

# FUEL SYSTEM

## GROUP 24 (9000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
AIR CLEANER AND DUCT SYSTEMS.....	24-41-1	FUEL SYSTEM—SERVICE.....	24-01-1
FUEL FILTERS.....	24-51-1	FUEL TANKS AND LINES.....	24-50-1
FUEL INJECTION, ELECTRONIC .....	24-05-1	THROTTLE LINKAGE .....	24-60-1
FUEL PUMP—ELECTRIC.....	24-35-1	TURBOCHARGER .....	24-45-1

## SECTION 24-01 Fuel System—Service

SUBJECT	PAGE	SUBJECT	PAGE
CLEANING AND INSPECTION		DESCRIPTION .....	24-01-1
Air Cleaner .....	24-01-2	TESTING AND ADJUSTMENTS.....	24-01-2
Fuel Injection, Electronic .....	24-01-2	VEHICLE APPLICATION .....	24-01-1

### VEHICLE APPLICATION

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### DESCRIPTION

The naturally aspirated and turbocharged vehicles use a multi-point electronic fuel injection system. Additional electronic components that control idle speed and engine warmup are incorporated into the fuel injection system.

A closed-type positive crankcase ventilation system and an exhaust emission system is used to keep engine emissions within government specifications.

To maintain the required exhaust emission levels, the fuel injection system must be kept in good operating condition and adjusted to specification, whenever serviced. Refer to the applicable Sections in this Group and to Engine / Emissions.

Additional engine performance checks are required to keep the exhaust emissions at the specified minimum pollutant level. Refer to Engine / Emissions for these performance checks and Section 10-02 for recommended service intervals.

This Section covers cleaning and inspection procedures.

For fuel system component removal, disassembly, assembly, installation and major service operations, refer to the applicable Section of this Group.

Always refer to the Master Parts List for parts usage and interchangeability before replacing a throttle body or a component part of a throttle body.

**TESTING AND ADJUSTMENTS**

Refer to Engine / Emissions for testing and adjustment procedures.

**CLEANING AND INSPECTION****Fuel Injection, Electronic**

**WARNING: DO NOT SMOKE OR CARRY LIGHTED TOBACCO OR OPEN FLAME OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE IGNITED, RESULTING IN POSSIBLE PERSONAL INJURY.**

Refer to Engine / Emissions.

**Air Cleaner**

Cleaning the air cleaner element is not recommended. It should be replaced at the specified mileage intervals. Clean the air cleaner body and the cover with a solvent or compressed air. Wipe the air cleaner body and cover dry if a solvent is used. Inspect the air cleaner body and cover for distortion or damage at the gasket mating surfaces. Replace cover or body if they are damaged beyond service. Hold filter in front of a light and carefully inspect it for any splits or cracks. If filter is split or cracked, replace it. Refer to Section 24-41.

## SECTION 24-05 Fuel Injection, Electronic

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Idle Mixture .....	24-05-13	Electronic Control Assembly.....	24-05-14
Idle Speed .....	24-05-13	Engine Coolant Temperature Sensor.....	24-05-15
Throttle Position Sensor .....	24-05-13	Fuel Injectors .....	24-05-15
<b>DESCRIPTION AND OPERATION</b>		Intake Manifold.....	24-05-14
Air Flow .....	24-05-8	Neutral Start Switch.....	24-05-17
Air Induction System.....	24-05-6	Oxygen Sensor.....	24-05-16
Bypass Air Control Valve .....	24-05-9	Throttle Body .....	24-05-13
Electronic Engine Control.....	24-05-10	Throttle Position Sensor .....	24-05-15
Fuel System.....	24-05-4	Turbo Boost Gauge .....	24-05-16
<b>DIAGNOSIS AND TESTING</b> .....	24-05-13	Vane Air Flow Meter .....	24-05-14
<b>REMOVAL AND INSTALLATION</b>		<b>SPECIAL SERVICE TOOLS</b> .....	24-05-17
BAC Valve.....	24-05-16	<b>SPECIFICATIONS</b> .....	24-05-17
BP Sensor.....	24-05-16	<b>VEHICLE APPLICATION</b> .....	24-05-1
Clutch Switch .....	24-05-17		

### VEHICLE APPLICATION

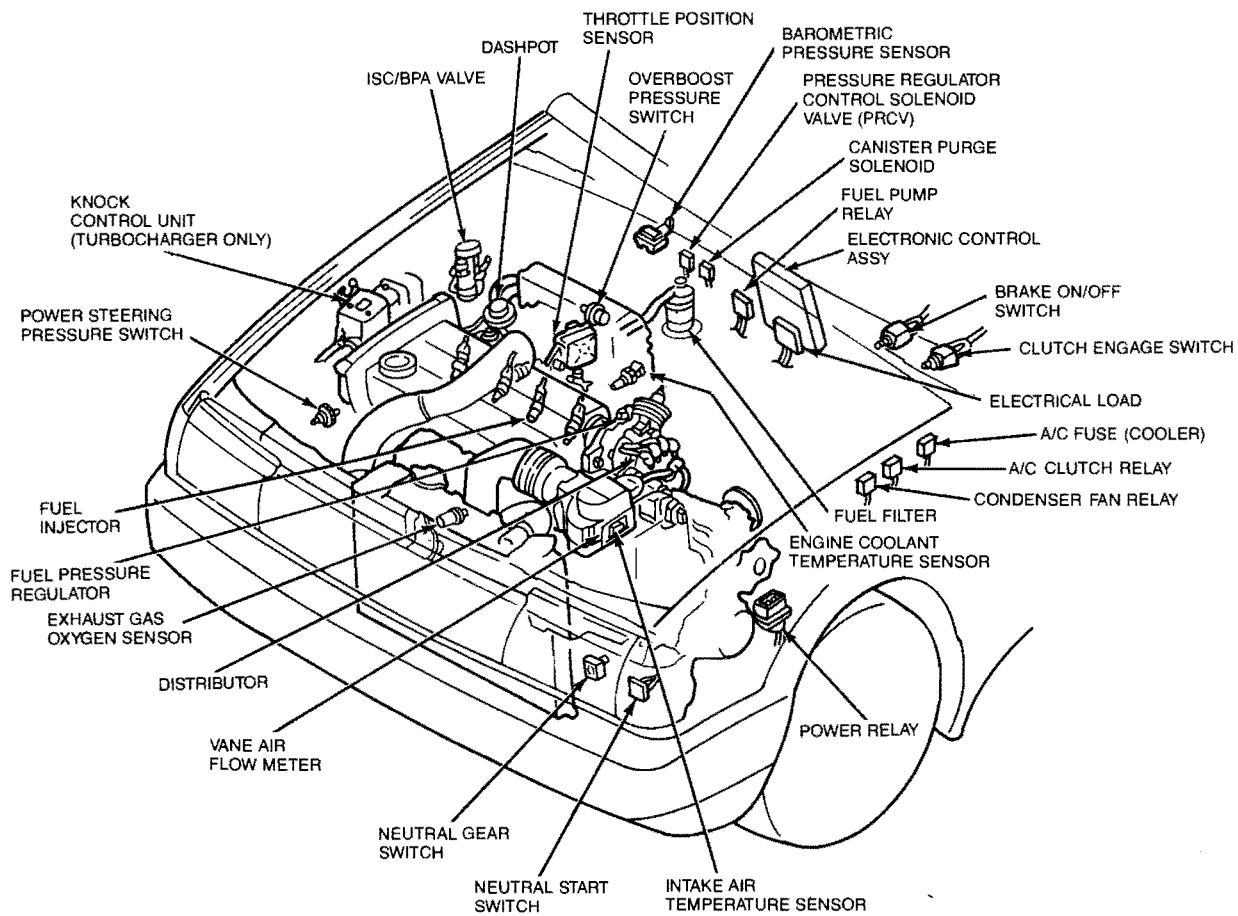
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### DESCRIPTION AND OPERATION

The Electronic Fuel Injection (EFI) system is classified as a multi-point, pulse fuel injection system. This system supplies the engine with the air / fuel mixture necessary for combustion. An air induction system and fuel injection system work in conjunction with an electronic engine control system which consists of various sensors, switches and an Electronic Control Assembly (ECA). All sensors and switches are connected to the ECA which interprets the data it receives and computes when and for how long the electrically operated injectors are energized.

The basic fuel requirement of the engine is determined from the data supplied to the ECA by the vane air flow meter which measures the amount of air being drawn into the engine. Other sensors and switches are used to measure air temperature, atmospheric pressure, coolant temperature, engine speed and exhaust oxygen content. The various sensors and switches detect any changes in the operating conditions and send signals to the ECA. This permits proper control over the opening duration of the injectors to maintain optimum exhaust emission control and engine performance for all operating conditions.

## DESCRIPTION AND OPERATION (Continued)

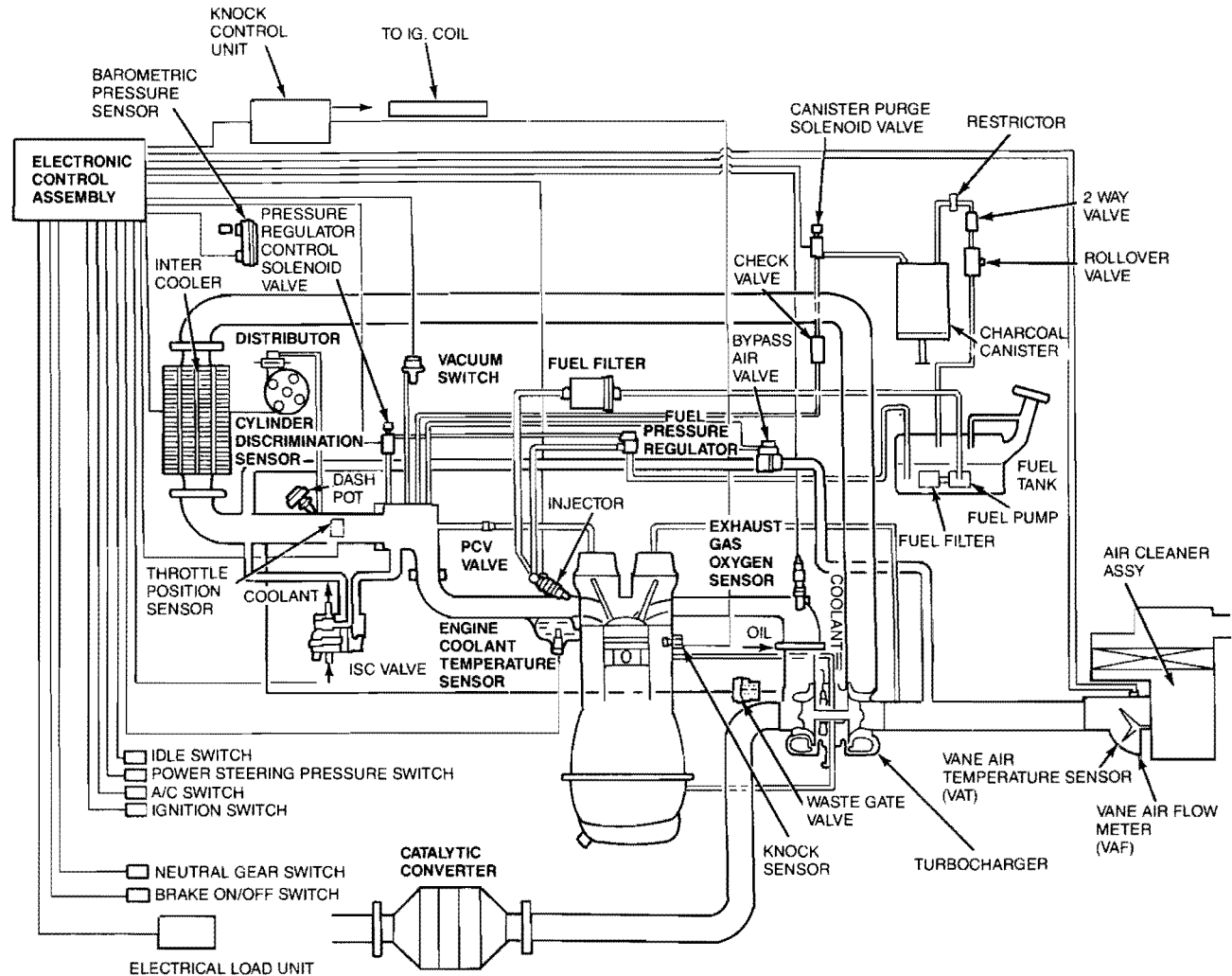


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## DESCRIPTION AND OPERATION (Continued)

## Emission Control Schematic

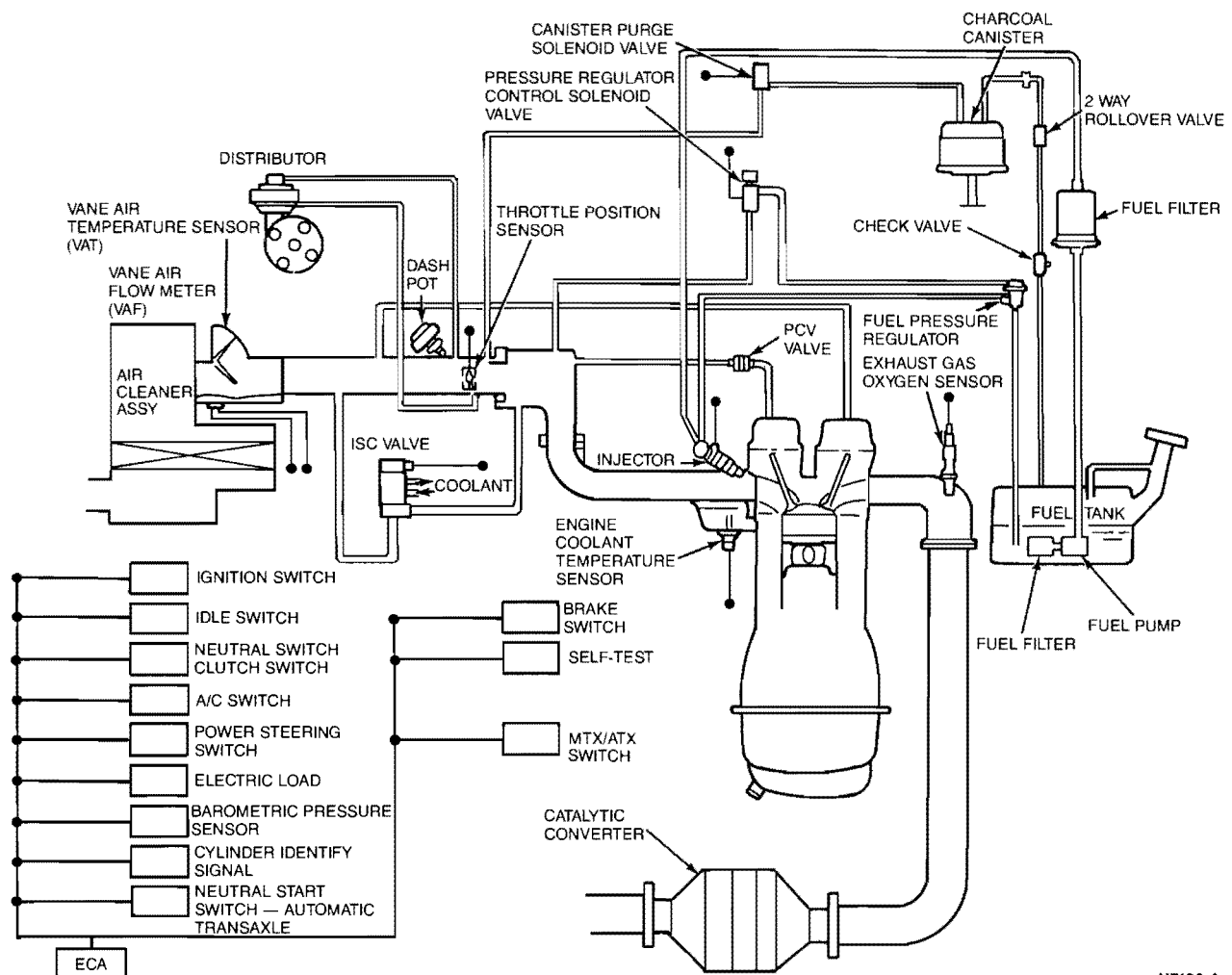
## Turbocharged Vehicles



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## DESCRIPTION AND OPERATION (Continued)

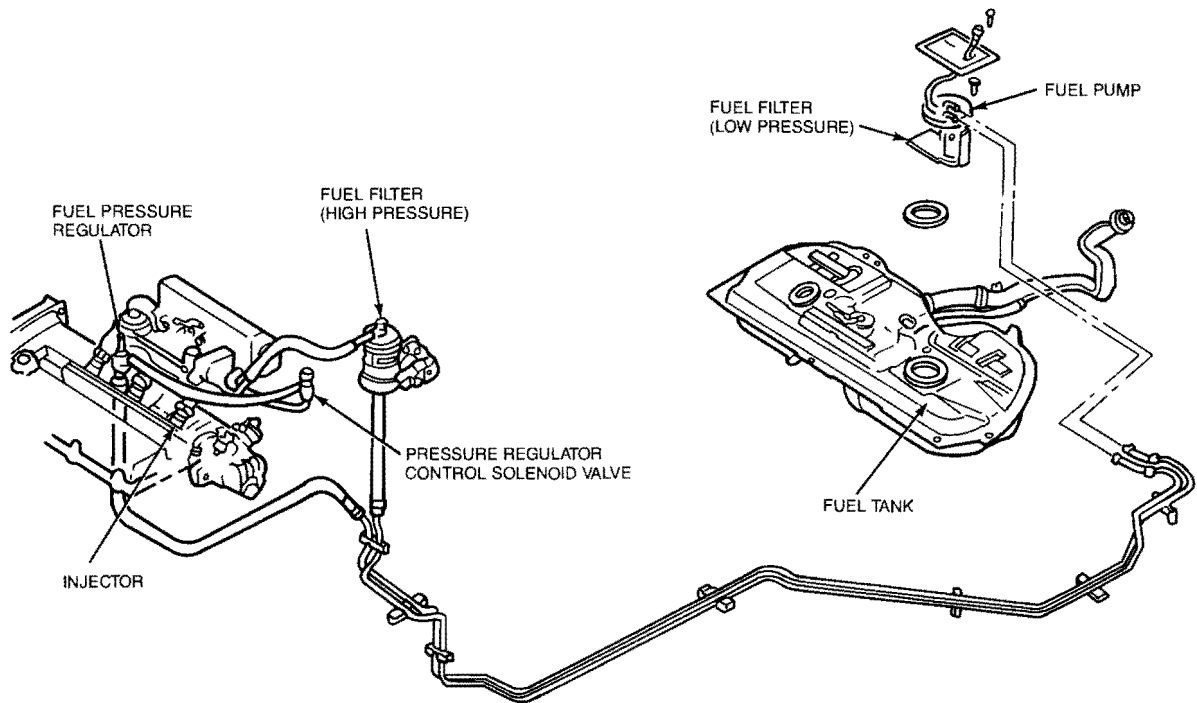
## Naturally Aspirated Vehicles

**Fuel System**

The fuel system supplies filtered, pressurized fuel to each injector. The system consists of the fuel pump, fuel filter, fuel rail, pressure regulator and the injectors. A fuel tank mounted electric fuel pump supplies filtered, pressurized fuel to each injector through the fuel rail. The fuel pressure is regulated by a pressure regulator valve which is located at the return line side of the fuel rail.

