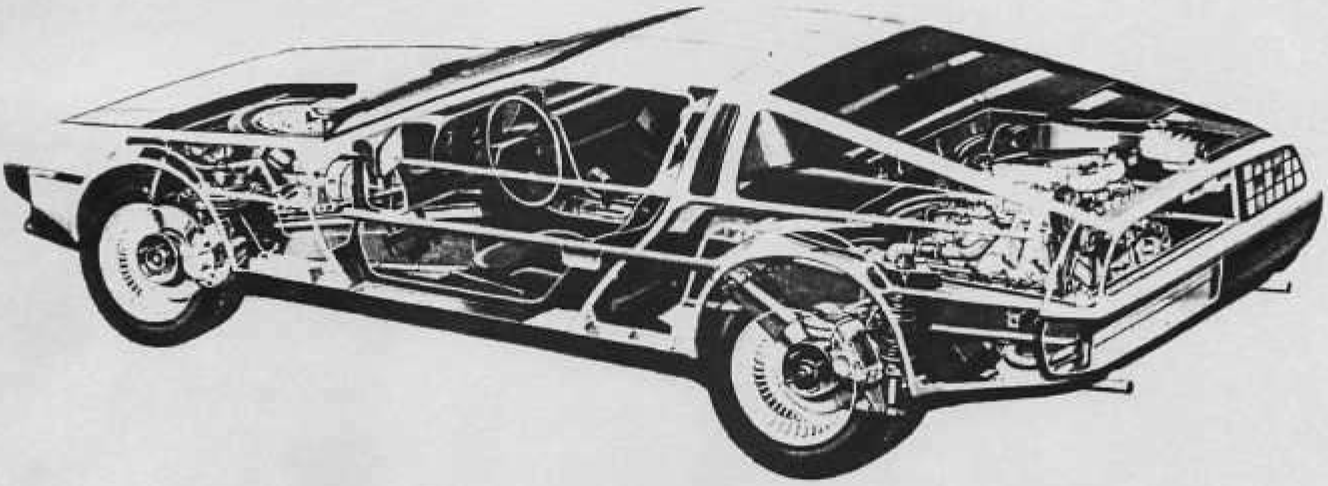
# TECHNICAL INFORMATION MANUAL



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DE LOREAN MOTOR COMPANY

# TECHNICAL INFORMATION MANUAL

## 1981 DeLorean

Technician Name ____________________

Dealership Name ____________________

Instructor Name ____________________

Date ____________________

PRINTED 3-81

# FOREWORD

This service publication has been prepared by the Service Training Department of De Lorean Motor Company to assist in understanding the design concepts and the general operation of the De Lorean. It is intended primarily for the experienced and qualified automotive technicians who have been selected to service the De Lorean. This publication includes the general description and operation of vehicle systems used on this vehicle which the selected technicians are basically familiar with as well as the more specifically detailed descriptions and operation for the systems which may be unique to this vehicle and/or the service technician.

All information, specifications and illustrations in this publication are based on the latest product information available at the time of printing. De Lorean Motor Company reserves the right to make changes or revisions at any time without notice. However, it is the objective of DMC and the Service Training Department to provide the DMC service technician with as much accurate and usable service information as is available, as quickly as possible, in order to sustain a high quality service standard.

**IMPORTANT:**
The De Lorean contains many parts dimensioned in the metric system. During any service procedure, replacement fasteners must have the same measurements and strength as those fasteners removed, either metric or customary. The numbers on the heads of metric bolts and on the surfaces of metric nuts indicate their strength. Customary bolts use radial lines on their heads for strength indicators while most customary nuts do not have strength indicators. Mismatched or incorrect fasteners can result in vehicle damage or malfunction, or possibly personal injury. Fasteners removed from the vehicle should be reused in the same locations whenever possible except when indicated otherwise. When fasteners are not satisfactory for reuse, care should be taken to select a replacement fastener that is equivalent to the original quality.

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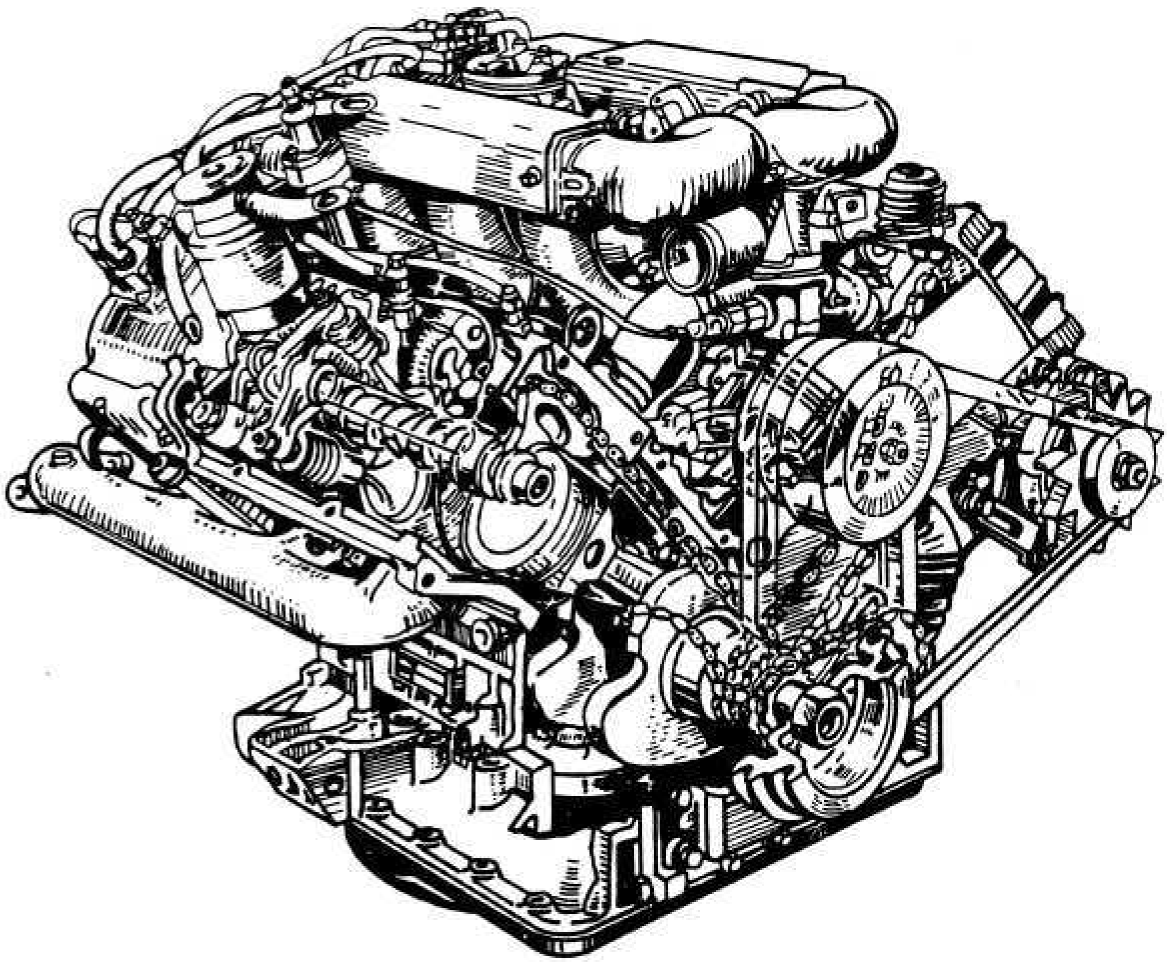
# GENERAL INFORMATION



# ENGINE

## GENERAL DESCRIPTION

The De Lorean is powered by a liquid cooled, 2.8 liter, rear mounted, aluminum alloy 90° V-6 uneven-fire engine with two (2) chain driven overhead camshafts.

The flywheel (or flexplate) end of the engine is referred to as the front of the engine due to the unique rear engine design. Therefore, the timing cover and drive belt pulleys are located at the rear of the engine. The right and left side of the engine is determined as viewed standing at the rear of the vehicle looking into the engine compartment.

Engine firing order is 1, 6, 3, 5, 2, 4.

The #1 cylinder is located at the right front of the engine followed with #2 and #3 cylinders. Cylinder #4 is located at the left front of the engine followed with #5 and #6 cylinders.

CYLINDER CRANKCASE ASSEMBLY: The cylinder crankcase assembly consists of aluminum alloy upper and lower crankcases. The upper crankcase contains six (6) cast iron cylinder liners and houses the crankshaft which is supported by four (4) cast iron main bearing caps. The upper crankcase also contains the chain driven oil pump drive and driven gears. The oil pump body is a machined portion of the upper crankcase. The lower crankcase provides side engine mount locations and completes the crankcase assembly. The aluminum oil pan, which houses the oil splash shield and oil pick up assembly, is secured to the lower crankcase.

CYLINDER HEADS: The aluminum alloy cross-flow cylinder heads, have hemispherical chambers and individual intake and exhaust ports for each cylinder. Both the intake and exhaust valve guides (8 MM) are pressed into the cylinder head.

NOTE: CYLINDER HEAD RESURFACING **IS NOT PERMITTED.**

The steel valve seats are fitted to the cylinder head.

VALVE TRAIN: Each cylinder head has a chain driven overhead camshaft. The camshaft operates both intake and exhaust valves on each bank by means of adjustable rocker arms mounted on a single, common rocker shaft. The rocker arms are positioned and held in place by means of two (2) spacers and one (1) thrust spring per cylinder.

The hollow rocker arm shaft, which also distributes engine oil through calibrated holes to the valve train and camshaft, is mounted and secured to each cylinder head with four (4) rocker shaft supports.

CAMSHAFT AND DRIVE: Each chain driven cast iron camshaft is supported at four (4) contact areas. Steel crankshaft sprockets drive the timing chains (2) which in turn drive the camshaft sprockets (2).

PISTONS AND CONNECTING RODS: Each aluminum alloy piston uses two (2) compression rings and one (1) oil ring. The steel piston pin has a floating fit in the piston. The pins are retained in the connecting rod by a 'hot' press fit. The connecting rod bearings are lubricated via drilled oil passages located in the crankshaft journals.

CRANKSHAFT: The cast iron crankshaft is supported with four (4) main bearings and main bearing caps. This uneven fire engine crankshaft has three (3) connecting rod journals. Lubrication for the connecting rod journal is delivered via drilled oil passages in the crankshaft, crankshaft main bearings and main bearing journals. The crankshaft is sealed at each end with a lip seal.

There are three (3) steel drive sprockets mounted on the rear of the crankshaft. These three (3) chain sprockets drive:

- right camshaft sprocket
- left camshaft sprocket
- oil pump sprocket

The drive chains and sprockets are covered by a timing chain cover which is secured to the upper and lower crankcase assembly.

ENGINE COOLING: The vehicle has two (2) electric fans for radiator cooling mounted at the front of the vehicle. These fans are activated when the engine coolant temperature exceeds 97°C (206°F) and deactivated at 91°C (195°F) Operation of these fans **is controlled by a temperature switch located on the coolant return pipe in the engine compartment.**

The water pump, located at the rear of the engine, is belt driven by the crankshaft pulley. The thermostat is housed in the top of the water pump under the thermostat housing cover. The thermostat housing cover is equipped with an air bleed screw used to purge the air from the coolant system when refilling.

Coolant leaving the engine is directed through a series of pipes and hose couplings along the left side of the vehicle center tunnel to the radiator. Coolant leaving the radiator is directed through a series of pipes and hose couplings along the right side of the vehicle center tunnel to the engine.

The coolant expansion tank (fill point) located on the right side of the engine compartment, is connected to the coolant return pipe by a hose.

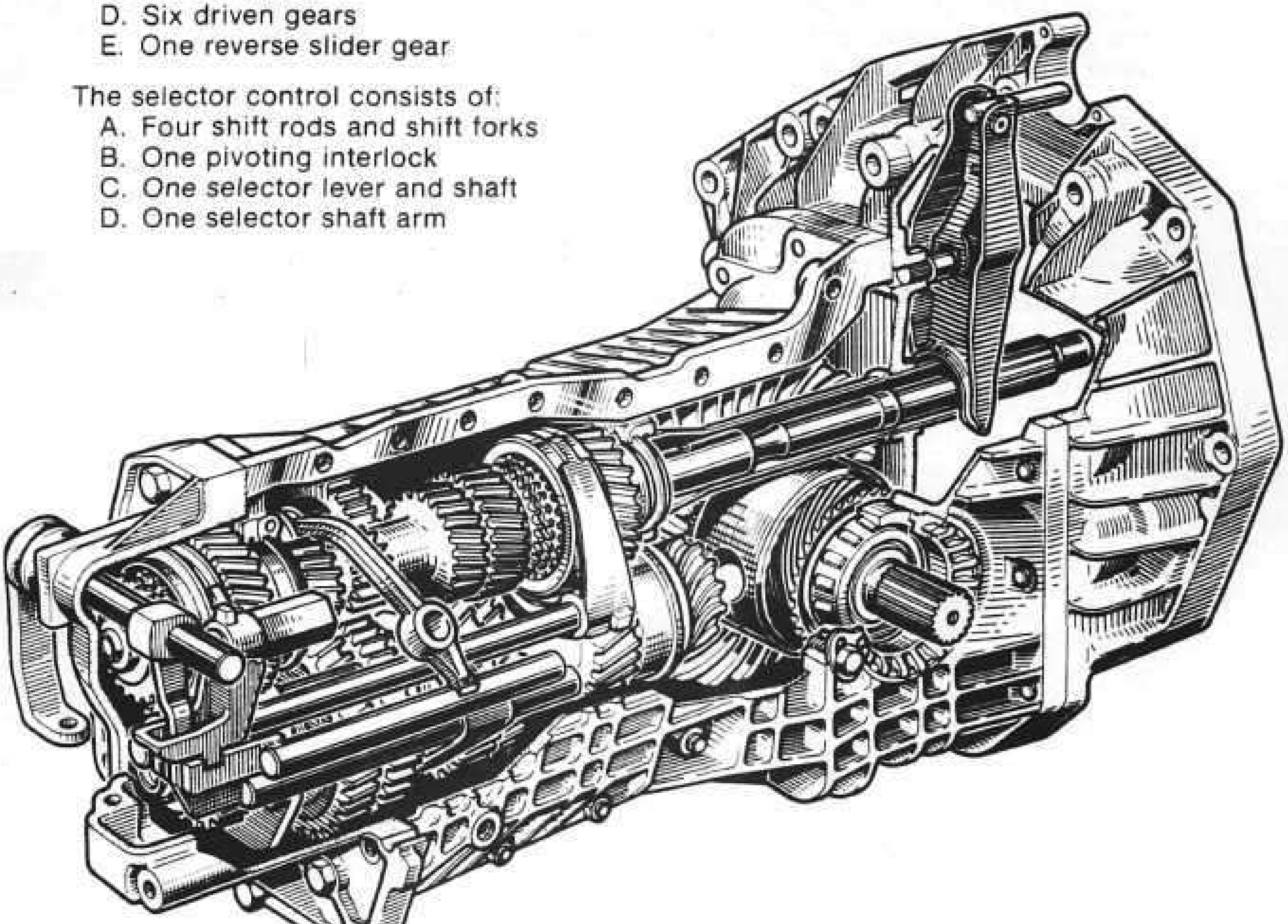
# TRANSMISSION - MANUAL

## GENERAL DESCRIPTION

The manual transmission is a constant mesh five speed. All forward gears are fully synchronized for ease of shifting. The aluminum case consists of two halves which, when repair is necessary, can be separated to provide easy access to internal parts. The final drive components are also contained within the transmission case. Both the final drive and transmission use the same lubricant eliminating the need for a separate final drive lube.

The power train consists of:
- A. Primary (input) shaft
- B. Secondary (output) shaft
- C. Six driving gears
- D. Six driven gears
- E. One reverse slider gear

The selector control consists of:
- A. Four shift rods and shift forks
- B. One pivoting interlock
- C. One selector lever and shaft
- D. One selector shaft arm



**OPERATION**

All forward gear power flow is transferred via:

A. Primary shaft (input)
B. The selected driving gear (primary shaft)
C. The selected driven gear (secondary shaft)
D. Pinion shaft/final drive unit

Reverse gear power flow is transferred by means of:

A. Primary shaft
B. Reverse driving gear
C. Reverse slider gear
D. Reverse driven gear
E. Pinion shaft/final drive unit

All gears are selected manually by the driver using the gearshift lever attached to the selector lever mounted on the side of the transmission rear housing. Inside the rear housing, a selector shaft arm, attached to the selector shaft, fits through a slot in the pivoting interlock. When a gear is selected, the selector shaft arm moves the interlock to the desired position and moves the appropriate shift rod in or out depending on the gear selected. The shift fork attached to the shift rod moves the desired gear into the proper position while the sychronizer ring matches the speed of the two gears being coupled. This shift sequence is repeated for all forward gears. Reverse operation is the same with the exception of the synchronizer ring, which is not required, since the vehicle should be stationary when shifting to reverse.

Gear ratios are as follows:

| | |
|---|---|
| 1st Gear: | 3.36 |
| 2nd Gear: | 2.06 |
| 3rd Gear: | 1.38 |
| 4th Gear: | 1.06 |
| 5th Gear: | 0.82 |
| Reverse Gear: | 3.18 |

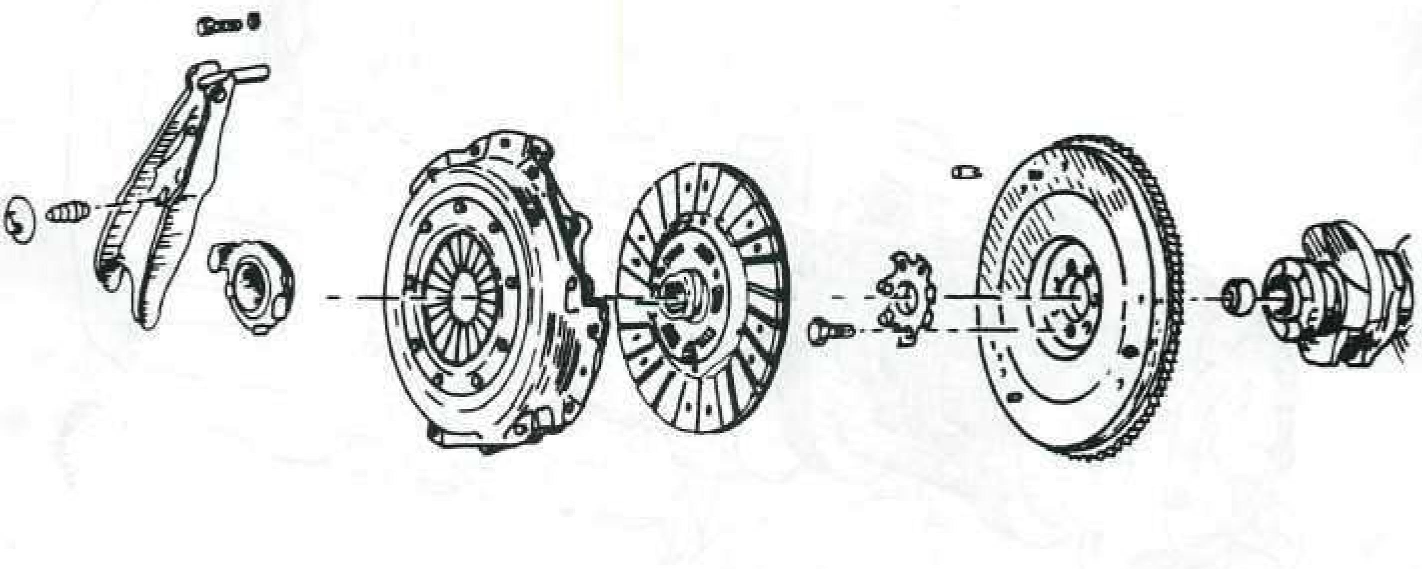
# CLUTCH

## GENERAL DESCRIPTION

The vehicle, when equipped with the five speed manual transmission, uses a single dry disc type clutch. The clutch is hydraulically operated. The pressure plate is a diaphram spring type and the disc has a spring cushioned hub. A self-aligning, sealed ball-type throw-out bearing is used to depress the diaphram spring. The clutch has its own fluid reservoir and master cylinder which provides hydraulic pressure when the clutch pedal is depressed.

## OPERATION

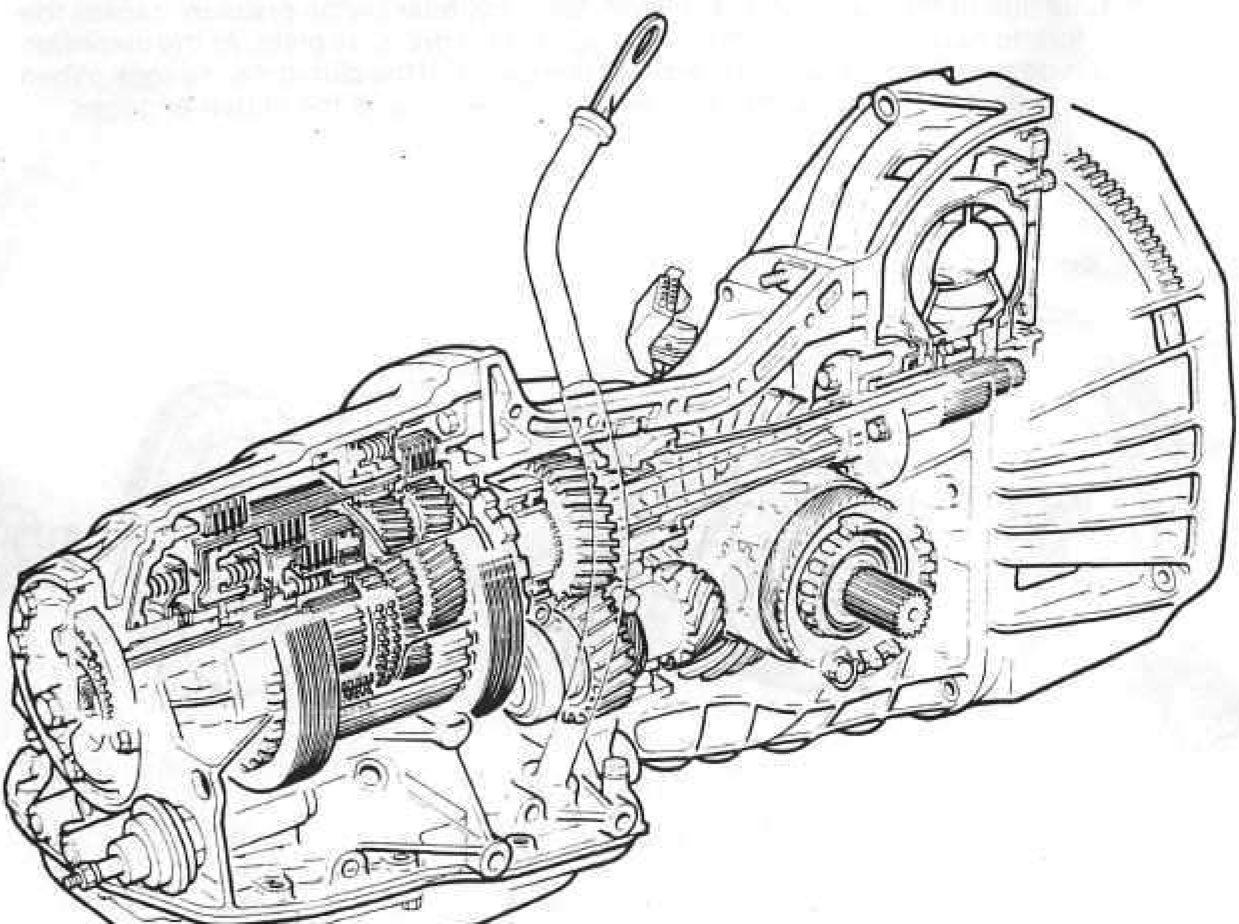
The clutch pedal is connected to the master cylinder with a pushrod. When the pedal is depressed, the pushrod exerts pressure against the master cylinder piston. As the piston begins to move, it draws fluid from the fluid reservoir and forces it through the hydraulic line to the slave cylinder piston. Slave cylinder piston pressure causes the clutch fork to move the throw-out bearing against the pressure plate. As the diaphram spring is depressed, pressure on the disc is released and the clutch disengages. When the clutch pedal is released, the procedure is reversed and the clutch engages.



# TRANSMISSION - AUTOMATIC

## GENERAL DESCRIPTION

The three (3) speed automatic transmission uses a conventional torque converter. This converter has a single stator supported on a one-way roller clutch. The final drive unit is contained within the transmission case. Gear reduction, direct drive, and reverse are achieved using one (1) planetary gear set, two (2) reaction members, and two (2) internal clutch packs. Hydraulic pressure for this transmission is developed with a crescent gear type oil pump. The pump is driven by a shaft which runs the entire length of the transmission case. This shaft is splined to the converter and turns at engine speed. Main line pressure is regulated by a pressure regulator valve and a vacuum operated actuator. As engine vacuum decreases, the valve increases main line pressure to assure positive application of the clutches and reaction members. The shift valves in the valve body are controlled by a computer governor assembly and two (2) electric solenoids. By comparison, a conventional valve body uses a mechanical governor and a vacuum modulator (or throttle valve) to perform this same function. The valve body is not servicable and must be replaced as a unit if required. The hydraulic transmission is operated and lubricated by automatic transmission fluid while the final drive assembly is in a separate area filled with gear lube.

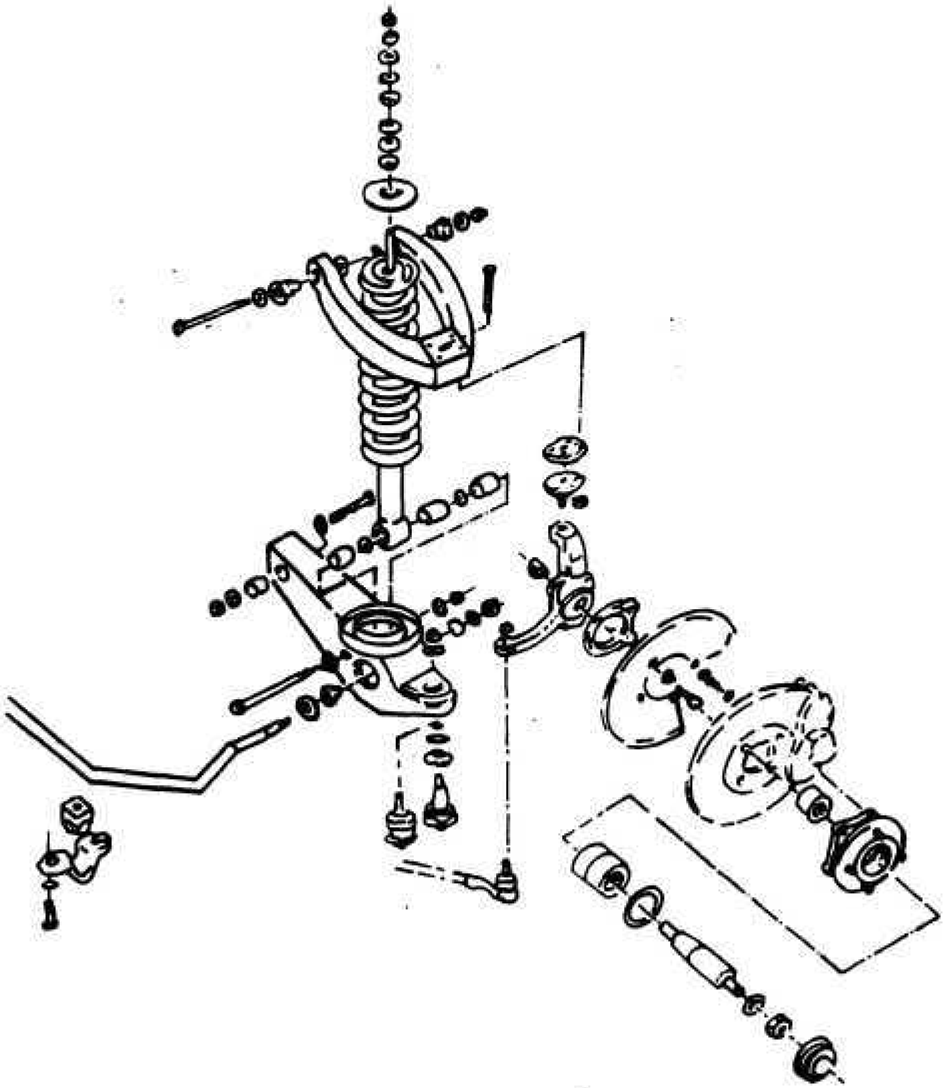


# FRONT SUSPENSION

## GENERAL DESCRIPTION

The front suspension is a fully independent type with upper and lower control arms, stabilizer bar and steering knuckle assembly. Telescopic shock absorbers, secured to the chassis frame tower at the absorber's upper end and to the lower control arm at the absorber's lower end, are positioned through the coil springs.

The single front hub bearing supports the hub assembly on the spindle which is fastened to the steering knuckle. The steering knuckle is secured to the upper and lower control arms with upper and lower ball joints and to the steering system with an adjustable ball-type tie rod.



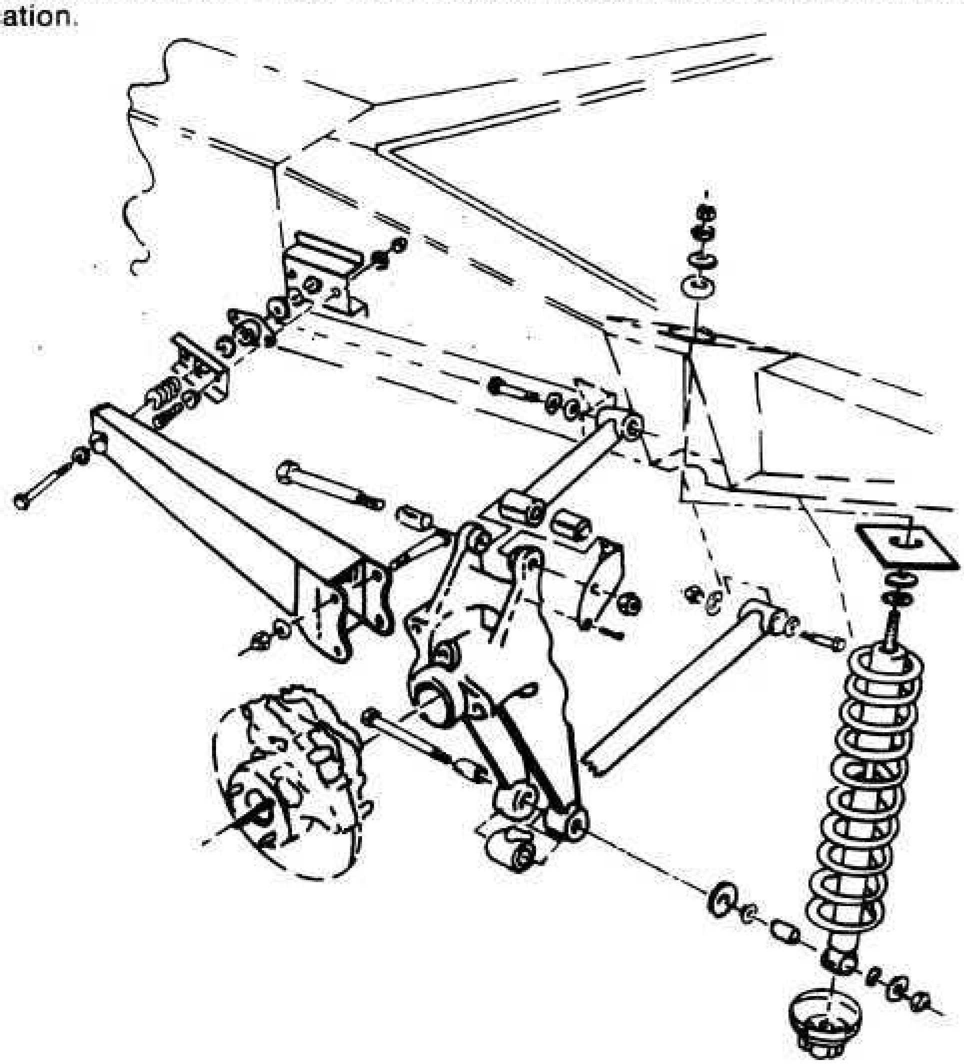
# REAR SUSPENSION

## GENERAL DESCRIPTION

The rear suspension is a fully independent type with a radius arm (trailing), upper and lower links and a rear hub carrier. Telescopic shock absorbers, secured to the chassis frame at the absorber's upper end and to the rear hub carrier at the absorber's lower end, are positioned through the coil springs.

The rear hub carrier is attached to the chassis frame with upper and lower links as well as the radius arm.

Rear suspension toe-in is achieved by shimming the radius arm at its frame attaching location.



# STEERING

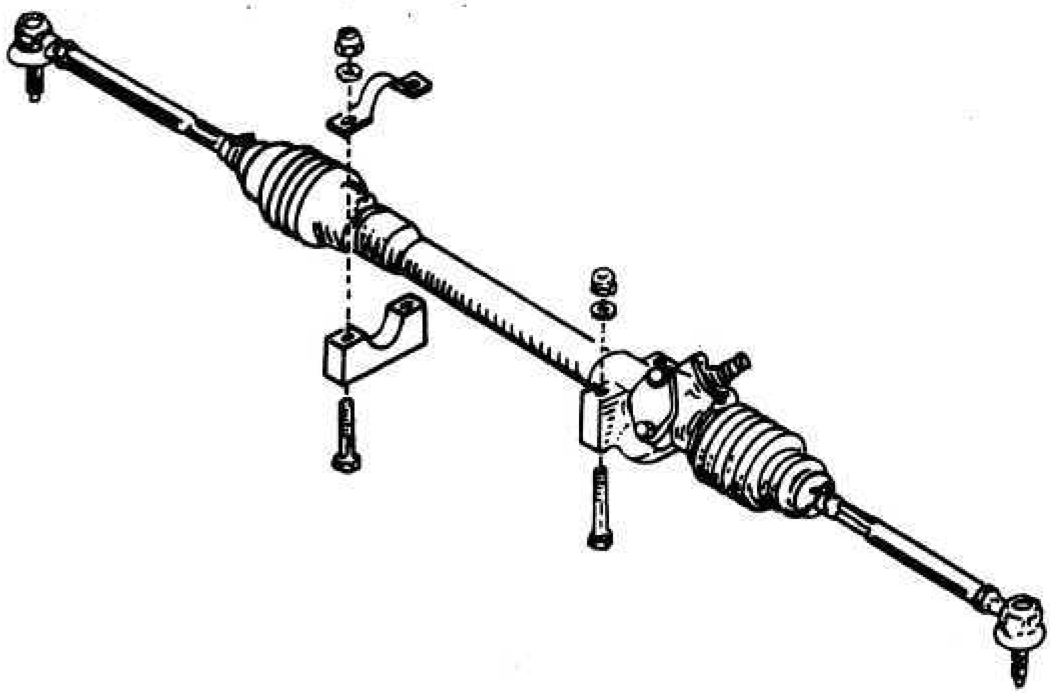
## GENERAL DESCRIPTION

The steering system consists of a collapsible steering column assembly, an intermediate shaft assembly and a rack and pinion type steering unit.

