User Guide

Elcometer 266

DC Holiday Detector

CONTENTS

For the avoidance of doubt, please refer to the original English language version.

Kit Dimensions: 520 x 370 x 125mm (20.5 x 14.5 x 5”)

Weight: Base Unit (including battery pack): 1.2kg (2.7lb); Handle: 0.6kg (1.3lb)
Base Unit, Handle & Connecting Cable: 2kg (4.4lb)

A Material Safety Data Sheet for the Elcometer 266 Battery Pack is available to download via our website:
http://www.elcometer.com/images/stories/MSDS/elcometer_266_280_battery_pack.pdf

1 WORKING SAFELY

The equipment should be used with extreme care. Follow the instructions given in this user guide. Caution - risk of electric shock.

The high voltage handle generates a voltage at the probe tip of up to 30 000 V. If the user makes contact with the probe, it is possible to experience a mild electric shock. Due to the current being very low, this is not normally dangerous, nevertheless Elcometer does not advise using this product if you are fitted with a pacemaker.

An electrical spark indicates detection of a coating flaw; do not use this instrument in hazardous situations and environments, e.g. an explosive atmosphere.

Due to its method of operation, the Elcometer 266 will generate broad band RF emissions when a spark is produced at the probe, i.e., when a flaw in the coating is located. These emissions may interfere with the operation of sensitive electronic apparatus in the vicinity. In the extreme case of a continuous spark of length 5mm, the magnitude of emissions at a distance of 3m was found to be approximately 60 dBµV/m from 30 MHz to 1000 MHz. It is therefore recommended that this equipment is not operated within 30m of known sensitive electronic equipment and that the user does not deliberately generate continuous sparks.

In order to avoid injury and damage, the following should always be observed:

- × DO NOT use this instrument in hazardous situations and environments, e.g. any combustible, flammable or other atmosphere where an arc or spark may result in an explosion.
- × DO NOT carry out tests close to moving machinery.
- × DO NOT use the instrument in a precarious, unstable or elevated situation from which a fall may result, unless a suitable safety harness is used.
- × DO NOT use this product if you are fitted with a pacemaker.
- × DO NOT use this product when it is raining, in a damp atmosphere or if the unit is wet.

1 WORKING SAFELY (continued)

✓ DO	read and understand these instructions before using the equipment.
✓ DO	charge the battery before the first use of the equipment. This will take approximately 4 hours, see Section 5.1 ‘Charging the Battery Pack’ on page en-7.
✓ DO	consult the plant or safety officer before carrying out the test procedure.
✓ DO	undertake testing well clear of other personnel.
✓ DO	work with an assistant to keep the test area clear and to help with the testing procedure.
✓ DO	check that there are no solvents or other ignitable materials from the coating activities left in the test area, particularly in confined areas such as tanks.
✓ DO	switch the instrument off and disconnect the leads when the work is finished and before leaving it unattended.
✓ DO	ensure that the earth signal return cable is connected and extended before you switch on the instrument.
✓ DO	only use on coatings that are cured, thickness tested and visually inspected and accepted.
✓ DO	only use on coatings having a dry film thickness of at least 200µm (0.008"). For thicknesses between 200µm and 500µm (0.008” to 0.020”), ensure that an appropriately low voltage is applied (to prevent damage to the coating), or use the wet sponge method (using the Elcometer 270).
✓ DO	bond the work piece to a ground potential to minimise the potential for build up of static charge, see Section 11 ‘Static Electricity’ on page en-21.
✓ DO	take care when using this product with coatings that are damp or wet.
✓ DO	dry the instrument if it gets wet, paying special attention to the ribbing area.

2 GAUGE OVERVIEW

The Elcometer 266 detects flaws in protective coatings up to 7mm (25mils) thick and is ideal for inspecting coatings on pipelines and other protective coatings.

The coating under test can be electrically non-conductive or partially conductive (such as coatings which contain metallic or carbon particles). The coating must be at least 200µm (0.008") thick, and preferably over 500µm (0.020"), thick.

The underlying substrate must be an electrically conductive material such as metal or concrete (concrete is reasonably conductive because of its water content).

Typical flaws are pinholes (a very narrow hole running from the coating surface to the substrate), holidays (small uncoated areas), inclusions (objects trapped in the coating, e.g. grit from blast cleaning), air bubbles, cracks and thin spots.

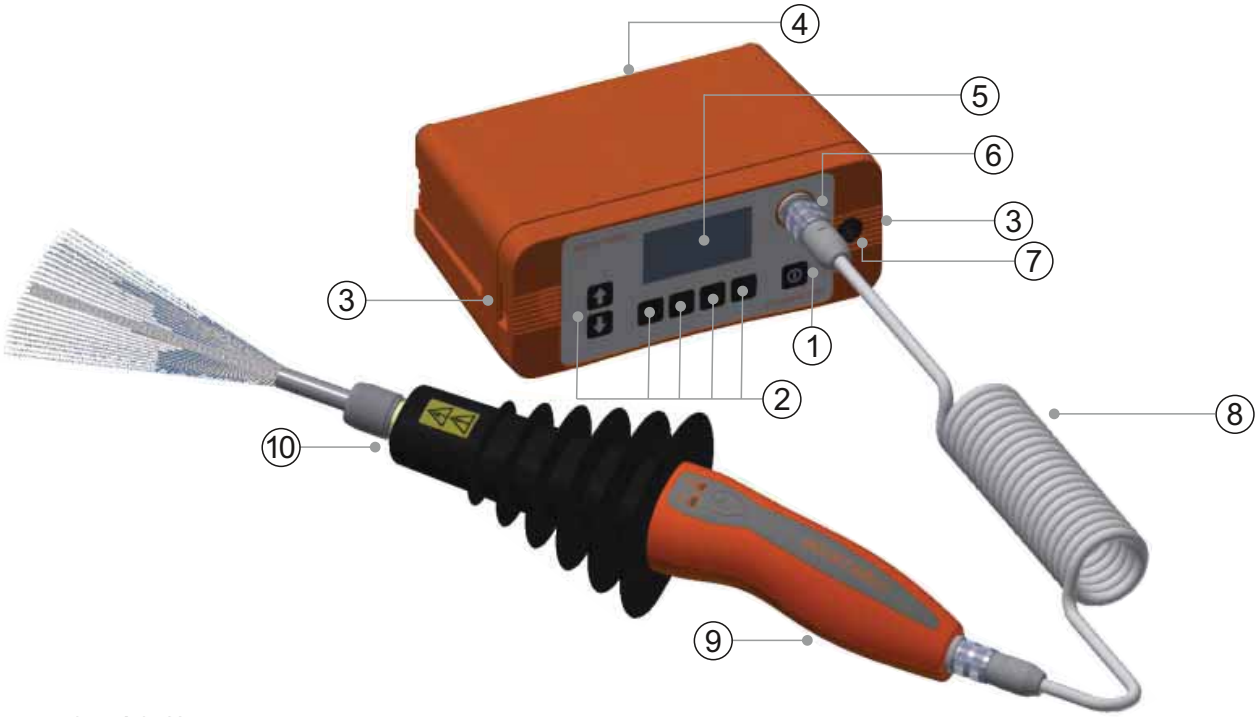
The Elcometer 266 probe handle generates a high DC voltage which is applied to the surface of the coating via a probe. An earth signal return cable is connected between the instrument and the substrate. When the probe is passed over a coating flaw, the electrical circuit is completed and current flows from the probe to the substrate. As a result, the instrument gives audible and visual alarms and a spark may be produced at the flaw.

The user can perform the test to any one of a number of international testing standards using the built-in Voltage Calculator.

The Elcometer 266 features an easy to use menu-driven graphical interface which guides the user during setup of the instrument and during measurement.

The instrument will operate in one of three voltage ranges; 0.5 kV to 5 kV, 0.5 kV to 15 kV and 0.5 kV to 30 kV. The voltage range is determined by the model of high voltage probe handle fitted to the instrument - not the instrument itself.

