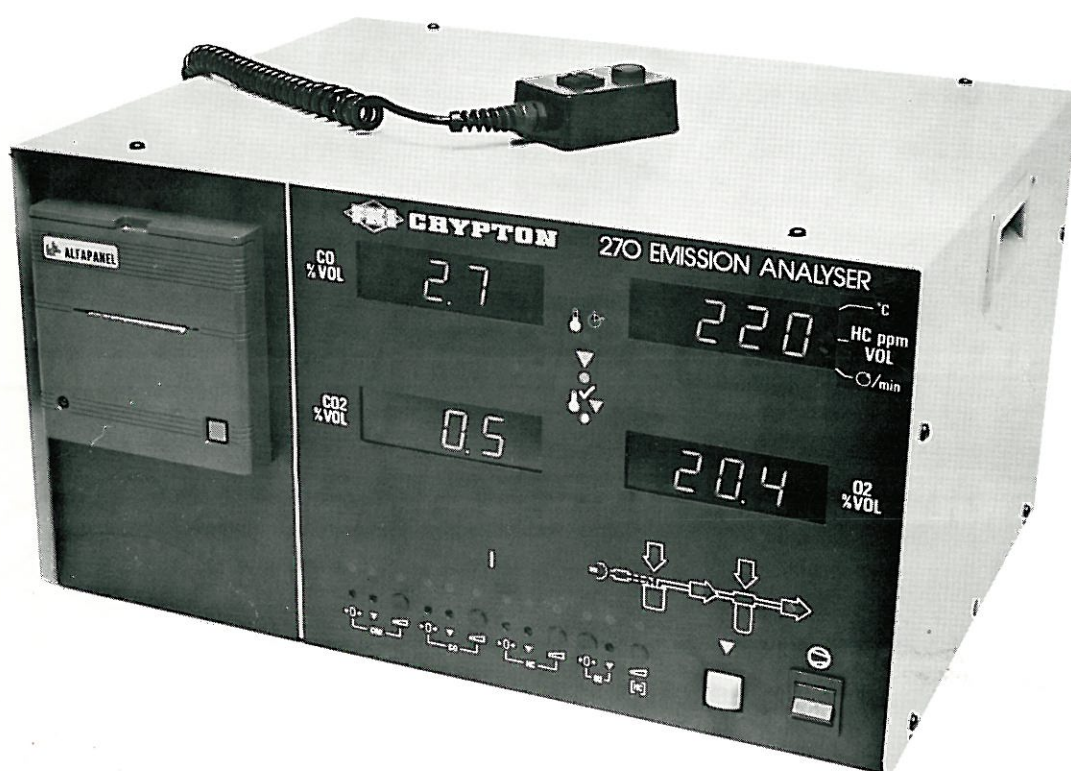


FKI CRYPTON



***267 CO/HC Analyser
270 CO/HC/CO₂/O₂ Analyser
267/270 POR & 267/270 PORD***

Operating & Maintenance Instructions

TES 903/9
April 1991

FKI CRYPTON

267 CO/HC Analyser

270 CO/HC/CO₂/O₂ Analyser

OPERATING INSTRUCTIONS

**Including instructions for the 267/270 POR &
267/270 PORD**

WARNING:

Do not attempt to operate this equipment unless you have read and understood these instructions.

The reliability of this equipment is fully supported by FKI Transervice with repair workshops and field service engineers to provide a full range of after-sales care, including installation, contract maintenance, factory overhaul and emergency repairs on-site. Please refer to the page at the end of this manual for details of your local service area.

NOTE:

Your attention is drawn to our Terms & Conditions of Sale, particularly paragraph 2 (an extract of which can be found at the back of this manual and full Terms & Conditions on our current Price List). If a service engineer is called out under service warranty where, upon inspection and test the equipment is found to be in full working order and no fault found, the user is liable to be charged the cost incurred for this call out. Before calling out an engineer, ensure your equipment is faulty by checking its operation, particularly mains supply and fault codes/self test if applicable.

Table of Contents

HEALTH & SAFETY PRECAUTIONS	1
Handling Precautions	1
RECEPTION	2
Mains Voltage	2
Connecting to mains supply	2
Overload Protection	2
Fitting the Emission Analyser into a Host Engine Analyser	2
Analyser Read-Out	2
MAINS TAPPING	3
WARM-UP SEQUENCE	5
CALIBRATION BUTTON	6
FILTERING SYSTEM	6
OIL TEMPERATURE	6
METHODS OF USE (CO)	7
METHOD OF USE (HC)	7
VEHICLE TEST PROCEDURE	8
ENVIRONMENTAL READINGS	9
RADIATOR COOLANT READINGS	9
ANALYSIS OF TEST RESULTS (CO/HC)	10
DILUTION OF HC AND CO	10
ANALYSIS OF TEST RESULTS (CO₂/O₂ - 270 only)	12

CARBURETTOR IDLE ADJUSTMENTS	14
Fixed Jet Carburettors	14
Adjusting Procedure (early fixed jet)	14
The Idle By-pass Duct	15
Adjusting Procedure (idle bypass)	15
Throttle Stop Setting (idle bypass)	16
Constant Depression Carburettors	16
Adjusting Procedure (CD carbs.)	16
The Ford VV Carburettor	17
Adjusting Procedure (Ford VV)	17
The Weber 2V Carburettor With Stepper Motor	18
The Idle Switch	18
Stepper Motor Adjustment	19
Tamperproofing	20
FAULT FINDING (poor engine idle condition)	21
FAULT FINDING (poor cruising condition)	22
SERVICING THE FILTERS	23
Indication of Blockage	23
Rectification Procedure	23
Servicing The Secondary Filter	24
ADJUSTING THE ANALYSER	25
AFR/LAMBDA	26
CONSUMABLE SPARES	26
267/270 POR	27
267/270 PORD	30

HEALTH & SAFETY PRECAUTIONS

IMPORTANT

1. The equipment is not weatherproof and should not be used outside in rain or snow.
2. The internal circuits should not be tampered with in any way.
3. Operators should exercise due caution with regard to the engine fan and associated belts.
4. When the test area is confined, provision should be made to extract the exhaust gases.

WARNING: CO is a highly poisonous gas. If breathed in, it is absorbed by the blood and will result in greatly slowed reactions and if absorbed in sufficient quantity can be fatal. Published figures show that a concentration of 0.3% CO in the air can be fatal if inhaled for 30 minutes. Provision should therefore be made to extract the exhaust gases.

5. Before starting an engine ensure that the gear selector is in neutral or park.
6. Care should be taken with regard to scalding from the cooling system, burns from the exhaust system and electric shocks from the ignition HT system.
7. When disconnecting the fuel system of a hot engine beware of the fire hazard caused by petrol spilling onto the manifolds, ignition distributor, etc.
8. Position the mains cable and sampler pipe in such a manner that they do not present a hazard to anyone.
9. The earth lead of the mains supply cable **MUST ALWAYS** be connected to a good earth point.
10. The O₂ (Oxygen) Sensor fitted to the 270 contains a caustic substance, Potassium Hydroxide and Granular Lead.

Handling Precautions

The oxygen sensors are sealed and under normal circumstances the contents of the sensors do not present a health hazard. The following information is given as a guide in the event that a cell leaks.

Protective Clothing: Rubber gloves, chemical splash goggles.

Clean-up Procedures: Wipe down the area several times with a wet paper towel. Use a fresh towel each time.

Protective Measures during Cell Replacement: Before opening the bag containing the cell, check the cell for leakage. If the cell leaks, do not open the bag. If there is liquid around the cell while in the instrument, put on gloves and eye protection before removing the cell.

Disposal: Should be carried out in accordance with all applicable local and national regulations.

In the event of contact carry out the following First Aid Procedures:

- | | |
|---------------|--|
| Eye Contact: | Flush eyes with water for at least 15 minutes and get immediate medical attention. |
| Skin Contact: | Wash affected area with plenty of water and remove contaminated clothing. If burning persists, seek medical attention. |
| Ingestion: | Give plenty of cold water. Do not induce vomiting. Get medical attention. |
| Inhalation: | Liquid inhalation is unlikely. |

RECEPTION

Unpack the equipment and examine for any damage. Check loose items against the despatch schedule enclosed. Report any breakage, loss or discrepancy to the supplier immediately.

Mains Voltage

The analyser leaves the factory connected for 240V/50Hz single phase mains supply, unless marked with a label stating another voltage. If your mains supply differs from the stated voltage change the voltage tapping as described on the opposite page.

Connecting to mains supply

(a) When used with an engine analyser:

The equipment is supplied with 2 metres (6 ft) of mains cable with a moulded plug at each end, when supplied for use with an engine analyser. The right angled connector should be plugged into the mains outlet at the rear and straight connector into the mains inlet on the rear of the emission analyser.

(b) When used as a stand-alone unit:

The equipment is supplied with 7 metres (23ft) of mains cable with a 13 amp mains plug at one end and a moulded plug at the other end. The mains plug should be fitted with a 3 amp fuse.

Overload Protection

A thermal overload button, which may trip out if a fault develops inside the analyser, is fitted on the rear panel. If the analyser fails to operate when switched on, push this button in firmly. Should the button spring out immediately or operate persistently a Transervice engineer or authorised agent (overseas customers) should be called.

Fitting the Emission Analyser into a Host Engine Analyser

For fitting instructions - refer to specific engine analyser operating instructions.

Analyser Read-Out

The 267 analyser has two digital displays which read simultaneously as follows:

CARBON MONOXIDE (CO)	0.0% to 9.9% in 0.1% increments.
HYDROCARBON (HC)	0 to 5000 ppm in 20 ppm increments (ppm = parts per million)
	0 to 9999 ppm in 40 ppm increments (10000 UNITS ONLY)

The 270 analyser has two additional displays:

CARBON DIOXIDE (CO₂)	0.0% to 20% in 0.1% increments.
OXYGEN (O₂)	0.0% to 20.9% in 0.1% increments.

MAINS TAPPING

Remove the 12 screws securing the top cover and lift the cover from the unit. The mains tapplings will be found on the left hand side of the unit (viewed from the front).

The illustration below (Fig.1) shows the wires tapped for a 240V supply.

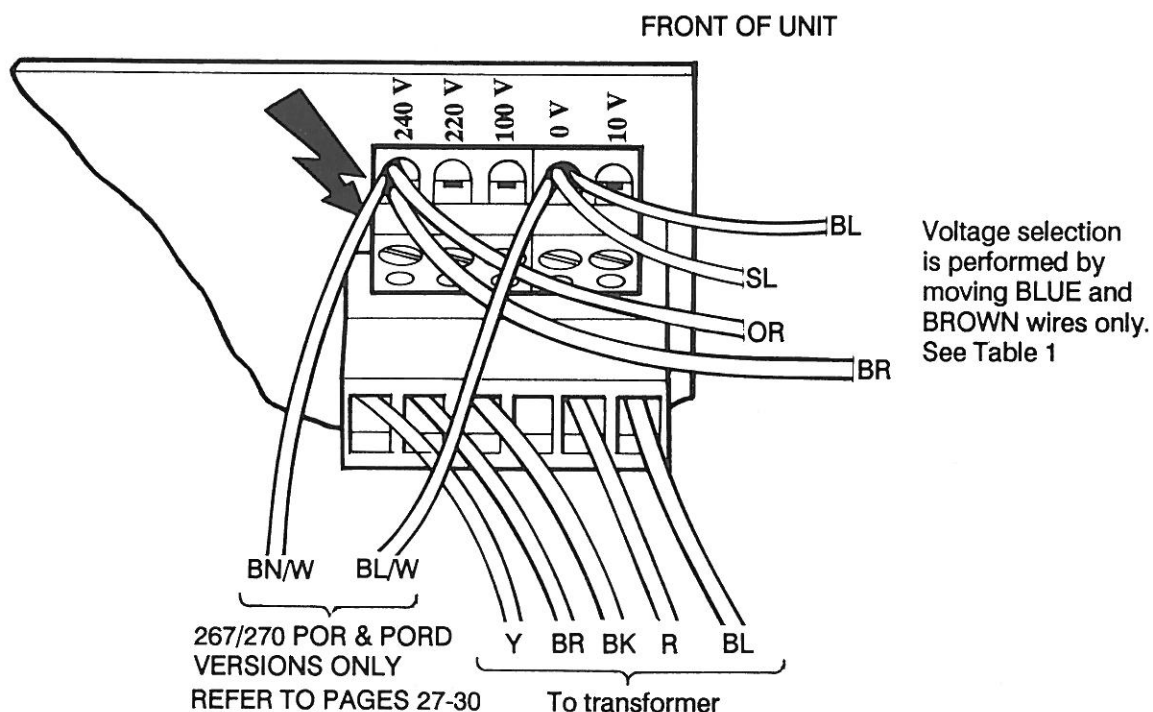


FIG.1 MAINS TAPPING

	REQUIRED VOLTAGE					
	100 V	110 V	220 V	230 V	240 V	250 V
POSITION OF BLUE (BL) WIRE	0 V	10 V	0 V	10 V	0 V	10 V
POSITION OF BROWN (BR) WIRE	100 V	100 V	220V	220 V	240 V	240 V

TABLE 1

IMPORTANT: Move only BL (blue) and BR (brown) wires.

