has power, replace the heater switch.
    - If neither wire has power, repair the ignition circuit.
    - If both wires have power, probe the pink wire at the heater connector (if no power, repair the connector of the heater switch).
2. If power exists at the pink wire, disconnect the heater connector and connect a tester across the harness terminal. If no power, repair the ground wire; if power exists, check the resistance of the heater.
3. If heater is over 3 ohms, replace the heater. If under 3 ohms, replace the connector, start the engine (operate to normal temperature) and probe the pink wire. If no power, the system is OK; if power exists, replace the heater switch.

REMOVAL & INSTALLATION

VACUUM SERVO TYPE

1. Disconnect the vacuum hose at the EFE.
2. Remove exhaust pipe to manifold nuts.
3. Remove the crossover pipe. Complete removal is not always necessary.
4. Remove the EFE valve.

To install:

5. Position the EFE valve into place.
6. Install the crossover pipe.
7. Install the exhaust pipe to manifold nuts.
8. Connect the vacuum hose at the EFE.

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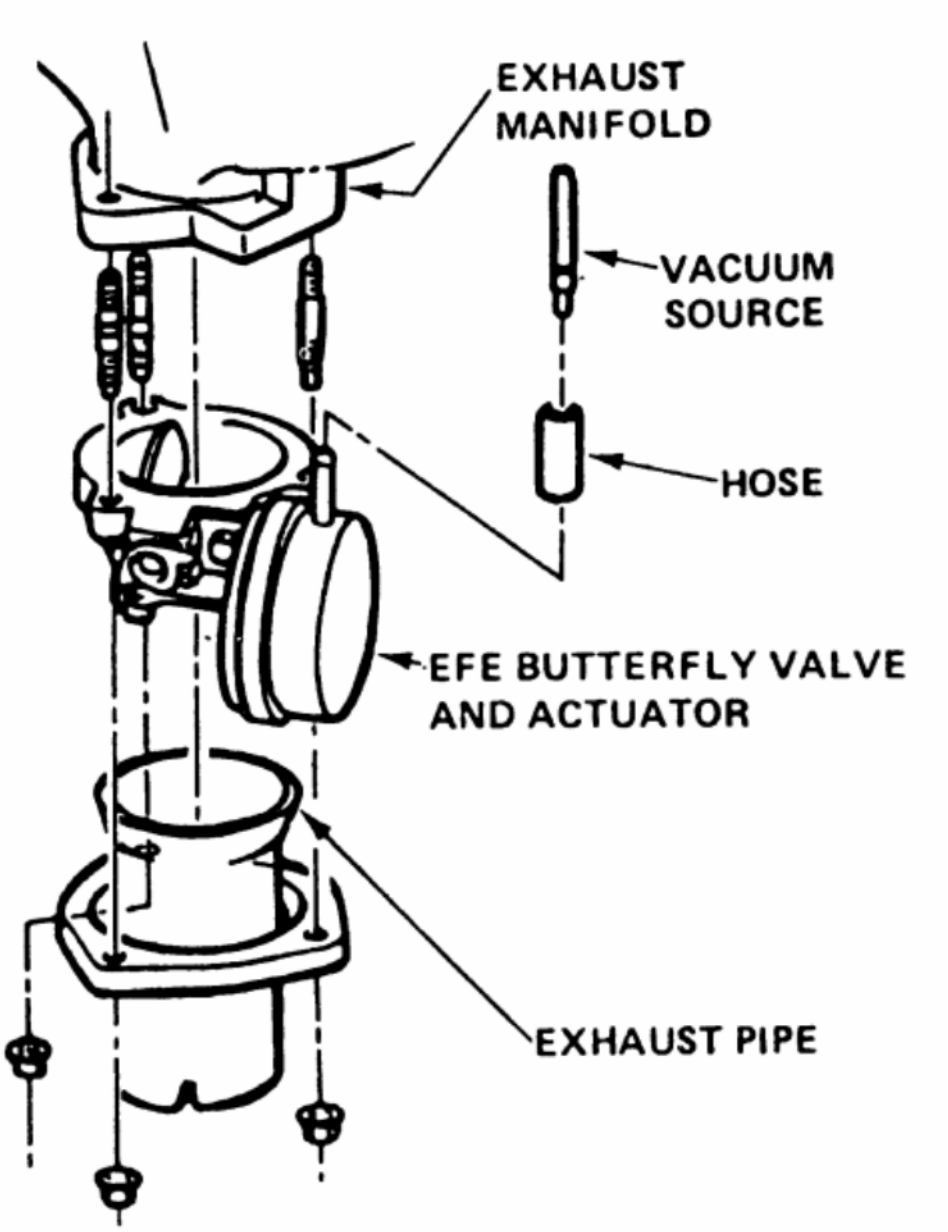


Fig. 1: Exploded view of a vacuum servo EFE valve assembly

ELECTRICAL TYPE

1. Remove the air cleaner and disconnect the negative battery cable.
2. Tag, then disengage all electrical, vacuum and fuel connections from the carburetor.
3. Disconnect the EFE heater electrical lead.
4. Remove the carburetor.
5. Lift off the EFE heater grid.

To install:

6. Position the EFE heater grid onto the manifold.
7. Install the carburetor.
8. Connect the EFE heater electrical lead.

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9. Connect all electrical, vacuum and fuel connection to the carburetor.
10. Install the air cleaner and connect the negative battery cable.

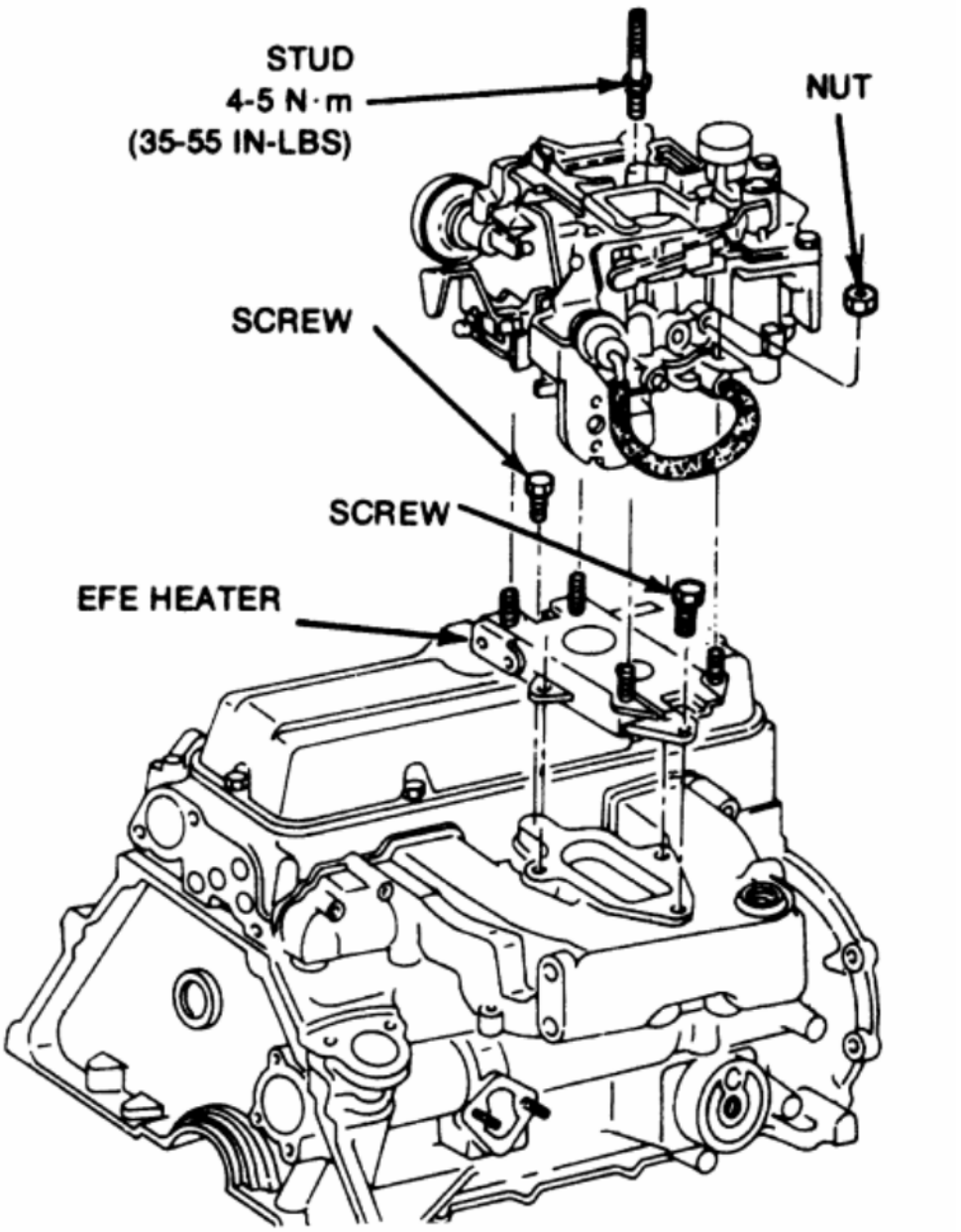


Fig. 2: Electric EFE heater assembly

ELECTRIC EFE RELAY

1. Disconnect the negative battery cable.
2. Remove the retaining bracket.
3. Tag and disconnect all electrical connections.
4. Unscrew the retaining bolts and remove the relay.

To install:

5. Position the relay into place and secure the relay with the retaining bolt.
6. Attach all electrical connections.

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7. Install the retaining bracket.
8. Connect the negative battery cable.

ELECTRONIC ENGINE CONTROLS

COMPUTER COMMAND CONTROL (CCC) SYSTEM

The Computer Command Control (CCC) System is an electronically controlled exhaust emission system that can monitor and control a large number of interrelated emission control systems. It can monitor various engine/vehicle operating conditions and then use this information to control multiple engine related systems. The CCC system is thereby making constant adjustments to maintain optimum vehicle performance under all normal driving conditions while at the same time allowing the catalytic converter to effectively control the emissions of HC, CO and NO_x.

OPERATION

The Electronic Control Module (ECM) is required to maintain the exhaust emissions at acceptable levels. The module is a small, solid state computer which receives signals from many sources and sensors; it uses these data to make judgements about operating conditions and then control output signals to the fuel and emission systems to match the current requirements.

Inputs are received from many sources to form a complete picture of engine operating conditions. Some inputs are simply Yes or No messages, such as that from the Park/Neutral switch; the vehicle is either in gear or in Park/Neutral; there are no other choices. Other data is sent in quantitative input, such as engine rpm or coolant temperature. The ECM is pre-programmed to recognize acceptable ranges or combinations of signals and control the outputs to control emissions while providing good driveability and economy. The ECM also monitors some output circuits, making sure that the components function as commanded. For proper engine operation, it is essential that all input and output components function properly and communicate properly with the ECM.

Since the control module is programmed to recognize the presence and value of electrical inputs, it will also note the lack of a signal or a radical change in values. It will, for example, react to the loss of signal from the vehicle speed sensor or note that engine coolant temperature has risen beyond acceptable (programmed) limits. Once a fault is recognized, a numeric code is assigned and held in memory. The SERVICE ENGINE SOON Malfunction Indicator Lamp (MIL), will illuminate to advise the operator that the system has detected a fault.

More than one code may be stored. Although not every engine uses every code, possible codes range from 12-999. Additionally, the same code may carry different meanings relative to each engine or engine family. For example, on the 3.3L (VIN N) engine, code 46 indicates a fault found in the power steering pressure switch circuit. The same code on the 5.7L (VIN F) engine indicates a fault in the VATS anti-theft system.

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In the event of an ECM failure, the system will default to a pre-programmed set of values. These are compromise values which allow the engine to operate, although possibly at reduced efficiency. This is variously known as the default, limp-in/limp-home or back-up mode. Driveability is almost always affected when the ECM enters this mode.

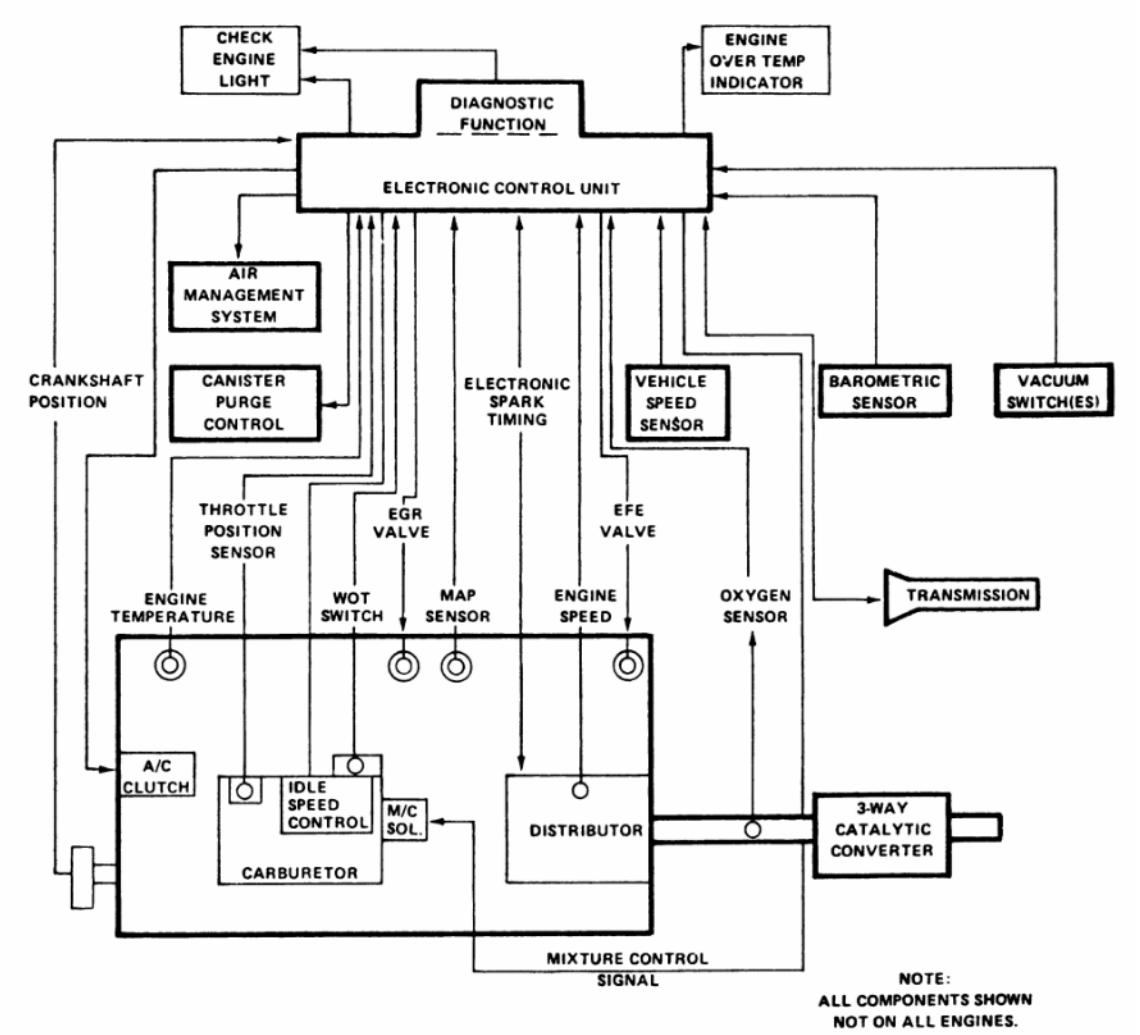


Fig. 1: Computer Command Control schematic

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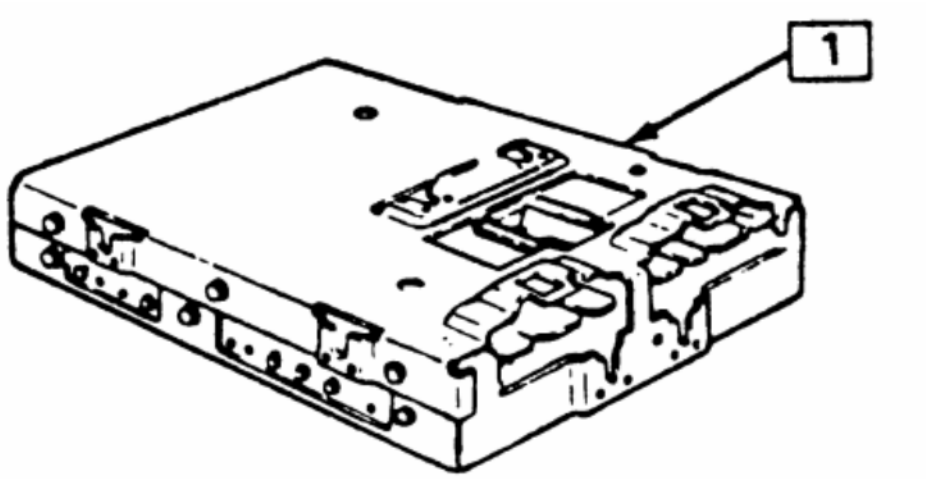


Fig. 2: Electronic Control Module (ECM)

LEARNING ABILITY

The ECM can compensate for minor variations within the fuel system through the block learn and fuel integrator systems. The fuel integrator monitors the oxygen sensor output voltage, adding or subtracting fuel to drive the mixture rich or lean as needed to reach the ideal air fuel ratio of 14.7:1. The integrator values may be read with a scan tool; the display will range from 0-255 and should center on 128 if the oxygen sensor is indicating a 14.7:1 mixture.



Fig. 3: Among other features, a scan tool combines many standard testers into a single device for quick and accurate diagnosis

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The temporary nature of the integrator's control is expanded by the block learn function. The name is derived from the fact that the entire engine operating range (load vs. rpm) is divided into sections or blocks. Within each memory block is stored the correct fuel delivery value for that combination of load and engine speed. Once the operating range enters a certain block, that stored value controls the fuel delivery unless the integrator steps in to change it. If changes are made by the integrator, the new value is memorized and stored within the block. As the block learn makes the correction, the integrator correction will be reduced until the integrator returns to 128; the block learn then controls the fuel delivery with the new value.



Fig. 4: Inexpensive scan tools, such as this Auto Xray®, are available to interface with your General Motors vehicle

The next time the engine operates within the block's range, the new value will be used. The block learn data can also be read by a scan tool; the range is the same as the integrator and should also center on 128. In this way, the systems can compensate for engine wear, small air or vacuum leaks or reduced combustion.

Any time the battery is disconnected, the block learn values are lost and must be relearned by the ECM. This loss of corrected values may be noticed as a significant change in driveability. To re-teach the system, make certain the engine is fully warmed up. Drive the vehicle at part throttle using moderate acceleration and idle until normal performance is felt.

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MALFUNCTION INDICATOR LAMP

The primary function of the MIL is to advise the operator and the technician that a fault is detected, and, in most cases, a code is stored. Under normal conditions, the malfunction indicator lamp will illuminate when the ignition is turned *ON*. Once the engine is started and running, the ECM will perform a system check and extinguish the lamp if no fault is found.

Additionally, the lamp can be used to retrieve stored codes after the system is placed in the Diagnostic Mode. Codes are transmitted as a series of flashes with short or long pauses. When the system is placed in the Field Service Mode, the dash lamp will indicate open loop or closed loop function to the technician.

INTERMITTENTS

If a fault occurs intermittently, such as a loose connector pin breaking contact as the vehicle hits a bump, the ECM will note the fault as it occurs and energize the dash warning lamp. If the problem self-corrects, as with the terminal pin again making contact, the dash lamp will extinguish after 10 seconds but a code will remain stored in the ECM memory.

When an unexpected code appears during diagnostics, it may have been set during an intermittent failure that self-corrected; the codes are still useful in diagnosis and should not be discounted.

OXYGEN SENSOR

OPERATION

An oxygen sensor is used on all models. The sensor protrudes into the exhaust stream and monitors the oxygen content of the exhaust gases. The difference between the oxygen content of the exhaust gases and that of the outside air generates a voltage signal to the ECM. The ECM monitors this voltage and, depending upon the value of the signal received, issues a command to adjust for a rich or a lean condition.

No attempt should ever be made to measure the voltage output of the sensor. The current drain of any conventional voltmeter would be such that it would permanently damage the sensor.

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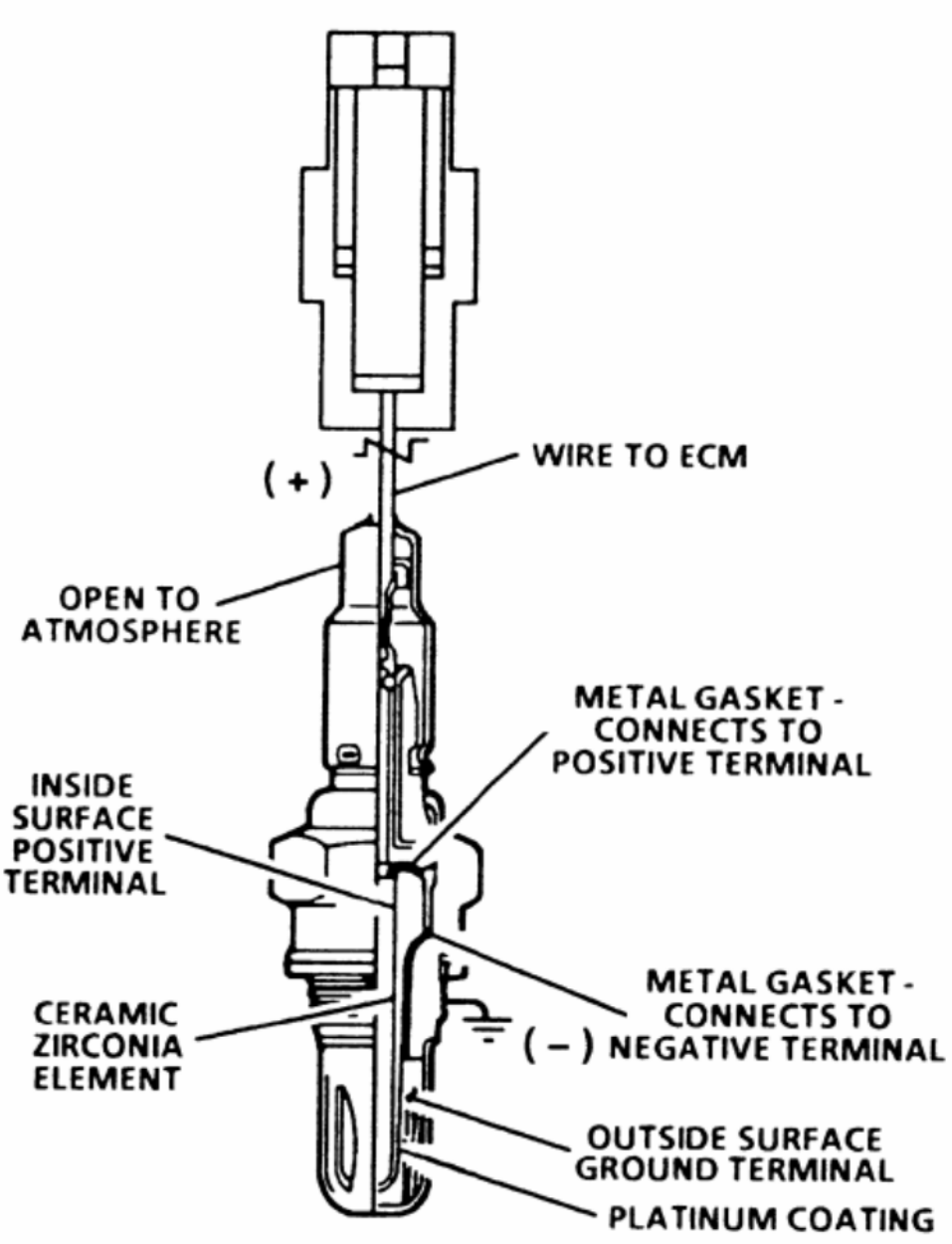


Fig. 1: Cutaway view of a single-wire oxygen sensor

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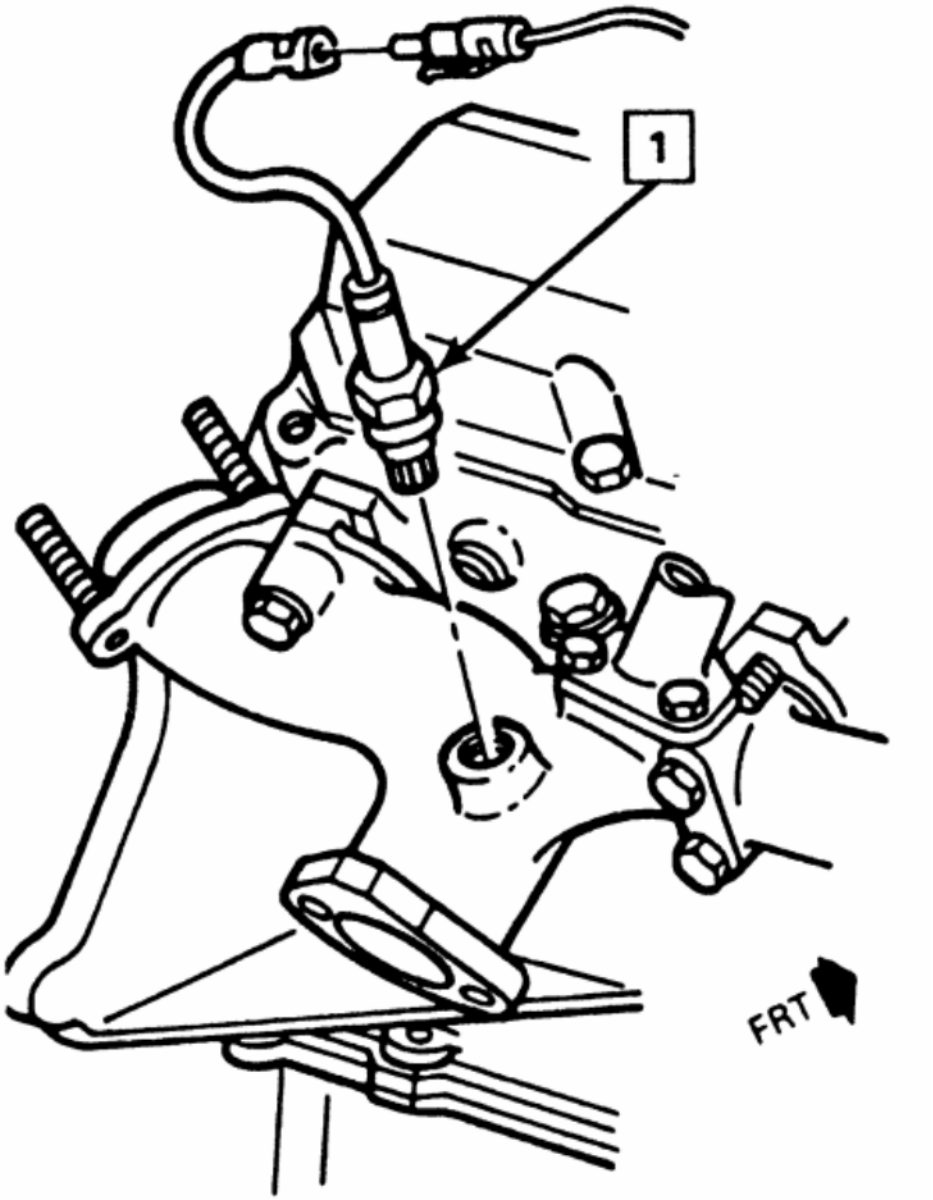


Fig. 2: The oxygen sensor can be located on either the left, right or both exhaust manifolds

REMOVAL & INSTALLATION

The sensor may be difficult to remove when the engine temperature is below 120°F (48°C). Excessive removal force may damage the threads in the exhaust manifold or pipe; follow the removal procedure carefully.

