Gunson's

Gastester MK2

VEHICLE EXHAUST GAS ANALYSER
WITH PULSE PUMP

HANDBOOK

CONTENTS

1. INTRODUCTION

Carbon monoxide (chemical symbol CO) is a colourless, odourless, but extremely poisonous gas that is present in the exhaust gas of petrol-engined vehicles. The amount of carbon monoxide in the exhaust gas is an accurate indicator of the air/fuel mixture strength being supplied to the engine, and for this reason motor manufacturers use the measurement of carbon monoxide in the engine exhaust as the recommended method for setting the air/fuel mixture strength on carburettors and fuel injection systems. The recommended percentage of carbon monoxide in the exhaust at engine idle (i.e. tickover speed) is usually specified in the engine maintenance handbook for each vehicle.

Manufacturers typically specify a CO level somewhere within the range 0.5% to 3.5% by volume, and often give an upper and lower limit for the recommended setting, for example, a manufacturer may specify 0.5% to 1.5% CO. Alternatively, the data may be given in the for 2% ± .5% CO (which means between 1.5% and 2.5%). Less commonly (and less exactly) a manufacturer may simply specify a maximum limit e.g. below 3.5% CO.

As can be seen, carbon monoxide only amounts to a relatively small percentage of the total volume of exhaust gas. The bulk of exhaust gas comprises nitrogen (N_2), carbon dioxide (CO_2), water vapour (H_2O). Hydrogen (H_2) is also present, particularly in association with carbon monoxide. Oxygen (O_2) can be present either due to a weak mixture, or due to engine misfiring. Very small amounts of other substances are also present in exhaust gas, such as unburnt or partially burnt fuel (generally referred to as hydrocarbons) and also some oxides of nitrogen. The way that the composition of exhaust gas varies with petrol/air mixture strength is illustrated in Figure 1.

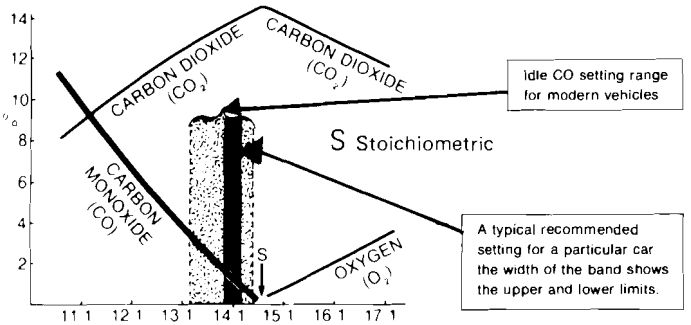


Figure 1

It can be seen from Figure 1 that at a particular air/fuel mixture ratio (somewhere near 14.7: 1 for petrol engines) the amount of oxygen present in the air that is entering the engine is exactly that required to completely burn all the petrol to carbon dioxide and water. There is therefore very little carbon monoxide in the exhaust, and no free oxygen. This particular ratio of air and petrol is known as the stoichiometric ratio. At this ratio, the percentage of carbon dioxide in the exhaust is at a maximum, and the percentage of carbon monoxide is very low.

In mixtures richer than the stoichiometric ratio (i.e. more fuel, or less air), there is insufficient oxygen in the air to burn all the carbon in the fuel completely to carbon dioxide. Some carbon therefore exists in the form of carbon monoxide, and the richer the

mixture the more carbon monoxide and the less carbon dioxide there is in the exhaust. It can be seen from Figure 1 that motor manufacturers generally specify a mixture strength at idle that is slightly richer than the stoichiometric ratio. Under some conditions, such as starting an engine from cold, or during acceleration, very much richer mixtures are used.

In mixtures weaker than the stoichiometric ratio (i.e. less fuel, or more air), there is more oxygen in the air than required for complete combustion of the petrol, and the surplus oxygen appears in the exhaust gas. The level of carbon monoxide is very low, since virtually all the carbon in the petrol is completely burnt to carbon dioxide. There is however a smaller percentage of carbon dioxide present in the exhaust than at the stoichiometric ratio of air and fuel, simply due to the diluting effect of the extra air passing through the engine. Engines are commonly designed to run with such weak mixtures under light load driving conditions, though not at idle.

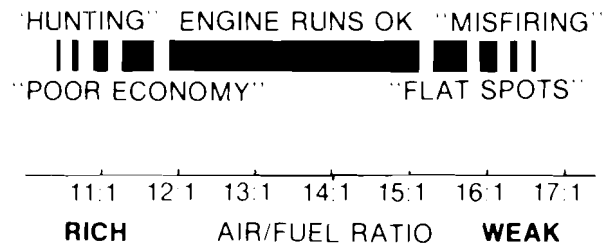


Figure 1a

An engine will run, indeed run quite well, at mixtures that are richer or weaker than those specified by the motor manufacturer. However, at settings richer than the manufacturer recommends, there is a loss in economy, and at very rich settings, typically 8% to 10% CO, the onset of poor running occurs, characterised by the particular engine sound that is known as "hunting."