The steering column assembly is supported in the passenger compartment with an adjustable (up and down) bracket. Each end of the steering column shaft is splined. The upper splined end is designed to accept the steering wheel. The lower splined end of the steering column shaft fits through an opening in the driver's foot well and is sealed with a gasket and plate.

The lower end of the steering column shaft is secured to the upper universal joint of the intermediate shaft. The lower universal joint of the intermediate shaft is secured to the splined stub shaft of the steering gear.

The steering unit consists of a rack and pinion assembly, tie rod assemblies and tie rod ends. Each end of the rack and pinion assembly is protected from the elements with a flexible rubber boot which is secured with two (2) clamps. The adjustable tie rod ends, for obtaining proper toe-in specifications, are fastened to the steering knuckles.



# BRAKES

## GENERAL DESCRIPTION

The vehicle is equipped with a four wheel, vacuum assisted, hydraulic disc brake system. The disc brakes are applied with separate front and rear hydraulic circuits. The hydraulic pressure for these circuits originates at a tandem master cylinder which is operated with push rods. Brake application is assisted with the aid of a mechanical/vacuum power servo unit which is activated by brake pedal application. The park brake mechanically operates the rear brakes only.

Each wheel assembly is equipped with a fixed caliper containing two opposing pistons (attached to knuckle or carrier), a brake disc (positioned over the hub and wheel studs) and a set or brake pads.

In addition to the service brake calipers and pads, the rear brakes are equipped with independent and separate park brake caliper and pad assemblies. The park brake calipers and pads are operated with the park brake lever inside the driver's compartment by means of two (2) separate cables to provide park and emergency braking of the rear discs. The park brake caliper and pad assemblies are secured to the rear service brake calipers. The park brake caliper and pad assemblies are self-adjusting by means of a spring loaded racheting pawl incorporated within the caliper apply lever.

The tandem master cylinder consists of two (2) independent cylinders in a single casting. Should one cylinder or system fail, the other system will remain operational. Each hydraulic system (front and rear) has a separate brake fluid supply well in the brake fluid reservoir which is mounted to the top of the master cylinder. The brake fluid reservoir is equipped with a float actuated, low fluid warning indicator. However, this system **is not equipped** with a low pressure indicator, a metering valve, proportioning valve or a combination of these valves.

The power assist from the brake servo unit is developed by engine vacuum. Engine vacuum, obtained from an intake manifold fitting, is applied to both sides of a diaphragm inside the servo unit. Depressing the brake pedal will allow atmospheric pressure to enter one side of the diaphragm. This difference in pressure develops the power assist used in applying the brake systems. The servo unit is located between the brake pedal and master cylinder. The apply pressure is transferred through two (2) in-line push rods. Should a vacuum failure occur, the two (2) push rods will act as a single rod and the brakes will continue to operate in the unassisted, conventional manner; however, additional brake pedal effort will be required. A vacuum check valve is used in the supply line where it connects to the servo unit. This check valve prevents vacuum loss from the servo unit after the engine stops running and provides enough vacuum reserve for emergency brake application.

# HEATING AND AIR CONDITIONING SYSTEM

## GENERAL DESCRIPTION

The vehicle uses a dual-function air conditioning system which provides both heating and cooling. The air conditioning system is the Cycling Clutch Orifice Tube type (C.C.O.T.). This system uses a pressure sensing switch to prevent evaporator freeze-up by cycling the compressor on and off. Heating is controlled by the amount of air flow through the heater core. This flow is controlled by a temperature door operated with a cable connected to the temperature knob.

## OPERATION

CONTROL FUNCTIONS: Air is drawn into the system by a fan either through the fresh air intake (located just ahead of the windshield), or from the interior of the vehicle depending on the position of the re-circulation door. The fan then forces the air through the evaporator core to the temperature door. The position of the temperature door controls the amount of system air directed through the heater core. Two mode doors (mounted on a common shaft) direct the conditioned air to either the footwell/windshield chamber or the door/face level vent chamber, or both. The footwell/windshield chamber contains a horizontally mounted door which directs the conditioned air either to the windshield or the footwell. The door/face level vent also contains a horizontally mounted door which either shuts off face level vents or shuts off a bridging duct connecting with the windshield vent.

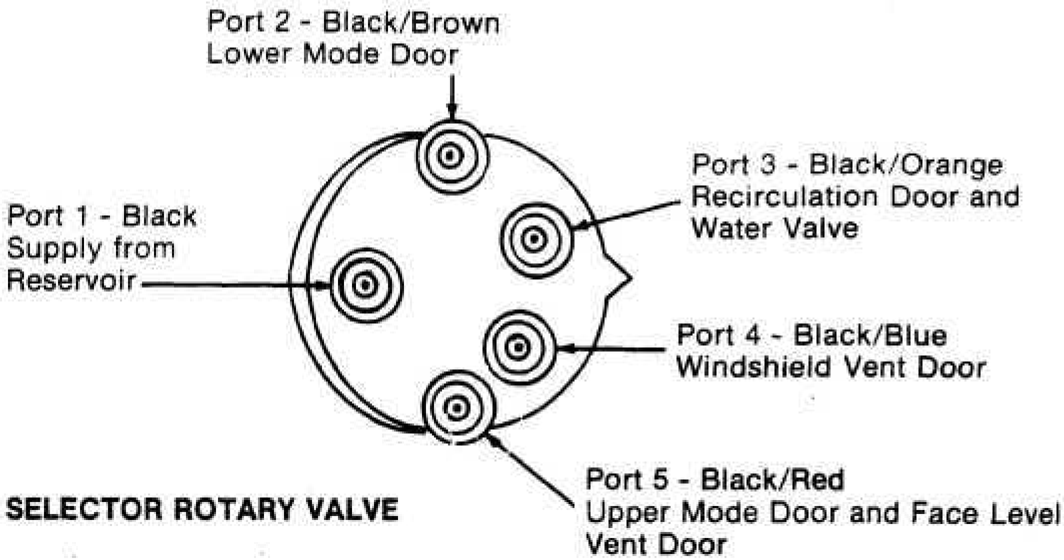
All doors, with the exception of the cable operated temperature door, are vacuum operated by diaphragm actuators. The air conditioning/heater selector switch has two functions. One function is to supply vacuum to the correct door actuators. The other function is to supply electric current to the air conditioning compressor and the blower fan as necessary when the different positions are selected.

The control of vacuum distribution is achieved by means of a five (5) port rotary valve. The rotation of this valve is controlled by air conditioning/heater selector movement. A vacuum hose harness connects all door vacuum actuators to the air conditioning/heater selector. The vacuum hose harness also delivers the operating vacuum source to the five-port rotary valve. Vacuum for this system's operation is supplied by engine vacuum and stored in a vacuum reservoir tank (located in the left rear body section).

Reservoir tank vacuum is maintained after the engine is shut off by means of vacuum supply line check valve. As the five (5) port rotary valve is turned (by selector movement), various vacuum ports will align to either vent or supply vacuum to the proper actuators required for the desired operating mode.

The connection and switching sequence of the selector switch is as follows:

## VACUUM CONNECTIONS




**SELECTOR ROTARY VALVE**

## VACUUM SWITCHING

| | SELECTOR CONTROL POSITION | | | | | | |
|---|---|---|---|---|---|---|---|
| **CONNECTION** | **OFF** | **MAX** | **NORM** | **BI-LEVEL** | **VENT** | **HEATER** | **DEFROST** |
| 1 Source | Seal | Vac | Vac | Vac | Vac | Seal | Vac |
| 2 Lower mode door | Vent | Vac | Vac | Vent | Vac | Vent | Vent |
| 3 Re-circulation door & water valve | Vent | Vac | Vent | Vent | Vent | Vent | Vent |
| 4 Windshield door | Vent | Vent | Vent | Vent | Vent | Vent | Vac |
| 5 Upper mode door & face level vent | Vent | Vac | Vac | Vac | Vac | Vent | Vent |

## ELECTRICAL CONTACTS

| | SELECTOR CONTROL POSITION | | | | | | |
|---|---|---|---|---|---|---|---|
| CONNECTION | OFF | MAX | NORM | BI-LEVEL | VENT | HEATER | DEFROST |
| 2 Supply | Hot | H | H | H | H | H | H |
| 3 Compressor | — | H | H | H | — | — | — |
| 4 Fan speed switch | — | H | H | H | H | H | H |

## SEQUENCE OF OPERATION

Off: The vacuum supply is sealed off at the rotary valve and the switch contact points are open. All doors are in the vented position; both the compressor and fan speed switch are inoperative.

Ventilation is provided to the foot wells to circulate fresh air through the vehicle.

Max: Vacuum is supplied to the lower mode door (Port 2), upper mode door and face level vent door (Port 5) and to the re-circulation door and water valve (Port 3).

The fresh air vent is closed and the re-circulation vent is opened. The compressor and fan speed switch are energized. Refrigerated re-circulated air is supplied to the door vents and face level vents. The water valve is closed, so that the heater core remains cold.

NOTE: The re-circulation door is designed not to seal the fresh air vent completely. This prevents stale air from developing in the vehicle.

Norm: Vacuum is supplied to the lower mode door (Port 2) and face level vent door (Port 5).

The re-circulation door closes the re-circulation vent and opens the fresh air vent. The water valve is opened. The compressor and fan speed switch are energized.

Refrigerated fresh air is supplied to the door vents and face level vents.

Bi-Level: Vacuum is supplied to the upper mode door and face level vent door only (Port 5). The compressor and fan speed switch are energized.

Refrigerated fresh air is supplied to the footwells, door vents and face level vents.

If the temperature control is turned towards the hot setting, the temperature door will direct a portion of air through the heater core which will then flow to the foot wells.

Vent: Vacuum is supplied to the lower mode door (Port 2) and to the upper mode door and face level vent door (Port 5).

The compressor is off; the fan speed switch is energized.

Ambient fresh air is supplied to the door vents and face level vents.

Heater: The vacuum supply is not present and electrical current is supplied to the fan speed switch only.

As the temperature control is turned towards the maximum hot setting, the temperature door directs an increasing portion of air through the heater core and then to the foot wells. The windshield vent door is designed not to seal completely, a certain amount of the hot air will be directed to the windshield vent, and to the bridging duct to the door vents, for defogging purposes.

Defrost: Vacuum is supplied to the windshield vent door (Port 4). Electrical current is supplied to the fan speed switch only.

With the temperature control turned to the maximum heat setting, air is directed through the heater core and is distributed to the windshield and door vents. A certain amount of hot air will be directed to the foot wells.

## NOTES

The heater core water valve is open at all times except when the re-circulation door is operated (maximum setting). Heated air is only available if the temperature control directs air through the heater core.

The selector switch may be removed for access to the vacuum harness or electrical contacts.

REFRIGERANT CYCLE: The refrigerant cycle begins at the compressor where refrigerant enters as a low pressure, low temperature vapor. After being compressed, it leaves as a high pressure, high temperature vapor. This vapor flows to the condenser where it is cooled by air flow through the condenser. As the refrigerant vapor gives up heat, it changes from high pressure, high temperature vapor to high pressure liquid. The liquid then passes through the orifice tube where it becomes a low pressure, low temperature liquid. This liquid enters the evaporator core absorbing heat from the vehicles interior compartment. The absorbtion of heat causes the liquid to change to a low pressure, low temperature vapor. This vapor, and the small amount of low pressure liquid that did not vaporize completely, enters the accumulator where the liquid is separated and trapped until it also vaporizes. From the accumulator, the low pressure vapor returns to the compressor where the cycle begins again. A pressure relief valve is built into the system between the condenser and the orifice tube. This valve is placed in the system as a safety device. This valve is designed to open automatically at approximately 440 psi, thus venting the system to atmosphere and helps prevent any damage from occuring at excessive pressures.

PRESSURE SENSING/CYCLING SWITCH: The pressure sensing switch is located near the top of the accumulator. Its function is to cycle the compressor off at 20 to 28 psi and back on at 41 to 51 psi to maintain cooling and prevent evaporator freeze-up. The pressure switch also turns the compressor off when accumulator pressure falls below approximately 23 psi. This function protects the compressor if system is undercharged or if ambient temperature is below 37°F.

# BODY AND CHASSIS

## GENERAL DESCRIPTION

The vehicle's body is made of structural composite glass reinforced plastic (GRP). The upper and lower halves are molded separately, then bonded together to form the body shell. Plastic is laid over pre-formed foam panels. The foam provides a larger surface to cover with plastic which gives more rigidity to the body shell. The body shell is covered with high quality grade 304 brushed stainless steel body panels to give the car its unique appearance. No paint or sealers are used on the exterior body and it is virtually corrosion-free.

The chassis consists of an epoxy coated steel backbone (center tunnel) frame, with front and rear wishbones, supporting crossmembers and 4-wheel fully independent suspension. The front crossmember carries the steering and front suspension components. The rear crossmember is welded to the center backbone and carries the engine and transaxle assemblies. The bumpers, sills, and spoiler are semi-rigid endura polyurethane, capable of considerable flexing without breakage. The doors are counter-balanced gull wing type which use torsion bars for balancing and gas struts for holding them open. Other standard features of the car include:

- Leather seating area
- Air Conditioning
- Electrically operated windows
- Adjustable steering wheel (tilt & telescoping)
- Electrically operated remote control side door mirrors
- Central door locking system
- Tinted glass

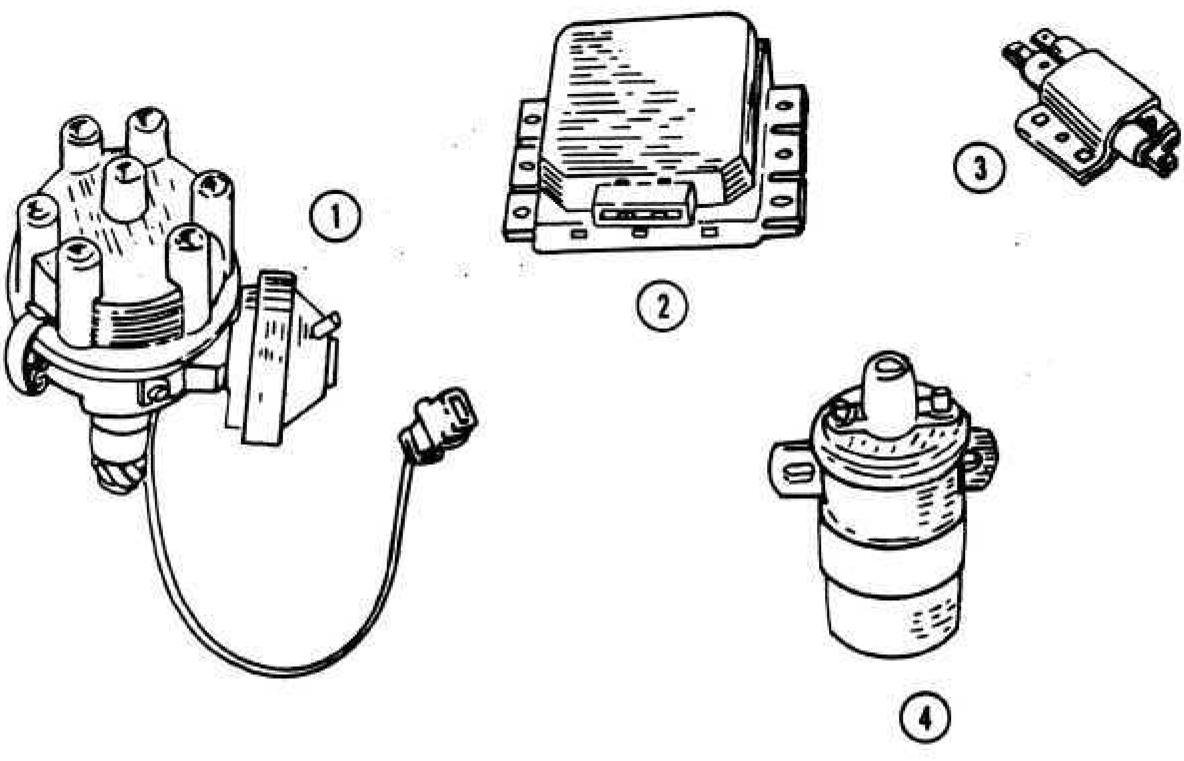
# ENGINE ELECTRICAL

# ELECTRONIC IGNITION SYSTEM

## SYSTEM DESCRIPTION

The De Lorean is equipped with a Bosch electronic ignition system. This breakerless ignition system is similar to a conventional ignition system except for the following modifications.

The breaker points in the distributor have been replaced by a pulse generator consisting of a stator, an induction coil and a trigger wheel. The pulse generator is connected to an electronic control unit (ECU) module in which the signal from the distributor is converted and amplified. The ECU module is connected to a high voltage ignition coil.




1 - Distributor
2 - ECU module

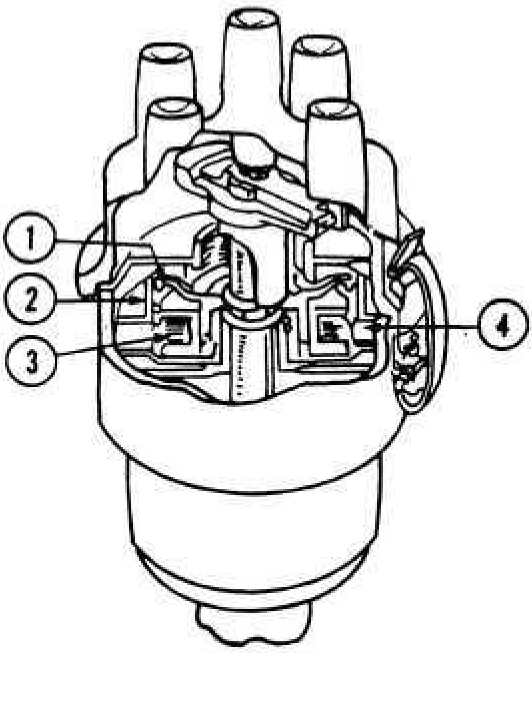
3 - Compensating resistor
4 - Coil

**SYSTEM OPERATION**

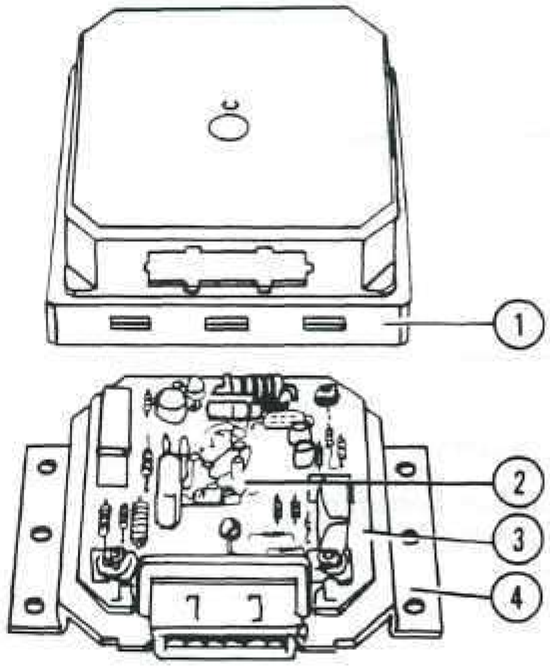
DISTRIBUTOR: The distributor contains a pulse generator which corresponds to the breaker points in a conventional distributor. The trigger wheel is attached to the distributor shaft and is designed with six fingers (poles). The stator, induction coil, and magnet are formed into one unit which is attached to the distributor plate. The stator is also designed with six fingers (poles).

When the trigger wheel rotates, an alternating voltage is produced in the pulse generator. This pulse is transmitted to the ECU module and its voltage will vary between 0.3V and 100V depending on engine speed.

The alternating voltage is produced by the trigger wheel passing through a magnetic field which creates a voltage in the induction coil. As the pole on the trigger wheel approaches the pole on the stator, a positive voltage is produced. The voltage then reverses polarity as the poles separate. The ECU module creates secondary ignition spark when the poles are directly aligned with each other.




1—Trigger Wheel
2—Stator
3—Induction Coil
4—Magnet




1—Cover

2—Output Transistor

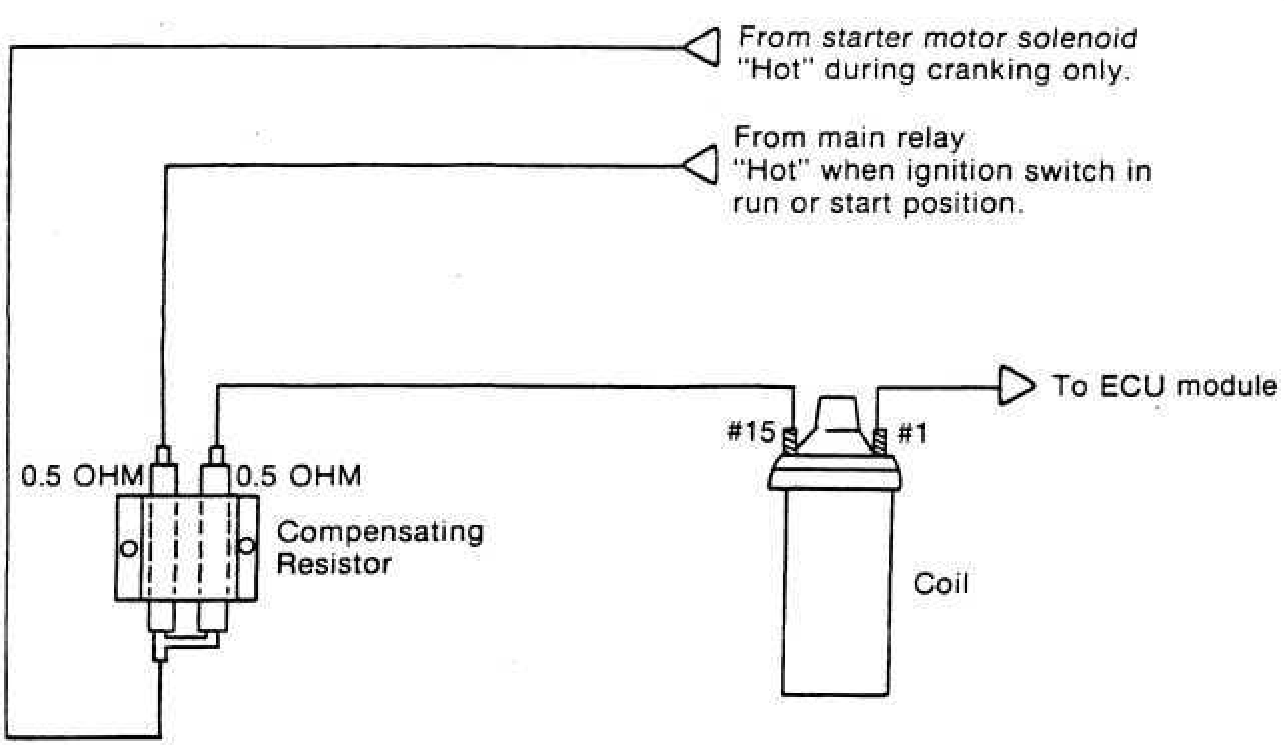
3—Printed Circuit Board

4—Base Plate

ELECTRONIC CONTROL UNIT MODULE: ECU module controls the operation of the ignition coil and determines the proper dwell angle. The module is a fully electronic sealed component which does not utilize any moving parts.

The module monitors engine operation by the varying voltage pulses it receives from the pulse generator in the distributor. This information is electronically analyzed and the proper dwell angle is established for different engine speeds. By varying the dwell angle, the coil is capable of operating at maximum efficiency.

After the dwell angle is determined, the output transistor turns the ignition coil primary circuit on and off. When current is flowing in the primary circuit, a magnetic field is built up within the coil. As current flow stops, the field collapses and the secondary ignition spark takes place. The secondary spark delivered from the coil high tension terminal is routed to the proper cylinder by the distributor rotor and cap.



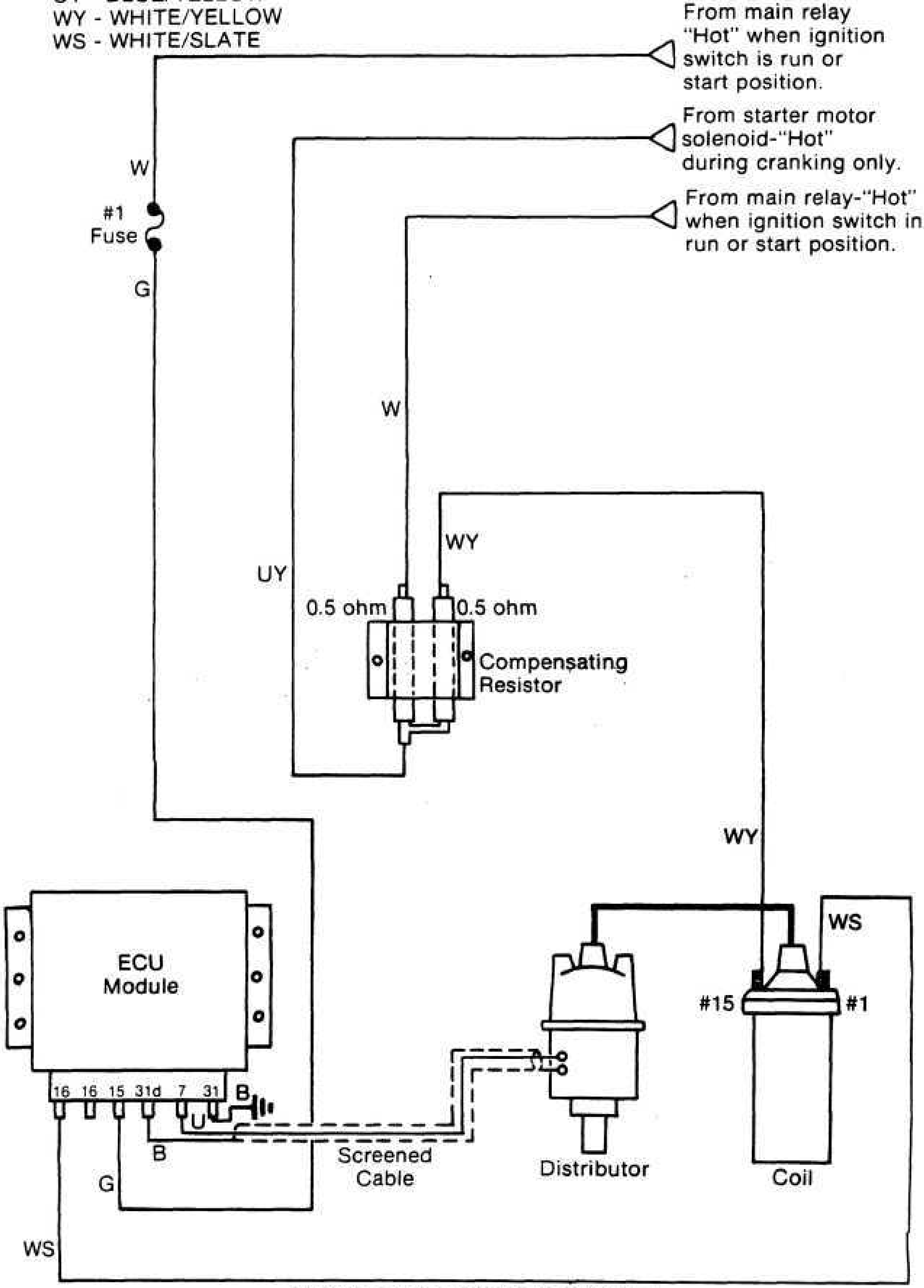

COMPENSATING RESISTOR: A dual resistance ballast resistor is used to control primary circuit voltage and current flow.

When the ignition switch is in the run position, the current flow is reduced by the resistor to prevent overheating of the coil during operation. To provide increased coil voltage for starting the engine, one-half of the resistor is bypassed during the engine cranking process. By reducing the circuit resistance, the coil primary voltage and current will increase, thus increasing the secondary output voltage.

IGNITION TIMING ADVANCE: The Bosch distributor provides timing advance by means of a centrifugal advance unit and a vacuum advance unit the same as a conventional distributor.

SPARK PLUGS AND WIRES: Bosch HR6DS spark plugs are used with copper core secondary wiring. Spark plugs are gapped to 0.6 - 0.7 mm (0.024 - 0.028 in).

U - BLUE
B - BLACK
W - WHITE
G - GREEN
UY - BLUE/YELLOW
WY - WHITE/YELLOW
WS - WHITE/SLATE




ELECTRONIC IGNITION CIRCUIT

## SYSTEM REPAIR NOTES

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"CAUTION"

When the engine is running, dangerously high voltage which may prove fatal may be present in the primary circuit of the coil and in all wires connected to terminal #1 of the coil.

---

1. Before working on the vehicle with the ignition switch in the "run" position and the engine not running, disconnect terminal #15 on the coil.
2. Before working on the ignition system, always ensure that the ignition is in the "off" position.
3. The ignition timing is adjusted in the same manner as a conventional system using the timing marks on the crankshaft pulley and the timing chain cover. Connect timing light to #1 cylinder plug wire.
4. If it is necessary to replace the ignition coil, use the proper replacement part designed for this particular system.
5. The ignition distributor is serviceable and repair parts are available. The cap and rotor can be removed without removing any engine components. To remove the complete distributor, it is necessary to loosen the fuel inlet system to provide sufficient clearance for removal of the distributor assembly.
6. THE ECU module cannot be repaired or adjusted. It is located in the bottom of the module compartment behind the driver's seat. The ignition ECU module is silver in color and is mounted under the black idle speed ECU module.
7. The ignition coil is located behind the black plastic cover in the right front corner of the engine compartment.
8. The compensating resistor is attached to the firewall at the left front corner of the engine.
9. The ignition distributor is located under the intake manifold on the L.H. cylinder head and is driven by the L.H. camshaft.
10. A defective or improperly wired compensating resistor will cause premature ignition coil failure. Before replacing a coil, refer to the wiring diagram for proper wiring and resistance values.
11. When replacing spark plugs, it is extremely important to install the new plugs without lubricating the plug threads and torque tighten them to the proper specification.

12. Due to the design of the crankshaft used in the PRV V-6 engine, a special distributor is used which has unequal spacing of the ignition secondary terminals. When viewing primary and secondary patterns on a scope, the patterns will have unequal dwell spacing.

13. The ignition dwell angle is electronically controlled and will vary with engine RPM.

**SPECIFICATIONS**

DISTRIBUTOR:

| | |
|---|---|
| Rotation | Clockwise |
| Firing Order | 1-6-3-5-2-4 |
| Compensating Resistor Value | 0.5 ohm each (1.0 ohm total) |
| Basic Ignition Timing | 13+2° BTDC at 775 +50 RPM (vacuum advance disconnected) |
| Induction Coil Resistance | 895 - 1,285 ohm |
| Trigger/Stator Pole Air Gap | 0.25 mm (use non-magnetic feeler gauge) |
| Dwell | Dwell angle is electronically controlled and will vary with engine RPM |
| Spark Advance-Vacuum (at idle speed) | 5 in.hg. = 3°<br>10 in.hg. = 12°<br>15 in.hg. = 20° |
| Spark Advance-Mechanical | 1000 RPM (engine) = 0°<br>2000 RPM (engine) = 10°<br>3000 RPM (engine) = 14°<br>4000 RPM (engine) = 20° |
| Rotor | 5000 ohms |

COIL:

| | |
|---|---|
| Primary winding resistance | 0.95-1.4 ohm at 20° C |
| Secondary winding resistance | 5.5-8.5 k ohm |
| Average Current Value Through Primary Winding at Idle | 3.2 amps |

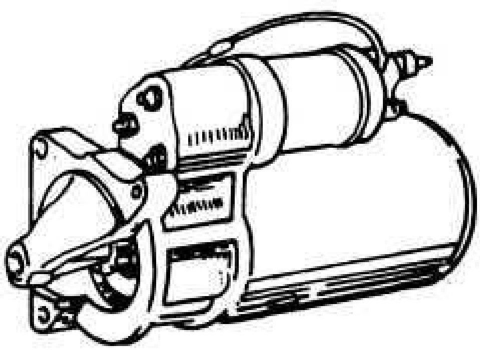
SPARK PLUGS:

| | |
|---|---|
| Torque Specifications | 17.5-20 NM (13-15 FT LB) |
| Gap | 0.6-0.7 mm (0.024-0.028 IN) |

# STARTER MOTOR CIRCUIT

## CIRCUIT DESCRIPTION

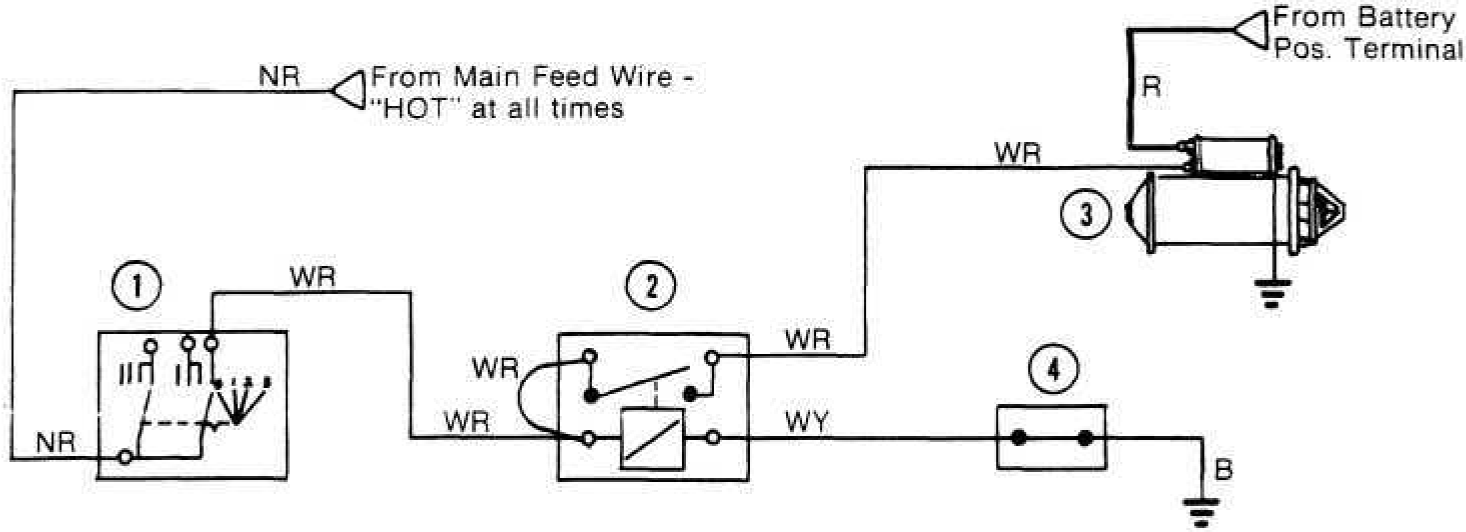
The starting circuit used is basically the same as any domestic or import automobile starting system. The Paris-Rhone starter motor is activated by a solenoid switch which simultaniously engages the starter drive gear to the flywheel. Solenoid plunger movement is transmitted to the starter drive gear via linkage and a shift fork during cranking. An over-running clutch is used in the starter drive gear to prevent damage to the starter motor after the engine starts if the ignition key is not released immediately.



