Chapter 4
Fuel and exhaust systems

Contents

	Section
Accelerator cable - removal and installation	9
Air filter element replacement	See Chapter 1
Air filter housing - removal and installation	8
Catalytic converter	See Chapter 6
Exhaust system check	See Chapter 1
Exhaust system - inspection and component replacement	15
Fuel filter replacement	See Chapter 1
Fuel injection system - general check	11
Fuel lines and fittings - general information	4
Fuel pressure relief procedure	2
Fuel pulsation damper - removal and installation	13
Fuel pump/fuel level sending unit module - removal and installation	5
Fuel pump/fuel pressure - check	3
Fuel rail and injectors - removal and installation	14
Fuel tank - removal and installation	6
Fuel tank cleaning and repair - general information	7
General information and precautions	1
Multi-port Fuel Injection (MFI) system - general information	10
Throttle body - inspection, removal and installation	12
Underbody fuel/brake line check	See Chapter 1
Underhood hose check	See Chapter 1

Specifications

Fuel pressure	
2001 (both engines)	35 to 65 psi (240 to 448 kPa)
2002	
Four-cylinder engine	35 to 65 psi (240 to 448 kPa)
V6 engine	39 to 55 psi (270 to 380 kPa)
2003 and 2004 (both engines)	50 to 65 psi (345 to 448 kPa)
2005 and later (both engines)	39 psi (270 kpa)
Fuel injector resistance	
2001	
Four-cylinder engine	11.4 to 12.6 ohms
V6 engine	10.3 to 17.3 ohms
2002 through 2004	
Four-cylinder engine	13.8 to 15.2 ohms
V6 engine	13.1 to 14.5 ohms
2005 and later	11 to 18 ohms

Torque specifications

Throttle body-to-intake manifold bolts	
Four-cylinder engine	62 in-lbs (7 Nm)
V6 engine	89 in-lbs (10 Nm)
Fuel rail mounting bolts	89 in-lbs (10 Nm)
Fuel pulsation damper bolts (four-cylinder engine)	53 in-lbs (6 Nm)

1 General information and precautions

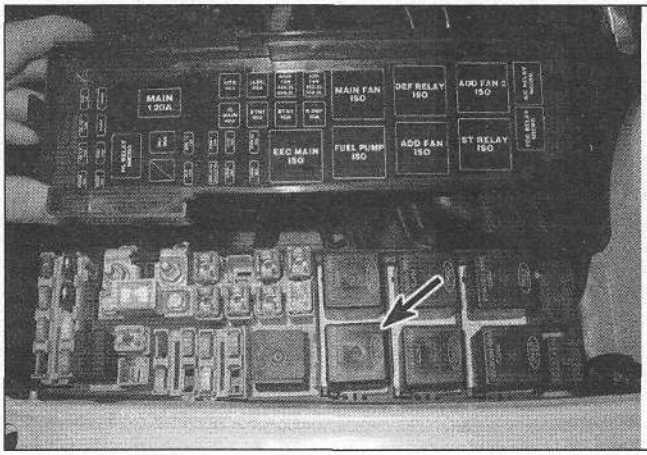
This Chapter covers the removal and installation procedures for the important parts of the air intake, fuel and exhaust systems. Because emission-control systems are integral parts of the engine management system, there are many cross-references to Chapter 6. Information on the engine management system, information sensors and output actuators is in Chapter 6.

The air intake system consists of the air filter housing, the air intake duct, the throttle body and the intake manifold. Incoming air passes through the air filter element, the Mass Air Flow (MAF) sensor, the throttle body, the intake manifold plenum and the intake manifold "runners" before being mixed with fuel sprayed into the intake ports by the fuel injectors. This Chapter covers removal of the air filter *housing*; the replacement procedure for the air filter *element* is in Chapter 1. The MAF sensor measures the mass (volume) of air entering the engine and sends an analog (continuously variable) voltage signal to the Powertrain Control Module (PCM), which uses this data to determine how much fuel to deliver for the correct air/fuel ratio. The replacement procedure for the MAF sensor is in Chapter 6. The removal and installation procedure for the throttle body is in this Chapter. The removal and installation procedure for the intake manifold is in Chapter 2.

The Multiport Fuel Injection (MFI) system consists of the fuel tank, an electric fuel pump/fuel level sending unit module mounted inside the tank, the fuel rail, the pulsation damper (dampens the pulsations produced by the pumping action of the electric fuel pump), the fuel injectors and the metal and plastic fuel lines that connect the various components of the MFI system. The electric fuel pump/fuel level sending unit module can be replaced (the procedure is in this Chapter) but you cannot replace the fuel pump, the fuel level sending unit or any other part of the module *separately*. If any part of the module is defective, you must replace the entire unit. You'll also find removal and installation procedures for the fuel rail and injectors and for the pulsation damper in this Chapter.

All vehicles covered by this manual are equipped with a "returnless" fuel system. Four-cylinder models use an Electronic Returnless Fuel System (ERFS). There is no fuel pressure regulator and no fuel return line on ERFS-equipped models. Instead, the fuel pressure is regulated by controlling the fuel pump speed. The fuel pump is controlled by the Fuel Pump Driver Module (FPDM) inside the Powertrain Control Module (PCM).

V6 models use a Mechanical Returnless Fuel System (MRFS). These models have a fuel pressure regulator, which is located on the fuel pump/fuel level sending unit module inside the tank. They also have a short return line between a junction in the fuel supply line and the fuel pump/fuel level sending unit module.



2.3 The fuel pump relay is located in the engine compartment fuse and relay box

The junction is located just downstream from, and to the left of, the fuel filter. Both the fuel supply line and the short fuel return line are pressurized. When the fuel pressure exceeds the upper threshold of the system's normal operating pressure, the fuel pressure regulator opens and fuel returns to the tank via the return line.

The exhaust system consists of the exhaust manifold(s), the catalytic converters, the muffler and the exhaust pipes connecting these components. The system is suspended from the vehicle pan by rubber hangers. You'll find the removal and installation procedures for the exhaust manifold(s) in Chapter 2, and for the rest of the exhaust system in this Chapter. There is also more information about catalytic converters in Chapter 6.

The exhaust system is another area that you should service carefully, particularly when the engine is running, because the exhaust system reaches very high operating temperatures. Even brief contact with any part of the exhaust system can cause serious burns if the engine is running or has just been turned off. The catalytic converters run at even higher temperatures than the rest of the exhaust system, so be extremely cautious when working around them.

2 Fuel pressure relief procedure

Refer to illustration 2.3

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a gas-type appliance (such as a water heater or a clothes dryer) is present. Since gasoline is carcinogenic, wear latex gloves when there's a possibility of being exposed to fuel, and, if you spill any fuel on your skin, rinse it off immediately with soap and water. Mop up any spills immediately and do not store fuel-soaked rags where they could ignite. The fuel system is under constant pressure, so, if any fuel lines are to be disconnected, the fuel pressure in the system must be relieved first. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

Caution: *After the fuel pressure has been relieved, it's a good idea to lay a shop towel over any fuel connection to be disassembled, to absorb the residual fuel that may leak out when servicing the fuel system.*

1 The fuel system referred to in this Chapter is defined as the fuel tank and tank-mounted fuel pump/fuel gauge sender unit, the fuel filter, the fuel injectors and the metal pipes and flexible hoses of the fuel lines between these components. All these contain fuel, which will be under pressure while the engine is running and/or while the ignition is switched on.

2 The pressure will also remain for some time after the ignition has been switched off, and it *must* be relieved before any fuel lines are disconnected.

3 To relieve fuel system pressure, start the engine and then remove the fuel pump relay **(see illustration)**. The engine will run briefly, then stall. Turn the engine over once or twice to verify that all fuel system pressure has been released, then switch off the ignition.

Warning: *This procedure will merely relieve the increased pressure necessary for the engine to run. Remember that fuel will still be present in the system components, and take precautions accordingly before disconnecting any of them.* Disconnect the cable from the negative terminal of the battery before performing any work on the fuel system.

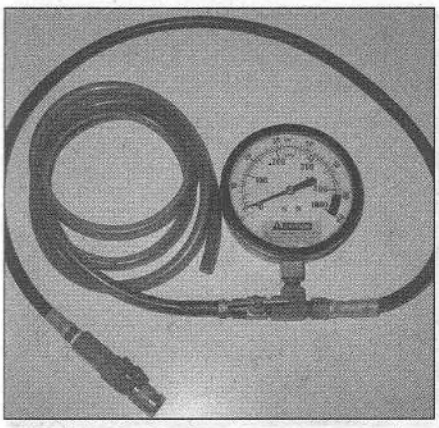
4 Don't forget to install the relay when your work is completed. Note that, once the fuel system has been depressurized and drained (even partially), it will take significantly longer to restart the engine - perhaps several seconds of cranking - before the system is refilled and pressure restored.

3 Fuel pump/fuel pressure - check

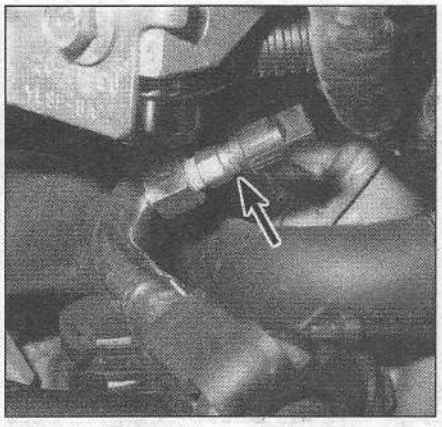
Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. See the* **Warning** *in Section 2.*

Fuel pump operation check

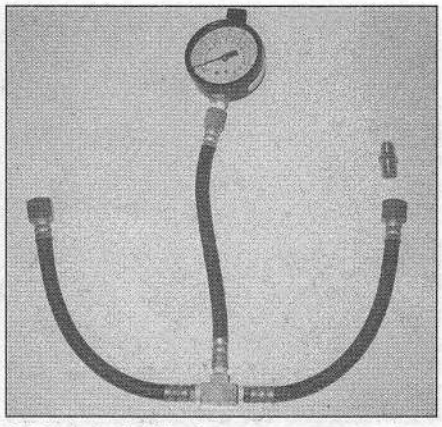
1 The fuel pump is located inside the fuel



3.3a A typical fuel pressure gauge setup suitable for checking the fuel pressure on V6 models



3.3b On V6 models, the fuel pressure test port is a Schrader valve located on the left end of the fuel rail



3.3c A typical fuel pressure gauge setup suitable for checking the fuel pressure on four-cylinder models; these models don't have a Schrader valve test port on the fuel rail, so you'll have to disconnect the fuel supply line at the fuel rail (or at some other fuel supply line connection in the engine compartment) and tee into it

tank, which muffles its sound when the engine is running. But you *can* actually hear the fuel pump if you sit inside the vehicle with the windows closed, turn the ignition key to ON (*not* START) and listen carefully for the whirring sound made by the fuel pump as it's briefly turned on to pressurize the fuel system prior to starting the engine (the sound will come from under the rear seat, because the fuel tank is located below it). You will only hear a soft whirring sound for a second or two, but that sound tells you that the pump is working. If you can't hear the pump, remove the fuel filler cap, depress the spring-loaded door inside the fuel filler neck, then have an assistant turn the ignition switch to ON while you listen for the sound of the pump being primed.

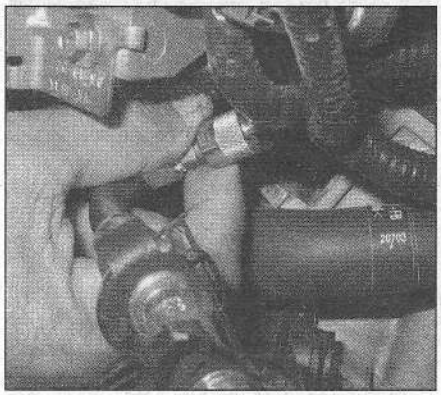
2 If the pump does not come on when the ignition key is turned to ON, check the fuel pump fuse and relay (both of which are located in the engine compartment fuse and relay box). If the fuse and relay are okay, check the wiring back to the fuel pump (see Section 5 for information on how to access the fuel pump electrical connector). If the fuse, relay and wiring are okay, the fuel pump is probably defective. If the pump runs *continuously* with the ignition key in its ON position, the Powertrain Control Module (PCM) is probably defective. Have the PCM checked by a dealer service department or other qualified repair shop.

Fuel pressure check

Refer to illustrations 3.3a, 3.3b, 3.3c, 3.4a, 3.4b, 3.4c,

3 To check the fuel pressure on a V6 engine, you'll need a fuel pressure gauge with an adapter that fits the Schrader valve on the left end of the fuel rail **(see illustration)**. Four-cylinder engines do not have a Schrader valve, so you will need to obtain a fuel pressure gauge **(see illustration)** with which you can tee into the fuel system at a suitable fuel line fitting.

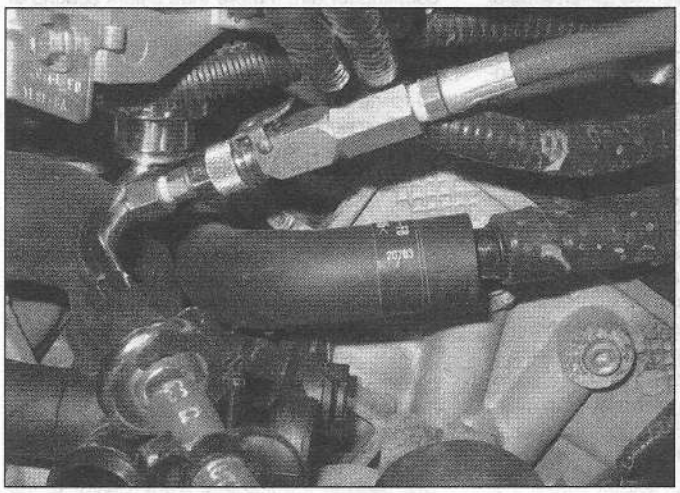
4 Relieve the fuel pressure (see Section 2). If you're using a pressure gauge with a bleeder valve, make sure that the valve is closed. On V6 models, it's easy to connect a fuel pressure gauge to the Schrader valve test port **(see illustrations)**. On four-cylinder models, you'll have to tee into the fuel system



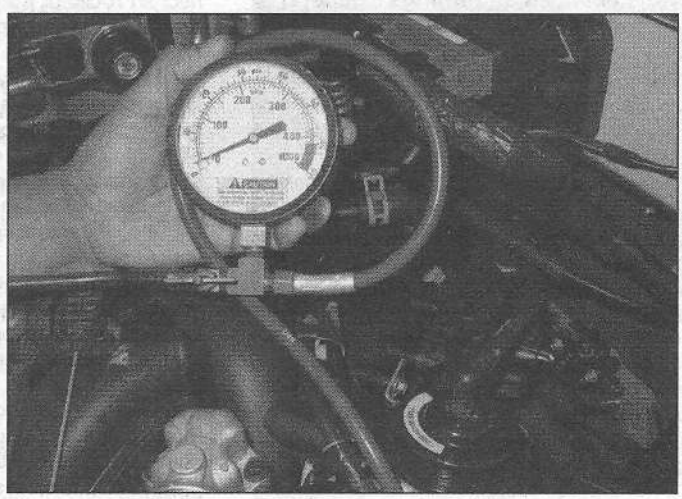
3.4a First, screw on the adapter . . .

at the connection between the fuel supply line and the fuel rail.