## DESCRIPTION AND OPERATION (Continued)

## Fuel System



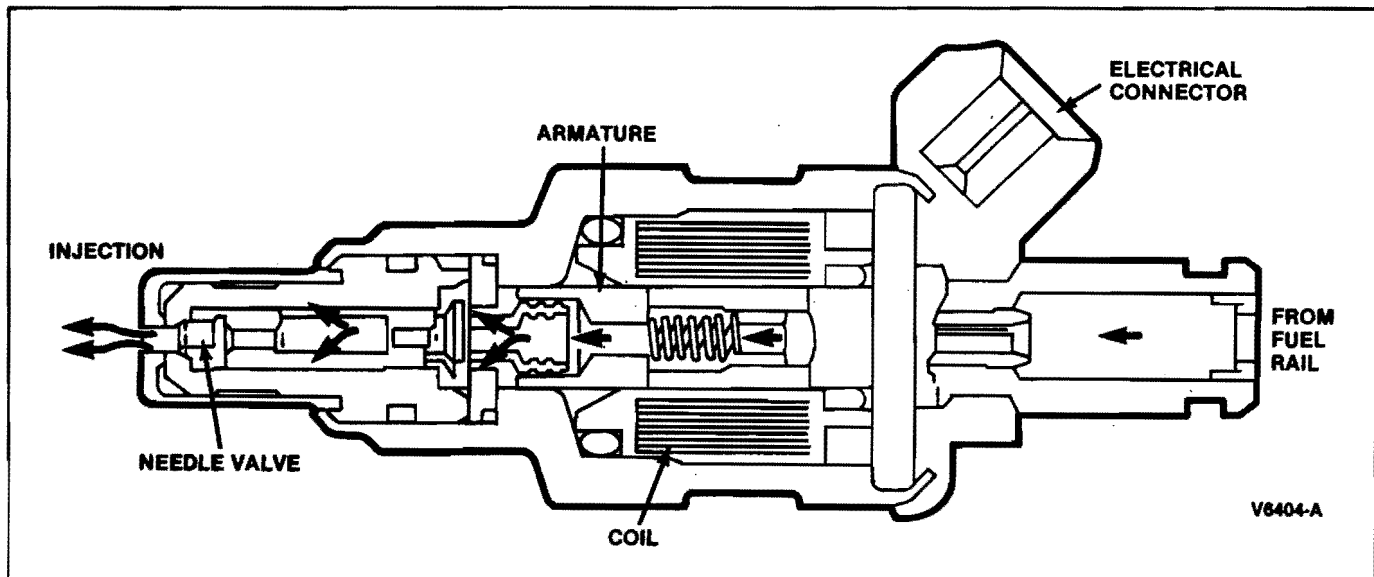
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Fuel is metered and injected into the intake ports according to the injection signals received from the ECA. When these injection signals are applied to the coil of the injector, the needle valve is pulled off its seat. Fuel is then injected around the back face of the intake valve. The amount of fuel supplied to the engine depends on the duration of time that the injectors stay open.

At idle speed, fuel is supplied by simultaneously providing one injection per crankshaft rotation (two injections per cycle) to all cylinders.

Between 5,000 and 6,800 rpm, the injectors could remain fully open due to injector lag, resulting in poor performance and fuel control. For this reason, when the engine speed rises above idle there is a changeover to one injection per two crankshaft rotations (one injection per cycle), that is controlled by a signal from the G-rotor in the distributor. The injectors stay open longer and the amount of fuel necessary for ideal combustion is supplied by one injection.

When engine speed reaches 6,800 rpm or higher, fuel injection is shut off in order to prevent the engine from over revving.

**DESCRIPTION AND OPERATION (Continued)**

For maximum efficiency and for calibration accuracy, the injector must have very little mechanical working lag of the needle valve for quick response. For this purpose the injection coil has very few windings and low inductance. Such a coil can, however, be burned out due to excessive current flow when energized. When checking the injectors, never apply battery voltage (12 volts) directly to the solenoid coil.

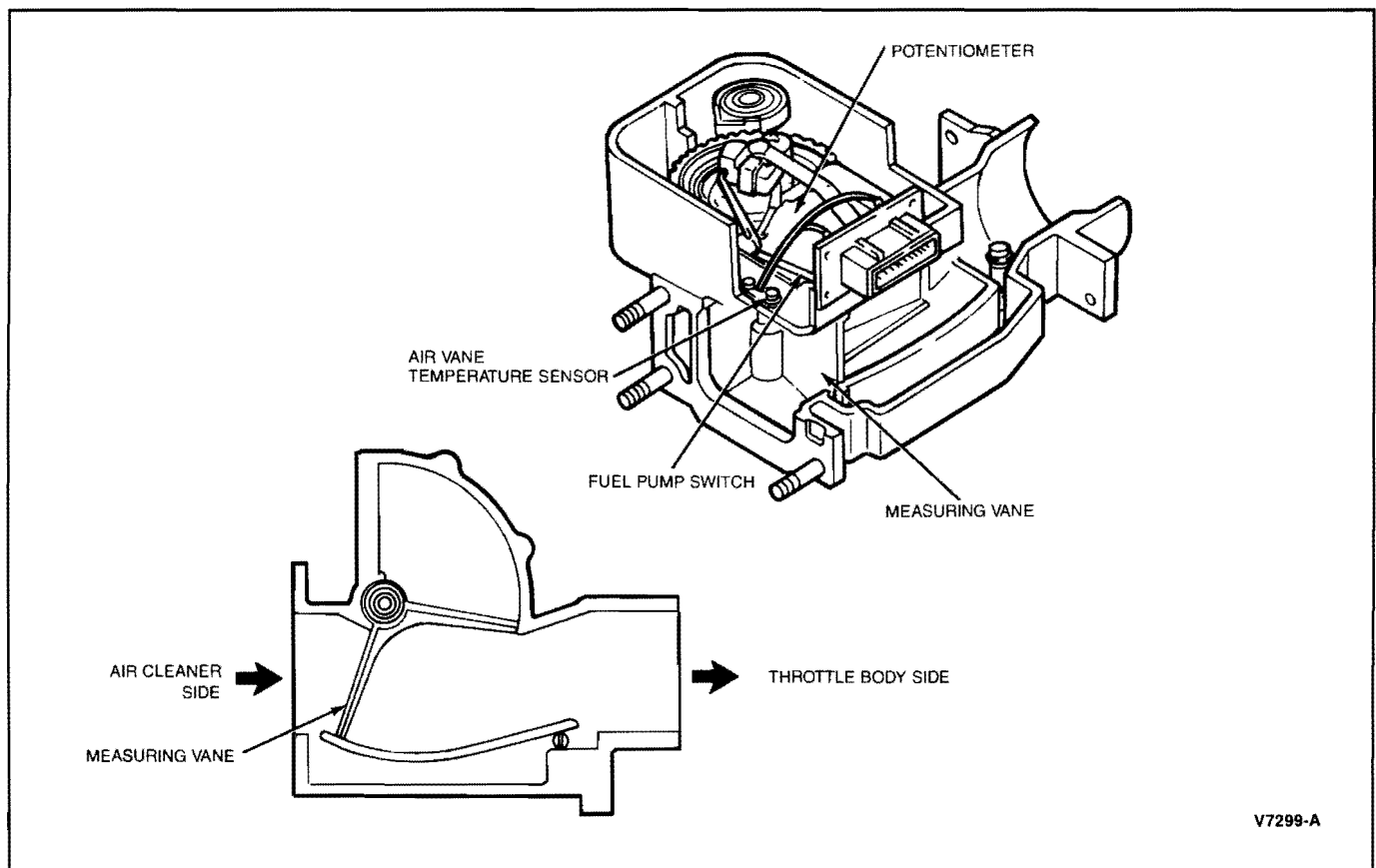
**Air Induction System**

The air induction system supplies filtered air to the engine to mix with the fuel for combustion purposes. It consists of an air cleaner assembly, vane air flow meter, throttle body, intake manifold and a Bypass Air Control (BAC) valve.

The vane air flow meter mounted to the air filter housing measures the amount of airflow and air temperature and provides this information to the ECA.



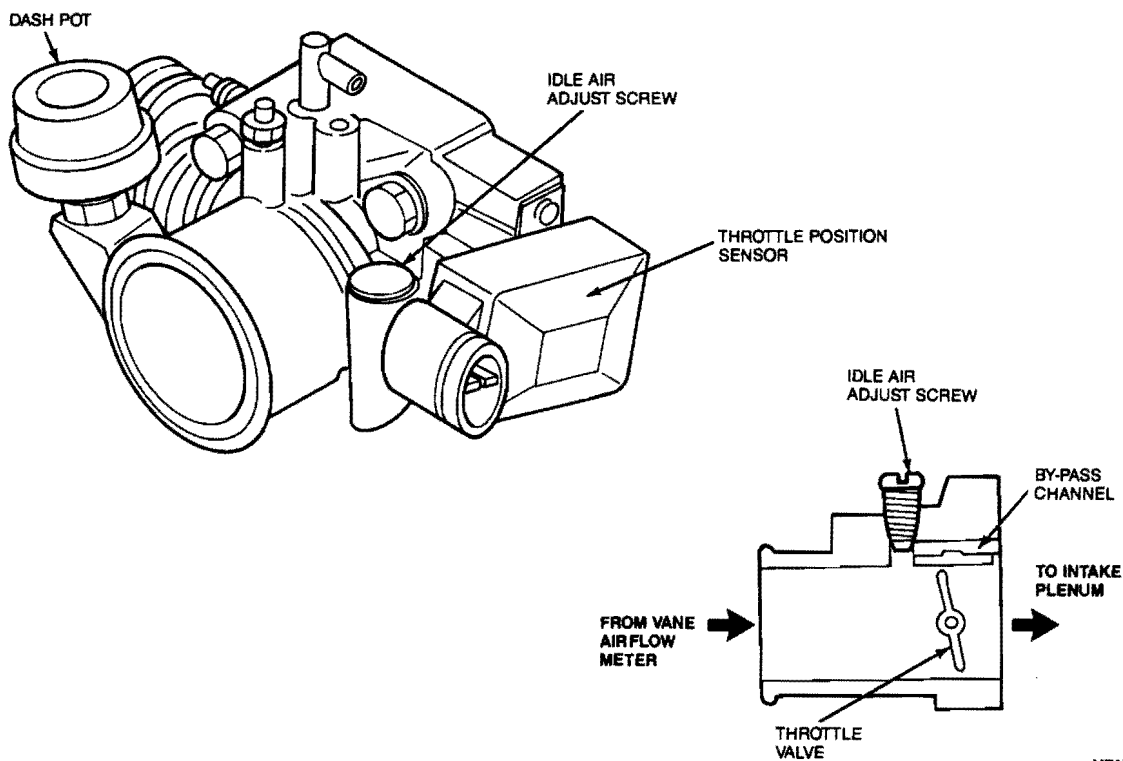
## DESCRIPTION AND OPERATION (Continued)



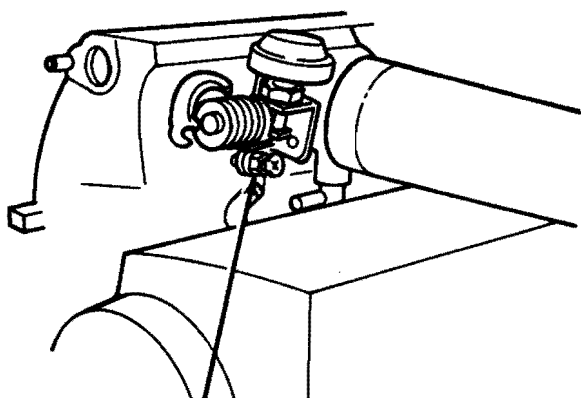
The throttle body controls intake air quantities and consists of an aluminum housing, throttle valve, throttle position sensor and a dash pot. An idle air bypass system supplies small quantities of air during engine idle. A throttle position sensor is mounted on the LH side of the throttle body. It detects the throttle valve position and provides the ECA with this information. A dashpot is mounted on the RH side of the throttle body to control throttle valve closing speed during deceleration.

**CAUTION:** Do not tamper with the throttle stop adjustment screw. Adjustment will affect driveability and may require throttle body replacement.

## DESCRIPTION AND OPERATION (Continued)



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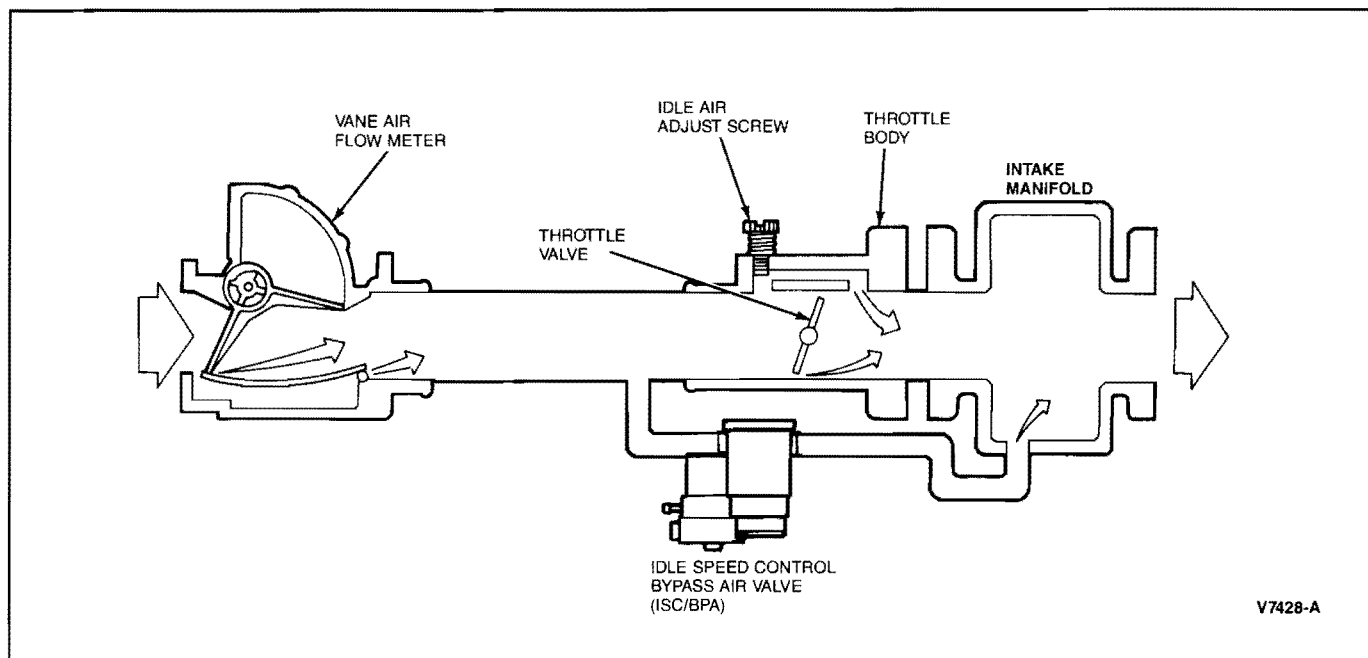
**CAUTION:**  
DO NOT ADJUST  
THROTTLE STOP SCREW

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**Air Flow**

During idle, the throttle valve is almost fully closed, so it is therefore necessary for the idle air bypass to supply air for combustion during idle. An air adjust screw is fitted in the idle air bypass to adjust intake airflow for idle speed adjustment. During off idle operation, the throttle valve controls the amount of air admitted into the engine. The ECA will increase the fuel injection output in proportion to the increased airflow to achieve the appropriate air / fuel ratios.

## DESCRIPTION AND OPERATION (Continued)

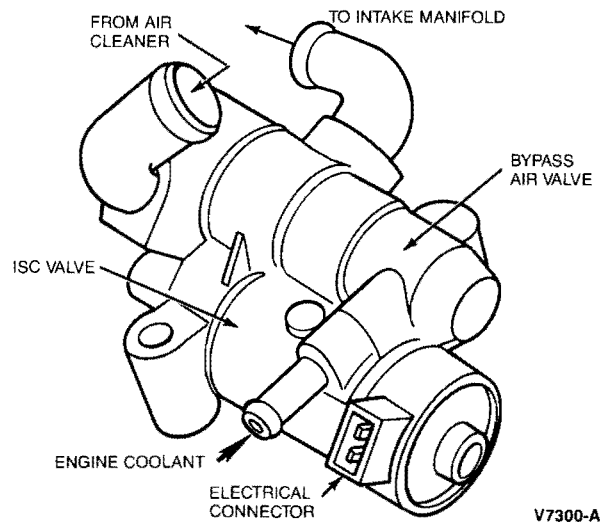
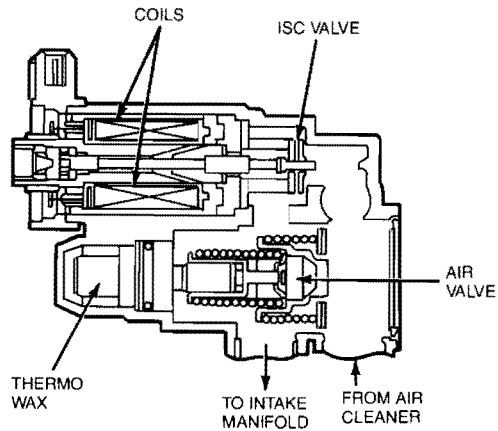
**Bypass Air Control Valve**

The Bypass Air Control (BAC) valve consists of the air bypass valve which functions only during cold engine conditions and the Idle Speed Control (ISC) valve which works throughout the entire engine range.

