



XJ12 Sedan

Technical Introduction: 1994 Model Year

V12



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Publication number S-81

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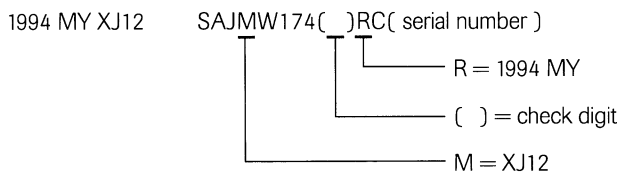
The Jaguar XJ12 is based on the XJ6 Vanden Plas model and features a 6.0 litre V12 engine coupled to a four-speed electronically controlled automatic transmission. Heavy duty front suspension and brakes, 16-inch forged alloy lattice wheels, ride leveling, limited slip differential, Connolly Autolux leather seats and CD autochanger are all standard features.

The 6.0 litre V12 engine has been developed from the 5.3 litre V12 engine and provides extra power and a significant increase in mid-range torque. The increased engine size is achieved by lengthening the stroke from 70 mm to 78.5 mm. Engine operation is controlled by an enhanced Lucas / Marelli engine management system with twin fuel pump modules providing fuel supply. The engine is isolated from the vehicle body by hydraulic engine mounts. A Hydra-matic 4L80-E4 four-speed electronically controlled automatic transmission with two operating modes – Normal and Sport – applies engine power to the drive train.

Under the hood, particular attention has been paid to visual appearance by careful layout of all components.

Many of the features of the 1993 Model Year Sedan Range are applicable to the XJ12. This XJ12 Technical Introduction describes only those features and changes that are not covered by the 1993 XJ6 Sedan Range Model Year Update.

Vehicle Identification Number (VIN)



XJ12 Sedan Range

The XJ12 technical features listed are those that are new or changed from the 1993 MY XJ6 VDP specification.

X Standard equipment **O** Optional equipment **N/C** No Cost **CDN** Canada

Technical Feature	XJ12
6.0 Litre 310 hp V12 engine	X
Revised engine management system with ECM air injection and canister purge control	X
Twin fuel pump modules with phased control	X
Four-speed electronically controlled automatic transmission with Normal and Sport modes	X
Lattice forged alloy 16-inch road wheels with 225/60 ZR 16 tires	X
Heavy duty front brakes and suspension	X
Power steering system with a renewable filter	X
Ride leveling	X
Limited slip differential	X
Driver and passenger 12-way power seats	X
Driver seat / rear view mirror 2-position memory	X
CD autochanger	X
HFC air conditioning system	X
High output generator – 120 amp	X
Twin electric auxiliary cooling fans	X
Connoly Autolux leather interior	X
Security system with intrusion sensing (dealer installed accessories and options available)	X
Passenger seat 2-position memory	O
Cold climate package (heated front seats, headlight power wash, engine block heater)	O (X – CDN)
Heated windshield	O (CDN only)
Metallic paint	O (N/C)

NOTE: All Canadian vehicles are equipped with the Cold climate package and a Canadian compliance package including: daytime running lights, European metric speedometer / odometer, ISO brake warning symbol, Canadian VIN, metric certification, and glove box label.

Specifications

Engine

Configuration	12 cylinder, 60 degree Vee
Cylinder head	2 valves per cylinder
Displacement	5994 cc
Bore / stroke	90 mm x 78.5 mm
Compression ratio	11.0 : 1
Power (DIN)	310 hp @ 5350 rpm
Torque (DIN)	342 ft lbs @ 3750 rpm
Spark plugs	NGK BR7 EF – 0.025 in gap (0.64 mm)
Fuel requirement	Unleaded gasoline – 95 RON octane rating

Transmission

	1st	2nd	3rd	4th	REV
Gear ratios	2.48 : 1	1.48 : 1	1 : 1	0.75 : 1	2.07 : 1
Max engine speed	6000 rpm	6000 rpm	6000 rpm		
Transmission fluid	Dexron II 'E'				

Capacities

Engine oil (with filter)	10.5 quarts (10 litre)
Transmission: approx. from dry	13.5 quarts (12.8 litre)
Transmission: drain and refill	7.7 quarts (7.3 litre)
Transmission: Min – Max difference	0.3 quart (0.3 litre)
Cooling system: fill from dry	21.1 quarts (20 litre)
Cooling system: drain and refill	16.2 quarts (15.3 litre)

Performance and Economy

Acceleration (0–60 mph)	7.2 seconds
Maximum speed	150 mph plus
Fuel economy, city	12.7 mpg
Fuel economy, highway	22.0 mpg
Fuel economy, combined (EPA)	15.7 mph

Wheels and Tires

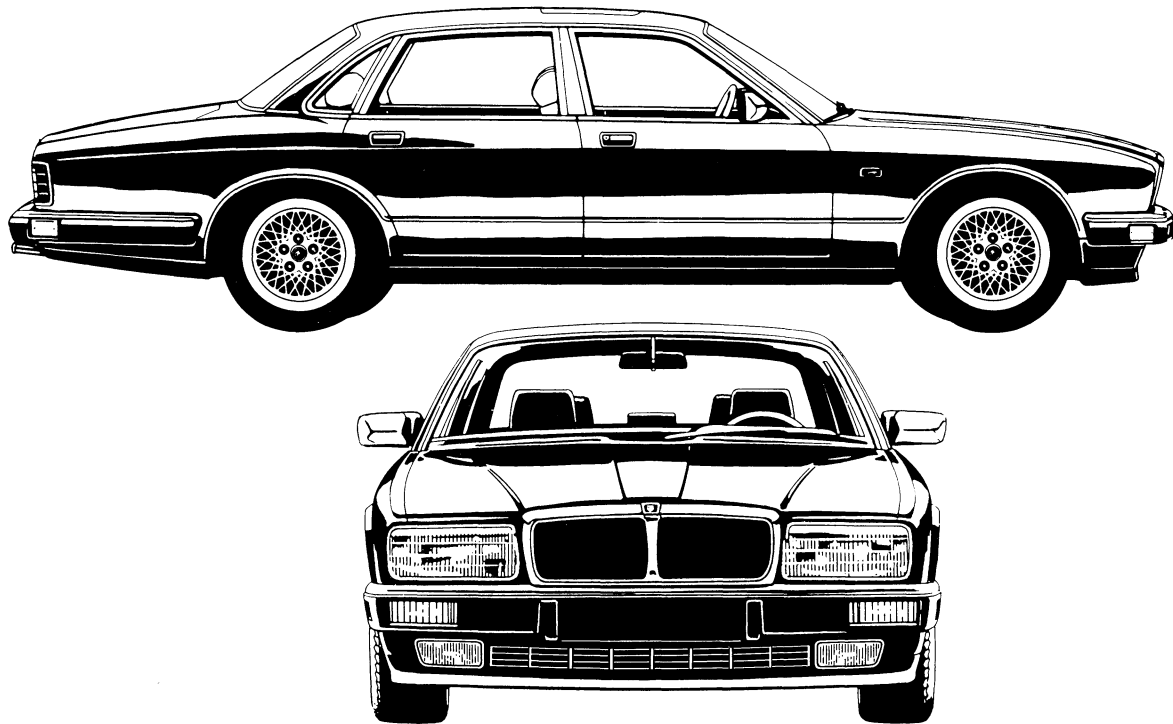
Wheels	Forged alloy lattice pattern; 7J x 16 in
Tires	Pirelli P4000 225/60 ZR 16
Snow tires	Pirelli M & S W210 225/55 R 16
Wheel nut tightening torque	65–70 lb ft (88 – 95 Nm)

Body Design

XJ12 Appearance

The XJ12 uses the same body as the XJ6 Sedan Range as described for the 1993 Model Year. Extensive revisions to the body structure and subassemblies were made for the 1993 Model Year vehicles in order to accommodate the future installation of the V12 engine and related equipment. Outwardly, the XJ12 can be immediately identified by the Lattice wheel design and the unique grille with blacked-out bars.

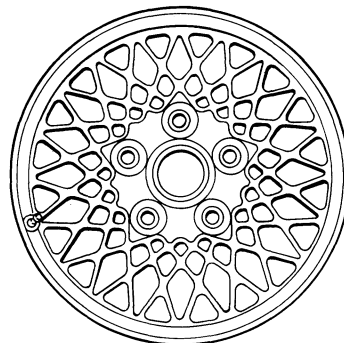
XJ12 BODY



Road wheels and tires

The XJ12 uses Pirelli P4000 225/60 ZR 16 tires mounted on 16-inch forged alloy Lattice design road wheels. Recommended cold inflation pressure (front and rear): Normal — 34 psi; Comfort — 28 psi (100 mph limit).

LATTICE WHEEL



Body Structure

V12 engine installation

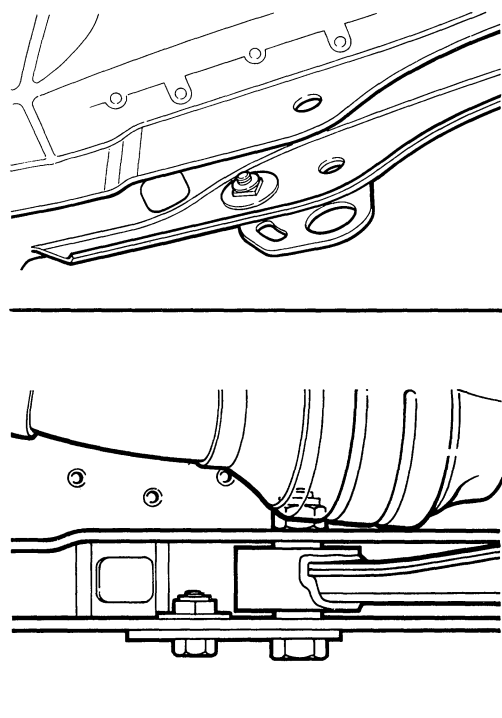
The XJ12 and XJ6 Sedan Range vehicles have a common body structure. A summary of changes made to accommodate both model range engine and drive train installations follows:

- Common body shell for AJ6 and V12 engines.
- Front spoiler and cooling air intake are redesigned to improve engine cooling and aerodynamic performance.
- Front body structure modified to accommodate cooling arrangements of both engines.
- Hood hinge mounting platform modified to allow installation and removal of V12 engine.
- Steering column body aperture moved outboard to allow V12 engine installation.
- Front suspension subframe mountings provided for both engine installations.
- Larger engine compartment bulkhead plenum to allow repositioned and revised wiper motor.
- Main floor and transmission mounting modified to accommodate all transmissions.
- Diagonal struts added to transfer crash loads to sills.

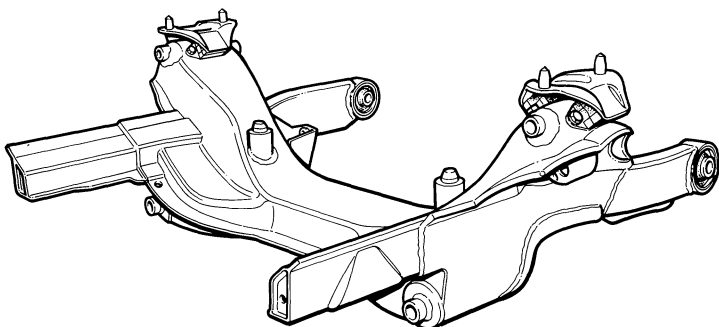
Front suspension subframe

A major change necessitated by the V12 engine installation occurred to the front suspension subframe. In order to gain clearance around the exhaust catalysts, the rear arms of the subframe have been extended outward. The arms have eccentric bushings and are bolted to the body through the outer channel sections. (XJ6 Sedans use an inner bracket and spacer arrangement.) The mounting bolts also attach the vehicle tie-down brackets.

SUBFRAME REAR MOUNTING



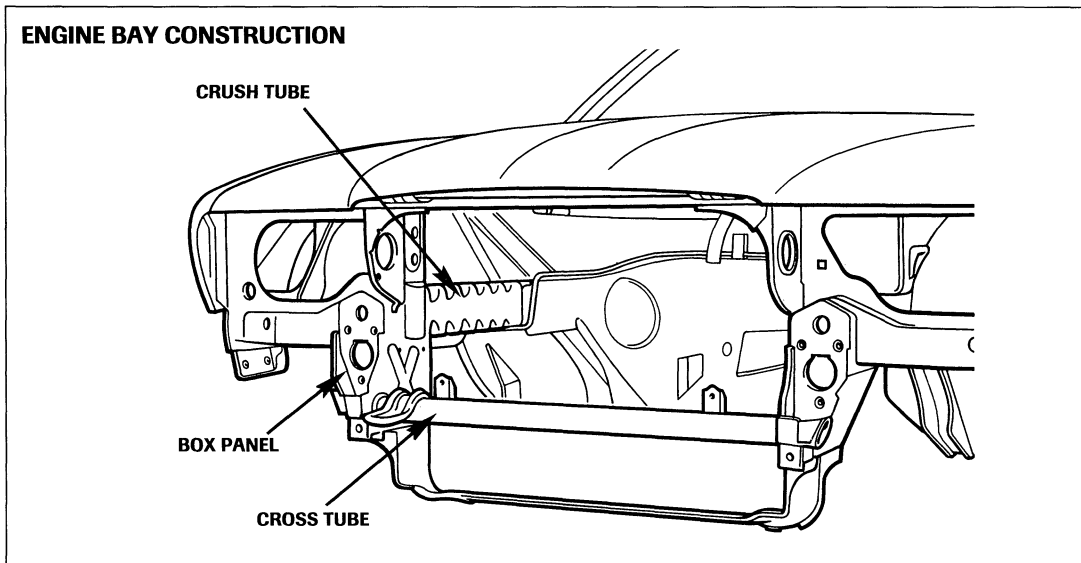
SUBFRAME



Front Vee mount materials have been changed to provide increased strength. The subframe forward arms have been extended to carry the anti-roll bar and act as a safety buffer in the event of a frontal impact. Seats for the engine "hydro-mounts" are incorporated into the subframe.

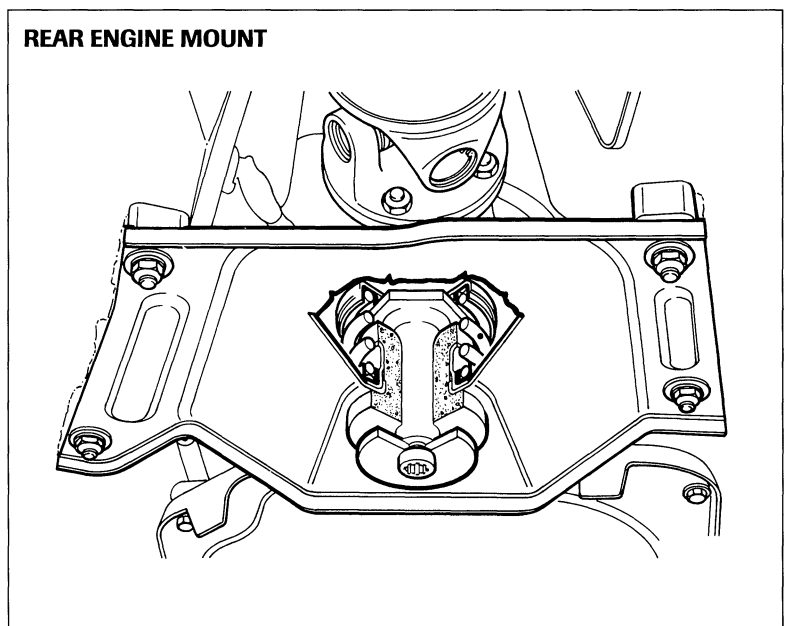
Engine bay construction

The front of the engine bay required redesigning to allow adequate V12 engine cooling while maintaining the necessary crash protection. The revised design and construction method ensures that air flow into the larger V12 radiator is not restricted.



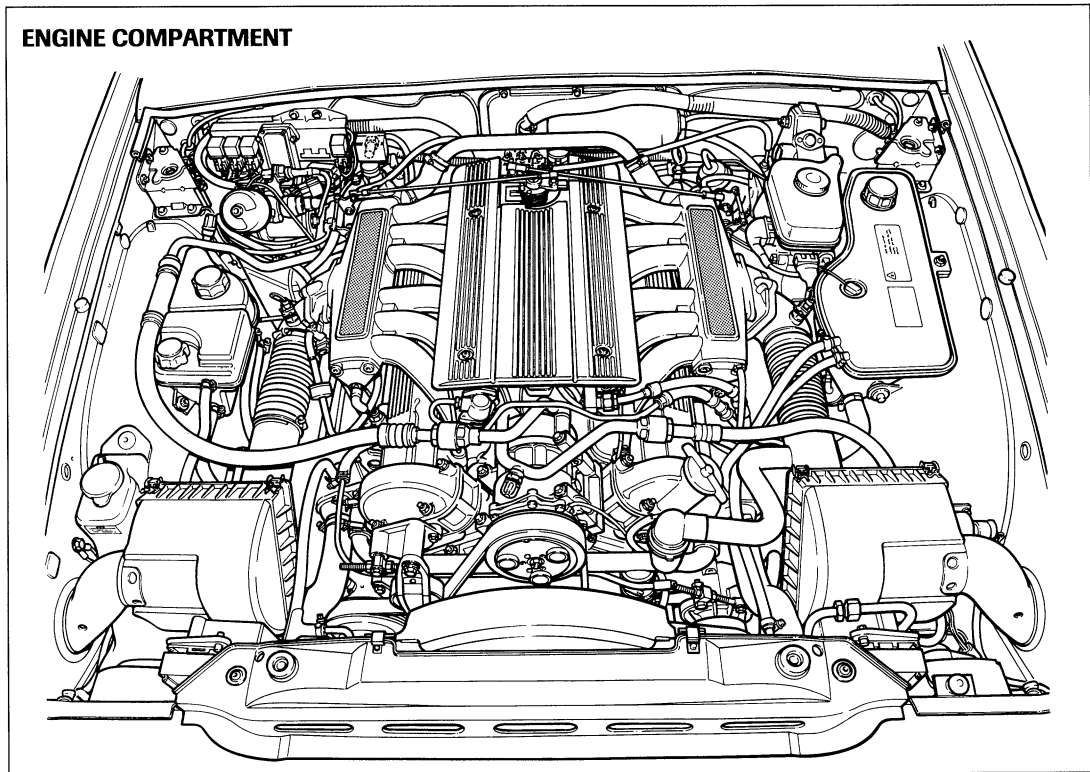
Rear engine / transmission mounting

The rear mount attaches to the body using stud plates and intermediate spacer plates similar to the XJ6 Sedan. The mount itself is designed to ensure silent operation with a single spring isolated by molded rubber caps at both ends.



Engine Compartment

The visual appearance of the engine compartment is refined by careful component layout. By rerouting of hoses and the addition of a new molded finisher covering the engine Vee, the engine appearance is greatly enhanced. The general layout of the engine compartment is common with the XJ6 models. Only those components unique to the V12 engine have different locations.



Engine Design / Construction

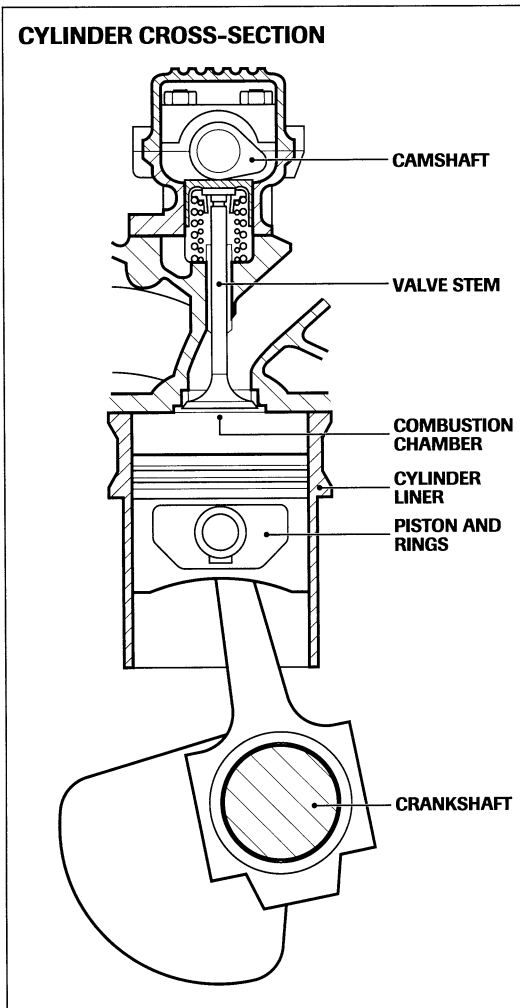
6.0 Litre V12 engine

The 6.0 litre V12 engine provides a substantial increase in power and torque over the previous 5.3 litre engine. The engine size increase was achieved by a lengthening of the stroke to 78.5 mm (5.3 L – 70 mm stroke). The following modifications are made:

- Revised cylinder block to accept new transmission
- 78.5 mm stroke forged steel crankshaft with heavier webs
- Cylinder liners 0.135 in. shorter than previous (to clear the connecting rods)
- Pistons with reduced pin-to crown dimension
- New piston rings to reduce combustion blow-by and oil consumption
- Camshafts with modified cam profiles to reduce noise at higher engine speed
- Enlarged combustion chambers to achieve 11.0:1 compression ratio
- Shorter stem intake valves to accommodate enlarged combustion chambers
- Redesigned oil pan with shorter, deeper sump area and lengthened oil pick-up tube
- Crankshaft shield (windage tray) modified to clear crankshaft and conform to new sump
- High integrity engine gaskets

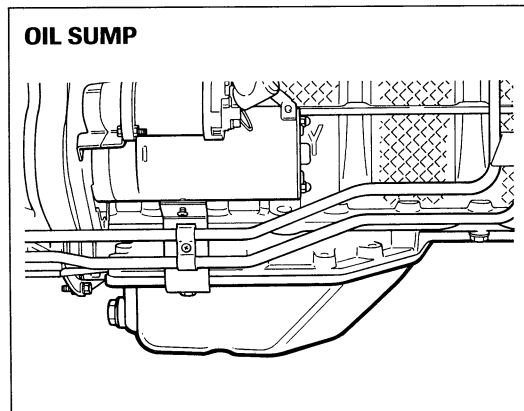
Specifications

For engine specifications, see page 2.