**STARTER MOTOR**

The electrical circuit that activates the starter contains a start inhibit relay. When the ignition switch is turned to the "start" position, the start inhibit relay is energized allowing current to flow to the starter solenoid. By using this type of circuit, the current required by the solenoid pull-in windings is routed through the relay contacts, thus eliminating high current arcing at the ignition switch contacts.

B — BLACK
R — RED
NR — BROWN/RED
WR — WHITE/RED
WY — WHITE/YELLOW




**STARTING CIRCUIT**

1 - Ignition switch - "start" position
2 - Start inhibit relay
3 - Starter motor and solenoid
4 - Neutral start switch (Auto. transmission only)

## CIRCUIT OPERATION

When the ignition switch (1) is placed in the "start" position, current flows through the electromagnet in the start inhibit relay (2) and on to ground via the transmission wiring harness. Current flowing through the relay magnet causes the contacts to close, completing the circuit to the solenoid pull-in windings (3). When the vehicle is equipped with an automatic transmission, the neutral start switch (4) must be in the "neutral" or "park" position to complete the ground circuit of the start inhibit relay. Manual transmission cars are connected to ground at the transmission wiring harness eliminating the neutral switch completely.

As the solenoid plunger moves rearward and engages the starter drive gear to the flywheel, electrical connection is made between the battery and the starter motor via a contact disc inside the solenoid. During the cranking process, a hold-in winding is activated in the solenoid to assist holding the drive gear in engagement with the flywheel.

The start inhibit relay is de-energized when the ignition switch is released. This allows the solenoid to de-energize, disconnect the starter motor from the battery, and retract the drive gear from the flywheel.

## SYSTEM REPAIR NOTES

1. The starter motor may be overhauled depending upon the extent of repair. Solenoid, drive gear, brushes, linkage and armature bushings are available for replacement.
2. The start inhibit relay is located in the relay panel in the relay compartment behind the passenger seat. (See "Chassis Electrical" section)
3. The automatic transmission neutral start switch is part of the valve body controls and is not adjustable.
4. The electrical portion of the ignition switch can be replaced without removing the lock cylinder and steering lock assembly.

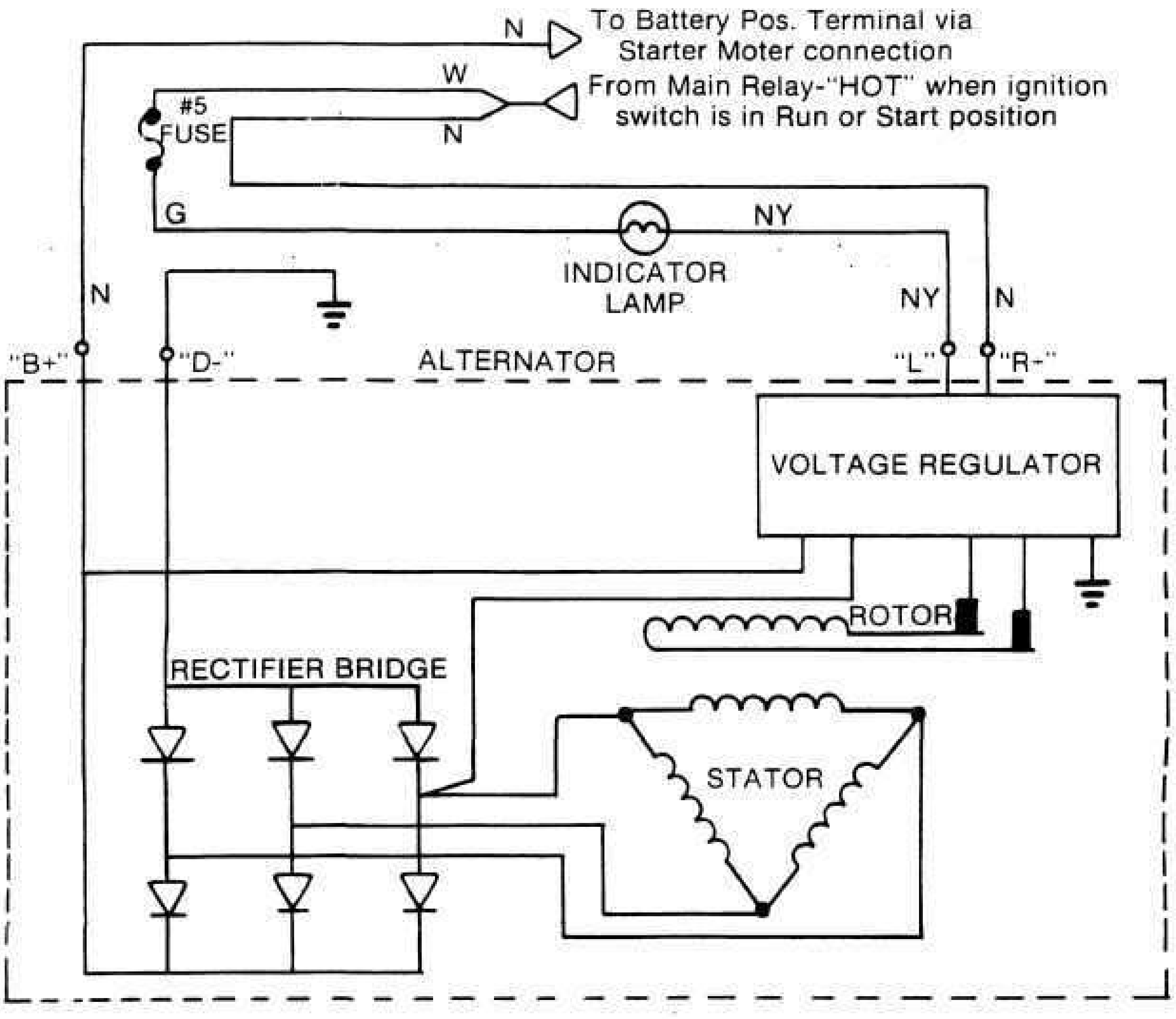
# CHARGING SYSTEM

## SYSTEM DESCRIPTION

The car is equipped with a Ducellier 80 amp alternator containing an integral voltage regulator. The alternator consists of a "delta" connected stator, a six diode rectifier bridge, and a "claw pole" rotor which is controlled by an electronic voltage regulator.

When the ignition switch is turned to the "start" or "run" position, the main relay supplies power to the voltage regulator and the "charge" indicator lamp. The charge indicator lamp operation is controlled by the voltage regulator. Whenever the ignition switch is in the "run" position and the alternator is not producing voltage, the voltage regulator will allow current to flow through the indicator bulb circuit, lighting the lamp. Any voltage produced by the alternator, above that of the battery, will cause the voltage regulator to turn the indicator lamp off.

N — BROWN W — WHITE
G — GREEN NY — BROWN/YELLOW




**CHARGING CIRCUIT**

**REPAIR NOTES:**

1. The alternator is serviceable and parts are available for necessary repairs.
2. When the alternator belt tension is adjusted correctly, the belt may be depressed 6-10 mm (¼ - ⅜ in.) with moderate thumb pressure midway between the pulleys.
3. Charging system voltage is regulated between 13.5V and 15.0V and is checked at approximately 3,000 RPM with accessories and lights turned off.
   NOTE: A discharged battery will lower voltage readings.
4. Current maximum output should be within ten percent of alternator rating at approximately 3,000 RPM with an electrical load of 80 amps.
   NOTE: If carbon pile tester is not available, load the system by turning on all lights and accessories.

   NOTE: It is not possible to "full field" the alternator to determine if the regulator is defective. DO NOT attempt to by-pass the regulator by using jumper wires.

   NOTE: Low charging system voltage and current output may be caused by a loose drive belt. Due to the high capacity of the alternator, it is necessary that the belt is adjusted properly.

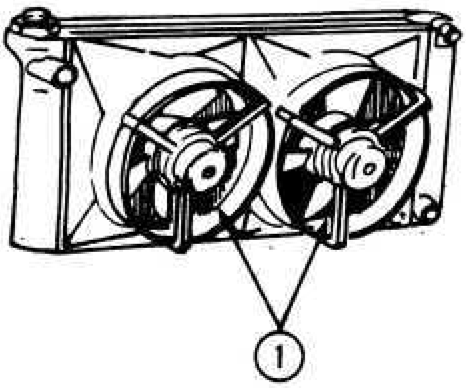
**SPECIFICATIONS:**

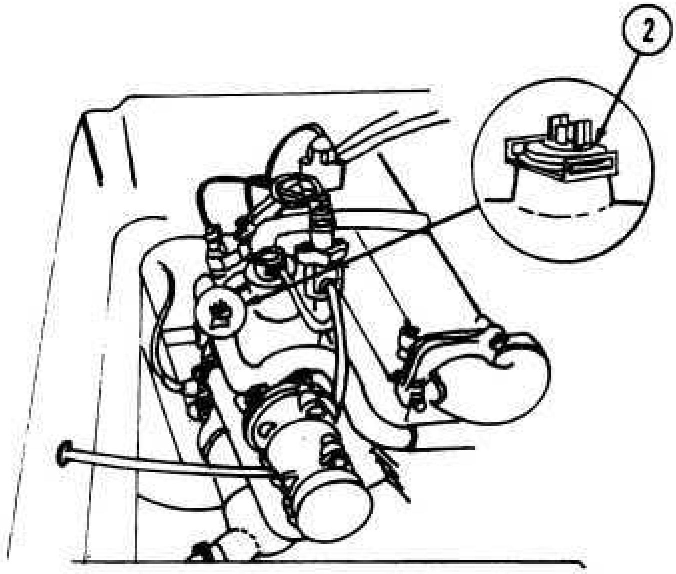
| | |
|---|---|
| Current Output | 80 amps |
| Regulated Voltage | 14.4V± 0.15V at 20°C (68°F) |

# COOLING FAN CIRCUIT

## CIRCUIT DESCRIPTION

The De Lorean Sports Car uses a forward mounted radiator fitted with two electric cooling fans to control engine coolant temperature.

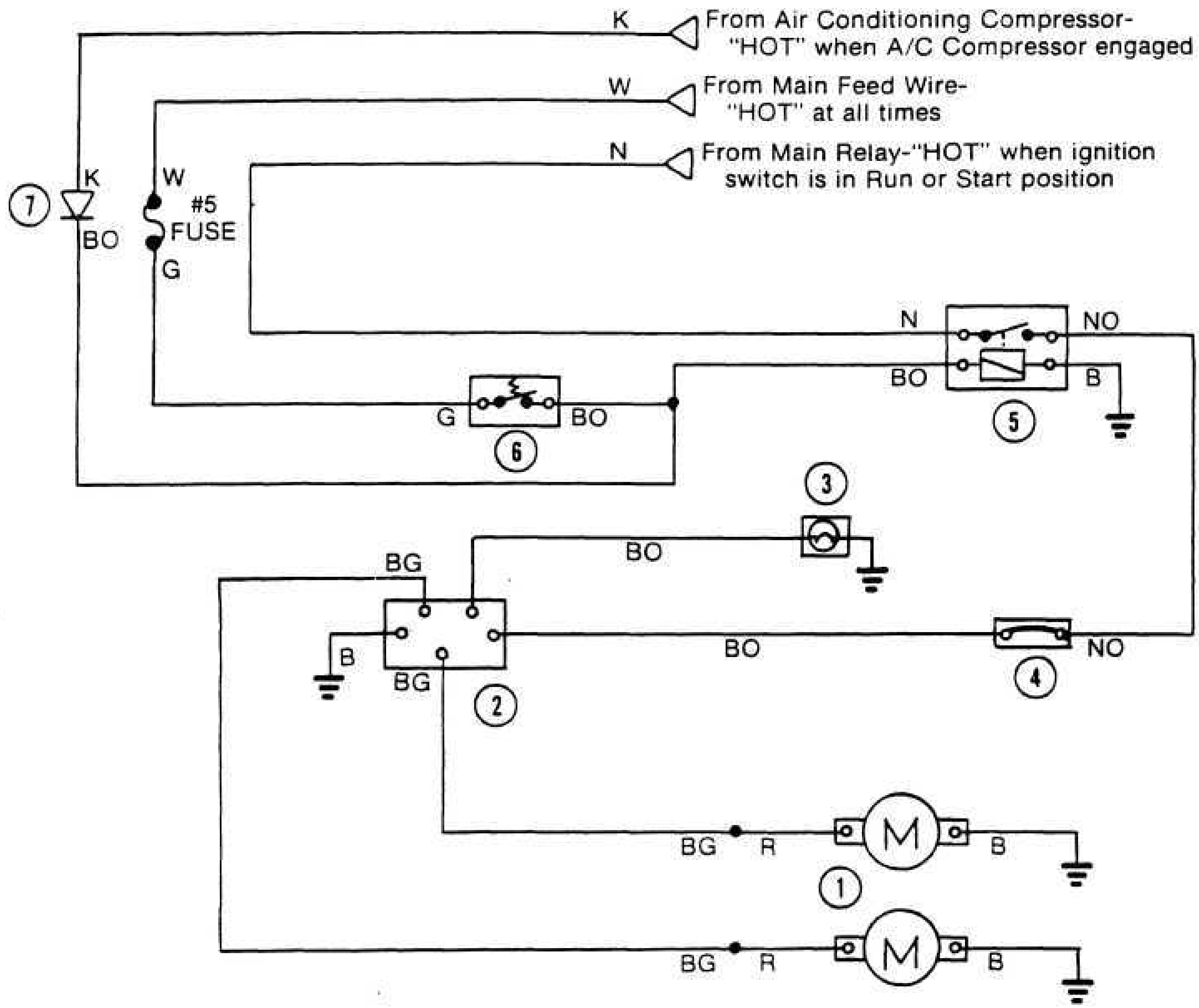



A temperature sensor (2), located in the coolant outlet pipe leading to the radiator, cycles the cooling fans (1) on and off to increase air flow through the radiator when coolant temperature increases above normal. The temperature sensor is calibrated to turn the fans on at approximately 97° C (207° F) and turn off when the temperature drops below 91°C (196°F). The fans will remain on continuously if the coolant temperature does not drop below 91° C.

The cooling fan circuit is also controlled by the air conditioning electrical circuit. Whenever the air conditioning compressor is activated, the cooling fans switch on and run continuously to provide constant air flow through the condenser which is mounted in front of the radiator.

K - PINK
W - WHITE
N - BROWN
G - GREEN
BO - BLACK/ORANGE
R - RED
NO - BROWN/ORANGE
B - BLACK
NS — BROWN/SLATE
NP - BROWN/PURPLE
BG - BLACK/GREEN




**COOLING FAN CIRCUIT**

1—Cooling fans
2—Fan fail module
3—"Fan fail" warning lamp
4—Circuit breaker
5—Fan relay
6—Temperature switch
7—A/C diode

## CIRCUIT OPERATION

With the ignition switch in the run or start position the main relay supplies voltage to the temperature switch (6) from fuse #5 in the fuse box. If the coolant temperature in the engine exceeds 97° C (207° F), the temperature switch closes and allows current to flow to the fan relay (5). Current flowing through the relay closes the contacts and connects both cooling fans (1) to the main feed wire which is "hot" at all times. When the coolant temperature drops below 91° C (196° F) the temperature switch opens, deactivating the fan relay and turning the fans off.

An air conditioning override circuit will bypass the temperature switch when the A/C compressor is energized. This allows the cooling fans to run whenever the A/C compressor is operating. An A/C diode (7) is used in this ciruit to prevent the cooling fan circuit from "feeding back" into the air conditioning circuit.

Current supplying the fan motors passes through a circuit breaker (4) which is used to protect the circuit from overload. The circuit breaker is designed to accept the high current surge developed when the fans start into operation, but will open the circuit if excessively high current flows due to a shorted or siezed fan motor. When the circuit breaker overloads and opens, it will cool down and reset automatically.

Current supplying the fan motors also passes through the fan fail module (2). The purpose of this module is to measure the current flowing to each fan motor and signal the driver by turning on a warning lamp (3) whenever the fans are drawing improper amounts of current. For example, the warning lamp would activate if one fan were to stop due to an open circuit or if one fan would begin to seize and draw higher amperage than normal.

NOTE: It is normal for the warning lamp to light for a few seconds when the fans turn on.

## CIRCUIT REPAIR NOTES

1. The cooling fan motors are not serviceable and each must be replaced as a unit if defective.
2. The fan relay, A/C diode, circuit breaker, and fan fail module are located in the relay compartment behind the passenger seat. (See "Chassis Electrical" section)
3. The A/C diode (color coded black) can be removed from the wiring harness and replaced if defective.

NOTE: A shorted A/C diode would cause the A/C compressor to run when the temperature switch closes and the A/C control is in the "off" position.

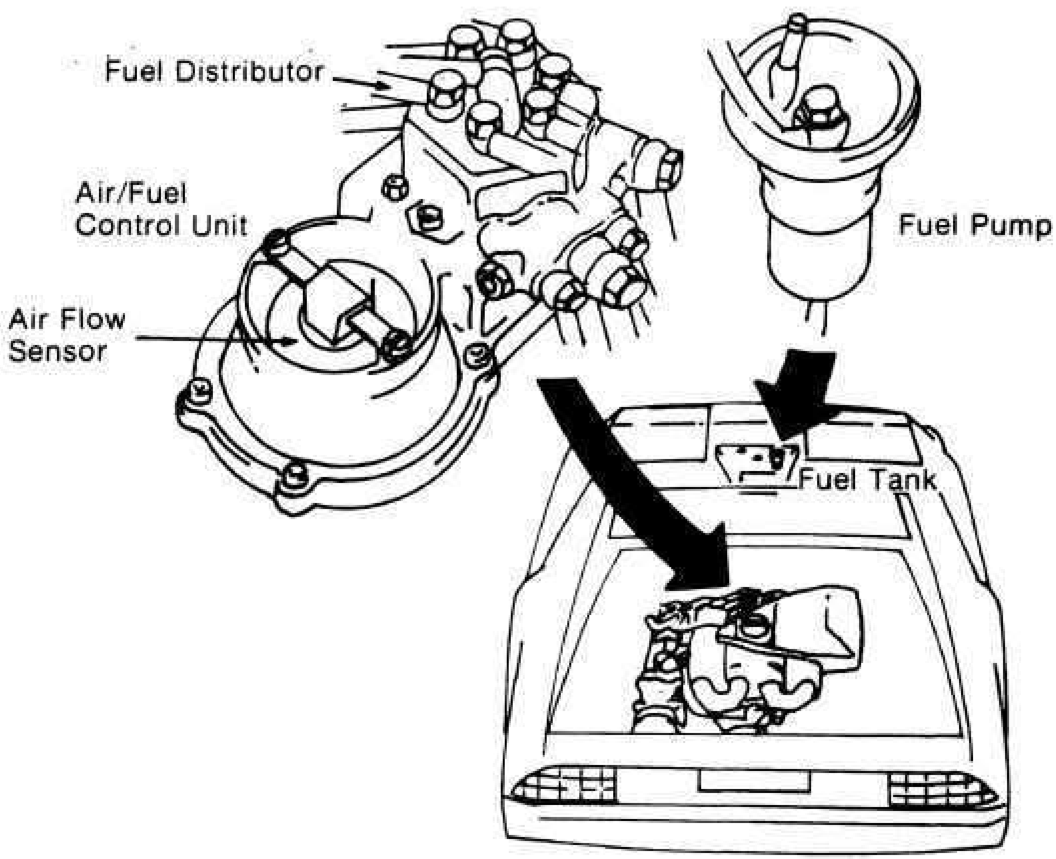
# FUEL INJECTION

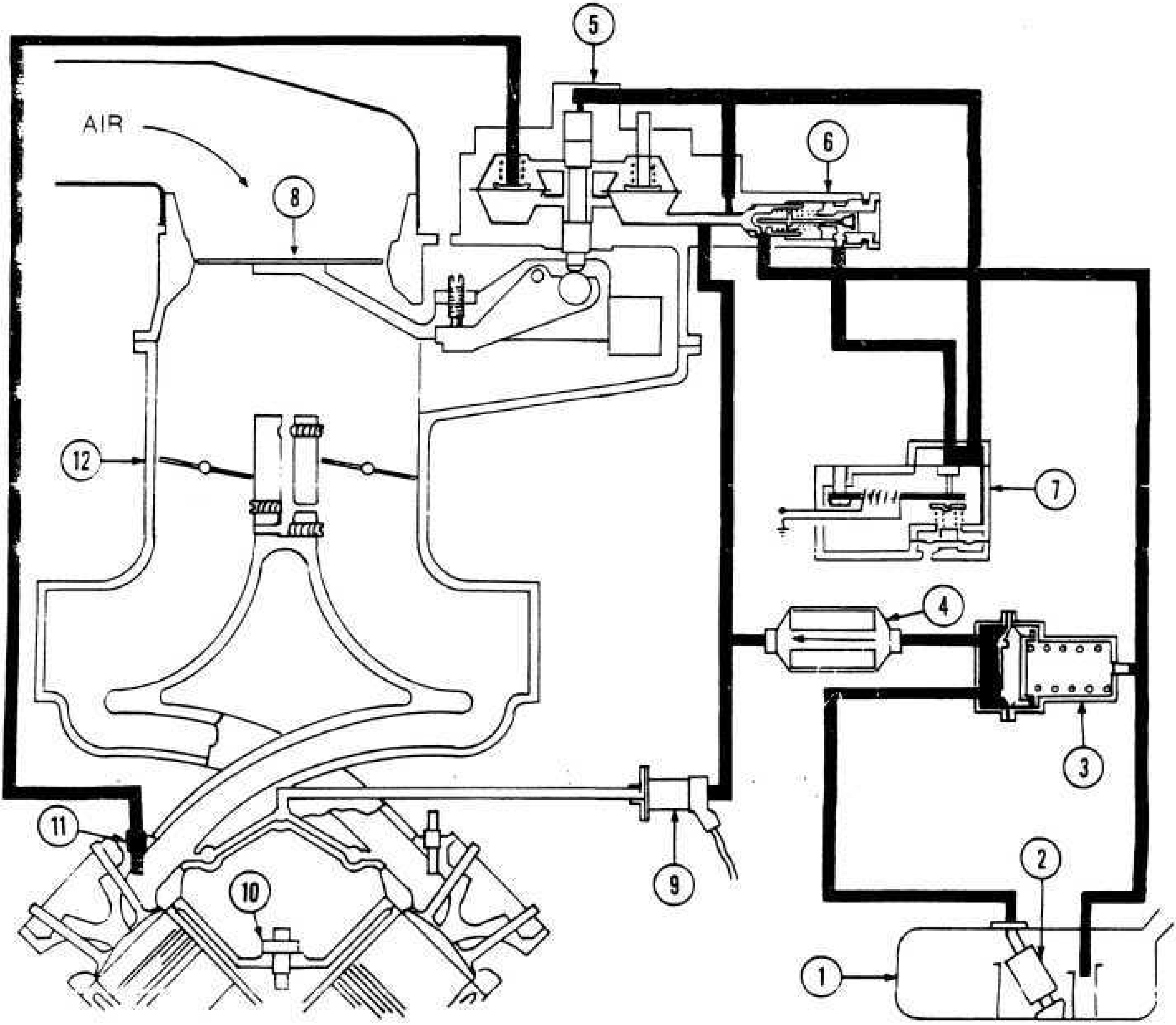
# FUEL INJECTION

## SYSTEM DESCRIPTION

The De Lorean is equipped with the Bosch K-Jetronic fuel injection system. This form of fuel induction by means of manifold injection permits the optimum adaptation of the air-fuel mixture to every operating phase of the engine. The K-Jetronic system ensures a lower pollutant level in the exhaust gas, high performance and increased fuel economy.

The K-Jetronic is a mechanical continuous fuel injection system which does not require any form of drive mechanism. An electric fuel pump mounted inside the tank provides fuel at a constant pressure to the mixture control unit. The control unit consists of an air flow sensor which measures the flow of air entering the engine, and a fuel distributor which is mechanically operated by the air flow sensor. The fuel distributor provides the injection valves with the correct amount of fuel. The fuel is injected into the inlet manifold immediately upstream of the intake valve. Injection takes place continuously, that is, without regard to the position of the intake valve. During the intake valve closed phase, the fuel is stored in the intake tubes of the manifold.






1 FUEL TANK
2 FUEL PUMP
3 FUEL ACCUMULATOR
4 FUEL FILTER
5 FUEL DISTRIBUTOR
6 PRIMARY PRESSURE REGULATOR
7 CONTROL PRESSURE REGULATOR
8 AIR FLOW SENSOR
9 COLD START VALVE
10 THERMO-TIME SWITCH
11 INJECTORS
12 THROTTLE VALVES

## COMPONENTS AND DESCRIPTION

1 Fuel Tank

A molded plastic fuel tank is located in the front wishbone of the frame. Access to the tank components is gained by removing the inspection panel inside the trunk.

2 Fuel Pump

An electric rotary pump is used to provide fuel for the system. The pump is mounted inside the fuel tank.

3 Fuel Accumulator

The accumulator keeps the system under pressure when the pump is not running. The accumulator is mounted inside the rear section of the frame backbone.

4 Fuel Filter

A special filter is used to remove foreign particles from the fuel. The filter is mounted on the left rear frame rail.

5 Fuel Distributor

The fuel distributor determines the necessary volume of fuel to be delivered to each injector.

6 Primary Pressure Regulator

The primary pressure regulator controls the primary or main line fuel pressure in the system. The regulator is located inside the fuel distributor.

7 Control Pressure Regulator

The control pressure regulator provides fuel enrichment during warm up and cold acceleration. The regulator is mounted on the left valve cover.

8 Air Flow Sensor

The air flow sensor measures the amount of air entering the engine.

9 Cold Start Valve

An electrically operated cold start valve is used to supply extra fuel to the engine during cold start conditions. The valve is mounted on the left side of the engine.

10 Thermo-Time Switch

The thermo-time switch regulates injection time of the cold start valve. The switch is mounted in the thermostat housing.

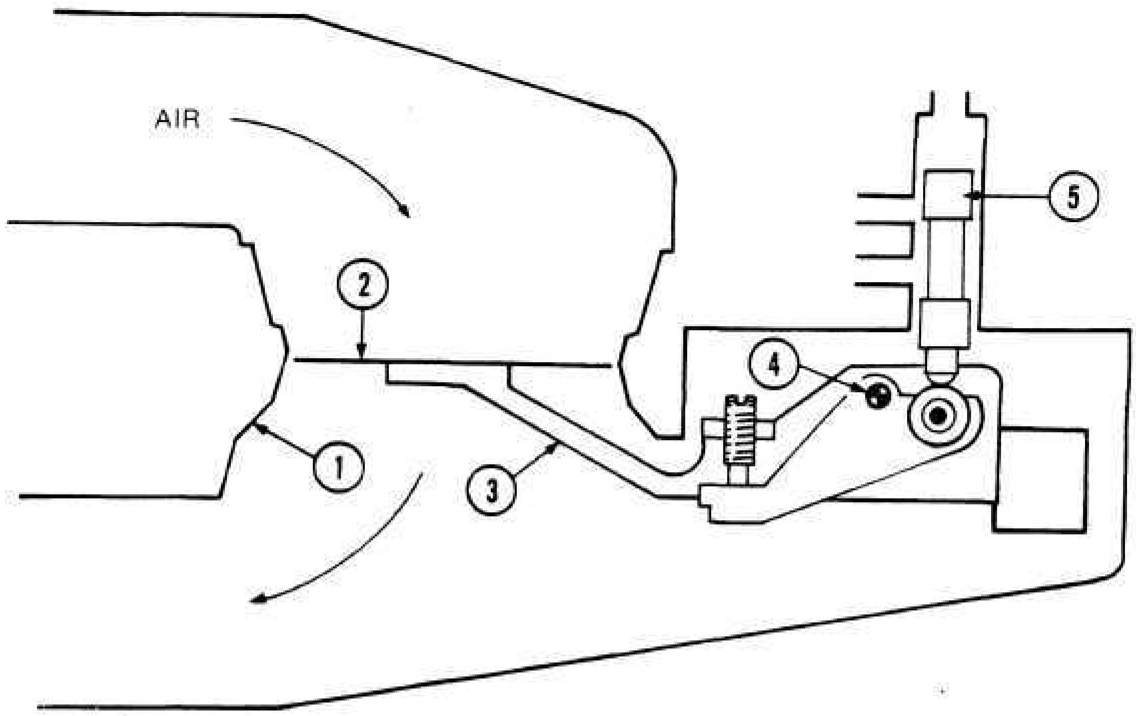
11 Injectors

The injectors are always open when the engine is running. Their main function is to atomize the fuel as it enters the intake chambers. The injectors are mounted in the cylinder heads.

12 Throttle Valves

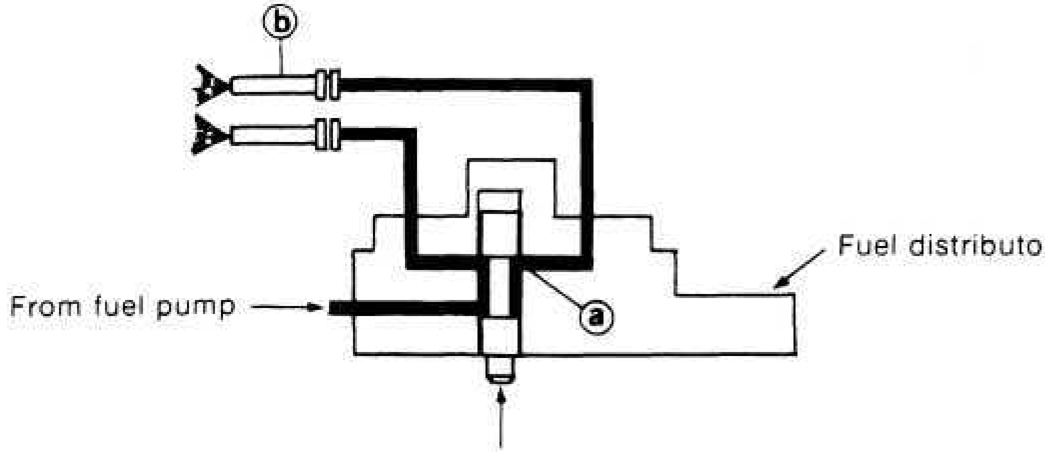
The throttle valves control the amount of air entering the engine. The throttle valves are located between the mixture control unit and the intake manifold.

## SYSTEM OPERATION

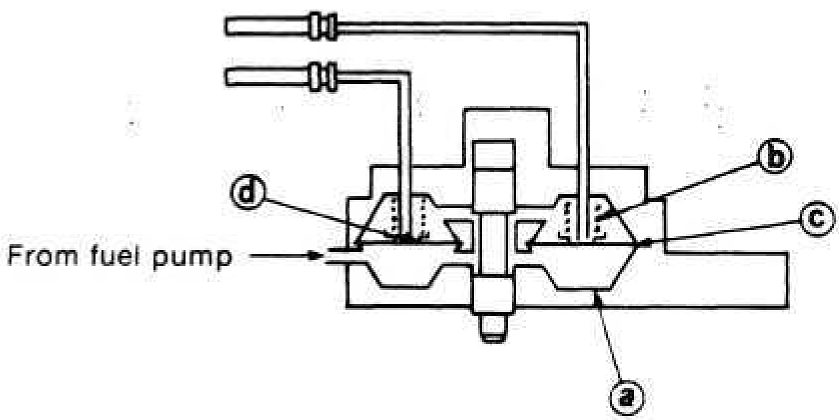



1 Air Funnel
2 Air Flow Sensor Plate
3 Balanced Lever Assembly
4 Pivot
5 Control Plunger

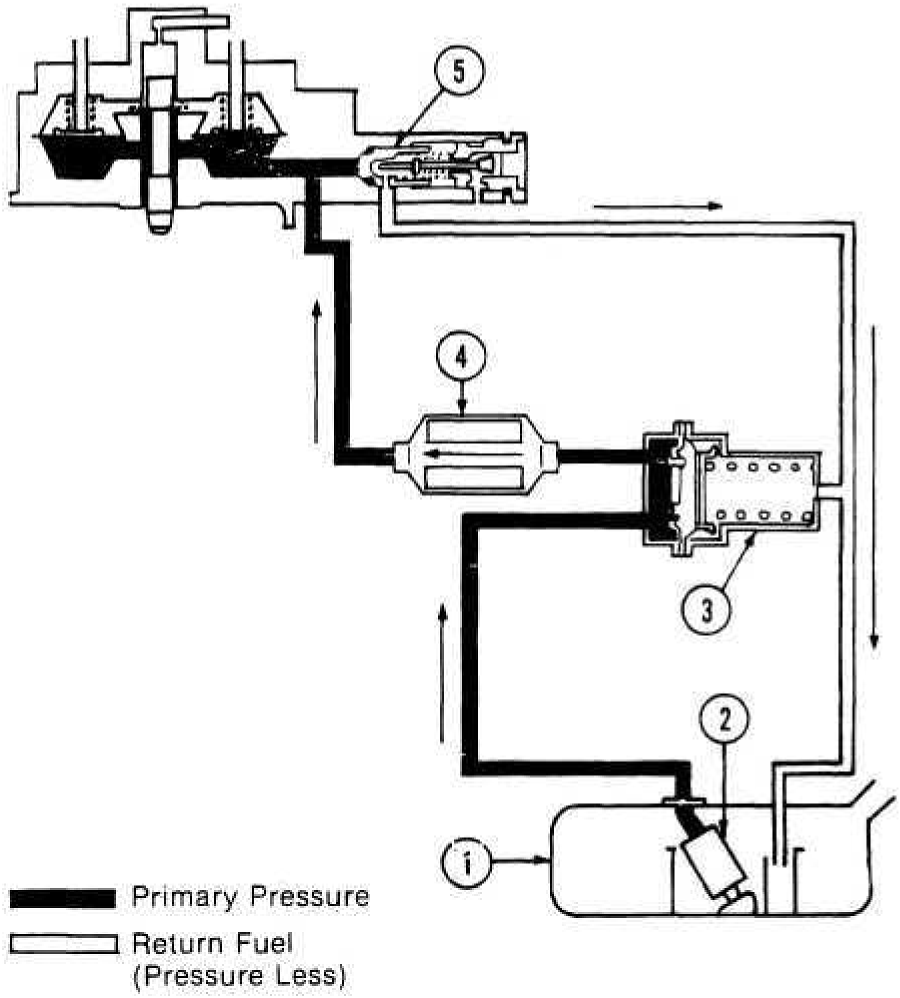
AIR MEASUREMENT: The amount of air entering the engine is controlled by the throttle valves, engine speed, and engine load. Air flowing through the air funnel (1) moves the sensor plate (2) downward in direct proportion to the air volume. This movement is transferred by the balanced lever assembly (3) to the control plunger (5) located in the fuel distributor.




FUEL DISTRIBUTION: Sensor plate movement causes the control plunger to move within a barrel containing one metering slot (a) per cylinder. As the control plunger rises, it allows an increased amount of fuel to be delivered to each injector (b) through the metering slots. The amount of fuel to the injectors is constantly controlled by the control plunger moving in relation to the amount of air entering the engine.




In the actual fuel distributor, there are six chambers that are separated by a diaphragm (c). The lower chambers (a) are connected together and the upper chambers (b) are separated with each one containing a pressure differential valve. The pressure differential valves (d) ensure that each cylinder will receive the same volume of fuel as the control plunger rises-or lowers.