At settings weaker than the manufacturer recommends there is poor engine performance and "flat spots", and at very weak settings, typically 2% to 4% oxygen, the engine will not run at all. Note that at very weak settings it is inappropriate to speak of the CO level, since CO reaches a very low level below which it hardly changes for further weakening of the mixture and some other indicator of mixture strength must be used, such as oxygen.

It has already been mentioned that motor manufacturers specify a CO level at a particular engine idle RPM, but that the CO level under other engine running conditions will generally be different from this. A richer mixture is used when starting the engine from cold, a weaker mixture when driving under light power, a richer mixture when accelerating, etc. However, the user does not need to be aware of this. It is simply necessary to set the mixture strength at idle as specified by the motor manufacturer, and the carburettor or fuel injection system then automatically sets the mixture right at other engine conditions.

Gastester is an exhaust gas analyser that works on the "Hot Wire" or "Thermal Conductivity " principle. According to this principle, the thermal conductivity of exhaust gas varies in proportion to the amount of carbon monoxide present.

2. PRODUCT ASSEMBLY

When received, the Gastester carton should contain the following individual items:

Gastester instrument including collector box and pulse pump/water trap assembly.
Metal exhaust probe with retaining springs
Flexible pipes (3 off).
Instruction handbook.

Warming the various pipes will assist assembly. Only the connection to the vented Collector Box inlet needs to be pressed fully home.

The procedure for assembling Gastester is as follows:

(1) Press the small diameter drain pipe inside the lower boss of the Pulse Pump/ Water Trap as shown in the diagram Figure 2A.

(2) Connect the longest plastic pipe between the metal exhaust probe and the Pulse Pump inlet. THE PULSE PUMP INLET IS THE CENTRE CONNECTION.

(3) Connect the short plastic pipe between the Pulse Pump outlet and the Collector Box inlet. (This connection is intentionally vented at the inlet boss). THE CONNECTION TO THE COLLECTOR BOX INLET NEEDS TO BE PRESSED FULLY HOME.

CHECK THESE CONNECTIONS ARE CORRECT AS SHOWN IN FIGURE 2A.

Figure 2

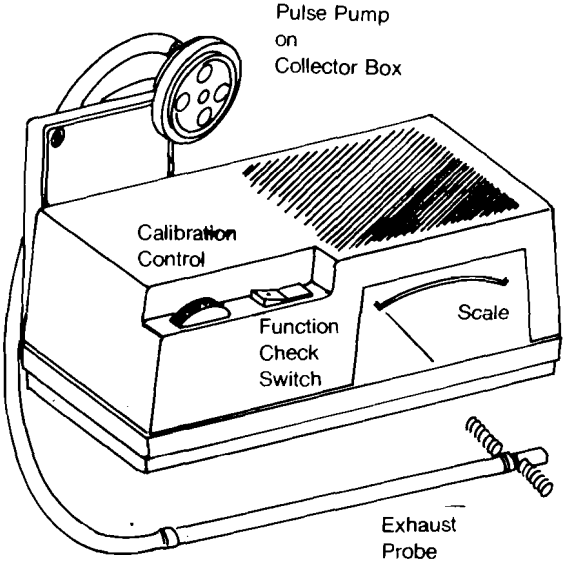
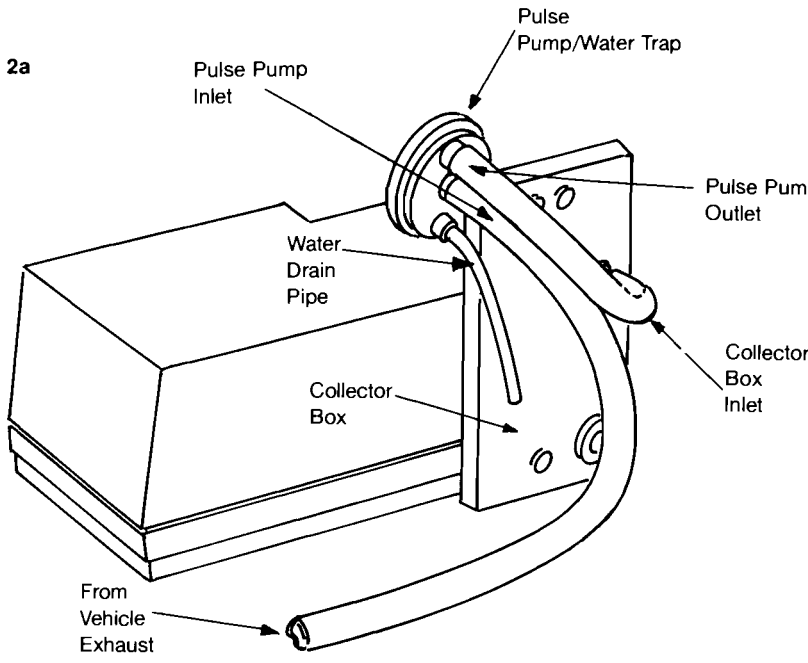