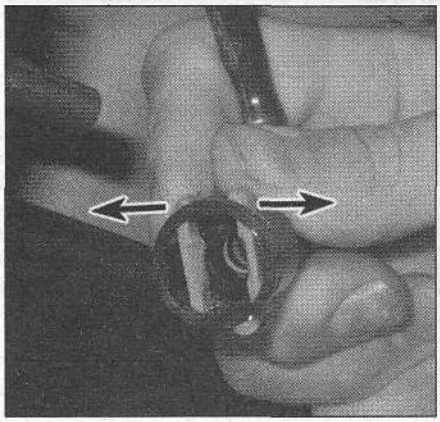
5 Start the engine and allow it to idle. Note the gauge reading as soon as the pressure



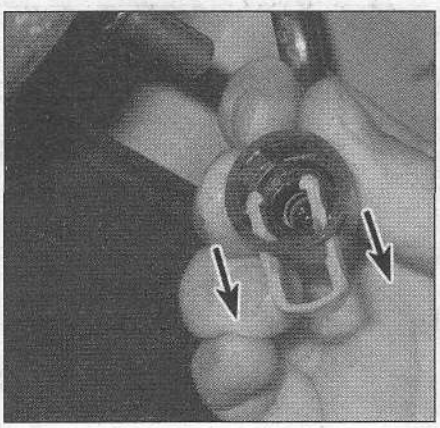
3.4b . . . then hook up the fuel pressure gauge . . .



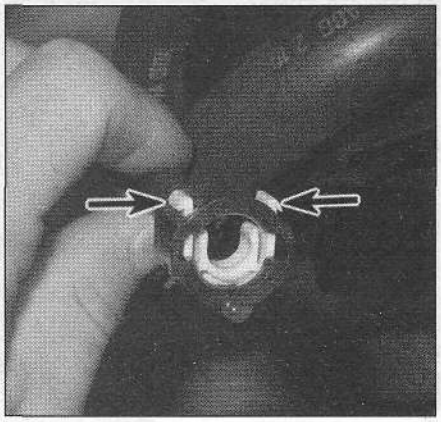
3.4c . . . and you're ready to check the fuel pressure on a V6 engine (this setup won't work on four-cylinder models because they don't have a test port)



4.3a To disconnect an R-clip type fuel line coupling (this one is the connector on the *inlet* side of the fuel filter), *spread* the two legs of the clip *apart* . . .



4.3b . . . then pull the clip out and detach the coupling from the component (coupling removed for clarity)



4.3c Here's another type of R-clip fuel line coupling (this one is the connector on the *outlet* side of the fuel filter); to disconnect it, *squeeze* the two legs of the clip *toward each other* . . .

stabilizes, and compare it with the pressure listed in this Chapter's Specifications.

a) *If the pressure is lower than specified, check the fuel lines and hoses for kinks, blockages and leaks. Remove the fuel pump module* (see Section 5) *and check the fuel strainer for restrictions. If all these components are okay, the fuel filter could be clogged or the fuel pump module could be defective.*

b) *If the fuel pressure is higher than specified, replace the fuel pump module (the pressure regulator, part of the fuel pump module, is not available separately).*

6 Turn off the engine. Verify that the fuel pressure stays at the specified level for five minutes after the engine is turned off.

7 Relieve the fuel pressure (see Section 2), then disconnect the fuel pressure gauge. Be sure to cover the fitting with a rag before loosening it. Mop up any spilled gasoline.

8 Start the engine and verify that there are no fuel leaks.

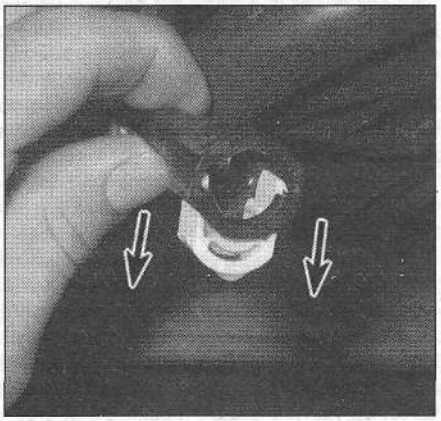
4 Fuel lines and fittings - general information

Warning 1: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. See the* **Warning** *in Section 2.*

Warning 2: *Before disconnecting any fuel line couplings, relieve the residual pressure in the fuel system* (see Section 2) *and equalize tank pressure by removing the fuel filler cap. This procedure will merely relieve the increased pressure necessary for the engine to run - remember that fuel will still be present in the system components, so you should be ready to mop up fuel spills when disconnecting fuel line couplings.*

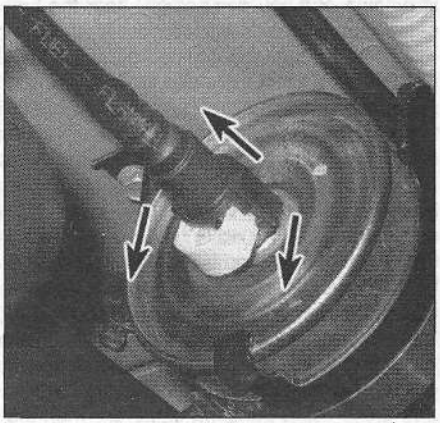
1 Ford uses three kinds of fuel line "couplings" (connectors):

"R-clip" (also known as "duck-bill clip" or "horseshoe clip") quick-release couplings
Push-connect quick-release couplings
Spring-lock couplings



4.3d . . . pull the clip down (coupling removed for clarity) . . .

The procedure for releasing each type of coupling is different. But a few rules of thumb apply to all Ford couplings. First, always disconnect all fuel line couplings from a fuel system component *before* loosening the component for removal. Second, when you disconnect an R-clip or push-connect quick-release coupling, always inspect the condition of the clip and the coupling *before reconnecting the coupling*. And when you disconnect a spring-lock coupling, always inspect the O-rings and the garter spring before reconnecting the coupling. Most of these couplings are under the same pressure as the rest of the fuel system, so to avoid leaks (and fires!) make very sure that the clip and coupling are in good condition. At one time, the clips for these couplings were generally available, at least at Ford dealerships (for example, factory fuel filter kits included new clips for the couplings connecting the fuel lines to the inlet and outlet sides of the filter). Now that is no longer the case. Even if a clip is the only part of the coupling that's damaged, you might not be able to obtain a new clip without buying a new coupling. And in most cases, the coupling itself is a non-removable part of the fuel line, so you might have to replace an entire fuel line just to get that new clip!



4.3e . . . then grasp the coupling and line and pull it straight off the pipe on the filter (this type of R-clip coupling is also referred to as a "horseshoe clip" coupling because of the shape of the clip)

All couplings

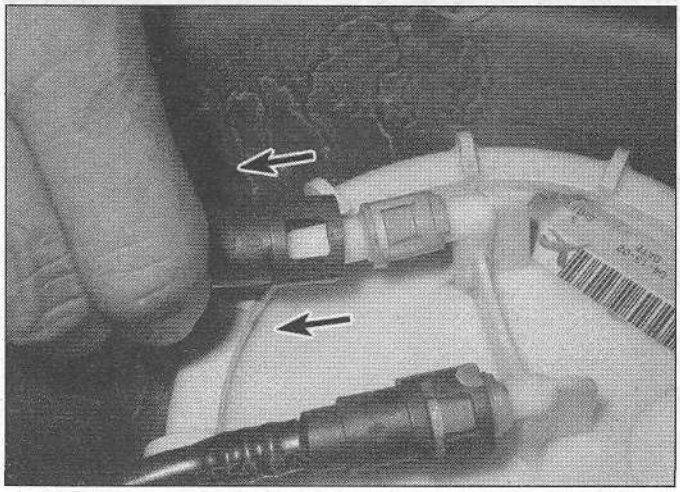
2 Inspect the visible internal parts of the coupling for dirt. If more than a light coating of dust is present, clean off the coupling before disassembling it. The seals in the coupling will stick to the fuel line as they age. Twist the coupling on the line, then push and pull the coupling until it moves freely.

R-clip quick-release couplings

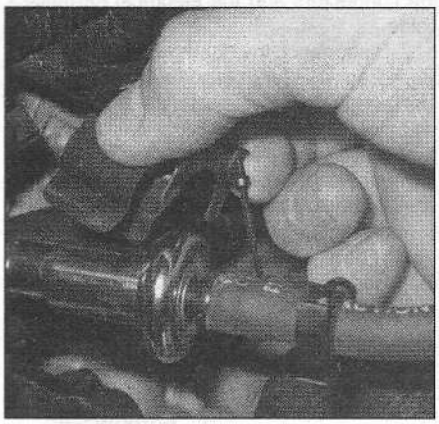
Refer to illustrations 4.3a through 4.3e

3 Relieve the fuel system pressure (see Section 2), then remove the clip from the coupling by bending the shipping tab down until it clears the coupling. Then, using only your hands, spread the two legs apart (or squeeze them together, depending on the type of R-clip coupling) to disengage the coupling, then pull the clip down until it protrudes from the coupling body. Do not use any tools for this part of the procedure. Finally, pull lightly on the wide part of the clip and work it clear of the line and the coupling **(see illustrations)**. Finally, grasp the coupling and pull it straight off.

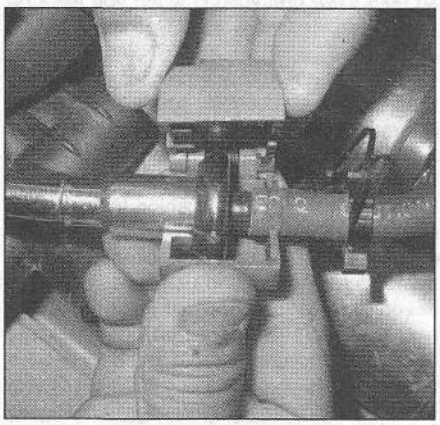
4.5a To disconnect a push-connect quick-release coupling, squeeze the two white locking tabs with a pair of needle-nose pliers . . .



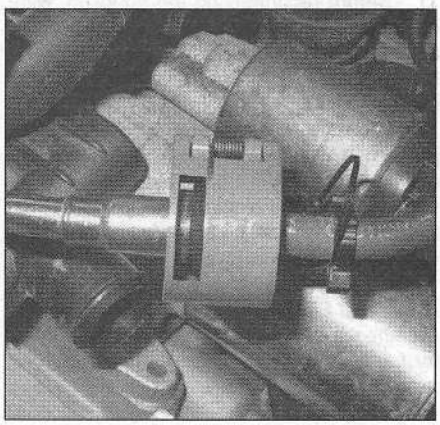
4.5b . . . then pull off the coupling (notice that the locking tab part of the coupling remains on the other fuel line (or, in this case, the pipe on top of the fuel pump/fuel level sending unit module)



4.9 Before disconnecting a spring-lock coupling, remove the safety cover



4.10a Install the special tool on the spring-lock coupling exactly as shown (the tool only fits one way) . . .



4.10b . . . close the clamshell halves of the tool around the coupling . . .

4 Before reinstalling the coupling on the line, wipe off the end of the line with a clean cloth. Inspect the inside of the coupling and make sure that it's free of dirt. To reinstall the coupling on the line, align the coupling and line and push the coupling into place. When the coupling engages, you will hear an audible click. Pull on the coupling to verify that it's completely engaged. When installing the clip, carefully guide the legs into their respective holes, then push the clip up until the legs snap into place. The coupling is now locked on.

Push-connect quick-release couplings

Refer to illustrations 4.5a and 4.5b

5 To disconnect this type of coupling, relieve the fuel system pressure (see Section 2), then squeeze the locking tabs together with a pair of needle-nose pliers **(see illustration)** and pull off the coupling **(see illustration)**.

6 Before reconnecting the coupling, wipe off the end of the line with a clean cloth. Inspect the inside of the coupling and make sure that it's free of dirt. To reconnect the coupling, insert the fuel line into the coupling until you hear an audible click. Pull on the coupling to verify that it's fully engaged.

Spring-lock couplings

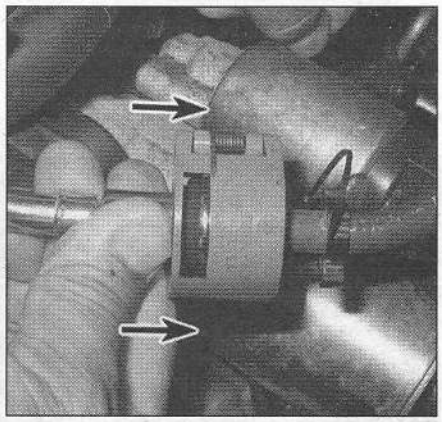
Refer to illustrations 4.9, 4.10a, 4.10b, 4.10c, 4.10d and 4.10e

7 The fuel supply line is connected to the fuel rail by a spring-lock coupling. The male side of the spring-lock coupling, which is sealed by two O-rings, is inserted into the flared female side. The coupling is secured by a garter spring which prevents disengagement by gripping the flared end of the female fitting. A safety cover clips onto the coupling to provide additional security.

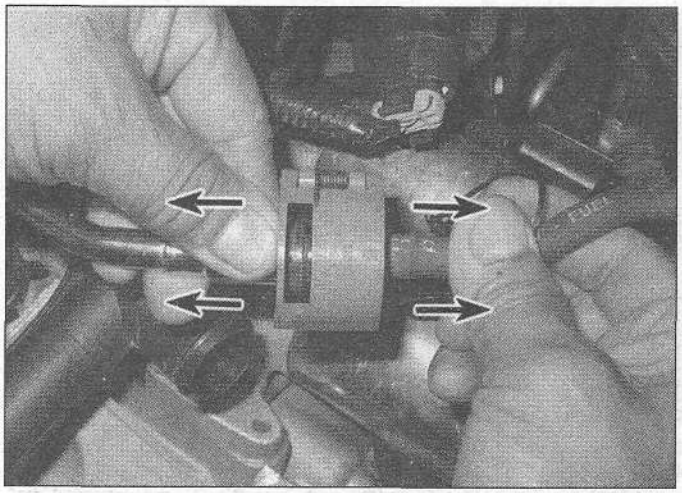
8 To disconnect a spring-lock coupling, you will need to obtain a spring-lock coupling tool, available at most auto parts stores. Be aware that 3/8-inch and 1/2-inch couplings (and other sizes) require different tools. These tools are inexpensive, and are usually sold in sets anyway.

9 First, relieve the fuel system pressure (see Section 2), then remove the safety cover **(see illustration)**.

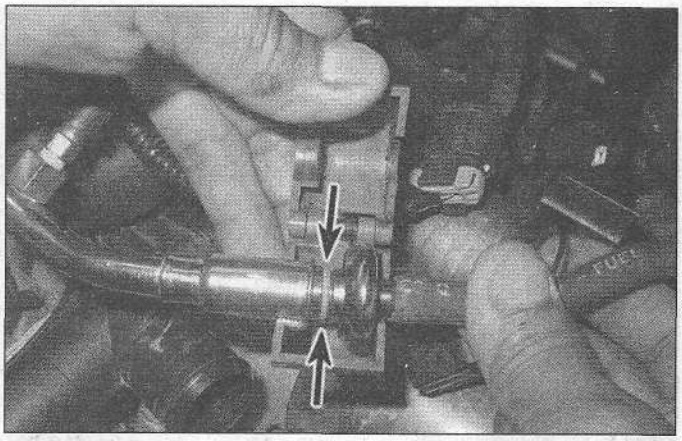
10 Install the spring-lock coupling tool **(see illustrations)**. Then push the coupling tool firmly toward the garter spring housing **(see illustration)** to disengage the garter spring from the flared end of the female side of the connection. Now pull the two fuel lines apart **(see illustrations)**.



4.10c . . . push the tool to the right to disengage the garter spring from the flared end on the female side of the coupling . . .



