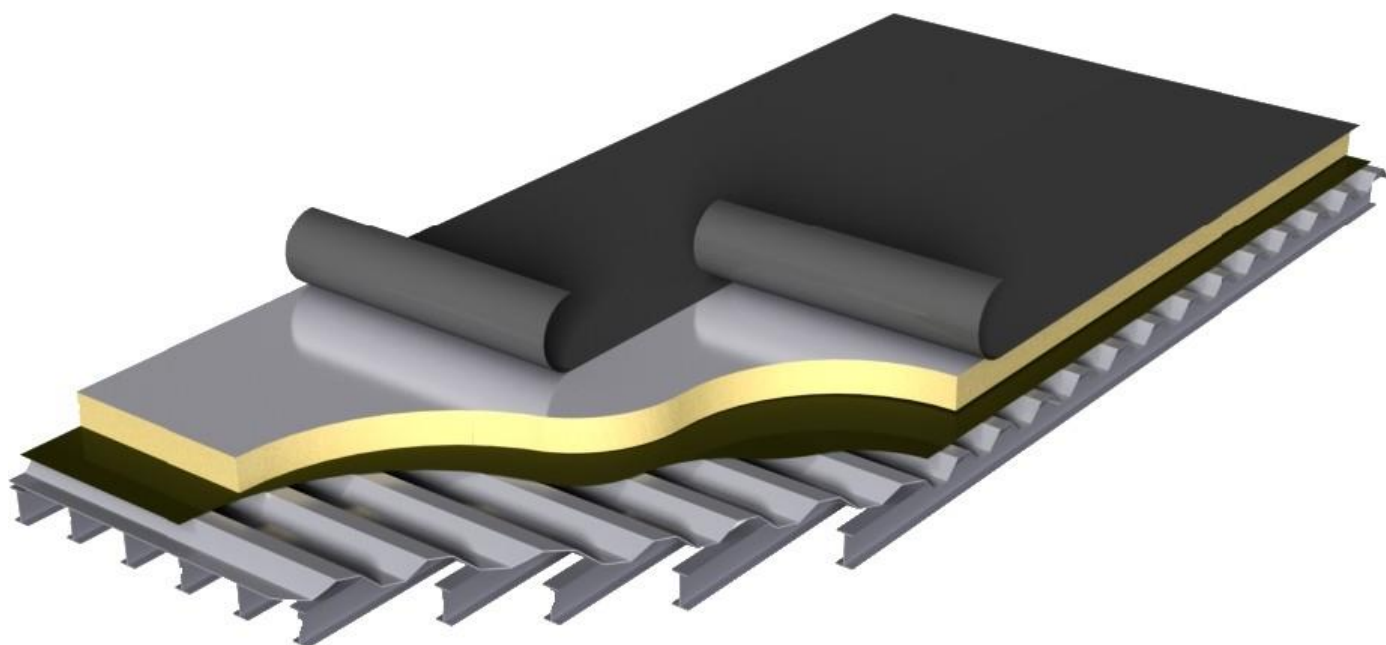


Testing Flat Roof Membranes

Application Guide R1

English Version



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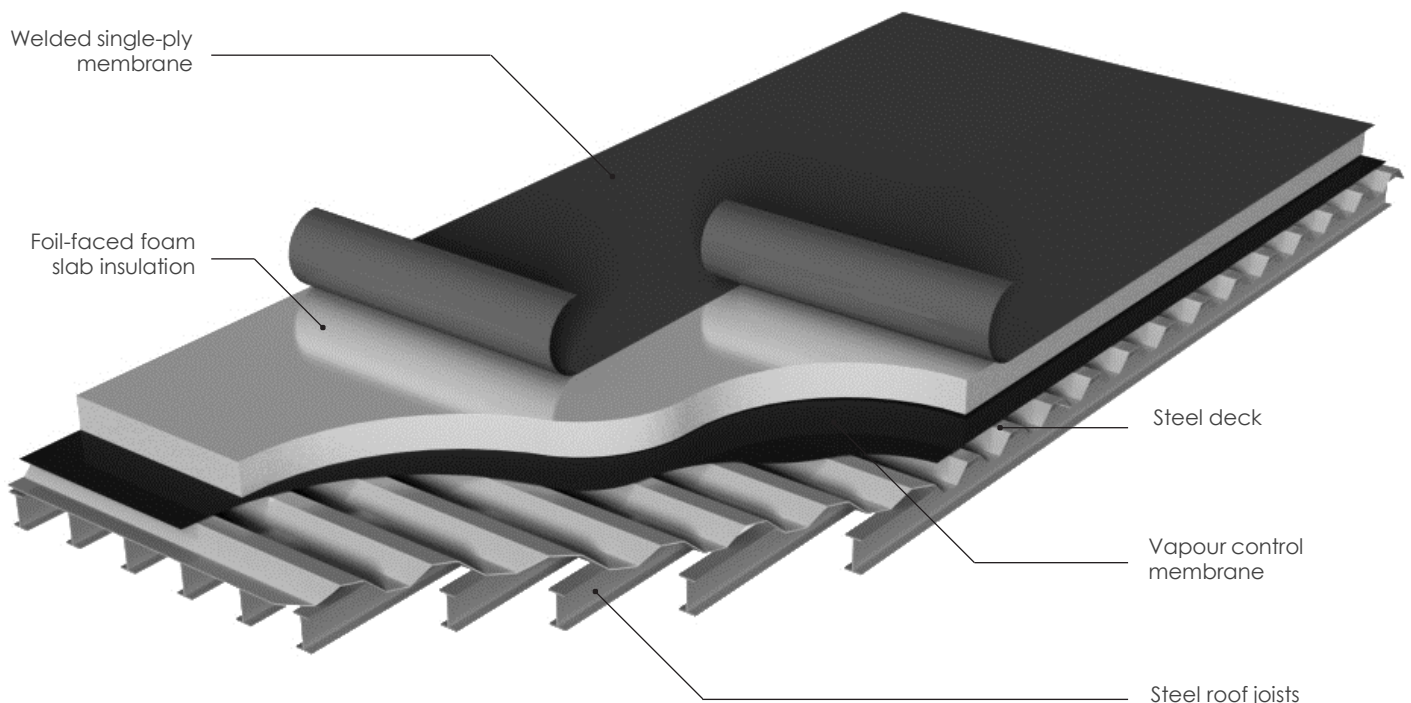
Buckleys (UVRAL) Ltd. are manufacturers of specialist test equipment and within our extensive product range are two types of detectors which can identify and locate leaks within flat roofs.

Flat roofs can develop leaks for a variety of reasons and at any point in their lifespan. Workers can accidentally (and unknowingly) pierce a roof's waterproof membrane even before construction is completed. Extreme weather, debris, poor design and poor construction can all conspire to create leaks. These leaks are often too small to spot with the naked eye yet, if left, can cause substantial damage to a building's structure in no time at all.

Detecting and repairing leaks in flat roofs at the earliest opportunity simply makes sense; especially as Buckleys' range of flat roof leak detectors offer a simple and easy-to-use way of quickly locating leaks.

Nowadays the vast majority of flat roofs are constructed from electrically conductive materials such as steel or concrete and many have a foil-faced insulation layer directly below the surface membrane. Buckleys' leak detectors use the conductive properties of these materials to locate faults by passing current through defects to earth.

Typical single-ply flat roof structure



We offer two types of leak detectors; one which detects leaks in dry conditions and one which detects leaks in wet conditions. Both detectors are supplied as complete, comprehensive kits; providing the user with everything required to test for leaks.

Testing Wet Roof Surfaces

The Wet Roof Pro' has been designed to locate leaks on flat roofing systems which incorporate dielectric membrane overlays such as single-ply, asphalt, bitumen and liquid applied roofs.

The Wet Roof Pro' uses the conductive properties of water (from either rainfall or a hose) to pinpoint leaks.

The kit comprises two main elements; a generator unit and a detector unit. The generator unit creates an electrical field across the roof surface via a 'boundary wire' which is positioned around the perimeter of the test area and connected to the positive terminal on the generator unit. The negative terminal is connected to a suitable earth on the building's structure.

Leaks in the roof membrane allow water to penetrate to the building's structure; creating a short circuit. The detector unit is connected to two hand-held test probes which are held in contact with the roof surface.