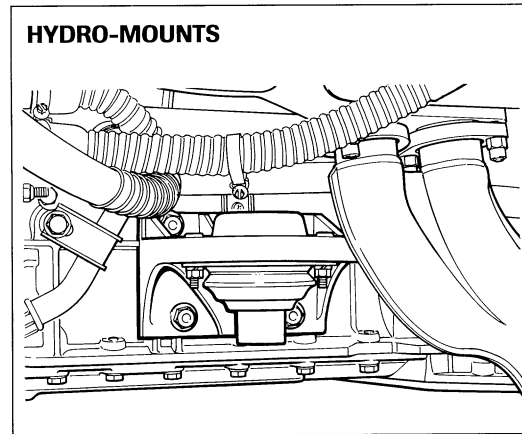
Oil sump and dip stick

The engine oil pan is reshaped to clear the front suspension subframe. The sump area is deeper to provide ample oil capacity in the new pan. A lengthened dip stick is relocated to the left rear of the cylinder block.



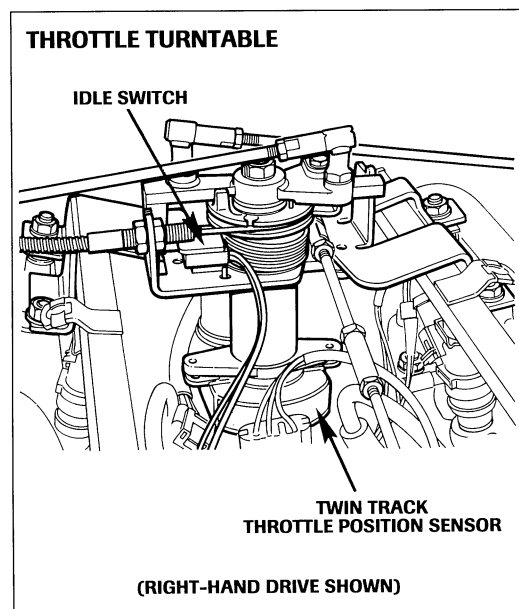
Engine mounts

Oil filled hydro-mounts support the engine and aid in isolating the vehicle body from engine operating noise. Cast brackets, bolted to the sides of the cylinder block, carry the hydro-mounts that in turn attach to the suspension subframe through pedestals welded to the subframe. Sheet metal heat shields protect the mounts from exhaust heat.



Throttle turntable assembly

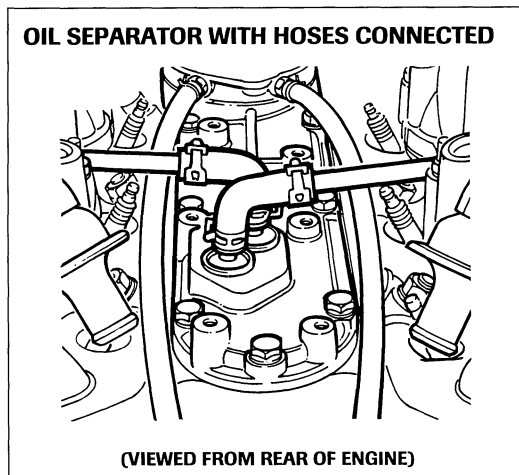
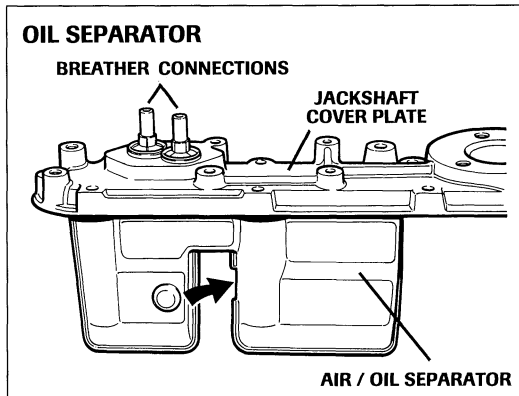
The redesigned throttle turntable has a smaller diameter pulley and is supported by a bracket spanning the intake manifold studs. A twin track throttle position sensor is mounted beneath the turntable. The ignition idle switch has been relocated to the turntable.



Engine Design / Construction (continued)

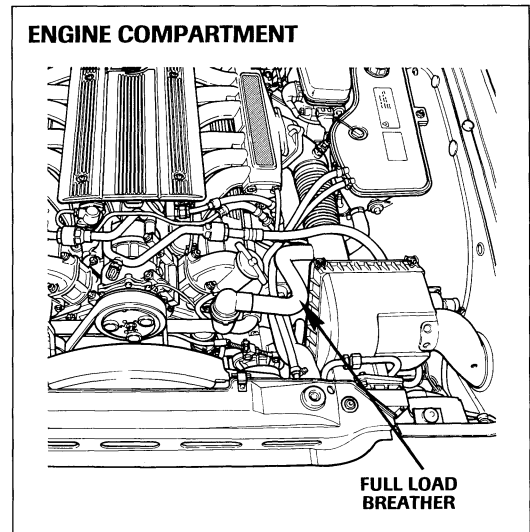
Part-load engine breather system

A part-load engine breather system is incorporated as part of the engine appearance enhancement program. An air / oil separator chamber is integral with the jack shaft cover plate. The system connects to the bottom of the intake manifolds downstream of the throttle housings.



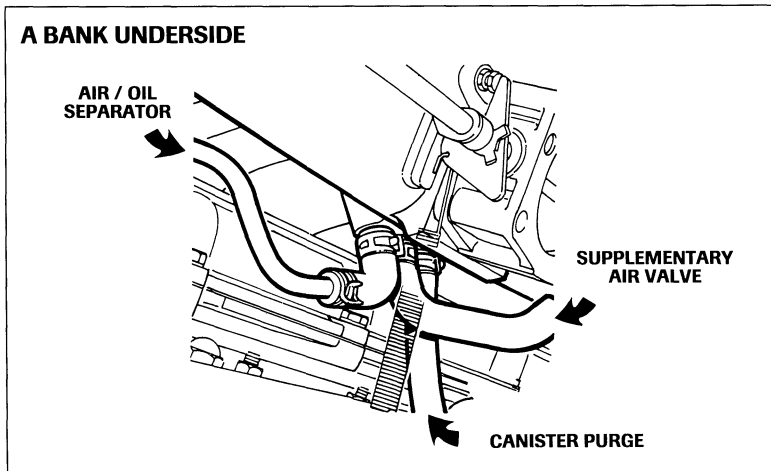
Full load engine breather system

A full load breather is connected from the B bank timing cover to the B bank air intake tube. The breather connection to the intake tube is located downstream from the filter to prevent filter contamination.



Engine air intake

Engine performance is improved by a low restriction air intake system drawing air from inlets located in front of the radiator on either side. This arrangement supplies the engine with ambient temperature air instead of heated air off the back of the radiator.



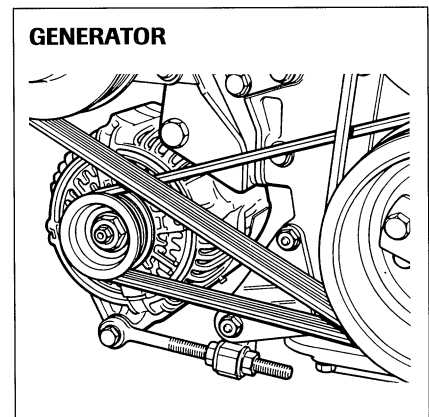
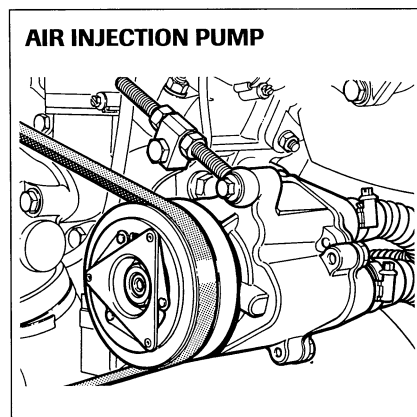
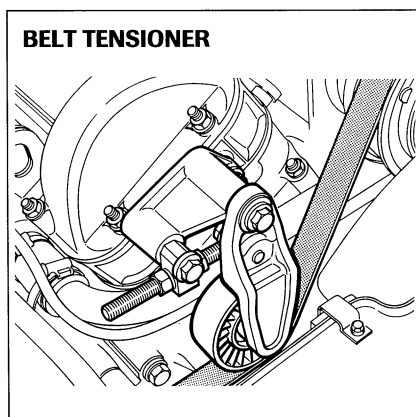
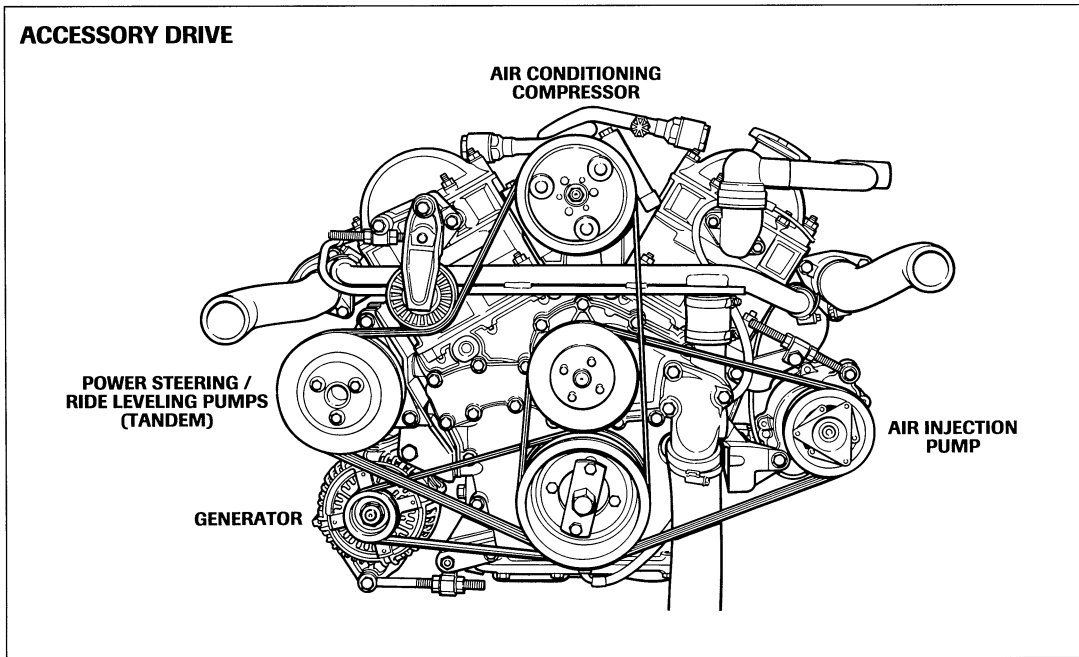
Engine Accessory Drive

Accessory drive belts

The accessory drive arrangement is changed from that of previous V12 engines to allow installation in the Sedan body and to increase belt life. Poly-vee belts are used to drive the air conditioning compressor and power steering / ride leveling pumps and the new 120 Amp generator.

Belt tension and adjustment

A free pulley and jack screw assembly is mounted on the A bank camshaft cover to tension the air condition compressor and power steering / ride leveling pumps drive belt. The generator and the air injection pump drive belts are adjusted by individual jack screws.



Belt tension specifications:

Air conditioning compressor, Power steering / ride leveling pumps drive belt:
(measured midway between crankshaft and air conditioning compressor)

New belt

178 lbs

In-service belt

61 - 142 lbs

Air injection pump, coolant pump and cooling fan drive belt:
(measured midway between crankshaft and air injection pump)

144 lbs

72 - 90 lbs

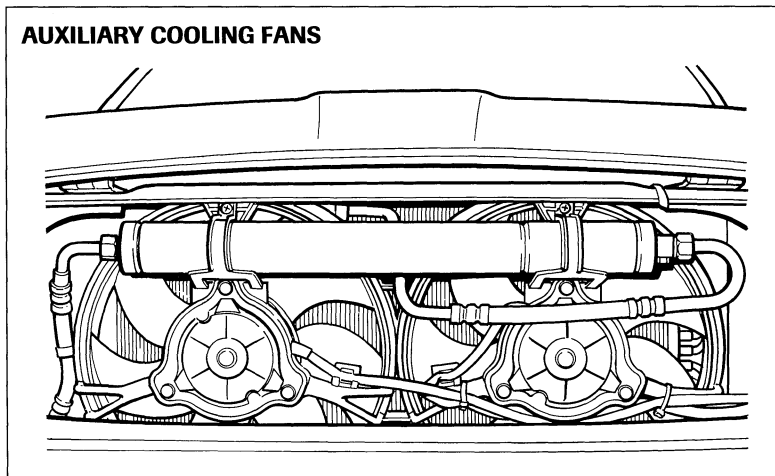
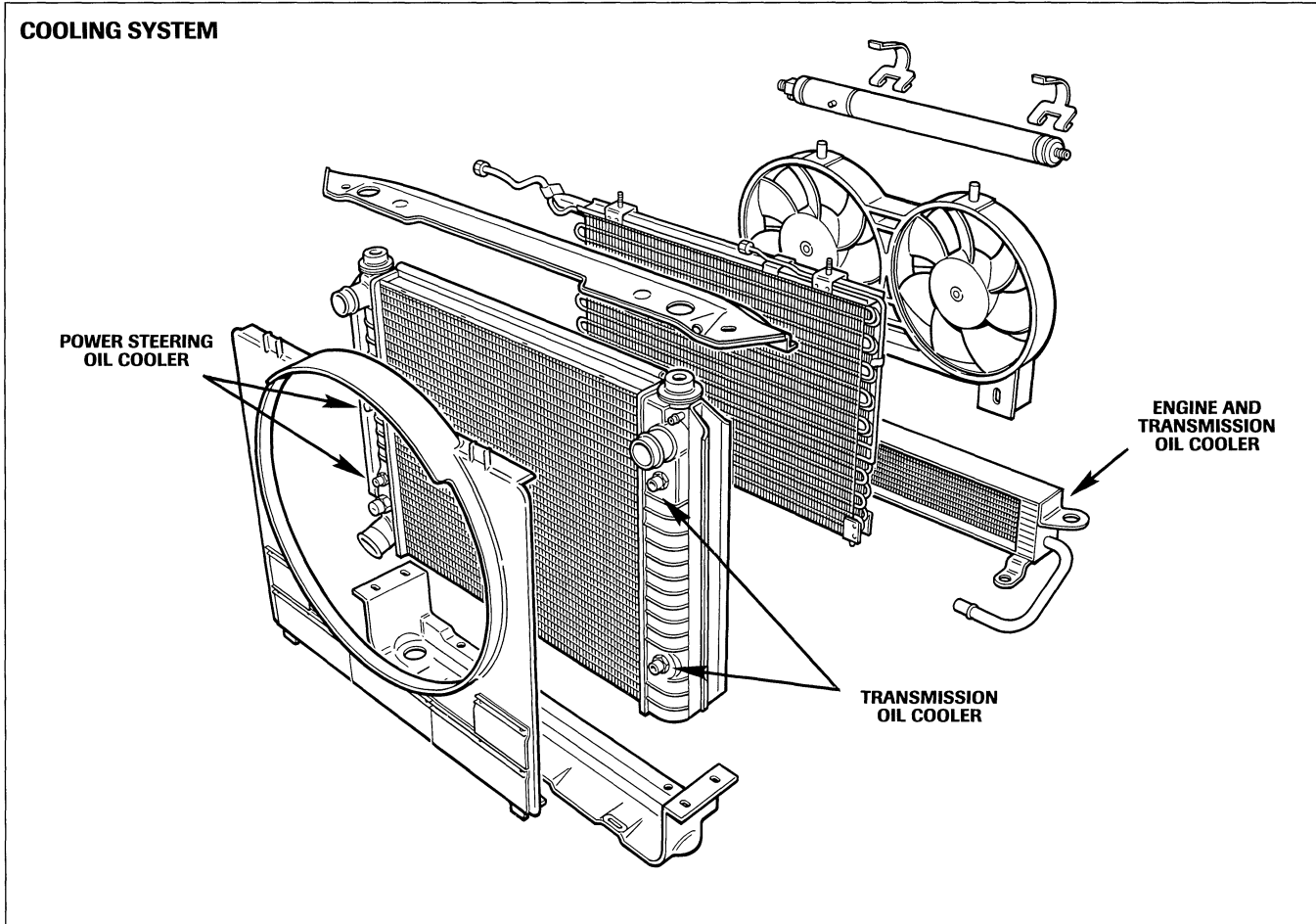
Generator drive belt:
(measured midway between crankshaft and generator)

124 lbs

52 - 90 lbs

Cooling System

The XJ12 uses an engine-driven viscous coupled cooling fan in combination with a twin electric fan auxiliary cooling pack. The electric fans are mounted in front of the cooling pack. The radiator includes "oil-to-water" coolers for the transmission and power steering fluids. A separate external oil cooler, shared by the engine and the transmission, is mounted ahead of the air conditioning condenser. The top eight rows of the separate cooler are used for engine oil cooling; the bottom three rows are connected in series with the radiator cooler and are used for transmission fluid cooling.



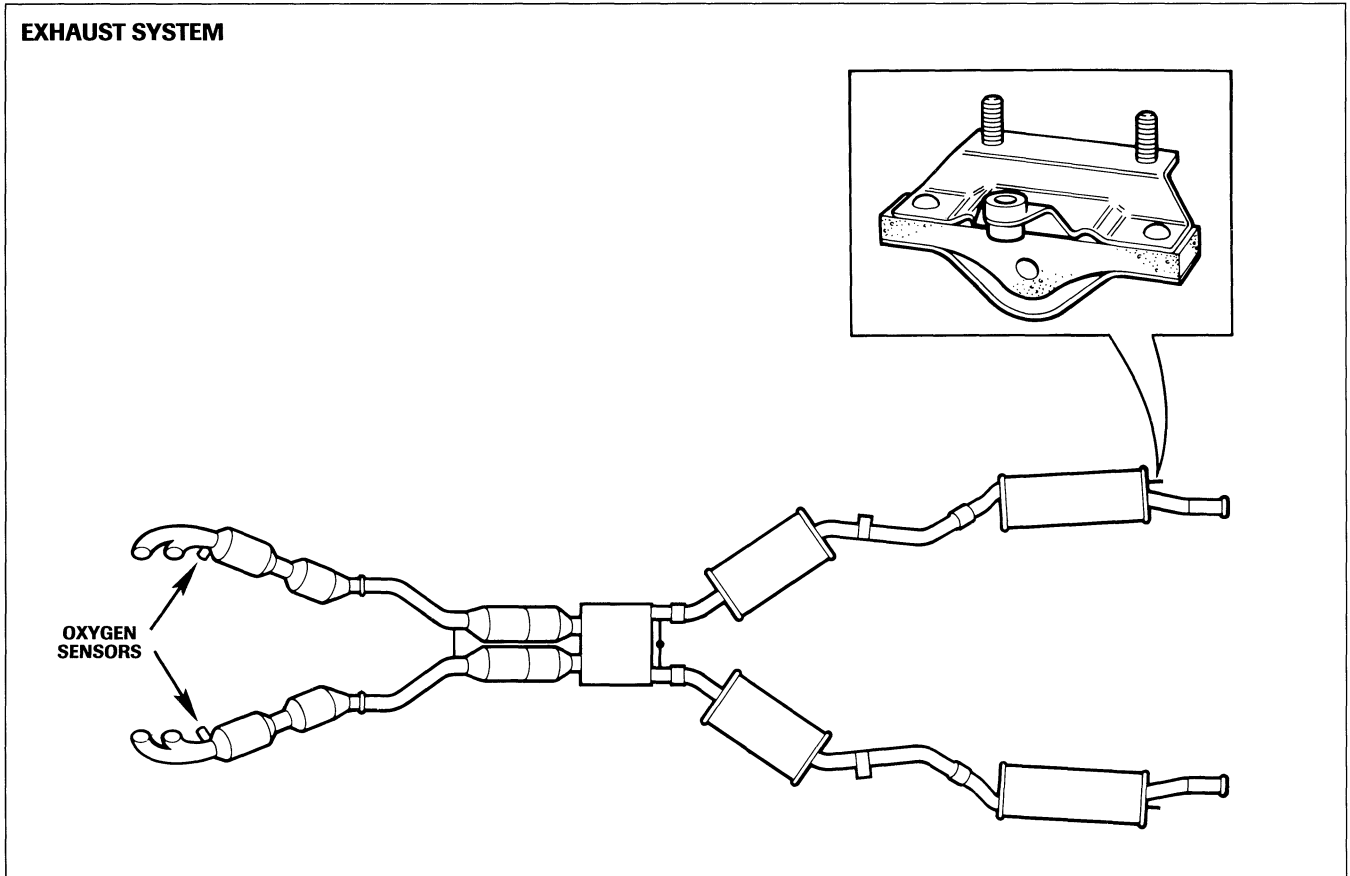
Auxiliary cooling fans

The electric auxiliary cooling fans are driven through the fan control relay module in a series circuit (low speed) or in a parallel circuit (high speed) depending on the need for additional engine cooling. The twin thermal switch, which controls the relay module, operates as follows:

- Series fans ON @ 187°F (86°C) – increasing temperature
- Series fans OFF @ 173°F (78°C) – decreasing temperature
- Parallel fans ON @ 212°F (100°C) – increasing temperature
- Parallel fans OFF @ 200°F (93°C) – decreasing temperature

