1 Principles of operation

Introduction

1 The following technical description of the Pierburg 2E3 carburettor should be read in conjunction with the more detailed description of carburettor principles in Part A.

Construction

2 The Pierburg 2E3 carburettor is a downdraught progressive twin venturi instrument with a vacuum-controlled secondary throttle **(see illustration)**. The throttle shafts are made of steel, while the throttle plates, all jets and the emulsion tube are manufactured from brass. The internal fuel channels and air passages are drilled and sealed with lead plugs where necessary. The choke system is semi-automatic in operation and acts on the primary venturi alone. The major body components are cast in light alloy.

3 Most versions of the 2E3 carburettor are used in conjunction with an electrical heater fitted to the inlet manifold. The purpose of the heater is to improve atomisation of the air/fuel mixture during the warm-up period. A thermal switch is usually wired to the supply voltage so that the heater is switched off at a pre-determined temperature. Some versions also use a throttle body heater to prevent carburettor icing. Both heaters function on the positive temperature coefficient (PTC) principle. As the temperature rises, the heater resistance also rises. The choke strangler flap is controlled by a bi-metal coil which is heated by both an electrical supply and the engine coolant.

4 From 1988, the 2E3 carburettor fitted to the Ford ICVH engine uses the ESC II ECU and a power relay for finer control of the choke bi-metal coil during warm-up.

Fuel control

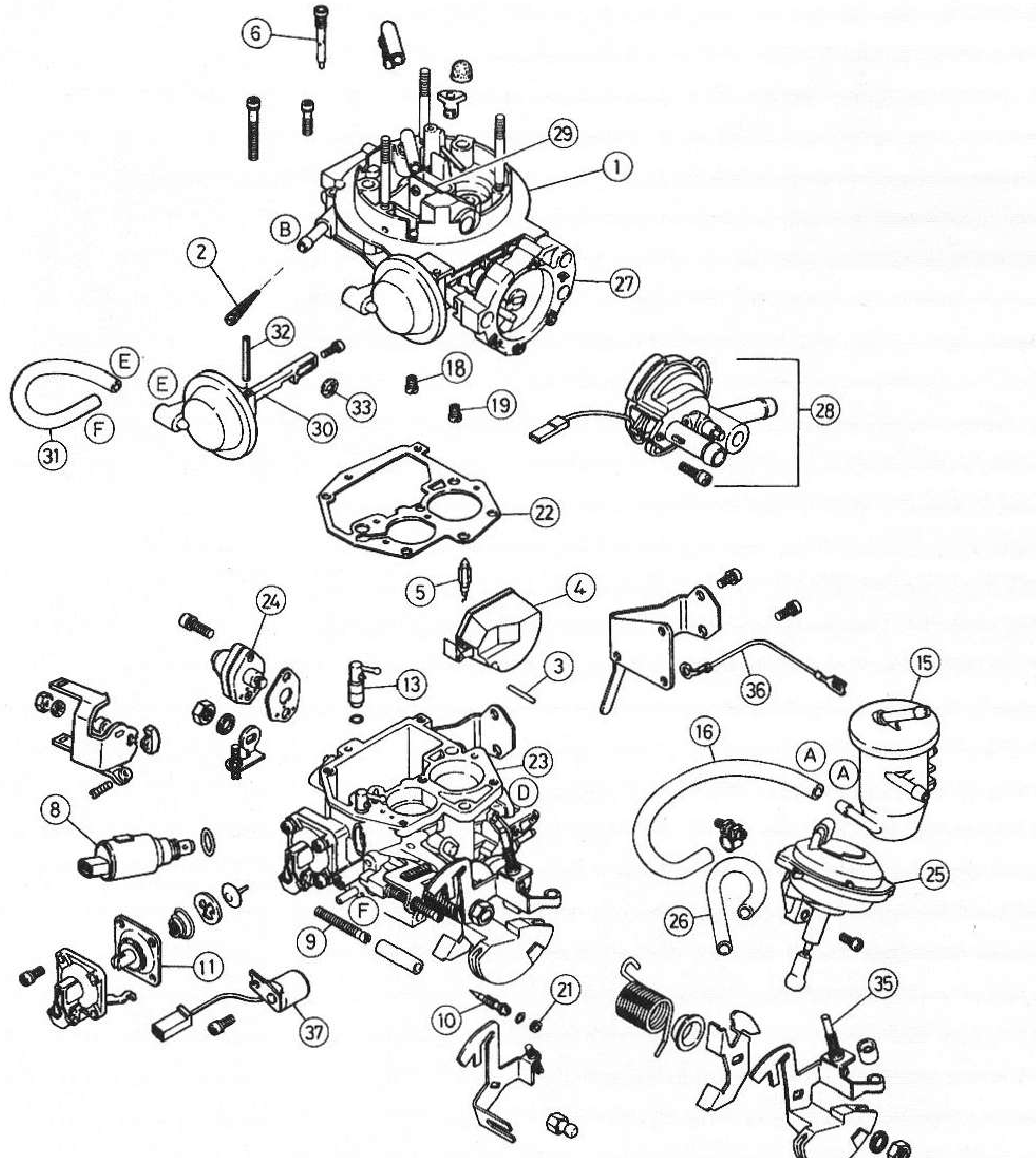
5 Fuel flows into the carburettor through a fine mesh filter located in the fuel inlet connection. The fuel level in the float chamber is controlled by a spring-loaded needle valve and plastic float assembly **(see illustration)**. The float level is considered critical and is set very accurately during production. The float chamber is vented internally into the upper air intake which is on the clean-air side of the air filter. Some variations use a vapour trap to prevent excess vapours and poor starting when the engine is hot. A calibrated fuel return system is provided to ensure that relatively cool fuel is supplied to the carburettor.

Idle, slow running and progression

6 Fuel is drawn from the primary main into the base of a vertical well which down into the fuel. A combined idle emulsion tube and air corrector is placed the well. The fuel is mixed with air, drawn through the calibrated air corrector and holes in the tube, to form an emulsion. resulting mixture is drawn through a chan to be discharged from the idle orifice the primary throttle plate. A tapered mix control screw is used to vary the outlet this ensures fine control of the idle mixt **(see illustration)**.

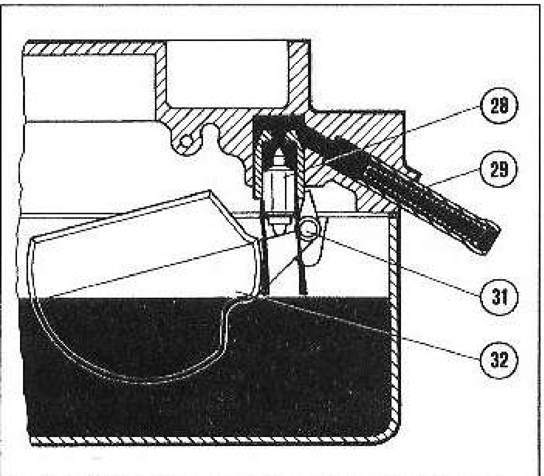
7 A progression slot provides a further contribution to the emulsion while the thro is closed. As the progression slot uncovered by the opening throttle, vacuum draw overcomes the air bleed into slot and a reversal occurs. Fuel is now dr out to add extra enrichment to the idle mix during initial acceleration.

8 The idle speed is set by an adjusta screw. The adjustable mixture screw tamperproofed at production level accordance with emission regulations.



1.2 Pierburg 2E3 carburettor

Upper body
Fuel inlet filter
Float pin
Float
Needle valve
Idle jet - primary
Idle cut-off valve
Idle speed adjustment screw
10 Idle mixture control screw
11 Accelerator pump diaphragm
13 Pump injector
15 Vapour separator
16 Fuel hose
18 Main jet - primary
19 Main jet - secondary
21 Tamperproof cap
22 Float chamber gasket
23 Main body
24 Part-load enrichment valve diaphragm
25 Secondary throttle diaphragm
26 Secondary throttle vacuum hose
27 Choke housing
28 Bi-metal housing assembly
29 Choke flap
30 Choke pull-down diaphragm
31 Choke pull-down hose
32 Roll pin
33 Star clip
35 Fast idle adjustment screw
36 Carburettor earth strap
37 Throttle body heater



1.5 Fuel supply and float arrangement

28 Float needle valve *31 Float pivot pin*
29 Fuel supply inlet *32 Float*

Idle cut-off valve (some variants)

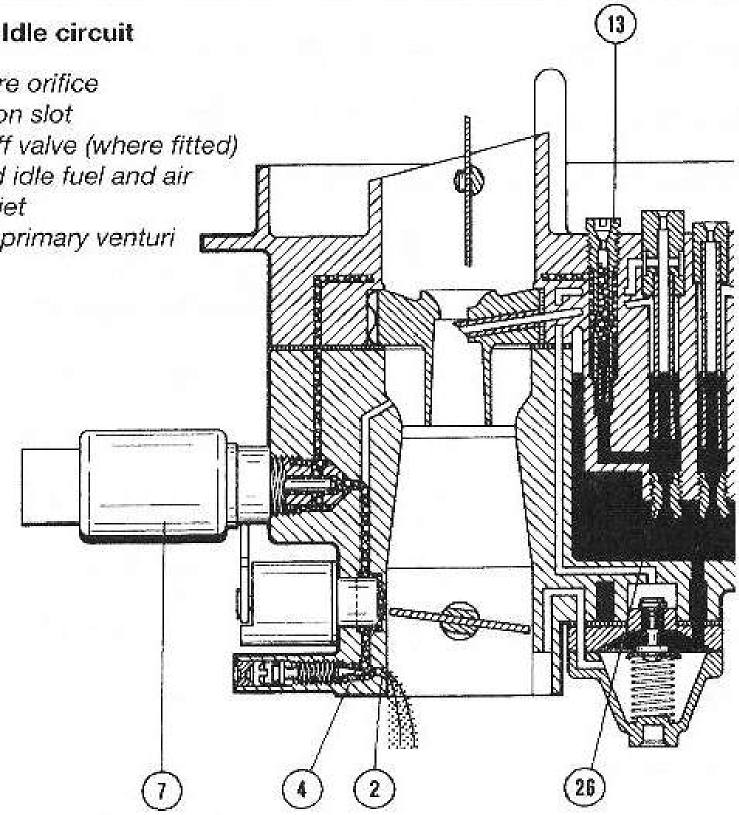
9 An idle cut-off valve is used to prevent run-on when the engine is shut down. It utilises a 12-volt solenoid plunger to block the idle channel when the ignition is switched off.

Accelerator pump

10 The accelerator pump is controlled by a diaphragm and is mechanically-operated by a lever and cam attached to the primary throttle linkage. The outlet valve consists of a ball incorporated into the pump outlet injector. The inlet valve consists of an inlet seal located in a channel from the float chamber. Excess fuel is returned to the float chamber through an additional channel and calibrated bush. The pump is designed to operate only when the throttle is less than half-open and it discharges into the primary venturi **(see illustration)**.

