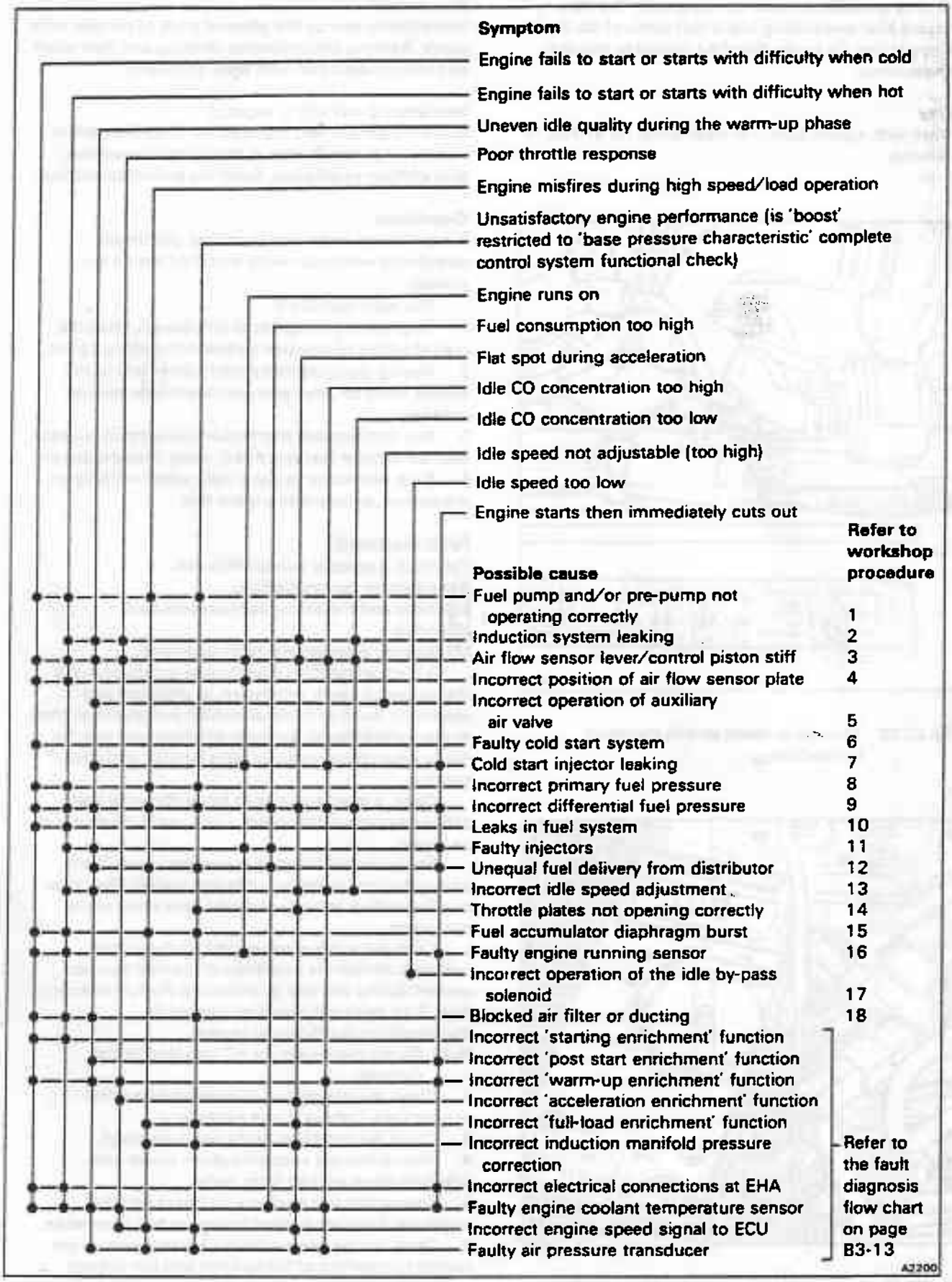



**Fig. B3-21 Basic KE2-Jetronic fault diagnosis chart**

(if none is available water can be given). The main hazard after swallowing fuel is that some of the liquid may get into the lungs. Send the patient to hospital immediately.

Eyes
Wash with a good supply of clean water for at least 10 minutes.

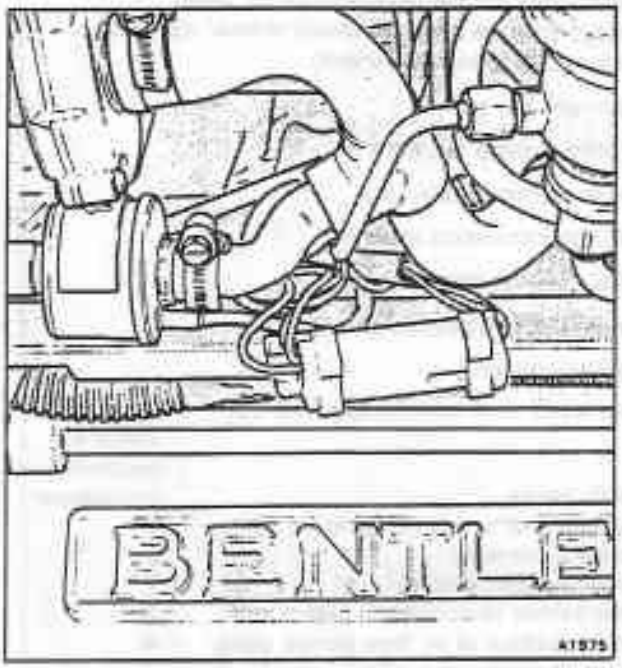



**Fig. B3-22 Throttle position switch electrical connection**

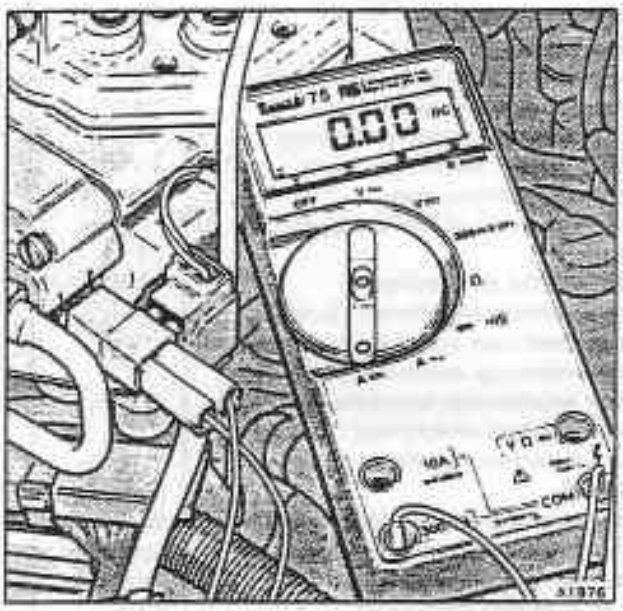



**Fig. B3-23 Multimeter connected in 'series' with the EHA**

Skin contact
Immediately drench the affected parts of the skin with water. Remove contaminated clothing and then wash all contaminated skin with soap and water.

Inhalation (breathing in vapour)
Move the patient into the fresh air. Keep the patient warm and at rest. If there is loss of consciousness give artificial respiration. Send the patient to hospital.

**Cleanliness**
It is extremely important to ensure maximum cleanliness whenever work is carried out on the system.

The main points are.

1. To prevent the ingress of dirt, always clean the area around a connection before dismantling a joint.
2. Having disconnected a joint (either fuel or air) always blank off any open connections as soon as possible.
3. Any components that require cleaning should be washed in clean fuel and dried, using compressed air.
4. If it is necessary to use a cloth when working on the system, ensure that it is lint-free.

## Fault diagnosis

This fault diagnosis section includes.
**Basic system test procedure.**
**Electrical and Electronic components fault diagnosis.**
**Mechanical components fault diagnosis.**

It is important that fault finding is carried out in the sequence given, otherwise, as electrical and electronic faults sometimes exhibit symptoms similar to mechanical faults, an incorrect diagnosis may be made which could result in both lengthy and costly repairs.

Often, a mechanical fault has sufficiently well defined symptoms to enable a very rapid diagnosis to be made.

The **basic fault finding procedure** is as follows, noting that any faults found in one system should be rectified before moving on to the next stage of the procedure.

1. Carry out a compression test on the engine cylinders. Inhibit the operation of the fuel injection system during this test by removing the fuel injection fuse. Also, isolate the ignition system by disconnecting the flywheel sensor.

**Note** Do not disconnect the HT king lead for this purpose.

2. Check the integrity of all hose and electrical connections, tighten where necessary.
3. Check the condition of the sparking plugs.
4. Ensure that the vacuum system hoses and pressure pipes are free from leaks.
5. Ensure that any auxiliary air hoses and the crankcase breather system hoses are free from leaks.
6. Carry out the basic system checks to ensure the correct functioning of the ignition and fuel system maps.

**During manufacture, the components of the fuel**

**injection system are precisely adjusted in order to comply with the relevant emission control regulations. Therefore, alterations to any of the settings should not normally be necessary.**

Before commencing any fault diagnosis or work on the fuel injection system ensure that the workshop safety precautions are fully understood.

**Fuel and ignition system functional checks**

The following series of fuel injection and digital ignition system functional checks are necessary to ensure the correct definition of the ignition and fuel system 'maps'.

**Note** These checks must be carried out with the engine stabilized at its normal operating temperature.

1. With the engine switched off, disconnect the three-way electrical plug to the throttle position switch (see fig. B3-22).
2. Using the multimeter, measure the resistance across the black and blue/purple cables from the switch as follows.

With the throttles closed the reading should be 0 to 0.5 ohms. With the throttles fully open, the reading should be 'infinity'.

3. Now measure the resistance across the black and yellow/purple cables as follows.

With the throttles closed the reading should be 'infinity'. With the throttles fully open the reading should be 0 to 0.5 ohms.

4. Leave the three-way electrical plug to the throttle position switch disconnected. Connect a digital multimeter in 'series' with the electro-hydraulic actuator using the adapter RH 9893 (see fig. B3-23). Set the meter to read milliamps.

**'Idle' fuel injection and ignition map check**

1. Using a length of cable with suitable connections, bridge the black and blue/purple cables on the electronic control unit (ECU) side of the throttle position switch connection.
2. Start the engine and with the air conditioning system switched off, set the idle speed to 580 rev/min using the idle by-pass screw. Turn the screw clockwise to reduce the engine speed and anti-clockwise to increase engine speed.
3. Check that the ignition timing is 7° ± 1° btdc using a stroboscope directed on the timing marks on the crankshaft pulley.

Check that the multimeter indicates 6mA ± 0.5mA.

**'Part load' fuel and ignition map check**

1. Stop the engine and remove the bridging cable from the throttle position switch. Disconnect the vacuum hose from the ignition system ECU to the induction manifold (see fig.B3-24) and blank off the manifold tapping.
2. Start the engine and, using the Mityvac pump RH 12495, apply a minimum of 508 mm Hg (20 in Hg) to the ignition ECU hose. This should result in a drop in engine speed of approximately 100 rev/min.

