EMISSION CONTROLS

LAMBDA CONTROL SYSTEM

DESCRIPTION

The De Lorean uses a Lambda control system developed by Bosch. The Lambda system is used in conjunction with the K-Jetronic fuel injection and a three-way catalytic converter to control exhaust emissions.

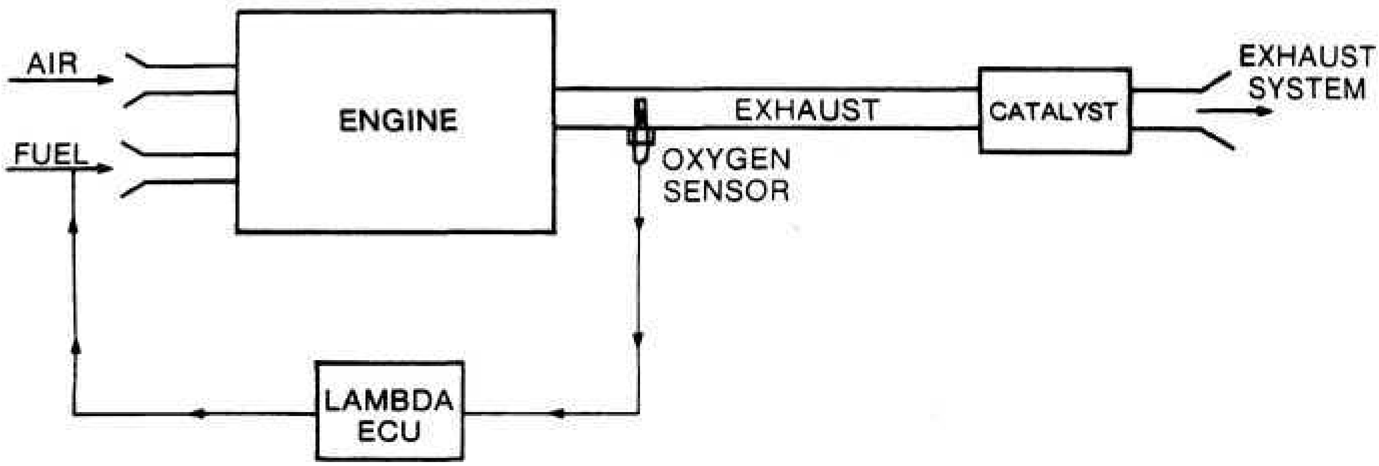
Lambda control, used with a three-way catalytic converter, is capable of reducing the noxious emissions of carbon monoxide (CO), hydrocarbons (CH) and nitrogen oxides (NO_x). A requirement for this action, however, is that the air-fuel ratio must be controlled to a high degree of accuracy so that the engine will operate within an "ideal" air-fuel mixture range.

LAMBDA CONTROL PRINCIPLE

The control principle employed is based on the fact that the Lambda sensor is continuously monitoring the exhaust gas and informing the fuel injection system to modify the mixture for minimum emissions.

Acting as a monitoring device, the oxygen sensor in the exhaust pipe provides data on whether the mixture is richer or leaner than the "ideal".

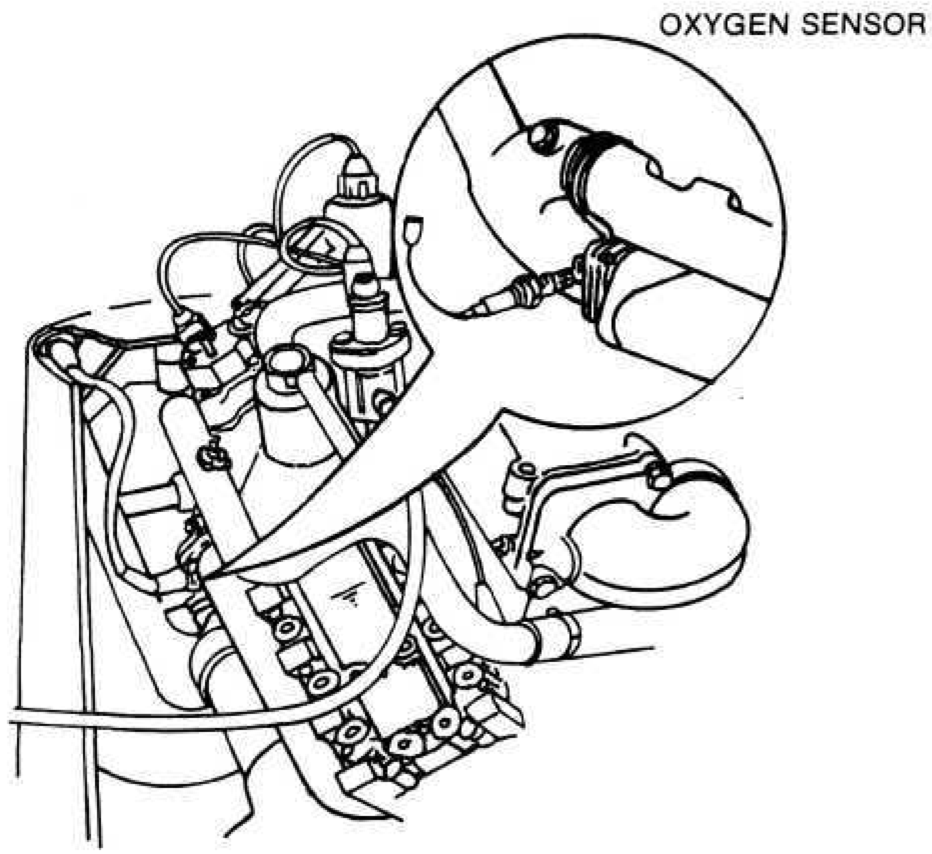
The Lambda electronic control unit (ECU) processes this data and sends a signal to the fuel injection system to change the amount of fuel injected into the engine.



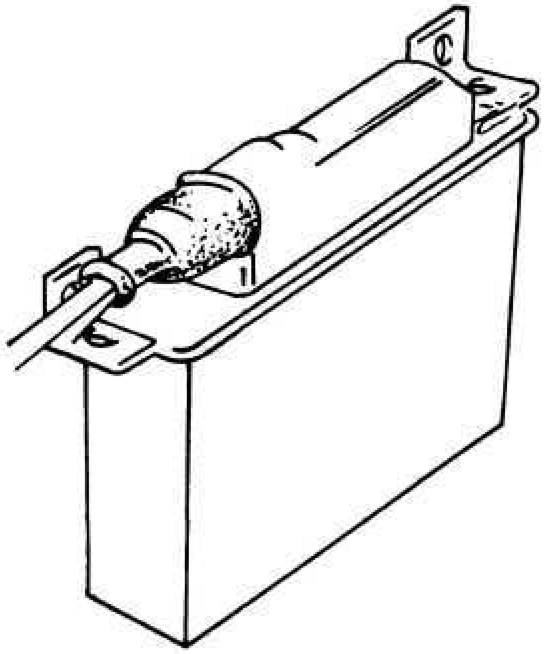
SYSTEM OPERATION

OXYGEN SENSOR: The oxygen sensor measures the amount of oxygen in the exhaust gases. As the sensor measures the exhaust gas, it produces an electrical signal which informs the Lambda ECU module if the engine is running richer or leaner than the "ideal" air-fuel mixture ratio.

The sensor is mounted in the exhaust pipe in a position where it will monitor the exhaust gas from both cylinder banks before it enters the catalytic converter.

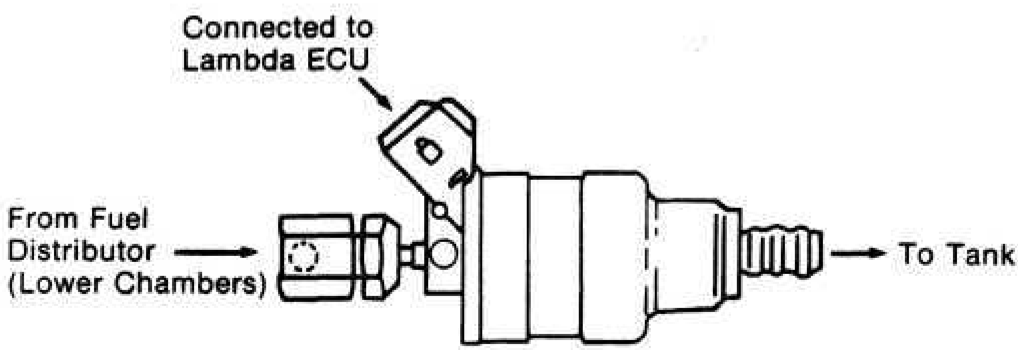


ELECTRONIC CONTROL UNIT (ECU): The Lambda ECU module receives the voltage signal from the oxygen sensor and determines if the amount of fuel injected to the engine should be increased or decreased. The module will then signal the frequency valve to adjust the fuel mixture.

