Chapter 4 Fuel and exhaust systems

Contents

Specifications

General

Carbureted	
Fuel pressure (mechanical type)	3.7 to 4.7 PSI
Fuel pressure (electrical type)	2.8 to 3.6 PSI
Fuel pump flow rate (electrical type)	52.5 cu in/min at 800 rpm
Fuel pump flow rate (mechanical type)	70.2 cu in/min at 800 rpm
Fuel injected	
Fuel pressure	28 to 37 PSI
Fuel pressure drop	21 PSI
Idle speed	See Chapter 1

1 Fuel system – general information

The fuel system is a conventional design. Simply put, fuel is pumped from the fuel tank, through the fuel lines and fuel filter into the carburetor, where it is mixed with air for combustion. The fuel system, as well as the exhaust system, is interrelated with and works in conjunction with various emissions control systems covered in Chapter 6. Thus, some elements that relate directly to the fuel system and carburetor functions are covered in that chapter.

All carburetors are down-draft, two-barrel types. Specific information on the carburetor can be found in Section 9.

Two types of fuel pumps are used. A conventional diaphragm-type, mechanical pump, is attached to the right front side of the cylinder head on earlier models. The operating arm of the pump extends into the cylinder head where it is actuated by an eccentric mounted on the front of the camshaft. This eccentric, when rotating, moves the operating arm back and forth, providing the pump action.

An electric pump is used on some models. It is mounted in the fuel tank or on the frame rail under the truck.

The fuel tank is located under the rear bed of the truck. Besides the fuel feed line leading to the fuel filter and pump, the tank also has an emission vent hose leading to the charcoal canister, an air ventilation line that connects back into the fuel filler hose and a fuel return hose to route excess fuel back to the tank.

2 Fuel tank – removal and installation

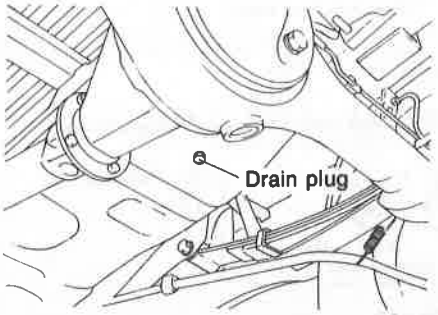
Refer to illustration 2.3

Refer to Section 10 for procedures pertaining to the fuel tank on fuel injected models.

Note: *Don't begin this procedure until the gauge indicates that the tank is empty or nearly empty. If the tank must be removed siphon or drain any remaining fuel from the tank prior to removal (see step 3 below).*

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Make sure the engine is cool. Don't smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present. Any repairs to the fuel tank or filler neck should be carried out by a professional who has experience in this critical and potentially dangerous work. While performing any work on the fuel tank, be sure to have a CO2 fire extinguisher on hand and wear safety glasses.*

1 Disconnect the negative battery cable from the battery.
2 Remove the fuel filler cap to relieve pressure in the fuel tank.



2.3 Most models will have a drain plug in the fuel tank (be careful when draining gasoline because fuel vapors are very flammable – store the gasoline in an appropriate storage container while the fuel tank is being repaired)

3 Remove the drain plug from the bottom of the fuel tank and drain the fuel into an approved gasoline container **(see illustration)**.
4 From the top of the fuel tank, disconnect the fuel filler hose, fuel outlet hose, air ventilation hose, breather hose, fuel return hose and the wiring connector leading to the fuel tank gauge unit. Immediately plug all openings to prevent the entry of dirt.
5 If equipped, remove the fuel tank protector shield mounted in front of the tank.
6 Support the tank with a floor jack and a piece of wood to spread the load. Remove the fuel tank mounting bolts and carefully lower the tank from the truck. Check for any hoses or wiring which may still be connected as the tank is lowered.
7 It is recommended that the tank be cleaned out immediately after removal, especially if it is to be worked on or stored. See Section 3.
8 Before installing the tank make sure that all traces of dirt and corrosion are cleaned from it. If the tank is rusted internally however, it should be replaced with a new one.
9 Installation is the reverse of the removal procedure.

3 Fuel tank – cleaning and repair

1 Repairs to the fuel tank or filler neck should be performed by a professional with the proper training to carry out this critical and potentially dangerous work. Even after cleaning and flushing, explosive fumes can remain and could explode during repair of the tank.
2 If the fuel tank is removed from the vehicle, it should not be placed in an area where sparks or open flames could ignite the fumes coming out of the tank. Be especially careful inside garages where a natural gas appliance is located because the pilot light could cause an explosion.

4 Fuel tank gauge unit – removal and installation

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Make sure the engine is cool. Don't smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present. While performing any work on the fuel tank be sure to have a CO2 fire extinguisher on hand and wear safety glasses.*

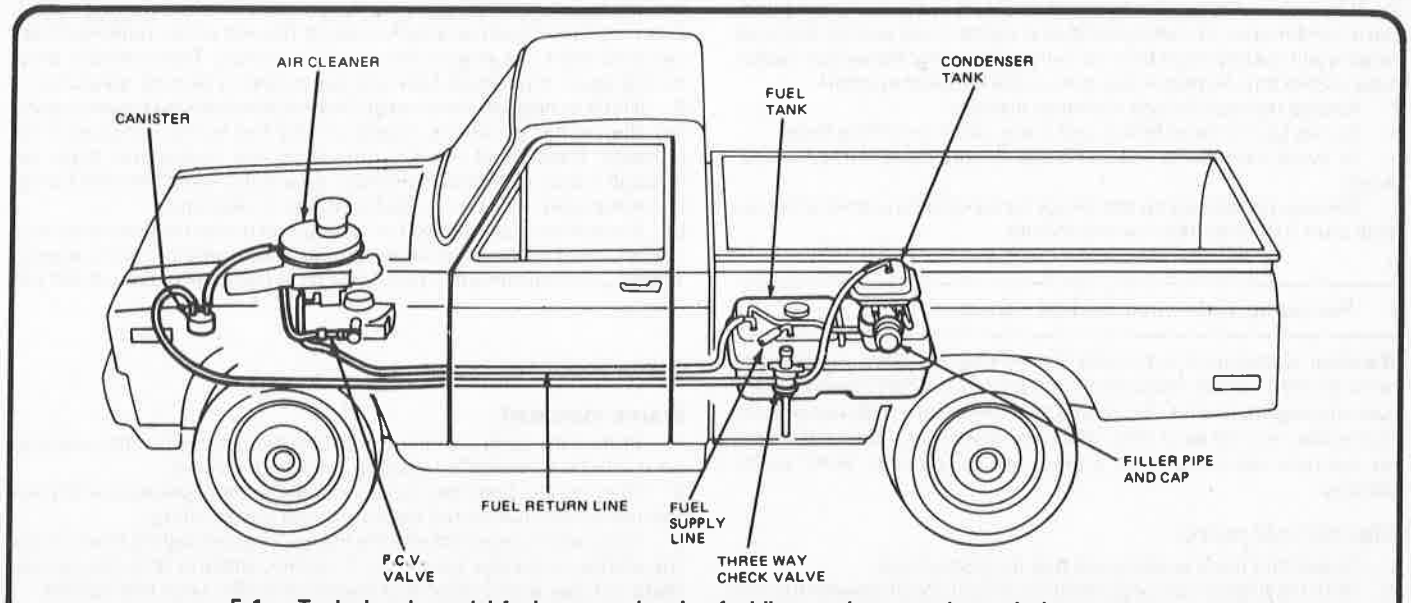
1 Disconnect the negative battery cable.
2 Disconnect the wires leading to the fuel tank gauge unit.
3 Remove the fuel tank as described in Section 2.
4 Remove the gauge unit lock plate by using a hammer and brass punch to turn it clockwise. **Warning:** *Don't use a screwdriver or punch made from any material other than brass. They could cause sparks which could cause an explosion!*
5 Lift the gauge unit from the tank, and cover the tank opening to prevent the entry of dirt.
6 Installation is the reverse of the removal procedure.