The air bypass valve increases idle speed during cold conditions to quickly warm up the engine. The air valve is made up of a thermo-type wax and a spring-loaded valve assembly. At engine temperatures below 140°C (60°F) the thermo wax is contracted and the air valve is open. As the engine gradually warms up, the thermo wax expands and the valve moves toward the closed position. The amount of air that passes through the valve gradually decreases as temperature increases and the engine speed gradually drops to set idle speed. At engine temperatures above 140°C (60°F) the air bypass valve is fully closed by the thermo wax.

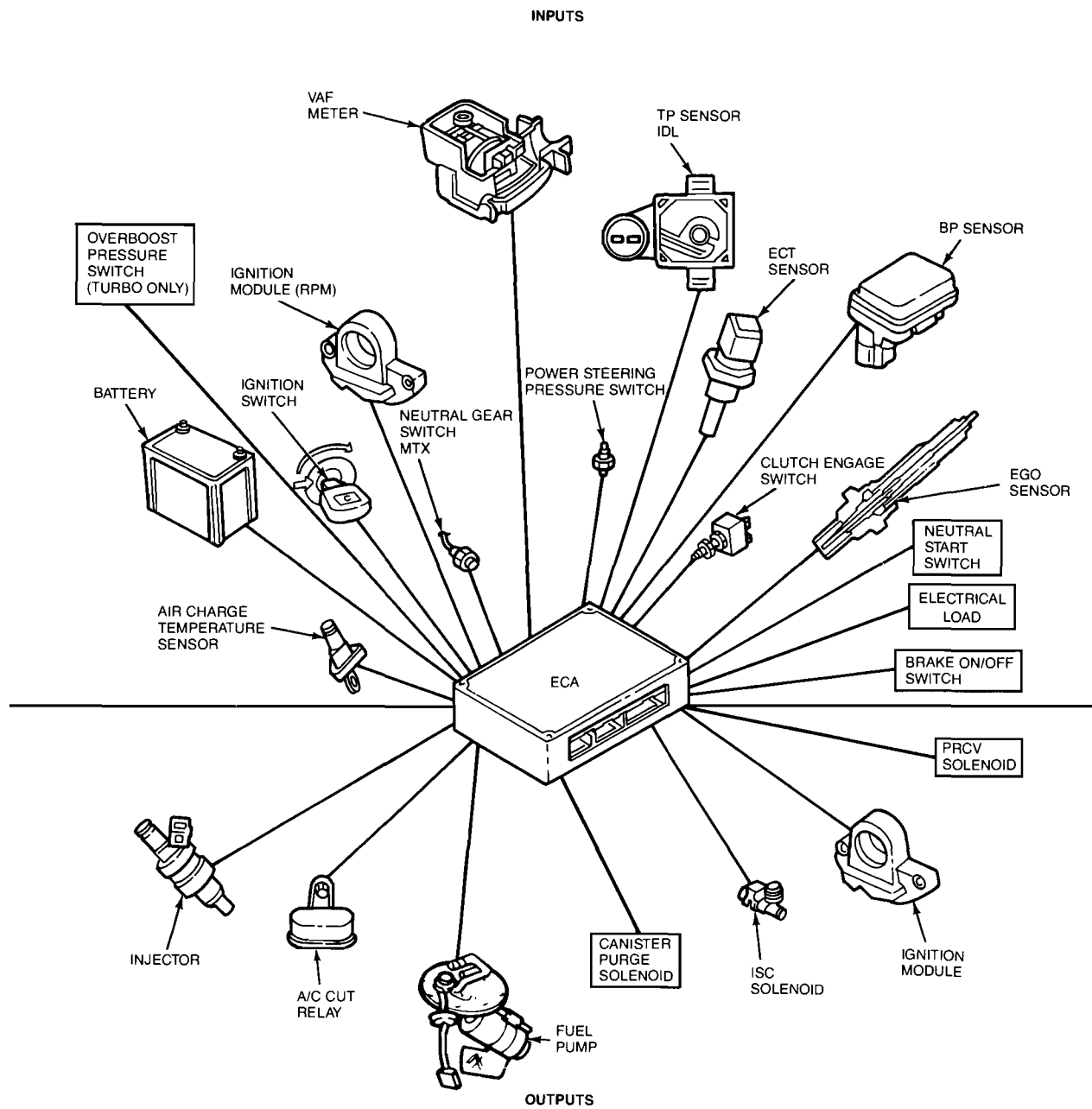
The BAC is located on the engine, mounted to the intake manifold.

The solenoid operated Idle Speed Control (ISC) valve controls the amount of bypass air to ensure proper idle speed for all operating conditions. When the engine is cold, below 140°C (60°F), air flows through both the ISC and the air bypass valve in order to maintain the projected engine speed set in the Electronic Control Assembly (ECA). During normal operation, at temperatures above 140°C (60°F), only the ISC valve controls the amount of bypass air to maintain the idle speed at the preset  $850 \pm 50$  rpm. To improve idle smoothness the ISC system controls the intake air amount detected by the air flow meter by regulating the amount of bypass air that passes through the throttle body, and thereby helps the engine to maintain a steady idle speed.

**DESCRIPTION AND OPERATION (Continued)****Electronic Engine Control**

The ECA detects the engine operating and driving conditions, and the exhaust gas oxygen content, from various switches, sensors and components and then controls the amount of fuel injected into the engine. The ECA also has control of the evaporative emission, idle speed control, ignition and deceleration systems. Refer to the appropriate section for information on these systems. The following identifies all of the inputs and outputs to and from the ECA.

## DESCRIPTION AND OPERATION (Continued)



V7433-A

## DESCRIPTION AND OPERATION (Continued)

## Relation of Inputs and Outputs

## Turbocharged Vehicles

Input Device	Output Device	Injector		Fuel Pressure Regulator Control Solenoid Valve	Idle Speed Control Bypass		Canister Purge Solenoid
		Fuel Injection Amount	Fuel Injection Timing		Bypass Air Valve	Isc Solenoid	
Ignition Coil		O	O	X	X	O	O
Vane Air Flow Meter		O	X	X	X	X	O
Idle Switch		O	X	O	X	O	X
Throttle Sensor		O	X	X	X	X	X
Engine Coolant Temperature Sensor		O	X	O	X	O	O
Vane Air Temperature Sensor		O	X	O	X	O	O
Barometric Pressure Sensor		O	X	X	X	O	O
Oxygen Sensor		O	X	X	X	O	O
Overboost Pressure Switch		O	X	X	X	X	X
Brake Light Switch		O	X	X	X	X	X
Neutral Gear and Clutch Engage Switch		O	X	O	X	O	O
Ignition Switch		O	O	O	X	X	X
A/C Switch		X	X	X	X	O	X
P/S Pressure Switch		X	X	X	X	O	X
CID Sensor		X	O	X	X	X	X
Self-Test Connector		X	X	X	X	O	X

O = Related  
X = Not-related

CV7291-A

## Naturally Aspirated Vehicles

Input Device	Output Device	Injector		Fuel Pressure Regulator Control Solenoid Valve	Idle Speed Control Bypass Air		Canister Purge Solenoid
		Fuel Injection Amount	Fuel Injection Timing		Bypass Air Valve	Isc Solenoid	
Ignition Coil		O	O	X	X	O	O
Vane Air Flow Meter		O	X	X	X	X	O
Idle Switch		O	X	O	X	O	X
Throttle Position Sensor		O	X	X	X	X	X
Engine Coolant Temperature Sensor		O	X	O	X	O	O
Vane Air Temperature Sensor		O	X	O	X	O	O
Barometric Pressure Sensor		O	X	X	X	O	O
Oxygen Sensor		O	X	X	X	O	O
Brake Light Switch		O	X	X	X	X	X
Neutral Gear and Clutch Engage Switch		O	X	O	X	O	O
Ignition Switch		O	O	O	X	X	X
A/C Switch		X	X	X	X	O	X
P/S Pressure Switch		X	X	X	X	O	X
CID Sensor		X	O	X	X	X	X
Self-Test Connector		X	X	X	X	O	X

O = Related  
X = Not-related

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## DIAGNOSIS AND TESTING

Refer to Engine / Emissions in this manual.

## ADJUSTMENTS

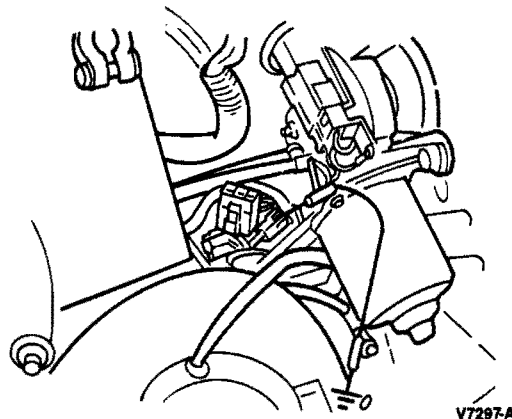
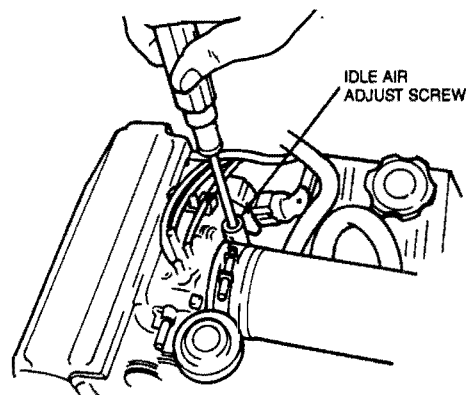
### Throttle Position Sensor

The throttle position sensor is preset at the factory. No adjustments are required.

### Idle Speed

**NOTE:** Before adjusting the idle speed, make sure the ignition timing is adjusted to specification. Turn off all lamps and other unnecessary electrical loads. This adjustment must be done while the cooling fan motor is not operating.

1. Warm up engine to normal operating temperature.
2. Attach Rotunda Dwell-Tach-Volt-Point Analyzer 059-00001 or equivalent to test connector (White: Pin 1).
3. Check idle speed on tachometer. Connect jumper wire between test connector (Green: Pin 1) and ground and turn air adjustment screw to obtain correct idle speed of 800-900 rpm.
4. Remove jumper wire.



### Idle Mixture

**NOTE:** The idle mixture screw is preset and sealed at the factory. Idle mixture cannot be adjusted.

## REMOVAL AND INSTALLATION

### Throttle Body

#### Removal

1. Disconnect negative battery cable.
2. Remove accelerator cable from throttle body.
3. Remove air duct.
4. Partially drain cooling system. Refer to Section 27-03.
5. Mark all vacuum and coolant hoses for ease of reassembly and disconnect hoses from throttle body.
6. Disconnect throttle position sensor connector.
7. Remove three retaining nuts and one retaining bolt.
8. Remove throttle body and gasket(s).

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**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Install new gasket(s) and position throttle body onto intake manifold.
2. Install three retaining nuts and one bolt and tighten to 16-23 N·m (12-17 lb-ft).
3. Connect throttle position sensor connector.
4. Connect all vacuum and coolant hoses to the throttle body in their proper location as noted during removal.
5. Install air duct.
6. Install accelerator cable.
7. Connect negative battery cable.
8. Fill cooling system. Refer to Section 27-03.

**Intake Manifold**

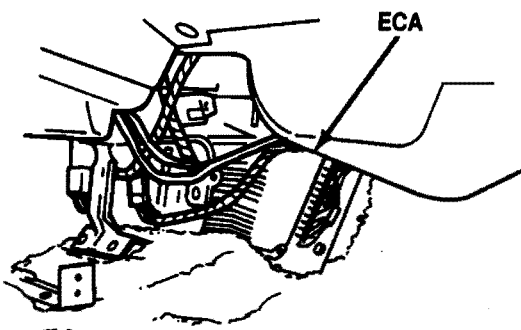
Refer to Section 21-10.

**Electronic Control Assembly****Removal**

1. Disconnect negative battery cable.
2. Pull back on front edges of both center carpet panels disengaging push pin retainers.
3. Remove retaining screws and carpet panels.
4. Remove screws retaining ECA to floorpan.
5. Remove connectors from ECA and remove ECA.

**Installation**

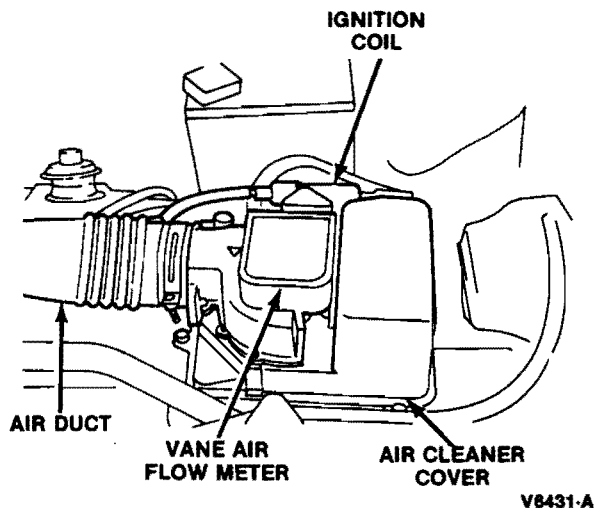
1. Install connectors to ECA.
2. Install ECA to floorpan and bracket with retaining screws.
3. Install center carpet panels.
4. Connect negative battery cable.



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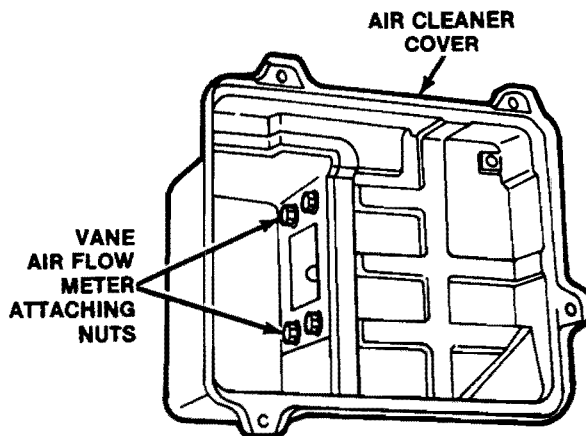
**Vane Air Flow Meter****Removal**

1. Disconnect negative battery cable.
2. Disconnect primary and secondary wires from coil.
3. Remove air duct from vane air flow meter.
4. Remove retaining bolt and ground wire from air cleaner cover.
5. Remove air cleaner cover retaining bolts.
6. Remove air cleaner cover.



V6431-A

7. Remove vane air flow meter retaining nuts from inside air cleaner cover.



V6432-A

8. Remove vane air flow meter.

**Installation**

1. Position vane air flow meter onto air cleaner cover and install retaining nuts.
2. Position air cleaner cover and install retaining bolts.
3. Install ground wire with retaining bolt.



**REMOVAL AND INSTALLATION (Continued)**

4. Install air duct and secure with clamp.
5. Connect coil primary and secondary wires.
6. Connect negative battery cable.

**Fuel Injectors****Removal**

1. Relieve fuel line pressure as follows:
  - a. Remove back seat cushion. Refer to Section 41-20.
  - b. Run engine while disconnecting fuel pump connector.
  - c. Run engine until it stalls. The fuel pressure is now relieved.
2. Remove throttle body as outlined.
3. Disconnect fuel supply line from fuel rail.
4. Disconnect fuel return line from pressure regulator.
5. Remove electrical connectors at injectors.
6. Remove retaining bolts and fuel rail.
7. Remove fuel injectors.
8. Remove O-rings from injectors.

**Installation**

1. Install new O-rings onto injectors and lubricate with clean engine oil.
2. Position fuel injectors into cylinder head.
3. Position fuel rail onto fuel injectors and install retaining bolts. Tighten to 19-25 N·m (14-19 lb-ft).
4. Install electrical connectors to fuel injectors.
5. Install fuel return line onto pressure regulator.
6. Connect fuel supply line onto fuel rail.
7. Install throttle body as outlined.
8. Connect fuel pump connector.
9. Install rear seat cushion. Refer to Section 41-20.

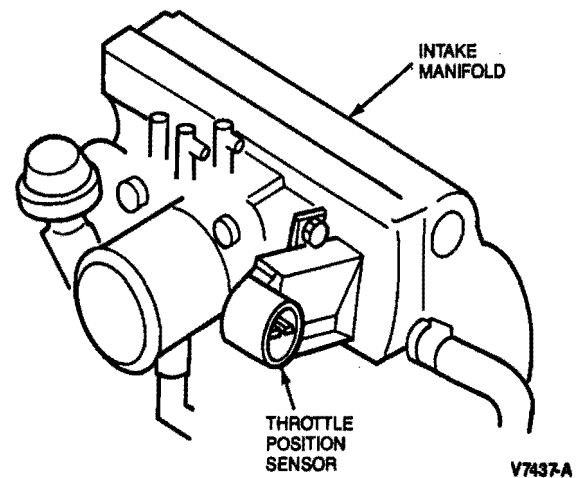
**Throttle Position Sensor****Removal**

1. Disconnect negative battery cable.

2. Disconnect electrical connector at sensor.
3. Remove two hold-down bolts.
4. Pull sensor from throttle body.

**Installation**

1. Position sensor onto throttle body.
2. Install two hold-down bolts finger-tight.
3. Adjust sensor as outlined.
4. Connect electrical connector at sensor.
5. Connect negative battery cable.

**Engine Coolant Temperature Sensor****Removal**

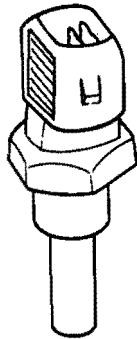
1. Disconnect negative battery cable.
2. Drain cooling system. Refer to Section 27-03.
3. Disconnect temperature sensor electrical connector.
4. Remove temperature sensor from intake manifold.

**Installation**

1. Install sensor into cylinder head.
2. Connect temperature sensor electrical connector.
3. Fill cooling system. Refer to Section 27-03.