1.6 Idle circuit

2 Idle mixture orifice
4 Progression slot
7 Idle cut-off valve (where fitted)
13 Combined idle fuel and air corrector jet
26 Main jet - primary venturi



Main circuit

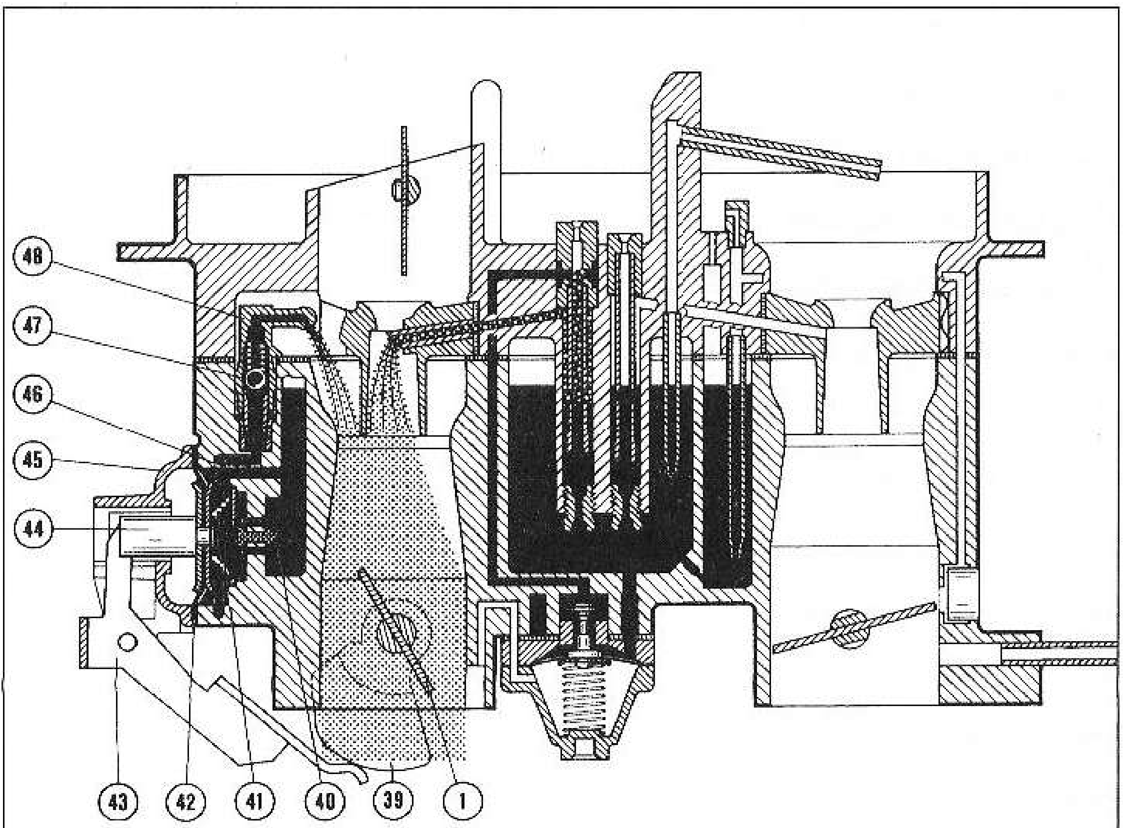
11 The amount of fuel discharged into airstream is controlled by a calibrated m jet. Fuel is drawn through the jet, into the b of a vertical well which dips down into the in the float chamber. A combined emuls tube and air correction jet is placed in well. The fuel is mixed with air, drawn through the calibrated air correction jet the holes in the emulsion tubes, to form air/fuel emulsion. The resulting mixture discharged from the main nozzle through auxiliary venturi into the main airstream.

Part-load enrichment (power valve)

12 Fuel flows from the float chamber into enrichment chamber through a fuel channel air passage is taken from under the thro plate to the cover of the chamber. At idle during light-throttle operation, manifold vacu draws the diaphragm back against spr pressure to close off the enrichment valve the fuel outlet channel. Under acceleration wide-open throttle operation, the vacuum in manifold is depleted. The diaphragm retu under spring pressure and the valve opens fuel channel. This allows fuel to flow through channel and a calibrated bushing supplement the fuel in the upper part of main well. The fuel level rises in the well and fuel mixture is enriched.

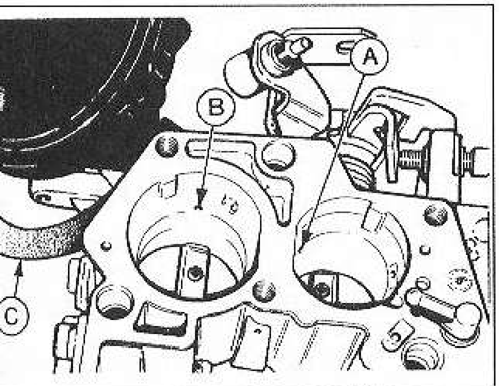
Secondary action

13 A port is located in both primary secondary venturis. Airways run from the ports into a common passage. A vacu hose is connected to the passage and to diaphragm that controls the second throttle plate **(see illustration)**.



1.10 Accelerator pump circuit

1 Throttle plate - primary venturi
39 Accelerator pump cam
40 Suction valve
41 Spring
42 Diaphragm
43 Accelerator pump lever
44 Plunger
45 Pump cover
46 Return jet
47 Outlet (ball) valve
48 Pump injector



1.13 Venturi vacuum sources

A Primary venturi port
B Secondary venturi port
C Vacuum supply pipe

During normal operation at low speeds, y the primary venturi is employed. When e air velocity through the primary venturi ches a certain level, depression acts upon e port to operate the secondary diaphragm d the secondary throttle. Vacuum created in e secondary venturi will further control the e of secondary opening.

The primary linkage is arranged to prevent e secondary plate from opening when the speed may be high but the engine is uising on a light throttle. Secondary action ll not take place until the primary throttle is out half open.

On some variants, a thermal valve is nnected to the vacuum supply hose so that e secondary throttle plate is inoperative ring the engine warm-up period. The valve mains open (low vacuum) when the engine is ld and closes at a pre-determined tempera- re to restore full vacuum to the diaphragm.

7 Once the secondary throttle plate has pened, the action of the secondary main rcuit is similar to that of the primary circuit.

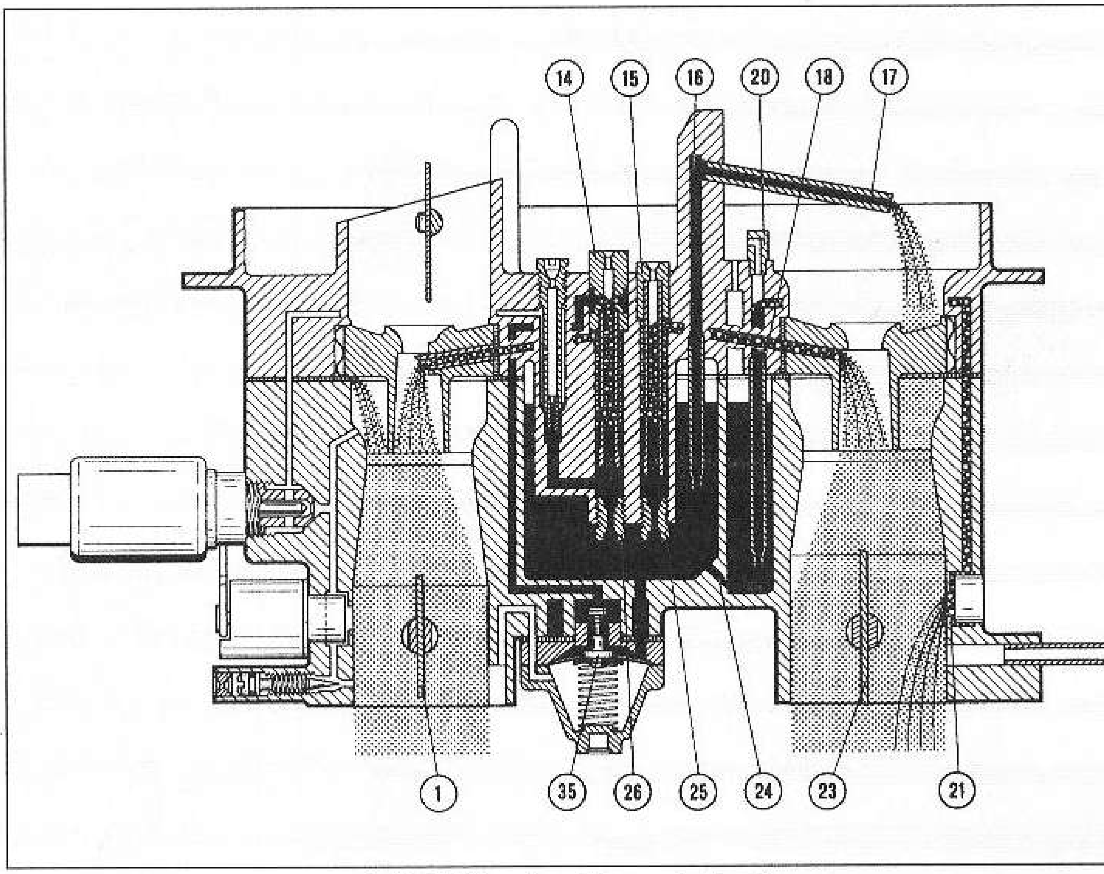
8 A progression jet is used to prevent esitation as the secondary throttle plate tarts to open. Fuel is drawn from the float hamber into the base of a vertical tube which ips down into the fuel. The fuel is mixed with ir drawn in through a calibrated air jet to form n emulsion. The emulsified mixture is ischarged into the secondary venturi, via a rogression slot, at the initial opening of the econdary throttle plate.

Full-load enrichment

19 At full-load and high engine speeds, the elocity of air creates a depression sufficient o raise fuel from the float chamber into the ase of a vertical tube. The fuel then passes hrough a calibrated bushing to the upper ection of the secondary air intake, where it is ischarged into the airstream from the full- oad enrichment nozzle **(see illustration)**.

Cold start system

20 The choke system is semi-automatic in operation and utilises a flap in the primary air ntake. The system is primed by depressing he accelerator pedal once or twice.



1.19 Full-load enrichment circuit

1 Throttle plate - primary venturi
14 Air corrector jet with emulsion tube - primary venturi
15 Air corrector jet with emulsion tube - secondary venturi
16 Calibrated channel for full-load enrichment - secondary venturi
17 Nozzle for full-load enrichment - secondary venturi
18 Emulsion tube for progression fuel - secondary venturi
20 Air bleed for progression fuel - secondar venturi
21 Progression slot - secondary venturi
23 Throttle plate - secondary venturi
24 Fuel drilling
25 Main jet - secondary venturi
26 Main jet - primary venturi
35 Part-load enrichment valve

21 The choke strangler flap is controlled by a combined coolant and electrically-heated bi-metal coil **(see illustration)**.