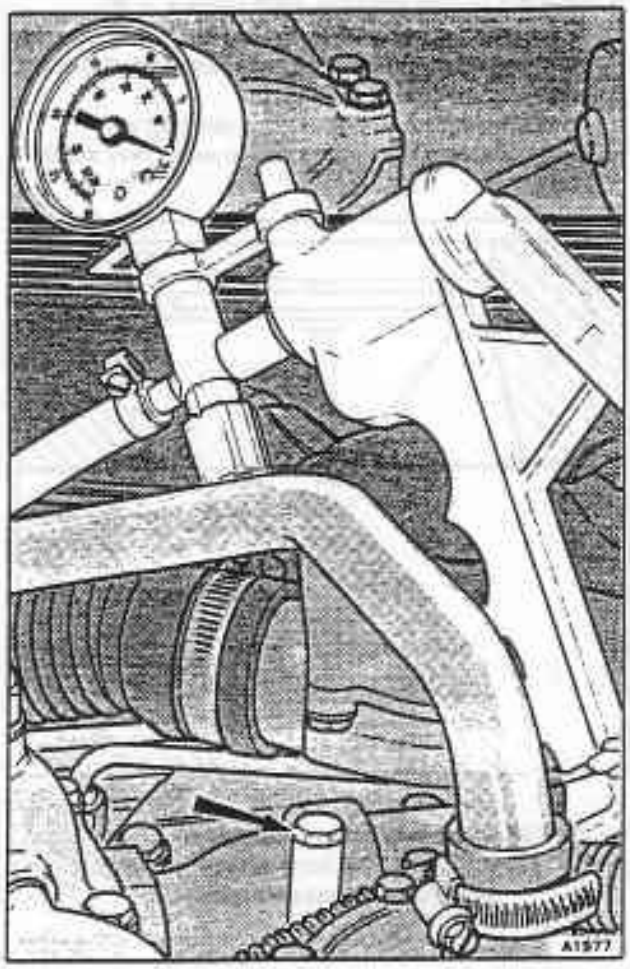


**Fig. B3-24 Ignition system manifold vacuum tapping (shown blanked off with 'Mityvac' connected to signal hose)**

**Note** If no decrease occurs, check the vacuum hose for leaks. Also check for an earth fault on the blue/purple or yellow/purple cables.

If no fault is found and the 'Full load' check is satisfactory the ignition system ECU is faulty and requires replacing.

Apply 304,8 mm Hg (12 in Hg) of vacuum to the ignition ECU and set the engine speed to 1500 rev/min ± 50.

Check that the ignition timing is 30° ± 3° btdc and that the multimeter reads 6 mA ± 0.5mA.

3. Remove the vacuum pump and re-connect the vacuum hose to the manifold.

**'Full load' fuel and ignition map check**

1. Bridge the black and yellow/purple connections on the ECU side of the throttle position switch connection.
2. Start the engine and set the speed to 2000 rev/min ± 50.

Check that the ignition timing is 20° ± 1° btdc and that the multimeter reading is 17mA ± 0.5mA.

3. Set the engine speed to 3000 rev/min ± 50.

Check that the ignition timing is 21° ± 1° btdc and that the multimeter reading is approximately 8.5mA ± 2mA.

It should be noted that the mA reading will fluctuate unless the engine speed is extremely stable.

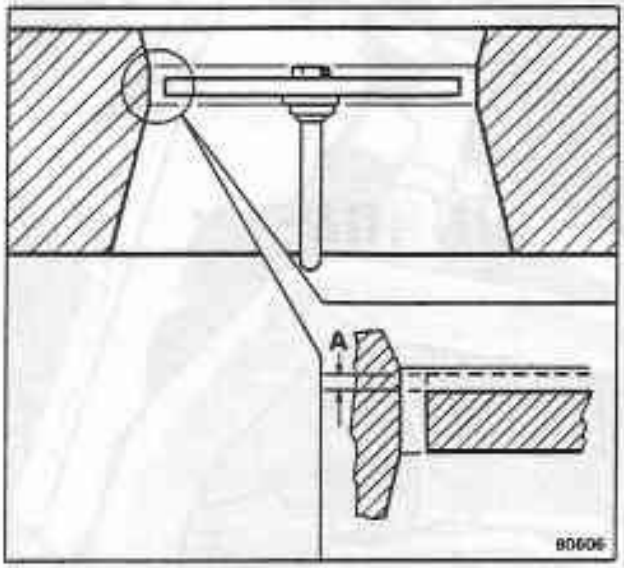



**Fig. B3-25 Air sensor plate position**
A 1,0 mm (0.040 in) free play with fuel system fully pressurized

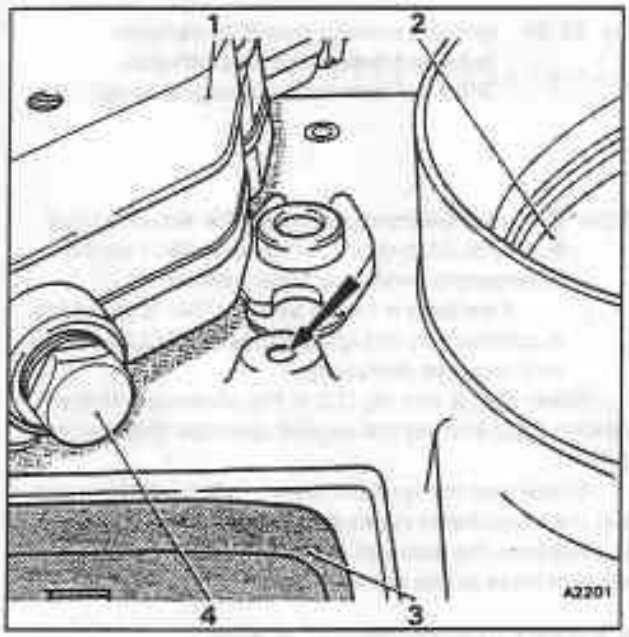



**Fig. B3-26 Height adjustment for the air flow sensor plate**
1 Fuel distributor
2 Air flow sensor plate
3 Electro-hydraulic actuator (EHA)
4 Differential fuel pressure tapping

If the ignition timing or the fuel injection system mA reading is incorrect, refer to the fault diagnosis flow chart on pages B3-13 and B3-15.

**Diagnosing and correcting faults**

The workshop procedure number given before the title of the operation refers to the fault diagnosis chart for the basic KE2-Jetronic system given in figure B3-21.

**Before carrying out any tests, ensure that the battery is in a fully charged condition.**

**It should be noted that all components of the system (except the injectors) can be tested on the vehicle.**

**Procedure 1 Fuel pump and/or pre-pump not operating correctly**

For information relating to these components refer to Chapter C.

**Procedure 2 Induction system air leaks**

Visually check all vacuum hoses, pipes, and clips for damage or looseness that may allow an air leak into the induction system.

Check the entire induction system for air leaks with the engine running. Use a suitable length of rubber hose as a listening aid. The leak will often be heard as a high pitched hiss or whistle.

**Procedure 3 Metering control unit lever sticking**

1. Ensure that the engine temperature is above 20°C (68°F).
2. Remove the air intake elbow from the inlet to the control unit.
3. Apply pressure to the control piston in the fuel distributor for approximately 10 seconds (refer to page B3-27). Switch off the power to the fuel pumps.
4. Press the air sensor plate slowly downwards to its maximum open position. The resistance to this movement should be uniform over the whole range of travel. Allow the air sensor plate to return to its rest position and repeat the operation.

If the resistance to the air sensor plate movement is uniform over the whole range of travel, the metering unit is not sticking.

**Note** Whenever the airflow sensor plate is depressed fuel will be sprayed into the engine. Therefore, the sensor plate should only be depressed the minimum number of times to carry out this operation.

5. Should the resistance to air sensor plate movement be greater in the rest position, it could be due to the plate being either out of position or bent.
6. If the condition described in Operation 5 is confirmed, depressurize the fuel system (refer to page B3-12). Then, press the plate fully downwards and allow it to return to the rest position. It should return smoothly to the rest position.
7. Should a resistance be confirmed in Operation 6, remove the air sensor plate and repeat the operation. If this alleviates the resistance, the air sensor plate is fouling the sides of the air funnel and should be

centralized (refer to Procedure 4) or the air funnel may be deformed in some way.

8. If there is still a resistance to the movement of the lever, it could be due to contamination within the fuel distributor barrel or occasional binding in the lever mechanism.

9. Contamination within the fuel distributor can be checked by separating the fuel distributor from the control unit for visual inspection.

Do not attempt to remove the control piston.

Remove the retaining screws situated on top of the fuel distributor. Lift off the fuel distributor (resistance will be felt due to the rubber sealing ring).

10. Examine the distributor for contamination.

11. Fit the fuel distributor by reversing the dismantling procedure. Ensure that the rubber sealing ring is in good condition and is lubricated with a suitable grease.

Ensure that the retaining screws are evenly tightened.

12. If a resistance is still noticeable, a new assembly should be fitted.

13. After fitting the fuel distributor check the idle mixture strength.

**Procedure 4 Positioning the air flow sensor plate**

1. Remove the air inlet ducting from above the air sensor plate.

2. Check that the sensor plate is flat and that it will pass through the narrowest part of the air funnel without fouling.

3. If necessary, loosen the plate securing bolt.

4. Insert the guide ring RH 9609 whilst retaining the sensor plate in the zero movement position. This will prevent the sensor plate from being forced downwards as the centring guide ring is being installed.

5. With the centring guide ring in position, tighten the retaining bolt to 5 Nm (0,50kgf m to 0,55kgf m, 44lbf in to 48lbf in). Carefully remove the centring guide ring.

6. Apply pressure to the control piston in the fuel distributor for approximately 10 seconds (refer to page B3-27)

7. The air sensor plate should be positioned as shown in figure B3-25, with the plate not protruding above or below the parallel section of the air cone.

8. If the air sensor plate is too high, carefully tap the guide pin lower (see fig.B3-26) using a mandrel and a small hammer.

**Note** This adjustment must be made very carefully, ensuring that the pin is not driven too low. Repeated adjustment can loosen the guide pin. Serious damage to the engine could result if the pin should fall out.

**Procedure 5 Checking the operation of the auxiliary air valve**

1. Ensure that the engine is cold.

2. Disconnect the electrical plug at the auxiliary air valve.

3. Disconnect the inlet and outlet rubber hoses from the auxiliary air valve.

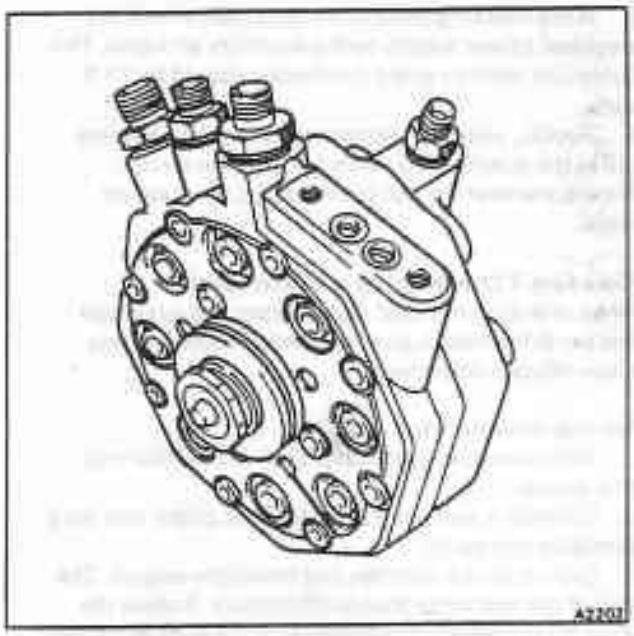


**Fig. B3-27 Fuel distributor removed**

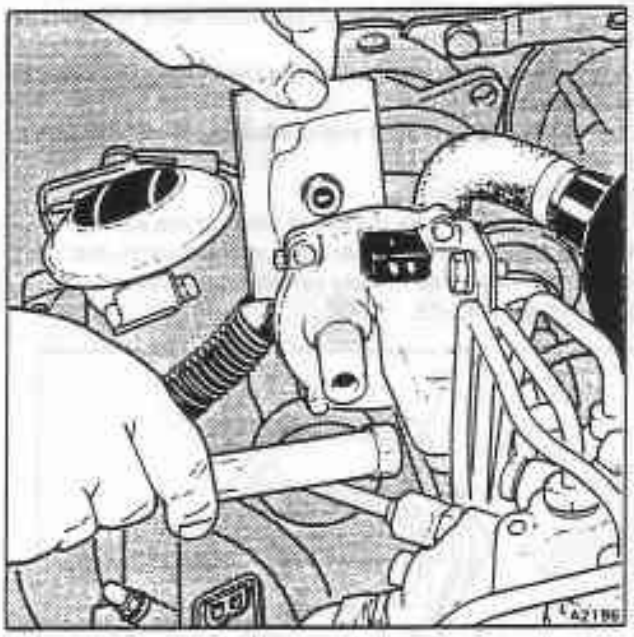


**Fig. B3-28 Checking the auxiliary air valve**

4. Using a flashlight and mirror, observe the position of the hole in the blocking plate (see fig.B3-28). It should be partially uncovered. If the blocking plate completely closes the air passage, fit a new auxiliary air valve.

