

Chapter 4 Part B: Fuel and exhaust systems - fuel-injected engines

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Degrees of difficulty

Easy , suitable for novice with little experience 	Fairly easy , suitable for beginner with some experience 	Fairly difficult , suitable for competent DIY mechanic 	Difficult , suitable for experienced DIY mechanic 	Very difficult , suitable for expert DIY or professional 
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Specifications

Note: For Idle speed and mixture settings, refer to Chapter 1 Specifications.

General

System type/application:	
1.3 litre HCS and 1.4 litre CVH engines	Central Fuel injection (CFI)
1.6 litre CVH engines	Electronic Fuel injection (EFI)
1.6 and 1.8 litre Zetec engines	Sequential Electronic Fuel injection (SEFi)

Fuel grade

Fuel octane requirement	95 RON unleaded
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Fuel pressure

CFI system:

Regulated fuel pressure - engine running at idle speed	1.0 ± 0.1 bars
Hold pressure - engine stopped after 1 minute	0.5 bars minimum

EFI system:

Pump pressure - engine not running	3.0 bars minimum
Regulated fuel pressure - engine running at idle speed	3.0 ± 0.1 bars
Hold pressure - engine stopped after two minutes	Not less than 0.8 bars below regulated pressure

SEFi system:

Regulated fuel pressure - engine running at idle speed:	
Pressure regulator vacuum hose connected	2.1 ± 0.2 bars
Pressure regulator vacuum hose disconnected	2.7 ± 0.2 bars
Hold pressure - engine stopped after five minutes	1.8 bars minimum*

*Note that if the engine is hot and the ambient temperature is high, the hold pressure may rise to 2.7 bars during this check.

Idle speed control valve

Resistance	6 to 14 ohms
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Torque wrench settings	Nm	lbf ft
CFi system		
CFi unit-to-inlet manifold	12 to 15	9 to 11
Fuel filter unions	14 to 20	10 to 15
Exhaust pipe-to-manifold	35 to 40	26 to 30
Exhaust heat shield	14 to 19	10 to 14
Exhaust system U-bolt clamps	35 to 40	26 to 30
Catalytic converter flange nuts	35 to 40	26 to 30
EFI system		
Idle speed control valve bolts	3.5 to 5.0	2.6 to 3.6
Fuel pressure regulator bolts	8 to 12	6 to 8
Fuel rail bolts	21 to 25	16 to 18
Fuel filter unions	14 to 20	10 to 15
Exhaust pipe-to-manifold	35 to 40	26 to 30
Exhaust heat shield	14 to 19	10 to 14
Exhaust system U-bolt clamps	35 to 40	26 to 30
Catalytic converter flange nuts	35 to 40	26 to 30
SEFi system		
Throttle housing-to-inlet manifold screws	8.5 to 12	6.3 to 8.8
Idle speed control valve bolts	5 to 7	3.7 to 5.2
Fuel filter unions	14 to 20	10 to 15
Fuel pressure regulator bolts	5 to 7	3.7 to 5.2
Fuel injector bolts	6	4
Fuel rail-to-inlet manifold bolts	8.5 to 12	6.3 to 8.8
Fuel feed and return line threaded couplings at fuel rail	24 to 30	17 to 22
Exhaust pipe to manifold	35 to 40	26 to 30
Exhaust heat shield	14 to 19	10 to 14
Exhaust system U-bolt clamps	35 to 40	26 to 30
Catalytic converter flange nuts	35 to 40	26 to 30

1 General information and precautions

This Chapter is concerned with those features of the engine management system that supply clean fuel and air to the engine, meter it in the required proportions, and dispose of the results. Since the emission control sub-systems modify the functions of both the fuel and exhaust sub-systems, all of which are integral parts of the whole engine management package, there are many cross-references to Chapters 5 and 6. Information on the electronic and emissions control systems is given in Chapter 6.

The fuel system consists of a fuel tank (mounted under the body, beneath the rear seats), fuel hoses, an electric fuel pump mounted in the fuel tank, and an electronic fuel injection system. Further specific information on the fuel injection systems is contained in Sections 12 and 13.

The exhaust system consists of an exhaust manifold, the front downpipe and catalytic converter and, on production-fit systems, a main section incorporating two silencers. The service replacement exhaust system consists of three sections: the front downpipe/catalytic converter, the intermediate pipe and front silencer, and the tailpipe and rear silencer. The system is suspended throughout its entire length by rubber mountings.

Extreme caution should be exercised when

dealing with either the fuel or exhaust systems. Fuel is a primary element for combustion. Be very careful! The exhaust system is an area for exercising caution, as it operates at very high temperatures. Serious burns can result from even momentary contact with any part of the exhaust system, and the fire risk is ever-present. The catalytic converter in particular runs at very high temperatures - refer to the information in Chapter 6.



Warning: Many of the procedures in this Chapter require the removal of fuel lines and connections, which may result in some fuel spillage. Petrol 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, in or near the work area. Don't work in a garage where a natural-gas appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses, and have a Class B type fire extinguisher on hand. Before carrying out any operation on the fuel system, refer also to the precautions given in "Safety first!" at the beginning of this manual, and follow them implicitly. Petrol is a highly-dangerous and volatile liquid, and the precautions necessary when handling it cannot be overstressed.

2 Fuel system - depressurisation



Warning: The fuel system will remain pressurised for long periods of time after the engine is switched off - this pressure must be released before any part of the system is disturbed. Petrol is extremely flammable - refer to the precautions at the end of the previous Section.

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 pressure regulator in the injector rail, 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 remain for some time after the ignition has been switched off, and must be relieved before any of these components is disturbed for servicing work.

3 The simplest method is simply to disconnect the fuel pump's electrical supply while the engine is running - either by removing the fuel pump fuse (No 5), or by lifting the red button on the fuel cut-off switch (see Section 11) - and to allow the engine to idle until it dies through lack of fuel pressure. Turn the engine over once or twice on the

starter to ensure that all pressure is released, then switch off the ignition; do not forget to refit the fuse (or depress the red button, as appropriate) when work is complete.



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.

4 Note that, once the fuel system has been depressurised 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 lines and fittings - general information



Warning: The fuel system pressure must be released before any part of the system is disturbed - see Section 2. Petrol 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, in or near the work area. Don't work in a garage where a natural-gas appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses, and have a Class B type fire extinguisher on hand.

Disconnecting and connecting quick-release couplings

1 Quick-release couplings are employed at many of the unions in the fuel feed and return lines.

2 Before disconnecting any fuel system component, relieve the residual pressure in the system (see Section 2), and equalise tank pressure by removing the fuel filler cap.



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.

3 Release the protruding locking lugs on each union, by squeezing them together and carefully pulling the coupling apart. Use rag to soak up any spilt fuel. Where the unions are colour-coded, the pipes cannot be confused. Where both unions are the same colour, note carefully which pipe is connected to which, and ensure that they are correctly reconnected on refitting.

4 To reconnect one of these couplings, press them together until the locking lugs snap into their groove. Switch the ignition on and off five times to pressurise the system, and check for any sign of fuel leakage around the disturbed coupling before attempting to start the engine.

Checking

5 Checking procedures for the fuel lines are included in Chapter 1.

Component renewal

6 If you must renew any damaged sections, use original-equipment replacement hoses or pipes, constructed from exactly the same material as the section you are replacing. Do not install substitutes constructed from inferior or inappropriate material, or you could cause a fuel leak or a fire.

7 Before detaching or disconnecting any part of the fuel system, note the routing of all hoses and pipes, and the orientation of all clamps and clips. Replacement sections must be installed in exactly the same manner.

8 Before disconnecting any part of the fuel system, be sure to relieve the fuel system pressure (see Section 2), and equalise tank pressure by removing the fuel filler cap. Also disconnect the battery negative (earth) lead - see Chapter 5, Section 1. Cover the fitting being disconnected with a rag, to absorb any fuel that may spray out.

4 Air cleaner assembly and air inlet components - removal and refitting



Note: Air cleaner element renewal and air cleaner temperature control system checks (where applicable) are described in Chapter 1.

Air cleaner assembly

CFi system

1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 Undo the retaining bolts and partially lift the air cleaner from the CFI unit, so that the hose and wiring connections to the underside of the air cleaner body are accessible.

3 Note their connections and routings, then



4.13 Detach the crankcase breather hose from the air cleaner housing



4.8 General view of the air filter (A) and air duct (B) fitted to the 1.6 litre EFI engine

detach the wiring and hoses from the underside of the air cleaner.

4 Lift the air cleaner clear from the CFI unit.

5 Refit in the reverse order of removal.

6 Renew any hoses that are perished or cracked, and ensure that all fittings are securely and correctly reconnected.

EFI system

7 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

8 Undo the retaining nut at the front, then loosen off the air duct-to-filter housing clip screw, and detach the air duct from the housing (see illustration).