5 Fuel lines – repair and replacement

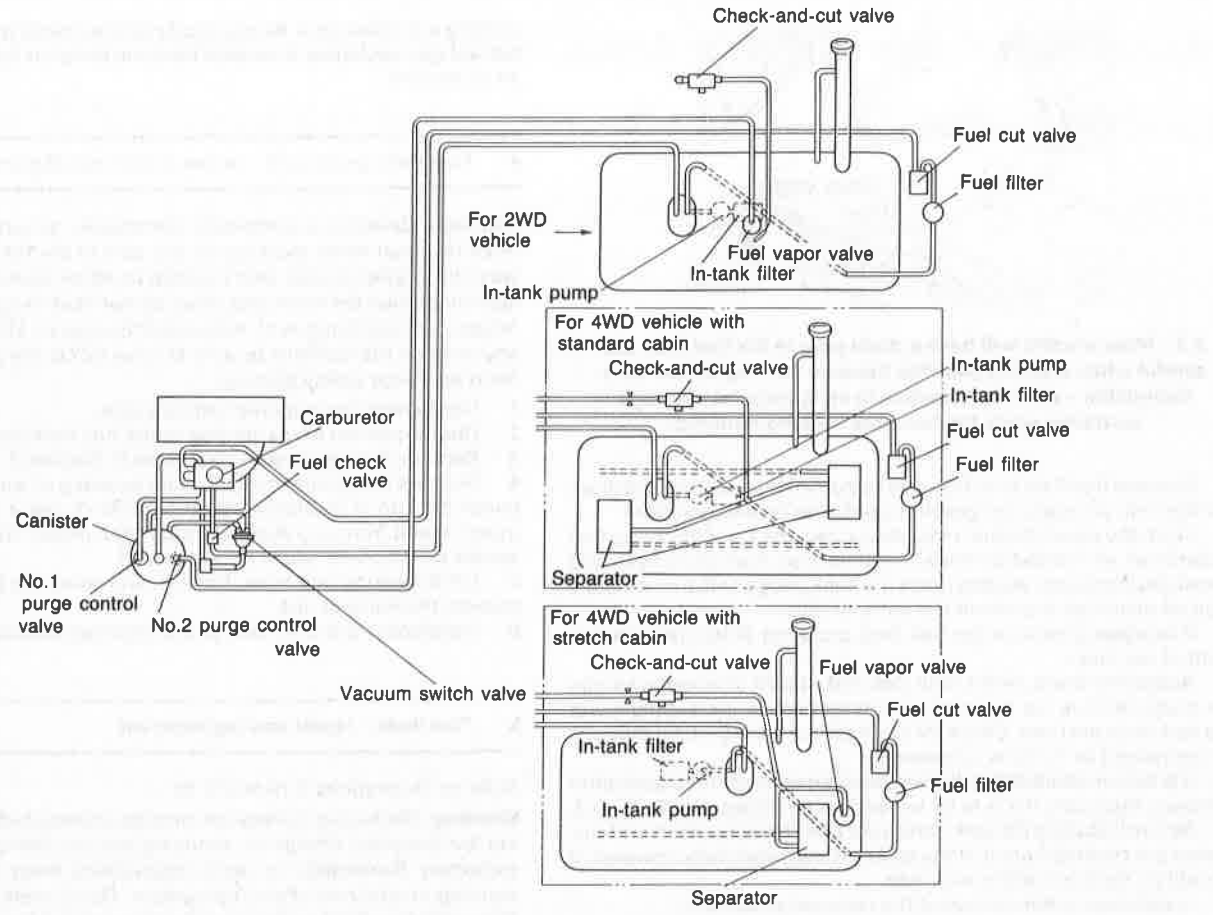
Refer to illustrations 5.1a and 5.1b

Warning: *The fuel tank pressure must be relieved before disconnecting fuel lines and fittings by removing the fuel filler cap. Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area. Also, don't work in a garage where a natural gas appliance such as a water heater or clothes dryer is present. Finally, prior to any operation in which a fuel line line will be disconnected, remove the negative cable from the battery to eliminate the possibility of sparks occurring while fuel vapor is present.*

1 If a section of metal fuel line must be replaced, only brazed seamless steel should be used, as copper or aluminum tubing doesn't have enough durability to withstand normal engine vibrations **(see illustrations)**.



5.1a Typical early model fuel system showing fuel lines and evaporative emission system



5.1b Later model fuel system showing fuel lines and evaporative emission system

2 If only one section of a metal fuel line is damaged, it can be cut out and replaced with a piece of rubber hose. The rubber hose should be cut four inches (100 mm) longer than the section it's replacing, so there is about two inches of overlap between the rubber and metal tubing at either end of the section. Hose clamps should be used to secure both ends of the repaired section.

3 If a section of metal line longer than six inches is being removed, use a combination of metal tubing and rubber hose so that the hose lengths will not be longer than 10-inches. **Warning:** *Never use rubber hose within four inches of any part of the exhaust system!*

4 Always replace O-rings and hose clamps.

5 Do not kink or twist hoses and tubes when installing them.

6 To avoid damage to hoses, do not tighten hose clamps excessively.

7 Always run the engine and check for leaks before driving the vehicle after fuel lines have been serviced.

6 Fuel pump (carbureted models) – check

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Make sure the engine is cool. Don't smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present. Wear safety glasses.*

Mechanical pump

1 Check that there is adequate fuel in the fuel tank.

2 With the engine running, examine all fuel lines between the fuel tank and fuel pump for leaks, loose connections, kinks or flattening in the rubber hoses. Do this quickly, before the engine gets hot. Air leaks upstream of the fuel pump can seriously affect the pump's output.

3 Check the pump diaphragm flange for leaks.

4 Remove the fuel filler cap to relieve fuel tank pressure. Disconnect the fuel line at the carburetor. Disconnect the ignition coil wire from the coil and ground it on the engine block (use a jumper wire to prevent sparks) so the engine can be cranked without it firing. Place a clean container such as a coffee can at the end of the detached fuel line and crank the engine for several seconds. There should be a strong spurt of gasoline from the line on every second revolution.

5 If little or no gasoline emerges from the line during engine cranking, then either the line is clogged or the fuel pump is not working properly. Disconnect the fuel line from the pump and blow air through it to be sure the line is clear. If the line is clear then the pump is suspect and needs to be replaced with a new one.

6 A more accurate method of testing fuel pump flow capacity is to perform the previous test using a measuring container and a watch. At 800 rpm in one minute, the pump should be able to pump 0.909 US quarts.

Electric pump

Frame mounted

7 Before checking the electric the fuse first and with a test voltmeter verify that voltage is reaching the electric pump.

8 Remove the fuel filler cap to relieve fuel tank pressure and then disconnect the fuel outlet hose from the pump fitting.

9 Connect a rubber hose to the fitting, long enough to reach into a measuring container located in a higher position than the pump. **Note:** *A hose with a smaller diameter will give false test results.*

10 Disconnect the secondary ignition coil wire from the coil to prevent the engine from starting. Use a jumper wire to ground the wire

to the engine block.
11 Turn the ignition switch to the Start position and operate the pump for a total of one minute, in 15-second intervals.
12 A normally operating pump will deliver 0.8 US quart into the container in one minute.
13 If little or no fuel emerged from the hose, either the fuel filter or line is clogged or the pump is defective. Remove the fuel filter and blow air through both fuel lines to be sure they are not clogged. Also, replace the fuel filter if not already done. If this does not improve the test results, the pump should be replaced with a new one.

In fuel tank

14 Before checking the electric fuel pump, always check the fuse first and with a test light or voltmeter verify that voltage is reaching the electric fuel pump.
15 With the engine running, check all metal lines and rubber hoses between the fuel tank (inside of which is the electric pump) and the carburetor to make sure that there are no leaks, kinked, flattened, or bent lines. Turn off the engine.
16 Relieve the fuel tank pressure by removing the fuel filler cap.
17 Detach the cable from the negative terminal of the battery.
18 Disconnect the fuel inlet hose at the carburetor.
19 Install a fuel pressure gauge in-line between the fuel inlet hose and the carburetor.
20 Reattach the cable to the battery negative terminal.
21 Start the engine and check the fuel line for fuel leakage.
22 Note the indicated fuel pressure reading. It should be within the specified range.
23 Detach the cable from the negative terminal of the battery.
24 Remove the pressure gauge from the fuel line.
25 Reconnect the fuel inlet hose.
26 Attach the cable to the negative terminal of the battery.

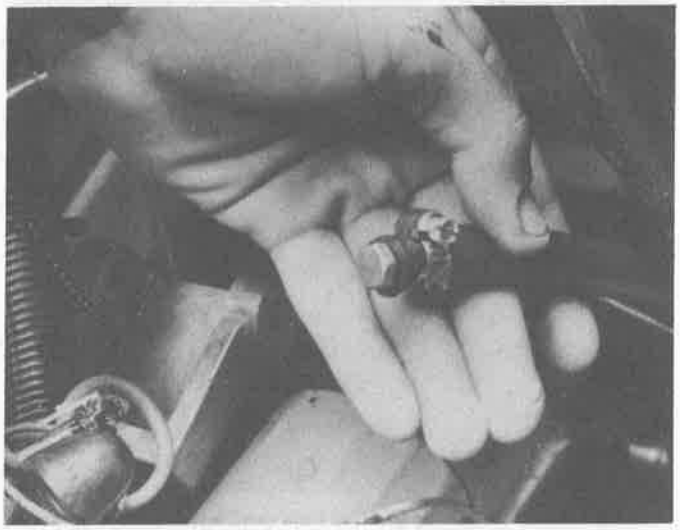
7 Fuel pump (carbureted models) – removal and installation

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Make sure the engine is cool. Don't smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present. Remove the cable from the negative terminal of the battery to eliminate the possibility of sparks occurring while fuel vapor is present.*

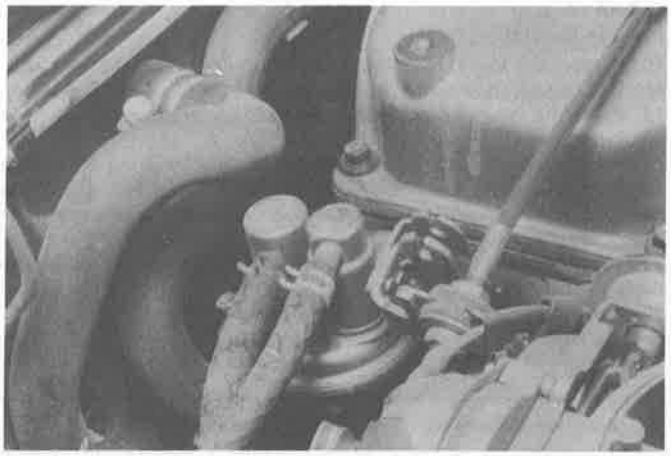
Mechanical pump

Refer to illustrations 7.2 and 7.3

1 Relieve fuel tank pressure by removing the fuel filter cap.
2 Locate the fuel pump on the front side of the cylinder head **(see illustration)**. Place rags underneath the pump to catch any spilled fuel.
3 Disconnect the fuel lines from the pump. Immediately plug them to prevent the leakage of fuel and the entry of dirt **(see illustration)**.
4 Remove the two bolts or nuts that attach the fuel pump to the cylinder head.
5 Detach the pump from the cylinder head.
6 Installation is the reverse of removal.
7 Always use new gaskets when replacing the fuel pump.



