

OMIGAS CALIBRATION TRAINING MANUAL



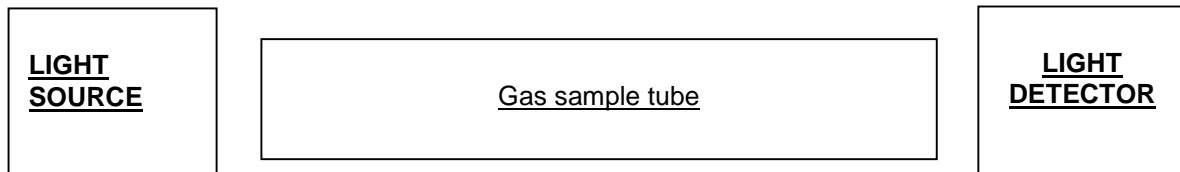
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EXHAUST GAS ANALYSER FUNCTIONAL DESCRIPTION

In principle, the exhaust gas analyser consists of a light source and detector between which a sample of gas is examined. The gas sample is in a tube with glass ends for the light to pass through.

Each molecule of gas absorbs some of the Infrared therefore less gets to the detector. This method is known as non-dispersive Infrared absorption analysis.



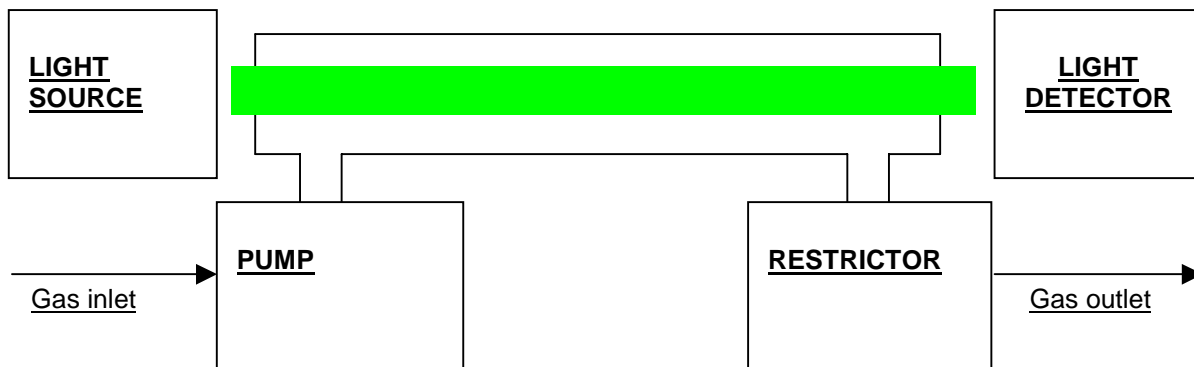
EFFECTS OF AMBIENT PRESSURE AND TEMPERATURE

In practice the gas sample is pumped in and is restricted on the outlet to retain a sample. Various things affect the measurement of gas.

A rise in barometric pressure will mean that the pump works more efficiently and the restrictor is operating against a higher pressure, therefore there will be more molecules of gas in the sample tube, subsequently a higher reading will be obtained. A drop in barometric pressure will have the opposite effect.

A rise in temperature causes the gas to expand therefore there will be less molecules of gas in the sample tube, subsequently a lower reading will be obtained. A drop in temperature will have the opposite effect.

Multiple measurements are taken and averaged to give a reading.



The light source is a simple broadband Infrared emitter.

The light detector has a set of filters corresponding to the absorption wavelength of the gases to be measured. The gases measured are Carbon Monoxide, Carbon Dioxide and Hydrocarbons.

The measurement of Carbon Monoxide and Carbon Dioxide are direct readings, however the measurement of Hydrocarbons is more complicated.