Figure 2a



3. DESCRIPTION AND CONTROLS

FIGURE 2 SHOWS THE ASSEMBLED GASTESTER UNIT, WHICH HAS THE FOLLOWING FEATURES:

(1) SCALE. This is calibrated in volume percent carbon monoxide (CO%)

(2) FUNCTION CHECK SWITCH. A two position switch, in which the first position (left side, indicated by a white dot pressed down) is simply used as an internal check on the correct operation of the electronics of the unit. When the unit is connected to a car battery, the pointer should move to the "CHECK" position. With the switch in the second position (right side pressed down) the unit is ready for operation.

(3) CALIBRATION CONTROL. This is used to set the pointer of the scale to the calibration position at the start of the tests, or periodically during tests as required. Note, the calibration is near 2% CO not at zero.

(4) 2 CORE CABLE WITH CROCODILE CLIPS. For connecting to the car battery.

(5) EXHAUST PROBE The metal pipe is for insertion into the exhaust pipe, and is retained in position by the metal springs which press against the INSIDE of the exhaust pipe. NOTE: In use the pipe from the exhaust probe should slope down continuously to the Pulse Pump/Water Trap so that water runs down and may be automatically expelled from the drain pipe.

4. PREPARATIONS BEFORE USE

(1) Any service maintenance such as air filter renewal, tappet adjustment, carburettor maintenance, ignition maintenance including ignition timing, should be carried out before setting the carburettor or fuel injection mixture adjustment. Petrol mixture setting should be the FINAL ADJUSTMENT in any engine tuning work.

(2) Carbon monoxide is an EXTREMELY POISONOUS gas. ANY work on the car with the engine running should therefore invariably be carried out IN THE OPEN AIR. The user should take care NOT TO BREATHE IN exhaust gas when using Gastester near the exhaust pipe with the engine running.

(3) The car should be thoroughly warm before the tests begin. It is not enough to leave the car to warm while parked. The car should be taken for a drive, and the tests not commenced until water temperature, engine, and exhaust system are thoroughly heated, and are at normal running temperature.

(4) Study the workshop manual for the particular car (or consult the information given later in this booklet) to identify the correct adjustment screws that control the mixture strength and the idle speed. Identify the direction to turn the screws to achieve the desired effect (i.e. mixture richer or weaker, idle speed faster or slower). Make a note of the initial position of the adjustments before commencing work, so that in case of difficulty, or of the wrong adjustment is changed, the setting can be restored to its original position.

(5) Have to hand the correct tools for making the necessary adjustments (e.g. screwdriver or allen key). If the manual quotes a CO level at a particular engine speed, then the user needs to provide a tachometer (Gunson's Testune and Autoranger incorporate a tachometer suitable for this purpose).

5. INSTRUCTIONS FOR USE

(1) Ensure that the car is thoroughly warm as mentioned above, that it is parked in the open air, with the handbrake applied, and with the engine running.

(2) Place the assembled Gastester on a convenient flat surface close to the vehicle's exhaust pipe outlet. Connect the red and black clips to the vehicle's battery (red to +, black to -). Only a 12 volt battery must be used. If the vehicle has a 6v or 24v battery, then an external battery must be used, such as the battery of a nearby car. The current draw of the unit is quite high (1A), and so a good battery should be used. DO NOT INSERT THE EXHAUST PROBE INTO THE EXHAUST PIPE AT THIS STAGE.

(3) Press the function check switch on the instrument to make sure that the pointer moves into the circuit check box on the right of the meter scale, otherwise check the connections. Return the switch to its normal operating position. DO NOT INSERT THE EXHAUST PROBE INTO THE EXHAUST PIPE AT THIS STAGE.

(4) Wait at least 8 minutes for the instrument to thoroughly warm up. Keep the car engine running. DO NOT INSERT THE EXHAUST PROBE INTO THE EXHAUST PIPE AT THIS STAGE.

(5) Use the rotary calibration control to carefully set the pointer to the CALIBRATE position marked on the meter scale. The CALIBRATE position can be found near the 2% marking on the scale. Having set the pointer to the CALIBRATE position, do not further adjust the calibration control for the subsequent tests. (NB. The CALIBRATE position represents what the instrument should register when the probe is in air. It is coincidental that air should measure the same as exhaust gas with 2% CO. When the probe is subsequently inserted into the exhaust pipe, the pointer of the instrument may move down or up from the CALIBRATE position, depending on whether the exhaust has less than, or more than, 2% CO).