Exhaust System

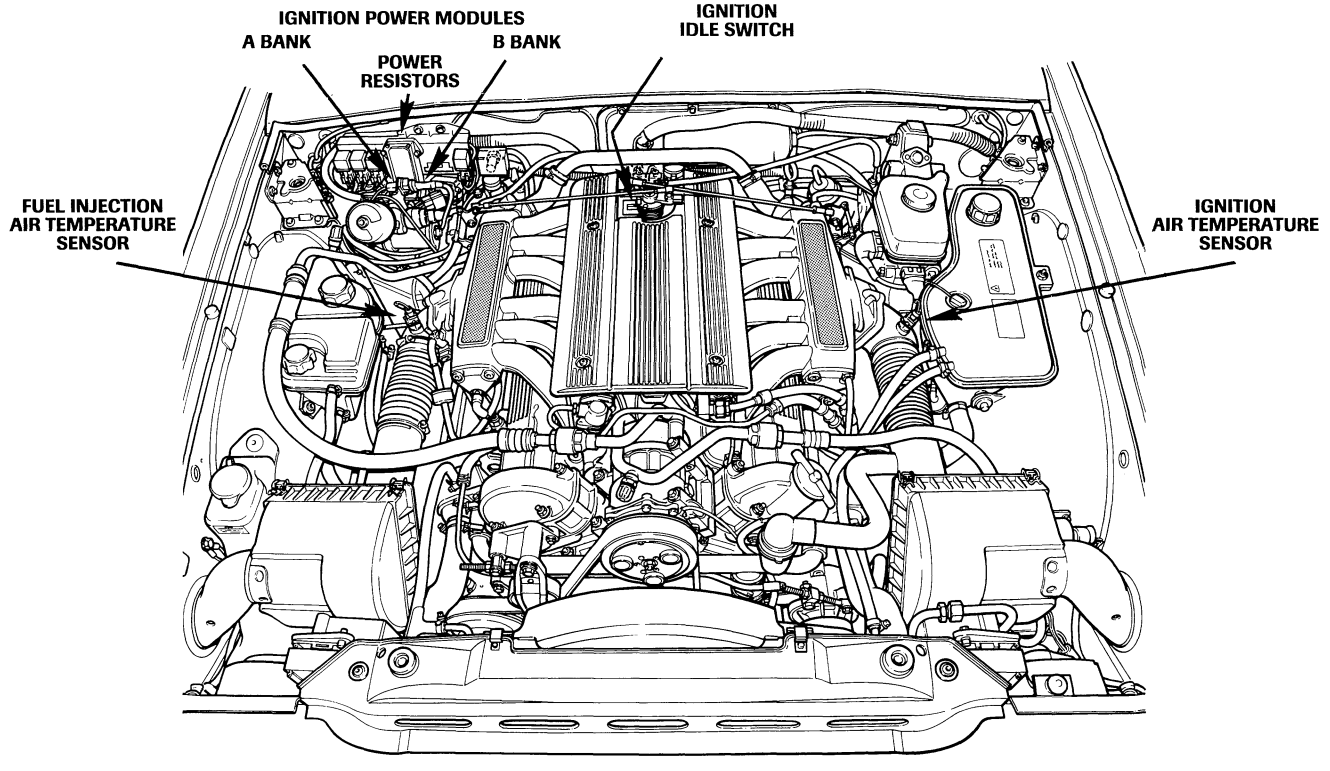
The 6.0 litre exhaust system incorporates three catalyts and two mufflers for each cylinder bank. The oxygen sensors are located in the downpipes ahead of the first catalyts.



Engine Management System Overview

The 6.0 litre engine management system is similar to the previous 5.3 litre models having a combination Lucas / Marelli fuel injection / ignition system. Both systems have revisions to include new and expanded functions. In addition to ECM functions, the operation of other systems that are not ECM controlled have been revised.

ENGINE MANAGEMENT SYSTEM COMPONENTS



Engine Management System: Fuel Injection

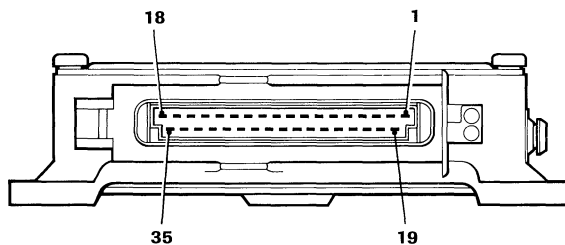
A provisional wiring diagram is included on pages 38 – 39 of this publication.

Engine control module (ECM): fuel injection

The fuel injection ECM is revised to include the following new features:

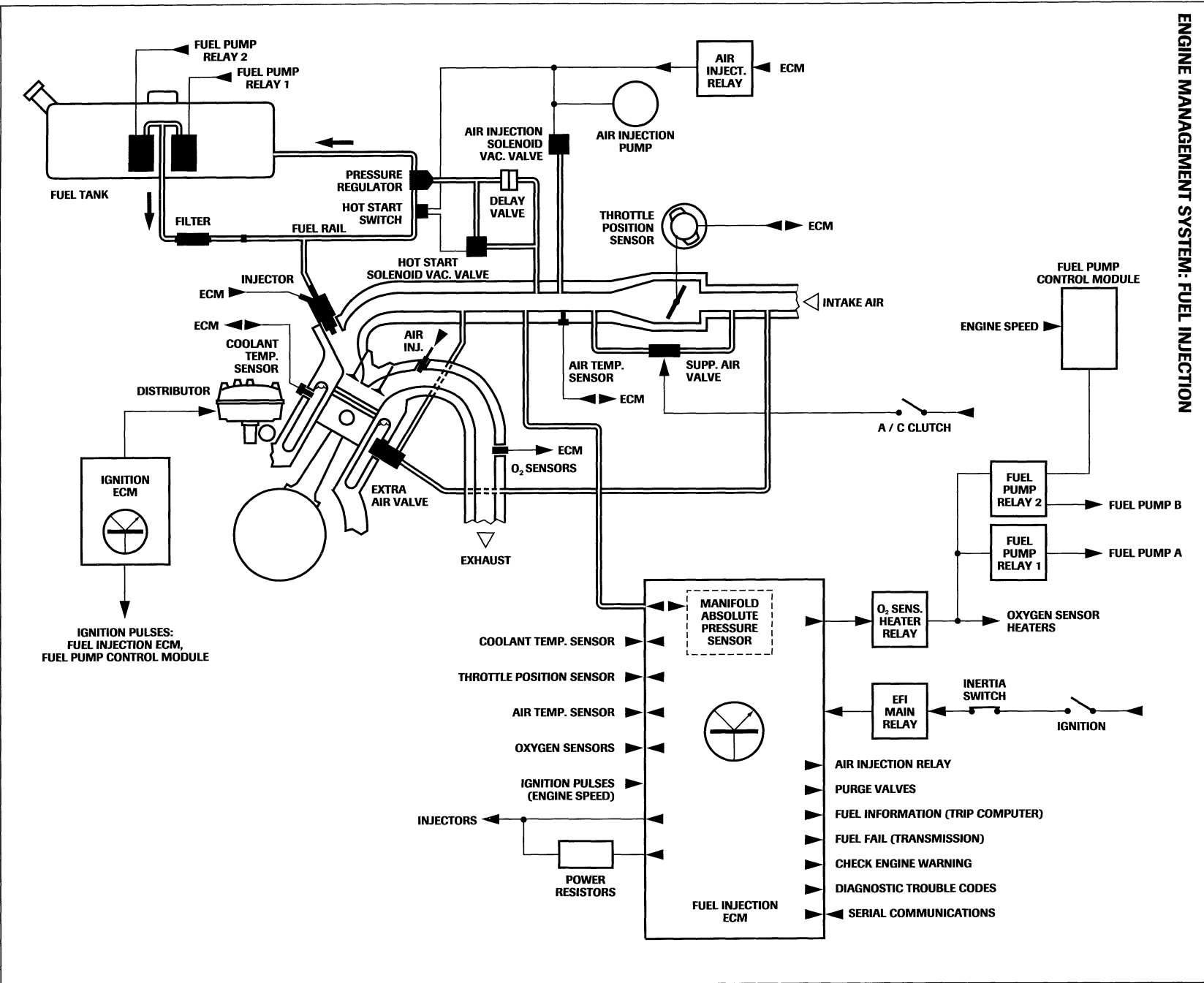
- Evaporative canister purge control
- Adaptive idle fueling trim
- Air injection control
- Hot start system timing
- Expanded On Board Diagnostics (OBD)
- Fuel level sensing
- Fuel fail output to transmission control module

FUEL INJECTION ECM PIN OUT INFORMATION



- | | |
|---|--|
| 1 THROTTLE POSITION AND COOLANT TEMP SENSORS GROUND | 18 ENGINE SPEED INPUT |
| 2 FUEL USED | 19 FUEL LEVEL |
| 3 BATTERY POWER | 20 THROTTLE POSITION AND AIR TEMP SENSORS SUPPLY VOLTAGE |
| 4 DATA LINK SERIAL INPUT | 21 AIR TEMPERATURE SENSOR |
| 5 COOLANT TEMP SENSOR SUPPLY VOLTAGE | 22 IGNITION POWER |
| 6 A BANK OXYGEN SENSOR | 23 OXYGEN SENSOR GROUND |
| 7 THROTTLE POSITION SENSOR WIPER | 24 B BANK OXYGEN SENSOR |
| 8 B BANK INJECTORS (1, 3, 5) ON | 25 PURGE CONTROL (GROUND) |
| 9 B BANK INJECTORS (1, 3, 5) ON | 26 AIR INJECTION CONTROL (GROUND) |
| 10 DATA LINK SERIAL OUTPUT | 27 B BANK INJECTORS (2, 4, 6) ON |
| 11 B BANK INJECTORS (1, 3, 5) HOLD | 28 B BANK INJECTORS (2, 4, 6) ON |
| 12 A BANK INJECTORS (1, 3, 5) HOLD | 29 B BANK INJECTORS (2, 4, 6) HOLD |
| 13 A BANK INJECTORS (1, 3, 5) ON | 30 A BANK INJECTORS (2, 4, 6) HOLD |
| 14 A BANK INJECTORS (1, 3, 5) ON | 31 A BANK INJECTORS (2, 4, 6) ON |
| 15 OXYGEN SENSOR HEATERS AND FUEL PUMP SUPPLY | 32 A BANK INJECTORS (2, 4, 6) ON |
| 16 GROUND | 33 FUEL FAIL OUTPUT (CHECK ENGINE) |
| 17 GROUND | 34 GROUND |
| | 35 GROUND |

ENGINE MANAGEMENT SYSTEM: FUEL INJECTION

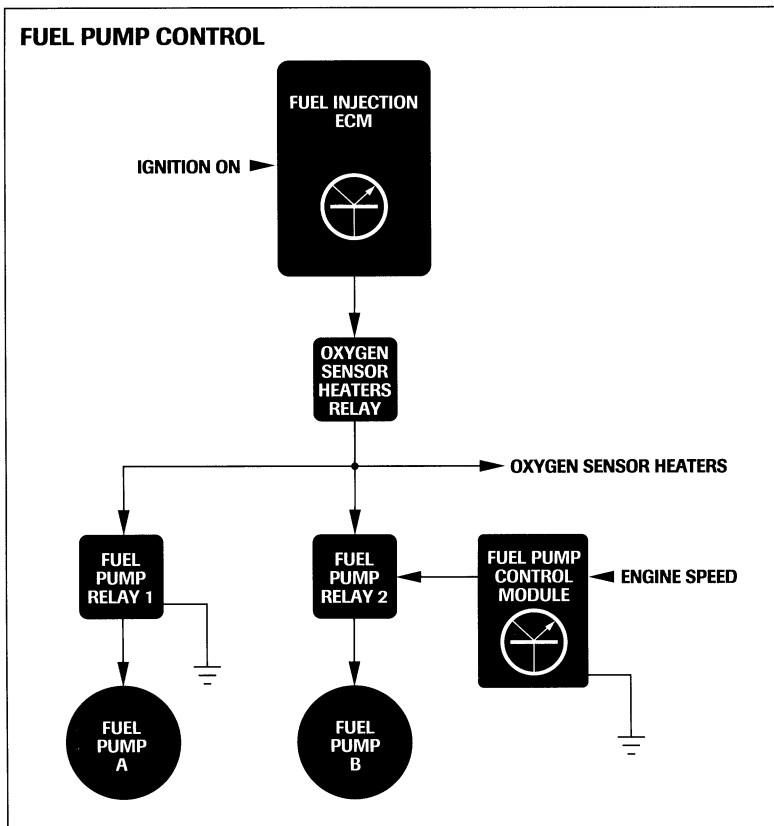
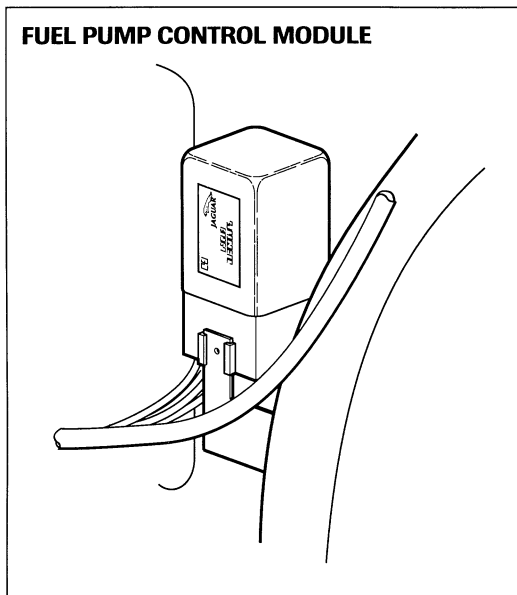
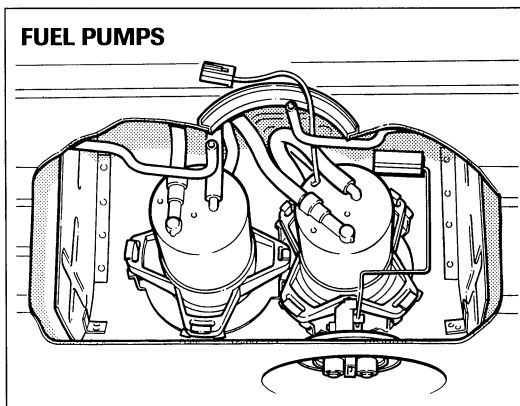


Engine Management System: Fuel Injection (continued)

Fuel delivery

In order to meet the fuel requirements of the 6.0 litre engine, two fuel pump modules are used. The modules are identical but operate independently with staged control. One pump runs continuously when the engine is running, the other is activated when the engine speed exceeds 2840 rpm.

Each pump is activated by a separate relay. The two fuel pump relays are switched by the Fuel Injection ECM via the oxygen sensor heaters relay; however, the coil circuit of relay 2 is completed to ground via the fuel pump control module. The fuel pump control module receives an engine speed input from the Ignition ECM and switches the relay 2 coil ground as follows. When the engine speed reaches 2840 rpm, the ground is completed; as the engine speed decreases, the ground is interrupted at 2000 rpm. Switching of fuel pump B requires only 0.25 of a second, ensuring instant response for additional fuel delivery.

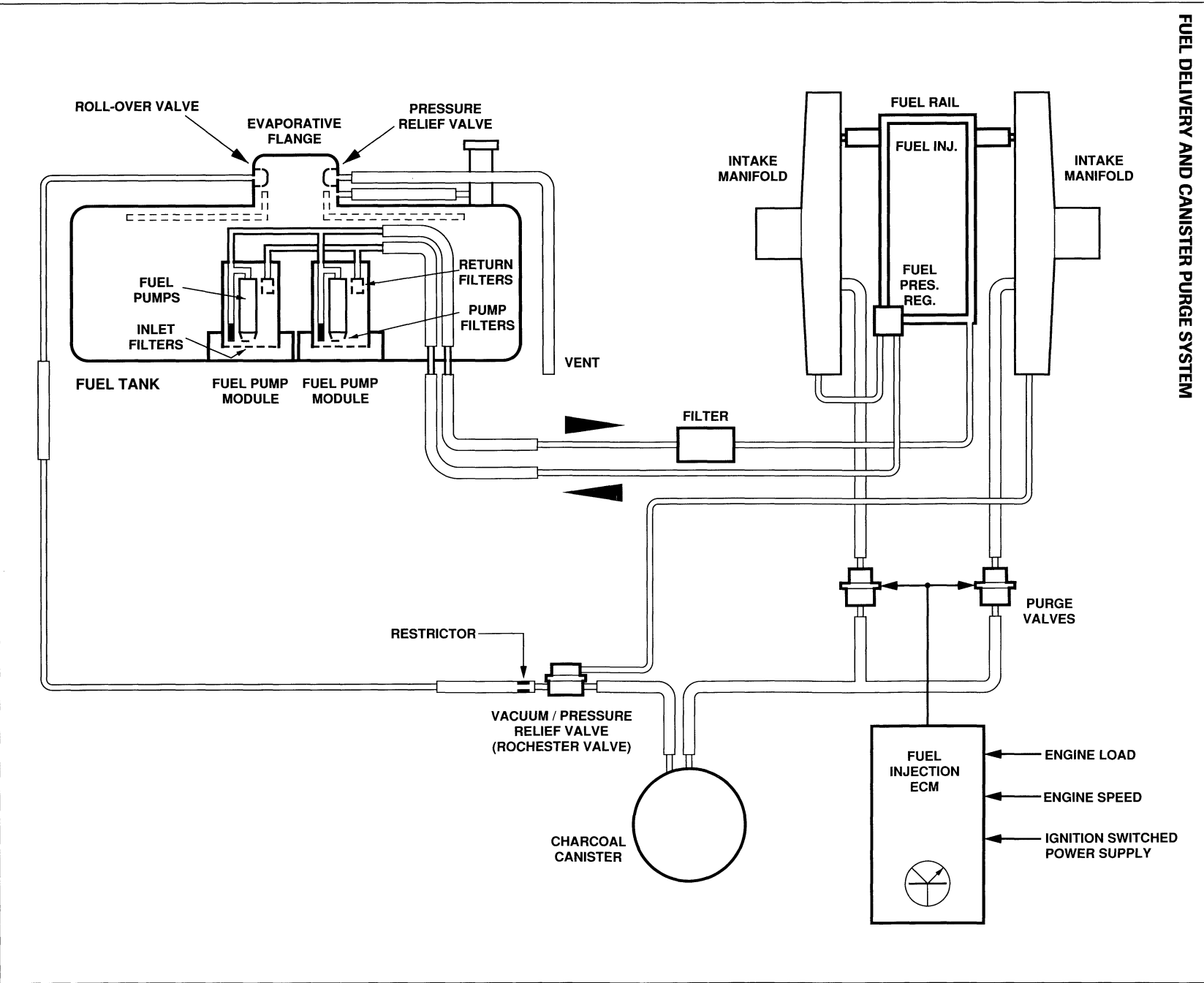


Fuel pressure regulator A new fuel pressure regulator maintains the fuel rail pressure at 44 psi (3 bar).

Evaporative emission control

The evaporative emission control system uses the same canister and vacuum / pressure relief valve as the 1993 model year XJ6 Sedans. Two purge control valves, one for each cylinder bank, are located in the engine compartment in front of the left cylinder head. The purge valves are controlled by the Fuel Injection ECM. The fuel injection ECM opens the valves simultaneously according to an engine load and speed strategy, allowing purge flow to the left and right intake manifolds. Purge flow is enabled at idle after adaptive idle fueling is completed.

FUEL DELIVERY AND CANISTER PURGE SYSTEM



Engine Management System: Fuel Injection (continued)

Adaptive idle fueling trim

In order to ensure optimum performance, the fuel injection ECM software contains an adaptive idle fueling function that automatically trims the strategy for fuel injector pulse duration at idle, throughout the life of the vehicle. The total available trim to the nominal injector pulse duration is $\pm 20\%$. This function eliminates the manual adjustment of idle trim. Adaptive fueling is performed by the ECM software only when the diagnostic trouble codes (DTC) are cleared and the listed preconditions are met.

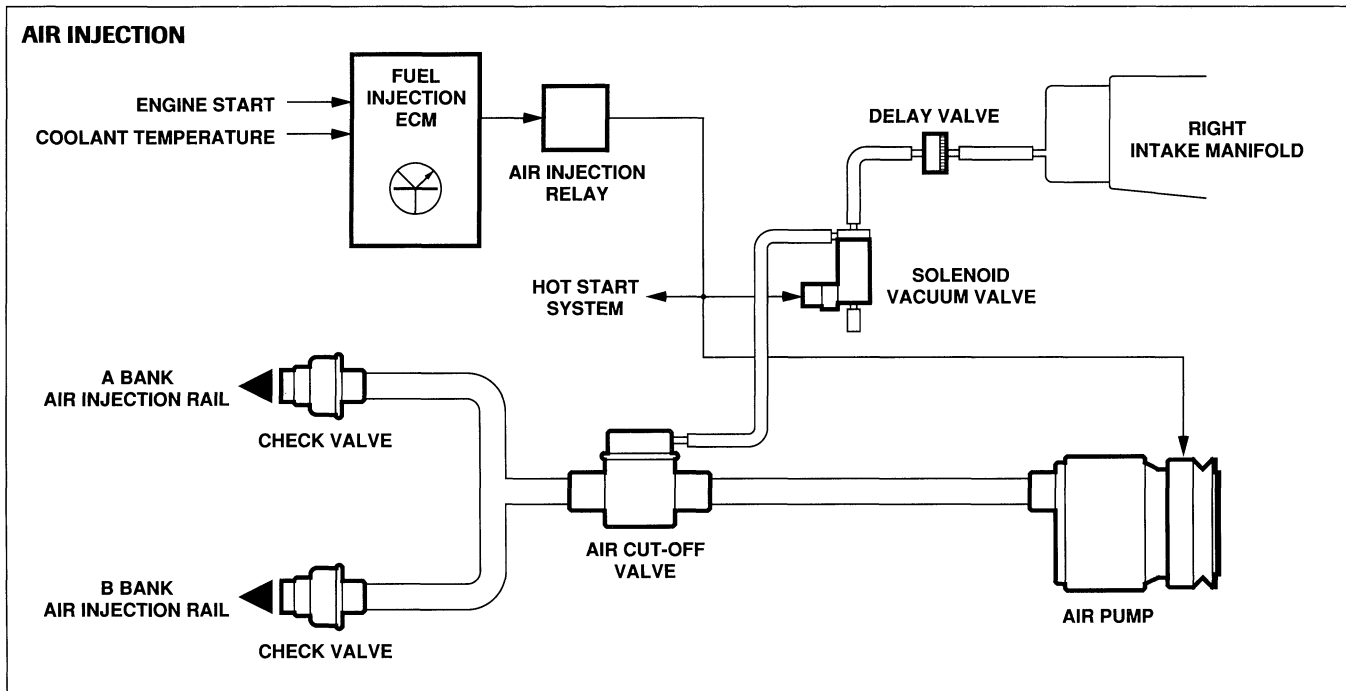
Adaptive idle fueling preconditions:

- Throttle closed
- Air injection disabled after engine start
- Engine speed below 900 rpm
- Closed loop fueling control enabled

If the DTC(s) are cleared and the preconditions are met, the ECM cancels purge flow and adapts the idle fueling. Between fueling adaptations, there is a delay of approximately eight minutes during which the preconditions must be met. If the preconditions are interrupted, the delay will be longer.

