






# Chapter 4 Fuel and exhaust systems

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## Degrees of difficulty

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

### Carburettor (Solex 2B4)

Main jet	
Stage 1 . . . . .	X120
Stage 2 . . . . .	X90
Air correction jet	
Stage 1 . . . . .	135
Stage 2 . . . . .	75
Venturi diameter	
Stage 1 . . . . .	24 mm
Stage 2 . . . . .	28 mm
Idle/air jet	
Stage 1 . . . . .	50/120
Stage 2 . . . . .	40/125
Float needle valve diameter . . . . .	2.0 mm
Choke gap (pulldown) . . . . .	4.0 to 5.5 mm
Throttle positioner spring preload . . . . .	22.0 to 24.0 mm
Float level	
Stage 1 float chamber . . . . .	27.0 to 29.0 mm
Stage 2 float chamber . . . . .	29.0 to 31.0 mm

## 4•2 Fuel and exhaust systems

### Carburettor (Solex 2BE)

Main jet	
Stage 1	X120
Stage 2	X110
Air correction jet	
Stage 1	140
Stage 2	70
Venturi diameter	
Stage 1	24 mm
Stage 2	28 mm
Idle fuel jet	
Stage 1	47.5 mm
Idle air jet	
Stage 2	180
Float needle valve diameter	2.0 mm
Throttle positioner coil resistance	0.97 to 1.63 ohms
Intake air temperature resistance	
-10° C	8200 to 10 500 ohms
20° C	2200 to 2700 ohms
80° C	300 to 360 ohms
Float level	
Stage 1 float chamber	27.0 to 29.0 mm
Stage 2 float chamber	29.0 to 31.0 mm

### Fuel pressure checks (carburettor engines)

Fuel pump delivery pressure (engine idling)	0.1 to 0.3 bars
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### Fuel pressure checks (fuel injection engines)

Fuel system pressure (relative to intake manifold pressure)	
3-Series (E30)	
316i with M40/B16 engine	3.0 ± 0.06 bars
318i with M10/B18 engine	2.5 to 3.0 bars
318i with M40/B18 engine	3.0 ± 0.06 bars
320i with M20/B20 engine (L-Jetronic)	2.5 to 3.0 bars
320i with M20/B20 engine (Motronic)	2.5 ± 0.05 bars
325i with M20/B25 engine	3.0 ± 0.05 bars
5-Series (E28/"old-shape")	
All models	2.5 to 3.0 bars
5-Series (E34/"new-shape")	
518i with M40/B18 engine	3.0 ± 0.06 bars
All other models	2.5 to 3.0 bars
Fuel system hold pressure	2.1 bars
Fuel pump maximum pressure	6.3 to 6.9 bars
Fuel pump hold pressure	5.5 bars
Transfer pump pressure	0.28 to 0.35 bars

### Injectors

Injector resistance	14.5 to 17.5 ohms
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Accelerator cable free play	1.0 mm
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### Torque wrench settings

	Nm
Carburettor mountings	10
Fuel pump to cylinder head	12
Throttle body nuts/bolts	19 to 26

## 1 General information

With the exception of early models (316 and 518 models) all engines are equipped with electronic fuel injection.

Early 316 and 518 models are equipped with Solex carburettors. The carburettor fitted is either a Solex 2B4 (early models) or 2BE (later models). The mechanical fuel pump

is driven by an eccentric lobe on the camshaft.

Fuel injection models are equipped with either the L-Jetronic or the Motronic fuel injection system. From 1988, fuel injection models are equipped with an updated version of the Motronic system - this system is easily distinguished from the earlier system by the absence of a cold start injector. The electric fuel pump is located beneath the rear of the vehicle, or inside the fuel tank. The fuel pump relay on Motronic systems is activated from a

earth signal from the Motronic control unit (ECU). The fuel pump operates for a few seconds when the ignition is first switched on, and it continues to operate only when the engine is actually running.

### Air intake system

The air intake system consists of the air filter housing, the airflow meter and throttle body (fuel injection models), and the intake manifold. All components except the intake manifold are covered in this Chapter; for

information on removing and refitting the intake manifold, refer to Chapter 2A.

The throttle valve inside the throttle body or carburettor is actuated by the accelerator cable. When you depress the accelerator pedal, the throttle plate opens and airflow through the intake system increases.

On fuel injection systems, a flap inside the airflow meter opens wider as the airflow increases. A throttle position switch attached to the pivot shaft of the flap detects the angle of the flap (how much it's open) and converts this to a voltage signal, which it sends to the computer.

### Fuel system

On carburettor models, the fuel pump supplies fuel under pressure to the carburettor. A needle valve in the float chamber maintains the fuel at a constant level. A fuel return system channels excess fuel back to the fuel tank.

On fuel injection models, an electric fuel pump supplies fuel under constant pressure to the fuel rail, which distributes fuel to the injectors. The electric fuel pump is located inside the fuel tank on later models, or beside the fuel tank on early models. Early models also have a transfer pump located in the fuel tank. The transfer pump acts as an aid to the larger main pump for delivering the necessary pressure. A fuel pressure regulator controls the pressure in the fuel system. The fuel system also has a fuel pulsation damper located near the fuel filter. The damper reduces the pressure pulsations caused by fuel pump operation, and the opening and closing of the injectors. The amount of fuel injected into the intake ports is precisely controlled by an Electronic Control Unit (ECU or computer). Some later 5-Series models have a fuel cooler in the return line.

### Electronic control system (fuel injection system)

Besides altering the injector opening duration as described above, the electronic control unit performs a number of other tasks related to fuel and emissions control. It accomplishes these tasks by using data relayed to it by a wide array of information sensors located throughout the engine

compartment, comparing this information to its stored map, and altering engine operation by controlling a number of different actuators. Since special equipment is required, most fault diagnosis and repair of the electronic control system is beyond the scope of the home mechanic. Additional information and testing procedures for the emissions system components (oxygen sensor, coolant temperature sensor, EVAP system, etc.) is contained in Chapter 6.

### 2 Fuel injection system - depressurising



**Warning:** Fuel 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. Also, don't work in a garage where a natural gas-type appliance with a pilot light is present.

- 1 Remove the fuel pump fuse from the main fuse panel (see illustrations). **Note:** Consult your owner's handbook for the exact location of the fuel pump fuse, if the information is not stamped onto the fusebox cover.
- 2 Start the engine, and wait for it to stall. Switch off the ignition.
- 3 Remove the fuel filler cap to relieve the fuel tank pressure.
- 4 The fuel system is now depressurised. **Note:** Place a rag around fuel lines before disconnecting, to prevent any residual fuel from spilling onto the engine (see illustration).
- 5 Disconnect the battery negative cable before working on any part of the system.



**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery. Refer to the information on page 0-7 at the front of this manual before detaching the cable. **Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

### 3 Fuel pump/fuel pressure - check



**Warning:** Fuel 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. Also, don't work in a garage where a natural gas-type appliance with a pilot light is present.

### Carburettor engines

- 1 To test the fuel pump, it will be necessary to connect a suitable pressure gauge between the fuel pump outlet, and the carburettor supply pipe. For this particular test, the fuel return valve, which is normally connected in the fuel line from the fuel pump to the carburettor, must be bypassed.
- 2 With the engine running at idle speed, the pump pressure should be between 0.1 and 0.3 bars.
- 3 Should a pressure gauge not be available, a simpler (but less accurate) method of testing the fuel pump is as follows.
- 4 Disconnect the outlet hose from the fuel pump.
- 5 Disconnect the LT lead from the coil, to prevent the engine firing, then turn the engine over on the starter. Well-defined spurts of fuel should be ejected from the outlet hose.

### Fuel injection engines

- Note 1:** The electric fuel pump is located inside the fuel tank on later models, or beside the fuel tank on early models. Early models are also equipped with a transfer pump located in the fuel tank. The transfer pump feeds the main pump, but can't generate the high pressure required by the system.
- Note 2:** The fuel pump relay on Motronic systems is activated by an earth signal from the Motronic control unit (ECU). The fuel pump operates for a few seconds when the ignition is first switched on, and then continues to operate only when the engine is actually running.



2.1a Removing the fuel pump fuse on 3-Series models



2.1b Removing the fuel pump fuse on 5-Series models



2.4 Be sure to place a rag under and around any fuel line when disconnecting

## 4•4 Fuel and exhaust systems



**3.6a** On L-Jetronic systems, use a jumper wire to bridge the terminals on the connector that correspond to the fuel pump relay pins 30 and 87b

**Note 3:** The following checks assume the fuel filter is in good condition. If you doubt the condition of your fuel filter, renew it (see Chapter 1).

**Note 4:** In order to get accurate test results, it is recommended that the fuel pressure be checked from both the main fuel pump and transfer pump where applicable.

### Fuel pump/transfer pump operational check

**6** Bridge the connector terminals that correspond to the fuel pump relay pins 30 and 87b (L-Jetronic systems) or 30 and 87 (Motronic systems) with a suitable jumper wire (see illustrations).

**7** Have an assistant switch the ignition on while you listen at the fuel tank. You should hear a whirring sound for a couple of seconds.

**Note:** This test applies to the transfer pump also. If there is no whirring sound, there is a problem in the fuel pump circuit. Check the fuel pump main fuse and relay first (see Chapter 12). If the main relay is OK, test the fuel pump relay.

### Fuel system pressure check

**8** Depressurise the fuel system (see Section 2).

**9** Detach the battery negative cable.



**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code



**3.6d** . . . then, use a jumper wire to bridge the terminals on the connector that correspond to fuel pump relay pins 30 and 87



**3.6b** On Motronic systems, use a jumper wire to bridge the terminals on the connector that correspond to the fuel pump relay pins 30 and 87

**before disconnecting the battery. Refer to the information on page 0-7 at the front of this manual before detaching the cable.**

**Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

**10** Detach the fuel feed line from the fuel rail on L-Jetronic (see illustration) and early Motronic systems, or from the fuel filter to the main fuel line on later Motronic systems.

**11** Using a tee-piece (three-way fitting), a short section of high-pressure fuel hose and clamps, attach a fuel pressure gauge without disturbing normal fuel flow (see illustration).

**Warning:** Do not use a plastic tee fitting for this test. It won't be able to withstand the fuel system pressure.

**12** Reconnect the battery.

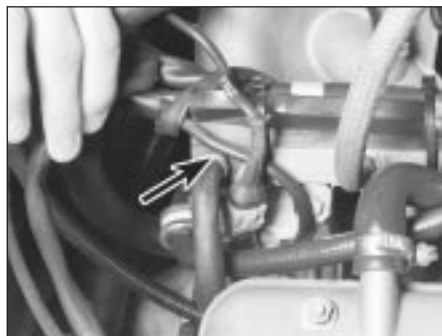
**13** Bridge the terminals of the fuel pump relay using a jumper wire.

**14** Turn the ignition switch on.

**15** Note the fuel pressure, and compare it with the pressure listed in this Chapter's Specifications.

**16** If the system fuel pressure is less than specified:

a) Check the system for fuel leaks. Repair any leaks found, and recheck the fuel pressure.



**3.10** Disconnect the fuel feed line (arrowed) from the fuel rail (L-Jetronic system shown) . . .



**3.6c** On all 1989 and later models, remove the four bolts and the protective cover to gain access to the fuel pump relay and ECU . . .

b) If there are no leaks, fit a new fuel filter and recheck the fuel pressure.

c) If the pressure is still low, check the fuel pump pressure (see below) and the fuel pressure regulator (see Section 18).