4.10d . . . hold the tool in that position and pull the two fuel lines apart



4.10e Open the clamshell halves of the tool and you should see at least one of the O-rings on the male side of the coupling exposed. This indicates that the coupling is disconnected, so you can remove the tool and pull the two lines apart

11 Before reconnecting the coupling, wipe off the ends of both fuel lines with a clean cloth. Inspect the condition of the O-rings and the garter spring. If either O-ring or the garter spring is damaged or worn, replace it.

12 To reconnect a spring-lock coupling, press the two sides of the connection together until the flared end of the male side of the fitting is locked into place by the garter spring. Pull on the coupling to verify that it's fully engaged. Be sure to install the safety clamp.

13 When you're done, turn the ignition key to ON (*not* START) and re-pressurize the fuel system, which will take a moment, then check for fuel leakage around the coupling. If there are no signs of leaks, start the engine and check again.

5 Fuel pump/fuel level sending unit module - removal and installation

Refer to illustrations 5.4a, 5.4b, 5.5, 5.7 and 5.8

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. See the* **Warning** *in Section 2.*

1 Relieve the residual pressure in the fuel system (see Section 2), and equalize tank pressure by removing the fuel filler cap.

2 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

3 Fold the rear seat cushion forward (see Chapter 11 if necessary).

4 Remove the carpeting covering the fuel pump/fuel level sending unit module access cover **(see illustration)**, then remove the access cover **(see illustration)**. To reduce the risk of introducing water, dirt and dust into the tank while it is open, use a vacuum cleaner to clean the carpeting surrounding the access cover hole. Also blow (or wipe) off any dirt from the top of the fuel pump/fuel level sending unit and from the surface of the tank surrounding the module.

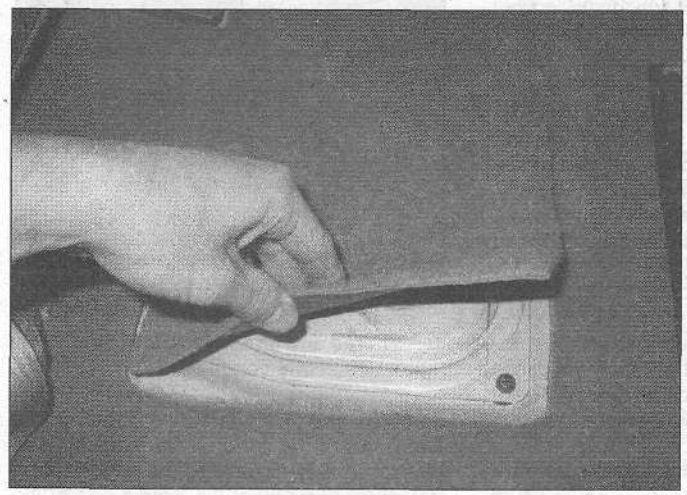
5 Disconnect the fuel pump/fuel level sending unit module electrical connector **(see illustration)**. Also disconnect the electrical connector for the fuel pressure sensor. Set the connectors and the electrical harnesses aside.

6 Disconnect the fuel supply and return lines from the fuel pump/fuel level sending unit module (see Section 4). Use a rag to soak up any spilled fuel.

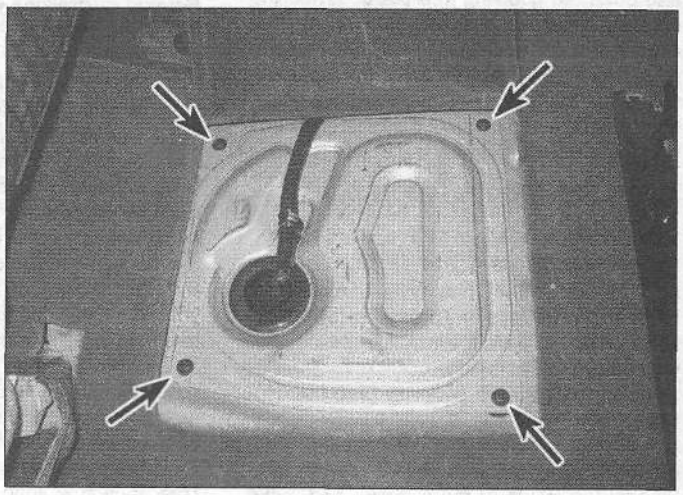
7 Unscrew the fuel pump/fuel level sending unit module retaining ring by turning it counterclockwise. If the ring is tight, use a hammer and a brass punch to loosen it **(see illustration)**.

8 Remove the fuel pump/fuel level sending unit module, taking care not to bend the sending unit float arm **(see illustration)**.

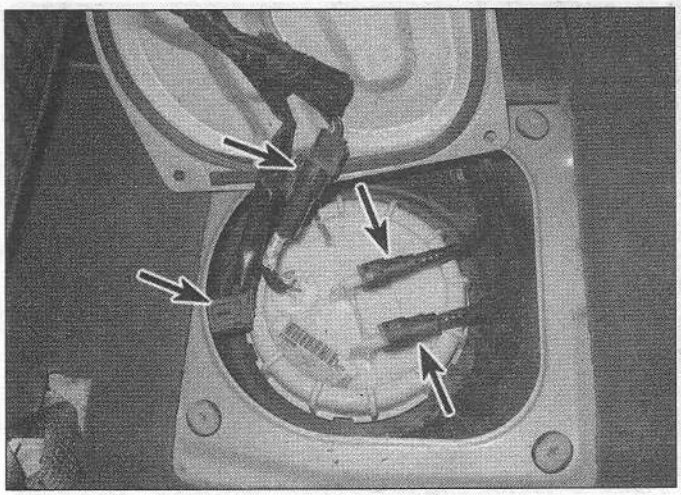
9 Before installing the pump, inspect the neoprene gasket **(see illustration 5.8)** for cracks, tears and deterioration. If it's worn or damaged, replace it. Also inspect the fuel pump inlet filter at the base of the pump. Make sure that it's clean and free of debris and dirt. If it's dirty, try washing it with carburetor cleaner spray. If this filter is seriously damaged, you'll have to replace the fuel pump/fuel level sending unit module. The filter is not available separately.



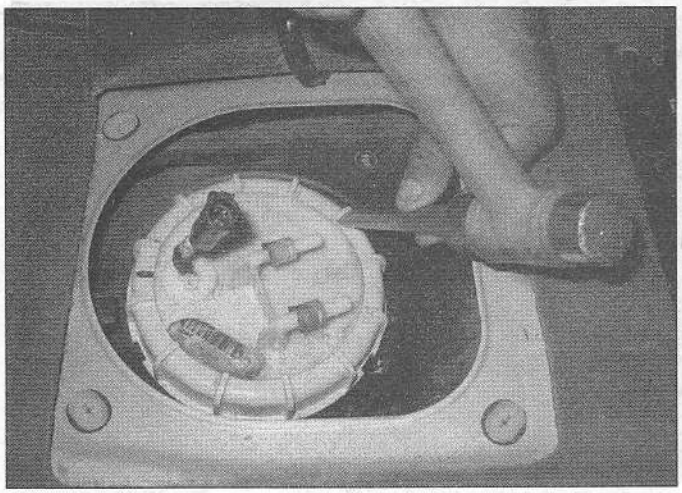
5.4a Pull back the carpeting covering the fuel pump/fuel level sending unit access cover . . .



5.4b . . . remove the access cover screws and remove the cover



5.5 Disconnect the electrical connectors for the fuel pump/fuel level sending unit module and for the fuel pressure sensor, then disconnect the fuel line connection(s) (see Section 4)



5.7 To unscrew the fuel pump/fuel level sending unit module retaining ring, turn it counterclockwise; if it's tight, loosen it with a hammer and a brass punch

10 Align the fuel pump/fuel level sending unit module with its hole in the tank and *carefully* insert it into the tank. Make sure that you don't damage the float arm during installation. If the float arm is bent, the fuel level gauge reading will be incorrect. The remainder of installation is the reverse of removal.

11 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

6 Fuel tank - removal and installation

Refer to illustrations 6.7, 6.8, 6.11, 6.12 and 6.13

Warning 1: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. See the* **Warning** *in Section 2.*

Warning 2: *Before disconnecting or opening any part of the fuel system, relieve the residual pressure* (see Section 2)*, and equalize the pressure inside the fuel tank by removing the fuel filler cap.*

1 There is no fuel tank drain plug, so it's easier to remove the fuel tank when it's nearly empty. If that's not possible, try to siphon out the fuel in the tank before removing the tank (see Step 5).

2 Relieve the fuel system pressure (see Section 2).

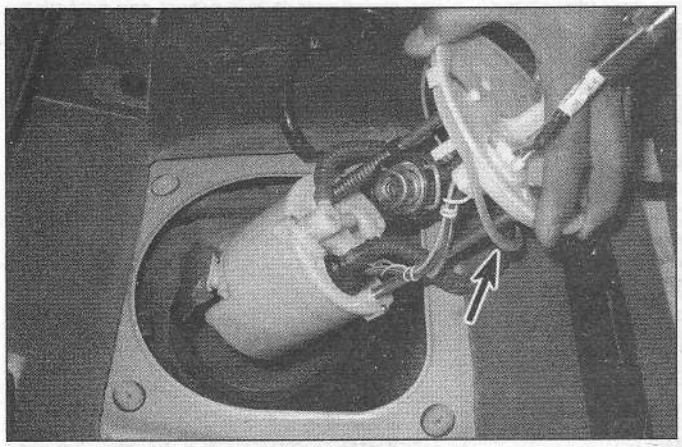
3 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

4 Working inside the vehicle, disconnect the electrical connectors from the fuel pump/fuel level sending unit module and from the fuel pressure sensor (see Section 5). Also disconnect the fuel line(s) (some models have two, others only have one). If you don't need to siphon any fuel from the tank, it's not necessary to remove the module to remove the tank (as long as everything is disconnected from the module!).

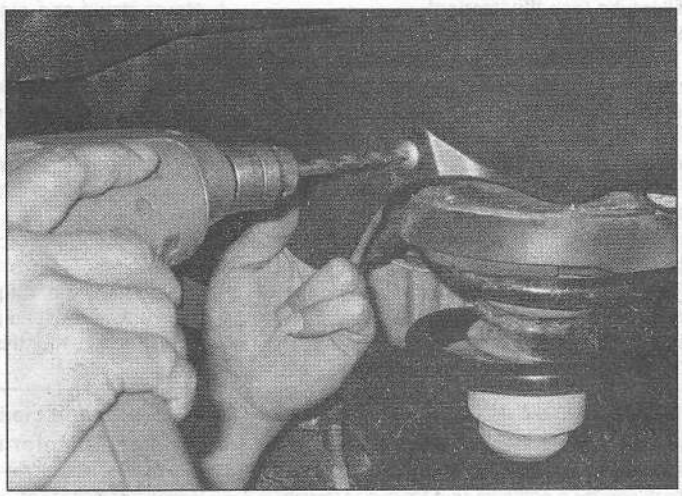
5 If there's still a lot of fuel in the tank, siphon or hand-pump the remaining fuel from the tank now. We recommend that you siphon the fuel out of the tank through the hole in the top of the tank for the fuel pump/fuel level sending unit module, but you can also siphon it out through the fuel filler neck or through the fuel filler neck pipe (at the tank), after you have disconnected the fuel filler neck hose from the fuel tank. **Warning:** *Don't start the siphoning action by mouth! Use a siphoning kit (available at most auto parts stores).*

6 Loosen the left rear wheel lug nuts, raise the vehicle and place it securely on jackstands. Remove the left rear wheel.

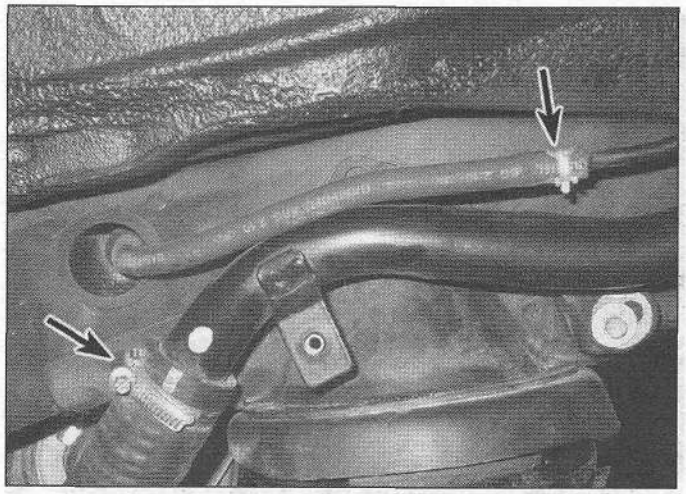
7 Drill out the rivets that attach the fuel filler hose shield **(see illustration)** and then remove the shield.



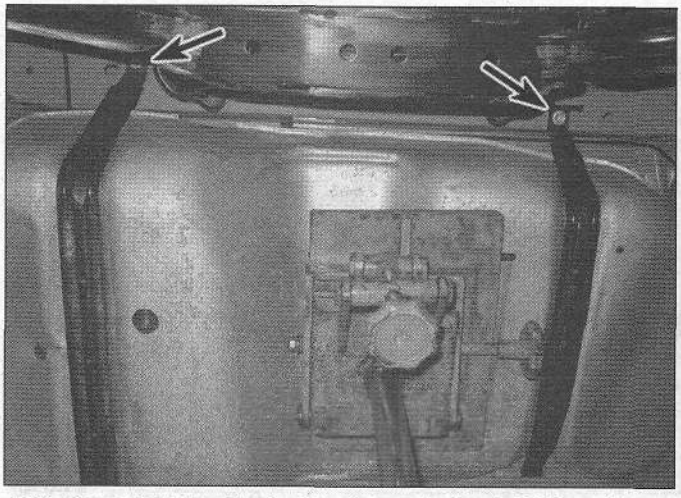
5.8 Carefully remove the fuel pump/fuel level sending unit module from the fuel tank; angle the pump as shown so that the fuel level sending unit float arm clears the edge of the access hole. Be sure to inspect the neoprene gasket for wear and damage while the pump is out



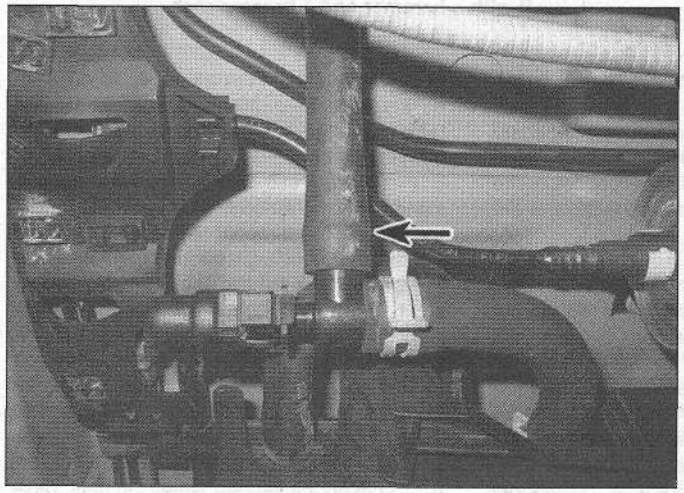
6.7 Drill out the rivets that attach the fuel filler hose shield and then remove the shield



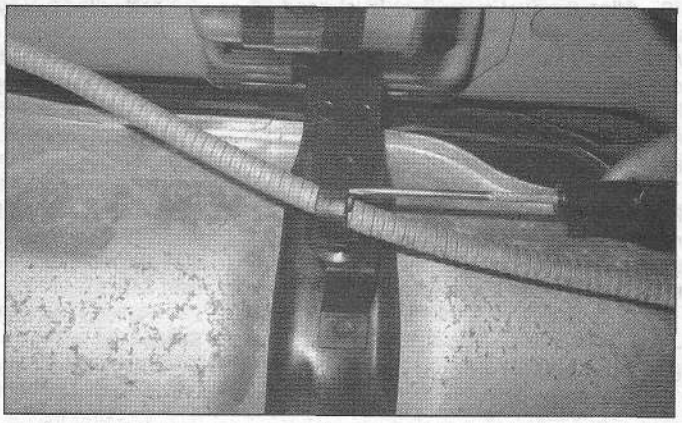
6.8 Loosen the hose clamps and disconnect the fuel filler hose and the fuel filler vent hose



6.11 Support the fuel tank with a transmission jack (shown) or a floor jack; if you're using a floor jack, be sure to put a sturdy piece of plywood between the jack head and the fuel tank to protect the tank; to detach the fuel tank straps, remove the bolts at rear end of each strap



6.12 Disconnect this EVAP hose



6.13 Detach this pin-type retainer from the front of the left fuel tank strap and reposition the parking brake cable so that it's out of the way

8 Disconnect the fuel tank filler hose and the fuel tank filler vent hose from the fuel tank filler tube **(see illustration)**.