22 On Ford and VW engines, the electrical supply to the choke is made through a coolant-heated thermal switch.

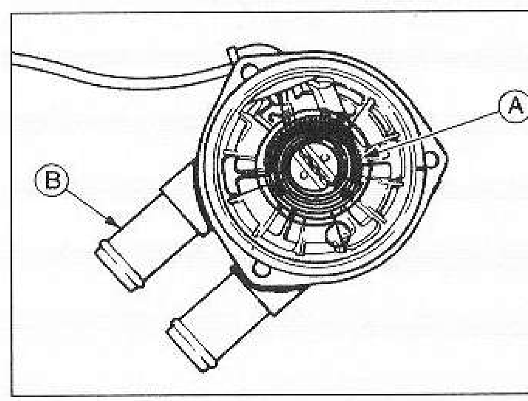
23 The electrical supply initially heats the choke coil after the first start from cold. As coolant passing through the bi-metal water housing warms up, it adds to the heating action applied to the choke spring. The choke flap will thus remain open while the coolant (and engine) remain warm. When the coolant reaches a preset temperature, the thermal switch cuts out the electrical supply (Ford and VW) and the coolant flow remains the only source of choke heating.

24 The choke flap is eccentrically-mounted, so that during cranking it is partially open to prevent an over-rich fuel mixture.

25 Once the engine has fired, the choke flap must open slightly to weaken the mixture and avoid flooding during idle and light-throttle operation. This is achieved by using manifold vacuum to actuate a pull-down diaphragm. A linkage attached to the diaphragm will then pull upon the flap.

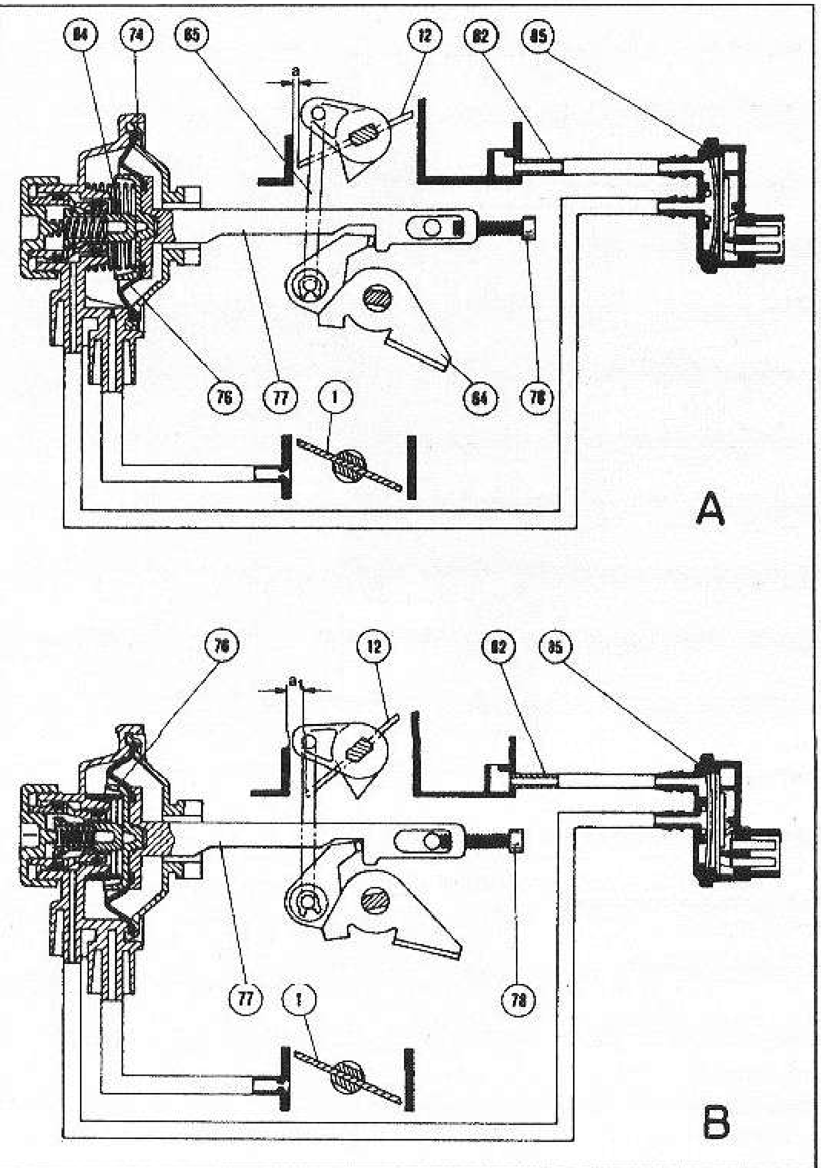
26 On early Ford OHC models, a dire manifold-to-choke vacuum connection wa made via a hose. The connection is mad through the carburettor base.

27 The type of pull-down fitted can mak either a single movement to actuate th diaphragm or may employ a two-stage pu down system. When the two-stage pu down system is used, the vacuum signal relayed through a thermal time valve (TTV



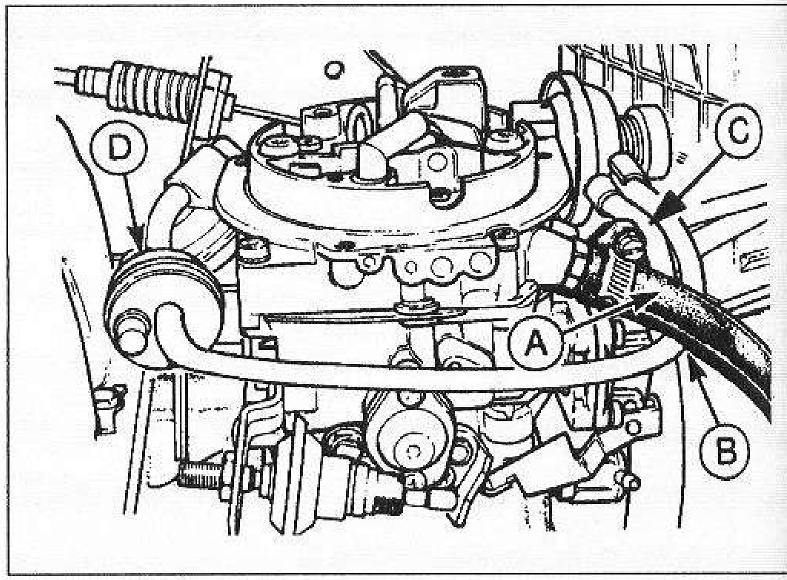
1.21 Bi-metal coil heating sources

A Electric heating coil
B Coolant water housing



1.27a Choke pull-down operation

A Stage 1 pull-down
B Stage 2 pull-down
1 Throttle plate - primary venturi
12 Choke flap
64 Choke lever
65 Choke connecting rod
74 Pull-down assembly
76 Diaphragm
77 Diaphragm rod
78 Pull-down adjustment screw 'a1'
82 Connection to thermal time valve (TTV)
84 Control valve
85 Thermal time valve (TTV)
a Stage 1 pull-down gap
a1 Stage 2 pull-down gap



1.27b Vacuum connection to thermal time valve (TTV)

A Fuel inlet hose
B Hose to TTV
C Hose to vacuum source
D TTV

The TTV is partially open to atmosphere at cold start time. When the engine fires, the vacuum applied to the pull-down diaphragm is low and it will only partially operate to pull-down gap 'a' **(see illustrations)**.

28 After 3 to 5 seconds, the electrically-heated TTV will close the connection to atmosphere and full manifold vacuum is applied to the pull-down diaphragm. The pull-down now fully operates to open the choke flap to gap 'a1'. The two pull-down stages ensure maximum richness for the few seconds after a cold start and then a rapid opening of the choke flap to reduce over-richness.

29 The Ford ICVH engine utilises a T-piece in the hose from the carburettor base to the pull-down diaphragm. The basic method of operation, however, is the same.

30 Some versions may use a thermal valve heated by the engine coolant to accomplish the two pull-down stages. In this instance, the second pull-down will not operate until the coolant temperature rises to over 50°C.

31 Fast idle is achieved with the aid of a stepped cam attached to the choke spindle. An adjustable screw, connected to the throttle lever mechanism and butting against the cam, can be used to vary the fast idle speed. This screw is fitted with a tamperproof cap. As the bi-metal coil is heated and the flap opens, the screw will rest on successively less-stepped parts of the cam. The idle speed is thus progressively reduced, until ultimately the cam is released and the idle speed returns to normal.

De-choke (wide-open kick)

32 If the throttle is opened fully when the engine is cold, the pull-down vacuum will deplete and the choke flap will tend to close. This may cause flooding and to prevent this, a wide-open kick mechanism is employed. When the throttle is opened fully, a cam on the throttle lever will turn the choke lever anti-clockwise to partially open the flap.

Choke relay and vacuum damper

33 This system is used only on the Ford ICVH engine from 1988. The ESC II ECU and a power relay achieve finer control of the choke bi-metal coil during warm-up. The ECU controls the rate at which the choke is opened. Current from the alternator is regularly switched on and off at various frequencies, according to coolant and ambient temperature.

34 The vacuum damper governs the rate throttle closing to reduce emissions. Th damper is operated by solenoid and is als controlled by the ECU.

Throttle damper

35 A throttle damper is fitted to som models, and this slows down the rate throttle closing to reduce exhaust emissions

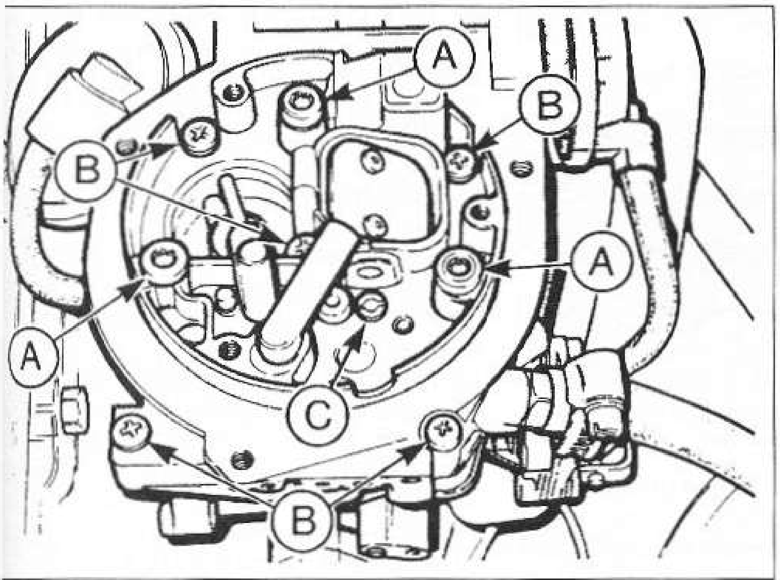
2 Identification

1 Pierburg 2E is stamped upon t carburettor upper and main bodies.

2 The manufacturer's identification code m be stamped on a metallic tag attached to t cover by an upper body fixing screw or on corner of the carburettor upper body. Whe the tag is missing, refer to Part B for oth means of identifying the carburettor.