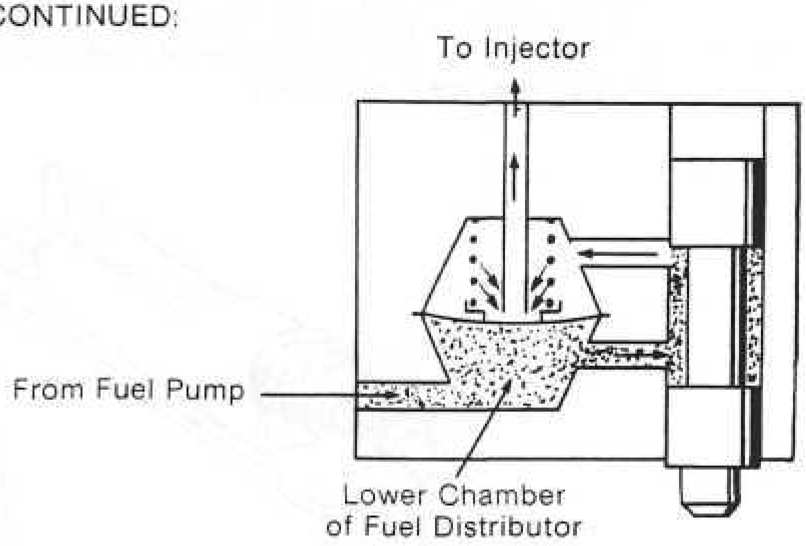


FREQUENCY VALVE: The frequency valve regulates the pressure in the lower chambers of the fuel distributor. This regulation will affect the normal operation of the fuel distributor.

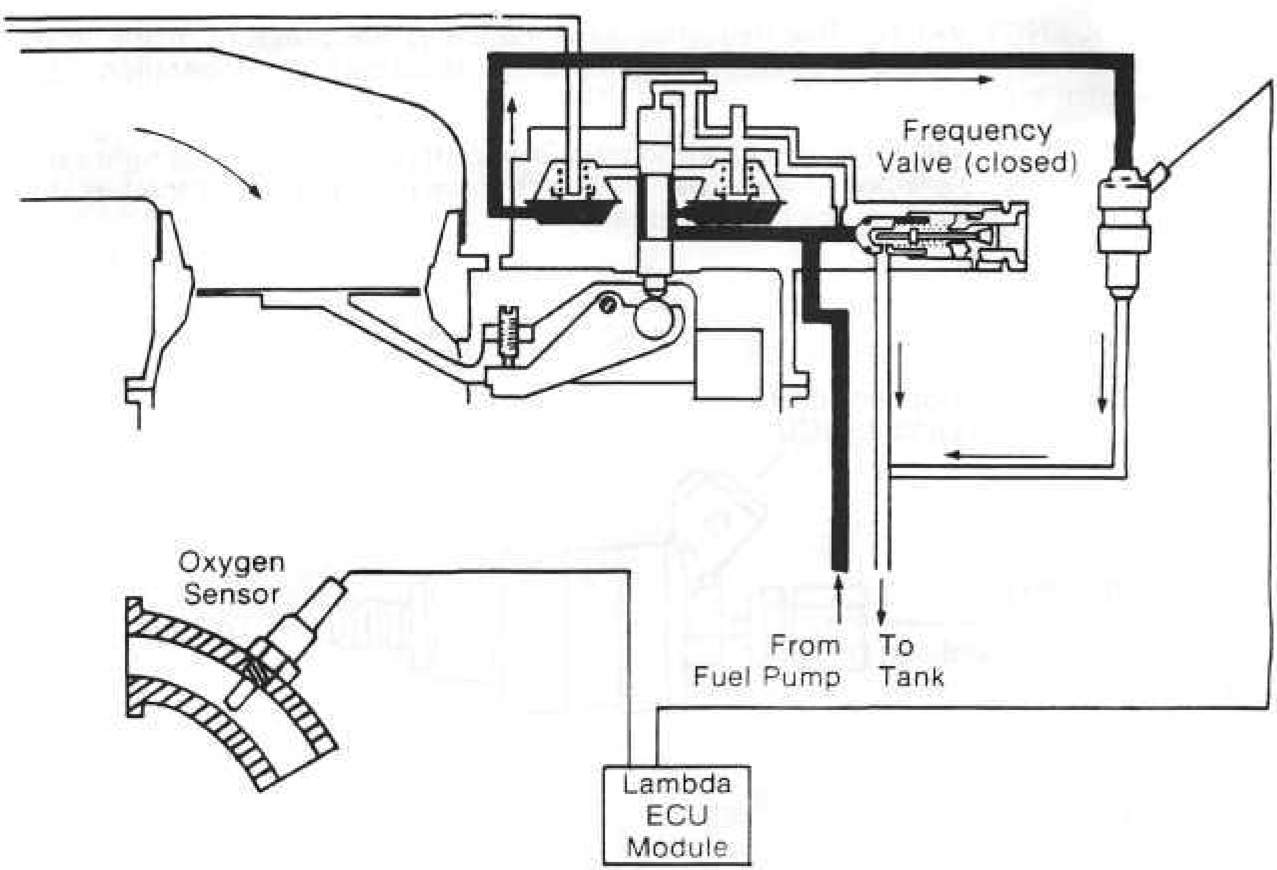
The frequency valve is an electrically operated valve. It is mounted on the right valve cover and is connected to the lower chambers (primary pressure) of the fuel distributor and the return line to the fuel tank.



FREQUENCY VALVE CONTINUED:



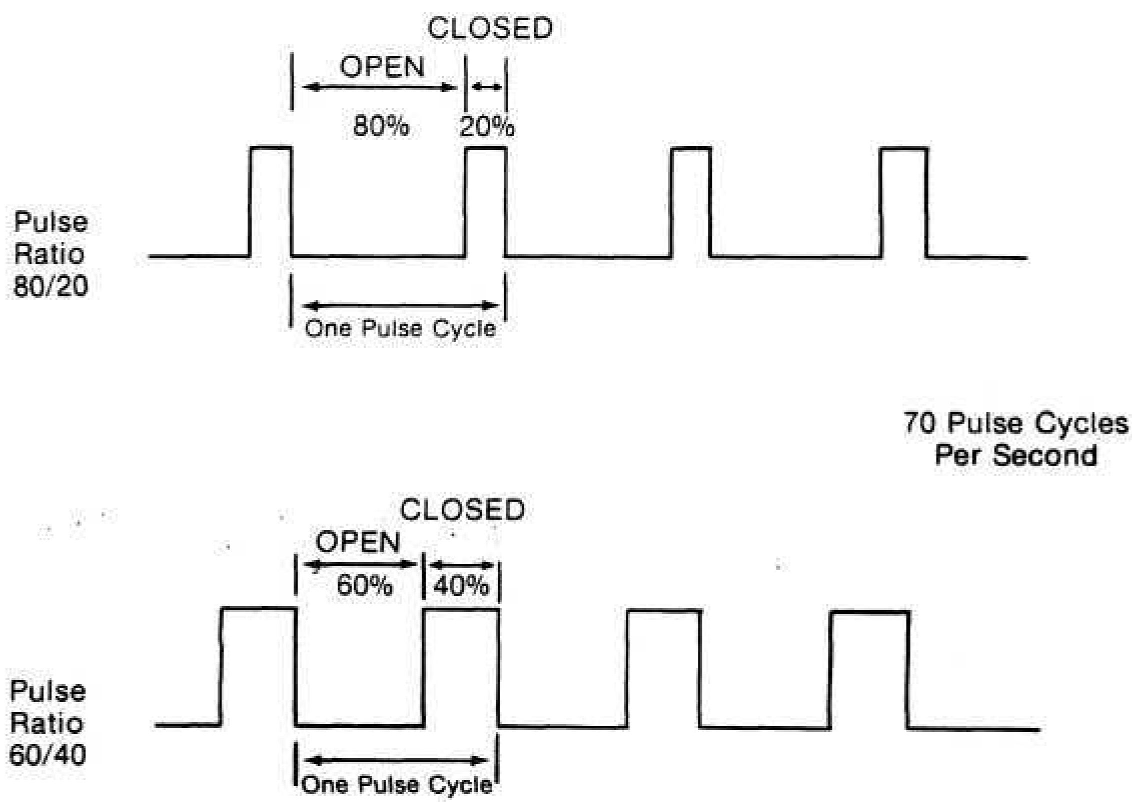
When the frequency valve is open, the fuel pressure in all of the lower chambers will be reduced by allowing some of the fuel to return to the tank. When the lower chamber pressure is reduced, the diaphragm downward movement will increase the passage opening to the injectors. This will increase the volume of fuel being injected to the engine, enrichening the mixture. When the frequency valve closes, the pressure in the lower chambers will return to normal and the diaphragm will return to its original position.