1. Disconnect the negative battery cable.
2. Locate the oxygen sensor. It protrudes from the exhaust manifold (it looks somewhat like a spark plug).
3. Disconnect the electrical wiring from the oxygen sensor harness.

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4. Spray a commercial solvent onto the sensor threads and allow it to soak in for at least five minutes.
5. Carefully remove the sensor with a special oxygen sensor socket.

To install:

6. First coat the new sensor's threads with GM anti-seize compound No. 5613695 or the equivalent. This is not a conventional anti-seize paste. The use of a regular compound may electrically insulate the sensor, rendering it inoperative. You must coat the threads with an electrically conductive anti-seize compound. Installation torque is 30 ft. lbs. (41 Nm). Do not overtighten.
7. Reconnect the electrical wiring. Be careful not to damage the electrical pigtail. Check the sensor boot for proper fit and installation.
8. Reconnect the negative battery cable.

COOLANT TEMPERATURE SENSOR

OPERATION

Most engine functions are affected by the coolant temperature. Determining whether the engine is hot or cold is largely dependent on the temperature of the coolant. An accurate temperature signal to the ECM is supplied by the coolant temperature sensor. The coolant temperature sensor is a thermistor mounted in the engine coolant stream. A thermistor is an electrical device that varies its resistance in relation to changes in temperature. Low coolant temperature produces a high resistance and high coolant temperature produces low resistance. The ECM supplies a signal of 5 volts to the coolant temperature sensor through a resistor in the ECM and measures the voltage. The voltage will be high when the engine is cold and low when the engine is hot.

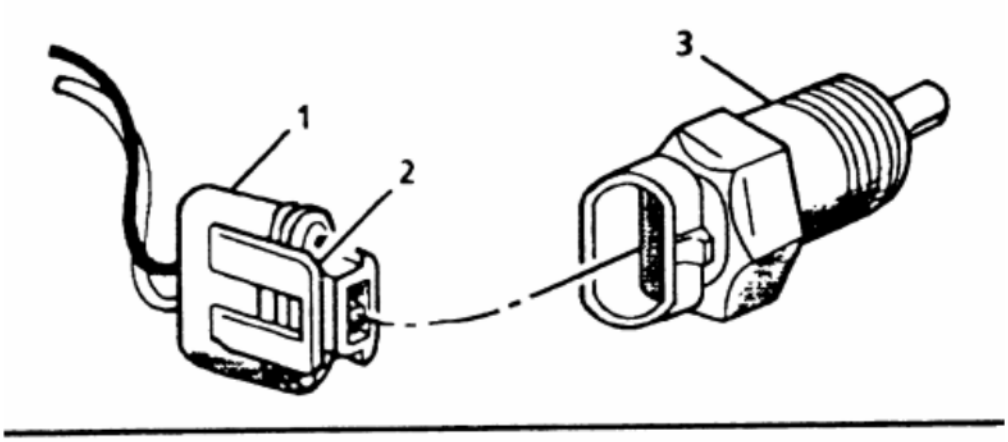
REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Drain the cooling system to an appropriate and clean container for reuse.
3. Disconnect the electrical wiring from the coolant temperature sensor.
4. Remove the coolant temperature sensor.

To install:

5. Install the coolant temperature sensor.
6. Connect the electrical wiring.
7. Fill the cooling system.
8. Connect the negative battery cable.
9. Start the engine and check for leaks.

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1 HARNESS CONNECTOR
2 LOCKING TAB
3 SENSOR

Fig. 1: Coolant temperature sensor. The intake air temperature sensor is similar in appearance

IDLE AIR CONTROL (IAC) VALVE

OPERATION

Engine idle speeds are controlled by the ECM through the IAC valve mounted on the throttle body. The ECM sends voltage pulses to the IAC motor windings causing the IAC motor shaft and pintle to move *IN* or *OUT* a given distance (number of steps) for each pulse (called counts). The movement of the pintle controls the airflow around the throttle plate, which in turn, controls engine idle speed. IAC valve pintle position counts can be observed using a scan tool. Zero counts correspond to a fully closed passage, while 140 counts or more corresponds to full flow.

Idle speed can be categorized in 2 ways: actual (controlled) idle speed and minimum idle speed. Controlled idle speed is obtained by the ECM positioning the IAC valve pintle. Resulting idle speed is determined by total air flow (IAC/passage + PCV + throttle valve + calibrated vacuum leaks). Controlled idle speed is specified at normal operating conditions, which consists of engine coolant at normal operating temperature, air conditioning compressor *OFF*, manual transmission in neutral or automatic transmission in *D*.

Minimum idle air speed is set at the factory with a stop screw. This setting allows a certain amount of air to bypass the throttle valves regardless of IAC valve pintle positioning. A combination of this air flow and IAC pintle positioning allows the ECM to control engine idle speed. During normal engine idle operation, the IAC valve pintle is positioned a calibrated number of steps (counts) from the seat. No adjustment is required during routine maintenance. Tampering with the minimum idle speed adjustment may result in premature failure of the IAC valve or improperly controlled engine idle operation.

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REMOVAL & INSTALLATION

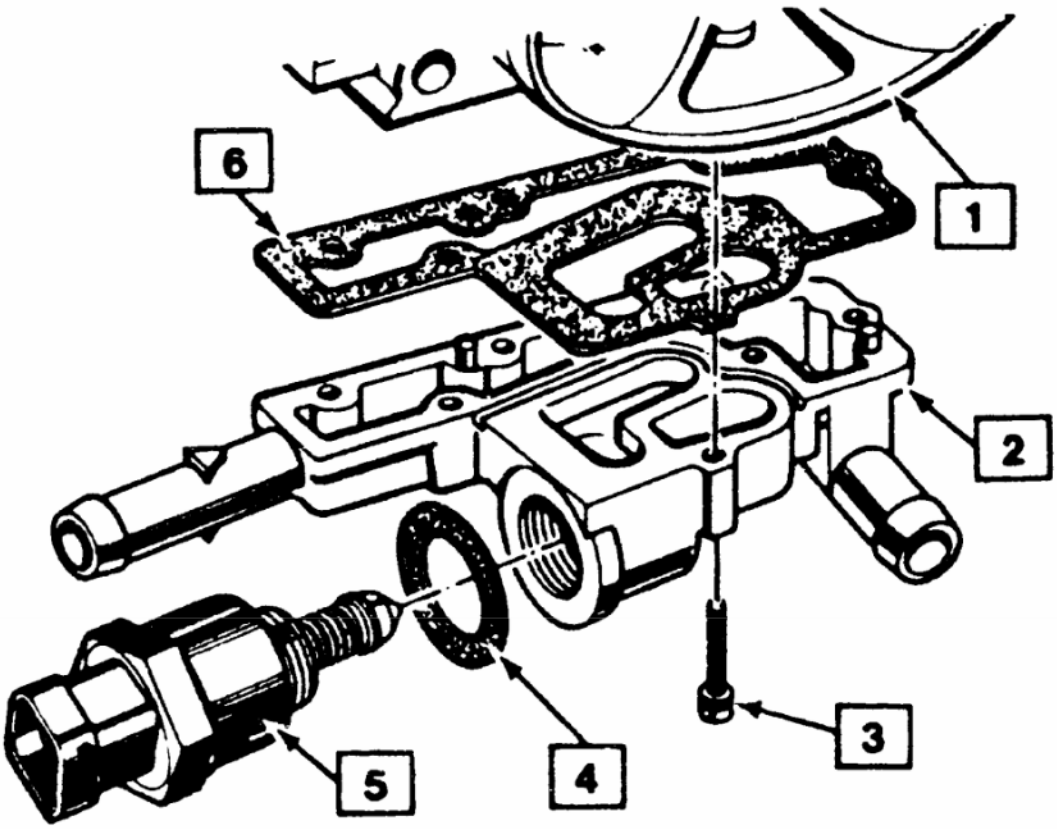
On some models it may be necessary to remove the air inlet assembly.

1. Disconnect the negative battery cable. Disconnect the IAC valve electrical wiring.
2. Remove the IAC valve by performing the following:
    a. On thread-mounted units, use a $1^{1}/_{4}$ inch (32mm) wrench.
    b. On flange-mounted units, remove the mounting screw assemblies.
3. Remove the IAC valve gasket or O-ring and discard.

To install:

4. Clean the mounting surfaces by performing the following:
    a. If servicing a thread-mounted valve, remove the old gasket material from the surface of the throttle body to ensure proper sealing of the new gasket.
    b. If servicing a flange-mounted valve, clean the IAC valve surfaces on the throttle body to assure proper seal of the new O-ring and contact of the IAC valve flange.
5. If installing a new IAC valve, measure the distance between the tip of the IAC valve pintle and the mounting flange. If the distance is greater than 1.102 inch (28mm), use finger pressure to slowly retract the pintle. The force required to retract the pintle of a new valve will not cause damage to the valve. If reinstalling the original IAC valve, do not attempt to adjust the pintle in this manner.
6. Install the IAC valve into the throttle body by performing the following:
    a. With thread-mounted valves, install with a new gasket. Using a $1^{1}/_{4}$ inch (32mm) wrench, tighten to 13 ft. lbs. (18 Nm).
    b. With flange-mounted valves, lubricate a new O-ring with transmission fluid and install on the IAC valve. Install the IAC valve to the throttle body. Install the mounting screws using a suitable thread locking compound. Tighten to 28 inch lbs. (3 Nm).
7. Connect the IAC valve electrical wiring.
8. Connect the negative battery cable.
9. No physical adjustment of the IAC valve assembly is required after installation. Reset the IAC valve pintle position by performing the following:
    a. Depress the accelerator pedal slightly.
    b. Start the engine and run for 5 seconds.
    c. Turn the ignition switch to the *OFF* position for 10 seconds.
    d. Restart the engine and check for proper idle operation.

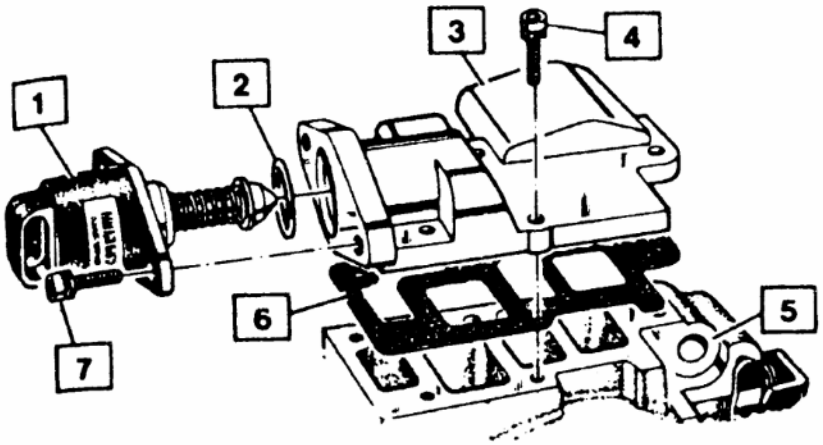
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1. Throttle body assembly
2. IAC coolant cover
3. IAC cover assembly to throttle body screw
4. IAC valve gasket
5. Idle air control valve
6. IAC coolant cover to throttle body gasket

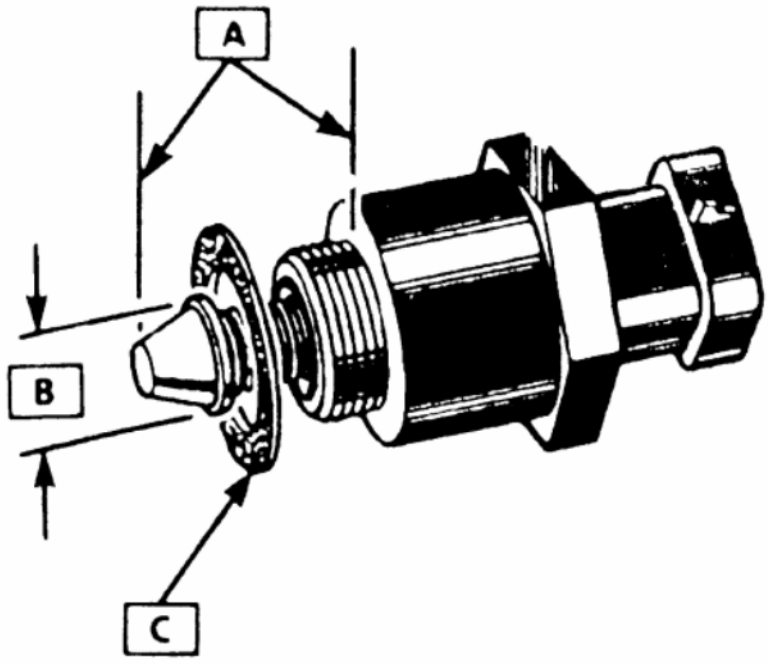
Fig. 1: Screw-in type IAC valve

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1. Idle air control (IAC) valve assembly
2. Idle air control valve O-ring
3. Idle air/vacuum signal housing assembly
4. Idle air/vacuum signal assembly screw
5. Throttle body assembly
6. Idle air/vacuum signal assembly gasket
7. Idle air control valve screw

Fig. 2: Flange-mounted IAC valves are retained by a screw



A. Distance of pintle extension
B. Diameter and shape of pintle
C. IAC valve gasket

Fig. 3: Measure the distance of pintle extension when installing a new IAC valve

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MANIFOLD ABSOLUTE PRESSURE SENSOR

OPERATION

The MAP sensor measures the changes in intake manifold pressure, which result from engine load/speed changes and converts this information to a voltage output. The MAP sensor reading is the opposite of a vacuum gauge reading: when manifold pressure is high, MAP sensor value is high and vacuum is low. A MAP sensor will produce a low output on engine coast-down with a closed throttle while a wide open throttle will produce a high output. The high output is produced because the pressure inside the manifold is the same as outside the manifold, so 100 percent of the outside air pressure is measured.

The MAP sensor is also used to measure barometric pressure under certain conditions, which allows the ECM to automatically adjust for different altitudes.

The MAP sensor changes the 5 volt signal supplied by the ECM, which reads the change and uses the information to control fuel delivery and ignition timing.

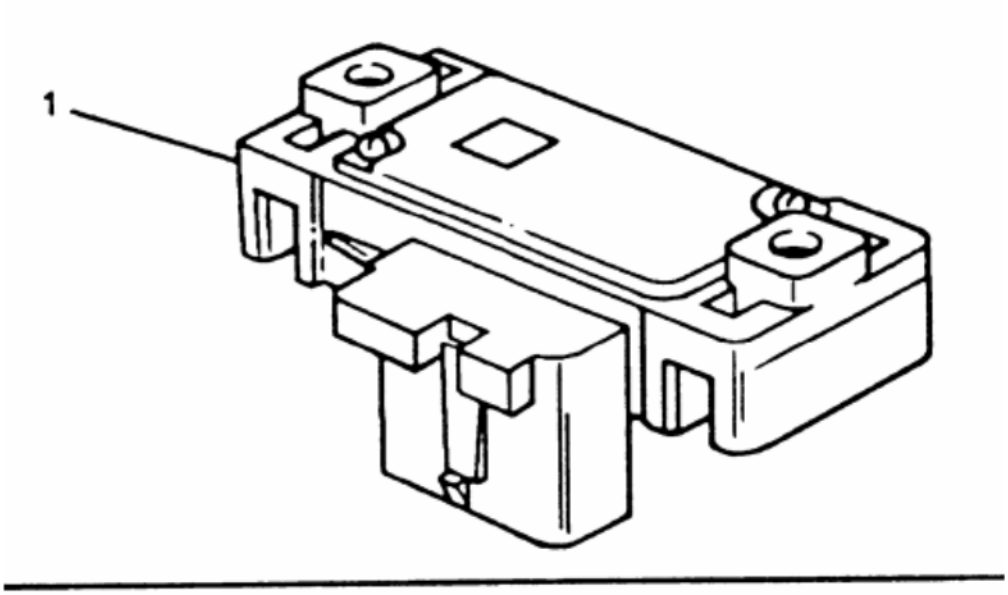


Fig. 1: MAP sensor

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Disconnect the vacuum connection.
3. Release the electrical wiring locking tab and disconnect the connector.
4. Remove the bolts or release the MAP sensor locking tabs and remove the sensor.

To install:

5. Install the bolts or snap sensor onto the bracket.

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6. Connect the MAP sensor electrical wiring.
7. Connect the MAP sensor vacuum harness connector.
8. Connect the negative battery cable.

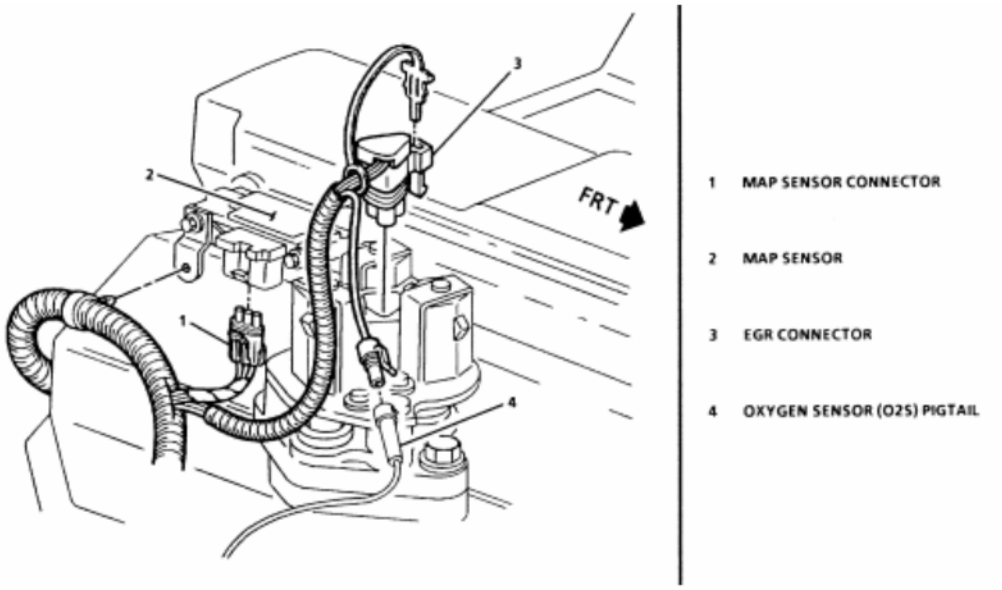


Fig. 2: A common MAP sensor location

INTAKE AIR TEMPERATURE (IAT) SENSOR

OPERATION

The IAT sensor is a thermistor which supplies intake air temperature information to the ECM. The sensor produces high resistance at low temperatures and low resistance at high temperatures. The ECM supplies a 5 volt signal to the sensor and measures the output voltage. The voltage signal will be low when the air is cold and high when the air is hot. On some models, this sensor is also known as the Manifold Air Temperature (MAT) sensor.

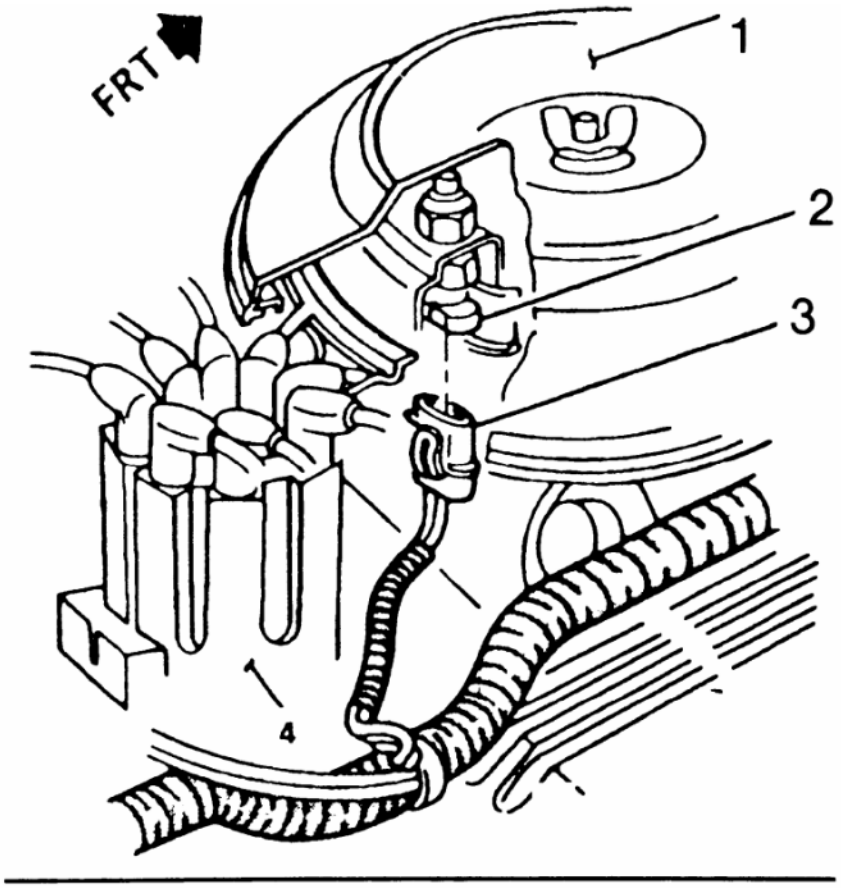
REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Detach the sensor electrical connector locking tab.
3. Carefully remove the sensor.