(6) Ensure that the engine is set to idle speed, or to the RPM stated by the manufacturer if this is specified. NOW INSERT THE PROBE INTO THE VEHICLE EXHAUST PIPE, to a minimum of 3/4 of its length, i.e. 8" or 20cm. In order for the automatic water drain to function, the probe pipe should fall continuously from the exhaust end to the pump end to allow water droplets to run down. Otherwise the water will collect at the lowest point and will have to be drained manually.

(7) Wait for a period of 15 seconds for the meter to respond and a further 1 minute to stabilise. Make a note of the reading of the CO level on the meter scale. If the reading is not in-between the manufacturer's recommended maximum and minimum, or below that specified as a legal requirement, then adjustment of the carburettor or fuel injection system will be required.

(8) If the indicated CO reading is too high or too low, then make a small adjustment to the mixture screw, and correct the idle speed by adjusting the idle speed screw (or throttle bypass screw if fitted - see section 9). Do this repeatedly in small increments, allowing approximately one minute for the reading to stabilise at each mixture setting.

6. FURTHER INFORMATION

(1) It should be noted that an engine, even in good overall condition, will show a fluctuation in idle CO over a period of time, of typically 0.5%. Bearing in mind this fluctuation, and also errors and drift in the instrument, the user should aim to set the average CO reading to be midway between the limits set by the manufacturer, or at a reasonable margin below the prescribed legal limit.

(2) Periodically, during the tests, examine the lowest point of the transparent plastic pipe to see if it contains water to a degree that might impede the flow of gas, and if it does, remove the pipe at the pulse pump inlet end and clear the pipe by allowing the water to drain out, then reconnect the pipe and carry on with the tests. If the transparent pipe falls continuously from the exhaust to the pump the automatic drain should operate and keep the pipe clear of water. NOTE; Operation of the pulse pump will usually be audible as the pulsations in the exhaust cause the internal diaphragm to vibrate. If the instrument ceases to respond to changes in mixture setting or the sound from the pulse pump becomes irregular, check the sample pipe for collected water.

(3) The calibration of the instrument may be checked at any time. Simply remove the exhaust probe and wait at least five minutes, or ten minutes in still air, for exhaust to disperse from the collector box. If necessary, the calibration may then be adjusted using the calibration control knob. The user is advised to periodically check the calibration of the instrument during tests.

(4) Some motor car engines will not readily "tick over" at idle speeds for long periods. The speed may become erratic, and engine misfiring may occur. With the prolonged testing of such engines, it may be necessary to occasionally "purge" the engine by, for instance, increasing the speed to 2000 rpm - 3000 rpm for 15 seconds. This may be done at any time during the tests but the exhaust probe should preferably be removed beforehand.

(5) If the exhaust pipe has a curved inlet it may be necessary to slightly bend the metal exhaust probe to give better fit. This should be done very carefully using slight bends in several places rather than a single big bend in order not to kink the pipe.

(6) Engine fuel systems are usually designed so that the mixture automatically becomes weaker at speeds above idle, except under rapid acceleration when the mixture is enriched (see also Section 1 Introduction). Gastester is designed to work at engine tick-over speeds, however it will also give a reliable reading at higher engine speeds. VIOLENT FULL THROTTLE ACCELERATION TO HIGH ENGINE SPEED SHOULD BE AVOIDED WHILE THE PROBE IS IN THE EXHAUST PIPE AS THIS MAY DISPLACE THE PULSE PUMP DIAPHRAGM CAUSING IT TO MALFUNCTION.

To test mixture weakening at higher RPM, increase the engine speed in increments of approximately 300 RPM (using a tachometer if available) up to a maximum of 2500 to 3000 rpm, observing the reading between each adjustment. (Remember that the instrument may take 15 seconds to respond to a particular adjustment, and a further 1 minute to stabilise). The CO level should fall progressively and stay low during the speed increase.

(7) The mixture enrichment for acceleration (accelerator pump/air valve damper) can be tested by rapid opening and immediate release of the accelerator. Opening to half throttle should be sufficient. Within a few seconds of this operation the Gastester CO indication should increase before returning to its previous setting. The degree of increase will vary according to how this procedure is carried out and also with the type of fuel system. A fixed choke carburettor with accelerator pump will usually give a more pronounced increase than a variable choke carburettor or fuel injection system.

7. COMMON PROBLEMS

(1) The car does not drive well with the correct idle mixture setting. This is a common complaint (it may even occur to a small extent on a new vehicle when the mixture is set to the lowest of the manufacturers stated CO tolerance). On older vehicles the cause is likely to be a fuel system fault which creates a weak mixture just above idle speed.