9 Remove the muffler (see Section 15).

10 On 4WD models, remove the driveshaft, remove the differential mounting bracket-to-subframe mounting bolt, remove the differential-to-bracket bolts, loosen the differential mounting bracket-to-subframe mounting bolts, rotate the brackets and position the axle assembly to the rear (see Chapter 8).

11 Support the fuel tank with a transmission jack **(see illustration)** or a floor jack. If you're going to use a floor jack, place a sturdy piece of plywood between the jack head and the tank to protect the tank.

12 Disconnect the EVAP hose **(see illustration)**.

13 Disconnect the pin-type retainer that attaches the parking brake to the left fuel tank strap **(see illustration)** and reposition the parking brake cable so that it's out of the way.

14 On 4WD models, disconnect the wiring harness clip from the rear of the left fuel tank strap.

15 Remove the fuel tank strap bolts **(see illustration 6.11)** and swing the fuel tank straps down and out of the way (the straps are hinged at the front; there are no front strap bolts).

16 Lower the tank enough to have a look at the top of the tank and unclip or detach any remaining cables, hoses or lines.

17 Lower the tank the rest of the way.

18 Installation is the reverse of the removal procedure.

19 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

7 Fuel tank cleaning and repair - general information

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. See the* **Warning** *in Section 2.*

1 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. Even after cleaning and flushing of the fuel system, explosive fumes can remain and ignite during repair of the tank.

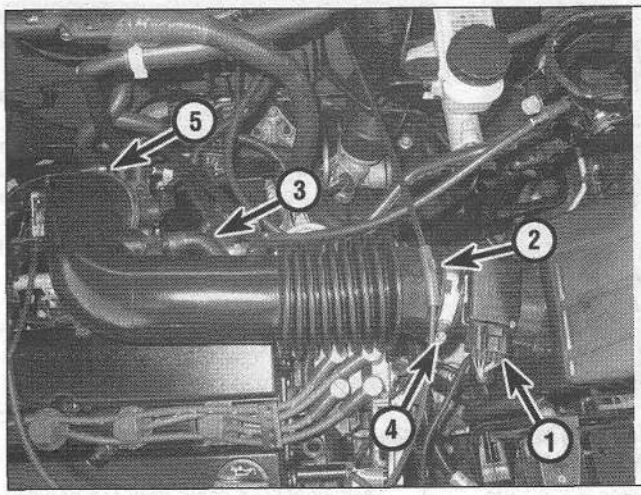
2 If the fuel tank is removed from the vehicle, it should not be placed in an area where sparks or open flames could ignite the fumes coming out of the tank. Be especially careful inside garages where a gas-type appliance is located, because it could cause an explosion.

8 Air filter housing - removal and installation

Air filter housing

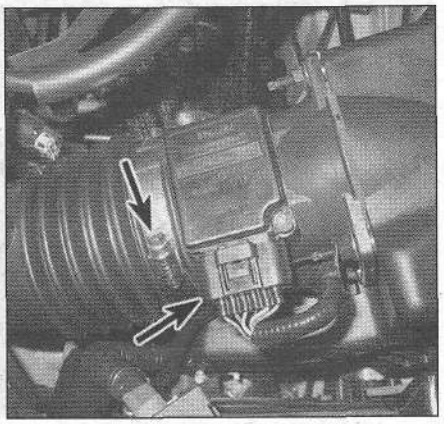
Refer to illustrations 8.2a, 8.2b, 8.3, 8.5a, 8.5b and 8.6

Note: *The accompanying photos (except illustration 8.2a) depict the air filter housing on a*

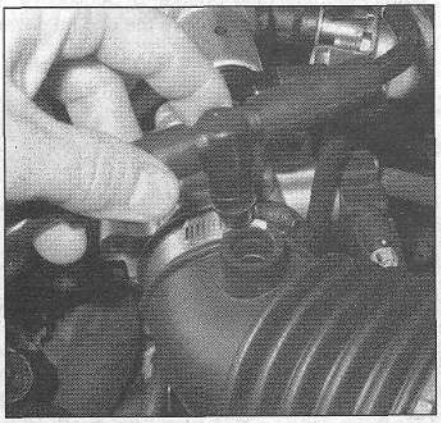


8.2a Air intake duct installation details (four-cylinder models)

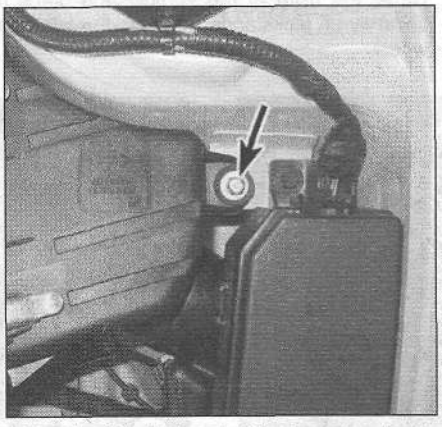
1 *Mass Air Flow (MAF) sensor electrical connector*
2 *Accelerator cable clip*
3 *Fresh air intake hose*
4 *Hose clamp at MAF sensor*
5 *Hose clamp at throttle body*



8.2b On V6 models, disconnect the electrical connector from the Mass Air Flow (MAF) sensor and loosen the air intake duct hose clamp screw



8.3 On V6 models, disconnect the crankcase vent hose from the air intake duct



8.5a To detach the air filter housing from the vehicle, remove this bolt

V6 model, but except for the air intake duct, which is slightly different on four-cylinder models, the actual air filter housing is virtually identical on all models.

1 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1)

2 Disconnect the electrical connector from the Mass Air Flow (MAF) sensor **(see illustrations)**.

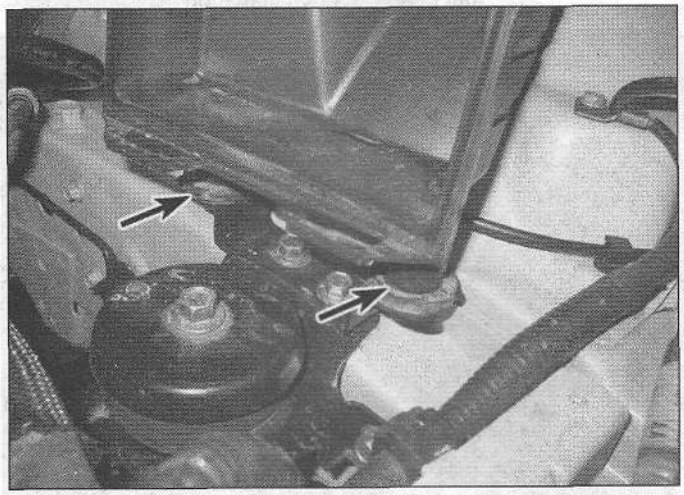
3 On four-cylinder models, detach the accelerator cable from the air intake duct **(see illustration 8.2a)**. On V6 models, disconnect the crankcase vent hose from the air intake duct **(see illustration)**.

4 Loosen the air intake duct hose clamp screw at the MAF sensor end of the air intake duct **(four-cylinder models, see illustration 8.2a; V6 models, see illustration 8.2b)** and disconnect the air intake duct from the air filter housing.

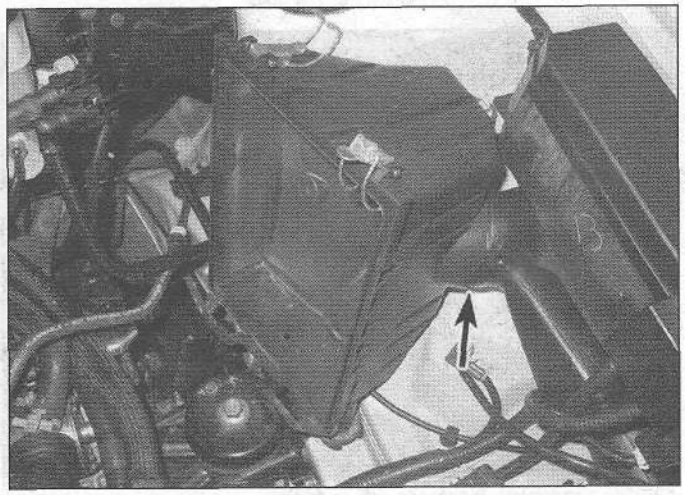
5 Remove the air filter housing retaining bolt **(see illustration)**. To disengage the air filter housing from its grommets **(see illustration)**, pull it straight up. You'll also have to pull the housing to the rear far enough to disengage it from the fresh air inlet duct.

6 Inspect the rubber grommets before installing the air filter housing. If they're cracked, torn or otherwise damaged, replace them. Installation is otherwise the reverse of removal. Make sure that the air filter housing locator pins are correctly seated in their grommets, and that the air intake mouth of the filter housing is correctly seated inside the fresh air inlet duct **(see illustration)**.

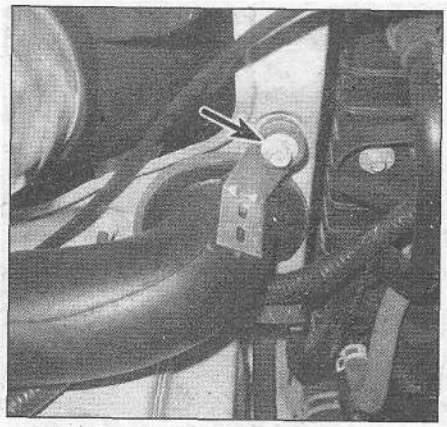
7 After you've reconnected the battery, the Powertrain Control Module (PCM) must



8.5b To disengage the air filter housing from these two grommets, pull it straight up (air filter housing cover and air filter element removed for clarity)



8.6 When installing the air filter housing, make sure that the air intake mouth of the housing is correctly seated



8.10 To detach the fresh air inlet duct from the vehicle body, remove this bolt

relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

Fresh air inlet duct

Refer to illustration 8.10

8 Remove the battery and the battery tray (see Chapter 5).

9 Remove the air filter housing (see Steps 1 through 6).

10 Remove the fresh air inlet duct retaining bolt **(see illustration)** and remove the inlet duct.

11 Installation is the reverse of removal.

12 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

Fresh air inlet duct resonator

Refer to illustrations 8.14 and 8.15

13 Loosen the left front wheel lug nuts. Raise the front of the vehicle and place it securely on jackstands. Remove the left front wheel.

14 Remove the pin-type retainers and screws, then remove the left inner fender splash shield **(see illustration)**.

15 Remove the resonator retaining bolt **(see illustration)** and remove the resonator.

16 Inspect the rubber insulator between the resonator and the fresh air inlet duct and the rubber grommet for the locator pin. If either is damaged or worn, replace it.

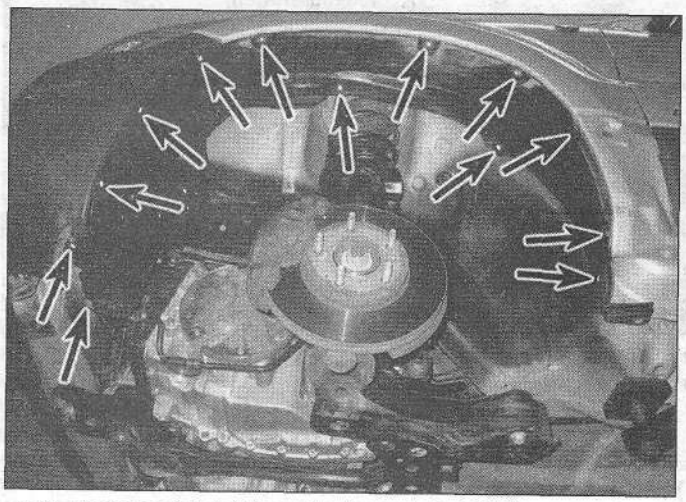
17 Installation is otherwise the reverse of removal.

9 Accelerator cable - removal and installation

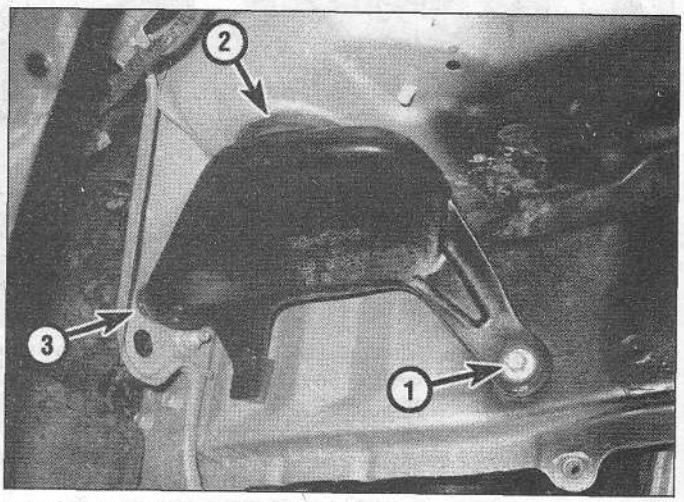
Refer to illustrations 9.2, 9.3, 9.4a, 9.4b, 9.5, 9.6, 9.7a and 9.7b

1 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

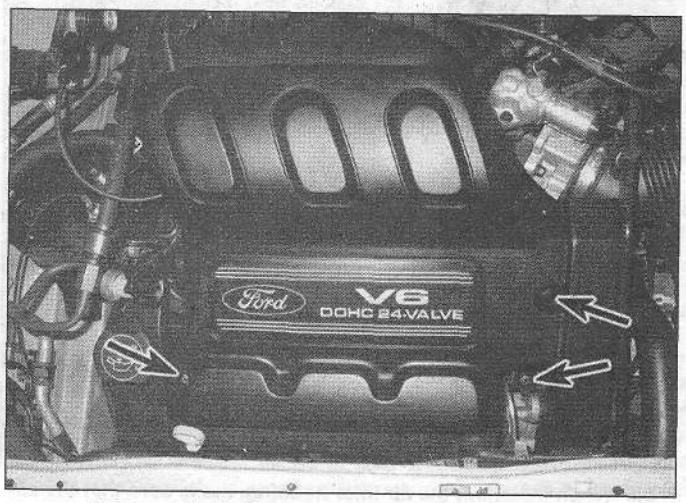
2 On V6 models, remove the engine cover **(see illustration)**.