To install:

4. Install the sensor.
5. Connect the electrical wiring.
6. Connect the negative battery cable.

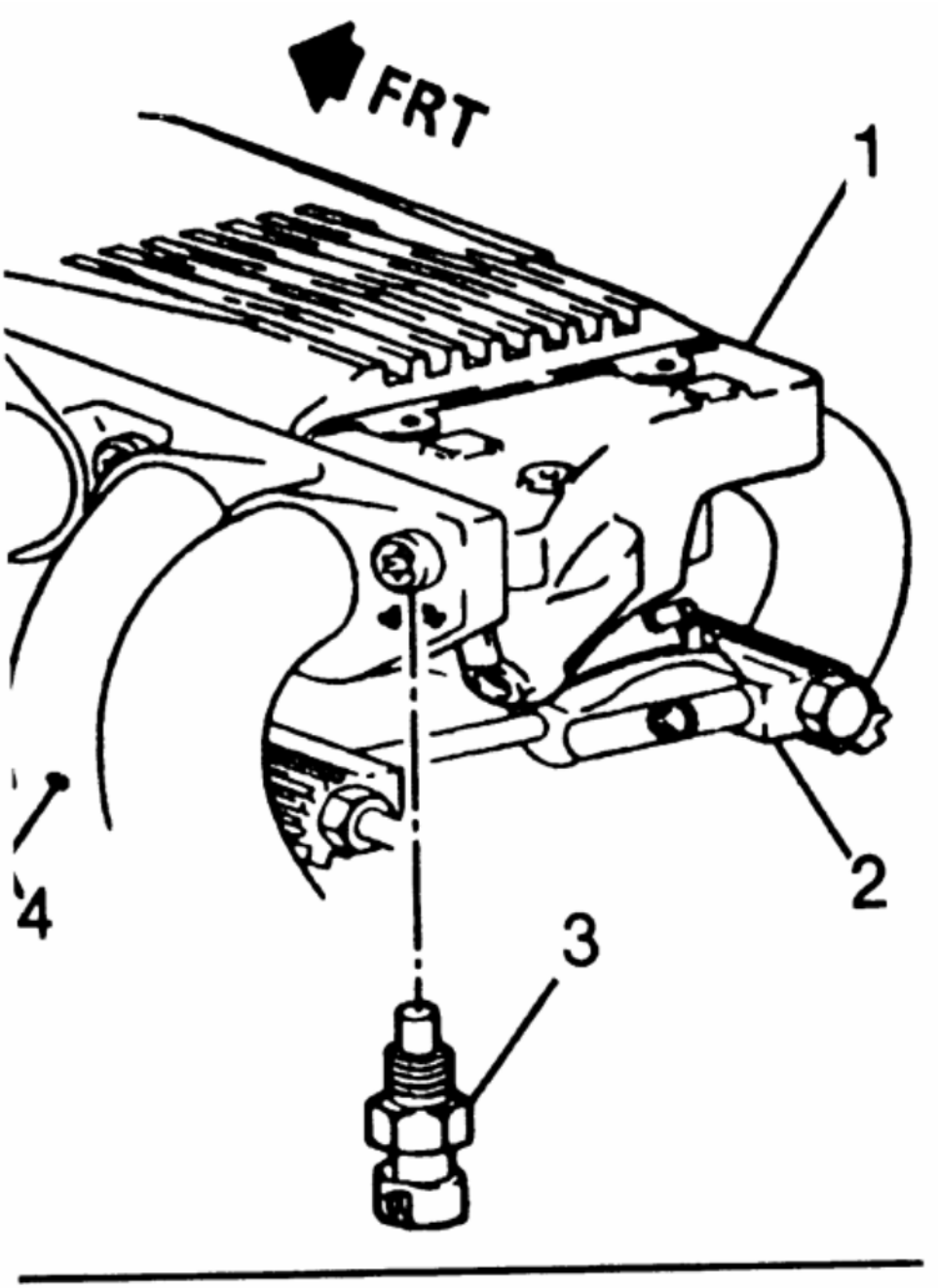
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1. Air cleaner
2. Intake Air TGemperature (IAT) sensor
3. Harness connector to ECM
4. Distributor

Fig. 1: Intake air temperature sensor location on some TBI engines

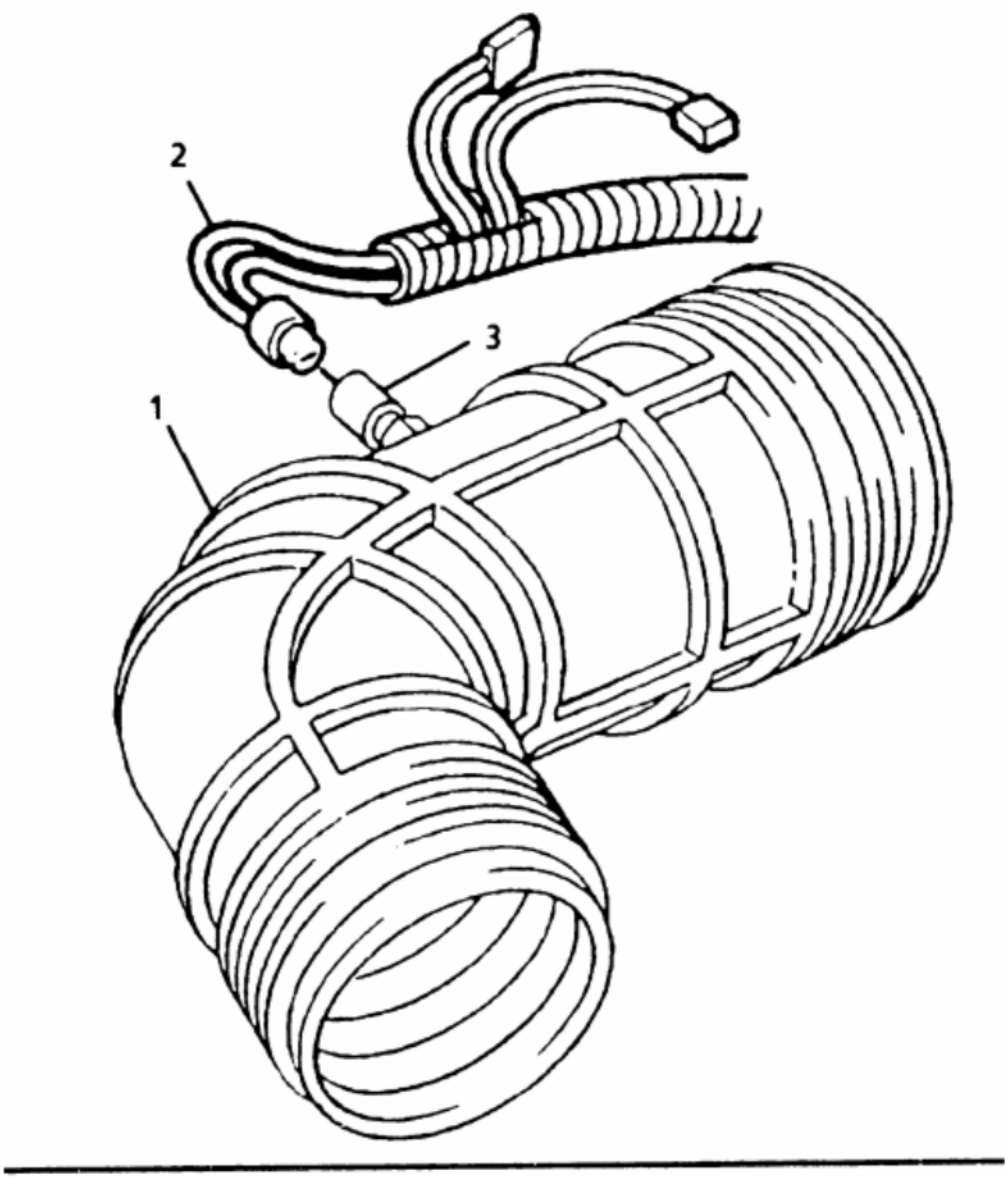
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1. Intake manifold
2. Fuel rail
3. Intake Air TGemperature (IAT) sensor
4. Left intake runners

Fig. 2: Intake air temperature sensor location on Tuned Port Injection engines

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1 AIR CLEANER OUTLET DUCT
2 ELECTRICAL HARNESS
3 INTAKE AIR TEMPERATURE (IAT) SENSOR

Fig. 3: On some models, the IAT sensor may be located on the air intake hose

THROTTLE POSITION SENSOR (TPS)

OPERATION

The TPS is mounted to the throttle body, opposite the throttle lever and is connected to the throttle shaft. Its function is to sense the current throttle valve position and relay that information to the ECM. Throttle position information allows the ECM to generate the required injector control signals. The TPS consists of a potentiometer which alters the flow of voltage according to the position of a wiper on the variable resistor windings, in proportion to the movement of the throttle shaft.

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REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Disconnect the TPS electrical wiring.
3. Remove the mounting screws.
4. Remove the TPS and, if equipped, sensor seal from the throttle body.

To install:

5. Place the TPS in position. Align the TPS lever with the sensor drive lever on the throttle body.
6. Install the TPS mounting screws.
7. Connect the electrical wiring.
8. Connect the negative battery cable.

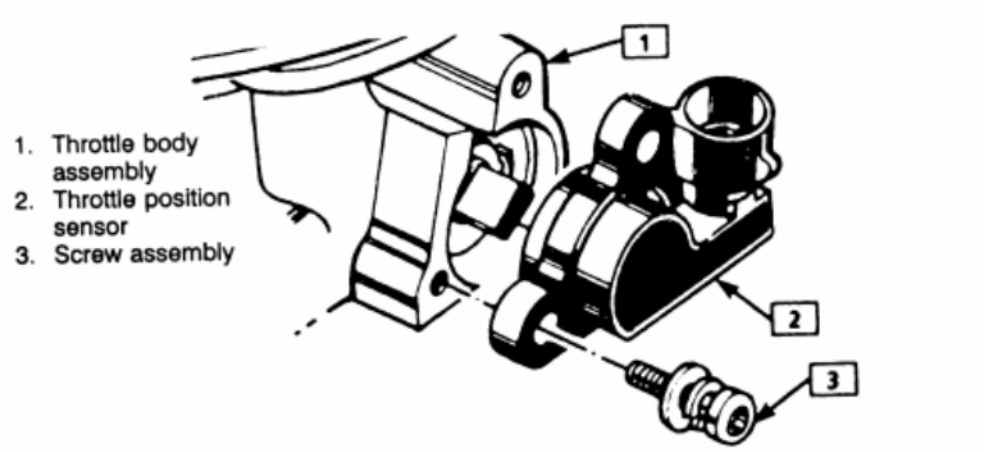


Fig. 1: Exploded view of a common TPS assembly

MASS AIR FLOW (MAF) SENSOR

OPERATION

The Mass Air Flow (MAF) sensor, found on some fuel injected engines, measures the amount of air passing through it. The ECM uses this information to determine the operating condition of the engine, to control fuel delivery. A large quantity of air indicates acceleration, while a small quantity indicates deceleration or idle.

The MAF sensor used on these vehicles is of the hot-wire type. Current is supplied to the sensing wire to maintain a calibrated temperature, and as air flow increases or decreases the current will vary. This varying current is directly proportional to air mass.

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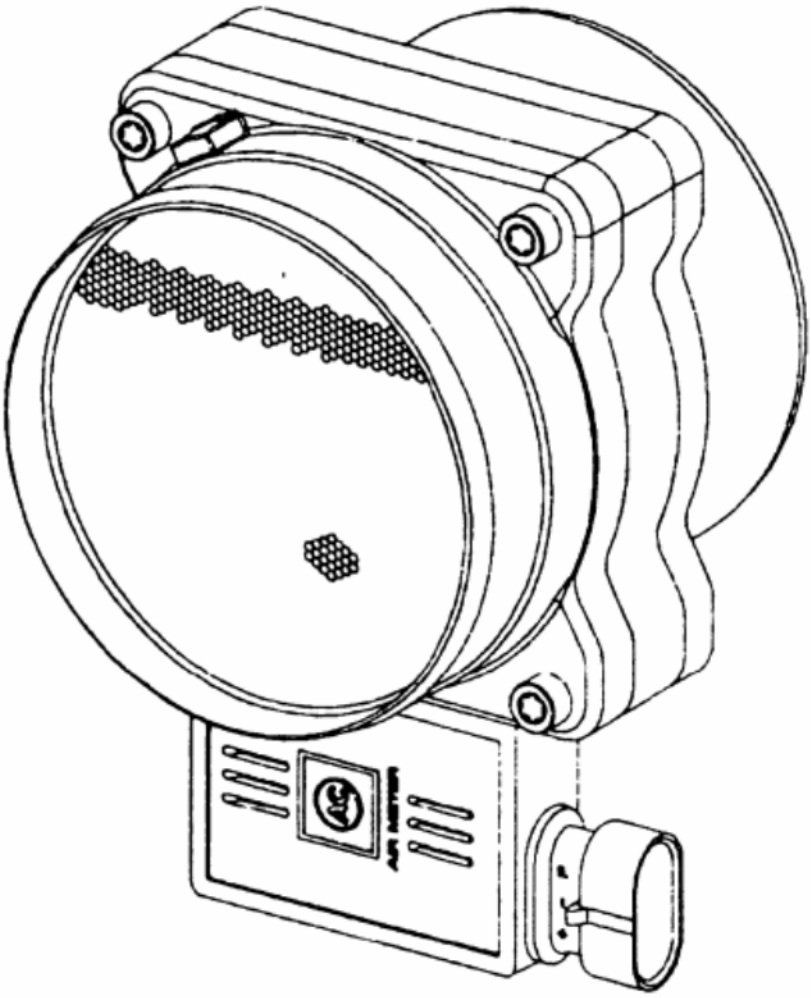
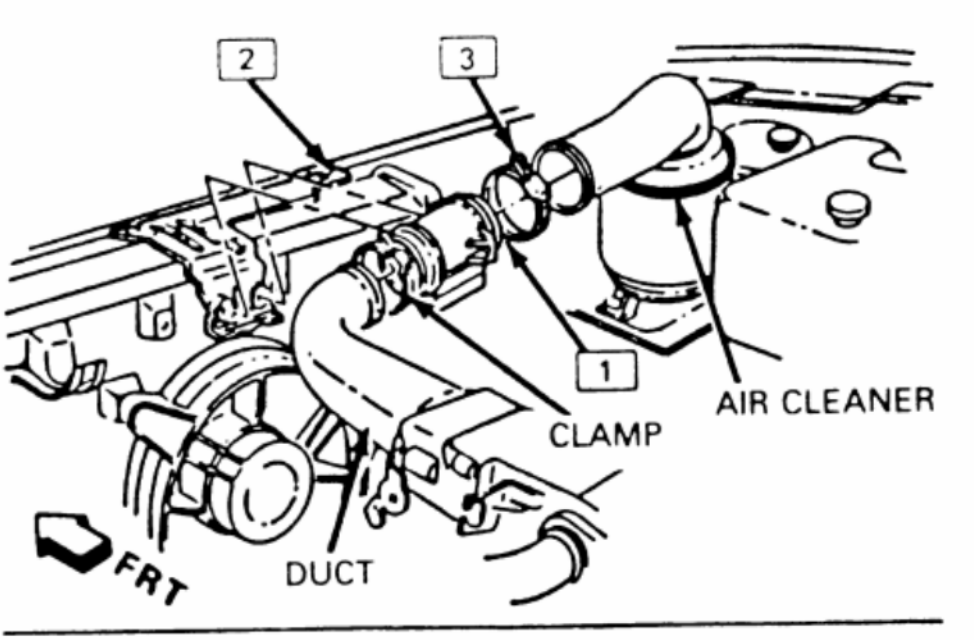


Fig. 1: MAF sensor

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Disconnect the sensor electrical connection.
3. Loosen the clamps and remove the air intake hoses from the MAF sensor.
4. Remove the sensor from the vehicle. On some models it will be necessary to remove the sensor-to-bracket attaching bolts.
5. Installation is the reverse of removal.

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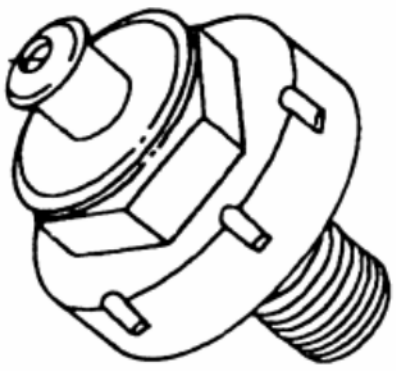
1 MAF SENSOR ASM (PONTIAC)
2 BRACKET MAF SENSOR
3 CLAMP 1.4-2.0 N·m (1-1.4 LBS. FT.)

Fig. 2: Mass Air Flow sensor mounting, all models similar

KNOCK SENSOR

OPERATION

The knock sensor is usually mounted to the right lower side of the engine block. When spark knock or pinging is present, the sensor produces a voltage signal which is sent to the ECM. The ECM will then retard the ignition timing based on these signals.



KNOCK SENSOR (KS)

Fig. 1: Knock sensor

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REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Drain the engine coolant.
3. Raise and properly support the vehicle.
4. Disconnect the knock sensor wiring harness.
5. Remove the knock sensor from the engine block.

CAUTION - The knock sensor is mounted in the engine block cooling passage. Engine coolant in the block will drain when the sensor is removed.

6. Installation is the reverse of removal. Tighten the sensor to 14 ft. lbs (19 Nm).

VEHICLE SPEED SENSOR (VSS)

OPERATION

The VSS is located on the transmission and sends a pulsing voltage signal to the ECM which is converted to miles per hour. This sensor mainly controls the operation of the TCC system, shift light, cruise control and activation of the EGR system.

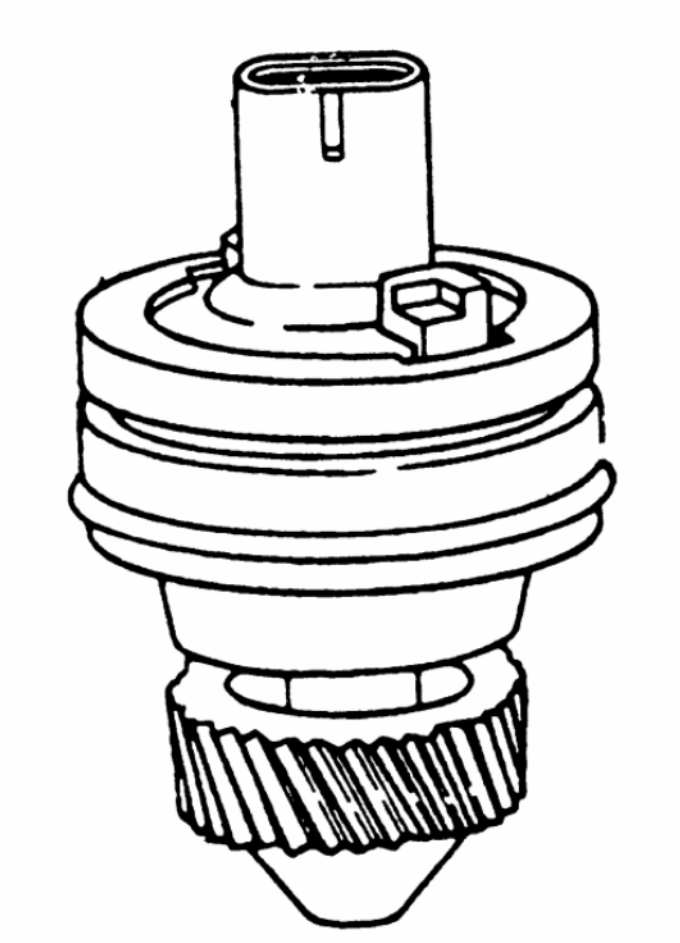


Fig. 1: Vehicle speed sensor (VSS)

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REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Raise and safely support the vehicle.
3. Disconnect the VSS electrical wiring.
4. Remove the retaining bolt.
5. Have a clean container to catch the transmission fluid and remove the VSS.
6. Remove and discard the O-ring.

To install:

7. Lubricate a new O-ring with a thin film of transmission fluid. Install the O-ring and VSS.
8. Install the retaining bolt.
9. Connect the electrical wiring.
10. Lower the vehicle.
11. Connect the negative battery cable.
12. Refill transmission to proper level.

TROUBLE CODES

SELF DIAGNOSTICS

READING CODES

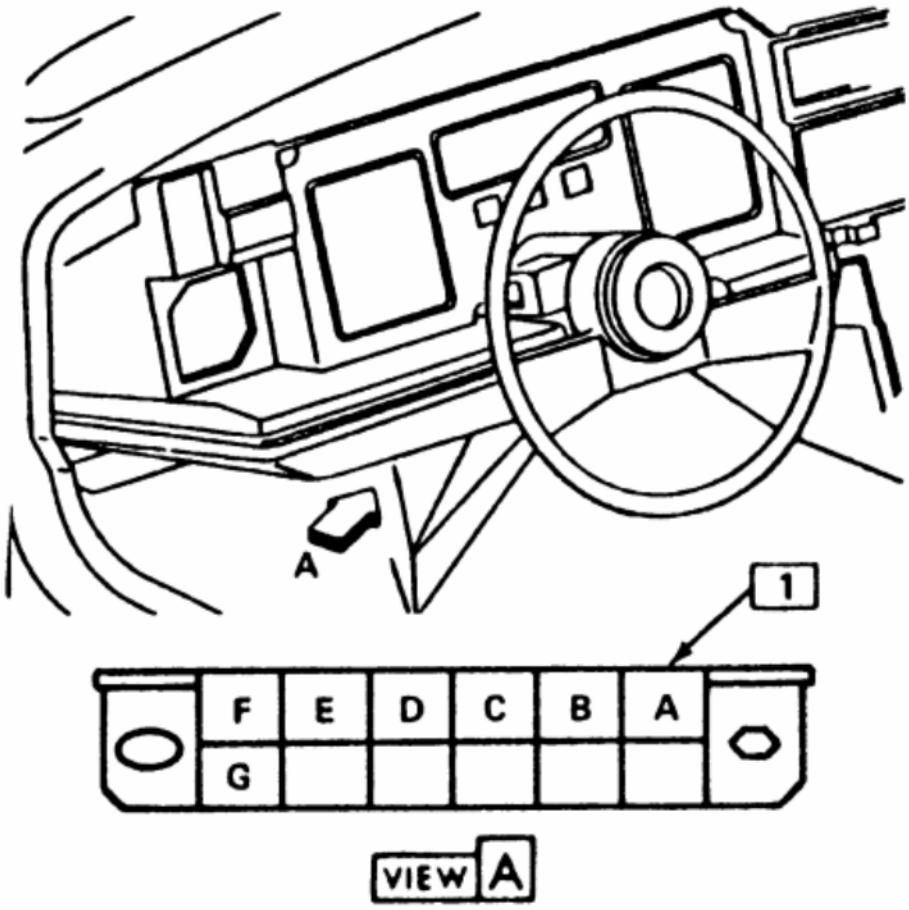
The following procedure applies to models with the 12 pin diagnostic connector only.

1. Turn the ignition switch *OFF*. Locate the Assembly Line Diagnostic Link (ALDL), usually under the instrument panel. It may be within a plastic cover or housing labeled DIAGNOSTIC CONNECTOR. This link is used to communicate with the ECM.
2. Use a small jumper wire to connect Terminal B of the ALDL to Terminal A. As the ALDL connector is viewed from the front, Terminal A is on the extreme right of the upper row; Terminal B is second from the right on the upper row.
3. After the terminals are connected, turn the ignition switch to the *ON* position but do not start the engine. The dash warning lamp should begin to flash Code 12. The code will display as one flash, a pause and two flashes. Code 12 is not a fault code. It is used as a system acknowledgment or handshake code; its presence indicates that the ECM can communicate as requested. Code 12 is used to begin every diagnostic sequence.
4. After Code 12 has been transmitted 3 times, the fault codes, if any, will each be flashed in the same manner three times. The codes are stored and transmitted in numeric order from lowest to highest.

The order of codes in the memory does not indicate the order of occurrence.

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5. If one or more codes are stored, record them. At the end of the procedure, perform a visual and physical check of each system.
6. Switch the ignition *OFF* when finished with code retrieval.



1. ALCL Connector
A. Ground
B. Diagnostic "Test Terminal"
C. A.I.R.
E. Serial data
F. T.C.C.
G. Fuel pump

Fig. 1: Diagnostic connector location shown with a 12 pin connector

VISUAL AND PHYSICAL UNDERHOOD INSPECTION

A detailed examination of connectors, wiring and vacuum hoses can often lead to a repair without further diagnosis. This step relies on the skill of the technician performing it; a careful inspector will check the undersides of hoses as well as the integrity of hard-to-reach hoses blocked by the air cleaner or other component. Wiring should be checked carefully for any sign of strain, burning, crimping, or terminal pull-out from a connector. Checking connectors at components or in harnesses is required; usually, pushing them together will reveal a loose fit. It is important to note that the fault code indicates a fault or loss of signal within that system, not necessarily the specific component. Due to the intricacy of the systems and the special testing equipment required, it is

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recommended to have a qualified technician perform any further testing, if needed.

FIELD SERVICE MODE

On fuel injected models, if the ALDL terminal B is grounded to terminal A with the engine running, the system enters the Field Service Mode. In this mode, the MIL will indicate whether the system is operating in open loop or closed loop.

If working in open loop, the MIL will flash rapidly $2^1/_2$ times per second. In closed loop, the flash rate slows to once per second. Additionally, if the system is running lean in closed loop, the lamp will be off most of the cycle. A rich condition in closed loop will cause the lamp to remain lit for most of the one second cycle.

When operating in the Field Service Mode, additional codes cannot be stored by the ECM. The closed loop timer is bypassed in this mode.

CLEARING CODES

Stored fault codes may be erased from memory at any time by removing power from the ECM for at least 30 seconds. It may be necessary to clear stored codes during diagnosis to check for any recurrence during a test drive, but the stored should be written down when retrieved. The codes may still be required for subsequent troubleshooting. Whenever a repair is complete, the stored codes must be erased and the vehicle test driven to confirm correct operation and repair.

The ignition switch must be OFF any time power is disconnected or restored to the ECM. Severe damage may result if this precaution is not observed.

Depending on the electric distribution of the particular vehicle, power to the ECM may be disconnected by removing the ECM fuse in the fusebox or disconnecting the inline ECM power lead at the positive battery terminal. Disconnecting the negative battery cable to clear codes will achieve the desired result, but this will also clear other memory data in the vehicle such as radio presets or seat memory.