**17** If the pressure is higher than specified, check the fuel return line for an obstruction. If the line is not obstructed, renew the fuel pressure regulator.

**18** Turn the ignition off, wait five minutes and look at the gauge. Compare the reading with the system hold pressure listed in this Chapter's Specifications. If the hold pressure is less than specified:

a) Check the system for fuel leaks. Repair any leaks found, and recheck the fuel pressure.

b) Check the fuel pump pressure (see below).

c) Check the fuel pressure regulator (see Section 18).

d) Check the injectors (see Section 20).

### Fuel pump pressure check

**Warning:** For this test, a fuel pressure gauge with a bleed valve will be needed, in order to relieve the high fuel pressure safely. After the test is completed, the normal procedure for depressurising will not work, because the gauge is connected directly to the fuel pump.



**3.11** . . . and connect the gauge between the fuel feed line and the fuel rail using a tee-piece fitting

- 19 Depressurise the fuel system (see Section 2).
- 20 Detach the battery negative cable.



**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code

before disconnecting the battery. Refer to the information on page 0-7 at the front of this manual before detaching the cable.

**Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

21 Detach the fuel feed hose from the fuel rail, and attach a fuel pressure gauge directly to the hose. **Note:** If the tee fitting is still connected to the gauge, be sure to plug the open end.

22 Reconnect the battery.

23 Using a jumper wire, bridge the terminals of the fuel pump relay.

24 Turn the ignition switch on to operate the fuel pump.

25 Note the pressure reading on the gauge, and compare the reading to the fuel pump pressure listed in this Chapter's Specifications.

26 If the indicated pressure is less than specified, inspect the fuel line for leaks between the pump and gauge. If no leaks are found, renew the fuel pump.

27 Turn the ignition off and wait five minutes. Note the reading on the gauge, and compare it to the fuel pump hold pressure listed in this Chapter's Specifications. If the hold pressure is less than specified, check the fuel lines between the pump and gauge for leaks. If no leaks are found, renew the fuel pump.

28 Remove the jumper wire. Relieve the fuel pressure by opening the bleed valve on the gauge and directing the fuel into a suitable container. Remove the gauge and reconnect the fuel line.

#### Transfer pump pressure check

- 29 Depressurise the fuel system (see Section 2).
- 30 Detach the battery negative cable.



**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code

before disconnecting the battery. Refer to the information on page 0-7 at the front of this manual before detaching the cable.

**Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

31 Remove the transfer pump access plate (on some models, it's located under the rear seat cushion - on others, it's located under the carpet in the luggage compartment). Disconnect the output hose from the transfer pump, and connect a fuel pressure gauge to the outlet pipe.

32 Reconnect the battery.

33 Using a jumper wire, bridge the terminals of the fuel pump relay.

34 Turn the ignition switch on to operate the fuel pump.

35 Note the pressure reading on the gauge, and compare to the value listed in this Chapter's Specifications.

36 If the indicated pressure is less than specified, renew the transfer pump.

#### Fuel pump relay check

37 Switch on the ignition.

38 Using a voltmeter, probe the following terminals from the back of the relay electrical connector. Check for battery voltage at terminal 30 (M20 and M30 engines) or terminal 15 (M10 and M40 engines). **Note:** If there is no voltage on models with luggage compartment-mounted batteries, check for a faulty fusible link. The 50-amp link is about 6 inches from the battery, in a black wire.

39 Turn the ignition off, and disconnect the relay from the electrical connector. Using a voltmeter, probe the connector terminals that correspond to fuel pump relay pins 85 (-) and 86(+) on M20 and M30 engines, or terminal 50 and earth on M10 and M40 engines. Have an assistant turn the engine over on the starter, and observe the voltage reading. Battery voltage should be indicated.

40 If there is no voltage, check the fuse(s) and the wiring circuit for the fuel pump relay. If the voltage readings are correct, and the fuel pump only runs with the jumper wire in place, then renew the relay.

41 If the fuel pump still does not run, check for the proper voltage at the fuel pump terminals (see Section 4). If necessary, renew the fuel pump.

### 4 Fuel pump, transfer pump and fuel level sender unit - removal and refitting



**Warning:** Fuel 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. Also, don't work in a garage where a natural gas-type appliance with a pilot light is present.

#### Fuel pump (carburettor engines)

1 Disconnect the battery negative cable. Disconnect both hoses from the pump, and unscrew and remove the two securing nuts (see illustration).

2 Carefully withdraw the pump from the cylinder head. If it's stuck, a slight downward tap on the thick insulating distance piece with a piece of wood, should free it.

3 Remove the two thin gaskets.

4 The fuel pump is a sealed unit, and it is not possible to renew any of the internal components. Should an internal fault occur, it must be renewed complete.



4.1 Fuel pump on carburettor engines

5 Refitting is a reversal of the removal procedure, but renew the thin gaskets each side of the insulating distance piece, and tighten the fuel pump down evenly to the torque stated in the Specifications. On no account alter the thickness of the distance piece, or the correct operation of the fuel pump will be upset.

#### Fuel pump (fuel injection engines)

**Note 1:** The electric fuel pump is located inside the fuel tank on later models with the Motronic system, or adjacent to the fuel tank on the L-Jetronic system. The early models are also equipped with a transfer pump located in the fuel tank. The transfer pump feeds the larger main pump, which delivers the high pressure required for proper fuel system operation.

**Note 2:** The fuel level sender unit is located in the fuel tank with the transfer pump on early models, or with the main fuel pump on later models.

6 Depressurise the fuel system (see Section 2) and remove the fuel tank filler cap to relieve pressure in the tank.

7 Disconnect the battery negative cable.



**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code

before disconnecting the battery. Refer to the information on page 0-7 at the front of this manual before detaching the cable.

**Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

#### Externally-mounted fuel pump

8 Raise and support the vehicle.

9 Remove the two rubber boots that protect the fuel pump connectors, and disconnect the wires from the pump (see illustration).

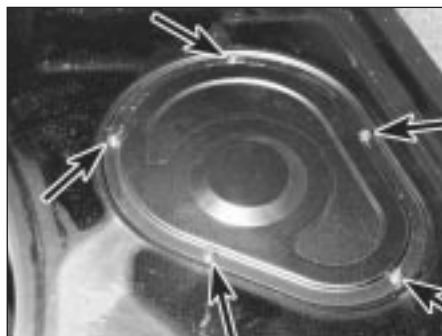
10 Using hose clamps, pinch shut the fuel hoses on each side of the fuel pump. If you don't have any hose clamps, wrap the hoses with rags, and clamp them shut with self-locking pliers, tightened just enough to prevent fuel from flowing out.

11 Disconnect the hoses from the pump.

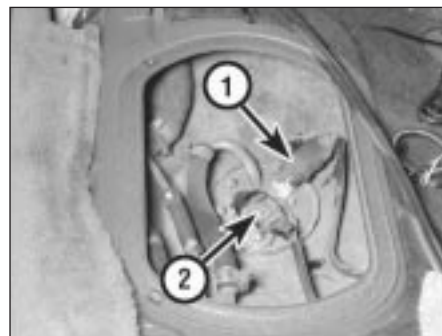
12 Remove the fuel pump mounting screws



4.9 Lift up the rubber boots (arrowed) and detach the electrical connectors from the fuel pump



4.15 Remove the fuel pump cover screws (arrowed) and lift the cover off the floor of the vehicle (on some models, the fuel pump cover is located under the rear seat - on other models it's located in the luggage compartment)



4.17a Transfer pump (1) and fuel level sender unit (2) electrical connectors on an early Motronic system



4.17b To unplug the connector, prise the bracket until the notch aligns with the slot on the retaining clip, and release the connector from the assembly

and clamps, and remove the fuel pump from the under the vehicle.

13 Refitting is the reverse of removal.

**In-tank fuel pump or transfer pump**

14 On some models, access to the fuel pump is gained by removing the rear seat cushion. On other models, access is gained by removing the carpet from the luggage compartment.

15 Remove the screws from the fuel pump access cover (see illustration).

16 Remove the cover.

17 Locate the fuel pump and sender unit electrical connectors (see illustrations) and

unplug them. Also, disconnect the fuel inlet and return lines.

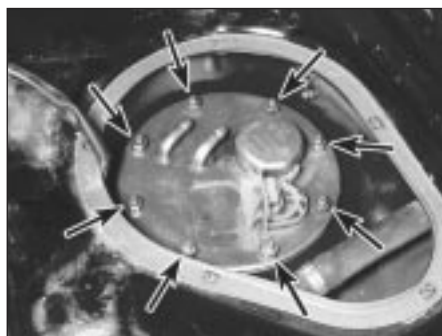
18 On some models, the assembly must be rotated anti-clockwise to disengage the locking lugs from the fuel tank (see illustration). On other models, the assembly is secured to the tank with nuts (see illustration). Carefully lift the assembly from the fuel tank (see illustrations). It may be necessary to twist the assembly slightly, to get the float to clear the opening.

19 On early models, remove the transfer pump mounting screws and clamps, and separate the transfer pump from the assembly.

20 Refitting is the reverse of removal. If the gasket between the fuel pump and fuel tank is dried, cracked or damaged, renew it.



4.18a On models with locking lugs, use two screwdrivers to rotate the assembly out of the notches



4.18b On models with mounting nuts, remove the nuts (arrowed) to release the assembly from the fuel tank



4.18c On later Motronic systems, first remove the fuel level sender unit . . .

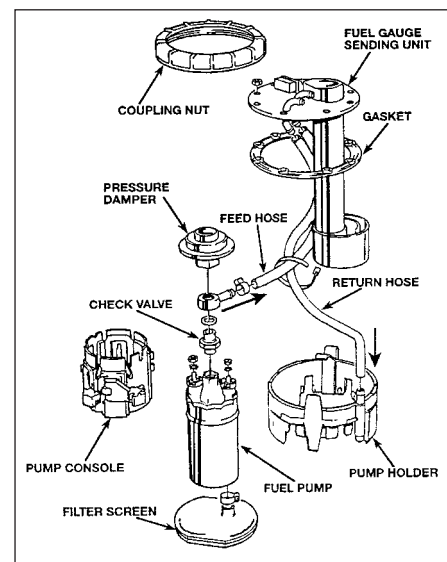


4.18d . . . then pull the fuel pump straight up and out of the turret at the bottom of the fuel tank (keep all the fuel lines intact)

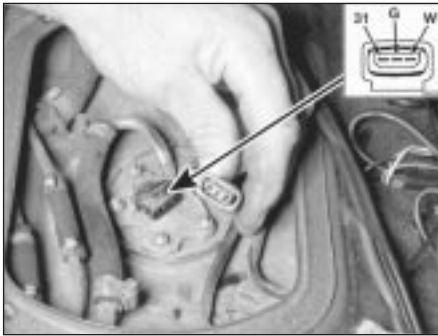
**Fuel level sender unit - check and renewal**

21 Remove the main fuel pump or transfer pump (as described previously) along with the fuel level sender unit.

22 Connect an ohmmeter across the designated terminals, and check for the



4.18e Exploded view of the fuel pump assembly on later Motronic systems



4.22a Fuel level sender unit terminal designations on L-Jetronic and early Motronic systems

correct resistance. On L-Jetronic and early Motronic systems, follow the table below. On later Motronic systems, connect the ohmmeter probes onto the fuel level sender unit terminals that correspond to pins 1 and 3 on the electrical connector (see illustrations). The resistance should decrease as the plunger rises.