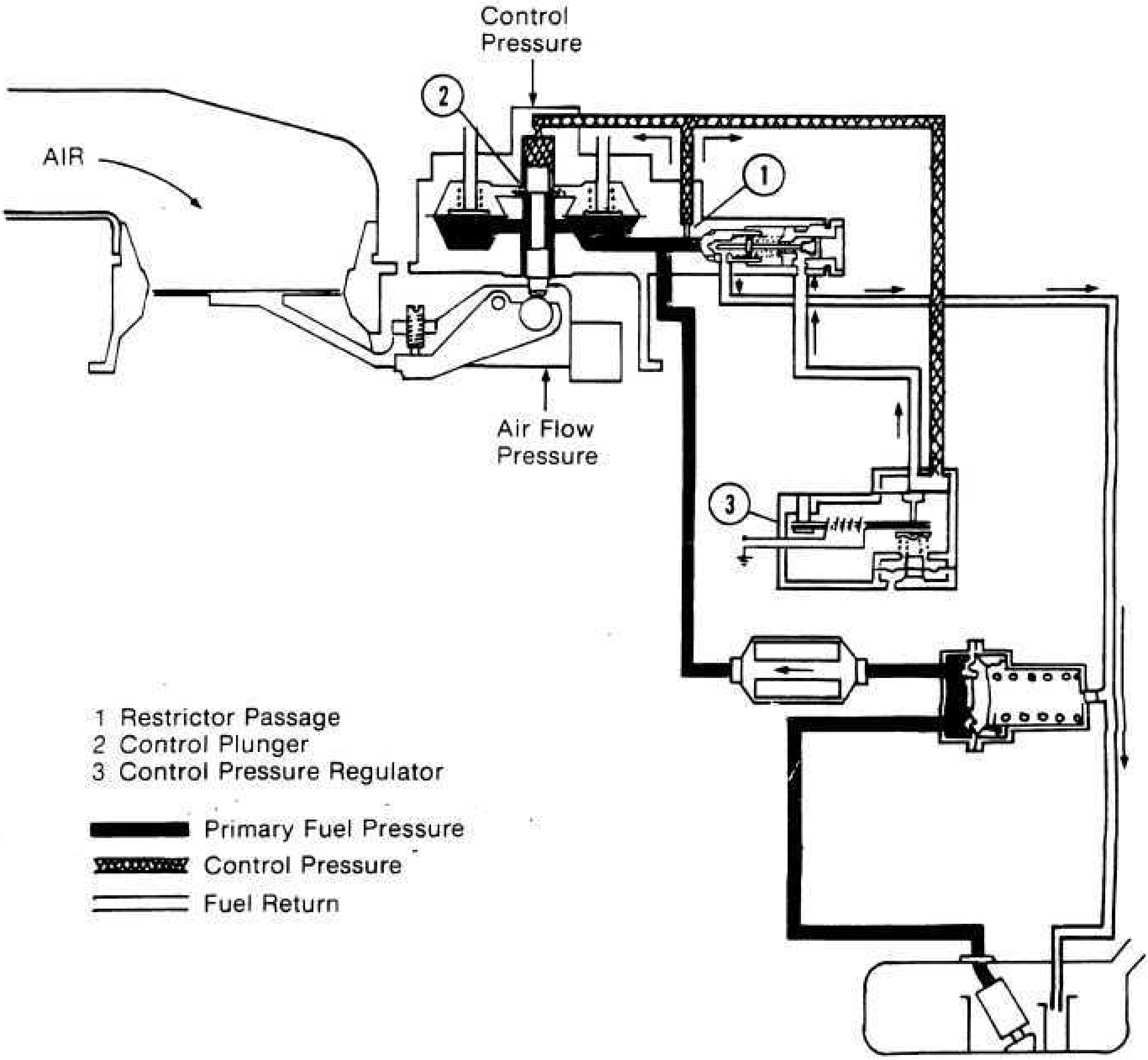

1 Fuel Tank
2 Fuel Pump
3 Accumulator
4 Filter
5 Primary Pressure Regulator

PRIMARY PRESSURE CIRCUIT: An electric fuel pump (2) runs constantly during cranking and when the engine is running. It supplies fuel to the lower chambers of the fuel distributor. Any fuel that is not used, returns to the fuel tank by passing through the primary pressure regulator (5).

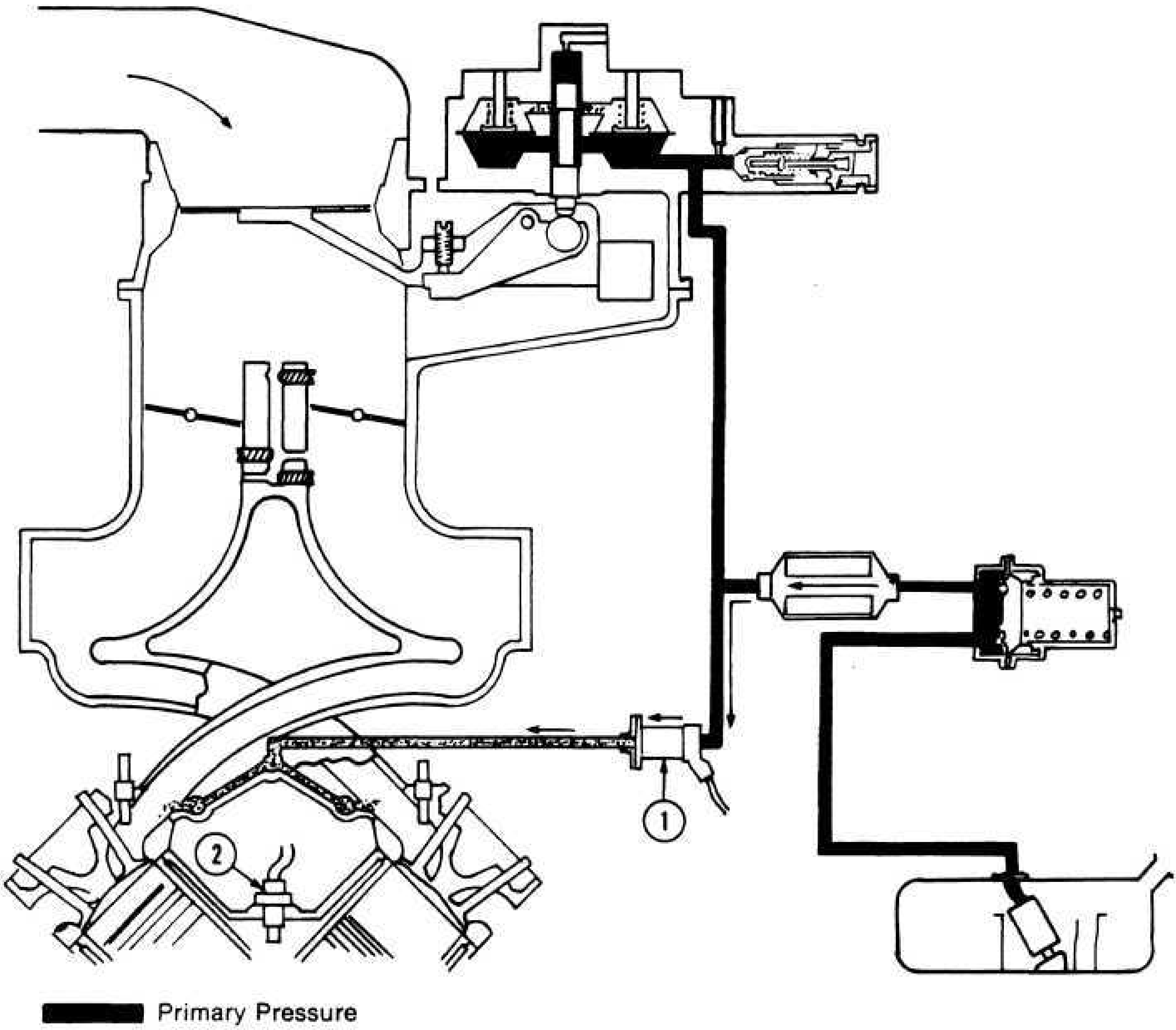
The primary pressure regulator controls main line fuel pressure. If the main line pressure increases above a pre-set value, the pressure forces the regulator open. This allows fuel to return to the tank, maintaining a constant main line pressure.

If the primary pressure decreases, the pressure regulator will close by opposing spring tension and restrict the amount of fuel returning to the tank. The movement of this regulator valve will maintain constant main line pressure and distributor lower chamber pressure regardless of engine fuel requirements or voltage fluxuations at the fuel pump. Main line pressure is regulated at approximately 5.2 Bar (75.4 PSI). The pump continuously circulates approximately 29 gallons of fuel per hour through the system.

The fuel accumulator (3) will charge during the first seconds of operation. This charging process will dampen initial fuel pump surge. When the engine is shut down, several check valves close throughout the system and prevent fuel from returning to the tank. The accumulator maintains pressure in the fuel system to prevent fuel vaporization while the vehicle is not in use.




CONTROL PRESSURE CIRCUIT: A portion of main line fuel is directed through a restrictor passage (1) to the top of the control plunger (2). This pressure circuit is referred to as the control pressure. The control pressure generates an opposing force to that originating from the air flow sensor plate. When the control pressure regulator (3) decreases the control pressure, the sensor plate will travel further downward per given air volume, thus increasing the amount of fuel injected to the engine (rich mixture). Increasing the control pressure will reduce the sensor plate travel with the same air volume reducing the amount of fuel injected to the engine (lean mixture).





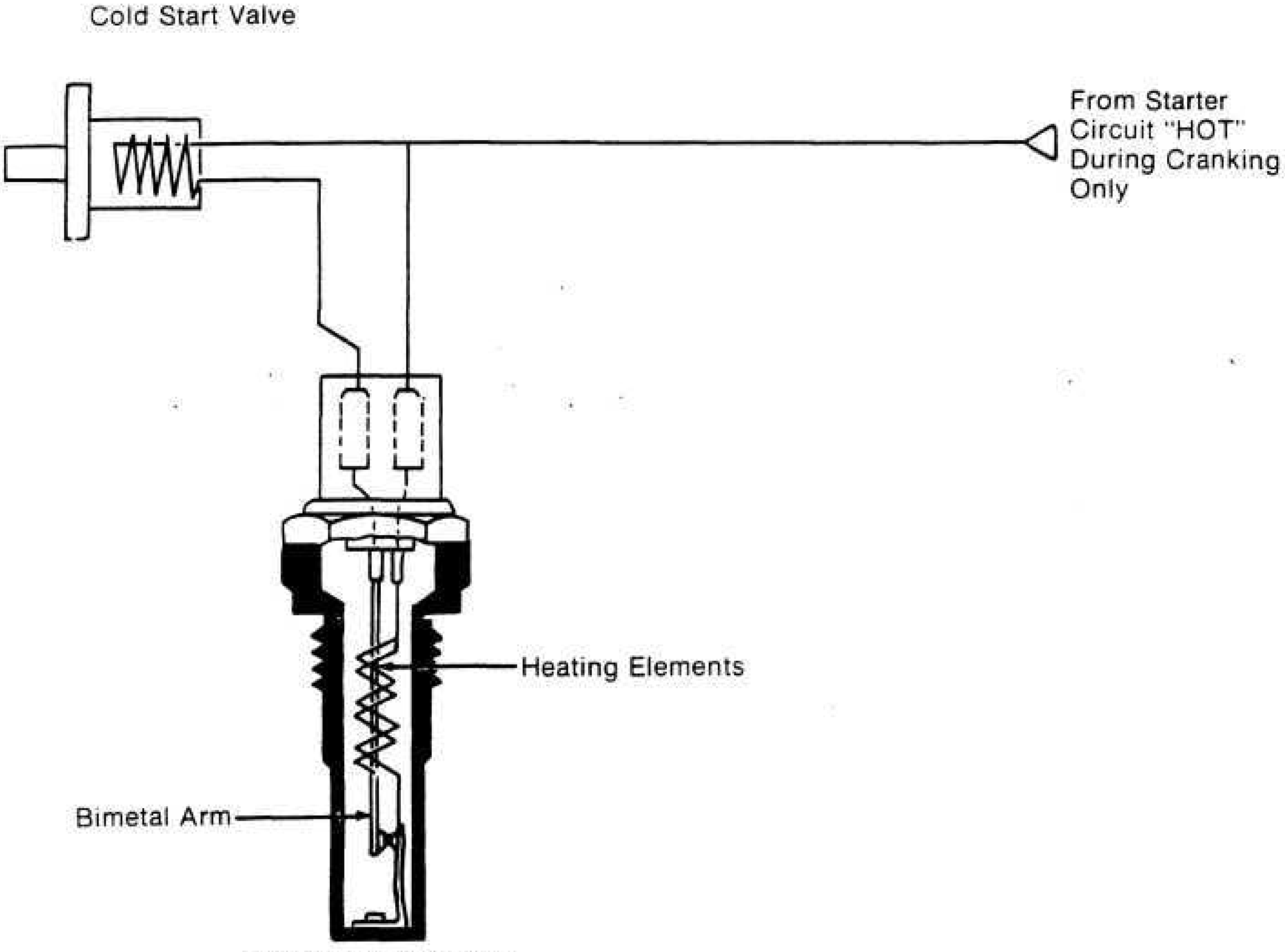
1—Cold Start Valve 2—Thermo-Time Switch

COLD START CIRCUIT: The cold start circuit provides a richer fuel mixture to facilitate starting a cold engine. The circuit operates only when the engine temperature is below +35° C (95° F) and during the cranking process.

The cold start valve (1) is of the solenoid-operated type. The winding of an electromagnet is fitted inside the valve. In the "off" position, the moveable armature of the electromagnet is forced against a seal by means of a spring. When the magnet is energized, the armature is pulled away from the seat and fuel is allowed to flow through the valve. A special nozzle atomizes the fuel as it leaves the valve and enters directly into the intake manifold.

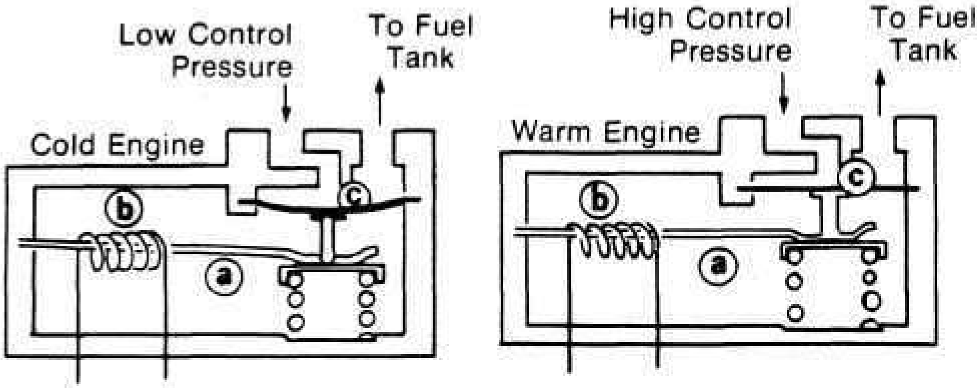
COLD START CIRCUIT (con't):

The thermo-time switch regulates the cold start valve injection time in relation to coolant temperature. When the coolant temperature is below approximately +35°C (95°F) the bimetal arm will bend enough to close the contact points. The closed contact points will provide a ground for the cold start valve, energizing the electromagnet and injecting additional fuel to the engine while it is being cranked. During cranking, voltage is also applied to the heating element in the thermo-time switch. The heating element will warm the bimetal arm and open the contact points to prevent excessive cold start injection (flooding). The length of time that it takes the heating element to open the contact points is dependent on the engine coolant temperature.



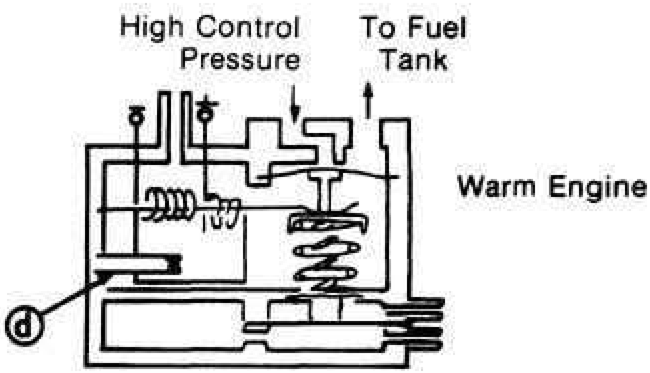

Thermo-Time Switch
(Below 35°C)

WARM-UP CIRCUIT: During the engine warm up period, it is necessary to provide a richer fuel mixture to improve driveability and eliminate hesitation during acceleration. The warm up circuit performs this function by lowering the control pressure which allows the air sensor plate to move further downward for a given volume of air.

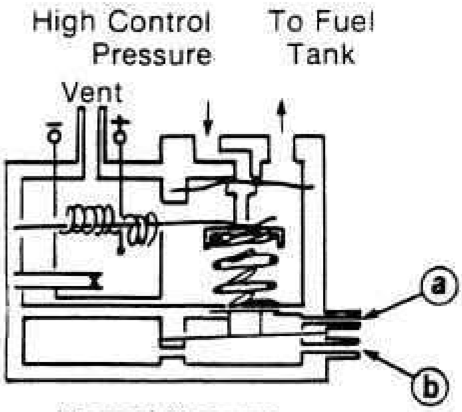



**CONTROL PRESSURE REGULATOR**

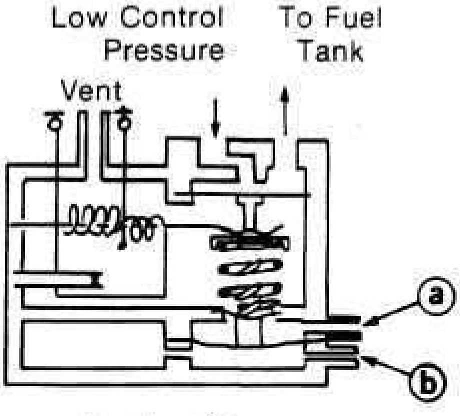
Control pressure is determined by the control pressure regulator and varies between approximately 1.5 Bar (22 PSI) and 3.8 Bar (55 PSI). The control pressure regulator is mounted on the left valve cover and is affected by engine radiant temperature. At engine start-up the control pressure is determined by engine radiant temperature rather than ambient air temperature. The regulator contains both a bimetal arm (a) which reacts to the engine temperature, and an electrical heating element (b). As the bimetal arm bends, the circuit pressure changes by opening or closing a passage (c) which allows fuel to return to the tank. On a cold engine, the bimetal arm will open the passage allowing more fuel to return to the tank, lowering the control pressure. This enriches the fuel mixture. As the heating element warms the bimetal arm, the passage will gradually close and allow the control pressure to build to its maximum valve.




In the actual control pressure regulator, a dual heating element is used with the bimetal arm, plus an additional bimetal switch (d) is used. When the regulator temperature is below 15° C (59° F), the bimetal switch will open allowing only one heater to operate thus increasing the engine warm-up time. Closing of the bimetal switch above 15° C will permit both heaters to operate which in turn will reduce the engine warm-up time.

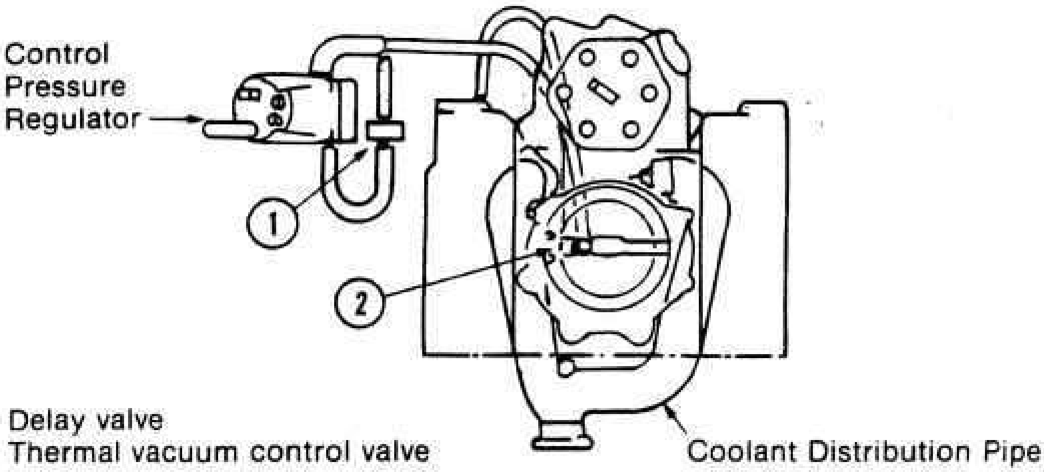



Normal Vacuum




Acceleration

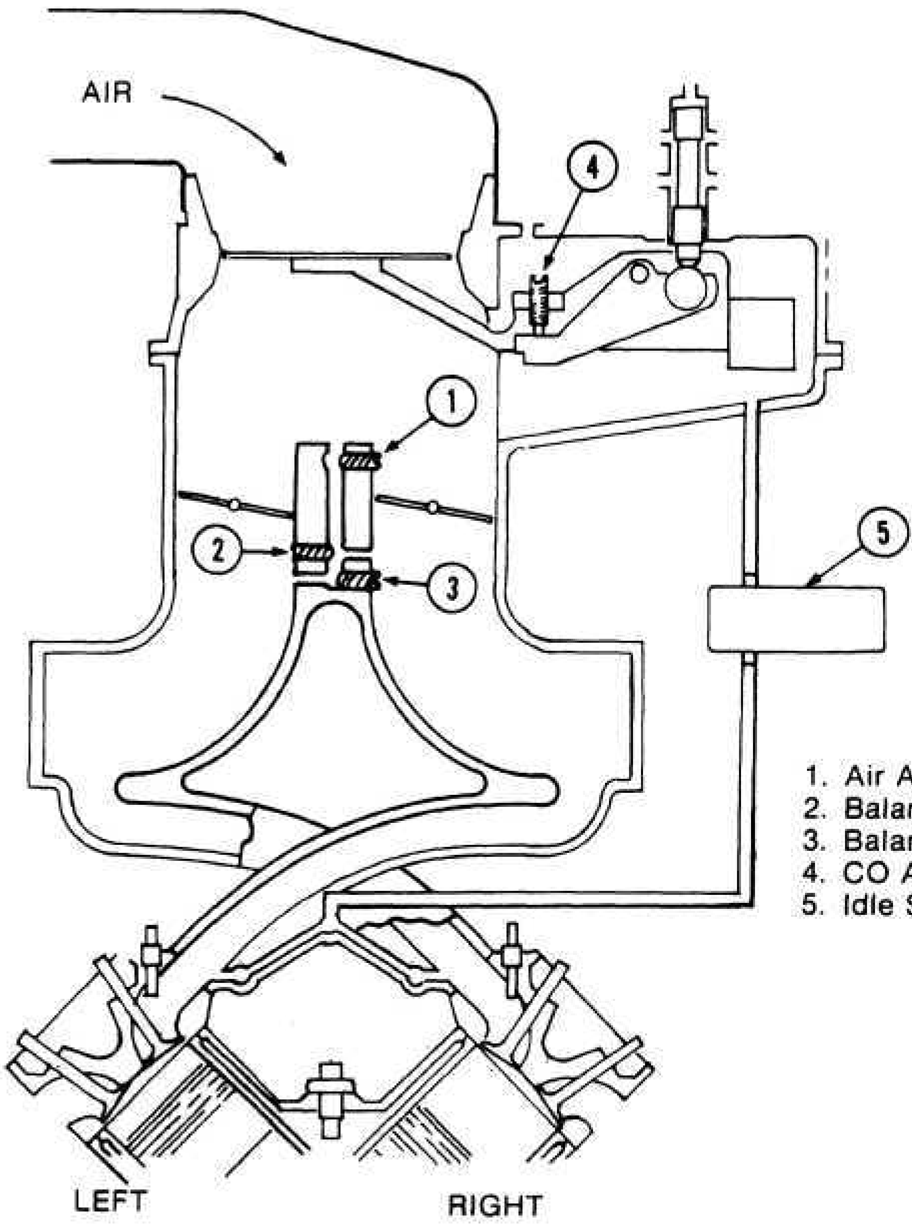
ACCELERATION ENRICHMENT CIRCUIT: The control pressure regulator is affected by engine manifold vacuum when the coolant temperature is below 40°C (104°F). Outlets (a) and (b) are both connected to the engine intake manifold. The hose to outlet (b) contains a delay valve. At coolant temperatures below 40°C the pressure increase (loss of vacuum) in the intake manifold during acceleration reaches the lower vacuum chamber later than it reaches the upper chamber due to the delay valve. The diaphram separating these two chambers then deflects downwards opening the pressure regulator momentarily. This results in a very *short* "enrichment spike" in the air-fuel mixture.




1 - Delay valve
2 - Thermal vacuum control valve

The vacuum delay valve (1) located in the hose connected to outlet (b) provides a 10 second delay during acceleration. After 10 seconds, the pressures above and below the diaphram will equalize and the control pressure will return to normal.

The thermal vacuum control valve (2) opens at coolant temperatures below 40°C (104°F) to allow manifold vacuum to reach the control pressure regulator. Above 40°C, the acceleration enrichment circuit is inoperative.

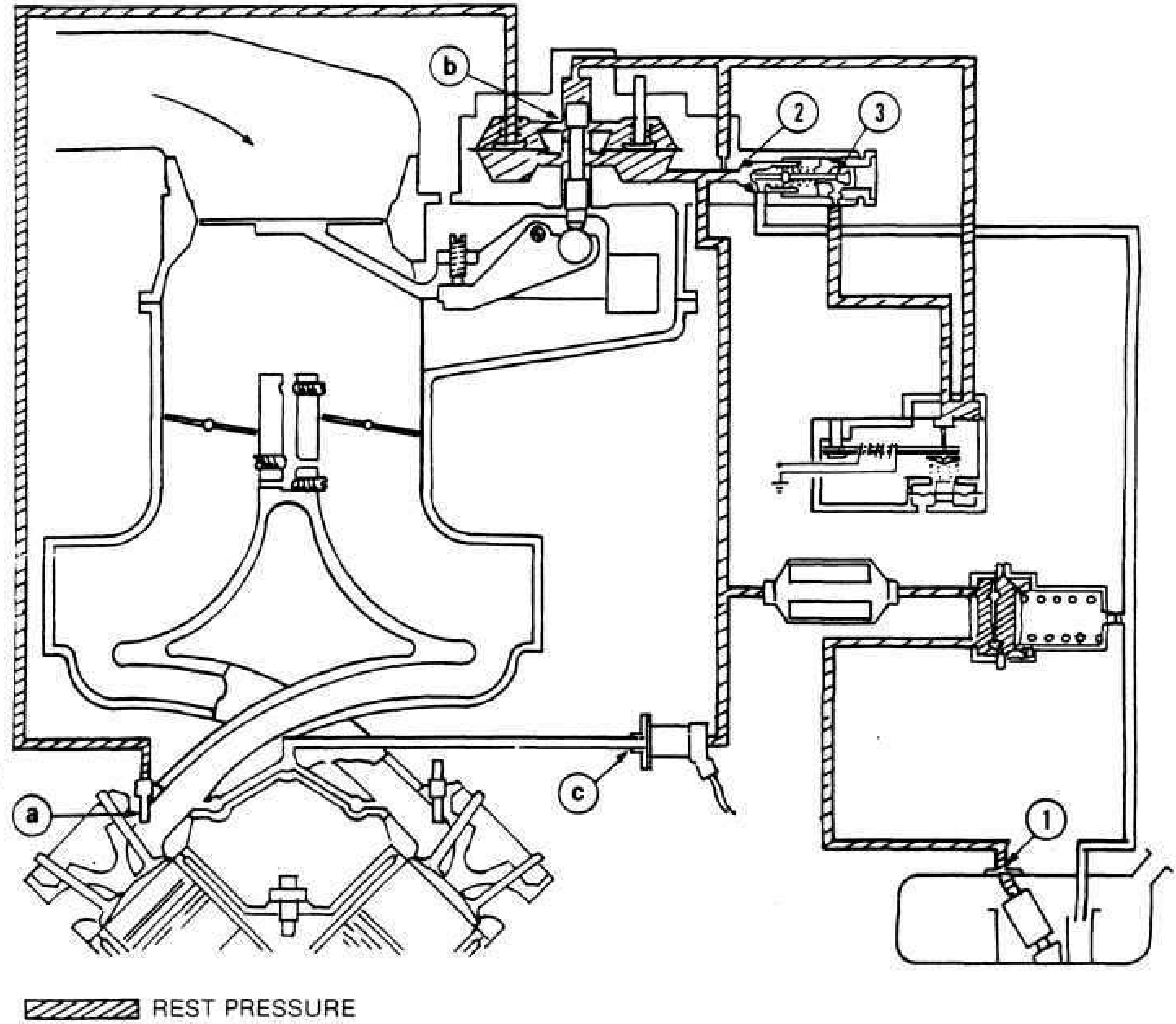



1. Air Adjusting Screw
2. Balancing Screw-Left Bank
3. Balancing Screw-Right Bank
4. CO Adjustment Screw
5. Idle Speed Regulator

IDLE CIRCUIT: The throttle body on the PRV V-6 engine contains an air adjusting screw (1) and two air balancing screws (2 and 3). These adjustment screws are not used on the De Lorean since an electronic idle speed control system is used. The air adjusting screw (1) should be fully seated to eliminate any air bypass at the throttle plates.

The idle speed regulator (5) allows the proper amount of air to bypass the closed throttle plates during an idle condition.

The CO adjusting screw (4) is used to control the amount of injected fuel in relation to the position of the air sensor plate. Turning this screw will increase or decrease the air-fuel ratio. This adjustment is performed at the factory and the access hole is plugged.

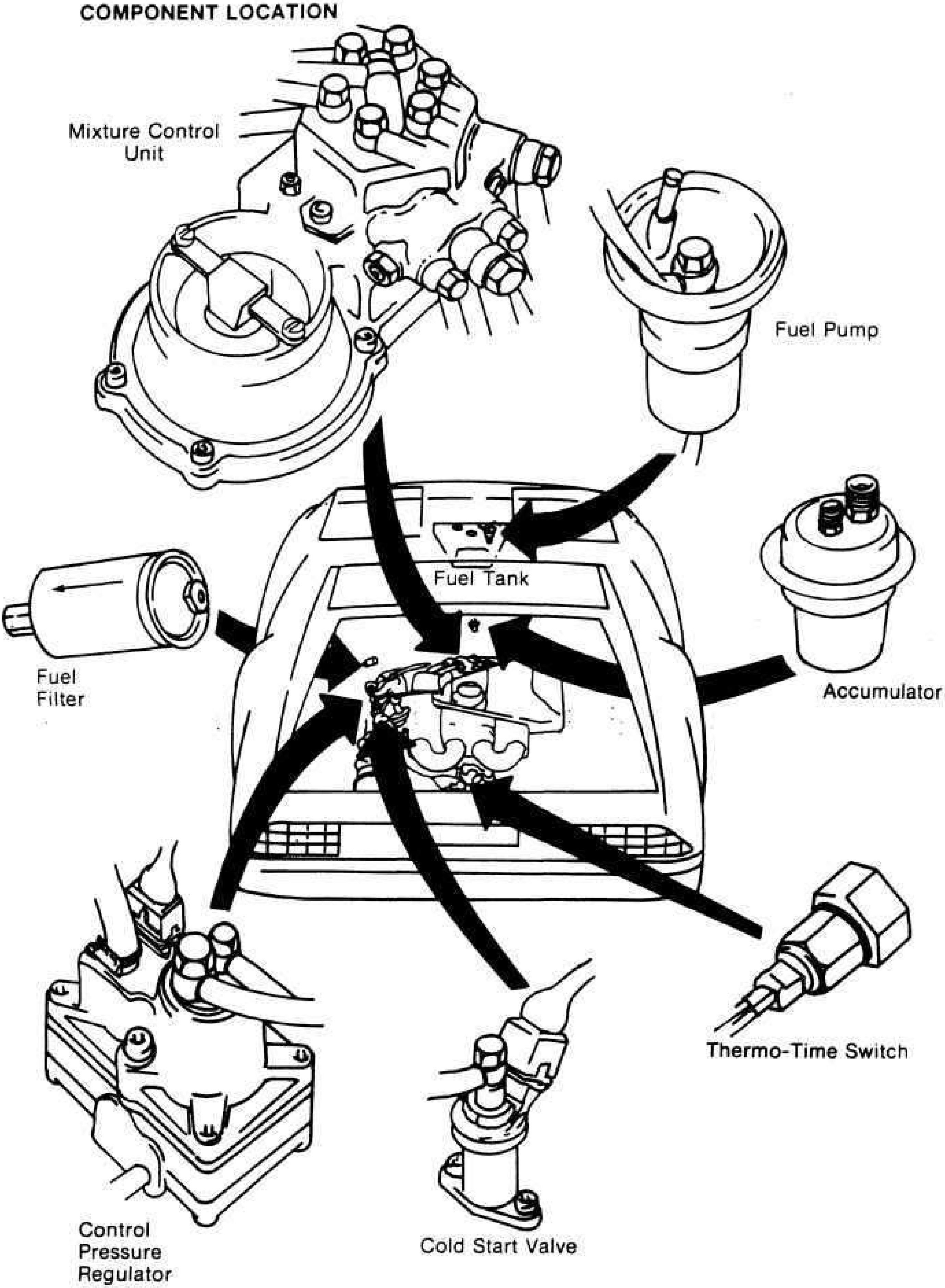



1 - Fuel Pump Check Valve
2 - Primary Circuit Seal
3 - Control Pressure Circuit Seal

REST PRESSURE: When the fuel pump is not operating, it is necessary to retain fuel under pressure in all lines. This "rest" pressure will prevent vapor from forming in the lines and insure instant restarting. When the fuel pump stops, a check valve (1) and two seals (2 & 3) close, sealing off the fuel return lines to the tank. The accumulator will then maintain pressure in the system to prevent vaporization.

In addition to the check valves and seals, it is important that the control plunger (b) returns to the closed position, all injectors (a) close tightly, cold start valve (c) closes tightly and all fuel connections are tight and leak free.

## COMPONENT LOCATION



## SYSTEM REPAIR NOTES

1. The majority of the fuel injection components are sealed units and cannot be adjusted or repaired. Tampering with a sealed component will automatically void the component warranty. The following guide indicates component serviceability and authorized repairs:

| | |
|---|---|
| Fuel Pump: | The fuel pump is not serviceable. The return check valve located in the fuel inlet cannot be replaced. |
| Accumulator: | Not serviceable. |
| Fuel Filter: | Not serviceable, replace when contaminated. |
| Mixture Control Unit: | |
| • Fuel Distributor: | The fuel distributor can be removed from the mixture control unit for replacement. Fuel distributor is not serviceable. |
| • Primary Pressure Regulator: | The regulator O-ring seals are replaceable and the primary pressure may be adjusted by adding or subtracting spring shims. |
| • Air Flow Sensor Assembly: | Sensor plate and arm assembly can be centered if a binding condition exists. Rest position of sensor plate can also be adjusted. |
| Control Pressure Regulator: | Not serviceable. |
| Cold Start Valve: | Not serviceable. |
| Thermo-time Switch: | Not serviceable. |
| Fuel Injectors: | Not serviceable. |
| Throttle valves: | Throttle idle stop position is preset and should not be tampered with. |

2. The largest problem affecting the operation of fuel injection components is dirt and moisture contamination. Therefore, precautions should be taken when working on the system to avoid contamination.

