

# PST-100

## Instruction Manual

English Version



Please read carefully before use

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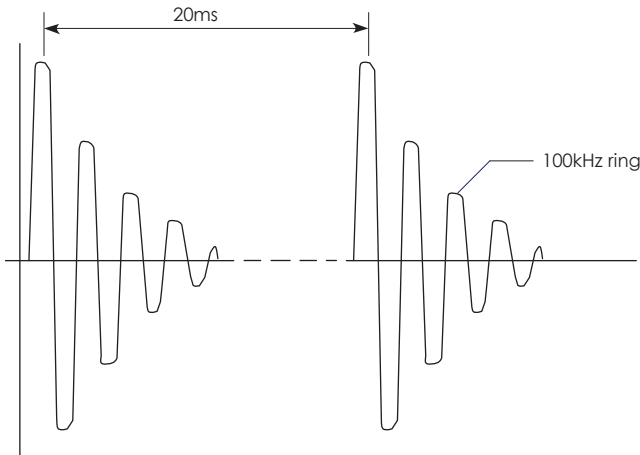
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## General Description

The PST-100 high voltage spark tester is a lightweight, hand held, spark-test pistol.

The PST-100 is primarily used for detecting pinholes or flaws in electrically non-conductive coatings, linings, membranes, pipe wraps and other plastic coated metals.

The PST-100 generates a pulsed ring output voltage. The pulse repetition is 20ms @ 50Hz or 16.6ms @ 60Hz mains. The ring frequency is approximately 100kHz. The output voltage is adjustable from 10kV to 55kV.



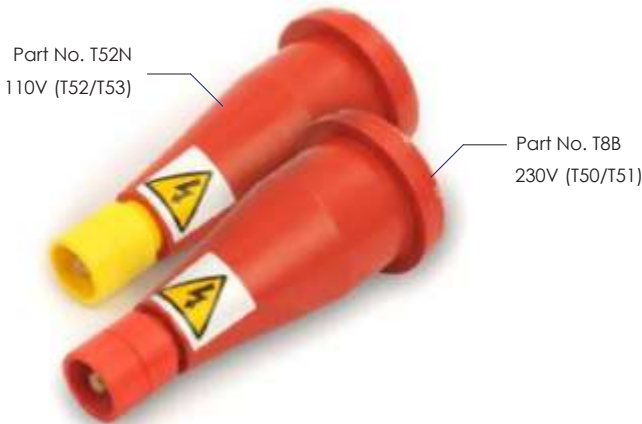
**Output voltage characteristics at 50hz mains frequency**

# Technical Specification

Operating temperature range:	0 to +30°C
Storage temperature range:	-10 to +40°C
Supply voltage: T50/T51	220/240V AC
T52/T53	105/120V AC
Supply frequency:	50 to 60 Hz
Max power consumption:	30VA
Output voltage:	10kV to 55kV
Output:	Pulsed Ring
Pistol weight:	1.0kg
Altitude:	Up to 2000m
Relative humidity:	80% Max (Non-Condensing)
Installation category:	Category II

**Note:** PST-100 nose cones are user replaceable. The voltage variants are identifiable from the colour of the solid insert as shown.

## Nose cone colour coding



This product has been manufactured under controls established by a quality management system that meets the requirements of ISO9001:2008 which has been independently certified by BVC under certificate number 3414

## Unpacking

Remove the PST-100 from its packaging and check for damage. If any part is damaged, the carrier and supplier should be notified immediately.

All packing material should be kept for inspection. The PST-100 should not be used.

### **The package contains the following items:**

- 1 x PST-100 pistol unit
- 1 x Flexible probe

## Safety precautions and symbols



**Caution, risk of danger**



**Caution, risk of shock**



**Category II double isolation**



**Earth (ground) terminal**

Read the information in this manual carefully before using the equipment.

**Note:** The works safety officer should approve the use of this equipment.

The PST-100 Spark Tester is intended to generate a high voltage discharge, it is only to be used by responsible and authorised personnel that have read and understood this manual.

The probe must **NEVER** be directed at the body.

There is a potential risk to those who might have an incipient heart condition.

There is also a potential risk from the reflex action when receiving a high voltage shock. Injury could also occur if the spark were discharged to sensitive parts of the body (e.g. eyes).

In a reasonably ventilated room of a volume greater than 40m<sup>3</sup>, the exposure to ozone produced by the high voltage spark should not present a risk to health. In a 'confined space' situation it is likely that ozone levels will exceed the exposure limit and present some risk to health. Under these conditions adequate ventilation must be provided.