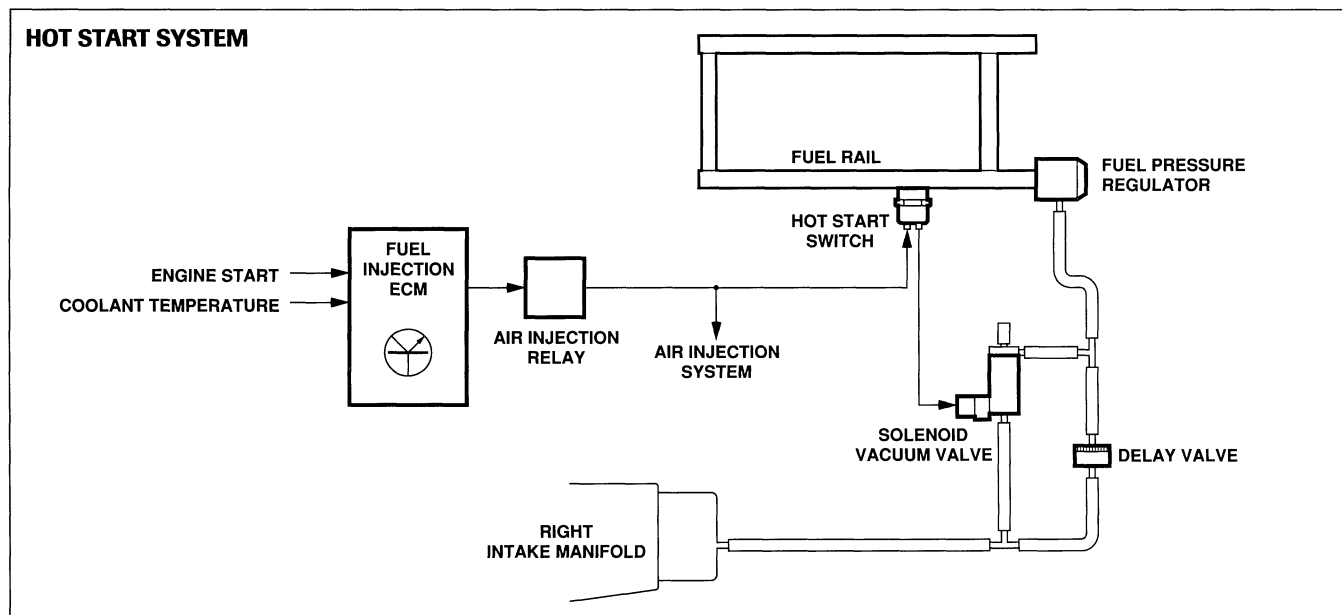
Air injection

The 6.0 litre air injection system is similar to the AJ6 4.0 litre air injection system. An air injection pump with an electric clutch and a vacuum-operated air cut-off valve are controlled by the fuel injection ECM. Air injection is enabled after all engine starts. The ECM uses a strategy comprised of a number of injector pulses versus engine coolant temperature for air injection switch-off. Air injection is enabled following all hot starts and always operates below 115°F (47°C) engine coolant temperature. The air shut-off valve is operated by vacuum applied by the solenoid vacuum valve when signaled from the ECM.



Hot start system

The hot start system remains the same as the previous 5.3 litre system with the exception of the timing control. The 45-second timer is replaced by fuel injection ECM control. When air injection is enabled, current is applied to the hot start switch. If the fuel rail temperature is 158°F (70°C) or above, the switch closes and activates the solenoid vacuum valve. The activated valve closes and directs vacuum to the fuel pressure regulator through the delay valve. The momentary vacuum delay increases fuel pressure to purge the fuel rail.



Idle speed control

Idle speed stabilization is enabled when the air conditioning compressor is operating. The supplementary air valve is activated with the compressor clutch to allow throttle-valve-bypass air flow to the right intake manifold. The valve operates in all gear selector positions.

On-board diagnostics (OBD)

The OBD system has been expanded to include two new diagnostic trouble codes (DTCs): 67 and 77. In order to prevent the erroneous flagging of codes, a fuel level input (voltage) to the fuel injection ECM is supplied. The ECM will not flag DTCs 13, 23, 34 or 36 when the fuel tank level falls to approximately 1 gallon.

Diagnostic trouble code summary

The available DTCs are listed in order of priority on the following table. Limp home mode is available as indicated. When multiple faults occur, only the highest priority code will be displayed.

DTC	Limp Home Mode	Input or Component Checked	DTC	Limp Home Mode	Input or Component Checked
29		ECM Self-test	19	X	Manifold pressure transducer / throttle position sensor circuit (low throttle voltage / high MAP)
44	X	Oxygen sensor circuit – A bank	23		Fuel metering at idle – A & B banks combined
45	X	Oxygen sensor circuit – B bank	49	X	Power resistors electrical circuits
13	X	Manifold pressure transducer and sensing hose	11	X	Pressure transducer / throttle position sensor circuit
34		Injector electrical circuits – A bank	16	X	Intake air temperature sensor circuit
36		Injector electrical circuits – B bank	67		Air injection operation (oxygen sensor response)
14	X	Coolant temperature sensor circuit	77		Engine speed (loss of input from ignition ECM)
17	X	Throttle position sensor circuit			
18	X	Manifold pressure transducer / throttle position sensor circuit (high throttle voltage / low MAP)			

Clearing diagnostic trouble codes

All DTCs are held in the ECM memory until cleared using JDS. If the vehicle battery is disconnected, the DTC(s) will be cleared.

Engine Management System: Ignition

A provisional wiring diagram is included on pages 40 – 41 of this publication.

Engine control module (ECM): Ignition

The ignition ECM contains a new manifold absolute pressure sensor and new software. The new software controls ignition retard at high intake air temperature with minimal compromise of vehicle performance.

Intake air temperature sensor

An intake air temperature sensor, located in the left intake elbow replaces the previous coolant temperature sensor and air temperature switch. The intake air temperature input to the ECM is used to determine the necessary ignition retard to prevent detonation.

Idle switch

The idle switch remains in the system to signal the ECM to use the idle ignition strategy; however, a micro switch located on the throttle turntable replaces the previous linkage switch.

Ignition retard / transmission control

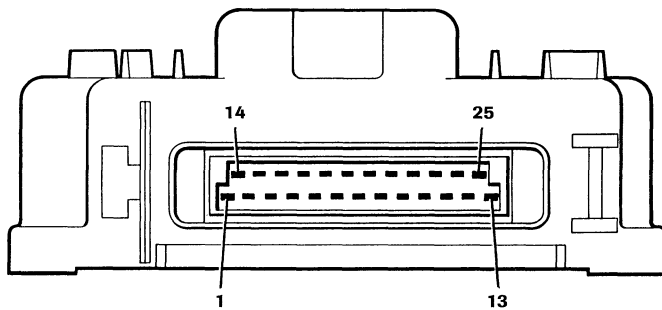
The ignition ECM receives an ignition retard request from the transmission control module during certain transmission apply and release functions. Before the transmission completes the function, an acknowledgment of the request is made by the ignition ECM.

Engine speed outputs

The ignition ECM provides engine speed outputs for the following:

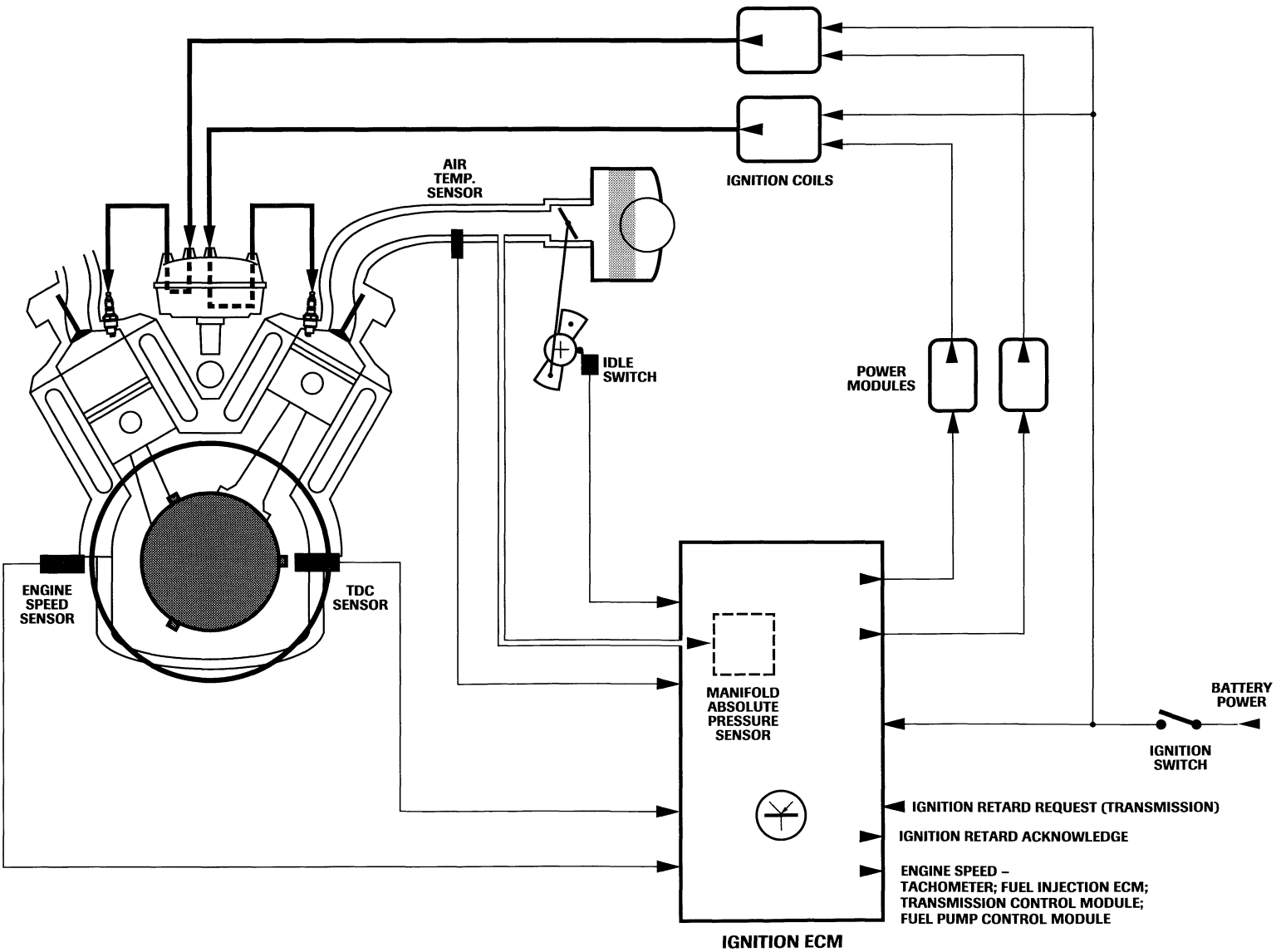
- Tachometer
- Fuel injection control
- Fuel pump B control
- Transmission control

IGNITION ECM PIN OUT INFORMATION



- 1 TDC SENSOR
- 2 TDC SENSOR SHIELD
- 3 ENGINE SPEED SENSOR SHIELD
- 4 GROUND
- 5 IDLE SWITCH GROUND
- 6 AIR TEMPERATURE SENSOR GROUND
- 7 ENGINE SPEED OUTPUT SHIELD
- 8 POWER MODULE SHIELD
- 9 B BANK POWER MODULE OUTPUT
- 10 B BANK POWER MODULE OUTPUT
- 11 GROUND
- 12 GROUND
- 13 IGNITION SWITCHED POWER SUPPLY
- 14 A BANK POWER MODULE OUTPUT
- 15 A BANK POWER MODULE OUTPUT
- 16 ENGINE SPEED SENSOR
- 17 STRATEGY SELECT
- 18 IDLE SWITCH
- 19 AIR TEMPERATURE SENSOR
- 20 NOT USED
- 21 IGNITION RETARD ACKNOWLEDGED
- 22 NOT USED
- 23 STRATEGY SELECT
- 24 ENGINE SPEED OUTPUT
- 25 IGNITION RETARD REQUEST

IGNITION CONTROL



Electronic Four-Speed Automatic Transmission

The Hydra-matic 4L80-E electronic four-speed automatic transmission incorporates electronic controls that utilize the transmission control module (TCM) to control shift points, torque converter clutch apply and release, and line pressure. Inputs from sensors and switches provide engine, transmission and vehicle operating information to the TCM. The TCM uses this information to determine the precise moment to upshift or downshift, apply or release the torque converter clutch, and what line pressure is required to apply the clutches or bands. This type of control, based on the operating conditions of the vehicle, results in consistent and precise shift points and shift quality.

A provisional wiring diagram is included on pages 42 – 43 of this publication.

NORMAL and SPORT modes

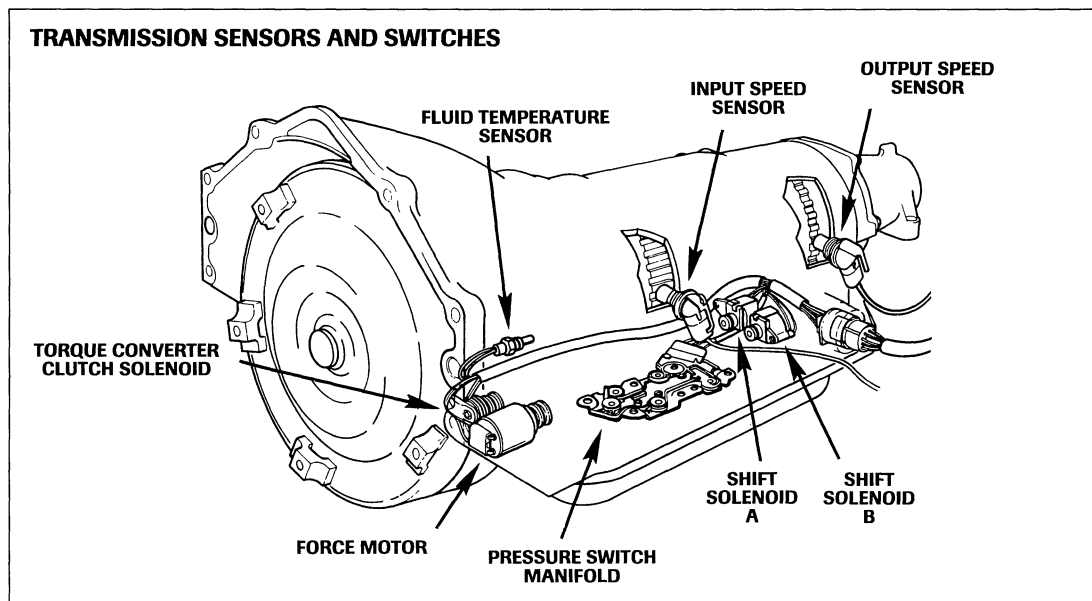
Two operating strategies are available to the driver.

NORMAL Normal mode provides economy operation by causing the transmission to upshift at lower engine speeds and throttle openings. Start-off occurs in second gear unless the accelerator is depressed to the kickdown position. High-speed performance is available as required.

SPORT Sport mode allows the engine power to be used to its full potential at all times. Start-off occurs in first gear and upshifts and kickdown are tailored to performance.

Torque converter lock-up clutch

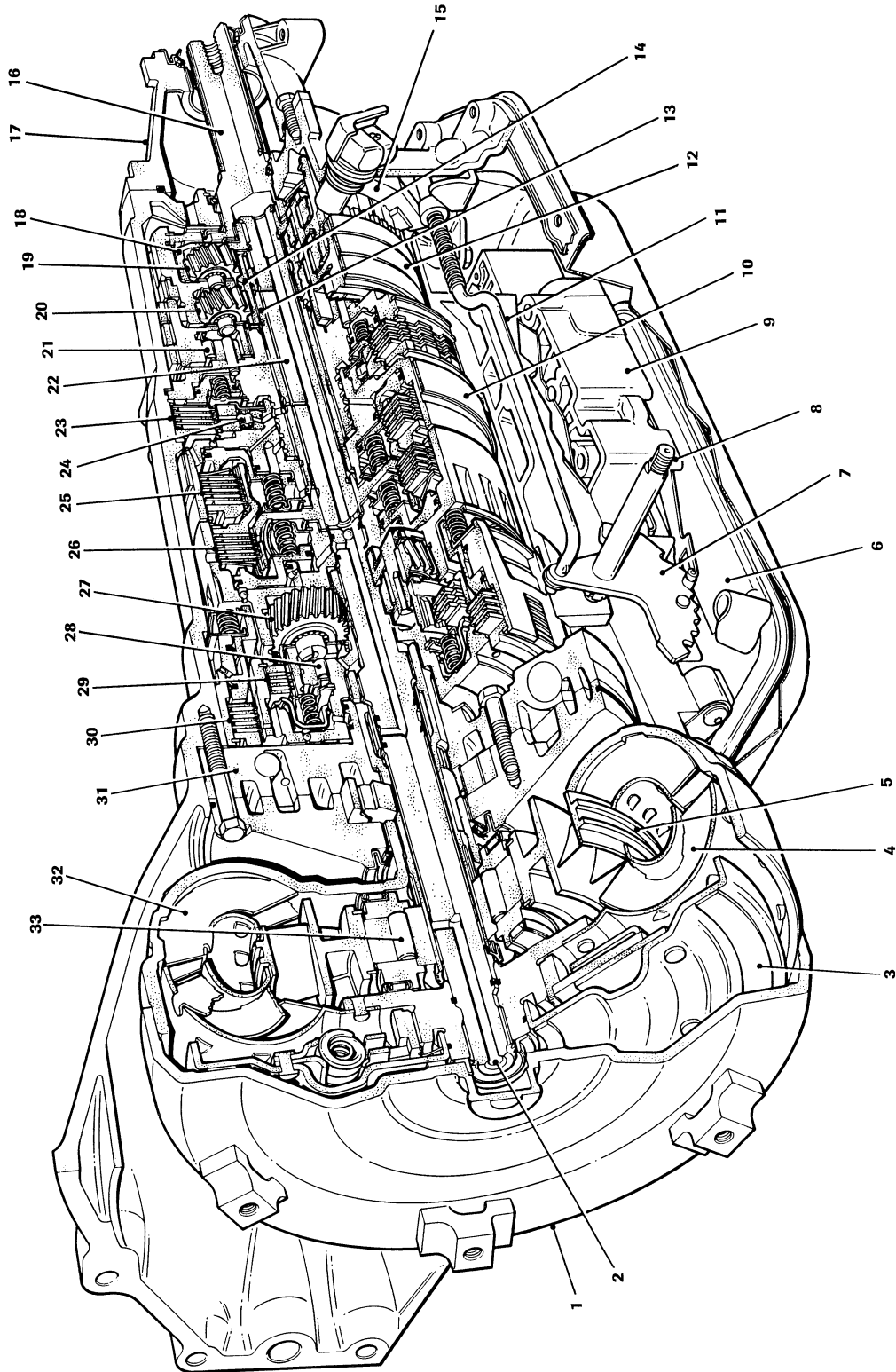
The torque converter assembly employs a lock-up clutch to provide a direct drive coupling between the engine and transmission.