2 GAUGE OVERVIEW (continued)



1 On/Off Key
2 Multi Function Menu Keys
3 Shoulder Strap Connection
4 Rechargeable Lithium-ion Battery Pack
5 LCD Display
6 High Voltage Probe Handle Connection
7 Earth Signal Return Cable Connection
8 High Voltage Probe Handle Connecting Cable
9 High Voltage Probe Handle
10 Probe Accessory Connection

3 BOX CONTENTS

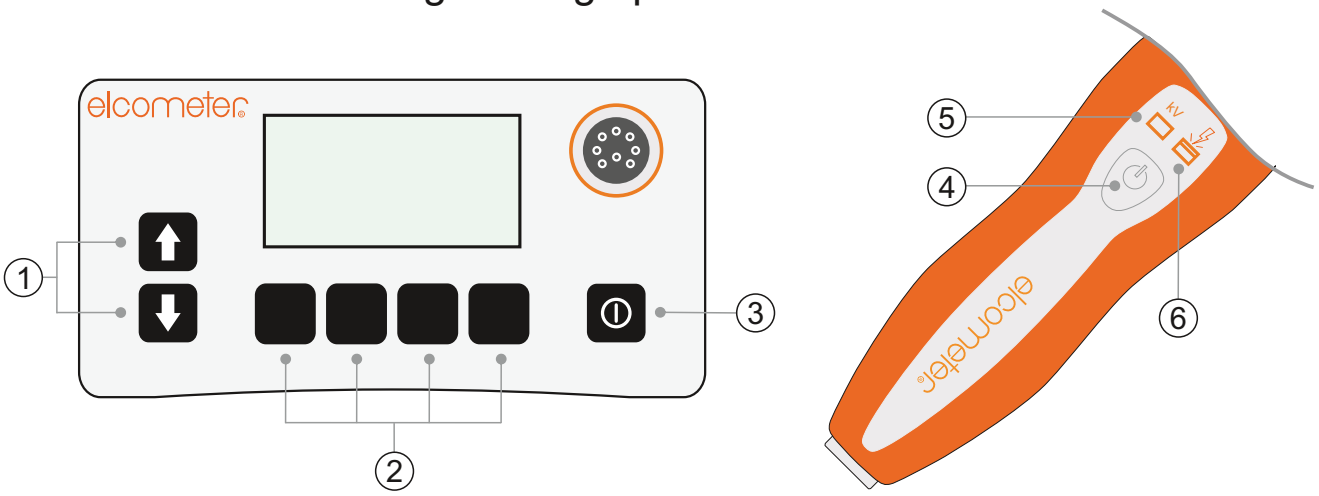
- Elcometer 266 DC Holiday Detector
- Earth Signal Return Lead, 10m (32 ft)
- Connecting Cable for High Voltage Probe Handle[a]
- Band Brush Probe
- Rechargeable Lithium-ion Battery Pack
- Battery Charger (UK, EU, US and AUS plugs included)
- Shoulder Strap
- Transit Case
- Calibration Certificate (if ordered)
- User Guide

[a] High voltage probe handle must be ordered separately - see Section 6 ‘High Voltage Probe Handle’ on page en-11.

4 USING THE GAUGE

4.1 THE CONTROLS

The Elcometer 266 is operated using the keypad on the instrument and the button on the high voltage probe handle.



1 Scroll up / down through menus and lists of values
Increases / Decreases Values

2 The function of these keys varies and is shown on the display

3 Switches the instrument on / off

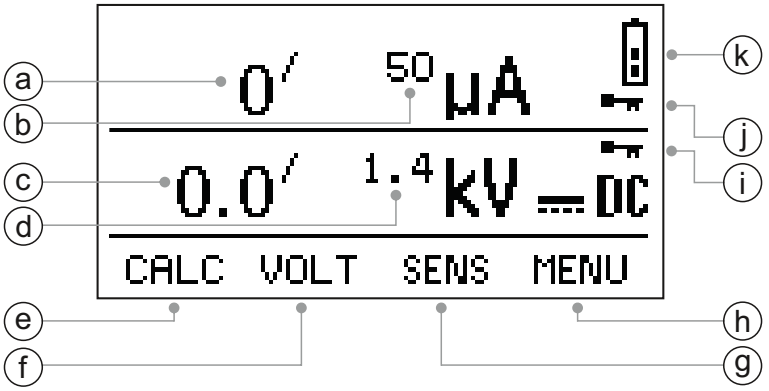
4 Press to toggle high voltage probe handle on / off

5 Red light: Probe voltage is on

6 Blue light: Flaw detected

4.2 THE DISPLAY

The main screen displayed (whilst taking measurements) is the Reading Screen.



a Current: Measured Value

b Current: Set Value

c Voltage: Measured Value

d Voltage: Set Value

e Calculate Voltage

f Adjust Voltage

g Adjust Sensitivity

h View Menu

i Voltage Locked (see page en-11)

j Sensitivity Locked (see page en-11)

k Battery Life Indicator

5 GETTING STARTED

5.1 CHARGING THE BATTERY PACK

The Elcometer 266 is powered by a rechargeable Lithium-Ion[b] battery pack which can be charged inside or outside the instrument.

Each instrument is dispatched from the factory with the battery discharged. Recharge the battery fully before using for the first time.

Note: Only one battery pack is supplied with each instrument. To increase productivity on site, we recommend purchasing a spare battery pack which can be charged whilst the instrument is in use, see Section 16.3 ' Batteries, Chargers & Earth Signal Return Leads' on page en-28.

Before you start:

- Use only the charger supplied with the Elcometer 266 to charge the battery. Use of any other type of charger is a potential hazard, may damage your instrument and will invalidate the warranty. Do not attempt to charge any other batteries with the supplied charger.
- Always charge the battery indoors.
- To prevent overheating, ensure that the charger is not covered.
- The instrument can be charged whilst it is switched on or off. If charged whilst switched on, the high voltage supply to the probe will be disconnected automatically and a battery charging icon will be shown on the display. If charged whilst switched off, the display will remain blank.

WARNING: Do not attempt to connect the supply side of the battery charger to generators or any other medium to high power source other than the single phase 50Hz A.C. mains outlet supplied from an approved and safe mains switchboard. Connection to other supply sources such as generators or inverters may have the potential to damage the charger, the battery and/or the instrument invalidating the warranty.

Charging the battery pack inside the instrument:

1 Unscrew the retaining screw *(a)* and open the access cover on the rear of the instrument.

2 Connect the lead from the charger into the socket marked 'Charger Input' behind the interface access cover.

[b] The Elcometer 266 is **not** designed to operate using dry cell batteries.

5 GETTING STARTED (continued)

3 Plug the charger supplied into the mains supply. The LED indicator on the charger will glow orange.
4 Leave the gauge charging for at least 4 hours. The LED indicator changes colour from orange to green when charging is complete.
5 When charging is complete, disconnect the charger from the mains supply before removing the lead from the instrument.

Charging the battery pack outside the instrument:

1 Unscrew the two battery pack retaining screws at the rear of the instrument and slide out the battery pack.
2 Connect the lead from the charger into the socket on the battery pack.
3 Plug the charger supplied into the mains supply. The LED indicator on the charger will glow orange.
4 Leave the battery pack charging for at least 4 hours. The LED indicator changes colour from orange to green when charging is complete.
5 When charging is complete, disconnect the charger from the mains supply before removing the lead from the battery pack.

Whilst the battery pack is removed from the instrument, do not allow metallic objects to come into contact with the battery terminals; this may cause a short circuit and result in permanent damage to the battery.

The battery condition is indicated by a symbol on the display:

Symbol	Battery Charge / Action Required
	70% to 100%
	40% to 70%
	20% to 40%
	10% to 20% - charging recommended
	<10%, instrument beeps every 10 seconds and symbol flashes - immediate charging required
	5 loud beeps, instrument switches off automatically

5 GETTING STARTED (continued)

5.2 SWITCHING THE INSTRUMENT ON / OFF

To switch on/off: Press the On/Off button '⏻'.

Note: To extend battery life (time between charges) the instrument can be set to switch off automatically after a user defined period of inactivity between 1 and 15 minutes. The default setting is 15 minutes.

5.3 SELECTING YOUR LANGUAGE

1 Press the MENU key to display the main menu.
- When the instrument is switched on for the first time after despatch from the Elcometer factory, the language selection screen will be displayed. Proceed to Step 2.

2 Select your language using the ↑↓ keys.
3 Press SEL to activate the selected language.

To access the language menu when in a foreign language:
1 Switch the instrument OFF.
2 Press and hold the left hand key and switch the instrument ON. The display will show the language selection screen with the current language highlighted by the cursor.
3 Select your language using the ↑↓ keys.
4 Press SEL to activate the selected language.

5.4 CONFIGURING THE INSTRUMENT

1 Press the MENU key to display the main menu.
2 Use the ↑↓ keys to scroll up and down the menu items.
3 Press SEL to activate the selected option or access the sub-menu, see Table 1.
4 Press BACK or ESC to leave the main menu or any sub-menu.

TABLE 1

Option	Action Required
BACKLIGHT	Press SEL to toggle the display backlight on or off.
BEEP VOLUME	Press SEL followed by ↑ or ↓ to set the beep volume; 1 (minimum) to 5 (maximum). Press OK when finished.
UNITS	Press SEL followed by ↑ or ↓ to select the measurement units; µm, mm, mil, thou or inch. Press OK when finished.
LANGUAGES	Press SEL followed by ↑ or ↓ to select the display language. Press OK when finished.

5 GETTING STARTED (continued)

TABLE 1	
Option	**Action Required**
ABOUT	Press SEL to view the ABOUT menu.
RESET	Press SEL to view the RESET menu
AUTO SWITCH OFF	Press SEL followed by + or - to set the auto switch off delay; 1 to 15 minutes or off (X). Press OK when finished.
OPENING SCREEN	Press SEL to toggle the opening screen on or off.
VOLTAGE LOCKED	Press SEL to toggle the voltage lock on or off, see Section 5.6 'Voltage and Sensitivity Locks' on page en-11.
SENSITIVITY LOCKED	Press SEL to toggle the sensitivity (current) lock on or off, see Section 5.6 'Voltage and Sensitivity Locks' on page en-11.

5.5 CLICKS, BEEPS, ALARMS AND LIGHTS

The Elcometer 266 emits a range of sounds and lights whilst in use, see Table 2 below.