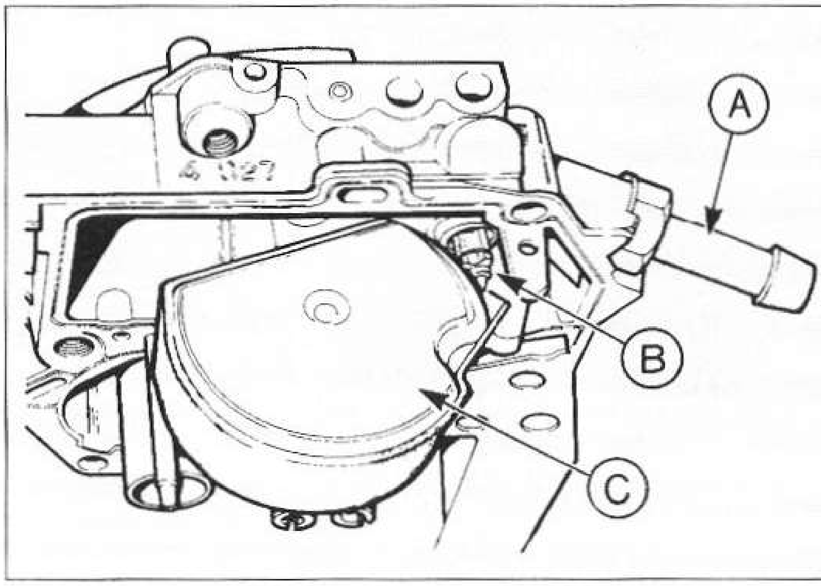
3 The Ford identification code is stamped a corner of the carburettor upper body.

4 Early versions of this carburettor may stamped with the trade name Solex.



3.3 Carburettor securing screws

A Carburettor-to-manifold Torx screws *B Carburettor upper-to-main body fixing screws* *C Idle jet*



3.9 Fuel supply system

A Inlet tube *B Needle valve* *C Float*

3 General servicing

ntroduction

Read this Chapter in conjunction with Part B hich describes some of the operations in ore detail. It is assumed that the carburettor removed for this service. However, many of e operations can be tackled with the rburettor in place. Where this is undertaken, st remove the carburettor upper body and ak the fuel out of the float chamber using a ean tissue or soft cloth.

lodifications - Ford

An idle cut-off valve kit (available from Ford ain agents) can be fitted to the idle circuit here a running-on condition exists. An idle t-off valve is fitted as standard to vehicles th catalytic converters.

ismantling and checking

Remove the carburettor from the engine ee Part B) **(see illustration)**.

Check the carburettor visually for damage nd wear.

Note the location and routing of the choke cuum hoses and disconnect them. Remove e four screws and detach the carburettor per body.

Remove the electrical earth strap (if fitted).

Inspect the float chamber for corrosion and lcium build-up.

Use a straight-edge to check for distorted nges on all facing surfaces.

Tap out the float pin and remove the float, edle valve and float chamber gasket. The edle valve seat is not removable **(see lustration)**.

0 Check that the anti-vibration ball is free in e needle valve end.

11 Check the needle valve tip for wear and ridges. Wear is more likely with the brass needle valve tip than when a viton one is used. Use a viton-tipped replacement when possible.

12 The float should be checked for damage and ingress of petrol. Shaking the float will indicate the presence of fuel inside it.

13 Renew the float pin if it shows signs of wear.

14 Remove the fuel filter from its position in the fuel inlet connection. Clean the filter and renew it if necessary.

15 Remove the mixture screw and inspect the tip for damage and ridges.

16 Remove the four screws and detach the accelerator pump cover, diaphragm, spring and seal assembly. Check the diaphragm for fatigue and damage.

17 The pump injector is a push fit in the body. Carefully prise it from its location and test it by shaking it. No noise from the outlet ball would indicate that the valve is seized.

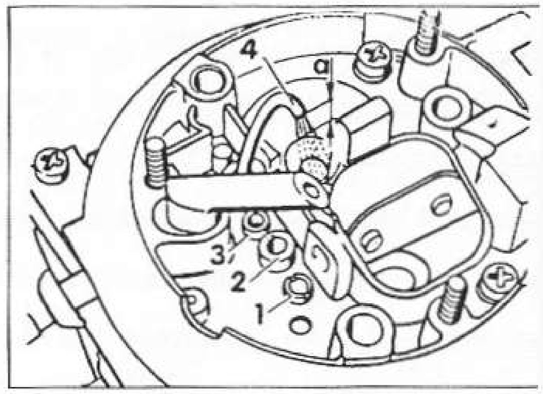
18 Remove the primary idle jet assembly, and both main jets. The primary idle jet can be removed from the carburettor without removing the upper body. It is not possible to remove any of the other jets or emulsion tubes **(see illustrations)**.

19 Check that the channels from the float chamber into the emulsion tube wells are clear.

20 Note the jet sizes and their locations for correct installation during reassembly.

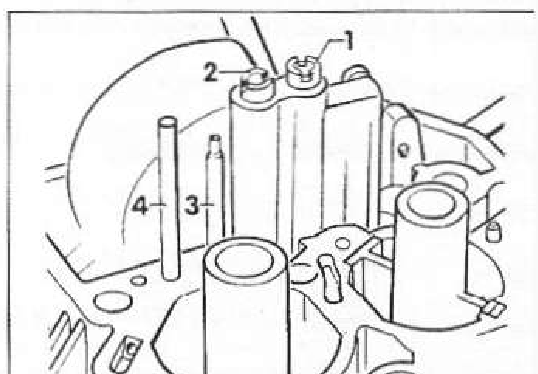
21 Check the jet calibration against that specified. It is possible that the jets may have been transposed (or the wrong size fitted) during the last overhaul.

22 Remove the two screws and detach the power valve housing cover, spring and diaphragm assembly. Check the diaphragm for damage and fatigue. Check the action of the power valve and the condition of the small seal. Check that the channel into the emulsion tube well is clear.



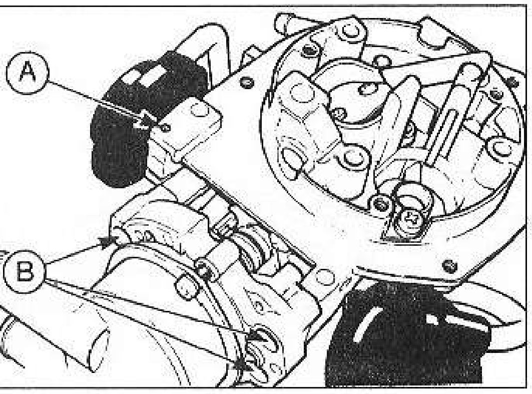
3.18a Location of upper jets in upper body

1 Idle jet - primary venturi
2 Main emulsion tube/air corrector - primary venturi
3 Main emulsion tube/air corrector - secondary venturi
4 Full-load enrichment tube
a Tube height above atomiser (VW models):
To end April 1984 - a = 15 mm
From May 1984 - a = 12 mm



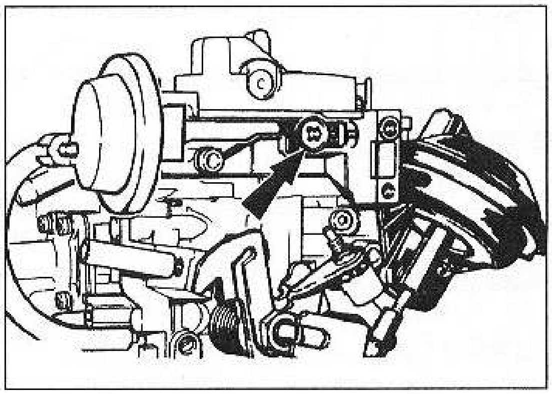
3.18b Location of lower jets in upper body

1 Main jet - primary venturi
2 Main jet - secondary venturi
3 Full-load enrichment tube
4 Secondary progression tube



3.28a Choke diaphragm assembly and lever housing

A Diaphragm assembly securing roll pin
B Choke lever housing securing screws



3.28b Star clip (arrowed) retaining diaphragm arm

3 Remove and check the condition of the econdary throttle vacuum hose. Attach a acuum pump to the vacuum connector and perate the pump until the diaphragm is ctuated. Renew the diaphragm assembly if it loes not operate fully or if vacuum is not naintained for at least 10 seconds.

4 Disconnect the secondary throttle perating rod by twisting the rod out of its ocket on the throttle lever. Remove the two r three) screws and detach the diaphragm ssembly from the body.

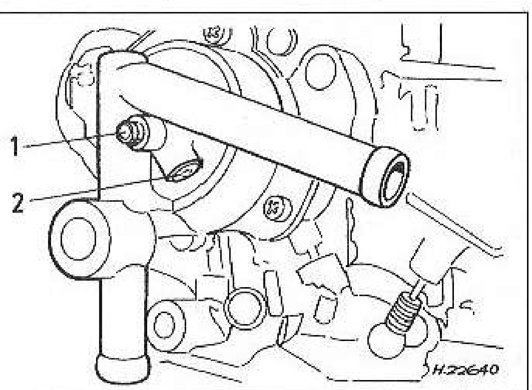
5 Do not disturb the adjustment of the econdary throttle angle, unless absolutely ecessary.

6 Inspect the choke flap, spindle and nkage for stickiness and wear.

7 Test the choke pull-down unit as lescribed in Section 4.

8 Punch out the roll pin that secures the hoke diaphragm assembly to the upper ody. Remove the three screws that secure he choke housing to the upper body. Allow he housing to drop. It is unnecessary to lisconnect the choke linkage. Remove the tar fixing clip and detach the pull-down liaphragm assembly **(see illustrations)**.

9 Certain VW models are fitted with a cover o the bi-metal housing, with a hexagon head nd locknut **(see illustration)**. Under no circumstances should this nut be tampered with as it is set at the factory. Maladjustment will almost certainly mean a new choke housing cover will be required.



3.29 Choke bi-metal housing cover - some VW models

1 Hexagon head *2 Calibration screw*

Under no circumstances must these two items be tampered with - maladjustment can only be corrected by a new choke cover

Preparation for reassembly

30 Inspect all vacuum hoses for condition and splits. Renew where necessary.

31 Clean the jets, carburettor body assemblies, float chamber and internal channels. An air line may be used to clear the internal channels once the carburettor is fully dismantled. Note that if high-pressure air is directed into the channels and passages with the diaphragms still in place, diaphragm damage may result. Spraying carburettor cleaner into all the channels and passages in the carburettor body will often clear them of gum and dirt.

32 During reassembly, a complete set of new gaskets should be fitted. Also renew the needle valve, the float pivot pin and all diaphragms. Inspect and renew (where necessary) the mixture screw, main jets, idle jet and the accelerator pump injector. Renew worn linkages, springs, vacuum hoses and other parts where necessary.

33 Ensure that all jets are firmly locked into their original positions (but do not over-tighten). A loose jet can cause a rich (or even lean) running condition.