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DIAGNOSTIC TROUBLE CODES

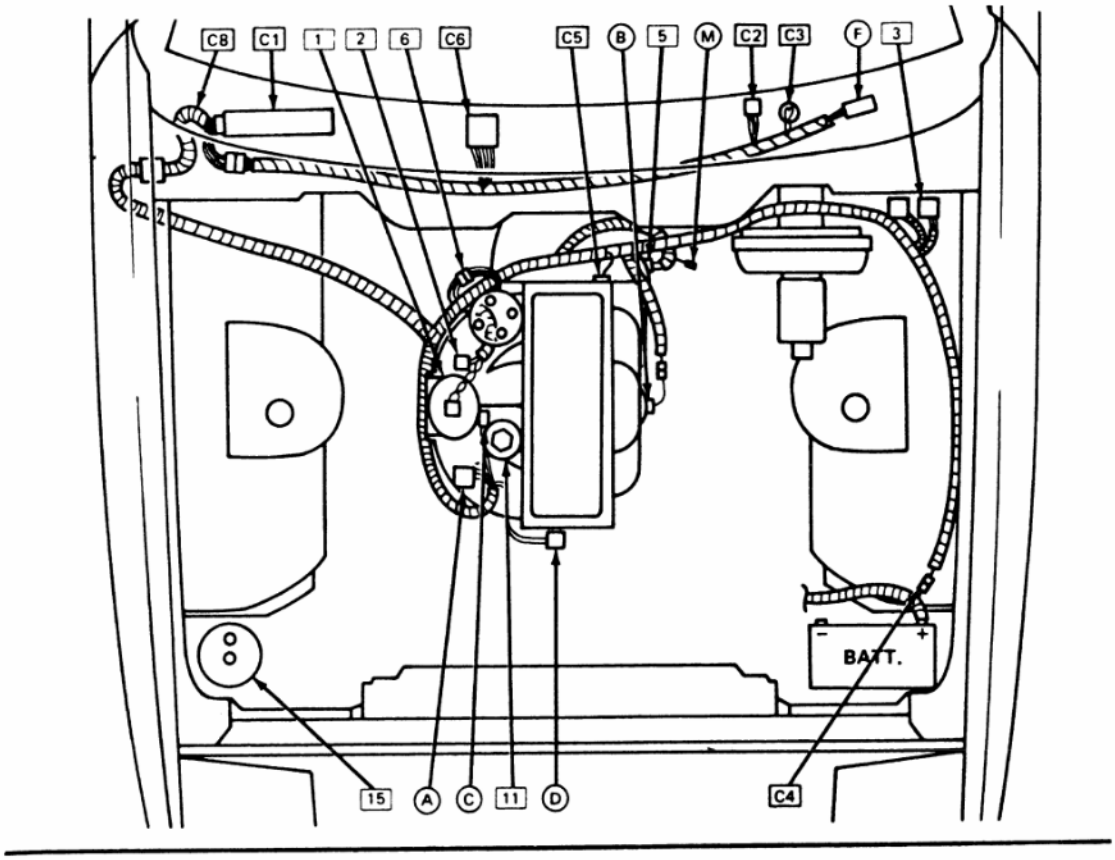
Trouble Codes	Engine (VIN) 4-2.5L (2)	6-2.8L (1)	6-2.8L (5)	6-3.1L (T)	8-5.0L (E)	8-5.0L (F)	8-5.0L (G)	8-5.0L (H)	8-5.7L (8)
12—Speed reference pulse	X ⑤	X ⑤	X ⑤	X ⑤	X ⑤	X ⑤	X ⑤	X ⑤	X ⑤
13—Oxygen sensor	X	X	X	X	X	X	X	X	X
14—CTS (Temp HI)	X	X	X	X	X	X	X	X	X
15—CTS (Temp LO)	X	X		X	X	X	X	X	X
16—System volts HI									
21—TPS (Volts HI)	X	X	X	X	X	X	X	X	X
22—TPS (Volts LO)	X		X	X	X	X			X
23—MAT (Temp LO)			X	X	X	X			X
23—M/C solenoid (open or ground)		X					X	X	
24—VSS	X	X	X	X	X	X	X	X	X
24B—Park/neutral switch									
25—MAT (Temp HI)			X	X	X	X			X
26—Quad-driver									
27/28—Gear switch									
28/29—Gear switch									
31—Park/neutral switch									
31—Wastegate overboost									
31—Canister purge (Volts HI)									
32—EGR failure		X ①	X	X	X	X	X ①	X ①	X
33—MAP (Volts HI/Vac LO)	X			X	X				
33—MAF (gm/sec HI)			X			X			X
34—MAP (Volts LO/Vac HI)	X	X ②		X	X		X ②	X ②	
34—MAF (gm/sec HI)			X			X			X
35—Idle speed error									
35—IAC				X					
36—Close throttle air flow HI									
36—MAF burn-off						X			X
38—Brake switch									
39—TCC									
41—1 X reference		X					X	X	
41—Cylinder select error/ MEM-CAL			X	X		X			X
41—Cam sensor									
42—EST	X	X	X	X	X	X	X	X	X
43—ESC		X		X	X	X	X	X	X
44—Oxygen sensor (lean)	X	X	X	X	X	X	X	X	X
45—Oxygen sensor (rich)	X	X	X	X	X	X	X	X	X
46—Power steering press switch									
46—VATS				X		X			X
48—Misfire diagnosis									

Fig. 2: Diagnostic trouble codes

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ENGINE COMPONENT LOCATIONS

COMPONENT LOCATION - 1982-1984 2.5L



"F" SERIES
2.5L (151 CID) L4 RPO: LR8 V.I.N. CODE: R

COMPUTER SYSTEM

- C1 Electronic Control Module (ECM)
- C2 ALCL Connector
- C3 "CHECK ENGINE" Light
- C4 System Power
- C5 System Ground
- C6 Fuse Panel
- C8 Computer Control Harness

AIR/FUEL SYSTEM

- 1 Throttle Body Injection
- 2 Idle Air Control
- 3 Fuel Pump Relay

TRANSMISSION CONVERTER CLUTCH CONTROL SYSTEM

- 5 Trans. Conv. Clutch Connector

IGNITION SYSTEM

- 6 Electronic Spark Timing Connector

EXHAUST GAS RECIRCULATION CONTROL SYSTEM

- 11 Exhaust Gas Recirculation Valve

FUEL VAPOR CONTROL SYSTEM

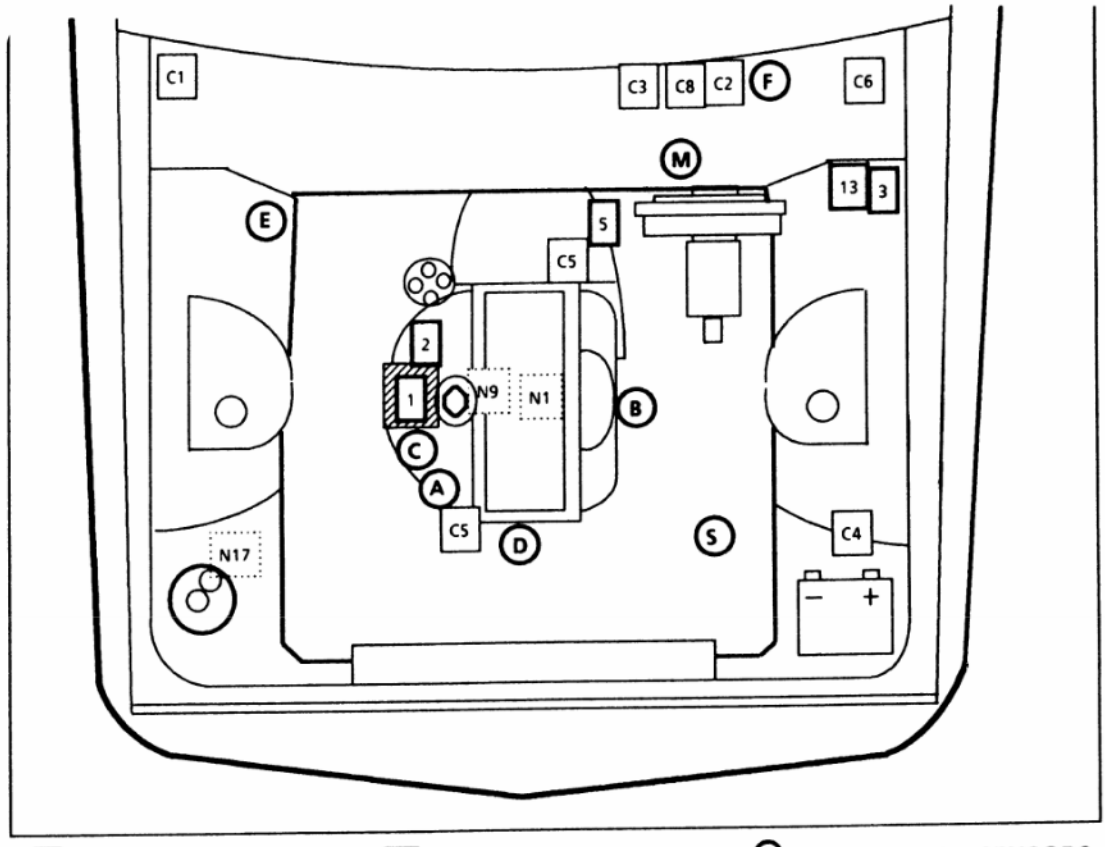
- 15 Vapor Canister

SENSORS/SWITCHES

- A Manifold Pressure Sensor
- B Exhaust Oxygen Sensor
- C Throttle Position Sensor
- D Coolant Sensor
- F Vehicle Speed Sensor
- M Fuel Pump Test Connector

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COMPONENT LOCATION - 1985-1986 2.5L



COMPUTER HARNESS

- C1 Electronic Control Module (ECM)
- C2 ALCL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C4 ECM power
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test (ALCL "G")

CONTROLLED DEVICES

- 1 Fuel injector solenoid
- 2 Idle air control valve
- 3 Fuel pump relay
- 5 Trans. Conv. Clutch connector
- 13 A/C compressor relay

Exhaust Gas Recirculation valve

INFORMATION SENSORS

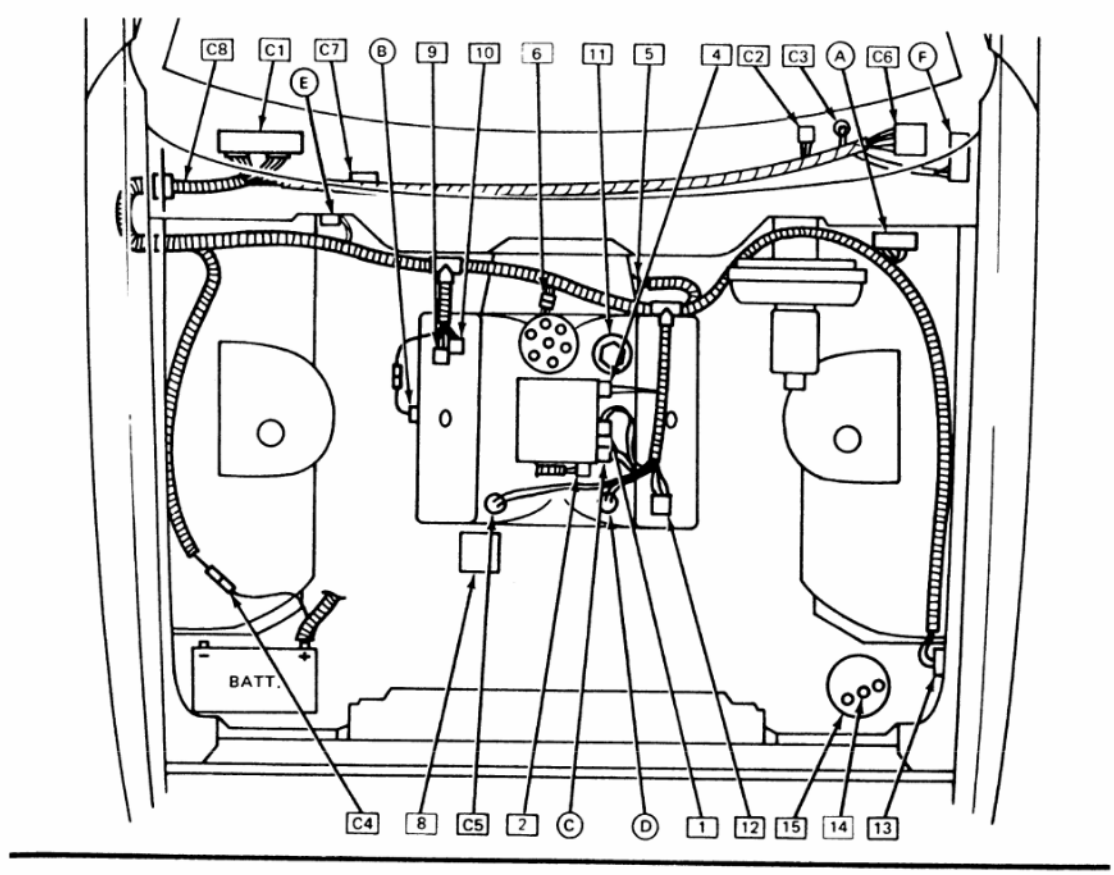
- A Manifold differential pressure
- B Exhaust oxygen
- C Throttle position
- D Coolant temperature
- F Vehicle speed
- M P/N switch / neutral start
- S Power steering switch

NOT ECM CONNECTED

- N1 Crankcase vent valve (PCV)
- N9 Exhaust Gas Recirculation valve
- N17 Fuel vapor canister

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COMPONENT LOCATION - 1982-1984 2.8L CARBURETED



"F" SERIES
2.8L (173 CID) V6 RPO: LC1/LL1 H.O. V.I.N. CODE: 1/L

COMPUTER SYSTEM
- C1 Electronic Control Module (ECM)
- C2 ALCL Connector
- C3 "CHECK ENGINE" Light
- C4 System Power
- C5 System Ground
- C6 Fuse Panel
- C7 Lamp Driver
- C8 Computer Control Harness

AIR/FUEL SYSTEM
- 1 Mixture Control
- 2 Idle Speed Solenoid
- 4 Heated Grid EFE

TRANSMISSION CONVERTER CLUTCH CONTROL SYSTEM
- 5 Trans. Conv. Clutch Connector

IGNITION SYSTEM
- 6 Electronic Spark Timing Connector

AIR INJECTION SYSTEM
- 8 Air Injection Pump
- 9 Air Control Solenoid Valve (Divert)
- 10 Air Switching Solenoid Valve

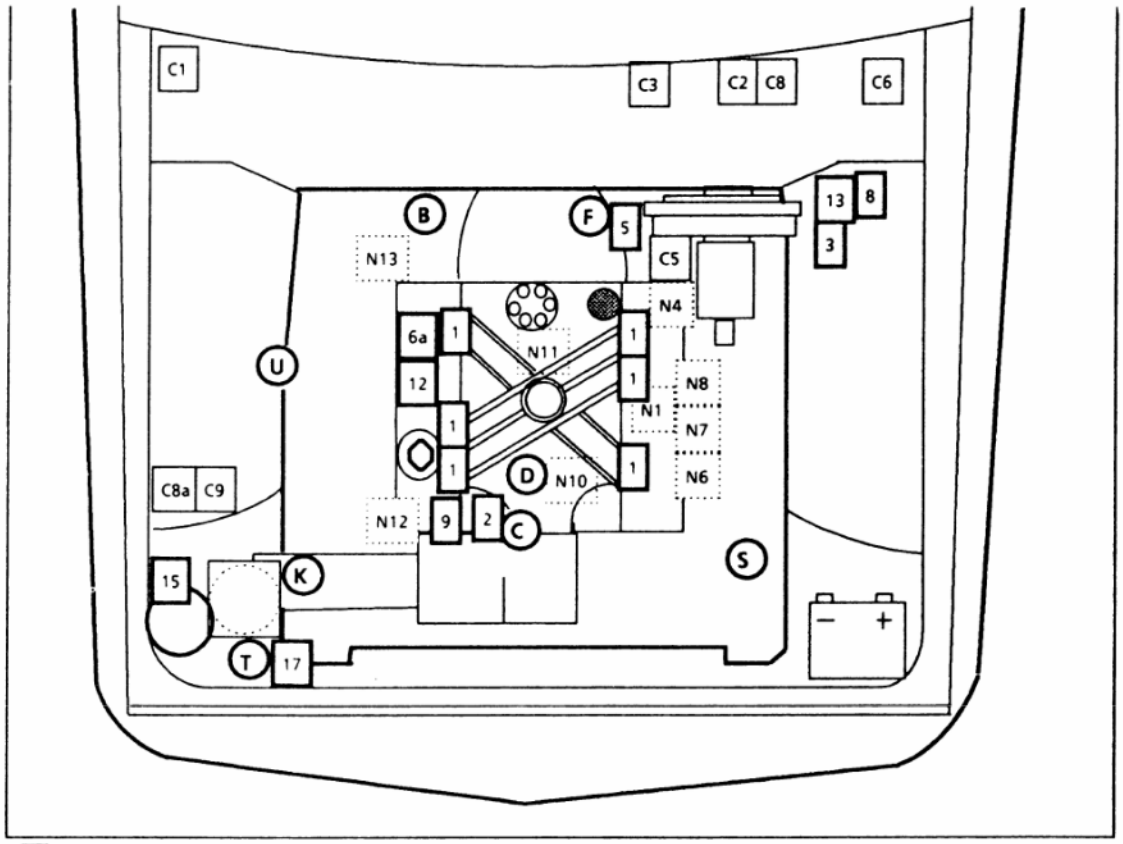
EXHAUST GAS RECIRCULATION CONTROL SYSTEM
- 11 Exhaust Gas Recirculation Valve
- 12 Exhaust Gas Recirculation Solenoid Valve

FUEL VAPOR CONTROL SYSTEM
- 13 Canister Purge Solenoid Valve
- 14 From Fuel Tank
- 15 Vapor Canister

SEM S/SWITCHES
- A Differential Pressure Sensor
- B Exhaust Oxygen Sensor
- C Throttle Position Sensor
- D Coolant Sensor
- E Barometric Pressure Sensor
- F Vehicle Speed Sensor

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COMPONENT LOCATION - 1985-1987 2.8L FUEL INJECTED



COMPUTER HARNESS

- C1 Electronic Control Module (ECM)
- C2 ALCL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector (ALCL"G")
- C8a Fuel pump/ECM fuse
- C9 MAF Fuse

NOT ECM CONNECTED

- N1 Crankcase vent (PCV) valve
- N4 Engine temp. switch(telltale)
- N4 Engine temp. sensor(gage)
- N6 Oil press. switch (telltale)
- N7 Oil press. sensor (gage)
- N8 Oil press. swich (fuel pump)
- N10 Cold start fuel injection switch
- N11 Cold start valve
- N12 Deceleration Valve
- N13 Fan override switch

CONTROLLED DEVICES

- 1 Fuel injector
- 2 Idle air control motor
- 3 Fuel pump relay
- 5 Trans. Conv. Clutch connector
- 6a Remote ignition coil
- 8 Engine coolant fan relay
- 9 Air injection control valve (M.T. only)
- 12 Exhaust Gas Recirculation solenoid
- 13 A/C compressor relay
- 15 Fuel vapor canister solenoid
- 17 Mass air flow sensor relay

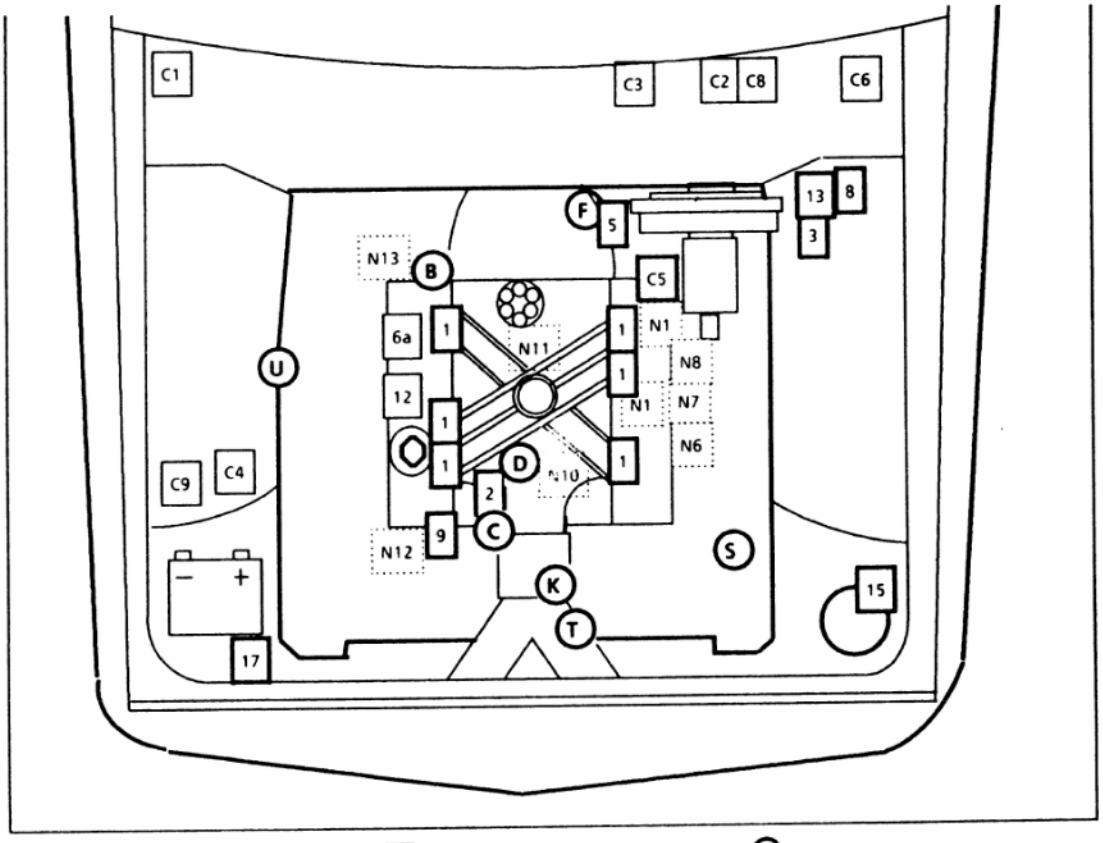
Exhaust Gas Recirculation valve

INFORMATION SENSORS

- B Exhaust oxygen
- C Throttle position
- D Coolant temperature
- F Vehicle speed
- K Mass Air Flow
- S Power steering pressure switch
- T Manifold Air Temperature
- U A/C pressure fan switch

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COMPONENT LOCATION - 1988-1989 2.8L FUEL INJECTED



COMPUTER HARNESS

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C4 ECM power/fuel pump fuse
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector (ALDL"G")
- C9 MAF fuse

NOT ECM CONNECTED

- N1 Crankcase vent valve (PCV)
- N4 Engine temp. switch (telltale)
- N5 Engine temp. sensor (gage)
- N6 Oil press. switch (telltale)
- N7 Oil press. sensor (gage)
- N8 Oil press. swich (fuel pump)
- N10 Cold start fuel injection switch
- N11 Cold start valve
- N12 Deceleration Valve (M/T only)
- N13 Fan Override Switch

CONTROLLED DEVICES

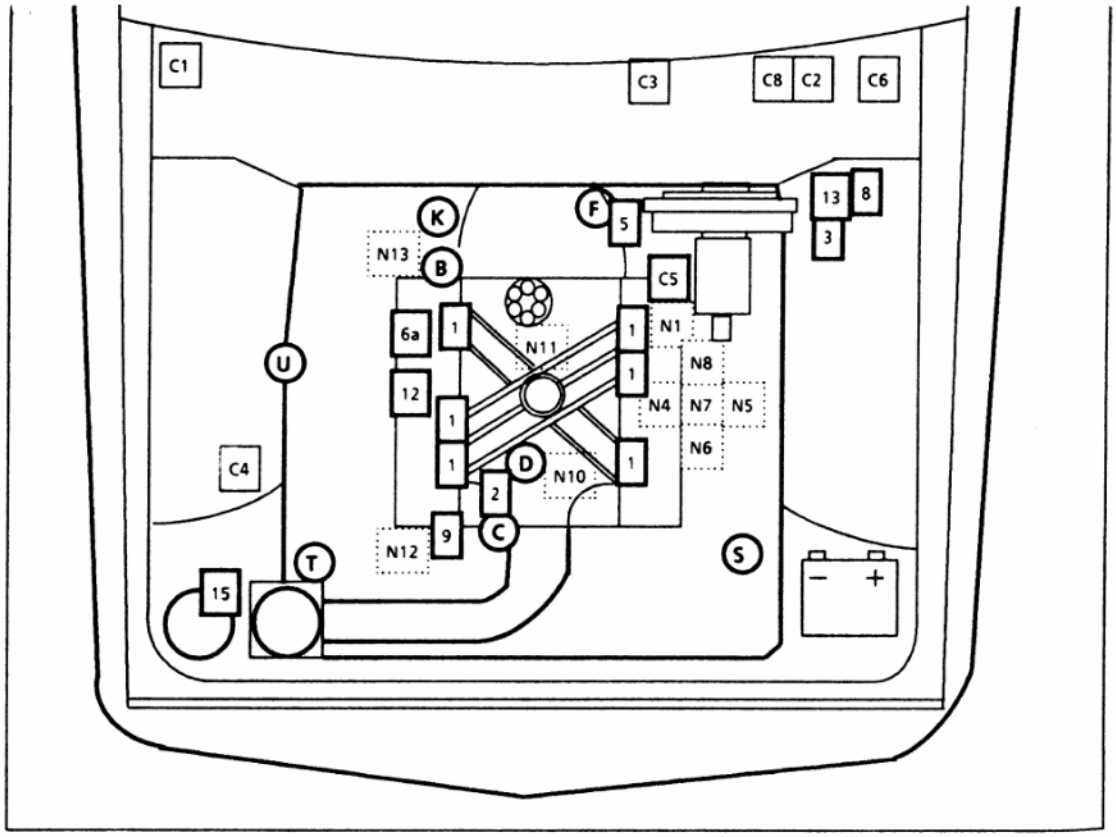
- 1 Fuel injector
- 2 Idle air control motor
- 3 Fuel pump relay
- 5 Trans. Conv. Clutch connector
- 6a Remote ignition coil
- 8 Engine coolant fan relay
- 9 Air control solenoid (M.T. only)
- 12 Exhaust Gas Recirculation solenoid
- 13 A/C compressor relay
- 15 Fuel vapor canister solenoid
- 17 Mass air flow sensor relay
- Exhaust Gas Recirculation valve