Remedy: Clean the idle jet and idle air bleed jet on fixed choke carburettors. Check for needle/jet wear on variable choke carburettors (above 40,000 miles). These are available as replacement parts. Check operation of acceleration enrichment device.

(2) The correct mixture setting cannot be achieved.

Setting is continually too rich.

Remedy: Clean the idle air bleed jet and air passage on fixed choke carburettors. Check for severe needle jet wear on variable choke carburettors. Check for high fuel level in the float chamber. Check cold start device.

Setting is continually too weak.

Remedy: Clean the idle jet on fixed choke carburettors. Check needle and jet for disengagement from adjusting device or sticking on variable choke carburettors. Check for air leaks.

(3) The engine misfires at idle with the correct mixture setting.

Remedy: Check for general engine condition - compression pressures, sparking plugs etc. Check for air leaks, these may cause severe variation in mixture between cylinders. Investigate mixture quality i.e. fuel air mixture should be provided to the engine in a finely atomised form. Faults may be due to partially blocked air jets, prematurely feeding main jet system due to high float chamber level etc.

(4) The mixture setting drifts

Remedy: Check for leaking float chamber needle valve if CO level steadily increases with prolonged idle. Check for high float chamber level. Check Gastester CALIBRATION in air, slight drift will occur during extended operation. Good stability should be obtained over a period of five minutes or more. A variation of, for example 0.5% CO at 2.0% CO is not uncommon on an engine which is in good working order.

(5) Gastester does not respond to mixture changes.

Remedy: Check correct fitting of probe pipes, see Fig 2A. Check for water in the probe pipe. The most common reason for lack of response is no gas flow through the collector box, (operation of the pulse pump is normally audible as the internal diaphragm vibrates with pulsations from the exhaust). If response is obtained at higher than idle speeds only, Pulse Pump may need replacement. (Alternatively, remove the Pulse Pump and twist the pump cap on the body to re-seat the diaphragm).

(6) Gastester cannot be set to the Calibration Position in air after warm-up.

Remedy: First check that the unit is correctly assembled according to the instructions and that the unit is being used the correct way up (the unit will not operate correctly if the collector box is inclined). Ensure that the unit is connected to a car battery (nb, a 12v dry cell battery, or a faulty car battery can not provide enough current and are unsatisfactory). Ensure that the unit is correctly warmed up (allow at least 8 minutes). Ensure that the unit is being calibrated to the calibration mark (near to 2%, NOT at zero). Ensure that the probe is in air and is not in the exhaust pipe. If these checks do not resolve the problem, it is possible that the instument has "drifted", generally due to collector box contamination or damage due to impact. The collector box is more prone to impact damage when warm and in use. The unit should be returned to Gunson for service. Fees for service and re-calibration are shown on the enclosed Gunson "Customer Services" leaflet. For further details of services and charges, or any other enquiries please send a Stamped Addressed Envelope to Service Department, Gunson Ltd.

8. TWIN/MULTIPLE CARBURETTORS

Where two separate carburettors are fitted, (not to be confused with a twin choke carburettor) two extra complications arise. Firstly the air flow through the carburettors must be accurately balanced before any mixture setting can be undertaken. This can be done using Gunson's Carbalancer, or less accurately with a tube to listen to the air intake hiss.

Secondly there will be separate mixture adjustments which must be synchronised. In the unlikely event that cylinders fed by each carburettor have totally separate exhaust, Gastester can be used in each exhaust to set the respective carburettor. When the exhaust is common to all cylinders another method must be used. One method is to count the turns of the mixture adjusting screws from the fully closed position (or jet flush with the bridge for variable venturi types) and then ensure that the screws are kept to the same number of turns throughout adjustment. An alternative (and better) method is to use Gunson's Colortune to set the mixture strengths equal at some point, then to ensure that the screws are turned the same amount during subsequent adjustments.

9. CARBURETTOR TYPES AND THEIR ADJUSTMENTS

GENERAL INFORMATION

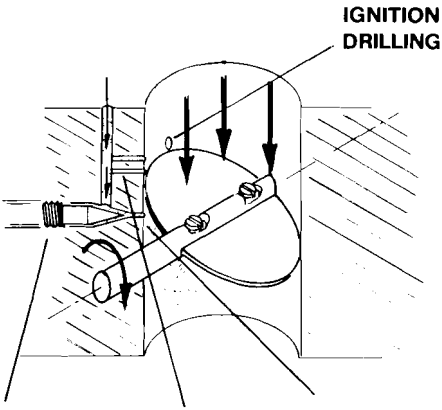
There are literally hundreds of different types of carburettor in use today, and finding the appropriate screws that control idle mixture strength and idle speed can pose quite a

problem. Wherever possible, the user is advised to consult a detailed workshop manual for the particular car, but the following notes are provided for use when such information is not available.