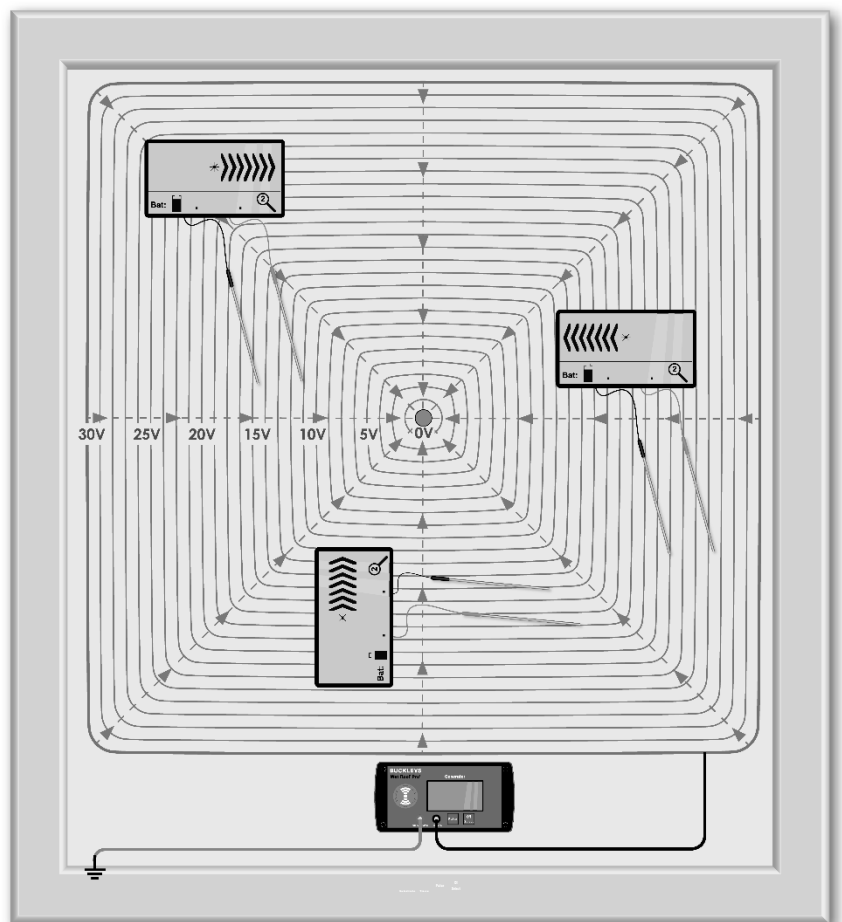
By measuring the voltage differential between the test probes, the detector unit is able to direct the operator to the location of the leak.

Principle of operation

The generator of the Wet Roof Leak Detector delivers a stabilised low frequency pulse. The negative output of the generator is applied to the trace wire which borders the test area, whilst the positive output is connected to a suitable building substrate. If moisture has penetrated the membrane or coating of the roof within the test area, a current will flow from this source point, via the moisture on the roof towards the trace wire. The detector is used to identify the direction of electrical current and detect the point of origin (ie where moisture is penetrating the roof covering).

The generator is powered by rechargeable batteries which are included in the kit, along with a charger.

Both units feature automatic shut-down when left unused for a prolonged period of time.



Method of testing

The test procedure is performed within a test area, created with stainless steel wire, which must be in good contact with the wet surface. If necessary, weights or adhesive tape should be used to hold the wire in position and the ends of the wire must be clipped together to form a closed circuit (ring). Any areas which protrude from the roof must be screened off by using an additional loop of wire, which in turn must be connected to the main border.

Test electrodes are supplied in three parts which can be put together easily on site to form two probes (poles). These are connected to the small detector unit with the red and black leads supplied. A suitable mechanically-fixed earthing point should be located on the building. Using the crocodile clip, the 10-metre lead (with red plug) should be securely attached to the earth point whilst the other end is connected into the positive (red) socket on the right-hand side of the generator unit. The black plug on the other connecting lead should be fitted into the negative (black) socket on the generator unit with the crocodile clip attached to the trace wire. The clip must be positioned to clamp together the free end of the trace wire to the section of wire emerging from the reel to complete the loop around the test area. The generator unit should now be switched on.



When the detector unit is switched on the unit will self-calibrate — it is important that the probes are not in contact with the test area at this point. The red probe should be held in the right hand and the black in the left, making sure that the leads do not cross over. Inside the test area, the probes should be positioned a distance apart either side of the body in contact with the wet roof. When the generator pulses the bar graph on the detector unit will show the direction of the fault. Starting at the edge of the screened area, re-positioning the probes and watching the detector will locate the direction of the fault (right or left). The search is continued in the direction of the pulse until the reading swings the opposite way. At this point, if the operator turns 90 degrees and repeats the procedure a crossover point can be reached to locate the source of the leak.