**WARNING:** This equipment must not be used in any combustible atmosphere; the high voltage discharge will cause a spark from which an explosion could result.



**WARNING:** This equipment must not be exposed to damp or wet conditions, or where the amount of conductive dust is greater than would occur in a normal situation.



**WARNING:** Never connect or disconnect the flexible probe electrode with the generator connected to the mains supply.

Misuse or failure to comply with the guidelines outlined in this manual may impair the safety provided by the equipment.

## **PST-100 Earth Terminal**

The PST-100 has been tested and verified by an authorised, independent third party as meeting the requirements of IEC 61010:2010 - Safety requirements for electrical equipment for measurement, control, and laboratory use.

The construction methods employed throughout comply with double insulation. The earth terminal located on the handle is a functional earth terminal, NOT a Protective Conductor Terminal as defined by IEC61010 and is intended as a high voltage return point during the operation of the PST-100. This arrangement also aids suppression of possible EMC interference.

Therefore when conducting an electrical safety test (Portable Appliance Test) to the PST-100 it should be considered a class 2 appliance and tested accordingly.

### **Symbol definitions – IEC61010:2010**



#### *Functional Earth (ground) Terminal*

Terminal by which electrical connection is made directly to a point of a measuring or control circuit or to a screening part and which is intended to be earthed for any functional purpose other than safety.

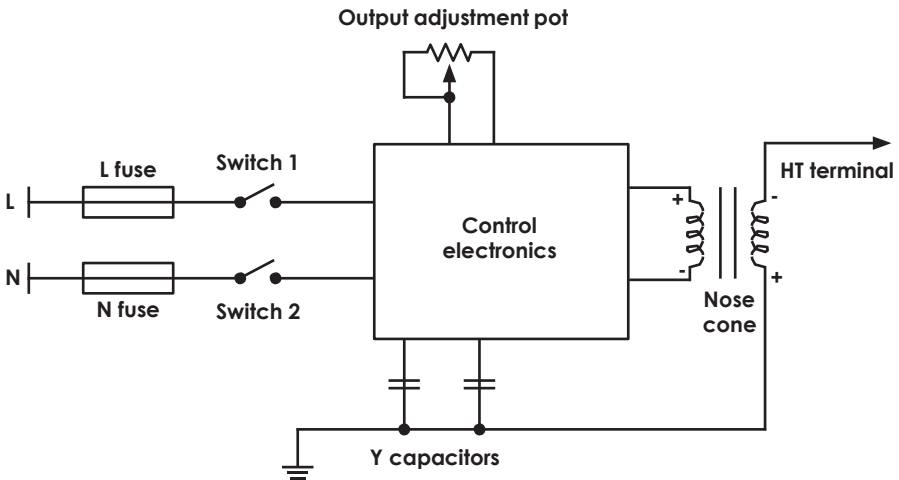


#### *Double Insulation*

Insulation comprising both basic insulation and supplementary insulation.



Below is a pictorial representation of the PST-100, detailing the functional earth terminal arrangement.



PST-100 functional earth terminal arrangement

## Calculating the test voltage

The test voltage needs to be high enough to locate a fault but not so high as to cause one. With reference to BS EN 60052:2002, (measurement of voltage with Sphere-Gaps) it can be seen that 32,000 volts will jump a gap of 1cm between spheres of 5cm diameter, however the same voltage will jump a gap of nearly 3cm between needles. This is because the shape of the electrode affects the point at which corona discharge starts. A spark or arc over, will occur when the voltage is high enough such as to cause localised breakdown of the air between the electrodes, a spark then forms, ionising the air drastically reducing its electrical resistance.

For materials with a thickness in the range of 1mm to 30mm, the NACE Standard SP-02-74 voltage calculation formula is normally used.

**SP-02-74 test voltage formula**

$$\text{Test Voltage} = 1250 \times \sqrt{T_{\text{coating}}}$$

Where  $T_{\text{coating}}$  is the coating thickness in mils (0.001").

**Alternatively**

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

Where  $T_{\text{coating}}$  is the coating thickness in microns (0.001mm).

After the test voltage is calculated it is necessary to check that the voltage is not so high as to damage the material. The dielectric strength is the voltage at which the material starts to breakdown, this is expressed in volts per mm, normally with D.C. As an example, a 2mm thick sheet of P.V.C. would require a voltage of 11.18kV using the above formula.

Referring to the manufacturer's technical data, the dielectric strength is 8.4kV per mm. Therefore, 2mm of such material has a dielectric strength of 16.8kV and is safe to test at 11.18kV.