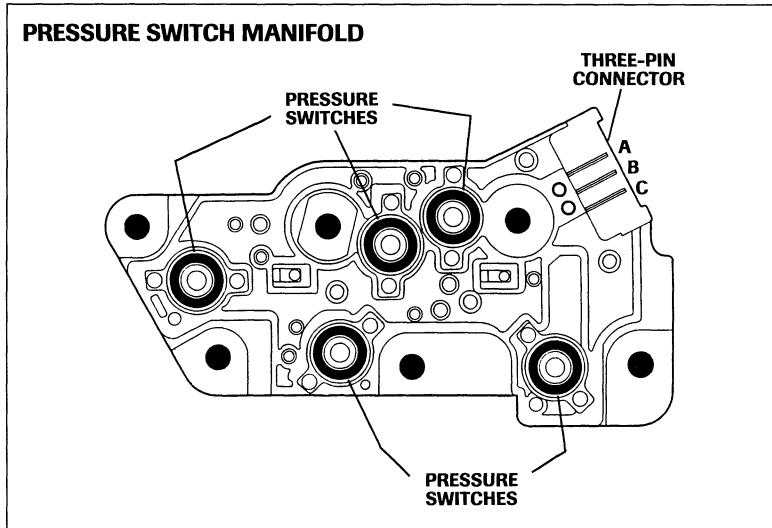
Transmission components (key to illustration on opposite page)

- | | | |
|---------------------------------------|--|---|
| 1 Torque converter assembly | 13 Sun gear shaft | 24 Intermediate sprag clutch assembly |
| 2 Turbine shaft | 14 Sun gear | 25 Direct clutch assembly |
| 3 Pressure plate | 15 Park lock pawl | 26 Forward clutch assembly |
| 4 Converter turbine | 16 Output shaft | 27 Overdrive planetary carrier assembly |
| 5 Converter stator | 17 Case extension | 28 Overdrive roller clutch assembly |
| 6 Filter | 18 Rear internal gear | 29 Overrun clutch assembly |
| 7 Detent lever | 19 Output planetary carrier assembly | 30 Fourth clutch assembly |
| 8 Manual shaft | 20 Reaction planetary carrier assembly | 31 Pump assembly |
| 9 Control valve assembly (valve body) | 21 Lo roller clutch assembly | 32 Converter pump assembly |
| 10 Front band assembly | 22 Main shaft | 33 Stator roller clutch assembly |
| 11 Park lock actuator | 23 Intermediate clutch assembly | |
| 12 Rear band assembly | | |

TRANSMISSION CUTAWAY



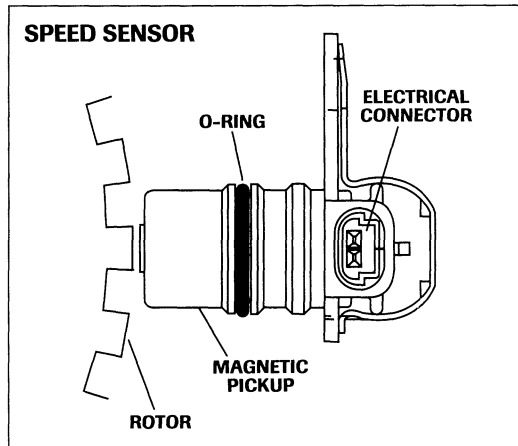
Electronic Four-Speed Automatic Transmission (continued)



Transmission control components

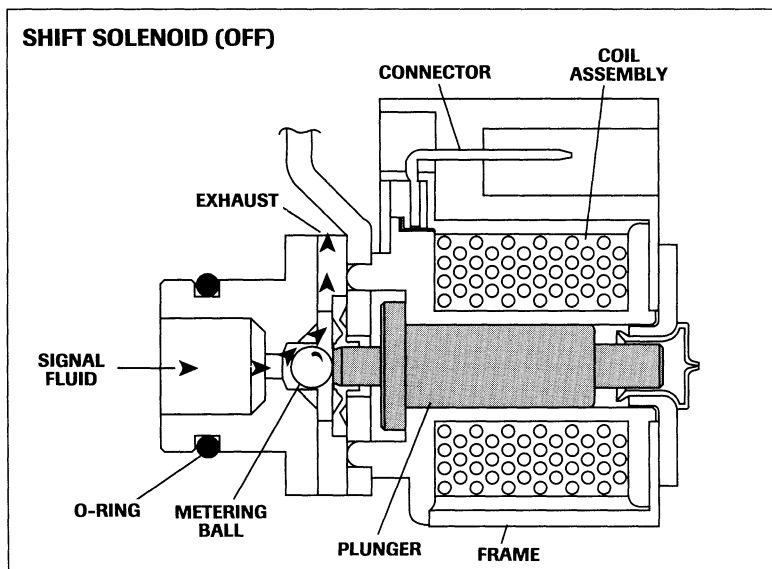
The mechanical operation of the transmission follows conventional epicyclic gear transmission operation. The components unique to the electronic control of the transmission are explained here.

Transmission control module (TCM) The TCM, located at the right front of the trunk, is a microprocessor based unit having control over all shift points and the transmission line pressure that determines shift quality. Control inputs are applied to the transmission operating strategy. From the strategy, the TCM controls the shift solenoids, force motor (line pressure), and the torque converter clutch solenoid. A diagnostic facility allows the TCM to diagnose transmission and related component problems. This information is accessed via JDS.



Pressure switch manifold The pressure switch manifold is a multiple switch assembly made up of 5 normally-open pressure switches to provide a logic input to the TCM. Various fluid pressures are fed from the manual valve to the switches depending on gear selector and manual valve positioning. These pressures determine the digital logic at the connector pins A, B and C.

Transmission output speed sensor The output speed sensor is a variable reluctance magnetic pick-up. The sensor is mounted in the case opposite the output speed sensor ring that is pressed onto the output carrier assembly. Whenever the vehicle is moving, the sensor produces an AC voltage input to the TCM proportional to vehicle speed.



Transmission input speed sensor The input speed sensor is identical to the output speed sensor except that it uses the machined teeth on the forward clutch housing as the rotor. The sensor produces an AC voltage input to the TCM proportional to torque converter turbine speed.

Fluid temperature sensor The transmission fluid temperature sensor, located on the control valve (valve body), is a temperature sensitive resistor (thermistor) that provides a fluid temperature input to the TCM.

Shift solenoids Two shift solenoids – A and B – are used to apply upshifts and downshifts in all forward gear ranges. The solenoids work together in a combination of ON and OFF sequences to apply hydraulic pressure to the various shift valves.

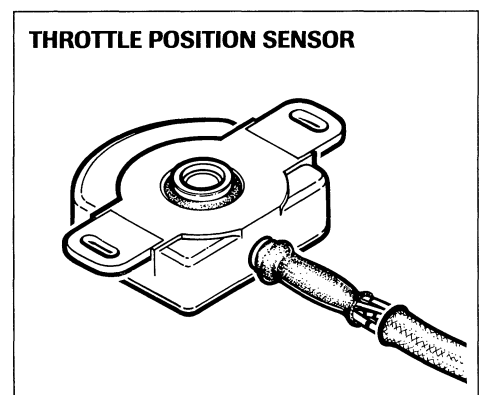
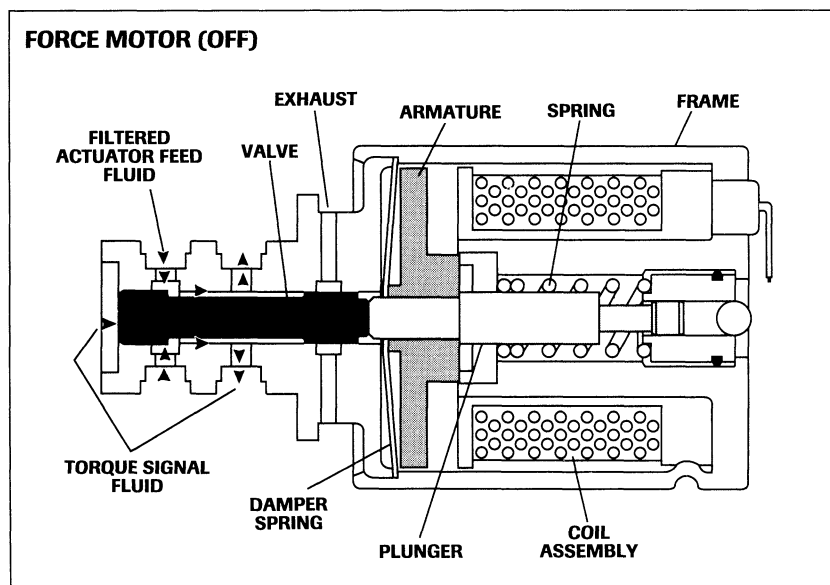
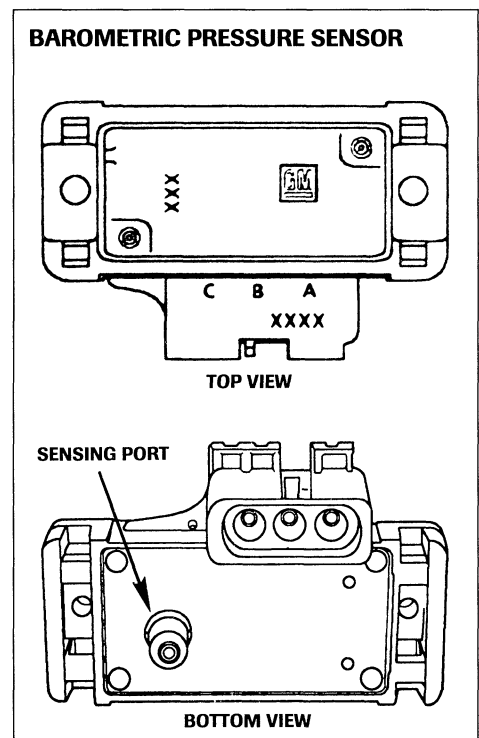
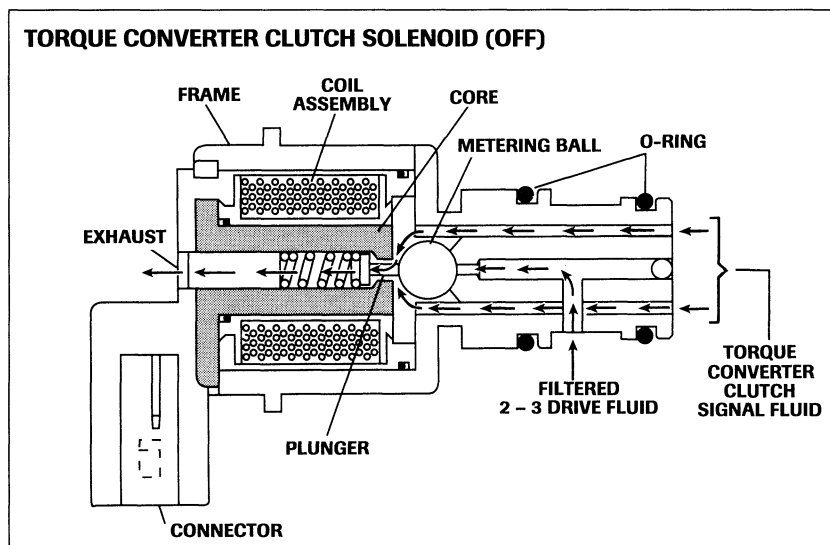
Torque converter clutch (TCC) solenoid The TCC solenoid is used to control the torque converter lock-up clutch apply and release. The solenoid duty cycle (percent time energized) is varied by TCM control of the ground circuit. The variable duty cycle of the solenoid allows the lock-up rate to be varied to ensure smooth operation.

Force motor The force motor is an electronic pressure regulator controlled by the TCM to produce a hydraulic "torque signal pressure" that is primarily an indication of throttle opening. The duty cycle (percent time energized) of the force motor is regulated by TCM control of supply current. No current flow applies maximum torque signal pressure; maximum current flow applies minimum torque

signal pressure. Torque signal pressure controls transmission main line pressure at the pressure regulator valve accordingly.

Throttle position sensor The twin track throttle position sensor is similar to the sensor used in the 1993 model year XJ6 Sedan, and is mounted under the throttle turntable. The throttle position input to the TCM is an approximation of engine torque.

Barometric pressure sensor A barometric pressure sensor, located in the trunk behind the right trim panel, provides a vehicle operating elevation signal (above sea level) to the TCM.



Electronic Four-Speed Automatic Transmission (continued)

Transmission Control Module inputs and outputs

The TCM receives inputs from the transmission, fuel injection and ignition ECMs, external components, and other vehicle systems and applies them to the operating strategy to determine the optimum transmission control outputs.

INPUTS

Mode switch The mode switch position inputs the driver's choice of operating strategy to the TCM.

Pressure switch manifold The pressure switch manifold output logic is used by the TCM to determine what gear range (PRND32) the transmission is operating in.

Input and output speed sensors The TCM uses the transmission input and output speeds to help determine line pressure, shift patterns, and torque converter lock-up clutch apply pressure and timing. The speed inputs are also used to calculate turbine speed, gear ratios, and lock-up clutch slippage for diagnostic purposes.

Force motor feedback The TCM senses the force motor duty cycle (percent time energized) to determine the prevailing transmission line pressure.

Transmission fluid temperature The TCM monitors the transmission fluid temperature to help determine torque converter lock-up clutch operation and line pressure. The TCM inhibits lock-up clutch operation until the fluid temperature reaches approximately 68°F (20°C).

If the fluid temperature becomes excessively high (approximately 250°F [122°C]), the TCM will apply the lock-up clutch whenever the transmission is in Second, Third or Fourth gears. Applying the lock-up clutch serves to reduce the fluid temperature as the torque converter fluid coupling is bypassed.

If the fluid temperature increases further (approximately 300°F [150°C]), the TCM will not apply the lock-up clutch in any gear range to prevent high fluid temperature from damaging the clutch.

Above approximately 310°F (154°C), the TCM will flag a fluid temperature diagnostic trouble code (DTC). Once the DTC is flagged, the TCM assumes a fixed temperature input of 266°F (130°C) and applies the lock-up clutch in Second, Third and Fourth gears.

Kickdown A kickdown ground input is supplied to the TCM when the driver activates the switch by depressing the accelerator to the kickdown position.

Engine throttle position A variable voltage input allows the TCM to sense throttle position. Throttle position, and other sensor inputs, are used to determine shift patterns and torque converter lock-up clutch apply and release. In general, the greater the throttle opening, the higher the upshift speeds and the greater the transmission line pressure. The TCM releases the lock-up clutch at minimum throttle opening and during open-throttle heavy acceleration.

Barometric pressure sensor The barometric pressure input allows the TCM to adjust the line pressure for changes in air density that affect engine power.

Engine speed An engine speed input is supplied to the TCM from the ignition ECM. Engine speed is one of the sensed inputs used to determine shift patterns and torque converter lock-up clutch apply and release.

Brake operation The TCM receives a brakes applied input via the high mount stop light relay. When the brakes are applied, the TCM releases the torque converter lock-up clutch.

A/C compressor clutch operation The TCM receives a compressor clutch operating input from the climate control module. When the compressor is operating, the TCM adjusts the line pressure and shift timing to compensate for the added engine load.

EMS fuel fail If a fuel fail input is received from the fuel injection ECM, the TCM defaults to a higher line pressure to compensate for the loss of engine power.

OUTPUTS

Force motor (line pressure) The TCM varies the current to the force motor to control "torque signal" pressure, which in turn, controls line pressure. The lower the "torque signal" pressure, the lower the line pressure; the higher the "torque signal" pressure, the higher the line pressure. At idle (throttle closed), current flow is close to maximum, positioning the force motor so that minimum "torque signal" pressure is applied to the line pressure regulator. At full throttle, current flow is close to minimum, positioning the force motor so that maximum "torque signal" pressure is applied to the line pressure regulator.

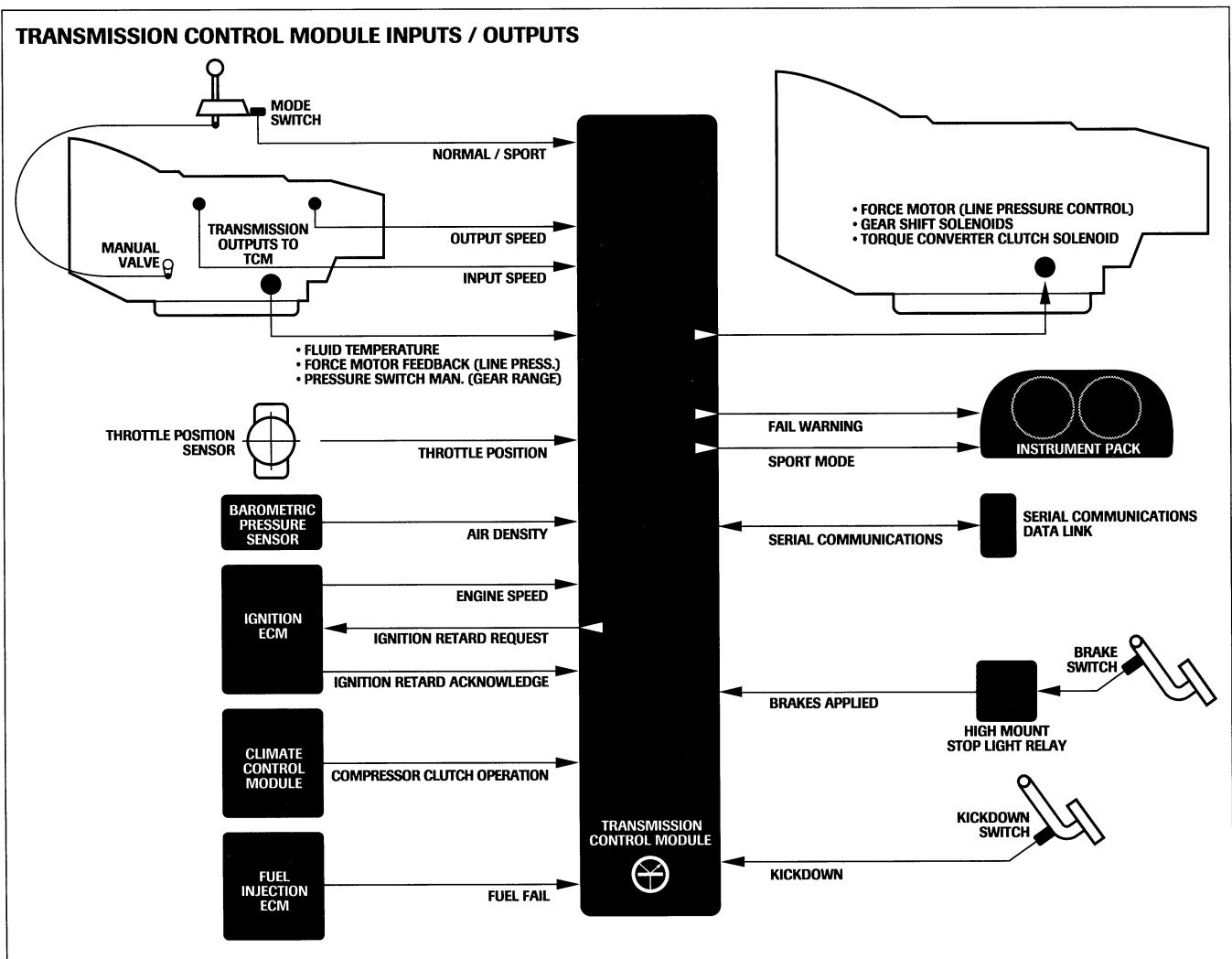
If the electrical system becomes disabled, current flow to the force motor will stop and maximum "torque signal" pressure will be applied creating maximum line pressure, thus preventing component slippage until the condition can be corrected.

Gear shift solenoids A and B The TCM controls the shift solenoids from the operating strategy by switching the solenoid coil ground circuits. The following table shows the solenoid state combination required for each gear range:

Gear Range	Solenoid A	Solenoid B
P,R,N	ON	OFF
First	ON	OFF
Second	OFF	OFF
Third	OFF	ON
Fourth	ON	ON

Torque converter clutch (TCC) solenoid The rate at which the torque converter lock-up clutch is applied depends on the torque converter clutch signal pressure as controlled by the duty cycle of the TCC solenoid. The TCM varies the duty cycle of the TCC solenoid by controlling the ground circuit. The TCC solenoid, in turn, varies the torque converter clutch signal pressure acting on the lock-up clutch shift valve. By varying the duty cycle of the TCC solenoid, lock-up clutch apply and release occurs smoothly.

Ignition retard request and acknowledge When the TCM senses that a reduction in engine torque is required to allow a "quality shift", a request for ignition retard is output to the ignition ECM. After the ignition has been retarded, the ignition ECM signals the TCM to acknowledge timing retard. When the acknowledgment is received, the TCM initiates the apply or release function.



Electronic Four-Speed Automatic Transmission (continued)

Fail safe mode

If the entire electronic control system becomes disabled, the following occurs:

- both of the shift solenoids will be de-energized forcing the transmission to operate in Second gear when the gear selector is in a forward drive range,
- the force motor is switched off, increasing line pressure to maximum,
- the torque converter clutch solenoid cannot apply the torque converter lock-up clutch.

Adaptive learning

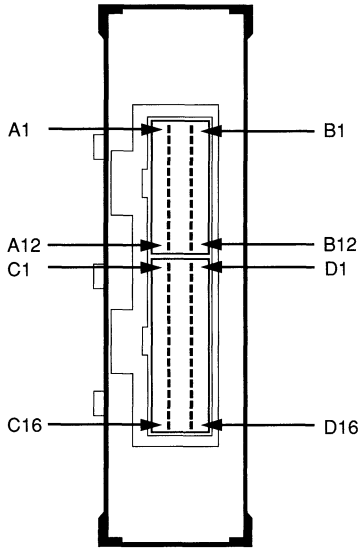
The TCM programming allows for adjustments in line pressure based on the changing characteristics of the transmission components as sensed from the various TCM inputs. This process is called "Adaptive Learning" and is used to ensure consistent shift patterns and to increase transmission durability. As transmission apply components wear and the time required to apply a clutch or band increases, the TCM adjusts line pressure to maintain the originally calibrated shift timing. Line pressure adjustment is accomplished through control of the torque signal fluid pressure, which in turn is controlled by the force motor.