**L-Jetronic and early Motronic systems**

Terminals	Float position	Resistance
G and 31	Slowly moving from the EMPTY position to the FULL position	Resistance slowly decreases
	EMPTY	71.7 ± 2.3 ohms
	FULL	3.2 ± 0.7 ohms
W and 31	EMPTY (low fuel warning)	Continuity

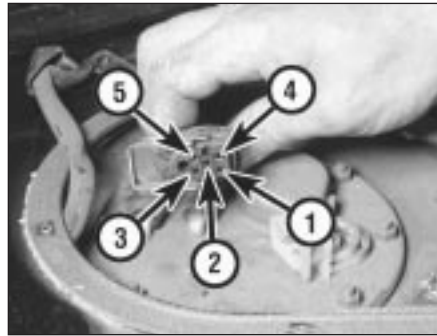
- 23 If the resistance readings are incorrect, renew the sender unit.
- 24 Refitting is the reverse of removal.

**5 Fuel lines and fittings - repair and renewal**



**Warning:** Fuel 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. Don't work in a garage where a natural gas-type 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 fire extinguisher on hand.

- 1 Always disconnect the battery negative cable, and (on fuel injection models) depressurise the fuel system as described in Section 2, before servicing fuel lines or fittings.
- 2 The fuel feed, return and vapour lines extend from the fuel tank to the engine compartment. The lines are secured to the underbody with clip and screw assemblies.



4.22b Fuel level sender unit terminal designations on later Motronic systems - check the sender unit resistance across terminals 1 and 3 of the connector

- 1 Fuel level sender unit earth
- 2 Warning light
- 3 Sender unit
- 4 Fuel pump earth
- 5 Fuel pump

These lines must be occasionally inspected for leaks, kinks and dents (see illustration).

3 If evidence of dirt is found in the system or fuel filter during dismantling, the lines should be disconnected and blown out. On fuel injection models, check the fuel strainer on the in-tank fuel pump for damage and deterioration.

4 Because fuel lines used on fuel injection vehicles are under high pressure, they require special consideration. If renewal of a rigid fuel line or emission line is called for, use welded steel tubing meeting BMW specification or its equivalent. Don't use plastic, copper or aluminium tubing to renew steel tubing. These materials cannot withstand normal vehicle vibration.

5 When renewing fuel hoses, be sure to use only hoses of original-equipment standard.

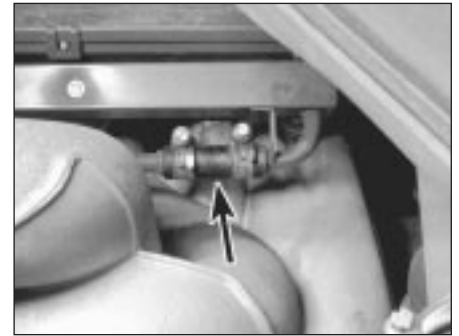
**6 Fuel tank - removal and refitting**



**Warning:** Fuel 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. Also, don't work in a garage where a natural gas-type appliance with a pilot light is present. When you perform any kind of work on the fuel system, wear safety glasses, and have a fire extinguisher on hand. If you spill any fuel on your skin, clean it off immediately with soap and water.

**Note:** To avoid draining large amounts of fuel, make sure the fuel tank is nearly empty (if possible) before beginning this procedure.

- 1 Remove the fuel tank filler cap to relieve fuel tank pressure.



5.2 When checking the fuel lines, don't overlook these short sections of fuel hose attached to the main fuel rail - they're a common source of fuel leaks

- 2 On fuel injection models, depressurise the fuel system (see Section 2).
- 3 Detach the battery negative cable.



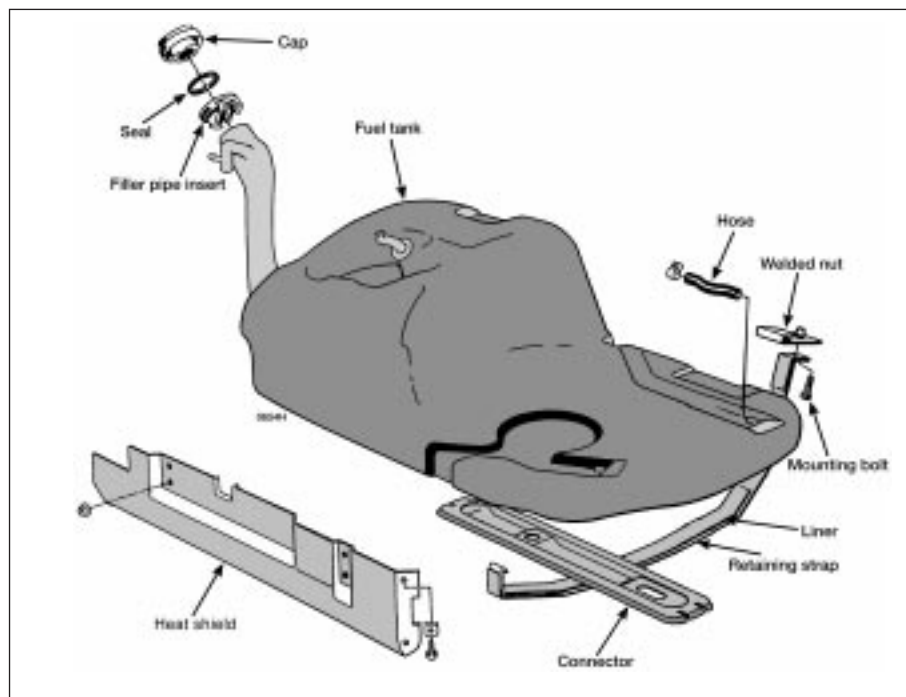
**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery. Refer to the information on page 0-7 at the front of this manual before detaching the cable.

**Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

- 4 Remove the tank drain plug (see illustration) and drain the fuel into an approved fuel container. If no drain plug is fitted, it should be possible to syphon the fuel out (not by mouth), otherwise the fuel will have to be drained during the removal operation.
- 5 Unplug the fuel pump/sender unit electrical connector (as applicable) and detach the fuel feed, return and vapour hoses (see Section 4). Where applicable, remove the rear seat cushion for access.
- 6 Remove the fuel tank shield (see illustration).
- 7 Detach the fuel filler neck and breather hoses.
- 8 Raise and support the vehicle. On some models, it will also be necessary to remove the exhaust system and propeller shaft.
- 9 Support the tank with a trolley jack.



6.4 Remove the tank drain plug (arrowed) and drain the fuel into a suitable container



6.6 Exploded view of the fuel tank assembly on later 5-Series models

Position a block of wood between the jack head and the fuel tank to protect the tank.

10 Remove the mounting bolts at the corners of the fuel tank, and unbolt the retaining straps (see illustrations). Pivot the straps down until they're hanging out of the way.

11 Lower the tank just enough so you can see the top, and make sure you have detached everything. Finish lowering the tank, and remove it from the vehicle.

12 Refitting is the reverse of removal.



6.10a Remove the fuel tank mounting bolts (one arrowed)



6.10b Remove the retaining strap bolts (one arrowed) and lower the fuel tank



8.2a Release the air cleaner cover spring clips . . .



8.2b . . . then remove the air cleaner cover centre nut, and lift off the cover

## 7 Fuel tank cleaning and repair - general information

1 All 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 natural gas-type appliance is located, because the pilot light could cause an explosion.

## 8 Air cleaner assembly - removal and refitting

1 Detach the battery negative cable.

**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery. Refer to the information on page 0-7 at the front of this manual before detaching the cable.

**Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

### Carburettor engines

2 Release the spring clips, then unscrew the centre nut and lift off the cover (see illustrations).

3 Remove the air filter element, and wipe clean the air cleaner body and cover (see illustration).

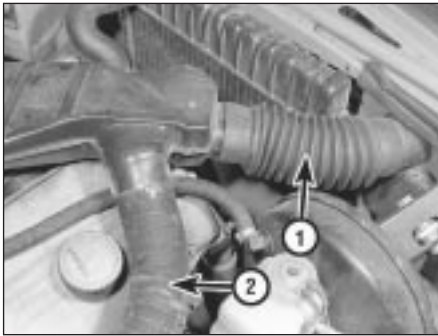
4 To remove the body, first disconnect the inlet duct and warm-air hose (see illustration).

5 Disconnect the vacuum line at the carburettor.



8.3 Remove the air cleaner element, and wipe clean the body and cover





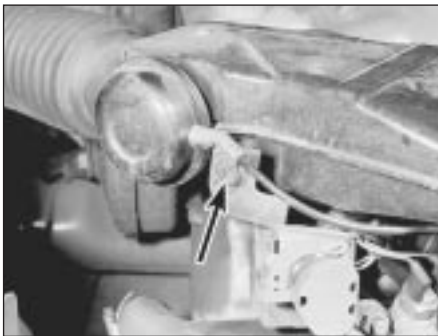
8.4 Air cleaner inlet duct (1) and warm-air hose (2)



8.6a Unscrew the four air cleaner-to-carburettor nuts . . .



8.6b . . . and remove the metal ring



8.7 Air cleaner mounting bracket nut (arrowed)



8.8 Disconnecting the crankcase ventilation hose from the air cleaner



8.9 Align the air cleaner cover arrows when refitting

6 Unscrew the four nuts retaining the air cleaner to the carburettor, and remove the metal ring (see illustrations).

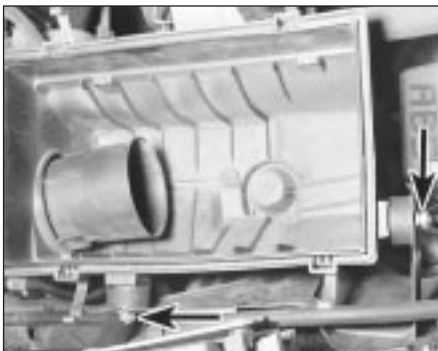
7 Unscrew the nut from the mounting bracket (see illustration).

8 Lift the air cleaner from the carburettor, and disconnect the crankcase ventilation hose (see illustration). If necessary, prise the sealing ring from the bottom of the air cleaner.

9 Refitting is a reversal of removal, but align the arrow on the cover with the arrow on the inlet tube (see illustration).

### Fuel injection engines

10 Detach the air intake duct from the front side of the air cleaner.



8.14 Remove the two nuts (arrowed) from the air cleaner assembly (Motronic system shown), and lift it off its mountings

11 Detach the duct between the air cleaner and the throttle body.

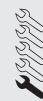
12 Remove the air filter (see Chapter 1).

13 Unplug the electrical connector from the airflow meter (see Section 12).

14 Remove the air cleaner mounting bolts (see illustration) and lift the air cleaner assembly from the engine compartment.

15 Refitting is the reverse of removal. Ensure that all ducts are securely refitted, or air leaks will result.

### 9 Accelerator cable - check, adjustment and renewal



#### Check

1 Separate the air intake duct from the throttle body (fuel injection models) or remove the air cleaner (carburettor models).