## Operation



**WARNING:** NEVER connect or disconnect the flexible probe electrode with the generator connected to the mains supply.



**WARNING:** This equipment must not be used in any combustible atmosphere; the high voltage discharge will cause a spark from which an explosion could result.



**WARNING:** This equipment must not be exposed to damp or wet conditions, or where the amount of conductive dust is greater than would occur in a normal situation.

Screw the flexible probe electrode into the red end of the PST-100. Set the output control knob on the rear fully anti-clockwise. Connect the plug to the mains supply socket.

### Setting the Output Voltage

Hold the end of the flexible probe at the determined distance for a spark to jump to an earthed metal test piece, squeeze the trigger and turn the output control knob slowly clockwise until the output voltage is high enough to cause a spark to jump the gap. Alternatively - for increased accuracy in setting the output voltage - a Buckleys Spark Gap Setter (part number A2) may be used.

The probe should always be kept moving when testing as the high voltage and ring frequency combination may cause heating in the article under test which may result in burning. The output control should be adjusted for the lowest output at which an effective test can be carried out.

When testing is complete, release the trigger to switch off the PST-100's output.

Disconnect the PST-100 from the mains supply before attempting to remove the flexible probe.

# Applications

## Insulation Testing

The insulation to be tested must have a conductive backing, e.g. if a joint in plastic or rubber is to be tested, it should be laid on a metal sheet. If this is not practical, aluminium foil or copper wire can be placed behind the joint. Ideally this should be earthed, although this is not necessary if the area of the metal backing is larger than the area of the probe by a ratio of at least 1000:1.

Slowly sweep the area to be tested, looking at the probe at all times. When a fault is passed over, the high voltage corona discharge will change to a single spark. Remove the probe from the surface and mark the point where the fault was detected.

**NOTE:** The electrode size has an effect on the output voltage. For this reason we recommend a maximum size of 150mm.

## Gas Discharge Lamp Testing

The PST-100 can be used to excite gas discharge lamps to confirm that the vacuum has not been lost.

The lamp/tube should not be fitted, as the high voltage could make contact with the fitting and be passed into the wiring, which may damage other equipment connected to that wiring.

Hold the probe against the glass of the lamp and increase the output voltage from minimum, if the lamp's vacuum is satisfactory, the lamp will glow where the probe touches the glass.

## Ozone Production

Small quantities of ozone can be produced from the high voltage spark, useful for chemistry lectures, demonstrations etc.

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# Electromagnetic compatibility

## **Electromagnetic Emissions European Union Directive 2004/108/EC**

Before operating this equipment it is essential that the following risk assessment be taken.

As this equipment will produce an electromagnetic emission when actually arcing down through a fault to earth, a risk assessment of the area in which the unit will be used should be carried out. For example, the equipment should not be operated where the electromagnetic disturbance generated may hinder the operation of such apparatus as:

- Domestic radios and television receivers
- Industrial manufacturing equipment
- Mobile radio equipment. Mobile radio and commercial radio telephone equipment
- Medical and scientific apparatus
- Information technology equipment
- Domestic appliances and household electronic equipment
- Aeronautical and marine radio apparatus
- Educational electronic equipment
- Telecommunications networks/apparatus
- Radio & television broadcast transmitters
- Lights and fluorescent lamps.

The Directive also requires the above types of equipment to have an adequate level of electromagnetic immunity from such emissions. However, it should be borne in mind when doing an assessment that the directive applies to equipment supplied or taken into service after 1st January 1996 and that the equipment you are assessing, although legal, because of age, may not have this immunity.

Common areas of risk are computers, critical safety equipment (fail/safe electronics), supply cables, control cables, signalling and telephone cables above, below and adjacent to the area where the

tests are being carried out. The wearers of pacemakers and hearing aids should also be considered. Measuring and calibration equipment may also be susceptible.

To make a comparison: an arc welder when in use, would create interference far greater than this type of tester. It would, therefore, be reasonable to assume that if an arc welder had been used in the area without problems, then an AC Pinhole Detector would be safe. However, it would be unwise to use both of these equipments on the same site at the same time as they may interfere with each other.

The test area itself should also be considered. For example, the layout of the area would affect the distances, which the emissions would travel. Buildings and metal structures would shield against, or reduce, emissions. If the tester was being used inside a metal tank, for example, the tank would act as a very good shield. This would not, however, have the same effect if you were testing a plastic tank. If you were testing the circumference of a metal pipe then the pipe would act as an aerial and transmit the emissions further than expected. Remember that electromagnetic emissions travel in all directions and can even be bent or deflected. Neighbouring works or sites should also be taken into account as there may be equipment in use that could be affected by your tester's emissions.