INFORMATION SENSORS

- B Exhaust oxygen
- C Throttle position
- D Coolant temperature
- F Vehicle speed
- K Mass Air Flow
- S Power steering pressure switch
- T Manifold Air Temperature
- U A/C pressure fan switch

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COMPONENT LOCATION - 1990-1992 3.1L



COMPUTER HARNESS

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C4 ECM power/fuel pump fuse
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector (ALDL"G")

NOT ECM CONNECTED

- Crankcase vent valve (PCV)
- N4 Engine temp. switch (telltale)
- N5 Engine temp. sensor (gage)
- N6 Oil press. switch (telltale)
- N7 Oil press. sensor (gage)
- N8 Oil press. swich (fuel pump)
- N10 Cold start fuel injection switch
- N11 Cold start valve
- N12 Deceleration Valve (M/T only)
- N13 Fan Override Switch

CONTROLLED DEVICES

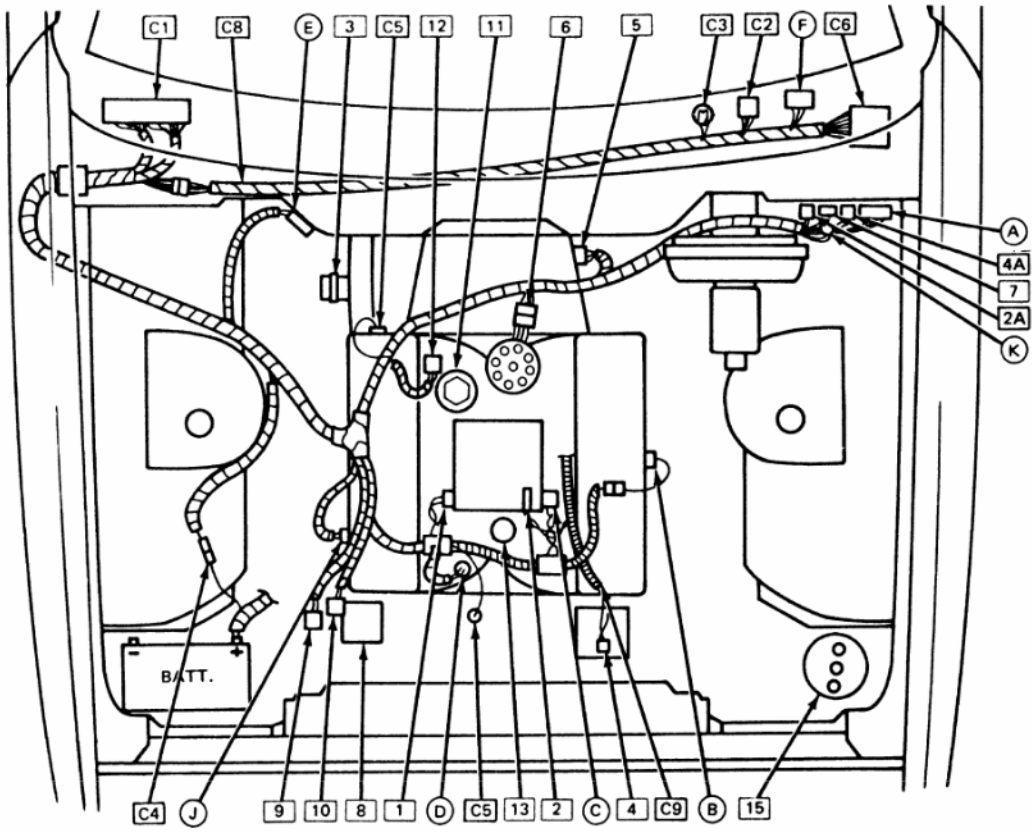
- 1 Fuel injector
- 2 Idle air control motor
- 3 Fuel pump relay
- 5 Trans. Conv. Clutch connector
- 6a Remote ignition coil
- 8 Engine coolant fan relay
- 9 Air control solenoid (M.T. only)
- 12 Exhaust Gas Recirculation valve
- 13 A/C compressor relay
- 15 Fuel vapor canister solenoid

INFORMATION SENSORS

- B Exhaust oxygen sensor
- C Throttle position sensor
- D Coolant Temperature sensor
- F Vehicle speed sensor
- K Manifold absolute pressure sensor
- S Power steering pressure switch
- T Manifold Air Temperature sensor
- U A/C pressure fan switch

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COMPONENT LOCATION - 1982-1984 5.0L CARBURETED



"F" SERIES
5.0L (305 CID) V8 RPO: LG4/L69 V.I.N. CODE: H/G

COMPUTER SYSTEM

- C1 Electronic Control Module (ECM)
- C2 ALCL Connector
- C3 "CHECK ENGINE" Light
- C4 Code Memory Power
- C5 System Ground
- C6 Fuse Panel
- C8 Computer Control Harness
- C9 Engine Harness

AIR/FUEL SYSTEM

- 1 Mixture Control
- 2 Idle Speed Solenoid
- 2A Throttle Kicker Control
- 3 EFE Valve
- 4 A/C Clutch Control
- 4A Engine Fan Relay

TRANSMISSION CONVERTER CLUTCH CONTROL SYSTEM

- 5 Trans. Conv. Clutch Connector

IGNITION SYSTEM

- 6 Electronic Spark Timing Connector
- 7 Electronic Spark Control (ESC) L69 Only

AIR INJECTION SYSTEM

- 8 Air Injection Pump
- 9 Air Control Solenoid Valve
- 10 Air Switching Solenoid Valve

EXHAUST GAS RECIRCULATION CONTROL SYSTEM

- 11 Exhaust Gas Recirculation Valve
- 12 Exhaust Gas Recirculation Solenoid Valve

FUEL VAPOR CONTROL SYSTEM

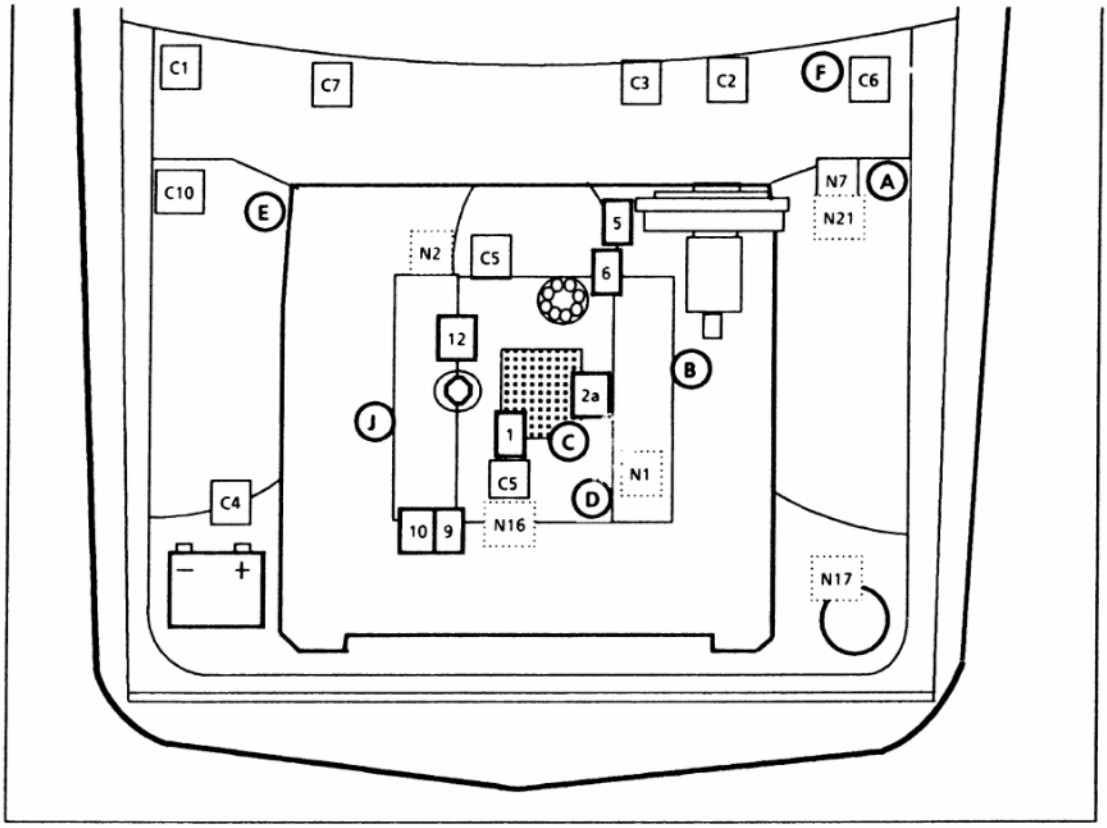
- 13 Canister Purge Valve
- 15 Vapor Canister

SENSORS/SWITCHES

- A Differential Pressure Sensor
- B Exhaust Oxygen Sensor
- C Throttle Position Sensor
- D Coolant Sensor
- E Barometric Pressure Sensor
- F Vehicle Speed Sensor
- J ESC Sensor (Knock) L69 Only
- K Hood Louver Vacuum Switch

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COMPONENT LOCATION - 1985-1987 5.0L CARBURETED



COMPUTER HARNESS

- C1 Electronic Control Module (ECM)
- C2 ALCL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C4 ECM power
- C5 ECM harness ground (2)
- C6 Fuse panel
- C7 "C. E." lamp driver
- C10 M/C dwell connector

NOT ECM CONNECTED

- N1 Crankcase vent (PCV) valve
- N2 Intake manifold warming (EFE)
- N16 Fuel vapor canister valve
- N17 Fuel vapor canister
- N21 Engine fan relay

CONTROLLED DEVICES

- 1 Mixture control solenoid
- 2a Electric throttle kicker (idle solenoid)
- 5 Trans. Conv. Clutch connector
- 6 Electronic Spark Timing Connector
- 7 Electronic Spark Control module
- 9 Air injection divert valve
- 10 Air injection switching valve
- 12 Exhaust Gas Recirc. solenoid (PWM)

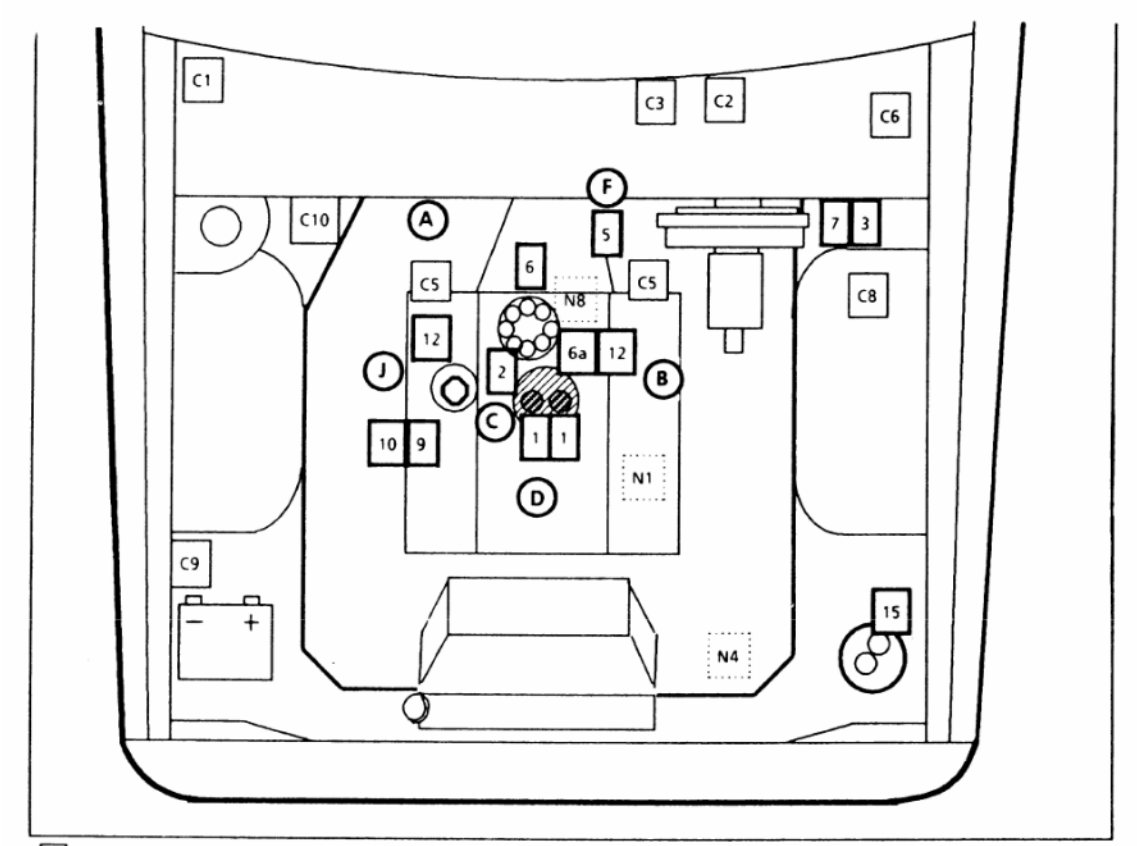
Exhaust Gas Recirculation valve

INFORMATION SENSORS

- A Differential Pressure (VAC)
- B Exhaust oxygen
- C Throttle position
- D Coolant temperature
- E Barometric pressure
- F Vehicle speed
- J ESC knock

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COMPONENT LOCATION - 1988-1990 5.0L TBI



COMPUTER HARNESS

- C1 Electronic Control Module
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness grounds
- C6 Fuse panel
- C8 Fuel pump test connector
- C9 Fuel pump fuse & ECM power
- C10 Set timing connector

NOT ECM CONNECTED

- N1 Crankcase vent valve (PCV)
- N4 P/S Switch
- N8 Oil pressure switch

CONTROLLED DEVICES

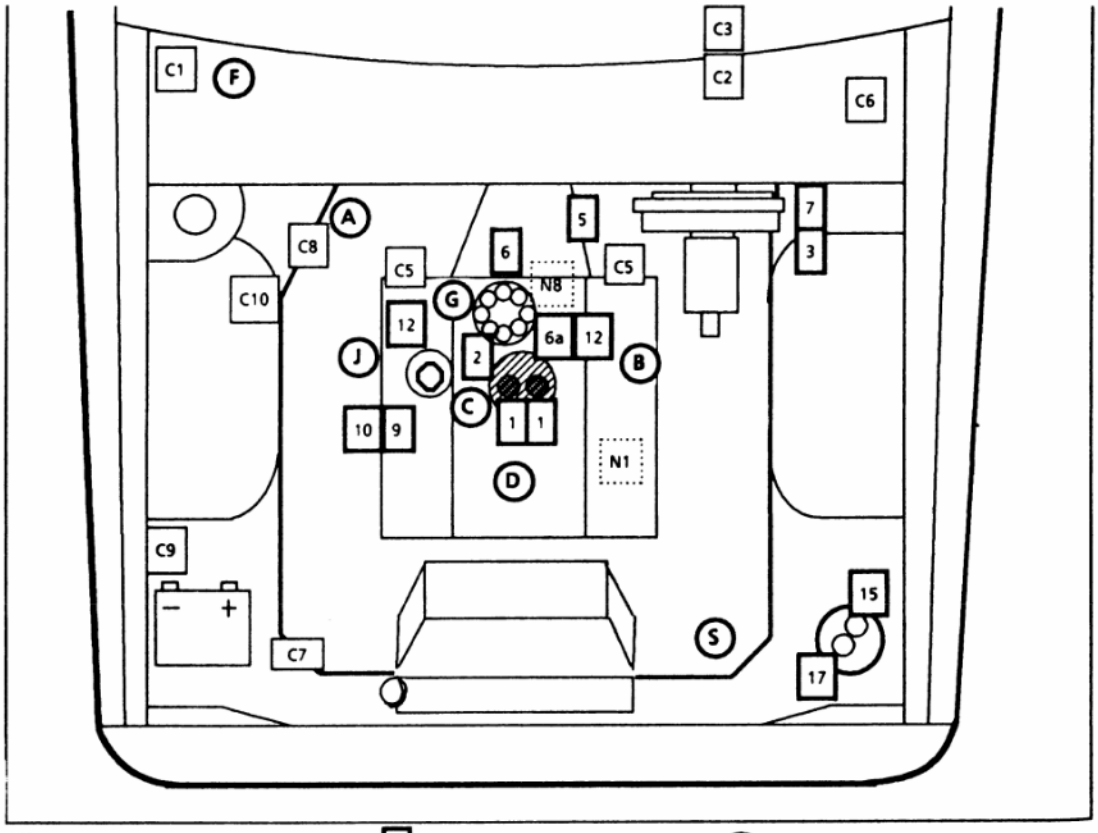
- 1 Fuel injectors
- 2 Idle air control motor
- 3 Fuel pump relay
- 5 Trans. Conv. Clutch connector
- 6 EST distributor
- 6a Remote ignition coil
- 7 Electronic Spark Control module
- 9 Air injection port solenoid
- 10 Air injection converter solenoid
- 12 Exh. Gas Recirc. vacuum solenoid
- 15 Fuel vapor canister solenoid
- Exhaust Gas Recirculation valve

INFORMATION SENSORS

- A Manifold Absolute Pressure
- B Exhaust oxygen
- C Throttle position
- D Coolant temperature
- F Vehicle speed
- J ESC knock
- MAT (on air cleaner)

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COMPONENT LOCATION - 1991-1992 5.0L TBI



COMPUTER HARNESS
- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C5 ECM harness grounds
- C6 Fuse panel
- C7 Battery junction block
- C8 Fuel pump test connector
- C9 Fuel pump/ECM fuse
- C10 Set timing connector

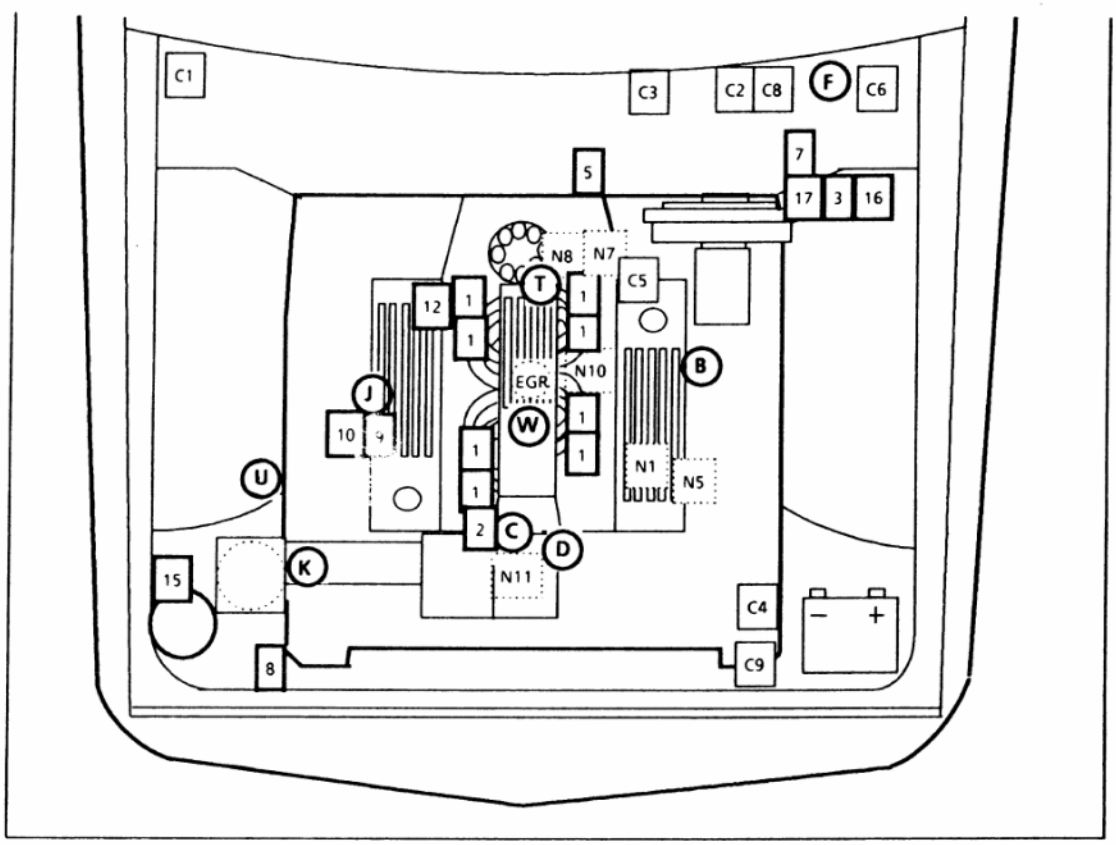
NOT ECM CONNECTED
- N1 Crankcase vent valve (PCV)
- N8 Oil pressure switch

CONTROLLED DEVICES
- 1 Fuel injector
- 2 Idle air control motor
- 3 Fuel pump relay
- 5 Torque converter clutch connector
- 6 EST distributor
- 6a Remote ignition coil
- 7 Electronic spark control module
- 9 AIR port solenoid
- 10 AIR converter solenoid
- 12 EGR solenoid
- 15 Fuel vapor canister solenoid
- 17 Fuel vapor canister
- Exhaust Gas Recirculation valve

INFORMATION SENSORS
- A Manifold absolute pressure
- B Exhaust oxygen
- C Throttle position
- D Coolant temperature
- F Vehicle speed (buffer)
- G MAT (in air cleaner)
- J ESC knock
- S Power steering pressure switch

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COMPONENT LOCATION - 1986 5.0L TUNED PORT INJECTION



COMPUTER HARNESS

- C1 Electronic Control Module (ECM)
- C2 ALCL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C4 ECM power
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector (ALCL "G")
- C9 Fuel pump/ECM fuse

NOT ECM CONNECTED

- N1 Crankcase vent valve (PCV)
- N5 Engine temp. sensor (gage.overheat)
- N7 Oil pressure sensor (gage)
- N8 Oil pressure switch (fuel pump)
- N10 Cold start valve
- N11 Cold start fuel injection switch

CONTROLLED DEVICES

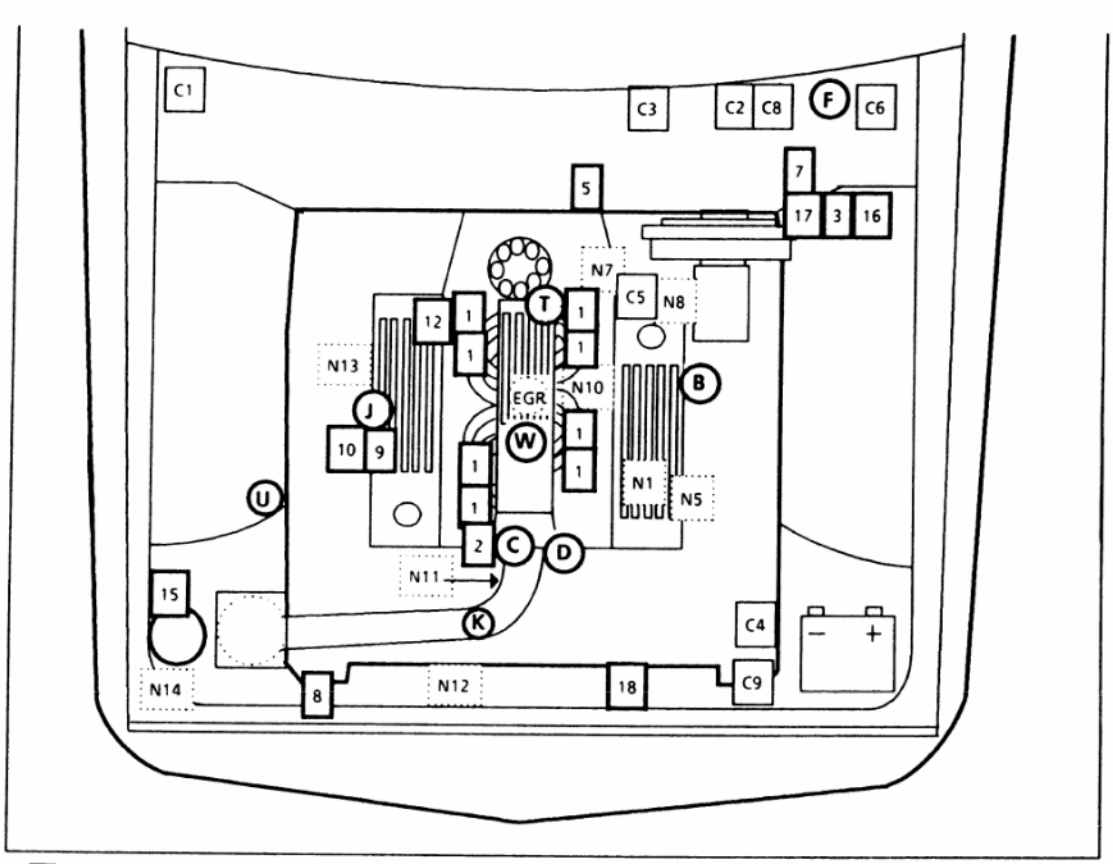
- 1 Fuel injector
- 2 Idle air control motor
- 3 Fuel pump relay
- 5 Trans. Converter Clutch connector
- 7 Electronic Spark Control module
- 8 Engine cooling fan relay
- 9 Air injection divert valve
- 10 Air injection switching valve
- 12 Exh. Gas Recirc. vacuum solenoid
- 15 Fuel vapor canister solenoid
- 16 MAF sensor power relay
- 17 MAF sensor burn-off relay