TABLE 2		
Sound	**Lights**	**Indicates**
Single beep - high pitch	Red light on high voltage probe handle illuminates	High voltage to probe is switched on
Double beep - high pitch	Red light on high voltage probe handle flashes on/off	The safety interlock on the high voltage probe handle is not being gripped by your hand
Clicks - continuous series of	Red light on high voltage probe handle is illuminated	High voltage is present at the probe
Alarm buzzing	Blue light on high voltage probe handle flashes on/off	Flaw detected

5 GETTING STARTED (continued)

5.6 VOLTAGE AND SENSITIVITY LOCKS

The voltage and sensitivity settings on the Elcometer 266 include a 'lock' feature which helps to prevent accidental changes to these values once they have been set.

- The voltage lock can be toggled on or off from the main menu, see Section 5.4 'Configuring the Instrument' on page en-9. The voltage lock also switches on automatically once the voltage has been set using CALC.
- The sensitivity lock can be toggled on or off from the main menu, see Section 5.4 'Configuring the Instrument' on page en-9.

If a voltage or sensitivity lock is switched on, it can be overidden during setting of the value by pressing the UNLOCK key. The lock will re-engage automatically once the value has been set.

6 HIGH VOLTAGE PROBE HANDLE

A range of interchangeable high voltage probe handles is available for the Elcometer 266. A label on the underside of the handle indicates the maximum working voltage of the handle (5 kV, 15 kV or 30 kV).

The choice of which high voltage probe handle to use depends upon the maximum test voltage required, which in turn depends upon the thickness of the coating being tested and the recommendations of any test standard which may be being followed.

The Elcometer 266 is not supplied with a probe handle, these must be ordered separately.

Description	Voltage	Part Number
Elcometer 266 Probe Handle, DC5	0.5 - 5 kV	T26620033-1
Elcometer 266 Probe Handle, DC15	0.5 - 15 kV	T26620033-2
Elcometer 266 Probe Handle, DC30	0.5 - 30 kV	T26620033-3
Elcometer 266 Probe Handle, DC30S *(Continuous Voltage)*	0.5 - 30 kV	T26620033-4

Note: The DC30S Continuous Voltage Probe Handle is compatible with Elcometer 266 instruments with serial numbers 'SC16119' onwards. The software in older instruments must be updated by Elcometer or your local Elcometer distributor to recognise the new DC30S handle.

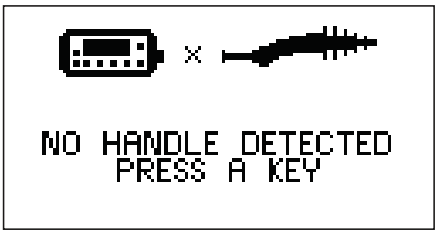
6 HIGH VOLTAGE PROBE HANDLE (continued)

6.1 CONNECTING A HIGH VOLTAGE PROBE HANDLE

The instrument must be switched off when a high voltage probe handle is fitted or removed.

Connect the high voltage probe handle to the instrument using the supplied connecting cable (the grey curly cable). The connecting cable is fitted with a metal screw-type connector at each end. To fit a connector, align the keyway, push the connector into place and then tighten the metal collar.

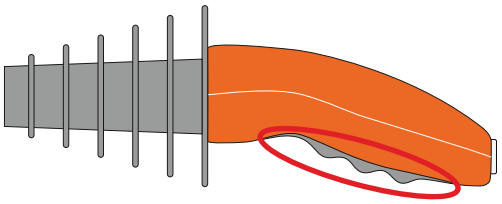
If the instrument is switched on without a high voltage handle fitted a warning message is displayed.



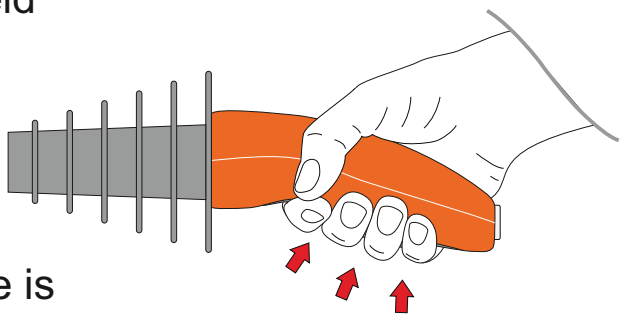
6.2 HIGH VOLTAGE PROBE HANDLE SAFETY INTERLOCK

All high voltage probe handles (with the exception of the DC30S Continuous Voltage Probe Handle, see Section 6.3 on page en-13) are fitted with a safety interlock device.

The safety interlock is fitted inside the black rubberised grip on the underside of the high voltage probe handle.



When this section of the handle is held by the hand as shown, the interlock switch is released and the voltage to the probe can be switched on (by pressing the button on the handle).



If the grip is released whilst the probe is at high voltage:

- the voltage at the probe will drop to zero immediately,
- the instrument will emit a high pitched beep, and
- the red light on the handle will flash.

6 HIGH VOLTAGE PROBE HANDLE (continued)

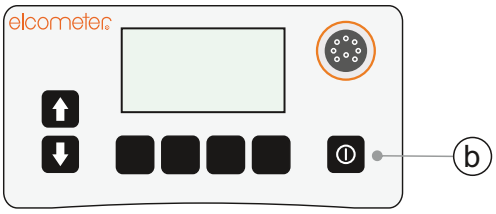
If the grip is then grasped again within approximately two seconds the voltage at the probe will be immediately restored. This feature allows the user to adjust their grip as required without interruption.

If the grip is not grasped within this two second interval, the high voltage probe handle is switched off automatically. To continue testing, grasp the handle again and press the button on the handle.

6.3 DC30S CONTINUOUS VOLTAGE PROBE HANDLE

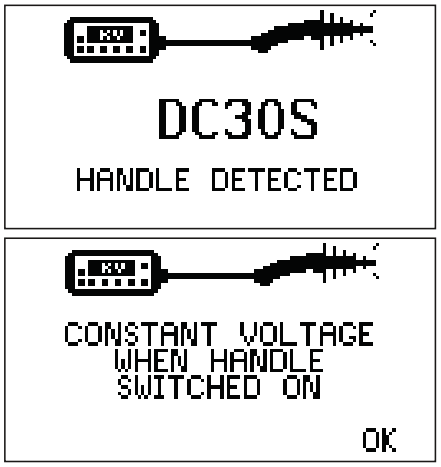
The DC30S probe handle does not have the safety interlock feature.

To switch off the voltage output, press the On/Off key *(a)* on the top of the handle. Alternatively, switch off the Elcometer 266 instrument using the On/Off key *(b)*.



To connect the handle to the instrument, follow the instructions outlined in Section 6.1 ‘Connecting a High Voltage Probe Handle’ on page en-12.

When a DC30S probe handle is connected to the instrument, a warning message is displayed each time the instrument is switched on. Press OK to acknowledge and continue operating as normal.



Note: The DC30S Continuous Voltage Probe Handle is compatible with Elcometer 266 instruments with serial numbers ‘SC16119’ onwards. The software in older instruments must be updated by Elcometer or your local Elcometer distributor to recognise the new DC30S handle.

7 PREPARING FOR TEST

Please read the information in Section 1 ‘Working Safely’ on page en-2 before using the equipment. If in doubt, contact Elcometer or your local Elcometer supplier.

7.1 CONNECT THE CABLES

1 Connect the high voltage probe handle to the instrument using the grey curly cable (Figure 1).

2 Connect the clamp of the earth signal return cable to an exposed section of substrate. Plug the other end of the cable into the instrument (Figure 2).

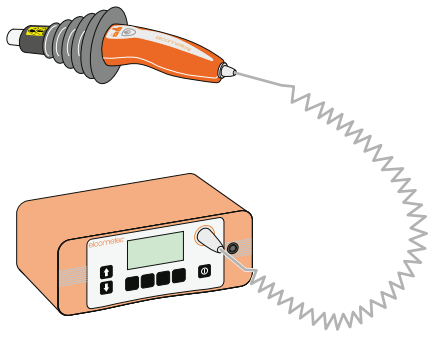


Figure 1

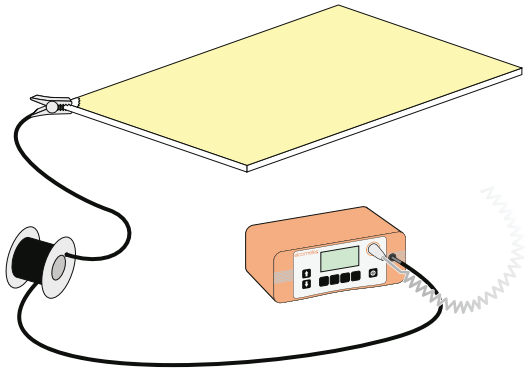


Figure 2

7.2 FIT THE PROBE ACCESSORY

Select the probe accessory best suited for the work being undertaken, see Section 12 ‘Probe Accessory Selection’ on page en-22, and attach it to the high voltage probe handle (Figure 3).