7.3 To plug rubber fuel hoses effectively, insert a bolt into the opening and secure it with a small hose clamp



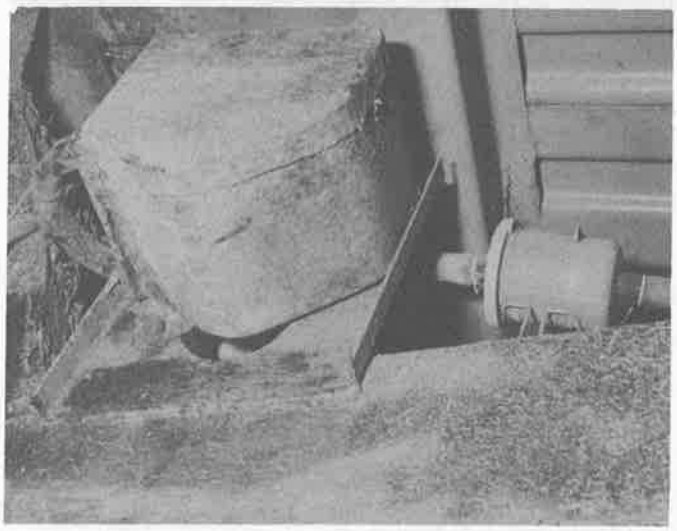
7.2 On some vehicles, a mechanical fuel pump is located on the cylinder head – when replacing the fuel pump, always use new gaskets

Electric pump

Frame mounted

Refer to illustration 7.11

8 Relieve fuel tank pressure by removing the fuel filler cap.
9 Disconnect the negative cable at the battery.
10 If necessary for clearance, raise the truck and support it on jackstands.
11 Locate the fuel pump on the frame rail, under the right side of the vehicle **(see illustration)**. Remove the fuel pump protector shield.
12 Place rags or a metal container under the pump to catch any fuel. Then disconnect the fuel lines from the pump and immediately plug them.
13 Disconnect the wiring connector leading to the pump.
14 Remove the bolts that attach the pump to its bracket and lift the pump off.
15 Installation is the reverse of the removal procedure.



7.11 Early model electric fuel pumps have a shield that must be removed for access to the pump

In fuel tank

Refer to illustration 7.21

16 Relieve the fuel tank pressure by removing the fuel filler cap.
17 Disconnect the cable from the negative terminal of the battery.
18 Raise the vehicle and place it securely on jackstands.
19 Remove the fuel tank (see Section 5).
20 Remove the fuel tank gauge unit lock plate by using a hammer and brass punch to turn it clockwise. **Warning:** *Sparks caused by the use of a screwdriver or a punch made of any material other than brass could cause an explosion.*
21 Lift the fuel tank gauge unit assembly from the tank **(see illustration)**.
22 Separate the fuel pump from the gauge unit.
23 Installation is the reverse of removal.

8 Air cleaner housing – removal and installation

Carbureted models

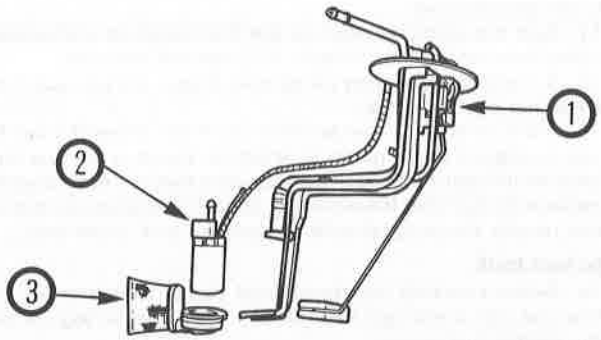
Refer to illustrations 8.3, 8.6a and 8.6b

1 Disconnect the cable from the battery negative terminal.
2 Detach the PCV hose from the elbow fitting on the air cleaner housing.
3 Label the vacuum hoses and fittings, then detach hoses from the air cleaner housing cover **(see illustration)**.
4 Remove the center wing nut and/or side clips and detach the cover and filter.
5 Depress the tang that secures the fresh air duct to the air cleaner housing and detach the duct from the housing by pulling it forward.
6 On later models, remove the housing nuts/bolts **(see illustrations)**. Raise the air cleaner and detach the pre-heat tube.
7 If you're planning to replace the housing, you'll have to remove both the vacuum motor and the temperature sensor and install them on the new housing. Refer to Chapter 6 for this procedure.
8 Installation is the reverse of removal.

Fuel injected models

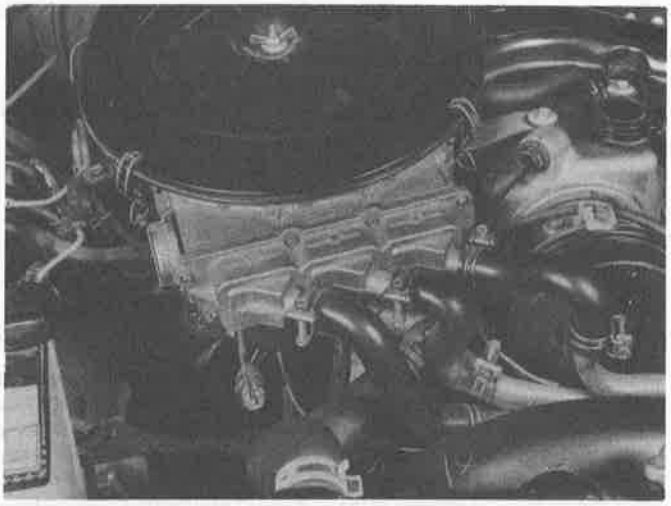
Refer to illustration 8.9

9 Loosen the hose clamp screws and detach the inlet and outlet hoses from the housing **(see illustration)**.
10 Remove bolts and lift off the housing cover and remove the filter element.
11 Remove the bracket bolts and lift the air cleaner housing out of the engine compartment.
12 Installation is the reverse of removal. the air cleaner-to-bracket mounting bolts and lift the air cleaner housing.

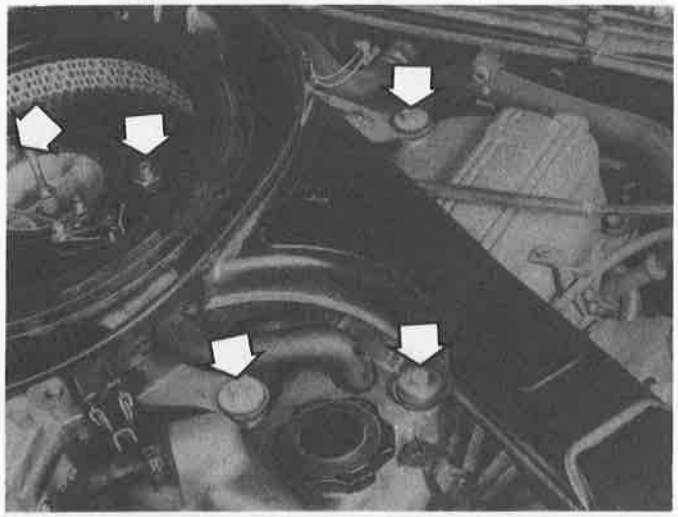


7.21 An exploded view of a typical "in fuel tank" electric fuel pump

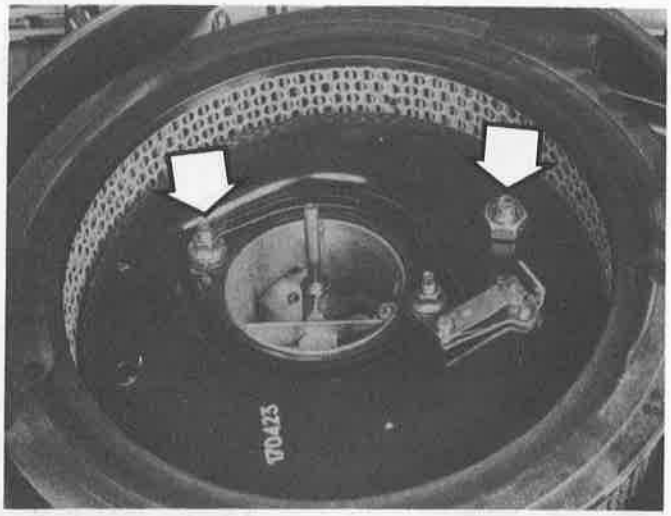
1 Fuel tank gauge unit
2 Electric fuel pump
3 Fuel strainer