INFORMATION SENSORS

- B Exhaust oxygen
- C Throttle position
- D Coolant temperature
- F Vehicle speed
- J ESC knock
- K Mass Air Flow
- T Manifold Air Temperature
- U A/C pressure fan switch
- W EGR temp. diagnostic switch

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COMPONENT LOCATION - 1987-1989 5.0L AND 5.7L TUNED PORT INJECTION



COMPUTER HARNESS

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C4 ECM power
- C5 ECM harness ground
- C6 Fuse panel
- C8 Fuel pump test connector (ALDL "G")
- C9 Fuel pump/ECM fuse

NOT ECM CONNECTED

- N1 Crankcase vent valve (PCV)
- N5 Engine temp. sensor (gage overheat)
- N7 Oil pressure sensor (gage)
- N8 Oil pressure switch (fuel pump)
- N10 Cold start valve
- N11 Cold start fuel injection switch
- N12 Secondary cooling fan
- N13 Cooling fan temperature switch
- N14 Secondary cooling fan relay

CONTROLLED DEVICES

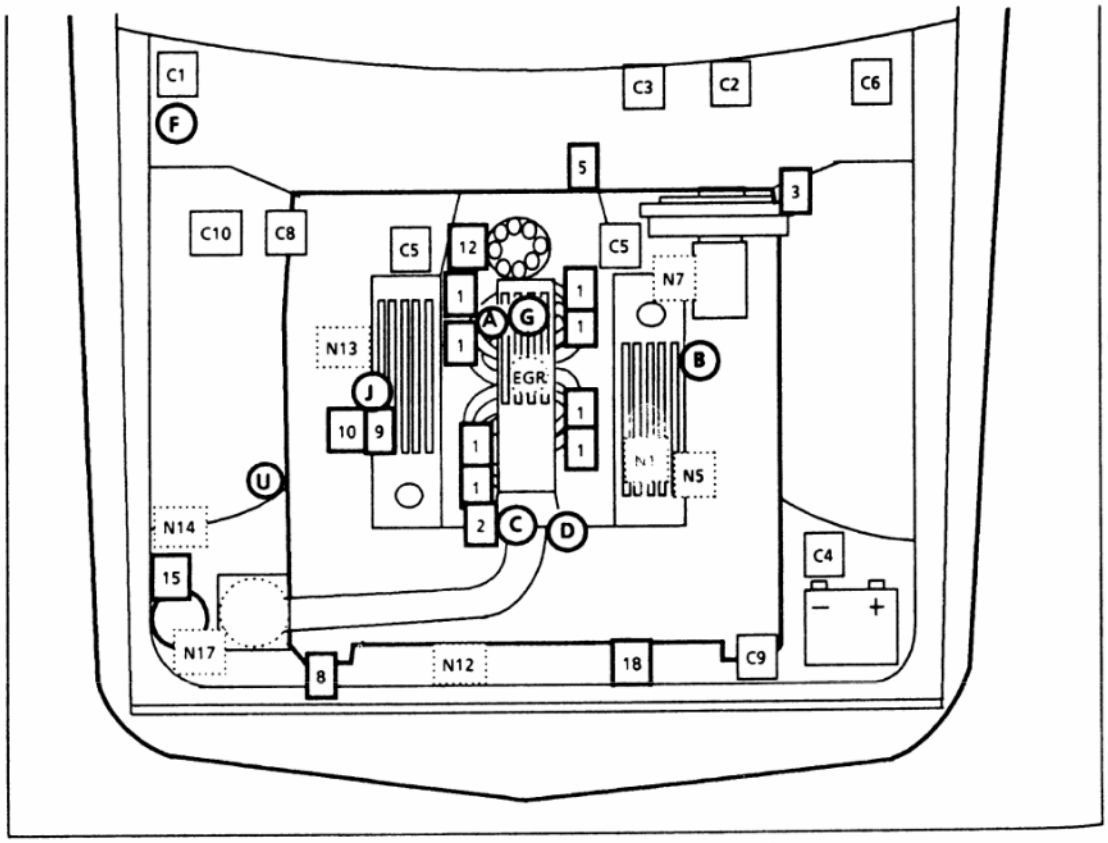
- 1 Fuel injector
- 2 Idle air control motor
- 3 Fuel pump relay
- 5 Trans. Converter Clutch connector
- 7 Electronic Spark Control module
- 8 Primary cooling fan relay
- 9 Air injection converter/divert solenoid
- 10 Air injection port solenoid
- 12 EGR vacuum solenoid
- 15 Fuel vapor canister solenoid
- 16 MAF sensor power relay
- 17 MAF sensor burn-off relay
- 18 Primary cooling fan

INFORMATION SENSORS

- B Exhaust oxygen
- C Throttle position
- D Coolant temperature
- F Vehicle speed
- J ESC knock
- K Mass Air Flow
- T Manifold Air Temperature
- U A/C pressure fan switch
- W EGR temp. diagnostic switch

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COMPONENT LOCATION - 1990 5.0L AND 5.7L TUNED PORT INJECTION



COMPUTER HARNESS

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C4 Power Feed Connectors
- C5 ECM harness grounds
- C6 Fuse panel
- C8 Fuel pump test connector
- C9 Fuel pump/ECM fuse
- C10 Set timing connector

NOT ECM CONNECTED

- N1 Crankcase vent valve (PCV)
- N5 Engine temp. sensor (gage overheat)
- N7 Oil pressure sensor (gage) and switch (fuel pump)
- N12 Secondary cooling fan
- N13 Cooling fan temperature switch
- N14 Secondary cooling fan relay
- N17 Fuel Vapor Canistor

CONTROLLED DEVICES

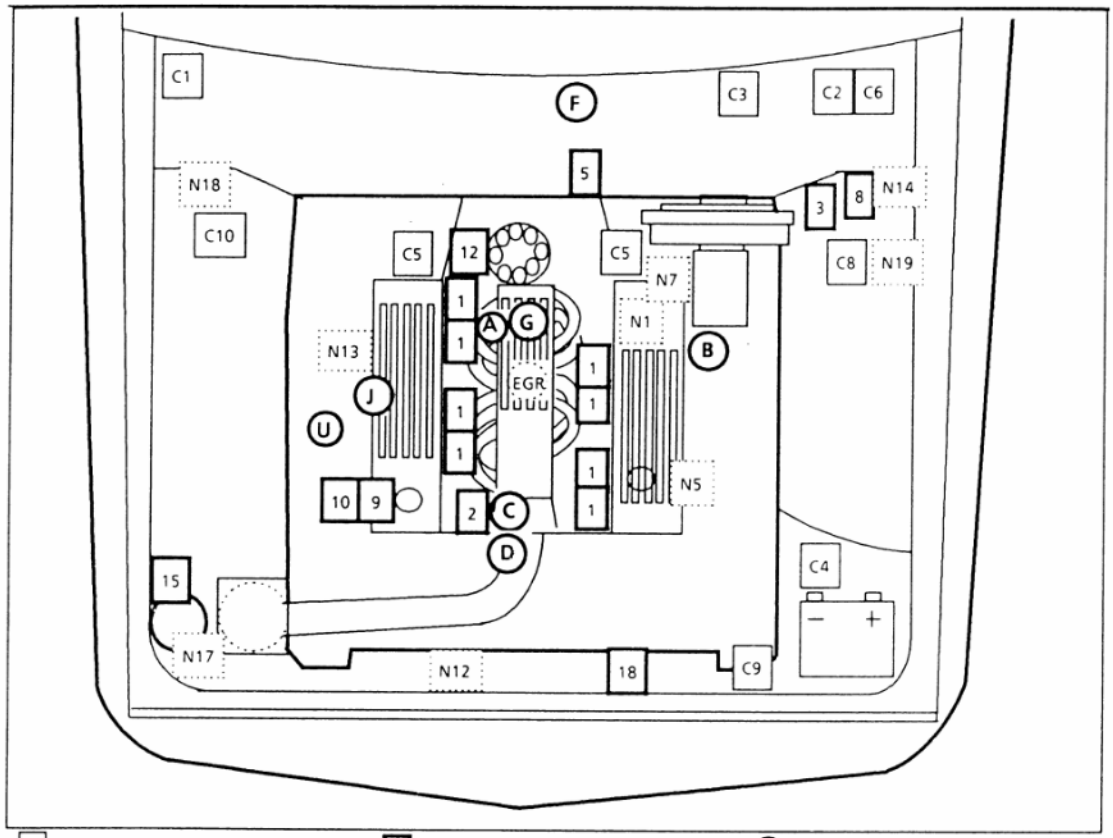
- 1 Fuel injector
- 2 Idle air control motor
- 3 Fuel pump relay
- 5 Torque converter clutch connector
- 8 Primary cooling fan relay
- 9 AIR port solenoid
- 10 AIR converter solenoid
- 12 EGR solenoid
- 14 Fuel vapor canister
- 15 Fuel vapor canister solenoid
- 18 Primary cooling fan

INFORMATION SENSORS

- A Manifold Absolute Pressure
- B Exhaust oxygen
- C Throttle position
- D Coolant temperature
- F Vehicle speed (buffer)
- G Manifold air temperature
- J ESC knock sensor
- U Fan control switch (A/C Pressure)

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COMPONENT LOCATION - 1991-1992 5.0L AND 5.7L TUNED PORT INJECTION



COMPUTER HARNESS

- C1 Electronic Control Module (ECM)
- C2 ALDL diagnostic connector
- C3 "SERVICE ENGINE SOON" light
- C4 Power feed connector
- C5 ECM harness grounds
- C6 Fuse panel
- C8 Fuel pump test connector
- C9 Fuel pump/ECM fuse
- C10 Set timing connector

NOT ECM CONNECTED

- N1 Positive Crankcase Ventilation (PCV) Valve
- N5 Engine temp. sensor (gage overheat)
- N7 Oil pressure sensor (gage) and switch (fuel pump)
- N12 Secondary cooling fan
- N13 Cooling fan temperature switch
- N14 Secondary cooling fan relay
- N17 Fuel vapor canistor
- N18 High blower relay

CONTROLLED DEVICES

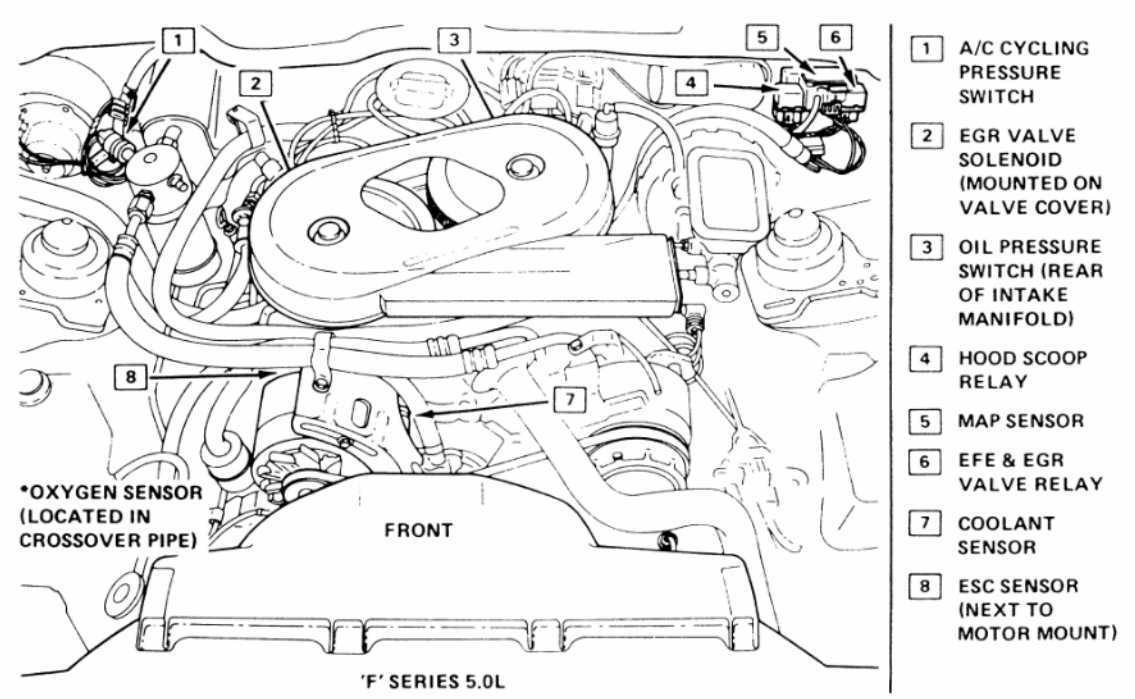
- 1 Fuel injector
- 2 Idle Air Control (IAC) valve
- 3 Fuel pump relay
- 5 Torque Converter Clutch (TCC) connector
- 8 Primary cooling fan relay
- 9 AIR port solenoid
- 10 AIR converter solenoid
- 12 EGR solenoid
- 15 Fuel vapor canister solenoid
- 18 Primary cooling fan

INFORMATION SENSORS

- A Manifold Absolute Pressure (MAP)
- B Exhaust Oxygen (O_2) sensor
- C Throttle Position Sensor (TPS)
- D Coolant Temperature Sensor (CTS)
- F Vehicle Speed Sensor (VSS)
- G Manifold Air Temperature (MAT)
- J ESC knock sensor
- U A/C cooling fan switch

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COMPONENT LOCATION - CROSS-FIRE FUEL INJECTION



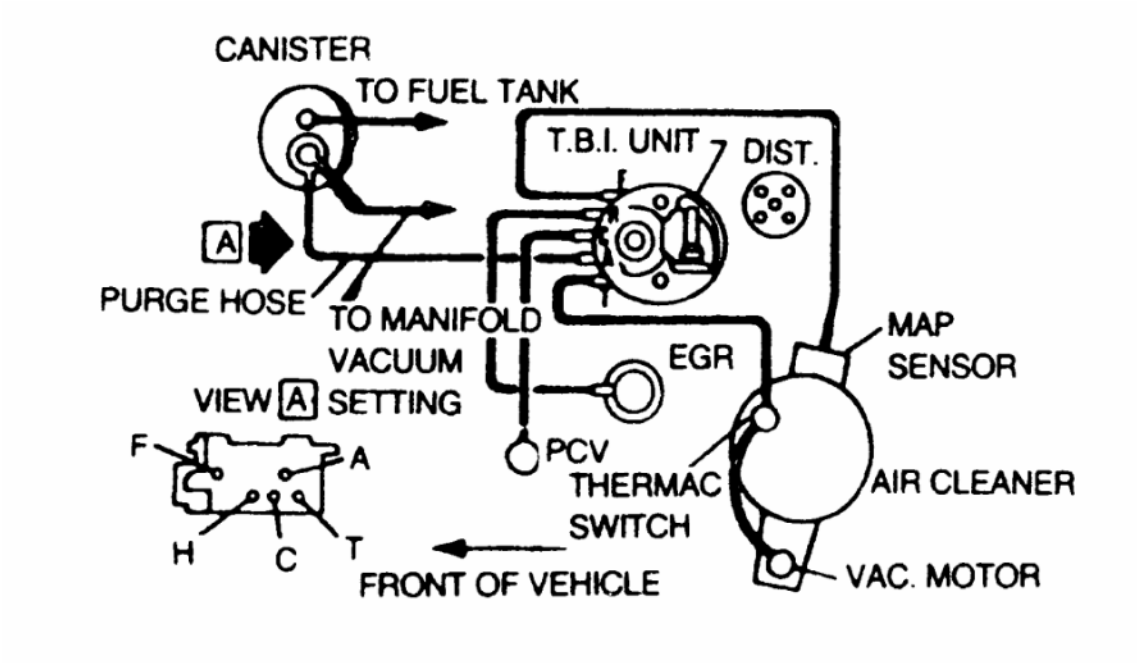
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VACUUM DIAGRAMS

Following are vacuum diagrams for most of the engine and emissions package combinations covered by this information. Because vacuum circuits will vary based on various engine and vehicle options, always refer first to the vehicle emission control information label, if present. Should the label be missing, or should vehicle be equipped with a different engine from the vehicle's original equipment, refer to the diagrams below for the same or similar configuration.

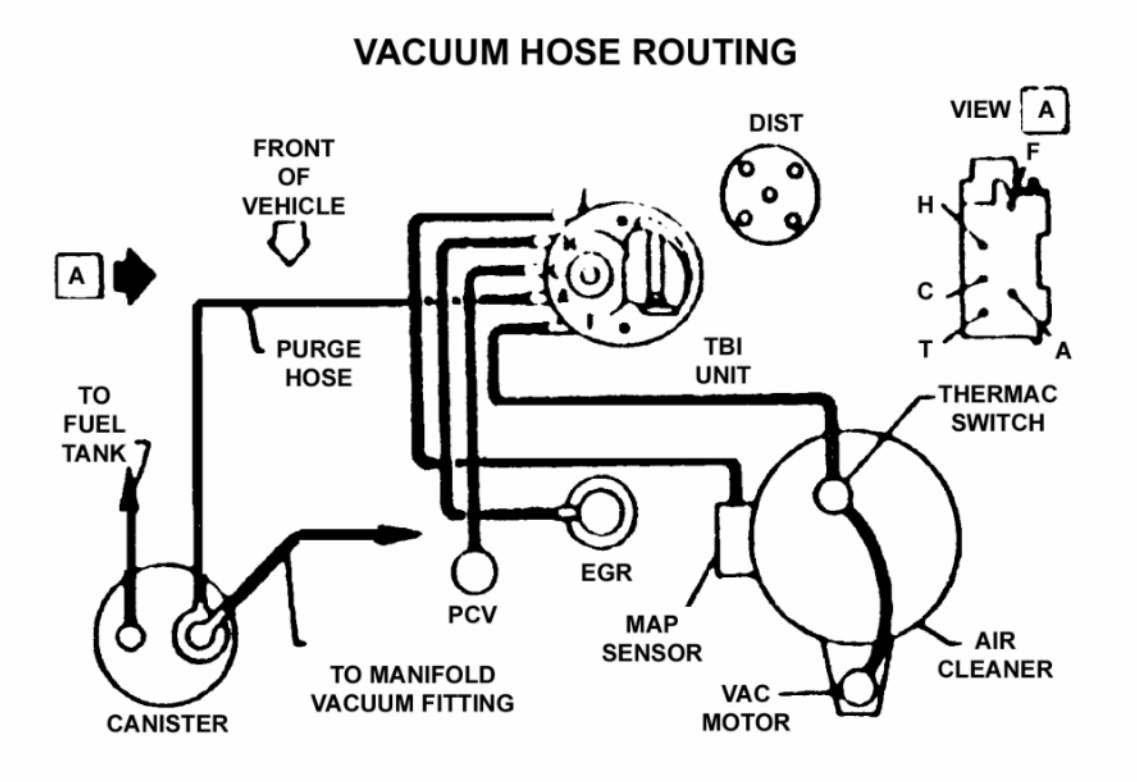
If you wish to obtain a replacement emissions label, most manufacturers make the labels available for purchase. The labels can usually be ordered from a local dealer.