5. If the air passage way is open, connect the electrical plug to the auxiliary air valve.

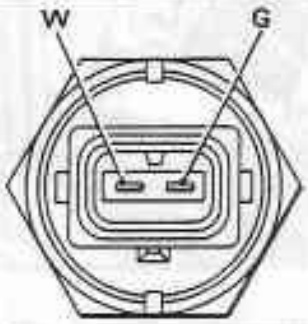
6. Apply electrical power to the heater in the auxiliary air valve (refer to page B3-27).

7. The air passage through the valve should be completely closed within four to five minutes.

8. If the blocking plate does not close, check the electrical power supply to the auxiliary air valve. The minimum voltage at the connector should be 11.5 volts.
9. Finally, using an ohmmeter, check the heating coil in the auxiliary air valve for an open circuit. Should the heating coil prove faulty, fit a new air valve.

**Procedure 6 Checking the cold start system**
When checking the cold start system it is essential that the information given in the Workshop safety precautions is observed.

Thermal time switch
1. Withdraw the electrical plug from the thermal time switch.
2. Connect a test lamp between one of the two plug terminals and earth.
3. Switch on the ignition and crank the engine. The bulb of the test lamp should illuminate. Repeat the check on the other plug terminal. If the bulb does not illuminate in either test the electrical connections and wiring of the respective circuit are suspect.
4. Produce a test lead using a Bosch electrical plug and two lengths of cable each approximately 500 mm (19.6 in) long.
5. Connect the test cables to the thermal time switch via the plug.
6. Refer to figure B3-29 and measure the resistance between
a. Terminals W and G.
b. Each terminal and the brass body of the switch.
Depending upon the temperature of the switch, the resistance measured should be within the values given in figure B3-29.




| Switch temperature | Resistance - Ohms (meter reading) | | |
|---|---|---|---|
| | Between terminal G and earth | Between terminal W and earth | Between terminals G and W |
| Less than 35°C (95°F) | 38 | 0 | 38 |
| More than 35°C (95°F) | 70 | 140 | 70 |

A177B

**Fig. B3-29 Thermal time switch**

7. If the values do not correspond with those given in figure B3-29 fit a new switch.
8. After the test has been satisfactorily carried out, remove the test lead assembly and connect the electrical loom plug.

**Procedure 7 Checking the cold start injector**
1. Detach the electrical plug from the cold start injector.
2. Produce a test lead using a Bosch electrical plug, two lengths of cable and a micro-switch.
3. Remove the cold start injector from the induction manifold with its feed pipe attached. Place the nozzle of the injector into a suitable clean container so that its operation can be observed.
4. Connect the electrical plug to the cold start injector and the two cables, one to an auxiliary electrical feed and the other to an earth point.
**Note** Exercise care to eliminate the possibility of an electrical spark (use the micro-switch to make and break the circuit).
5. Apply electrical power to operate the fuel pump (refer to page B3-27).
6. Operate the micro-switch to complete the auxiliary electrical circuit. The cold start injector should spray fuel as the contacts in the micro-switch complete the electrical circuit; if it does not spray fuel, fit a new injector.
7. Dry the nozzle of the cold start injector.
8. Repeat Operation 5 but do not operate the micro-switch. Note that no drops of fuel should form on or drip from the injector nozzle. If the injector is defective a new one should be fitted.
9. Remove the auxiliary test lead from the injector and connect the loom plug.

**Procedure 8 Checking the operation of the primary fuel circuit**
Fuel delivery
1. Depressurize the fuel system (refer to page B3-12).
2. Disconnect the fuel return line at the fuel pressure regulator lower connection. Using a 'Tirtree' type nipple and nut (SPM 1390/1), connect one end of an auxiliary fuel return hose to the connection. Hold the other end of the hose in a graduated measuring container capable of holding more than 10 litres (2.2 Imp gal).
3. Disconnect the electrical plug from the auxiliary air valve.
4. Apply electrical power to operate the fuel pump (refer to page B3-27). At least 10 litres (2.2 Imp gal) of fuel should be delivered into the measuring container within five minutes.
5. If the delivery quantity is satisfactory, check the primary system pressure. However, if the delivery quantity is below the prescribed amount proceed as follows. Check the fuel pump delivery after each operation.
6. Check the voltage at the fuel pump. When the pump is operating this should be 11.5 volts.
7. Fit a new 'in-tank' filter.

8. Fit a new main fuel filter.
9. Check the fuel lines for blockage.
10. Fit a new fuel pre-pump.
11. Fit a new fuel pump.
12. After establishing that the fuel delivery is correct, remove the test equipment.
13. Connect the fuel return pipe.

Primary system pressure
To carry out this test, fit the pressure tester RH 9612 (Bosch Number KDEP 1034) as shown in figure B3-34.
1. Apply electrical power to operate the fuel pump (refer to page B3-27). The pressure gauge will show primary system pressure which should be between 5,7 bar and 5,9 bar (82.7 lbf/in$^2$ and 85.6 lbf/in$^2$).
2. If the primary fuel pressure is too high.
a. Check for a restriction in the return line to the tank.
b. The fuel pressure regulator is faulty.
3. If the primary fuel pressure is too low.
a. Check the fuel supply.
b. The fuel pressure regulator is faulty.

**Procedure 9 Checking the differential fuel (lower chamber) pressure**
The engine must be at normal operating temperature for this test to ensure a stable reading.
1. Measure the primary fuel pressure. Ensure that the reading is within the specification.
2. Remove the pressure tester and re-connect the cold start injector pipe to the fuel distributor.
3. Install the pressure tester (see fig. B3-35).
4. Apply electrical power to operate the fuel pump for 30 seconds (refer to page B3-27). Switch off the power to the fuel pump.
The gauge will now show the differential pressure valve lower chamber pressure which should be 5,3 bar to 5,5 bar (76.9 lbf/in$^2$ to 80.0 lbf/in$^2$).
5. If the differential fuel pressure is outside the specified limit.
a. The fuel pressure regulator is faulty.
b. The fuel metering unit is faulty.
c. The electro-hydraulic actuator (EHA) is faulty.
d. The mA supply to the EHA is incorrect.
**Note** When the engine is fully warmed-up the mA supply at idle to the EHA should be 6 mA (± 0.5 mA).

**Procedure 10 Checking the fuel system for leaks**
The engine should be at normal operating temperature for this test.
1. Fit the pressure tester RH 9612 (see fig. B3-34).
2. Apply electrical power to operate the fuel pump for 30 seconds (refer to page B3-27).
3. Allow the primary system pressure to build-up. Switch off the power to the fuel pump.
4. Note the time it takes for the pressure to fall to zero and compare this with the graph (see fig. B3-30).
5. If the pressure loss is outside the acceptable limits, the leak may be due to.
a. Defective pressure regulator.
b. Leaking cold start injector.
c. Faulty non-return valve in the fuel pump.

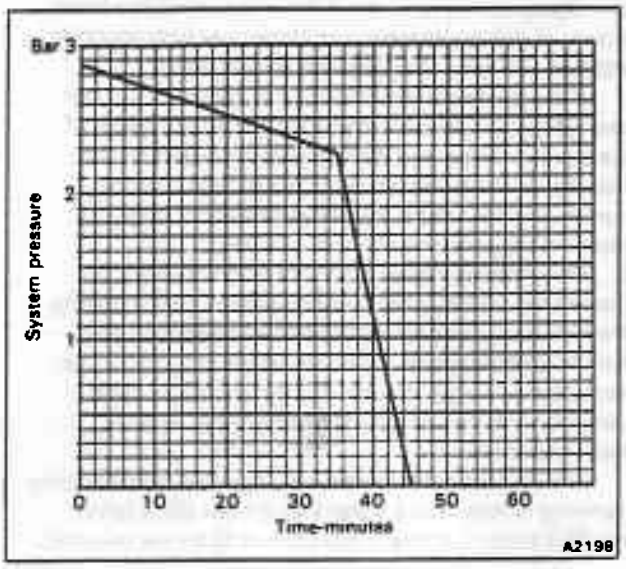



**Fig. B3-30 Fuel system 'leak down'**

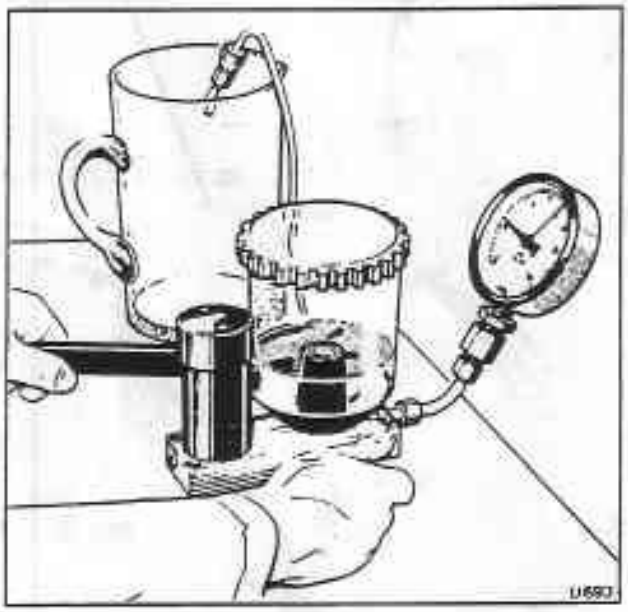


**Fig. B3-31 Testing an injector**

d. Leaking accumulator diaphragm.
e. An external leak from one of the fuel system pipes.
f. One or more of the injectors leaking.

**Procedure 11 Checking the injectors**
1. Remove the injectors from the engine.
2. Connect one injector to the test equipment RH 9614 (Bosch Number KDJE 7452). Refer to figure B3-31.
Opening pressure
3. Bleed the discharge tube by moving the operating lever several times with the union slackened. Tighten the union.

4. Check the injector for dirt by operating the lever slowly at approximately one stroke per two seconds, with the valve on the pressure gauge open.