LAMBDA CONTROL SYSTEM

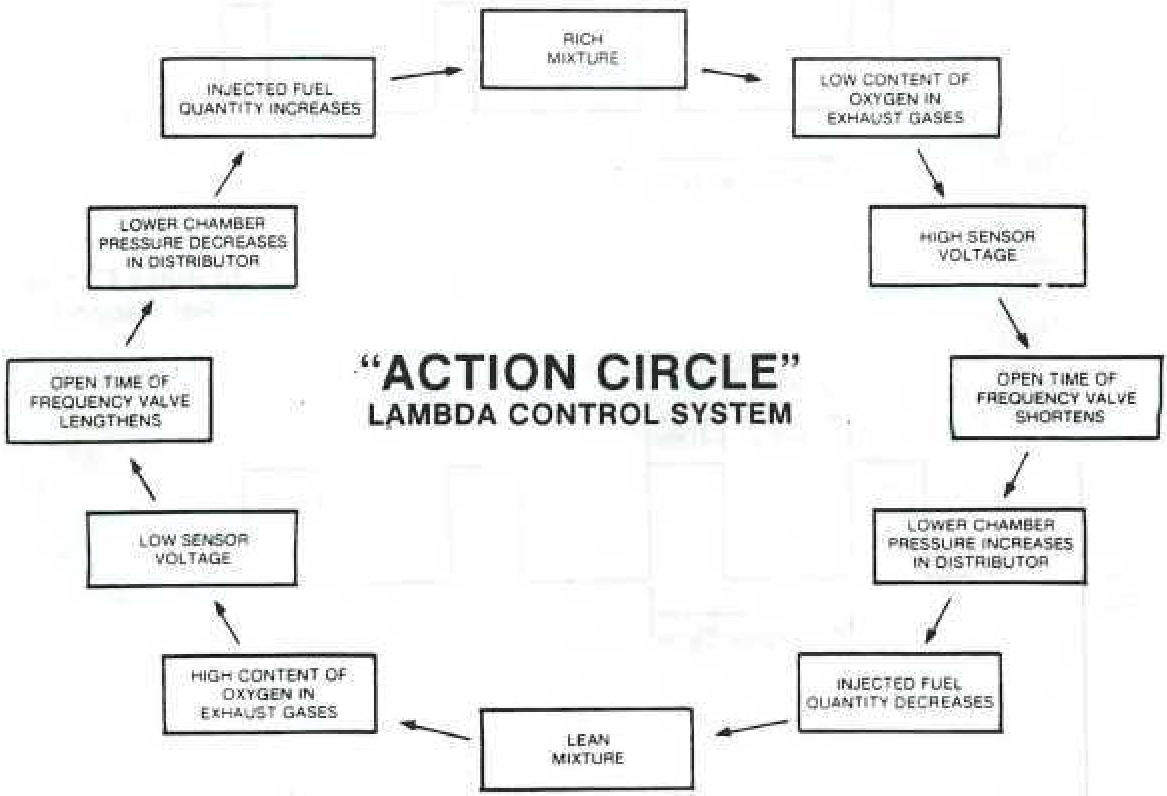
FREQUENCY VALVE CONTINUED: The frequency valve operates at 70 cycles per second. The length of time the valve is held open during each cycle depends on the pulse ratio supplied by the Lambda ECU module.

The pulse ratio is the frequency valve open time versus closed time during one cycle of operation. A pulse ratio of 80/20 means that the frequency valve is open 80 percent of the time and closed 20 percent of the time during one cycle of operation.



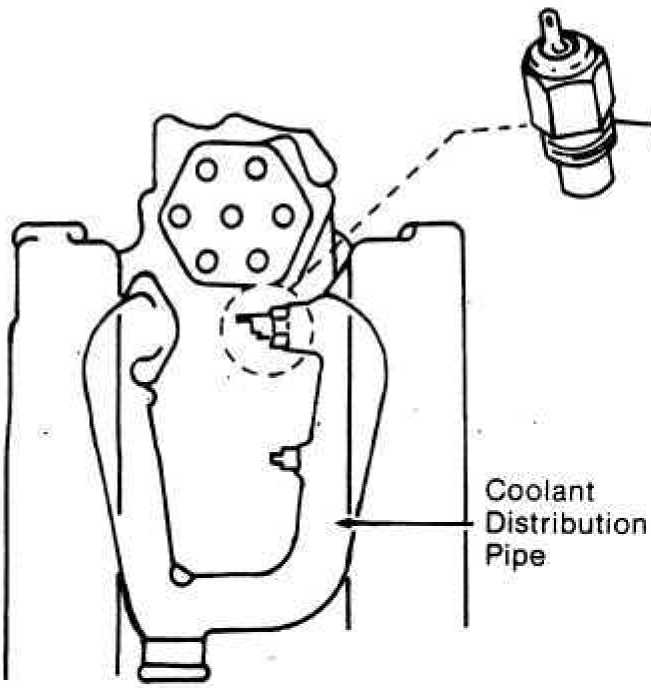
To operate the frequency valve at a pulse ratio of 80/20, the ECU module will allow current to flow through the frequency valve for 80 percent of one cycle and stop the current flow for the remaining 20 percent of the cycle. When current is flowing in the frequency valve, the electromagnet will energize and open the valve.

FREQUENCY VALVE CONTINUED: When the frequency valve is open, fuel from the lower chambers of the fuel distributor is released and routed back to the fuel tank. For example, if the exhaust gases reflect a lean condition, the oxygen sensor will signal the ECU module to change to a pulse ratio that will allow the frequency valve to remain open for a longer period. Therefore, an increased amount of fuel is released from the lower chambers. This reduction of pressure in the lower chambers will cause the diaphram in the fuel distributor to deflect, injecting more fuel into the engine. The fuel mixture is now enrichened. The oxygen sensor will then sense the richer mixture and signal the ECU module to switch the frequency valve back to a shorter open time pulse ratio that will reduce the amount of fuel injected. This process repeats constantly to maintain the "ideal" air-fuel mixture ratio.

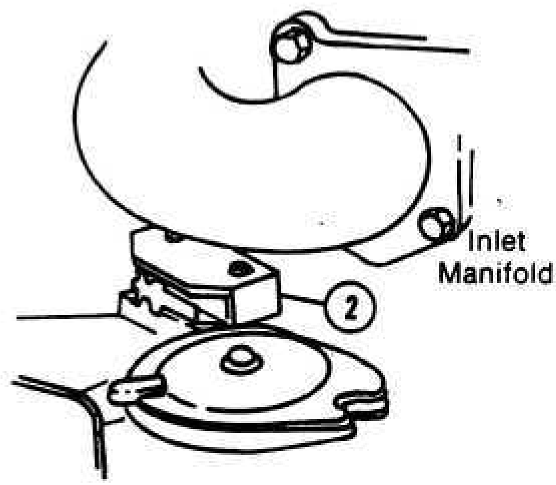


SYSTEM CONTROL MONITORS: The oxygen sensor needs a minimum operating temperature to deliver a signal (approximately 300°C). In order to achieve drive-ability from start, the ECU module sets the frequency valve on a fixed pulse ratio until the sensor warms up. This is also the case if the sensor fails at any time during operation. The fixed ratio will provide a richer fuel mixture than normal.