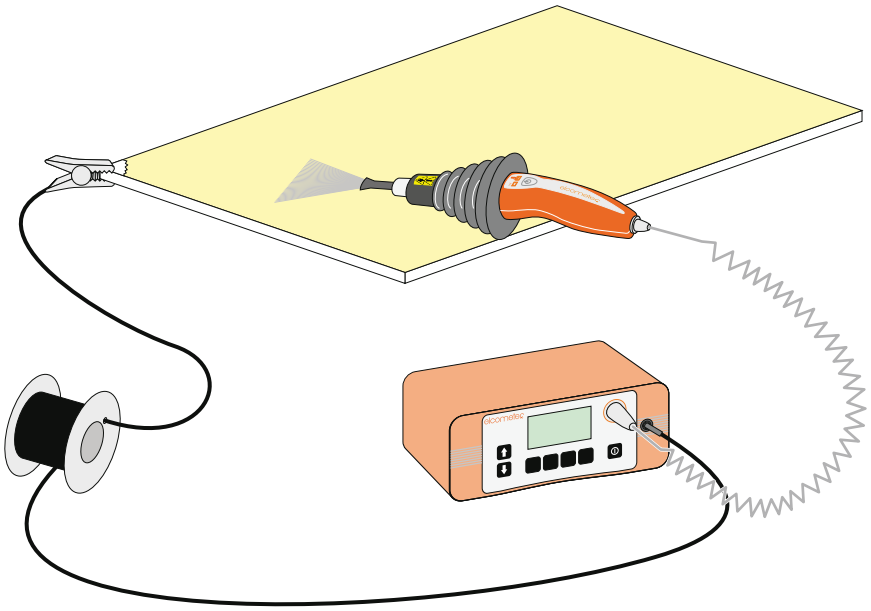


Figure 3

7.3 CHECK THE CABLE CONNECTIONS

1 Press the On/Off button to switch the instrument on.
2 Reduce the voltage setting to the minimum value, see Section 9 ‘Setting the Probe Handle Voltage’ on page en-17.
3 Reduce the current setting to the minimum value, see Section 10 ‘Setting the Sensitivity’ on page en-19.
4 Hold the high voltage probe handle firmly with the probe in free air and press the button on the handle to switch on.
5 Touch the probe against the bare substrate and check that the instrument signals a flaw.

(a) If the instrument signals a flaw then the instrument is operating correctly and is ready to use for testing.

(b) If the instrument does not signal a flaw check all connections and try again. If you are still unable to get the instrument to signal a flaw, contact Elcometer or your local Elcometer supplier for advice.

6 When finished, press the button on the probe handle to switch off.

7.4 SET THE PROBE HANDLE VOLTAGE

See Section 9 ‘Setting the Probe Handle Voltage’ on page en-17.

7.5 SET THE SENSITIVITY

See Section 10 ‘Setting the Sensitivity’ on page en-19.

7.6 CHECK FOR CORRECT OPERATION

1 Either find or make a flaw in the coating.
2 Using the procedure outlined in Section 8 ‘Test Procedure’ on page en-16, test that the flaw can be detected.
3 If the flaw is not detected, confirm that all the preceding steps have been undertaken correctly and check again.
4 If the flaw is still not detected, contact Elcometer or your local Elcometer supplier for advice.

8 TEST PROCEDURE

8.1 TESTING IN A SINGLE LOCATION

1 Holding the high voltage probe handle firmly, ensure that your fingers grasp and squeeze the black rubberised grip on the underside of the handle, as shown (Figure 4).

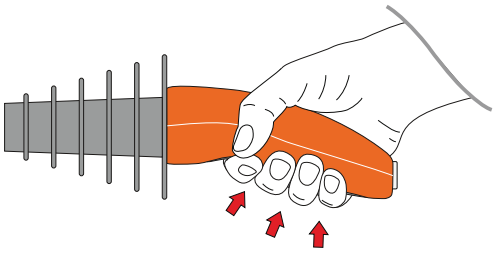


Figure 4

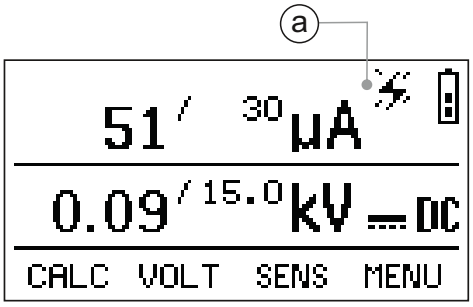
2 With the probe in free air, press and release the button on the handle to switch on the high voltage. The red light on the handle will illuminate and the instrument will emit a regular clicking, indicating that the probe is at high voltage.

3 Place the probe on the test surface.

4 Keeping the probe in contact[c] with the surface, move it over the work area at a speed of approximately one metre every four seconds, 0.25m/s (10"/s).

Any flaws in the coating will be indicated by one or more of the following:

(a) A spark is seen between the probe and the surface
(b) The blue light on the high voltage handle flashes
(c) The alarm sounds
(d) The alarm icon is shown on the display *(a)*
(e) The display backlight flashes



8.2 MOVING TO A NEW TEST LOCATION

If you need to test in more than one location:

1 Always switch off the instrument before disconnecting any cables.

2 After reattaching cables in the new test location and before you recommence testing, repeat the steps given in Sections 7.3, 7.4 and 7.5 on page en-15.

[c] The probe must always touch the surface. Gaps between the probe and the coating can result in genuine flaws not being detected.

8 TEST PROCEDURE (continued)

8.3 AFTER TEST

Always switch off the instrument and disconnect the cables when you have finished testing and when leaving work unattended.

9 SETTING THE PROBE HANDLE VOLTAGE

The probe handle voltage can be set automatically or manually.

9.1 AUTOMATICALLY SETTING THE VOLTAGE

The Elcometer 266 includes a built-in Voltage Calculator which will determine and set the correct test voltage based upon the test standard and the thickness of coating you are testing.

Using the Voltage Calculator is a two stage process;

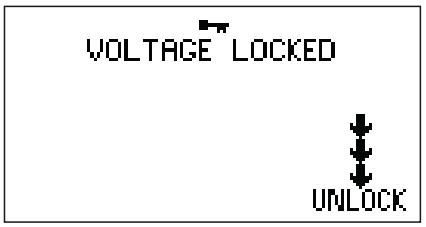
- First select your test standard and;
- then select your coating thickness.

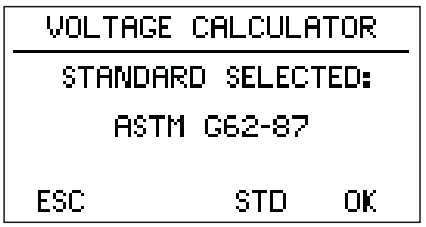
To select the test standard:

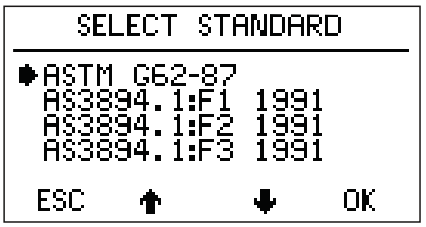
1 With the reading screen displayed, press the CALC key. The 'VOLTAGE CALCULATOR' screen will be displayed. The current test standard selected is shown.
   - If the voltage has been locked, see Section 5.6 'Voltage and Sensitivity Locks' on page en-11, a warning screen will be displayed; press UNLOCK to allow the voltage to be adjusted - the lock will re-engage automatically after the voltage has been set by the calculator.

2 Press STD to display a list of test standards, see also Appendix A 'Standards' on page en-35.

3 Using the ↑↓ keys, move the arrow to the required test standard then press OK. The selected test standard will be shown.







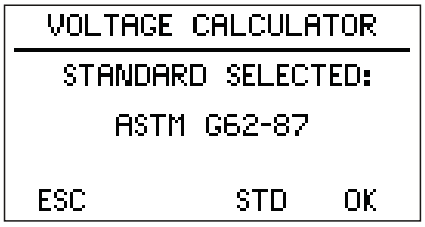
9 SETTING THE PROBE HANDLE VOLTAGE (continued)

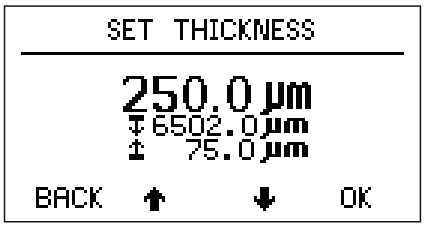
To select the coating thickness:

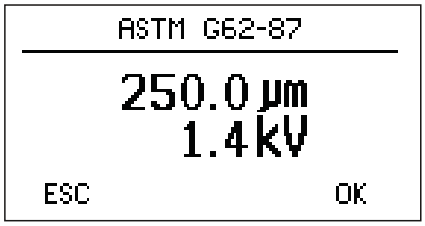
1 With the Voltage Calculator showing the test standard selected, press OK. The 'SET THICKNESS' screen will show the last used coating thickness and the upper and lower thickness values for the test standard selected.

2 Using the ↑↓ keys, adjust the coating thickness to the required value and then press OK. A confirmation screen is shown which displays the selected test standard, the coating thickness and the calculated test voltage.