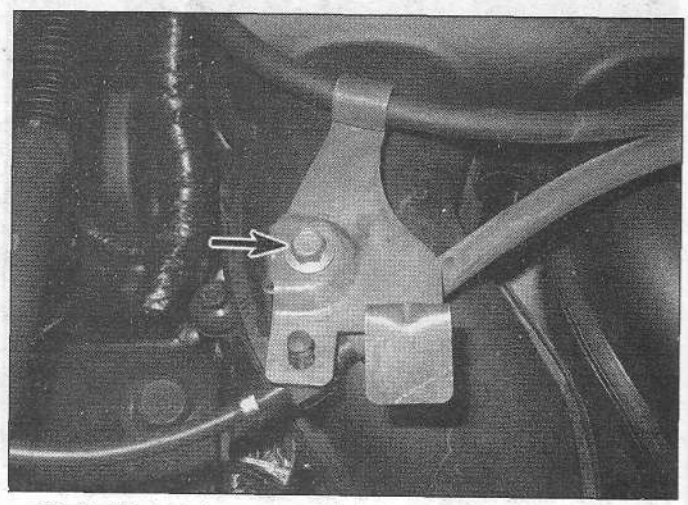
8.14 To detach the left inner fender splash shield, remove these fasteners (the shield uses a combination of screws and pin-type retainers; if any of them are damaged or missing, be sure to replace them when installing the shield)



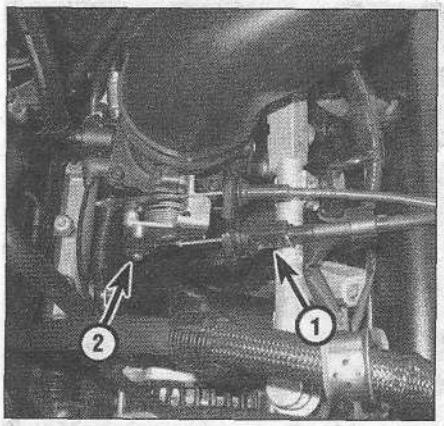
8.15 To detach the fresh air inlet duct resonator from the vehicle body, remove the bolt (1), then disengage the resonator from the fresh air inlet insulator (2) and from the locator pin grommet (3); inspect both the insulator and the grommet and make sure that they're in good condition



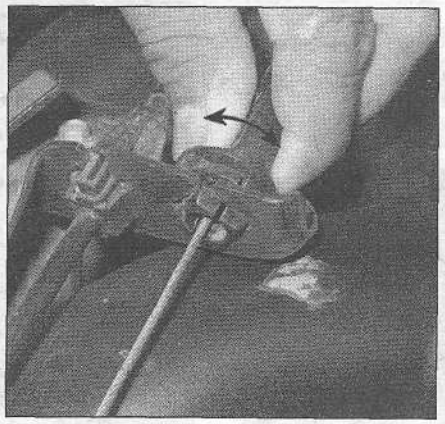
9.2 To detach the engine cover from a V6 model, remove these three nuts



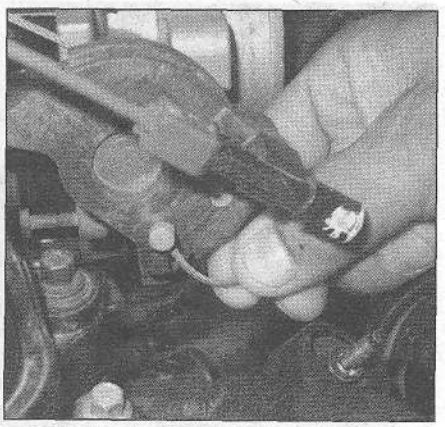
9.3 On V6 models, remove this bolt to detach the accelerator cable bracket from the intake manifold



9.4a To disengage the accelerator cable housing (1) from the cable bracket, rotate the cable housing 90 degrees to the left or right and pull the housing out of its slot in the bracket; to disconnect the cable from the throttle linkage, remove the retainer clip (2) and pull the cable end off the pin on the linkage (four-cylinder models)



9.4b To disengage the accelerator cable from the cable bracket, rotate the cable housing 90 degrees to the left or right, then pull the housing out of its slot in the bracket



9.5 To disconnect the end of the accelerator cable from the throttle body on a V6 model, slide the end plug out of its slot in the throttle lever cam

3 On four-cylinder models, detach the accelerator cable from the air intake duct **(see illustration 8.2a)**. On V6 models, detach the accelerator cable bracket from the intake manifold **(see illustration)**.

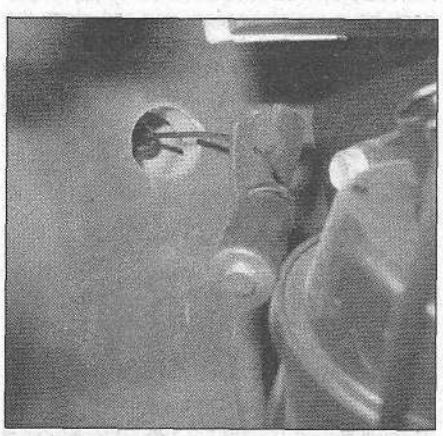
4 Disengage the accelerator cable from the cable bracket **(see illustration)**.

5 Disconnect the accelerator cable from the throttle body **(see illustration)**.

6 Working inside the passenger compartment, disengage the lower end of the accelerator cable from the accelerator pedal **(see illustration)**.

7 Returning to the engine compartment, pull the cable through the firewall until the cable's lower end plug reaches the grommet, then remove the grommet and pull the cable through the hole **(see illustrations)**.

8 Installation is the reverse of the removal procedure.



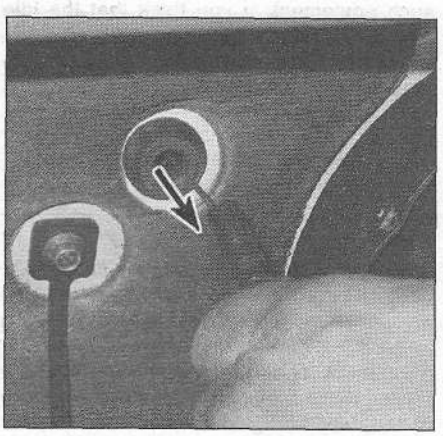
9.6 To disengage the lower end of the accelerator cable from the top of the accelerator pedal, pull firmly on the plug at the end of the cable to free it from the top of the pedal, then slide the cable out of the slot

9 Have an assistant depress and release the accelerator pedal while you verify that the throttle valve moves smoothly and easily from the fully closed to the fully open position and back again.

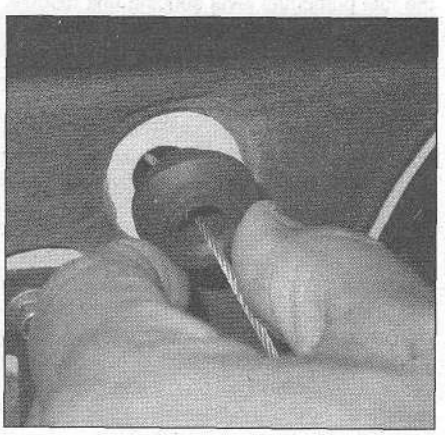
10 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

10 Multiport Fuel Injection (MFI) system - general information

These models are equipped with a Multiport Fuel Injection (MFI) system. The MFI system consists of three basic sub-systems: the air induction system, the fuel system and the electronic control system. **Note:** *Refer to Chapter 6 for further information on the components of the electronic control system.*



9.7a Pull out the cable from the engine compartment side . . .

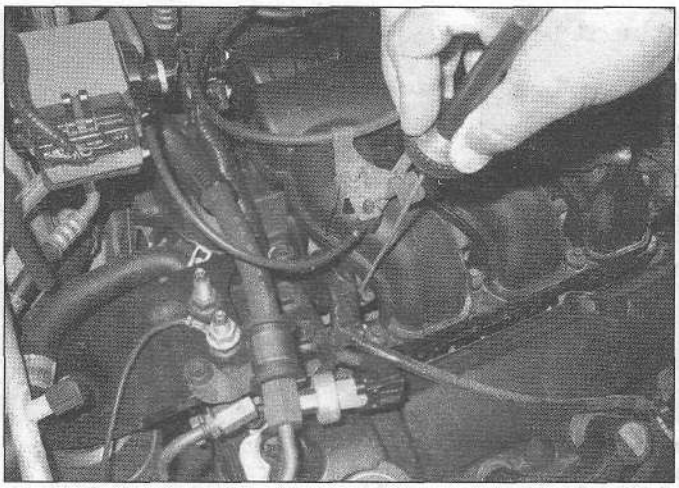


9.7b . . . until the cable's lower end plug reaches the grommet, then pry out the grommet and remove the cable and grommet from the vehicle

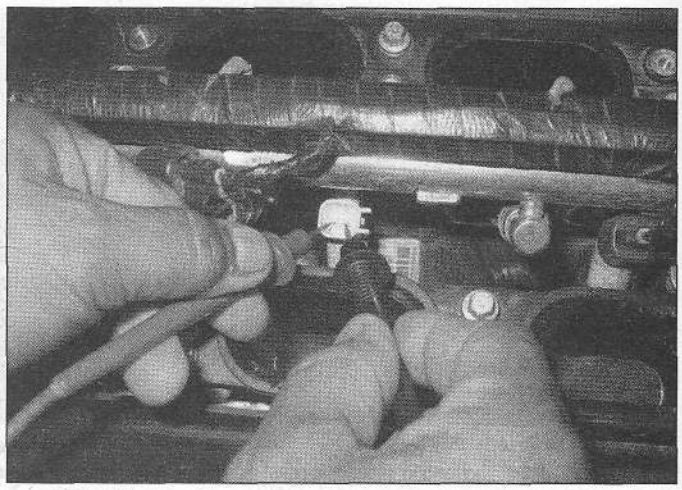
Air induction system

The air induction system consists of the fresh air inlet duct and resonator, the air filter housing, the Mass Air Flow (MAF) sensor, the air intake duct, the throttle body, the air intake plenum and the intake manifold. The MAF sensor is an information sensor for the Powertrain Control Module (PCM). The MAF sensor uses a heated wire system to send the PCM a constantly varying (analog) voltage signal corresponding to the volume of air passing into the engine. Another sensor measures intake air temperature. The PCM uses these signals to calculate the mass (density) of air entering the engine.

The throttle valve inside the throttle body is controlled by the driver, through the accelerator pedal. As the valve opens, the amount of air that can pass through the system increases. The Throttle Position (TP) sensor opens further, the MAF sensor's signal alters and the PCM opens each injector for a longer duration to increase the amount of fuel delivered to the inlet ports.



11.7 Use a stethoscope to listen to the injectors: they should be making a smooth and steady clicking sound as they open and close



11.8 Use an ohmmeter to measure the resistance of the inductive coil winding inside each injector

Fuel system

An electric fuel pump located inside the fuel tank supplies fuel under pressure to the fuel rail, which distributes fuel evenly to all injectors. A filter between the fuel pump and the fuel rail protects the components of the system. From the fuel rail, fuel is injected into the intake ports, just above the intake valves, by a fuel injector.

All vehicles covered by this manual are equipped with a "returnless" fuel system. Four-cylinder models use an Electronic Returnless Fuel System (ERFS). There is no fuel pressure regulator and no fuel return line on ERFS-equipped models. Instead, the fuel pressure is regulated by controlling the fuel pump speed. The fuel pump is controlled by the Fuel Pump Driver Module (FPDM) inside the Powertrain Control Module (PCM).

V6 models use a Mechanical Returnless Fuel System (MRFS). These models have a fuel pressure regulator, which is located on the fuel pump/fuel level sending unit module inside the tank. They also have a short return line between a junction in the fuel supply line and the fuel pump/fuel level sending unit module. The junction is located just downstream from, and to the left of, the fuel filter. Both the fuel supply line and the short fuel return line are pressurized. When the fuel pressure exceeds the upper threshold of the system's normal operating pressure, the fuel pressure regulator opens and fuel returns to the tank via the return line.

The amount of fuel supplied by the injectors is precisely controlled by injector "drivers" inside the PCM. The PCM uses signals from the Crankshaft Position (CKP) sensor and the Camshaft Position (CMP) sensor to determine when to trigger each injector in cylinder firing order (sequential injection), with benefits in terms of better fuel economy and lower exhaust emissions.

Electronic control system

The PCM controls the MFI system and the other sub-systems of the entire engine management system. It receives signals from a number of information sensors, which monitor such variables as intake air mass and temperature, coolant temperature, engine speed and position, acceleration/deceleration, and exhaust gas oxygen content. These signals help the PCM determine the injection duration necessary for the optimum air/fuel ratio. These sensors and associated PCM-controlled relays are located throughout the engine compartment. For further information regarding the PCM and its control of the engine management system, see Chapter 6.

Idle speed and mixture adjustment

Both the idle speed and mixture are under the control of the Powertrain Control Module (PCM) and neither can be adjusted. Not only can they not be adjusted, they cannot even be checked, except with the use of special diagnostic equipment, which makes this a task for a specialist. *Do not* attempt to "adjust" these settings in any way without such equipment. If you think that the idle speed and mixture are incorrect, take the vehicle to a dealer service department an have the system tested.

11 Fuel injection system - general check

Refer to illustrations 11.7 and 11.8

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. See the* **Warning** *in Section 2.*

1 Check all electrical connectors that are related to the system. Check the ground wire connections for tightness. Loose connectors and poor grounds can cause many problems that resemble more serious malfunctions.

2 Check to see that the battery is fully charged, as the control unit and sensors depend on an accurate supply voltage in order to properly meter the fuel.

3 Check the air filter element. A dirty or partially blocked filter will severely impede performance and economy (see Chapter 1).

4 Check the related fuses. If a blown fuse is found, replace it and see if it blows again. If it does, search for a wire shorted to ground in the harness.

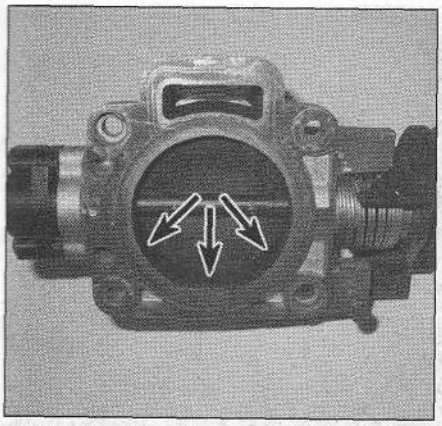
5 Check the air intake duct to the intake manifold for leaks, which will result in an excessively lean mixture. Also check the condition of all vacuum hoses connected to the intake manifold and/or throttle body.

6 Remove the air intake duct from the throttle body and check for dirt, carbon, varnish, or other residue in the throttle body, particularly around the throttle plate. If it's dirty, clean it with carburetor cleaner spray, a toothbrush and shop towel.

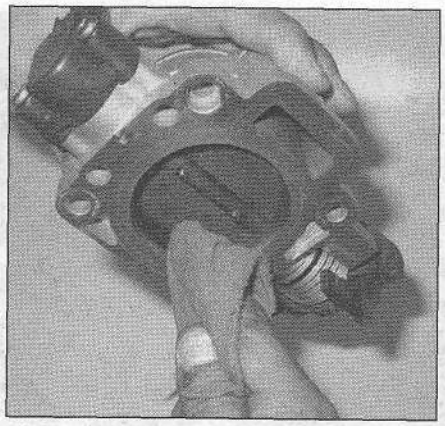
7 With the engine running, place an automotive stethoscope against each injector, one at a time, and listen for a clicking sound that indicates operation **(see illustration)**. If you don't have a stethoscope, you can place the tip of a long screwdriver against the injector and listen through the handle. If you hear the injectors operating but there is a misfire condition present, the electrical circuits are functioning, but the injectors may be dirty or fouled from carbon deposits - commercial cleaning products may help, or the injectors may require replacement.