34 Clean all mating surfaces and flanges of old gasket material and reassemble with new gaskets. Ensure that housings are positioned with their air and fuel routes correctly aligned.

Reassembly

35 Slide the choke diaphragm assembly into position and secure with a new star clip and roll pin. Refit the choke housing and secure with the three screws.

36 Ensure that the choke flap and linkage move smoothly and progressively.

37 Refit the secondary throttle diaphragm assembly and secure with the fixing screws. Reconnect the throttle operating rod and the vacuum hose.

38 Check that the secondary throttle plate is fully closed. The adjustment screw should not normally be used to alter the throttle plate position. However, if necessary, it can be adjusted so that the plate is open just enough to prevent its seizure in the throttle body.

39 Refit the power diaphragm, spring a cover assembly, then secure with the screws.

40 Refit two main jets and a primary idle into their original positions (do not transp the jets).

41 Align the pump injector **(see illustrati** and tap it into position after renewing small seal on the injector body.

42 Refit the accelerator pump seal, spri diaphragm and cover assembly, then sec with the four screws.

43 Refit the idle mixture screw after renew the small seal. Turn the screw in gently unt just seats. From this position, unscrew it th full turns. This will provide a basic setting allow the engine to be started.

44 Place the fuel filter in the fuel inlet tube.

45 Insert the needle valve into the seat w the ball facing outwards. Refit the float a pivot pin. Ensure that the top of the need valve engages into the slot on the float.

46 Check the float level (see Section 4). R the float gasket to the upper body.

47 Refit the upper body to the main body a secure with the four screws. Ensure that t choke earth strap (where fitted) is secured one of the upper body screws.

48 Refit the choke vacuum hoses in th original positions.

49 Check that the full-load enrichment tu is directed into the centre of the seco venturi. Gently bend the tube so that this accomplished. On VW models, check the tu height as shown in illustration 3.18a.

50 Refit the carburettor to the engine.

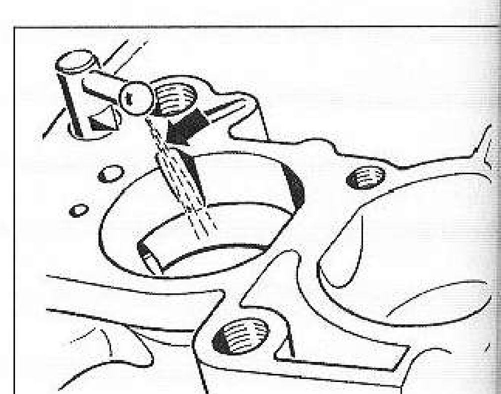
51 Always adjust the carburettor idle spe and mixture after any work has been carri out on the carburettor, preferably with the a of a CO meter.

52 Adjust the choke (see Section 4).

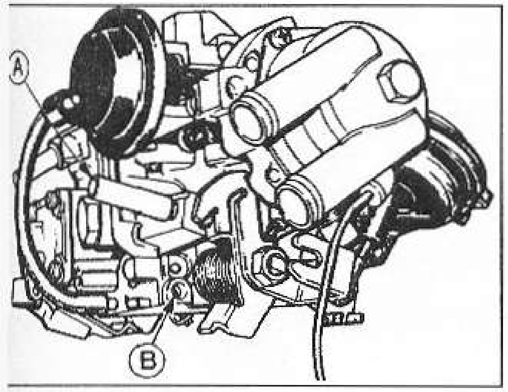
4 Service adjustments

Adjustment pre-conditions

1 Refer to Part B for general advice on th pre-conditions for correct adjustment of th carburettor.



3.41 Alignment of accelerator pump injector



4.7 Idle adjustment screw location

A Idle speed adjustment screw
B Idle mixture control screw

'W models

On VW models, disconnect the engine reather hose from the air filter and plug the pening in the air filter. Reconnect the reather hose after all adjustments are ompleted.

'auxhall/Opel models

On Vauxhall/Opel models, the breather ose may remain connected while the djustments are being made. However, on ompletion, disconnect the breather hose.

ll models

If the CO level decreases more than 1 to .5%, change the sump oil. If the CO level still ecreases after an oil change, suspect worn r sticking piston rings. If no CO change is oted on connecting/disconnecting the reather hose, suspect a clogged crankcase reather (PCV) system.

dle speed and mixture (CO)

Run the engine at 3000 rpm for 30 seconds ɔ clear the manifold of fuel vapours, then llow the engine to idle.

Remove the air filter assembly and place it lear of the carburettor. The vacuum hoses ıust remain connected.

Use the idle speed screw to set the pecified idle speed **(see illustration)**.

Check the CO level. If incorrect, remove the ımperproof plug and adjust the idle mixture crew to obtain the correct level. Turning the crew clockwise (inwards) will reduce the CO ɜvel. Turning the screw anti-clockwise ɔutwards) will increase the CO level. Refer to art B for a method of setting the idle mixture ithout the aid of a CO meter.

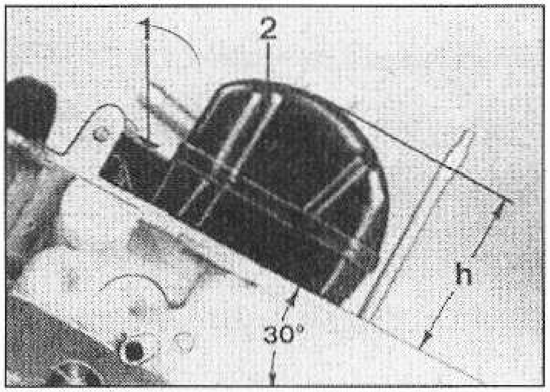
Repeat paragraphs 7 and 8 until both djustments are correct.

0 Clear the manifold every 30 seconds uring the setting operation by running the ngine at 3000 rpm for 30 seconds.

1 Increase the speed to 2000 rpm and note ɪe CO reading. The cruise reading should be ɛss than half the idle CO reading.

2 Fit a new tamperproof plug to the mixture djusting screw on completion.

3 Refit the air filter assembly, ensuring that ɪe vacuum hoses remain connected.



4.16 Float level checking

1 Needle valve pin
2 Float
h Float height

Float level

14 It is not possible to adjust the plastic float. It is possible, however, to check the level.

15 Hold the upper body at an angle of 30° with the float tag gently touching the ball of the fully-closed needle valve.

16 Measure the distance between the upper body (without its gasket) and the top of the float (see Specifications) **(see illustration)**.

17 If the level is incorrect, check the needle valve seat for correct position. Remove the float and check the float weight (see Specifications). If the float seat and weight are satisfactory, renew the float if the level is still incorrect.

Accelerator pump

18 On the Pierburg 2E3 carburettor, it is possible to adjust the volume of fuel injected by the accelerator pump.

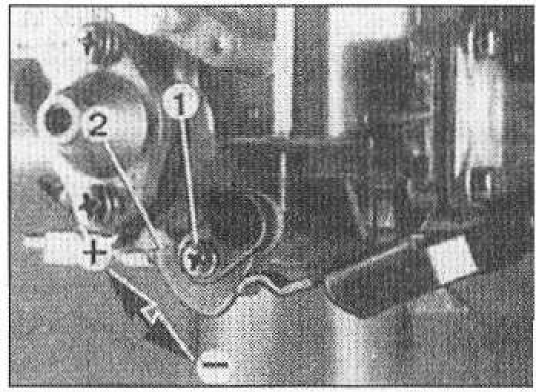
19 Loosen the clamping screw (1) **(see illustration)**. Move the cam in direction (+) to increase the volume or in direction (-) to decrease the volume.

20 Tighten the clamping screw on completion.

Automatic choke

Fast idle

21 Warm the engine to normal running temperature and adjust the idle speed and mixture before attempting choke fast idle adjustment.



4.19 Accelerator pump adjustment

1 Clamping screw
2 Pump cam

22 Remove the air filter assembly and place i clear of the carburettor. The vacuum hose must remain connected.

23 Position the fast idle adjustment screv against the second-highest step of the fas idle cam **(see illustration)**.

24 Start the engine without moving th throttle and record the fast idle speed (se Specifications).

25 Remove the tamperproof plug and adjus as necessary by turning the fast idle screw i the appropriate direction.

26 Because access to the adjustment screv is limited, stop the engine and partially ope the throttle so that a small screwdriver can b used.

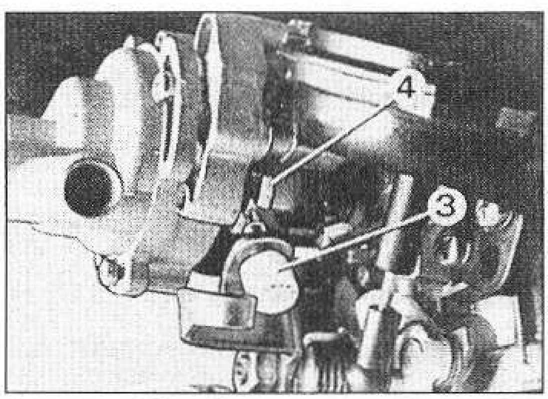
Choke pull-down (Ford)

27 Remove the three screws and detach th bi-metal coil housing from the carburettor.

28 Position the fast idle screw on the highes step of the fast idle cam.

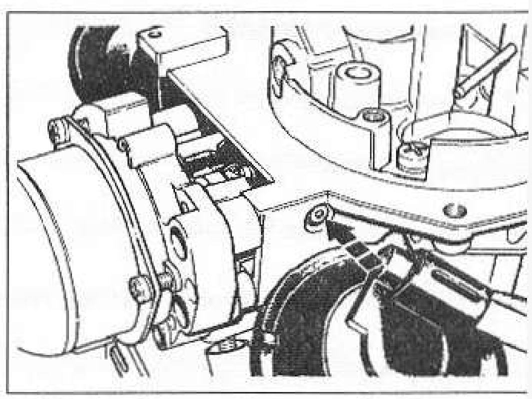
29 Move the pull-down operating rod up t its stop by fully pushing on the pull-dow adjusting screw or by using a vacuum pum **(see illustration)**. At the same time, use th shank of a twist drill to measure the ga between the lower section of the choke fla and the air intake **(see illustration)**. Se Specifications for correct drill size.

30 Adjust as necessary, using a 2.5 mm Alle key to turn the pull-down adjusting screw i the appropriate direction **(see illustration)**.