3. When replacing fuel lines or components, use only approved replacement parts that were designed for this system. Due to the high fuel pressures used in this system, do not attempt to splice fuel hoses.

ELECTRICAL CIRCUIT FUNCTION: If the engine coolant temperature is below 35° C (95° F) the thermo-time switch is closed providing a ground for the cold start valve. During cranking conditions, power is supplied to the cold start valve from the starter solenoid, activating the valve to inject additional fuel to the engine. If the cranking process takes longer than 8 to 15 seconds, the thermo-time switch heating element opens the switch, deactivating the cold start valve to prevent the engine from flooding. In this case, the thermo-time switch functions as a time switch.

If the temperature of the engine coolant is above 35° C (95° F) when the starting process is commenced, the thermo-time switch is open eliminating the cold start valve ground. In this case the thermo-time switch functions as an engine coolant temperature switch.

This circuit is equipped with an RPM relay which receives power from the main relay through fuse #1. The rotational speed of the engine produces ignition pulses at terminal #1 of the ignition coil. These pulses are processed by an electronic circuit in the RPM relay which closes the relay contacts. Current from #7 fuse is then supplied to the fuel pump and control pressure regulator.

The RPM relay remains closed as long as the ignition switch is "on" and the engine is running. If the pulses from terminal #1 of the ignition coil stop because the engine has stopped turning, the RPM relay opens about one second after the last pulse is received. This safety circuit prevents the fuel pump from pumping when the ignition switch is "on" but the engine is not running.

Another safety feature in the fuel pump circuit is the inertia switch. This switch provides the ground circuit for the electric fuel pump. In the case of an accident where high impact is involved, the inertia switch will open the circuit between the fuel pump and ground. This will prevent the fuel pump from pumping fuel out of a possible ruptured hose. The inertia switch also activates the door lock circuit to unlock the doors upon high impact.

The control pressure regulator receives power from the RPM relay when the engine is rotating. Thus current will heat the bimetal arm in the pressure regulator for proper engine warm-up operation.

The car is wired for a hot start relay. This relay can be installed if a hot starting problem is experienced in excessively hot regions of the country. When this relay is used, the cold start valve will inject intermittently during cranking when engine is hot.

## SYSTEM REPAIR NOTES

1. The majority of the fuel injection components are sealed units and cannot be adjusted or repaired. Tampering with a sealed component will automatically void the component warranty. The following guide indicates component serviceability and authorized repairs:

| | |
|---|---|
| Fuel Pump: | The fuel pump is not serviceable. The return check valve located in the fuel inlet cannot be replaced. |
| Accumulator: | Not serviceable. |
| Fuel Filter: | Not serviceable, replace when contaminated. |
| Mixture Control Unit: | |
| • Fuel Distributor: | The fuel distributor can be removed from the mixture control unit for replacement. Fuel distributor is not serviceable. |
| • Primary Pressure Regulator: | The regulator O-ring seals are replaceable and the primary pressure may be adjusted by adding or subtracting spring shims. |
| • Air Flow Sensor Assembly: | Sensor plate and arm assembly can be centered if a binding condition exists. Rest position of sensor plate can also be adjusted. |
| Control Pressure Regulator: | Not serviceable. |
| Cold Start Valve: | Not serviceable. |
| Thermo-time Switch: | Not serviceable. |
| Fuel Injectors: | Not serviceable. |
| Throttle valves: | Throttle idle stop position is preset and should not be tampered with. |

2. The largest problem affecting the operation of fuel injection components is dirt and moisture contamination. Therefore, precautions should be taken when working on the system to avoid contamination.

3. When replacing fuel lines or components, use only approved replacement parts that were designed for this system. Due to the high fuel pressures used in this system, do not attempt to splice fuel hoses.

4. After replacing any major fuel injection component, the engine idle speed and CO level should be checked and adjusted if necessary.

5. The RPM relay is located in the relay compartment behind the passenger seat. (See "Chassis Electrical" section)

6. The inertia switch is located under the left side of the dash panel and is mounted to the Lambda mileage counter bracket. When the button on the inertia switch is in the "up" position the switch is in the "open" position. In this position the fuel pump will not operate and the door locks will move to the unlock position. To reset the inertia switch, depress the button or move to the "down" position.

7. Excessively high fuel pressures can be caused by a plugged fuel return line.

8. Positive pressure buildup in the fuel tank is normal for this system.

9. If it is necessary to adjust the CO level, the adjusting hole plug can be removed by drilling down to the hardened steel insert and threading a pulling tool into the plug.

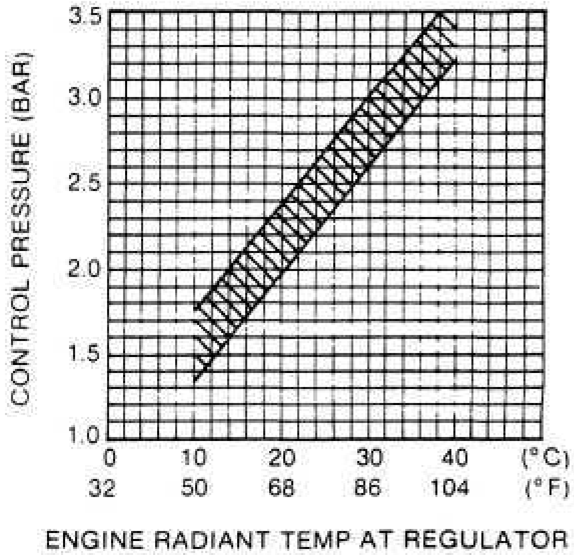
**SPECIFICATIONS**

1. Electric fuel pump

   Fuel Delivery: Minimum 850 $cm^3$/30 sec. (1.8 pints/30 sec.)

2. Control pressure "COLD" (Regulator temp. below 40° C)

   Test with intake manifold vacuum hoses disconnected from control pressure regulator




NOTE: 1 Bar = 14.5 PSI

3. Control Pressure "WARM" (Regulator temp. above 40° C)

| | |
|---|---|
| a. Test with intake manifold vacuum hoses disconnected from control pressure regulator | 3.4 - 3.8 Bar |
| b. Connect vacuum pump to vacuum port on control pressure regulator which contains the delay valve | 1.4 - 1.8 Bar |

   Vacuum Setting Value: 450-550 mbar (13.3-16.2 in Hg)

4. Primary Pressure

| | |
|---|---|
| Checking value | 4.9 - 5.5 Bar |
| Setting value | 5.1 - 5.3 Bar |

5. Rest pressure leakage test

| | |
|---|---|
| Rest Pressure | 3.3 Bar |
| Minimum pressure after 10 min. | 1.7 Bar |

6. Injection valves

| | |
|---|---|
| Opening pressure | 3.5 - 4.1 Bar |

7. Control pressure regulator delay valve

| | |
|---|---|
| Time required to bleed-down from 16 in. Hg vacuum to 8 in. Hg | 10 ± 2 seconds |

8. Acceleration enrichment thermal vacuum control valve

   a. Fully closed at temperatures above 53°C (127°F).
   b. Must start to open at 48°C (118°F) when temperature is decreasing.

9. Thermo-time Switch

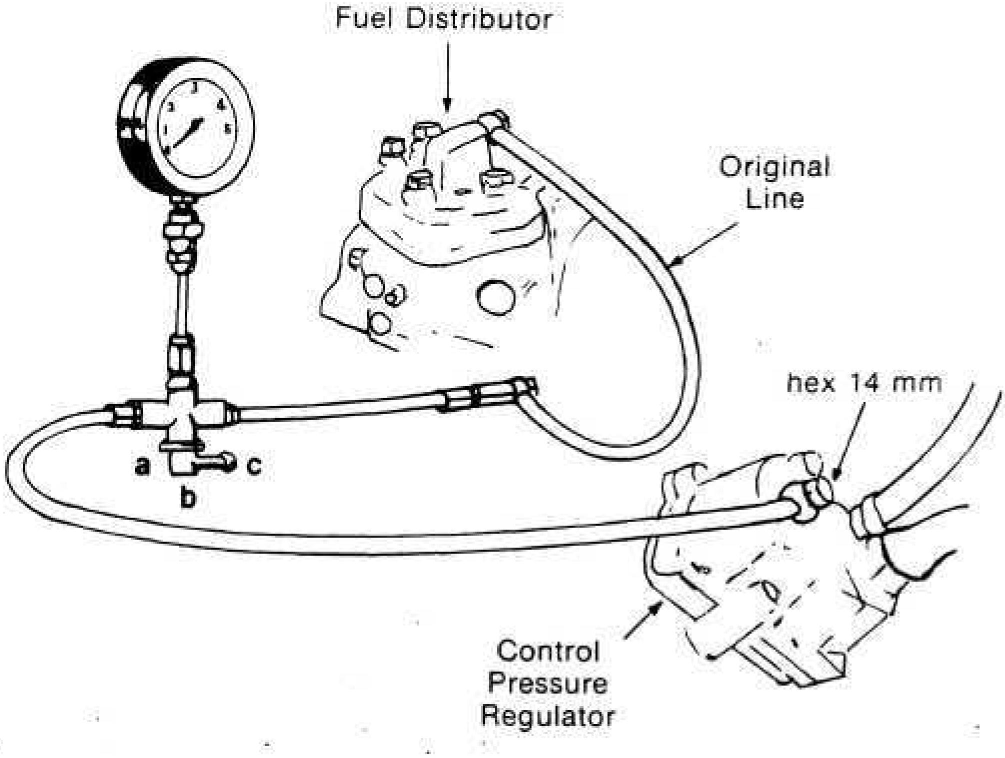
| **Coolant Temperature** | **Contact Opening Time** |
|---|---|
| -20°C (-5°F) | 7.5 ± 2 seconds |
| 35 ± 4°C (95°F) | 0 |

10. 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.) |

11. Throttle idle stop adjustment: See "Engine adjustment, tests and diagnosis" section.

## TEST GAUGE CONNECTION




## VALVE POSITION

| | |
|---|---|
| "A" | Off |
| "B" | Check control pressure |
| "C" | Check primary pressure |

NOTE: When checking fuel pressures, it is necessary to operate the fuel pump without the engine running. To by-pass the RPM relay, remove relay and connect a jumper wire between terminals #87 and #30 in the connector. The RPM relay is located in the relay compartment behind the passenger seat. (See "Chassis Electrical" section)

CAUTION: When connecting or disconnecting the test gauge, rest pressure will be present in the fuel system. Fuel fittings should be loosened slowly to avoid fuel spray in the engine compartment and a container should be available to drain fuel into.

# 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.

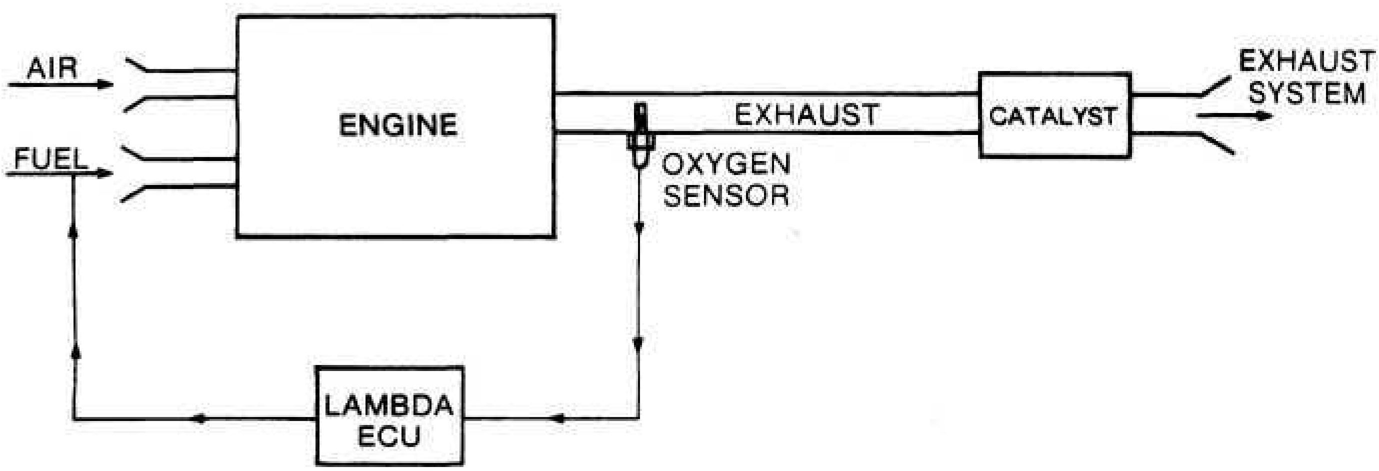
Lambda control, used with a three-way catalytic converter, is capable of reducing the noxious emissions of carbon monoxide (CO), hydrocarbons (CH) and nitrogen oxides ($NO_x$). A requirement for this action, however, is that the air-fuel ratio must be controlled to a high degree of accuracy so that the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

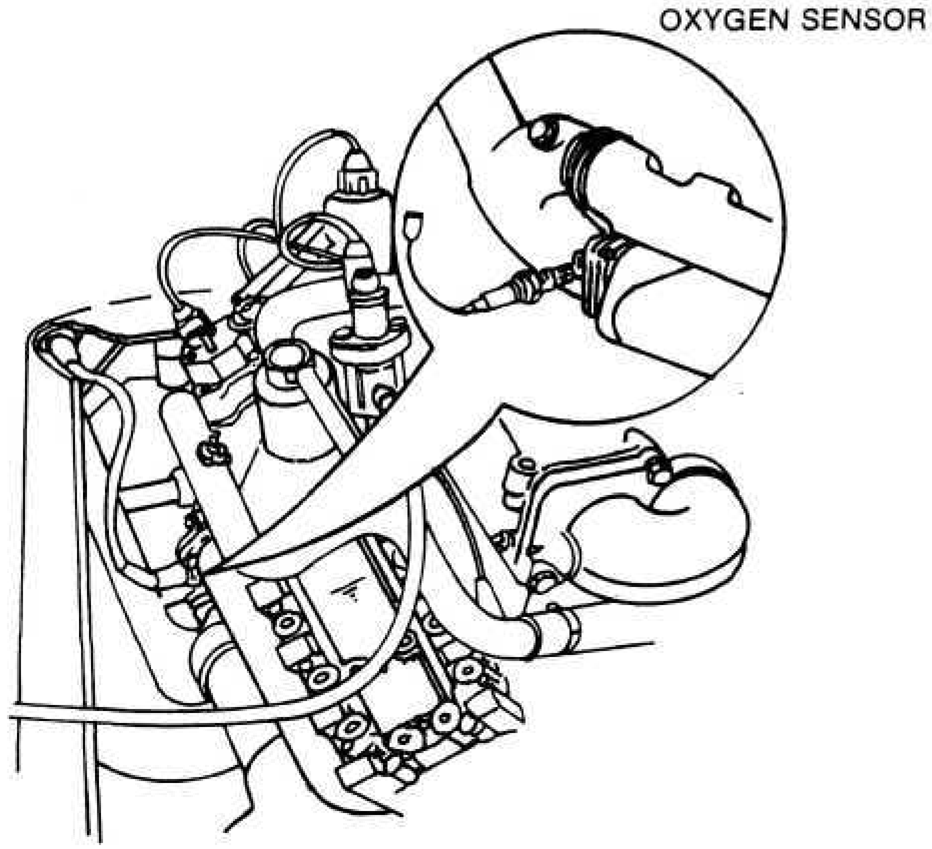
The Lambda electronic control unit (ECU) processes this data and sends a signal to the fuel injection system to change the amount of fuel injected into the engine.



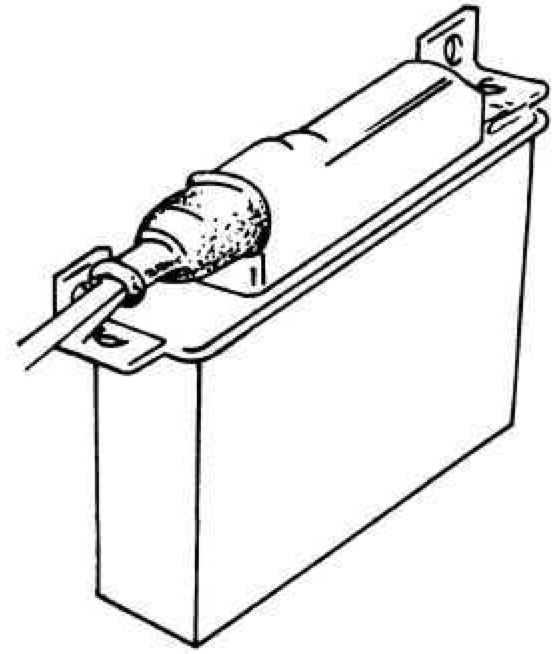
**SYSTEM OPERATION**

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.

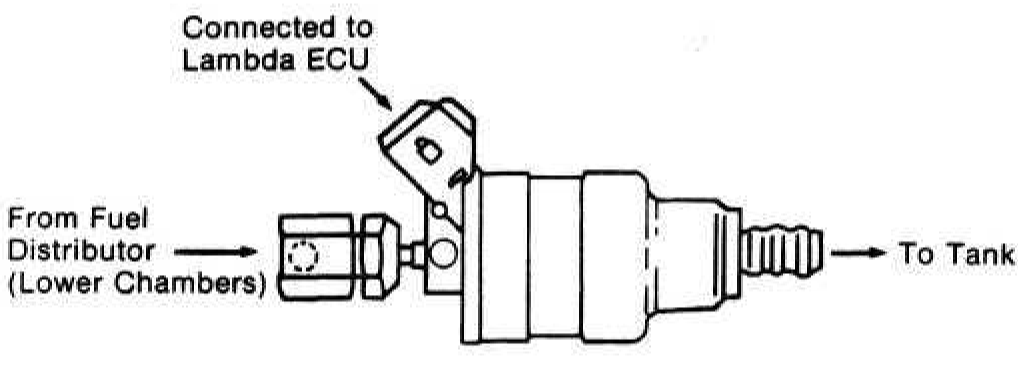


ELECTRONIC CONTROL UNIT (ECU): The Lambda ECU module receives the voltage signal from the oxygen sensor and determines if the amount of fuel injected to the engine should be increased or decreased. The module will then signal the frequency valve to adjust the fuel mixture.

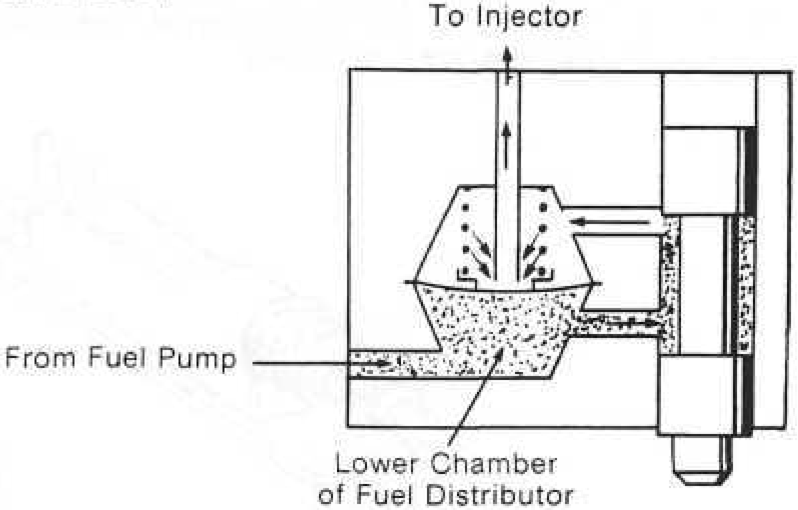


FREQUENCY VALVE: The frequency valve regulates the pressure in the lower chambers of the fuel distributor. This regulation will affect the normal operation of the fuel distributor.

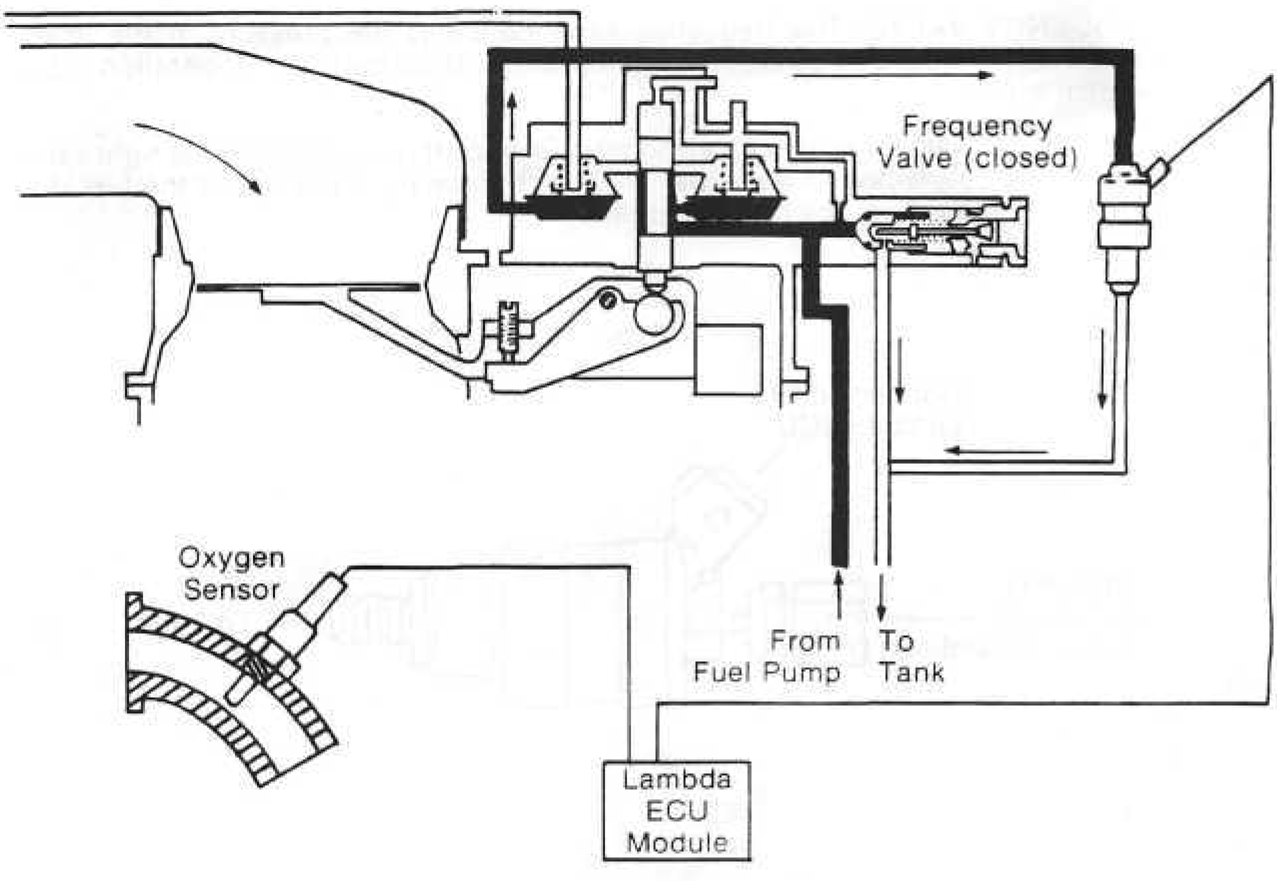
The frequency valve is an electrically operated valve. It is mounted on the right valve cover and is connected to the lower chambers (primary pressure) of the fuel distributor and the return line to the fuel tank.



FREQUENCY VALVE CONTINUED:



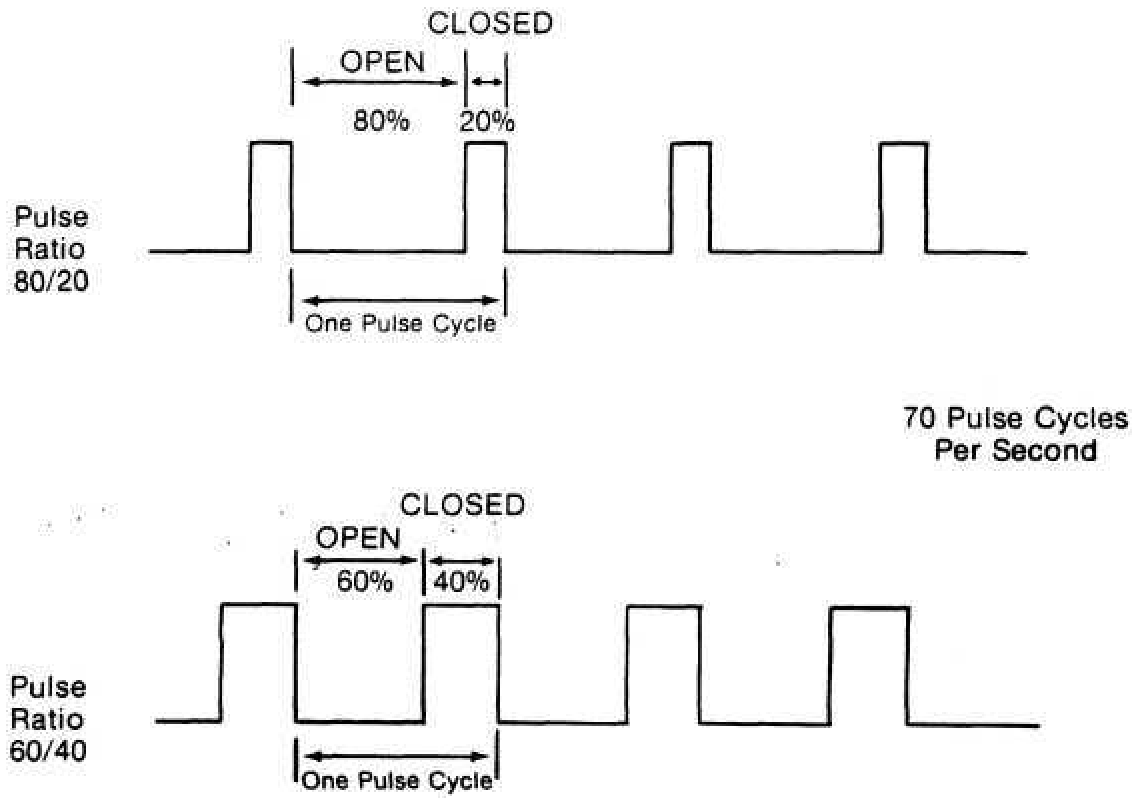

When the frequency valve is open, the fuel pressure in all of the lower chambers will be reduced by allowing some of the fuel to return to the tank. When the lower chamber pressure is reduced, the diaphragm downward movement will increase the passage opening to the injectors. This will increase the volume 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**

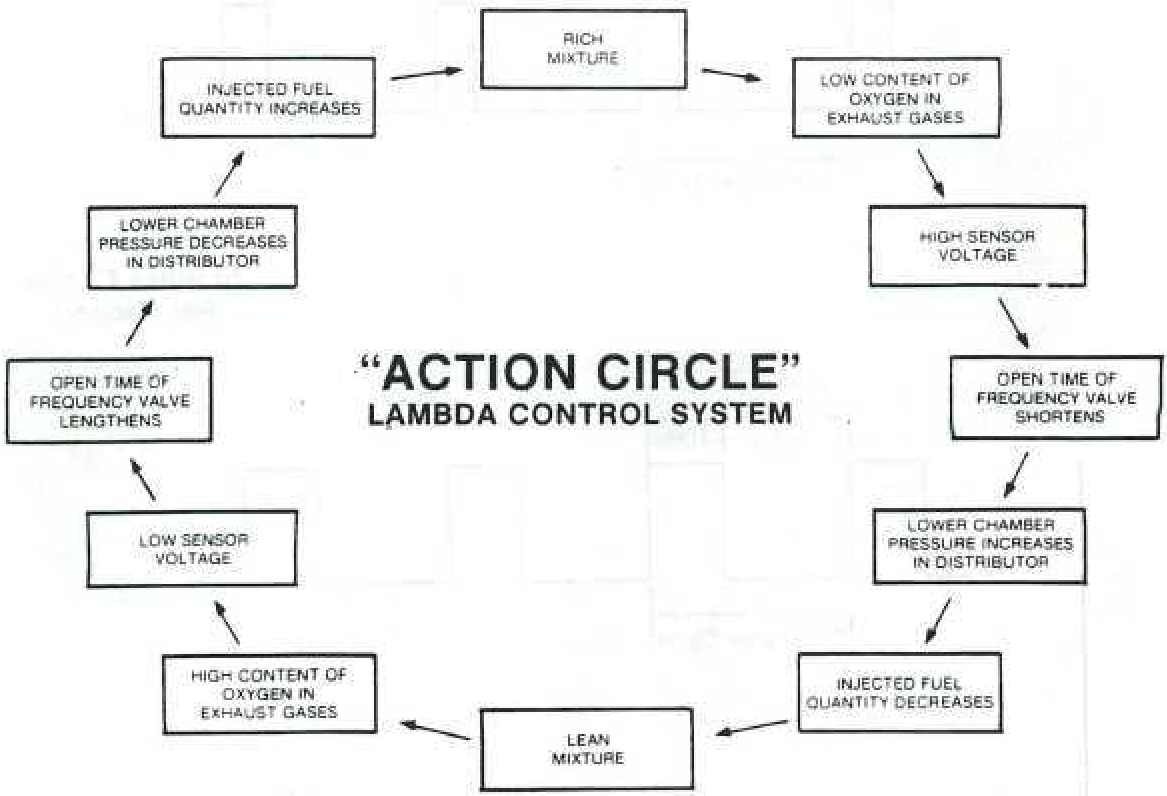
FREQUENCY VALVE CONTINUED: The frequency valve operates at 70 cycles per second. The length of time the valve is held open during each cycle depends on the pulse ratio supplied by the Lambda ECU module.

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.



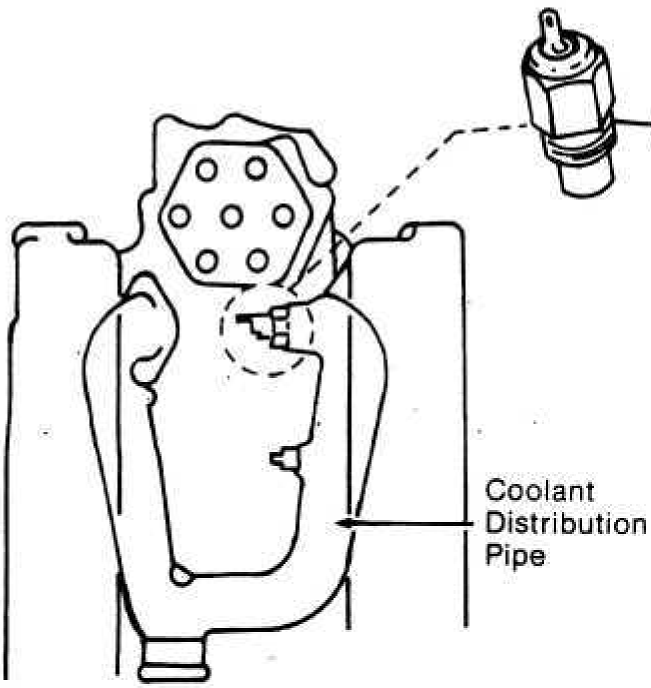

To operate the frequency valve at a pulse ratio of 80/20, the ECU module will allow current to flow through the frequency valve for 80 percent of one cycle and stop the current flow for the remaining 20 percent of the cycle. When current is flowing in the frequency valve, the electromagnet will energize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

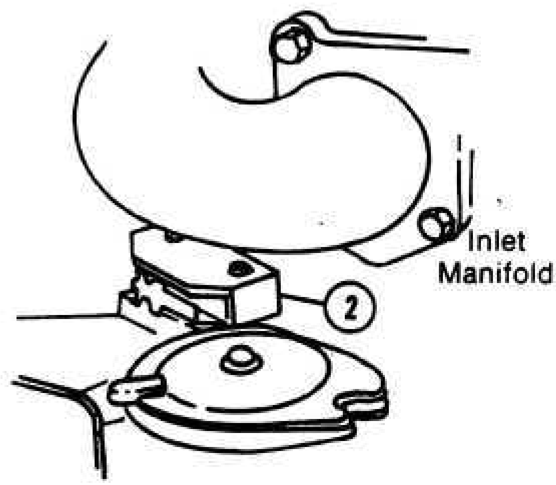


SYSTEM CONTROL MONITORS: The oxygen sensor needs a minimum operating temperature to deliver a signal (approximately 300° C). In order to achieve driveability from start, the ECU module sets the frequency valve on a fixed pulse ratio until the sensor warms up. This is also the case if the sensor fails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

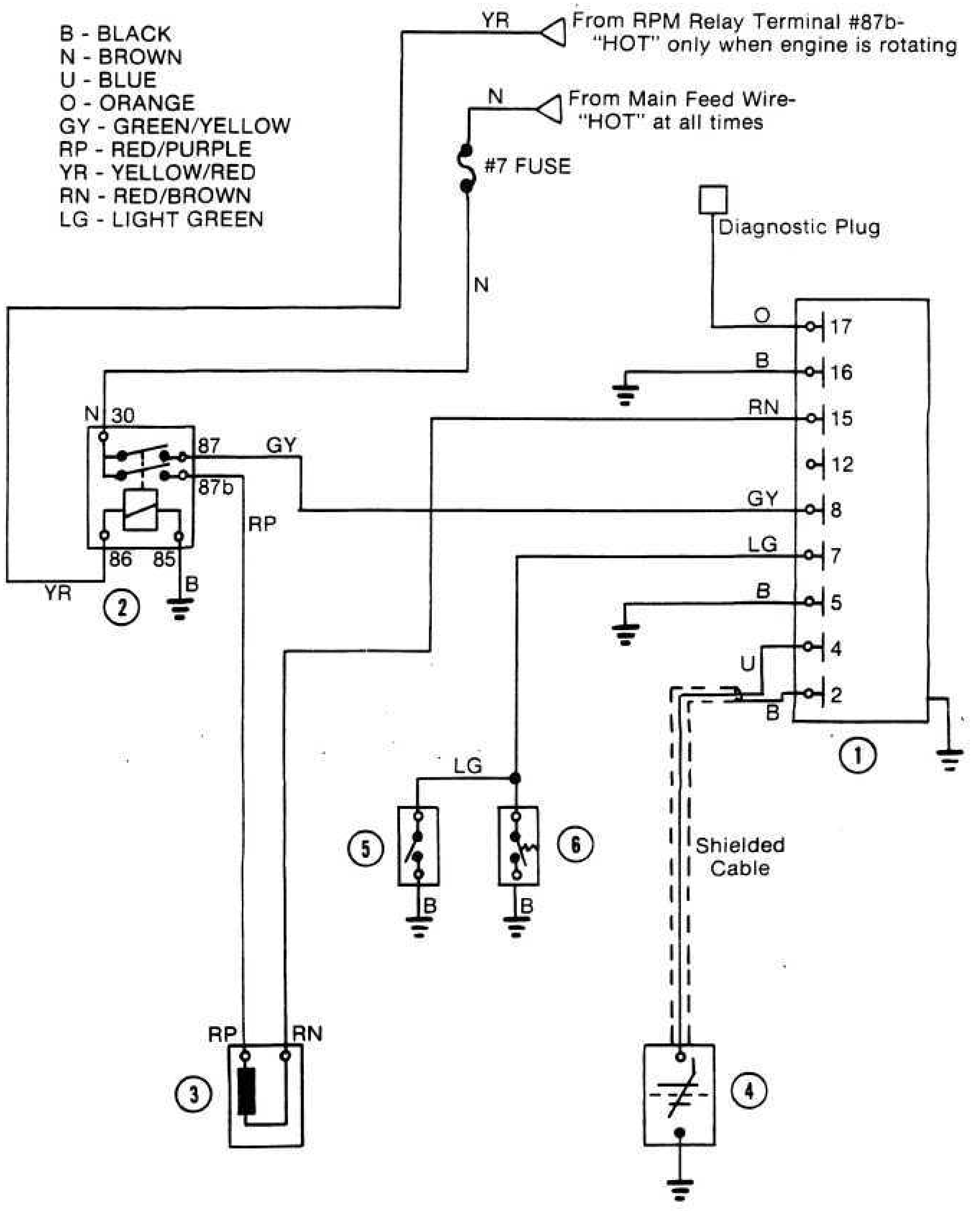
The pulse ratio is controlled at another fixed value when the engine coolant temperature is below 15°C (59°F) or when the engine is at wide open throttle. These conditions are determined by a thermal switch (1) and a full throttle micro switch (2). The fixed pulse ratio provides a rich fuel mixture to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