9 Unscrew and remove the two retaining nuts on the underside of the housing (that secure it to the location studs).

10 Disconnect the hose at the base of the unit (to the inlet manifold) and lift the air cleaner clear.

11 Refit in the reverse order of removal. Ensure that the air hose and duct are securely located.

SEFi system

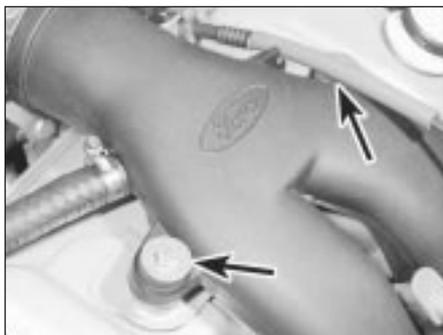
12 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

13 Detach the crankcase breather hose from the air cleaner housing (see illustration).

14 Disconnect the air mass meter wiring multi-plug, then release the two clips and withdraw the air mass meter, complete with inlet hose, from the air cleaner cover (see illustration). Carefully position the air mass meter and hose assembly to one side.



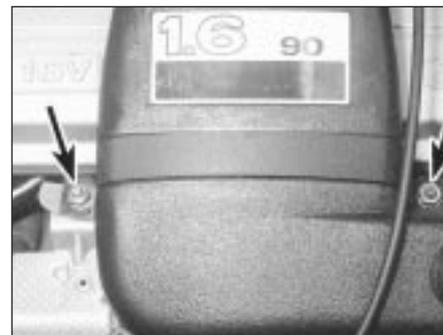
4.14 Disconnect the air mass meter wiring multi-plug, then release the two clips and withdraw the air mass meter, complete with inlet hose



4.21 Undo the two retaining bolts (arrowed) and remove the air inlet duct from the rocker cover



4.24 Detach the air inlet hose from the inlet duct. Note the small projection on the end of the hose which engages with a cut-out in the inlet duct



4.25 Undo the two nuts (arrowed) and lift off the air inlet duct retaining strap

15 Detach the air inlet duct from the air cleaner housing.

16 Unscrew the air cleaner housing front retaining nut, then pull the housing sharply upwards to release the two lower locating pegs from their rubber grommets. Remove the assembly from the car.

17 Refitting is the reverse of the removal procedure. Ensure that the housing pegs seat fully in their grommets, and that the air inlet duct is correctly located.

Air inlet components

CFi system

18 The air cleaner inlet spout and related components are removed with the air cleaner assembly as described above.

EFI system

19 Disconnect the HT leads from the spark plugs, labelling them if necessary to avoid confusion on refitting.

20 Slacken the retaining clips, and detach the air inlet hose and breather hose from the air inlet duct.

21 Undo the two retaining bolts, and remove the air inlet duct from the rocker cover (see illustration).

22 Slacken the retaining clip, and remove the air inlet hose from the air cleaner assembly.

23 Refitting is the reverse of the removal procedure.

SEFi system

24 Slacken the hose clips at each end, and detach the air inlet hose from the inlet duct and air mass meter. Note the small projection on the end of the hose, which engages with a cut-out in the inlet duct to ensure correct orientation when refitting (see illustration).

25 Undo the two nuts, and lift off the air inlet duct retaining strap (see illustration).

26 Withdraw the inlet duct from the throttle housing.

27 Refer to Chapter 6, Section 4 for further information on the air mass meter.

28 Refitting is the reverse of the removal procedure, but ensure correct orientation of the inlet hose by aligning the projections and cut-outs.

5 Accelerator cable - removal, refitting and adjustment



Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 Fold back the carpet and insulation in the driver's footwell to gain access to the accelerator pedal.

3 Detach the accelerator cable from the pedal.

4 On CFI systems, remove the air cleaner assembly as described in Section 4.

5 Working at the throttle housing end of the cable, pivot the throttle quadrant by hand to release the tension from the cable, then detach the inner cable nipple from the throttle lever (see illustration).

6 Detach the outer cable from the adjuster/support bracket, then remove the cable (see illustration).

Refitting and adjustment

7 Refit in the reverse order of removal. When the cable is reconnected at each end, have an assistant depress the accelerator, and check that the throttle fully opens and shuts without binding. Ensure that there is a small amount of slack in the inner cable when the throttle is fully released. If adjustment is required,

release the outer cable retaining clip from the cable at the adjustment/support bracket, slide the cable through the adjuster grommet to the point required, then refit the retaining clip to secure it in the set position.

6 Accelerator pedal - removal and refitting



Refer to Section 5 in Part A of this Chapter.

7 Fuel pump/fuel pressure - checking



Warning: Petrol 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, in or near the work area. Don't work in a garage where a natural-gas appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses, and have a Class B type fire extinguisher on hand.



5.5 Disconnecting the accelerator inner cable from the throttle quadrant



5.6 Accelerator outer cable location at the adjuster/support bracket

Fuel pump operation check

1 Switch on the ignition, and listen for the fuel pump (the sound of an electric motor running, audible from beneath the rear seats). Assuming there is sufficient fuel in the tank, the pump should start and run for approximately one or two seconds, then stop, each time the ignition is switched on. **Note:** *If the pump runs continuously all the time the ignition is switched on, the electronic control system is running in the backup (or “limp-home”) mode referred to by Ford as “Limited Operation Strategy” (LOS). This almost certainly indicates a fault in the ECU itself, and the vehicle should therefore be taken to a Ford dealer for a full test of the complete system, using the correct diagnostic equipment; do not waste time or risk damaging the components by trying to test the system without such facilities.*

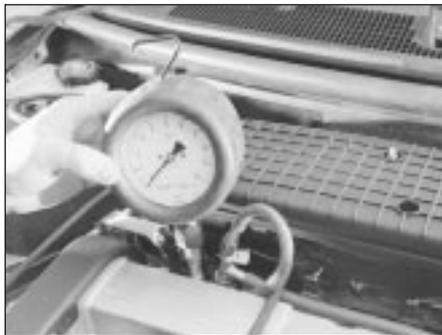
2 Listen for fuel return noises from the fuel pressure regulator. It should be possible to feel the fuel pulsing in the regulator and in the feed hose from the fuel filter.

3 If the pump does not run at all, check the fuse, relay and wiring (see Chapter 6). Check also that the fuel cut-off switch has not been activated and if so, reset it.

Fuel pressure check

4 A fuel pressure gauge will be required for this check. On CFI and EFI systems, the gauge should be connected in the fuel line between the fuel filter and the CFI unit or fuel rail, in accordance with the gauge maker's instructions. On SEFi systems, a pressure gauge equipped with an adapter to suit the Schrader-type valve on the fuel rail pressure test/release fitting (identifiable by its blue plastic cap, and located on the union of the fuel feed line and the fuel rail) will be required. If the Ford special tool 29-033 is available, the tool can be attached to the valve, and a conventional-type pressure gauge attached to the tool.

5 If using the service tool, ensure that its tap is turned fully anti-clockwise, then attach it to the valve. Connect the pressure gauge to the service tool. If using a fuel pressure gauge with its own adapter, connect it in accordance with its maker's instructions (see illustration).



7.5 Fuel pressure gauge connected to the fuel line

6 With the gauge connected proceed as follows according to engine type.

CFi system

7 Start the engine and allow it to idle. Note the gauge reading as soon as the pressure stabilises, and compare it with the figures given for regulated fuel pressure in this Chapter's Specifications. If the pressure is high, check for a restricted fuel return line. If the pressure is low, renew the fuel pressure regulator.

8 Switch off the engine, and check that after one minute, the hold pressure has not fallen below that specified. If it has, check the seals on the fuel injector (see Section 15) and renew them if they appear in any way suspect. If the seals are okay, then the fuel pressure regulator or CFI unit are suspect.

9 Carefully disconnect the fuel pressure gauge, depressurising the system first as described in Section 2.

10 Run the engine, and check that there are no fuel leaks.

EFi system

11 Disconnect the wiring from the E-DIS ignition coil and the fuel injectors.

12 Switch the ignition on and off twice, and check that the pump pressure is as listed in this Chapter's Specifications.

13 If the pressure is not as specified, check the fuel system for leaks or damage. If the system appears okay, renew the fuel pump.

14 Reconnect the wiring to the ignition coil and fuel injectors.

15 If the pump pressure was satisfactory, start the engine and allow it to idle. Disconnect the vacuum hose at the fuel pressure regulator, and plug the hose. Note the gauge reading as soon as the pressure stabilises, and compare it with the figures given for regulated fuel pressure in this Chapter's Specifications.

16 If the regulated fuel pressure is not as specified, remove the plug from the top of the fuel pressure regulator, and using a suitable Allen key, adjust the pressure regulator as necessary.

17 Switch off the engine, and check that the fuel pressure stays at the specified hold pressure for two minutes after the engine is turned off.

18 Carefully disconnect the fuel pressure gauge, depressurising the system first as described in Section 2. Reconnect the ignition coil and fuel injector wiring.