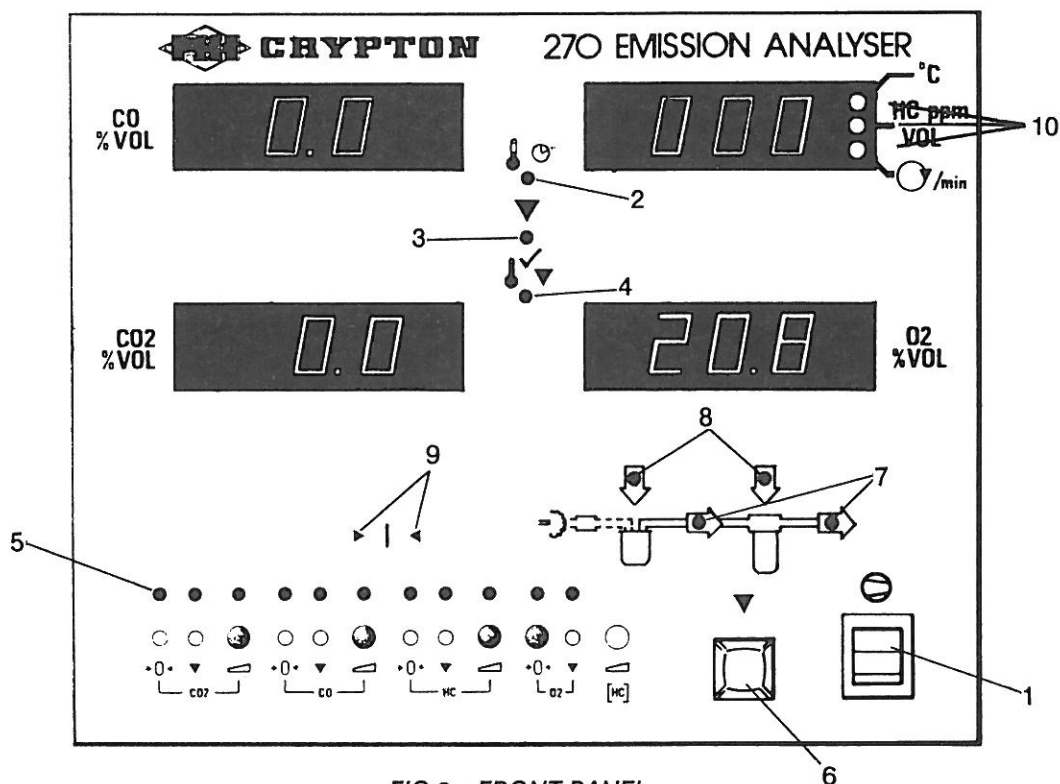


FIG.2 FRONT PANEL

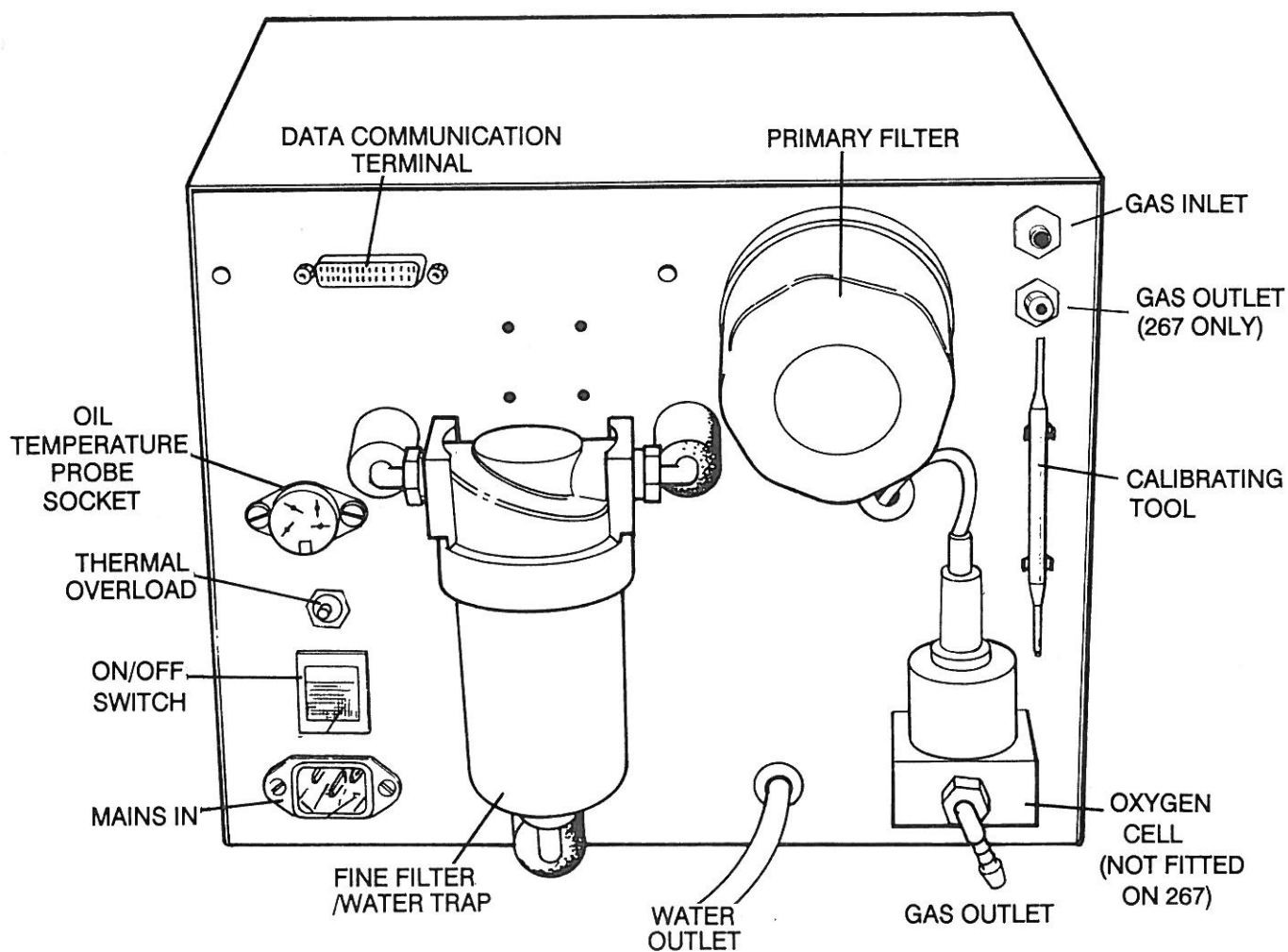


FIG.3 REAR PANEL

WARM-UP SEQUENCE

NOTE:

Figure 2 illustrates the front panel of the 270 'Four Gas' analyser. The location of controls and lamps on the 267 unit are the same, with the omission of the CO₂ and O₂ gas references.

To switch the analyser ON press the button on the back of the unit (Fig.3-1) which will be illuminated. If switched on from cold the analyser will take a minimum of 10 minutes to warm up. During the warm-up period the internal circuitry will pass through several different modes of calibration indicated by a display of lamps as follows:

1. **INITIAL SWITCH-ON.** The analyser passes through a self test mode for a few seconds. During this time the indicator lamps (Fig.2-2,3 & 4) will light accompanied by a pre-determined sequence of numbers appearing on the digital display. Finally, provided no fault is detected, the digits will be extinguished and all the lamps (Figs.2-5, 9 & 10) will light briefly. These will then be extinguished and a solenoid will be heard to click inside the analyser.
2. **FAULT INDICATION.** This is seen only if a circuit fault is discovered during the self test routine. The indicator lamps will remain on, or flash and a number will be shown on the display panel of the CO and HC digits. This number, together with the condition of the fault indicator lamps should be conveyed to the Transervice regional controller (see back of this manual). This will assist the engineer in identifying the fault before arriving on the site.
3. **WARM UP.** Throughout the warm up period the red lamp (Fig.2-2) will light. This period is approx. 10 minutes, dependent on ambient temperature and previous usage of the analyser. During this period the gas pump will be heard to operate automatically, regardless of the gas pump switch.
4. **SELF CALIBRATION.** At the end of the warm-up period the circuitry will go into the self calibration mode shown by the orange lamp (Fig.2-3). The analyser automatically enters this self calibration mode every 30 minutes when switched on but not in use. During this calibration the gas pump will be heard to operate and the analyser may require adjustment. This will be indicated by one of the red lamps (Fig.2-5) together with one of the adjust indicator lamps (Fig.2-9) illuminating. Adjustment procedure can be found on page 25.
5. **READY FOR USE.** The orange lamp goes out and the green lamp (Fig.2-4) comes on. The red lamp next to the HC ppm VOL will also be illuminated. This indicates that the analyser is ready for use.

NOTE 1 (Fig.2-10):

These lamps are used when a printer/tach module is fitted. For standard 267/270 the HC lamp only will be used.

NOTE 2 (Model 270 only):

If the green (ready for use) lamp comes on but the oxygen display is blank, the oxygen sensor has failed and a service engineer should be called (see Health & Safety Precautions and back of manual for details). The analyser may still be used for other gases.

CALIBRATION BUTTON

The orange button (Fig.2-6) allows manual initiation of the self calibration circuitry. As already mentioned, the analyser calibrates itself automatically every 30 minutes when switched on and not in use.

NOTE:

When in use, the analyser will self calibrate if the sampler pipe or filters become blocked and a period exceeding 30 minutes has elapsed since the last calibration.

FILTERING SYSTEM

Two filters are employed in the analyser to remove carbon particles and moisture from the exhaust gases. No regular emptying of the water trap is required as water is automatically expelled from the system during normal use. However, it is recommended that the oil filter be removed regularly to prevent corrosion from clogging up the threads.

IMPORTANT: A considerable amount of water can accumulate in the sampler pipe during normal use. NEVER roll up the pipe towards the unit whilst connected to the analyser as this will result in flooding the filters with water, which will block the fine filter.

When the filters require attention or the system becomes blocked in any way, the green flow indicator lamps (Fig.2-7) will go out and be replaced by the red lamps (Fig.2-8). When this occurs refer to page 23 for filter servicing.

OIL TEMPERATURE

CAUTION: GREAT CARE MUST BE TAKEN WHEN PERFORMING THIS TEST TO ENSURE THAT NO DAMAGE TO THE OIL TEMPERATURE PROBE AND/OR ENGINE IS INCURRED BY CONTACT WITH MOVING ENGINE PARTS.

Remove the dipstick from the engine and check that the oil is at a reasonable level. Compare the temperature probe to the dipstick and adjust the rubber bung so that the length of probe inserted into the engine is 10-15 mm shorter than that of the dipstick. There must, therefore, be sufficient oil to reach the probe. Insert the probe into the engine via the dipstick hole. The oil temperature will be displayed on the Host equipment during carburettor/injection test modes in steps of one degree.

METHODS OF USE (CO)

The CO reading can be used in various ways as follows:

1. To adjust the CO content of the exhaust gas to the level permitted by government legislation where applicable.

or
2. To adjust the CO content of the exhaust gas to the vehicle manufacturer's specification. Available in UK for cars built after October 1976 (not a legislative requirement for in-service use).

or
3. To adjust the CO content of the exhaust gas to a reasonable level, consistent with good engine performance. Applies in UK to cars built before October 1976.

or
4. To check the high speed economy of a vehicle by monitoring the CO level at 3000 rpm.

METHOD OF USE (HC)

1. To check for good combustion of the petrol vapour entering the cylinders and thereby detect misfiring caused by excessively rich or lean mixture, low compression, close valve clearances, air leaks, etc. (see page 10.)
2. To check for cylinder leakage into the engine coolant by allowing vapours from the coolant filler orifice to be sampled by the HC analyser.

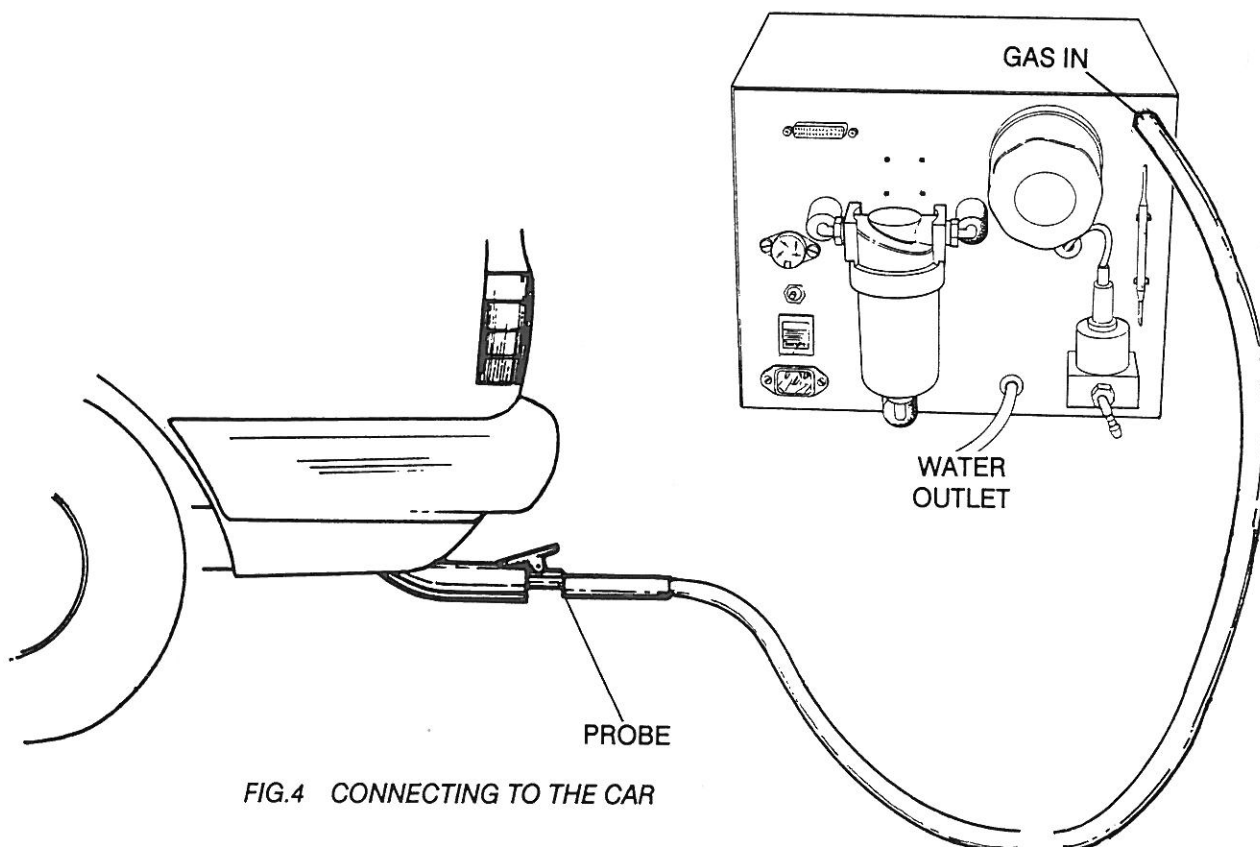


FIG.4 CONNECTING TO THE CAR

NOTE:

The model '35' Twin Exhaust Probe is available as an option.

VEHICLE TEST PROCEDURE

1. Switch the analyser ON and allow it to warm-up as previously described. Note that if installed in an engine analyser the power supply to the emission analyser will also be controlled by the mains ON/OFF switch of the engine analyser.
2. Operate the black rocker switch (Fig.2-1) to start the gas pump. Note that when installed in an engine analyser the pump will be switched on automatically when the 'emission test and cylinder balance' are selected. The pump may be switched on at other times if required but the switch should normally be left in the OFF position.
3. Check the condition of the gas flow indicators. If the red lamps are ON refer to page 23 for filter servicing. The green lamps indicate that the system is clear.
4. Warm up the engine to normal operating temperature and ensure that all components essential to performance, i.e. spark plugs, contact points, etc. are in good condition (ideally exhaust gas analysis should be carried out after a complete engine tune).
5. Connect the gas sampler pipe to the inlet pipe on the rear panel of the analyser and insert the probe into the vehicle tailpipe (see Fig.4).

NOTE:

Model 35 Twin Exhaust probes are available as an option.

6. Start the engine and adjust to the correct idle speed. Refer to Crypton Tune-Up Data.
7. Check the readings, making adjustments to the mixture where necessary. Refer to Crypton Tune-Up Data. See page 14 for information on specific carburettors, or page 21 for Fault Finding.
8. Raise the engine speed to 3000 rpm and hold steady until readings stabilise.
9. Check the readings and see page 22 for Fault Finding.
10. Lower engine speed to idle and switch off engine. Remove the sample probe from the tailpipe.
11. Switch off the gas pump by operating the rocker switch (Fig.2-1) on the analyser. Note that if installed in an engine analyser, selection of another test will cause the pump to be switched OFF.