**REMOVAL AND INSTALLATION (Continued)**

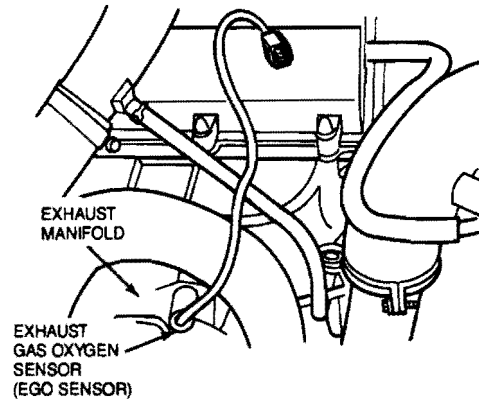
4. Connect negative battery cable.



ENGINE COOLANT  
TEMPERATURE SENSOR  
(ECT)

V7438-A

3. Connect negative battery cable.



V7430-A

**BAC Valve****Removal**

1. Disconnect negative battery cable.
2. Disconnect electrical connector at BAC valve.
3. Drain cooling system. Refer to Section 27-03.
4. Remove two coolant hoses and clamps.
5. Remove two air hoses and clamps.
6. Remove retaining bolts and BAC valve assembly.

**Installation**

1. Position BAC valve and install retaining bolts.
2. Install two air hoses and secure with clamps.
3. Install two coolant hoses and secure with clamps.
4. Connect electrical connector at BAC valve.
5. Fill cooling system. Refer to Section 27-03.
6. Connect negative battery cable.

**BP Sensor****Removal**

1. Disconnect negative battery cable.
2. Disconnect electrical connector.
3. Remove retaining nut and sensor.

**Installation**

1. Install sensor with retaining nut. Tighten to 6-10 N·m (4.5-7 lb-ft).
2. Connect electrical connector at sensor.
3. Connect negative battery cable.

**Oxygen Sensor****Removal**

1. Disconnect negative battery cable.
2. Disconnect sensor electrical connector.
3. Remove oxygen sensor.

**Installation**

1. Install oxygen sensor into manifold.
2. Connect sensor electrical connector.

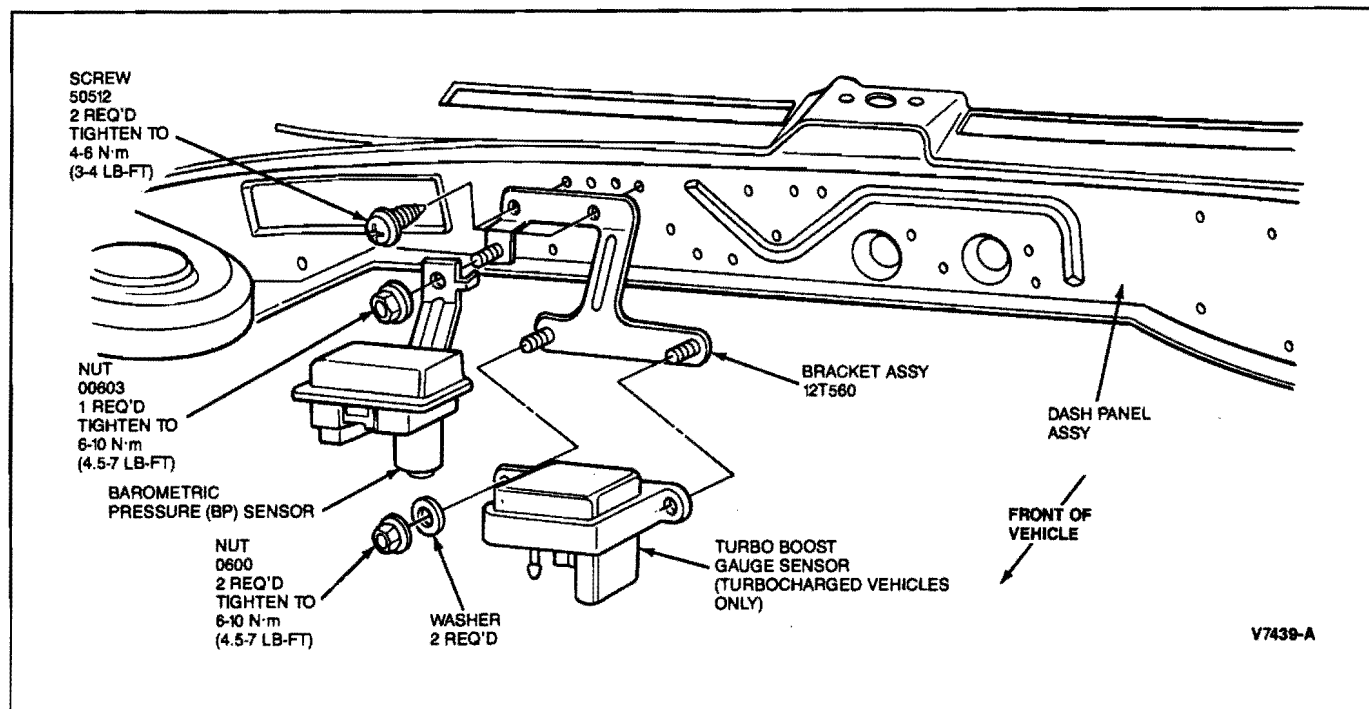
**Turbo Boost Gauge****Turbocharged Vehicles****Removal**

1. Disconnect negative battery cable.
2. Disconnect vacuum hose and electrical connector.
3. Remove two retaining nuts and remove sensor.

**Installation**

1. Position sensor and install two retaining nuts. Tighten to 6-10 N·m (4.5-7 lb-ft).
2. Connect electrical connector and vacuum hose.
3. Connect negative battery cable.

## REMOVAL AND INSTALLATION (Continued)

**Clutch Switch****MTX Only**

Refer to Section 16-02.

**Neutral Start Switch****ATX Only**

Refer to Section 28-01.

## SPECIFICATIONS

**TORQUE SPECIFICATIONS**

Description	N·m	Lb-Ft
Throttle Body Retaining Nuts and Bolt	16-23	12-17
BP Sensor Retaining Nut	6-10	4.5-7
Map Sensor Retaining Nuts	6-10	4.5-7
Fuel Rail Retaining Bolts	19-25	14-19

## SPECIAL SERVICE TOOLS

**ROTUNDA EQUIPMENT**

Model	Description
059-00001	Dwell-Tach-Low Volt Points Analyzer
059-00010	Inductive Dwell-Tach-Volts Ohms Tester

# SECTION 24-35 Fuel Pump—Electric

SUBJECT	PAGE	SUBJECT	PAGE
<b>DESCRIPTION</b>		<b>REMOVAL AND INSTALLATION</b>	
Control Circuit .....	24-35-2	Fuel Pump .....	24-35-3
Fuel Pump .....	24-35-1	Fuel Pump Relay .....	24-35-4
Pressure Regulator .....	24-35-2	Pressure Regulator .....	24-35-3
		<b>VEHICLE APPLICATION</b> .....	24-35-1

## VEHICLE APPLICATION

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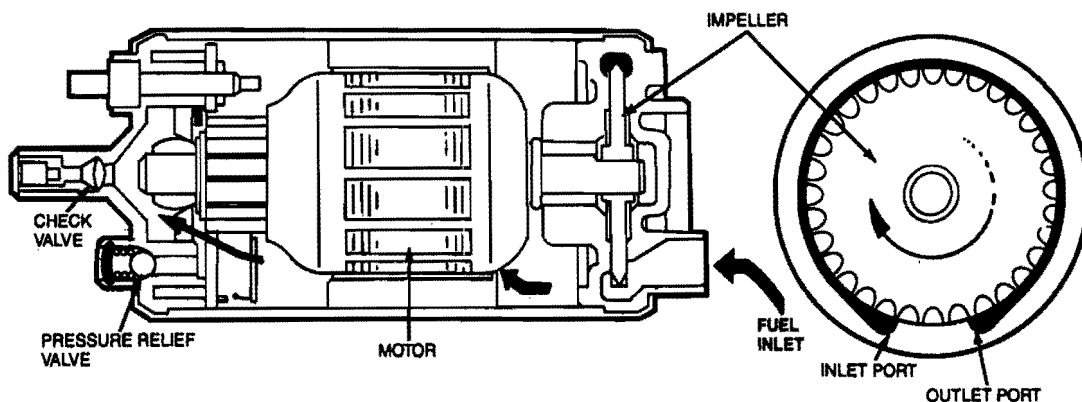
## DESCRIPTION

All vehicles with electronic fuel injection are equipped with an electric fuel pump. The fuel pump system consists of an electric fuel pump, a pressure regulator, a fuel pump relay, fuel pump switch and a fuel pump shut-off switch (inertia switch).

### Fuel Pump

The fuel pump is mounted on the fuel sending unit assembly inside the fuel tank. The pump assembly includes a check valve located at the fuel pump outlet. The function of this valve is to maintain pressure in the system after the ignition is turned to the OFF position. The pressure retention helps prevent hot starting problems. A pressure relief valve is provided to regulate the maximum fuel pump outlet pressure.

The fuel pump is protected at its inlet by a filter element. This element filters dirt and contaminants which could plug or damage the internal pump components. Refer to Section 24-51 for fuel filter service.

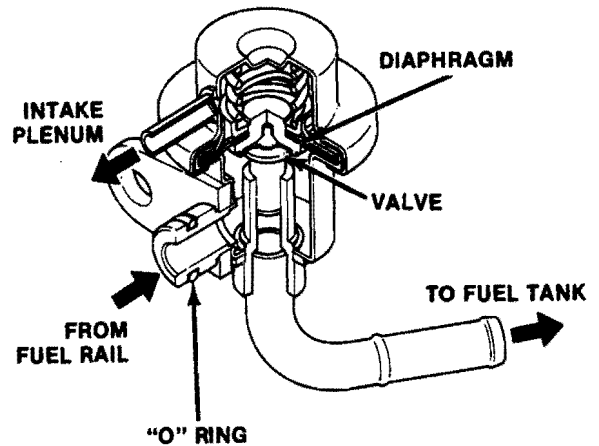


## DESCRIPTION (Continued)

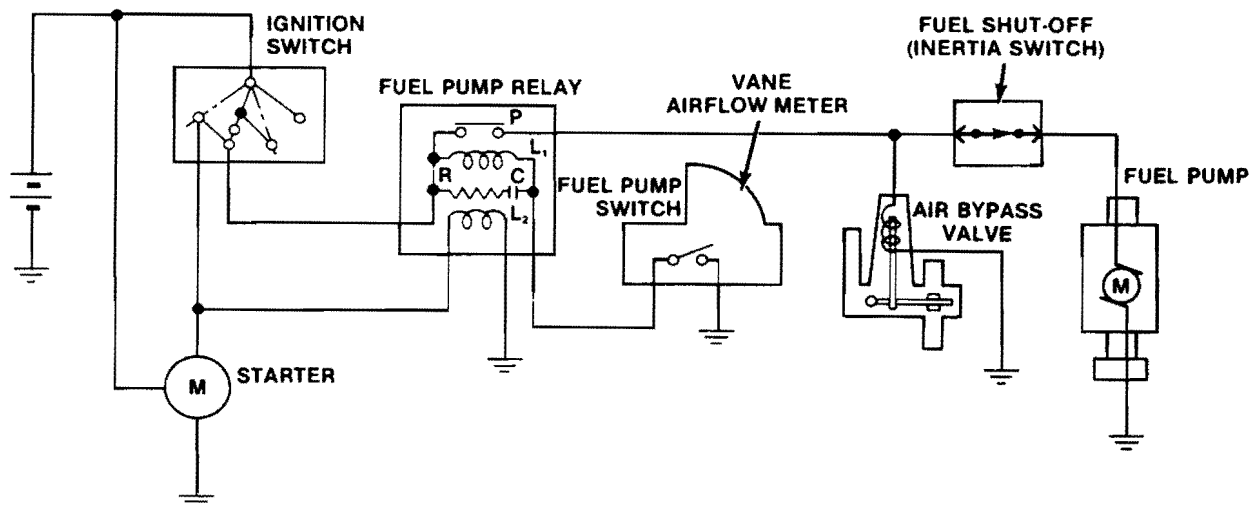
**Pressure Regulator**

The pressure regulator is mounted to the return line end of the fuel rail. It is controlled by manifold vacuum and will always maintain fuel pressure constantly 250 kPa (36.3 psi) above intake manifold pressure. When intake manifold vacuum is low (fuel demand high) spring pressure inside the regulator causes the valve to partially close which will increase fuel pressure in the fuel rail. When intake manifold vacuum is high (fuel demand low) vacuum acting on the diaphragm compresses the spring, opening the valve further. Return fuel flow increases resulting in lower fuel pressure in the fuel rail.

A Pressure Regulator Control Valve (PRCV) is used to aid in hot starting. During hot starting, the PRCV cuts off manifold vacuum to the fuel pressure regulator. This permits an increase in fuel pressure resulting in more fuel for starting. After the engine is started, vacuum is returned to the pressure regulator and fuel pressure is lowered to regular operating pressure.



V8455-A



V6458-A

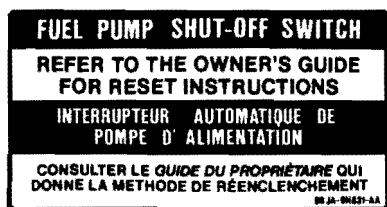
**Control Circuit**

The fuel pump switch and fuel pump relay work together to control fuel pump operation. The fuel pump switch is located inside the vane airflow meter and is not serviceable. The fuel pump relay is mounted under the center of the instrument panel between the panel and the floor. The fuel pump only operates when the engine is cranking or running. It does not operate when the engine is not running, even with the ignition switch turned to the ON position. When cranking, power from the ignition switch causes the fuel pump relay to close the feed circuit to the fuel pump. The fuel pump switch will also close the fuel pump relay whenever airflow is detected by the vane airflow meter.

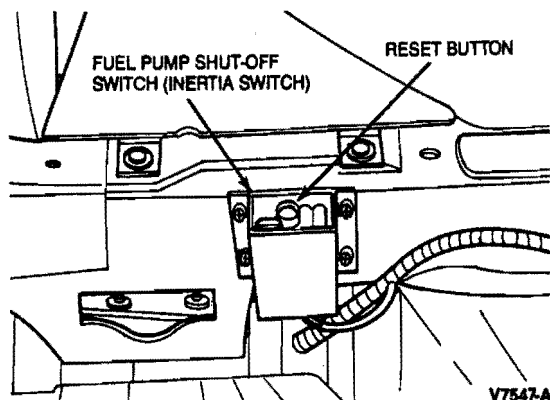
A resistor and a capacitor are built into the fuel pump relay in addition to the coils. These permit discharge current to flow through the coil in the event that the fuel pump switch is momentarily opened due to the sudden loss of airflow during rapid deceleration. This will provide uninterrupted fuel pump operation.

## DESCRIPTION (Continued)

A fuel pump shut-off switch (inertia switch) is connected in series with the fuel pump switch circuit and will stop fuel pump operation in the event of a major collision or vehicle rollover. The switch is mounted to the LH side of the spare tire well. The reset button must be pushed to reset the switch once it has been triggered.

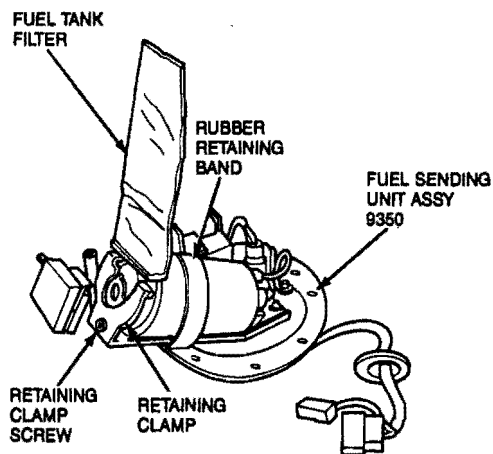


V7298-A



## Installation

1. Install fuel pump to sending unit bracket and secure with retaining clamp.
2. Install rubber retaining band.
3. Connect fuel pump wires to sending unit.
4. Install sending unit onto fuel tank. Refer to Section 33-20.



V7548-A

## REMOVAL AND INSTALLATION

## Fuel Pump

## Removal

1. Relieve the fuel pressure as follows:
  - a. Remove rear seat cushion. Refer to Section 41-20.
  - b. Run engine while disconnecting fuel pump electrical connector.
  - c. Allow engine to stall. Fuel pressure is now relieved.
2. Remove fuel tank sending unit. Refer to Section 33-20.
3. Remove two fuel pump wires from sending unit.
4. Remove retaining clamp screw and remove clamp.
5. Remove rubber retaining band.
6. Remove fuel pump from sending unit.

## Pressure Regulator

## Removal

1. Relieve the fuel pressure as follows:
  - a. Remove rear seat cushion. Refer to Section 41-20.
  - b. Run engine while disconnecting fuel pump electrical connector.
  - c. Allow engine to stall. Fuel pressure is now relieved.
2. Disconnect vacuum hose from pressure regulator.
3. Disconnect the fuel return hose.
4. Remove the retaining bolts and remove the pressure regulator.
5. Remove the O-ring from the pressure regulator.

## Installation

1. Install a new O-ring onto the pressure regulator and lubricate with engine oil.
2. Position the pressure regulator into the fuel rail and install the retaining bolts.
3. Connect the fuel return hose onto the pressure regulator and secure with clamp.
4. Connect vacuum hose to pressure regulator.

**REMOVAL AND INSTALLATION (Continued)**

5. Connect fuel pump electrical connector.
6. Install rear seat cushion. Refer to Section 41-20.

**Fuel Pump Relay****Removal**

1. Disconnect negative battery cable.
2. Pull back on the front edges of the center carpet panel, disengaging the push pin retainers.
3. Remove the attaching screw and carpet panel.

4. Disconnect relay connector.
5. Remove relay connector.

**Installation**

1. Install relay with retaining bolt.
2. Connect relay connector.
3. Install the center carpet panel with the center attaching screw and secure with two push pins.
4. Connect negative battery cable.

# SECTION 24-41 Air Cleaner and Duct Systems

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	24-41-1	TESTING.....	24-41-1
REMOVAL AND INSTALLATION		VEHICLE APPLICATION .....	24-41-1
Air Cleaner Assembly.....	24-41-2		
Air Filter .....	24-41-1		

## VEHICLE APPLICATION

Capri.

## DESCRIPTION

The air filter housing is located at the left front of the engine compartment. It houses a dry type replaceable air cleaner element and supplies the engine with filtered air for combustion. The vane air flow (VAF) meter and ignition coil are attached to the air cleaner cover.

## TESTING

Refer to Engine / Emissions in this manual.