19 Run the engine, and check that there are no fuel leaks.

SEFi system

20 Start the engine and allow it to idle. Note the gauge reading as soon as the pressure stabilises, and compare it with the regulated fuel pressure figures listed in this Chapter's Specifications.

a) *If the pressure is high, check for a restricted fuel return line. If the line is clear, renew the fuel pressure regulator.*

b) *If the pressure is low, pinch the fuel return line. If the pressure now goes up, renew the fuel pressure regulator. If the pressure does not increase, check the fuel feed line, the fuel pump and the fuel filter.*

21 Detach the vacuum hose from the fuel pressure regulator; the pressure shown on the gauge should increase. Note the increase in pressure, and compare it with that listed in this Chapter's Specifications. If the pressure increase is not as specified, check the vacuum hose and pressure regulator.

22 Reconnect the regulator vacuum hose, and switch off the engine. Verify that the hold pressure stays at the specified level for five minutes after the engine is turned off.

23 Carefully disconnect the fuel pressure gauge, depressurising the system first as described in Section 2. Be sure to cover the fitting with a rag before slackening it. Mop up any spilled petrol.

24 Run the engine, and check that there are no fuel leaks.

8 Fuel tank - removal and refitting



Warning: *Petrol 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, in or near the work area. Don't work in a garage where a natural-gas appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses, and have a Class B type fire extinguisher on hand.*

Removal

1 Run the fuel level as low as possible prior to removing the tank.

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



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.*

3 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

4 Remove the fuel filler cap, then syphon or pump out the remaining fuel from the fuel tank (there is no drain plug). The fuel must be emptied into a suitable container for storage.

5 Chock the front wheels, then raise and support the vehicle on axle stands at the rear.

6 Disconnect the fuel filler pipe from the fuel tank. Drain any remaining fuel into the

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container for safe storage, and plug the hose and tank connections. Disconnect the handbrake cable locating strap from the fuel filler pipe on the tank.

7 Disconnect the filler neck pipe sensing hose from the rear of the tank.

8 Support the underside of the fuel tank to hold it in position, then remove the four tank retaining bolts.

9 Partially lower the fuel tank, and detach the ventilation tube from the tank top surface. Also disconnect the fuel pump/fuel gauge sender unit wiring multi-plug and the fuel hoses. Where quick-release couplings are used on the fuel hoses, release the protruding locking lugs on each union, by squeezing them together and carefully pulling the coupling apart.

10 Slowly lower the tank; as it is withdrawn, detach the filler pipe.

Inspection

11 When removed, the fuel tank can be inspected for damage or deterioration. Removal of the pump/sender unit (see Section 9) will allow a partial inspection of the interior. If the tank is contaminated with sediment or water, swill it out with clean petrol. Do not under any circumstances undertake any repairs on a leaking or damaged fuel tank; this work must be carried out by a professional who has experience in this critical and potentially-dangerous work.

12 Whilst 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.

13 Check the condition of the filler pipe seal in the fuel tank, and renew it if necessary.

Refitting

14 Refitting is a reversal of the removal procedure. Apply a light smear of grease to the filler pipe seal, to ease fitting. Ensure that all connections are securely fitted. Where quick-release fuel couplings are fitted, press them together until the locking lugs snap into their groove. If evidence of contamination was found, do not return any previously-drained fuel to the tank unless it is carefully filtered first.

9 Fuel pump/fuel gauge sender unit - removal and refitting

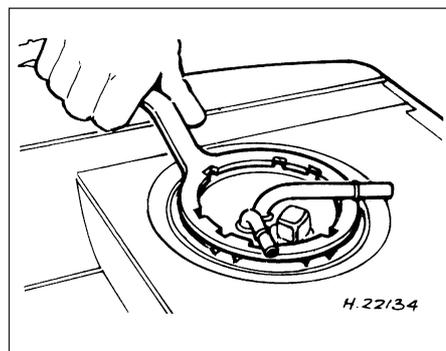


Warning: Petrol is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke, or allow open flames or bare light bulbs, in or near the work area. Don't work in a garage where a natural-gas appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses, and have a Class B type fire extinguisher on hand.

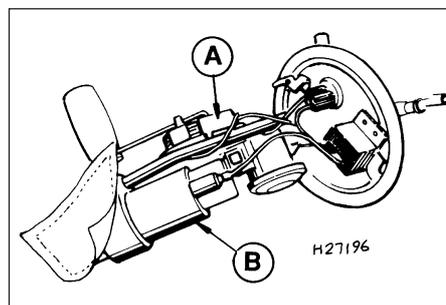
Note: Ford specify the use of their service tool 23-014 or 23-026 (a large box spanner with projecting teeth to engage the fuel pump/sender unit retaining ring's slots) for this task. While alternatives are possible, in view of the difficulty experienced in removing and refitting the pump/sender unit, owners are strongly advised to obtain the correct tool before starting work.

Removal

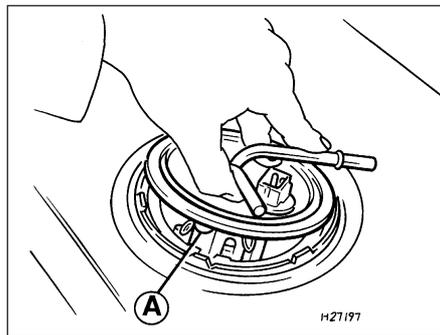
1 A combined fuel pump and fuel gauge sender unit are located in the top face of the



9.2 Fuel pump/sender unit removal from the fuel tank using Ford special tool 23-026



9.3 In-tank fuel pump (B) and sender unit (A)



9.4 Fuel pump/sender unit refitting to the tank, showing position of the locating lug (A)

fuel tank. The combined unit can only be detached and withdrawn from the tank after the tank is released and lowered from under the vehicle. Refer to Section 8 and remove the fuel tank, then proceed as follows.

2 With the fuel tank removed, the pump/sender unit can be unscrewed using the special tool (see illustration).

3 Withdraw the unit upwards from the tank (see illustration), and detach the seal ring. The seal ring must be renewed whenever the pump/sender unit is withdrawn from the tank.

Refitting

4 Refit in the reverse order of removal. Lightly coat the new unit seal ring with grease to ease fitting, and ensure that the seal is not distorted as the unit is fitted into position. Insert the unit so that the lug of the unit is in engagement with the slot in the tank aperture, then turn the unit to lock and secure (see illustration).

10 Roll-over valve - removal and refitting



Refer to Section 10 in Part A of this Chapter.

11 Fuel cut-off switch - removal and refitting



Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 Remove the front footwell side cowl trim panel on the driver's side as described in Chapter 11.

3 Undo the retaining screws and withdraw the cut-off (inertia) switch unit from the body (see illustration). As it is withdrawn, disconnect the wiring connector to the switch.



11.3 Fuel cut-off switch location in the driver's footwell

Refitting

- 4 Reconnect the wiring connector to the switch, ensuring that it is felt to snap securely into position.
- 5 Relocate the switch, and refit the screws to secure it.
- 6 Reset the switch by pushing the top button down, then refit the side cowl trim panel.
- 7 Reconnect the battery and restart the engine to ensure that the switch has reset.

12 Fuel injection system/engine management system (1.3 and 1.4 litre CFI) - general information

Fuel is supplied from the fuel tank by an integral electric fuel pump (and combined fuel gauge sender unit). The fuel is passed through an in-line filter within the engine compartment, then to the fuel injection unit. The fuel is maintained at the required operating pressure by a pressure regulator unit.