2 Have an assistant depress the accelerator pedal to the floor while you watch the throttle valve. It should move to the fully-open position.

3 Release the accelerator pedal, and make sure the throttle valve returns smoothly to the fully-closed position. The throttle valve should not contact the body at any time during its movement; if it does, the unit must be renewed.

#### Adjustment

4 Warm the engine to normal operating temperature, then switch it off. Depress the

accelerator pedal to the floor twice, then check the cable free play at the carburettor/throttle body. Compare it to the value listed in this Chapter's Specifications.

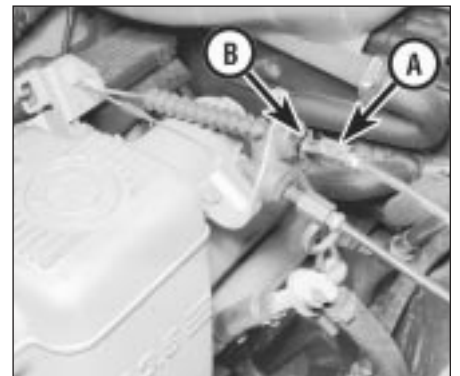
5 If the free play isn't as specified, adjust it by turning the adjustment nut (see illustration).

6 Have an assistant help you verify the throttle valve is fully open when the accelerator pedal is depressed to the floor.

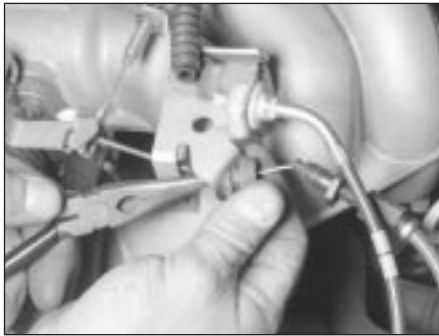
#### Renewal

**Note:** The following paragraphs describe the procedure for fuel injection engines - the procedure is similar on carburettor engines

7 Disconnect the battery negative cable.



9.5 To adjust the accelerator cable free play, hold nut B stationary and turn nut A (fuel injection engine shown)



9.8 Push the rubber grommet from the rear, and separate the cable from the bracket



9.9 Pinch the plastic retainer, and push it through the bracket recess on the throttle valve



9.10a Rotate the throttle valve and remove the cable end from the slotted portion of the valve



**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery. Refer to the information on page 0-7 at the front of this manual before detaching the cable.

**Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

8 Loosen the cable adjuster locknuts, and detach the cable from its support bracket located on the intake manifold (see illustration).

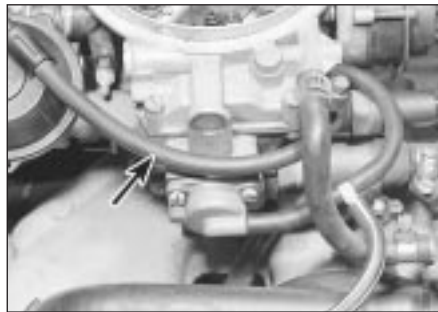
9 Pinch the plastic retainer with a pair of needle-nose pliers, and push it out of the bracket (see illustration).



9.10b After the cable is off the throttle valve assembly, remove the plastic retainer from the cable



11.5 Remove the screw, and disconnect the carburettor earth cable (arrowed)



11.6 Note the locations of the carburettor vacuum hoses (arrowed) before disconnecting them



11.8 Disconnect the fuel supply hose (arrowed)

10 Pull the cable down through the slot and away from the bracket (see illustrations).

11 Working from underneath the driver's side of the fascia, reach up and detach the accelerator cable from the top of the pedal.

12 Pull the cable through the bulkhead, from the engine compartment side.

13 Refitting is the reverse of removal. Adjust the cable as described earlier.

## 10 Carburettor - general information

1 Early models are fitted with a Solex 2B4 carburettor, and later models are fitted with a Solex 2BE carburettor. Both carburettors are of downdraught, two-stage type. The first stage is operated mechanically by the accelerator pedal, and the second stage by vacuum control.

2 Each stage has its own float chamber, float assembly and needle valve, designed to reduce the effects of braking and centrifugal forces.

3 On the 2B4 version, the primary stage choke valve is operated by an automatic choke (a bi-metal spring which is electrically heated) during the warm-up period. Warm-up enrichment is also provided by a coolant-operated thermal valve and air temperature-controlled flow valve.

4 On the 2BE version, an electronic control

unit is used to automatically adjust the carburettor settings during warm-up and normal temperature operation. The control unit is located beneath the right-hand side of the fascia.

## 11 Carburettor - removal and refitting



### Removal

1 Remove the air cleaner as described in Section 8.

2 Disconnect the accelerator cable from the carburettor with reference to Section 9.

3 On automatic transmission models, disconnect the kickdown cable.

4 Disconnect the wiring from the carburettor, noting the location of each wire.

5 Remove the screw, and disconnect the earth cable from the throttle positioner bracket (see illustration).

6 Disconnect the vacuum hoses, noting that the hose with the white tracer is located on the white plastic 'T' piece, and the distributor vacuum hoses are located on the side of the carburettor (see illustration).

7 On the 2B4 carburettor, disconnect and plug the coolant hoses from the TM (thermal starter) valve.

8 Disconnect the fuel supply hose (see illustration).



11.9 Unscrew the four bolts (arrowed) and lift the carburettor from the intake manifold



11.10 Carburettor insulating flange on the intake manifold can be removed if necessary



12.3 Using a screwdriver to disconnect the accelerator pump linkage (arrowed)

9 Unscrew the four bolts, and lift the carburettor from the insulating flange on the intake manifold (see illustration).

10 If necessary, unscrew the nuts and remove the insulating flange from the intake manifold (see illustration).

### Refitting

11 Refitting is a reversal of removal, but clean the mating faces thoroughly. The insulating flange may be re-used, if it's in good condition. Adjust the accelerator cable with reference to Section 9, and the kickdown cable (where applicable) with reference to Chapter 7B.

## 12 Carburettor - cleaning and adjustment



**Note:** This Section describes the procedure for the 2B4 carburettor. The procedure for the 2BE carburettor is similar.

### Cleaning

1 Obtain a complete set of gaskets and seals for the carburettor.

2 Wash clean the exterior surfaces of the carburettor.

3 Using a screwdriver, prise the accelerator pump linkage from the primary throttle arm (see illustration).

4 Unscrew the bolts securing the cover to the main body. An Allen key is necessary to remove the centre bolt (see illustration).

5 Prise the link from the choke valve plastic lever (see illustration).

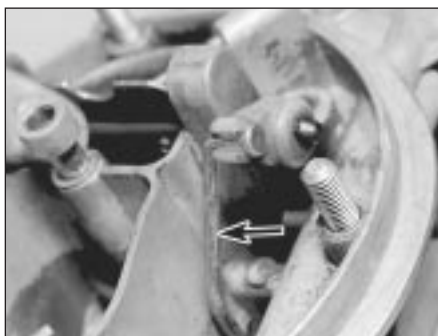
6 Lift the cover from the main body, and remove the gasket (see illustrations).

7 Remove the screw securing the throttle positioner bracket to the throttle housing (see illustration).

8 Disconnect the vacuum unit pullrod from the secondary throttle lever (see illustration).



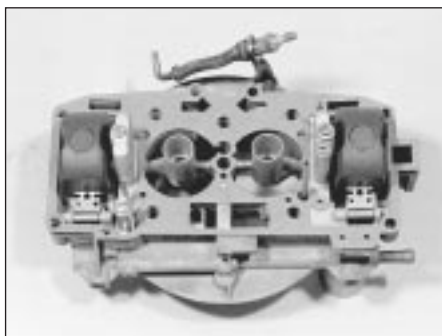
12.4 Using an Allen key to remove the carburettor cover centre bolt



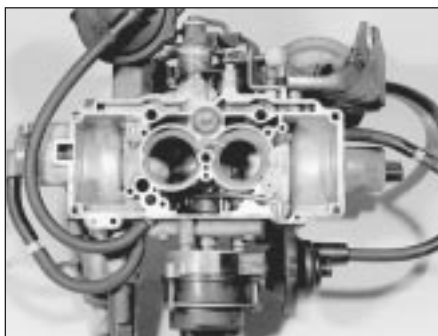
12.5 Prise the link (arrowed) from the choke valve plastic lever



12.6a Lifting the cover from the carburettor main body



12.6b View of the underside of the cover

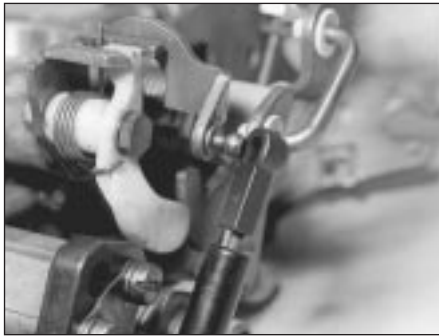


12.6c View of the carburettor main body with the cover removed

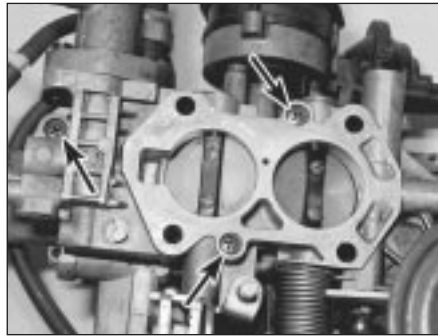


12.7 Throttle positioner bracket-to-throttle housing screw (arrowed)

## 4•12 Fuel and exhaust systems



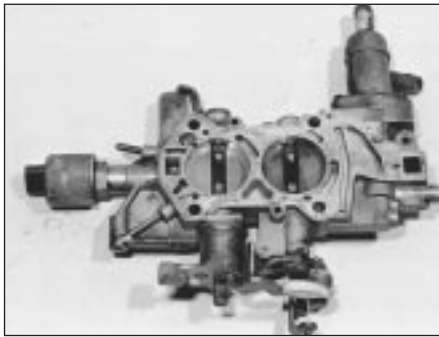
12.8 Disconnecting the vacuum unit pullrod



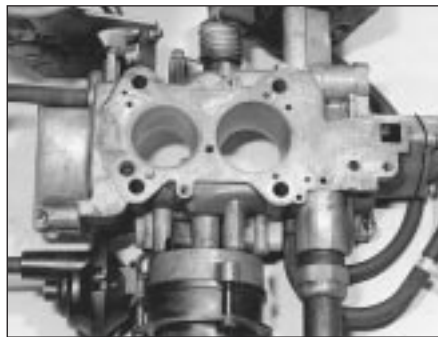
12.9 Throttle housing-to-main body securing screws (arrowed)



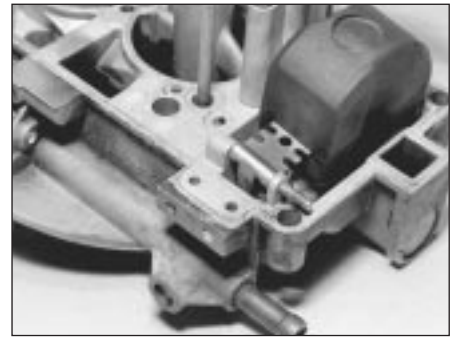
12.10 Primary throttle lever securing nut - if removed, take care not to disturb the return spring



12.11a Throttle housing removed from the carburettor



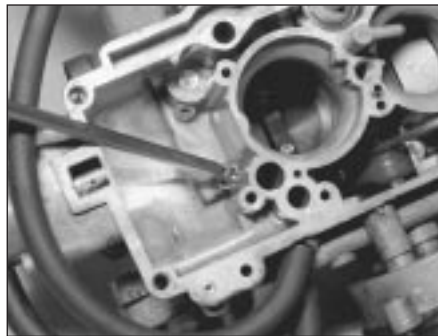
12.11b Underside of the main body with throttle housing removed - note gasket



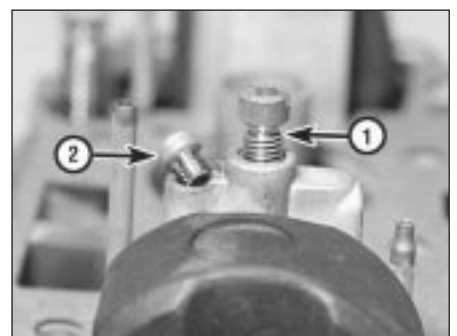
12.12a Tap out the float pivot pins, and remove the floats . . .