NOTE:

If the analyser is to be used several times each day it is recommended that the mains switch be left ON and only switched OFF at the end of the last test of the day. The gas pump should be switched OFF when not required to maximise the life of the pump assembly.

ENVIRONMENTAL READINGS

A proportion of exhaust gases accumulate in the workshop environment, additionally a certain amount of residual gas may be left in the instrument. For these reasons a low reading may be noticed on the analyser even when not connected to a vehicle. This should not be taken as an indication that the unit requires calibration. The O₂ channel (270 only) will normally read 20.9 when drawing in fresh air direct from the atmosphere.

RADIATOR COOLANT READINGS

By removing the filler cap and holding the sampler probe above (**NOT IN**) the engine coolant, an HC reading on the analyser indicates that the cylinder head gasket or engine castings are at fault.

WARNING: Care should be taken to avoid scolding. The cooling system remains hot and pressurised for a considerable time after the engine has been switched off.

ANALYSIS OF TEST RESULTS (CO/HC)

CO - Carbon Monoxide is formed in the cylinders when there is incomplete combustion and an excess of fuel. Fig.5 shows the level of CO to be high when the mixture is rich, falling considerably at around the ideal mixture of 14.7:1, then falling to zero before rising again when the air/fuel ratio exceeds 20:1.

Catalytic converters which can only be used with lead-free petrol, reduce the level of CO to near zero by chemical reaction. Early 2-way converters work in conjunction with an air injector pump. With the air pump working, levels up to 0.2% CO may be seen. By disabling the air pump, the effect of the converter will be somewhat reduced, when CO levels up to 0.8% may be seen. No pump is required with the later 3-way converter.

On cars without converters, CO levels up to 5% or more may be needed for good engine performance. See pages 14-20 for specific examples.

In general, with older vehicles the CO level at 2500 rpm will be lower than at idle, a typical reading being around 2 to 3%.

HC - Petrol is mainly composed of hydrocarbons, so the HC level in the exhaust gas is a result of incomplete combustion. The level is high when the mixture is rich, falling to a minimum at around 16:1 air fuel ratio. If the mixture is too lean, misfiring begins to occur, increasing in frequency as the mixture gets leaner. Every time the spark fails to ignite the mixture, a full cylinder charge of hydrocarbon/air mixture is pumped into the exhaust, so raising the HC reading. Fig.6 shows the effect on HC due to mixture variation.

Some modern cars have catalytic converters installed which reduce the HC level close to zero by chemical reaction. Early 2-way converters work in conjunction with an air injector pump. With the air pump working, a level of 10-20 ppm may be seen. By disabling the air pump, the effect of the converter can be somewhat reduced when levels up to 100 ppm are normal.

On cars with a carburettor and without a converter, levels up to 400 ppm are normal, whereas about 300 ppm should be expected on later cars. Injected engines normally give between 80-300 ppm.

The HC level at 2500 rpm should be lower than at idle, generally being around half the idle reading.

WARNING: CO is a highly poisonous gas. If breathed in, it is absorbed by the blood and will result in greatly slowed reactions and if absorbed in sufficient quantity can be fatal. Published figures show that a concentration of 0.3% CO in the air can be fatal if inhaled for 30 minutes. Provision should therefore be made to extract the exhaust gases.

DILUTION OF HC AND CO

Dilution is caused by a leaking exhaust system. Always check the vehicle exhaust system for leaks. A serious leak will dilute the CO and HC level and give misleading results.

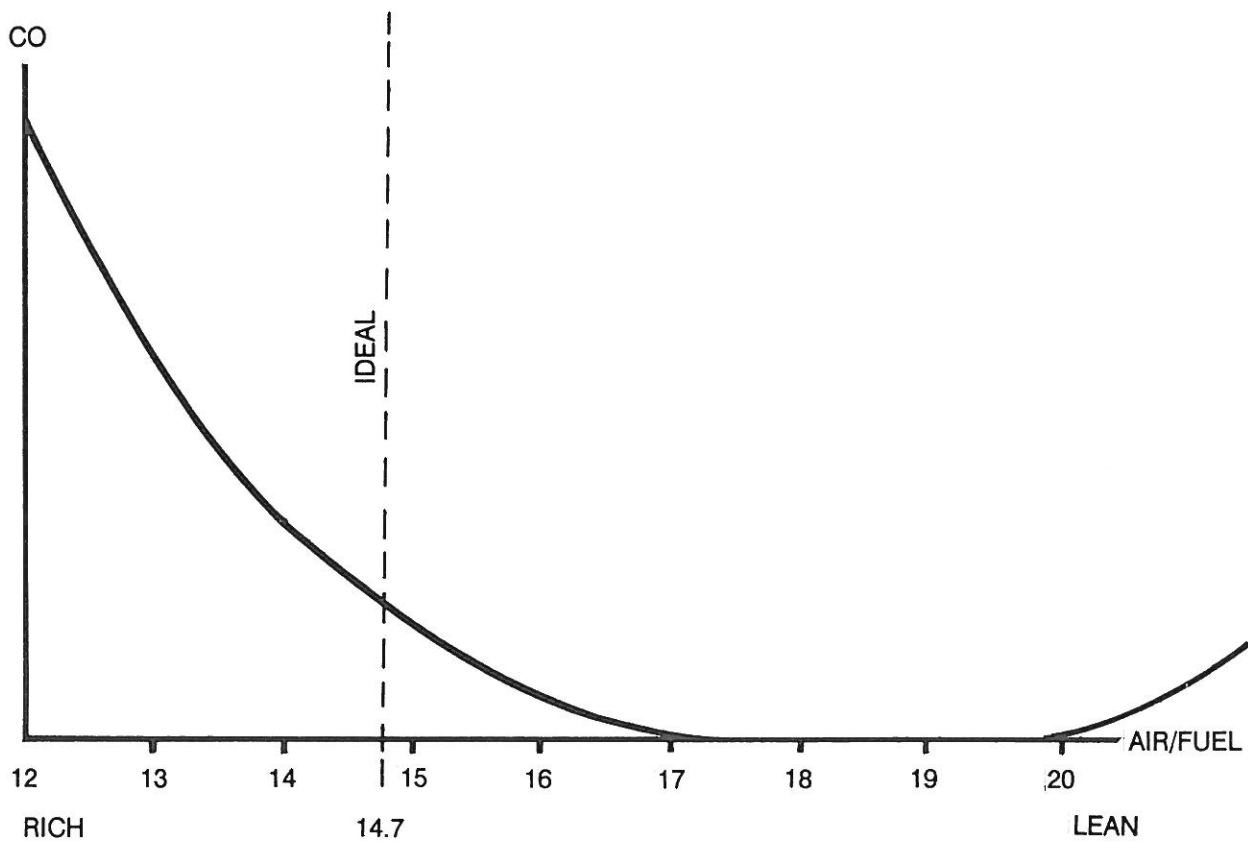


FIG.5

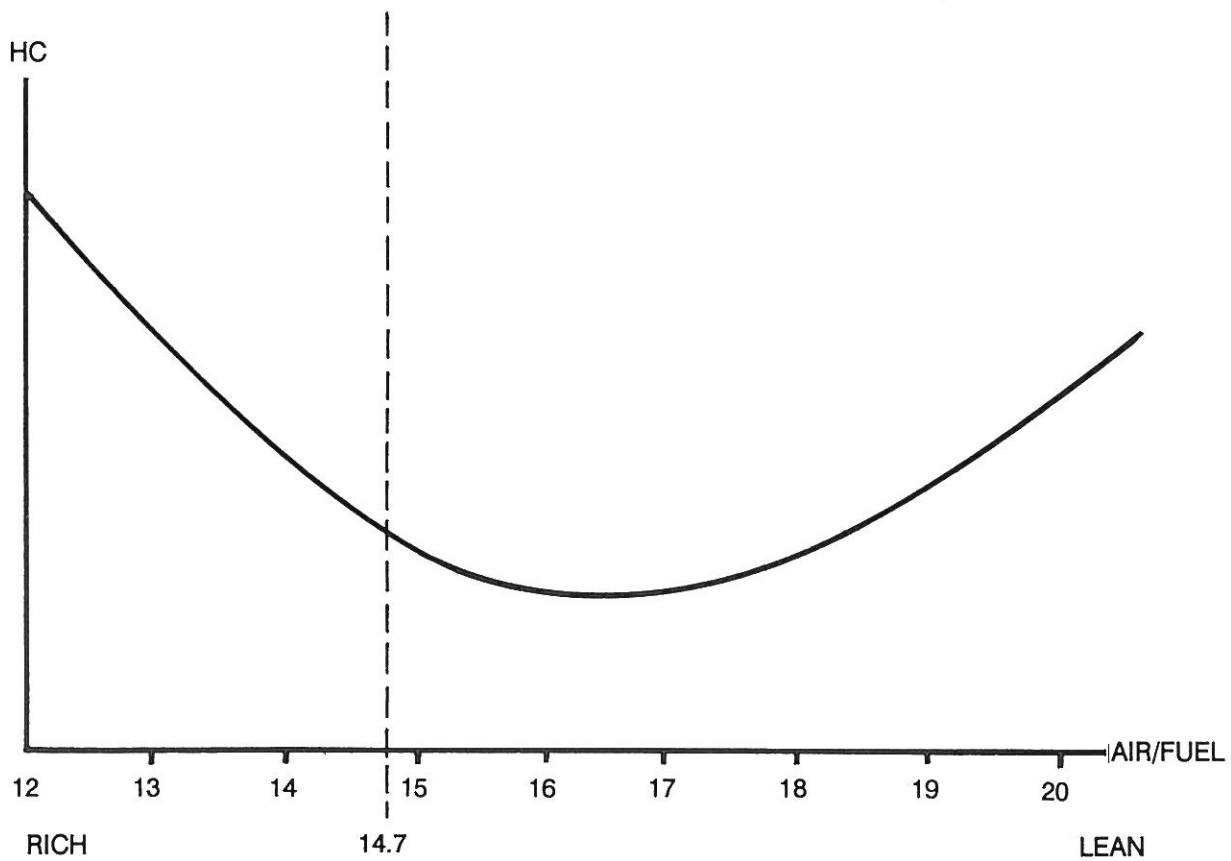


FIG.6

ANALYSIS OF TEST RESULTS (CO₂/O₂ - 270 only)

CO₂ - This gas gives a direct indication of combustion efficiency. Fig.7 shows that as the air/fuel ratio moves from rich through ideal (stoichiometric) and then to lean, the level of CO₂ rises to a peak and then falls back again. It will generally be found that the level of CO₂ will be 1-2% higher at 2500 rpm than at idle. This is due to the improved gas flow resulting in better combustion efficiency. The maximum level of CO₂ possible is close to 16%.

NOTE:

If an air injection system is operating while the CO₂ measurement is taking place, the % of CO₂ will be reduced to about 10% maximum. This is because the engine exhaust gases are now being mixed with air. As a % of the total gas the CO₂ level is, therefore, less. It is best to disable the air injection system by removing the drive belt, activating the air divert solenoid or clamping the air pump feed hose with a suitable smooth jaw grip.

O₂ - This is the oxygen level present in the exhaust gas. With rich mixtures most of the oxygen is burnt during combustion. With very lean mixtures much more oxygen escapes the combustion process so the level rises. Fig.8 shows the result. Levels between 0.5% and 4% oxygen will be present for an engine which is correctly adjusted.

NOTE:

If an air injection system is operating while the O₂ measurement is taking place, the % of O₂ will increase to about 10%. This is because the exhaust gases are being mixed with air which contains approximately 21% oxygen by volume. Once again, it is best to disable the air injection system by removing the drive belt, activating the air divert solenoid or clamping the air pump feed hose with a suitable smooth jaw grip.