Firstly it should be mentioned that it is a legal requirement that all carburettors have either a method of sealing the adjusting screws, or require the use of a special tool to enable adjustments to be made. In some ways this has been a retrograde step, as although it may stop "tinkering" by an unskilled owner, wear of the various parts takes place during the life of the car, and mixture adjustment is frequently ignored until it becomes troublesome in terms of starting, performance or economy. These seals are usually thin metal or plastic plugs which are destroyed on removal, and are usually removed using a sharp screwdriver bit or short self-tapping screw. Other types offer a limited adjustment which can be increased by removal of a cap, and some cover seals have a removable centre section allowing access to the adjustment. The vehicle manufacturer will invariably recommend that the seals are renewed after adjustment, but this is frequently ignored by the service trade or vehicle owner, particularly after the service warranty has expired. In some countries, particularly the USA and Japan, this would be an offence.

Carburettor types can be divided into those that have a separate fuel circuit for idle, and those without a separate idle circuit. Figure 3 shows a typical arrangement of separate idle circuit. The mixture is made richer (i.e. CO higher by screwing the screw out)

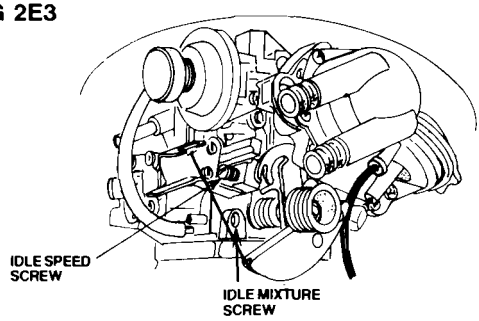
Figure 3



In such carburettors, idle speed can be of the adjustable throttle stop type, an example being shown in Figure 4.

PIERBURG 2E3

Figure 4



An alternative arrangement of separate idle fuel circuit with idle speed adjustment of the throttle bypass type, is shown in Figures 5 and 6. In this type, idle speed is controlled by a screw controlling the flow of air and fuel through a bypass channel, and not by varying the position of the throttle plate. In such types, the idle speed adjustment and idle mixture adjustment are usually located near to each other, on the same side of the carburettor. On certain types, the bypass channel may have its own mixture adjustment (shown dotted), for example some Solex EEIT carburettors. In this Solex twin carburettor, the mixture to both barrels is adjusted using the mixture bypass screw, the two conventional mixture screws normally remaining unaltered. It should be noted that with this type, when the bypass screw is used to change the engine speed, the mixture is affected also. It is therefore important to correct idle speed after each mixture adjustment, and to work in small increments of adjustment. It should also be noted that when a throttle bypass screw is fitted, the throttle stop screw will normally be locked or sealed, and in such units, the throttle stop screw should not be disturbed.

Figure 5

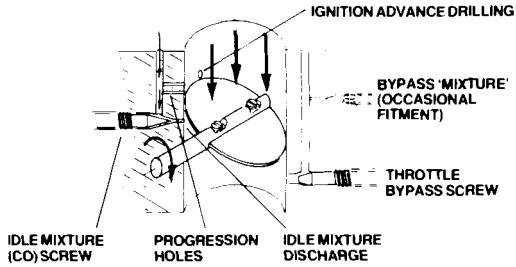
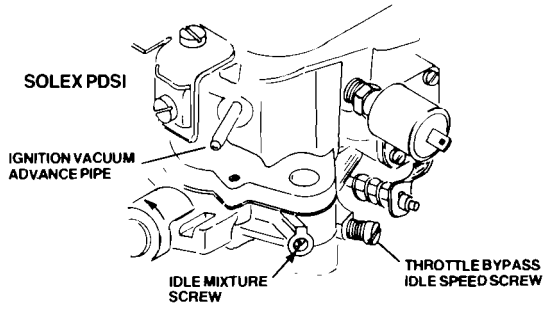


Figure 6



Carburettors without a separate idle mixture circuit are typified by the SU and CD horizontal variable venturi types. Mixture throughout the speed range is governed by a long tapered needle in a jet. Lowering the jet or raising the needle by manual adjustment causes a richening of the mixture throughout the operating range of the engine.

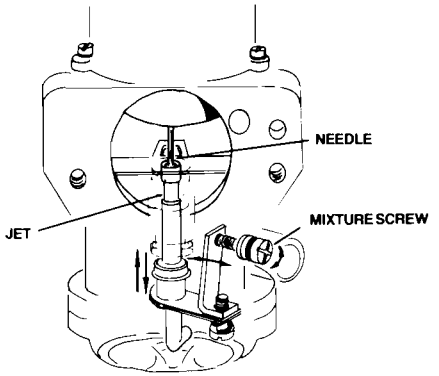


Figure 7
SU H.I.F. TYPE

The following notes describe particular types of carburettors and the methods of adjustment.