## REMOVAL AND INSTALLATION

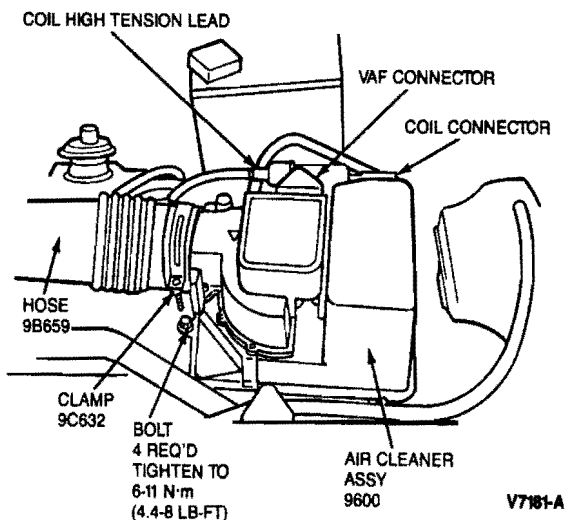
### Air Filter

#### Removal

1. Remove negative battery cable.
2. Disconnect coil high tension lead, coil connector and VAF connector.
3. Remove clamp and position intake hose out of the way.
4. Remove four bolts and air cleaner cover.
5. Remove air cleaner element.

#### Installation

1. Install air cleaner element and cover. Tighten retaining bolts.
2. Connect intake hose and tighten clamp.
3. Install VAF and coil connectors. Connect coil high tension lead.
4. Connect negative battery cable.
5. Start engine and check for vacuum leaks. Service as required.

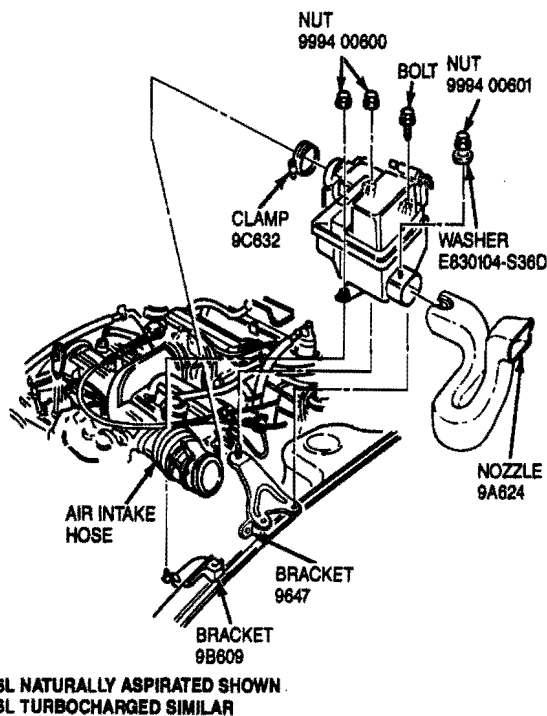




## REMOVAL AND INSTALLATION (Continued)

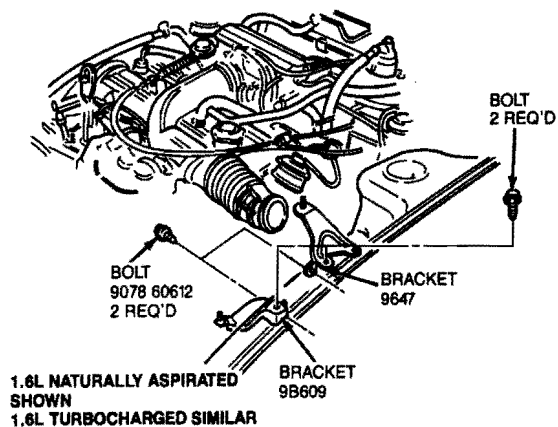
**Air Cleaner Assembly****Removal**

1. Remove negative battery cable.
2. Disconnect coil high tension lead, coil connector and VAF connector.
3. Remove clamp and position intake hose out of the way.
4. Remove two nuts, one bolt and air cleaner assembly.
5. Loosen nut and remove nozzle, if required.
6. Remove two nuts, one bolt and air cleaner assembly.



V7182-A

7. Remove bolts and brackets if necessary,



V7183-A

**Installation**

1. Install brackets with bolts, if removed.
2. Install nozzle with nut and washer, if removed.
3. Install air cleaner assembly with two bolts and one nut. Tighten securely.
4. Connect intake hose and tighten clamp.
5. Install VAF and coil connectors. Connect coil high tension lead.
6. Connect negative battery cable.
7. Start engine and check for vacuum leaks. Service as required.

# SECTION 24-45 Turbocharger

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	24-45-1	REMOVAL AND INSTALLATION (Cont'd.)	
DIAGNOSIS AND TESTING		Intercooler .....	24-45-7
Bearing Clearance Check .....	24-45-9	Intercooler Hoses .....	24-45-8
LUBRICATION .....	24-45-1	Oil Return Hose .....	24-45-7
OPERATION		Oil Supply Line .....	24-45-6
Air-Fuel/Exhaust Gas Flow .....	24-45-2	Overboost Pressure Switch .....	24-45-8
Boost Control, Automatic .....	24-45-2	Turbocharger .....	24-45-3
REMOVAL AND INSTALLATION		SPECIFICATIONS .....	24-45-13
Coolant Return Hose .....	24-45-7	VEHICLE APPLICATION .....	24-45-1
Coolant Supply Hose and Fitting .....	24-45-7		

## VEHICLE APPLICATION

Capri.

## DESCRIPTION

The 1.6L DOHC electronic fuel injected, turbocharged, intercooled engine offers performance comparable to a larger displacement, naturally aspirated engine, but offers substantially better fuel economy. Related design improvements include precise control of port injected fuel metering with computer controlled spark and engine idle speed.

The turbocharger is an "on-demand" system that boosts engine output at high-load / high-speed conditions, but has little effect on fuel economy at moderate to light load conditions.

The intercooler is mounted next to the radiator. The intercooler cools intake air from the turbocharger before it enters the engine, providing for a denser air charge for increased engine performance.

**NOTE:** The turbocharger is not just a bolt-on option. It is a part of a highly integrated engine turbocharging system. Turbocharged parts and equipment are not interchangeable with similar parts on non-turbocharged engines.

The turbocharger is mounted on the lower left (front) side of the engine.

The turbocharger consists of five major components:

- The ACTUATOR is a spring-loaded diaphragm device that senses and controls the pressure in the compressor discharge.
- The COMPRESSOR is a centrifugal, radial outflow type.
- The TURBINE is a centripetal, radial inflow type, which drives the compressor.
- The integral WASTEGATE ASSEMBLY, which allows a portion of the exhaust gas to bypass the turbine wheel limiting compressor speed, is controlled automatically to limit boost pressure.
- The CENTER HOUSING supports the bearings, the compressor, turbine wheels and oil seals.

## LUBRICATION

The turbocharger is lubricated by engine oil. Because a turbocharger operates at speeds up to 150,000 revolutions per minute, lubrication of the bearings, which support the shaft, is important for cooling and friction reduction. As with any engine, accelerating the engine to top rpm immediately after starting can damage the engine and / or turbocharger. In the same respect, immediately shutting down an engine that has been operating at a higher rpm for an extended period of time can damage the engine and / or turbocharger.

1. Turbocharger oil pressure is obtained through an adapter fitting on the rear of the engine.
2. Oil pressure is supplied to the turbocharger through an oil supply tube.
3. Oil enters the turbocharger through a controlled orifice in the center housing, which controls the flow of oil into the turbocharger.

**NOTE:** Excessive oil pressure can cause oil seal leaks in the turbocharger.

## LUBRICATION (Continued)

4. Center housing bearings are lubricated through oil passages which direct oil to the bearings.
5. Bearings are drilled to improve oil circulation.
6. A piston ring seal is used at each end of the turbocharger shaft to prevent engine oil leakage into the compressor and turbine housing.

**CAUTION: Exhaust system suction can cause oil to leak past these seals during diagnosis.**

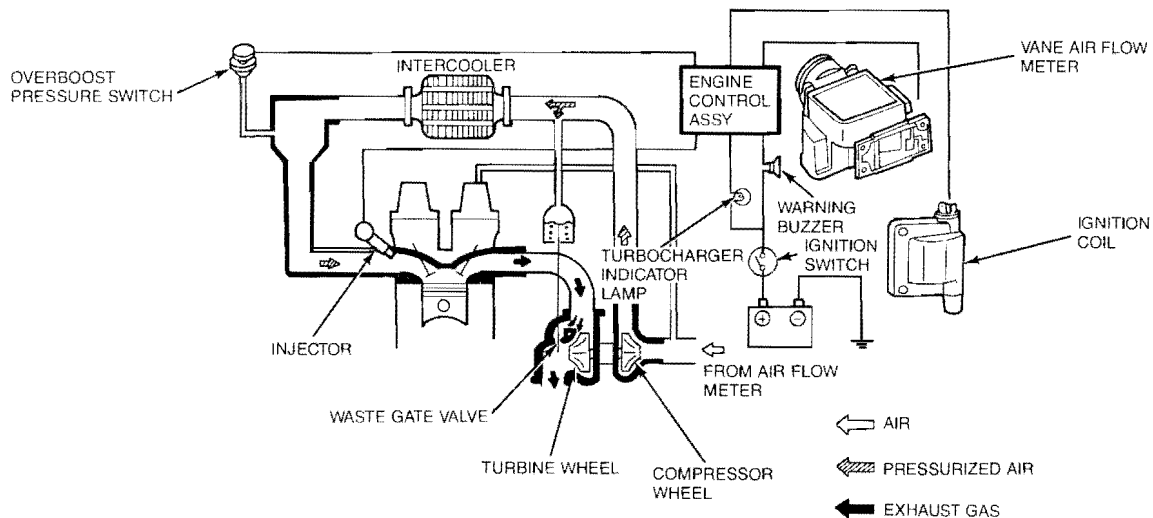
7. Oil drains from the turbocharger through a return port in the bottom of the center housing.
8. Oil returns to the engine through an oil return line.

## OPERATION

### Air-Fuel/Exhaust Gas Flow

A turbocharger enables an engine to consume a denser air-fuel mixture. This increases horsepower and torque (on demand) in comparison with a non-turbocharged engine of the same displacement. Also, it gives better fuel economy than larger displacement engines of comparable horsepower ratings.

The fuel injectors are located in the intake manifold. Fuel is introduced downstream of the compressor.



V7440-A

### Boost Control, Automatic

Boost is controlled by the wastegate. The wastegate closes to optimize vehicle performance, opening only to limit boost to maximum specified levels.

## REMOVAL AND INSTALLATION

The turbocharger is serviced by replacement only. Before starting any turbocharger unit service / removal procedure, clean the area around turbocharger assembly with non-caustic solution.

Cover openings of engine assembly and turbocharger connections to prevent entry of foreign material while turbocharger is off the engine.

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When removing turbocharger assembly, take special care not to bend, nick, or in any way damage the turbine or compressor wheel blades. Any damage may result in rotating assembly imbalance, and failure of the bearings and oil seals.

Any time a basic engine bearing (main bearing, connecting rod bearing, camshaft bearing) has been damaged in a turbocharged engine, the oil and oil filter should be changed as a part of the service procedure. In addition, the turbocharger should be flushed with clean engine oil to reduce the possibility of contamination.

**CAUTION: Interruption or contamination of the oil supply to the bearings in the center housing, which support the rotating assembly, can result in severe turbocharger damage.**

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## REMOVAL AND INSTALLATION (Continued)

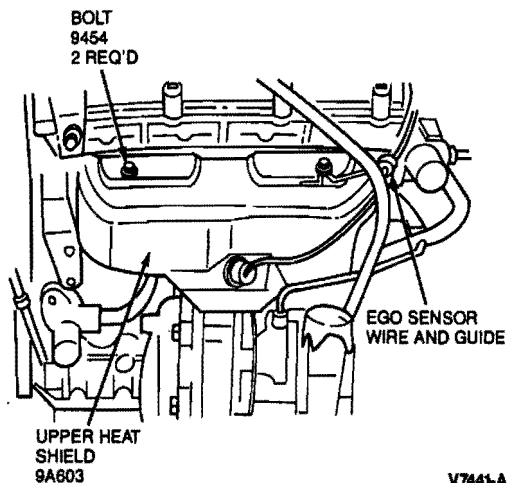
After changing the oil and oil filter on a turbocharged engine, or when performing any service operation, start the engine and let idle for 30-60 seconds before driving.

### Turbocharger

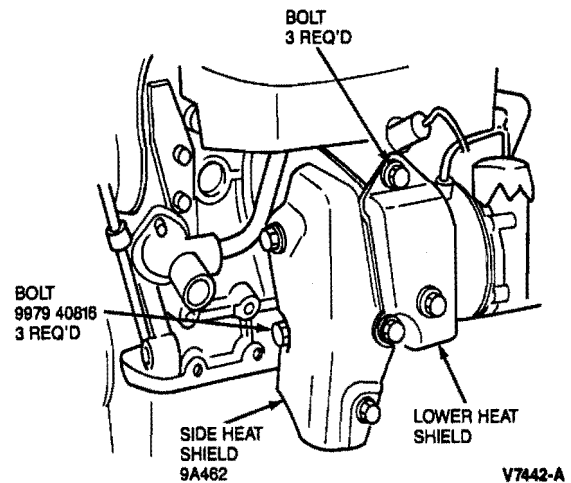
#### Removal

1. Disconnect negative battery cable.
2. Drain cooling system. Refer to Section 27-03.
3. Remove throttle body air intake tube.
4. Disconnect intercooler hose from turbocharger assembly and position both intercooler hoses out of the way.
5. Remove EGO sensor connector from its retaining clip and disconnect EGO sensor.
6. Remove three bolts retaining lower heat shield to turbocharger and remove lower heat shield.
7. Remove two bolts retaining upper heat shield to exhaust manifold and remove upper heat shield.

NOTE: Feed EGO sensor wire and guide through upper heat shield.

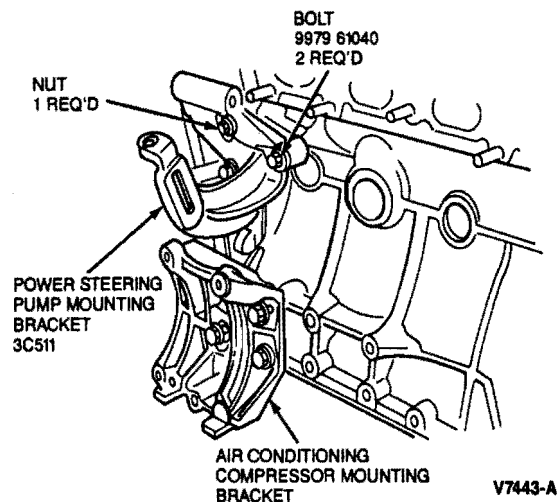


8. Remove three bolts retaining side heat shield to turbocharger and remove side heat shield.



NOTE: It will be necessary to remove the power steering pump and mounting bracket to access the lower LH exhaust manifold retaining nut and to remove exhaust manifold from studs.

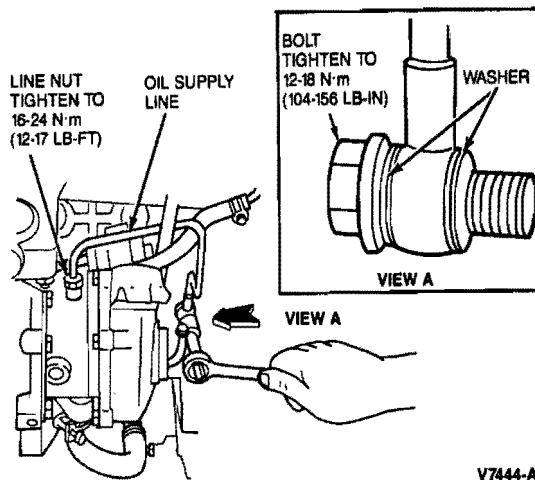
9. Remove power steering belt. Refer to Section 27-02.
10. Remove power steering pump through bolt and remove nut and bolt from adjuster.
11. Pull pump from mounting bracket and position out of the way.
12. Disconnect lower radiator hose from water pump.
13. Position power steering pump to access mounting bracket retaining bolts and nut.
14. Remove two bolts and one nut retaining mounting bracket to engine and remove bracket.



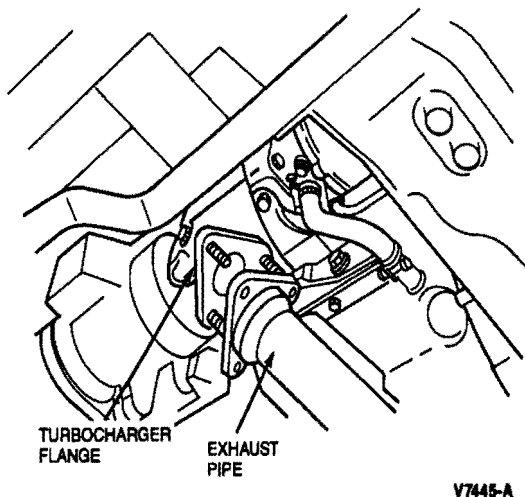
15. Remove two screws retaining air cleaner duct tube, loosen clamp at turbocharger and position duct tube out of the way.

## REMOVAL AND INSTALLATION (Continued)

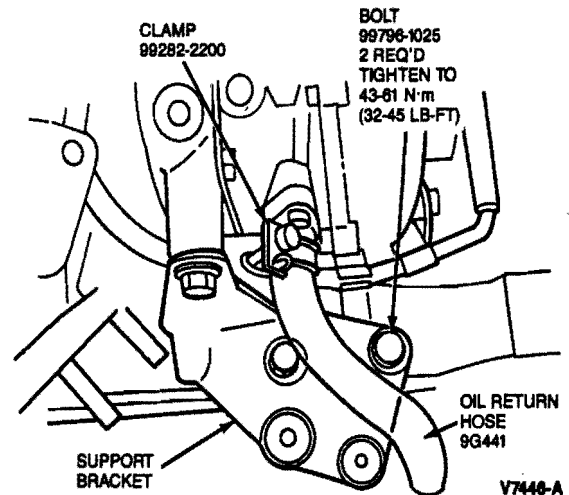
16. Disconnect coolant return hose at turbocharger.
17. Remove bolt and brass sealing washers retaining oil supply line at engine block.