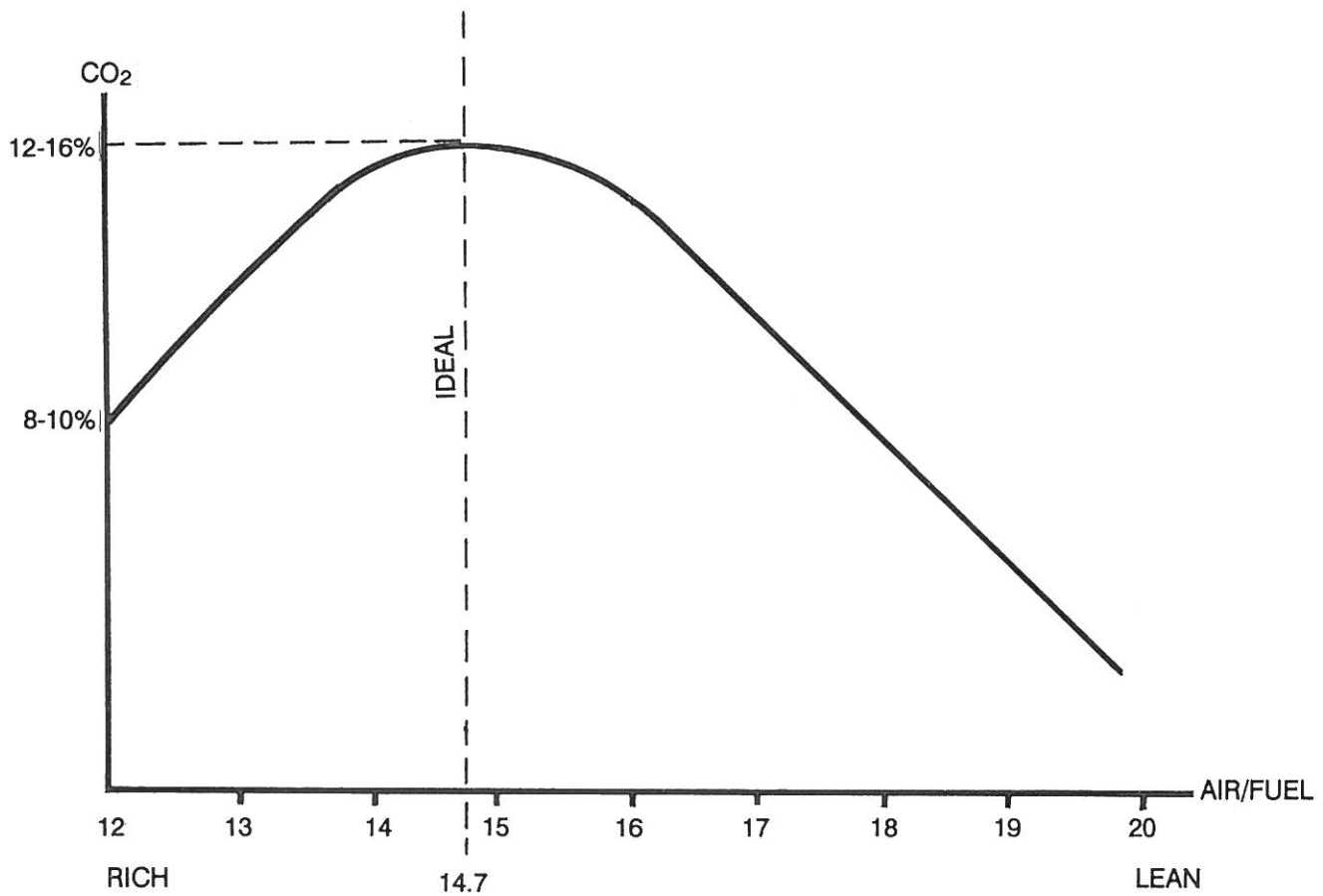


FIG. 7

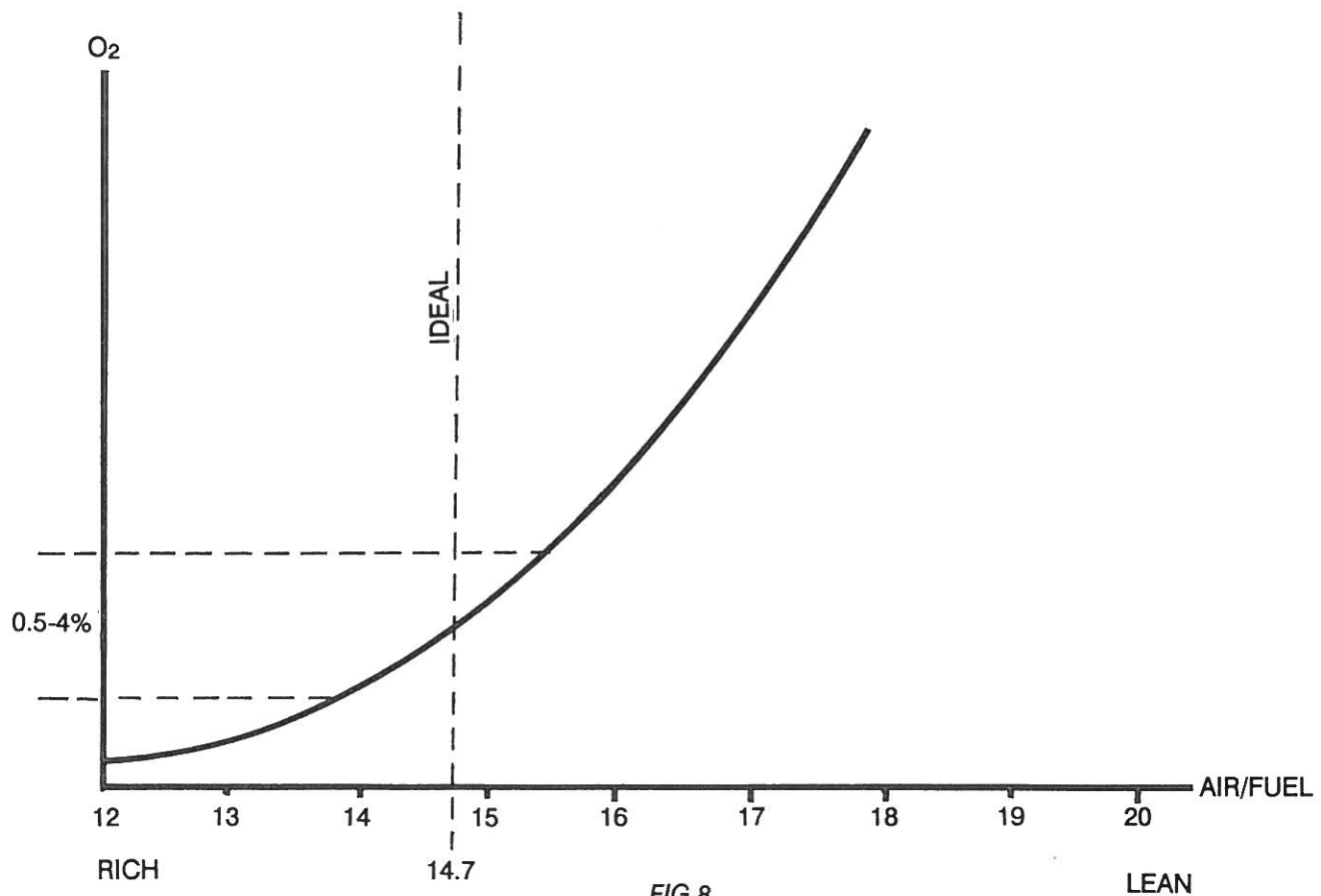


FIG. 8

CARBURETTOR IDLE ADJUSTMENTS

To enable the correct mixture adjustment to be obtained over the wide range of carburettors currently in use requires quite a high degree of knowledge and skill.

Whilst the basic designs are discussed in this manual, those wishing to make a more thorough study of carburation are referred to the Crypton Technical Bulletin Service and the Autodata Carburettor Manual.

Although methods of adjustment have changed considerably over the last few years, carburettors can still be divided into two basic groups: the fixed jet designs and the constant depression designs.

Fixed Jet Carburettors

Most earlier models of carburettor have two adjustments for the idle condition: idle speed and idle mixture. Fig.9 shows the location of these screws on the 'Motorcraft' carburettor. In general with this arrangement, the air and petrol for idling are mixed together in a relatively slow moving air stream before issuing into the main venturi. The main volume of air enters around the throttle butterfly.

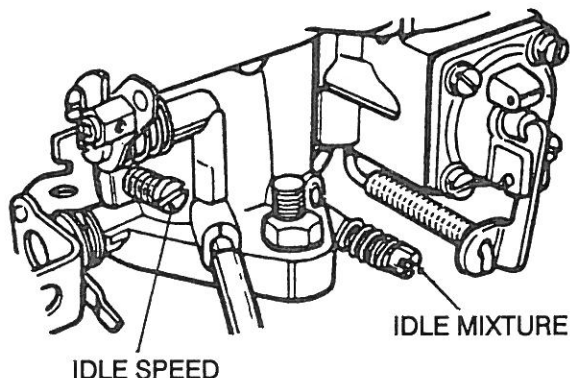


FIG.9

Adjusting Procedure (early fixed jet)

1. Warm up engine thoroughly, at least 10 minutes at fast idle if starting from cold.
2. Check engine test data for correct idle speed.
3. Turn the idle speed screw to achieve the stated rpm.

NOTE:

If the engine is particularly hot, e.g. the electric fan is cutting in regularly, the idle speed can be set high by 50 rpm to allow for cooler running on the road.

4. Adjust the mixture screw to bring the CO reading to the desired value.

NOTE:

With earlier carburettors, good performance and steady idling may require a CO setting of at least 4%.

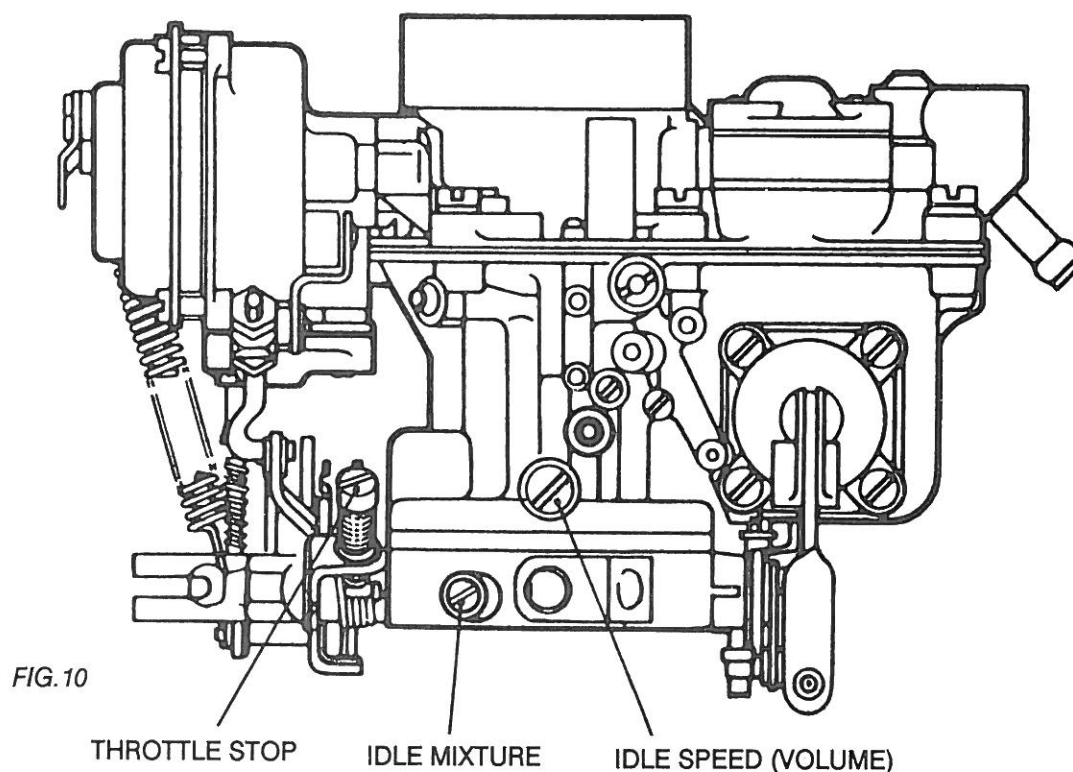
5. If the rpm drifts outside of the idle speed limits, re-adjust the throttle stop to correct the idle speed then re-check the CO.
6. Repeat Step 5 until both the idle speed and CO readings are correct.

NOTES:

- (a) An engine which cannot be made to idle smoothly at any setting of the carburettor probably has tight valve clearances or close plug gaps.
- (b) If idle mixture adjustment is prolonged for over 2 minutes, the engine speed should be raised to clear accumulations of excess fuel from the inlet manifold.

The Idle By-pass Duct

Fig.10 shows a carburettor where a third idle adjusting screw is incorporated. This design was introduced to give better control of exhaust emission by improving the atomisation of the idle mixture. Essentially, the fuel and air are pre-mixed in a separate chamber where the air velocity is raised, in some cases to the speed of sound, before issuing into the venturi. With this design the main volume of air for idling enters through the idle bypass duct.



Adjusting Procedure (idle bypass)

1. Warm up the engine thoroughly, at least 10 minutes at fast idle if starting from cold.
2. Check engine test data for correct idle speed.
3. Turn the idle volume adjusting screw (Fig.10) to achieve the stated idle rpm.

NOTES:

- (a) It should not be necessary to adjust the throttle stop to achieve the correct idle speed.
- (b) If the idle speed is too slow and the mixture weak, the engine may not respond to the volume adjuster until the mixture is richened.

4. Adjust the mixture screw (Fig.10) to bring the CO reading to the desired value. See engine test data.
5. Re-adjust the idle volume adjusting screw to correct the engine idle speed if necessary.
6. Repeat Steps 4 and 5 until both the idle speed and CO level are satisfactory.

NOTES:

- (a) An engine in poor condition may require a CO level higher than that specified to achieve an acceptable idle condition.
- (b) Some engines, e.g. Vauxhall 'Cavalier' and Opel 'Manta' (cam-in-head engine) have a thermal valve attached to the inlet manifold which opens to weaken the mixture under high temperature conditions. This valve must be shut during idle speed and CO adjustments.

Throttle Stop Setting (idle bypass)

The type of carburettor shown in Fig.10 does not require regular adjustment of the throttle stop which, in this case, is fitted primarily to prevent the throttle butterfly valve from jamming inside the carburettor body.

Incorrect setting of the throttle stop may result in high CO levels which can be reduced only at the expense of engine idle quality.

Another indication of an incorrect throttle stop setting is the inability of the volume adjuster to produce an acceptable idle rpm.

To reset the throttle stop, connect a sensitive vacuum gauge to the vacuum advance take-off on the carburettor and adjust the throttle to produce 1-15 mmHg (20-200 mmH₂O) (-0.1 to -2 kPa).

If an adjustment has to be made without the aid of a vacuum gauge, turn the throttle stop counter-clockwise until the throttle disc is felt to bind inside the carburettor, then turn the stop in the opposite direction until the throttle just ceases to bind.

Constant Depression Carburettors

The two most popular constant depression carburettors seen in the UK are the SU/Butec and Zenith/Stromberg types. It should be noted that later Zenith/Stromberg carburettors are also known as Pierburg carburettors, the manufacturing name having been changed. Fig.11 shows the basic SU type with two adjustments for the idle condition: idle speed and idle mixture. The idle mixture is controlled by raising or lowering the jet around a tapered needle, so increasing or decreasing the effective jet orifice. The Zenith/Stromberg carburettor also operates in a similar manner.

Adjusting Procedure (CD carbs.)

1. Warm up the engine thoroughly, at least 10 minutes running at fast idle if starting from cold.
2. Check engine test data for correct idle speed.
3. Turn the idle speed screw (Fig.11) to achieve the stated rpm.
4. Adjust the mixture control nut underneath the carburettor to bring the CO reading to the desired value.

NOTE:

Later Stromberg CD carburettors are fitted with an adjusting nut that is inserted into the bottom of the float chamber and has a castellated form. For this particular type of mixture control nut, a special 'cup' tool is required that fits directly onto the nut and into the float chamber aperture. This type of nut also forms the Tamperproofing seal as described on page 20.

5. Reset the idle rpm to the correct speed if necessary.

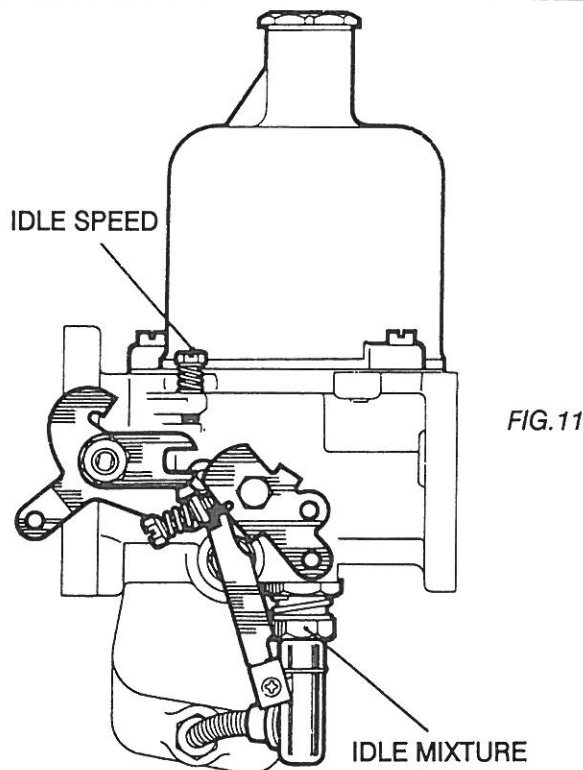
NOTES:

(a) With multi-carb. installations, particularly on earlier designs of sports car, readings up to 7% at idle may be required to produce satisfactory high speed performance.

(b) To improve fuel atomisation consistency, modern CD carburettors have spring biased needles which make contact with the jet at one side. Under certain types of usage, e.g. town driving, the jet orifice will become enlarged causing excess fuel to be drawn off. This can be corrected initially by raising the jet.