If the pressure does not rise to between 1,0 bar and 1,5 bar (14.5 lbf/in² and 21.8 lbf/in²) the valve of the injector has a bad leak, possibly caused by dirt. Attempt to flush the valve by operating the lever rapidly several times. If the injector valve does not clear the injector should be discarded.

5. Check the opening pressure of the injector by closing the valve of the test equipment and bleeding the injector by operating the test equipment lever rapidly several times. Open the valve and move the lever slowly at approximately one stroke per two seconds, note the pressure at which the injector begins to spray.

The correct pressure for the injector to commence spraying is between 3,5 bar and 4,1 bar (50.8 lbf/in² and 59.5 lbf/in²). If this is not correct fit a new injector.

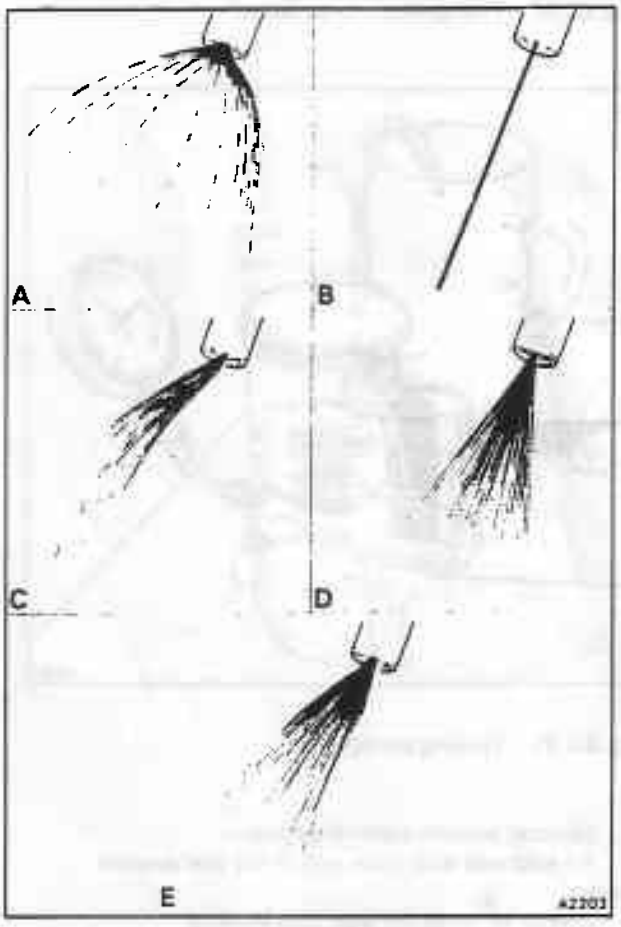



**Fig. B3-32 Injector spray patterns**

Unacceptable spray patterns
- A Drop formation
- B Cord spray
- C Spray in strands

Acceptable spray patterns
- D Good spray formation
- E Single-sided but still a good spray formation

Leakage test

6. Open the valve on the test equipment and slowly operate the lever until the pressure reading is 0,5 bar (7.3 lbf/in²) below the previously determined opening pressure.
7. Hold this pressure constant by moving the lever.
8. No drops should appear from the injector for the next 15 seconds.

Evaluation of spray and 'chatter' test

9. Operate the lever of the test equipment at one stroke per second. As this is done, the valve in the end of the injector should be heard to 'chatter'.
10. The injector should produce an even spray with an approximate spray angle of 35°. If drops form at the mouth of the injector valve or if the spray is excessively one-sided, the injector should be discarded.

The various spray formations and angles are shown in figure B3-32.

**Repeat Operations 1 to 10 inclusive on the remaining injectors noting that only new test fluid must be used to replenish the reservoir of the test equipment.**

**Procedure 12 Checking the delivery balance of the fuel distributor**

1. Fit the delivery quantity comparison tester RH 9613 (Bosch Number KDJE 7455).
2. Remove the air intake elbow to reveal the air sensor plate.
3. Apply electrical power to operate the fuel pump and build-up pressure in the system (refer to page B3-27).
4. Bleed the test equipment.
5. This test is carried out under simulated idle, part load, and full load conditions as follows.

**Note** The test equipment rotameter scale may read either ml/min or $cm^3$/min. Whichever scale is used, the flow figures are identical (i.e. 1 ml/min=1 $cm^3$/min).

Idle conditions

6. Press switch number one on the test equipment and move the air flow sensor plate downwards (using the adjusting device shown in figure B3-33) until the reading on the small rotameter indicates a flow of approximately 6,7 ml/min.
7. Test the remaining outlets and determine which one has the lowest fuel delivery.
8. Press the switch of the outlet with the lowest fuel delivery and using the adjusting device, adjust the height of the air flow sensor plate until the reading on the rotameter is 6,7 ml/min.
9. Measure the fuel delivery from each outlet, noting that none of them should exceed 7,7 ml/min.

Part load conditions

10. Repeat Operations 6 to 9 inclusive, moving the air flow sensor plate downwards, until a fuel delivery of 20,8 ml/min is measured (on the large rotameter) from the fuel outlet with the lowest delivery.

11. Measure the fuel delivery from each outlet, noting that it should not exceed 22,4 ml/min.

Full load conditions

12. Repeat Operations 6 to 9 inclusive, moving the air flow sensor plate further downwards, until a fuel delivery of 94 ml/min is measured from the fuel outlet with the lowest delivery.
13. Measure the fuel delivery from each outlet, noting that it should not exceed 99 ml/min.

If the fuel delivery exceeds the limits quoted, a new distributor should be fitted.

**Procedure 13 Checking the engine idle speed**

Refer to Idle speed – To set in the service adjustments section.

**Procedure 14 Checking the operation of the throttle plates**

1. Depress the accelerator pedal fully and observe the position of the throttle levers.
2. Ensure that the throttle levers are fully open (i.e. against the stops).
3. Also, ensure that the throttle linkage operates smoothly through both primary and secondary stages.
4. If the throttles do not open fully, or if the linkage does not operate smoothly, the problem should be investigated and corrected as described in Chapter K.

**Procedure 15 Checking the fuel accumulator diaphragm for a leak**

1. Locate the flexible hose connecting the accumulator to the fuel tank return pipe.
2. Suitably clamp the hose to prevent unpressurized fuel from flowing out during the test.
3. Unscrew the worm drive clip securing the flexible hose to the connection on the fuel accumulator.
4. Withdraw the hose from the connection.
5. Apply electrical power to operate the fuel pump (refer to page B3-27) and pressurize the fuel accumulator.
6. Ensure that no fuel flows from the open connection on the fuel accumulator during the test.
7. If fuel does flow from the open connection, the accumulator diaphragm is leaking and a new fuel accumulator must be fitted.
8. Connect the fuel pipe and remove the clamp.

**Procedure 16 Checking the engine running sensor**

1. Switch on the ignition, the fuel pumps should not operate.
2. Switch off the ignition.
3. Disconnect the battery.
4. Disconnect the engine running sensor electrical plug and socket situated approximately 75 mm (3 in) along the loom from the sensor.
5. Produce a fused test lead with an appropriate 'TTS' type connection on each end. Bridge the white/pink and pink on the vehicle loom socket (ensure that the connections are insulated).
6. Connect the battery, noting that the fuel pump operates.

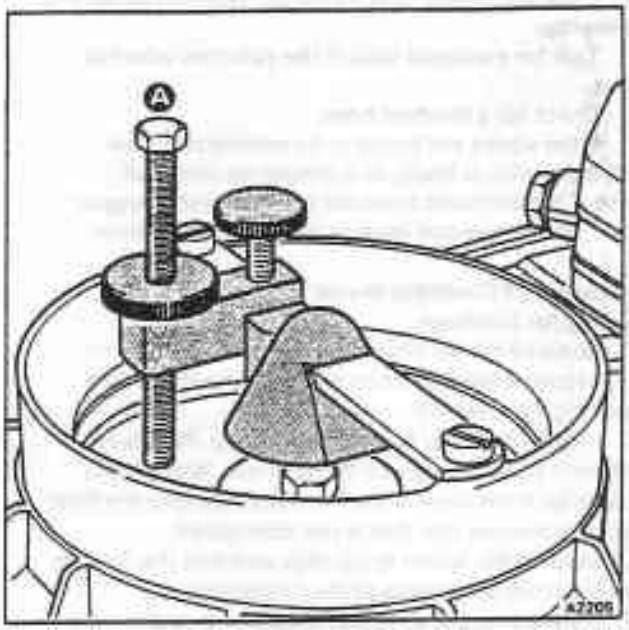



**Fig. B3-33 Air flow sensor plate movement adjustment device**
A Adjusting screw (part of accessory kit RH 9960)

This test isolates the engine running sensor from the fuel pump circuit.

If the fuel pump still does not operate, check for a fault in one of the following.

a. The pink cable to the vehicle loom socket via fuse B5 F2.
b. The white/pink cable to the main fuel pump.
c. The fuel pump.

7. Disconect the battery, remove the bridging cable and reconnect the engine running sensor. Connect the battery.

Apply electrical power to operate the fuel pump (refer to page B3-27).

If the fuel pumps do not operate, check for a fault in the following.

a. The brown/black cable from the starter relay to the loom socket.
b. Check for continuity of the white/black cable.

Normally, a symptom of a fault in this supply is that the engine will start when cranked by the starter motor but stops immediately the key is released.

If the fault diagnosis indicates that the loom and ancillary components are satisfactory, fit a new engine running sensor.

**Procedure 17 Checking the operation of the idle speed by-pass solenoid**

1. Ensure that the parking brake is applied. Warm-up the engine.
2. Allow the engine to idle at 580 rev/min in park with the air conditioning system switched on.
3. Apply the foot brake and engage drive. Check that the idle speed is between 560 rev/min and 620 rev/min.

If the idle speed falls below 560 rev/min check the following.

a. Test for electrical feed to the solenoid when in drive.

b. Check for a blocked hose.

If the above are found to be satisfactory, the solenoid valve is faulty and should be replaced.

**Note** This solenoid does not operate with the gear range selector lever in the reverse position.

**Procedure 18 Checking the air intake filter and ducting for blockage**

1. Remove the air filter element.
2. Examine the condition of the element and fit a new one if necessary.
3. Inspect the filter housing assembly. Particular attention should be given to the intake 'scoop' that diverts air from behind the front bumper into the filter housing; ensure that this is not obstructed.
4. Slacken the worm drive clips and free the flexible ducting from either side of the turbocharger.

Ensure that the air intake elbow and ducting are not blocked.

5. Spin the turbocharger to ensure that the blades of the assembly rotate freely.
6. Carry out the tests given in the Workshop procedures 4 and 14.
7. Fit all hoses, clips, and the filter element upon satisfactory completion of the tests.