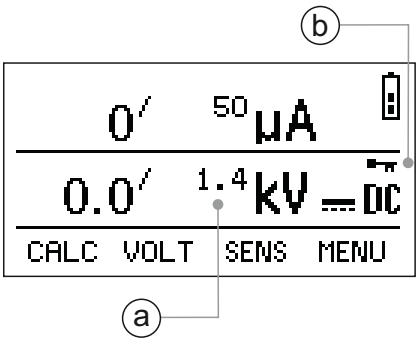
3 Press OK to set the instrument voltage to the calculated value, otherwise to return to the reading screen without making any changes, press ESC.







The calculated value of voltage will be shown on the reading screen *(a)* and a key icon will appear to indicate that the voltage has been locked *(b)*.

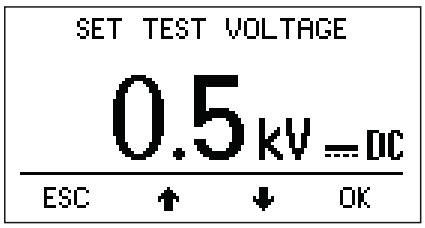


9.2 MANUALLY SETTING THE VOLTAGE

Before you start, read the notes given in Appendix B 'Calculating the Correct Test Voltage' on page en-38.

1 With the reading screen displayed, press the VOLT key. The 'SET TEST VOLTAGE' screen will be displayed.

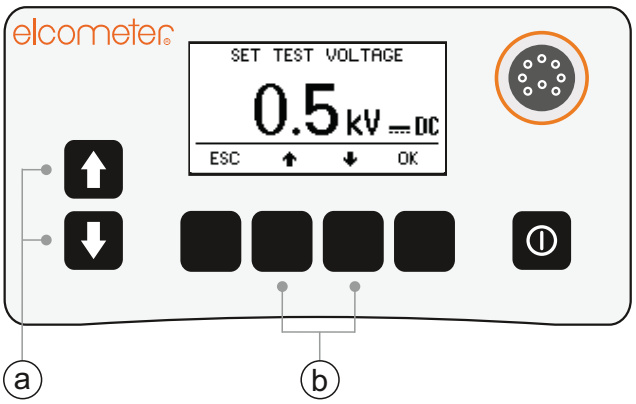
- If the voltage has been locked, see Section 5.6 'Voltage and Sensitivity Locks' on page en-11, a warning screen will be displayed; press UNLOCK to allow the voltage to be adjusted - the lock will re-engage automatically after the voltage has been set by the calculator.



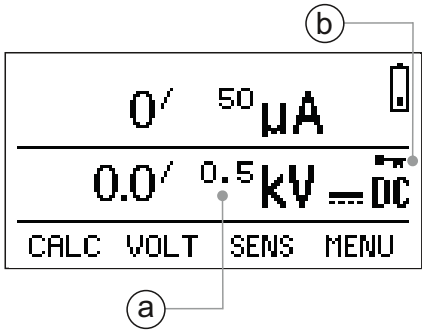
9 SETTING THE PROBE HANDLE VOLTAGE (continued)

2 Using the ↑↓ keys, adjust the voltage to the required value. The keys on the left of the display *(a)* adjust in increments of 1 kV; the keys below the display *(b)* adjust in increments of 0.1 kV.
   - Press and hold any of these keys to advance rapidly.

3 Press OK when finished.



The new probe set voltage will be displayed on the reading screen *(a)*. If the voltage lock is active, see Section 5.6 ‘Voltage and Sensitivity Locks’ on page en-11, a key icon indicates that the voltage is locked *(b)*.



10 SETTING THE SENSITIVITY

The sensitivity can be set automatically or manually.

10.1 AUTOMATICALLY SETTING THE SENSITIVITY

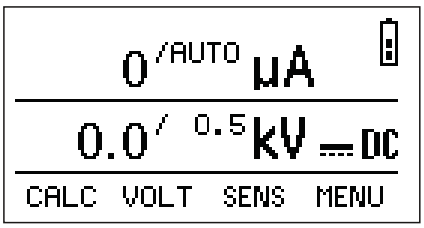
When the Elcometer 266 is set to automatic sensitivity mode, the instrument measures the current returning via the earth signal return cable.

If significant changes in the current are detected, the instrument analyses these changes - looking for the electrical ‘signature’ of a coating flaw.

When such a signature is detected, the instrument will signal the presence of the flaw.

Auto mode is beneficial when conductive coatings are being tested.

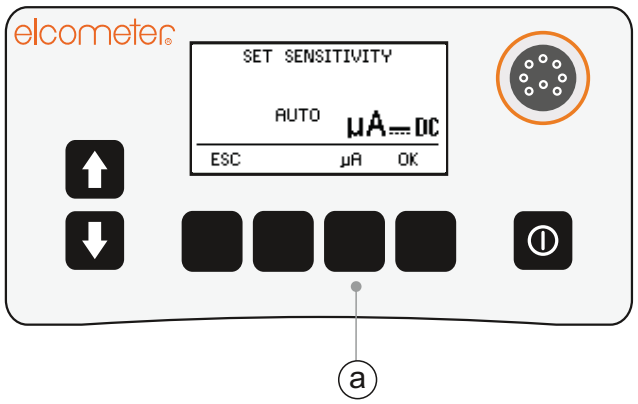
If the set value of the current on the reading screen is displayed as ‘AUTO µA’, the instrument is already set to automatic sensitivity mode and you need do nothing more.



10 SETTING THE SENSITIVITY (continued)

If 'AUTO' is not displayed:

1 Press the SENS key. The 'SET SENSITIVITY' screen will be displayed.
2 Press AUTO *(a)* to switch to automatic sensitivity mode.
3 Press OK to return to the reading screen.
4 Check that 'AUTO' is now displayed as the set value of the current.



10.2 MANUALLY SETTING THE SENSITIVITY

Manual setting of sensitivity may be required in certain instances and to comply with some test standards. To set the sensitivity of the instrument manually, the set current value must be adjusted.

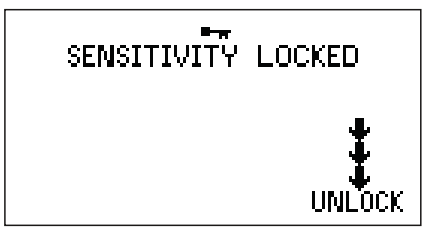
The set current value is adjustable between 5 µA and 99 µA in 1 µA increments.

- As the value is increased towards its maximum (99 µA), the instrument becomes LESS sensitive.
- As the value is decreased towards its minimum (5 µA), the instrument becomes MORE sensitive.

Typically, manual adjustment may be required when testing partially conductive coatings at high voltages.

The probe is placed onto a section of coating known not to contain any flaws. The measured 'background' current flow is noted and the set current value then adjusted to a value a few µA above this figure. Erroneous alarms due to the background current flow are therefore avoided in this instance.

1 With the reading screen displayed, press the SENS key. The 'SET SENSITIVITY' screen will be displayed.
   - If the sensitivity has been locked, see Section 5.6 'Voltage and Sensitivity Locks' on page en-11, a warning screen will be displayed; press UNLOCK to allow the current to be adjusted - the lock will re-engage automatically after the current has been set.

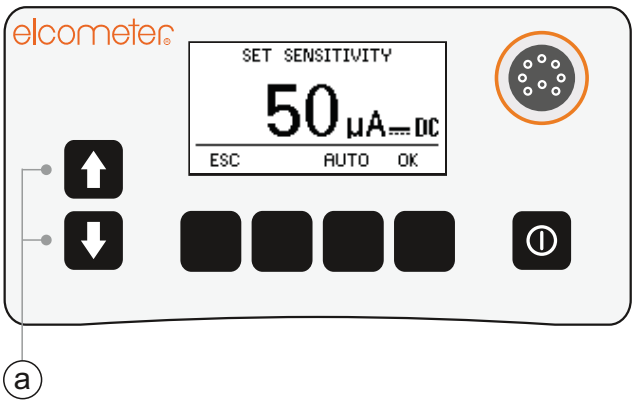


10 SETTING THE SENSITIVITY (continued)

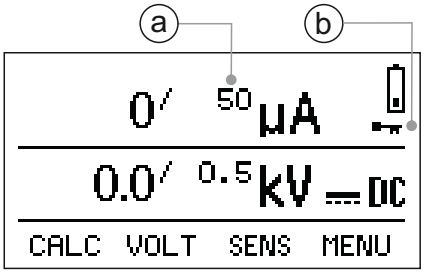
2 If the sensitivity is set to 'AUTO µA', press 'µA'. The last used set current value will be displayed.

3 Using the ↑↓ keys, adjust the set current to the required value; each press changes the display by 1 µA.
   - Press and hold either key to advance rapidly.

4 Press OK when finished.



The new set current will be displayed on the reading screen *(a)*. If the sensitivity lock is active, see Section 5.6 'Voltage and Sensitivity Locks' on page en-11, a key icon indicates that the sensitivity is locked *(b)*.



11 STATIC ELECTRICITY

As the probe is moved over the surface of a coating, a static charge builds up which can:

- Cause objects in contact with the surface to become charged with the same polarity.
- Induce an opposite charge on nearby objects electrically insulated from the surface.

Charged surfaces (or adjacent objects) can be discharged by turning off the high voltage and brushing the surface with the probe.