MEASUREMENT OF HYDROCARBONS

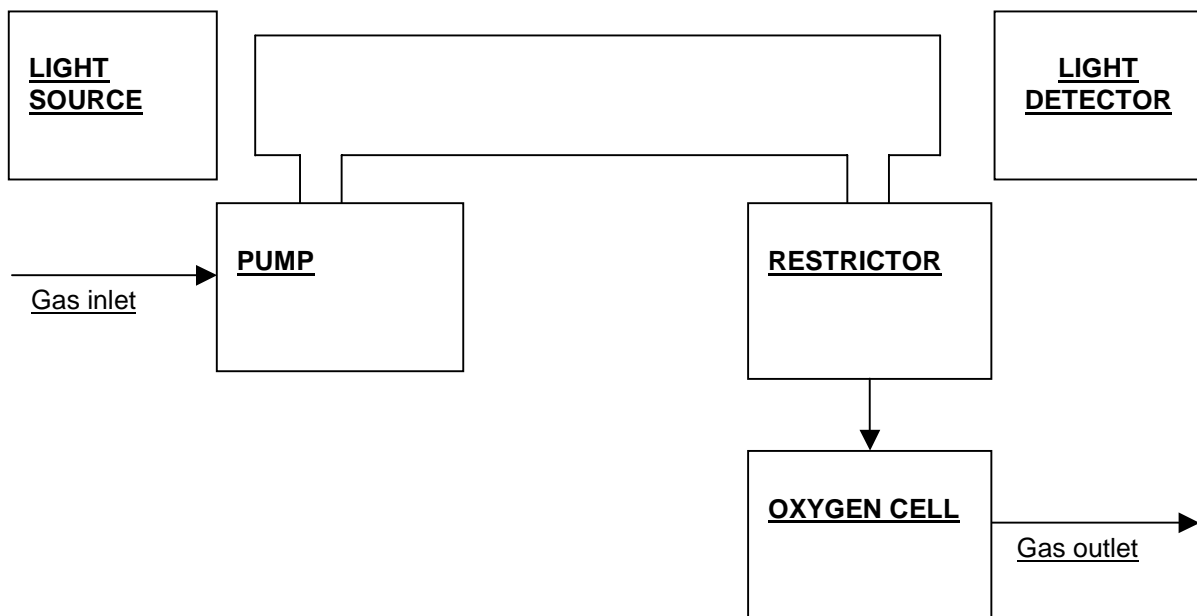
The emissions from vehicles are n-Hexane, but this is difficult to store in a gas mixture as it settles out of the mixture and needs constant agitation. The gas in the calibration mixture is Propane. There is a correlation between the two in that Propane absorption is approximately twice the n-Hexane absorption; the exact correlation is marked on each bench as its specific P.E.F. (**P**ropane **n**-Hexane **E**quivalence **F**actor). As an example, if the Propane concentration is 1970 ppm (parts per million) and the P.E.F. is 0.509 then the n-Hexane value displayed should be $(1970 \times 0.509 = 1002.73)$ rounded to 1003 ppm.

MEASUREMENT OF OXYGEN

Oxygen is measured using a device called an Oxygen Cell. This is fitted after the measurement bench, but its electronics are mounted on the bench.

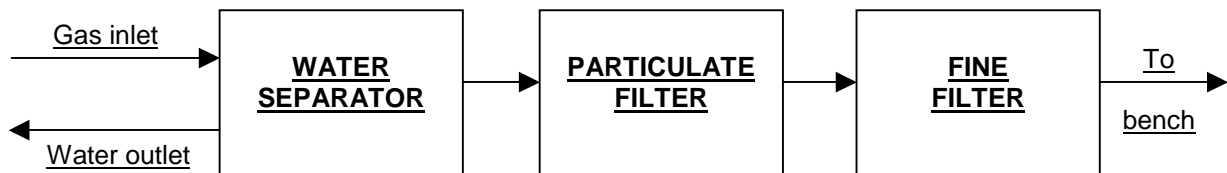
The cell acts like a "battery" whose output is dependant on the amount of oxygen reaching its sensor. With the normal atmospheric oxygen (21%) the cells output is high, with little oxygen the output is low. These cells will need replacement after 6 to 12 months.

SAFETY NOTE; the cells contain a caustic substance, if they get wet they produce a corrosive liquid.



FILTRATION

To ensure that no moisture or particulates get to the measurement bench the exhaust gases are filtered.



Firstly, water is separated and pumped away, secondly the gases are filtered to remove particulates, thirdly the gases are passed through a fine filter which removes minute particles and helps to remove moisture

BAROMETRIC PRESSURE AND TEMPERATURE COMPENSATION

The calibration gas is analysed at a pressure of 1013mb (millibar) and a 20 degrees Celsius, this is the agreed average for this planet at sea level and is used as the standard.

If the analyser calibration is performed at a barometric pressure other than 1013 mb then compensation must be applied.