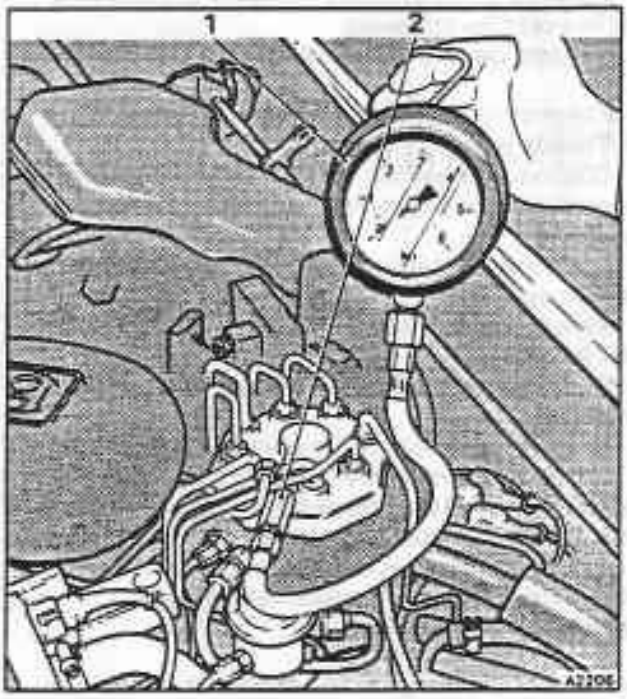



**Fig. B3-34 Pressure tester equipment – testing for leaks or primary system pressure**

1 Pressure gauge assembly RH 9612 or RH 9873
2 Special adapter RH 9881

**Fault diagnosis test equipment and special procedures**

This section contains information relating to the fitting procedures for the test equipment used when diagnosing a fault. Also included are the special procedures associated with the fuel injection system.

**Depressurizing the fuel system**

The fuel in the system may be pressurized (except for the fuel tank and return lines). Therefore, unless the engine has been stationary for a minimum of four hours, it is recommended that the fuel system be depressurized before dismantling any parts of the system.

The depressurizing procedure is given on page B3-12.

**Fuel injection system – pressure tester**

The pressure tester equipment (see figs. B3-34 and B3-35) should be connected into the cold start injector feed line, on top of the fuel distributor or the lower differential pressure valve tapping point.

With the gauge connected at these points, the fuel system can be checked for.

a. Fuel system leakage either internal or external (see fig. B3-34).

b. Primary system fuel pressure (see fig. B3-34).

c. Differential fuel pressure (see fig. B3-35).

Installation of the test equipment

1. Carry out the usual workshop safety precautions.
2. Switch on the ignition. Ensure that the gear range selector is in the park position. Switch off the ignition and withdraw the gear range selector fuse (A6) from fuseboard F2.
3. Disconnect the battery.
4. Depressurize the fuel system.
5. The pressure gauge may now be connected to the fuel distributor as shown in either figure B3-34 or B3-35. Ensure that all pipe nuts and unions are tight.

Bleeding the test equipment

After fitting, but prior to using the test equipment, always ensure that it is properly bled as follows.

6. Remove the electrical connection from the auxiliary air valve.
7. Apply electrical power to operate the fuel pump (refer to page B3-27).
8. Allow the gauge to hang down under its own weight with the flexible hose fully extended, for a few seconds.
9. Lift up the gauge and suspend it from a suitable point.
10. The pressure tester equipment is now ready for use.

**Fuel delivery quantity comparison tester**

If there is any discrepancy in the quantity of fuel delivered by the individual fuel distributor outlets, it can be measured by a comparison test, using the test equipment RH 9613 (Bosch Number KDJE 7455), refer to figure B3-37.

The test equipment is designed in such a way that the tests can be carried out without removing the fuel distributor from the engine.

Ideally, the tester should be set permanently on a mobile trolley, so that once it is levelled-up, only the trolley needs to be manoeuvred to the test site. However, the tester can be set up on a table close to the test vehicle and the test equipment is levelled-up for each test using the levelling screws and spirit level.

The test equipment should be fitted to the vehicle as follows.

1. Disconnect the battery.
2. Unscrew the unions securing the fuel injector lines to the fuel distributor outlets.
3. Screw the special adapters supplied with accessory kit RH 9960 into the fuel distributor outlets.
4. Fit the automatic couplings fastened on the ends of the test equipment to the special adapters in the fuel distributor outlets.

**Note** Outlet one from the fuel distributor should always be nearest to the fuel inlet connection. Figure B3-36 indicates which test line and switch of the test equipment are connected to which engine cylinder.

5. Route the fuel return pipe across the engine, along the side of the car and into the filler for the fuel tank.
6. Disconnect the electrical plug from the auxiliary air valve.
7. Connect the battery.

**Note** The condition of the battery is critical for this test. Therefore, always check the state of charge of the battery.

8. Apply electrical power to operate the fuel pump (refer to page B3-27).
9. To bleed the test equipment, remove the air intake ducting from the mixture control unit and push the air flow sensor plate downwards to its fully opened position. Press each key on the flowmeter one after the other, whilst simultaneously operating the three-way tap. Continue this operation until there are no bubbles in the two rotameters.
10. Allow the air sensor plate to return to the zero position. The test equipment is now ready for use.
11. To remove the test equipment, depressurize the system and reverse the procedure.

**Apply control pressure to the system**

1. Withdraw the starter inhibit relay (see fig. B3-38).
2. Produce a bridge cable of suitable length.
3. Bridge the green cable in the windscreen washer reservoir motor and the white/pink cable connection on the starter inhibit relay mounting block.
4. Switch on the ignition.
5. The fuel pump will run and pressure will build-up in the system.
6. Always remove the bridging cable immediately the test is complete.

**Apply electrical power to operate the fuel pump and build-up pressure in the system**

1. Carry out the operations listed under the heading, Apply control pressure to the system.

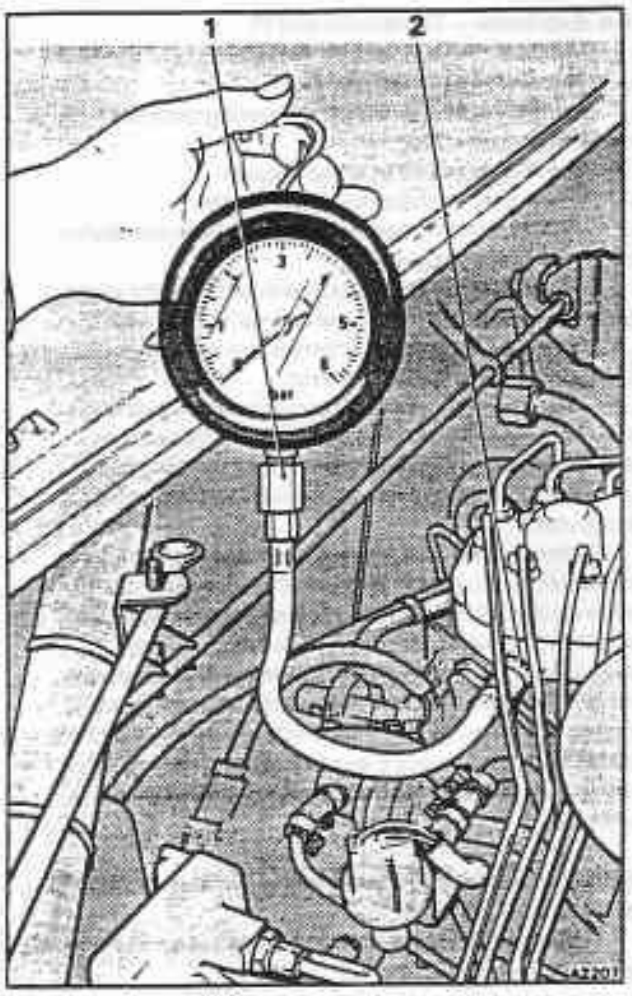



**Fig. B3-35 Pressure tester equipment – testing differential (lower chamber) pressure**
1 Pressure gauge assembly RH 9612 or RH 9873
2 Special adapter RH 9881

Apply control pressure to the system.

**Apply electrical power to the heater in the auxiliary air valve**

1. Carry out the operations listed under the heading, Apply control pressure to the system.

## Removal and fitting of components

Before dismantling any connections and removing any components always depressurize the system. Always blank off any open connections to prevent the ingress of dirt.

**Mixture control unit** (see figs. B3-39 and B3-40)

The mixture control unit comprises the air meter and the fuel distributor.

The fuel distributor can be removed separately from the mixture control unit, however, in the process of general dismantling the components would be removed as one assembly.

**Fuel distributor – To remove and fit**

1. Disconnect the battery and depressurize the fuel system (refer to page B3-12).
2. Unscrew and remove the following connections on the fuel distributor.
a. Fuel supply to the fuel distributor.
b. Fuel supply to the cold start injector.
c. Small diameter pipe between the fuel distributor and the pressure regulator.
3. Unscrew the unions from both ends of the eight injector pipes and carefully withdraw the pipes.
4. Using a screwdriver, unscrew the securing screws situated on top of the distributor.
5. Lift the fuel distributor from the mixture control unit and collect the rubber sealing ring (resistance will be encountered due to the rubber sealing ring).
6. Do not remove the control piston from the fuel distributor.
7. Fit the fuel distributor by reversing the removal procedure, noting that the rubber sealing ring fitted in between the fuel distributor and mixture control unit must be in good condition. If in doubt, fit a new sealing ring. When installing the sealing ring ensure that it is lubricated with a suitable grease and that it does not become trapped when the fuel distributor is fitted. This could cause a subsequent air leak which may be difficult to detect. Check the idle mixture strength.

**Mixture control unit assembly – To remove and fit**

(see figs. B3-39 and B3-40)

1. Disconnect the battery and depressurize the fuel system (refer to page B3-12).
2. Unscrew the worm drive clips securing the air intake hose to the cast elbow. Free the joint.
3. Unscrew the worm drive clips securing the dump valve flexible hose to the return pipe. Free the joint.
4. Free the small diameter pipes to the dump valve.
5. Unscrew the two nuts retaining the long reach studs to the mixture control unit.
6. Withdraw the intake elbow.
7. Disconnect the electrical plug to the auxiliary air valve.
8. Unscrew the worm drive clips and free the two hoses to the auxiliary air valve and the smaller diameter hose to the rear of the idle speed control solenoid.
9. Unscrew the injector pipe nuts from on top of the fuel distributor. Free the pipes.
10. Unscrew and remove the following connections on the fuel distributor.
a. Fuel supply to fuel distributor.
b. Fuel supply to cold start injector.
c. Small diameter pipe between the fuel distributor and the pressure regulator.
11. Unscrew the pipe nut securing the fuel return pipe to the bottom of the pressure regulator.
12. Unscrew the setscrew clamping the fuel pipes to the bracket at the rear of the mixture control unit.
13. Unscrew the two mounting setscrews, one at the front and one at the rear of the unit.
14. Detach the electrical cables to.
a. The electro-hydraulic actuator.
b. The air flow sensor potentiometer.
c. The dump valve solenoid valve.
d. The dump valve vacuum switch.
15. Free the small diameter signal hoses to the solenoid and vacuum switch.
16. Unscrew the rear mounting nut (situated under the dump valve solenoid) and the front mounting setscrew (situated under the dump valve).
17. Carefully lift the assembly from the engine with the ancillary units still attached.
18. Remove the upper section of the mixture control unit from the lower half (air outlet duct) by unscrewing the cap nuts situated around the face joint.
19. Fit the assembly by reversing the procedure given for removal, noting that the face joint between the two halves of the assembly should be clean and coated with Wellseal.
20. Ensure that any rubber sealing rings that have been disturbed are in good condition.

**Note** Whenever a hose or an electrical plug is disconnected, it is advisable to attach an identification label to facilitate assembly.
In addition any open connections should be blanked as soon as possible to prevent the ingress of dirt.