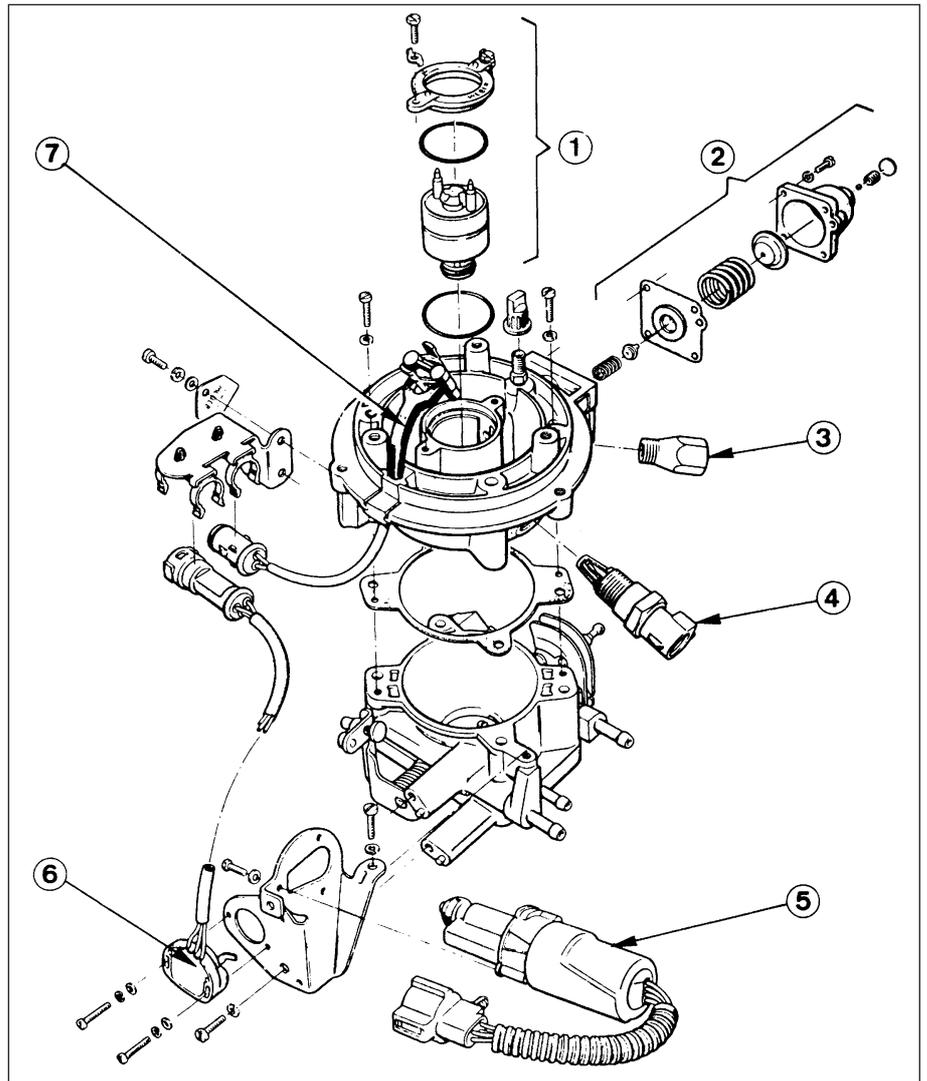
The CFI unit itself is a relatively simple device when compared with a conventional carburettor. Fuel is injected by a single solenoid valve (fuel injector) which is mounted centrally on top of the unit. It is this feature which gives the system CFI (or Central Fuel Injection) its name (see illustration).

The injector is energised by an electrical signal sent from the engine management ECU. When energised, the injector pintle is lifted from its seat, and atomised fuel is delivered into the inlet manifold under pressure. The electrical signals take two forms of current - a high current to open the injector, and a low current to hold it open for the duration required. At idle speed, the injector is pulsed at every other inlet stroke, rather than with every stroke as during normal operation.

The air-to-fuel mixture ratio is regulated by the engine management ECU, based on inputs from the various engine sensors, the operation of which is described in greater detail in Chapter 6. No adjustments to the fuel mixture are possible.

The throttle plate control motor (mounted on the side of the CFI unit) regulates the idle speed by reacting to the signals sent by the ECU. The signals are calculated by the values and information provided from the engine sensors. When the throttle position sensor indicates that the throttle is closed, the ECU enters the idle speed mode or dashpot mode (according to engine speed). The ECU maintains the idle speed at a constant value, making minor adjustments as necessary for different loads and conditions. The base idle speed can only be adjusted by a dealer or fuel injection specialist with the necessary equipment to link up to the engine management ECU.

To prevent the engine from running on (or dieselling) when it is switched off, the ECU sends a signal to the throttle plate control motor, to fully close the throttle plate and return it to its preset position ready for



12.2 Exploded view of the CFI unit fitted to 1.3 and 1.4 litre engines

- | | | |
|--------------------------------|--------------------------------|----------------------------|
| 1 Fuel injection unit | 3 Fuel feed connector | 6 Throttle position sensor |
| 2 Fuel pressure regulator unit | 4 Inlet air temperature sensor | 7 Fuel injector wiring |
| | 5 Throttle plate control motor | |

restarting. When the ignition is switched on to restart the engine, the motor repositions the throttle plate to the position required according to the prevailing conditions.

13 Fuel injection/engine management systems (1.6 and 1.8 litre EFI and SEFi) - general information

EFI system

Fuel is supplied under pressure from the fuel pump to the fuel distributor rail mounted on top of the inlet manifold (see illustration). The fuel rail acts as a pressurised fuel reservoir for the fuel injectors. The electro-mechanical injectors have only "on" or "off" positions, the volume of fuel being injected to

meet the engine operating conditions being determined by the length of time that the injectors are opened. The volume of fuel required for one power stroke is determined by the engine management ECU, and is divided by two equal amounts. The first half of the required volume is injected into the static air ahead of the inlet valve one complete engine revolution before the inlet valve is due to open. After one further revolution, the inlet valve opens and the required fuel volume is injected into the air flow being drawn into the cylinder. The fuel will therefore be consistently injected to two inlet valves simultaneously at a particular crankshaft position.

The volume of air drawn into the engine is governed by the air filter unit and other variable operating factors. These variables are assessed by the engine management ECU

4B•8 Fuel and exhaust systems – fuel-injected engines

and the corresponding signals are produced to actuate the injectors accordingly.

The engine base idle speed can be adjusted (if required), by turning the adjuster screw (covered by a tamperproof cap) in the throttle housing. Provision for adjusting the fuel mixture is made by the mixture screw in the potentiometer unit mounted on the bulkhead.

Further information on the engine management system and its various sensors and sub-systems will be found in Chapter 6.

SEFi system

The electric fuel pump located inside the fuel tank supplies fuel under pressure to the fuel rail, which distributes fuel evenly to all injectors. A pressure regulator controls the system pressure in relation to inlet tract depression. From the fuel rail, fuel is injected into the inlet ports, just above the inlet valves, by four fuel injectors. The system also includes features such as the flushing of fresh (ie, cold) fuel around each injector on start-up, thus improving hot starts.

The amount of fuel supplied by the injectors is precisely controlled by the engine management ECU. The ECU uses the signals derived from the engine speed/crankshaft position sensor and the camshaft position sensor, to trigger each injector separately in cylinder firing order (sequential injection), with benefits in terms of better fuel economy and lower exhaust emissions.

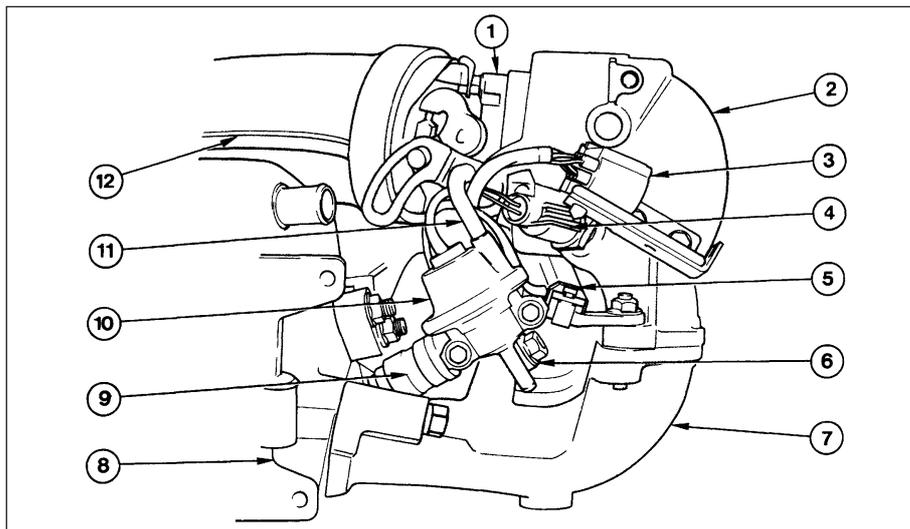
The air inlet side of the system consists of an air cleaner housing, an air mass meter, an inlet hose and duct, and a throttle housing. The air mass meter is an information-gathering device for the ECU; it uses a "hot-wire" system to send the ECU a constantly-varying (analogue) voltage signal corresponding to the volume of air passing into the engine. Another sensor in the air mass meter measures inlet air temperature. The ECU uses these signals to calculate the mass of air entering the engine.

The throttle valve inside the throttle housing 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 potentiometer opens further, the air mass meter's signal alters, and the ECU opens each injector for a longer duration, to increase the amount of fuel delivered to the inlet ports.

Both the idle speed and mixture are under the control of the ECU, and cannot be adjusted. Not only can they not be adjusted, they cannot even be checked, except with the use of special diagnostic equipment, which makes it a task for a Ford dealer service department. *Do not* attempt to "adjust" these settings in any way without such equipment.

If the idle speed and mixture are thought to be incorrect, take the vehicle to a Ford dealer for the complete system to be tested.

Further information on the engine management system and its various sensors and sub-systems will be found in Chapter 6.



13.1 General view of the fuel injection system arrangement on the 1.6 litre EFI model

- | | | |
|--------------------------------|-----------------------------------|----------------------------|
| 1 Throttle housing | 6 Fuel distributor rail | 9 Fuel injector |
| 2 Upper inlet manifold section | 7 Lower section of inlet manifold | 10 Fuel pressure regulator |
| 3 Wiring loom connector | 8 Cylinder head | 11 Vacuum hose |
| 4 Inlet air temperature sensor | | 12 Air inlet duct |
| 5 Wiring harness ducting | | |

14 Fuel injection system/engine management system - checking



Warning: Petrol 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. Don't work in a garage if a natural-gas appliance with a pilot light is present. While performing any work on the fuel system, wear safety glasses, and have a dry chemical (Class B) fire extinguisher on hand. If you spill any fuel on your skin, rinse it off immediately with soap and water.