As an example;

barometric pressure = 987 mb
Calibration Gas Mixture
Carbon Monoxide = 3.535%
Carbon Dioxide = 13.94%
Propane = 1955 ppm

Then the following compensations must be applied to give the readings expected on the displays

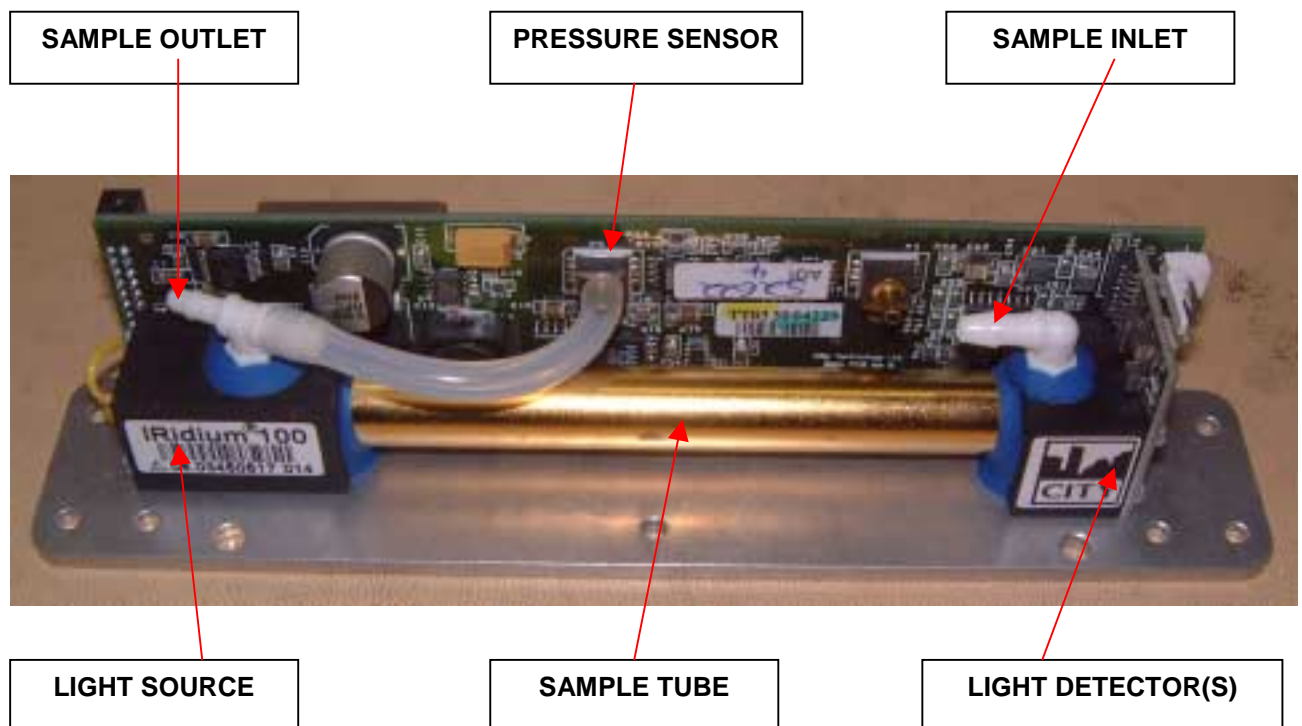
Carbon Monoxide $(3.535 \times 987) \text{ divided by } 1013 = 3.4442694$ (3.44 rounded to 2 decimal places)

Carbon Dioxide $(13.94 \times 987) \text{ divided by } 1013 = 13.582211$ (13.6 rounded to 1 decimal place)

Hydrocarbon $(1955 \times 987) \text{ divided by } 1013 = 1904.8223$
 1904.8223×0.509 (P.E.F example) = 969.55455 (970 rounded)

Even though modern benches apply barometric pressure compensation automatically you need to understand the above. It is necessary to perform a manual compensation check if any of the readings do not appear to be correct, to prove the operation of the analyser.

Modern measurement benches apply temperature compensation automatically.