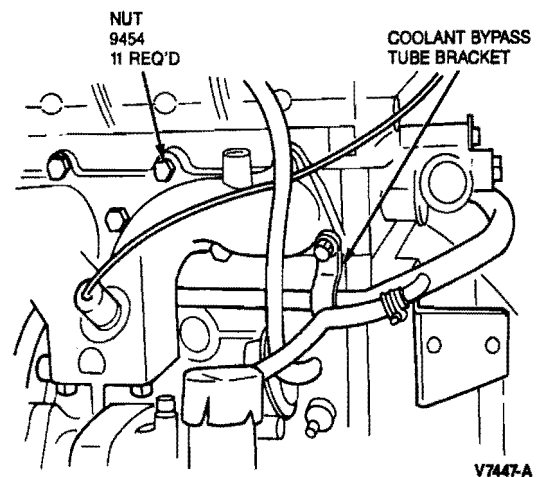
18. Raise vehicle on a hoist.
19. Remove three retaining nuts and washers from exhaust pipe flange.
20. Remove two bolts retaining exhaust hanger to engine block.
21. Slide off two rubber exhaust hangers at catalyst.
22. Pull downward on exhaust pipe and to the LH side of vehicle.



23. Disconnect oil return hose at turbocharger.
24. Disconnect coolant return hose at turbocharger.
25. Remove two retaining bolts from turbocharger support bracket.



26. Remove two bolts retaining coolant bypass tube outlet to water pump.
27. Lower vehicle.
28. Loosen retaining clamp bolt on coolant bypass tube at rear of cylinder head.
29. Remove 11 retaining nuts from exhaust manifold.
30. Pull coolant bypass tube bracket from exhaust stud and position tube out of the way.



31. Grasp exhaust manifold, pull off studs and move assembly slightly to the RH side of engine compartment to clear cooling fan, and remove from vehicle.

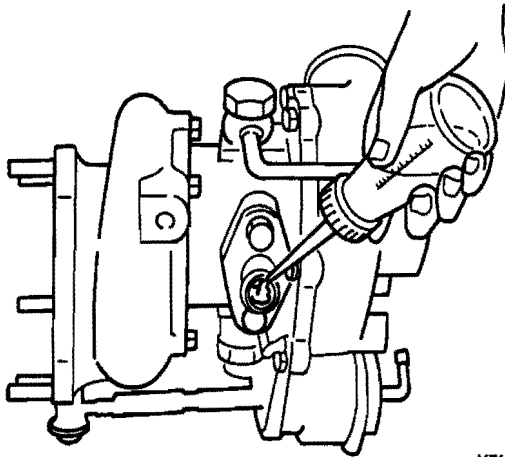
32. Working on bench, remove four nuts retaining turbocharger to exhaust manifold, separate assembly and discard gasket.

NOTE: When reinstalling the turbocharger, perform the following:

- a. Remove all gaskets and sealant.

## REMOVAL AND INSTALLATION (Continued)

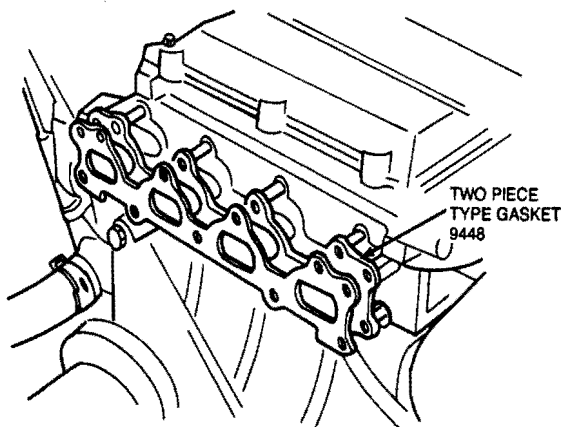
- b. Use new gaskets.
- c. Add 25cc (1.53 cu in) of oil in the oil passage of the turbocharger.



V7452-A

## Installation

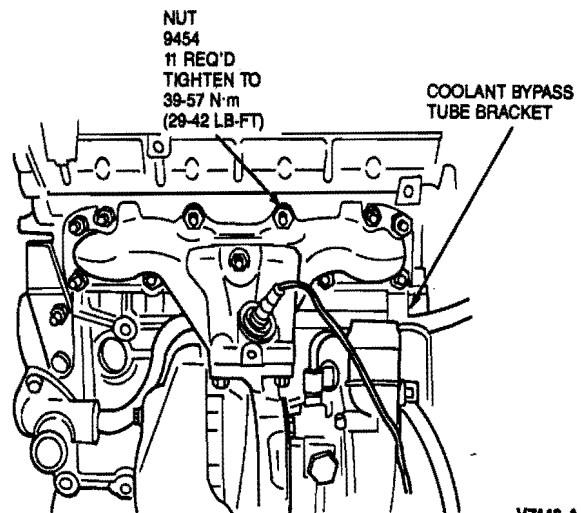
1. Position new gasket on exhaust manifold and install turbocharger onto studs.
  2. Install four retaining nuts and tighten to 27-33 N·m (20-25 lb-ft).
- NOTE: Use only the specified nuts to mount the turbocharger to the exhaust manifold.
3. Remove oil supply line from turbocharger.
  4. Position new exhaust gasket on cylinder head.



V7448-A

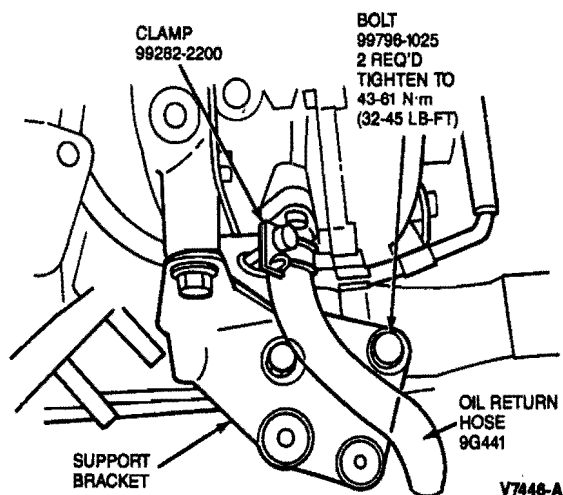
5. Carefully position turbocharger assembly in engine compartment and slide exhaust manifold onto studs.
6. Position heater tube bracket onto exhaust stud.

7. Install 11 retaining nuts onto exhaust manifold and tighten to 39-57 N·m (29-42 lb-ft).



V7449-A

8. Tighten heater tube retaining clamp bolt securely.
9. Raise vehicle.
10. Position new gasket and install two retaining bolts on heater tube outlet. Tighten bolts to 19-25 N·m (14-19 lb-ft).
11. Install two retaining bolts into turbocharger support bracket. Tighten bolts to 43-61 N·m (32-45 lb-ft).

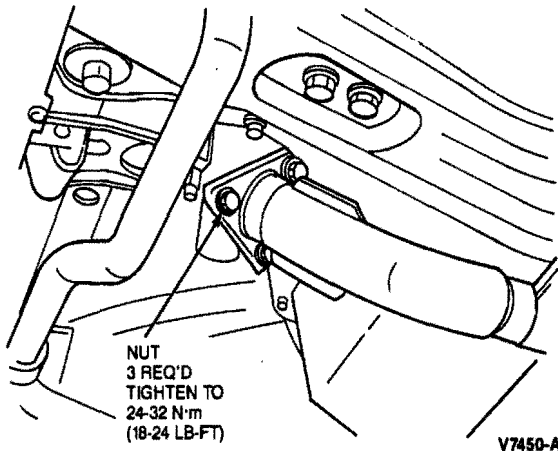


V7446-A

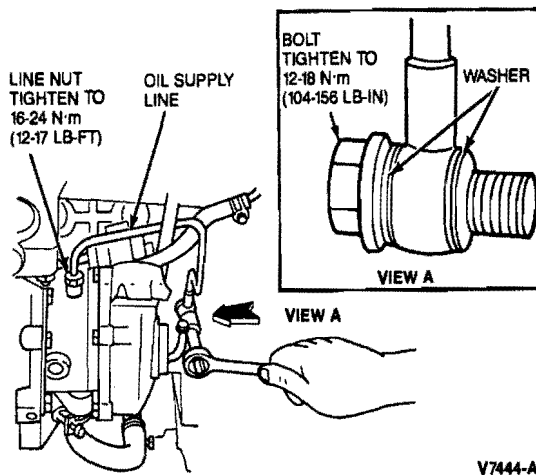
12. Connect coolant return hose.
13. Connect oil return hose and secure with clamp.
14. Position exhaust pipe onto turbocharger and start nuts and washers.
15. Install two retaining bolts on exhaust hanger at engine.
16. Slide on two rubber exhaust hangers at catalyst.

## REMOVAL AND INSTALLATION (Continued)

17. Tighten exhaust pipe retaining nuts to 24-32 N·m (18-24 lb-ft).



18. Lower vehicle.
19. Install retaining bolt and brass washers on oil supply line and carefully position oil line into vehicle and hand-start bolt into engine block. Connect oil line to turbocharger and finger-tighten. Tighten oil line bolt to 12-18 N·m (104-156 lb-in).



NOTE: Make sure that one brass washer is on each side of oil line fitting.

20. Tighten oil supply line on turbocharger to 16-24 N·m (12-17 lb-ft).
21. Connect coolant supply hose.
22. Position air cleaner duct tube on turbocharger and tighten clamp.
23. Install two screws retaining air cleaner duct tube.

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24. Position power steering pump bracket on engine and install two retaining bolts and one retaining nut and tighten to 47-66 N·m (35-48 lb-ft).
25. Position power steering pump on mounting bracket and install through bolt and adjuster.
26. Connect lower radiator hose.
27. Install power steering belt. Refer to Section 27-02.
28. Position side heat shield and install three retaining bolts finger-tight.
29. Position upper heat shield and install two retaining bolts finger-tight.
- NOTE: Feed EGO sensor wire through upper heat shield. Install wire retainer under LH bolt.
30. Position lower heat shield and install three retaining bolts finger-tight.
31. Tighten all heat shield retaining bolts to 19-25 N·m (14-19 lb-ft).
32. Connect EGO sensor and install connector into its retaining clip.
33. Position intercooler hose on turbocharger and secure with clamp.
34. Install throttle body air intake tube.
35. Connect negative battery cable.
36. Refill cooling system. Refer to Section 27-03.
37. If turbocharger was replaced, perform the following:
- Disconnect ignition coil.
  - Crank engine for 20 seconds.
  - Connect ignition coil.
  - Start engine and run at idle for 30 seconds.
  - Check for leaks.

## Oil Supply Line

## Removal

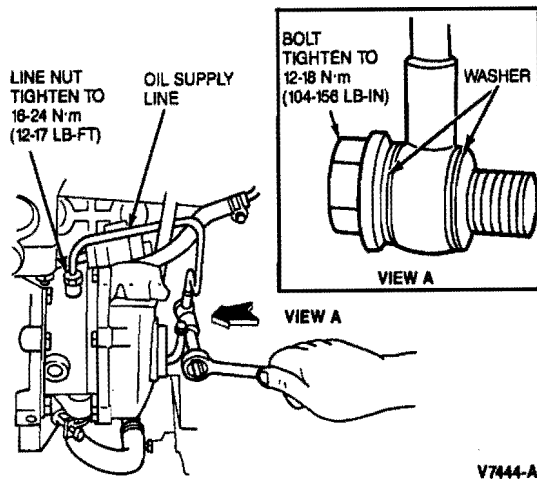
- Disconnect negative battery cable.
- Remove two screws retaining air cleaner duct tube, loosen clamp at turbocharger and position duct tube out of the way.
- Remove oil line fitting at turbocharger.
- Remove bolt and brass sealing washer from oil line at engine block.
- Remove oil supply line.

## Installation

- Insert bolt through oil line, with a brass washer on each side of fitting.

**REMOVAL AND INSTALLATION (Continued)**

2. Carefully position oil line into vehicle and hand-start bolt into engine block.
3. Connect oil line to turbocharger and finger-tighten.
4. Tighten oil line bolt to 12-18 N·m (104-156 lb-in).
5. Tighten oil line fitting to 16-24 N·m (12-17 lb-ft).



6. Install air cleaner duct tube to turbocharger and secure with clamp and install two retaining bolts.
7. Connect negative battery cable.
8. Start engine and check for leaks.

**Oil Return Hose****Removal and Installation**

1. Raise vehicle on a hoist.
2. Loosen clamps on each end of hose.
3. Remove hose.
4. To install, reverse Steps 1, 2 and 3.

**Coolant Supply Hose and Fitting****Removal**

1. Disconnect negative battery cable.
2. Drain cooling system. Refer to Section 27-03.
3. Remove two screws retaining air cleaner duct tube, loosen clamp at turbocharger and position duct tube out of the way.

4. Disconnect coolant hose from engine block.
5. Raise vehicle on a hoist.
6. Disconnect coolant hose from turbocharger fitting.
7. If necessary, remove bolt and brass sealing washers from turbocharger.

**Installation**

1. If fitting was removed, install bolt through fitting with a brass sealing washer on each side of fitting.
2. Install fitting onto turbocharger and tighten bolt securely.
3. Route hose into position and connect one end to turbocharger fitting and secure with clamp.
4. Lower vehicle.
5. Connect coolant hose to engine block and secure with clamp.
6. Install air cleaner duct to turbocharger and secure with clamp.
7. Install two retaining bolts into air cleaner duct tube.
8. Connect negative battery cable.
9. Refill cooling system. Refer to Section 27-03.
10. Start engine and check for leaks.

**Coolant Return Hose****Removal and Installation**

1. Drain cooling system. Refer to Section 27-03.
2. Loosen clamp on each end of hose.
3. Remove coolant return hose.
4. To install, reverse Steps 1, 2 and 3.

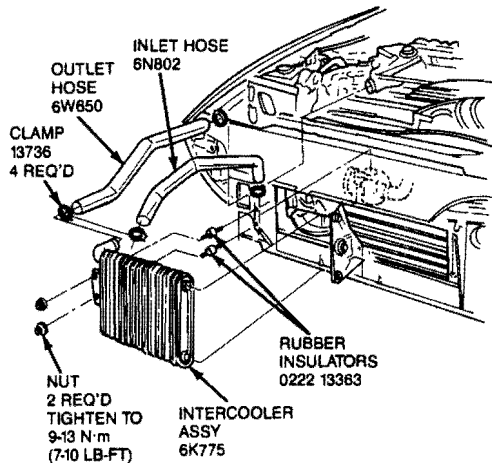
**Intercooler****Removal**

1. Raise vehicle and remove bumper assembly. Refer to Section 47-02.
2. Loosen retaining clamps and disconnect intercooler hose from intercooler.
3. Remove two nuts retaining intercooler to core support.



**REMOVAL AND INSTALLATION (Continued)**

4. Remove intercooler.

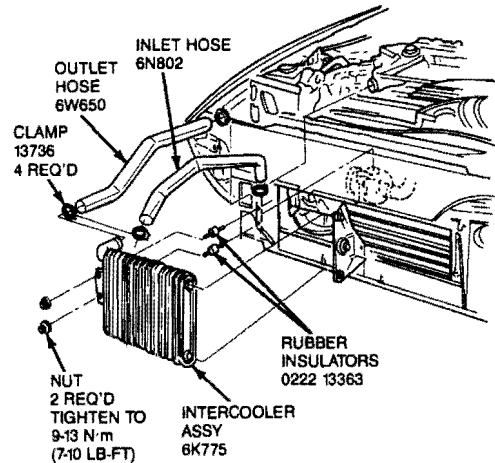


V7451-A

**Installation**

1. Position intercooler and align rubber grommets.
2. Install two retaining nuts on intercooler and tighten securely.
3. Connect intercooler hoses and tighten clamps securely.
4. Install bumper assembly. Refer to Section 47-02.
5. Lower vehicle and check operation.

4. Note routing and remove intercooler hose.



V7451-A

**Installation**

1. Route intercooler hose through core support in its original position.
2. Connect hose to intercooler and secure with retaining clamp.
3. Lower vehicle.
4. Connect intercooler hose and secure with retaining clamp.
5. Check operation.

**Intercooler Hoses****Removal**

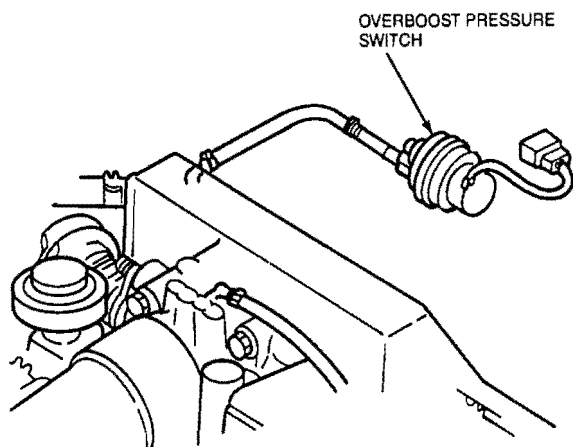
1. Open hood, loosen clamp and disconnect one end of intercooler hose being serviced.
2. Raise vehicle on a hoist.
3. Loosen clamp and disconnect opposite end of intercooler hose being serviced.

**Overboost Pressure Switch****Removal and Installation**

1. Disconnect electrical connector.
2. Disconnect vacuum hose.
3. Remove switch from retaining clip.

**REMOVAL AND INSTALLATION (Continued)**

4. To install, reverse Steps 1, 2 and 3.



V7453-A

**DIAGNOSIS AND TESTING**

NOTE: For additional specifications not covered in this section, refer to Engine / Emissions.

**Bearing Clearance Check**

1. Manually move the turbocharged blade shaft assembly as far in one direction as possible. Spin the shaft by hand.
2. Manually move the shaft in the opposite direction as far as possible, and spin the shaft again.
3. If neither the turbine band nor the compressor blade contacts any portion of their respective housings, the bearings are still good.
4. If either blade comes in contact with the housing, the bearings are worn, and the turbocharger should be replaced.

Refer to the Diagnosis Charts for further diagnosis.