Note: This is a basic check of the fuel delivery and air induction sub-systems of the engine management system, to be carried out in conjunction with the operational check of the fuel pump (see Section 7), and as part of the initial system checks of the complete engine management system (see Section 3 of Chapter 6).

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

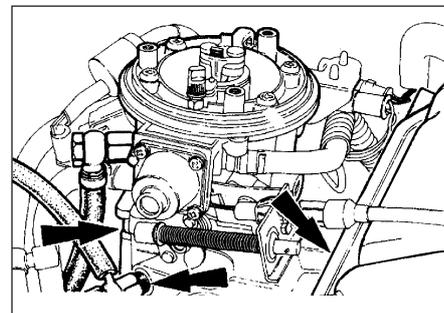
2 Check to see that the battery is fully-charged. The ECU and sensors depend on an accurate supply voltage to properly meter the fuel.

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

4 If a blown fuse is found, renew it and see if it blows again. If it does, search for a short-circuited wire in the harness related to the system (see Chapter 6).

5 Check the CFI unit/throttle housing and inlet manifold joints for leaks, which will result in an excessively-lean mixture (see illustration). Also check the condition of the vacuum hoses connected to the inlet manifold.

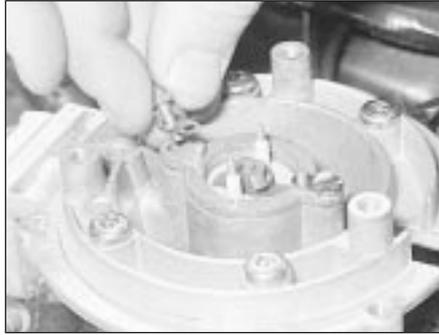
6 On EFI and SEFi systems, remove the air inlet duct from the throttle housing. Check the throttle valve for dirt, carbon or other residue build-up. If it's dirty, seek the advice of a Ford dealer - since the electronic control system is designed to compensate for factors such as the build-up of dirt in the throttle housing, it may well be best to leave it dirty, unless the deposits are extensive. **Note:** A warning label on the housing states specifically that the housing bore and the throttle valve have a special coating, and must **not** be cleaned using carburettor cleaner, as this may damage it.



14.5 Check the points indicated on the CFI unit for induction leaks



15.8 Disconnect the multi-plug from the injector



15.9A Remove the injector retaining collar bolt and locktab . . .



15.9B . . . and remove the injector retaining collar

7 On EFi and SEFi systems, with the engine running, place a screwdriver or a stethoscope against each injector, one at a time. Listen through the screwdriver handle or stethoscope for a clicking sound, indicating operation.

8 If an injector doesn't appear to be operating, turn off the engine and carefully check the wiring plug connection on the injector, and the wiring itself. If all appears okay, have the injector tested by a specialist.

9 A rough idle, diminished performance and/or increased fuel consumption could also be caused by a clogged or fouled fuel injector(s). Fuel additives that can sometimes clean fouled injectors are available at car accessory shops.

10 The remainder of the system checks should be left to a dealer service department or other qualified repair specialist, as there is a chance that the ECU may be damaged if tests are not performed properly.

15 Fuel injection system components (1.3 and 1.4 litre CFI) - checking and renewal



Warning: The fuel system pressure must be released before any part of the system is disturbed - see Section 2. Petrol 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, in or near the work area. Don't work in a garage where a natural-gas appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses, and have a Class B type fire extinguisher on hand.

Fuel injector

Check

1 Refer to Section 4 and remove the air cleaner.
2 Disconnect the multi-plug connector from the E-DIS ignition coil (to prevent the engine from starting).
3 Get an assistant to turn the engine over on the starter motor, while you look down through the top of the CFI unit and check that fuel is seen to be delivered into the central venturi.

4 If the fuel supply is seen to be acceptable but the engine will not start, refer to the ignition and engine management system test procedures contained in Chapters 5 and 6.

Renewal

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

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.

6 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

7 Refer to Section 4 and remove the air cleaner.

8 Release the injector feed wiring multi-plug, and detach it from the injector (pulling on the plug - not the wire) (see illustration).

9 Bend over the locking tabs retaining the injector screws, then undo and remove the screws. Withdraw the injector retaining collar, then carefully withdraw the injector from the CFI unit (noting its orientation) followed by its seal (see illustrations).

10 Refit in the reverse order of removal. Always use new seals in the CFI unit and the retaining collar, and lightly lubricate them with clean engine oil prior to assembly. Take care not to damage the seals as they are fitted and as the injector is fitted, check that the location peg engages correctly (see illustration).

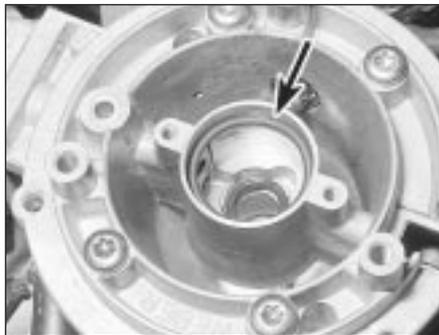
Fuel pressure regulator

Check

11 Refer to the fuel pump/fuel pressure check procedure (Section 7).



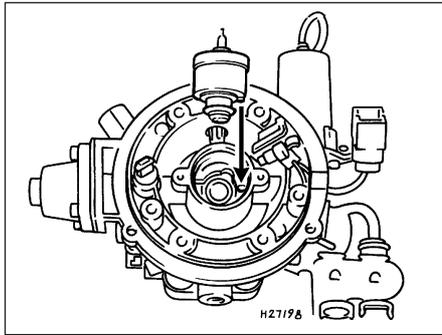
15.9C Withdraw the injector from the CFI unit



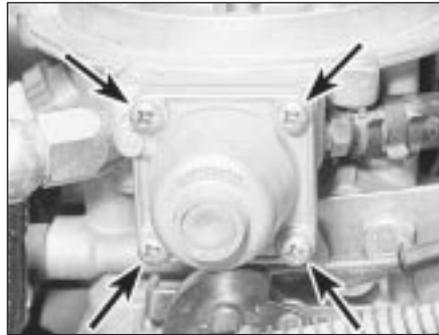
15.9D Injector seal location (arrowed) in the CFI unit



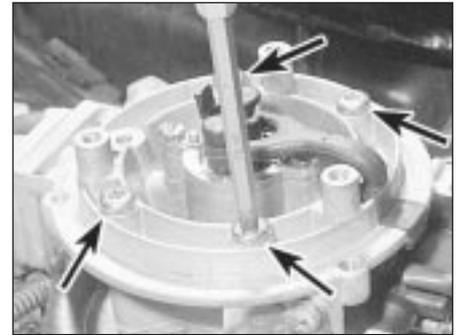
15.9E Withdrawing the seal from the injector retaining collar



15.10 Showing position of the injector location peg (arrowed)



15.13 Fuel pressure regulator and retaining screws (arrowed) - shown in situ



15.28 CFI unit retaining screws (arrowed)

Renewal

12 Refer to paragraphs 20 to 28 in this Section and remove the CFI unit from the vehicle.

13 Unscrew and remove the four regulator retaining screws, and remove the regulator (see illustration). As they are removed, note the fitting positions and the orientation of the components. **Do not** (unless absolutely necessary) attempt to prise out the plug or adjust the screw in the centre of the housing (if no plug fitted), as this will alter the system pressure.

14 Examine the components, and renew any that are defective or suspect.

15 To refit, position the regulator on its side, then insert the small spring, the valve, diaphragm (ensuring that it seats correctly), large spring, cup and then the regulator cover. Insert and tighten the retaining screws, but take care not to overtighten them, or the cover will be distorted.

16 Carefully place the ball into position on the spring cup, and ensure that it seats correctly.

17 If removed, fit the central Allen type adjuster screw, hand-tighten it and then unscrew it (from the hand-tight position) three full turns to make a provisional adjustment.

18 Refit the CFI unit in accordance with paragraphs 29 to 31 in this Section, but note that further checks for fuel leaks must be made with the engine running. The fuel system pressure must be checked by a Ford

dealer or other suitable specialist at the earliest opportunity.

CFi unit

Check

19 Refer to paragraphs 1 to 4 in this Section.

Renewal

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

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.

21 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

22 Refer to Section 4 and remove the air cleaner.

23 Position a suitable drain tray under the coolant hose connections to the CFI unit, then detach the hoses from the unit. Plug or clamp the hoses to prevent further coolant spillage whilst the hoses are detached.

24 Disconnect the fuel return pipe from the CFI unit.

25 Refer to Section 5 and disconnect the accelerator cable from the CFI unit.

26 Disconnect the inlet air temperature sensor, throttle plate control motor and throttle position sensor wiring multi-plug connectors.

27 Disconnect the vacuum hose from the CFI unit.

28 Unscrew and remove the four retaining screws, and remove the CFI unit from the inlet manifold (see illustration). Remove the gasket.