1982-1984 2.5L TBI

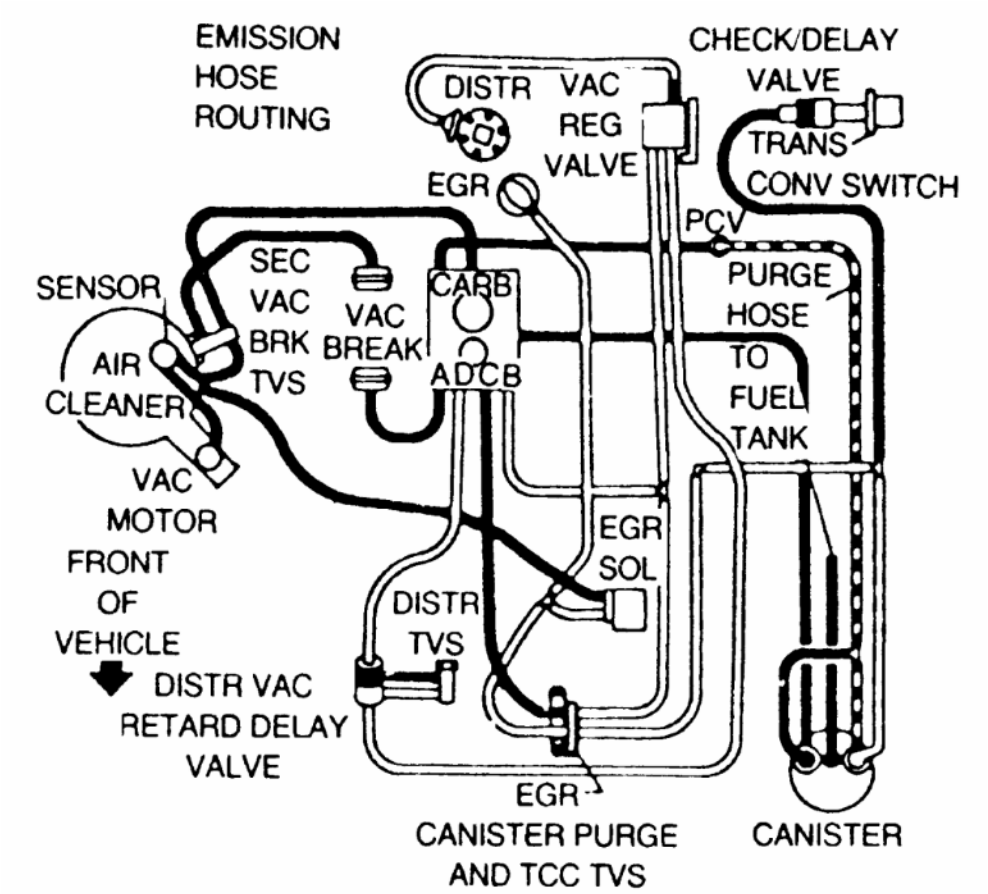


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1985-1986 2.5L TBI

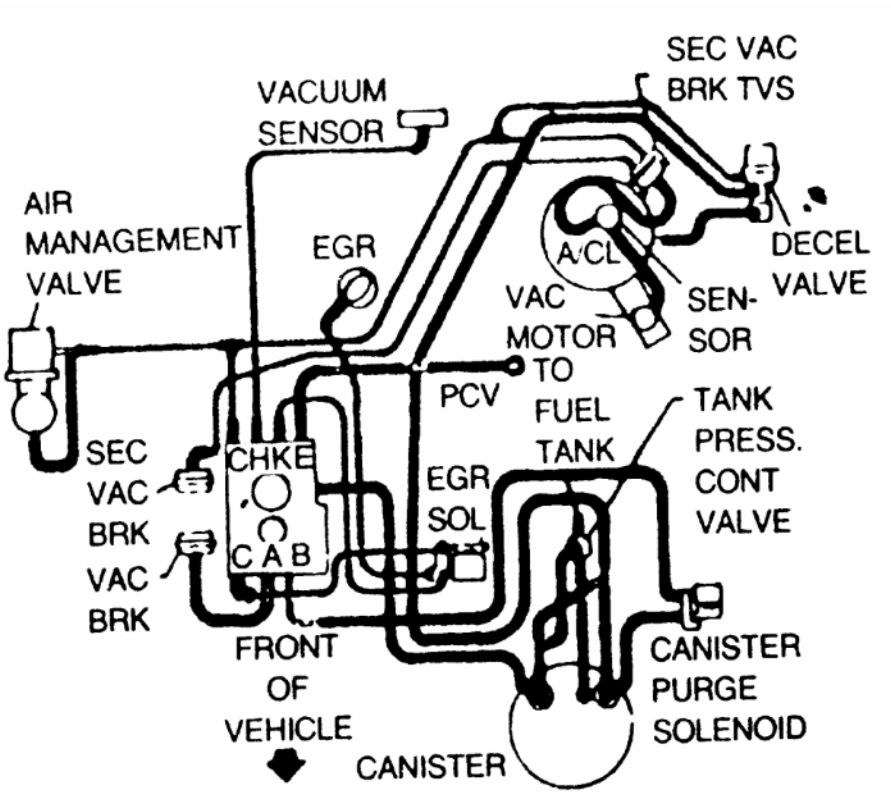


1982 2.8L CARBURETED

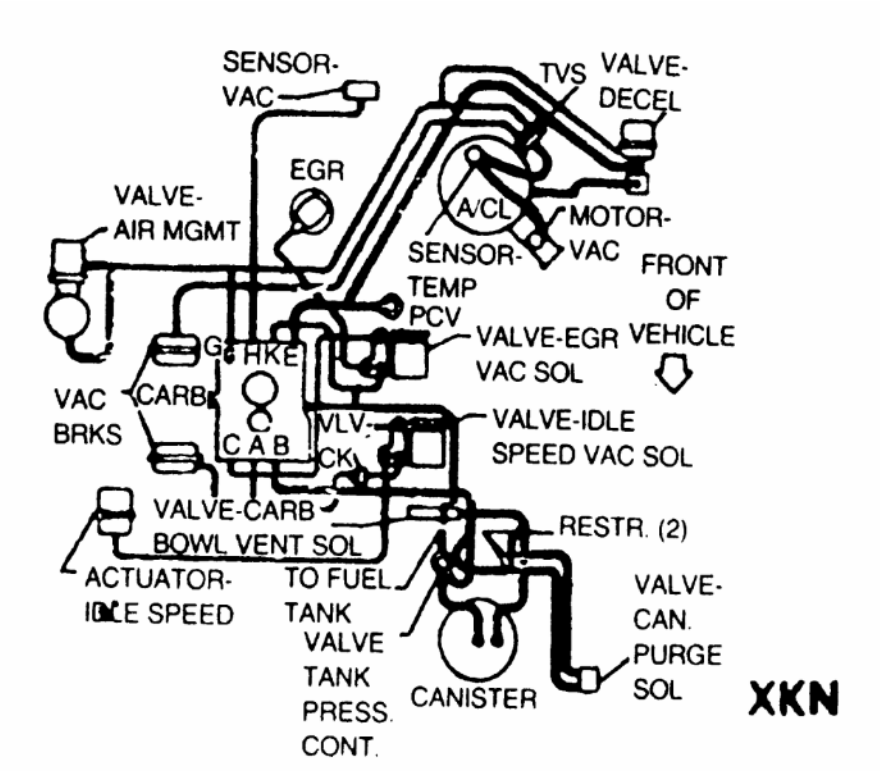


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1983 2.8L CARBURETED

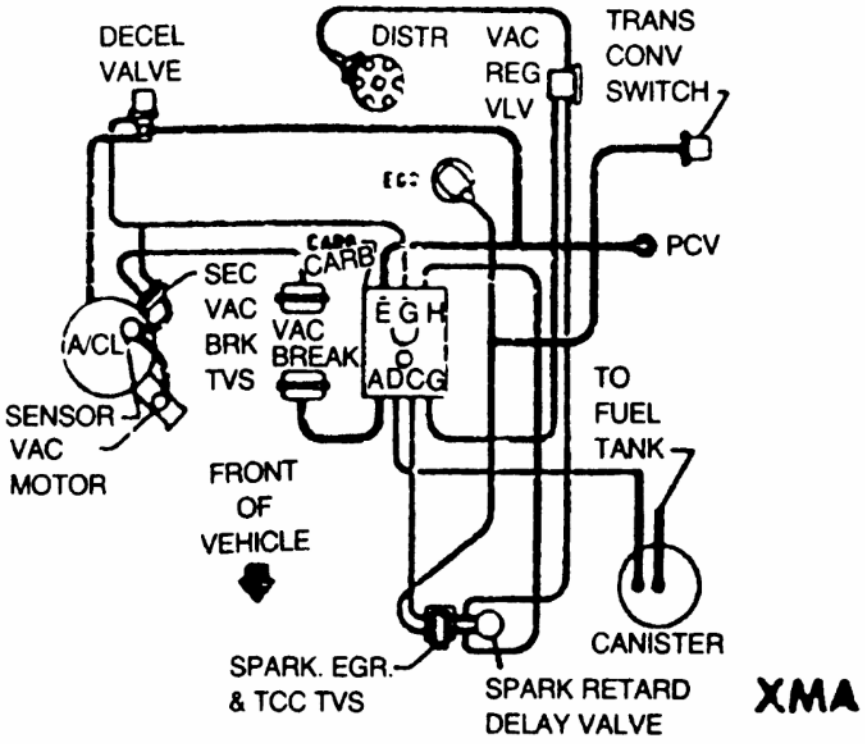


1984 2.8L CARBURETED; EXCEPT CANADA

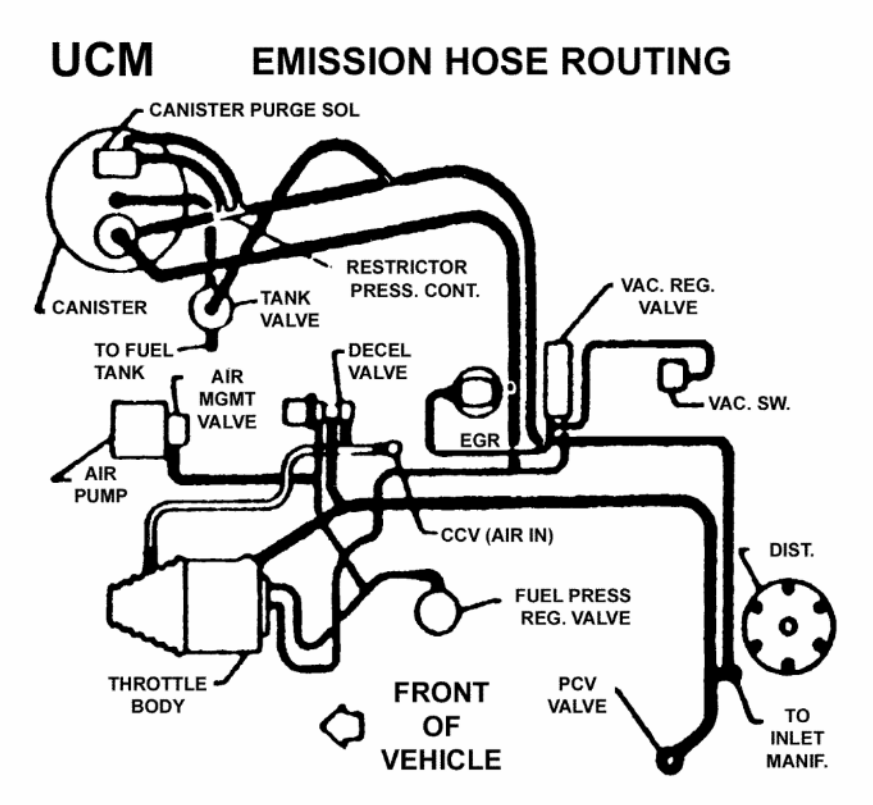


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FIG. 6: 1984 2.8L CARBURETED; CANADA

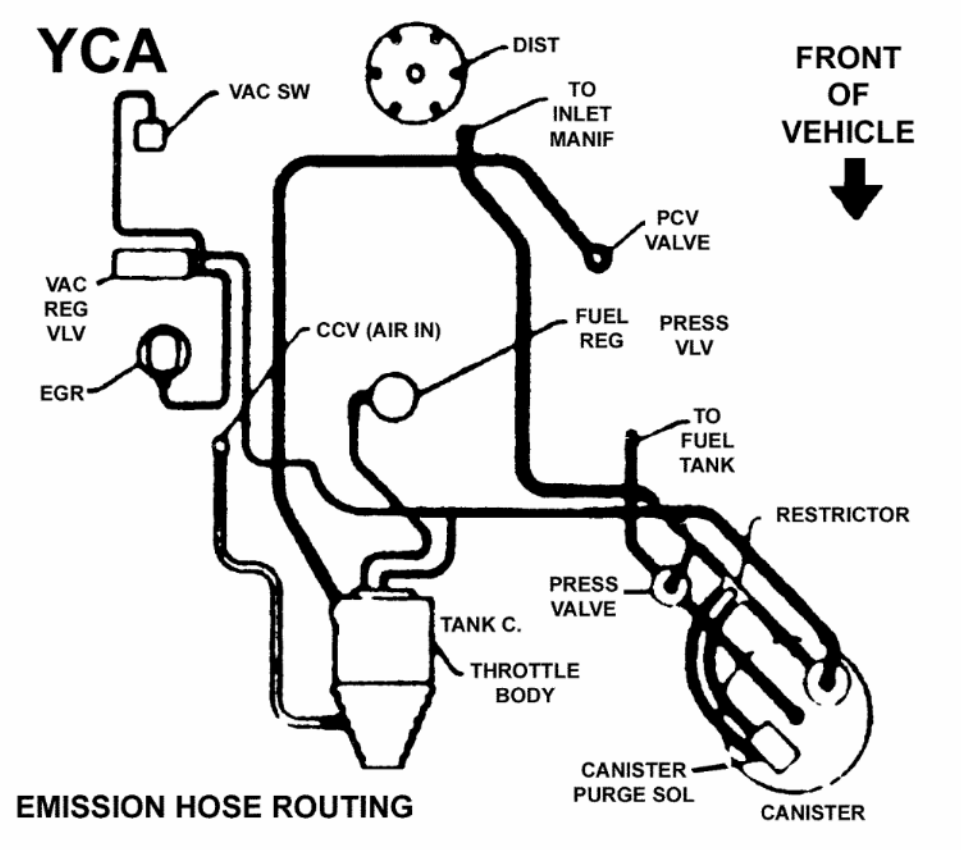


1985 2.8L FUEL INJECTED

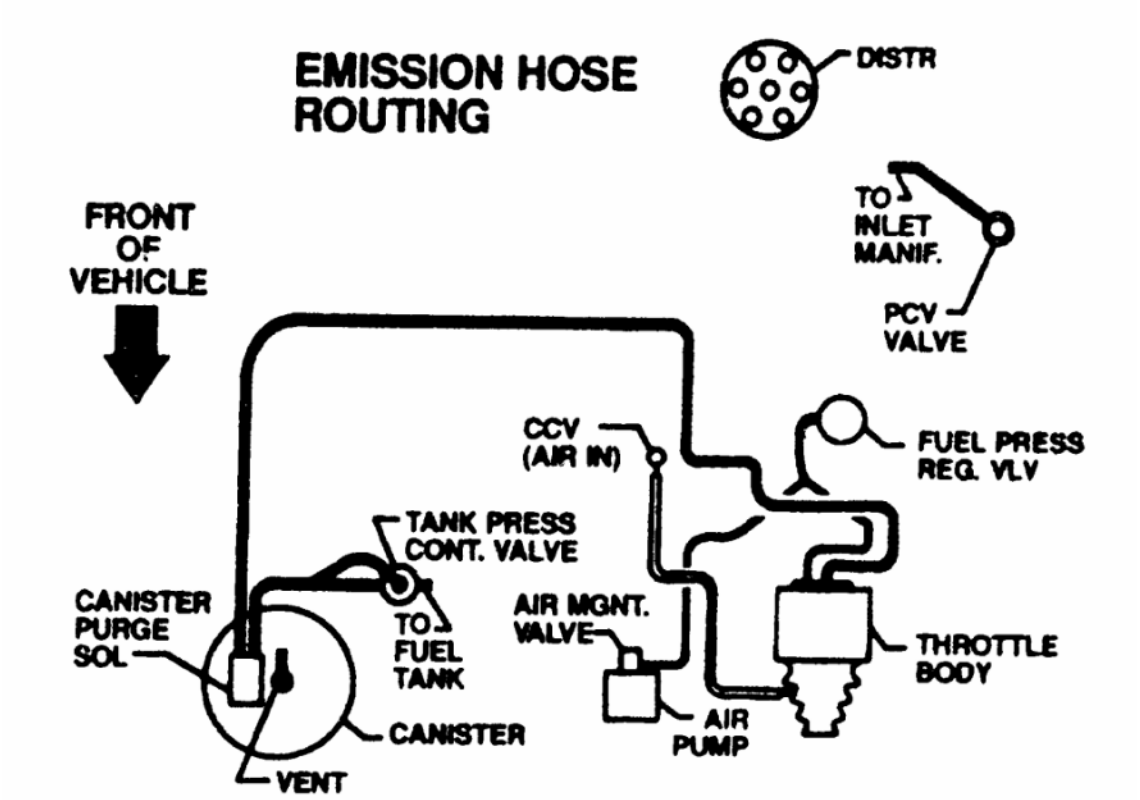


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1986-1989 2.8L FUEL INJECTED

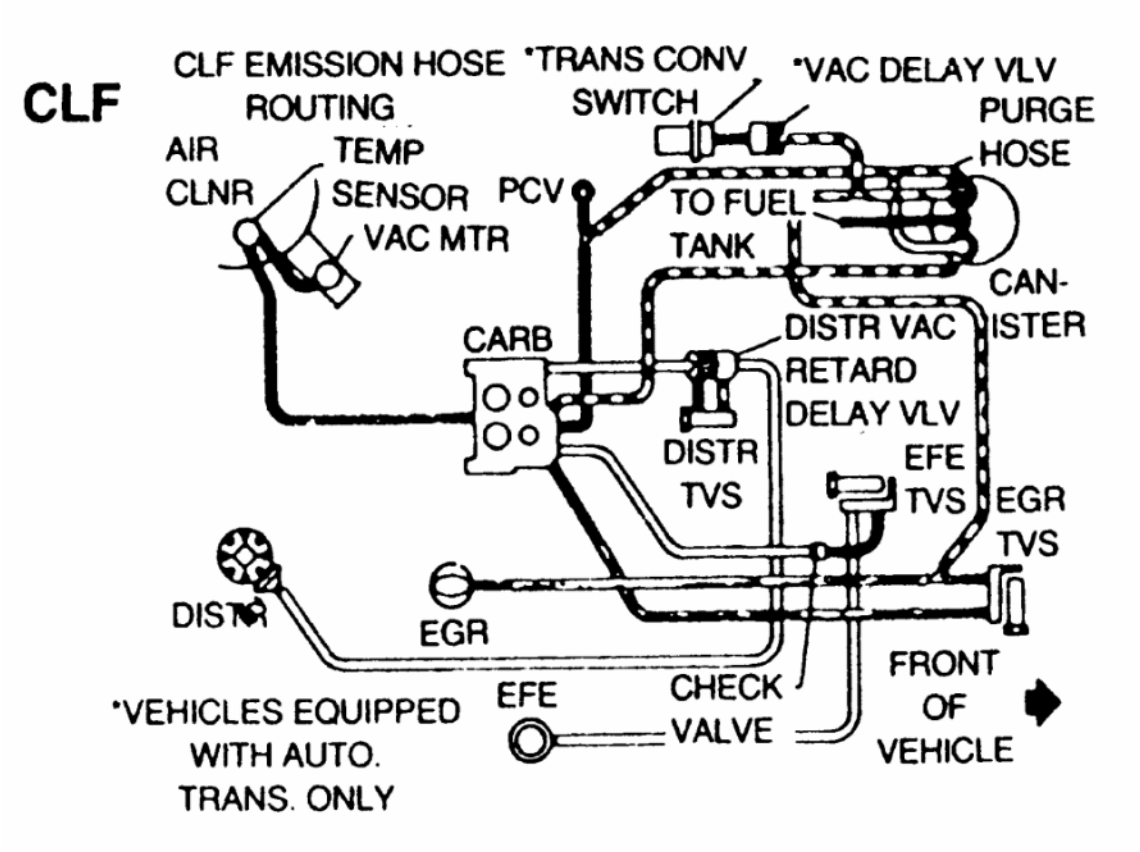


1990-1992 3.1L FUEL INJECTED

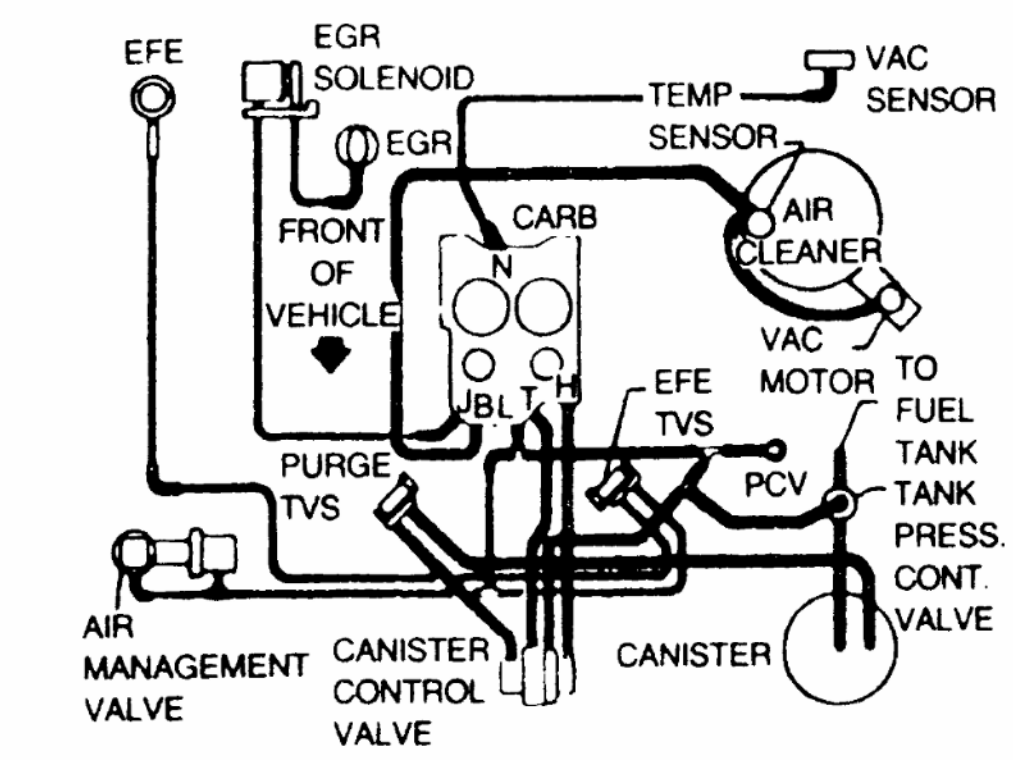


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1982 5.0L CARBURETED

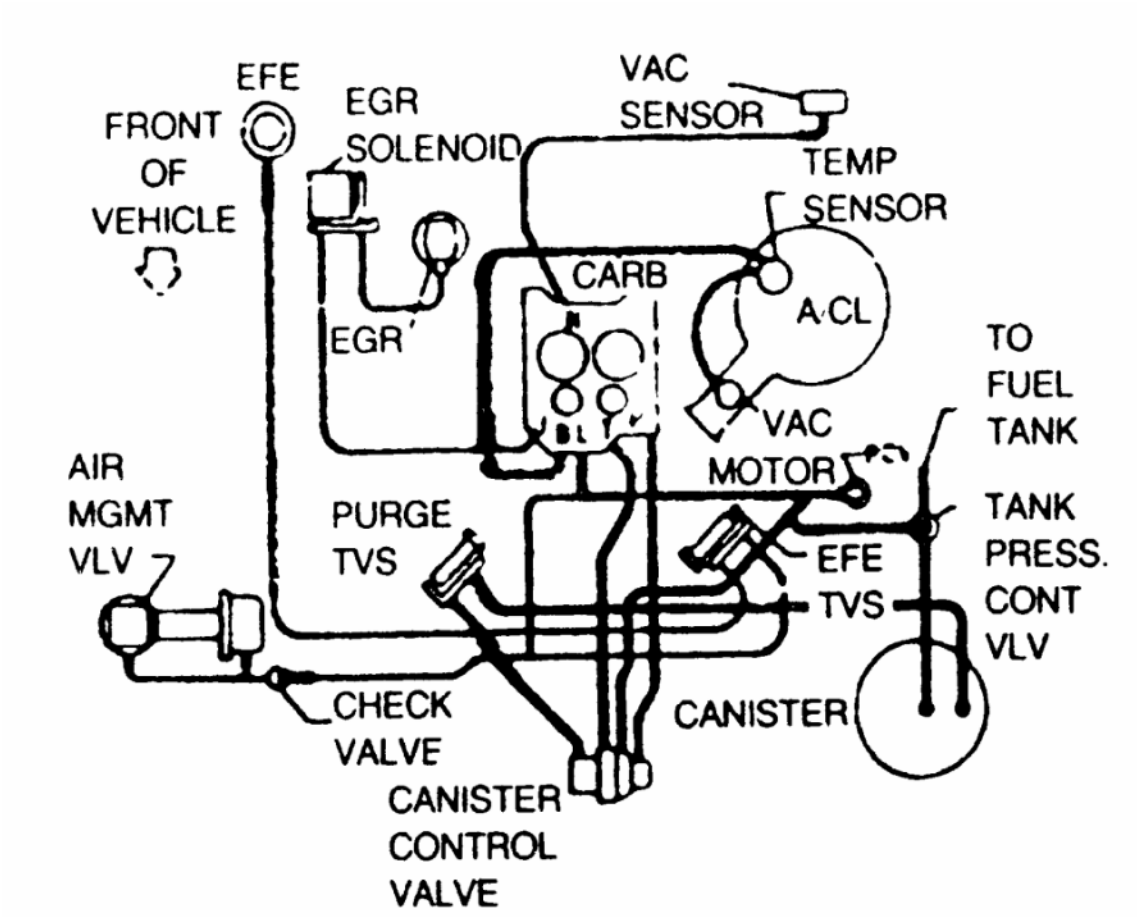


1983 5.0L CARBURETED

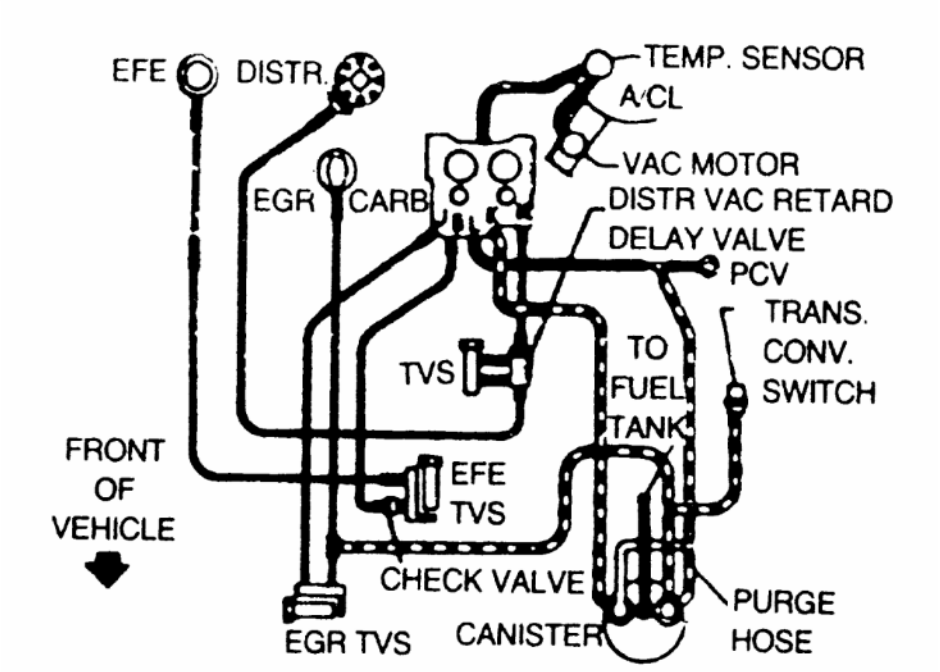


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1984 5.0L CARBURETED; EXCEPT CANADA

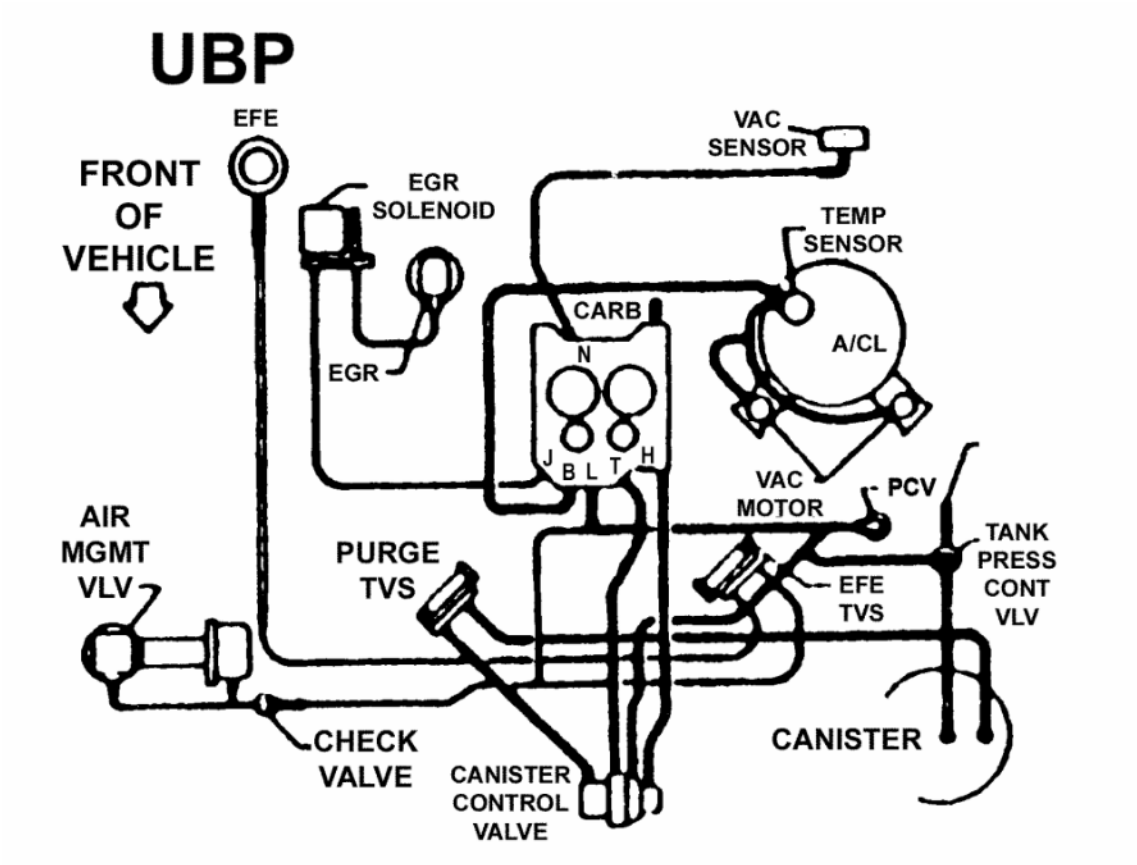


1984 5.0L CARBURETED; CANADA

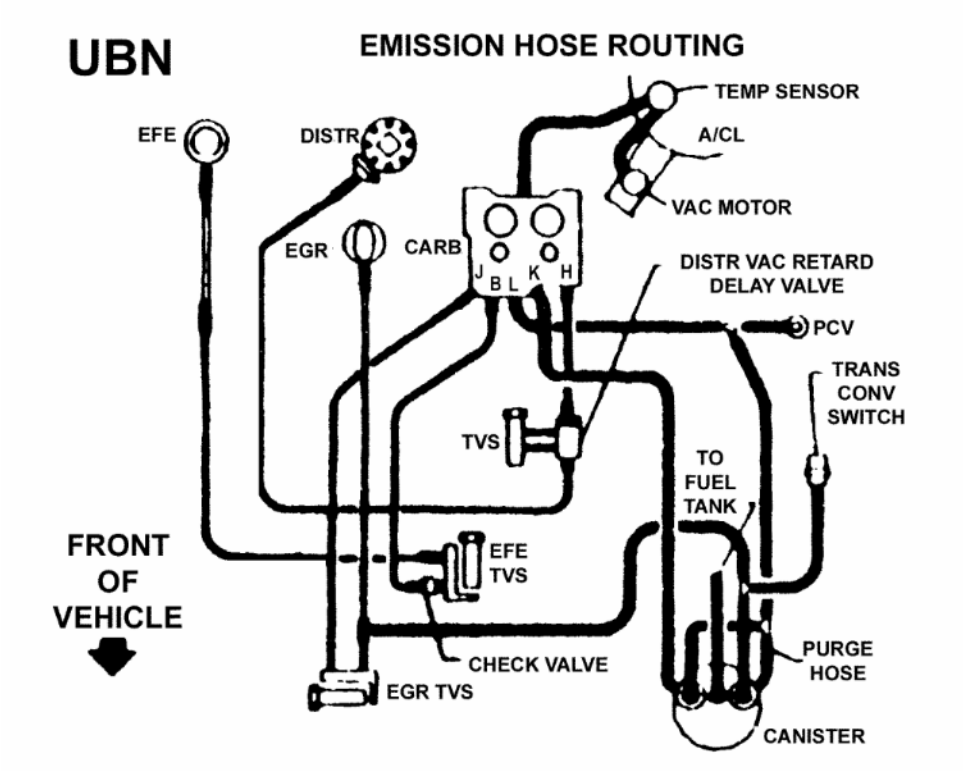


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1985 5.0L CARBURETED; EXCEPT CANADA