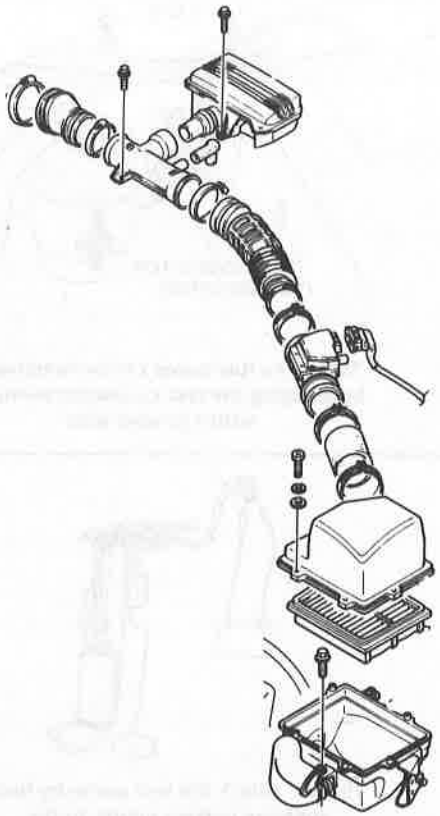
8.3 Late model vehicles have numerous hoses which must be detached from the air cleaner housing, including the three large hoses shown here. Using tape, label all hoses before disconnecting them. Also visible in this photo are the top cover securing clips and center wing nut.



8.6a On late models six bolts/nuts secure the air cleaner housing – five are shown here (arrows) with the sixth bolt on the other side of the housing



8.6b When removing the two nuts (arrows), place a rag in the throat of the carburetor to prevent the nuts or tools from accidentally falling into the carburetor



8.9 Fuel injection model air cleaner assembly – exploded view

9 Carburetor – removal and installation

Warning: *Gasoline is extremely flammable so extra precautions must be taken when working on any part of the fuel system. DO NOT smoke or allow open flames or bare light bulbs in or near the work area. Also, don't work in a garage if a natural gas appliance such as a water heater or clothes dryer is present.*

Removal

1 Remove the air cleaner assembly from the carburetor.
2 Disconnect the throttle cable from the throttle lever (some early models will have a choke cable to detach).
3 Label all vacuum hoses and fittings before removing them to simplify installation. Disconnect all vacuum hoses and the fuel line from the carburetor.
4 Label the wires and terminals, then unplug all wire harness connectors.
5 Remove the four mounting nuts and detach the carburetor from the intake manifold. Remove the carburetor mounting gasket.

Installation

6 Clean the gasket mating surfaces of the intake manifold and the carburetor to remove all traces of the old gasket. Be careful not to drop old gasket material into the intake manifold. Place a new gasketon the intake manifold. Position the carburetor on the gasket and install the mounting nuts. Tighten them evenly and securely.
7 The remaining installation steps are the reverse of removal.
8 Check and adjust if necessary the curb idle speed.

10 Fuel injection system – description, checking and component replacement

General information

Later model engines are equipped with an Electronic Fuel Injection (EFI) system. The EFI system is composed of three basic subsystems: a fuel system, an air intake system and an electronic control system **(see illustration 10.20)**.

Fuel delivery system

An electric pump located inside the tank supplies fuel under constant pressure to the fuel distribution pipe, which distributes it to all four injectors. From the distribution pipe, fuel is injected into the intake ports, just above the intake valves, by the four fuel injectors. The amount of fuel supplied by the injectors is precisely controlled by an electronic control module called the EGI control unit. A pressure regulator controls system pressure in relation to intake manifold vacuum. The fuel filter, mounted between the distribution pipe and fuel pump, protects the components of the system.

Air Intake system

The air intake system consists of an air filter housing, an air flow meter and a throttle body. An auxiliary air valve and air bypass solenoid valve control the idle speed under different operating conditions. The air flow meter is an information gathering device for the EGI control unit. A potentiometer measures intake air flow and a temperature sensor measures intake air temperature. This information helps the EGI determine the amount (duration) of fuel to be injected by the injectors. The throttle plate inside the throttle body is controlled by the driver. As the throttle plate opens, the amount of air that can pass through the system increases, so the potentiometer opens further and the EGI signals the injectors to increase the amount of fuel delivered to the intake ports.

Electronic control system

The electronic control system controls the EFI and other systems through an electronic control module, which employs a microcomputer called the EGI control unit. The EGI receives signals from a number of information sensors which monitor such variables as intake air volume, intake air temperature, coolant temperature, engine rpm, acceleration/deceleration and exhaust oxygen content. These signals help the EGI determine the injection duration necessary for the optimum fuel/air ratio. Some of the sensors and the corresponding EGI-controlled solenoids are not contained within EFI components, but are scattered throughout the engine compartment.

General diagnosis

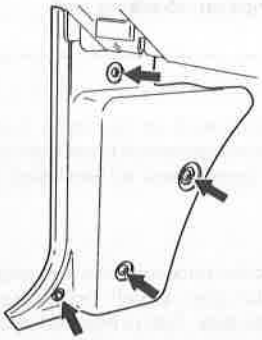
Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. DO NOT smoke or allow open flames or bare light bulbs near the work area. Also, don't work in a garage if a natural gas appliance (such as a water heater or clothes dryer) is present.*

The EFI system is not usually the direct cause of engine problems. Trouble is usually caused by a bad contact in the wiring connectors or contaminated fuel, which could clog the injectors. Always make sure that all connections are secure by tapping or wiggling the connectors to see if the signal changes. Make sure that the connector terminals are not bent and that the connectors are pushed completely together and locked.

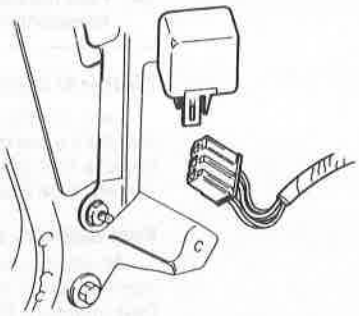
Before troubleshooting the EFI system, always check the condition of the ignition system. Make sure the battery, all fuses, fusible links and ground connections, the ignition coil, the coil high tension wire, the distributor, the plug wires and the spark plugs are all in good condition, properly connected and functioning correctly. Also check the ignition timing and the idle speed.

Check the general engine condition, such as compression pressure and valve clearances. Refer to Chapter 1 for the compression check and valve adjustment procedures.

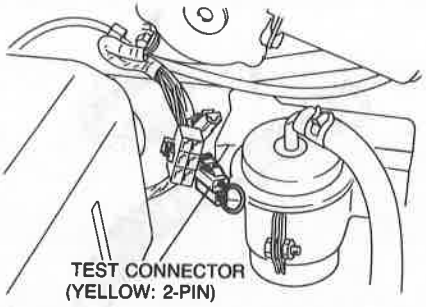
Check the fuel delivery system for fuel leaks. Make sure the fuel pump is operating properly and the filter is not clogged.



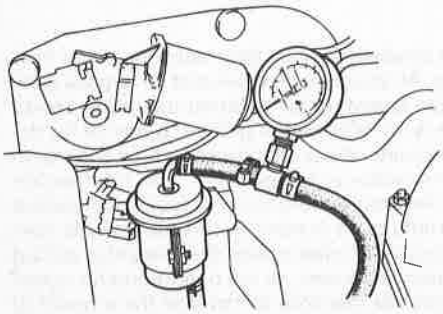
10.1 The circuit opening relay is accessible after removing the driver's side kick panel



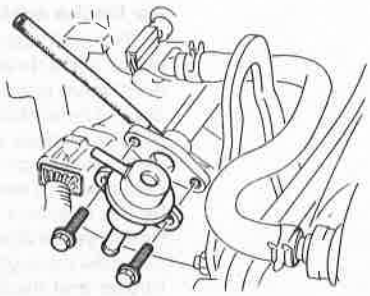
10.2 Unplug the circuit opening relay to deactivate the fuel pump



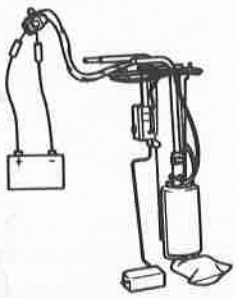
10.3 The fuel pump can be reactivated by bridging the test connector terminals with a jumper wire



10.5 Connect a fuel pressure gauge between the filter and distribution pipe to check the system pressure



10.9 Fuel regulator details



10.10a Check the fuel pump by first applying battery power to the connector terminals

Check the air intake system for vacuum leaks. Removal of components such as the engine oil dipstick, oil filler cap, PCV hose, etc. can cause the engine to run poorly. Check for a restricted air filter element.

Although this system requires a special tester for complete diagnosis, some checks of the individual components may be performed using regular shop test equipment.