If the wear exceeds certain limits, however, correction of the idle mixture will cause extreme weakness and misfiring at higher speeds. When this occurs, the jet should be replaced.

The latest SU KIF carburettor has been modified to give separate adjustment of idle and high speed mixture, thereby offsetting the effect of jet wear.



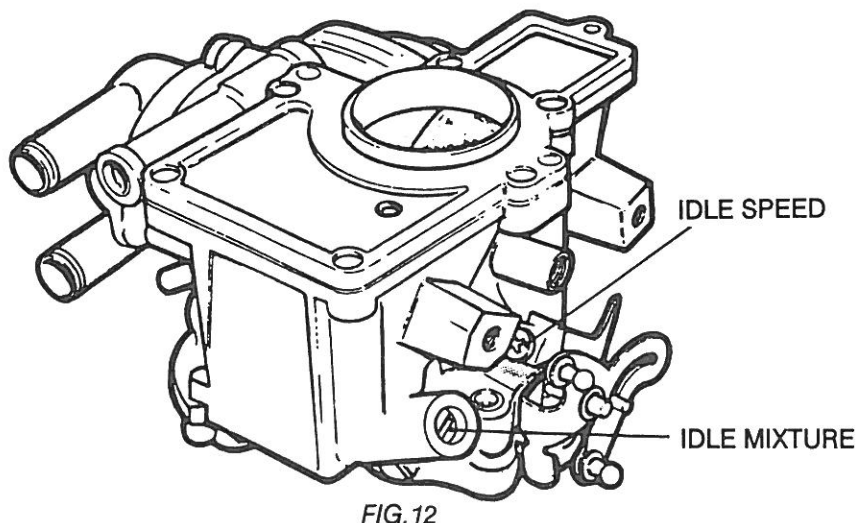
The Ford VV Carburettor

Fig.12 shows the Ford VV carburettor which has been specifically designed to comply with present and future exhaust emission requirements and to improve fuel consumption.

The main departure in design from the SU and Zenith/Stromberg/Pierburg carburettors is the provision of a separate idle system with its own fuel supply, mixture screw and discharge tube.

Adjusting Procedure (Ford VV)

1. Warm up the engine thoroughly, at least 10 minutes running at fast idle if starting from cold.
2. Check engine test data for correct idle speed.
3. Ensure air cleaner is fitted and has a serviceable filter element.
4. Adjust idle speed screw (Fig.12) to achieve the stated idle rpm.
5. Adjust the idle mixture screw (Fig.12) to bring the CO level to the manufacturer's specification.
6. Reset the idle rpm to the correct speed if necessary.
7. Repeat Steps 5 and 6 until both the idle CO and speed are correct.



The Weber 2V Carburettor With Stepper Motor

More recent carburettors may be fitted with a stepper motor on the throttle lever which enables the ECU (electronic control unit) to maintain a constant idle speed. The Weber described here, which is fitted to some Ford engines since 1985, is a typical example.

A general view of this carburettor is shown in Fig.13, where it will be seen that although a conventional idle mixture adjusting screw is used, there is no throttle stop.

The carburettor has a vacuum operated secondary venturi which opens in response to vacuum produced in the primary barrel.

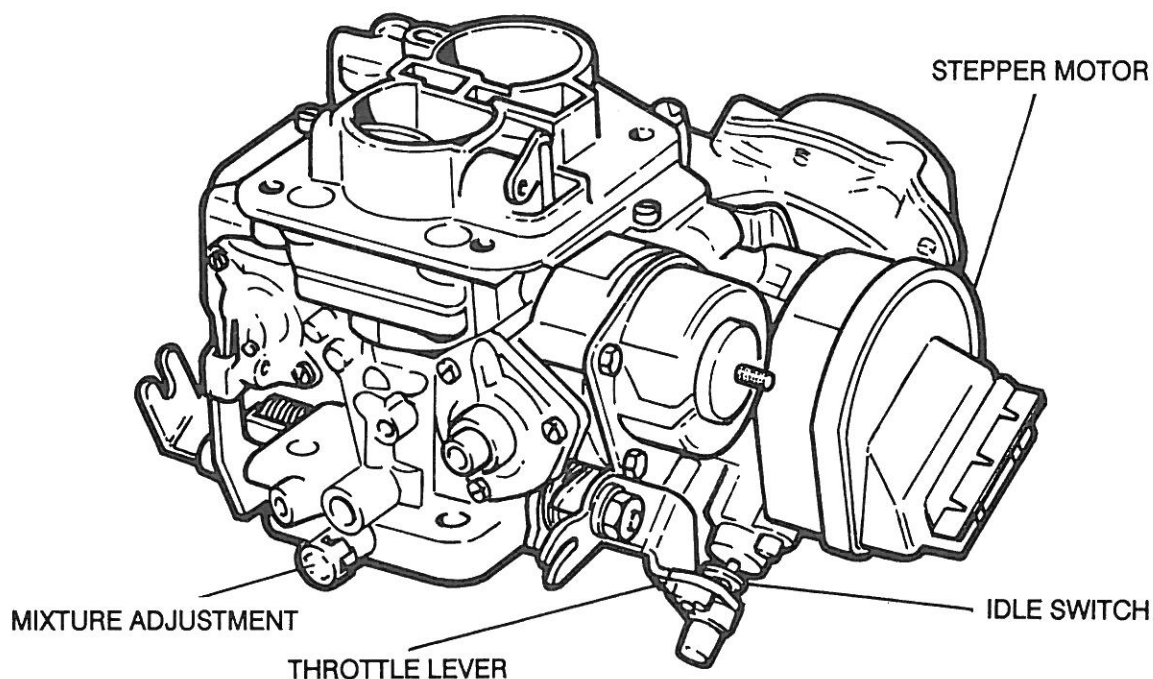


FIG.13 WEBER 2V WITH STEPPER MOTOR

The Idle Switch

The idle switch (Fig.14) is set during production and **MUST NOT** be adjusted during normal service. The switch sends signals to the ECU when the throttle of stage one is closed. The switch assembly comprises three components, the stage one throttle lever, the stop screw and the stepper motor plunger.

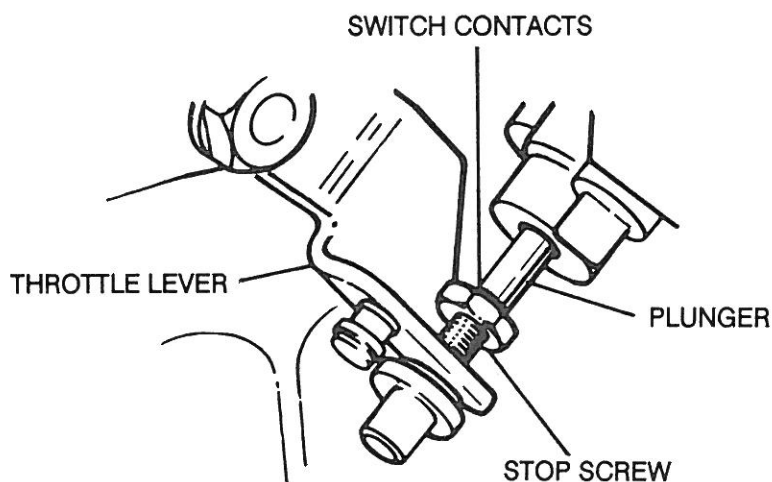


FIG.14 THROTTLE SWITCH

Stepper Motor Adjustment

If a new stepper motor has been fitted or if obvious tampering has occurred, the stepper motor should be set up as follows:

1. Switch all electrical components off and warm up the engine to operating temperature.
2. Accelerate the engine over 2500 rpm at least twice.
3. Place a 1mm feeler gauge or drill between the plunger and the throttle lever stop screw (Fig.15).
4. The engine speed should now be 850-900 rpm. Adjust if necessary by slackening the locknut, setting the correct speed and re-tightening the locknut (Fig.15).
5. Remove the feeler gauge and accelerate the engine over 2500 rpm twice. Re-insert the feeler gauge and recheck the idle speed.
6. Check the stepper motor in all its operating modes, i.e. starting, idling, acceleration.
7. Adjust the CO level to 0.75-1.25% if necessary.

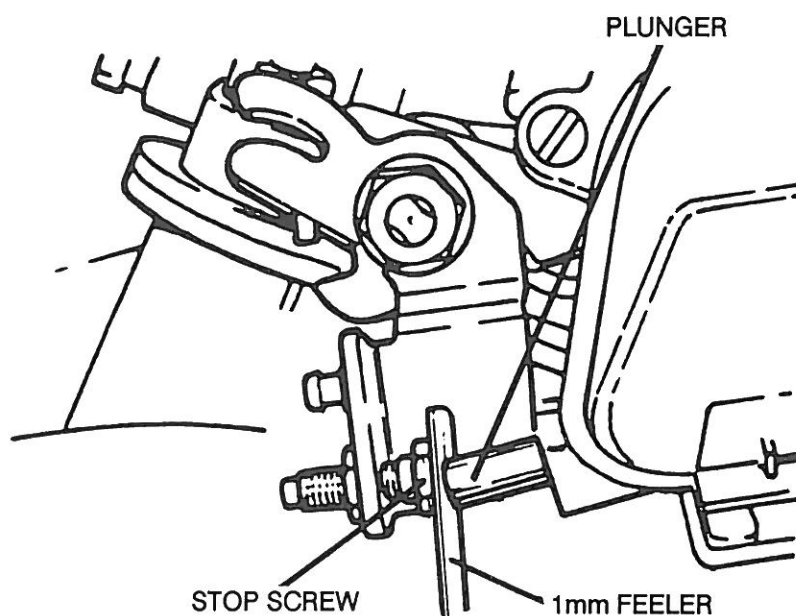


FIG. 15 STEPPER MOTOR ADJUSTMENT

Tamperproofing

From the 1st April 1977, vehicle manufacturers have been obliged by law, in the UK, to despatch all vehicles with the mixture adjusting screw tamperproofed. In addition, tamperproofing of the throttle stop screw is required if alteration of its setting increases the CO emission considerably. Tamperproofing may take several forms, e.g. sealing plugs (Fig.16); shrouds (Fig.17) or special tools (Fig.18).

During normal service work on relatively new vehicles, an operator should check the CO level and if this is satisfactory, i.e. complies with the manufacturer's recommendation, the sealing device should not be disturbed. When adjustment is required, the sealing device should be removed, with a special tool if necessary. At present in the UK, legislation does not require re-tamperproofing in service when the original device has been removed. Replacement sealing devices are, however, available from many main vehicle dealerships.

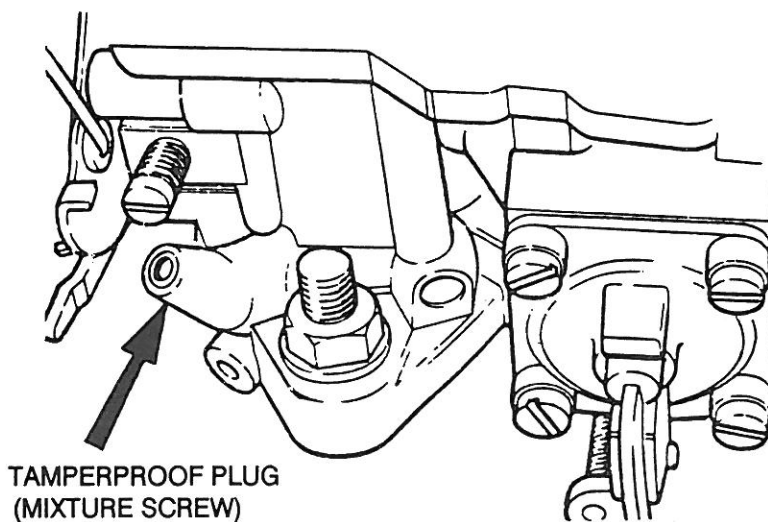


FIG.16

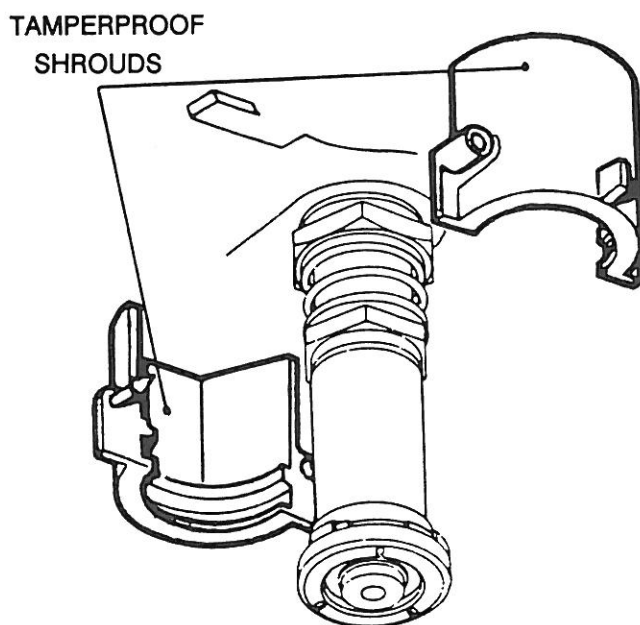


FIG.17

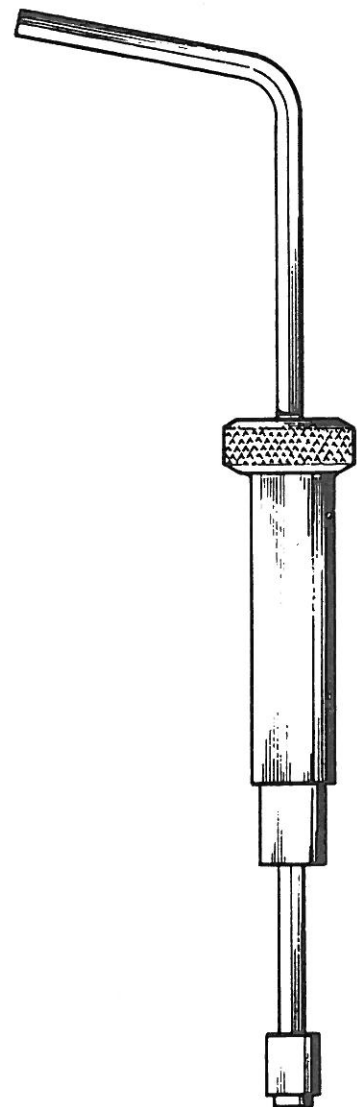


FIG.18

FAULT FINDING

(poor engine idle condition)

FAULT	CARB. TYPE	POSSIBLE CAUSE	RECTIFICATION
High CO reading at idle cannot be reduced by normal adjustment.	WEBER	Idle jet not seating.	Remove idle jet, partly withdraw jet from holder and install to reseat jet.
HC reading excessive.	SOLEX WEBER	Solenoid type idle jet loose.	Tighten idle jet.
	ZENITH 36 IV	Float chamber sealing ring leaking inside venturi.	Tighten carb. top cover. If necessary dismantle and fit new 'O' ring.
	SU	Jet worn out.	Replace jet.
High CO reading at idle cannot be reduced by adjustment.	FORD VV	Choke unit loose on carburettor body.	Tighten three securing screws inside choke unit.
	ALL TYPES	Leaking accelerator pump diaphragm.	Replace diaphragm.
		Badly restricted air filter.	Replace air filter.
CO reading very sensitive at idle/rich at speed.	FORD VV	Crankcase emission system blocked.	Remove valves and pipes including manifold elbow (CVH engines) and clear out.
Engine idles roughly when CO level correct.	ALL TYPES	Tight valve clearances.	Check valve clearances and reset.
HC reading excessive.		Air leak in inlet manifold.	Replace manifold gasket, defective servo unit, air hoses etc.
		Low cylinder compression.	Regrind valves.
		Close spark plug gaps.	Reset plugs to correct gap.
		Ignition timing over advanced.	Set ignition timing to correct figure.
Engine cannot be made to idle by adjustment of idle mixture screw.	ALL FIXED JET TYPES	Blocked idle jet.	Remove idle jet and blow out.