## DIAGNOSIS AND TESTING (Continued)

TURBOCHARGER DIAGNOSIS		
CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>• No Boost</li> </ul>	<ul style="list-style-type: none"> <li>• Compressor inlet hose collapsed.</li> <li>• Compressor outlet to throttle body hose leaking.</li> <li>• Turbocharger turbine or compressor wheel damage.</li> <li>• Turbocharger bearings seized.</li> <li>• Wastegate stuck open.</li> <li>• Clogged air cleaner element or restriction upstream of compressor.</li> </ul>	<ul style="list-style-type: none"> <li>• Service as required.</li> <li>• Tighten Hose.</li> <li>• Replace turbocharger.</li> <li>• Replace turbocharger.</li> <li>• Service/Replace as required. ②</li> <li>• Service as required.</li> </ul>
<ul style="list-style-type: none"> <li>• Lack of Power</li> </ul>	<ul style="list-style-type: none"> <li>• Engine               <ul style="list-style-type: none"> <li>• Low compression.</li> <li>• Incorrect valve timing and/or clearance.</li> <li>• Incorrect ignition timing.</li> </ul> </li> <li>• Clogged air cleaner element or restriction upstream of compressor.</li> <li>• Insufficient fuel supply.               <ul style="list-style-type: none"> <li>• Restriction.</li> <li>• Low fuel pressure.</li> <li>• EGO sensor malfunctioning.</li> <li>• Electronic control assembly malfunctioning.</li> <li>• Vane meter malfunctioning.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• ③</li> <li>• Service as required.</li> <li>• ③</li> </ul>
<ul style="list-style-type: none"> <li>• Detonation               <ul style="list-style-type: none"> <li>• With No Boost</li> </ul> </li> <li>• With Normal Boost</li> </ul>	<ul style="list-style-type: none"> <li>• Low grade fuel.</li> <li>• Ignition timing advanced too far.</li> <li>• Low grade fuel.</li> <li>• Ignition timing advanced too far.</li> <li>• Insufficient fuel supply.               <ul style="list-style-type: none"> <li>• Restriction.</li> <li>• Low fuel pressure.</li> <li>• EGO sensor malfunctioning.</li> <li>• Electronic control assembly malfunctioning.</li> <li>• Engine overheating.</li> </ul> </li> <li>• Oil leaking into compressor from turbocharger. ①</li> <li>• Valve seals leaking oil. ①</li> </ul>	<ul style="list-style-type: none"> <li>• Draw fuel tank and fill with correct octane fuel.</li> <li>• Adjust</li> <li>• Drain fuel tank and fill with correct octane fuel.</li> <li>• Adjust.</li> <li>• ③</li> <li>• Service as required. ①</li> <li>• Service as required. ①</li> </ul>

① Refer to Exhaust Smoky — Internal Oil Leaks Diagnosis.

② Refer to Wastegate System Diagnosis.

③ Refer to Capri Engine/Emissions Diagnosis.

CV7290-A

## DIAGNOSIS AND TESTING (Continued)

## TURBOCHARGER DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Excessive Fuel Consumption (Black Exhaust Smoke)</li> </ul>	<ul style="list-style-type: none"> <li>Engine out of tune.</li> <li>Vane Meter Malfunctioning.</li> <li>High fuel pressure.               <ul style="list-style-type: none"> <li>Pressure regulator.</li> <li>Fuel return plugged or kinked.</li> </ul> </li> <li>Injectors leaking.</li> <li>EGO sensor malfunctioning.</li> <li>Electronic engine control malfunctioning.</li> </ul>	<ul style="list-style-type: none"> <li>Service as required. ③</li> <li>Service as required. ③</li> <li>Service as required. ③</li> <li>Clean or Replace as required.</li> <li>③</li> <li>③</li> </ul>
<ul style="list-style-type: none"> <li>Excessive Oil Consumption (Blue, Gray, or White Exhaust Smoke)</li> </ul>	<ul style="list-style-type: none"> <li>Incorrect type or grade of oil.</li> <li>Extended oil change intervals.</li> <li>Clogged air cleaner element or restriction upstream of compressor.</li> <li>Engine wear (piston rings, valve guides).</li> <li>PCV system malfunctioning.</li> <li>Turbocharger oil seals leaking. ①</li> </ul>	<ul style="list-style-type: none"> <li>Drain and fill with specified oil.</li> <li>Change oil as recommended.</li> <li>Service as required.</li> <li>Service as required.</li> <li>③</li> <li>Replace turbocharger. ①</li> </ul>
<ul style="list-style-type: none"> <li>Noise or Vibration</li> </ul>	<ul style="list-style-type: none"> <li>Leaks at turbocharger inlet and outlet connections.</li> <li>Foreign object damage to turbine or compressor blades.</li> <li>Turbine bearing failure.</li> </ul>	<ul style="list-style-type: none"> <li>Service as required.</li> <li>Replace turbocharger.</li> <li>Replace turbocharger.</li> </ul>
<ul style="list-style-type: none"> <li>High Boost</li> </ul>	<ul style="list-style-type: none"> <li>Wastegate not operating. ②</li> <li>Leak in exhaust system before muffler.</li> <li>Leak in wastegate activator to compressor.</li> <li>Discharge hose. ②</li> </ul>	<ul style="list-style-type: none"> <li>Service/Replace as required. ②</li> <li>Service as required.</li> <li>Service as required.</li> <li>Service/Replace as required.</li> </ul>

① Refer to Exhaust Smoky — Internal Oil Leaks Diagnosis.

② Refer to Wastegate System Diagnosis.

③ Refer to Capri Engine/Emissions Diagnosis.

CV7293-A

EXHAUST SMOKY—INTERNAL OIL  
LEAKSCAUTION: EXHAUST SYSTEM SUCTION CAN CAUSE OIL TO LEAK PAST THE SHAFT  
SEALS DURING DIAGNOSIS PROCEDURES

TEST STEP		RESULT	ACTION TO TAKE
A1	CHECK COMPRESSOR OUTLET		
	<ul style="list-style-type: none"> <li>Check compressor outlet for evidence of oil.</li> </ul>	Oil found No oil found	GO to A2. GO to A5.

## DIAGNOSIS AND TESTING (Continued)

EXHAUST SMOKY — INTERNAL OIL  
LEAKSCAUTION: EXHAUST SYSTEM SUCTION CAN CAUSE OIL TO LEAK PAST THE SHAFT  
SEALS DURING DIAGNOSIS PROCEDURES (Continued)

TEST STEP		RESULT	ACTION TO TAKE
<b>A2</b>	<b>CHECK COMPRESSOR INLET</b>		
	<ul style="list-style-type: none"> <li>Check compressor inlet for evidence of oil.</li> </ul>	Oil found	Turbocharger OK. CHECK PCV system for proper operation.
		No oil found	GO to A3.
<b>A3</b>	<b>CHECK FOR OIL SUPPLY RESTRICTION</b>		
	<ul style="list-style-type: none"> <li>Check for restriction in the turbocharger oil supply tube.</li> </ul>	Restriction found	SERVICE as required.
		No restriction found	GO to A4.
<b>A4</b>	<b>CHECK OIL RETURN TUBE</b>		
	<ul style="list-style-type: none"> <li>Check for restriction in the turbocharger oil return tube.</li> </ul>	Not restricted	REPLACE turbocharger.
		Restricted	SERVICE as required.
<b>A5</b>	<b>CHECKING TURBINE OUTLET</b>		
	<ul style="list-style-type: none"> <li>Check turbine outlet for evidence of oil.</li> </ul>	Oil found	GO to A6.
		No oil found	Turbocharger OK. If exhaust is smoky, problem is elsewhere in vehicle. REFER to Engine/Emissions.
<b>A6</b>	<b>CHECK TURBINE INLET</b>		
	<ul style="list-style-type: none"> <li>Check turbine inlet for evidence of oil.</li> </ul>	Oil found	Problem internal in engine.
		No oil found	GO to A7.
<b>A7</b>	<b>CHECK OIL RETURN TUBE</b>		
	<ul style="list-style-type: none"> <li>Check for restriction in the turbocharger oil return tube.</li> </ul>	Not restricted	REPLACE turbocharger.
		Restricted	SERVICE as required.

## WASTEGATE SYSTEM

TEST STEP		RESULT	ACTION TO TAKE
<b>B1</b>	<b>CHECK DIAPHRAGM</b>		
	<ul style="list-style-type: none"> <li>Remove actuator diaphragm hose at diaphragm.</li> <li>Connect pressure diagnostic gauge or equivalent, to diaphragm inlet.</li> <li>Apply 48-59 kPa (7-8.5 psi) of pressure to diaphragm.</li> <li>Wastegate actuator rod should move.</li> </ul>	Rod moves	Wastegate system OK.
		Rod does not move	REPLACE turbocharger.

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·Ft
Exhaust Manifold to Cylinder Head	39-57	29-42
Turbocharger to Exhaust Manifold	27-33	20-25
Exhaust Shield Bolts	19-25	14-19
Exhaust Pipe to Turbocharger	24-32	18-24
Oil Supply to Turbocharger	16-24	12-17
Turbocharger Support Bracket Bolts	43-61	32-45
Oil Supply Line to Engine Block Bolt	12-18	104-156 (Lb·In)
Power Steering Pump Bracket Bolts	47-66	35-48

## SECTION 24-50 Fuel Tanks and Lines

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	24-50-1	REMOVAL AND INSTALLATION (Cont'd.)	
REMOVAL AND INSTALLATION		Fuel System Pressure Relief .....	24-50-2
Fuel Filler Door .....	24-50-3	Fuel Tank .....	24-50-4
Fuel Filler Neck .....	24-50-5	VEHICLE APPLICATION .....	24-50-1

### VEHICLE APPLICATION

Capri.

### DESCRIPTION

**WARNING: DO NOT SMOKE, CARRY LIGHTED TOBACCO OR AN OPEN FLAME OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE IGNITED, RESULTING IN POSSIBLE PERSONAL INJURY.**

**WARNING: FUEL SPRAY WHEN REMOVING THE CAP MAY CAUSE INJURY. REMOVE CAP SLOWLY.**

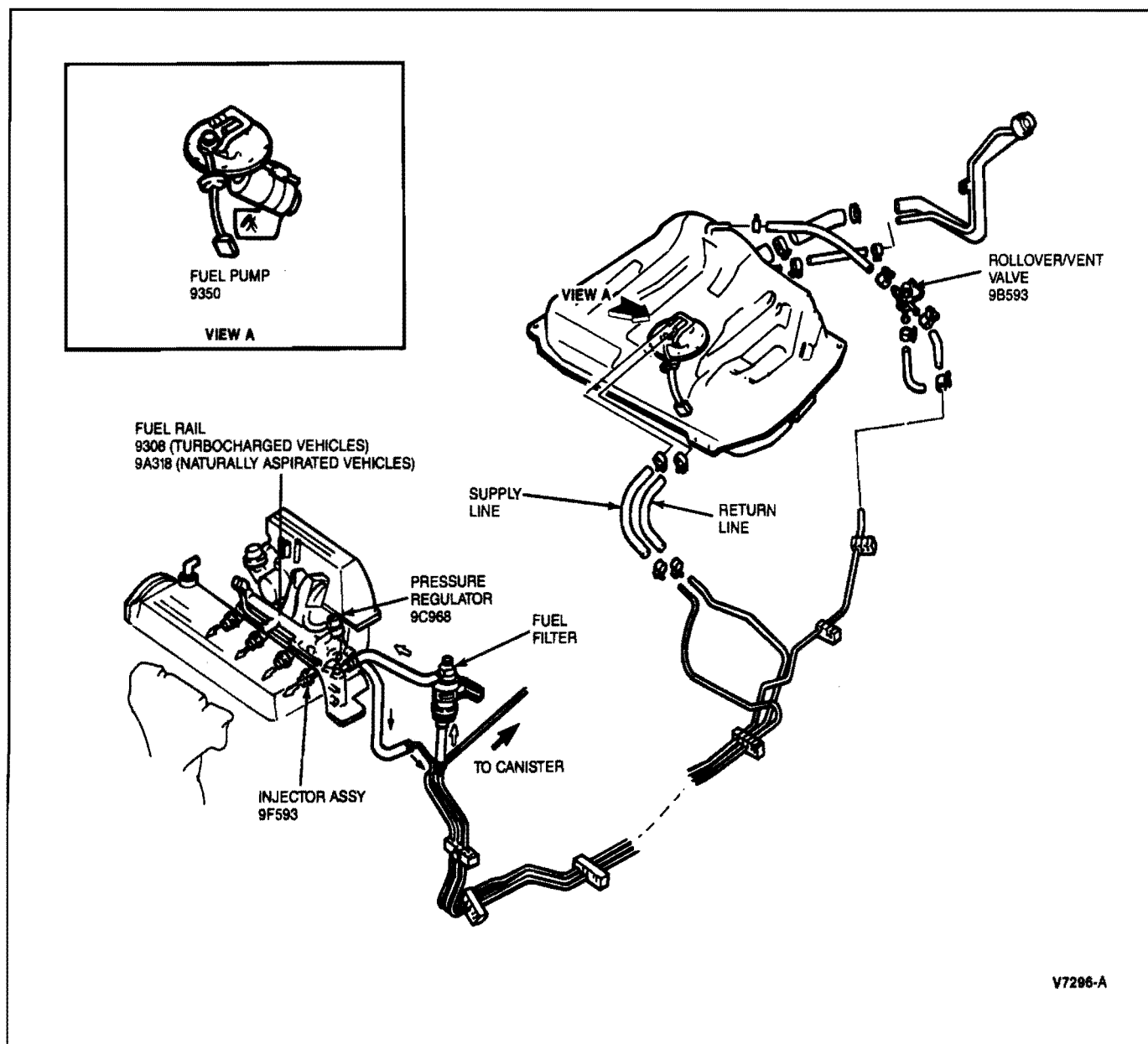
The fuel tank is mounted under the rear of the vehicle. It contains supply and return lines, a fuel pump and fuel gauge sending unit.

Fuel is drawn from the tank by a fuel tank mounted electric fuel pump and delivered under pressure through the fuel supply line and fuel filter to the fuel rail and on to the fuel injectors.

Excess fuel is returned to the fuel tank through the return line. A vapor line is routed from the fuel tank to the vapor canister. All lines run parallel to each other underneath the vehicle on the left side.

Fuel pressure is controlled by a pressure regulator mounted at the return side of the fuel rail. Refer to Section 24-35 for information on the fuel pump and pressure regulator.

## DESCRIPTION (Continued)



## REMOVAL AND INSTALLATION

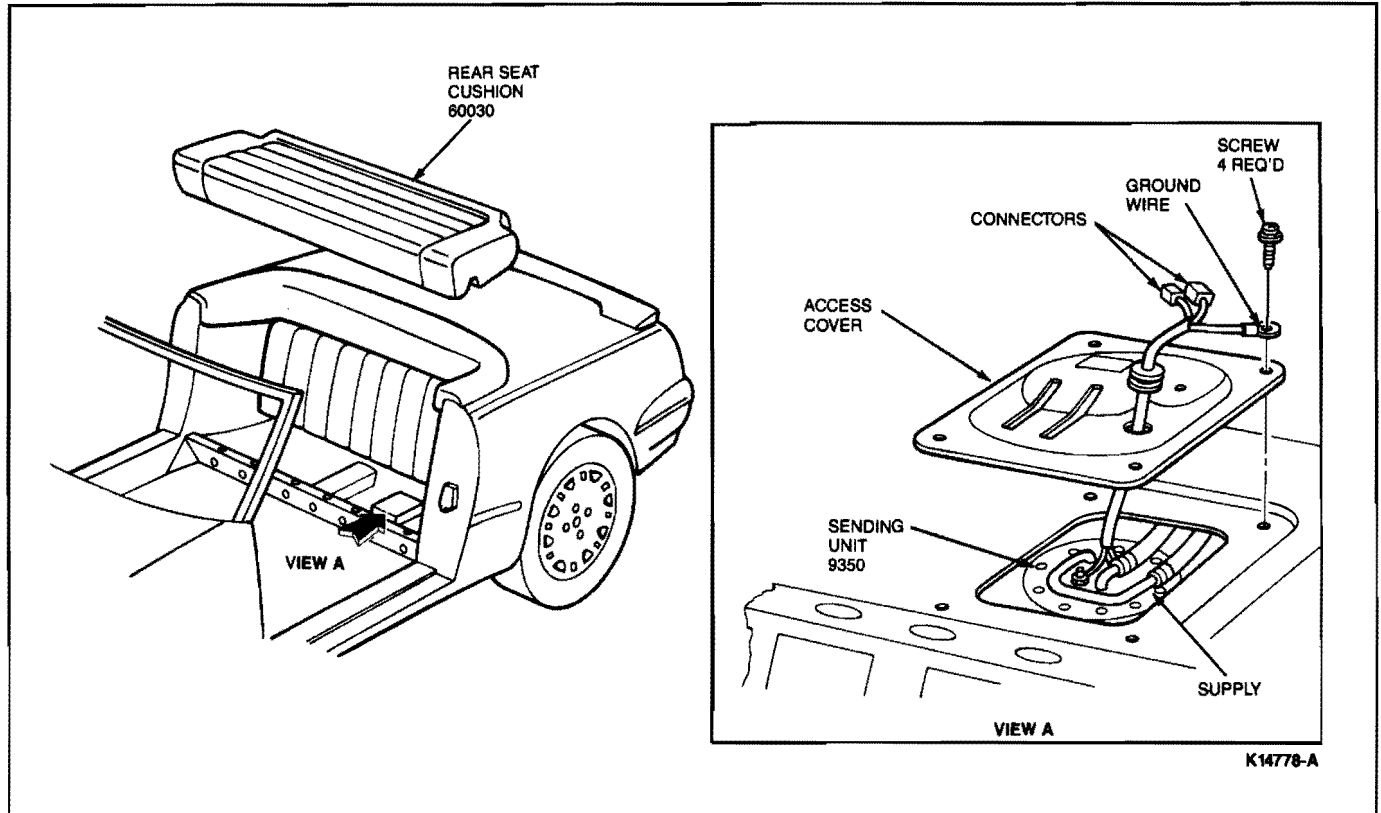
### Fuel System Pressure Relief Removal and Installation

**NOTE:** Fuel pressure must be relieved prior to servicing any fuel system component.

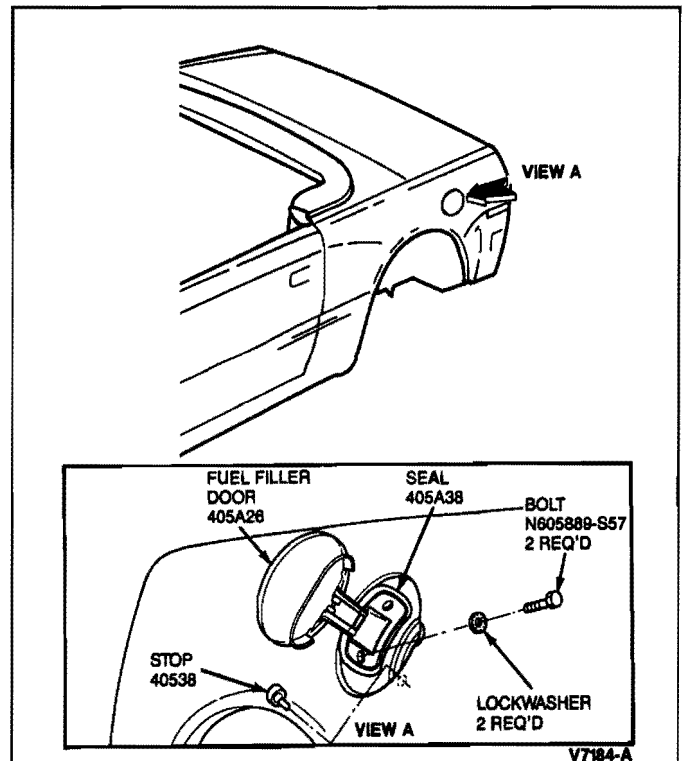
1. Remove the back seat cushion. Refer to Section 41-14.
2. Disconnect the fuel pump connector.
3. Run engine until it stalls. The fuel pressure is now relieved.