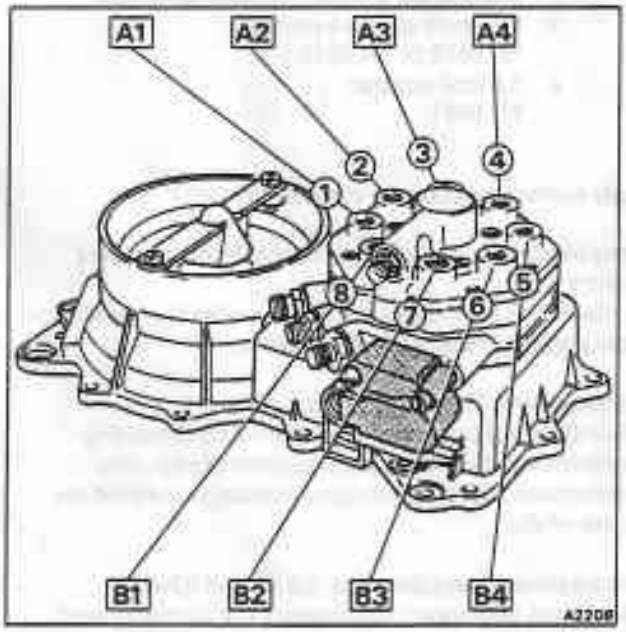



**Fig. B3-36 Fuel distributor connections**
○ Key number on test equipment (left to right)
□ Engine cylinder

**Throttle body – To service**

To remove, fit, and overhaul the throttle body refer to Chapter K.

**Auxiliary air valve – To remove and fit**

(see figs. B3-1 and B3-12)

1. Disconnect the electrical plug.

2. Unscrew the worm drive clips securing both of the rubber hoses.
3. Unscrew the two mounting setscrews.
4. Withdraw the auxiliary air valve.
5. Fit the auxiliary air valve by reversing the removal procedure.

**Cold start injector – To remove and fit**
(see figs. B3-7 and B3-39)
1. Disconnect the battery and depressurize the fuel system (refer to page B3-12).
2. Detach the electrical plug from the cold start injector.
3. Unscrew the union connecting the fuel feed pipe to the injector.
4. Unscrew the two small setscrews retaining the injector in position. Collect the washer from each setscrew.
5. Withdraw the injector and collect the rubber sealing ring.
6. To fit the cold start injector reverse the procedure given for removal.

**Thermal time switch – To remove and fit**
(see fig. B3-13)
1. Disconnect the battery and remove the electrical plug from the thermal time switch.
2. Drain the engine coolant (refer to Workshop Manual TSD 4700, Chapter L).
3. Locate the brass thermal time switch (the forward switch on the inside of the thermostat housing).
4. Detach the electrical plug and carefully unscrew the switch.
5. Fit the switch by reversing the procedure, noting the following.
   Always fit a new aluminium sealing washer.
   Always coat the threads of the switch with a suitable sealant (e.g. Loctite 572).
   Do not overtighten the switch.

**Injector – To remove and fit** (see figs. B3-6 and B3-39)
There are eight injectors fitted to the engine one for each cylinder. The removal and fitting procedure given below is for one injector but the instructions apply equally to all of the injectors.
1. Disconnect the battery and depressurize the fuel system (refer to page B3-12).
2. Free the loom rail from the respective side of the engine. Manoeuvre the rail away to gain access to the injectors.
3. Unscrew the union connecting the fuel line to the injector.
4. Unscrew the two setscrews securing the injector retaining plate to the cylinder head.
5. Remove the plate and withdraw the injector.
6. Fit the injectors by reversing the procedure given for removal, noting that the rubber insulating sleeve must be in good condition.

**It is essential to check the spray patterns of the injectors before they are fitted.**

**New injectors must be thoroughly flushed out before they are tested.**

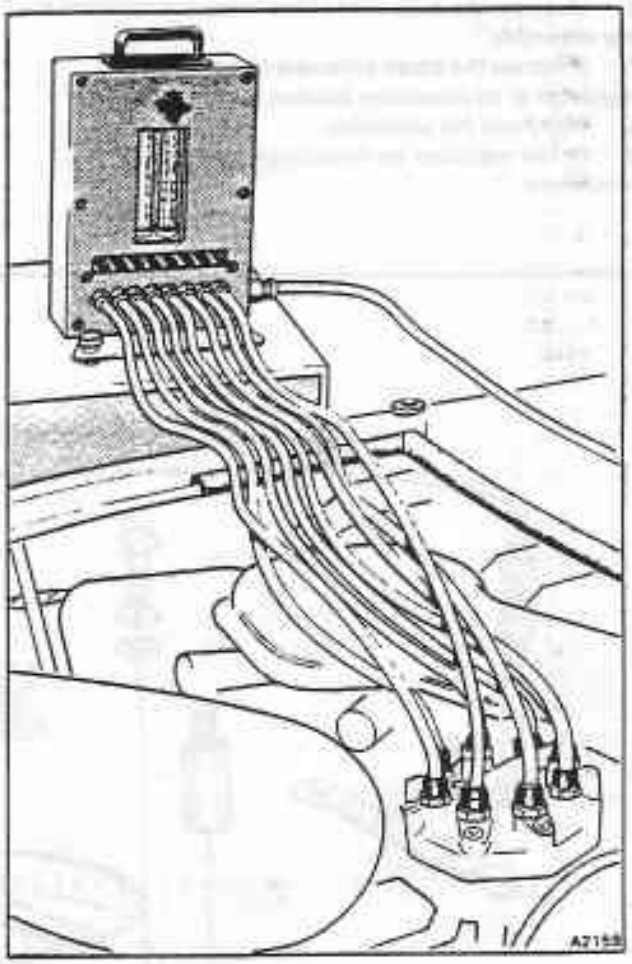


**Fig. B3-37 Installation of comparison tester**
1 Fuel delivery quantity comparison tester RH 9613 (Bosch No. KDJE 7455)
2 Adapters (part of accessory kit RH 9960)

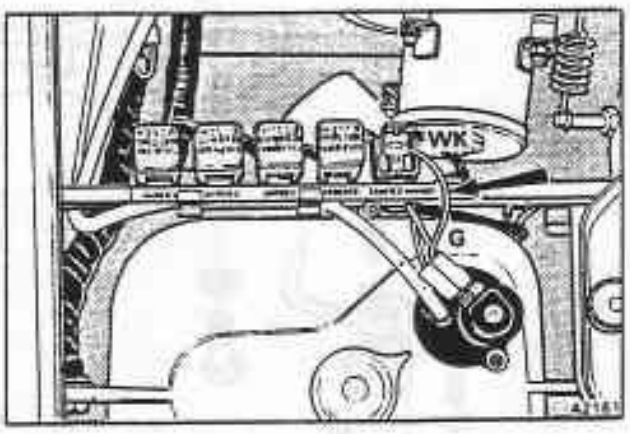



**Fig. B3-38 Bridging the starter inhibit relay**

**Fuel pressure regulator – To remove and fit**
(see figs. B3-1 and B3-9)
1. Disconnect the battery.
2. Depressurize the fuel system (refer to page B3-12).

3. Unscrew the pipe nuts of the three connections to the assembly.
4. Unscrew the small setscrew retaining the regulator to its mounting bracket.
5. Withdraw the assembly.
6. Fit the regulator by reversing the removal procedure.

**Electro-hydraulic actuator – To remove and fit**
(see figs. B3-17 and B3-41)
1. Disconnect the battery.
2. Depressurize the fuel system (refer to page B3-12).
3. Remove the fuel pressure regulator.
4. Unscrew the two special (non-magnetic) retaining

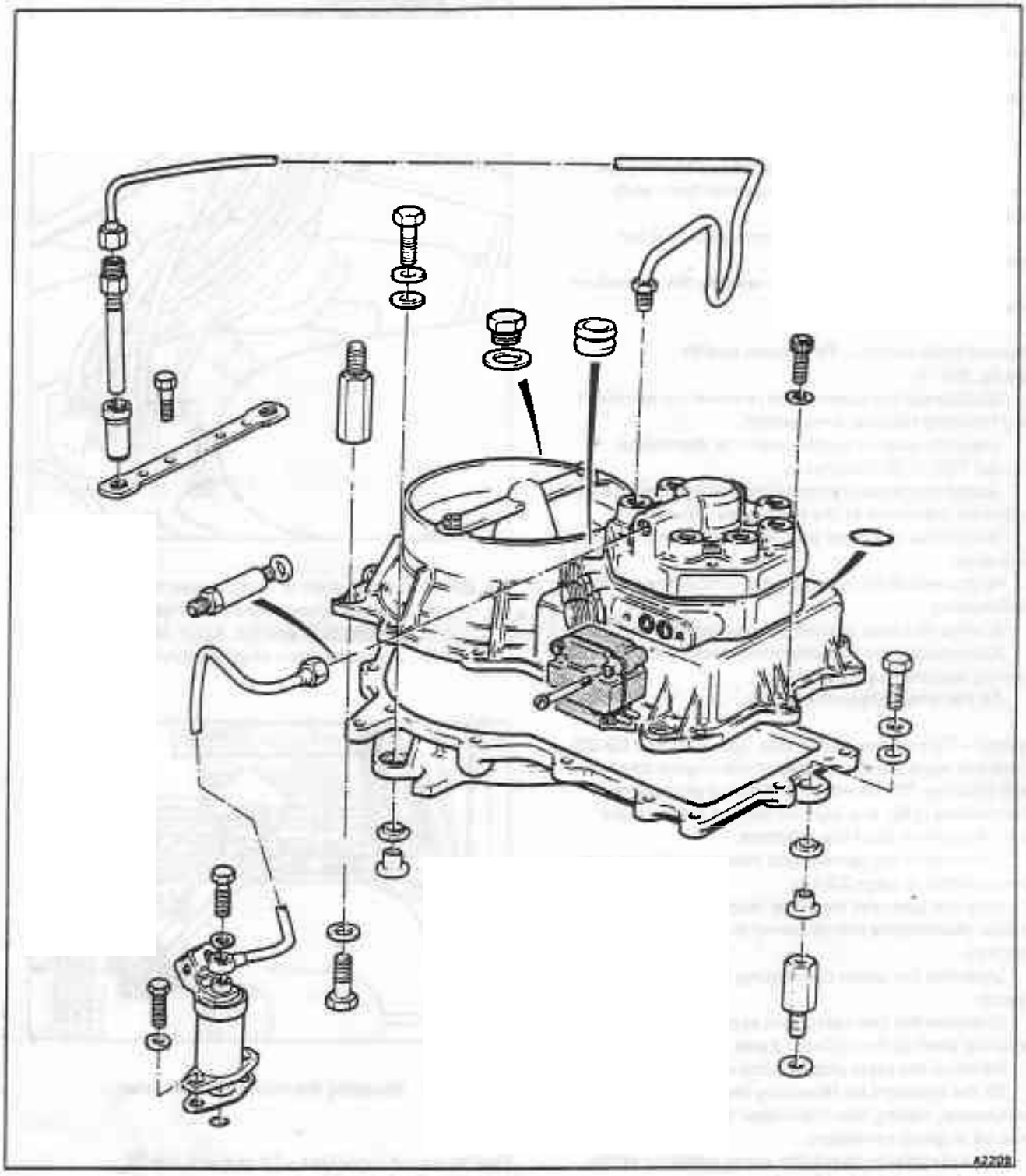



Fig. B3-39 Fuel distributor and associated components

screws and withdraw the actuator.

5. Fit the actuator by reversing the removal procedure, noting the following.

Always ensure that the rubber sealing rings are in good condition.

Always use the special non-magnetic screws to secure the actuator in position.