29 Clean the CFI unit and the inlet manifold mating faces.

30 Refit in the reverse order of removal. Tighten the retaining bolts to the specified torque wrench setting. Check and top-up the cooling system as required (Chapter 1).

31 When the CFI unit is refitted, turn the ignition on and off at least five times to pressurise the system, and check for leaks.

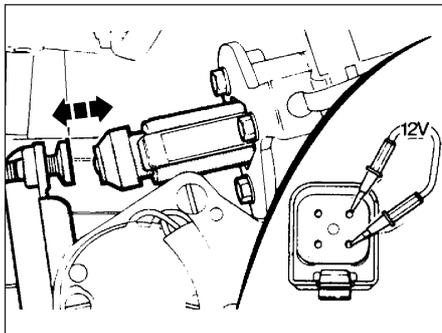
Throttle plate control motor

Check

32 Open the bonnet and watch the throttle plate control motor, while an assistant starts the engine, then turns the ignition key off. The motor should be seen to retract and then extend so that it is ready for the next engine restart. The throttle plate control motor can be individually checked for operation by connecting a 12-volt supply direct to the motor multi-plug (see illustration). Depending on the polarity, the motor should extend or retract. Changing the polarity should reverse the action.

Renewal

33 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).



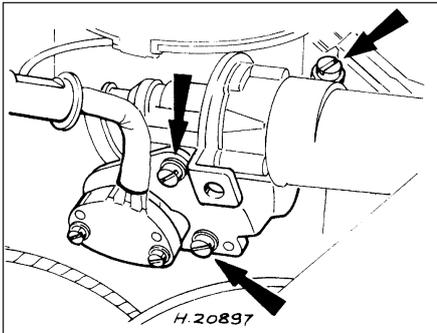
15.32 Throttle plate control motor check. Inset shows test connections to multi-plug



15.35A Disconnecting the throttle plate control motor multi-plug



15.35B Releasing the throttle position sensor multi-plug from the retaining clip



15.36 Throttle plate control motor retaining screws (arrowed)

34 Refer to Section 4 and remove the air cleaner.

35 Detach the wiring multi-plugs from the throttle position sensor and the throttle plate control motor, and release the retaining clips on the bracket (see illustrations).

36 Undo and remove the motor support bracket screws, and remove the bracket complete with the motor from the CFI unit (see illustration).

37 Undo the motor retaining screws and remove it from the support bracket.

38 Refit in the reverse order of removal, but note the following points:

- a) When refitting the motor and its support bracket to the injector unit, the throttle position sensor must locate on the accelerator linkage, and the bracket must align with the pegs.
- b) On completion, the idle speed should be checked by a Ford garage or fuel injection specialist who has the required equipment to link up with the engine management ECU.

Fuel trap

Check

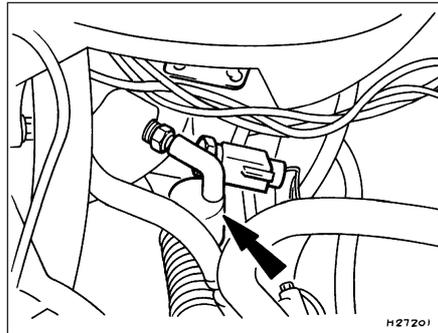
39 A fuel trap is fitted to the Manifold Absolute Pressure (MAP) sensor hose (see illustration).

40 Disconnect the vacuum hose between the MAP sensor and the inlet manifold, and check carefully for any sign that fuel may be present in the hose. Remove both hoses from the fuel trap, and blow out both with compressed air. Ensure that when in its fitted position there are no dips in the hose, and that it does not chafe against any components or wiring. Note that if fuel was found to be present in the vacuum hose, it is possible that the MAP sensor may have been contaminated; this component should be tested by a Ford dealer using specialist equipment.

Renewal

41 To renew the fuel trap, first disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1), then disconnect the vacuum hoses from the fuel trap and withdraw it.

42 Refit in the reverse order of removal. It is important to ensure that the trap is correctly orientated, with the "CARB" mark on one end



15.39 Fuel trap location (arrowed) in MAP sensor vacuum hose

face towards the inlet manifold, and the "DIST" mark towards the MAP sensor (see illustration).

16 Fuel injection system components (1.6 litre EFi) - checking and renewal

Warning: The fuel system pressure must be released before any part of the system is disturbed - see Section 2. Petrol 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, in or near the work area. Don't work in a garage where a natural-gas appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses, and have a Class B type fire extinguisher on hand.

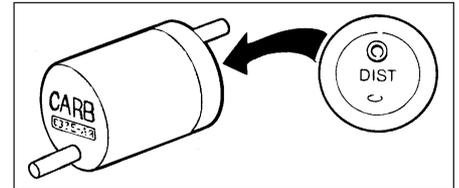
Fuel rail and injectors

Check

1 Refer to the procedure in the fuel injection system check (see Section 14).

Renewal

Note: For simplicity, and to ensure the necessary absolute cleanliness on reassembly, the following procedure describes the removal of the fuel rail assembly, complete with the



15.42 Fuel trap orientation markings

injectors and pressure regulator, so that the injectors can be serviced individually on a clean work surface. It is also possible to remove and refit an individual injector, once the fuel system has been depressurised and the battery has been disconnected. If this approach is followed, read through the complete procedure, and work as described in the relevant paragraphs, depending on the amount of preliminary dismantling required. Be careful not to allow any dirt to enter the system.

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

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.



3 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

4 Loosen off the retaining clip, and detach the hot-air hose duct from the exhaust manifold (see illustration).

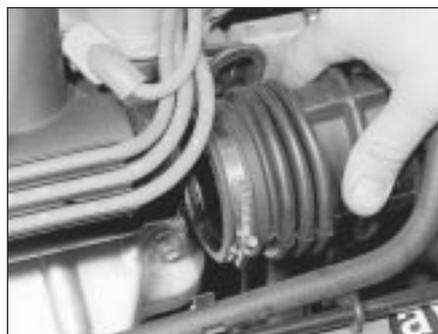
5 Disconnect the ignition HT lead connectors from the spark plugs, and release the leads from their locating grooves in the air inlet duct. Position them out of the way.

6 Unscrew the retaining nuts and the bolt, and detach the accelerator cable support bracket at the throttle housing.

7 Disconnect the wiring connector from the throttle position sensor.

8 Unscrew the four retaining bolts, and remove the throttle housing and its mating face gasket (see illustration).

9 Disconnect the wiring multi-plug from the



16.4 Disconnecting the hot-air duct from the exhaust manifold



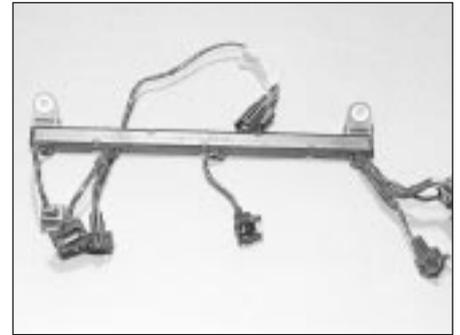
16.8 Throttle housing retaining bolt locations (arrowed)



16.10A Disconnect the wiring connector from each injector . . .



16.10B . . . unbolt the wiring harness . . .



16.10C . . . and remove the injector wiring harness

engine coolant temperature sensor and the air inlet temperature sensor.

10 Disconnect the wiring connectors from the fuel injectors, then undo the two retaining bolts and detach the wiring harness from the fuel rail (see illustrations).

11 Unscrew the fuel supply pipe at the fuel rail. Plug the rail and pipe, to prevent further fuel spillage and the possible ingress of dirt.

12 Disconnect the fuel return and vacuum pipes from the pressure regulator, and catch any fuel spillage in a clean cloth.

13 Unscrew the fuel rail securing bolts, and carefully withdraw the rail (complete with injectors) from the engine (see illustrations).

14 Detach the fuel injectors from the fuel rail, then remove the upper and lower seal from

each injector. All seals must be renewed (even if only one injector is to be renewed).

15 Prior to refitting the injectors, ensure that all mating surfaces are perfectly clean. Lubricate the new injector seals with clean engine oil to ease their assembly to the injectors (see illustration).

16 Refitting is a reversal of the removal procedure. Refer to the Specifications at the start of this Chapter for the tightening torques. When refitting the fuel rail, ensure that the mating surfaces of the throttle housing are perfectly clean before assembling.

17 On completion, restart the engine and check the various fuel connections for any signs of leaks.

Fuel pressure regulator

Check

18 Refer to the fuel pump/fuel pressure check procedure (see Section 7).

Renewal

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

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.