Fuel pressure relief procedure

Refer to illustrations 10.1 and 10.2

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. DO NOT smoke or allow open flames or bare light bulbs near the work area. Also, don't work in a garage if a natural gas appliance (such as a water heater or clothes dryer) is present.*

1 Locate the circuit opening relay located behind the driver's side kick panel **(see illustration)**.

2 Start the engine and unplug the connector from the circuit opening relay **(see illustration)**. The engine will die within a few seconds. Even though the fuel pressure should now be safely relieved, it's always a good idea to disconnect the negative battery cable from the battery and place a shop rag over any fuel fitting before loosening it.

Fuel system priming procedure

Refer to illustration 10.3

3 After it has been depressurized, the fuel system should be primed before putting it back into service to avoid the necessity of excessive cranking to start the engine. Connect the starting relay and bridge the yellow fuel pump test connector terminals (located in the engine compartment next to the fuel filter) with a jumper wire **(see illustration)**. Turn the ignition switch on for 10 seconds, then shut it off and check for fuel leaks. Turn the ignition switch off and remove the jumper wire.

Fuel pressure check

Refer illustration 10.5

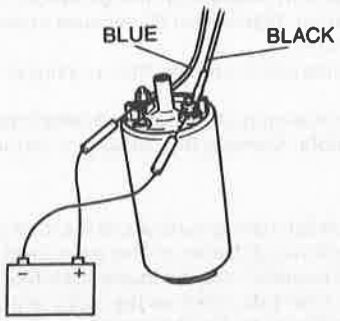
4 Relieve the fuel system pressure (see Steps 1 and 2 above). Reconnect the circuit opening relay connector.

5 Disconnect the hose from the fuel filter to the distribution pipe and install a fuel pressure gauge with a T-fitting **(see illustration)**.

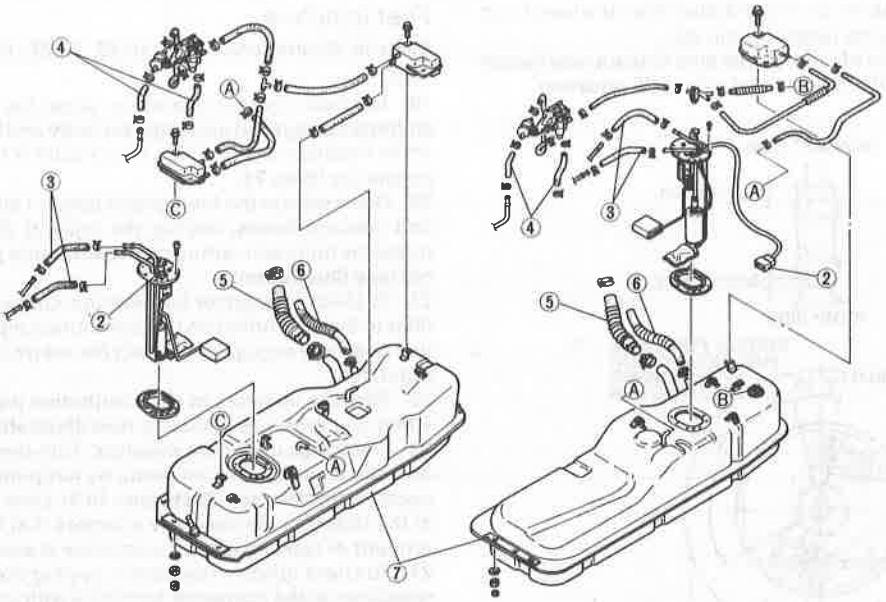
6 Start the engine and let it idle. The pressure should be as noted in the Specifications at the beginning of this Chapter.

7 If there is no pressure (even though the pump is running), the in-line fuel filter is probably clogged. Replace it and check the pressure again. If there is still zero pressure, the fuel feed line may be clogged. If the fuel feed line is clear, check the fuel pump in-tank filter.

8 If the fuel pressure is low, the in-line fuel filter may be partially clogged. Replace it and check the pressure again. If it's still low, check for a loose fuel line fitting or a punctured fuel line. Also check the pressure regulator, fuel distribution pipe and injectors for leaks. If nothing is leaking, block the fuel return line (the hose connected to



10.10b Apply power directly to the fuel pump terminals to see if it runs



10.12 Fuel tank system details

1 *Fuel filler cap*
2 *Pump electrical connector*
3 *Fuel hoses*
4 *Evaporative hoses*
5 *Filler hose*
6 *Breather hose*
7 *Fuel tank*

the fuel pressure regulator) and bridge the fuel pump test connector terminals on the firewall with a jumper wire **(see illustration 10.3)**. Note the indicated pressure. If the pressure is now above the upper limit, the fuel pressure regulator is faulty. If the pressure is still low, replace the fuel pump.

Fuel pressure drop check

Refer to illustration 10.9

9 Depressurize the fuel system (steps 1 and 2) and install a fuel pressure gauge (step 5). Plug the fuel return line from the pressure regulator side of the return line. Bridge the fuel pump test connector **(see illustration 10.3)** and turn the ignition switch on for 10 seconds. Turn the switch off and remove the jumper wire. After 5 minutes note the fuel pressure, this is the fuel pressure drop. If it is not as specified, depressurize the system, disconnect the hoses and replace the regulator **(see illustration)**.

Fuel delivery components – check, removal and installation

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. DO NOT smoke or allow open flames or bare light bulbs near the work area. Also, don't work in a garage if a natural gas appliance (such as a water heater or clothes dryer) is present.*

Fuel pump

Refer to illustrations 10.10a, 10.10b, 10.12, 10.16 and 10.18

10 For fuel pump/pressure diagnosis, refer to Steps 4 through 9. If the fuel pump does not run (make a clicking sound) when the ignition is on, check the circuit opening relay (see Steps 30 thru 33). If the relay is okay, remove the pump and tank gauge unit as described below.
Warning: *For the following test, the pump must be completely removed from the vehicle and away from any source of explosive fuel fumes. Make the electrical connections to the fuel pump connector/terminals **before** the connections at the battery.* Apply battery power to the connector **(see illustration)**. If the pump does not run, apply battery power directly to the pump terminals **(see illustration)**. If the pump still does not run, replace the pump.

11 To replace the fuel pump, relieve the fuel system pressure, then disconnect the cable from the negative battery terminal.

Fuel tank

Warning: *DO NOT perform the following operation if the fuel tank is full. Using a siphon pump (don't suck on the hose to start a siphon action) drain the fuel into an approved gasoline container.*

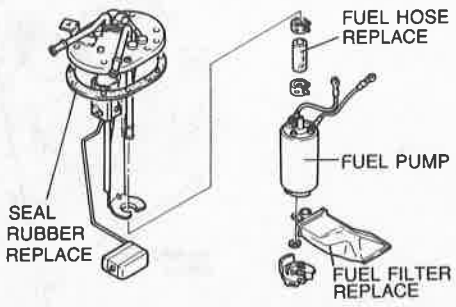
12 After depressurizing the system, remove the bolts and lower the fuel tank, referring to Section 2 **(see illustration)**.

13 Unplug the harness connector. Mark the fuel main and return hoses with pieces of tape. Loosen the hose clamps and disconnect the hoses **(see illustration 10.12)**.

14 Remove the pump bracket screws and lift the fuel pump and bracket out of the fuel tank.

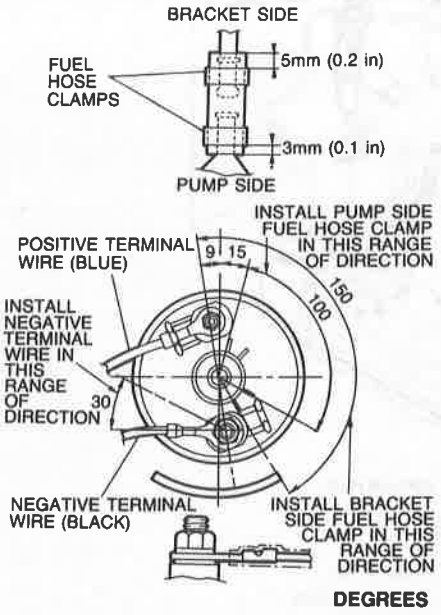
15 Disconnect the electrical leads from the pump terminals.

16 Loosen the pump clamp screw, slide the hose clamps toward the center of the hose, then swing the bottom of the pump out of the bracket. Pull the pump assembly and hose from the bracket **(see illustration)**.



10.16 Fuel pump and related components – exploded view

17 Remove the rubber cushion and in-tank filter from the lower end of the fuel pump by prying the retaining clip off.
18 Installation is the reverse of removal. Be sure to use a new gasket between the fuel tank and the pump bracket **(see illustration)**.