FAULT FINDING

(poor cruising condition)

FAULT	CARB. TYPE	POSSIBLE CAUSE	RECTIFICATION
Engine will not idle slowly enough.	ALL TYPES	Choke fast idle adjuster screwed in too far.	Reset fast idle adjuster to correct position.
		Choke mechanism not returning fully.	Adjust choke mechanism.
		Throttle cable set too tight.	Adjust throttle cable.
		Throttle butterfly nut loose.	Tighten throttle butterfly nut.
High CO reading at 3000 rpm when idle CO correct.	ZENITH 36 IV	Float chamber sealing ring leaking inside venturi.	Tighten carb. top cover. If necessary dismantle carb. and fit new 'O' ring.
Excessive HC reading.	ALL TYPES	Air filter restricted.	Replace air filter.
		High float level.	Adjust float level and/or replace float and needle valve.
	WEBER 32/36 DGAV and DFAV	Fuel leaking through or around power jet in base of float chamber.	Remove carb. top cover and check power jet for tightness and good seating.
		Defective power jet operating diaphragm.	Replace diaphragm.
	MOTOR-CRAFT	Power jet assembly displaced.	Remove carb. top cover and check for power jet needle valve lying loose in float chamber. Replace needle valve, spring and plug in top cover housing.
	STROM-BERG	Split diaphragm on piston assembly.	Replace diaphragm.
Normal CO reading at 3000 rpm.	SU/STROM-BERG	Worn main jet.	Replace main jet.
HC reading excessive.	ALL TYPES	Excessive auto-ignition advance.	Check advance degrees at 3000 rpm and compare with test data.
		Close plug gaps.	Re-gap plugs as necessary.

November 1990

Servicing The Secondary Filter

The site bowl on the secondary filter is made of Polycarbonate. Certain substances attack this material including paint thinners, carbon tetrachloride and other solvents. The bowl should be washed in liquid detergent only.

1. Unplug the filter assembly from the analyser by withdrawing from the rubber connectors carefully.
2. If the unit is a Schrader Bellows 3163 030 unscrew filter bowl (Fig.20-5) from the body (Fig.20-1). If the unit is a SMC AF4000 pull the plastic clip (Fig.20-6) downwards and twist the unit until the marks on the bowl and body align (Fig.20-7), and then pull apart.
3. Unscrew the nylon filter holder (Fig.20-4) and withdraw the assembly. This holds the filter (Fig.20-3) in place.
4. Discard the filter and replace with a new one.
5. Re-assemble the components in the correct order and for the Schrader Bellows tighten both the filter holder (Fig.20-4) and bowl (Fig.20-5) just sufficiently to obtain an airtight seal on the 'O' ring (Fig.20-2).

To order replacement filter elements quote part No. 113041. These are available from FKI Transervice Ltd.

Should the complete filter unit become damaged, it can be replaced by a service exchange unit available from FKI Transervice Ltd. by quoting stock No. 104147 (Schrader Bellows) or 113058 (SMC).

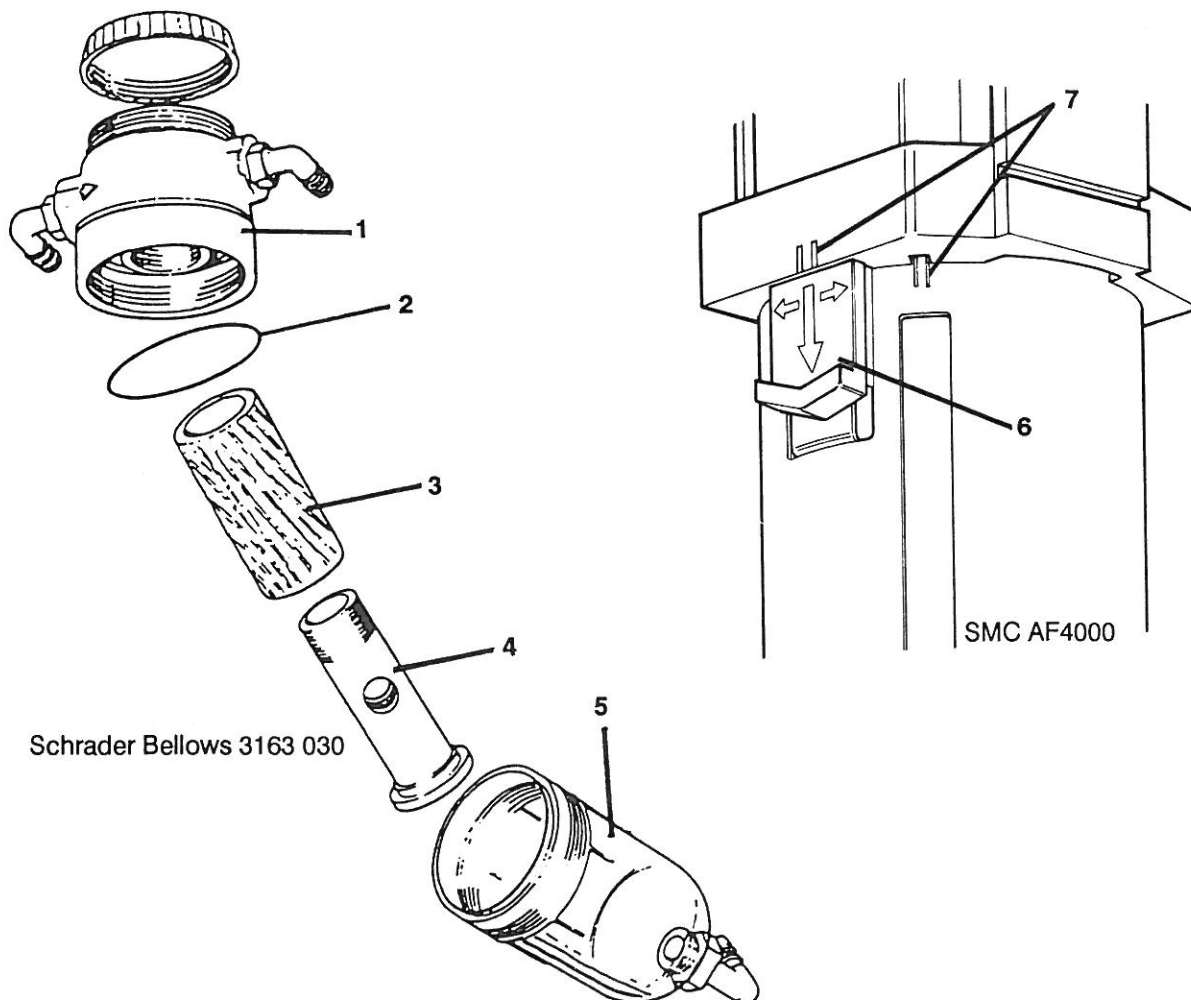


FIG.20 COMPONENTS OF SECONDARY FILTER

ADJUSTING THE ANALYSER

The analyser incorporates automatic self-calibrating circuitry which extends the period of usage between operator adjustments. The analyser will need manual adjustment occasionally. This is indicated at the end of the warm up period or when the orange manual calibration button (Fig.2-6) is depressed or after the 30 minute automatic calibration. One of the red lamps (Fig.21-1) will illuminate above the potentiometer which requires adjusting. This is accompanied by a direction indicator lamp (Fig.21-2).

Adjust the analyser as follows:

1. Turn the adjusting screw in the direction indicated using the calibrating tool supplied (see Fig.3) or a small screwdriver. Several complete turns may be required and the screw should be turned slowly to avoid overshooting the required position.
2. Stop turning when the direction indicator lamps (Fig.21-2) both light together. If the screw is turned too far the opposite direction indicator lamp will light on its own. In this case the screw must be turned in the reverse direction to bring both direction indicator lamps on.

NOTE:

After a short time the orange calibration lamp (Fig.22-2) will go out and the green 'ready' lamp (Fig.22-1) will come on. At this stage the unit is ready for operation.

3. Repeat steps 1 and 2 for each adjustment until all lamps are extinguished and replaced by the green lamp (Fig.22-1). If both lamps cannot be lit by this adjustment then there is a fault which will require a Service call - see back page for details.

NOTE: Adjust the potentiometers that are accessible. DO NOT adjust the screws which are blanked off, DO NOT attempt to remove the blanking plugs.

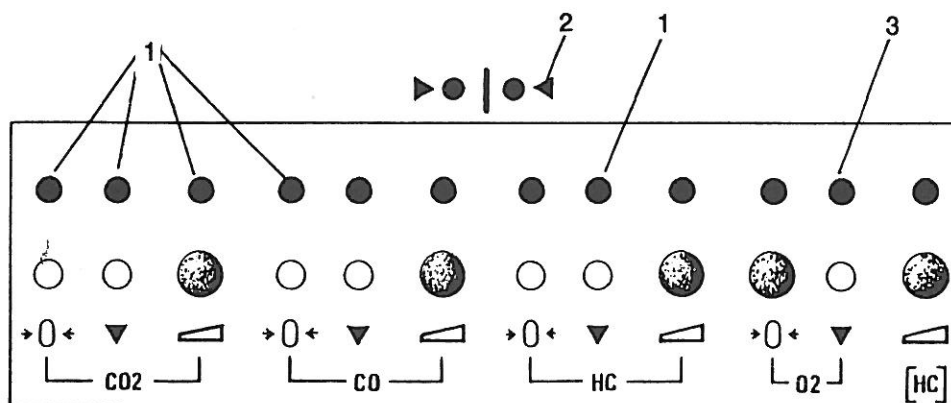


FIG.21 (270)

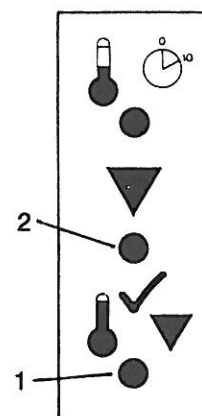


FIG.22

270 Only

If O₂ gain lamp (Fig.21-3) is on and it is not possible to adjust the screw such that the direction indicator lamps (Fig.21-2) both light together, the O₂ sensor is unserviceable. A Service call will be required to replace the sensor and recalibrate the O₂ channel. The 270 may still be used as a 3 gas analyser if the mains is switched off and then on again. The O₂ display will then be blank.

Should any of the lamps above the blanking plugs come on, do not perform any adjustment. The unit will return to its normal operating mode after approximately 3 minutes (the displays may also read during this period).

AFR/LAMBDA

The 270 Emission Analyser, when working in conjunction with the 440 and 900 Engine Analyser will print and/or display readings of Air Fuel Ratio (AFR). The AFR is calculated by the engine analyser from the four gases measured by the 270 and is expressed as air to petrol by weight. When the gases coming into the 270 are outside certain limits the AFR display and printout will be BLANK, thereby indicating that the calculated AFR is not a credible value.

In the UK and Europe the latest production vehicles may be fitted with a Lambda sensor in the exhaust system. This sensor feeds back information to the injection computer to keep the air fuel ratio at the required value. The stoichiometric AFR gives a Lambda reading of 1.0. Weaker mixtures have a higher value, e.g. 1.5, while richer mixtures have a lower value. If the air fuel ratio is outside the limits of 5 to 25:1 the Lambda display will be blanked or 'not calculated' will be printed.

Later versions of the 270 can calculate and display LAMBDA readings on the digits normally used to show O₂ values. Operate the toggle switch adjacent to the display to select the required readings. The switch position and the decimal point illuminated indicate which result is currently displayed.

To produce an accurate LAMBDA reading the internal calculations need to know which fuel the test vehicle is using. Select the correct fuel type by operating the three position toggle switch located on the rear panel. This switch is labelled 'Leaded, Unleaded and LPG' and specifies stoichiometric ratios of 14.7:1, 14.8:1 and 15.5:1 respectively. Lambda values are displayed if in the range 0.3 to 1.7; outside of these limits the display will be blanked.

Printer models (270P & 270PORD) will print all gas values and calculated Lambda irrespective of the front panel switch position, but the rear panel fuel type switch MUST be positioned correctly to ensure an accurate result.

Use Lambda display to check the operation of closed loop feedback fuel systems on vehicles fitted with catalytic converters. Ensure that sample tube is correctly inserted into the exhaust and that any exhaust gas extraction equipment does not introduce reading errors.

CONSUMABLE SPARES

The following spares can be ordered from Transervice:

Description	Transervice Part No.
Sampler probe	105059
Spare secondary filters (pack of three)	113041
Primary filter	113031
Mains cable (2 metres) for connection between 440 and analyser	123274
Mains cable (8 metres) when used as a 'Stand-alone' analyser	123298
Neoprene tubing (10 metres)	127075

267/270 POR

NOTE:

These operating instructions cover the 267/270 POR (and PORD) only and must be used in conjunction with the standard operating instructions already described in this manual.

Fig.23 shows the front panel of the 270 POR ('four gas' emission analyser and printer module). For the 267 POR the location of controls and lamps are the same, with the omission of the CO₂ and O₂ gas references.

1. **INITIAL SWITCH - ON.** Switch the emission analyser on and allow to warm up. It should be noted that the unit will behave in exactly the same way as a standard 267/270. The printer and other handset controls shown in Fig.25, will be inactive throughout the warm up period with the exception of the paper feed button (Fig.23).
2. **READY FOR USE.** After the emission analyser has warmed up, the green ready lamp will be illuminated along with one of three red 'display select' lamps shown in Fig.23. These indicate which display has been selected, ie. engine speed, hydrocarbons or oil temperature and are controlled by the display switch on the handset as shown in Fig.25.

NOTE:

The display will be blanked if oil temperature is selected when there is no probe plugged in.

3. **ENGINE SPEED.** Plug the red HT clip extension lead into the jack socket in the back of the printer module shown in Fig.24. Clamp the HT clip around No.1 spark plug lead ensuring that it is clear of all rotating parts. Start the engine and select rpm display using the handset switch. Engine speed will be displayed in steps of 10rpm.
4. **OIL TEMPERATURE.**

CAUTION: GREAT CARE MUST BE TAKEN WHEN PERFORMING THIS TEST TO ENSURE THAT NO DAMAGE TO THE OIL TEMPERATURE PROBE AND/OR ENGINE IS INCURRED BY CONTACT WITH MOVING ENGINE PARTS.