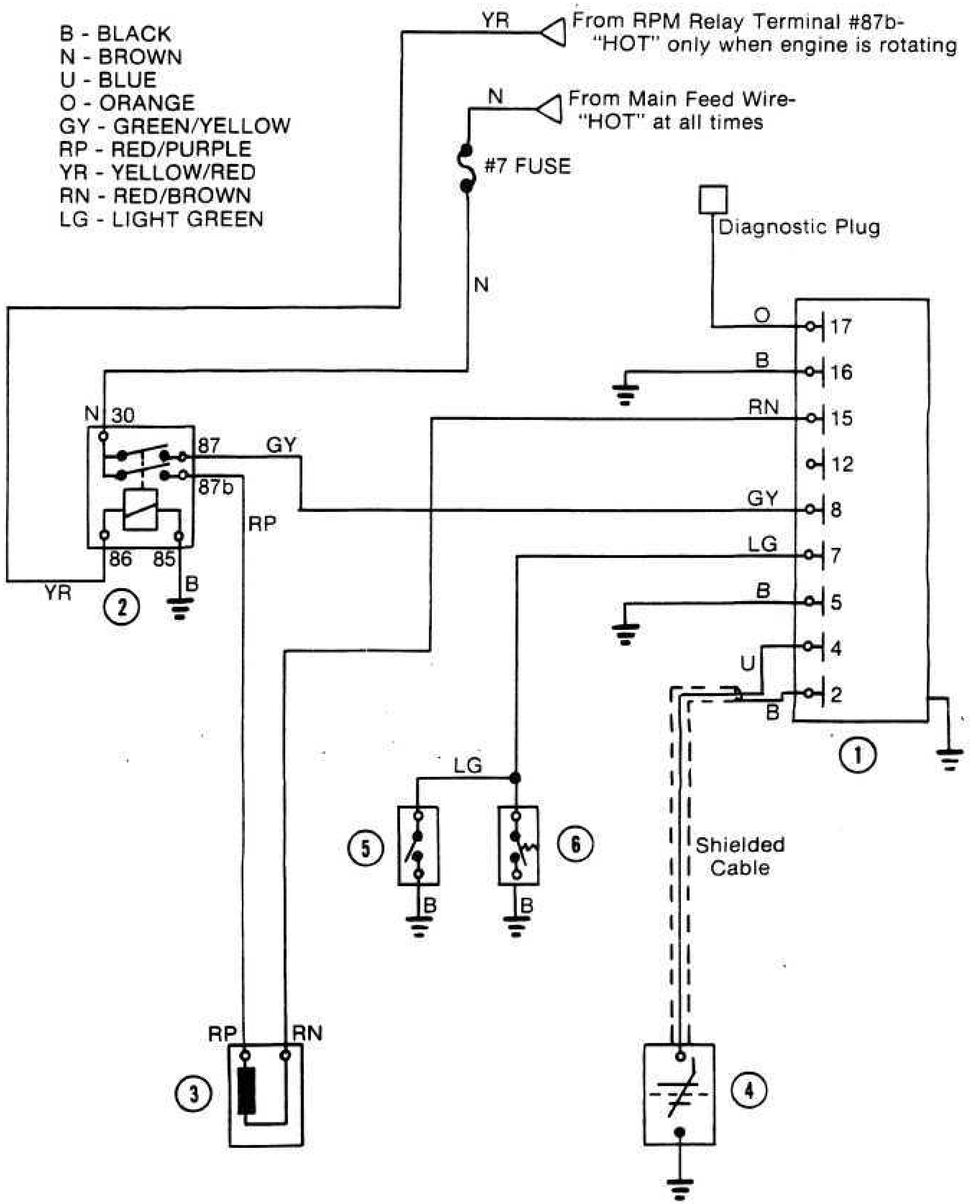
The pulse ratio is controlled at another fixed value when the engine coolant temperature is below 15°C (59°F) or when the engine is at wide open throttle. These conditions are determined by a thermal switch (1) and a full throttle micro switch (2). The fixed pulse ratio provides a rich fuel mixture to improve engine performance when cold or in the full throttle position.



LAMBDA THERMAL SWITCH



FULL THROTTLE MICRO-SWITCH



LAMBDA CONTROL CIRCUIT

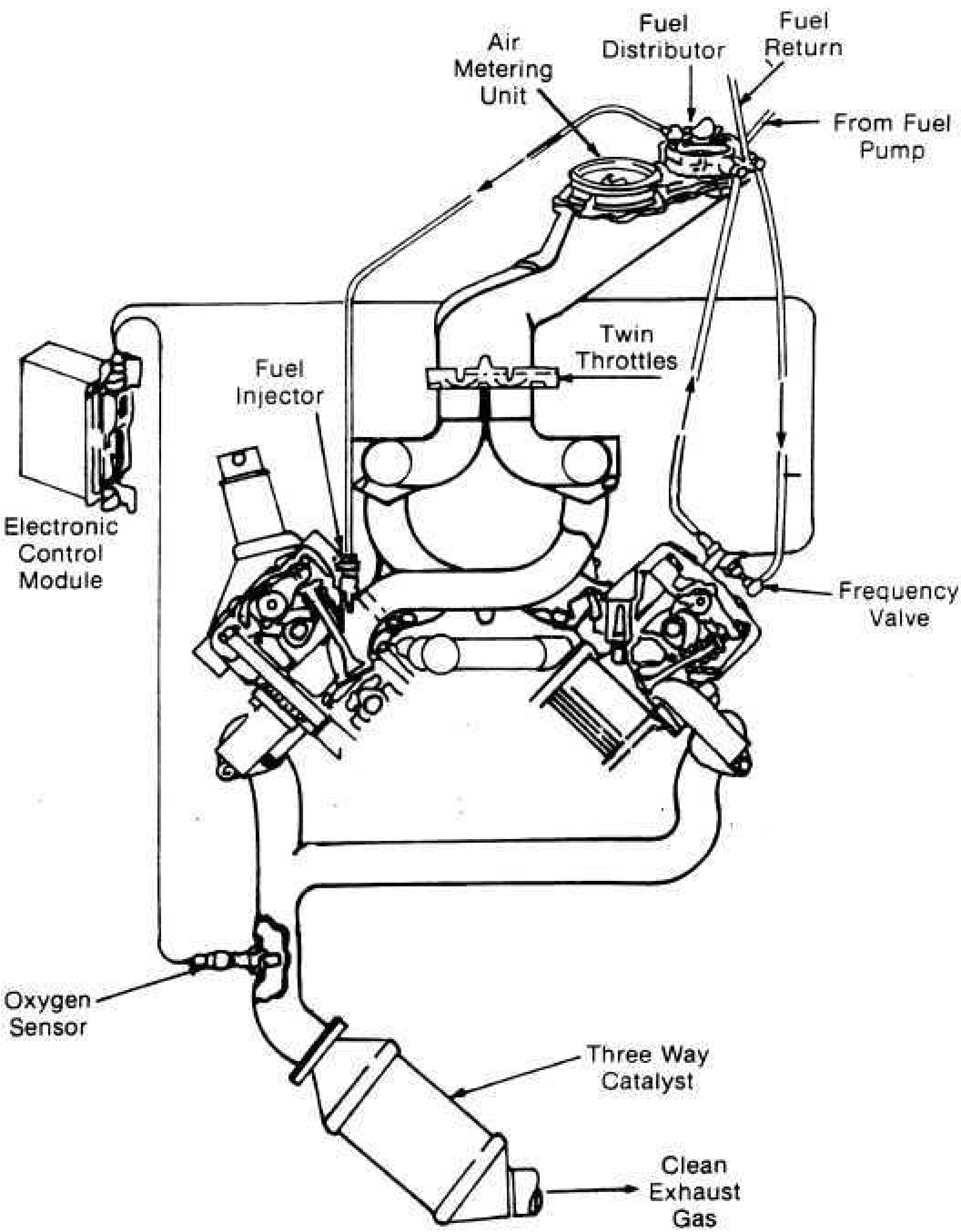
1 - ECU Module
2 - Lambda Relay
3 - Frequency Valve
4 - Oxygen Sensor
5 - Full Throttle Enrichment Switch
6 - Thermal Switch

ELECTRICAL CIRCUIT FUNCTION: The Lambda relay (2) receives power from the RPM relay and is energized only when the engine is rotating. When the relay is energized, the contacts close and voltage from fuse #7 is applied to the frequency valve (3) and the ECU module (1).