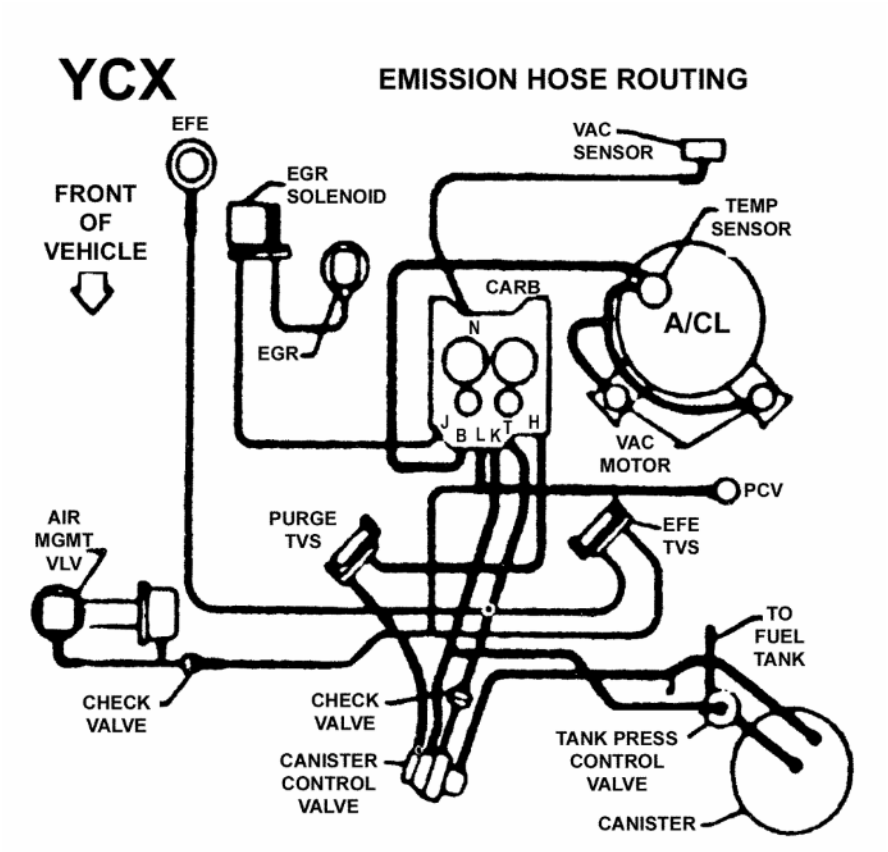


1985 5.0L CARBURETED; CANADA

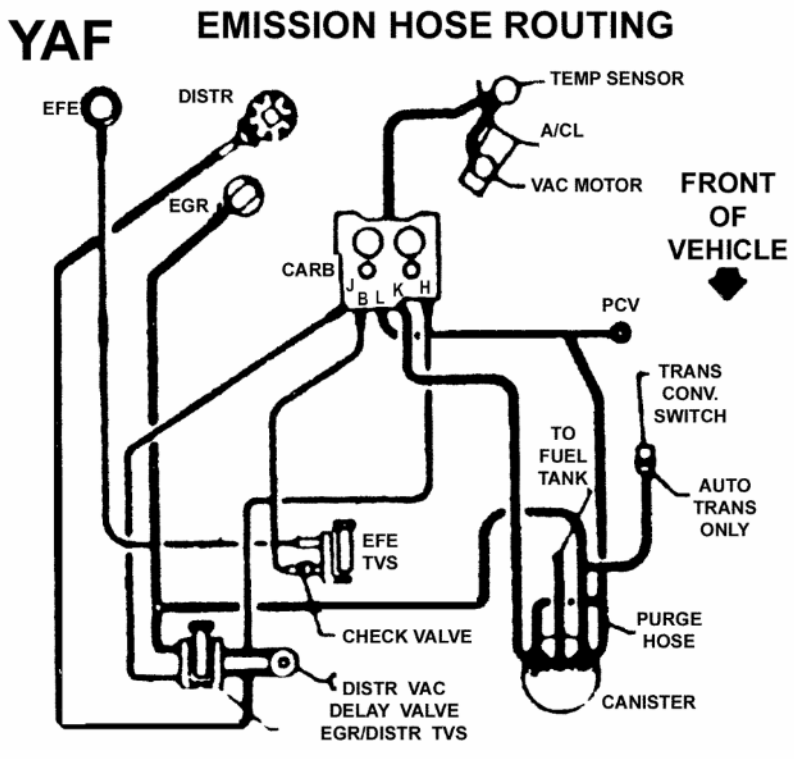


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1986 5.0L CARBURETED; EXCEPT CANADA

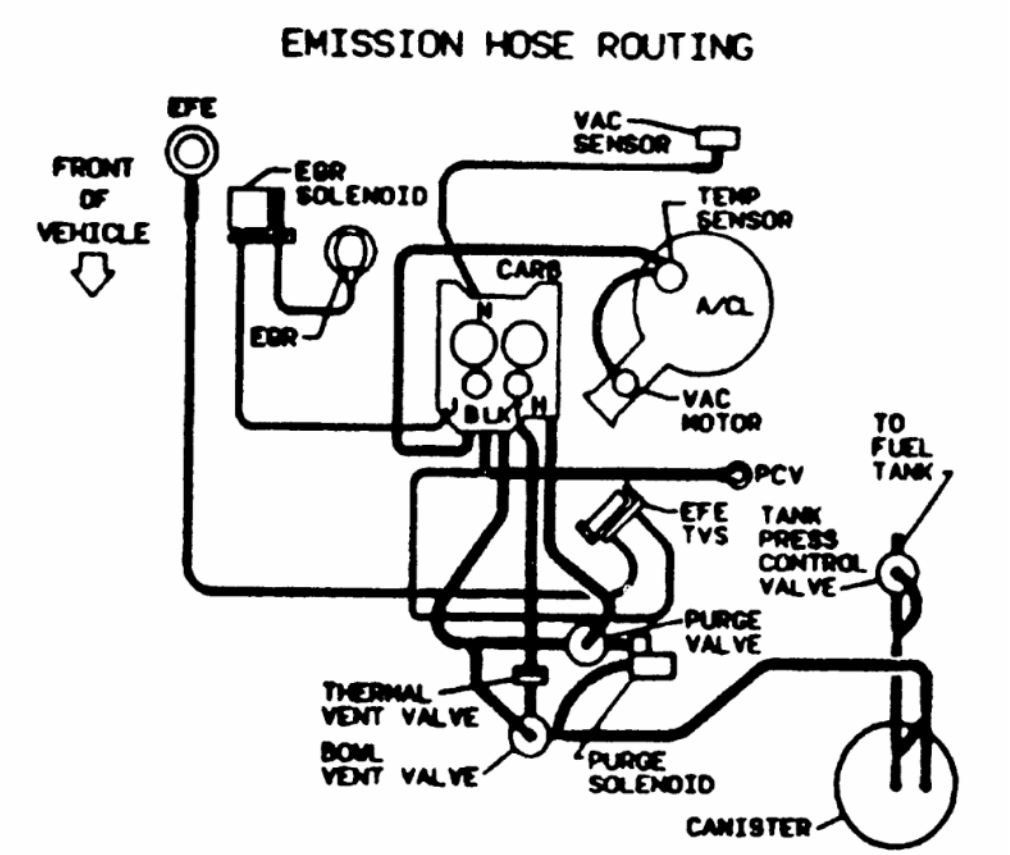


1986 5.0L CARBURETED; CANADA

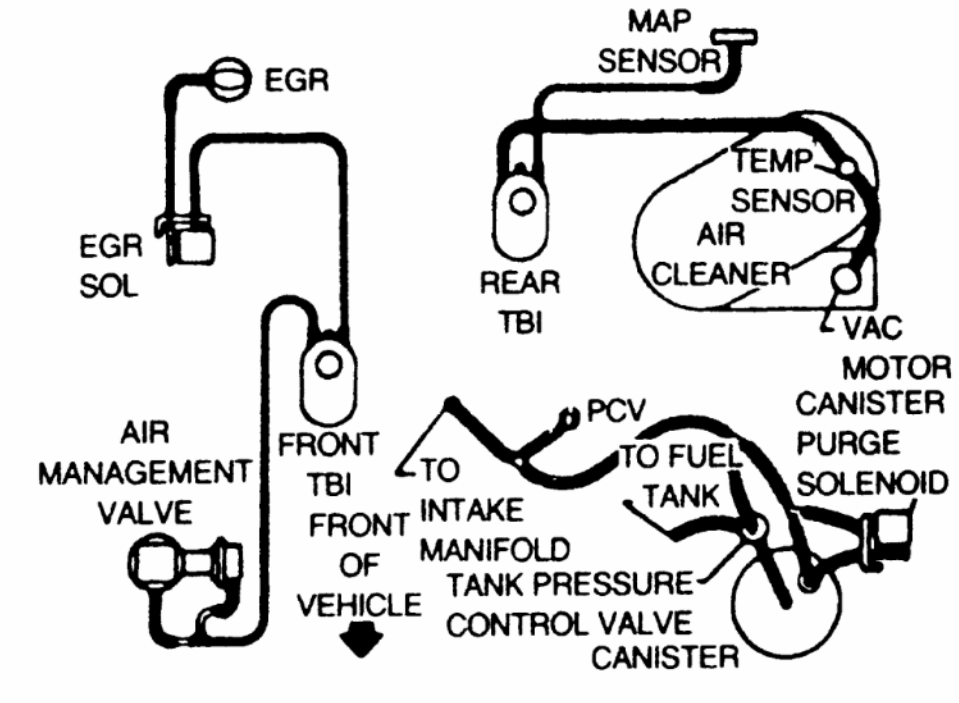


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1987-1988 5.0L CARBURETED

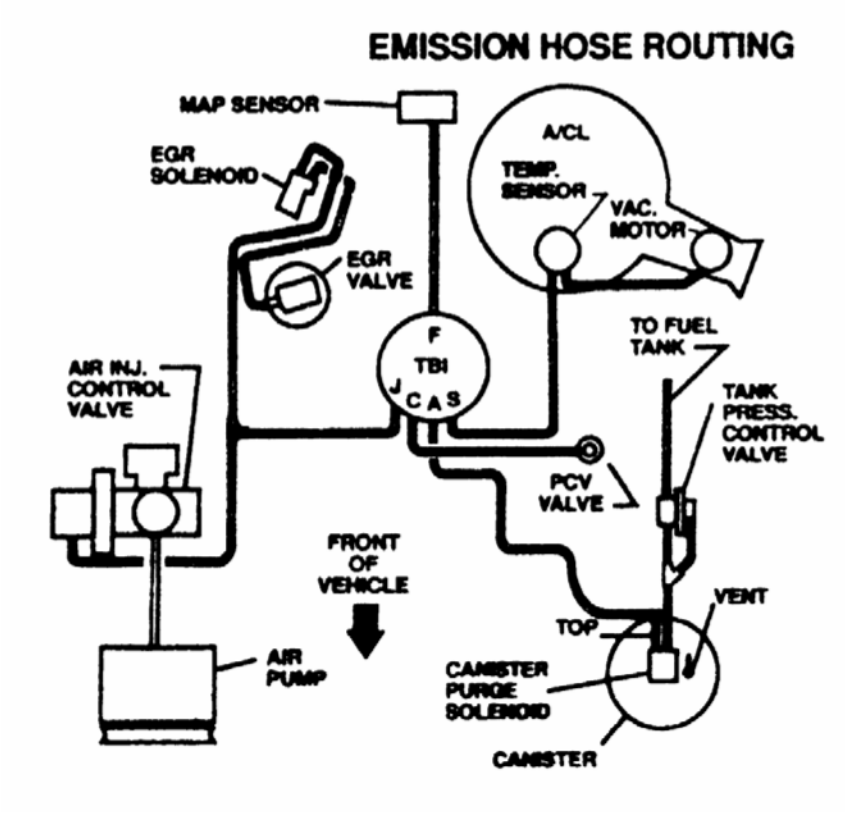


5.0L CROSS-FIRE FUEL INJECTION

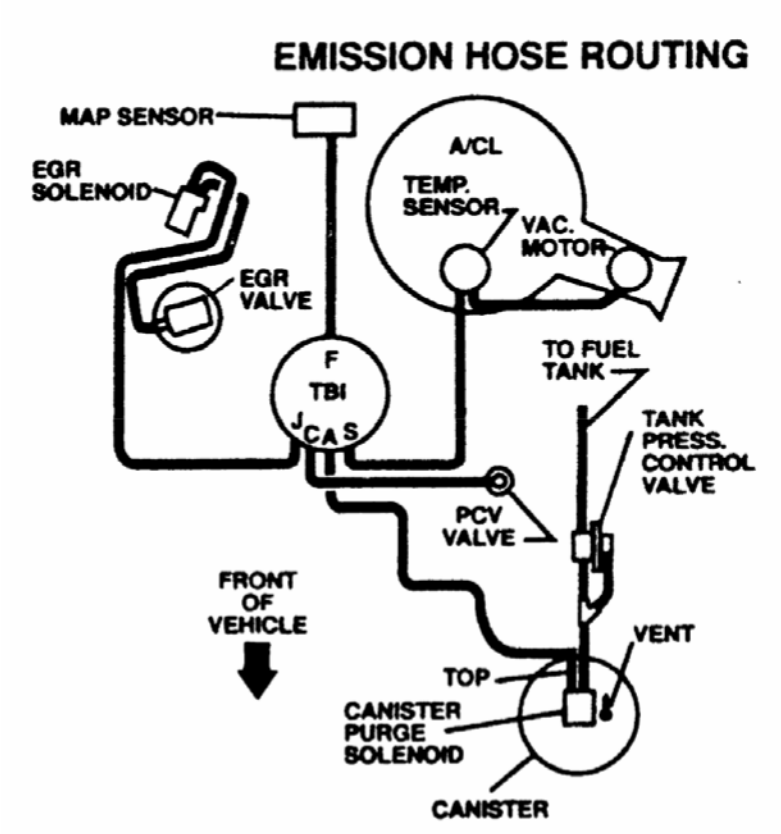


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1988-1992 5.0L THROTTLE BODY INJECTION; MANUAL TRANSMISSION

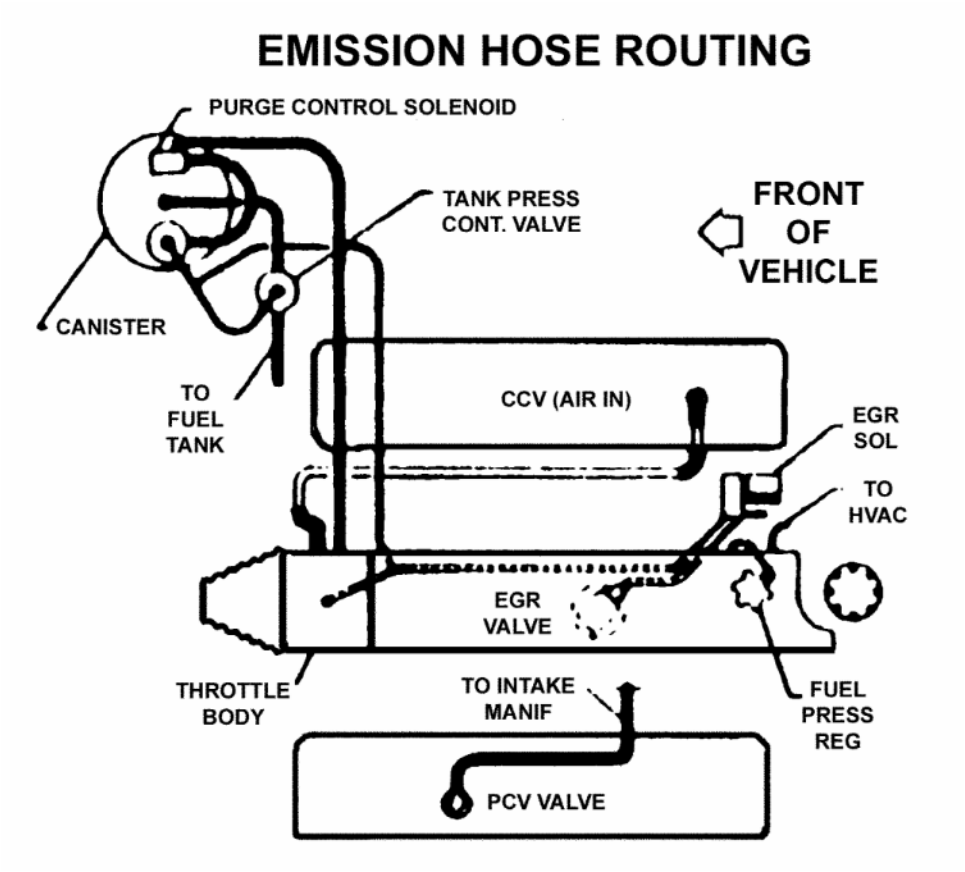


1988-1992 5.0L THROTTLE BODY INJECTION; AUTO TRANS.

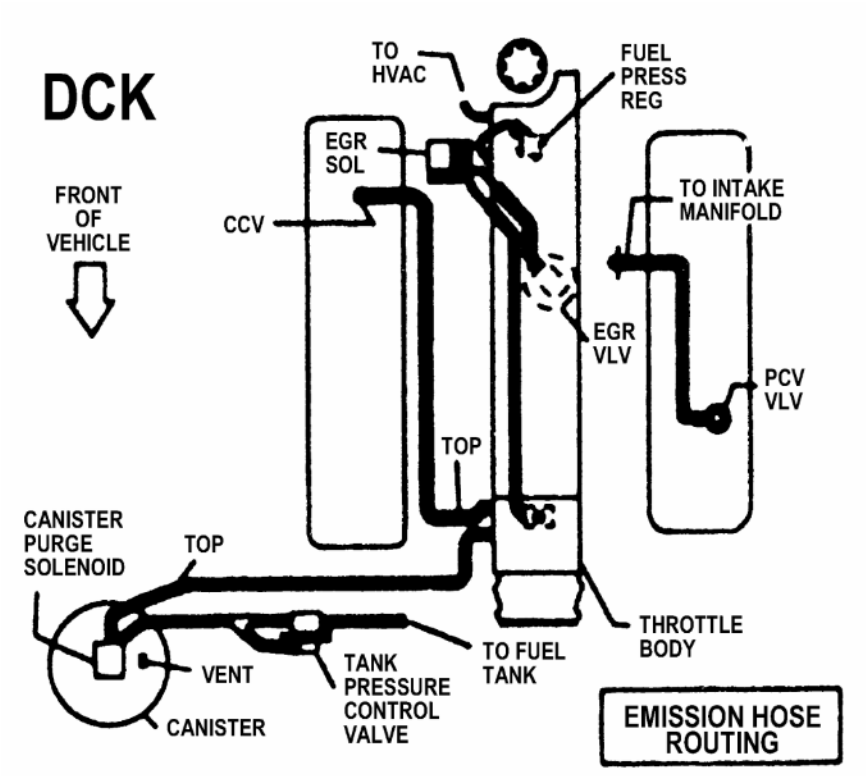


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1985-1986 5.0L TUNED PORT INJECTION

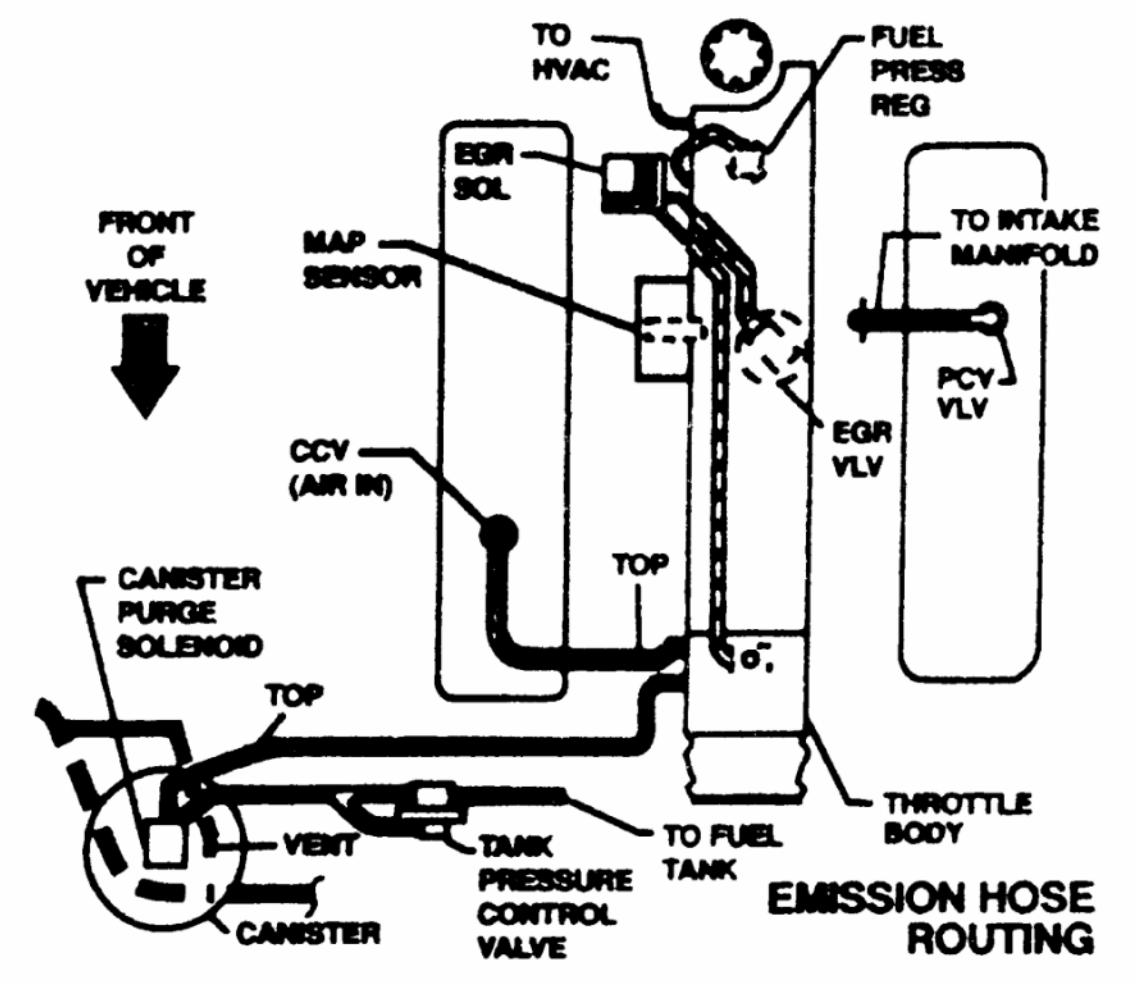


1987-1989 5.0L AND 5.7L TUNED PORT INJECTION



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1990-1992 5.0L AND 5.7L TUNED PORT INJECTION



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