## REMOVAL AND INSTALLATION (Continued)

**Fuel Filler Door****Removal**

1. Remove two bolts, lockwashers and fuel filler door.
2. Remove seal.
3. Remove stop if required.

**Installation**

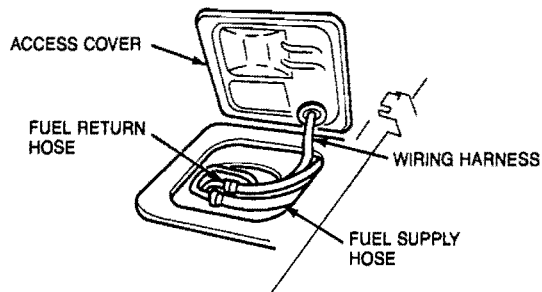
1. If required, paint fuel filler door.

**REMOVAL AND INSTALLATION (Continued)**

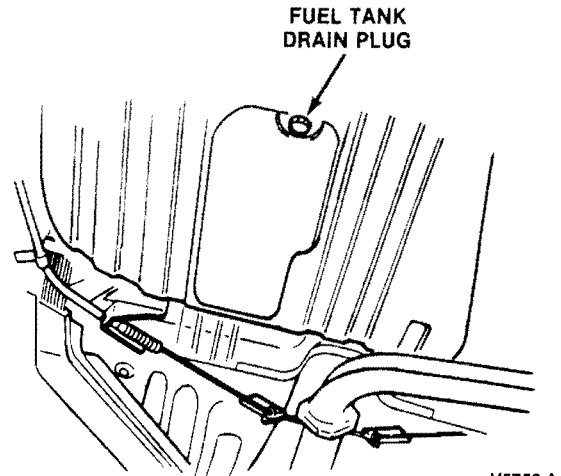
2. Install fuel filler door with seal, two lockwashers and two bolts.
3. Install stop if removed.

**Fuel Tank****Removal**

1. Relieve fuel pressure as outlined.
2. Disconnect negative battery cable.
3. Remove rear seat cushion.
4. Remove four screws, ground wires and fuel pump access cover. Pull fuel pump wiring harness through access cover.
5. Loosen and pull back hose clamps. Remove and plug supply and return hoses.

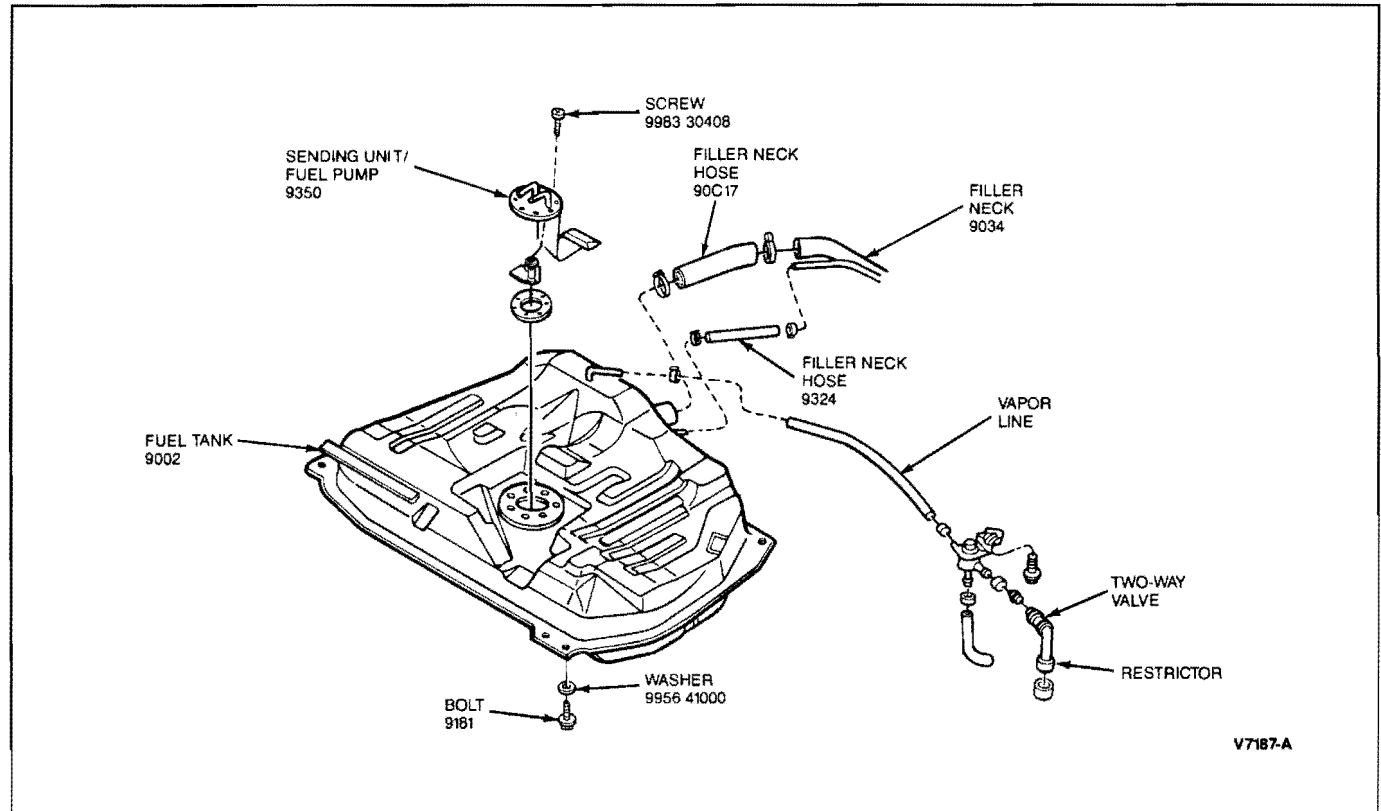


6. Raise the vehicle and support with safety stands.
7. Remove the fuel tank drain plug and carefully drain remaining fuel into an approved safety container.



8. Remove two hose clamps and hoses at filler neck.
9. Support fuel tank and remove four retaining bolts.
10. Lower fuel tank enough to gain access to vapor line.
11. Remove clamp and vapor line. Remove fuel tank.
12. Remove fuel sending unit and fuel pump if required. Refer to Section 24-35.

## REMOVAL AND INSTALLATION (Continued)

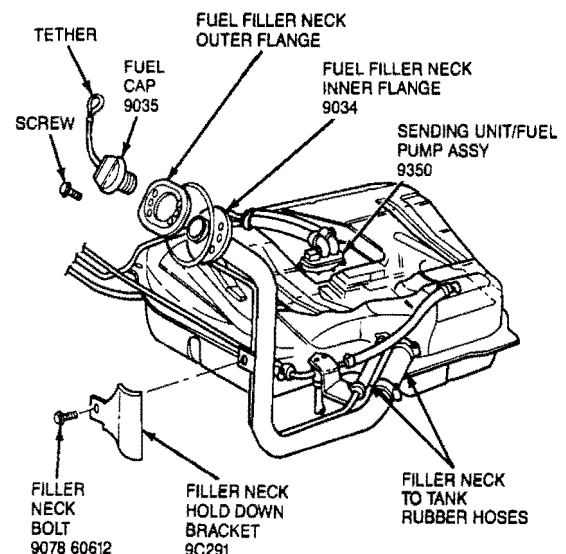


V7187-A

**Installation**

1. Install fuel pump and sending unit if removed. Refer to Section 24-35.
2. Position fuel tank and install vapor line with clamp.
3. Install fuel tank with four retaining bolts.
4. Install filler neck hoses and tighten clamps.
5. Install fuel tank drain plug.
6. Lower the vehicle and connect the supply and return hoses with clamps.
7. Pull wiring harness through access cover.
8. Install access cover with four screws. Make sure ground wires are secured.
9. Connect fuel pump connectors.
10. Install rear seat cushion. Refer to Section 41-14.
11. Connect negative battery cable.
12. Add fuel to tank. Operate engine and check for leaks. Service as required.

3. Remove the fuel tank drain plug and carefully drain remaining fuel into an approved safety container.
4. Remove two hose clamps and hoses at filler neck.
5. Remove retaining screw from inside wheel well. Remove fuel filler neck, gaskets and bracket.



V7191-A

**Fuel Filler Neck****Removal**

1. Remove filler cap, tether, and two filler neck retaining screws inside filler door.
2. Raise the vehicle and support with safety stands.

**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Install filler neck with bracket and gaskets. Install retaining screw inside wheel well.
2. Install two hoses and secure with clamps at filler neck.
3. Install drain plug into fuel tank.
4. Install two screws to secure filler neck to body.
5. Add fuel to tank and install fuel filler cap.
6. Operate engine and check for fuel leaks. Service as required.

# SECTION 24-51 Fuel Filters

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	24-51-1	REMOVAL AND INSTALLATION (Cont'd.)	
REMOVAL AND INSTALLATION		In-Tank Filter .....	24-51-1
In-Line Filter .....	24-51-1	VEHICLE APPLICATION .....	24-51-1

## VEHICLE APPLICATION

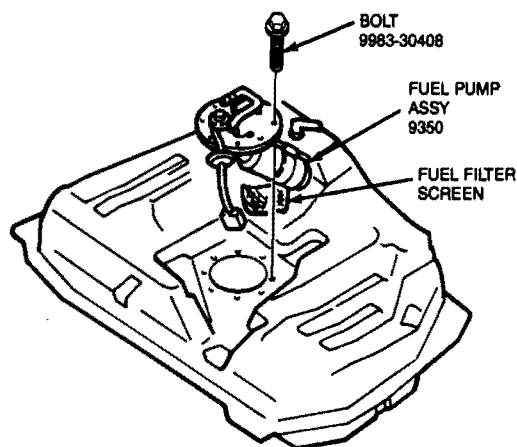
Capri.

## DESCRIPTION

**WARNING: DO NOT SMOKE, CARRY LIGHTED TOBACCO OR AN OPEN FLAME OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE IGNITED, RESULTING IN POSSIBLE PERSONAL INJURY.**

**WARNING: FUEL SPRAY WHEN REMOVING THE CAP MAY CAUSE INJURY. REMOVE CAP SLOWLY.**

The fuel system is protected by two fuel filters. A replaceable cartridge is located in the engine compartment in-line between the fuel tank and the inlet side of the fuel rail. A serviceable filter screen is located inside the fuel tank at the inlet of the fuel pump.



V7295-A

## REMOVAL AND INSTALLATION

### In-Tank Filter

#### Removal

1. Relieve fuel system pressure. Refer to Section 24-50.
2. Remove rear seat cushion. Refer to Section 41-20.
3. Remove the fuel tank sending unit / pump. Refer to Section 24-35.
4. Remove fuel filter from fuel pump assembly.

### Installation

1. Install filter on fuel pump assembly.
2. Install fuel tank sending unit / pump assembly. Refer to Section 24-35.
3. Install rear seat cushion. Refer to Section 41-20.
4. Start engine and check for leaks.

### In-Line Filter

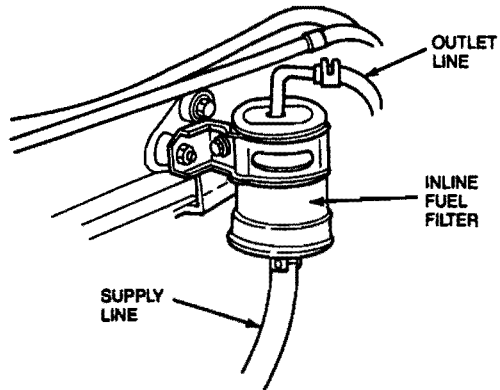
#### Removal

1. Relieve fuel system pressure. Refer to Section 24-50.

2. Remove clamp and supply line from bottom of filter. Plug supply line.

**REMOVAL AND INSTALLATION (Continued)**

3. Remove clamp and outlet line from top of filter. Remove fuel filter from bracket.

**Installation**

1. Install fuel filter into bracket.
2. Install outlet line onto filter with clamp.
3. Unplug and install supply line onto fuel filter. Secure with clamp.
4. Start engine and check for leaks.

# SECTION 24-60 Throttle Linkage

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION</b>	
Free Play .....	24-60-1	Throttle Cable .....	24-60-2
Wide-Open Throttle Position .....	24-60-1	VEHICLE APPLICATION .....	24-60-1
<b>DESCRIPTION</b> .....	24-60-1		

## VEHICLE APPLICATION

Capri.

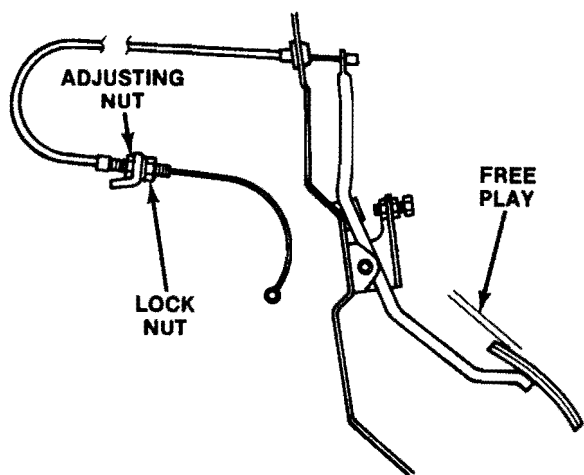
## DESCRIPTION

The throttle is controlled by an accelerator cable and a pedal assembly. The pedal should travel smoothly from an idle to wide-open throttle position. Hesitation on return and/or prevention of return to idle position must not occur throughout the total travel of the pedal assembly. Surrounding components such as wiring, hoses, sound insulator and floor covering, must not contact the sliding inner member of the cable or the pedal assembly. The throttle assembly is adjustable for free play and distance of travel.

## ADJUSTMENTS

### Free Play

1. Adjust the idle to specification. Refer to Engine / Emissions.
2. Measure the free play at the accelerator pedal.
3. Free play should be 1-3mm (0.04-0.12 inch). If necessary, loosen the locknut and adjust at cable housing brace, located near the throttle body.
4. Tighten locknut after proper free play is achieved.
5. Adjust the wide-open throttle position as outlined.



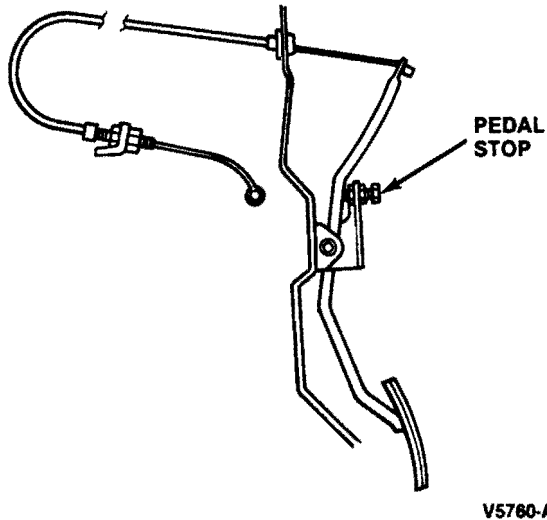
### Wide-Open Throttle Position

1. Adjust accelerator pedal free play as outlined.
2. Depress the accelerator all the way to the floor.

3. Make sure that the throttle plate in the throttle body is in the wide-open position.

## ADJUSTMENTS (Continued)

4. If necessary, loosen the locknut and adjust at the pedal stop on the pedal bracket.
5. Tighten locknut after adjustment is completed.

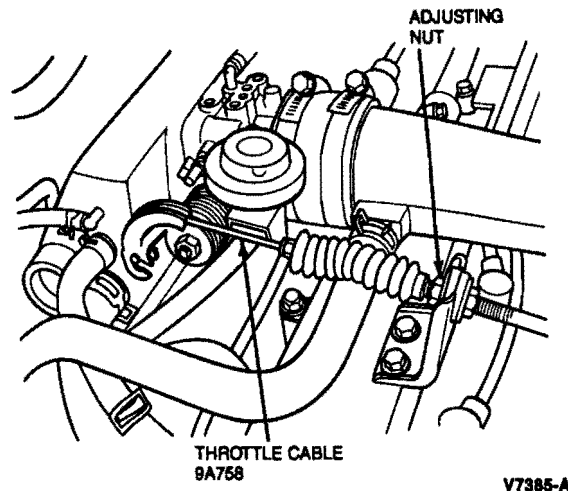


## REMOVAL AND INSTALLATION

### Throttle Cable

#### Removal

1. Remove the cable end from the throttle body.
2. Remove the adjusting nut at the cable housing brace located near the throttle body.
3. Remove cable routing bracket retaining bolt.
4. Squeeze the lock tabs and remove the cable end from the pedal assembly.
5. Squeeze the lock tabs securing the cable housing to the dash panel and remove the cable assembly.



#### Installation

1. Position the cable housing into hole in dash panel and snap it into place.
2. Install cable end onto accelerator pedal and snap it into place.
3. Install cable routing bracket and retaining bolt.
4. Install cable into cable housing brace near throttle body and install locknut finger-tight.
5. Install cable end onto throttle linkage.
6. Adjust pedal free play and wide-open throttle position as outlined.