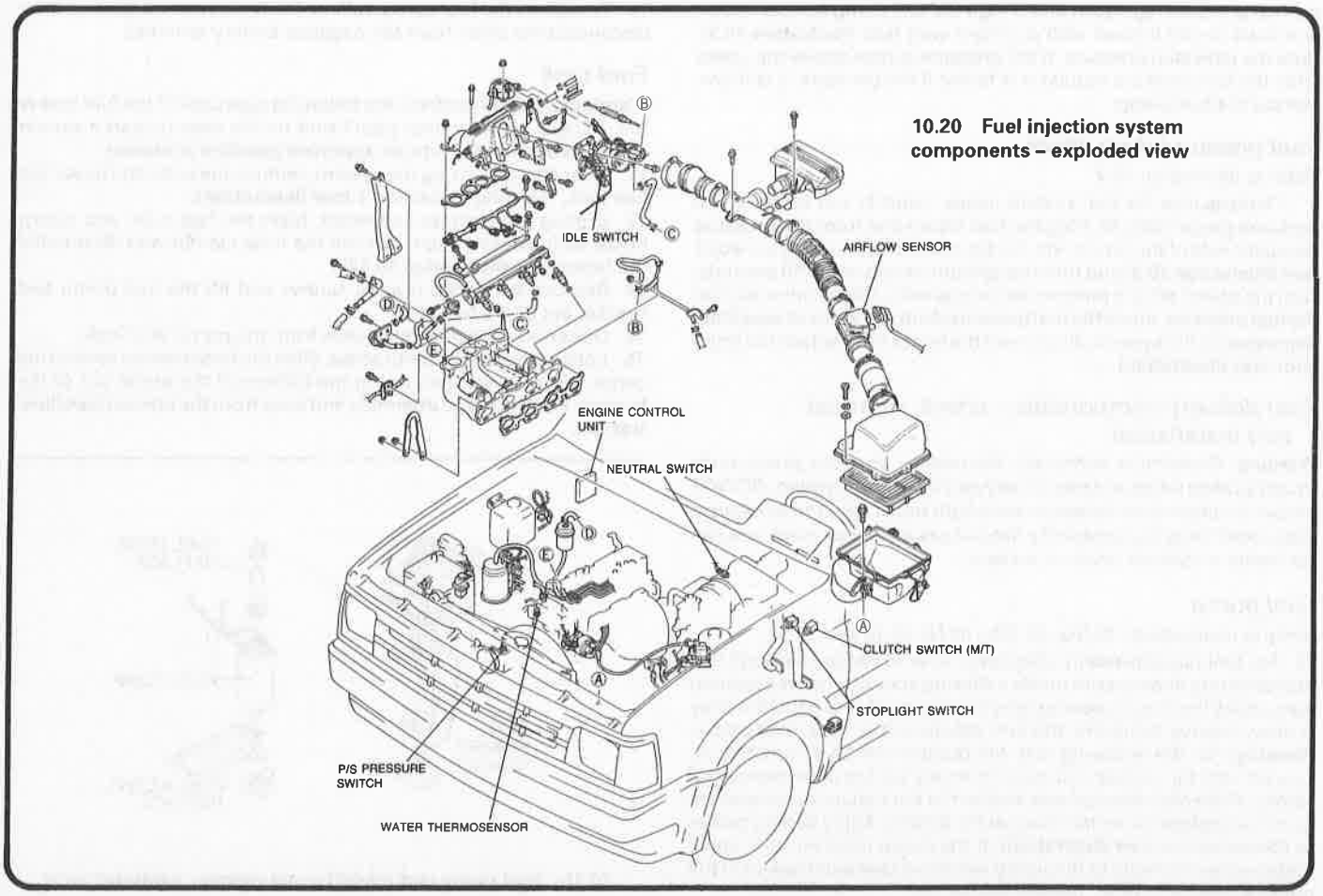


10.18 Fuel pump installation details

Fuel injectors

Refer to illustrations 10.20, 10.22, 10.23, 10.24a, 10.24b, 10.26 and 10.27

19 To check injector operation, place the tip of a screwdriver or stethoscope against each injector body and listen for a clicking noise while the engine is running. If no sound is heard, check the injector resistance (Step 24).
20 Depressurize the fuel system (steps 1 and 2), disconnect the fuel and vacuum hoses, unplug the injector electrical connectors, remove the bolts and remove the distribution pipe and injector assembly **(see illustration)**.
21 To check for injector fuel leakage, connect the hose from the fuel filter to the inlet fitting on the distribution pipe. Using a piece of extra fuel hose and a coupler, connect the return hose to the fuel pressure regulator.
22 Wire the injectors to the distribution pipe so they won't pop off when fuel pressure builds up **(see illustration)**.
23 Place rags under the injectors. Turn the ignition to the On position and energize the fuel pump by jumping the fuel pump test connector terminals **(see illustration 10.3)**. Look for drops or seeping fuel at the injectors. Replace any injectors that leak. **Note:** *A very slight amount of leakage after five minutes is acceptable.*
24 To check injector resistance, unplug the harness and check the resistance at the connector terminals with an ohmmeter **(see illustration)**. It should be 6-to-8 ohms and if it isn't, check for faults in the harness and the injectors themselves. Remove the injector (step 26) and connect an ohmmeter across the injector terminals. The reading should be 12-to-16 ohms **(see illustration)**. If it isn't, replace the injector.
25 To replace a fuel injector, disconnect the extra hose that was connected to perform the leak test. Wrap a rag around the hose when removing it to control the fuel spray, as the pressure relief procedure can't be followed with the distribution pipe removed.



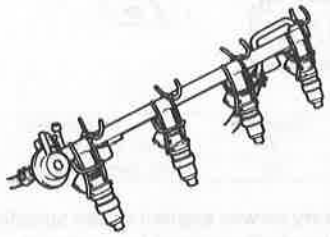
10.20 Fuel injection system components – exploded view

26 Pull the injector out of the distribution pipe using a twisting motion. Inspect the rubber insulator, grommet and O-ring **(see illustration)**. It's a good idea to routinely replace them to eliminate the possibility of fuel leaks.
27 Install the new O-ring, grommet and insulator. Apply a light coat of engine oil to the O-ring and insulator to ease installation and reduce the possibility of tearing them **(see illustration)**.
28 Insert the injector into the fuel distribution pipe. Be sure to push it in straight, otherwise the O-ring may be damaged. The electrical connector must face up.
29 Install the fuel distribution pipe and injectors and tighten the bolts securely. Connect the fuel feed, return and vacuum sensing hoses. Pressurize the fuel system (step 3) and check for leaks.

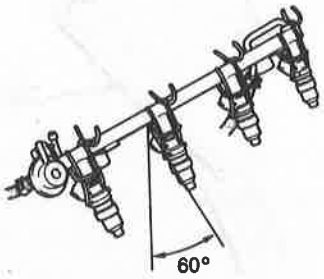
Circuit opening relay

Refer to illustrations 10.31a, 10.31b and 10.32

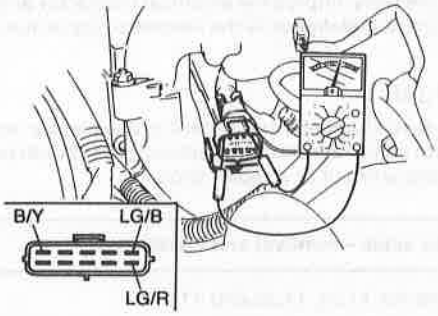
30 The circuit opening relay, located under the driver's side kick panel, supplies power to the fuel pump when the starter is operated **(see illustrations 10.1 and 10.2)**. It continues to feed the pump until the key is turned off, at which time the relay resets itself (no power is is directed to the pump when the ignition key is turned to the On position – the engine must be turned over first).
31 Check the resistance between the terminals of the relay as shown in the accompanying illustrations. If the resistance values are not within the specified limits, replace the relay.



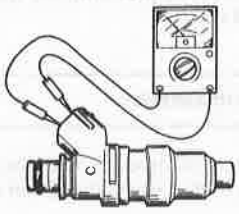
10.22 Wire the injectors to the distribution pipe to prevent them from popping out during the injector leakage check



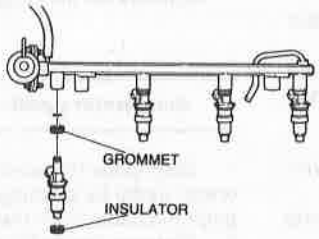
10.23 The injectors shouldn't leak when moved 60-degrees



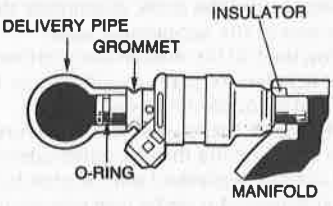
10.24a Check the injector harness resistance with an ohmmeter at the indicated terminals



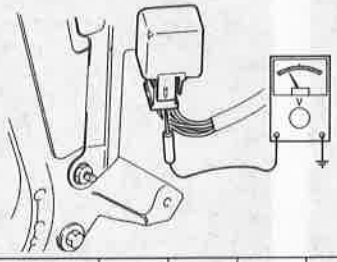
10.24 b Checking the injector solenoid resistance with an ohmmeter



10.26 Injector removal details

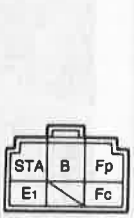


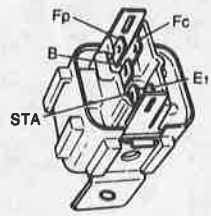
10.27 Fuel injector mounting details (it's a good idea to replace all of the rubber insulators, grommets and O-rings whenever any of the injectors are removed)



Condition \ Terminal	Fp	Fc	B	STA	E1
Ignition switch: ON	0V	12V	12V	0V	0V
Ignition switch: START	12V	0V	12V	12V	0V
At idle	12V	0V	12V	0V	0V

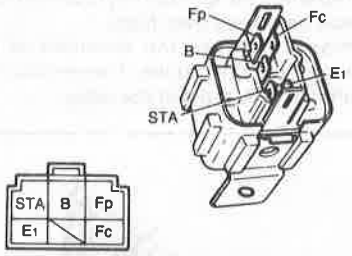
10.31a Check the circuit opening relay terminal voltages and compare your readings with the chart





Between terminals	Resistance (Ω)
STA-E1	21—43
B-Fc	109—226
B-Fp	∞

10.31b Check the circuit opening relay terminal resistance between the indicated terminals – if the values aren't correct, replace the relay



12V	Grounded	Correct result
STA	E1	B-Fp: Continuity
B	Fc	Fp: Battery voltage

10.32 With battery power applied to the specified terminals, the readings must be as shown

32 Apply battery power to the circuit opening relay terminals and check the operation of the relay **(see illustration)**. Replace the relay with a new one if the results are not as specified in the accompanying chart.