**Engine running sensor – To remove and fit**

1. Disconnect the battery.
2. Locate the main fuseboard, the engine running sensor is located directly behind the fuseboard on the right-hand side.
3. Follow the cables that emerge from the top of the assembly, to the cable connector situated

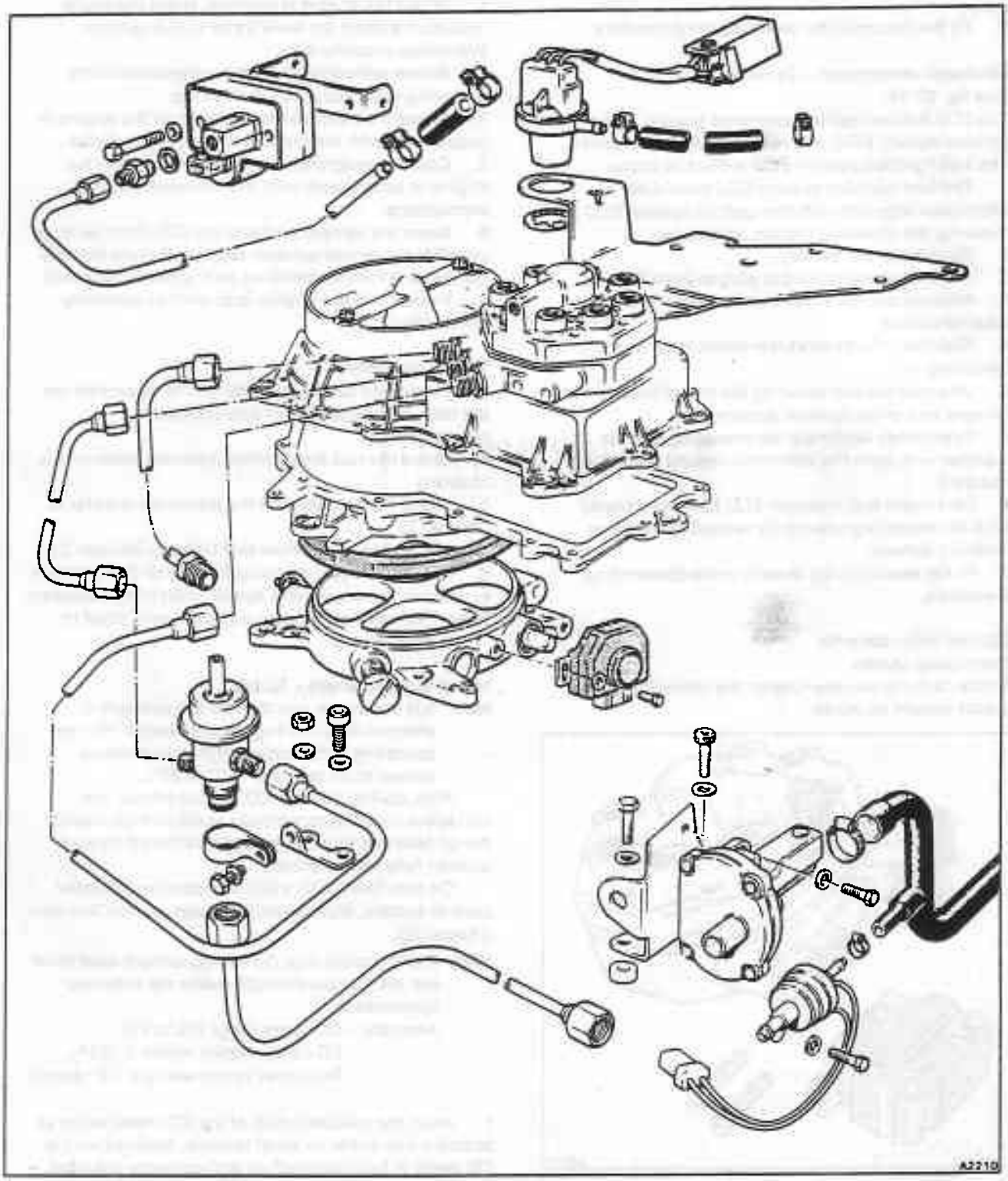



**Fig. B3-40 Fuel distributor and associated components**

approximately 50,8 mm (2 in) from the sensor.
Disconnect the cables at this junction.
4. Withdraw the relays and mounting block situated directly in line with the engine running sensor.
5. Working from behind the assembly, unscrew the two securing nuts.
6. Withdraw the two long mounting setscrews.
7. Carefully manoeuvre the engine running sensor free.
8. Fit the assembly by reversing the procedure.

**Electronic control unit – To remove and fit**
(see fig. B3-18)
The ECU is mounted on a common bracket with the ignition system ECU, above the right-hand footwell. The fuel injection system ECU is black in colour.
The fuel injection system ECU should be withdrawn together with the ignition system ECU by removing the mounting bracket, as follows.
1. Disconnect the battery.
2. Disconnect the multi-pin plug to each ECU.
3. Remove the two screws at the rear of the mounting plate.
4. Withdraw the bracket rearwards from its front mounting clip.
5. Unscrew the clip securing the signal hose to the forward end of the ignition system ECU.
6. Completely withdraw the mounting bracket together with both the electronic control units still attached.
7. Detach the fuel injection ECU (coloured black) from the mounting bracket by removing the three retaining screws.
8. Fit the assembly by reversing the dismantling procedure.

## Service adjustments

**Preliminary checks**
Before carrying out any tuning, the following basic checks should be made.

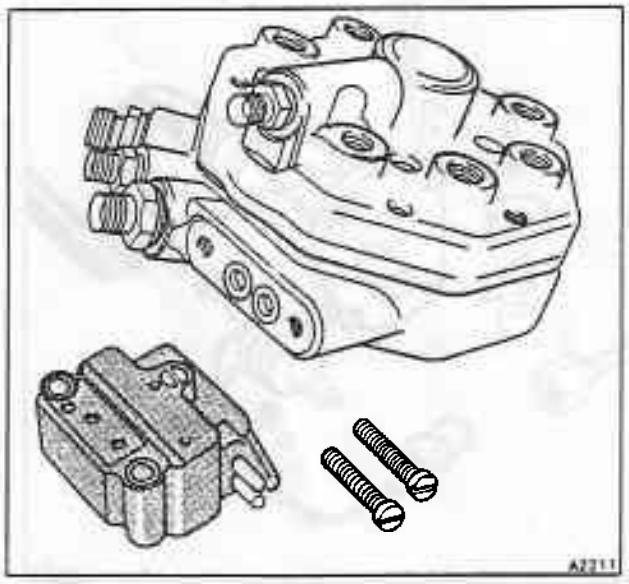



**Fig. B3-41 Electro-hydraulic actuator – removed**

a. Check the condition of the sparking plugs.
b. Ensure that the throttle linkage is correctly set (refer to Chapter K).
c. Ensure that the throttle position switch is correctly set (refer to Chapter K).
d. Check all air hose connections for tightness.
e. Start the engine and visually check the fuel system for leaks.
f. Whilst the engine is running, check the entire induction system for leaks (refer to this section, Workshop procedure 2).
Before undertaking the tuning procedure the following work should be carried out.
1. Connect an impulse tachometer to the engine in accordance with the manufacturer's instructions.
2. Connect an ignition stroboscopic lamp to the engine in accordance with the manufacturer's instructions.
3. Insert the sample probe of the CO meter as far as possible into either exhaust tailpipe. Ensure that the CO meter is fully warmed-up and correctly adjusted.
4. Ensure that the engine is at normal operating temperature.

**Tuning procedure**
If the complete tuning procedure is to be carried out the following sequence of operations is recommended.
a. Check the fuel and ignition systems (refer to this chapter).
b. Check the operation of the dump valve (refer to Chapter D).
c. *Check the purge flow rate (refer to Chapter G).
d. Check the mixture strength (refer to this chapter).
e. Check the engine idle speed (refer to this chapter).
**Note** The asterisk denotes a system only fitted to certain cars.

**Idle mixture strength – To set**
**Note** It is important that the idle CO strength is checked with the engine stabilized at normal operating temperature and in an ambient temperature range of 15°C to 30°C.
Also, during any idle CO measurement, the crankcase must be completely sealed which means the oil filler cap **must be closed** and the oil dipstick pushed fully into position.
On cars fitted with a fuel evaporative emission control system, disconnect the purge control line (see Chapter G).
**Note** It is important that the test equipment used to set the idle mixture strength meets the following specification.
Accuracy – CO meter range 0% to 2%
CO concentration within ± 0·1%
Rotational speed within ± 10 rev/min.

1. Insert the sample probe of the CO meter as far as possible into either exhaust tailpipe. Ensure that the CO meter is fully warmed-up and correctly adjusted.
2. Set the engine speed to 580 rev/min (air conditioning system switched on) using the idle by-

pass screw (see fig. B3-11).

**Note** To avoid rev/min fluctuations due to the air conditioning compressor cycling in and out; it is permissible to bridge out the system thermostatic switch located in the evaporator by using a length of cable and suitable connectors.

Ensure that the air conditioning function switch is set to high and both temperature selectors are on full cold. Open all windows/doors. **Only keep the thermostat bridged for a maximum of 10 minutes, then remove the bridge for at least five minutes.**

**Do not forget to remove the bridge cable when the CO has been set.**

3. Check that the CO concentration is within the range 0.8% to 1.0%.
4. If the CO reading is outside the specified limits, remove the tamperproof plug and blanking screw from the fuel metering unit (see fig. B3-42).
5. Insert the mixture adjusting tool RH 9608 and adjust the mixture strength as follows.

Turn the mixture adjusting tool clockwise to richen the mixture (increase CO%) or anti-clockwise to weaken the mixture (reduce CO%).

**Note** Always approach the final setting from the lean/weak side.

After making an adjustment, remove the adjusting tool and replace the blanking screw. **Failure to replace this screw will result in an incorrect CO measurement.**

6. If necessary reset the idle speed to 580 rev/min using the idle by-pass screw. Briefly accelerate the engine and re-check the idle CO% reading.

Repeat Operations 5 and 6 until the correct CO% reading is achieved.

When correctly set, remove the sample probe and fit a new tamperproof plug to the fuel metering unit.

Connect the purge line if applicable.

**Note** Accurate setting of the idle CO is critical to ensure satisfactory engine performance.

Because of this, it is recommended that a final idle speed and CO check is carried out immediately after road testing the motor car. This is always the best time to take accurate CO readings.

**Idle speed – To set**

**Note** It is important that the test equipment used to set the idle speed meets the following specification. Accuracy – Rotational speed within ± 10 rev/min.

1. To set the idle speed, ensure that the engine has stabilized at its normal operating temperature. This can be achieved by allowing the engine to run at idle speed for at least 15 minutes after the thermostat has opened. The opening of the thermostat can be detected by a sudden rise in the temperature of the thermostat elbow pipe.
2. If a fuel evaporative emission control system is fitted, disconnect the purge line at the restrictor, leave the restrictor fitted into the hose to the engine (refer to Chapter G).
3. Ensure that the gear range selector lever is in the park position.
4. Ensure that the automatic air conditioning system is switched off.
5. Open the engine oil filler. Set the engine idle speed to 580 rev/min by turning the adjustment screw situated on the side of the throttle body (see fig. B3-11).
6. Finally, check the operation of the idle speed solenoid (refer to Workshop procedure 17).
7. Stop the engine and connect all necessary hoses and cables.