The oxygen sensor (4) generates a signal voltage (approximately 500 mv) which is carried by a screened cable to the module. The signal voltage will vary depending on the oxygen content in the exhaust gas. The less oxygen content in the exhaust (rich condition), the greater the signal voltage produced by the sensor.

During operation, the ECU module will analyze the oxygen sensor signal and send a pulse cycle signal to the frequency valve. This signal will allow a pulsating current flow to the valve which will turn it on and off as required. The pulse cycle can be measured by connecting a dwell meter to the diagnostic plug which is connected to terminal #17 of the ECU module.

The full-throttle enrichment switch (5) sends a ground signal to the ECU module when the throttle is in the wide-open position. The thermal switch (6) also sends a ground signal to the ECU module when the coolant temperature is below 15°C (59°F). These two switches override the oxygen sensor input to the ECU module, allowing a fixed pulse cycle to be sent to the frequency valve.



LAMBDA CONTROL SYSTEM

SYSTEM REPAIR NOTES

All of the Lambda system parts, with the exception of the throttle microswitch, are sealed units and cannot be adjusted or repaired. Tampering with a sealed unit will automatically void the warranty.

1. The Lambda ECU module is located in the module compartment behind the driver's seat. It is in the forward section of the compartment and is silver in color.
2. When replacing the oxygen sensor, it is necessary to use an antiseize compound on the sensor threads. Do not allow any of the compound to get on the tube projecting from the sensor. Do not attempt to disconnect the wire lead directly at the sensor.
3. If it is necessary to supply power to the Lambda system when the engine is not running, by-pass the RPM relay by removing the relay and connecting a jumper wire between terminals #87b and #30 in the connector. The RPM relay is located in the relay compartment behind the passenger seat. (See "Chassis Electrical" section)
4. When checking the pulse ratio, a fluctuating dwell reading when the sensor is connected indicates that the system is operating. Readings above or below specifications could be caused by a rich or lean CO adjustment.

SPECIFICATIONS

1. Lambda Sensor:

Torque specifications	40 Nm (29 FT LB)

2. Thermal Switch:

   Contact shall open at 15 ± 3° C. (59° F)
   Close at max. of 5° C below its opening temperature

3. Throttle Micro-Switch

   Shall operate during the final 1.5 mm (0.060 IN) of throttle movement.

4. Fuel Line Tightening Torques:

M8 Bolt	10-12 Nm (7-9 FT Lb.)
M10 Bolt	13-15 Nm (9-11 FT Lb.)
M12 Bolt	20-24 Nm (14-17 FT Lb.)
M14 Bolt	15-20 Nm (11-14 FT Lb.)
M12 Cap Nut	15-20 Nm (11-14 FT Lb.)
M14 Cap Nut	25-30 Nm (18-22 FT Lb.)

5. Pulse Ratios:

A. Normal Operation (Sensor connected and CO properly adjusted)	35-45° (reading pulsates)
B. Oxygen sensor disconnected	40-50° (steady reading)
C. Oxygen sensor lead disconnected. Ground lead.	87° minimum (steady reading)
D. Oxygen sensor lead disconnected. 1.5 volts applied to lead.	20° maximum (steady reading)
E. Full throttle or engine cold (below 15° C or 59° F)	50-60° (steady reading)

IDLE SPEED CONTROL SYSTEM

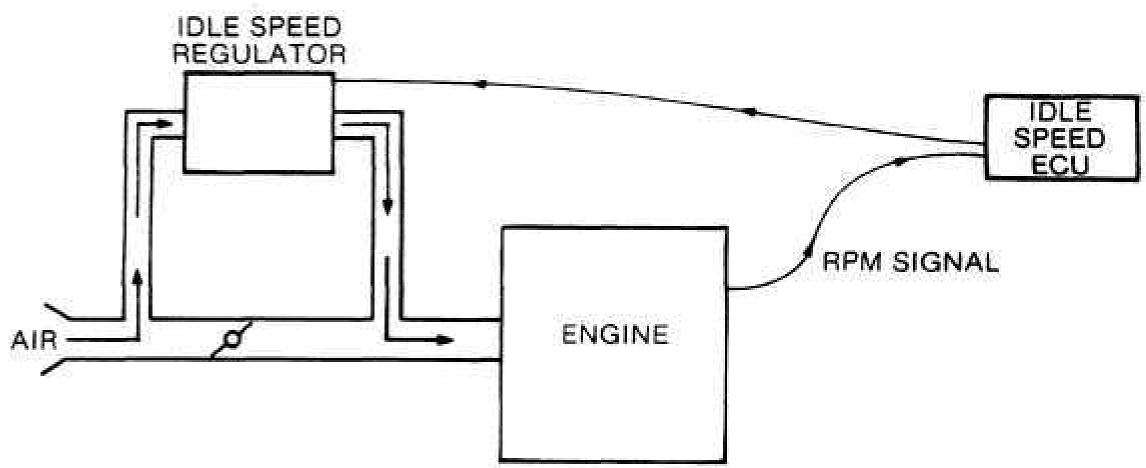
SYSTEM DESCRIPTION

The De Lorean Sports Car is equipped with a Bosch electronic idle speed control system. This system is used to maintain an extremely accurate engine idle speed under all operating conditions.

IDLE SPEED CONTROL PRINCIPLE

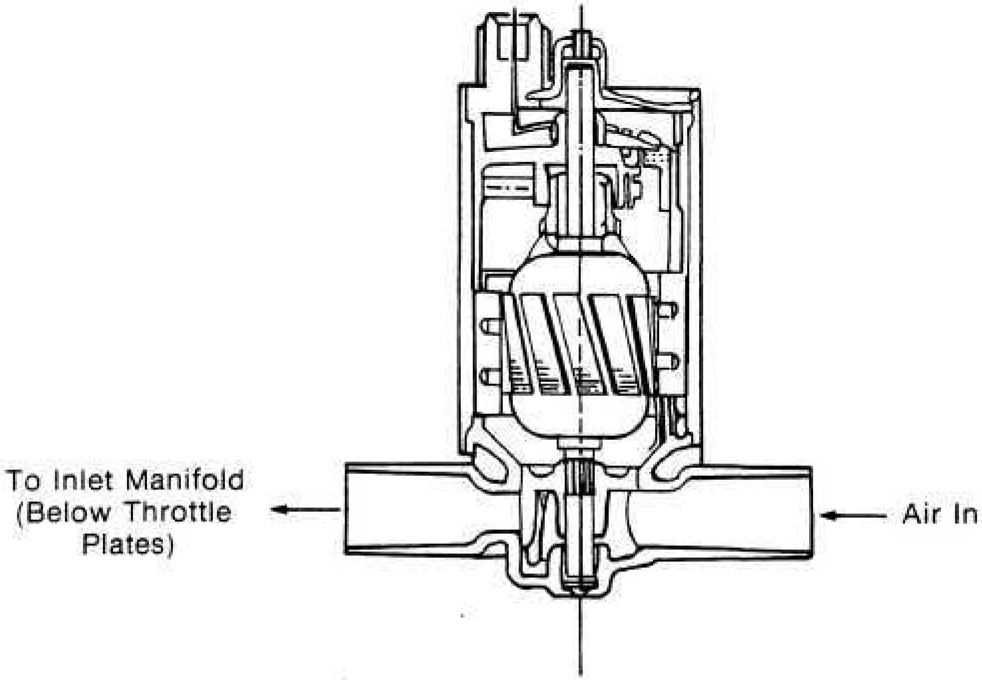
The control principle used is based on the fact that an electronic control unit (ECU) module is constantly monitoring the engine speed during an idle condition and correcting this speed when necessary.

The idle speed regulator contains a rotary valve which controls the air flow through a duct that by-passes the throttle plates. During engine warm-up, for example, the engine speed is reduced due to friction. The idle speed regulator will open allowing additional air flow to the engine, increasing the RPM to specification.