33 To replace the relay, unplug the electrical connector and remove the mounting screw. Installation is the reverse of the removal procedure.

EGI control unit

34 Due to the specialized test equipment and expertise required to check the control unit, diagnosis and replacement should be left to a dealer service department or a repair shop.

11 Accelerator cable – removal and installation

Refer to illustrations 11.2a, 11.2b and 11.7

1 Remove the air cleaner housing.

2 Disconnect the accelerator cable from the carburetor. Early model vehicles have a mechanical linkage set-up and must be unbolted from the carburetor **(see illustrations)**.

3 Working under the dash, disengage the accelerator cable from the upper end of the accelerator pedal.

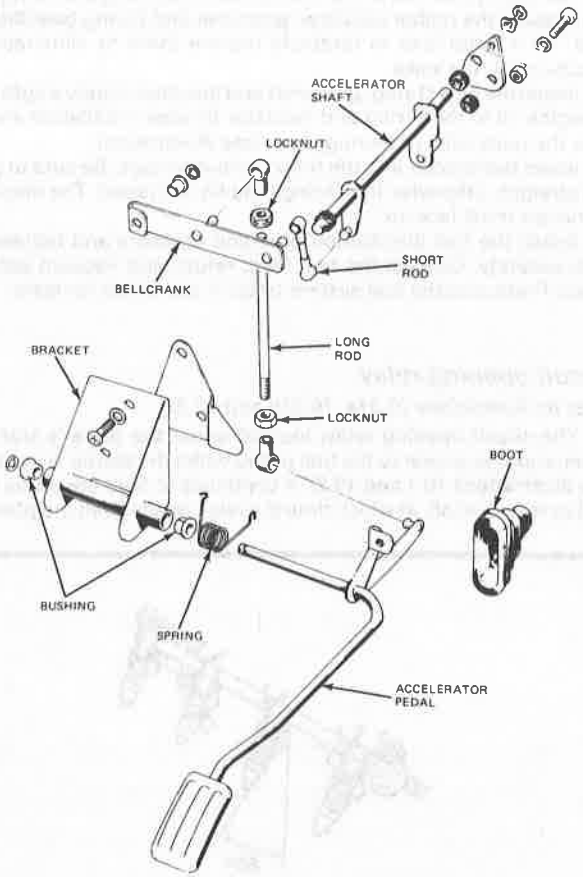
4 Moving back to the engine compartment, remove the bolts that attach the accelerator cable guide tube to the firewall and then pull the cable out through the opening.

5 Installation is the reverse of the removal procedure.

6 Make sure that the throttle valve opens fully when the accelerator pedal is fully depressed and returns to idle when released.

7 Adjust accelerator pedal free play by turning the adjusting nuts **(see illustration)**.

8 Make sure that the throttle cable does not contact any components in close proximity to it.



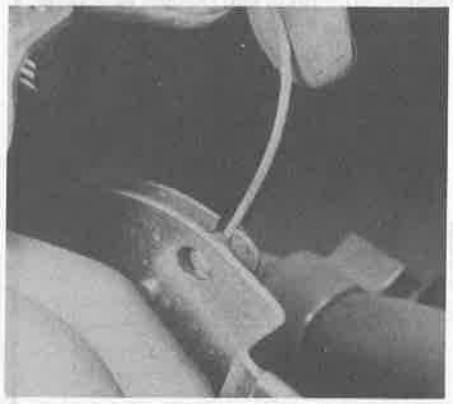
11.2a Typical early model mechanical operated throttle linkage – to adjust the linkage free play, loosen the locknuts on the long rod and turn the rod just until the free play is taken up

12 Accelerator pedal – removal and installation

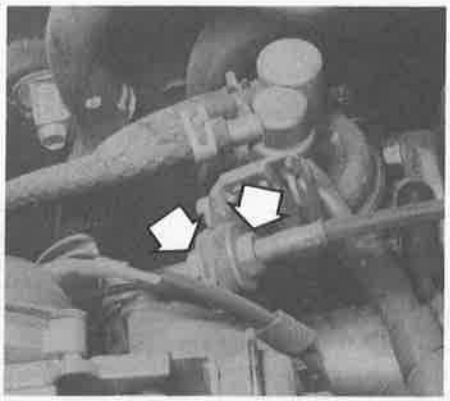
1 Disengage the accelerator cable from the upper end of the accelerator pedal by pushing it toward the end of the cable. Then disengage the cable from the pedal.

2 Remove the bolts that retain the accelerator pedal mounting bracket and lift out the pedal.

3 Installation is the reverse of the removal procedure.

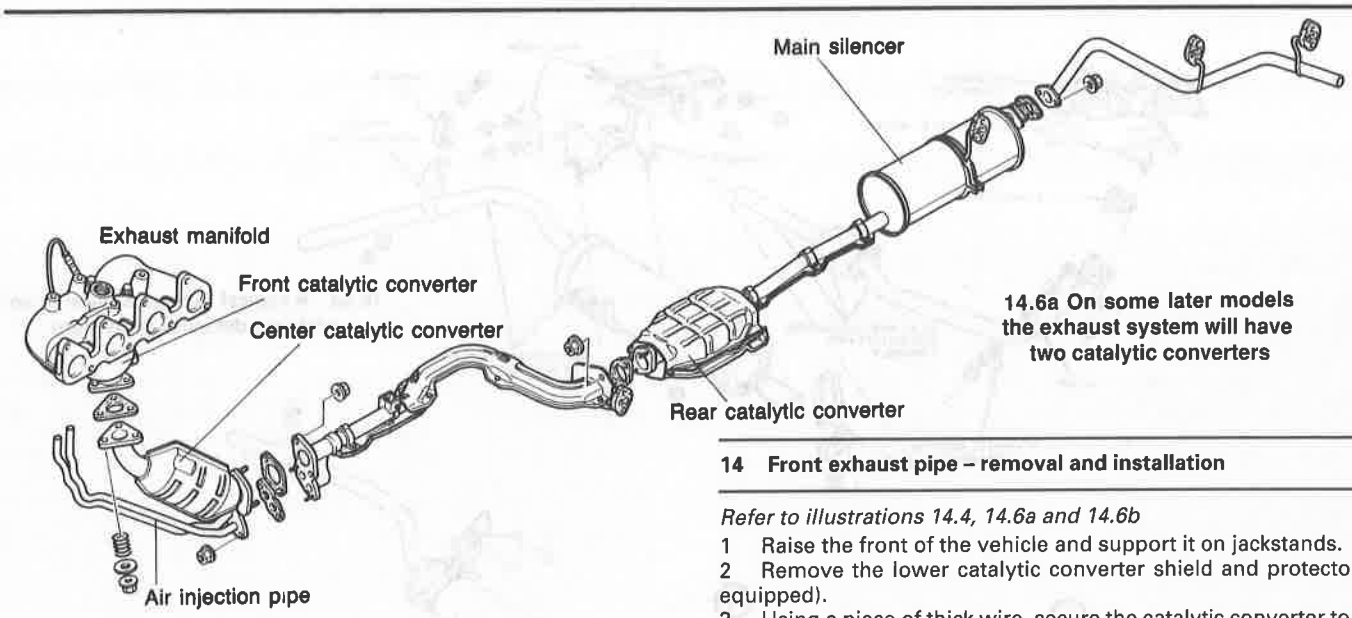


11.2b Removing a typical accelerator cable



11.7 To adjust the cable operated throttle linkage, simply turn the adjusting nuts (arrows) until the free play is taken up

14.4 On early models the front exhaust pipe is attached to the transmission



14.6a On some later models the exhaust system will have two catalytic converters

4 On early models with mechanical linkage, disengage the long rod, remove the clip at the end of the pedal and slide the accelerator pedal out of the bracket **(see illustration 11.2a)**.

13 Exhaust system – general information

The exhaust system consists of the muffler, catalytic converter and exhaust pipes, and includes four main pieces; the front exhaust pipe which attaches to the exhaust manifold, the catalytic converter, the center tube and the muffler/tailpipe assembly.