8 If you can't hear the injector operating, disconnect the injector electrical connector and measure the resistance across the terminals of each injector connector with an ohmmeter **(see illustration)**. Compare your measurement with the resistance value listed in this Chapter's Specifications. Replace any injector whose resistance value does not fall within the specifications.

9 If the injector is not operating, but the resistance reading is within specifications, the PCM or the circuit between the PCM and the injector might be faulty.



12.2a Over time, the area right behind the throttle plate is prone to a build-up of sludge because of the crankcase vapors vented to the intake manifold by the PCV system; if the build-up becomes excessive, it can prevent the throttle plate from closing at idle (throttle body removed for clarity)



12.2b Wipe the sludge from this area with a clean shop rag and a small amount of solvent; do NOT scrub it with a stiff metal brush or you will damage the protective coating in the throttle bore (throttle body removed for clarity)

12 Throttle body - inspection, removal and installation

Inspection

Refer to illustrations 12.2a and 12.2b

1 Verify that the throttle linkage operates smoothly.

2 Remove the air intake duct from the throttle body, open the throttle plate and inspect the throttle body bore for carbon and residue build-up. If it's dirty, clean it with solvent or carburetor cleaner **(see illustrations)**. Make sure that the solvent or carb cleaner is safe for oxygen sensor systems and catalytic converters. **Caution:** *Do not clean the Throttle Position (TP) sensor or the Idle Air Control (IAC) motor with the solvent. Also, do NOT use a metal brush to clean the bore of the throttle body, which is protected by a special coating. Scrubbing the bore with a stiff brush could ruin the coating. Instead, wipe out the bore with a clean shop rag and a little solvent.*

Removal

Refer to illustrations 12.5, 12.7, 12.8, 12.9a, 12.9b, 12.10, 12.11a, 12.11b, 12.11c and 12.12

Warning: *Wait until the engine is completely cool before beginning this procedure.*

3 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

4 On four-cylinder models, detach the accelerator cable from the air intake duct. On V6 models, disconnect the crankcase vent hose from the air intake duct **(see illustration 8.3)**.

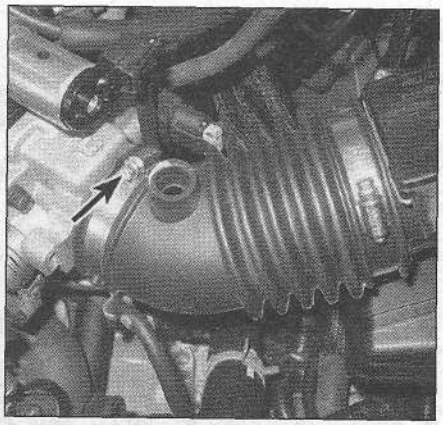
5 Disconnect the air intake duct from the throttle body **(see illustration)**.

6 Disconnect the accelerator cable from the throttle body (see Section 9).

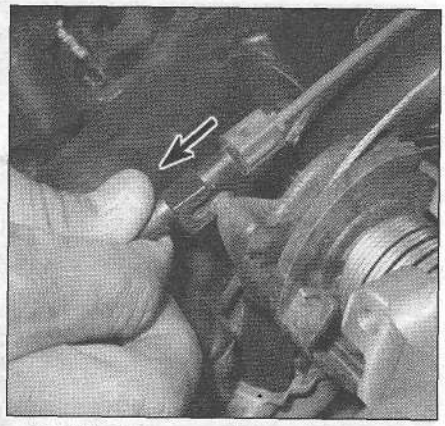
7 If the vehicle is equipped with cruise control, disconnect the cruise control cable from the throttle body **(see illustration)**.

8 Disconnect the electrical connector from the Throttle Position (TP) sensor **(see illustration)**.

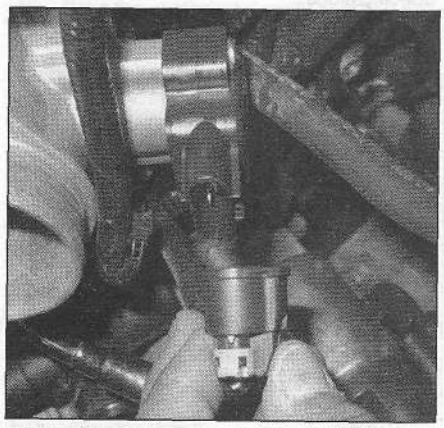
9 Disconnect the electrical connector from the Idle Air Control (IAC) valve **(see illustration)**. On V6 models, detach the IAC harness from the throttle body mounting stud located near the TP sensor **(see illustration)**.



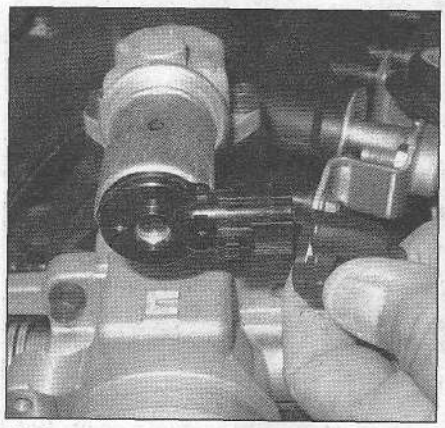
12.5 To detach the air intake duct from the throttle body, loosen this hose clamp screw (V6 model shown, four-cylinder models similar)



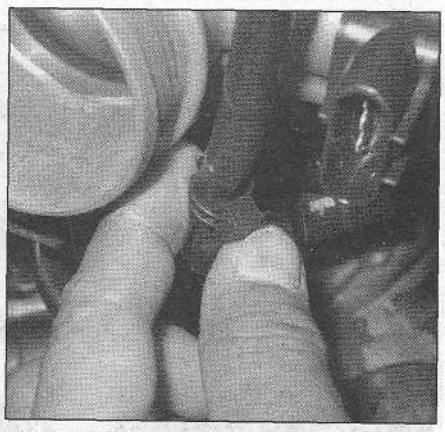
12.7 To disconnect the cruise control cable from its pin on the throttle lever, pull the end of the cable (V6 model shown, four-cylinder models similar)



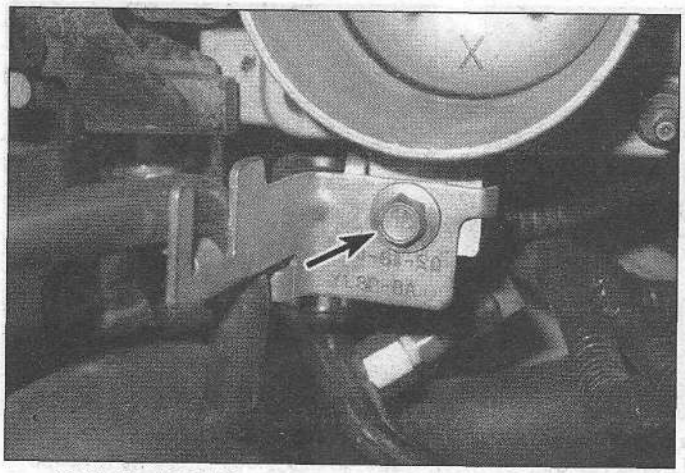
12.8 Disconnect the electrical connector from the Throttle Position (TP) sensor (V6 model shown, four-cylinder models similar)



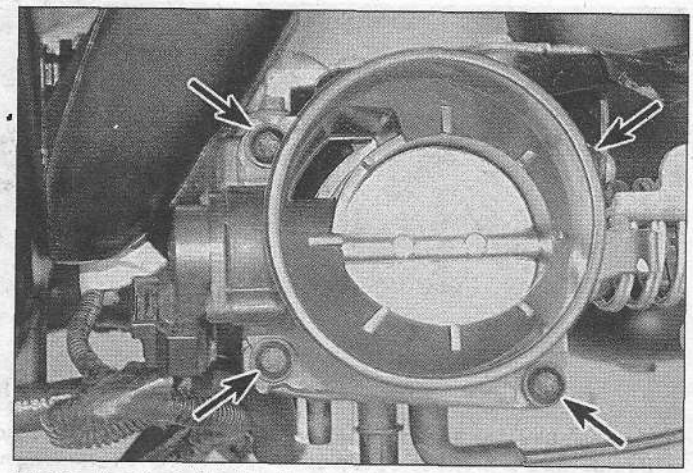
12.9a Disconnect the electrical connector from the Idle Air Control (IAC) valve (V6 model shown, four-cylinder models similar)



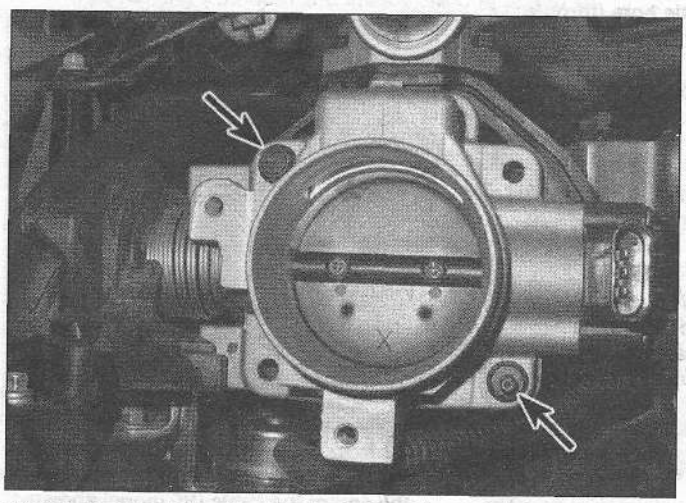
12.9b On V6 models, detach the IAC valve harness clip from the throttle body mounting stud located near the Throttle Position (TP) sensor



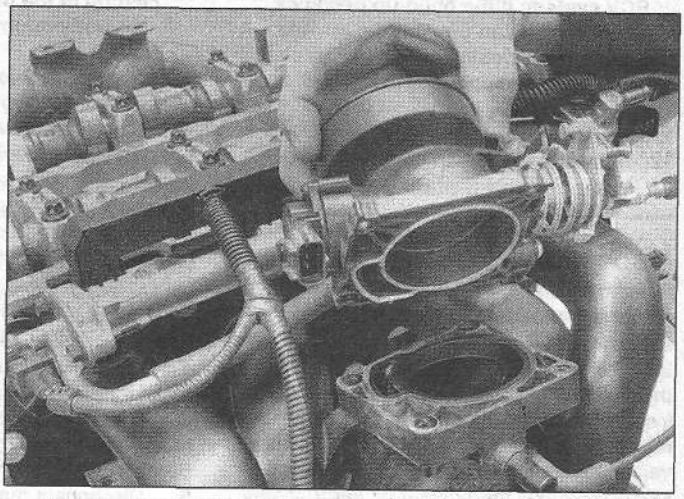
12.10 To detach the transaxle vent tube bracket from the throttle body, remove this bolt



12.11a To detach the throttle body from the air intake manifold on a four-cylinder model, remove these four bolts



12.11b To detach the throttle body from the air intake manifold on a V6 model, remove these two bolts



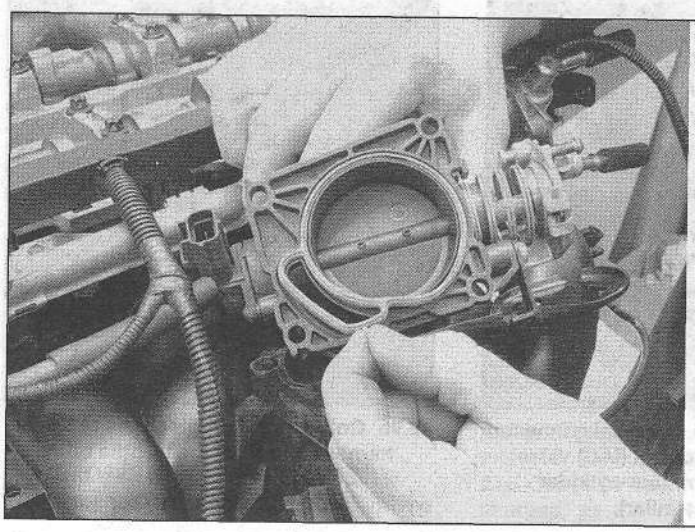
12.11c Remove the throttle body from the intake manifold (four-cylinder model shown)

10 On V6 models, remove the transaxle vent tube bracket from the throttle body **(see illustration)**.

11 Remove the throttle body mounting bolts **(see illustrations)** and then remove the throttle body **(see illustration)** from the manifold.

12 Remove the throttle body gasket **(see illustration)** and discard it.

13 If necessary, clean the throttle body as outlined in Step 2.



12.12 Remove the throttle body gasket and discard it; when installing the throttle body, be sure to use a NEW gasket

Installation

14 Using a NEW gasket, install the throttle body and tighten the throttle body mounting bolts to the torque listed in this Chapter's Specifications.

15 The remainder of installation is the reverse of removal.

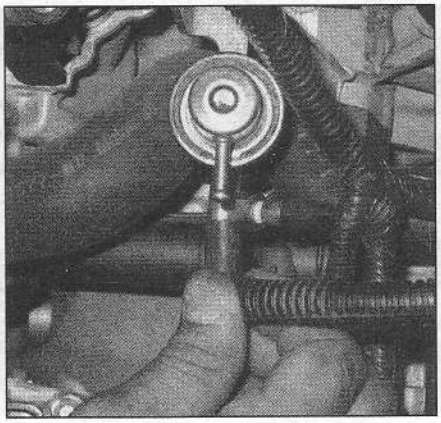
16 *After you've reconnected the battery,* the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

17 Start the engine and verify that the throttle body operates correctly and that there are no air leaks.

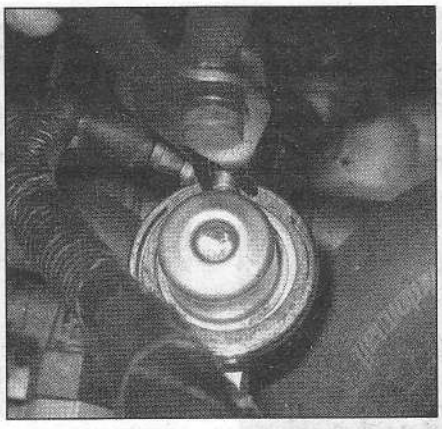
13 Fuel pulsation damper - removal and installation

Refer to illustrations 13.4, 13.6a, 13.6b and 13.7

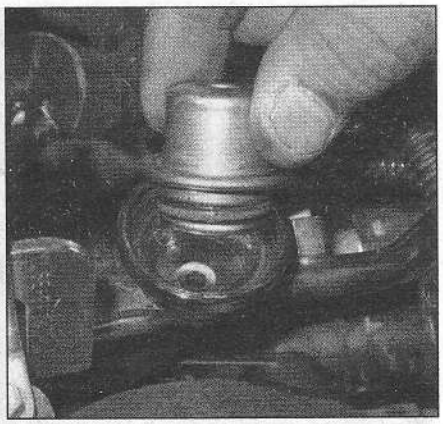
Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. See the* **Warning**



13.4 Disconnect the vacuum line from the pulsation damper (V6 model shown)



13.6a On V6 models, remove the pulsation damper snap-ring . . .



13.6b . . . and remove the pulsation damper

in Section 2.

1 Relieve the fuel system pressure (see Section 2).

2 Disconnect the cable from the negative battery terminal.

3 On V6 models, remove the throttle body (see Section 12).

4 Disconnect the vacuum line from the pulsation damper **(see illustration)**.

5 On four-cylinder models, remove the two bolts that attach the pulsation damper to the fuel rail and then remove the damper.