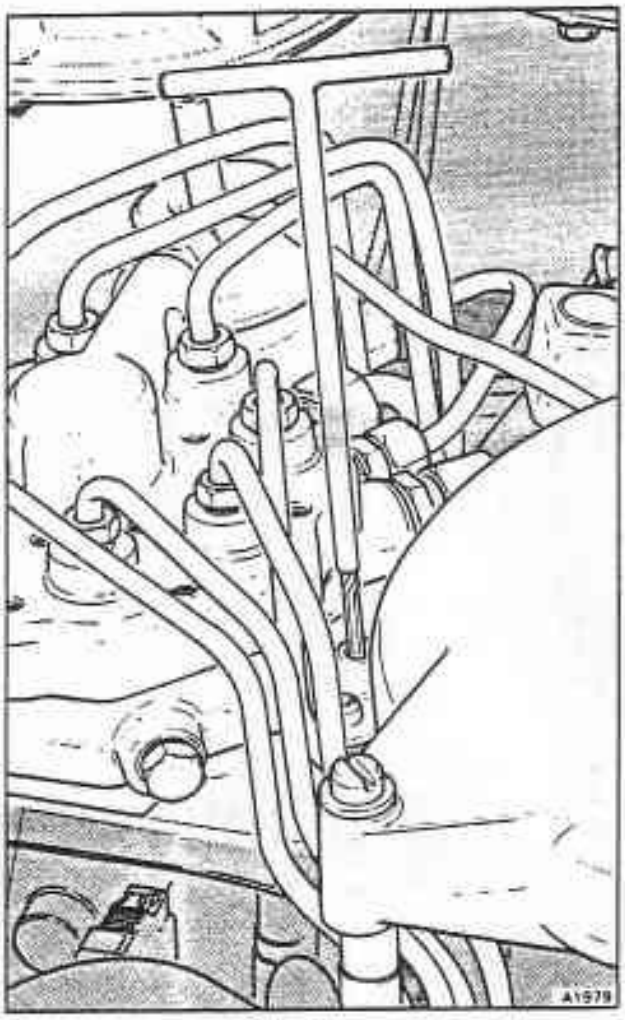


**Fig. B3-42 Adjusting the idle mixture strength**

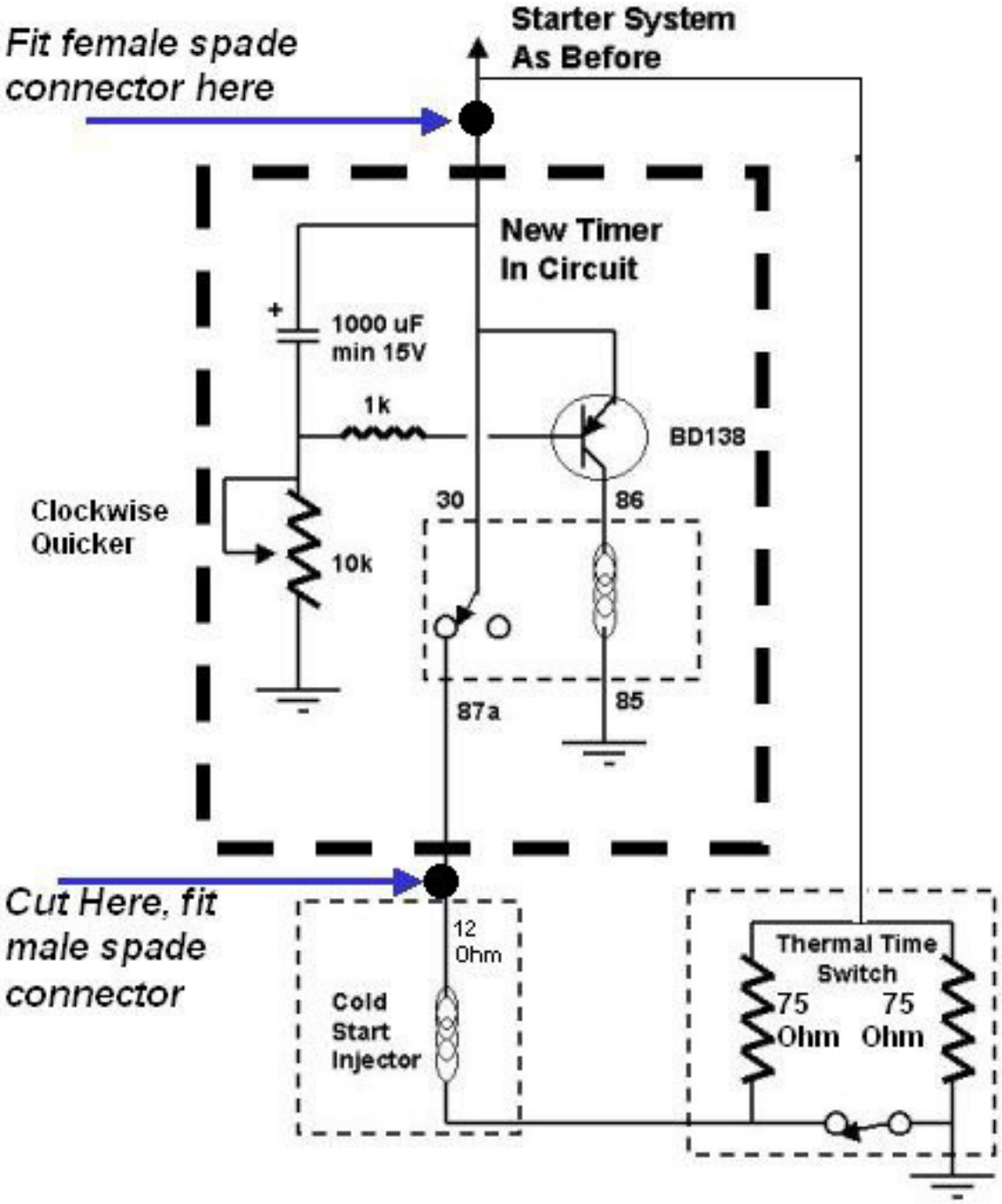
**Tamperproofing**

Tamperproofing of the mixture strength adjusting screw is carried out by screwing a small blanking plug into the mixture strength adjusting screw access hole (see fig. B3-42), above the actual adjusting screw.

A small black plastic plug should then be pressed into position to complete the operation. If the plug is fitted onto the end of a guide rod and then inserted, it will assist in the fitting operation.

# Cold Start Timer Relay

**Additional Timer Relay**
**to Limit Cold Start Injection**




RHT October 2006

# Running changes
# No 1 The fitting of two air pressure transducers

During production of the 1987 model year Bentley Turbo R, a change was introduced to the method of signalling induction manifold pressure to both the fuel injection system ECU and the boost control system ECU.

Originally, the signalling operation was carried out by one air pressure transducer (APT). The unit received a voltage feed from the fuel injection system ECU. Then, dependent upon induction manifold pressure (either positive or negative pressure), it electrically signalled the information primarily to the fuel injection system ECU and also to the boost control system ECU.

A modified crankcase was introduced during production of 1987 model year cars, that resulted in a change of frequency pick-up by the knock sensors, during detonation. This demanded a finer tuned system and therefore, a second identical APT was fitted adjacent to the existing unit (see fig. N2-1).

The fuel injection system and the boost control system now have their own APT which works independently of the other. Each APT receives its voltage feed from its own ECU and dependent upon induction manifold pressure, electrically signals the information back to its respective ECU.

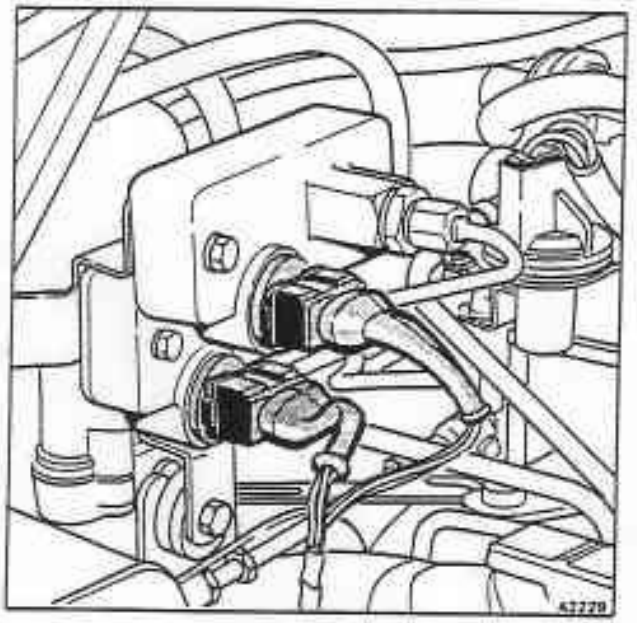


**Fig. N2-1 Air pressure transducers**

# Running changes
# No 2 1988 Model year changes

The information contained within this running change up-dates the manual for 1988 model year cars.

The main changes to the various build specifications affect cars produced to a Swiss or Austrian specification. For the 1988 model year these cars are fitted with a catalytic converter and a power train very similar to that fitted to cars produced to a North American specification. The only differences are that the Swiss and Austrian cars do not have an oxygen sensor warning lamp on the facia. They do however, have a new type of exhaust gas sample tapping (see fig. N3-1) fitted in front of the catalytic converter.

The other change that affects all 1988 model year cars is that the model year identification letter in the vehicle identification number (VIN) has changed. The tenth digit in the VIN of 1988 model year cars is the letter J (e.g. *SCAZS02A6JCX21057*).

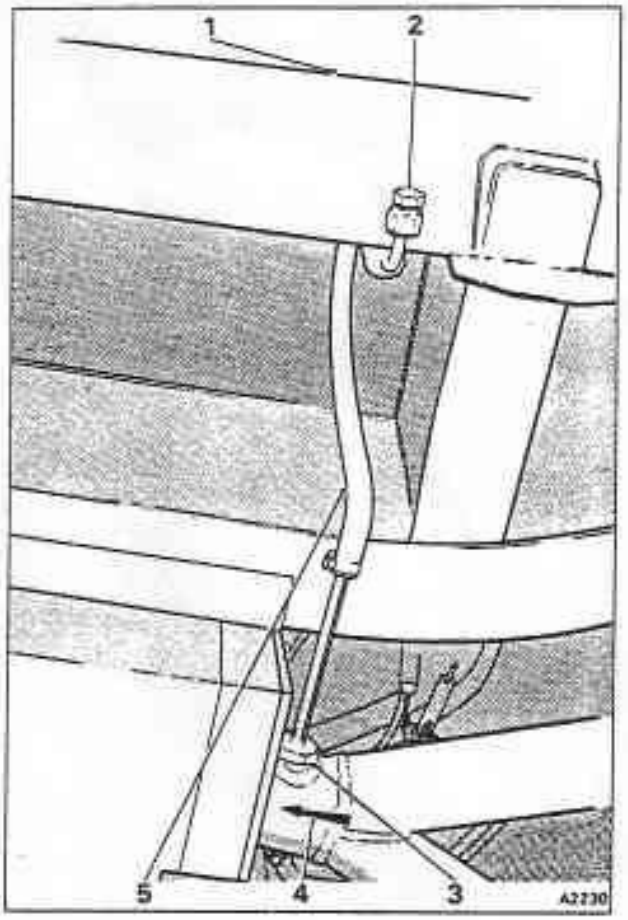



**Fig. N3-1 Exhaust gas sample take-off**

1 Outside edge of vehicle
2 Tube end cap
3 Exhaust adapter
4 Exhaust gas flow into catalytic converter
5 Heat resistant flexible tube