The catalytic converter is attached to both the front exhaust pipe and the center tube by mounting bolts. The muffler is attached to the center tube by a clamp and is welded to the tailpipe.

The interior of the catlytic converter is a honeycomb-like design that is coated with platinum and rhodium. When these elements interact with the hydrocarbon (HC), carbon monoxide (CO) and oxides of nitrogen (NOx) in the exhaust, it causes reactions to occur that convert the CO to CO2 (carbon dioxide), the HC to CO and H20 (water), and reduces the NOx.

Since lead and phosphorus additives in gasoline can poison the converter's catalytic elements, thus rendering it ineffective in altering the gases' toxic elements, only unleaded fuel should be used in the vehicle.

Periodic maintenance of the converter is not required.

In order to accurately test the functioning of the converter, a CO tester is needed. For this reason, we recommend you take the vehicle to a Mazda dealer or other qualified shop to have the converter tested.

If, through physical damage, the use of leaded fuels or because its active elements have been depleted, the catalytic converter is rendered ineffective, it must be replaced as a unit.

Caution: *It should be noted that since the internal chemical conversions occur between the 600-degrees and 1200-degrees F, the converter operates at a very high temperature. Before performing any work on or near the converter be sure it has cooled sufficiently to avoid serious burns.*

When replacing any exhaust system parts, be sure you allow enough clearance from all points on the body to avoid overheating the floor pan and possibly damaging the interior carpet and insulation.

The entire exhaust system is attached to the body with mounting brackets and rubber hangers. If any one of the parts is improperly installed, excessive noise and vibration will be transmitted to the body.

Regular inspection of the exhaust system should be made to keep it at maximum efficiency. Look for any damage or mispositioned parts, open seams, holes, loose connections, excessive corrosion or other defects which could allow exhaust fumes to seep into the vehicle.

14 Front exhaust pipe – removal and installation

Refer to illustrations 14.4, 14.6a and 14.6b

1 Raise the front of the vehicle and support it on jackstands.

2 Remove the lower catalytic converter shield and protector (if equipped).

3 Using a piece of thick wire, secure the catalytic converter to the underside of the vehicle.

4 Remove any insulating shields mounted to the front exhaust pipe. Then disconnect the bracket that attaches the pipe to the body or transmission **(see illustration)**.

5 Loosen , but do not remove the two bolts attaching the front exhaust pipe to the catalytic converter. If the bolts are corroded and cannot be easily broken loose, penetrating oil and tapping with a hammer may help.

6 Remove the bolts that attach the front exhaust pipe to the exhaust manifold **(see illustration)**. Again, penetrating oil and tapping may be necessary. Later models will have two catalytic converters **(see illustration)**.

7 Now, while supporting the front exhaust pipe, remove the two bolts holding the pipe to the converter, and lift out the pipe.

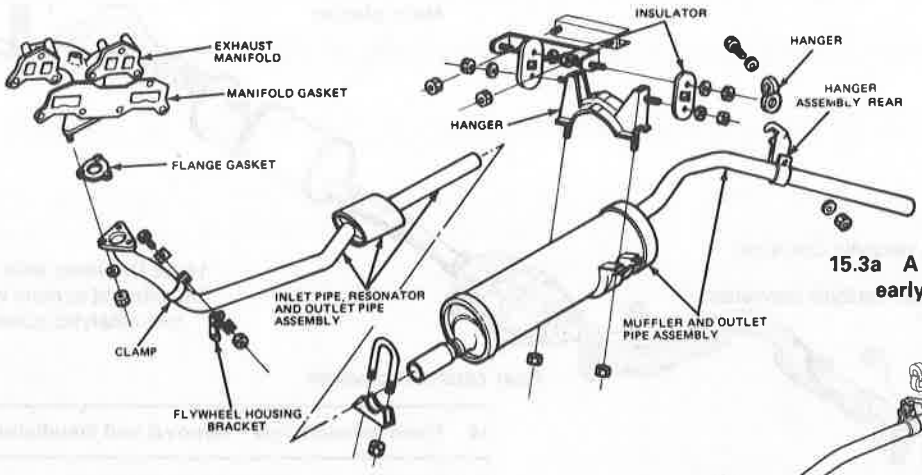
8 Installation is the reverse of the removal procedure. **Note:** *Be sure to use new gaskets between the front exhaust pipe and the exhaust manifold, and the front exhaust pipe and the catalytic converter. Also, before installing the bolts that attach these parts, apply an anti-seize compound to the threads.*

14.6b The front exhaust pipe-to-manifold nuts on a late–model vehicle

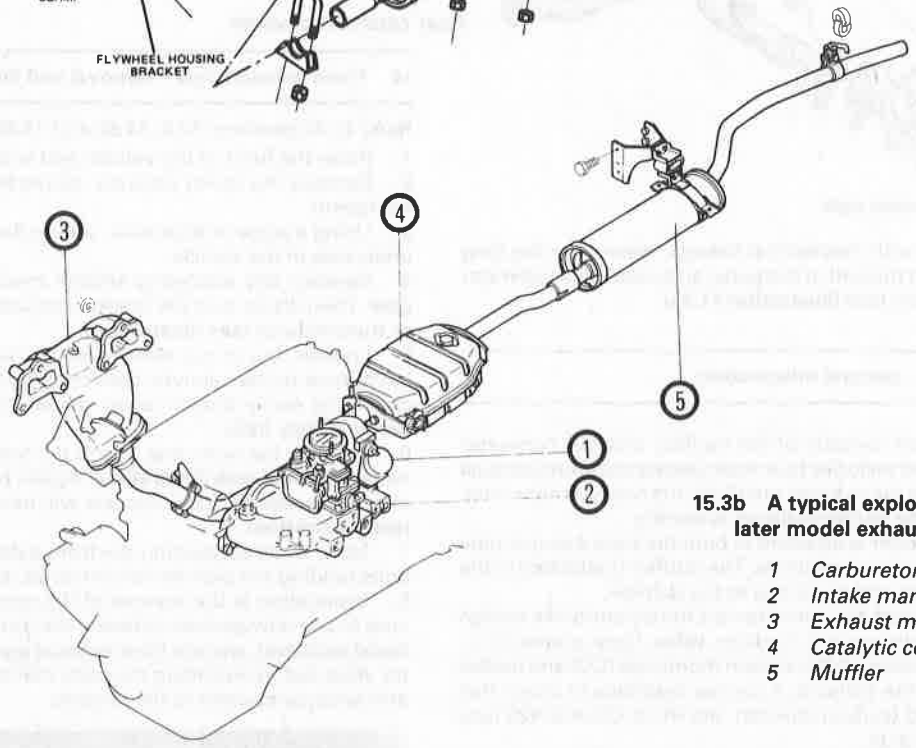
15 Muffler/tailpipe assembly – removal and installation

Refer illustrations 15.3a and 15.3b

1 The muffler is welded to the tailpipe, and both pieces are designed to be replaced as a unit. However, if either piece needs replacing, but the other is in good condition, a muffler shop will be able to cut off the muffler or tailpipe and weld on a new one without having to replace both pieces. The cost of this procedure, though, may offset the savings realized as a result of not replacing the entire assembly.



15.3a A typical exploded view of an early model exhaust system



15.3b A typical exploded view of a later model exhaust system

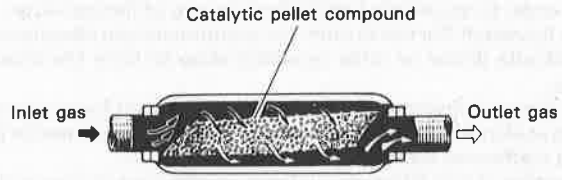
1 Carburetor
2 Intake manifold
3 Exhaust manifold
4 Catalytic converter
5 Muffler

2 Raise the rear of the truck and support it on jackstands.
3 Remove the U-bolt clamp that secures the muffler to the center pipe **(see illustrations)**.
4 Lightly tap all around the connection with a hammer to break up the internal sealant.
5 With a soft-faced hammer, tap on the front end of the muffler while pushing it backwards until the muffler is disengaged from the center pipe.
6 Remove the bolts attaching the tailpipe mounting bracket to the frame and lift the assembly out.
7 Installation is the reverse of the removal procedure. **Note:** *To ensure that no exhaust leaks occur at the muffler-to-center tube connection, an exhaust sealant should be used during installation. Follow the directions supplied with the sealant. Always use new exhaust gaskets.*

16 Catalytic converter – removal and installation

Refer to illustration 16.2

1 Raise the front of the vehicle and support it on jackstands.
2 Remove the lower catalytic converter shield and protector **(see illustration)**.
3 Using a piece of strong wire, secure the center pipe to the driveshaft or body.
4 While supporting the catalytic converter, break loose, but do not yet remove the four converter mounting bolts that attach the converter to the front exhaust pipe and center pipe. If the bolts are corroded



16.2 A typical catalytic converter used on later model vehicles to 1984

and cannot be easily broken loose, penetrating oil and tapping with a hammer may help.
5 While supporting the catalytic converter, remove all four mounting fasteners, and detach the converter from the vehicle.
6 Installation is the reverse of the removal procedure. **Note:** *Be sure to use new gaskets during installation and apply anti-seize compound to the mounting bolts.*