Diagnostics

The TCM continuously monitors the operation of the transmission to detect a fault. When detected, the TCM attempts to rectify a fault with "adaptive learning". If adaptive learning successfully rectifies the fault, the line pressure increase becomes the normal line pressure for that portion of the operating strategy. If the TCM cannot rectify the fault, a diagnostic trouble code (DTC) is flagged and the TCM selects a mode of operation that protects the transmission from damage. DTCs are accessed via the serial communications data link by JDS. The following DTCs are available and are listed in the order of priority:

DTC	Input or Component Checked	DTC	Input or Component Checked
21	Throttle position high	38	Brake switch stuck off
22	Throttle position low	84	Kickdown switch stuck on
33	Barometric pressure high	78	Kickdown switch stuck off
34	Barometric pressure low	73	Force motor current
58	Transmission temperature high	69	Torque converter lock-up clutch stuck on
59	Transmission temperature low	39	Torque converter lock-up clutch stuck off
79	Transmission hot	83	TCC solenoid circuit fault
53	System voltage high	82	Shift solenoid A circuit fault
75	System voltage low	81	Shift solenoid B circuit fault
71	Engine speed low	89	1 - 2 maximum adapt and long shift
74	Input speed low	89	2 - 3 maximum adapt and long shift
24	Output speed low	89	3 - 4 maximum adapt and long shift
72	Loss of output speed	68	Overdrive (Fourth) ratio
77	Mode select switch	85	Undefined ratio / pressure switch manifold
28	Pressure switch manifold	87	Shift solenoid B stuck off
37	Brake switch stuck on	86	Shift solenoid B stuck on

TRANSMISSION CONTROL MODULE PIN OUT INFORMATION



- | | | | |
|-----|----------------------------------|-----|---------------------------------|
| A1 | NORMAL INPUT | B12 | OUTPUT SPEED |
| A2 | SPORT MODE INPUT | C1 | GROUND |
| A3 | GEAR CODE MODE A | C2 | GROUND |
| A4 | GEAR CODE MODE B | C3 | SENSOR GROUND |
| A5 | GEAR CODE MODE C | C4 | SENSOR SUPPLY VOLTAGE |
| A6 | SHIFT SOLENOID B | C6 | FUEL OCTANE SELECT |
| A7 | SHIFT SOLENOID A | C7 | CATALYST SELECT |
| A10 | IGNITION RETARD REQUEST | C8 | KICKDOWN SWITCH |
| A11 | TRANSMISSION FAIL OUTPUT | C9 | ENGINE SPEED SHIELD |
| A12 | BATTERY POWER | C15 | FORCE MOTOR FEEDBACK |
| B2 | ENGINE FUEL FAIL | C16 | IGNITION SWITCHED POWER |
| B3 | A/C COMPRESSOR CLUTCH OPERATION | D3 | INPUT SPEED |
| B4 | BRAKE LIGHT OPERATION | D4 | INPUT SPEED |
| B5 | TORQUE CONVERTER CLUTCH SOLENOID | D5 | ENGINE SPEED INPUT |
| B6 | SPORT MODE INDICATOR OUTPUT | D9 | IGNITION RETARD ACKNOWLEDGED |
| B7 | NOT USED | D10 | THROTTLE POSITION SENSOR WIPER |
| B10 | DATA LINK SERIAL OUTPUT | D12 | DATA LINK SERIAL OUTPUT |
| B11 | OUTPUT SPEED | D13 | TRANSMISSION TEMPERATURE SENSOR |

Specifications

For transmission specifications, see page 2.

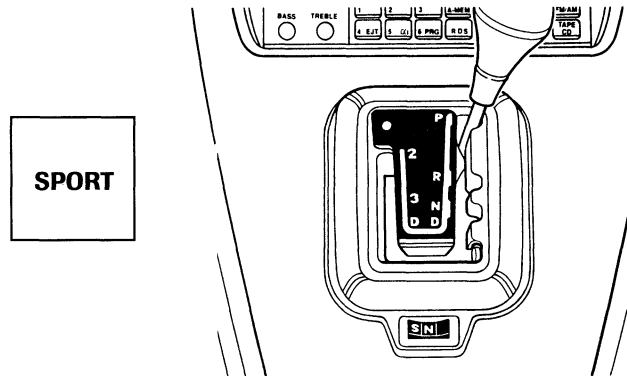
J Gate and gear shift interlock

The J gate gear selector assembly and the gear shift interlock system are similar to the XJ6 Sedan Range. Linear gear position switches replace the decoder module. The linear switches are used for switching the gear range state illumination and for providing inputs to the central micro-processor (CPU) for engine cranking inhibit. The mode switch has only Normal and Sport positions available for driver selection.

Propeller shaft, differential and final drive

The remainder of the drive train is unchanged from the XJ6 Sedan Range with the exception of a shortened propeller shaft. The rear axle unit is the same as the XJ6 Sedan including "limited slip". Depending on the differential unit installed, the rear axle ratio is 3.54 : 1 (Dana) or 3.58 : 1 (GKN).

INSTRUMENT PACK INDICATOR AND MODE SWITCH



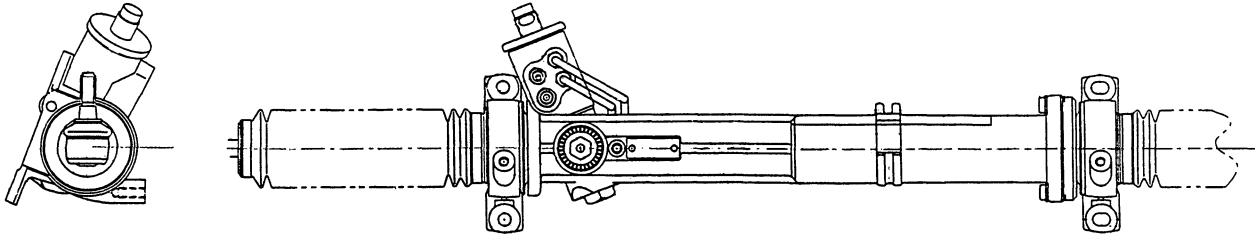
Power Steering

The power steering system has been redesigned to incorporate all the new components covered in the XJ6 Sedan Range 1993 Model Year Update, plus a new steering rack, steering pump and system fluid filter. The system uses Dexron II E automatic transmission fluid.

Steering rack

The new rack mounts to the rear of the front suspension subframe so that the top is tilted to the rear approximately 10°. The installation arrangement and attaching hardware are different for the XJ6 and XJ12 models.

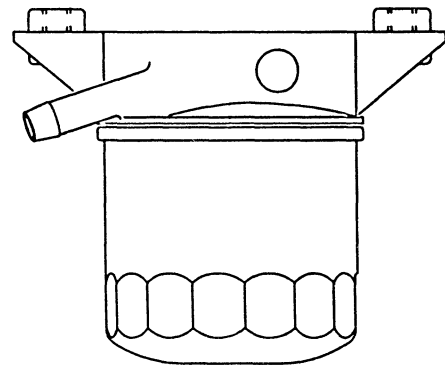
STEERING RACK INSTALLATION



System filter

A renewable cartridge type filter is used to protect the system components from contamination. The filter is located for easy access under the right body crush tube. The filter cartridge must be changed at regular intervals and in the case of a major component failure.

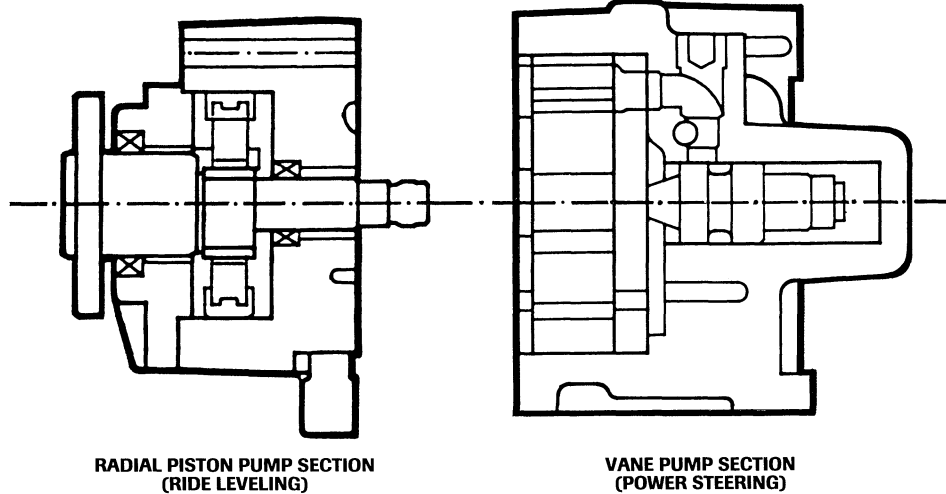
STEERING SYSTEM FILTER



Power steering / ride leveling tandem pump

The power steering pump is part of a tandem pump used to serve both the steering and ride leveling systems. The pump sections are completely separate and share only a common drive shaft. The forward section is a radial piston pump for the ride leveling system. The rearward section is a vane pump for the power steering system.

TANDEM PUMP



**RADIAL PISTON PUMP SECTION
(RIDE LEVELING)**

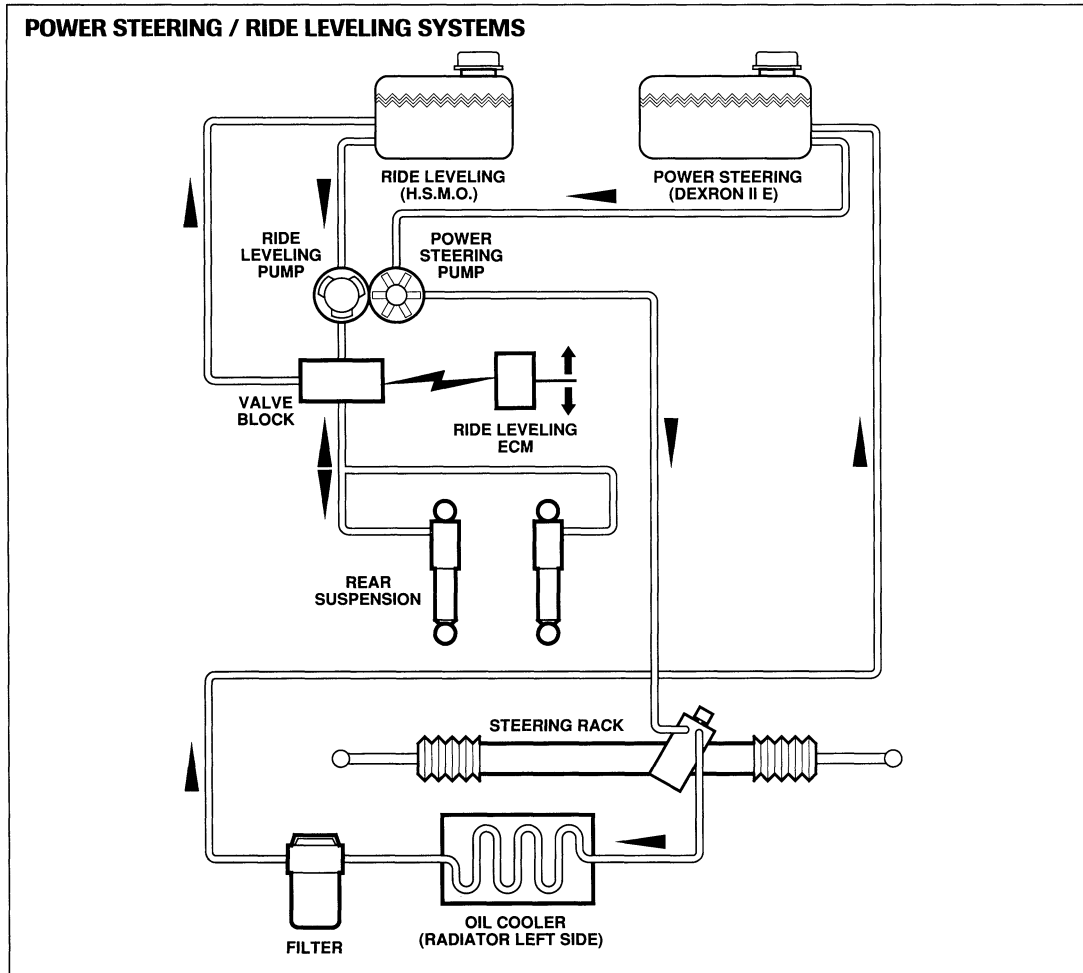
**VANE PUMP SECTION
(POWER STEERING)**

Ride Leveling

The XJ12 Sedan is equipped with a ride leveling system employing a new, simplified valve block and electrical circuit, and the previously mentioned tandem pump. Hydraulic system mineral oil (HSMO) continues to be the specified fluid for ride leveling.

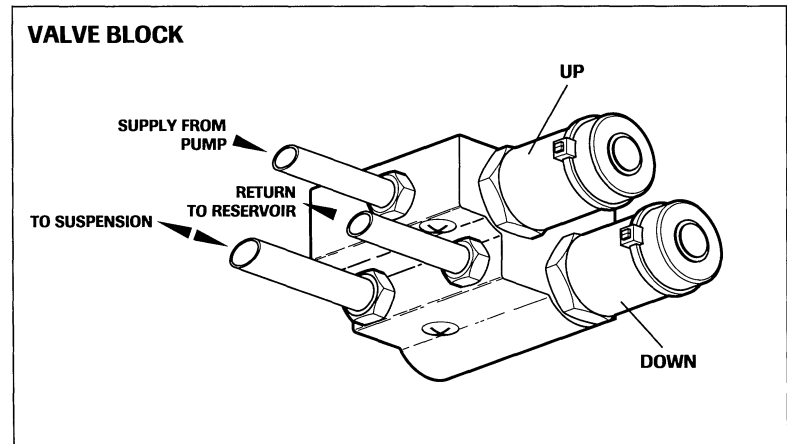
Electrical circuit

The electrical circuit is greatly simplified from 1992 and earlier model year vehicles. The electronic control module drives the valve block solenoids directly, eliminating relays from the circuit.



Valve block

The new valve block is a compact unit having two solenoid operated valves for rear suspension up or rear suspension down. The up portion of the valve block contains a non-return valve. The down portion of the valve block contains a "trapped line pressure" valve and a relief valve. Both of the solenoid valves are serviceable; the internal valves are non-serviceable. Located behind and below the right front headlight, the valve block is accessed from under the vehicle.



Front Suspension

Heavy duty front suspension components are used to complement the additional power and weight of the V12 engine.

Revised components

A summary of the revised components follows:

- Wishbones – Larger cross sections; lower wishbone has two-bolt outer joint
- Road springs – Spring rate increased to 66.5 N/mm
- Anti-roll bar – Revised geometry; larger cross section; rate increase to 27.75 kN/m
- Shock absorbers – Large diameter top cups; strengthened lower “U” brackets; red identification mark near the bottom of the shock absorber indicates XJ12 unit.

Whenever possible, the heavier XJ12 front suspension components (except for shock absorbers) will be used in XJ6 production.

Braking and ABS

The increased performance of the XJ12 requires front brakes that are more powerful than the XJ6 Sedan brakes.

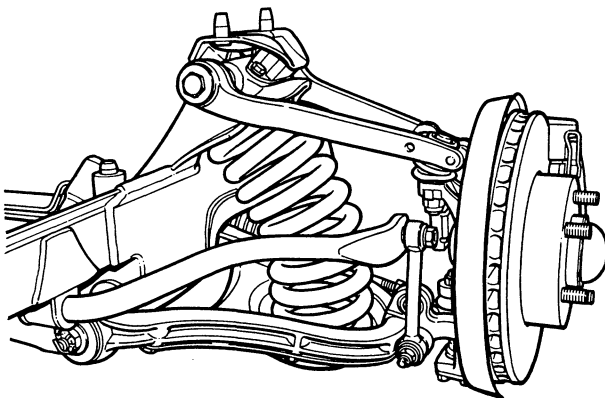
Calipers and discs

The front calipers are larger Teves “ATE” twin piston units with “Textar” T 4046 pads. The larger ventilated discs are 298 mm in diameter by 28 mm thick. The hoses and splash shields are changed to fit the new assembly.

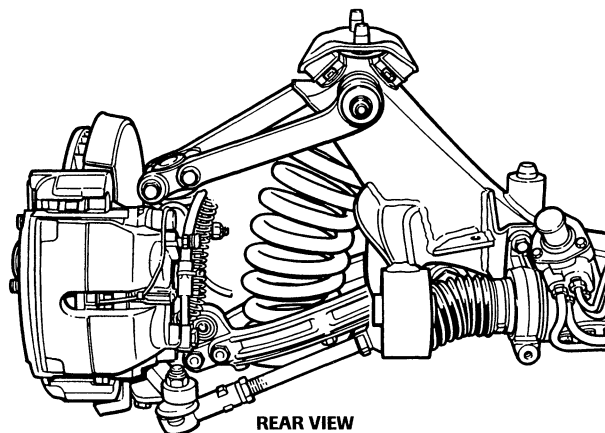
Road speed input from ABS

The road speed input for the speedometer and cruise control is supplied by the ABS ECU from the left / rear wheel speed sensor.

FRONT SUSPENSION



FRONT VIEW



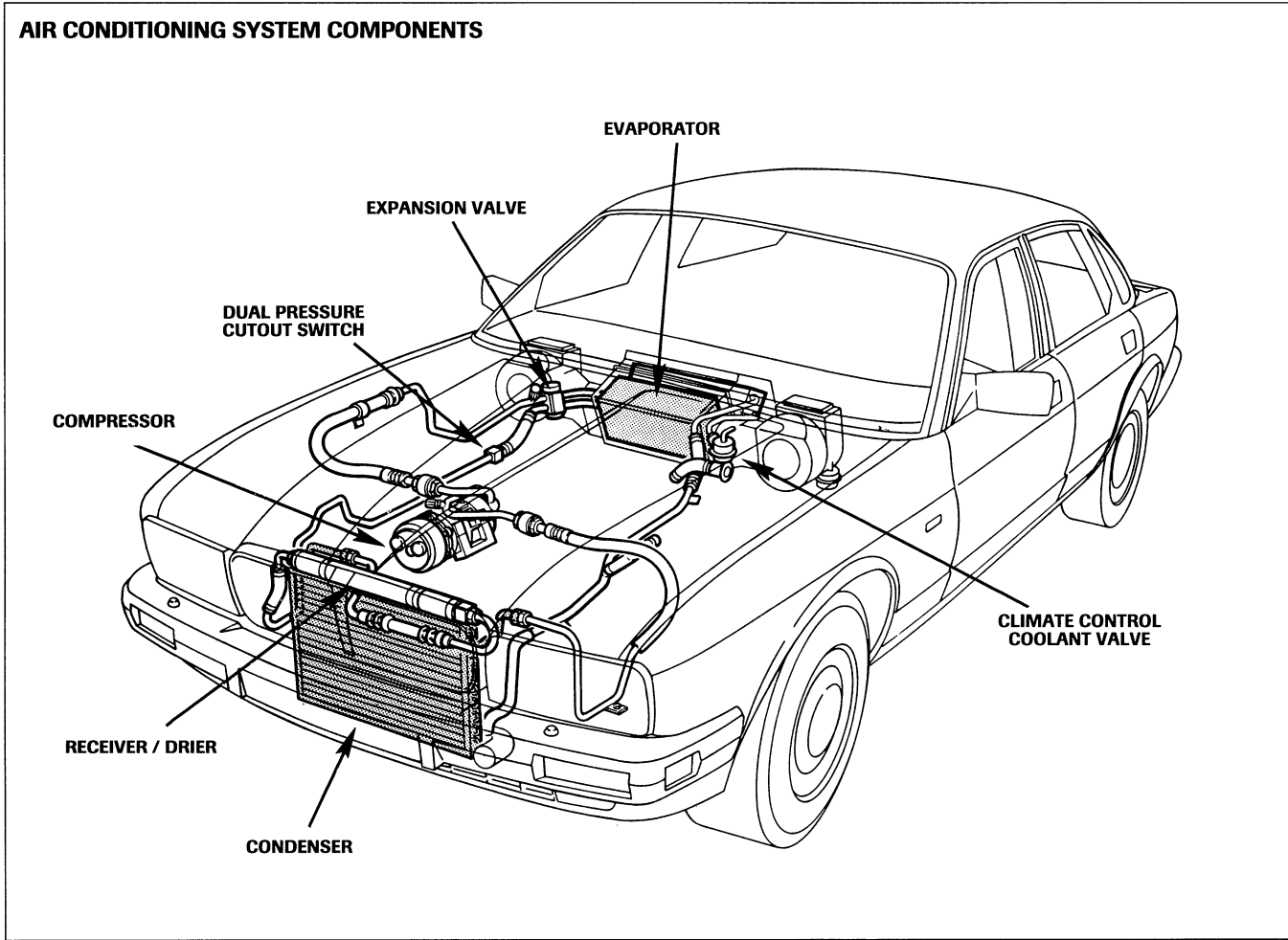
REAR VIEW

HFC Air Conditioning System

The HFC air conditioning system follows the design of the XJ6 system and uses the same type of components, fittings and valves. There is no control of the auxiliary cooling fans from the air conditioning system. HFC procedures must be followed when servicing the system.

Specifications

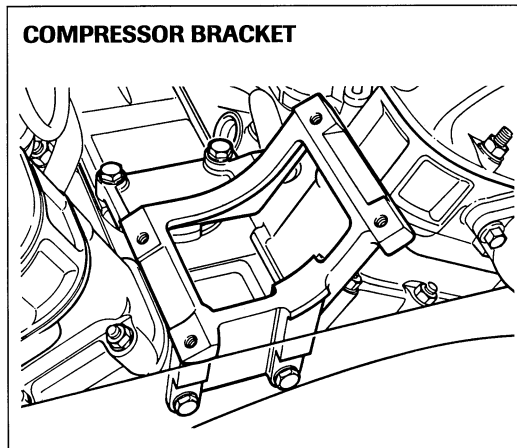
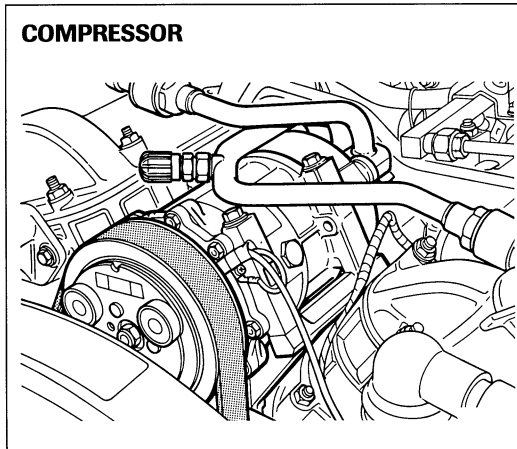
Refrigerant charge weight	2.75 lbs (1.25 kg)
Compressor oil charge (initial)	4.5 fl oz (135 cc)



HFC Air Conditioning System (continued)

Compressor

The Sanden 7 cylinder compressor is located in the engine vee on a stationary mounting bracket. An aluminum manifold assembly is used to make pipe connection to the compressor.