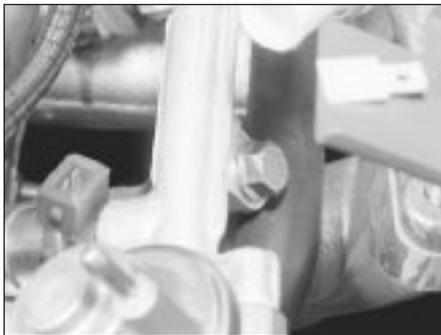
20 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

21 Release the fuel return pipe securing clip, and detach the pipe from the regulator.

22 Pull free the vacuum pipe from the regulator connector (see illustration).

23 Unscrew the two retaining bolts and remove the regulator. Remove the old sealing ring for renewal.

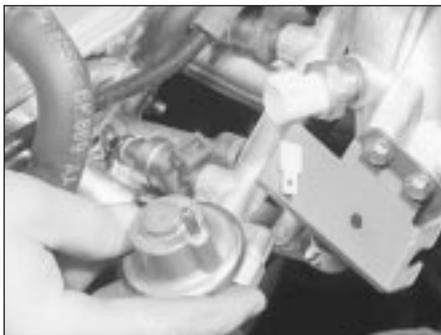
24 Refit in the reverse order of removal. Lubricate the new seal ring with clean engine oil to ease assembly. When the regulator is refitted and the fuel and vacuum lines are reconnected, turn the ignition on and off five times (without cranking the engine) and check for any sign of fuel leaks before restarting the engine.



16.13A Remove the injector rail retaining bolts . . .



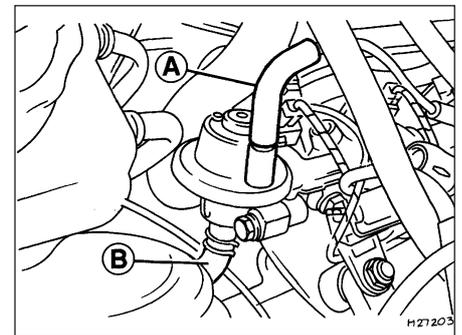
16.13B . . . release each injector . . .



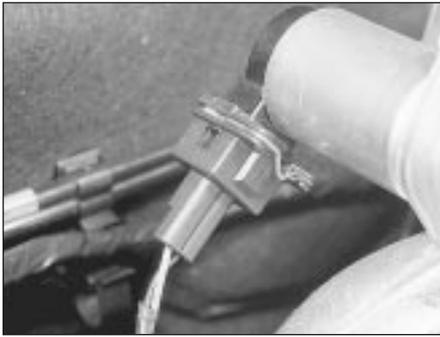
16.13C . . . and withdraw the fuel rail and injectors



16.15 Fuel injector with new seals fitted



16.22 Fuel pressure regulator showing vacuum pipe (A) and return pipe connections (B)



16.26 Idle speed control valve and wiring connector

Idle speed control valve

Check

- 25 Disconnect the battery negative (earth) lead - see Chapter 5, Section 1.
- 26 Unplug the valve's electrical connector (see illustration).
- 27 Connect a 12-volt battery across the valve's terminals - positive (+) to terminal 37, and negative (-) to terminal 21.



Caution: It is essential that the correct polarity is observed, or the diode incorporated in the valve may be damaged.

- 28 A distinct click should be heard each time contact is made and broken. If not, measure the resistance between the terminals. If the resistance is as specified, the valve is okay (but there may be a problem with the wiring or the ECU). If the resistance is not as specified, renew the valve (see below).
- 29 Plug in the valve's electrical connector.

Renewal

- 30 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 31 Unplug the valve's electrical connector.
- 32 Undo the four retaining screws, and remove the idle speed control valve.
- 33 Refitting is a reversal of the removal procedure. Ensure that the mating faces of the valve and inlet manifold are clean before reassembling.
- 34 When the valve is refitted, restart the engine and check that there are no induction leaks. Run the engine until its normal operating temperature is reached, and check that the idle speed is stable. Stop the engine, connect up a tachometer in accordance with its maker's instructions, then restart the engine and check that the idle speed is as specified with all electrical items (lights, heater blower motor, etc) switched off, then on. The idle speed should remain the same. Switch off the electrical items, turn the engine off and detach the tachometer to complete the test.

Throttle housing

Check

- 35 Remove the air inlet duct (see Section 4), and verify that the throttle linkage operates smoothly.

36 If the housing bore and valve are dirty enough for you to think that this might be the cause of a fault, seek the advice of a Ford dealer. *Do not* clean the housing (see the notes in the checking procedure given in Section 14).

Renewal

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



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.

- 38 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 39 Loosen off the retaining clip, and detach the hot-air duct from the exhaust manifold (see illustration 16.4).
- 40 Disconnect the ignition HT lead connectors from the spark plugs, and release the leads from their locating grooves in the air inlet duct. Position them out of the way.
- 41 Unscrew the retaining nuts and the bolt, and detach the accelerator cable support bracket at the throttle housing.
- 42 Disconnect the vacuum hoses from the inlet manifold and the fuel pressure regulator.
- 43 Detach the wiring connections from the idle speed control valve, the temperature sensor and the harness connector.
- 44 Disconnect the fuel return hose from the pressure regulator unit.
- 45 Unscrew the throttle housing-to-manifold retaining bolts, and unbolt the throttle housing support bracket bolts (see illustration 16.8). Remove the throttle housing and gasket.
- 46 Refit in the reverse order of removal. Check that the mating faces are clean, and fit a new gasket.

17 Fuel injection system components (1.6 and 1.8 litre SEFi) - checking and renewal



Warning: The fuel system pressure must be released before any part of the system is disturbed - see Section 2. Petrol

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, in or near the work area. Don't work in a garage where a natural-gas appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses, and have a Class B type fire extinguisher on hand.

Throttle housing

Check

- 1 Refer to Section 16, paragraphs 35 and 36.
- #### Renewal
- 2 Disconnect the battery negative (earth) lead - see Chapter 5, Section 1.
 - 3 Remove the air inlet duct as described in Section 4.
 - 4 Disconnect the accelerator cable from the throttle linkage (see Section 5).
 - 5 Disconnect the throttle position sensor multi-plug.
 - 6 Remove the throttle housing mounting screws, then detach the throttle housing and gasket from the inlet manifold (see illustration). Discard the gasket - this must be renewed whenever it is disturbed.
 - 7 Using a soft brush and carburettor cleaner, thoroughly clean the exterior of the throttle housing, then blow out all passages with compressed air.



Caution: Do not clean the throttle housing's bore, the throttle valve, or the throttle position sensor, either by scraping or with a solvent. Just wipe them over carefully with a clean soft cloth.

8 Refitting is the reverse of the removal procedure. Fit a new gasket, and tighten the housing screws to the specified torque.

Fuel rail and injectors

Check

- 9 Refer to the procedure in the fuel system check (see Section 14).

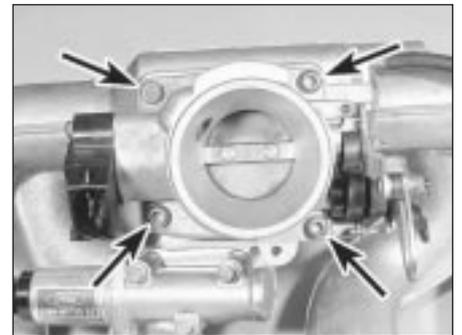
Renewal

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

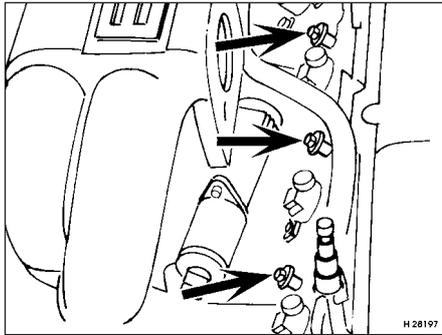


Warning: This procedure will merely relieve the increased pressure necessary for the engine to run - remember that fuel will still be present in the system components, and take precautions accordingly before disconnecting any of them.

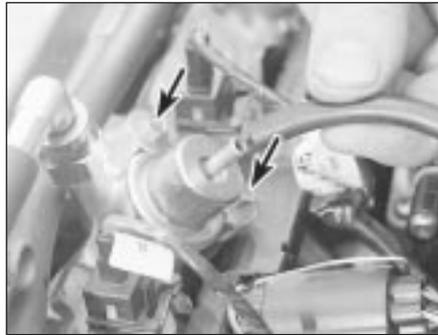
- 11 Disconnect the battery negative (earth) lead - see Chapter 5, Section 1.



17.6 Throttle housing mounting screw locations (arrowed)



17.19 Undo the three bolts (arrowed) to release the fuel rail from the manifold



17.28 Disconnect the vacuum hose and undo the bolts (arrowed) to withdraw the fuel pressure regulator



17.33 Unscrew the three retaining bolts (arrowed) and withdraw the idle speed control valve from the inlet manifold

12 Remove the air inlet duct as described in Section 4.

13 Disconnect the accelerator cable from the throttle linkage (see Section 5).

14 Disconnect the throttle position sensor multi-plug.

15 Remove the throttle housing mounting screws, then detach the throttle housing and gasket from the inlet manifold. Discard the gasket - this must be renewed whenever it is disturbed.

16 Detach the crankcase breather hose from the cylinder head cover, and the fuel pressure regulator vacuum hose from the inlet manifold.