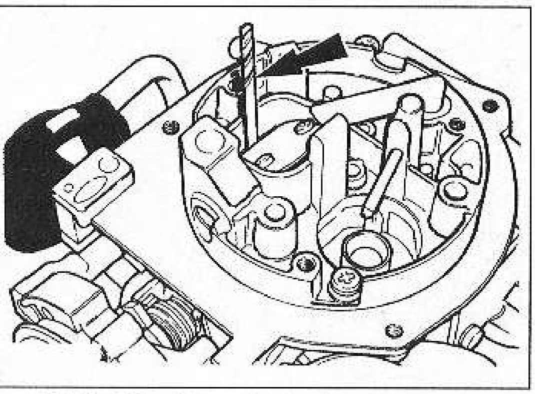


4.23 Fast idle adjustment - engine running

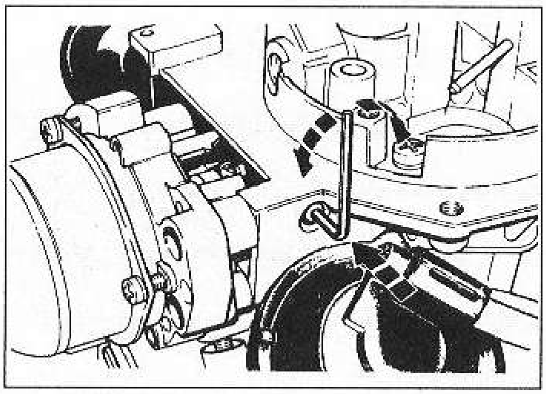
3 Fast idle adjustment screw
4 Stepped cam



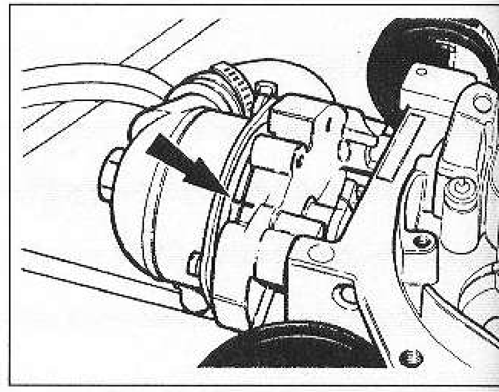
4.29a Push on pull-down adjusting screw (arrowed) to achieve maximum pull-down clearance



4.29b **Checking choke flap clearance using a twist drill**



4.30 **Choke pull-down adjustment**



4.32 **Choke alignment marks**

31 Refit the bi-metal coil housing and ensure :hat the spring locates in the slot of the choke ever. Secure loosely with the three screws.

32 Align the cut mark on the bi-metal cover with the correct mark on the choke assembly housing and tighten the three screws. Note :hat the choke housing has six screw holes and any three can be used **(see illustration)**.

Choke pull-down (VW and Vauxhall/Opel)

33 Remove the three screws and detach the bi-metal coil housing from the carburettor.

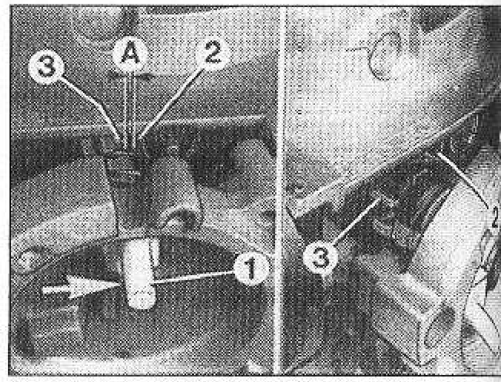
34 Fully close the choke flap using the choke control lever. The throttle plate must be closed.

35 If the flap does not close completely, set clearance 'A' **(see illustration)** to between 0.2 and 1.0 mm. The gap is adjusted by bending the lever '3' in the appropriate direction.

36 Remove the vacuum hose from the carburettor base to the inlet connection (supply side) of the pull-down unit and attach a vacuum pump to the connection. Remove the second hose from the outlet side and leave the connection unplugged **(see illustrations)**.

37 Operate the pump, and the pull-down should move to the first stage.

38 Maintaining the vacuum, plug the pull-down outlet connection and then operate the pump until 225 mmHg (300 mbars) is obtained. The pull-down should now move to the second stage and hold vacuum for at least 10 seconds. If the diaphragm does not operate as described, renew the pull-down unit.



4.35 **Closure of choke flap**

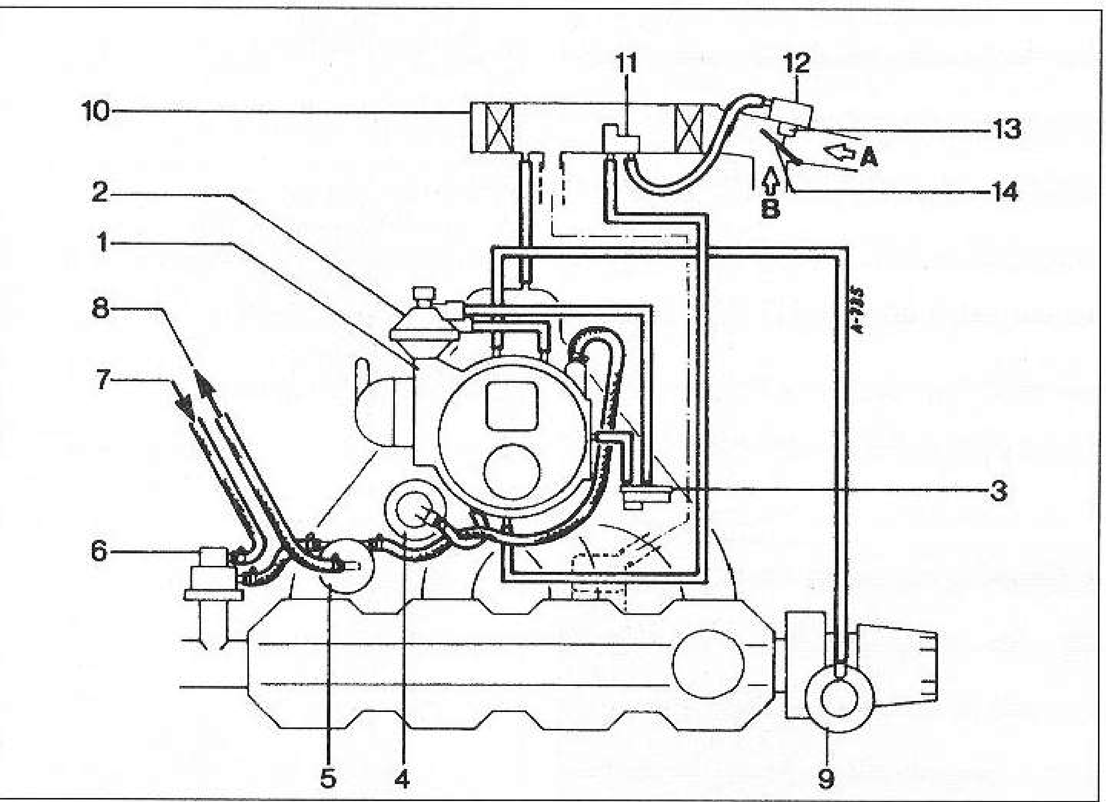
1 *Move choke control lever fully in direction of arrow*
2 *Diaphragm rod*
3 *Adjustment lever*
A *Clearance = 0.2 to 1.0 mm*

39 Note that if the pull-down unit is a singl stage type, follow the procedure for testi the second stage of the two-stage un described above.

40 Place the fast idle screw on the highes step of the fast idle cam.

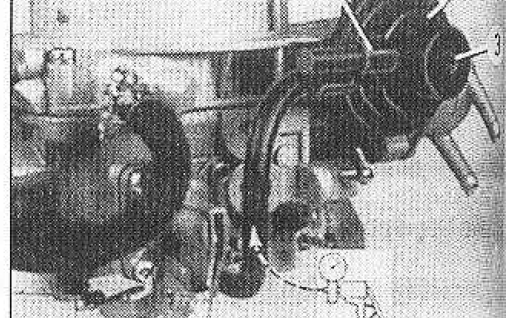
Single-stage pull-down unit

41 Where a single-stage pull-down unit fitted, remove the outlet vacuum hose an plug the pull-down connection. Move the pu down operating rod up to its stop b operating the vacuum pump. Lightly close th choke flap and use the shank of a twist drill t measure the 'a1' gap between the lowe



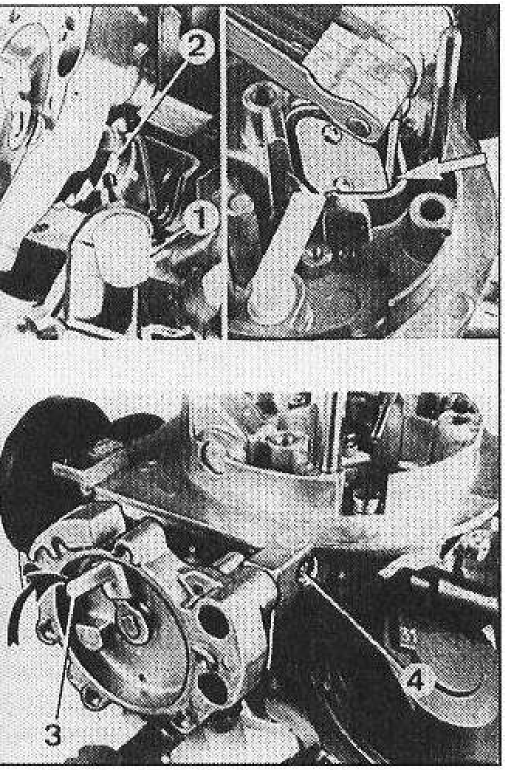
4.36a **Typical vacuum hose connections - Vauxhall/Opel**

1 *Carburettor*
2 *Pull-down diaphragm*
3 *TTV*
4 *Secondary throttle diaphragm*
5 *Vapour separator*
6 *Fuel pump*
7 *Fuel supply*
8 *Fuel return*
9 *Ignition distributor*
10 *Air filter*
11 *Thermal valve*
12 *Heated air warm-up system diaphragm*
13 *Wax element*
14 *Hot air control flap*
A *Cold air*
B *Warm air*



4.36b **Testing vacuum pull-down**

1 *Pull-down unit*
2 *Outlet connection*
3 *First stage adjustment screw 'a'*



4.41 Choke pull-down adjustment

Fast idle adjustment screw
Stepped cam
Close choke flap by moving choke control lever fully in direction of arrow
Second stage adjustment screw 'a1'

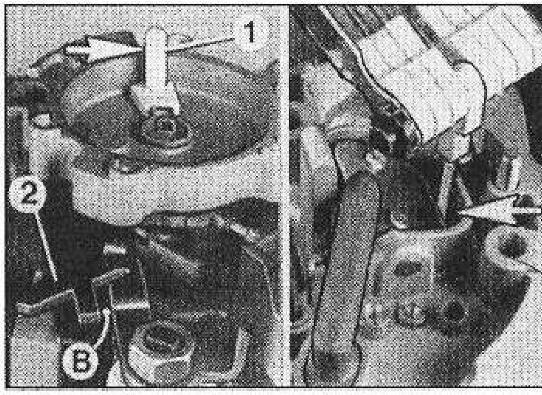
ction of the choke flap and the air intake. e Specifications for the required drill size. just as necessary by turning the pull-down justing screw '4' in the appropriate ection **(see illustration)**.

vo-stage pull-down unit

Where a two-stage pull-down unit is ed, detach the pull-down to the thermal ne valve (or thermal valve) vacuum hose m the connection on the pull-down unit. Do t plug the connection. Operate the vacuum mp and the choke flap should open to the st stage setting. Lightly close the choke flap d use the shank of a twist drill to measure e a clearance between the lower section of e choke flap and the air intake. See ecifications for the required drill size.