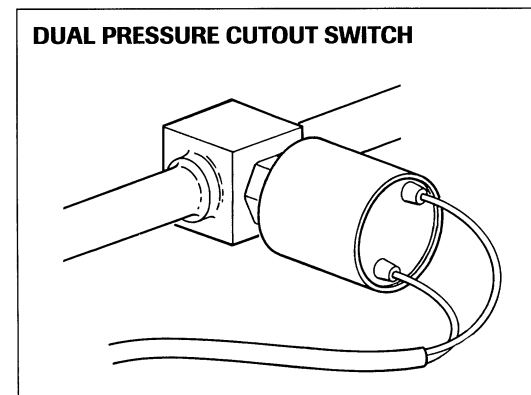
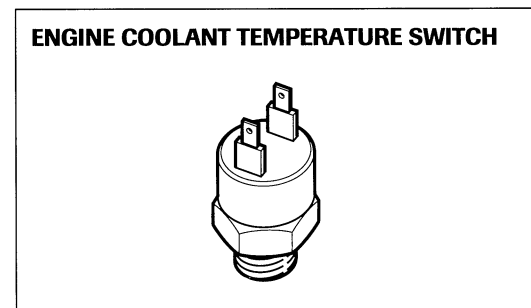
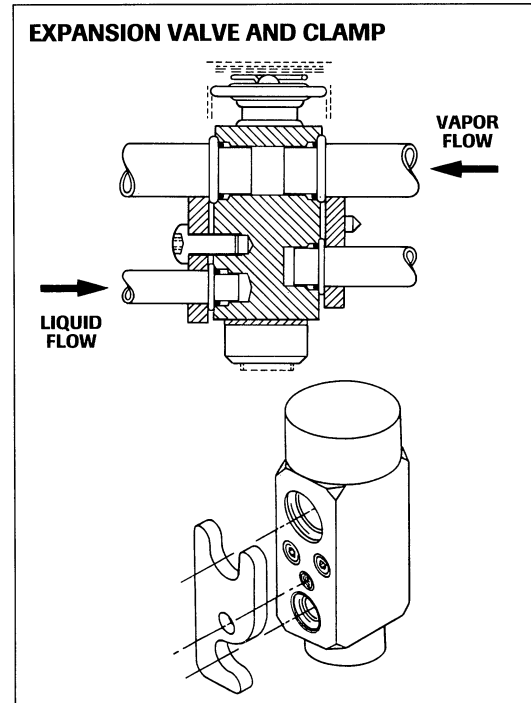


Compressor clutch override

Compressor clutch operation is overridden by an engine coolant temperature switch and a refrigerant dual pressure cutout switch connected in series with the compressor clutch relay coil ground circuit. The coolant temperature switch is located in the right front engine coolant rail and is closed to allow compressor operation below 250°F (122°C). The refrigerant dual pressure switch is located in the air conditioning high pressure line and is closed to allow compressor operation between 29 and 392 psi (2 and 27 bar).

Expansion valve

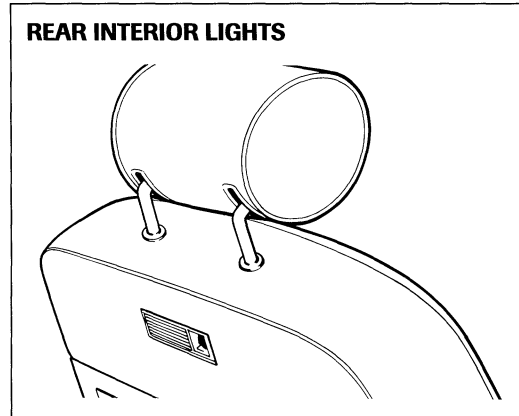
The expansion valve appearance is similar to the XJ6 valve; however, the calibration is revised. Do not interchange the expansion valves.



Interior Lighting

Rear interior lights

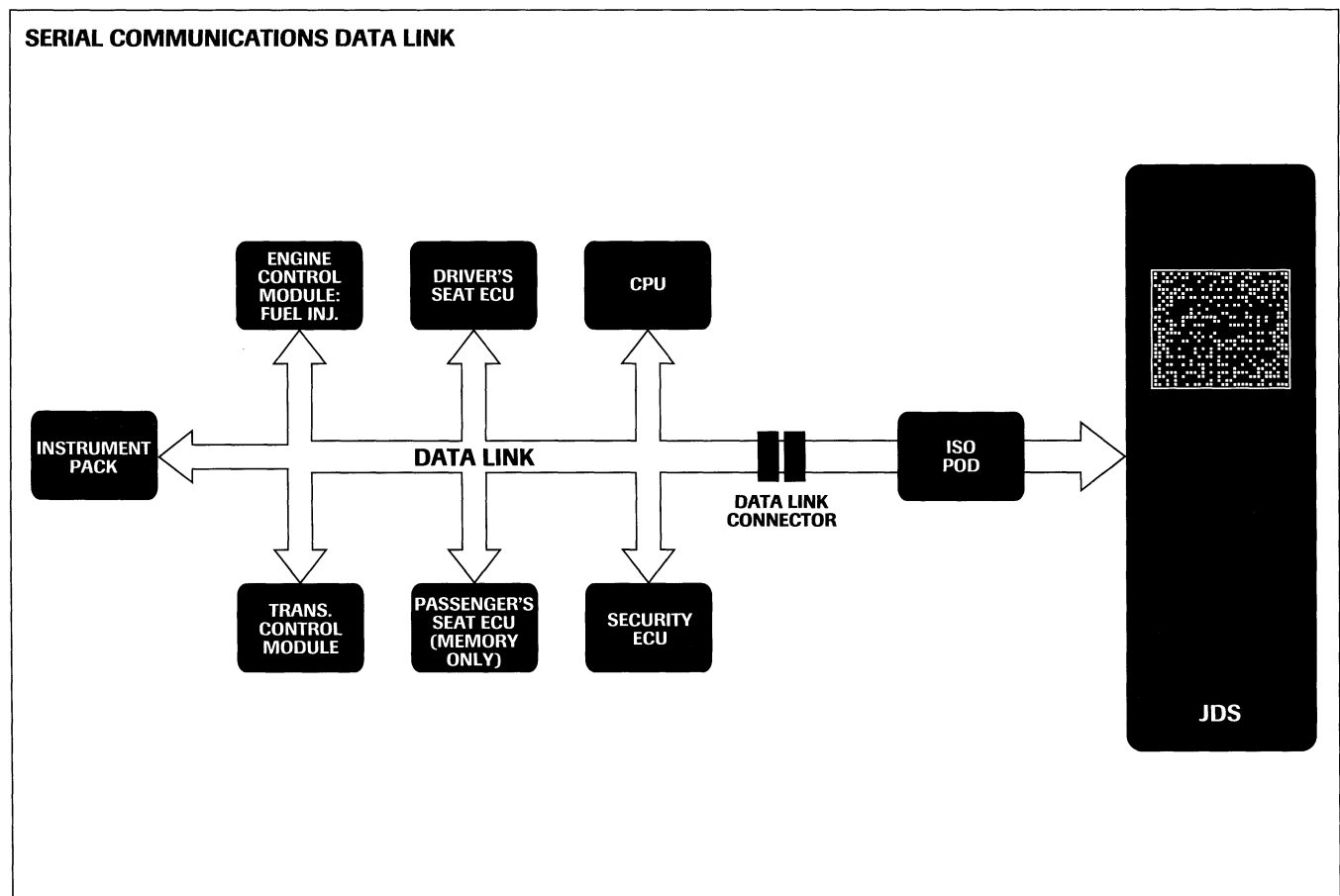
The control of the rear interior lights has been revised so that the integral light switches only operate the lights when the ignition is switched to position I or II (AUX. or ON). However, the lights can be operated at all times by the interior lighting switch on the center console. All other functions remain as previous.



Jaguar Diagnostic System

JDS (Jaguar Diagnostic System) software issue 4070 applies to the 1994 model year XJ12 Sedan. Software issue 4070 provides diagnostics for XJ12 Fuel Injection EMS and Transmission Control. Serial communication with seven of the vehicle's Electronic Control Modules is accomplished through the Serial Communications Data Link. The Data Link Connector (DLC) remains in the battery support frame.

The Ignition ECM, the ABS ECU and the Climate Control ECU each have individual diagnostic connection to JDS.



Fuse Identification and Location

Left fuse panel

Number	Color	Value	Circuit(s)
A1	Red	10A	Driver's seat ECU and memory Mirror heaters Dimmer
A2	Lt. Green	30A	Cooling fans
A3	Violet	3A	Not used
A4	White	25A	Driver's seat power
A5	Violet	3A	Lighting logic Ignition on relay Passenger's seat control Radio memory Transmission ECU memory Center console, LCD lock
A6	Red	10A	Purge control valve Air injection pump Data link power
A7	Lt. Green	30A	Cooling fans relay module
A8	Yellow	20A	Windshield wiper motor
A9	Violet	3A	Not used
B1	Lt. Green	30A	Left rear window lift Driver's window lift
B2	Yellow	20A	Sun roof
B3	Violet	3A	Not used
B4	Yellow	20A	Left blower
B5	Red	10A	Instrument pack
B6	Red	10A	Security ECU
B7	Violet	3A	Not used
B8	Lt. Blue	15A	Left rear lights: fog light, reverse light, turn signal, stop light
B9	Lt. Green	30A	ABS power
C1	Yellow	20A	Engine management system power
C2	Red	10A	Interior lights Cigar lighter illumination, hood lights
C3	Red	10A	CPU power
C4	Red	10A	Gear shift interlock
C5	White	25A	Left windshield heater
C6	Lt. Green	30A	ABS pump
C7	Brown	7.5A	Left front side marker, turn signal, side light Left rear tail, license, side marker lights
C8	Lt. Blue	15A	Left headlight high beam
C9	Lt. Blue	15A	Left headlight low beam, left front fog light

Right fuse panel

Number	Color	Value	Circuit(s)
A1	Red	10A	Driver's lumbar pump Passenger's lumbar pump Air conditioning clutch
A2	Red	10A	Transmission control power
A3	Violet	3A	Not used
A4	White	25A	Passenger's seat power
A5	Lt. Blue	15A	Central locking
A6	White	25A	Trailer Telephone

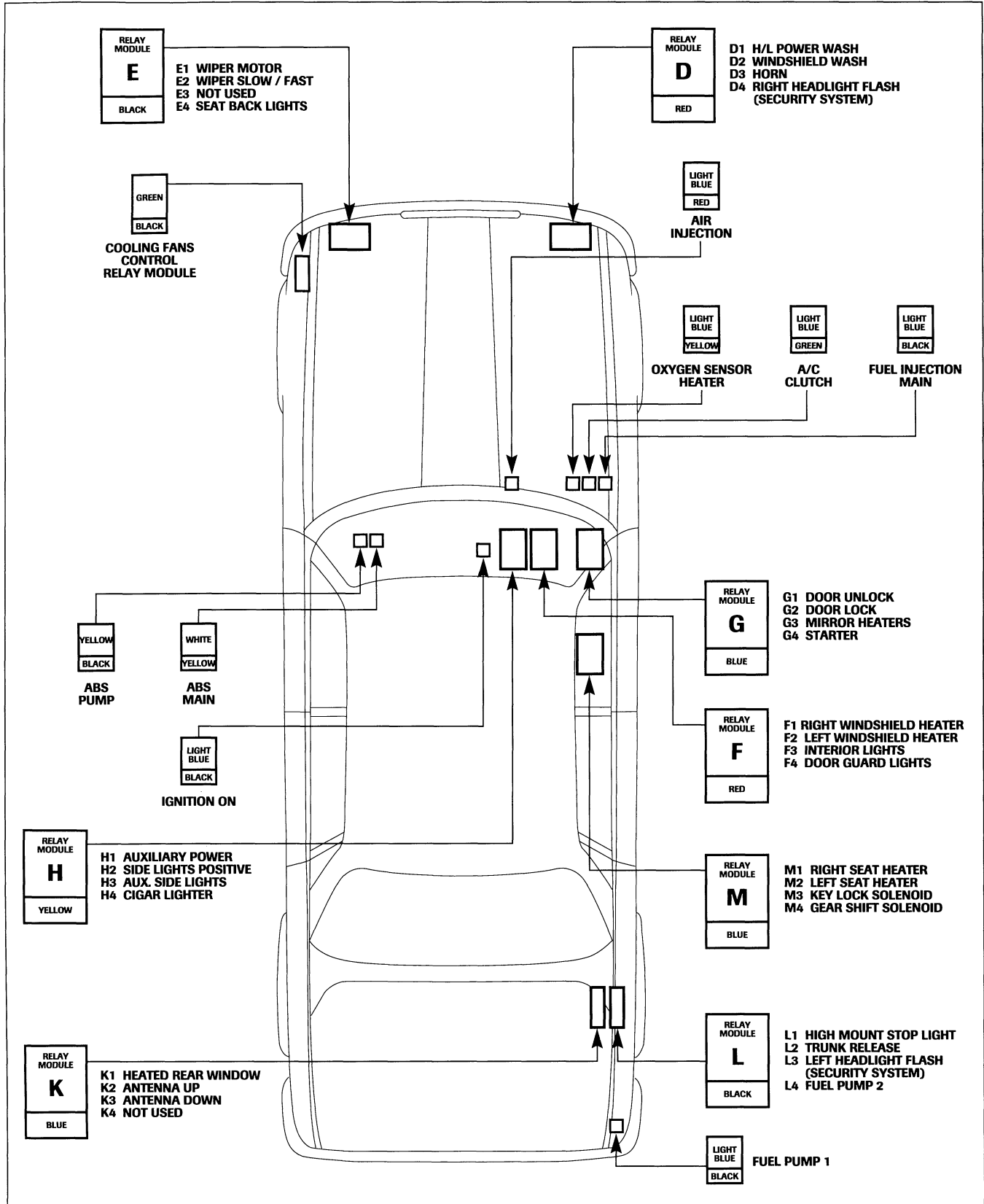
Right fuse panel (continued)

Number	Color	Value	Circuit(s)
A7	White	25A	Heated rear window
A8	Red	10A	Trunk release Antenna Ride leveling
A9	White	25A	Fuel pump #2
B1	Lt. Green	30A	Right rear window lift Passenger's window lift
B2	Lt. Blue	15A	Auxiliary power
B3	Violet	3A	Not used
B4	Yellow	20A	Right blower
B5	Red	10A	Engine management system ECM memory
B6	Lt. Blue	15A	Horns
B7	Red	10A	Windshield washer pump
B8	Lt. Blue	15A	Right rear lights: fog light, reverse light, turn signal, stop light
B9	Lt. Green	30A	Headlight washer pump
C1	Yellow	20A	Cigar lighters
C2	White	25A	Passenger's seat heater Driver's seat heater
C3	White	25A	Starter relay
C4	Red	10A	Oxygen sensor heater, fuel pump relay
C5	White	25A	Right windshield heater
C6	White	25A	Fuel pump #1
C7	Brown	7.5A	Right front side marker, turn signal, side light Headlight flash (security system) Right rear tail, license, side marker lights
C8	Lt. Blue	15A	Right headlight high beam
C9	Lt. Blue	15A	Right headlight low beam, right front fog light

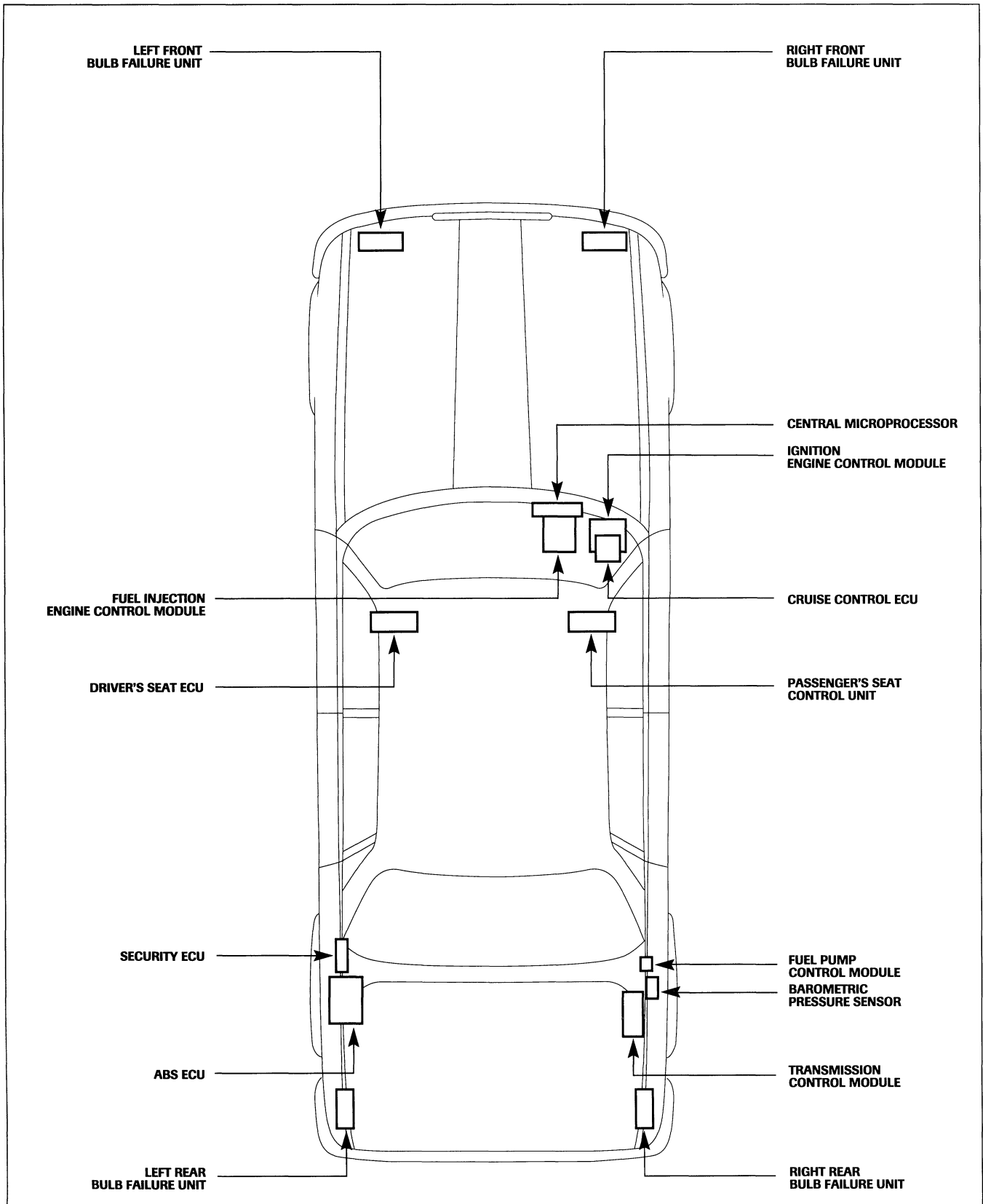
Center fuse panel

Number	Color	Value	Circuit(s)
1	Tan	5A	Generator (regulator) Right front bulb failure module (relays): right headlight low beam, fog light Left rear bulb failure module (relays): fog light, reverse light
2	Tan	5A	Passenger's seat heater relay Wiper fast / slow relay Driver's seat heater relay CPU ignition-on input Lighting logic unit
3	Tan	5A	Left front bulb failure module (relays): left headlight low beam, fog light Right rear bulb failure module (relays): fog light, reverse light High mount stop light Fuel pump control module
4	Tan	5A	Ride leveling
5	Tan	5A	Cruise control
6	Tan	5A	Cigar lighter relay Starter relay Transmission solenoids Transmission mode switch illumination
7	Tan	5A	Heated washer jets sensor Motorized aspirator
8	Tan	5A	ABS ECU, ABS main relay
9	Tan	5A	Instrument pack
10	Tan	5A	Transmission control module