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Wet Roof Pro' (Ref: WRP01) comprises:

- Generator unit
- 10m earth lead
- 2 x multi-section test probes
- Red and black test probe connecting leads
- Black carrying bag for generator unit
- Comprehensive instruction manual
- Detector unit
- 10m boundary connection lead
- 200m stainless steel boundary wire on a reel
- Batteries and battery charger included
- Adjustable neck strap for detector unit
- Complete in robust carry case

Testing Dry Roof Surfaces

Buckleys roofing test kits have been used for many years to locate leaks in roof membranes. The Dry Roof Pro' leak detector kit can be used to find faults in non-conductive roof membranes with great success.

Capable of testing non-conductive roofing membranes ranging from 64 microns to 25.6mm in thickness, the Dry Roof Pro' provides an effective, quick and dependable method of testing a wide range of flat roof coverings for leaks and defects.

Principle of operation

The earth lead from the Dry Roof Pro' is connected to a convenient earth point on the structure. A high-voltage DC current – calculated against the membrane thickness – is applied (using an electrode) to the dry surface of the membrane.

When there are no faults present, the membrane acts as an electrical insulator by stopping the flow of current out of the Dry Roof Pro'. When the electrode passes over a fault or hole, the high-voltage jumps the gap between the electrode and the water (or conductive layer) under the membrane, causing a current to flow.

The audible and visual alarm on the Dry Roof Pro' will alert the operator, who can then mark the area in need of repair.

Two types of electrodes are recommended for testing; a phosphor bronze brush for uneven surfaces, or a special roller for large smooth areas.

The Dry Roof Pro' kit comprises:

- Dry Roof Pro' detector unit, probe handle & coiled interconnecting lead
- Drum brush electrode
- 4 x rechargeable D-cell batteries and charger
- 5m earth lead on reel
- 50m earth extension lead
- ESD anti-static wrist band
- 75mm pointed probe electrode
- 2 x 332mm insulated mid-section extension rod
- 1 x 332mm insulated end-section extension rod
- 450mm straight phosphor-bronze brush electrode (45° angled)
- Knurled thumb-nut & back nut (for electrode attachment)
- Test voltage calculator
- Carry bag with shoulder strap
- User instruction manual and calibration certificate
- Supplied in a robust, foam lined, high-visibility transit case



Method of testing

A suitable point on the structure should be identified as an earth connection for the earth lead of the Dry Roof Pro'.

Following the instructions in the operating manual of the Dry Roof Pro', the output voltage should be set according to the calculation made using the formula shown above. The earth lead and test probe handle should be connected to the Dry Roof Pro' whilst the unit is turned off.

The other end of the earth lead should be attached to the earth connection point of the structure ensuring that a good electrical contact has been made.