Adjust as necessary by turning the first ge pull-down adjusting screw '3' (see stration 4.36b) in the appropriate direction. te that the a clearance should only be ecked if the pull-down unit has been newed or the setting has been disturbed. g the pull-down outlet connection. Fully erate the vacuum pump and the choke flap ould open to the second stage setting. htly close the choke flap and use the shank a twist drill to measure the 'a1' clearance tween the lower section of the choke flap d the air intake. Refer to Specifications for e required drill size.

Adjust as necessary by turning the second ge pull-down adjusting screw '4' (see stration 4.41) in the appropriate direction. ere a vacuum pump is not available, a small rewdriver can also be used to fully push on



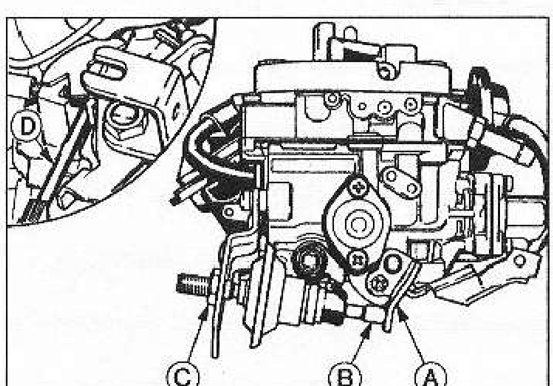
4.48 De-choke adjustment

1 *Close choke flap by moving choke control lever fully in direction of arrow*
2 *Dechoke lever*
B *Adjustment tag*

the a1 adjusting screw. In this instance, the screw should be pushed until a resistance is felt. The clearance obtained at this point is the first stage setting. Continue pushing until the screw cannot be pushed any further. The clearance now obtained is the second stage setting.

De-choke adjustment

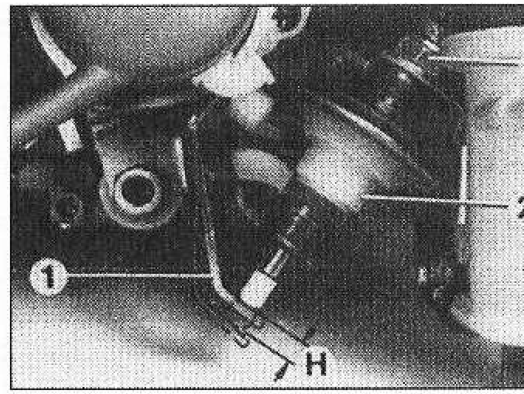
45 Fully close the choke flap and hold it in this position. The operation is simplified with the aid of a rubber band, arranged between the choke control lever and the carburettor body.
46 Fully operate the throttle and the choke flap should be forced open to leave a small clearance.
47 Use the shank of a twist drill to measure the gap between the lower section of the choke flap and the air intake. Refer to Specifications for the required drill size.
48 Adjust as necessary by bending the tag 'B' **(see illustration)** in the appropriate direction.
49 Reconnect all the vacuum hoses.
50 Refit the bi-metal coil housing, ensuring that the spring locates in the slot of the choke lever. Secure loosely with the three screws.
51 Align the cut mark on the bi-metal cover with the correct mark on the choke assembly housing and tighten the three screws (see illustration 4.32).



4.56 Throttle damper adjustment

A *Actuating lever* C *Damper locknut*
B *Damper plunger*

Inset shows 2 mm feeler gauge (D) in place



4.54 Throttle damper adjustment

1 *Lever* 3 *Locknut*
2 *Damper* H *Lift = 3.0 ± 0.5 m*

52 Refit the air filter assembly, ensuring th the vacuum hoses remain connected.

Throttle damper (automatic transmission models)

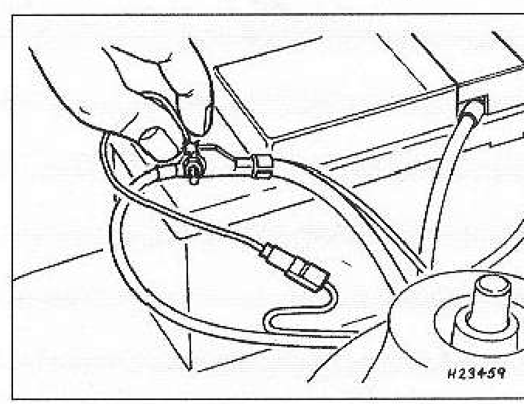
53 Warm the engine to normal runni temperature and ensure that the idle spe and mixture are correctly adjusted.
54 Slacken the damper locknut and wind t damper up until a gap of 0.05 mm exis between the dashpot rod and the throttle lev **(see illustration)**.
55 Wind the damper down 2.5 turns a tighten the locknut in this position complete.

Throttle damper (Ford OHC engine)

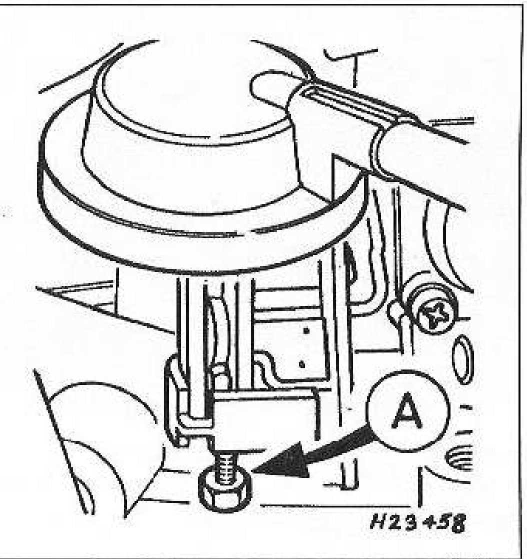
56 Stop the engine and slacken the damp locknut **(see illustration)**.
57 Position a 2 mm feeler gauge between t idle speed screw and throttle lever.
58 Adjust the damper so that the plunger ju touches the operating lever witho compressing the plunger. Tighten the lockn in this position.

Vacuum damper (Ford ICVH engine)

59 Put the ECU into service-adjust mode. T service connector is located by the batte Allow the engine to idle and use a jump lead connect the service connector to earth for least ten seconds **(see illustration)**.



4.59 Earth service connector for at leas 10 seconds



4.64 Vacuum damper adjustment (A)

0 The vacuum damper will be activated and he engine speed will rise to 1700 ± 100 rpm.
1 If the speed does not rise, first check the acuum hose and diaphragm for leaks.
2 Locate the damper solenoid (on the ffside inner wing) and check for a voltage upply when the ignition is switched on.
3 Check the solenoid earth which is made hrough terminal 12 on the ECU. While the olenoid is activated, the reading on the olenoid earth connection will be 1 volt. When ot activated, the reading will be nominal attery voltage.
4 Adjust the engine speed as necessary by urning the adjustment screw in the ppropriate direction **(see illustration)**.
5 Turn off the service adjuster by ensuring hat the jump lead is no longer connected to arth and then by simply switching off the gnition.

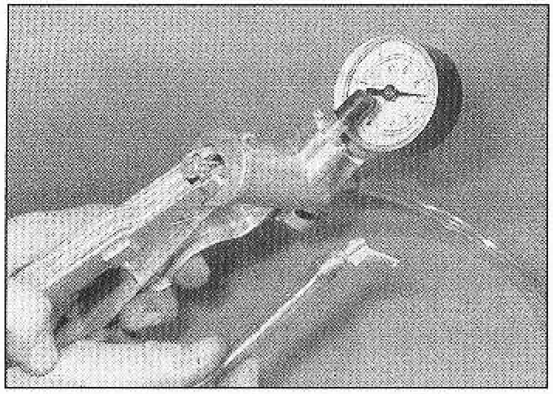
5 Component testing

Vacuum components

After removing the accelerator pump njector, attach the hose of a vacuum pump to he injector body (opposite end to injector ozzle). Operate the pump until 300 mm Hg is egistered. Renew the injector assembly if the acuum is not maintained for 10 seconds **(see lustration)**.

Attach a vacuum pump to the secondary hrottle vacuum connector and operate the ump until the diaphragm is actuated. Renew he diaphragm assembly if it does not fully perate, or if vacuum is not maintained for 10 econds.

Attach a vacuum pump to a choke iaphragm connector (seal the second onnector with a finger if there is more than ne connector) and operate the pump until he diaphragm is actuated. Renew the iaphragm if it does not fully operate, or if vacuum is not maintained for 10 seconds **(see illustration)**.



5.1 Testing accelerator pump injector assembly with a vacuum pump

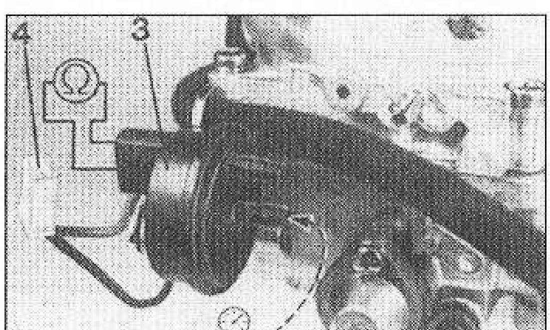
4 Start the engine and attach a vacuum gauge to the choke vacuum source connector, then to the secondary throttle vacuum source connector on the carburettor body. If manifold vacuum is not obtained, check for a blockage at the appropriate connector.

Thermal time valve (VW, Vauxhall/Opel and Ford OHC)

5 With the engine cold, disconnect the vacuum hose to the TTV and attach a vacuum pump. Operate the pump and it should not be possible to obtain a reading **(see illustration)**.
6 Keep operating the pump and start the engine. Within 5 to 10 seconds, 300 mmHg (400 mbars) should be obtained and held for at least 10 seconds.
7 If the TTV does not function as above, check the voltage supply and earth at the electrical connection.
8 The TTV resistance should be 4.5 to 7.5 ohms at 20°C.
9 If the electrical supply is satisfactory, renew the TTV if it does not function correctly.

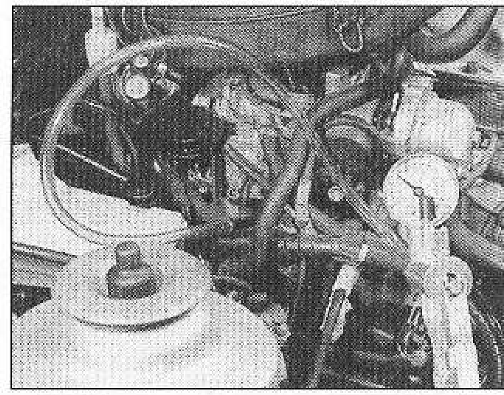
Thermal switch

10 Refer to Part D for general tests on the thermal switch, automatic choke electrical heater, and the inlet manifold and throttle body heaters.
11 Below 55 ± 10°C, a voltmeter should indicate battery voltage (switch open).