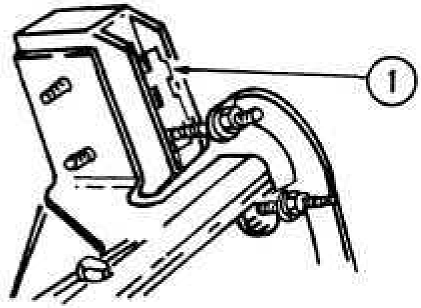
SYSTEM OPERATION

The idle speed regulator is constructed in a similar fashion to that of an electric motor. Its purpose is to control the position of a rotary valve mounted on its shaft. This valve controls the air flow through a duct that by-passes the throttle plates. The regulator is mounted on the left side of the intake manifold.



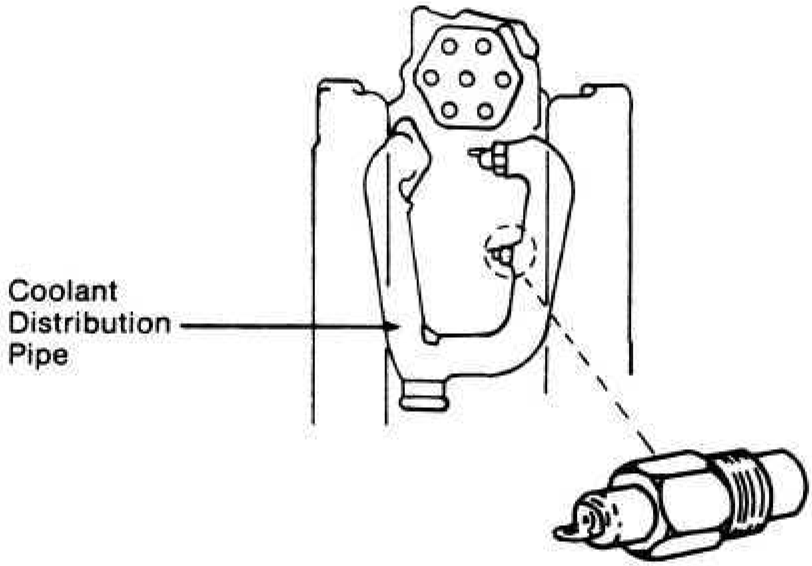
IDLE SPEED REGULATOR

The idle speed control system is only in operation when a microswitch (1) is closed by the throttle plates being in a fully closed position. This switch is located on the engine throttle linkage and allows the ECU module to operate. The ECU module senses engine speed from the tachometer and activates the idle speed regulator. The regulator changes the position of the rotary air valve in order to maintain a specified idle speed.

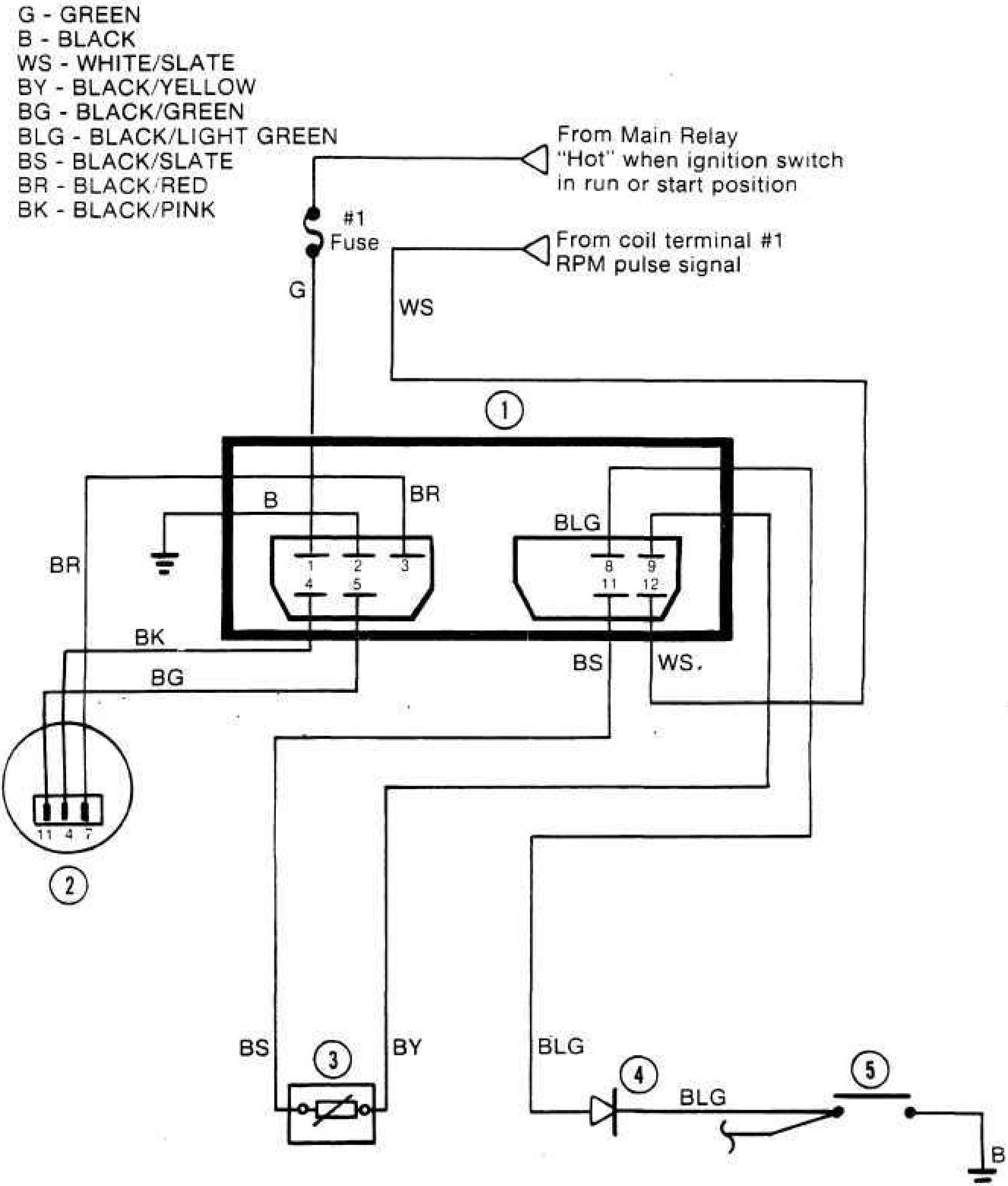


IDLE SPEED MICRO-SWITCH

At engine coolant temperatures below 15° C (59° F), a thermistor, located on the coolant distribution pipe, signals the ECU module to switch the regulator to a "wider" open position. This will increase the idle speed (fast idle) during the engine warm-up period.



THERMISTOR



IDLE SPEED CONTROL CIRCUIT

1 ECU module
2 Idle Speed Regulator
3 Thermistor
4 Idle Speed Diode
5 Idle Speed Micro-Switch

ELECTRICAL CIRCUIT FUNCTION

The ECU module (1) receives power through fuse #1 from the main relay when the ignition switch is in the "run" or "start" position.

When the throttle plates are fully closed, the micro-switch (5) provides ground for the ECU module to begin operation. An idle speed diode (4) is used to prevent "feed back" to the ECU module from another circuit which also uses the idle speed micro-switch to provide its ground.