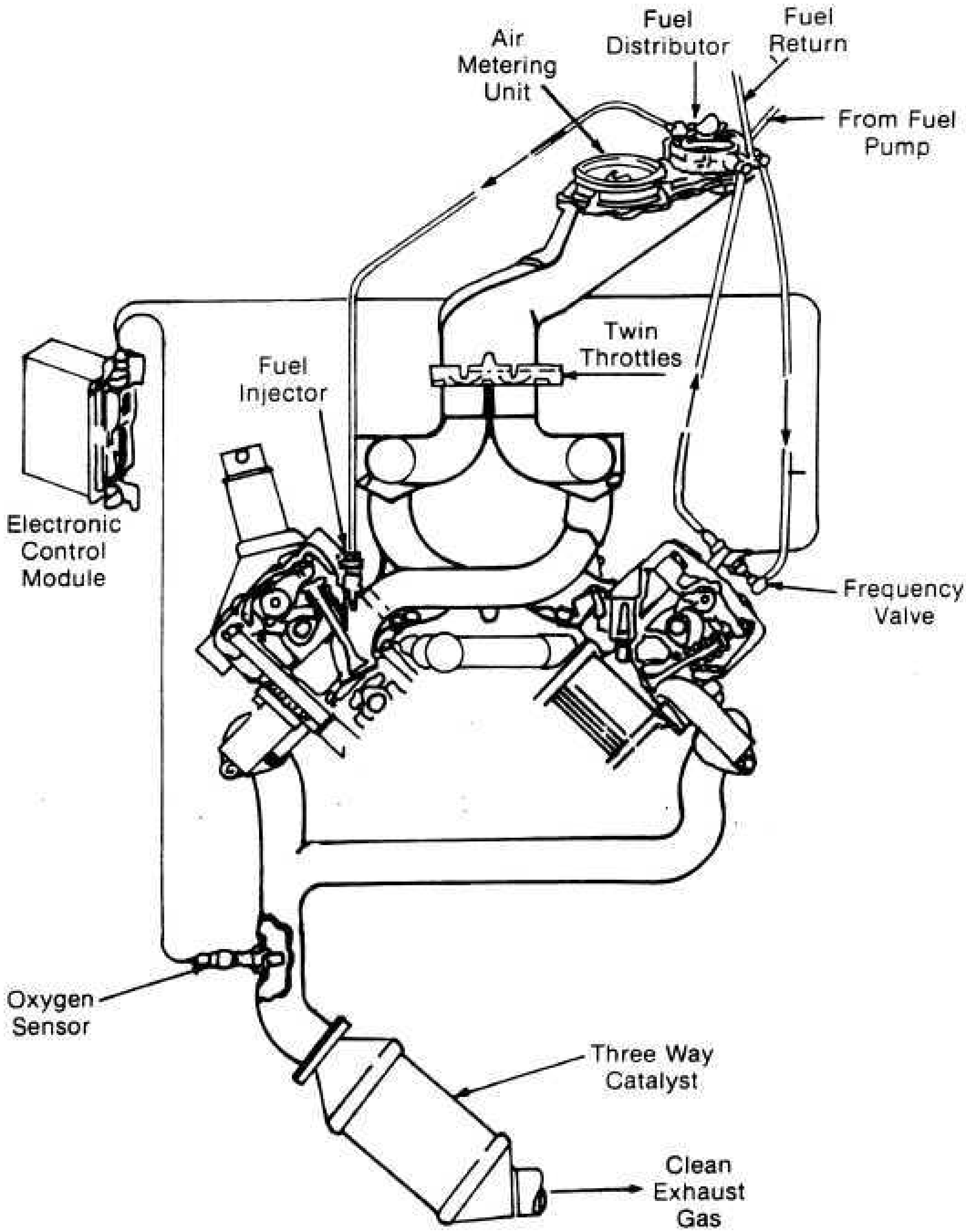
5 - Full Throttle Enrichment Switch
6 - Thermal Switch

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 dis-connected. 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

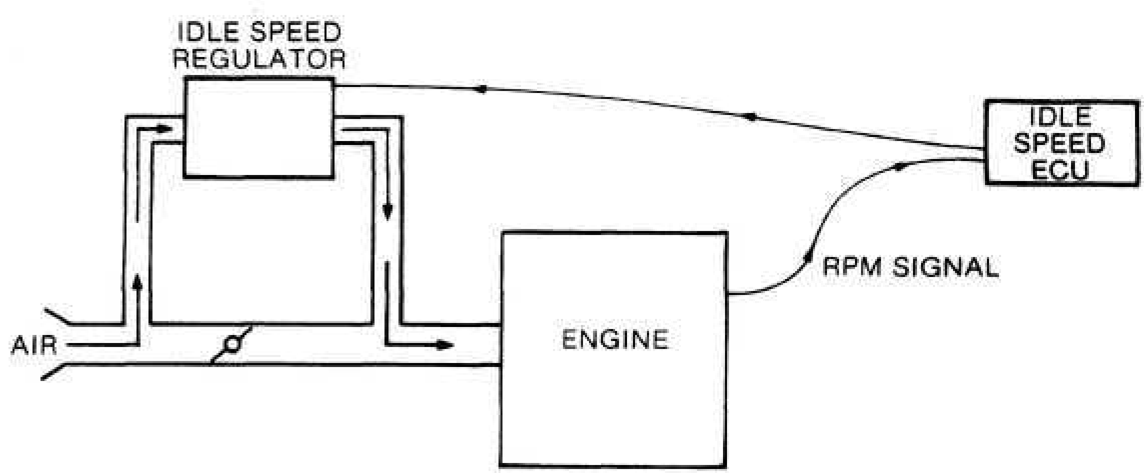
## SYSTEM DESCRIPTION

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

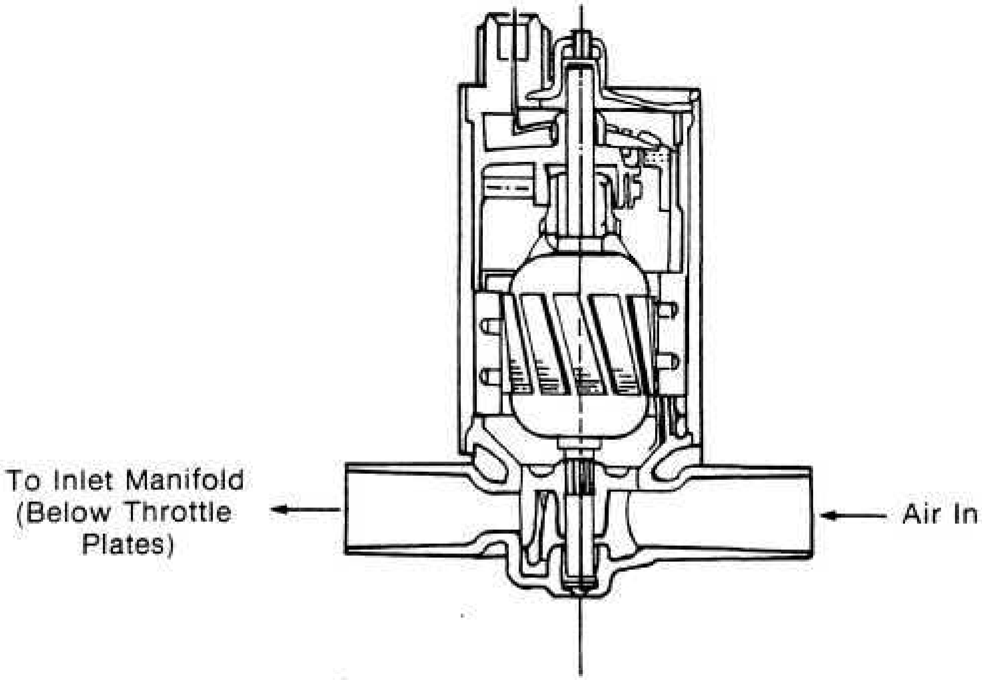
The control principle used is based on the fact that an electronic control unit (ECU) module is constantly monitoring the engine speed during an idle condition and correcting this speed when necessary.

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.



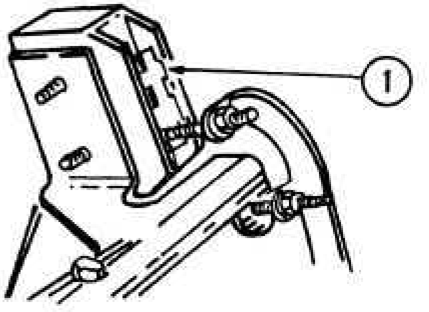
## SYSTEM OPERATION

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.



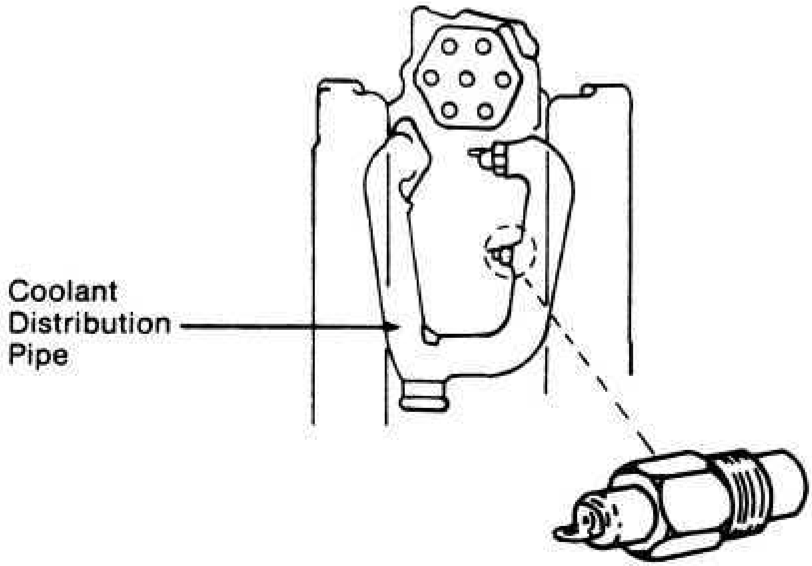

**IDLE SPEED REGULATOR**

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.

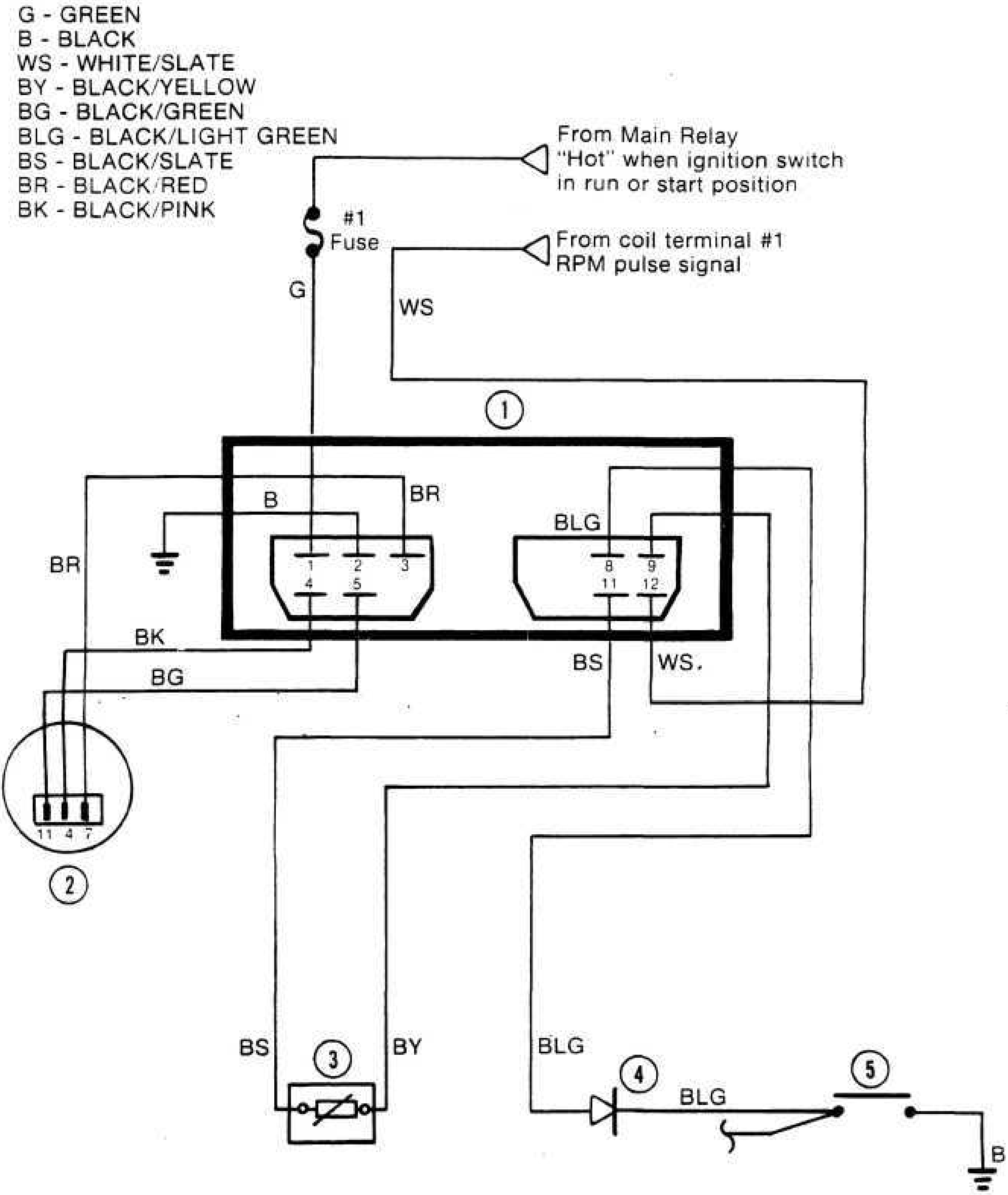



**IDLE SPEED MICRO-SWITCH**

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.

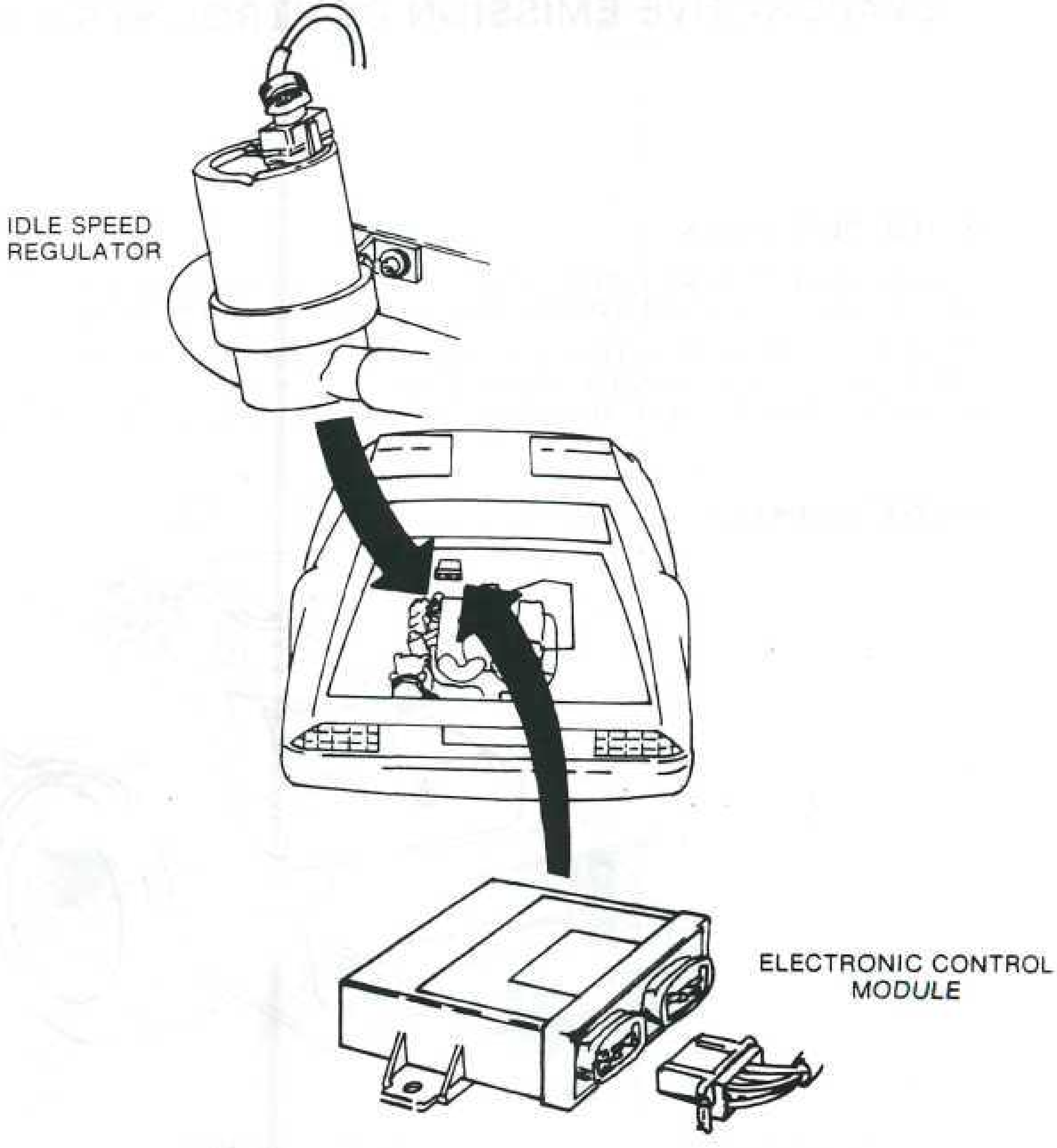
A thermistor (3), located in the coolant system distribution pipe, will activate another circuit within the ECU module when the coolant temperature is below 15° C (59° F). This circuit will provide a fast idle condition.

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**

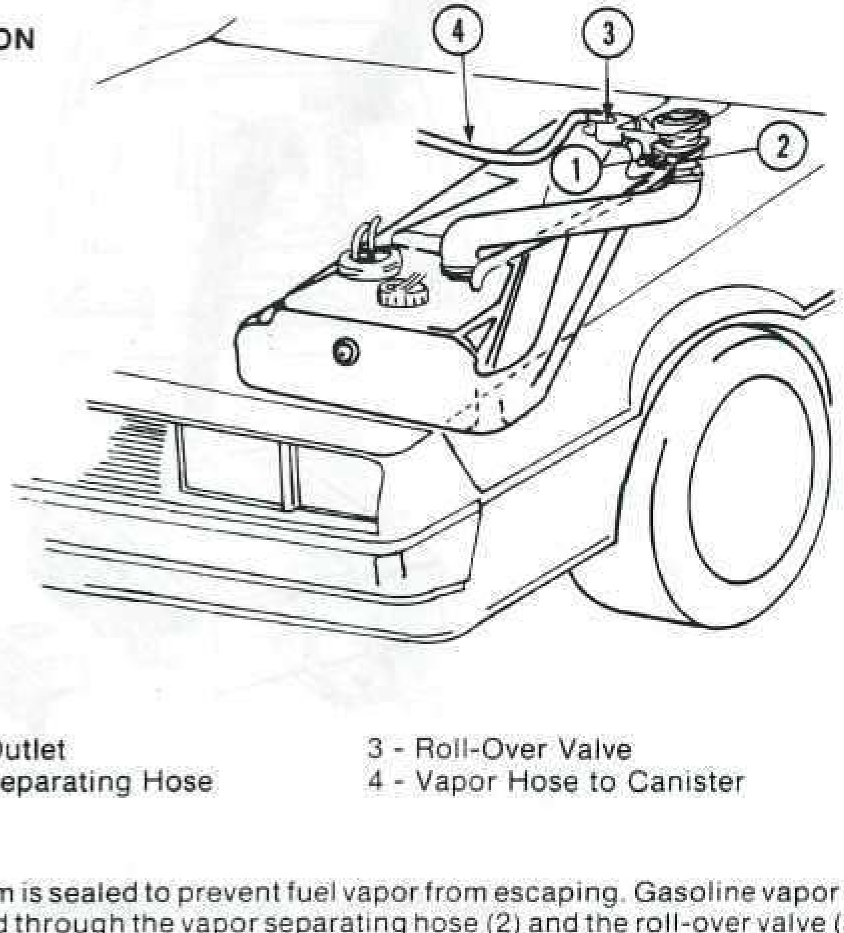
# EVAPORATIVE EMISSION CONTROL SYSTEM

## 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.

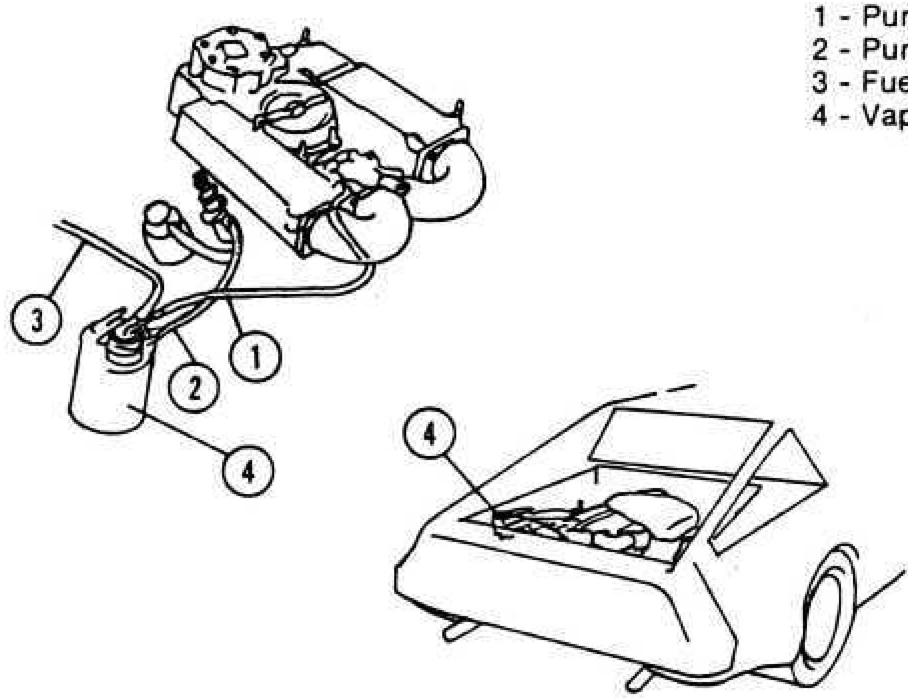
## SYSTEM OPERATION




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.

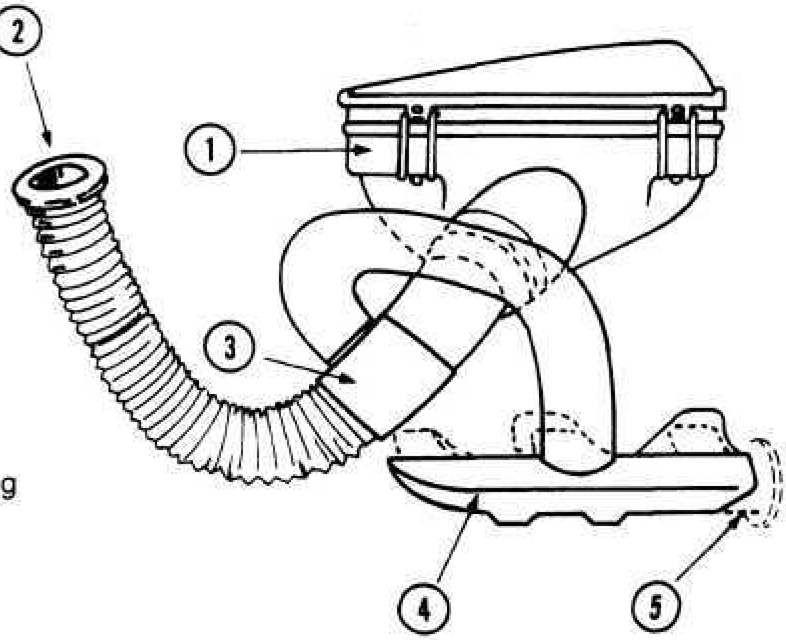
   b. An air leak in the engine crankcase will cause a lean running condition since the crankcase is connected to the intake manifold. Possible air leaks could be the oil dip stick not installed completely, oil filler cap not sealing properly, or leaking engine gaskets.

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).



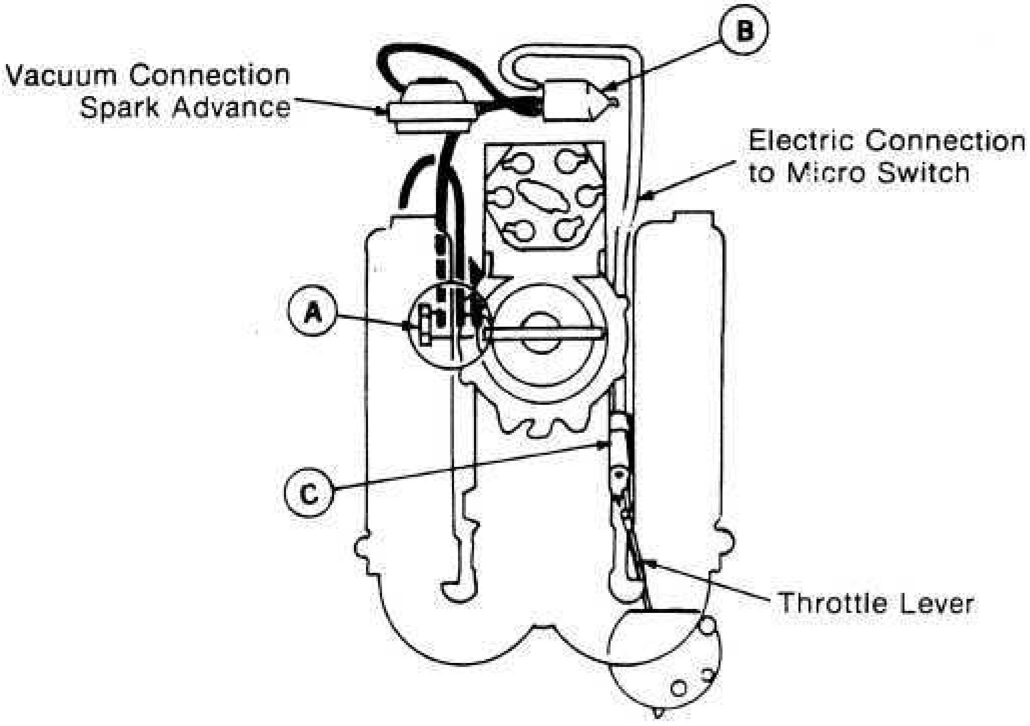

1 - Air cleaner assy
2 - Cold air inlet
3 - Hot/cold air valve housing
4 - Hot air stove
5 - Exhaust manifold

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).



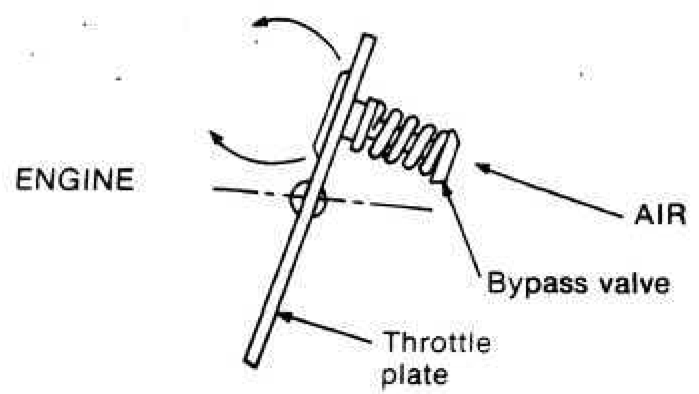

The electrically operated solenoid valve (B) is energized whenever the throttle plates are closed. Energizing the solenoid closes the vacuum passage to the distributor advance, thus eliminating an over-advanced condition during idle or deceleration. Solenoid operation is controlled by a throttle micro-switch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



# CHASSIS ELECTRICAL

# FUSES AND FUSE BOX

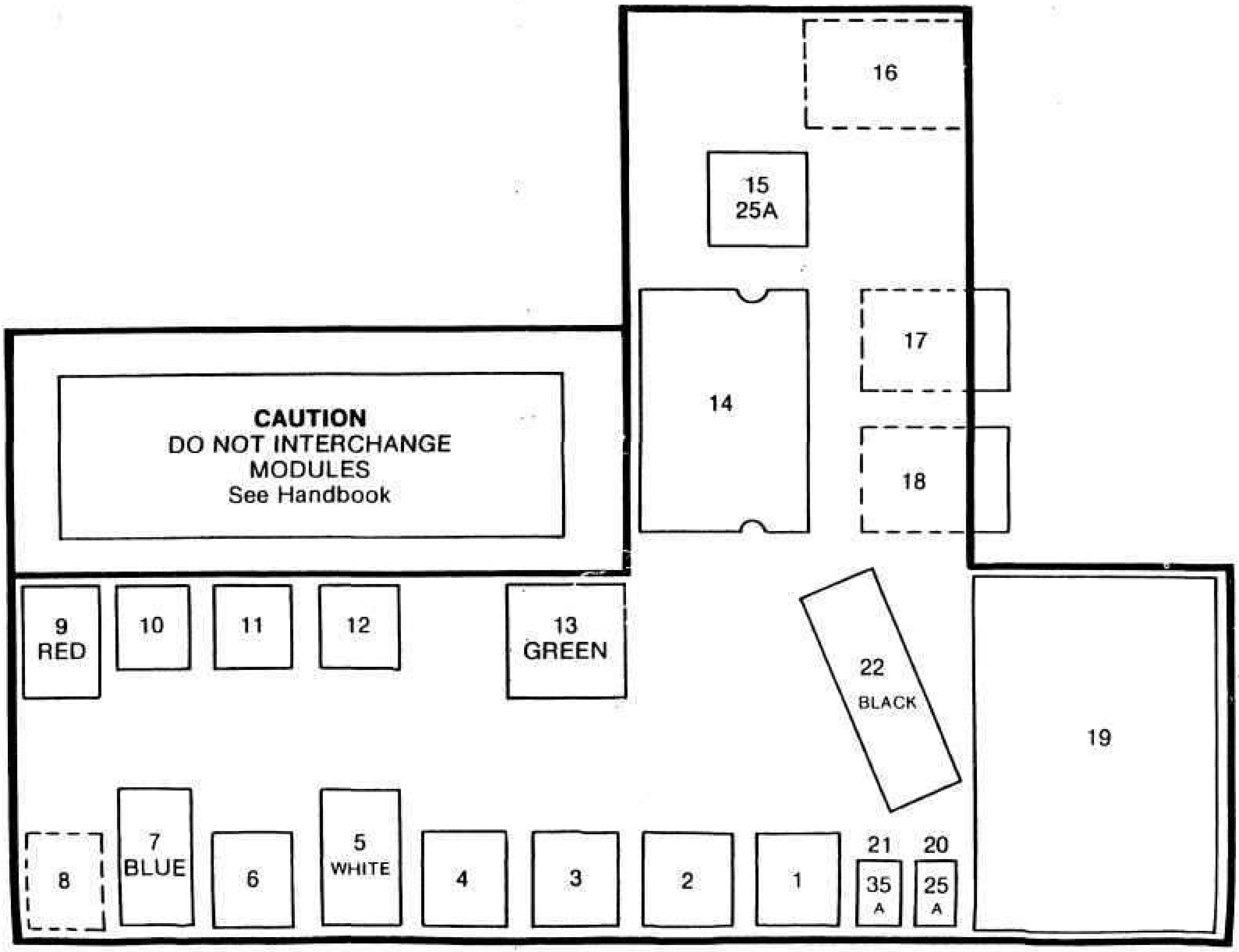
## DESCRIPTION

All of the fused circuits are routed through the fuse box located in the relay compartment behind the passenger seat. There are 17 fuses in use and one spare in the fuse box. Each fuse has a number on the back side which corresponds to its amperage rating. The fuses are of the two terminal autofuse type. The radio has two (2) in-line fuses which are located at the unit.

## FUSED CIRCUITS

| Fuse No. | Rating | Circuits |
|---|---|---|
| 1 | 10 A | RPM relay, distributor vacuum solenoid, ignition ECU, and idle speed ECU. |
| 2 | 10 A | L.H. tail lamp, side lamps, front parking lamp, and license plate lamp. |
| 3 | 10 A | Windshield wiper and washer motors. |
| 4 | 20 A | Directional indicator switch and stop light switch. |
| 5 | 10 A | All dash instruments and indicators, service interval counter, cool fan relay, and voltage regulator "charge" lamp circuit. |
| 6 | 20 A | Hazard warning switch, horns, and buzzer logic box. |
| 7 | 20 A | Lambda relay, Lambda ECU, frequency valve, fuel pump, and control pressure regulator. |
| 8 | 10 A | R.H. tail lamp, side lamps, front parking lamp, license plate lamp, cigar lighter lamp, instrument panel illumination lamps, main light switch lamp, hazard warning switch lamp, and digital clock lamp. |
| 9 | 10 A | Heated rear window and electric mirrors. |
| 10 | 20 A | A/C mode switch and door lock warning lamp. |
| 11 | 30 A | Radio, clock, gear selector lamp, A/C panel lamps, and power windows. |
| 12 | 10 A | Diagnostic plug, engine compartment lamp, luggage compartment lamp, glove box lamp, door lamps, interior lamps, and interior lamp delay unit. |
| 13 | 10 A | Automatic transmission |
| 14 | 20 A | Low beam headlamps |
| 15 | 20 A | High beam headlamps |
| 16 | 10 A | Reverse lamps |
| 17 | 20 A | Cigar lighter and clocks |
| 18 | 20 A | Spare fuse. |
| In-Line | 1 A | Radio purple wire |
| In-Line | 5 A | Radio light green wire |

# RELAY COMPARTMENT



1. LOW BEAM RELAY
2. HIGH BEAM RELAY
3. FAN RELAY 3RD SPEED
4. FAN RELAY 4TH SPEED
5. INTERIOR LAMP DELAY UNIT
6. COOL FAN RELAY
7. FAN FAIL MODULE
8. NOT USED
9. A/C PANEL ILLUMINATION RESISTOR
10. START INHIBIT RELAY
11. A/C PANEL ILLUMINATION RELAY
12. LAMBDA RELAY
13. REAR DEFOG TIMER
14. DOOR LOCK MODULE
15. DOOR LOCK CIRCUIT BREAKER
16. R.P.M. RELAY
17. ACCESSORY RELAY
18. MAIN RELAY
19. FUSE PANEL
20. FAN SPEED CIRCUIT BREAKER
21. COOL FAN CIRCUIT BREAKER
22. A/C OVERRIDE DIODE

# IGNITION SWITCH CIRCUITS

## CIRCUIT DESCRIPTION

A three position ignition switch is used to control the operation of the starter motor, two relays, and the ignition key warning buzzer. The various positions of the ignition switch control the operation of the relays which in turn supply power to most fused circuits.