Remove the dipstick from the engine and check that the oil is at a reasonable level. Compare the temperature probe to the dipstick and adjust the rubber bung so that the length of probe inserted into the engine is 10 -15 mm shorter than that of the dipstick. There must therefore, be sufficient oil to reach the probe. Insert the probe into the engine via the dipstick hole and select oil temperature using the handset switch. The temperature will then be displayed in steps of one degree.

NOTE:

The 267/270 cannot display negative numbers, so any temperature below zero will be suppressed to 0.

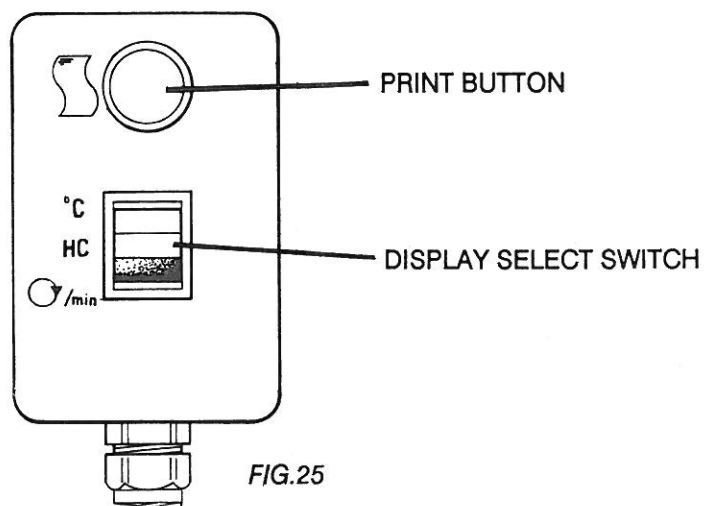
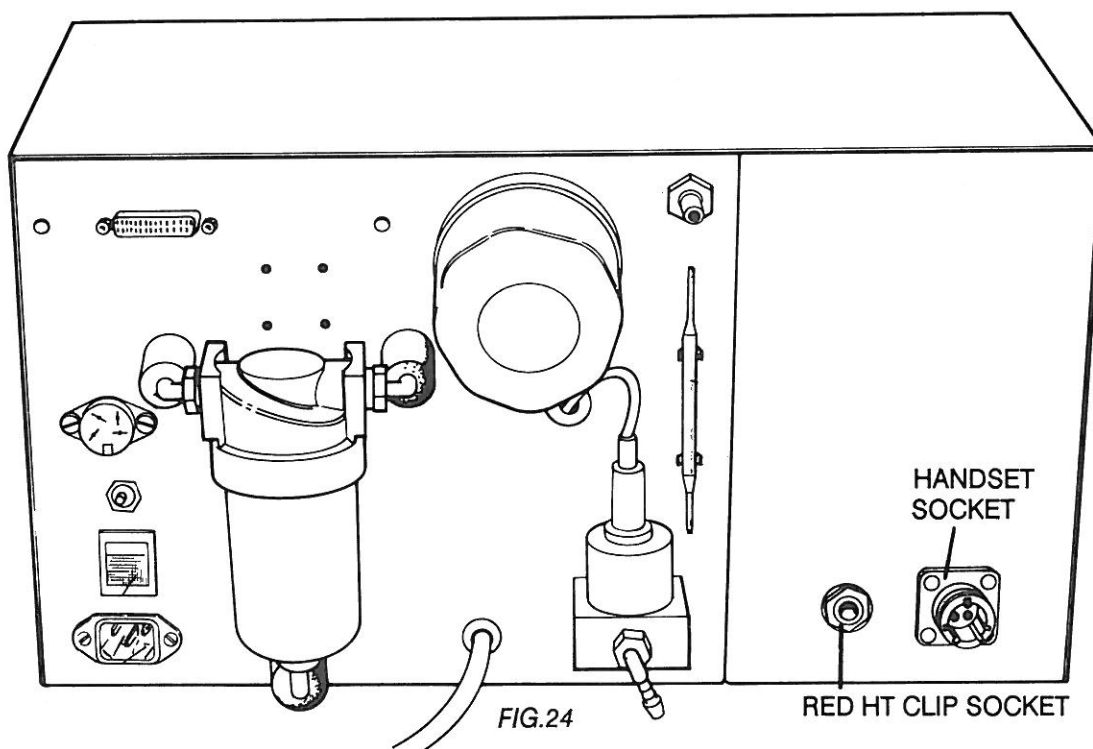
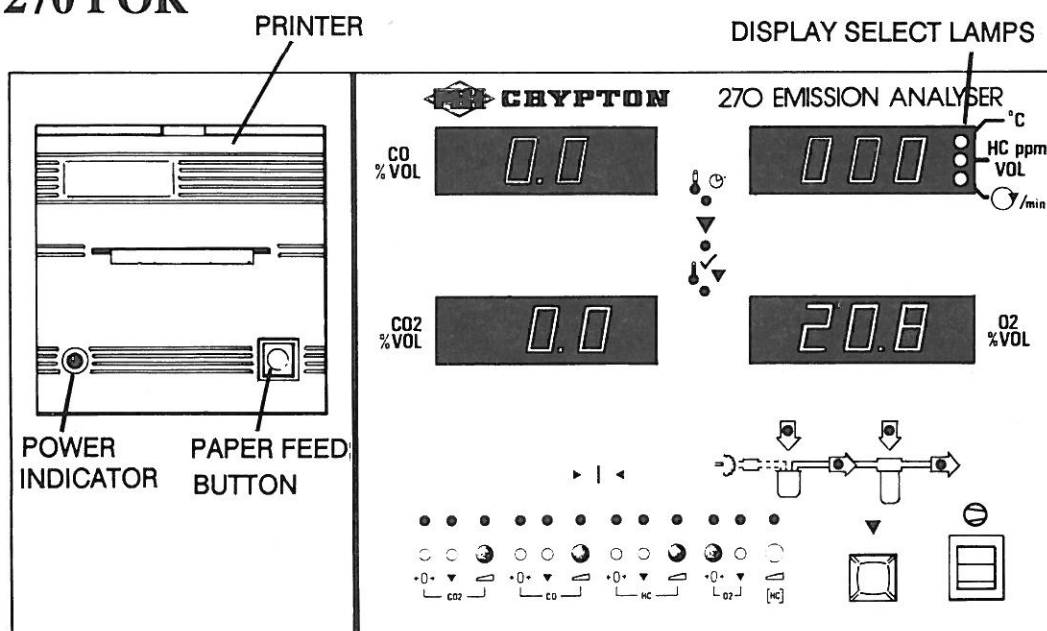
5. **DIS / WANKEL ENGINES.**

The printer has the facility to adjust the engine RPM display for use with Distributorless Ignition System (DIS) engines and vehicles fitted with Wankel engines.

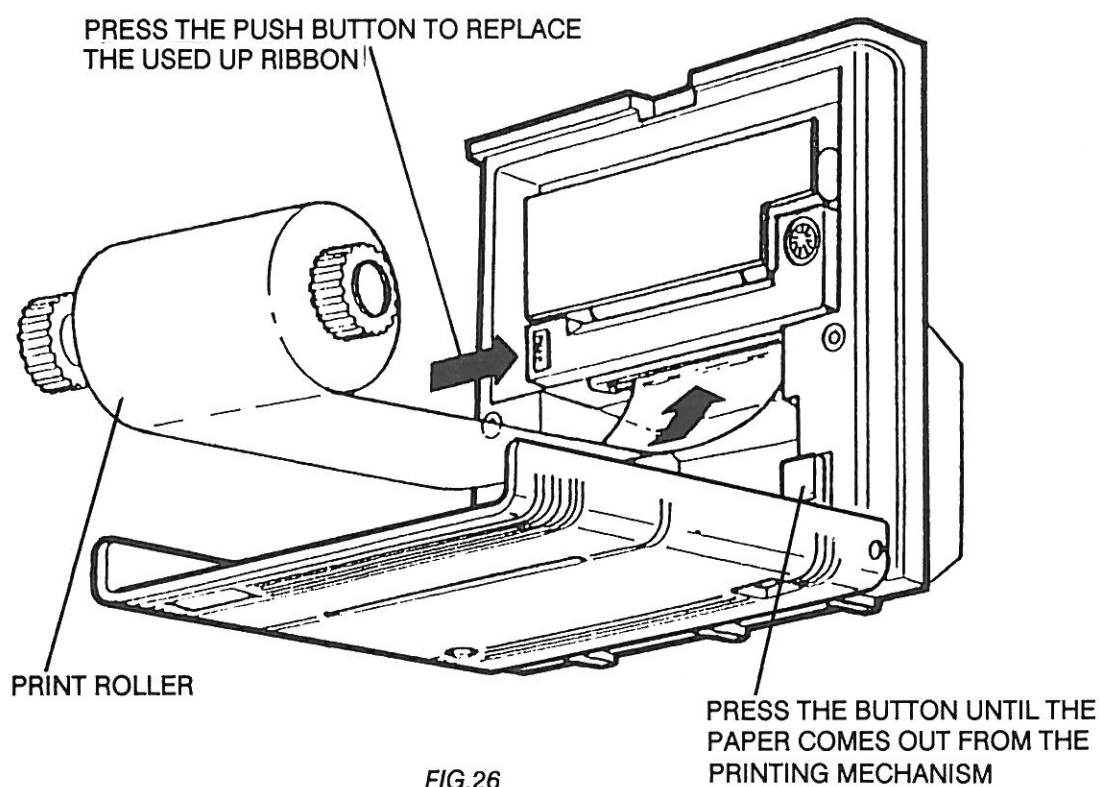
For normal 4 stroke engines the rear panel mounted switch should be left in the "4ST" position.

For DIS and Wankel engines the switch should be moved to the "DIS" position; this will ensure that the RPM signal is correctly displayed.

270 POR



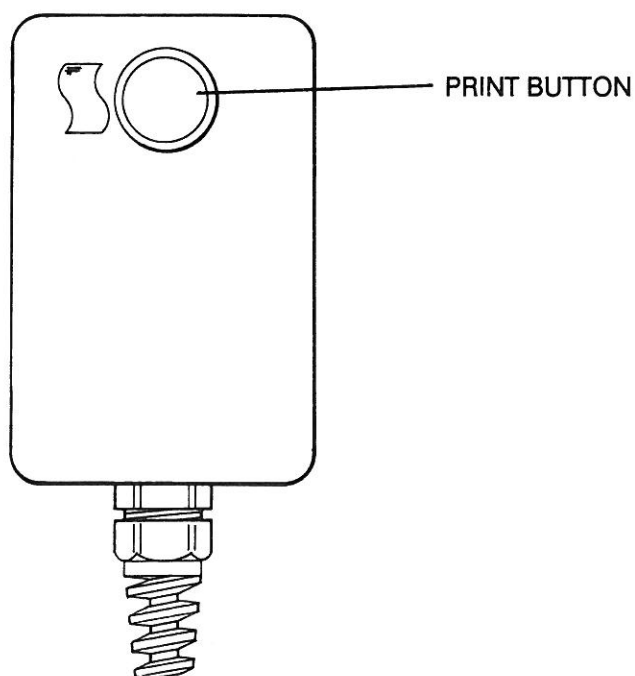
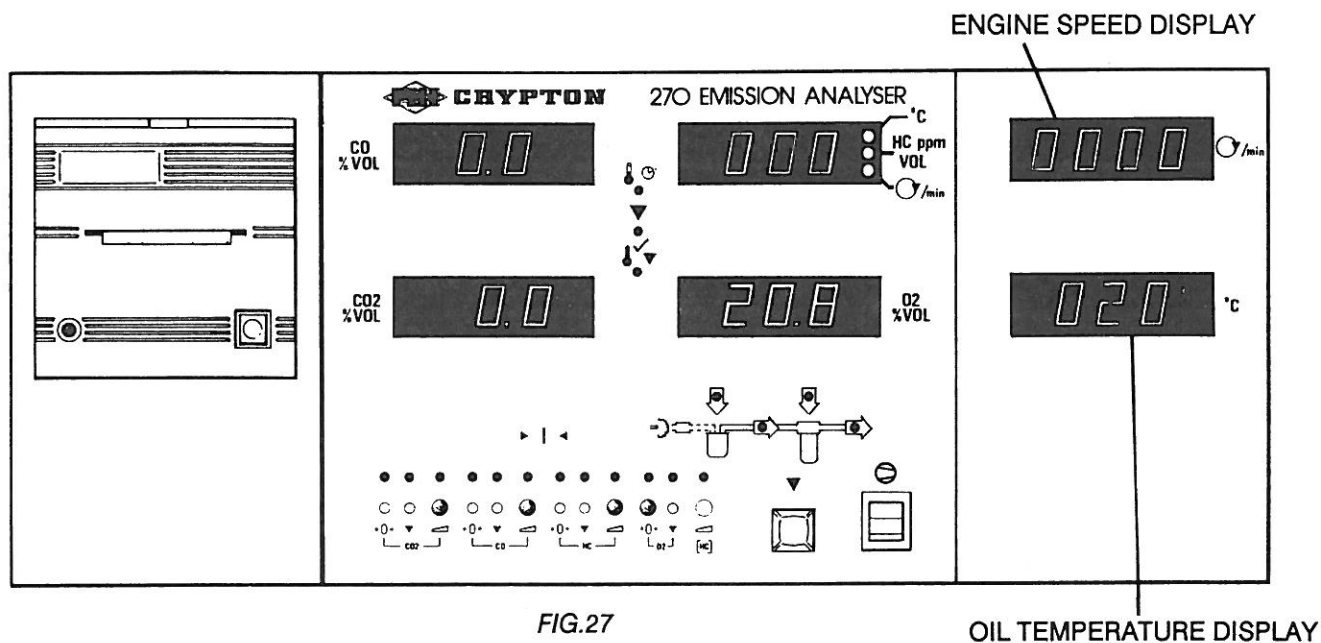
5. **PRINTER.** To operate the printer, press the print button on the handset shown in Fig.25. The emission analyser displays will be frozen during the printout and a full copy of all values will be produced regardless of the display select mode. If the oil temperature probe is not plugged in, oil temperature will be omitted from the print out. This also applies to the oxygen channel on the 270. If the O₂ sensor is unserviceable, the O₂ will be omitted from the printout.
- 5.1 **CHANGING THE PRINTER RIBBON.** To change the printer ribbon, hinge down the front panel of the printer as shown in Fig.26. Remove the old ribbon by pressing on the left hand side of the ribbon cartridge marked 'push'. Slot the 'push' end of the new cartridge into position and clip into place.
- 5.2 **CHANGING THE PAPER ROLL.** Place new paper roll onto the print roller noting the orientation shown in Fig.26. Insert the free end of the paper roll into the print mechanism as shown. Press paper feed button until paper emerges from the print mechanism. Close up the printer, ensuring that the paper is fed through the slot in the front panel.