This type of tester will usually be used on outdoor sites and remote from susceptible equipment, but the SITE SAFETY OFFICER should always be consulted before any testing is carried out. This is particularly necessary where electronically controlled equipment is being used.

Timing of the testing should also be considered as a means to avoiding interference problems. Consider testing when all susceptible equipment in the test area is switched off.

If your tester is only used in one area, then simple tests will ascertain where the tester interferes with other equipment and these can be resolved by scheduling the proper testing accordingly. Again, you should remember neighbouring works.

The PST-100 has been designed with EMC in mind and therefore all leads are of optimum length. If longer leads are used then they could transmit similar to aerials and cause interference.

Always ensure that the tester and test piece is securely earthed because this will reduce any interference generated by the spark. This also prevents static build-up in the operator and thereby avoiding electric shock.



Wherever you are intending to use equipment of this type, on your site or on a customers, always obtain clearance from the company safety officer.

## Maintenance

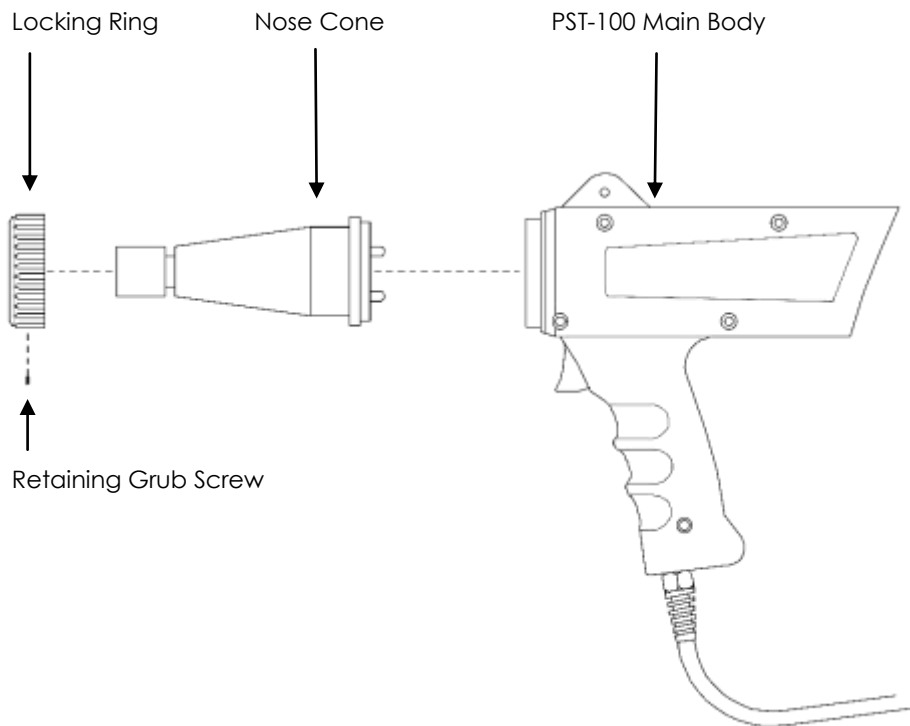
The PST-100 has been designed to be maintenance free, however the PST-100 should be inspected regularly, checking for damage to the unit. If any damage is found, the PST-100 must not be used, and should be returned to the manufacturer for repair.

Two operator replaceable fuses are located on the rear panel.  
Rating: 500mA anti-surge.

Before carrying out maintenance ensure the PST 100 has been disconnected from the AC mains supply.

To replace the PST 100 nose cone, first remove the small M4 x 6.0mm retaining grub screw from the nose cone locking ring, unscrew the nose cone locking ring and remove the nose cone from the PST 100 by gently pulling on the nose cone to separate it from the PST 100 main body.

Fit the replacement nose cone in the reverse order to that described above ensuring that both the nose cone locking ring and retaining grub screw are tightened sufficiently to prevent the nose cone from coming loose.



## Disposal information

Producer registration number: WEE/HJ0051TQ



This product must be disposed of in accordance with UK WEEE regulations.

For further information on UK WEEE regulations click on:

[www.gov.uk/government/publications/weee-regulations-2013-government-guidance-notes](http://www.gov.uk/government/publications/weee-regulations-2013-government-guidance-notes)



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