LOCATION OF MAJOR COMPONENTS

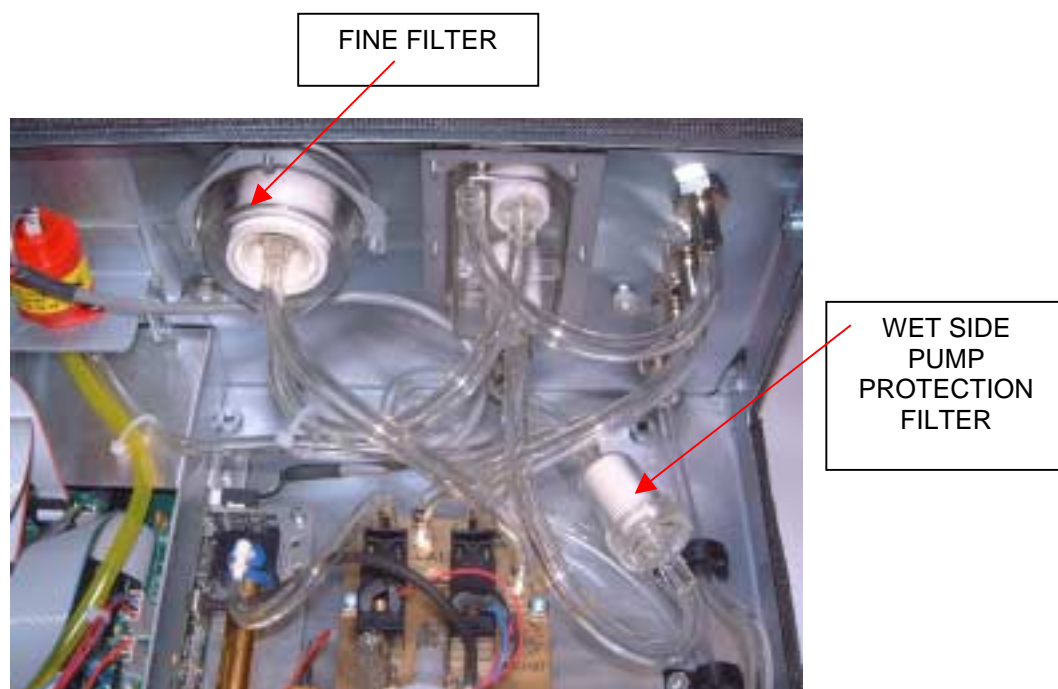
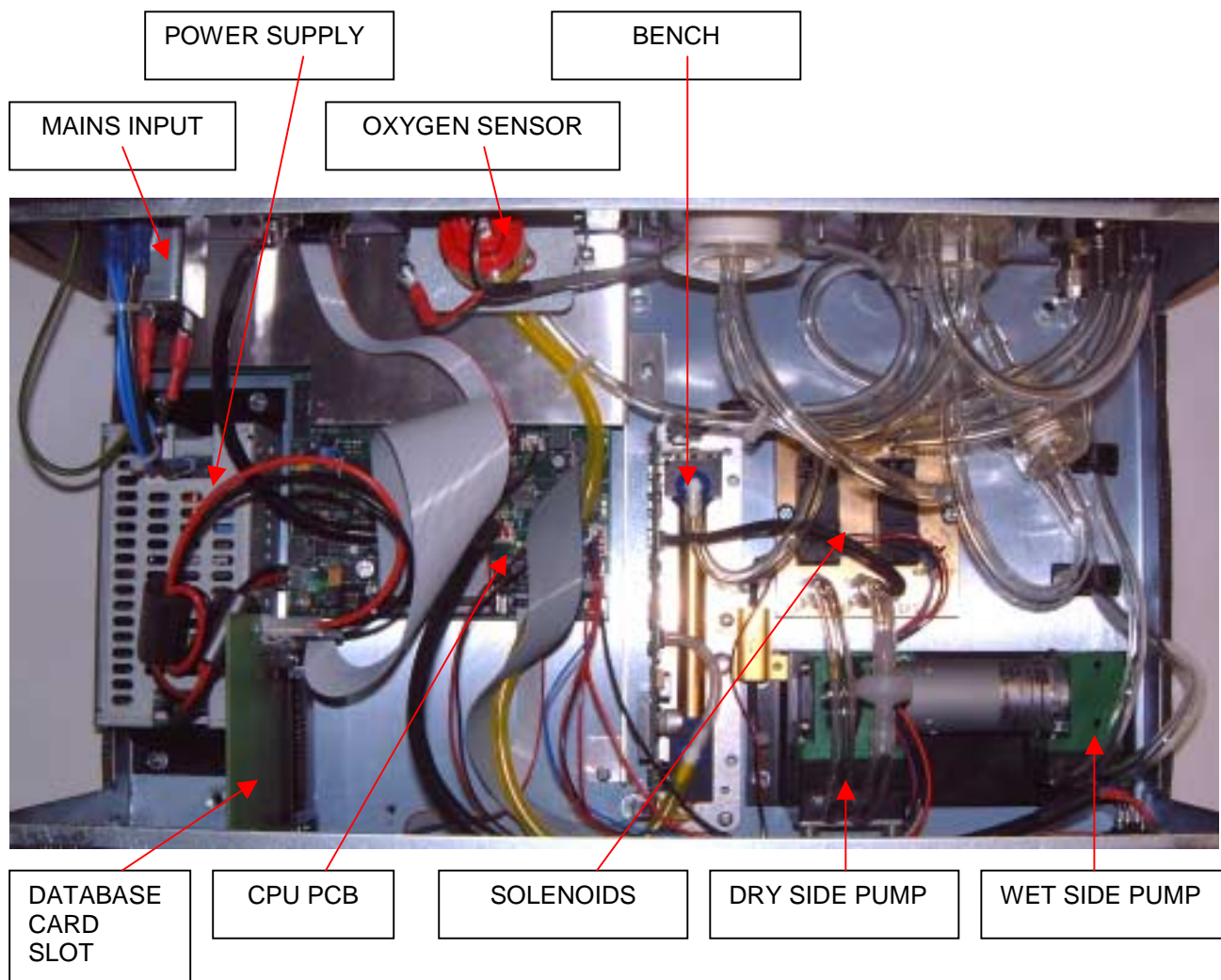