267/270 PORD

The operation of the 267/270 PORD (analyser with printer and slave display module) is identical to that of the POR version. The engine speed and oil temperature however, are shown on additional displays to the right hand side of the emission analyser.

Fig.27 shows the front panel of the 270 PORD. Addition of the extra displays means that the display select switch is no longer required on the handset. Fig.28 shows the simplified handset fitted to this version.



Terms and Conditions of Sale

FKI CRYPTON

GUARANTEE

We guarantee our products as free from defects due to faulty material or bad workmanship for a period of 12 calendar months for all products. The period of the guarantee commences from the date of delivery to the Purchaser, either by us or by our distributor. Our liability is limited to the replacement of parts found defective and making good defects found within the prescribed period arising solely from faulty material or bad workmanship, in the products of our own manufacture, properly used solely for the purposes for which they were intended, and not due to wear and tear, misuse, neglect or improper adjustment.

Any product alleged to be defective shall be forwarded to us, carriage paid, immediately the alleged defect is discovered, for identification, examination and report or if not capable of being so forwarded, notice in writing shall be sent to us immediately. The Purchaser will be charged for engineers time and travelling expenses if a warranty repair is carried out on site, other than for fixed items of equipment such as brake testers. If we accept liability the repaired or new product, in replacement, will be delivered free from our works. We give no guarantee in respect of any proprietary electrical or other equipment made by other manufacturers, and supplied with our products, but will so far as possible, transfer the benefit of such guarantee, if any, given by such other manufacturers. We are in no circumstances liable for any consequential or other loss or damage arising through any defect in our product. In lieu of any express or implied statutory or other warranties, guarantees, conditions or liabilities (whether as to fitness, quality, standard of workmanship or otherwise) which are hereby excluded, the following provisions shall apply:

- (a) The Purchaser shall not be entitled to rescind the contract or to claim damages on the grounds of any statement whatsoever as to the suitability of the goods for any particular purpose, and the Purchaser assumes responsibility for the capacity and performance of the goods being sufficient and suitable for his purpose, and for his premises being suited to the installation and operation of the plant and machinery. The Purchaser agrees and confirms that apart from the express terms of the contract, no statement or representation has been made by the Company relating to the goods to be supplied under the contract or, if any has been made, he has not relied on it.
- (b) The Company's liability in respect of any defect whether of quality, suitability of performance or otherwise in any goods supplied or for any loss, injury or consequential damage attributable thereto is limited to the terms of this guarantee and the Purchaser hereby acknowledges:
 - (i) that it purchased the goods in a competitive market and that the bargaining strength of the Company was in no way a relevant factor in the purchase of the goods from the Company
 - (ii) that the Purchaser knows the extent of the meaning of this Condition and the limitations thereby imposed by it under Sections 13, 14 and 15 of the Sale of Goods Act 1979.

Our guarantee does not apply should equipment be operated or stored under adverse conditions e.g. outside installations or in areas used for steam cleaning or pressure washing, etc., unless otherwise specified in the relevant equipment manual.

The above guarantee is given in lieu of all other terms, conditions, warranties, guarantees, undertakings and representations, express or implied, statutory or otherwise, which, except to the extent that this provision is held to be void or unenforceable under or by virtue of any provision contained in the Sale of Goods Act 1979 or the Unfair Contract Terms Act 1977 or any statutory modification or re-enactment thereof for the time being in force, are hereby expressly excluded.

DESIGN

We reserve the right to alter the design or construction of equipment at any time without notice.

LAW OF CONTRACT

All contracts for the sale of the company's products shall be deemed to be made and executed in England, and the same shall be construed, performed and enforced in accordance with English Law and the parties submit to the jurisdiction of the English Courts. The application of the Uniform Laws of International Sales shall be excluded. This condition shall not prevent the Company instituting proceedings in the Courts of any other country to enforce such contract against the customer.

DELIVERY

Delivery dates, given in good faith, are approximate and reflect conditions prevailing at that time. No liability can be accepted arising from delays in delivery, irrespective of the cause of any such delay.

CANCELLATION AND VARIATION

Orders once accepted by us are binding and cannot be cancelled or varied unless we at our discretion accept the cancellation or variation. We will make every effort to meet our Purchasers in this respect but

- (a) we cannot accept cancellation for non-standard products; and
- (b) we cannot accept cancellation changes in delivery dates or other variations notified to us later than the end of the penultimate month prior to the month fixed for delivery; and in such circumstances and any other cancellations or variations to which we have not agreed we shall enforce our contractual rights and/or impose an appropriate charge.

TERMS

Quotations given are open for acceptance within 14 days and are subject to revision should the state of the raw material market or other circumstances render this action necessary.

Orders, whether received as a result of a quotation or not, can only be accepted for execution at prices ruling at date of despatch.

Payment – except where otherwise stated in our invoice, or agreed in writing, our terms are net cash and payment is due on presentation of invoice. Where we have agreed to open an account with the Purchaser invoices are due for payment by the 25th of the month following month of invoice.

VALUE ADDED TAX

VAT is not included in our prices and will be shown separately on all invoices at the rate ruling at date of despatch.

CARRIAGE

Carriage is paid to destinations on the mainland of England, Scotland and Wales on all orders of £300 Nett or over, except accessories, spare parts and repairs. Where carriage is chargeable its cost is added to the invoice value.

PACKING AND UNLOADING

Damages or shortages must be signed for as such and claim made on the carriers, in writing, within three days of delivery. Where Company vehicles are used the driver must be notified at the time of unloading and the consignment note marked to indicate the damage or shortage. The practice of signing for the goods "not examined" does not absolve the Purchaser from this condition.

The consignee is responsible for unloading.

Packing cases and slings, when used, are charged extra but credited in full on return, carriage paid and in good condition.

LOSS IN TRANSIT

British Rail, Public Transport Companies and the Post Office only accept claims for loss in transit made within a limited period. If goods are not received within 14 days of the date of our invoice, we must be advised immediately otherwise neither the carriers or ourselves will be liable for any loss involved.

PASSING OF RISK

The risk in the goods shall remain in us until delivery to the Purchaser or his agent. In the absence of written notice from the Purchaser to us and the carriers as prescribed above, the goods shall be deemed to have been delivered complete and in satisfactory condition.

PASSING OF PROPERTY

Until such time as all sums due to the Company from the Purchaser whether in respect of goods delivered by the Company to the Purchaser or otherwise have been paid the provisions of this Condition shall have effect;

- (a) All goods delivered by the Company to the Purchaser will remain the property of the Company to the intent that the whole legal and beneficial interest therein shall remain that of the Company.
- (b) If the Purchaser becomes or threatens to become insolvent or being a body corporate has a Receiver appointed or passes a resolution for winding up or if a Court makes an Order to that effect or being an individual or partnership makes any composition or arrangements with his or their creditors or has a receiving order made against him or them or if the Purchaser shall be in breach of these Conditions, then the Company shall be at liberty to forthwith remove and repossess all goods which remain the property of the Company in accordance with this Condition and enter upon any property to do so or to inspect goods to identify the Company's goods.
- (c) The Purchaser shall only be at liberty to resell the goods purchased from the Company prior to the passing of title on the understanding that if it does resell the goods then it will hold on trust for the Company so much of the proceeds of sale received by it under contracts which include any of the goods hereby sold either in their original or altered state as are necessary to discharge payment in full to the Company.
- (d) No provision of this Condition shall be deemed to cause a Mortgage or Charge of the Property or undertaking of the Purchaser or any part thereof to have been created by the Purchaser in favour of the Company.

SEPARABILITY

Any failure by us in respect of one delivery shall not entitle the Purchaser to treat the contract as repudiated, each delivery being, for such purpose, deemed a separate contract.

INSTALLATION

The Purchaser is responsible for the preparation of the site, where such a site is necessary, together with the provision of any supplies and services that may be required. The specifications and the responsibilities of agents, distributors and end users are clearly set forth in separate leaflets, available on the various products concerned.

If failure to fulfil this responsibility extends the time taken to commission equipment or results in extra visits by engineers the Purchaser is fully liable for the extra cost. If installation of equipment is unduly delayed, the Company reserves the right to pass on cost inflation as a supplementary charge.

REFUSAL

Goods consigned to the order of end-users and/or distributors render them liable for all carriage and handling charges incurred, if delivery of the goods is refused on arrival at destination.

RETURNED EQUIPMENT

In exceptional conditions, subject to agreement in writing, and the equipment being of current standard design, new equipment in good condition will be accepted, carriage paid to factory, subject to a handling charge. Any costs incurred in making the equipment as new will be charged in addition to the handling charge.

SPARES AND AFTER SALES SERVICE

Service is available through our service company FKI Transervice, Brearley Works, Luddendenfoot, Halifax, West Yorks, HX2 6JB. Tel: Halifax (0422) 882383. Telex 517249. Spare parts are available from FKI Transervice, Bristol Road, Bridgwater, Somerset TA6 4DD. Tel: Bridgwater (0278) 426891. All spare parts purchases are subject to minimum order values.

RIGHT TO TERMINATE

If the Purchaser breaks any of these conditions or becomes insolvent or subject to any law relating to bankrupts or being a corporation goes into liquidation, whether voluntary or compulsory or has a receiver appointed over its assets, we may suspend deliveries or, by notice to the Purchaser, terminate the contract and such termination shall be without prejudice to any other rights or remedies to which we may be entitled.

All quotations and tenders are given and contracts are made by the Company subject to the above terms and conditions and unless previously agreed in writing by an authorised officer of the Company:

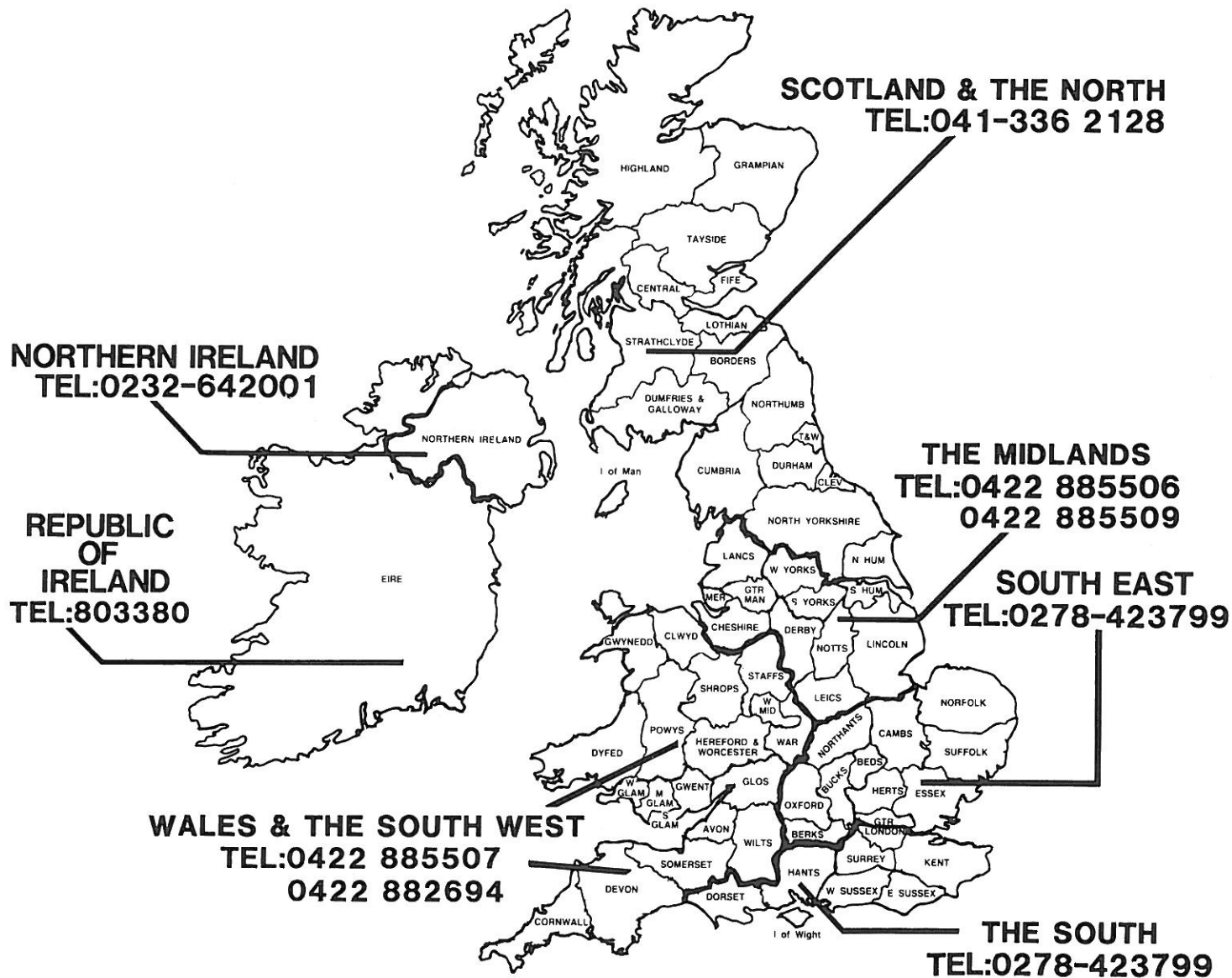
- (i) no verbal, written or other addition hereto or variation hereof including (without prejudice to the generality of the foregoing) any representation or warranty relating to the goods or services to be provided by the Company shall be effective; and
- (ii) these terms and conditions supersede any other terms and conditions appearing elsewhere and shall prevail over and exclude any course of dealing established between the Company and the Purchaser and any other terms and conditions stipulated or incorporated or referred to by the Purchaser or his agent or any third party; and
- (iii) it shall be a pre-condition of the Company giving any quotation or tender or entering into any agreement for the supply of any goods or services that such agreement be made subject to these terms and conditions.

AFTER SALES SERVICE

Apart from the routine maintenance and adjustments stipulated in this manual the equipment must not be tampered with in any way. All further servicing must be carried out only by a Transervice engineer or Authorised Agent, as below. Failure to observe these conditions will invalidate the Guarantee.

ON-SITE SERVICE

If you require a Service Engineer to attend ON SITE, please contact the Service Office shown in your area. All have 24hr. answering services.



OVERHAUL CENTRE

If the equipment covered by this manual requires to be sent back for factory overhaul, please send it to:

FKI Transervice Limited,
P.O. Box 4, Bristol Road,
BRIDGWATER,
Somerset. TA6 4DD
TEL: 0278-426891
TELEX: 46356
(24 hour answering service)

FULLY COMPREHENSIVE AFTER-SALES SERVICE

Installations. Contract Maintenance. Factory Overhaul.
Repairs on Site. Spare Parts. Certification and
Calibration of Equipment. Lift Safety Kits. Car Data.
Technical Manuals.

OVERSEAS

Service abroad is provided by the agent from whom
your equipment was purchased

FKI**TRANSERVICE**

The Service Organisation for **CRYPTON · BRADBURY**

FKI Transervice Limited
Brearley Works
Luddendenfoot Halifax
West Yorkshire HX2 6JB
TEL: Halifax (0422) 882383
TELEX: 517249 FKE TUL G