SINGLE FIXED VENTURI TYPE

This is one of the simpler forms of carburettor with a single air inlet and throttle plate, with a variety of air and petrol metering jets and channels. The main jet and associated main air jet and emulsion tube etc, provide an aerated "emulsion" which is fed to the venturi at speeds above idle. This already aerated fuel and air mixture breaks down further in the airstream.

The idle circuit is separate and also has a fuel and an air jet which feed an aerated mix to a drilling downstream of the throttle plate, further drillings are found in the area of the throttle plate. Just above the idle drilling would be found "progression" holes which are progressively uncovered by the movement of the throttle plate and increase the fuel flow when exposed to the manifold depression (or vacuum). This supplements idle fuel flow until the main fuel discharge in the venturi is well established. All of these fluid circuits are fed from a small reservoir of fuel whose level is controlled by a float and needle valve.

SINGLE VARIABLE VENTURE TYPE

This type of carburettor consists of a single air inlet (but more than one carburettor is sometimes fitted: see Section 8, Twin and Multiple carburettors), a throttle plate (or butterfly), and an air valve or a piston which closes off the air inlet to which is attached a tapered fuel metering needle. This needle runs inside a fuel jet which draws mixture from a small reservoir of fuel. The level of fuel is controlled by a float and valve.

At idle, when the throttle is nearly closed, the air valve is almost completely closed and the tapered needle which is attached to it restricts the flow of fuel to a great extent. As the throttle is opened the air valve is drawn upwards allowing more air to enter and the needle is drawn out of the jet allowing more fuel to flow. If the throttle is opened fully at low RPM the air valve rises about halfway. As the engine speeds up and draws in even more air the air valve will continue to rise. Thus the top half of the needle governs part throttle mixture and the lower half (slim end) governs full throttle mixture.

Mixture enrichment during acceleration is achieved using an oil filled damper which reduces the rate at which the air valve can rise.

Two types of needle are fitted:

(a) a rigidly fixed needle which should not touch the jet. In some cases after stripping the carburettor it is necessary to centralise the needle and jet during re-assembly (this is a very early type).

(b) A needle which is spring loaded against the side of the jet: when in good condition this type gives improved accuracy of fuel metering. (Replace at 50,000 miles / 80,000 km intervals).

Note: the needle housing should not be rotated as the direction of spring loading will be affected. Fuel metering needles are manufactured to within .0025mm (.0001") and should be handled carefully.

SU type HIF and Stromberg CDSE types have a temperature compensating device fitted but other SU and Stromberg CD types should be set when the carburettor is warm to the touch but not hot, to achieve maximum setting accuracy.

IDLE ADJUSTMENT

The idle speed screw generally acts on the throttle spindle to which the accelerator linkage is connected: this will give very fine adjustment of the throttle. The mixture screw (also affecting mixture at high speeds) is located in different positions on different types.

SU TYPE

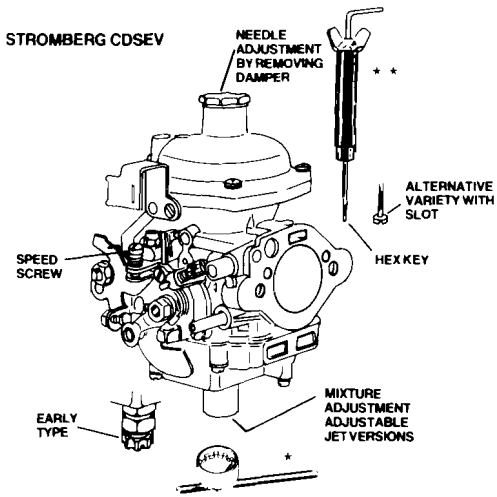
On early versions this is generally a hexagon nut underneath the carburettor and is screwed up to weaken (clockwise looking from underneath). Other types, HSB, HD, etc., have a screw which raises and lowers the jet through a system of levers. HIF types have a screw which is located behind removable plug in the right hand side of the carburettor: screwing in clockwise enriches the mixture.

Occasionally adjustment is on the left (one left, one right on twins).

CD TYPE

On early versions there is, generally underneath the carburettor, either a large slotted screw or, in later types a castellated bush which requires a special tool for easy adjustment*. It is screwed up to weaken (clockwise looking from underneath). Other types (adjustable needle) are plugged underneath and have a slot in the air valve (piston) guide rod. Remove damper and look inside to check for this. (The slot is across the smallest tube which is visible). An adjusting tool is also required here ** (See Figure 8 for alternative adjusting tools).

Figure 8



TWIN VENTURI CARBURETTORS (TWIN CHOKE) PROGRESSION TYPE

On this type two venturis are incorporated in the same casting. One throttle plate opens before the other (observe while operating the throttle linkage). At low speeds and for idle mixture adjustment this type can be considered similar to the single choke type, all adjustments being carried out on the barrel which opens first.