17 Releasing the wire clips, unplug the four fuel injector multi-plugs and the inlet air temperature sensor multi-plug.

18 Refer to Section 3 and disconnect the fuel feed and return lines at the quick-release couplings next to the braking system vacuum servo unit, then unclip the fuel hoses from the inlet manifold; use rag to soak up any spilt fuel. **Note:** Do not disturb the threaded couplings at the fuel rail unions unless absolutely necessary; these are sealed at the factory. The quick-release couplings will suffice for all normal service operations.

19 Unscrew the three bolts securing the fuel rail (see illustration). Withdraw the rail, carefully prising it out of the inlet manifold, and draining any remaining fuel into a suitable clean container. Note the seals between the rail noses and the manifold; these must be renewed whenever the rail is removed.

20 Clamping the rail carefully in a vice fitted with soft jaws, unscrew the two bolts securing each injector, and withdraw the injectors. Place each in a clean, clearly-labelled storage container.

21 If you are renewing the injector(s), discard the old injector, the nose seal and the O-rings. If you are simply renewing leaking injector O-rings, and intend to re-use the same injectors, remove the old nose seal and O-rings, and discard them.

22 Further testing of the injector(s) is beyond the scope of the home mechanic. If you are in doubt as to the status of any injector(s), these can be tested at a dealer service department.

23 Refitting is the reverse of the removal procedure, noting the following points:

a) Lubricate each nose seal and O-ring with clean engine oil on installation.

b) Locate each injector carefully in the fuel rail recess, ensuring that the locating tab on the injector head fits into the slot provided in the rail. Tighten the bolts to the specified torque.

c) Fit a new seal to each fuel rail nose, and ensure the seals are not displaced as the rail is refitted. Ensure that the fuel rail is settled fully in the manifold before tightening the three bolts evenly and to the torque wrench setting.

d) Fasten the fuel feed and return quick-release couplings as described in Section 3.

e) Ensure that the breather hose, vacuum hose and wiring are routed correctly, and secured on reconnection by any clips or ties provided.

f) On completion, switch the ignition on and off five times, to activate the fuel pump and pressurise the system, without cranking the engine. Check for signs of fuel leaks around all disturbed unions and joints before attempting to start the engine.

Fuel pressure regulator

Check

24 Refer to the fuel pump/fuel pressure check procedure (see Section 7).

Renewal

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

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.

26 Disconnect the battery negative (earth) lead - see Chapter 5, Section 1.

27 Disconnect the vacuum hose from the regulator.

28 Unscrew the two regulator retaining bolts

(see illustration) then use a wad of clean rag to soak up any spilt fuel, and withdraw the regulator.

29 Refitting is the reverse of the removal procedure, noting the following points:

a) Renew the regulator sealing O-ring whenever the regulator is disturbed. Lubricate the new O-ring with clean engine oil on installation.

b) Locate the regulator carefully in the fuel rail recess, and tighten the bolts to the specified torque wrench setting.

c) On completion, switch the ignition on and off five times, to activate the fuel pump and pressurise the system, without cranking the engine. Check for signs of fuel leaks around all disturbed unions and joints before attempting to start the engine.

Idle speed control valve

Check

30 Refer to the procedures given in Section 16, paragraphs 25 to 29, noting that on the SEFI system, the valve is located on the right-hand side of the inlet manifold, just below the throttle position sensor.

Renewal

31 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

32 Disconnect the valve's wiring multi-plug.

33 Unscrew the three retaining bolts, and withdraw the valve from the inlet manifold (see illustration).

34 Refitting is the reverse of the removal procedure, noting the following points:

a) Clean the mating surfaces carefully, and always fit a new gasket whenever the valve is disturbed.

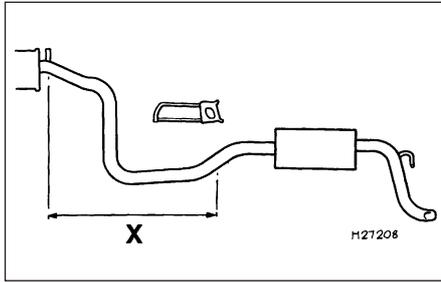
b) Tighten the bolts evenly and to the specified torque wrench setting.

c) Once the wiring and battery are reconnected, start the engine and allow it to idle. When it has reached normal operating temperature, check that the idle speed is stable, and that no induction (air) leaks are evident. Switch on all electrical loads headlights, heated rear window, etc), and check that the idle speed is still correct.

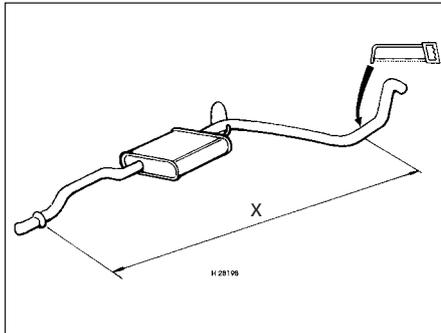
18 Exhaust system - general information and component renewal



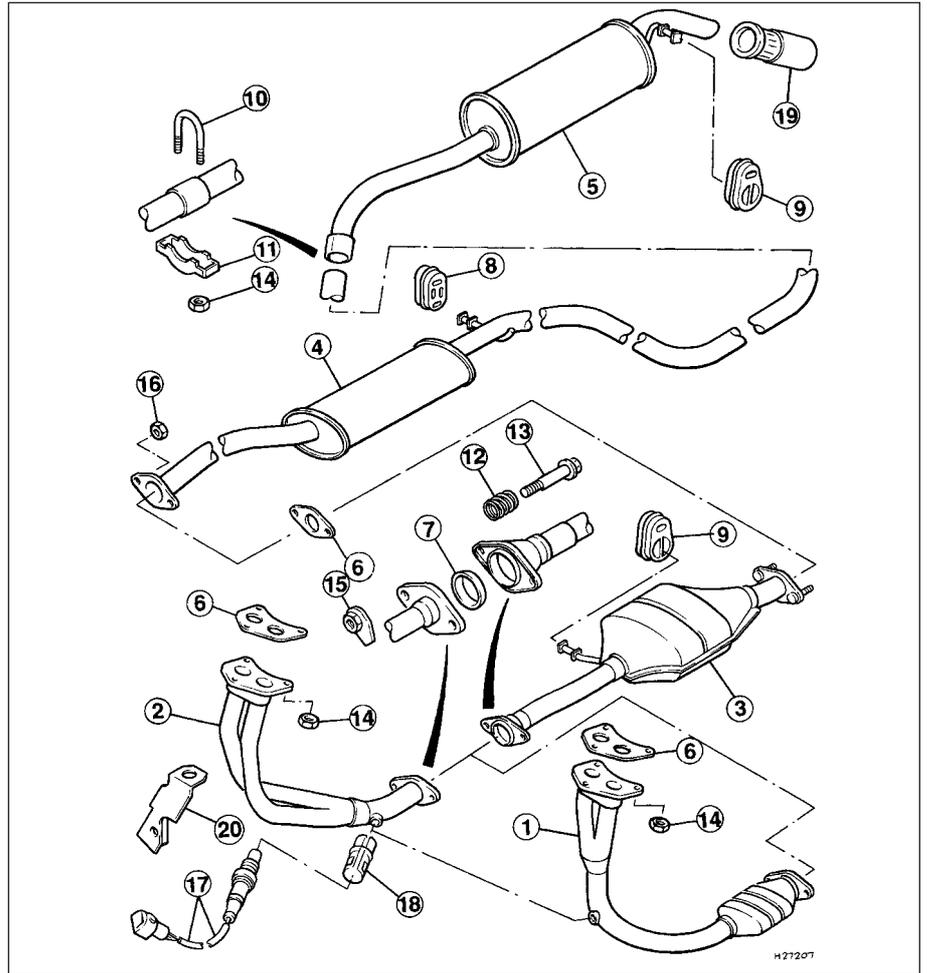
Refer to Section 25 in Part A of this Chapter, but note the system layout and cutting points for system renewal as shown here (see illustrations).



18.1A Cut at points indicated when renewing the rear silencer on HCS and CVH engines with CFI and EFI systems
X = 720 mm



18.1B Cut at points indicated when renewing the rear silencer on Zetec engine with SEFi system
X = 1717 mm



18.1C Exhaust system fitted to the CFI engine models (1.6 litre EFI and SEFi systems similar)

- | | | |
|---|-------------------|------------------------------|
| 1 Front downpipe (manual transmission) | 6 Gasket | 14 Self-locking nut |
| 2 Front downpipe (CTX transmission) | 7 Sealing ring | 15 Nut |
| 3 Catalytic converter | 8 Rubber mounting | 16 Nut |
| 4 Front silencer | 9 Rubber mounting | 17 Oxygen sensor |
| 5 Rear silencer (1.6 litre EFI and SEFi tailpipes differ) | 10 U-bolt | 18 Heat shield |
| | 11 Clamp | 19 Rear silencer outlet trim |
| | 12 Spring | 20 Bracket |
| | 13 Bolt | |