12.12b . . . then lift out the needle valves, keeping all components identified side for side



12.13a Unscrew the bypass jet from the secondary float chamber



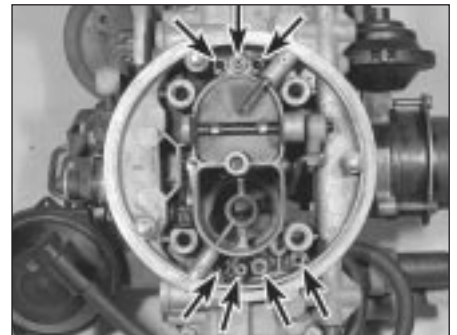
12.13b Secondary main jet (1) and TM (thermal starter) fuel jet (2)



12.13c Secondary main jet (left) and TM fuel jet (right) tightened in the cover



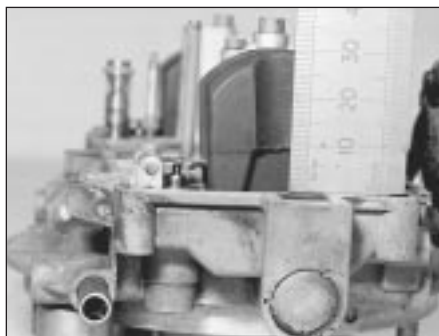
12.13d Secondary bypass air jet (1), TM air jet (2), and air correction jet (3)



12.13e The jet positions in the cover (arrowed)



12.15a Choke linkage arm located in the automatic choke lever



12.15b To check the float level, measure the distance between the contact face and the top of the float



12.15c Accelerator pump seal (arrowed)

9 Remove the screws securing the throttle housing to the main body (see illustration).

10 Prise out the intermediate throttle link. If this proves difficult, unscrew the nut and disconnect the lever from the primary throttle spindle, taking care not to disturb the return spring (see illustration).

11 Separate the throttle housing from the main body, and remove the gasket (see illustrations).

12 With the cover inverted, tap out the float pivot pins, remove the floats, and lift out the two needle valves - keeping all the components identified side for side (see illustrations).

13 Unscrew the bypass fuel jet from the secondary float chamber, then similarly remove the jets from the cover - keeping them all identified for location (see illustrations).

14 Clean all the components, and blow all the internal channels clear using low air pressure.

15 Reassembly is a reversal of dismantling, but note the following points:

- a) Fit the new gaskets and seals supplied in the repair kit.
- b) Before refitting the cover, check that the choke linkage arm is correctly located in the lever (see illustration).
- c) Check and if necessary adjust the float settings. Invert the cover, and check the

distance from the contact face (without gasket) to the top of the float, making sure that the needle valve spring-tensioned ball is not depressed (see illustration). Note that the dimension is different for the primary and secondary floats (see Specifications). If adjustment is necessary, bend the float arm as required.

- d) Make sure that the seal is fitted to the top of the accelerator pump (see illustration).

### Adjustment

**Note:** Idle speed and mixture adjustments are covered in Chapter 1.

### Automatic choke (2B4)

16 Check that the automatic choke cover and housing alignment marks are clearly visible; if not, make new marks.

17 Remove the three screws and withdraw the metal ring (see illustration).

18 Remove the plastic cover, at the same time disengaging the bi-metal spring from the control lever (see illustration).

19 Fit a rubber band to the bottom of the control lever. Push the pulldown lever to the right and use a 4.2 mm diameter drill to check the distance between the lower edge of the choke valve and the wall of the carburettor



12.17 Remove the three screws and withdraw the metal ring

(see illustration). Alternatively apply vacuum to the pulldown unit to move the lever.

20 If adjustment is necessary, turn the screw on the end of the pulldown unit (see illustration).

21 Refit the cover in reverse order, making sure that the alignment marks are in line.

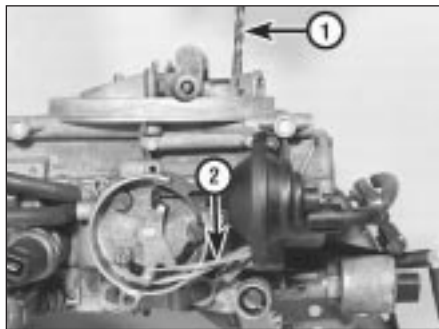
### Throttle positioner (2B4)

22 With the throttle in the idle position, check that the length of the spring on the throttle positioner is  $23.0 \pm 1.0$  mm. If not, adjust the nut as required.

23 With no vacuum applied (engine stopped) check that the control travel, measured between the stop screw and lever, is  $5.0 \pm 0.5$  mm. If necessary, loosen the locknut and turn the diaphragm rod as required. Tighten the locknut on completion.



12.18 Remove the automatic choke cover, at the same time disengaging the bi-metal spring from the control lever



12.19 Fit a rubber band (2) to the bottom of the control lever, then push the pulldown lever to the right, and use a 4.2 mm diameter drill (1) to check the distance between the lower edge of the choke valve and the wall of the carburettor



12.20 If adjustment is necessary, turn the screw (arrowed) on the end of the pulldown unit

### Throttle positioner (2BE)

24 Special tools are required to carry out a comprehensive adjustment on the 2BE carburettor. This work should therefore be left to a BMW dealer.

### 13 Fuel injection - general information

The fuel injection system is composed of three basic sub-systems: fuel system, air intake system and electronic control system.

#### Fuel system

An electric fuel pump, located inside the fuel tank or beside the fuel tank, supplies fuel under constant pressure to the fuel rail, which distributes fuel evenly to all injectors. From the fuel rail, fuel is injected into the intake ports, just above the intake valves, by the fuel injectors. The amount of fuel supplied by the injectors is precisely controlled by an Electronic Control Unit (ECU). An additional injector, known as the cold start injector (L-Jetronic and early Motronic systems only), supplies extra fuel into the intake manifold for starting. A pressure regulator controls system pressure in relation to intake manifold vacuum. A fuel filter between the fuel pump and the fuel rail filters the fuel, to protect the components of the system.

#### Air intake system

The air intake system consists of an air filter housing, an airflow meter, a throttle body, the intake manifold, and the associated ducting. The airflow meter is an information-gathering device for the ECU. These models are equipped with the vane-type airflow meter. A potentiometer measures intake airflow, and a temperature sensor measures intake air temperature. This information helps the ECU determine the amount of fuel to be injected by the injectors (injection duration). The throttle plate inside the throttle body is controlled by the driver. As the throttle plate opens, the amount of air that can pass through the system increases, so the potentiometer opens further and the ECU signals the injectors to increase the amount of fuel delivered to the intake ports.

#### Electronic control system

The computer control system controls the fuel system and other systems by means of an Electronic Control Unit (ECU). The ECU receives signals from a number of information sensors which monitor such variables as intake air volume, intake air temperature, coolant temperature, engine rpm, acceleration/deceleration, and exhaust oxygen content. These signals help the ECU determine the injection duration necessary for the optimum air/fuel ratio. These sensors and their corresponding ECU-controlled output

actuators are located throughout the engine compartment. For further information regarding the ECU and its relationship to the engine electrical systems and ignition system, refer to Chapters 5 and 6.

Either an L-Jetronic system or a Motronic system is fitted. Later models have an updated version of the original Motronic system.

### 14 Fuel injection systems

#### L-Jetronic fuel injection system

The Bosch L-Jetronic fuel injection system is used on most 3-Series models up to 1987, and on most E28 ("old-shape") 5-Series models. It is an electronically-controlled fuel injection system that utilises one solenoid-operated fuel injector per cylinder. The system is governed by an Electronic Control Unit (ECU) which processes information sent by various sensors, and in turn precisely meters the fuel to the cylinders by adjusting the amount of time that the injectors are open.

An electric fuel pump delivers fuel under high pressure to the injectors, through the fuel feed line and an in-line filter. A pressure regulator keeps fuel available at an optimum pressure, allowing pressure to rise or fall depending on engine speed and load. Any excess fuel is returned to the fuel tank by a separate line.

A sensor in the air intake duct constantly measures the mass of the incoming air, and the ECU adjusts the fuel mixture to provide an optimum air/fuel ratio.

Other components incorporated in the system are the throttle valve (which controls airflow to the engine), the coolant temperature sensor, the throttle position switch, idle stabiliser valve (which bypasses air around the throttle plate to control idle speed) and associated relays and fuses.

#### Motronic fuel injection system

The Motronic system combines the fuel control of the L-Jetronic fuel injection system with the control of ignition timing, idle speed and emissions into one control unit.

The fuel injection and idle speed control functions are similar to those used on the L-Jetronic system described above. For more information on the Motronic system, see Chapter 6.

An oxygen sensor is mounted in the exhaust system on later models with a catalytic converter. This sensor continually reads the oxygen content of the exhaust gas. The information is used by the ECU to adjust the duration of injection, making it possible to adjust the fuel mixture for optimum converter efficiency and minimum emissions.

### 15 Fuel injection system - check



**Warning:** Fuel 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. Don't work in a garage where a natural gas-type 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 fire extinguisher on hand.

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

2 Make sure 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 If a blown fuse is found, renew it and see if it blows again. If it does, search for an earthed wire in the harness related to the system.

5 Check the air intake duct from the airflow meter to the intake manifold for leaks. Intake air leaks can cause a variety of problems. Also check the condition of the vacuum hoses connected to the intake manifold.

6 Remove the air intake duct from the throttle body, and check for dirt, carbon and other residue build-up. If it's dirty, clean it with carburettor cleaner and a toothbrush.

7 With the engine running, place a screwdriver or a stethoscope against each injector, one at a time, and listen for a clicking sound, indicating operation (see illustration).



15.7 Use a stethoscope or screwdriver to determine if the injectors are working properly - they should make a steady clicking sound that rises and falls with engine speed changes



16.1 Check for binding of the flap in the airflow meter as it nears closing position or wide-open position. Any hesitation or binding will cause erratic idle conditions, rich fuel mixture or poor acceleration and throttle response (airflow meter removed for clarity)

8 Check the fuel system pressure (see Section 3).

9 If these checks do not locate the problem, take the vehicle to a BMW dealer, who will be able to read the fault codes stored in the ECU, using special equipment.