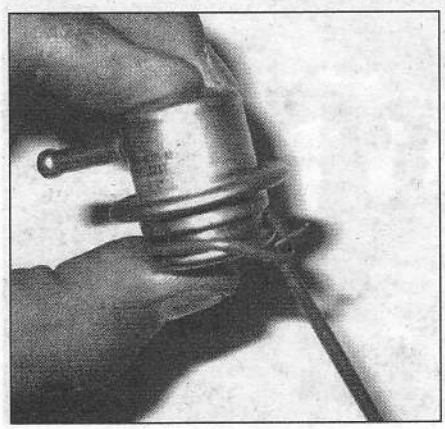
6 On V6 models, remove the fuel pulsation damper snap-ring and then remove the damper **(see illustrations)**.

7 Before installing the pulsation damper, be sure to remove the old O-ring **(see illustration)** and discard it. Install a new O-ring on the pulsation damper (even if you're planning to reuse the old damper).

8 Installation is the reverse of removal. On four-cylinder models, be sure to tighten the pulsation damper bolts to the torque listed in this Chapter's Specifications.

9 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

10 Start the engine and verify that there are no fuel leaks.



13.7 Remove the old O-ring from the pulsation damper (V6 model shown)

14 Fuel rail and injectors - removal and installation

1 Relieve the fuel system pressure (see Section 2) and equalize tank pressure by removing the fuel filler cap.

2 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

Four-cylinder models

Refer to illustrations 14.10 and 14.11

3 Remove the air intake duct.

4 Disconnect the accelerator cable from the throttle lever cam. If equipped, also disconnect the cruise control cable.

5 Disconnect the fuel supply line from the fuel rail.

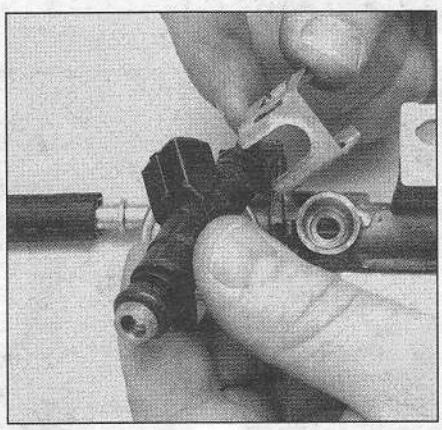
6 Disconnect the vacuum line from the fuel pulsation damper.

7 Disconnect the electrical connectors from the fuel injectors.

8 Remove the fuel rail mounting bolts.

9 Remove the fuel rail and injectors as a single assembly.

10 Remove the clamp that secures each fuel injector to the fuel rail and pull out the injector **(see illustration)**.



14.10 To disengage an injector from the fuel rail on a four-cylinder model, remove this clamp and pull the injector straight out of the fuel rail (wiggle and pull at the same time if the O-ring is stuck to the injector bore)

11 Remove the old O-rings from each injector **(see illustration)** and discard them. Always install new O-rings on the injectors before reassembling the injectors and the fuel rail.

12 Installation is otherwise the reverse of removal. To ensure that the new injector O-rings are not damaged when the injectors are installed into the fuel rail and into the intake manifold, lubricate them with clean engine oil. And be sure to tighten the fuel rail mounting bolts to the torque listed in this Chapter's Specifications.

13 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

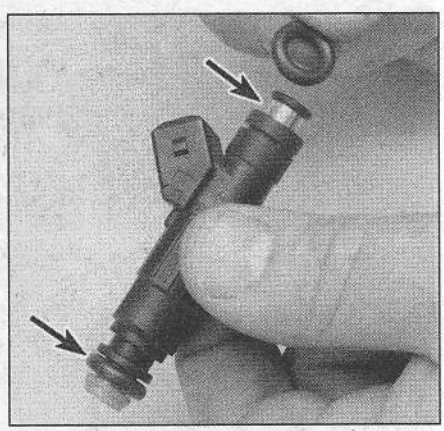
14 Start the engine and verify that there are no fuel leaks.

V6 models

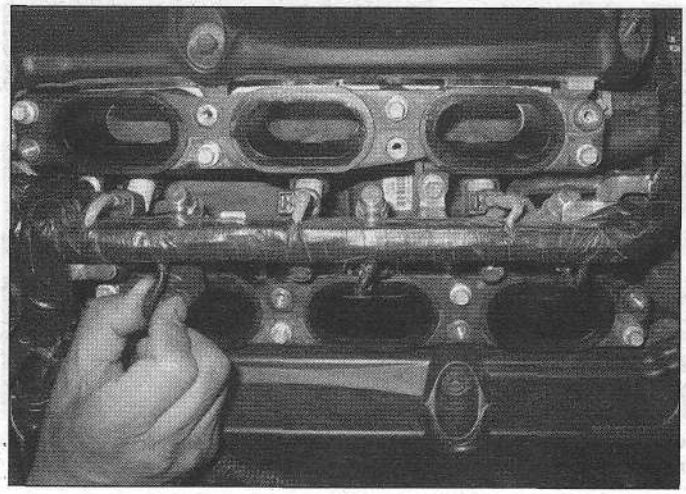
Refer to illustrations 14.18a, 14.18b, 14.18c, 14.19, 14.20, 14.21 and 14.22

15 Remove the upper intake manifold (see Chapter 2B).

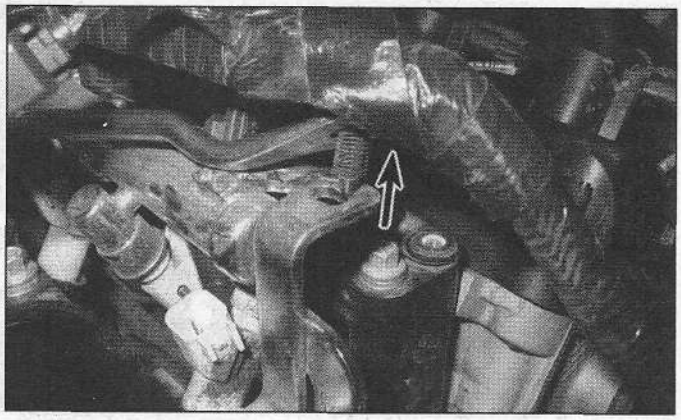
16 Disconnect the vacuum line from the fuel pulsation damper **(see illustration 13.4)**.



14.11 Always remove and discard the old injector O-rings and install new O-rings on each injector (four-cylinder models)



14.18a Disconnect the electrical connectors from the injectors . . .



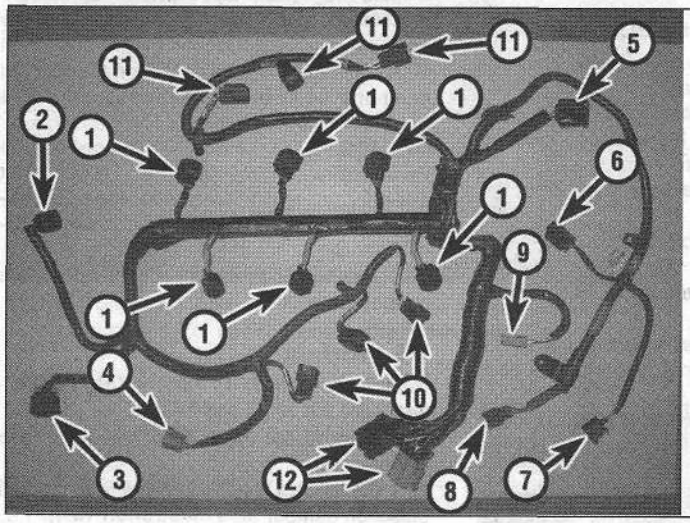
14.18b . . . detach the injector wiring harness from the two brackets located in the vee between the cylinder heads (other bracket not visible in this photo), then trace the harness to each electrical device to which it's connected, disconnect it and set it aside (V6 models)

17 Disconnect the fuel supply line from the fuel rail (see Section 4).

18 Disconnect the electrical connectors from the injectors **(see illustration)** and detach the fuel injector harness from the brackets at the left and right ends of the vee **(see illustration)**. Then trace the harness to each electrical device to which it's connected and disconnect the electrical connectors from those devices **(see illustration)** and set the harness aside.

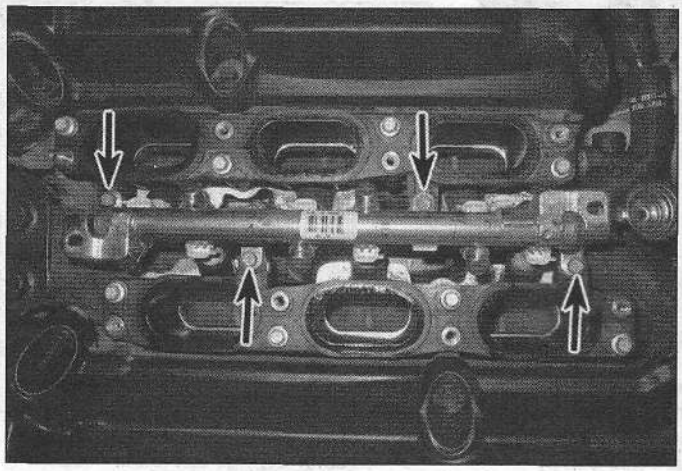
19 Remove the fuel rail mounting bolts **(see illustration)**.

20 Carefully disengage the injectors from the lower intake manifold and lift the fuel rail

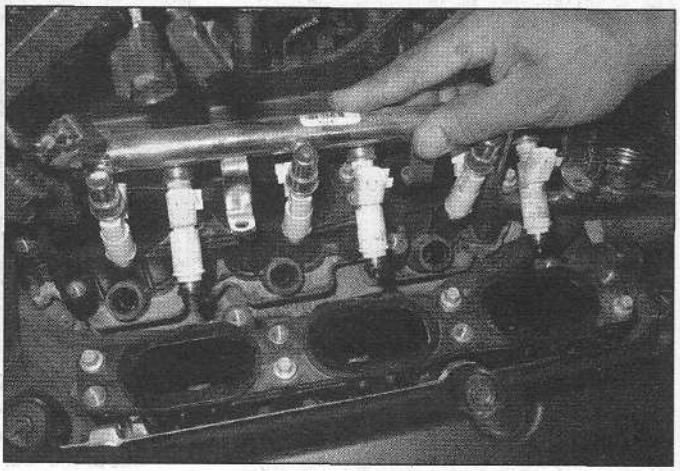


14.18c Electrical connector guide for main engine wiring harness (V6 models)

1 *Fuel injector connectors*
2 *Idle Air Control (IAC) valve connector*
3 *Throttle Position (TP) sensor connector*
4 *Engine Coolant Temperature (ECT) sensor connector*
5 *Power Steering Pressure (PSP) switch connector*
6 *Camshaft Position (CMP) sensor connector*
7 *Oil pressure sending unit connector*
8 *Crankshaft Position (CKP) sensor connector*
9 *Noise suppressor connector*
10 *Ignition coil connectors (rear cylinder head)*
11 *Ignition coil connectors (front cylinder head)*
12 *Powertrain Control Module (PCM) connectors*

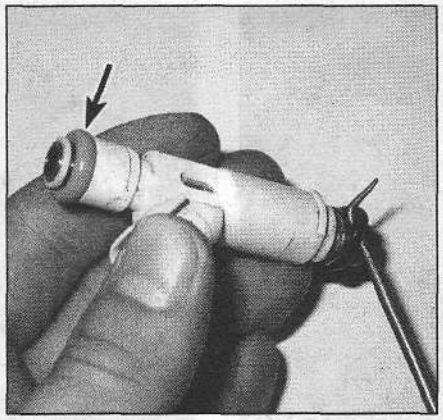


14.19 To detach the fuel rail from the engine, remove these four bolts (V6 models)



14.20 Remove the fuel rail and the injectors as a single assembly (V6 models)

14.21 To detach an injector from the fuel rail, simply wiggle it side to side a little to loosen the O-ring and then pull it straight out as shown (V6 models)



14.22 Remove the old O-rings from each injector and discard them; always install new O-rings when installing the injectors (V6 models)

and all six injectors from the engine as a single assembly **(see illustration)**.

21 Remove the injectors from the fuel rail **(see illustration)**.

22 Remove and discard the old injector O-rings **(see illustration)**. Always install new O-rings on the injectors before reassembling the injectors and the fuel rail.

23 Installation is the reverse of the removal procedure. To ensure that the new injector O-rings are not damaged when the injectors are installed into the fuel rail and into the intake manifold, lubricate them with clean engine oil. Be sure to tighten the fuel rail mounting bolts to the torque listed in this Chapter's Specifications.

24 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

25 Start the engine and verify that there are no fuel leaks.

15 Exhaust system - inspection and component replacement

Inspection

Warning: *Inspect and repair exhaust system components only after allowing the exhaust components to cool completely. This applies particularly to the catalytic converter, which operates at very high temperatures. Also, when working under the vehicle, make sure it is securely supported on jackstands.*

1 The exhaust system consists of the exhaust manifold(s), the catalytic converter(s), the exhaust pipes, the resonator (V6 models), the muffler and all brackets, hangers and clamps. Inspect the exhaust system regularly to ensure that it remains safe and quiet. Look for any damaged or bent parts, open seams, holes, loose connections, excessive corrosion or other defects which could allow exhaust fumes to enter the vehicle. Also check the catalytic converter(s) when you inspect the exhaust system. Inspect the catalytic converter heat shield(s) for cracks, dents and loose or missing fasteners. If a heat shield is damaged, the converter might also be damaged. Have the converter inspected by a dealer service department. Damaged or deteriorated exhaust system components should not be repaired; they should be replaced with new parts.

2 Before trying to disassemble any exhaust components, spray the fasteners with a penetrating oil to help ease removal. If the exhaust system components are extremely corroded or rusted together, welding equipment will probably be required to remove them. The convenient way to accomplish this is to have a muffler repair shop remove the corroded sections with a cutting torch. If, however, you want to save money by doing it yourself (and you don't have a welding outfit with a cutting torch), simply cut off the old components with a hacksaw. If you have compressed air, special pneumatic cutting chisels can also be used. If you decide to tackle the job at home, be sure to wear safety goggles to protect your eyes from metal chips and work gloves to protect your hands.

3 Here are some simple guidelines to follow when repairing the exhaust system:

a) Work from the back to the front when removing exhaust system components.

b) Apply penetrating oil to the exhaust system component fasteners to make them easier to remove.

c) Use new gaskets, hangers and clamps when installing exhaust systems components.

d) Apply anti-seize compound to the threads of all exhaust system fasteners at reassembly.

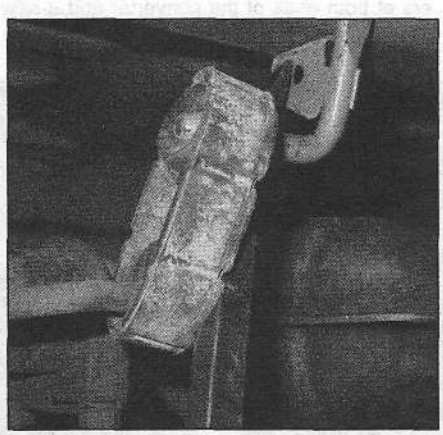
e) Be sure to allow sufficient clearance between newly installed parts and all points on the underbody to avoid overheating the floor pan and possibly damaging the interior carpet and insulation. Pay particularly close attention to the catalytic converter and heat shield.