Induced static on the operator is minimised by means of a dissipative contact point on the high voltage probe handle (the rubber handgrip). Simply holding the handle ensures that the operator is always at the same potential as the earth signal return cable, and therefore the test substrate.

It is recommended that the substrate of the item being tested is bonded to an earth potential, thus preventing any overall build-up of charge, which can otherwise remain on an isolated test piece for several minutes after testing has been completed.

11 STATIC ELECTRICITY (continued)

The wearing of rubber gloves and insulating footwear is not necessary, although in certain unusual circumstances there may be a benefit.

For further guidance on minimising the effect of static, contact Elcometer or your Elcometer supplier.

12 PROBE ACCESSORY SELECTION

Table 3 below shows the most suitable probe accessory to use depending on the characteristics of the surface to be tested, e.g. internal and external pipe surfaces, large surfaces and complex shapes.

In addition, long reach applications can be carried out using extension pieces that are suitable for use with all probe types.

All these probe accessories are available from Elcometer or your local Elcometer supplier, see Section 16 ‘Spares & Accessories’ on page en-27 for details.

TABLE 3

Type of Surface	Recommended Probe	Notes
Small area, complex surface, general application	Band brush probe	Provides low contact pressure
Large surface areas	Wire brush probe/Rubber probe	Available in different widths. Use rubber probe for light contact and wire brush probe for medium contact
Insides of pipes 40mm to 300mm (1.5” to 12") diameter	Circular brush probe	Includes 250mm (9.8") extension rod
Outside of pipes, 50mm to 1000mm (2” to 36") diameter	Rolling spring probe	Phosphor bronze and stainless steel springs are available

13 THE SECOND HAND GRIP

The Second Hand Grip is an optional accessory which can enhance the use of the instrument.

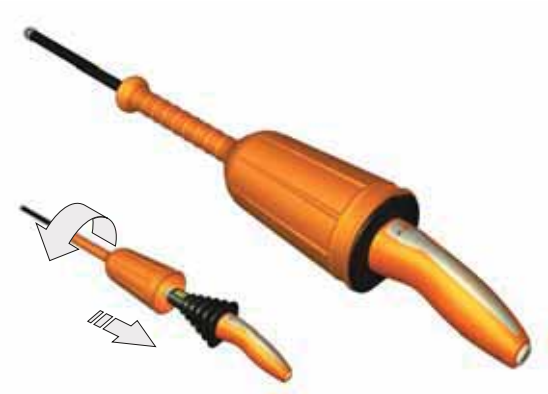
The grip is fitted between the high voltage probe handle and the probe accessory and enables the high voltage probe handle to be held by both hands, rather than just one:

- Allows the user to hold heavy probe accessories or long extension rods with greater ease and for longer periods of time.
- Highly insulated - does not affect the safe use of the instrument.
- Serves as a 0.5m extension rod.

Description	**Part Number**
Second Hand Grip	T26620081

To fit the Second Hand Grip:

1 Slide the grip onto the end of the high voltage handle.
2 Rotate anti-clockwise until it is firmly screwed in place.



The probe accessory is then attached to the end of the Second Hand Grip using the standard coupling.

14 SPECIAL CONSIDERATIONS

14.1 CONDUCTIVE COATINGS

If the displayed voltage drops sharply when the probe is applied to the test surface or the alarm sounds continuously, then the coating may be conductive. The usual occurrences of conductive coatings are described in the following.

- **Existence of metallic, carbon or other conducting particles in the coating:** During normal use, the particles in this type of coating are not linked. However, when the coating is subjected to high voltages the material between the particles can break down. This results in the coating becoming conductive and the detector indicating the presence of a flaw.

14 SPECIAL CONSIDERATIONS (continued)

- **Surface moisture or contamination:** Certain soluble salts attract moisture from the atmosphere and this and other forms of surface contamination can form a path across the surface to the high voltage that is not due to a coating flaw. Under these conditions the detector indicates non-existent flaws. When these circumstances occur, the surface should either be dried using a suitable cloth or cleaned with a non-conducting cleaner or solvent which will not damage the coating.

  Note: Ensure that any cleaner or solvent containers are removed from the test area before re-commencing the test.

- **Moisture penetration or absorption:** Moisture can enter materials, e.g. glass reinforced plastic along the reinforcing glass fibres, if the surface is eroded or scratched and then immersed in water. In this case, allow adequate time for the coating to dry prior to testing.

- **Rubber linings**: These may be slightly conductive due to their carbon content. As with other conductive coatings, reduce the sensitivity so that the detector indicates a known flaw but does not sound when the probe is placed on sound coating. It may also be necessary to increase the test voltage to compensate for the current flow through the coating.

- **Coating may not be fully cured:** In this case the coating still contains solvents which allow the path to the high voltage to be formed even if a flaw is not present. To overcome this problem, allow the coating to cure before undertaking the test.

14.2 CONCRETE SUBSTRATES

If a concrete or cement substrate contains enough moisture, then it will conduct electricity and the holiday detector can be used to detect flaws in its coating.

The procedure is generally the same as that described in ‘Preparing For Test’ on page en-14 and ‘Test Procedure’ on page en-16, but the following points should be noted. Hammering a masonry nail, or similar conducting spike, into the concrete or cement makes the earth signal return contact.

14 SPECIAL CONSIDERATIONS (continued)

The suitability of the concrete for use with a holiday detector can be checked using the following:

1 Make a high voltage return contact by hammering a nail or similar into the concrete.
2 Attach the earth signal return cable to the nail, set test voltage for the thickness of coating, or in the range 3 kV - 6 kV if the test voltage is not known and set the sensitivity to maximum (5 µA current).
3 Place the probe on uncoated concrete about 4m (13ft) from the nail.

If the alarm sounds, then the concrete is sufficiently conductive. If the concrete is too dry, i.e. the alarm does not sound, then it is unlikely that the holiday detector will be a suitable inspection method.

14.3 LENGTHENING THE EARTH SIGNAL RETURN CABLE

Lengthening the return lead by connecting several leads together may invalidate the EMC performance of the equipment.

15 ERROR MESSAGES

Under certain conditions the instrument will display error messages. These messages are normally cleared by pressing one of the keys. The cause of the error will be indicated by the message and should be corrected before proceeding, see Table 4.

TABLE 4

Error Message	Causes	Action to Take
SPARKING TO CASE	Current is returning from the probe to the instrument via a route other than the earth signal return cable.	Check that all cables are connected correctly. If the instrument is in contact with the item being tested, move it to a location isolated from the item. Ensure that you are not touching the probe against the metal connector at the end of the high voltage handle connecting cable.
00	High voltage probe handle device error.	Remove high voltage probe handle and refit. If error persists, contact Elcometer[d].

[d] Or your local Elcometer supplier.

15 ERROR MESSAGES (continued)

TABLE 4 (continued)		
Error Message	**Causes**	**Action to Take**
01, 02 and 03	High voltage probe handle ADC error.	Remove high voltage probe handle and refit. If error persists, contact Elcometer[d].
04, 05 and 06	High voltage probe handle DAC error.	Remove high voltage probe handle and refit. If error persists, contact Elcometer[d].
07 and 08	High voltage probe handle EEPROM error.	Remove high voltage probe handle and refit. If error persists, contact Elcometer[d].
09	High voltage probe handle CRC error.	Remove high voltage probe handle and refit. If error persists, contact Elcometer[d].
10	High voltage probe handle connecting cable (curly cable) fault.	Return high voltage probe handle to Elcometer[d].
11	Current leakage.	Return to Elcometer[d] for software upgrade.
12	Handle not compatible.	Remove high voltage probe handle and refit. If error persists, contact Elcometer[d].
13	Handle data invalid.	Remove high voltage probe handle and refit. If error persists, contact Elcometer[d].
14	Handle not recognised.	Remove high voltage probe handle and refit. If error persists, contact Elcometer[d].
15, 16 and 17	Handle switch presses not recognised.	Remove high voltage probe handle and refit. If error persists, contact Elcometer[d].

[d] Or your local Elcometer supplier.

16 SPARES & ACCESSORIES

16.1 HIGH VOLTAGE PROBE HANDLES

A range of interchangeable high voltage probe handles is available depending on the voltage required. The Elcometer 266 is not supplied with a probe handle, these must be ordered separately.

For further information regarding connecting and using a high voltage probe handle, see Section 6 ‘High Voltage Probe Handle’ on page en-11.

Description	Voltage	Part Number*
Elcometer 266 Probe Handle, DC5	0.5 - 5 kV	T26620033-1
Elcometer 266 Probe Handle, DC15	0.5 - 15 kV	T26620033-2
Elcometer 266 Probe Handle, DC30	0.5 - 30 kV	T26620033-3
Elcometer 266 Probe Handle, DC30S *(Continuous Voltage)*	0.5 - 30 kV	T26620033-4

* Add ‘C’ to the end of the part number for a probe handle supplied complete with calibration certificate.

Note: The DC30S Continuous Voltage Probe Handle is compatible with Elcometer 266 instruments with serial numbers ‘SC16119’ onwards. The software in older instruments must be updated by Elcometer or your local Elcometer distributor to recognise the new DC30S handle.