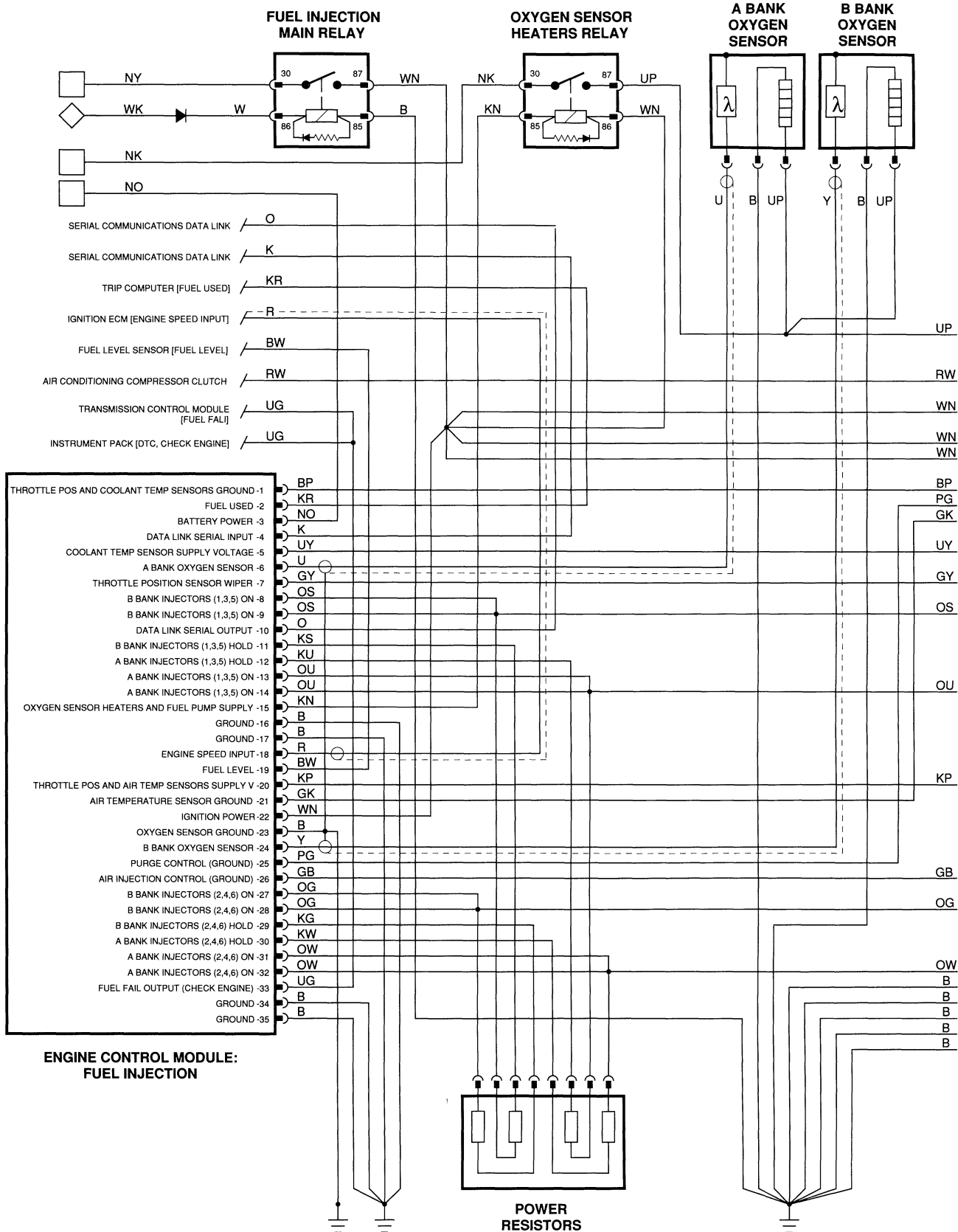
Relay Identification and Location



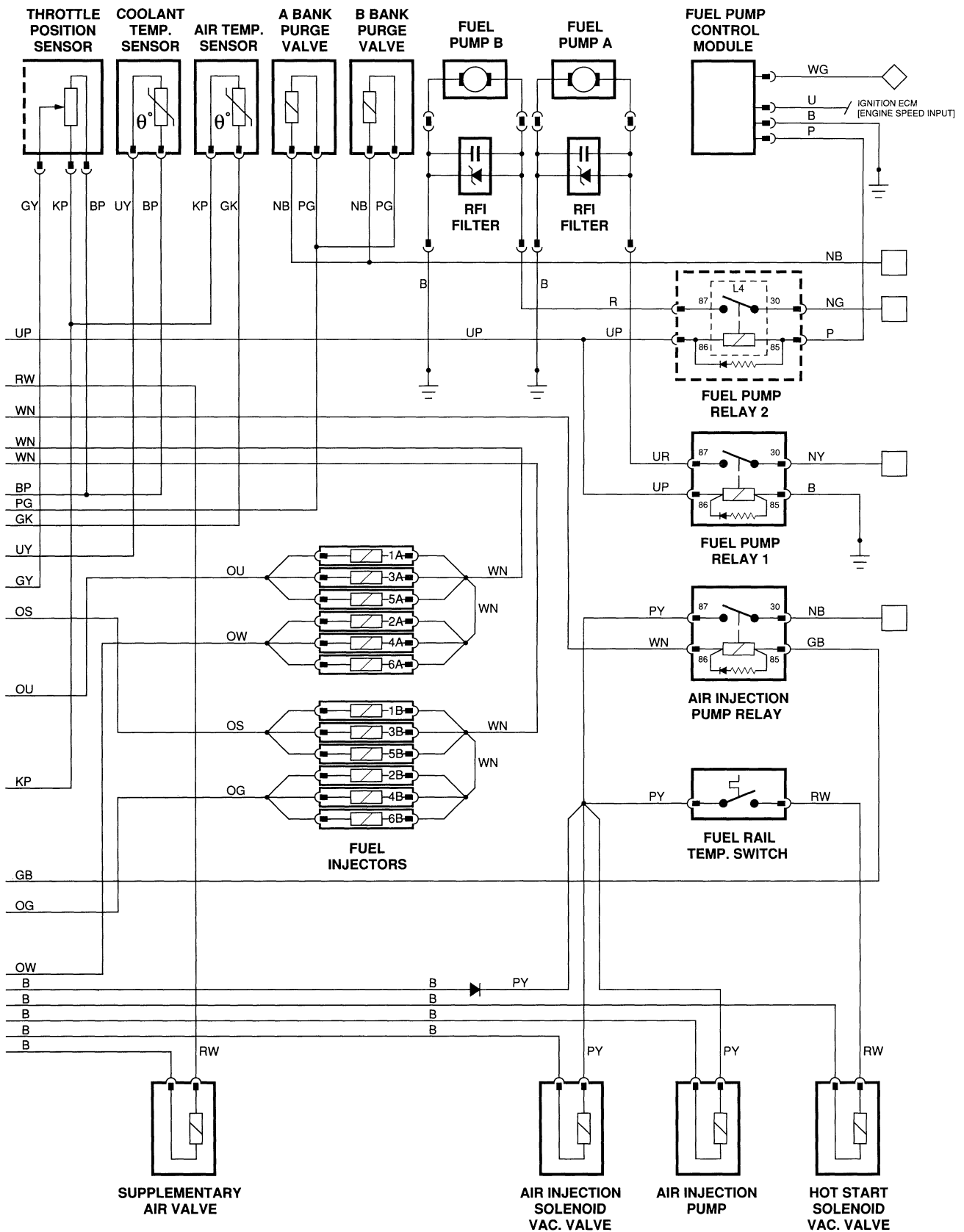
Electronic Components Identification and Location



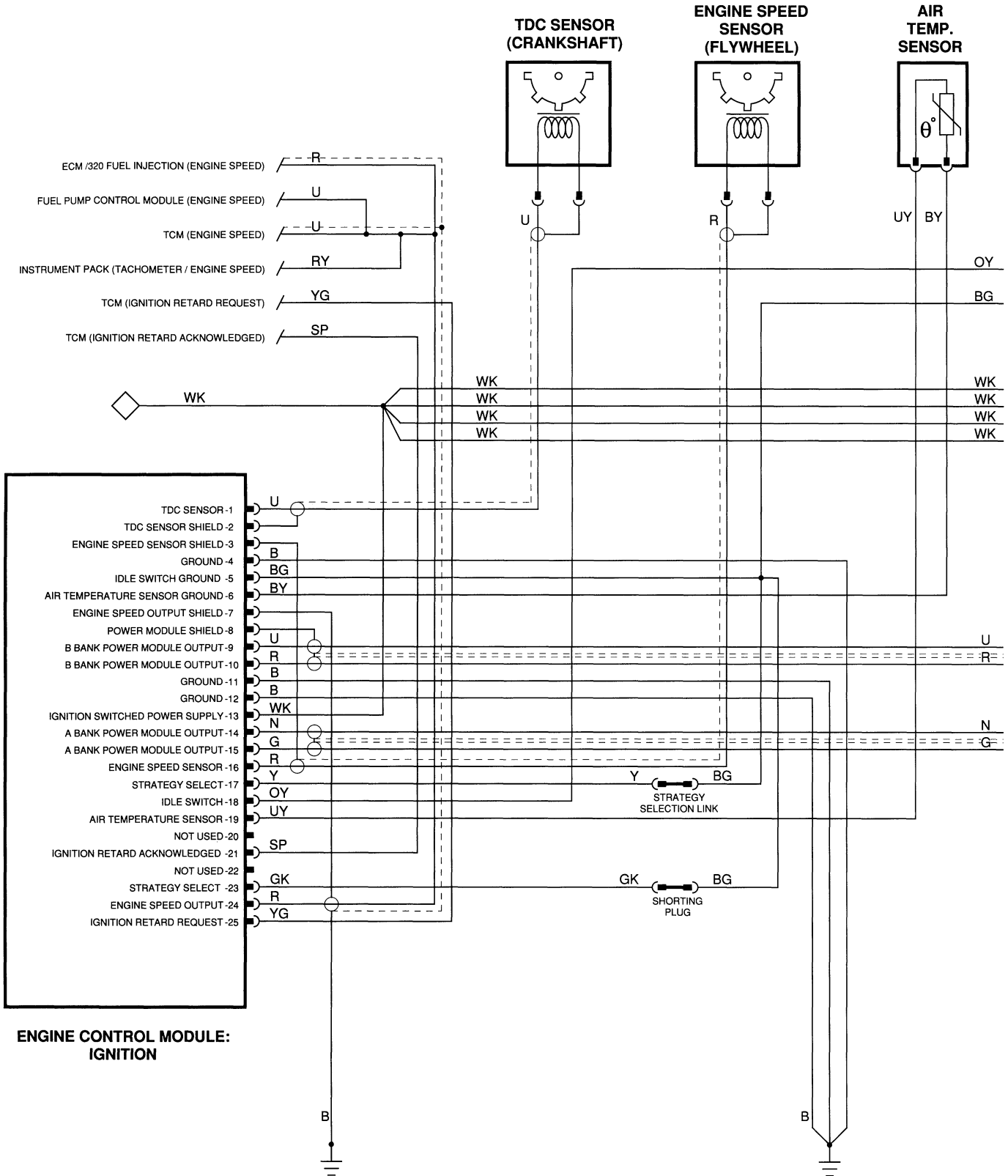
Engine Management System: Fuel Injection



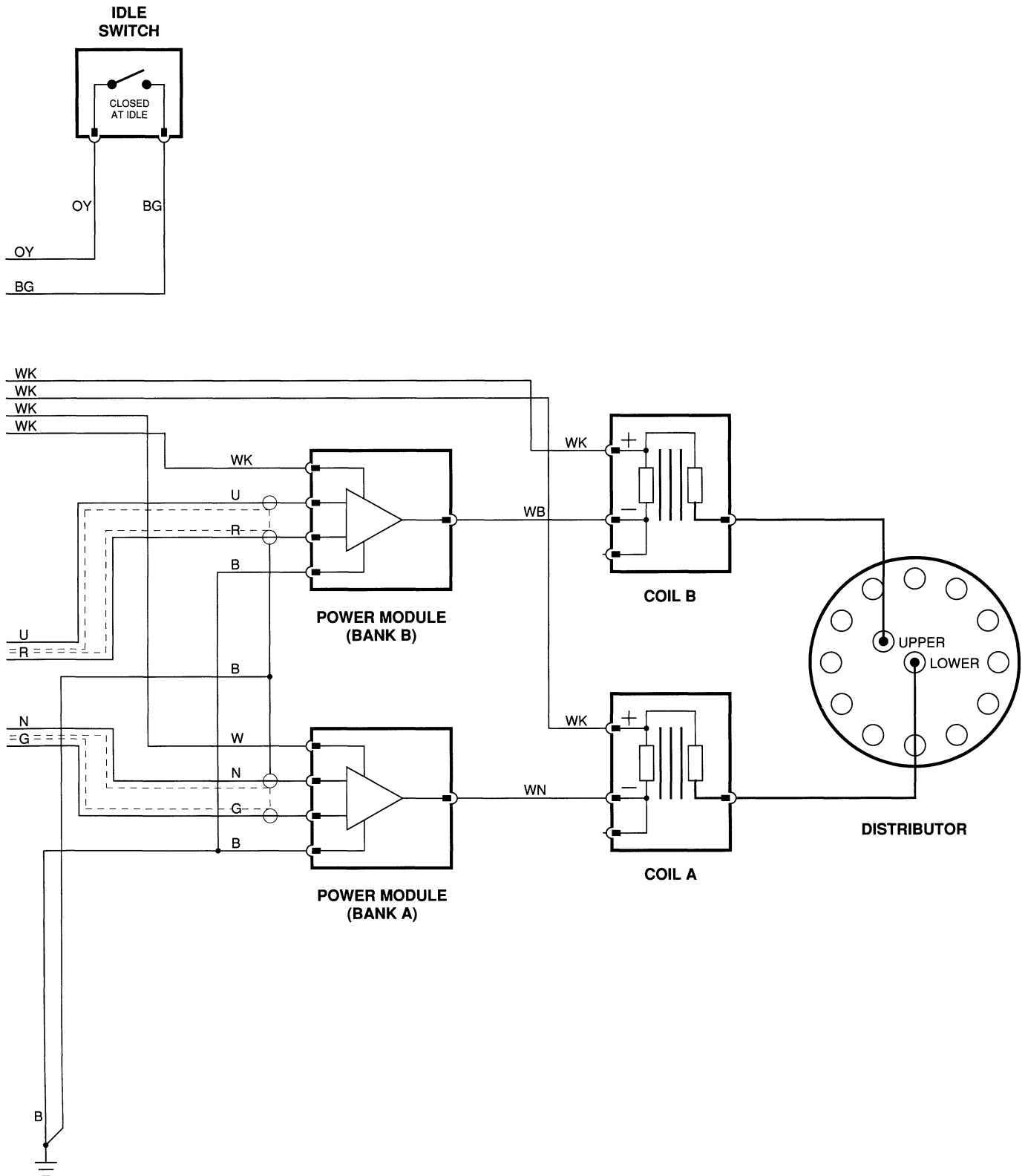
REFER TO PAGE 44 OF THIS PUBLICATION FOR IMPORTANT INFORMATION REGARDING THIS WIRING DIAGRAM.



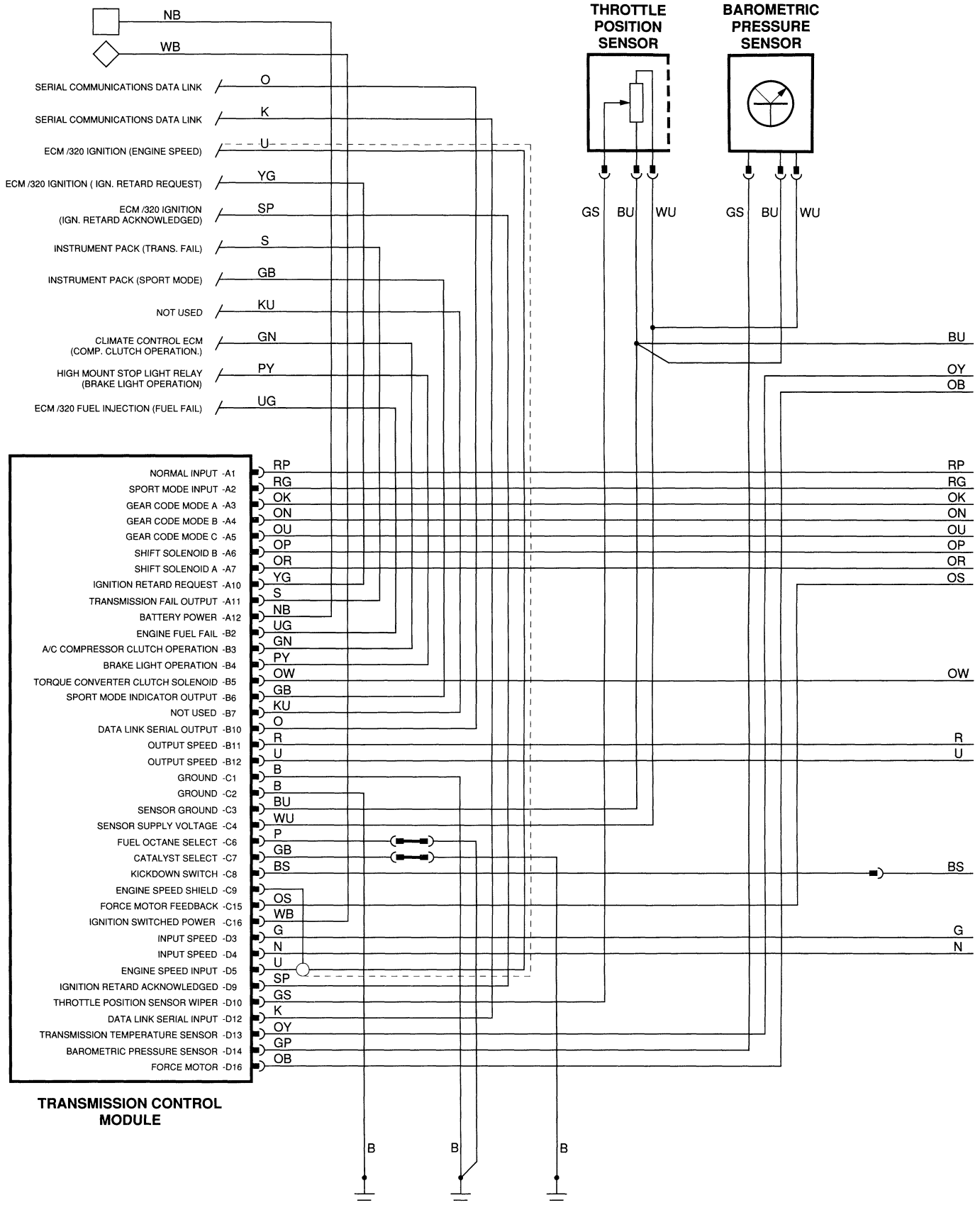
Engine Management System: Ignition



▲ REFER TO PAGE 44 OF THIS PUBLICATION FOR IMPORTANT INFORMATION REGARDING THIS WIRING DIAGRAM.

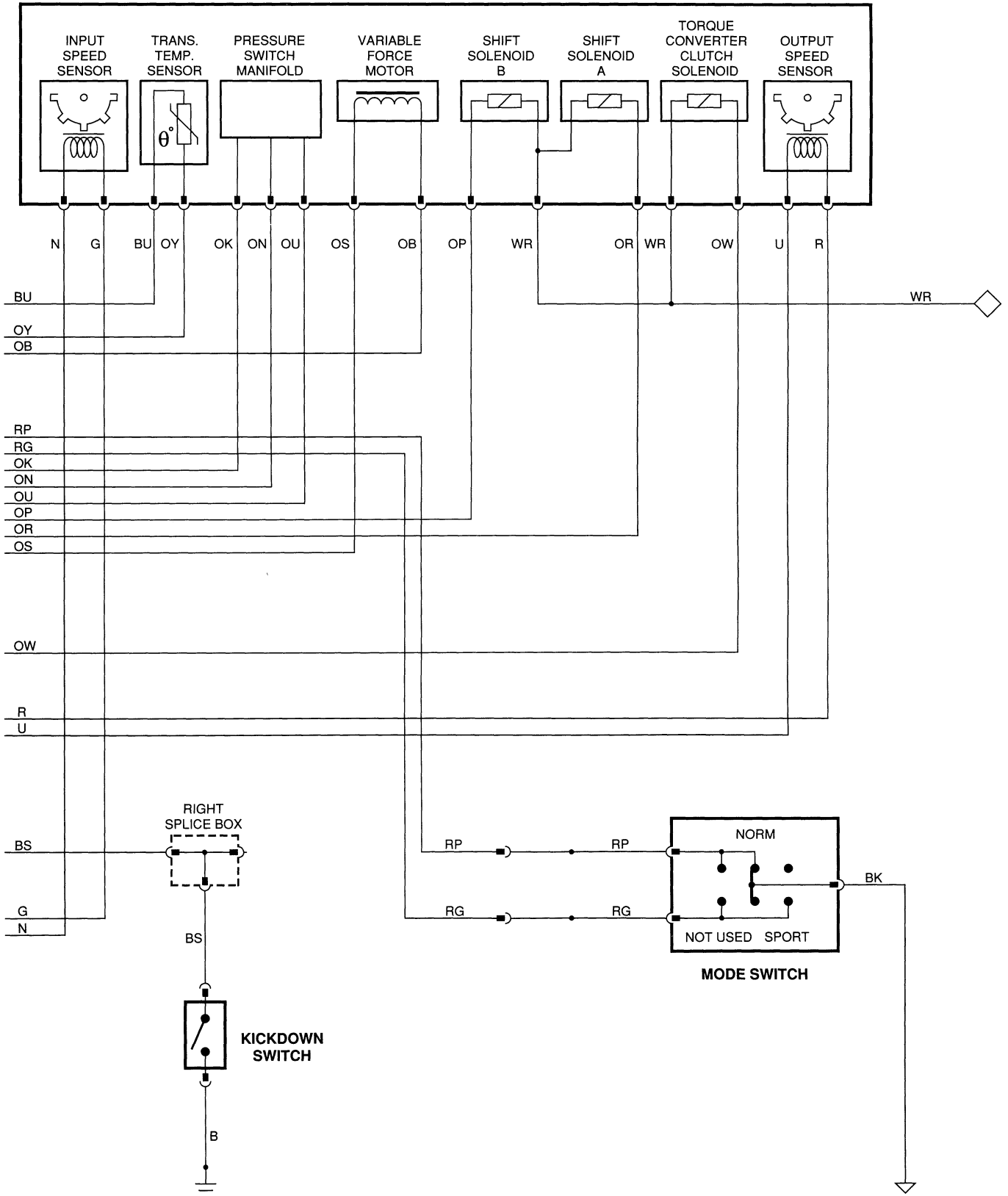


Transmission Control



▲ REFER TO PAGE 44 OF THIS PUBLICATION FOR IMPORTANT INFORMATION REGARDING THIS WIRING DIAGRAM.

TRANSMISSION



The wiring diagrams in this publication are provisional only and should not be used for circuit diagnosis. Refer to the Sedan Range Electrical Guide.

Key to Symbols and Codes

Reference symbols

Two reference symbols are used to indicate the remainder of the circuit:

 BATTERY POWER DISTRIBUTION

 IGNITION SWITCHED POWER DISTRIBUTION

Wiring color codes

N	Brown	Y	Yellow
B	Black	O	Orange
W	White	S	Slate
K	Pink	L	Light
G	Green	U	Blue
R	Red	P	Purple

When a wire has two or more code letters, the first letter indicates the main color and the subsequent letter(s) indicate the tracer color(s).



Printed in USA
Jaguar Cars Inc.