## CIRCUIT OPERATION

The ignition switch receives power from the main feed wire which is "hot" at all times. Placing the switch in position 1 or "accessory position", allows current to flow from the ignition switch to the accessory relay thus activating the relay and closing the contact points. When this relay is activated, power is supplied to fused circuits 9, 10, 11, 13, and 16 from the main feed wire.

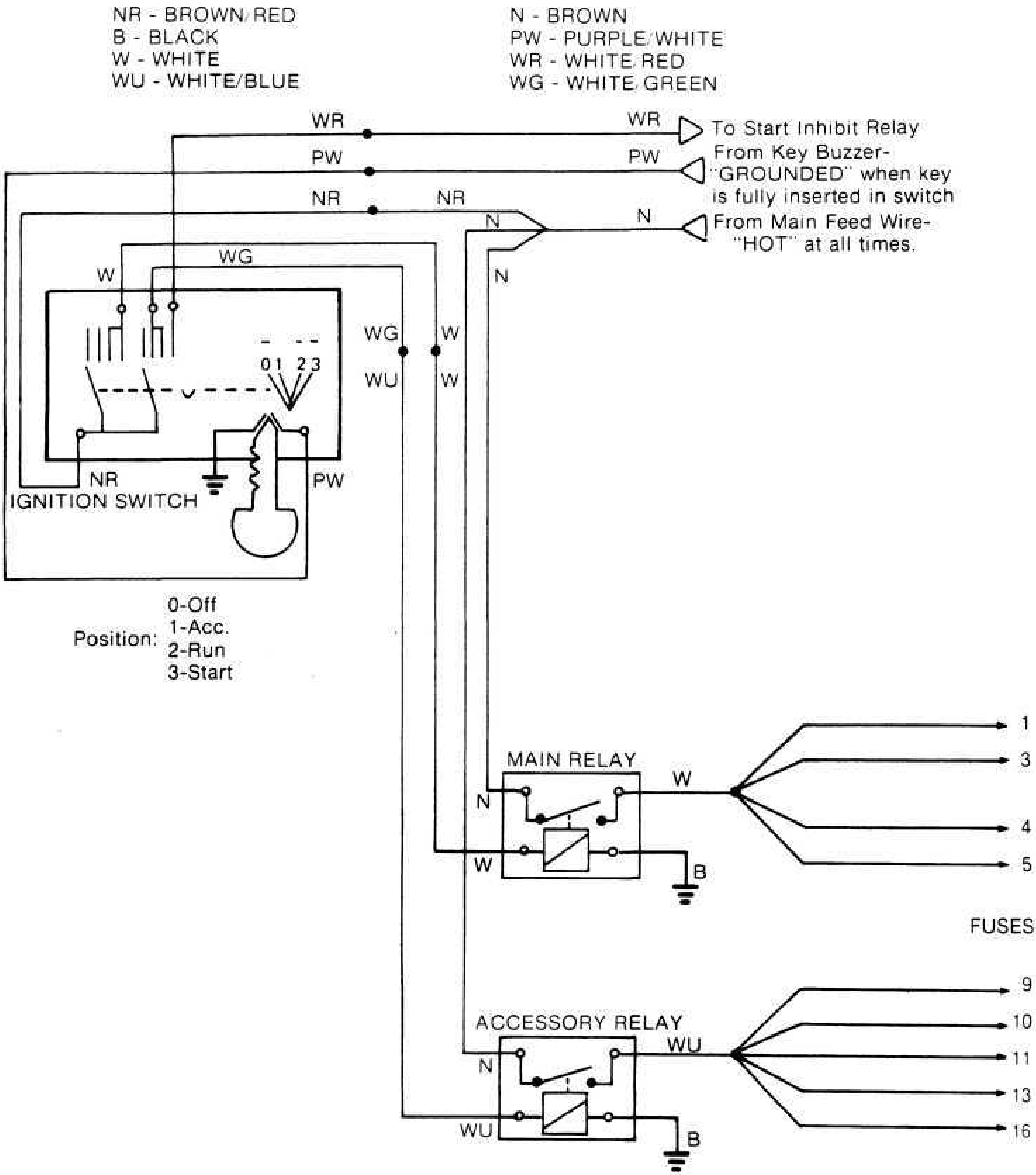
Placing the ignition switch in position 2 or "run position", activates the main relay. This relay connects fused circuits 1, 3, 4, and 5 to the main feed wire. The accessory relay remains activated when the ignition switch is in position 2.

By moving the switch to position 3 or "start position", power is supplied to the start inhibit relay which controls the operation of the starter motor. The accessory relay is deactivated during the cranking process and will reactivate when the spring loaded ignition switch is released and returns to the "run" position. The main relay remains activated during cranking to supply power to the circuits that are required for the starting process.

When the ignition key is inserted into the ignition switch, an electrical circuit is completed from the buzzer unit. This unit activates the buzzer if the driver's door is opened and the key is in the ignition switch.

## REPAIR NOTES

1. The ignition switch can be removed from the lock cylinder/steering column lock assembly for replacement. It is not necessary to remove the lock assembly to perform this operation.
2. The relays are in the relay compartment located behind the passenger seat. (See "Chassis Electrical" section)
3. The ignition key buzzer module is located under the instrument panel on the left side of the steering column.




IGNITION SWITCH CIRCUIT

# WINDSHIELD WIPER SYSTEM

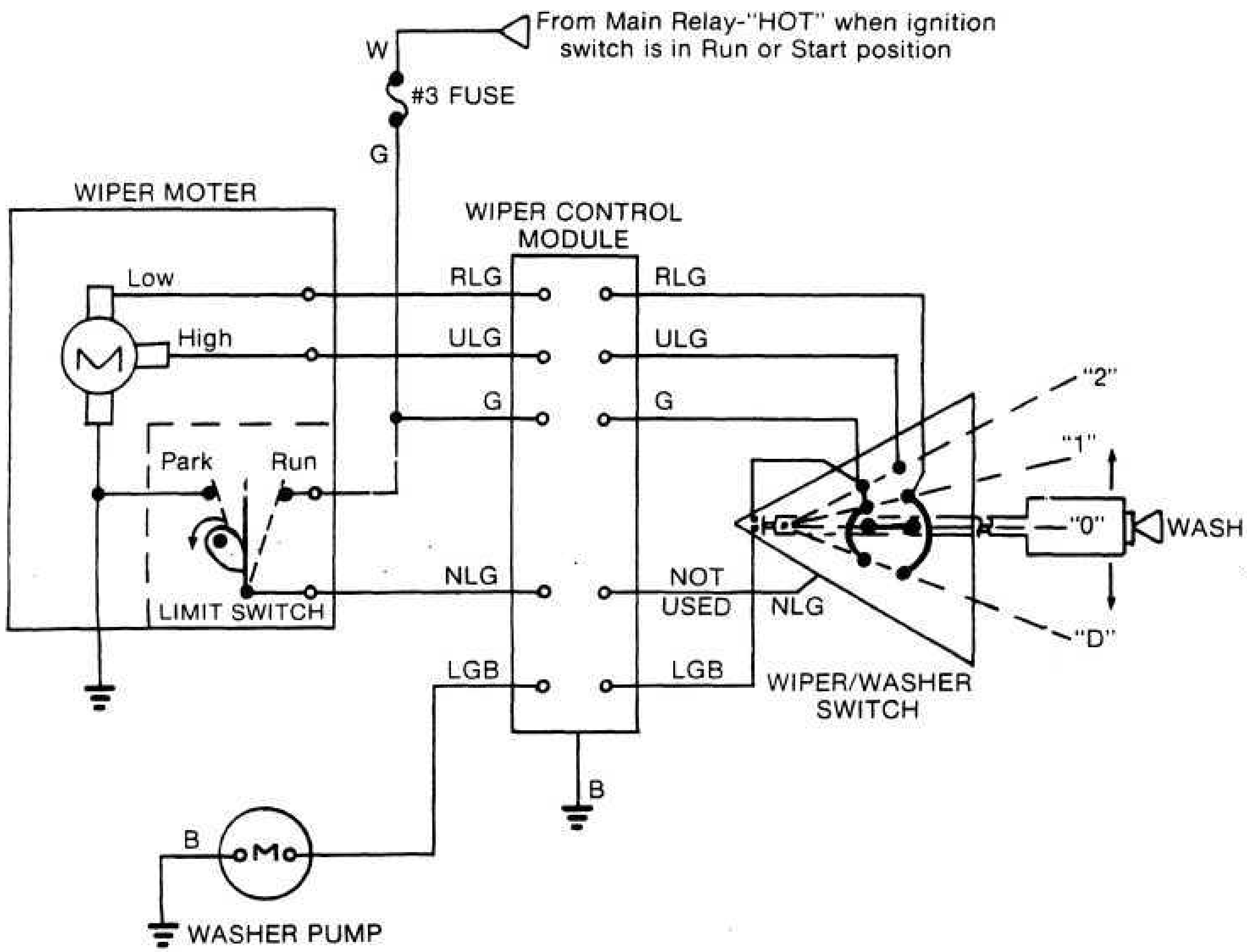
## SYSTEM DESCRIPTION

The wiper switch, mounted on the right hand side of the steering column, has four control positions and a sliding sleeve which is used to activate the windshield washer.

A two speed electric wiper motor is used which contains a limit switch to return the motor to the "park" position when the system is turned off. An electronic intermittent wipe control module is placed between the wiper switch and the motor to provide an intermittent wipe at slow speed. An electric windshield washer pump supplies fluid to the windshield during the wash cycle. Pushing inward on the end of the wiper switch arm activates both the pump and the wiper circuit. The intermittent wipe control module provides a delay period to allow the wipers to operate for a short period of time after the wash button is released.

G - GREEN
W - WHITE
B - BLACK
R - RED
N - BROWN

LGB - LT. GREEN/BLACK
RLG - RED/LT. GREEN
ULG - BLUE/LT. GREEN
NLG - BROWN/LT. GREEN




**WINDSHIELD WIPER-WASHER CIRCUIT**

## WIPER CIRCUIT OPERATION

Power for the windshield wiper/washer circuit is supplied by the main relay and the circuit is protected by fuse #3 in the fuse box. When the ignition switch is in the "run" position, voltage is supplied to the limit switch inside the wiper motor and the main contacts within the wiper switch.

POSITION 1: When the switch lever is moved to the "1" position, the contact bar on the switch lever connects the terminals in the wiper switch together allowing current to flow through the low speed circuit in the wiper motor.

POSITION 2: Moving the lever to position "2" connects the terminals together allowing current to flow to the high speed circuit in the wiper motor. In this position, power is supplied only to the high speed brush of the wiper motor.

POSITION O: Moving the switch lever to the "O" position stops current flow through the wiper switch. If the wipers are not in the park position, the limit switch will be in contact with the "run" terminal and supply power to the wiper control module. The module internally completes a circuit to the low speed motor brush for continued wiper motor operation. When the wipers reach the park position, the limit switch opens, stopping current flow to the module. This will stop wiper motor operation.

POSITION D: This position is spring loaded and the switch lever will return to the "O" position when released. Moving the switch lever to position "D" closed the contacts in the wiper switch allowing current to flow through the wiper control module to the low speed wiper motor circuit. The length of time that this circuit is closed is determined by the wiper control module. Switch closure for less than 1.0 second will cause the wipers to cycle only once. Switch closure for 1.0 to 15 seconds will cause the wipers to cycle once every four to six seconds. Switch closure for more than 15 seconds will cause the wipers to shut off when lever is released. To disengage the delay cycle it is necessary to move the switch lever to position "1" or "2" and then back to "O".

WASH POSITION: Depressing the end of the wiper lever closes the contacts in the wiper switch allowing current to flow to the washer pump motor. This current flow also activates the wiper control module which turns the wipers onto low speed and allows the wipers to continue for four to six seconds after the wash button is released. The washer pump stops immediately when the button is released.

**SYSTEM REPAIR NOTES**

1. The wiper motor assembly is non-repairable and must be replaced as a unit. The wiper motor and linkage are located under the dash panel and access is gained from the inside of the car.
2. The wiper control module is attached under the dash panel next to the pedal box on the left side of the steering column.
3. The washer motor is non-repairable and is located in the washer fluid reservoir.
4. The washer reservoir is mounted on the left front inner fender panel.
5. The windshield wiper switch is part of the combination switch assembly which includes the turn signal switch. Replacement of the combination switch assembly requires removal of the steering wheel.
6. To diagnose a defective wiper control module, disconnect the wiring harnesses from the module and connect the harnesses together. The wipers should work properly now, but they will not have an intermittent wipe cycle. If the wipers do not operate properly, the switch or motor is defective.

# EXTERIOR LIGHTING CIRCUIT

## CIRCUIT DESCRIPTION

The car is equipped with four halogen sealed beam headlamps. The high beam circuit, controlled by the high beam relay, operates the single filament inner headlamps and one filament in both of the outer twin filament headlamps. The low beam circuit, controlled by the low beam relay, operates only the low beam filament in both outer headlamps.

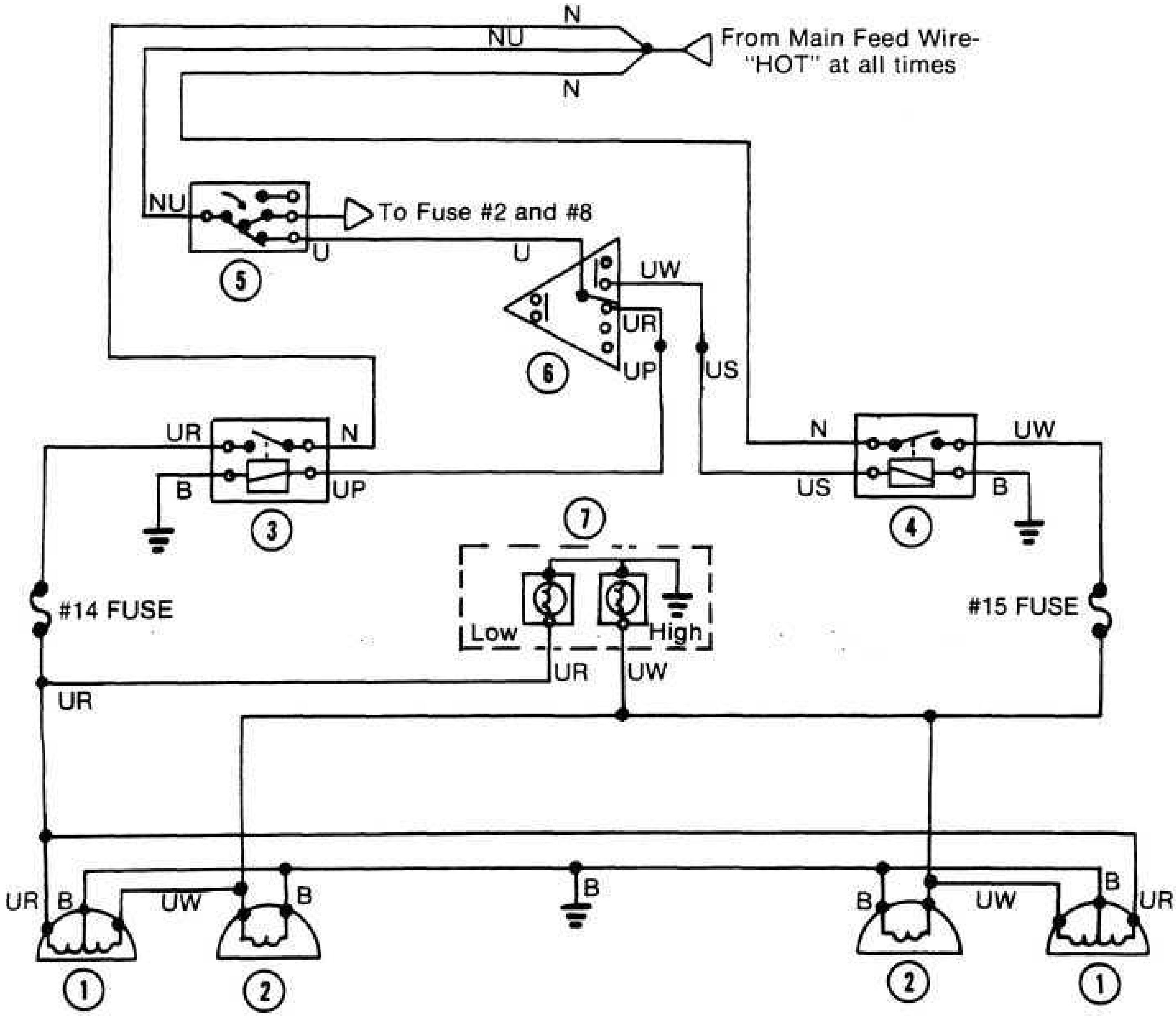
The circuit is controlled by the main light switch which supplies power to the high-low dimmer switch, part of the combination switch (turn signal switch). The high-low dimmer switch activates either the high or low beam relays which in turn activate their respective circuits.

Each rear lamp cluster incorporates a direction indicator, two stop lamps, a tail lamp and a reverse lamp. All of the bulb holders are located on a printed circuit board which is clipped to the rear of the lamp housing. Other external lamps are the front direction indicator/parking lamps located in the front bumper recess, a side marker on each front and rear fender, and two rear license plate lamps.

When the main lighting switch is depressed to its first position, the front parking lamps, tail lamps, all side marker lamps, and the rear license plate lamps are operated. When the main light switch is depressed to its second position (fully in), the headlamps are operated in addition.

N - BROWN
NU - BROWN/BLUE
U - BLUE
UP - BLUE/PURPLE

B - BLACK
UR - BLUE/RED
UW - BLUE/WHITE
US - BLUE/SLATE




**HEADLAMP CIRCUIT**

1—High/Low Beam Headlamps
2—High Beam Headlamps
3—Low Beam Relay
4—High Beam Relay
5—Main Light Switch
6—High/Low Dimmer Switch
7—"High" and "Low" Beam Indicator Lamps

## CIRCUIT OPERATION

EXTERIOR LIGHTING CIRCUIT: When the main light switch (5) is depressed to its first position, power is supplied to fuse #8 and fuse #2 in the main fuse box. Fuse #8 is the circuit which contains the right hand running lamps front and rear and the instrument panel illumination lamps. Fuse #2 is the circuit which contains the left hand running lamps, front and rear.

HEADLAMP CIRCUIT: Depressing the main light switch (5) to its second position supplies power to the high/low dimmer switch (6). The dimmer switch will supply power to either the high beam relay (4) or the low beam relay (3). When voltage is applied to either of the relays, that particular relay will energize and close the contacts, connecting the main feed wire directly to the respective light circuit.

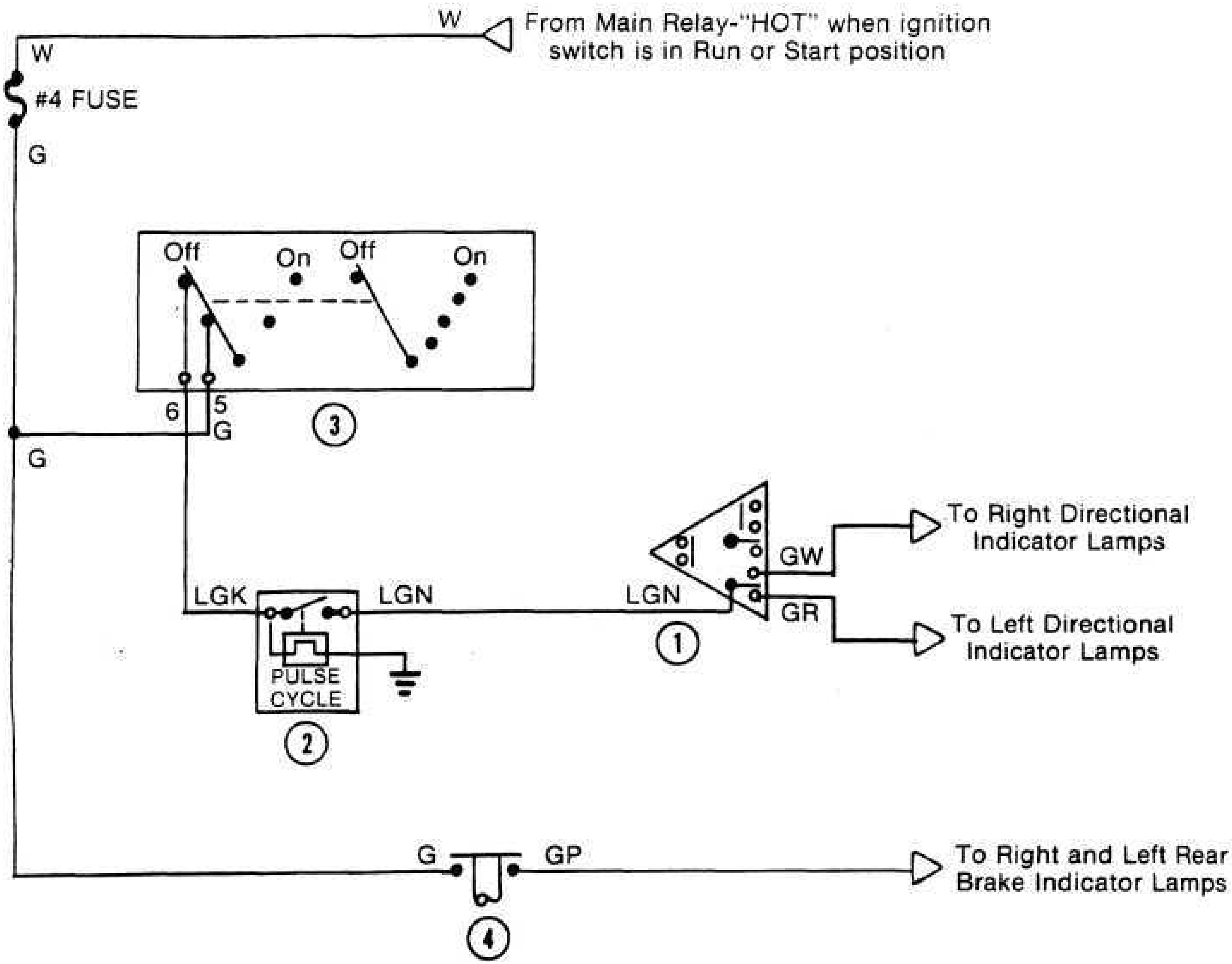
When the low beam relay (3) is energized, current passes through fuse #14 in the main fuse box and on to the low beam filaments of the outer headlamps (1) only. Power is also supplied to the low beam indicator lamp on the instrument panel (7).

When the high beam relay (4) is energized, current passes through fuse #15 in the fuse box to the high beam inner headlamps (2) and the high beam filaments of the outer headlamps (1). Power is also supplied to the high beam indicator lamp on the instrument panel (7).

## REPAIR NOTE

1. The high and low beam relays are located in the relay compartment behind the passenger seat. (See "Chassis Electrical" section)

W - WHITE
G - GREEN
LGK - LT. GREEN/PINK
LGN - LT. GREEN/BROWN
GW - GREEN/WHITE
GP - GREEN/PURPLE
GR - GREEN/RED




**DIRECTIONAL INDICATOR AND BRAKE LIGHT CIRCUIT**

1—Directional Indicator Combination Switch
2—D.I./Hazard Flasher Unit
3—Hazard Switch
4—Brake Light Switch

DIRECTIONAL INDICATOR CIRCUIT OPERATION: Power for the circuit is provided by the main relay which is hot when the ignition switch is in the "run" or "start" position. The entire circuit is protected by fuse #4 in the fuse box.

When the directional indicator switch (1) is moved to the desired position, the electrical circuit is completed allowing current to flow to either the left or right lamp circuits. The path of current flow is from fuse #4, through the contacts in the hazard switch (3), and through the flasher unit (2) to the directional indicator switch. Current flowing through the flasher unit activates the unit to provide the pulsating "on/off" current flow.

When the hazard switch (3) is placed in the "on" position, the directional indicator circuit is deactivated since the contacts are opened inside the hazard switch.

BRAKE LIGHT CIRCUIT OPERATION: Power is supplied to the brake light switch (4) by the #4 fused circuit from the main relay. Whenever the brake pedal is depressed, the mechanical brake light switch closes the circuit allowing current to flow to the brake lamps.

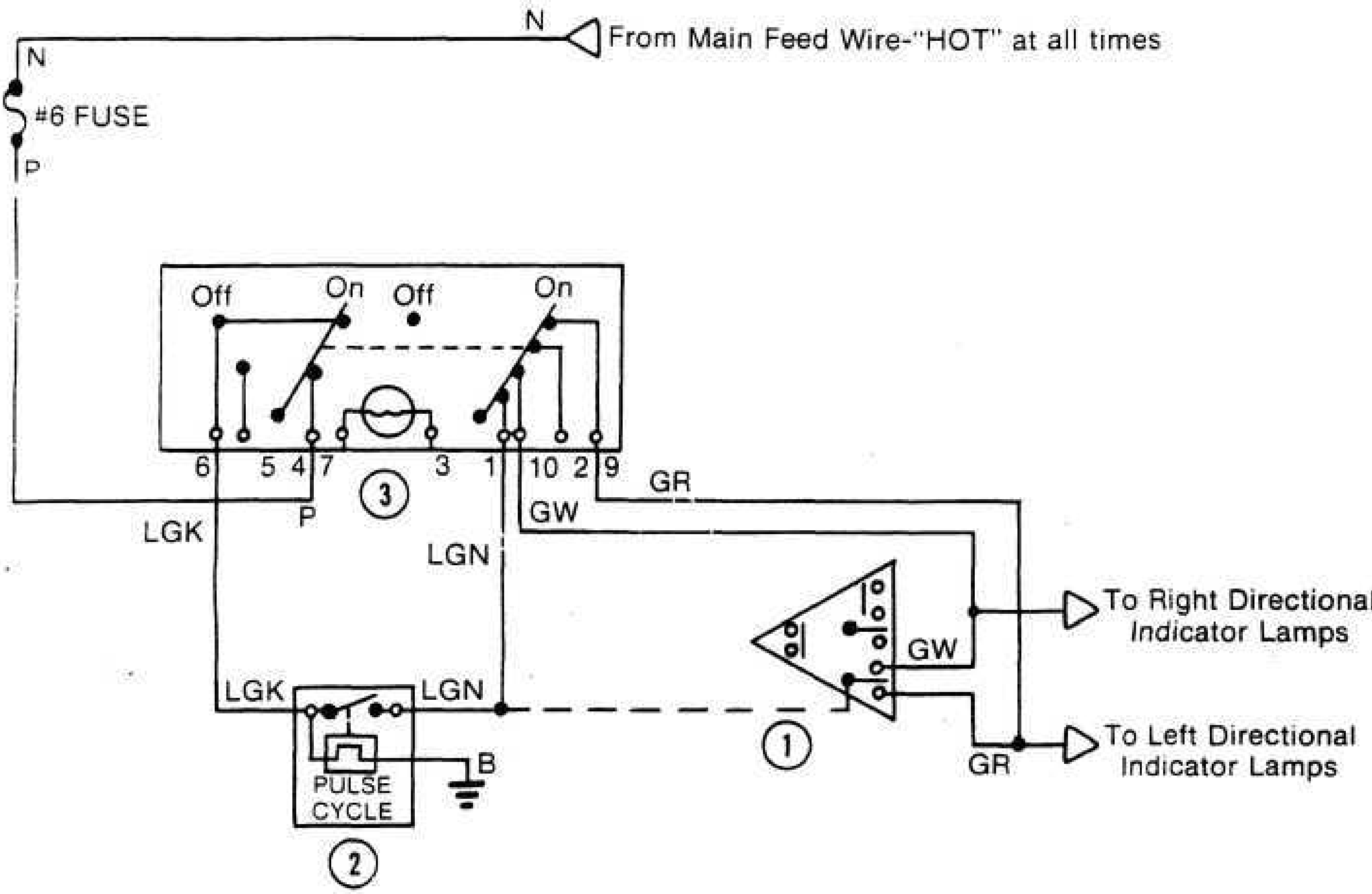
The brake lamps are single filament bulbs and are not connected to the turn indicator lamp circuit.

## REPAIR NOTES

1. The directional indicator and hazard flasher unit is located under the dash panel to the left of the steering column on the side of the pedal box.
2. The brake light switch is located on the pedal box just above the brake pedal linkage.
3. The hazard switch is located in the center console and can be removed by pulling outward on switch assembly.
4. The directional indicator switch is part of the combination switch which includes the windshield wiper switch. Replacement of either switch requires replacement of complete assembly.

N - BROWN
P - PURPLE
LGK - LT. GREEN/PINK

LGN - LT. GREEN/BROWN
GW - GREEN/WHITE
GR - GREEN/RED




**HAZARD WARNING CIRCUIT**

1—Directional Indicator Switch
2—D.I./Hazard Flasher Unit
3—Hazard Switch

HAZARD WARNING CIRCUIT OPERATION: Power is supplied to the circuit by the main feed wire which is "hot" at all times. The circuit is protected by fuse #6 in the fuse box.

When the hazard switch (3) is placed in the "on" position, the double contacts move into position and complete the circuit. Current then flows through fuse #6, the closed contacts on the left side of the hazard switch (3) and on to the flasher unit (2). From the flasher unit, the current flows through the closed contacts on the right side of the hazard switch (3) and on to the left and right directional indicator circuits.

The combination D.I./Hazard flasher unit (2) will be activated by the current flow and turn the circuit on and off intermittently.

Terminals #3 and #7 are connected to the instrument panel illumination lamp circuit. Terminals #2 and #5 are not used.

# DOOR OPERATED INTERIOR LAMP CIRCUITS

## DESCRIPTION

Several interior lamp circuits have been combined together sharing the use of a common contact switch mounted in each of the gull-wing doors. Opening either of the doors will activate the door switch and provide a ground circuit for each of the lamp circuits. Due to the complexity of these circuits, four diodes are used to prevent electrical feedback. Therefore, if a problem should occur, it will be necessary to have a thorough understanding of how each circuit operates.

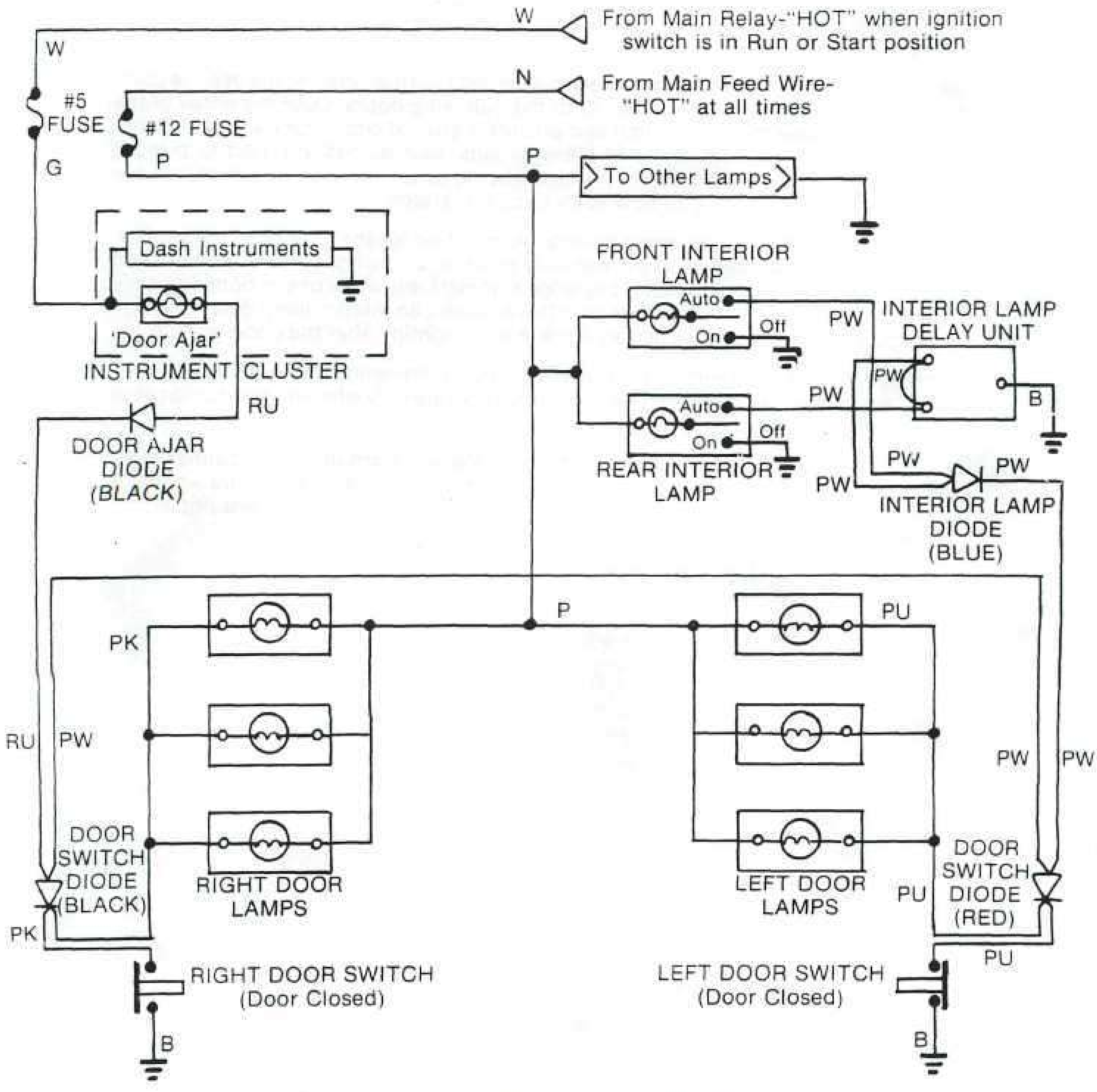
The front and rear interior lamps provide illumination for the interior of the vehicle. The lamps can be turned on or off manually by using the switch on each lamp. A third position on the lamp allows them to operate automatically when one or both doors are opened. When one of the switches is in this position, an interior lamp delay unit is in the circuit to provide a delay period in the interior lighting after the doors are closed.

Each door is equipped with three lamps to provide illumination and warning when the doors are in the open position. The door lamps operate only when that particular door is opened.