The Pierburg 2E3 shown in figure 4 has a diaphragm operated second barrel and the idle adjustment is by the throttle stop screw and idle mixture screw shown.

On the G.M. Varajet carburettor shown in Figure 9 the secondary barrel is of variable venturi design. This has no bearing on the idle setting which is of the by-pass type. Idle speed is adjusted on the throttle by-pass screw.

GM VARAJET

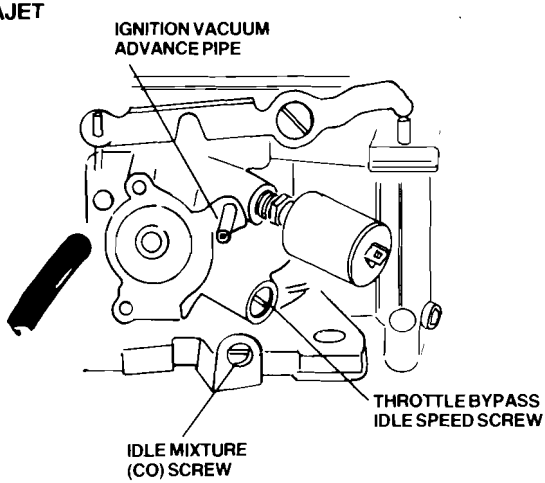


Figure 9

TWIN VENTURI CARBURETTOR SIMULTANEOUS TYPE

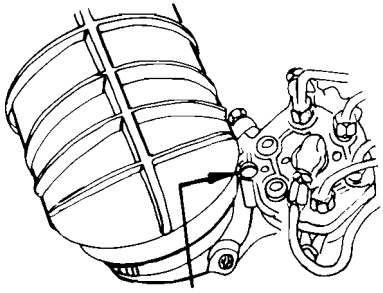
On this type the two venturis are incorporated in the same casting and both throttle plates operate at the same time. There is usually no need to balance the air flows through the two barrels. they are often linked by a single throttle spindle. Balancing of the two mixture screws is obtained by setting to the same number of turns open.

10. PETROL INJECTION SYSTEMS

Modern fuel injection systems can be either of the continuous type (e.g. Bosch K & KE-Jetronic), or intermittent type (e.g. Bosch L, LE, LE2-Jetronic, Motronic, Lucas LH etc) Adjustment screws are provided for idle mixture (CO). In some versions idle speed is not mechanically adjustable. The manufacturer's instructions should be carefully followed for particular models. The illustrations below show examples of types of adjustments.

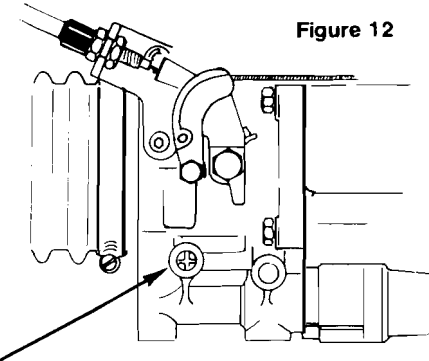
Figure 10

'K' JETRONIC



IDLE MIXTURE (CO) ADJUSTMENT

Figure 12



LUCAS LH

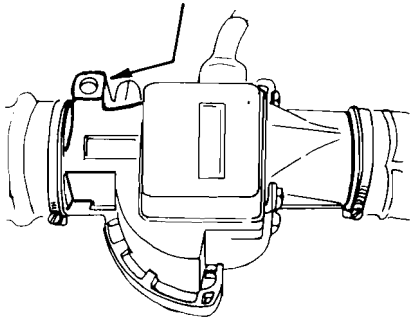


Figure 11

'L' JETRONIC

Some older types of system (e.g. Triumph PI) used separate throttle plates per cylinder and a common idle mixture screw. With this type it is essential to obtain an accurate balance through each throttle plate before any mixture setting is undertaken. This can be done using Carbalancer or Colortune as described in Section 8. Where separate mixture control screws are provided for each cylinder, adjustment should remain synchronised, by using the same turns for each screw during adjustments.

GUARANTEE

This guarantee is in addition to the purchaser's statutory rights.

Gunson have made every effort to ensure that GASTESTER is of the highest quality.

If this GASTESTER should require service or repair at any time, it should be returned to Gunson Ltd (Service Department), Pudding Mill Lane, Stratford, London E15 2PJ.

All technical enquiries must accompanied with a stamped self-addressed envelope.

Postage may be refunded (UK only) and repairs will be completed free of charge for manufacturing defects within one year of purchase.

Defects due to other than manufacturing faults may be charged for.

When sending goods for service or repair, please give full details of faults requiring attention, and an indication of purchase date.

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