16.2 SECOND HAND GRIP

Ideal for testing pipes and tank floors with two hands - without compromising safety.

For further information regarding the second hand grip, see Section 13 on page en-23.

Description	Part Number
Second Hand Grip	T26620081

16 SPARES & ACCESSORIES (continued)

16.3 BATTERIES, CHARGERS & EARTH SIGNAL RETURN LEADS

Description	Part Number
Rechargeable Lithium Ion Battery Pack	T99923482
Battery Charger (with UK, EU, US & AUS plugs)	T99919999
Earth Signal Return Lead; 4m (13')	T99916954
Earth Signal Return Lead; 10m (32')	T99916996

16.4 PROBE EXTENSION RODS

Description	Part Number
Probe Extension Piece; 250mm (9.8")	T99919988-3
Probe Extension Piece; 500mm (20")	T99919988-1
Probe Extension Piece; 1000mm (39")	T99919988-2

16.5 ACCESSORY ADAPTORS

Allow other manufacturer's accessories to be used with the Elcometer 266.

Adaptor for Models	Part Number
AP, APS, AP/S1, AP/S2, AP/W, 10/20, 14/20, 10, 20 & 20S	T99920084
P20, P40, P60, 780, 785 & 790	T99920083
PHD 1-20 & PHD 2-40	T99920252
Elcometer 266 with old Elcometer Accessories	T99920082

16.6 BAND BRUSH PROBES

Description	Part Number
Band Brush Probe	T99919975
Band Brush Probe; Phosphor Bronze	T99922751

16.7 RIGHT ANGLED WIRE BRUSH PROBES

Complete Assembly		Spare Electrode Only	
Part Number	**Width**	**Part Number**	**Width**
T99920022-1	250mm (9.8")	T99926621	250mm (9.8")
T99920022-2	500mm (19.7")	T99926622	500mm (19.7")
T99920022-3	1000mm (39")	T99926623	1000mm (39")

16 SPARES & ACCESSORIES (continued)

16.8 INTERNAL CIRCULAR WIRE PIPE BRUSH PROBES

Complete Assembly		Spare Electrode Only	
Part Number	**Diameter**	**Part Number**	**Diameter**
T99920071-1	38mm (1.5")	T9993766-	38mm (1.5")
T99920071-2	51mm (2.0")	T9993767-	51mm (2.0")
T99920071-3	64mm (2.5")	T9993768-	64mm (2.5")
T99920071-4	76mm (3.0")	T9993769-	76mm (3.0")
T99920071-5	89mm (3.5")	T9993770-	89mm (3.5")
T99920071-6	102mm (4.0")	T9993771-	102mm (4.0")
T99920071-7	114mm (4.5")	T9993772-	114mm (4.5")
T99920071-8	127mm (5.0")	T9993773-	127mm (5.0")
T99920071-9	152mm (6.0")	T9993774-	152mm (6.0")
T99920071-10	203mm (8.0")	T9993775-	203mm (8.0")
T99920071-11	254mm (10")	T9993776-	254mm (10")
T99920071-12	305mm (12")	T9993777-	305mm (12")
T99920071-13	356mm (14")	T9993778-	356mm (14")
T99920071-14	406mm (16")	T9993779-	406mm (16")
T99920071-15	508mm (20")	T9993780-	508mm (20")
T99920071-16	610mm (24")	T9993781-	610mm (24")

16.9 'C-TYPE' WIRE BRUSHES

'C-Type' wire brushes are not supplied with a holder as standard. Please order the holder separately.

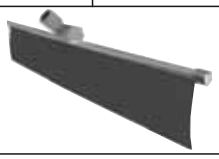
A wire brush support handle is also available - ideal for two handed use or second person when using larger diameter wire brushes.

Description	Part Number
'C-Type' Wire Brush Holder	T99922752
'C-Type' Wire Brush Support Handle	T99922907

16 SPARES & ACCESSORIES (continued)

'C-Type' Wire Brushes					
Part Number	Outside Diameter		Part Number	Outside Diameter	
	DN	NPS		DN	NPS
T99922745-1	150 - 250mm	6 - 9"	T99922745-6	650 - 750mm	24 - 28"
T99922745-2	250 - 350mm	9 - 12"	T99922745-7	750 - 850mm	28 - 32"
T99922745-3	350 - 450mm	12 - 16"	T99922745-8	850 - 950mm	32 - 36"
T99922745-4	450 - 550mm	16 - 20"	T99922745-9	950 - 1050mm	36 - 40"
T99922745-5	550 - 650mm	20- 24"	T99922745-10	1050 - 1150mm	40 - 44"

16.10 CONDUCTIVE RUBBER PROBES



Complete Assembly		Spare Electrode Only	
Part Number	Width	Part Number	Width
T99920022-11	250mm (9.8")	T99926731	250mm (9.8")
T99920022-12	500mm (19.7")	T99926732	500mm (19.7")
T99920022-13	1000mm (39")	T99926733	1000mm (39")
T99920022-14	1400mm (55")	T99926734	1400mm (55")

16.11 ROLLING SPRINGS

Available in phosphor bronze or stainless steel, each spring is supplied with an easy release coupling piece allowing users to quickly connect and disconnect the rolling spring at stanchions, pillars, etc.

Rolling springs are not supplied with a holder as standard. Please order the appropriate holder separately.

The 19mm (0.75") diameter phosphor bronze springs are almost three times lighter than the 34mm (1.33") diameter stainless steel springs.

Description	Part Number
Phosphor Bronze Rolling Spring Holder	T99920086
Stainless Steel Rolling Spring Holder	T99922746

16 SPARES & ACCESSORIES (continued)

Part Number		Nominal Pipe Size		Pipe Outside Diameter (OD)			
Phosphor Bronze	Stainless Steel	DN (mm)	NPS (inches)	Min (mm)	Max (mm)	Min (inches)	Max (inches)
T99920438-15A	-	40	1.5	48	54	1.9	2.1
T99920438-15B	-			54	60	2.1	2.4
T99920438-20A	-	50	2.0	60	66	2.4	2.6
T99920438-20B	-			66	73	2.6	2.9
T99920438-25A	T99922744-25A	65	2.5	73	80	2.9	3.1
T99920438-25B	T99922744-25B			80	88	3.1	3.5
T99920438-30A	T99922744-30A	80	3.0	88	95	3.5	3.7
T99920438-30B	T99922744-30B			95	100	3.7	3.9
T99920438-35A	T99922744-35A	90	3.5	100	108	3.9	4.3
T99920438-35B	T99922744-35B			108	114	4.3	4.5
T99920438-40A	T99922744-40A	100	4.0	114	125	4.5	4.9
T99920438-45A	T99922744-45A	114	4.5	125	136	4.9	5.4
T99920438-45B	T99922744-45B			136	141	5.4	5.6
T99920438-50A	T99922744-50A	125	5.0	141	155	5.6	6.1
T99920438-50B	T99922744-50B			155	168	6.1	6.6
T99920438-60A	T99922744-60A	152	6.0	168	180	6.6	7.1
T99920438-60B	T99922744-60B			180	193	7.1	7.6
T99920438-70A	T99922744-70A	178	7.0	193	213	7.6	8.4
T99920438-70B	T99922744-70B			213	219	8.4	8.6
T99920438-80A	T99922744-80A	203	8.0	219	240	8.6	9.4
T99920438-90A	T99922744-90A	229	9.0	240	264	9.4	10.4
T99920438-100A	T99922744-100A	254	10.0	264	290	10.4	11.4
T99920438-110A	T99922744-110A	279	11.0	290	320	11.4	12.6
T99920438-120A	T99922744-120A	305	12.0	320	350	12.6	13.8
T99920438-140A	T99922744-140A	356	14.0	350	375	13.8	14.8
T99920438-140B	T99922744-140B			375	400	14.8	15.7
T99920438-160A	T99922744-160A	406	16.0	400	435	15.7	17.1
T99920438-160B	T99922744-160B			435	450	17.1	17.7

16 SPARES & ACCESSORIES (continued)

Part Number		Nominal Pipe Size		Pipe Outside Diameter (OD)			
Phosphor Bronze	Stainless Steel	DN (mm)	NPS (inches)	Min (mm)	Max (mm)	Min (inches)	Max (inches)
T99920438-180A	T99922744-180A	457	18.0	450	500	17.7	19.7
T99920438-200A	T99922744-200A	508	20.0	500	550	19.7	21.7
T99920438-220A	T99922744-220A	559	22.0	550	600	21.7	23.6
T99920438-240A	T99922744-240A	610	24.0	600	650	23.6	25.6
T99920438-260A	T99922744-260A	660	26.0	650	700	25.6	27.6
T99920438-280A	T99922744-280A	711	28.0	700	750	27.6	29.5
T99920438-300A	T99922744-300A	762	30.0	750	810	29.5	31.9
T99920438-320A	T99922744-320A	813	32.0	810	860	31.9	33.9
T99920438-340A	T99922744-340A	864	34.0	860	910	33.9	35.8
T99920438-360A	T99922744-360A	914	36.0	910	960	35.8	37.8
T99920438-380A	T99922744-380A	965	38.0	960	1010	37.8	39.8
T99920438-400A	T99922744-400A	1016	40.0	1010	1060	39.8	41.7
T99920438-420A	T99922744-420A	1067	42.0	1060	1110	41.7	43.7
T99920438-440A	T99922744-440A	1118	44.0	1110	1160	43.7	45.7
T99920438-460A	T99922744-460A	1168	46.0	1160	1210	45.7	47.6
T99920438-480A	T99922744-480A	1219	48.0	1210	1270	47.6	50.0
T99920438-500A	T99922744-500A	1270	50.0	1270	1320	50.0	52.0
T99920438-520A	T99922744-520A	1321	52.0	1320	1370	52.0	53.9
T99920438-540A	T99922744-540A	1372	54.0	1370	1425	53.9	56.1

17 WARRANTY STATEMENT

The Elcometer 266 DC Holiday Detector and High Voltage Probe Handles are supplied with a 12 month warranty against manufacturing defects, excluding contamination and wear.