A 'door ajar' warning lamp in the instrument cluster will warn the driver if either of the doors is not fully closed. This warning is beneficial during daylight hours when it is not obvious that the interior or door lamps are on and the doors are not closed completely.

N - BROWN
B - BLACK
P - PURPLE
G - GREEN
W - WHITE

PW - PURPLE/WHITE
PU - PURPLE/BLUE
PK - PURPLE/PINK
RU - RED/BLUE




**DOOR AND INTERIOR LAMP CIRCUITS**

## CIRCUIT OPERATION

DOOR AJAR CIRCUIT: The door ajar circuit is protected by fuse #5 in the fuse box and receives power from the main relay which is "hot" when the ignition switch is in the "run" or "start" position.

When either the left or right door is opened, current will flow through the door ajar indicator lamp to the door ajar diode, and to ground through the door switch diode and door switch. The door ajar diode, located at the instrument cluster, is used to prevent the interior lamp circuit from "feeding back" through the door ajar lamp to the dash panel instruments. Without this diode, reverse current flow would cause the door ajar lamp to illuminate slightly with the doors fully closed.

INTERIOR LAMP CIRCUIT: The interior lamp circuit receives power from the main feed wire which is "hot" all the time. Either the front or rear interior lamp can be switched on manually which will allow current to flow through fuse #12 to the bulb, and to ground at the lamp switch. When either of the lamp switches are in the center or off position, the circuit is open in that lamp and it will not operate when the doors are opened.

Positioning either of the lamp switches in the "auto" position allows that lamp to operate by either door switch. When a door is opened, the door switch contact closes allowing current to flow in that circuit. Current flow would be through fuse #12, the interior lamp bulb, interior lamp diode, door switch diode, and to ground through the door switch. The interior lamp diode is used to prevent the door ajar circuit from "feeding back" through the interior lamps to one of the other circuits fed by the fuse #12.

Whenever current flows in the interior lamp circuit, the delay unit is activated to provide an alternate ground for the circuit. The circuit remains grounded through the delay unit for a short period of time after the door switches are opened (door closed). After pre-determined time, the delay unit will open and the interior lights will turn off.

DOOR LAMP CIRCUITS: Three parallel connected bulbs, powered by the #12 fused circuit are used on each door. When a door is opened, the door switch grounds the circuit and allows current to flow through the bulbs in that particular door. The path of current flow is from fuse #12 to the door lamps via the purple wire and to ground through the door switch.

A diode is used in each door switch circuit to isolate the left circuit from the right. Without these diodes, opening the left or right door would allow the other door lights to illuminate.

## REPAIR NOTES

1. A possible problem that could be experienced in this circuit is a "feed back" situation caused by a defective diode. The diodes can be checked using an ohmmeter; they should show continuity in one direction only. If a reading is obtained in both directions, the diode is shorted and will allow "feed back" to occur. If a reading cannot be obtained in either direction the diode is open. If a door switch diode is open, that particular door switch will not operate the "door ajar" lamp or the interior lamps.

   NOTE: Feed back through one of the door lamp switch shorted diodes will allow both sets of door lamps to illuminate when one door is opened. Feed back through the door ajar diode or interior lamp diode will cause the door ajar lamp to illuminate slightly with the doors fully closed.

2. The interior lamp diode is located in the main wiring harness and is positioned at the left front corner of the center console. The diode is color coded blue.

3. The door ajar diode is located in the wiring harness behind the instrument cluster directly above the steering column. It is color coded black.

4. The door switch diodes are located in the main wiring harness and are positioned at the left front corner of the center console. The left door diode is color coded red. The right door diode is color coded black.

5. The interior lamp delay unit is located in the relay compartment behind the passengers seat. (See "Chassis Electrical" section)

# ENGINE ADJUSTMENTS, TESTS AND DIAGNOSIS

# ENGINE ADJUSTMENTS, TESTS AND DIAGNOSIS

A. Adjustment
   1. Ignition Timing
   2. Idle Speed
   3. CO Emission

B. System Operation Tests
   1. Lambda
   2. Idle Speed Control

C. Diagnostic Charts
   1. "Engine will not start" — Ignition System
   2. "Engine will not start" — Fuel System
   3. Lambda System Troubleshooting
   4. Troubleshooting

# A1 — IGNITION TIMING ADJUSTMENT

STEP 1: Connect tachometer to engine. Start engine and allow to warm up to normal operating temperature.

STEP 2: Check engine curb idle speed to see that it is within specification (775 RPM ± 50, auto trans. in park). If idle speed is **not** within specification, perform "Idle Speed Control System Operation Test", item B2 in this section.

STEP 3: Disconnect vacuum hose at distributor advance and check to see there is **not** vacuum at the hose. Reconnect hose to advance unit.
If vacuum is present at hose during idle speed, diagnose malfunction in idle speed control system. (i.e., limit switch adjustment, distributor vacuum cut-off solenoid, TVS switch).

STEP 4: Connect timing light to #1 cylinder and check ignition timing. Set timing to 13° ± 2 BTDC at curb idle (775 RPM ± 50), adjust timing by loosening distributor hold-down nut and rotating distributor assembly.
Stop engine.

STEP 5: Tighten distributor hold-down nut and disconnect timing light.

# A2 — IDLE SPEED ADJUSTMENT

The De Lorean is equipped with an electronic idle speed control system. This system continuously monitors engine idle RPM and electronically maintains a fixed curb idle speed. The curb idle speed is pre-determined within the factory installed ECU module and cannot be altered.

The engine should idle at 775 RPM ± 50 during normal engine operating temperature. This check is made with an external tachometer connected to the engine. If there is excessive deviation from specification, the "Idle Speed Control System Operation Test" (B2 in this section) should be performed.

# A3 — CO EMISSION ADJUSTMENT

Since the De Lorean is equipped with an Idle Speed Control System, there is **no** provision to balance CO between left and right cylinder banks. This is due to the engine idle speed screw being completely closed and therefore non-functional. The **only** CO adjustment is total CO emission of left and right cylinder banks combined. This adjustment is performed with the air flow sensor adjusting screw.

**ENGINE CO EMISSION CHECK:**

STEP 1: Connect tachometer to engine.

STEP 2: Disconnect Lambda oxygen sensor wire from under vehicle at underbody connection located above left rear suspension. Do **not** attempt removing wire directly from oxygen sensor.

STEP 3: By-pass cooling fan temperature switch by disconnecting connectors from switch and installing a jumper wire between the terminals in the connectors. The temperature switch is located on the coolant pipe, left side of engine.

STEP 4: Remove both exhaust pipe plugs. Plugs are located in left and right exhaust pipes at exhaust manifolds.

STEP 5: Install exhaust gas probes and valve assembly, Tool No. J28886, in plug locations. Connect CO analyzer to probe and valve assembly.

STEP 6: Start engine and allow to warm up to normal operating temperature.

STEP 7: With both left and right gas probe assembly valves in the open position, read CO level. It should be 1.0% + .3% at an engine speed of 950 RPM. If not, perform "Air Flow Sensor Adjustment" (Page 120).
**Note:** To adjust idle speed to 950 RPM, open idle adjustment screw (slotted screw on inlet manifold).

STEP 8: Reconnect cooling fan temperature switch and Lambda oxygen sensor wire. Remove exhaust gas probe and valve assembly, and install exhaust pipe plugs. Disconnect tachometer.

STEP 9: Close idle adjustment screw.

**AIR FLOW SENSOR ADJUSTMENT:**

The air flow sensor is adjusted to the proper CO level at the factory. The *adjustment* screw access hole in the mixture control unit is sealed at the factory to prevent tampering with this setting.

If the proper CO reading could not be achieved in Step 7 of the "Engine CO Emission Check", it may be necessary to readjust the air flow sensor. Before performing this adjustment, it is important to check the following:

1) Proper procedures were followed when performing the "Engine CO Emission Check".
2) Possible intake manifold leaks causing a lean condition.
3) Possible vacuum hose or crankcase leaks causing a lean condition.
4) Refer to fuel injection "Troubleshooting Chart" (C4 in this section), and check for possible causes i.e., control pressure, cold start valve leaking, etc.

**ADJUSTMENT PROCEDURE:**

STEP 1: Perform Steps 1-6 of "Engine CO Emission Check".

STEP 2: Stop engine.

STEP 3: Remove air sensor adjustment access hole plug located between the fuel distributor and air flow sensor on the mixture control unit.

STEP 4: Start engine and insert 4mm allen wrench into air flow sensor adjusting access hole.

STEP 5: Adjust CO level to 1.0% ± .3% at 775 RPM ± 50.

NOTE: After each CO level adjustment, wrench must be removed and access hole covered to prevent a lelan condition during CO reading. Counterclockwise reduces total CO level and clockwise *increases* total CO level.

STEP 6: Stop engine, install new access hole plug.

STEP 7: Perform Step 8 of "Engine CO Emission Check".

# B1 - LAMBDA SYSTEM OPERATION TEST

The purpose of this test is to check if the Lambda Emission Control System is working properly. This test is not intended to determine what component of the system is malfunctioning. If the vehicle fails any procedure within this test it is necessary to refer to the "Lambda Systems Diagnostic Chart," Item C3 in this section.

STEP 1: Perform procedure for "Ignition Timing Adjustment" (A-1 in this section) to check timing and curb idle speed.

STEP 2: Remove both exhaust pipe plugs. Plugs are located in left and right exhaust pipes at exhaust manifold.

STEP 3: Install exhaust gas probes and valve assembly, Tool No. 105336, in plug locations. Connect CO analyzer to probe and valve assembly. With both left and right gas probe valves in the open position read combined total CO level of right and left cylinder banks.

STEP 4: Connect dwell meter leads to diagnostic plug. The positive dwell lead is connected to the lower right corner terminal of the plug as viewed with the plug cover hinge on the right side. The negative dwell lead is connected to the terminal directly above the positive as viewed with the plug cover hinge on the right. Set the dwell meter to four (4) cylinder scale.

STEP 5: Disconnect Lambda oxygen sensor wire from under vehicle at underbody connection located above left rear suspension. **Do not** attempt removing wire directly from oxygen sensor.

STEP 6: Check for dwell reading to confirm correct hook-up and meter operation. Start engine and check pulse ratio of Lambda frequency valve by reading on dwell meter. Dwell should be steady within 40° to 50°. Record reading.

STEP 7: Check total CO reading. CO should be 1.0% ± .3% at curb idle speed (750 RPM).

STEP 8: Connect jumper wire to disconnected oxygen sensor lead which goes to ECU module. Ground jumper wire.

STEP 9: Check CO and dwell readings. The CO percentage should increase and the dwell should be steady at a minimum of 87°.

STEP 10: Apply a 1.5 volt power source (flashlight battery) to jumper wire from ECU module.

STEP 11: Check CO and dwell readings. The CO percentage should decrease and the dwell should be steady at a maximum of 20°.

STEP 12: Reconnect the Lambda oxygen sensor wire.

STEP 13: Check total CO reading. CO should drop below 1.0% and dwell reading should fluctuate between 35° to 45°.

NOTE: If CO does not drop below 1.0% raise engine speed to 1500 RPM. If CO now drops check for leaks in exhaust manifold or mixture control unit to inlet manifold gasket.

STEP 14: Depress full-throttle microswitch with finger to simulate full-throttle condition. The microswitch is located at the rear of the engine adjacent to the thermostat housing cover.

STEP 15: Check CO and dwell readings. The CO percentage should increase and the dwell should be 50° to 60°. Release microswitch.

STEP 16: Remove exhaust gas probes and valve assembly, install exhaust pipe plugs, and disconnect dwell meter.

# B2 - IDLE SPEED CONTROL OPERATION TEST

The curb idle speed on the De Lorean Sports Car is non-adjustable. The speed is electronically controlled by an ECU module which is preset internally and cannot be altered. The module is also designed with a variable range fast idle circuit which is activated by a thermistor when coolant temperature is below 15°C (59°F). As the coolant temperature decreases below 15°C the fast idle speed increased proportionally to compensate for the resistance within the engine due to cold temperature.

The purpose of this test procedure is to verify that idle speed control system operates with the engine at normal operating temperature. If the vehicle experiences a problem with the fast idle circuit it is necessary to perform a temperature-resistance test on the thermistor. These specifications follow the procedure below.

STEP 1: Connect tachometer to engine.

STEP 2: Start engine and allow to warm up to normal operating temperature. Read engine idle RPM. Idle speed should be 775 RPM ± 50.

STEP 3: Remove air cleaner and disconnect wire from idle speed microswitch.

STEP 4: Read engine idle RPM. The RPM should increase. Reconnect microswitch wire.

STEP 5: Stop engine. Install air cleaner and remove tachometer.

If the vehicle failed any step in the above procedure there is a possible malfunctioning component within the system. A list of items to check are as follows:

a) #1 fuse blown.
b) Restricted air filter element.
c) Improper or no RPM pulse signal from coil terminal #1.
d) Idle adjustment screw located on inlet manifold not completely closed.
e) Vacuum leak at idle circuit by-pass pipe or hoses.
f) Idle speed regulator shorted or open.
g) Open circuit in thermister or wiring giving a fast idle condition at all engine coolant temperatures.
h) Idle speed microswitch misadjusted or internally open.
i) Throttle plates not completely closed at idle.

j) Open idle speed diode causing no electronic idle speed control operation.
k) Shorted idle speed diode causing possible internal damage to idle speed ECU module by voltage feedback from distributor vacuum cut-off solenoid.
l) Idle speed ECU module malfunctioning.
m) Malfunction in Fuel Injection or Lambda system.

# C1 - IGNITION SYSTEM DIAGNOSTIC CHART
## CONDITION: "ENGINE WILL NOT START"

| TEST | READING | PROBABLE FAULT | CHECK AND REMEDY AS NECESSARY |
|---|---|---|---|
| 1). Turn engine over with starter and check the length of spark between the high tension lead from the coil to ground. | More than 12 mm | Starter circuit and solenoid probably working o.k., may be problem in areas indicated to check. | Check 0.5 compensating resistor (resistor with single wire attached) using ohmmeter. Check ignition timing. Check for flashover in coil insulator, distributor cap, rotor, ignition leads and plugs. Check fuel injection system. |
| | Less than 12 mm or no spark. | Starter circuit or starter solenoid resistance. | Check that current flows to the compensating resistor (blue/yellow lead) with starter cranking. With the starter cranking the voltage between this lead and the positive battery terminal should be approximately 0 V. If not, check for excessive resistance in starter solenoid or wiring to resistor.<br><br>Proceed to Test 2. |
| 2). Battery voltage **must** be greater than 11 volts. Turn ignition switch to 'Run' and measure voltage between terminal #15 on coil and ground. | 0 Volts | Break in compensating resistor or open from main relay to compensating resistor. | Check compensating resistor using ohmmeter. Check that voltage is present at the white wire connected to the resistor. If not, check main relay and ignition switch wiring. |
| | Less than 6 Volts. | Short-circuit in primary winding of coil. | Check resistance of primary coil winding (0.95-1.4 Ohms). |
| | 6-8 Volts. | Primary Coil winding and compensator resistor o.k. | Proceed to Test 3. |
| | 8-12 Volts. | Bad ground connection. | Check using ohmmeter that contact pin #31 on ignition ECU module has good ground connection. |
| | 12 Volts | Break in primary coil winding. ECU Module not conducting. | Check resistance of primary coil winding (0.95-1.4 Ohms). Check for battery voltage at contact pin #15 of ignition ECU module, using voltmeter with ignition in 'Run' position. |
| 3). Measure the voltage between terminal #1 on coil and ground. | 0 Volts | Short-circuit in ECU module. | Exchange ignition ECU Module. |
| | 0.5-2 Volts | Power Transistor in module o.k. | Proceed to test 4. |
| | 12 Volts | ECU Module not conducting. | Change ECU module. Check for faulty insulation on wire from terminal #1 on coil to terminal #16 on ECU module. |

# C1 - IGNITION SYSTEM DIAGNOSTIC CHART (cont.)
## CONDITION: "ENGINE WILL NOT START"

| TEST | READING | PROBABLE FAULT | CHECK AND REMEDY AS NECESSARY |
|---|---|---|---|
| 4). Measure the resistance in the secondary coil winding. | 5.5 - 8 k Ohm | O.K. | |
| | Appreciable deviation. | Defective secondary winding in coil. | Change coil.<br>Proceed to test 5. |
| 5). Connect Dwell Meter and check dwell angle. | 45°±5° depending on engine RPM. | ECU Module and distributor pulse generator probably working o.k. | |
| | Maximum reading on scale. | Dwell meter range insufficient. | Connect a voltmeter between pins 7 and 31d of ECU module. At cranking speed (100RPM), a minimum reading of 1.0 volt A.C. should be obtained. This indicates that impulses of sufficient strength are being generated by the distributor. If there is no or low voltage, check the screened impulse cable for damage. Thereafter, check the pulse generator in the distributor with an ohmmeter (895-1285 Ohm). Check the air gap between the rotor and stator and adjust to 0.25 mm if necessary using a nonmetalic feeler gauge. If the fault persists change the pulse generator. |
| | | The ECU module does not react to impulse changes from the pulse generator with varying engine RPM. | Change ignition ECU module. |

# C2 - FUEL SYSTEM DIAGNOSTIC CHART
# CONDITION: "ENGINE WILL NOT START"

| TEST | READING | PROBABLE FAULT | CHECK AND REMEDY AS NECESSARY |
|---|---|---|---|
| 1). Turn engine over with starter and check the length of spark between the high tension lead from the coil to ground. | 12 mm. | Normal. | Proceed to Test 2. |
| | More/less 12mm or no spark. | Malfunction in ignition system. | Refer to C1 chart in this section ("Ignition System Diagnostic Chart") |
| 2). Connect Fuel pressure gauges for primary line pressure check. Crank engine. | Pressure exists | Fuel pump o.k. | Proceed to test 3. |
| | No pressure reading. | No voltage to fuel pump. | Check condition and voltage at Fuse #1. Voltage should be present in 'Run' and 'Start' positions. If not, check main relay circuits. |
| | | | Check condition and voltage at fuse #7. Voltage should be present at all times. If not, check wiring. |
| | | | Check RPM relay. By-pass relay with jumper wire between terminal 87 and 30 in relay socket. If fuel pump runs, either RPM relay is defective or there is an open circuit between coil and terminal 31b on relay. |
| | | Open fuel pump ground-inertia switch. | With RPM relay by-passed check for voltage at black/purple wire attached to inertia switch. If none, there is an open between RPM relay and pump or pump and inertia switch. If there is voltage, by-pass inertia switch by connecting a jumper wire between the black/purple and black wires at the switch. If the pump runs, the inertia switch is open or improperly grounded. |
| 3). Check for air flow sensor deflection during engine cranking. | Normal deflection | Air intake system and sensor o.k. | Proceed to test 4. |
| | Minimal or no deflection. | Air intake leak. | Check for intake manifold leaks. Check for air leaks at vacuum hose connections, hoses between by-pass pipe and idle speed regulator, and by-pass pipe connection to take manifold. |
| | | Air flow sensor binding or seized. | By-pass RPM relay (see test 2 above) and depress sensor plate releasing it quickly. The plate should return at once. NOTE: Injectors spray when plate is depressed, so use caution not to flood engine. The control pressure will offer some resistance when plate is depressed. Do not confuse this resistance with siezure. |

# C2 - FUEL SYSTEM DIAGNOSTIC CHART (cont.)
# CONDITION: "ENGINE WILL NOT START"

| TEST | READING | PROBABLE FAULT | CHECK AND REMEDY AS NECESSARY |
|---|---|---|---|
| 4). With coolant temp. below 35°C (95°F) place cold start valve in vessel and check operation with starter motor cranking. NOTE: If engine was previously cranked, let set for 10 minutes to allow thermo-time switch heating element to cool before proceeding with test. | Valve operates for 0-7.5 seconds depending on coolant temp. | 7.5 sec. at -20°C (-5°F) decreasing to 0 sec. at 35°C (95°F) - valve o.k. | Proceed to test 5. |
| | Valve does not operate. | Thermo-time switch to warm. | Allow thermo-time switch to cool. Coolant temp. too high. |
| | | Electrical Malfunction. | Check for voltage at cold start valve during cranking.<br>Check for open between cold start valve and thermo-time switch. |
| | | Defective thermo-time switch. | Replace Switch. |
| | | Defective cold start valve. | Replace Valve. |
| 5). Check additional items for possible no start condition. | | Spark plugs and engine fuel flooded. | Clean or replace plugs. If engine starts, check fuel injection system to eliminate reoccurance. ance.<br>-Cold start valve leaking.<br>-Control plunger in fuel distributor binding.<br>-Other mixture control unit malfunctions. |
| | | Low engine compression. | Perform engine compression test. |
| | | Low secondary voltage. | Perform "Ignition System Diagnosis" (C1 in this section.) |
| | | Incorrect ignition timing. | Perform "Ignition Timing Adjustment" (A1 in this section.) |
| | | Low primary fuel pressure. | Plugged fuel filter, ruptured accumulator, primary pressure regulator stuck open, etc. |
| | | Control pressure out of specification. | Check and diagnose control pressure regulator |

# C3-LAMBDA SYSTEM TROUBLESHOOTING CHART

Allow engine to reach operating temperature, stop engine and install dwell meter to diagnostic connector.

| TEST | READING | PROBABLE FAULT | CHECK AND REMEDY AS NECESSARY |
|---|---|---|---|
| 1). By-pass RPM relay terminals 30 and 87b. Read dwell. Should be steady between 40°-50°. | Frequency valve audibly works and dwell within spec. | Frequency valve o.k. | Proceed to test 2. |
| | Frequency valve audibly works, dwell deviates from 40°-50° spec. | Dwell meter incorrectly connected. | Check meter hook-up, if o.k. proceed to test 2. |
| | Frequency valve audibly works, no dwell readout. | Open or short in wire from ECU terminal 17 to diagnostic connector. | Check for continuity of wire from ECU terminal 17 to diagnostic connector. |
| | Frequency valve does not work and dwell deviates from 40°-50° spec. or is 0°. | Defective frequency valve winding. | Check frequency valve winding resistance (2-3 Ohms). |
| | | Open or short in Lambda system wiring harness. | Test continuity of Lambda wiring harness. If wiring is o.k. ECU module is defective. |
| 2). Disconnect oxygen sensor wire at underbody connector. **Do Not** ground. | Dwell remains stable at 40°-50°. | None | Proceed to test 3. |
| | Dwell slowly moves to within 40°-50°. | Oxygen sensor defective. | Replace oxygen sensor. |
| | Dwell still deviates from 40°-50° spec. | Lambda thermal switch defective. | Disconnect wire at thermal switch. If dwell moves within 40°-50° switch is defective. |
| | | Full throttle microswitch misadjusted or defective. | Move throttle to 'Full' position. If dwell does not move to 50°-60° check switch for ground **only** in 'Full' throttle position. |
| | | Lambda ECU module defective. | Proceed to test 3. |

# C3 - LAMBDA SYSTEM TROUBLESHOOTING CHART (cont.)

| TEST | READING | PROBABLE FAULT | CHECK AND REMEDY AS NECESSARY |
|---|---|---|---|
| 3). Disconnect oxygen sensor wire at connector and ground connector lead from ECU module. | Dwell does not increase. | Open or short in wire from ECU terminal 2 to oxygen sensor connector. | Check for continuity of wire from ECU terminal 2 to oxygen sensor connector. If o.k., exchange Lambda ECU module. |
| | Dwell increases to a minimum of 87°. | None. | Reconnect oxygen sensor connector, dwell should return to 40°-50° steady. |

# C4 — TROUBLESHOOTING DIAGNOSTIC CHART

**- FUEL INJECTION SYSTEM -**
**- LAMBDA CONTROL SYSTEM -**
**- IDLE SPEED CONTROL SYSTEM -**

| ENGINE WILL NOT START WHEN COLD | ENGINE WILL NOT START WHEN HOT | POOR COLD STARTING | POOR WARM STARTING | POOR IDLING - IN WARM-UP PHASE | POOR IDLING - WHEN ENGINE IS WARM | ENGINE BACKFIRES IN INTAKE MANIFOLD | ENGINE BACKFIRES IN EXHAUST | ENGINE MISFIRES WHILE DRIVING CAR | ENGINE POWER OUTPUT INSUFFICIENT | ENGINE RUNS ON | FUEL CONSUMPTION TOO HIGH | CO% BY VOLUME AT IDLE TOO HIGH | CO% BY VOLUME AT IDLE TOO LOW | FAULT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | X | | | | | | | | | | | | | Electric fuel pump does not run |
| X | | X | | X | | | | | | | | | | Cold control pressure out of tolerance |
| | X | | X | | X | X | | X | X | | | | X | Warm control pressure too high |
| | X | | X | | X | | X | | X | | X | X | | Warm control pressure too low |
| | | X | | | | | | | | | | | | Hot start relay inoperative (if equipped) |
| X | | X | | | | | | | | | | | | Cold start valve does not open |
| | | X | X | X | X | | X | | X | X | X | X | | Cold start valve leaks |
| | | | | | | | | X | | | | | | Primary pressure out of tolerance |
| X | X | X | X | | | | | | | | | | | Sensor plate rest position set incorrectly |
| X | X | X | X | X | X | | | X | X | X | | X | | Sensor plate or control piston binding |
| X | X | X | X | X | X | X | | | X | | | | X | Leaks in air intake system |
| X | X | X | X | X | X | | X | X | | | X | X | | General fuel system leaks |
| | | | X | X | X | | | | | X | | | | Injection valves leak |
| | | | X | | X | | X | | X | | X | X | | Idle CO adjustment too rich |
| | | | X | X | X | X | | | X | | | | X | Idle CO adjustment too lean |
| | | | | X | X | | | X | X | | | | | Injection valves not spraying properly |
| | | | X | | | | | | | | | | | Fuel accumulator leaks |
| | | | X | | | | | | | | | | | Seals in primary pressure valve or fuel pump leak |
| | | | | | X | | | | | | X | X | X | Lambda E.C.U. malfunction |
| | | | | | X | | | | | | X | X | X | Lambda sensor malfunction |
| | | | | | | | | | X | | X | X | | Lambda full-throttle micro-switch malfunction |
| | | | | | | | | | | | X | X | | Lambda thermal switch malfunction |
| | | | | | X | | | | | | X | X | X | Lambda frequency valve malfunction |
| | | | | X | X | | | | | | | | | Idle speed E.C.U. malfunction |
| | | | | X | X | | | | | X | | | | Idle speed regulator inoperative or sticking |
| | | | | X | X | | | | | | | | | Idle speed throttle micro-switch malfunction |
| | | | | X | X | | | | | | | | | Idle speed thermistor malfunction |

# SPECIFICATIONS AND CAPACITIES

# SPECIFICATIONS

## ENGINE

| | |
|---|---|
| Brake Horsepower @ 5500 RPM | 130 H.P. SAE net |
| Maximum Torque | 220 NM (162 ft.lb) at 2,750 r.p.m. |
| Number of Cylinders | 6 |
| Bore | 91 mm (3.58") |
| Stroke | 73 mm (2.87") |
| Displacement | 2,849 cc (173.86 cu. in) |
| Compression ratio | 8.8 : 1 |
| Valve Clearances (cold) | |
| Intake | 0.10 - 0.15 mm (0.004" - 0.006") |
| Exhaust | 0.25 - 0.30 mm (0.010" - 0.012") |
| Idle Speed | 775 ± 50 r.p.m. |

## COOLING SYSTEM

| | |
|---|---|
| Type | Positive pressure closed system |
| Thermostat begins open | 85-89°C (185-192°F) |
| Thermostat fully open | 100°C (212°F) |
| Radiator Position | Forward mounting |
| Cooling liquid | Water/ethylene glycol (borax free) |
| Concentration | 50% Anti-freeze, 50% Water |
| Fans | Electrically operated<br>Twin thermostatically controlled |

## ELECTRICAL SYSTEM

12 Volt negative ground

## BATTERY

| | |
|---|---|
| Type | Delco Remy Freedom (maintenance free) |
| Capacity | 70 amp/hour |

## ELECTRICAL SYSTEM (con'd)

### ALTERNATOR

| | |
|---|---|
| Type | Ducellier |
| Rated output power | 80 amp |

### STARTER

| | |
|---|---|
| Type | Paris-Rhone |
| Inbrush current | 50-60 amps |
| Holding current (solenoid) | 8-10 amps |
| Pull in voltage (solenoid) | 8 volts |
| 12 Volt supply | |

### IGNITION SYSTEM

| | |
|---|---|
| Type | Bosch (electronic contactless) |
| Firing Order | 1-6-3-5-2-4 |
| Ignition timing | 13° ± 2° @ 775 r.p.m. ± 50 |
| Spark Plugs | Bosch HR 6 DS |
| Spark Plug gap | 0.6 to 0.7 mm (0.024" to 0.028") |
| Spark Plug tightening torque | 17.5 to 20 NM (13 to 15 ft.lb) |

### DISTRIBUTOR

| | |
|---|---|
| Direction of Rotation | Clockwise when viewed from top |

## FUEL SYSTEM

### FUEL INJECTION

| | |
|---|---|
| Type | Bosch K Jetronic (mechanical) |
| Operation | Continuous injection (C.I.) |
| Line Pressure | 5.2 bar (75.4 PSI) |
| Injectors open at | 3.5 to 4.1 bar (51 to 59 PSI) |
| Rest Pressure | 3.3 bar (48 PSI) |

## FUEL SYSTEM (cont'd)

### *FUEL PUMP*

| | |
|---|---|
| Operation | Electric (12 volts) |
| Location | Immersed in fuel tank |
| Pressure | 5.2 bar (75.4 PSI) |
| Minimum output | 110 litres/hour (29 US Gallons/hour) |
| Maximum output | 120 litres/hour (32 US Gallons/hour) |

### FUEL FILTER

| | |
|---|---|
| Type | Paper with nylon gauze |

## TRANSMISSION

Gear Ratio

Manual — 5 speed

| | | | |
|---|---|---|---|
| 1st | 3.364 | 4th | 1.057 |
| 2nd | 2.059 | 5th | 0.8205 |
| 3rd | 1.381 | Rev | 3.1818 |

Automatic — 3 speed

| | | | |
|---|---|---|---|
| 1st | 2.40 | 3rd | 1.00 |
| 2nd | 1.48 | Rev | 1.92 |

## FINAL DRIVE — MANUAL AND AUTOMATIC

| | |
|---|---|
| Transaxle | Double Universal Half Shafts |
| Reduction Ratio | 3.44 : 1 |

## CLUTCH

| | |
|---|---|
| Disc diameter | 235 mm (9.25") |
| Total pedal travel | 150 mm (5.90") |
| Maximum pedal load | 15 kg (33lb) |

## BRAKES

| | |
|---|---|
| Type | Power assisted. Discs front and rear |
| Boost ratio | 2.2 to 1 |
| Diameter of Vacuum servo | 190 mm (7½") |
| Effective braking area — front | 1800 sq.cm (279 sq.in) |
| Effective braking area — rear | 1690 sq.cm (262 sq.in) |

**BRAKES** (cont'd)

| | |
|---|---|
| Disc diameter — front | 254 mm (10") |
| Disc diameter — rear | 276 mm (10½") |

Parking Brake
Mechanical, self-adjusting, acting on rear discs.

**STEERING**

| | |
|---|---|
| Rack and pinion | |
| Min. Turning Radius | 6.157 meters (20.2 ft) |
| Wheel Turns, lock to lock | 2.4 turns |

**SUSPENSION**

| | |
|---|---|
| Front | Unequal length wishbones, and coil springs with telescopic shock absorbers and stabilizer bar. |
| Rear | Diagonal trailing radius arms upper and lower links, coil springs with telescopic shock absorbers. |

**GEOMETRY**

| | | |
|---|---|---|
| Front | Toe-In | 3mm (0.12 in.) per wheel |
| | Caster Angle | 3½° — 4° positive |
| | Camber Angle | 0° — ½° negative non-adjustable |
| | King pin inclination | 8° ± ½° — 0° non-adjustable |
| Rear | Toe-In | 3mm (0.12 in.) per wheel |
| | Camber | ¼° — ¾° negative non-adjustable |

**TIRES**

| | |
|---|---|
| Type | Goodyear NCT, low profile (60 aspect) steel belt, tubeless, radial. |
| Front | 195/60 HR 14 |
| Rear | 235/60 HR 15 |
| Spare | T125/70 D15 Goodyear tubeless convenience spare |

## WHEELS

| | |
|---|---|
| Front | 6" x 14" |
| Rear | 8" x 15" |
| Spare | 4" x 15" |

## TIRE PRESSURES

**Normal loads**

| | |
|---|---|
| Front | 23 PSI |
| Rear | 30 PSI |
| Spare | 60 PSI |

## AIR CONDITIONING

| | |
|---|---|
| Regrigerant | R12 - Freon |
| Refrigerant oil | Suniso 5GS oɽ Texaco Carpella 'E' or equivalent |
| Refrigerant quantity | 1,250 grammes (2 lb. 12 oz.) |
| Compressor | Sankyo SD 510 |

## DIMENSIONS

| | Inches | Millimeters |
|---|---|---|
| Length (overall) | 168.0 | 4267 |
| Width (overall) | 78.3 | 1988 |
| Width (over doors) | 72.83 | 1850 |
| Height (doors closed) | 44.88 | 1140 |
| Height (doors open-over mirror) | 77.2 | 1960 |
| Track - Front | 62.6 | 1590 |
| Track - Rear | 62.5 | 1588 |
| Wheel Base | 94.8 | 2408 |
| Ground Clearance - front | 5.6 | 142 |
| Ground Clearance - rear | 6.1 | 155 |

## GENERAL INFORMATION

| | |
|---|---|
| Curb weight w/full fuel tank | 2712 pounds (1232.73 kg) |
| Luggage capacity | 14 cu. ft. - 1.2 cu. meters |
| Ramp angle | 22° front<br>27° rear |
| Approach angle | 17° |
| Approx. weight distribution | 35% front<br>65% rear |

## RECOMMENDED LUBRICANTS

| Item | Classification | |
|---|---|---|
| Engine Oil | API Service SF | Above - 12°C (10°F) 20w/40<br>20w/50<br>Below - 12°C (10°F) 10w/50 |
| Automatic Transmission Fluid | ATF Type (Dextron II) | |
| Manual Transmission Oil | MIL-L-2105C or GL5 | Above - 20°C (-4°F) SAE 80<br>Below - 20°C (-4°F) SAE 75 |
| Rear Axle Oil | MIL-L-2105C or API Service GL-5 | |
| Steering Gear Box Oil | API Service GL-5 | |
| Wheel Bearing Grease Multi-Purpose Grease | NLGI No. 2 (Lithium Base) | |
| Brake and Clutch Fluid | DOT 3 or DOT 4 | |
| Cooling System Anti-Freeze | Ethylene Glycol Based (Containing no borax) with suitable corrosion inhibitors | |

## CAPACITIES

| Unit | Metric Measures | U.S. Measure |
|---|---|---|
| Engine crankcase drain and refill when changing filter add | 6.5 liters | 6.8 quarts |
| Cooling System | 11.0 liters | 2.9 gallons |
| Manual Transmission including final drive | 3.7 liters | 7.75 pints |
| Final Drive (automatic transmission only) | 1.6 liters | 3.6 pints |
| Fuel Tank (91 Octane only) | 51.6 liters | 13.2 gallons |

# NOTES

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