**16 Airflow meter - check, removal and refitting**



**Check (L-Jetronic systems)**

1 Remove the duct from the intake end of the airflow meter. Carefully open and close the sensor flap (see illustration), and check for binding. The flap can bend during a backfire, and cause incorrect resistance readings. The flap will bind and stick in a partially-open position, causing the engine to run rich, and stall when it returns to idle.

2 Disconnect the electrical connector from the airflow meter.

3 Using an ohmmeter, check the resistance



16.3 Connect an ohmmeter to terminals 7 and 8 of the airflow meter, and check for a smooth change in resistance as the vane door of the airflow meter is slowly opened and closed

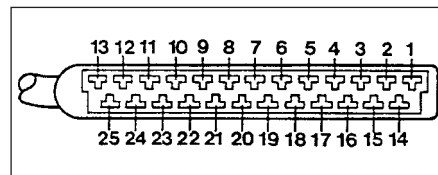
between terminals 7 and 8 (see illustration). The resistance should increase steadily (without any "flat spots") as the sensor flap is slowly moved from the fully-closed position to the fully-open position.

4 Also, check the intake air temperature sensor (inside the airflow meter). Using an ohmmeter, probe terminals 8 and 9 (see illustration 16.3) and check for the proper resistance. The resistance should be 2200 to 2700 ohms at 20° C.

5 If the resistance readings are correct, check the wiring harness (see Chapter 12). Plug in the connector to the airflow meter. Ensure that the ignition is switched off. Disconnect the electrical connector from the ECU (located under the right-hand side of the facia) and probe terminals 7 and 8 (see illustration) with an ohmmeter. Carefully move the door of the airflow meter, and observe the change in resistance as it moves from closed to fully-open. The test results should be the same as paragraph 3. If there are any differences in the test results, there may be a shorted-out or broken wire in the harness.

**Check (Motronic systems)**

6 Ensure that the ignition is switched off.



16.5 The ECU is located under the right-hand side of the facia. Unplug the electrical connector, and check the resistance between terminals 7 and 8 as in paragraph 3. The test results should be the same.

Remove the ECU access cover (see Chapter 6) and disconnect the harness connector (see illustration).

7 Using an ohmmeter, probe the designated terminals of the ECU electrical connector (see illustrations) and check for the proper change in resistance while moving the sensor flap. On early Motronic systems, probe terminals 7 and 9. On later Motronic systems, probe terminals 7 and 12. The resistance should increase steadily (without any "flat spots") as the sensor flap is slowly moved from the fully-closed position to the fully-open position. **Note:** Early Motronic systems are distinguishable by the 35-pin ECU electrical connector; later Motronic systems use a 55-pin connector.

8 If the resistance readings are incorrect, check the wiring harness.

**Removal and refitting (all systems)**

9 Disconnect the electrical connector from the airflow meter.

10 Remove the air cleaner assembly (see Section 8).

11 Remove the nuts (see illustrations), and lift the airflow meter from the engine compartment or from the air cleaner assembly.

12 Refitting is the reverse of removal.



16.6 Remove the under-facia panel to gain access to the ECU on Motronic systems (left-hand-drive model shown)



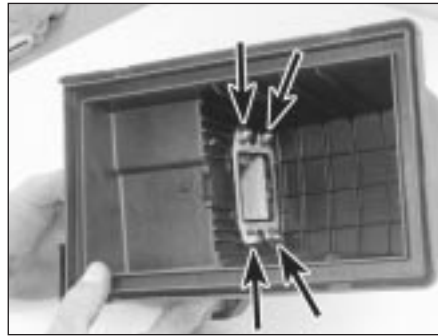
16.7a Connect the ohmmeter probes to terminals 7 and 12 (later Motronic systems) of the ECU connector and check for a smooth change in resistance as the door on the airflow meter is slowly opened and closed



16.7b Unplug the connector, connect the ohmmeter probes to terminals 7 and 9 (early Motronic systems) and check for a smooth change in resistance as the door on the airflow meter is slowly opened and closed



16.11a Push the tab and remove the air duct from inside the air cleaner assembly



16.11b Remove the nuts (arrowed) from the air cleaner housing, and detach the airflow meter



17.11 Remove the nuts (arrowed) and lift the throttle body from the intake manifold (the two lower bolts are hidden from view)

## 17 Throttle body - check, removal and refitting



### Check

- 1 Detach the air intake duct from the throttle body (see Section 8) and move the duct out of the way.
- 2 Have an assistant depress the throttle pedal while you watch the throttle valve. Check that the throttle valve moves smoothly when the throttle is moved from closed (idle position) to fully-open (wide-open throttle).
- 3 If the throttle valve is not working properly, renew the throttle body unit.



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



**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code

before disconnecting the battery. Refer to the information on page 0-7 at the front of this manual before detaching the cable.

**Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

### Removal and refitting

- 4 Detach the battery negative cable.
- 5 Detach the air intake duct from the throttle body, and place to one side.
- 6 Detach the accelerator cable from the throttle body (see Section 9).
- 7 Detach the cruise control cable, if applicable.
- 8 Clearly label all electrical connectors (throttle position sensor, cold start injector, idle air stabiliser, etc), then unplug them.
- 9 Clearly label all vacuum hoses, then detach them.
- 10 Unscrew the radiator or expansion tank cap to relieve any residual pressure in the cooling system, then refit it. Clamp shut the coolant hoses, then loosen the hose clamps and detach the hoses. Be prepared for some coolant leakage.

- 11 Remove the throttle body mounting nuts (upper) and bolts (lower), and detach the throttle body from the air intake plenum (see illustration).

- 12 Cover the air intake plenum opening with a clean cloth, to prevent dust or dirt from entering while the throttle body is removed.

- 13 Refitting is the reverse of removal. Be sure to tighten the throttle body mounting nuts to the torque listed in this Chapter's Specifications, and adjust the throttle cable (see Section 9) on completion.

## 18 Fuel pressure regulator - check and renewal



**Warning:** Fuel 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. Don't work in a garage where a natural gas-type 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 fire extinguisher on hand.



**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code

before disconnecting the battery. Refer to the information on page 0-7 at the front of this manual before detaching the cable.

**Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

### Check

- 1 Depressurise the fuel system (see Section 2).
- 2 Detach the battery negative cable.
- 3 Disconnect the fuel line and connect a fuel pressure gauge (see Section 3). Reconnect the battery.

- 4 Pressurise the fuel system (refit the fuel pump fuse and switch on the ignition), and check for leakage around the gauge connections.

- 5 Connect a vacuum pump to the fuel pressure regulator (see illustration).

- 6 Run the fuel pump (see Section 3). Read the fuel pressure gauge with vacuum applied to the pressure regulator, and also with no vacuum applied. The fuel pressure should decrease as vacuum increases.

- 7 Stop the fuel pump and reconnect the vacuum hose to the regulator. Start the engine and check the fuel system pressure at idle, comparing your reading with the value listed in this Chapter's Specifications. Disconnect the vacuum hose and watch the gauge - the pressure should jump up to maximum as soon as the hose is disconnected.

- 8 If the fuel pressure is low, pinch the fuel return line shut and watch the gauge. If the pressure doesn't rise, the fuel pump is defective, or there is a restriction in the fuel feed line. If the pressure now rises sharply, renew the pressure regulator.

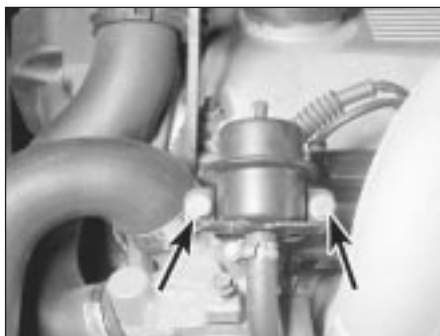
- 9 If the indicated fuel pressure is too high, stop the engine, disconnect the fuel return line and blow through it to check for a blockage. If there is no blockage, renew the fuel pressure regulator.

- 10 If the pressure doesn't fluctuate as described in paragraph 7, connect a vacuum



18.5 Carefully watch the fuel pressure gauge as vacuum is applied (fuel pressure should decrease as vacuum increases)





18.15 Remove the two bolts (arrowed) and remove the fuel pressure regulator from the fuel rail



19.1 Cold start injector electrical connector (arrowed) on the M10 engine. Most cold start injectors are mounted in the intake manifold



19.2 Watch for a steady, conical-shaped spray of fuel when the starter motor is operated

gauge to the pressure regulator vacuum hose, and check for vacuum (engine idling).

11 If there is vacuum present, renew the fuel pressure regulator.

12 If there isn't any reading on the gauge, check the hose and its port for a leak or a restriction.

### Renewal

13 Depressurise the fuel system (see Section 2).

14 Detach the battery negative cable.

**Caution:** If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery. Refer to this manual on page 0-7 at the front of this manual before detaching the cable.

**Note:** If, after connecting the battery, the wrong language appears on the instrument panel display, refer to page 0-7 for the language resetting procedure.

15 Detach the vacuum hose and fuel return hose from the pressure regulator, then unscrew the mounting bolts (see illustration).

16 Remove the pressure regulator.

17 Refitting is the reverse of removal. Be sure to use a new O-ring. Coat the O-ring with a light film of engine oil prior to refitting.

18 Check for fuel leaks after refitting the pressure regulator.

*any kind of work on the fuel system, wear safety glasses, and have a fire extinguisher on hand.*

### Check

#### Cold start injector

1 The engine coolant should be below 30°C for this check. Preferably, the engine should have been switched off for several hours. Disconnect the electrical connector from the cold start injector (see illustration) and move it aside, away from the work area - there will be fuel vapour present. Remove the two screws holding the injector to the air intake plenum, and take the injector out. The fuel line must be left connected. Wipe the injector nozzle. Disable the ignition system by detaching the coil wire from the centre terminal of the distributor cap, and earthing it on the engine block with a jumper wire. Run the fuel pump for 1 minute by bridging the appropriate relay terminals (see Section 3). There must be no fuel dripping from the nozzle. If there is, the injector is faulty and must be renewed. Switch off the ignition and remake the original fuel pump relay connections.

2 Now direct the nozzle of the injector into a can or jar. Reconnect the electrical connector to the injector. Have an assistant switch on the ignition and operate the starter. The injector should squirt a conical-shaped spray

into the jar (see illustration). If the spray pattern is good, the injector is working properly. If the spray pattern is irregular, the injector is fouled or damaged, and should be cleaned or renewed.

3 If the cold start injector does not spray any fuel, check for a voltage signal at the electrical connector for the cold start injector when the starter motor is operated (see illustration). If there is no voltage, check the thermotime switch.

#### Thermotime switch

4 The thermotime switch detects the temperature of the engine, and controls the action of the cold start injector. It is usually located up front, near the coolant temperature sensor. The engine coolant should be below 30°C for this check. Preferably, the engine should have been switched off for several hours. Disable the ignition system by detaching the coil wire from the centre terminal of the distributor cap, and earthing it on the engine block with a jumper wire. Pull back the rubber boot from the thermotime switch (see illustration) and probe the black/yellow wire connector terminal with a voltmeter.

5 Have an assistant switch on the ignition and operate the starter. The voltmeter should register a voltage signal the moment the starter engages. This signal should last approximately 6 to 10 seconds, depending on the temperature of the engine.