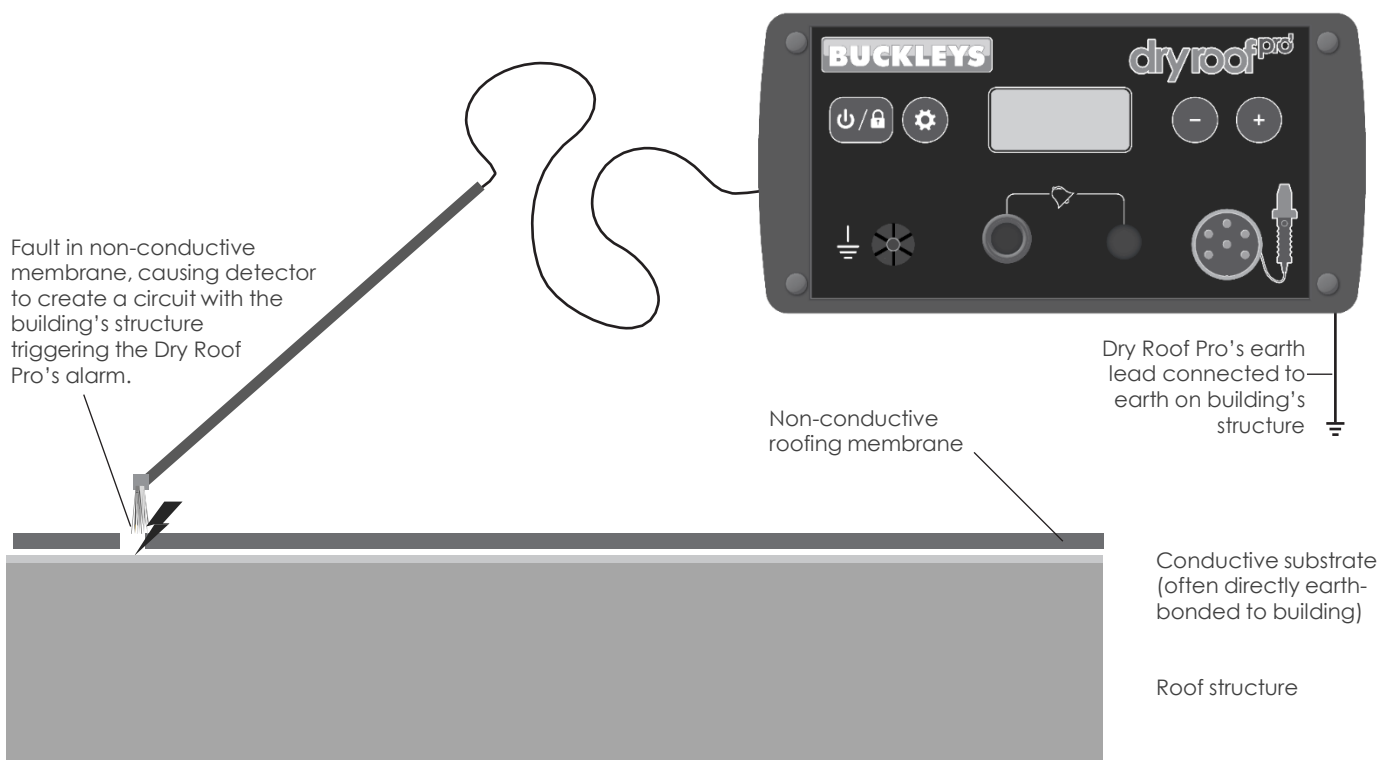
With the Dry Roof Pro' still turned off, extension rods should be connected to the test probe handle. Using the shoe attachment, a suitable electrode should be attached to the opposite end of the extension rods. Any electrode used must be in good condition as a damaged one will not make full contact and faults could be missed.

The operation of the Dry Roof Pro' should be checked by touching the electrode onto the substrate. The audible alarm should then be activated, but if not, the lead connections should all be checked. Sometimes it may be necessary to adjust the sensitivity control on the unit. Reducing the setting will make the unit more sensitive, while increasing the setting will make the unit less sensitive.

The electrode should be passed slowly over the membrane surface at a maximum rate of 100mm per second, paying attention to edges, holes and irregularities in the coating. The test voltage may need to be reduced to test the edges as the coating may be thinner.

When a fault is identified by the detector, the electrode should be moved sideways to identify the precise location of the fault. All faults should be ringed with a suitable marker so that repairs can be carried out later. The identification of the fault should be far enough away from the defect to allow the repairs to be made without covering the markings, as the substances contained in some markers can affect the adhesion of the repair material.

Testing should be continued across the complete surface and all faults marked. Damaged areas should be re-tested after repairs have been carried out.



Criteria for successful testing

There are a number of criteria that need to be met for successful detection of membrane faults:

- A** The test can only be carried out on roof membranes which have a conductive substrate (aluminium foil, concrete, brick, steel or water etc).
- B** The surface must be dry when the testing procedure is carried out. As water is a conductor of electricity, it would be impossible to find faults in a wet surface.
- C** The membrane material must be able to withstand the test voltage — testing a sample laid on a sheet of metal would confirm this (see below).
- D** The thickness of the waterproof membrane must be known so that the test voltage can be calculated.

Use the following formula to calculate the correct voltage:

$$\text{Test Voltage} = 250 \times \sqrt{^{\circ}\text{coating}}$$

Where $^{\circ}\text{coating}$ is the membrane thickness in microns (0.001mm)

Note: Setting the test voltage too high may damage the membrane and give false alarms.

Testing a sample

A sample of material of uniform thickness (approximately 30cm square and less than 2mm thick) should be laid onto a metal sheet. Whilst the Dry Roof Pro' is turned off, the test probe handle (fitted with a pointed probe electrode) and earth lead should be connected to the unit. The other end of the earth lead should be attached to the metal sheet.