Component replacement

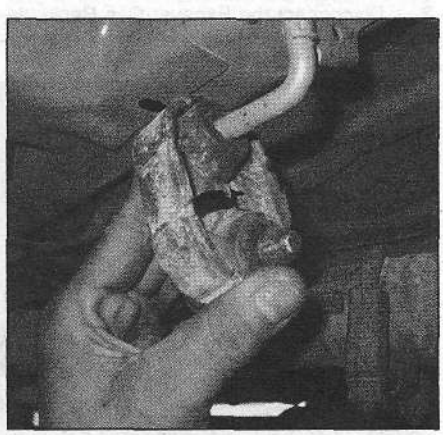
Rubber exhaust hangers

Refer to illustrations 15.4a and 15.4b

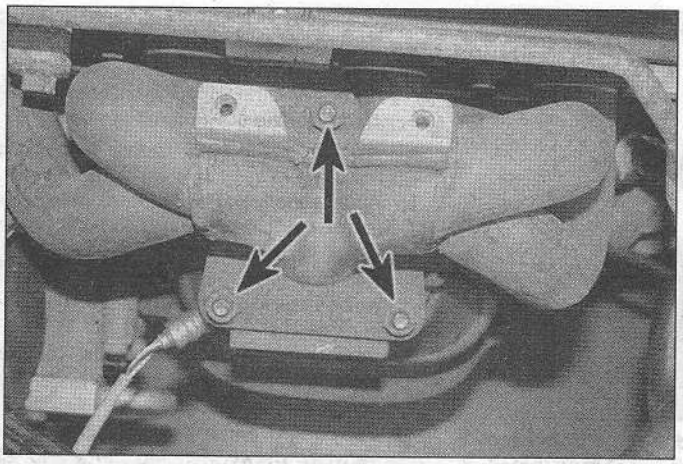
4 The exhaust system is attached to the body with mounting brackets and rubber hangers. Because of the intense heat generated by the exhaust system, these hangers should be inspected regularly and often. Anytime you must raise the vehicle to perform any under-vehicle service, make sure that you inspect the rubber exhaust hangers. Look for cracks, tears and deterioration. If a hanger is worn or damaged, replace it **(see illustrations)**. If a hanger breaks or becomes disconnected from its hanger bracket or from the bracket on the part that it supports, the exhaust system will transmit excessive noise and vibration to the vehicle body.



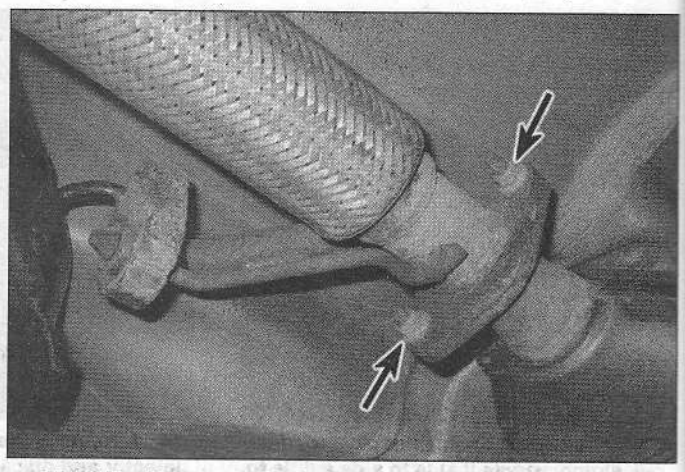
15.4a A typical rubber exhaust hanger; to remove an exhaust hanger, simply disengage it from the bracket attached to the floorpan and from the bracket attached to the exhaust pipe, catalytic converter, muffler, etc. If the hanger is difficult to remove, use a large prybar as a lever to pry it off



15.4b To install a new rubber exhaust hanger, simply push it onto the bracket attached to the floorpan and the bracket attached to the exhaust pipe, catalytic converter, muffler, etc. If the hanger is difficult to install, use a little talcum powder to help it slide onto the brackets more easily



15.9 To detach the upper end of the catalytic converter from the exhaust manifold on a four-cylinder model, remove these three nuts



15.18 To disconnect the front end of the catalytic converter from the crossover and flexible exhaust pipe, remove these two flange nuts

Catalytic converters

Warning: *The catalytic converters get extremely hot during operation, and can remain very hot for hours after the engine has been turned off. Make sure that a converter has cooled down before you touch it.*

Four-cylinder models

Refer to illustration 15.9

5 Four-cylinder models are equipped with a three-way catalytic converter (TWC) that's bolted to the exhaust manifold **Note:** *See Chapter 6 for more information on the function and operation of the catalytic converter.*

6 Remove the exhaust manifold heat shield (see "Exhaust manifold - removal and installation" in Chapter 2A).

7 Disconnect the electrical connectors for the upstream and downstream oxygen sensors and then remove the upstream sensor (see "Oxygen sensors - replacement" in Chapter 6).

8 Disconnect the Exhaust Gas Recirculation (EGR) pipe (see "Exhaust Gas Recirculation system - component replacement" in Chapter 6).

9 Remove the three nuts from the exhaust manifold flange **(see illustration)**.

10 Raise the vehicle and place it securely on jackstands.

11 Remove the downstream oxygen sensor (see "Oxygen sensors - replacement" in Chapter 6).

12 Remove the two bolts from the clamp that attaches the catalyst to the engine block. (It's not necessary to unbolt the clamp bracket from the engine block.)

13 Remove (and discard) the nuts from the flange at the lower end of the short section of exhaust pipe below the converter. Discard the old flange gasket.

14 Remove the catalytic converter assembly.

15 Installation is the reverse of removal. Apply anti-seize compound to the threads of all bolts and studs. Be sure to use new fasteners at both ends of the converter and a new flange gasket. Tighten all fasteners securely.

V6 models

Refer to illustrations 15.18 and 15.19

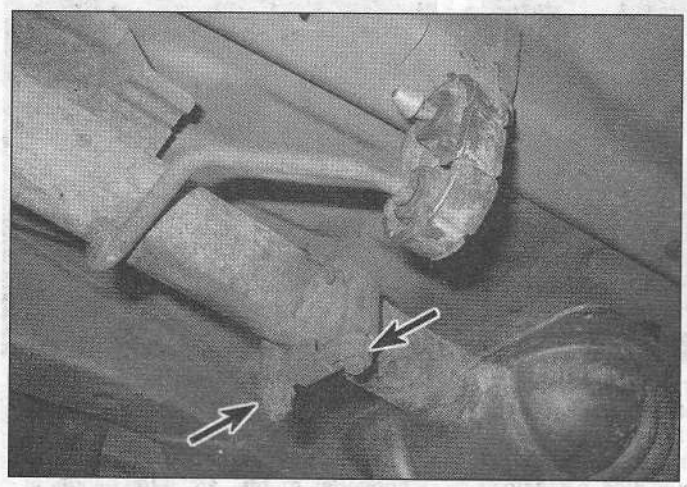
16 V6 models are equipped with three converters: an upstream "fast-light-off" catalyst directly below each exhaust manifold (and an integral part of the manifold), and a conventional three-way catalytic converter (TWC) located behind the junction between the two exhaust pipes for the front and rear cylinder heads. The following procedure applies to the larger catalyst underneath the vehicle. To replace an upstream converter, refer to "Exhaust manifold - removal and installation" in Chapter 2B.

17 Raise the vehicle and place it securely on jackstands.

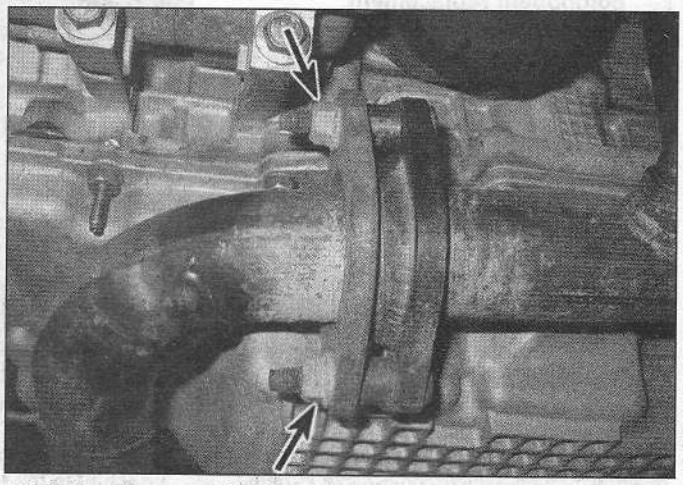
18 Remove the nuts from the flange located in front of the catalytic converter **(see illustration)**.

19 Loosen the clamp located behind the converter **(see illustration)**.

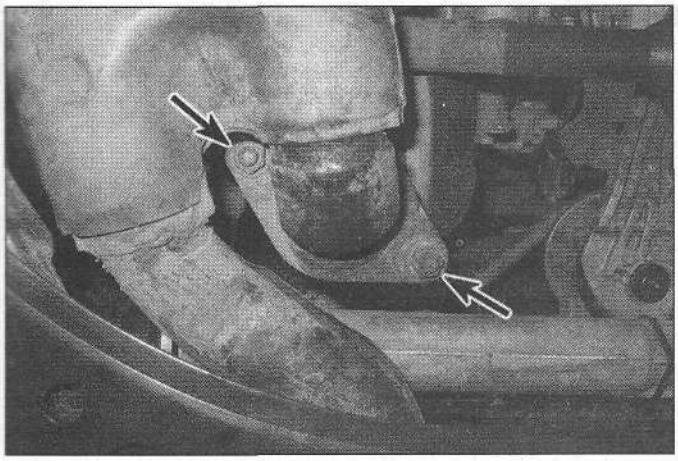
20 Disengage the two catalytic converter hanger brackets from their rubber exhaust hangers and then remove the catalytic converter.



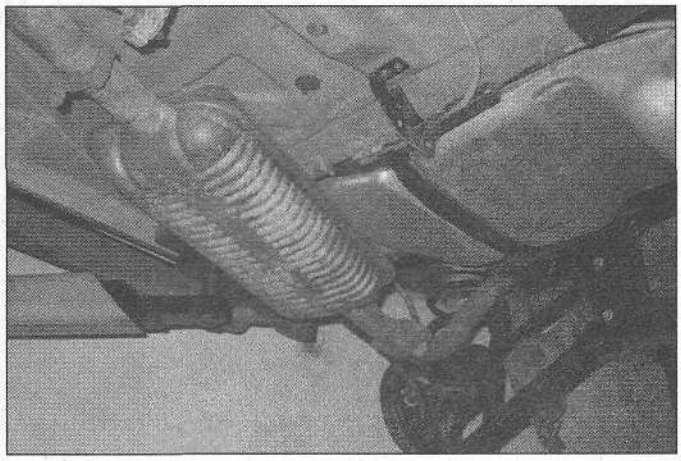
15.19 To disconnect the rear end of the catalytic converter from the exhaust pipe behind it, loosen the two nuts on this clamp and slide the clamp to the rear



15.23 To disconnect the front flange of the crossover and flexible exhaust pipe from the exhaust manifold/catalytic converter for the front cylinder head, remove these two nuts



15.24 To disconnect the rear flange of the crossover and flexible exhaust pipe from the exhaust manifold/catalytic converter for the rear cylinder head, remove these two nuts



15.28 The resonator is a small muffler that helps the muffler to reduce exhaust noise (V6 models only)

21 Be sure to inspect both rubber hangers (see Step 1). Installation is the reverse of removal. Apply anti-seize compound to the threads of all bolts and studs. Be sure to use new fasteners at both ends of the converter and a new flange gasket. Tighten all fasteners securely.

Crossover and flexible exhaust pipe (V6 models)

Refer to illustrations 15.23 and 15.24

22 Raise the vehicle and place it securely on jackstands.

23 Remove the nuts that attach the forward crossover flange to the front exhaust manifold/catalytic converter **(see illustration)**. Discard the nuts and the old flange gasket.

24 Remove the nuts that attach the rear crossover flange to the rear exhaust manifold/catalytic converter **(see illustration)**. Discard the nuts and the old flange gasket.

25 Remove the nuts that attach the flange behind the flexible exhaust pipe to the front end of the downstream catalytic converter **(see illustration 15.18)**. Discard the nuts and the old flange gasket.

26 Remove the crossover and flexible exhaust pipe assembly.

27 Installation is the reverse of removal. Be sure to use new flange nuts and flange gaskets. Apply anti-seize compound to the threads of all bolts and studs. Tighten all fasteners securely.

Resonator (V6 models)

Refer to illustrations 15.28 and 15.31

28 The resonator **(see illustration)** is a small auxiliary muffler that helps the main muffler reduce exhaust noise. (Usually, the resonator reduces noise in one frequency, the muffler reduces noise in another frequency.)

29 Raise the vehicle and place it securely on jackstands.

30 Loosen the clamp ahead of the resonator **(see illustration 15.19)** and slide the clamp out of the way. Discard the nuts.

31 Remove the two nuts from the flange behind the resonator **(see illustration)**. Discard the nuts.

32 Remove the resonator.

33 Installation is the reverse of removal. Be sure to use new flange nuts and a new flange gasket at the front, and new nuts for the clamp at the rear, of the resonator. Apply anti-seize compound to the threads of all bolts and studs. Tighten all fasteners securely.

Muffler (all models)

Refer to illustrations 15.36a and 15.36b

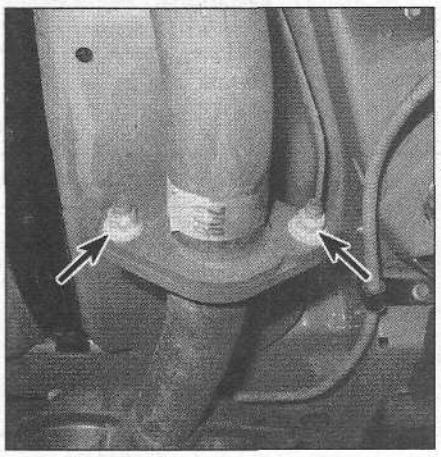
34 Raise the vehicle and place it securely on jackstands.

35 Remove the two nuts from the flange behind the resonator **(see illustration 15.31)** and discard the nuts. (On 2.0L models, there's no resonator, just a straight exhaust pipe, but the flange is still there.)

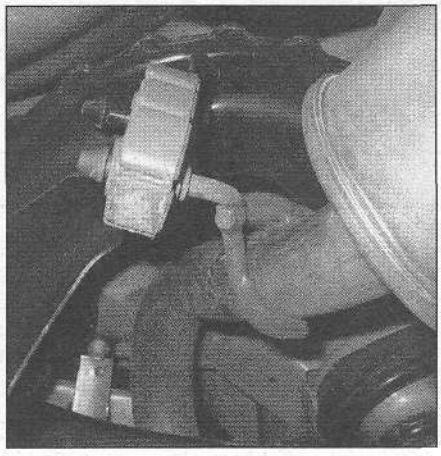
36 Disengage the muffler hanger brackets from the front and rear muffler exhaust hangers **(see illustrations)** and remove the muffler.

37 Inspect the condition of the rubber exhaust hangers. Replace them if they're worn or damaged.

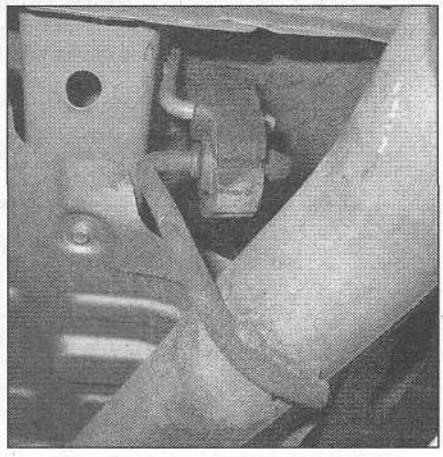
38 Installation is the reverse of removal. Be sure to use new fasteners and tighten all fasteners securely.



15.31 To disconnect the resonator flange from the muffler flange, remove these two nuts



15.36a Front muffler hanger (all models)



15.36b Rear muffler hanger (all models)