## 19 Cold start injector and thermotime switch - check and renewal



**Warning:** Fuel 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. Don't work in a garage where a natural gas-type 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



19.3 Check for a voltage signal (about 12 volts) at the cold start injector connector when the starter motor is operated



19.4 Check for a voltage signal on the black/yellow wire of the thermotime switch when the ignition is on



**19.6** Check the resistance of the thermotime switch with the engine coolant temperature below 30° C. There should be continuity

6 If the voltage is correct, unplug the electrical connector and, using an ohmmeter, check for continuity between the terminals of the thermotime switch (see illustration). Continuity should exist.

7 Reconnect the coil lead, start the engine and warm it up above 41°C. When the engine is warm, there should be no continuity between the terminals. If there is, the switch is faulty and must be renewed. **Note:** On 5-Series models, there are several types of thermotime switch. Each one is stamped with an opening temperature and maximum duration.

### Renewal

#### Cold start injector

8 Depressurise the fuel system (see Section 2).

9 Disconnect the electrical connector from the cold start injector.

10 Where applicable, using a ring spanner or deep socket, remove the fuel line fitting connected to the cold start injector. On other models, simply loosen the hose clamp and detach the hose from the injector.

11 Remove the cold start injector securing bolts, and remove the injector.

12 Refitting is the reverse of removal. Clean the mating surfaces, and use a new gasket.

#### Thermotime switch



**Warning:** Wait until the engine is completely cool before beginning this procedure. Also, remove the cap from the expansion tank or radiator to relieve any residual pressure in the cooling system.

13 Prepare the new thermotime switch for fitting by applying a light coat of thread sealant to the threads.

14 Disconnect the electrical connector from the old thermotime switch.

15 Using a deep socket, or a ring spanner, unscrew the switch. Once the switch is removed coolant will start to leak out, so insert the new switch as quickly as possible. Tighten the switch securely, and plug in the electrical connector.



**20.5** Check the resistance of each of the fuel injectors

### 20 Fuel injectors - check and renewal



**Warning:** Fuel 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. Don't work in a garage where a natural gas-type 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 fire extinguisher on hand.

#### Check

##### In-vehicle check

1 Using a mechanic's stethoscope (available at most car accessory shops), check for a clicking sound at each of the injectors while the engine is idling (see illustration 15.7).



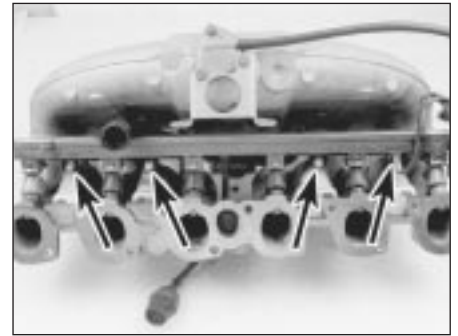
**Hint:** If you don't have a mechanic's stethoscope, a screwdriver can be used to check for a clicking sound at the injectors. Place the tip of the screwdriver against the injector, and press your ear against the handle.

2 The injectors should make a steady clicking sound if they are operating properly.

3 Increase the engine speed above 3500 rpm. The frequency of the clicking sound should rise with engine speed.

4 If an injector isn't functioning (not clicking), purchase a special injector test light (a car accessory shop or fuel injection specialist may be able to help) and connect it to the injector electrical connector. Start the engine and make sure the light flashes. If it does, the injector is receiving the proper voltage, so the injector itself must be faulty.

5 Unplug each injector connector, and check



**20.8** Remove the bolts (arrowed) and separate the fuel rail and injectors from the intake manifold

the resistance of the injector (see illustration). Check your readings with the values listed in this Chapter's Specifications. Renew any that do not give the correct resistance reading.

#### Volume test

6 Because a special injection checker is required to test injector volume, this procedure is beyond the scope of the home mechanic. Have the injector volume test performed by a BMW dealer or other specialist.

#### Renewal

7 Unplug the main electrical connector for the fuel injector wiring harness. Remove the intake manifold (see Chapter 2A).

8 Detach the fuel hoses from the fuel rail, and remove the fuel rail mounting bolts (see illustration).

9 Lift the fuel rail/injector assembly from the intake manifold.

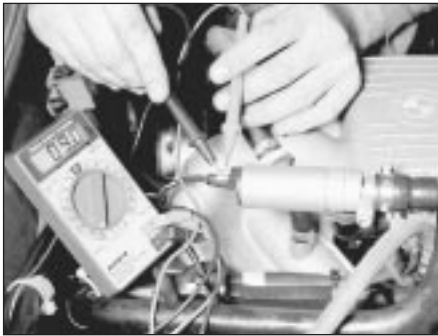
10 Unplug the electrical connectors from the fuel injectors. Detach the injectors from the fuel rail.

11 Refitting is the reverse of removal. Be sure to renew all O-rings. Coat the O-rings with a light film of engine oil to prevent damage during refitting. Pressurise the fuel system (refit the fuel pump fuse and switch on the ignition) and check for leaks before starting the engine.

### 21 Idle air stabiliser valve - check, adjustment and renewal



1 The idle air stabiliser system works to maintain engine idle speed within a 200 rpm range, regardless of varying engine loads at idle. An electrically-operated valve allows a small amount of air to bypass the throttle plate, to raise the idle speed whenever the idle speed drops below approximately 750 rpm. If the idle speed rises above approximately 950 rpm, the idle air stabiliser valve closes and stops extra air from bypassing the throttle plate, reducing the idle speed.



21.9 Check the resistance of the idle air stabiliser valve - it should typically be 9 to 10 ohms (L-Jetronic system)



21.19 Location of the adjustment screw on the metal-type idle air stabiliser valve (L-Jetronic system)



21.21 Check the idle air stabiliser valve resistance on the two outer terminals on later Motronic systems - it should be about 40 ohms

2 L-Jetronic systems are equipped with a separate idle speed control unit (computer) located under the facia. The idle air stabiliser valve has an adjusting screw. Early models are equipped with plastic valves, but they still can be adjusted by removing the hose and inserting a very thin screwdriver inside.

3 Early Motronic systems are also equipped with a separate idle speed control unit (computer) located under the facia. The idle air stabiliser valve has an adjusting screw.

4 On later Motronic systems, the idle air stabiliser valve is ECU-controlled, and no provision is made for adjustment.

### Preliminary check

5 Before performing any checks on the idle air stabiliser valve, make sure these criteria are met:

- The engine must be at operating temperature (60°C)
- Turn off all electrical accessories (air conditioning, heater controls, headlights, auxiliary cooling fan, etc)
- The throttle position sensor must be operating correctly (see Chapter 6)
- There must not be any exhaust leaks
- There must not be any vacuum leaks
- Where fitted, the oxygen sensor must be operating properly (see Chapter 6)

6 Connect a tachometer in accordance with the manufacturer's instructions.



**Caution:** The ignition must be switched off before making any electrical connections.

7 The idle air stabiliser valve operates continuously when the ignition is on. Start the engine and make sure the valve is vibrating and humming slightly.

### L-Jetronic system

#### Check

8 With the engine running, disconnect the electrical connector from the valve. The idle speed should increase to about 2,000 rpm.

9 If the idle speed does not increase, turn the engine off. Using an ohmmeter, check the resistance across the terminals of the valve

(see illustration). It should be 9 to 10 ohms with the ambient air temperature at about 20° C.

10 Using a pair of jumper wires, apply battery voltage to the valve, and confirm that the valve closes tightly. When the voltage is removed, the valve should re-open.

11 If the idle air stabiliser valve fails any of the tests, renew it.

12 If the idle air stabiliser valve passes the tests, check the control current.

13 Unplug the electrical connector from the valve. Using a jumper wire, connect one terminal of the electrical connector to one of the terminals on the valve. Connect an ammeter (0 to 1000 mA range) between the other terminal on the electrical connector and the remaining terminal on the valve. Start the engine and allow it to idle. With the engine running, the current reading should be between 400 and 500 mA. Adjust the valve if the current reading is not as specified (see paragraph 15). **Note:** The idle air stabiliser current will fluctuate between 400 and 1100 mA if the engine is too cold, if the coolant temperature sensor is faulty, if the idle speed needs to be adjusted, if there is an engine vacuum leak or if electrical accessories are on.

14 If there is no current reading, have the idle speed control unit diagnosed by a BMW dealer or other specialist. **Note:** The idle air stabiliser control unit (located under the facia) can develop an electrical connector problem that intermittently turns the valve on and off. Check the connector very carefully before fitting any new parts. Sometimes, a new control unit will only fix the problem temporarily.

#### Adjustment

15 With the ignition switched off, connect a tachometer in accordance with the equipment manufacturer's instructions.

16 Make sure the ignition timing is correct (see Chapter 5).

17 Connect an ammeter to the valve (see paragraph 13).

18 With the engine running, the current reading should be 450 to 470 mA at 850 to

900 rpm (manual transmission), or 460 to 480 mA at 850 to 900 rpm (automatic transmission).

19 If the control current is not correct, turn the adjusting screw until it is within the correct range (see illustration). **Note:** On metal-type valves, the adjusting screw is mounted externally. On plastic-type valves, the adjustment screw is inside, and can be reached by removing the hose at the end of the valve.

### Motronic systems

#### Check

**Note:** There are two types of idle air stabiliser valve on these systems; early models usually have a two-wire valve, while later models are equipped with a three-wire valve.

20 With the engine running, disconnect the electrical connector from the valve. The idle speed should increase to about 2000 rpm.

21 If the idle speed does not increase:

- Two-wire valve - Using a pair of jumper wires, apply battery voltage to the valve, and confirm that the valve closes tightly. When the voltage is removed, the valve should re-open. Also, check the resistance of the valve (see illustration 21.9). The resistance should be about 9 or 10 ohms.
- Three-wire valve - Turn the engine off and unplug the electrical connector from the valve. Using an ohmmeter, check the resistance on the two outer terminals of the valve. (see illustration). It should be about 40 ohms. Check the resistance on the centre and outside terminals of the valve. They should both be about 20 ohms.

22 If the idle air stabiliser valve fails any of the tests, renew it.

23 If the idle air stabiliser valve tests are all correct, check the control current (two-wire valve) or the voltage (three-wire valve) as follows.

24 On two-wire valves, connect an ammeter (0 to 1000 mA range) as described in paragraph 13. Start the engine, and allow it to idle. With the engine running, the current



21.26 Check for battery voltage on the centre terminal

reading should be between 400 and 500 mA. Adjust the valve if the current reading is not as specified. **Note:** *The idle air stabiliser current will fluctuate between 400 and 1100 mA if the engine is too cold, if the coolant temperature sensor is faulty, if there is an engine vacuum leak, or if electrical accessories are on.*

25 If there is no current reading, have the idle speed control unit (under the facia) checked by a BMW dealer or other specialist.

26 On three-wire valves, check for voltage at the electrical connector. With the ignition on, there should be battery voltage present at the centre terminal (see illustration). There should be about 10 volts between the centre terminal and each of the outer terminals.

27 If there is no voltage reading, have the idle speed control unit (early models) or the ECU (later models) checked by a dealer service department or other specialist.