HANDSET AND COILED HANDSET CABLE

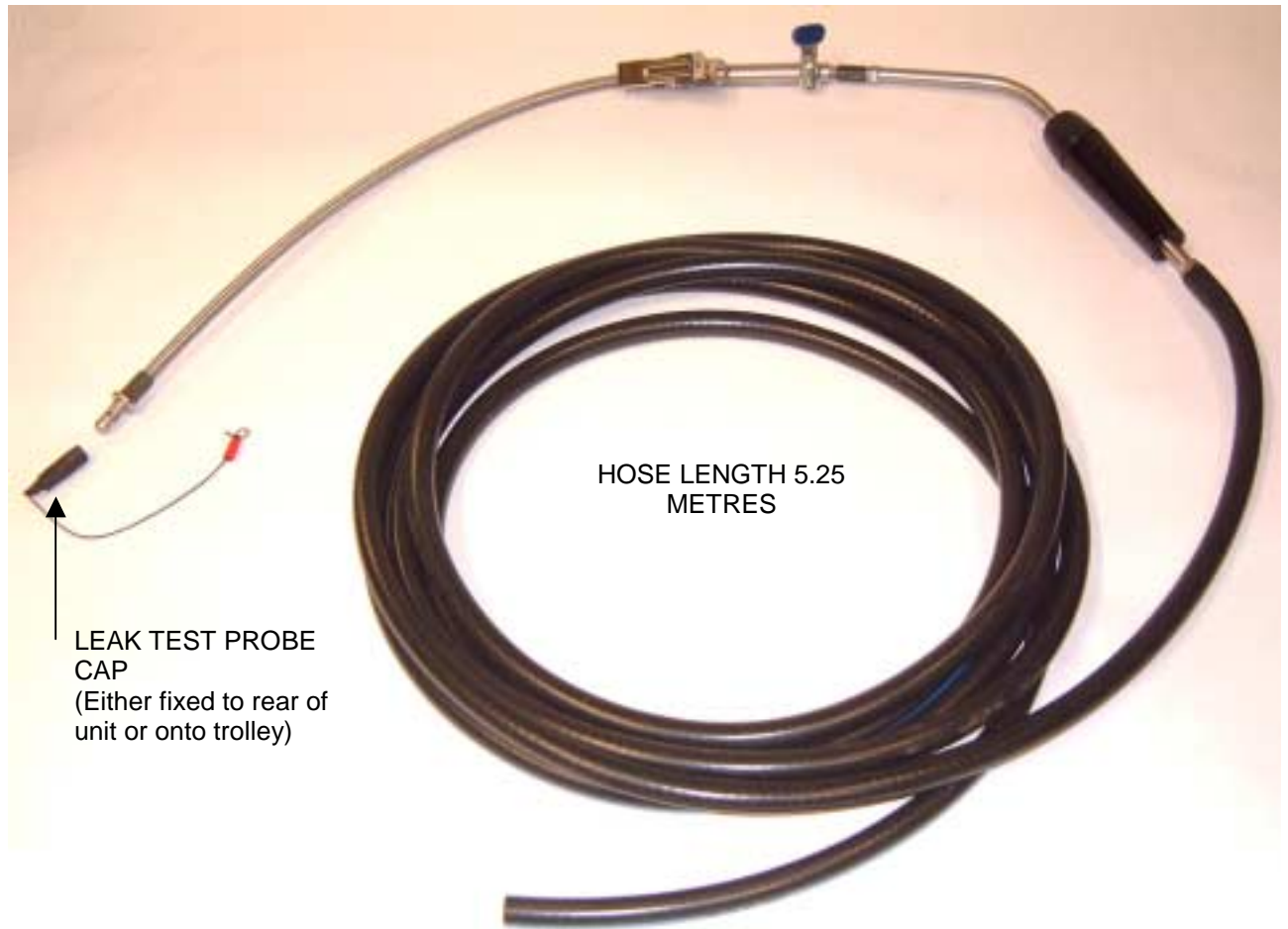
<p>INLETS (from top down) SAMPLE INLET ZERO GAS CALIBRATION GAS</p>	<p>FILTER COVER</p>	<p>OXYGEN SENSOR</p>	<p>CONNECTORS (from top down) AUXILIARY SERIAL INTERFACE VI INTERFACE</p>
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<p>WATER OUTLET</p>	<p>EXHAUST OUTLET</p>	<p>CONNECTORS (from left to right) RPM PROBE OIL TEMPERATURE PROBE KEYBOARD PRINTER USB PORT</p>
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SAMPLE PROBE AND HOSE