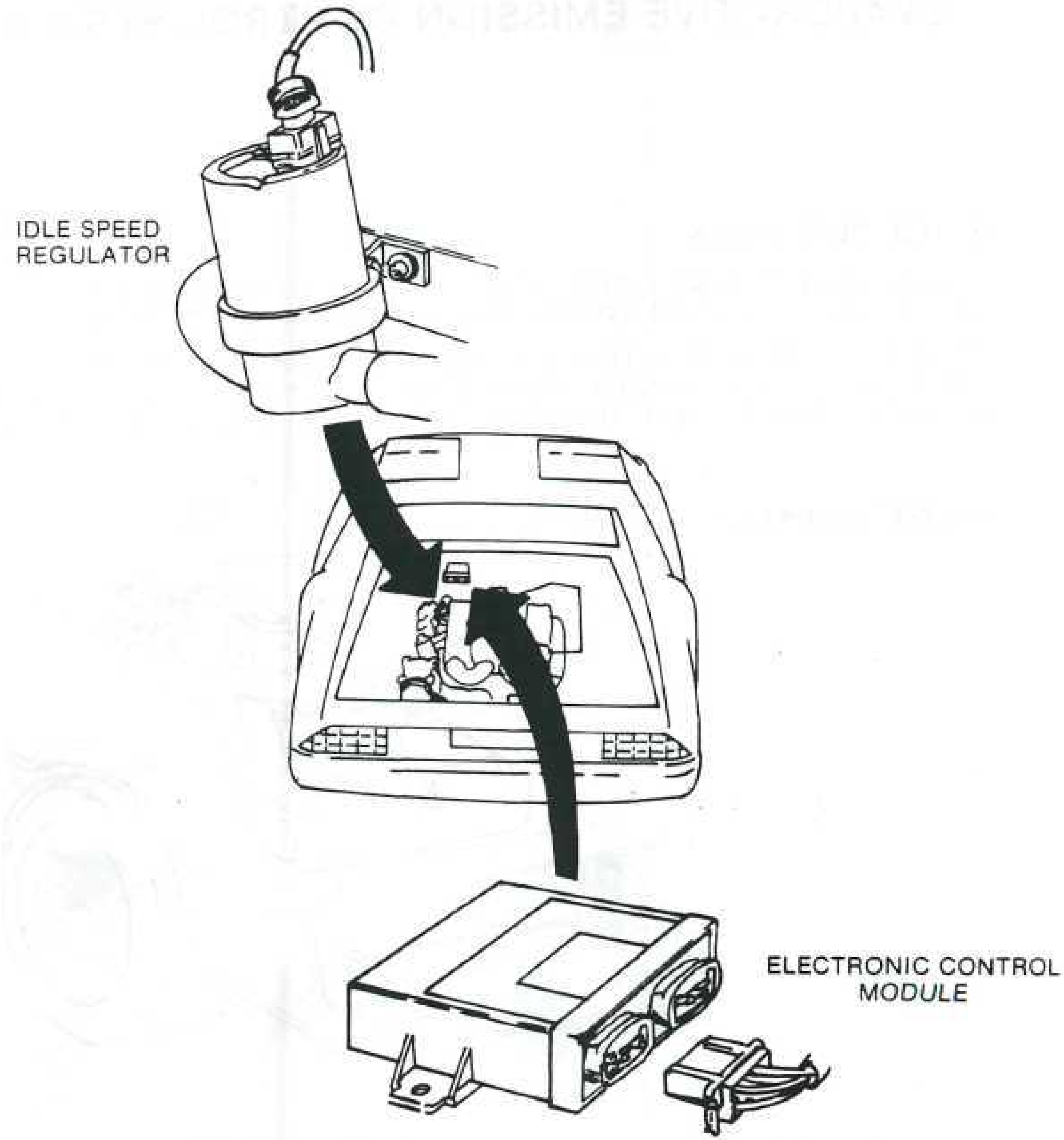
A thermistor (3), located in the coolant system distribution pipe, will activate another circuit within the ECU module when the coolant temperature is below 15° C (59° F). This circuit will provide a fast idle condition.

The ECU module receives an RPM signal from coil terminal #1. When the engine idle speed is above or below specifications, the ECU module activates the electric motor in the idle speed regulator (2). The signal from the module will run the motor in a forward or reverse direction which will open or close the rotary valve as necessary to achieve proper engine idle speed.

SYSTEM REPAIR NOTES

1. All of the idle speed control system parts are sealed units and cannot be adjusted or repaired. Tampering with a sealed unit will automatically void the warranty.
2. The idle speed ECU module is located in the module compartment behind the drivers seat. The module is black in color and is mounted in the upper portion of the compartment.
3. The idle speed diode is located in the module compartment behind the driver's seat. The diode is black in color.
4. The idle speed micro-switch is not adjustable and is preset to activate the control system when the throttle plates are in the closed position.
5. Engine idle speed is not adjustable. Speed is electronically controlled to 775 RPM ± 50 RPM.
6. Do not disconnect the idle speed regulator when adjusting the CO level. (See "Engine adjustments, tests and diagnosis" section)

COMPONENT LOCATION



IDLE SPEED CONTROL SYSTEM

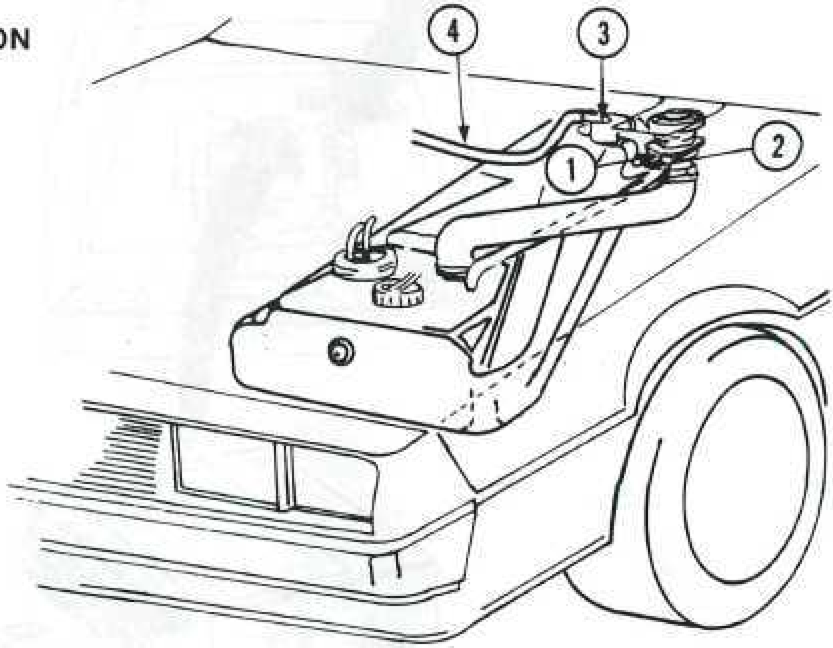
EVAPORATIVE EMISSION CONTROL SYSTEM

SYSTEM DESCRIPTION

An evaporative emission control system consisting of the fuel tank, vapor lines, vapor storage canister and a closed engine crankcase is used on the De Lorean.

The purpose of the system is to prevent fuel and oil vapors from entering the atmosphere. All vapors are stored within the system when the vechicle is not running. During operation, the vapors are purged from the system and burned in the engine.

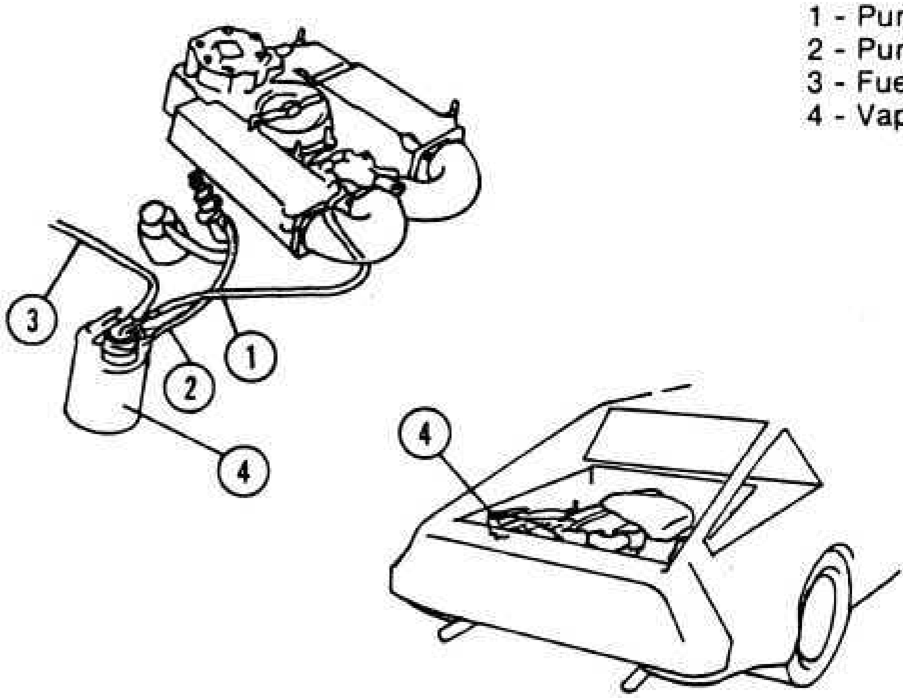
SYSTEM OPERATION



1 - Vapor Outlet
2 - Vapor Separating Hose
3 - Roll-Over Valve
4 - Vapor Hose to Canister

The entire fuel system is sealed to prevent fuel vapor from escaping. Gasoline vapor in the fuel tank is routed through the vapor separating hose (2) and the roll-over valve (3) to a storage canister in the rear of the car. When the engine is not running, fuel vapors will remain in the storage canister.