#### Adjustment (early models only)

28 With the ignition switched off, connect a tachometer in accordance with the equipment manufacturer's instructions.

29 Make sure the ignition timing is correct (see Chapter 5).

30 Connect an ammeter to the valve as described in paragraph 13.

31 With the engine running, the current draw should be 450 to 470 mA at 700 to 750 rpm.

32 If the control current is not correct, turn the adjusting screw until it is within the specified range. **Note:** *Turn the idle air bypass screw clockwise to increase the current, or anti-clockwise to decrease the current.*



22.1 A typical exhaust system rubber mounting

#### Renewal

33 Remove the electrical connector and the bracket from the idle air stabiliser valve. Remove the valve, disconnecting the hoses.

34 Refitting is the reverse of removal.

### 22 Exhaust system servicing - general information



**Warning:** *Inspect or repair exhaust system components only when the system is completely cool. When working under the vehicle, make sure it is securely supported.*

#### Silencer and pipes

1 The exhaust system consists of the exhaust manifold, catalytic converter, silencers, and all connecting pipes, brackets, mountings (see illustration) and clamps. The exhaust system is attached to the body with brackets and rubber mountings. If any of the parts are improperly fitted, excessive noise and vibration may be transmitted to the body.

2 Inspect the exhaust system regularly. 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. Generally, deteriorated exhaust system components cannot be satisfactorily repaired; they should be renewed.

3 If the exhaust system components are extremely corroded or rusted together, it may be necessary to cut off the old components with a hacksaw. Be sure to wear safety goggles to protect your eyes from metal chips, and wear work gloves to protect your hands.

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

- a) *Work from the back to the front of the vehicle when removing exhaust system components.*
- b) *Apply penetrating oil to the exhaust system nuts and bolts to make them easier to remove.*
- c) *Use new gaskets, mountings and clamps when fitting exhaust system components.*
- d) *Apply anti-seize compound to the threads of all exhaust system nuts and bolts during reassembly.*
- e) *Be sure to allow sufficient clearance between newly-fitted parts and all points on the underbody, to avoid overheating the floorpan, and possibly damaging the interior carpet and insulation. Pay particularly close attention to the catalytic converters and heat shields. Also, make sure that the exhaust will not come into contact with suspension parts, etc.*

#### Catalytic converter

5 Although the catalytic converter is an emissions-related component, it is discussed here because, physically, it's an integral part of the exhaust system. Always check the converter whenever you raise the vehicle to inspect or service the exhaust system.

6 Raise and support the vehicle.

7 Inspect the catalytic converter for cracks or damage.

8 Check the converter connections for tightness.

9 Check the insulation covers welded onto the catalytic converter for damage or a loose fit.

**Caution:** *If an insulation cover is dented so that it touches the converter housing inside, excessive heat may be transferred to the floor.*

10 Start the engine and run it at idle speed. Check all converter connections for exhaust gas leakage.

# Fuel injection system - fault finding

## L-Jetronic fuel injection system

### Engine difficult to start, or fails to start (when cold)

#### Probable cause

Cold start injector or thermotime switch faulty  
 Fuel pump inoperative  
 Airflow meter flap (door) binding or stuck in open position  
 Fuel pressure incorrect  
 Intake air leaks  
 Fuel injectors clogged or not operating  
 Coolant temperature sensor faulty or wiring problem  
 Throttle position sensor (TPS) incorrectly adjusted  
 Incorrect ignition timing  
 Dirt or other contaminants in fuel  
 Faulty ECU

#### Corrective action

Test cold start injector and thermotime switch. Renew faulty components (see Section 19)  
 Check fuel pump fuse and fuel pump relay (see Sections 3 and 4)  
 Inspect the airflow meter for damage (see Section 16)  
 Test system pressure (see Section 3). Test fuel pressure regulator (Section 18)  
 Inspect all vacuum lines, air ducts, and oil filler and dipstick seals  
 Check fuel injectors (see Section 20) and wiring harness  
 Test coolant temperature sensor (see Chapter 6, Section 4)  
 Check TPS adjustment (see Chapter 6, Section 4)  
 Check ignition timing (see Chapter 5). Check vacuum advance system  
 Check the fuel and drain the tank if necessary  
 Have the ECU tested at a dealer service department or other specialist

### Engine difficult to start, or fails to start (when warm)

#### Probable cause

Cold start injector leaking or operating continuously  
 Fuel pressure incorrect  
 Insufficient residual fuel pressure  
 Fuel leak(s)  
 Coolant temperature sensor faulty or wiring problem  
 Vapour lock (warm weather)  
 EVAP system faulty (where applicable)  
 Incorrect ignition timing  
 Faulty ECU  
 Idle speed control system faulty

#### Corrective action

Test cold start injector and thermotime switch (see Section 19)  
 Test fuel pump(s). Renew if necessary (see Section 3)  
 Test residual fuel pressure. Renew fuel pump or fuel accumulator as necessary (see Section 18)  
 Inspect fuel lines and fuel injectors for leaks. Correct leaks as required (see Chapter 4)  
 Test coolant temperature sensor (see Chapter 6, Section 4)  
 Check fuel pressure (see Section 3)  
 Check EVAP system (see Chapter 6, Section 6)  
 Check ignition timing (see Chapter 5). Check vacuum advance system  
 Have the ECU tested at a dealer service department or other specialist  
 Test the idle air stabiliser valve (see Section 21)

### Engine misses and hesitates under load

#### Probable cause

Fuel injector clogged or faulty  
 Fuel pressure incorrect  
 Fuel leak(s)  
 Engine maintenance  
 Airflow meter flap (door) binding, or stuck in open position  
 Intake air leaks

#### Corrective action

Test fuel injectors. Check for clogged injector lines. Renew faulty injectors (see Section 20)  
 Test fuel system pressure (see Section 3). Test fuel pressure regulator (see Section 18)  
 Inspect fuel lines and fuel injectors for leaks (see Chapter 4)  
 Tune-up engine (see Chapter 1). Check the distributor cap, rotor, HT leads and spark plugs, and renew any faulty components  
 Inspect the airflow meter for damage (see Section 16)  
 Inspect all vacuum lines, air ducts and oil filler and dipstick seals

### Engine has erratic idle speed

#### Probable cause

Idle air stabiliser valve faulty  
 No power to the idle air stabiliser valve  
 Vacuum advance system faulty  
 Idle speed control unit faulty

#### Corrective action

Check the idle air stabiliser valve (see Section 21)  
 Check the idle air stabiliser relay and wiring circuit (see Chapter 12)  
 Check vacuum advance system and electronic vacuum advance relay  
 Have the idle speed control unit checked by a dealer

## Motronic fuel injection system

**Note:** With this system, when faults occur, the ECU stores a fault code in its memory. These codes can only be read by a BMW dealer, as specialised equipment is required. It may save time to have at least the initial fault diagnosis carried out by a dealer.

### Lack of power

#### Probable cause

Coolant temperature sensor faulty, or wire to sensor broken  
 Fuel pressure incorrect  
 Throttle plate not opening fully

#### Corrective action

Test coolant temperature sensor and wiring. Repair wiring or renew sensor if faulty (see Chapter 6)  
 Check fuel pressure from main pump and transfer pump, as applicable (see Section 3)  
 Check accelerator cable adjustment to make sure throttle is opening fully. Adjust cable if necessary (see Section 9)

## 4•22 Fuel and exhaust systems

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### Engine difficult to start, or fails to start (when cold)

#### Probable cause

Cold start injector or thermostime switch faulty (early Motronic system only)  
Fuel pump not running  
Airflow meter flap (door) binding, or stuck in open position  
Fuel pressure incorrect  
Intake air leaks  
Fuel injectors clogged or not operating  
Coolant temperature sensor faulty or wiring problem  
TPS (throttle position sensor) incorrectly adjusted  
Dirt or other contaminants in fuel  
Faulty ECU  
Crankshaft position signal missing

#### Corrective action

Test cold start injector and thermostime switch. Renew faulty components (see Section 19)  
Check fuel pump fuse and fuel pump relay (see Sections 2 and 3)  
  
Inspect the airflow meter for damage (see Section 16)  
Test system pressure (see Section 3)  
Inspect all vacuum lines, air ducts and oil filler and dipstick seals  
Check fuel injectors (see Section 20) and wiring harness  
Test coolant temperature sensor (see Chapter 6, Section 4)  
  
Check TPS adjustment (see Chapter 6, Section 4)  
Check the fuel and drain the tank if necessary  
Have the ECU tested at a dealer service department or other specialist  
Faulty position sensor or flywheel, or reference pin missing (see Chapter 5)

### Engine difficult to start, or fails to start (when warm)

#### Probable cause

Cold start injector leaking or operating continuously (early Motronic system only)  
Fuel pressure incorrect  
Insufficient residual fuel pressure  
Fuel leak(s)  
Coolant temperature sensor faulty or wiring problem  
Vapour lock (in warm weather)  
EVAP system faulty  
Faulty ECU  
Idle speed control system faulty  
Oxygen sensor faulty (where applicable)

#### Corrective action

Test cold start injector and thermostime switch (see Section 19)  
Test fuel pressure (see Section 3)  
Test fuel system hold pressure (see Section 3)  
Inspect fuel lines and fuel injectors for leaks. Correct leaks as necessary  
  
Test coolant temperature sensor (see Chapter 6, Section 4)  
Check fuel pressure (see Section 3)  
Check EVAP system (see Chapter 6, Section 6)  
Have the ECU tested at a dealer service department or other specialist  
Test the idle air stabiliser valve (see Section 21)  
Check the oxygen sensor (see Chapter 6, Section 4)

### Engine misses and hesitates under load

#### Probable cause

Fuel injector clogged  
Fuel pressure incorrect  
Fuel leak(s)  
Engine maintenance  
  
Airflow meter flap (door) binding, or stuck in open position  
Intake air leaks  
Throttle position sensor (TPS) incorrectly adjusted

#### Corrective action

Test fuel injectors. Check for clogged injector lines. Renew faulty injectors (see Section 20)  
Test fuel system pressure (see Section 3). Test fuel pressure regulator (see Section 18)  
Inspect fuel lines and fuel injectors for leaks (see Chapter 4)  
Tune-up engine (see Chapter 1). Check the distributor cap, rotor, HT leads and spark plugs, and renew any faulty components  
Inspect the airflow meter for damage (see Section 16)  
  
Inspect all vacuum lines, air ducts, and oil filler and dipstick seals  
Check TPS adjustment (see Chapter 6)

### Engine idles too fast

#### Probable cause

Accelerator pedal, cable or throttle valve binding  
  
Air leaking past throttle valve

#### Corrective action

Check for worn or broken components, kinked cable, or other damage. Renew faulty components  
Inspect throttle valve, and adjust or renew as required

### Engine has erratic idle speed

#### Probable cause

Idle air stabiliser valve faulty  
No power to the idle air stabiliser valve  
Idle speed control unit faulty

#### Corrective action

Check the idle air stabiliser valve (see Section 21)  
Check the idle air stabiliser relay and wiring circuit (see Chapter 12)  
Have the idle speed control unit checked by a dealer

### Poor fuel economy

#### Probable cause

Cold start injector leaking (early Motronic system only)  
Oxygen sensor faulty (where applicable)  
Sticking handbrake/binding brakes  
Tyre pressures low

#### Corrective action

Test and, if necessary, renew cold start injector (see Section 19)  
Test the oxygen sensor (see Chapter 6, Section 4)  
Check the handbrake/braking system (see Chapter 9)  
Check tyre pressures (Chapter 1)