With the output of the Dry Roof Pro' set at minimum to start with, the probe should be placed onto the membrane surface. The high voltage output should be turned on and slowly increased until the material beaks down and activates the alarm on the Dry Roof Pro', or the output reaches maximum. The electrode should then be lifted off the surface and the output voltage shown on the Dry Roof Pro' which caused the material to break down should be noted. The process should be repeated several times on new areas of the sample, allowing at least 20mm from any previously used areas, noting the break- down voltage each time

A calculation should be made to find an average of the voltages. The dielectric strength of the material would be approximately 75% of the average of the voltages. If the material will not break down, the thickness of the membrane material should be reduced by half and the above processes repeated. The results obtained can vary from 8kV to 40kV per mm.

For a material to be tested using high voltage, its dielectric strength must be greater than 4kV per mm and preferably 8kV per mm. The greater the dielectric strength the less chance there is of making a fault during the testing process.

Method of testing



A suitable point on the structure should be identified as an earth connection for the earth lead of the Dry Roof Pro'.

Following the instructions in the operating manual of the Dry Roof Pro', the output voltage should be set according to the calculation made using the formula shown above. The earth lead and test probe handle should be connected to the Dry Roof Pro' whilst the unit is turned off.

The other end of the earth lead should be attached to the earth connection point of the structure ensuring that a good electrical contact has been made.

With the Dry Roof Pro' still turned off, extension rods should be connected to the test probe handle. Using the shoe attachment, a suitable electrode should be attached to the opposite end of the extension rods. Any electrode used must be in good condition as a damaged one will not make full contact and faults could be missed.

The operation of the Dry Roof Pro' should be checked by touching the electrode onto the substrate. The audible alarm should then be activated, but if not, the lead connections should all be checked. It may be necessary to adjust the sensitivity control on the unit. Reducing the setting will make the unit more sensitive, while increasing the setting will make the unit less sensitive, ie for situations when the coating is damp.

The electrode should be passed slowly over the membrane surface at a maximum rate of 100mm per second, paying attention to edges, holes and irregularities in the coating. The test voltage may need to be reduced to test the edges as the coating may be thinner.

When a fault is identified by the detector, the electrode should be moved sideways to identify the precise location of the problem. All faults should be ringed with a suitable marker so that repairs can be carried out later. The identification of the fault should be far enough away from the defect to allow the repairs to be made without covering the markings, as the substances contained in some markers can affect the adhesion of the repair material.

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Electrodes for use with the Dry Roof Pro'



Roller Electrode (in widths of):

20"/500mm (ref: E850)
24"/600mm (ref: E860)
28"/700mm (ref: E870)

Straight Phosphor Bronze Electrodes:

100mm — 600mm (refs: E104 — E124)

The straight phosphor bronze electrodes are normally supplied with a 90° backing strip for fitting into the Shoe Attachment (A12). They can be supplied with a 45° backing strip to enable the electrode to be connected directly to an extension rod or, with an adaptor (A4), straight onto the test probe handle.

To order the 45° fitting, add an 'A' to the end of the code number; E104 = 100mm (90°), E104A = 100mm (45°).



Shoe Attachment

(ref: A12)

Connects rolling spring electrodes to an extension rod. Can also be used to connect straight phosphor bronze or straight silicone rubber electrodes.

Knurled Thumb-nut and Back-nut

(ref: AA3)

Supplied as standard with the Dry Roof Pro'; the knurled thumb-nut and back-nut provide a secure method of attaching 45° electrodes to the Dry Roof Pro' while keeping the weight of the test probe assembly to a minimum; reducing fatigue for the user and wear on the electrode.

Safety notice

Ensure all guidelines are followed as set out in the operating manual supplied with the kit.

All Buckleys products are manufactured under the controls established by a quality management system that meets the requirements of BS EN ISO 9001:2008 and are supplied with a one-year back-to-base warranty. The equipment is robust and reliable and will give years of service if maintained in accordance with our instructions.

Annual re-calibration is recommended for the Dry Roof Pro'. Buckleys can provide a full repair and calibration facilities, offering a fast turn-around service for customers' equipment.

Note: Due to ongoing technical developments, all stated information is typical and is subject to change without notice or obligation.

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