In the event of a roll-over accident, the roll-over valve prevents liquid fuel from leaking out of the fuel tank and traveling through the vapor hose to the canister (4).



1 - Purge Signal Hose
2 - Purge Hose
3 - Fuel Tank Vapor Hose
4 - Vapor Canister

A purge valve located inside the vapor canister (4) controls the operation of the vapor storage system. When the engine throttle plates are opened, the purge signal hose (1) applies engine vacuum to the purge valve and opens a passage inside the vapor canister. The purge hose (2) then connects the cold start air tube to the vapor canister.

Opening of the purge valve allows the canister to be purged of fuel vapors. These vapors are drawn into the cold start valve air tube which is connected to the air inlet system. The vapors are mixed with incoming air and burned in the combustion chambers.

The engine oil filter cap is also connected to the cold start valve air tube. This allows any engine vapors to be drawn from the crankcase through the left valve cover to the cold start valve air tube. An orfice in the air tube meters the amount of vacuum applied to the closed crankcase of the engine.

SYSTEM REPAIR NOTES

1. All connections must be tight and leak-free for the evaporative control system to operate properly.

2. Due to the design of the fuel injection system, it will be normal to have a slight amount of pressure in the fuel tank. This pressure will be noticed when removing the fuel filler cap.

3. A restricted vapor hose between the fuel tank and the vapor canister will cause a vacuum to be created in the fuel tank and possible collapse of tank.

4. The closed crankcase system does not have an air inlet for air circulation within the crankcase. This system applies manifold vacuum to the crankcase which is completely sealed to outside air.

   a. A plugged orfice in the cold start valve air tube or a plugged hose that connects the oil filler cap to the air tube would cause excessive pressure build-up within the crankcase resulting in possible oil seal and/or gasket damage.

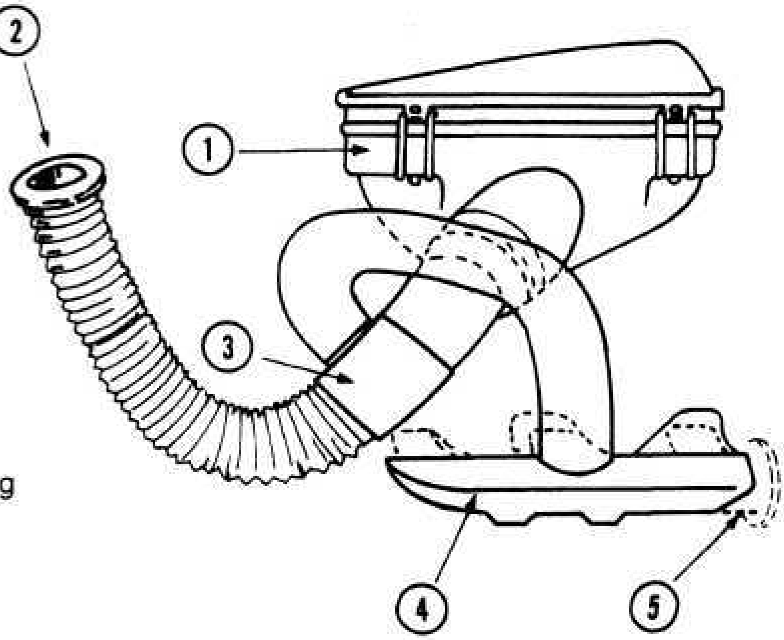
   b. An air leak in the engine crankcase will cause a lean running condition since the crankcase is connected to the intake manifold. Possible air leaks could be the oil dip stick not installed completely, oil filler cap not sealing properly, or leaking engine gaskets.

5. The vapor canister is not serviceable and must be replaced as a complete assembly. The canister is located inside the left rear body section and is attached to the cover plate which is fastened to the body with (4) bolts.

AIR INLET SYSTEM

DESCRIPTION AND OPERATION

The temperature of the incoming air to the engine is controlled to improve drive-ability and reduce exhaust emissions. The temperature of the air is controlled by the air valve housing (3) which is connected to the cold air inlet (2) and the hot air stove (4).



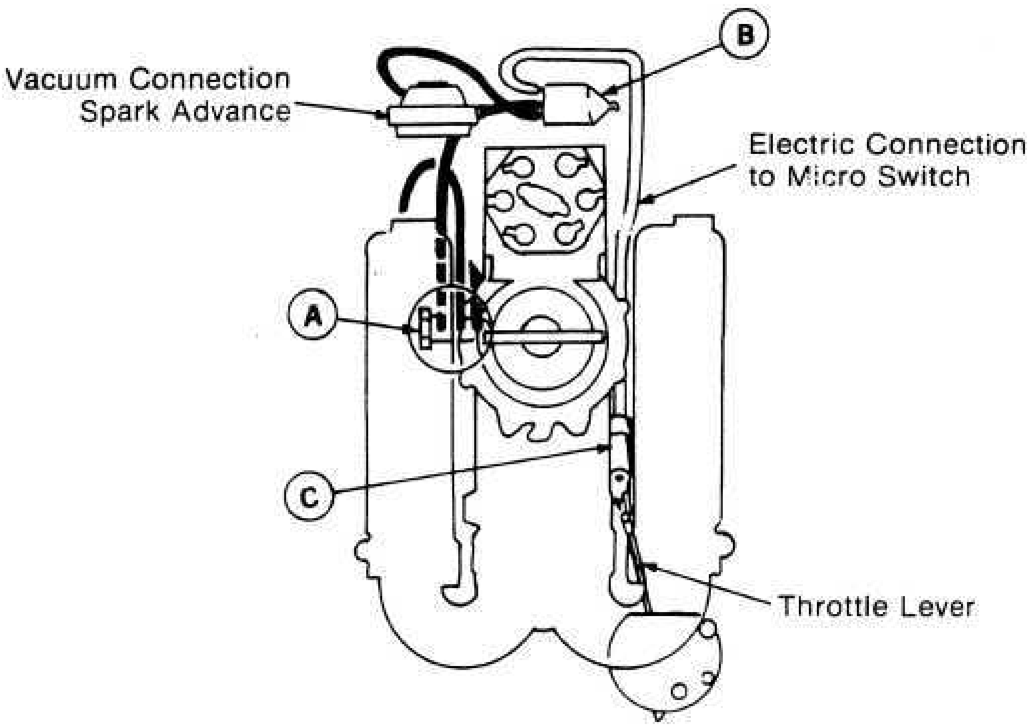
1 - Air cleaner assy
2 - Cold air inlet
3 - Hot/cold air valve housing
4 - Hot air stove
5 - Exhaust manifold

A wax thermostat inside the air valve housing determines the position of a flap controlling the incoming air. The flap is fully open to exhaust manifold heated air at temperatures below 15° C (59° F). As ambient temperature increases, the flap allows a mixture of hot and cold air to enter the engine until 25° C (77° F) is reached. At this time, the flap is fully closed to hot air and fully open to the outside cold air inlet.

IGNITION VACUUM ADVANCE CONTROL

DESCRIPTION AND OPERATION

The vacuum signal to the distributor advance is not present during idle and at low engine temperatures. Distributor advance is cut out at low temperatures to improve catalytic converter warm-up. A thermal vacuum control valve (A), located in a coolant passage, closes when the coolant temperature is below 40°C (104°F) to prevent manifold vacuum from reaching the distributor advance. Above 40°C, the control valve is open allowing vacuum to pass to the solenoid valve (B).



The electrically operated solenoid valve (B) is energized whenever the throttle plates are closed. Energizing the solenoid closes the vacuum passage to the distributor advance, thus eliminating an over-advanced condition during idle or deceleration. Solenoid operation is controlled by a throttle micro-switch (C) which provides an electrical ground for the solenoid valve when the throttle plates are closed.

DECELERATION CONTROL

DESCRIPTION AND OPERATION

During deceleration, a high manifold vacuum is created behind the closed throttle plates and lean condition occurs due to the loss of air flow through the air flow sensor. To eliminate this lean condition which causes high hydrocarbon emissions, a by-pass valve is located in each throttle plate.

The by-pass valves open when the manifold vacuum is above the normal idling vacuum. This allows enough air flow to by-pass the throttle plates and permit continued fuel injection.