5.5 Thermal time valve testing

3 TTV
4 Electrical connector plug



5.3 Vacuum gauge connected to chok vacuum source connector

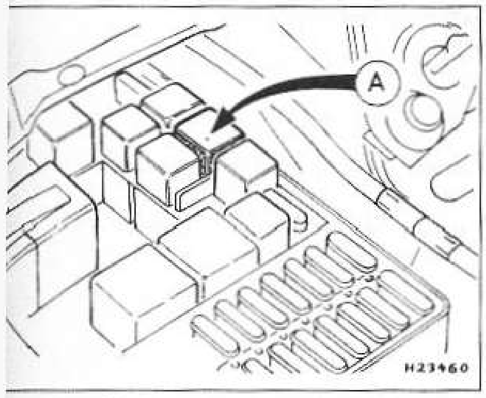
12 Above 65 ± 10°C, the voltmeter sho indicate zero volts (switch closed).
13 Renew the thermal switch if it does function in accordance with the above.

Thermal valve (VW)

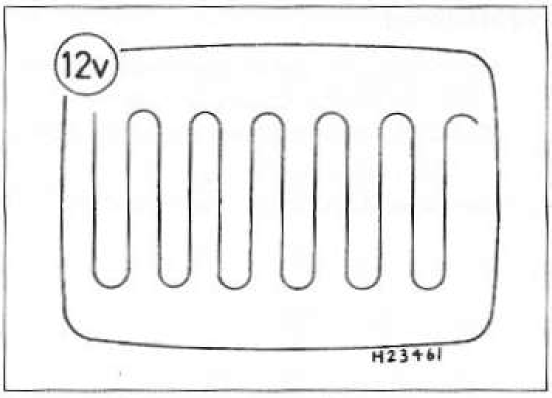
14 Refer to Part D for general tests on thermal valve fitted to the choke pull-do and secondary throttle vacuum hoses (sc models).
15 Below 17°C, no vacuum should regis (switch open).
16 Above 53°C, normal idle vacuum sho register (switch closed).
17 Renew the thermal valve if it does function in accordance with the above.

Choke relay (Ford)

18 Allow the engine to cool completely.
19 Remove the air filter and operate throttle once or twice to set the choke fl Check that the flap blocks the carburettor intake.
20 Start the engine and check that the c idle speed is within limits.
21 Check that the choke pull-down opera satisfactorily.
22 As the engine warms up, check that choke flap gradually opens until it is f open.
23 If the choke flap operation unsatisfactory, check the choke pull-do adjustment and look for a sticking, worn broken linkage, or split vacuum hoses.
24 It is possible to test the choke pulsing putting the ECU into service-adjust mode. service connector is located by the batte Allow the engine to idle and use a jump le to connect the service connector to earth at least 10 seconds. The vacuum damper be activated and the engine speed will rise 1700 rpm.
25 Switch on the ignition and place a fin on the choke relay. Regular pulsing should felt **(see illustration)**.
26 Attach a voltmeter to the choke electr connection. With the engine running, instrument should alternate between 6 t volts and almost zero. An oscilloscope wit low-voltage facility is recommended for test. A trace similar to that shown **(s illustration)** should be obtained.



5.25 Choke relay location (A)



5.26 Choke relay oscilloscope trace

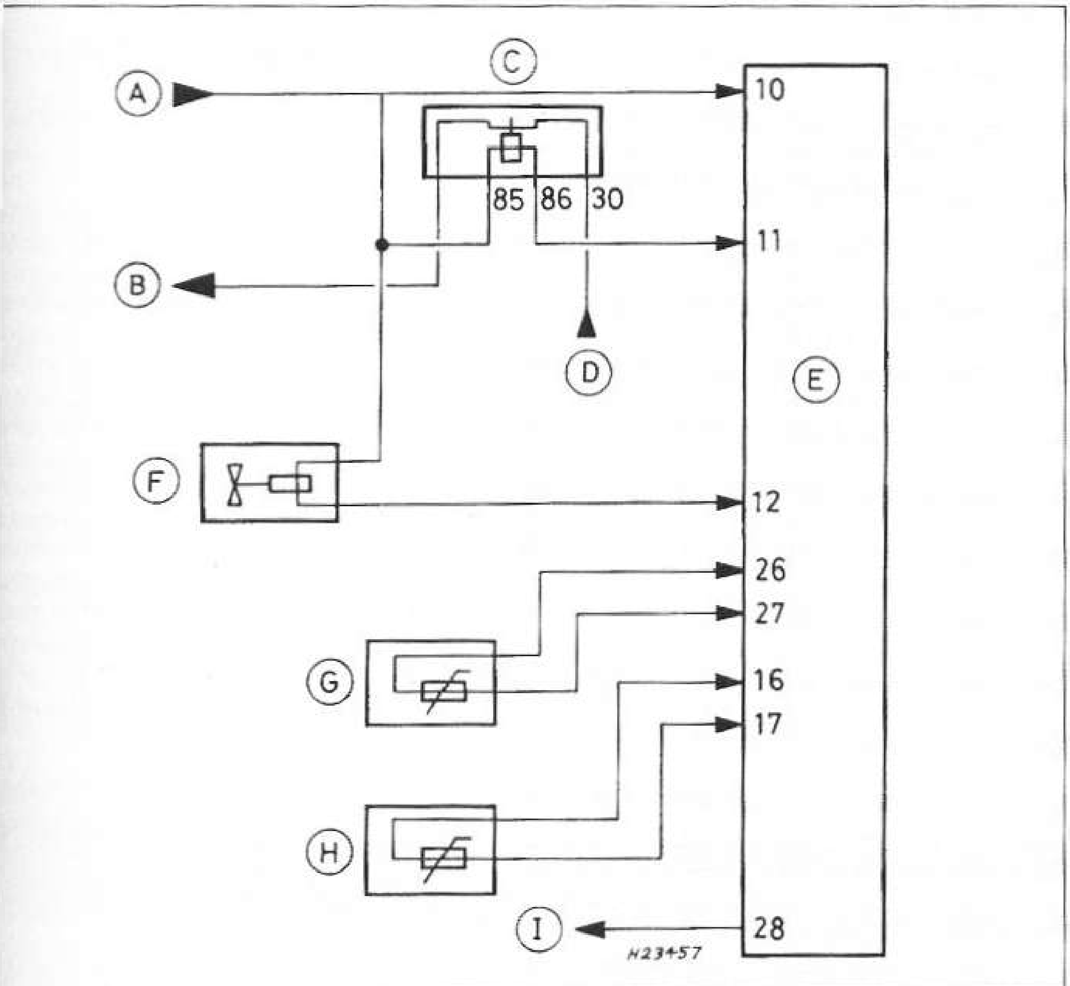
If voltage is low or zero, attach the
tmeter between the alternator output
pply to the choke and earth. If there is still
voltage, repair or renew the alternator **(see**
stration).
If voltage is present at the alternator but
t at the choke, first check for a constant
tage supply to relay pin 30. Check for
ntinuity between the relay pin (87b) and the
omatic choke. Check for a voltage supply
th the ignition on) to relay pin 85. Finally,
eck for continuity between relay earth pin
and ECU terminal 11. If all connections are
isfactory, renew the relay.

29 Turn off the service adjuster by ensuring that the jump lead is no longer connected to earth and then by simply switching off the ignition.

30 A faulty air temperature or coolant temperature sensor will also affect choke operation.

Air temperature sensor

31 Connect a voltmeter across the terminals at the air temperature sensor in the air filter assembly. The voltage will vary from about 3.5 volts (cold air) to 1 volt (hot air) **(see illustration)**.



5.27 Choke relay wiring diagram

From ignition switch
To choke housing
Choke relay
D *From alternator*
E *ECU*
F *Vacuum damper solenoid*
G *Coolant temperature sensor*
H *Air temperature sensor*
I *To service connector*

32 Check for a nominal battery voltage supply to pin 10 of the ECU. The pins on the ECU are impossible to probe with the ECU connected and it may be necessary to push a sharp pin through the wire.

Coolant temperature sensor

33 Connect a voltmeter across the terminals at the coolant temperature sensor in the inlet manifold. The voltage when the engine is cold will be about 3 volts. Start the engine and the voltage should slowly reduce to between 0.5 and 0.8 volts when the engine is hot **(see illustration)**.

ECU multi-plug

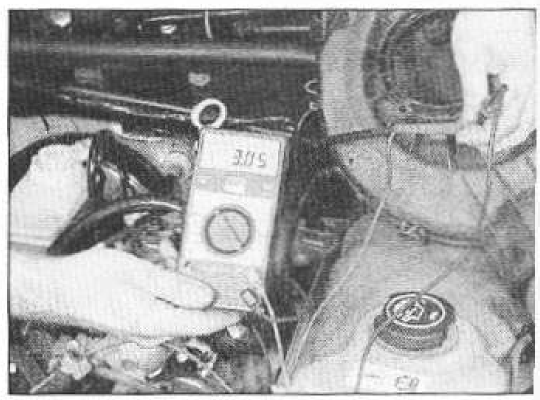
34 The ECU is bolted to the offside inne wing. Ensure that the ignition is switched off then remove the ECU multi-plug by unscrewing the central bolt. Check the multi plug connecting pins for corrosion and ensure that they make good contact.

6 Fault diagnosis

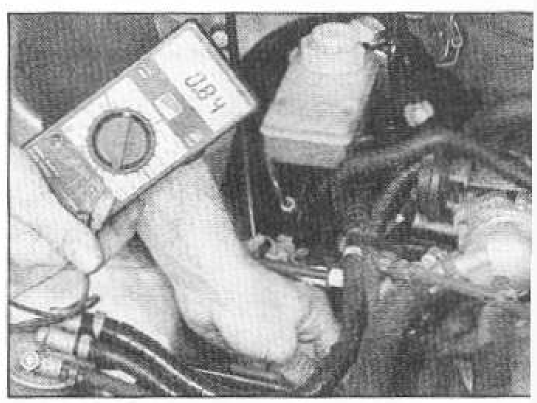
Refer to Part D for diagnosis of genera carburettor faults. The following faults ar specific to 2E3 carburettors.

Poor choke operation/poor cold running

☐ Over-choking due to pull-down diaphragm failure, relaxing of bi-metal co or poor adjustment.



5.31 Measuring air temperature sensor voltage



5.33 Measuring coolant temperature sensor voltage (engine warm)

- ☐ Sticking choke flap.
- ☐ Failure of inlet manifold pre-heater or throttle body heater.
- ☐ Failure of thermal time valve or coolant-heated thermal switch.

Heavy fuel consumption

- ☐ Leaking power valve diaphragm or O-ring seal.

Hesitation

- ☐ The accelerator pump diaphragm utilises a slot and spring-loaded ball into which the pump actuating lever fits. If the spring becomes weak, the delay in operation can cause a flat spot on acceleration.

Uneven running

- ☐ Air leak due to defective rubber mounting flange.

Lack of power

- ☐ Failure of secondary throttle plate diaphragm.