OIL TEMPERATURE PROBE



The oil temperature probe is fitted with a moveable rubber stop. This is to be set to match the same distance from the tip to the stop as on the vehicle dipstick as shown in the operators manual.

Failure to set this correctly may cause damage to the vehicles engine if the probe catches any moving internal components.

RPM CLAMP

The jaws of the RPM clamp must be kept clean, failure to do so will cause erratic readings.

The jaws are made of a very brittle material, if stressed or dropped this material will crack, making the clamp unusable.



ROUTINE MAINTENANCE – CLEANING

GAS ANALYSER AND HANDSET

ENSURE THAT THE OMIGAS IS TURNED OFF AND THE HANDSET AND POWER SUPPLY ARE DISCONNECTED.

CLEAN WITH A NON-AGGRESSIVE CLEANER AND A SOFT CLOTH

ROUTINE MAINTENANCE – FILTERS

PARTICULATE FILTERS – CLEAN DAILY

REMOVE THE FILTER FROM THE ANALYSER, PLACE IN A JAR OF CLEAN PETROL (DO NOT USE BRAKE CLEANER) SHAKE JAR, THEN BRUSH FILTERS WITH A TOOTHBRUSH OR SIMILAR. RETURN TO THE JAR AND SHAKE AGAIN.

REMOVE FROM JAR, WASH IN WARM SOAPY WATER TO REMOVE PETROL, DRY THOROUGHLY.

CLEAN FILTER CAPS AND O-RINGS WITH RUNNING WATER.

CLEAN FILTER HOUSING WITH CLEAN DAMP CLOTH.

FINE PAPER FILTER – DO NOT CLEAN – REPLACE WHEN LOW FLOW OCCURS

AFTER REPLACING FILTERS DO A MANUAL LEAK TEST.

A SECOND SET OF FILTERS IS USEFUL, IT ALLOWS YOU TO CLEAN THEM LAST THING AT NIGHT AND HAVE A SET READY IF THEY BLOCK UP DURING THE DAY.

IN CASE OF BREAKDOWN

SERVICE OR REPAIR

CONTACT:

SPARES

<u>ITEM DESCRIPTION</u>	<u>ORDER CODE</u>
DATABASE CARD	OM4000/15
FILTER - DISPOSABLE PAPER (BOX 10)	OM4000/13
FILTER – COALESCING (29MM)	OM4000/18
FILTER – GAS (37MM)	OM4000/17
HANDSET	OM4500/2
HANDSET CABLE	OM4500/4
KEYBOARD	CO6008A
OIL TEMPERATURE PROBE	OM4500/9
OIL TEMPERATURE PROBE RUBBER STOP	OM4000/22
OXYGEN CELL	OM4000/12
PRINTER – A4	PE1031A
PRINTER LEAD	LD2018A
RPM CLAMP	OM4500/6
SAMPLE PROBE TIP & HOSE	OM4500/11
SAMPLE PROBE TIP	OM4000/19
SAMPLE PROBE HOSE	OM4000/20
SAMPLE PROBE LEAK TEST CAP	OM4000/23
USB LEAD	OM4500/8
USER MANUAL	OM4500/5