The warranty can be extended to two years within 60 days of purchase via www.elcometer.com.

18 TECHNICAL SPECIFICATION

Output Voltage[e]	0.5 kV to 5 kV 0.5 kV to 15 kV 0.5 kV to 30 kV	
High Voltage Output Accuracy	±5% or ±50 V below 1 kV	
Measured Current Flow Accuracy (sensitivity)	±5% of full scale	
Display Resolution	Voltage - Measured:	0.01 kV below 10 kV; 0.1 kV above 10 kV
	Voltage - Set:	0.05 kV below 1 kV; 0.1 kV above 1 kV
	Current - Measured:	1µA
	Current - Set:	1µA
Output Current	99µA Maximum	
Operating Temperature	0 to 50°C (32 to 122°F)	
Power Supply[f]	Internal rechargeable lithium ion battery	
Battery Life[g]	8/10 hours continuous use at 30 kV 15/20 hours continuous use at 15 kV 20/40 hours continuous use at 5 kV	
Battery Charger Fuse Rating (if fitted)	3 A	
Weight	Base Unit: (including battery pack)	1.2kg (2.7lb)
	Handle:	0.6kg (1.3lb)
	Base Unit, Handle & Connecting Cable:	2kg (4.4lb)
Kit Dimensions	520 x 370 x 125mm (20.5 x 14.5 x 5")	
Can be used in accordance with: See Appendix A 'Standards' on page en-35.		

[e] Depending on which high voltage handle is fitted.

[f] Battery packs must be disposed of carefully to avoid environmental contamination. Please consult your local environmental authority for information on disposal in your region. Do not dispose of the battery pack in a fire.

[g] Typical battery life with or without backlight.

19 CARE & MAINTENANCE

- The gauge incorporates a Liquid Crystal Display (LCD). If the display is heated above 50°C (120°F) it may be damaged. This can happen if the gauge is left in a car parked in direct sunlight.
- Keep the instrument, high voltage probe handle, connecting cables and probe accessories clean. Before cleaning, switch off the instrument and disconnect all cables. To clean, wipe with a damp cloth and then allow ample time to air dry before use. Do not use any solvents to clean the instrument.
- At regular intervals, check the instrument, high voltage probe handle, probe and high voltage return leads and connectors for damage. Replace any parts that are worn or are of doubtful condition, see Section 16 ‘Spares & Accessories’ on page en-27.
- Regular calibration checks over the life of the instrument are a requirement of quality management procedures, e.g. ISO 9000, and other similar standards. For checks and certification contact Elcometer or your Elcometer supplier.

The instrument does not contain any user-serviceable components. In the unlikely event of a fault, the gauge should be returned to your local Elcometer supplier or directly to Elcometer. The warranty will be invalidated if the gauge has been opened.

20 LEGAL NOTICES & REGULATORY INFORMATION

This product meets the Electromagnetic Compatibility Directive and the Low Voltage Directive.

This product is Class A, Group 1 ISM equipment according to CISPR 11.

Group 1 ISM product: A product in which there is intentionally generated and/or used conductively coupled radiofrequency energy which is necessary for the internal functioning of the equipment itself.

Class A product: Suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

NOTE: Additional information in given in Section 1 ‘Working Safely’ on page en-2.

Product Description: Elcometer 266 DC Holiday Detector

Manufactured by: Elcometer Limited, Manchester, England.

elcometer is a registered trademark of Elcometer Limited, Edge Lane, Manchester, M43 6BU. United Kingdom

All other trademarks acknowledged.

The Elcometer 266 DC Holiday Detector is packed in cardboard and plastic packaging. Please ensure that this packaging is disposed of in an environmentally sensitive manner. Consult your local Environmental Authority for further guidance.

APPENDIX A: STANDARDS

The voltage calculator included in the Elcometer 266 DC Holiday Detector is programmed with the following standards:

ASTM G6-83	AS3894.1:F3 1991	NACE SP0188-2006
ASTM G62-87	AS3894.1:F4 1991	NACE SP0490-2007
AS3894.1:F1 1991	ANSI/AWWA C213-91	NACE RP0274-04
AS3894.1:F2 1991	EN14430:2004	

Other standards which do not derive the test voltage directly from the coating thickness are not available within the Voltage Calculator function. Testing to these standards is still possible however, by setting the test voltage manually - see Section 9.2 'Manually Setting the Voltage' on page en-18.

The Elcometer 266 DC Holiday Detector can be used in accordance with the following list of standards and test methods:

Standard or Method Number	**Date**	**Title**	**Notes**	**Voltage Setting†**
ANSI/AWWA C214-89	1990	Tape coating systems for the exterior of steel water pipes	Minimum voltage is 6 kV. Use NACE RP0274	M
ANSI/AWWA C214-89	1992	Fusion-bonded epoxy coating for the interior and exterior of steel water pipes	$V = 525 \cdot \sqrt{\text{Thickness (mil)}}$	VC, M
AS3894.1	1991	Site testing of protective coatings. Method 1: Non-conductive coatings - Continuity test - High voltage (brush) method	Testing coatings >150µm at voltages >500 V $V = 250 \cdot \sqrt{\text{Thickness (µm)}} / \text{factor}$	VC, M
ASTM D4787	1988	Continuity verification of liquid or sheet linings applied to concrete	High voltage (above 900 V) test. Set voltage below dielectric breakdown strength of lining. Move probe at 0.3m/s (1 ft/s) max.	M

† Elcometer 266 Voltage Setting: VC = Voltage Calculator; M = Manual

APPENDIX A: STANDARDS (continued)

Standard or Method Number	Date	Title	Notes	Voltage Setting†
ASTM F423	1975	PTFE plastic-lined ferrous metal pipe and fittings	Electrostatic test: 10 kV, spark at defect is cause for rejection	M
ASTM G6	1983	Abrasion resistance of pipeline coatings	Porosity test prior to abrasion testing. Test voltage is calculated as $V = 1250 \cdot \sqrt{\text{Thickness (mil)}}$	VC, M
ASTM G62-B	1987	Holiday detection in pipeline coatings	Method B. Thickness <1.016mm $= 3294 \cdot \sqrt{\text{Thickness (mm)}}$ Thickness >1.041mm $= 7843 \cdot \sqrt{\text{Thickness (mm)}}$	VC, M
BS 1344-11	1998	Methods of testing vitreous enamel finishes Part II: High voltage test for articles used under highly corrosive conditions	Same as ISO 2746 (Test voltage above 2 kV for enamel thicker than 220µm)	M
EN 14430	2004	Vitreous and porcelain enamels - High Voltage Test	DC or pulsed test voltage. V = 1.1 kV to 8.0 kV for thicknesses of 100µm to 2000µm	VC, M
ISO 2746	2014	Vitreous and porcelain enamels - Enamelled articles for service under highly corrosive conditions - High voltage test	Test voltage above 2 kV for enamel thicker than 220µm	M
ISO 29601	2011	Corrosion protection by protective paint systems - Assessment of porosity in a dry film	Low and high voltage equipment and test	M
JIS G-3491	1993	Asphalt coatings on water line pipes	Inside walls: 8-10 kV Dipped Coatings: 6-7 kV Outside walls: 10-12 kV	M

† Elcometer 266 Voltage Setting: VC = Voltage Calculator; M = Manual

APPENDIX A: STANDARDS (continued)

Standard or Method Number	Date	Title	Notes	Voltage Setting†
JIS G-3492	1993	Coal-tar enamel coatings on water line pipes	Inside walls: 8-10 kV Dipped coatings: 6-7 kV Outside walls: 10-12 kV Welded areas as inside walls	M
NACE SP0188	2006	Discontinuity (Holiday) Testing of new Protective Coatings on Conductive Substrates	Low and high voltage equipment and tests.	VC, M
NACE RP0274	1974	High Voltage Electrical Inspection of Pipeline Coatings prior to installation	DC or Pulsed test voltage $V = 1250 \cdot \sqrt{\text{Thickness (mil)}}$	VC, M
NACE SP0490	2007	Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings of 10-30mils (0.25 - 0.76mm)	DC in dry conditions $V = 525 \cdot \sqrt{\text{Thickness (mil)}}$ Trailing ground lead of 9m allowed if pipe is connected to 2-3ft earth spike and soil is not dry	VC, M

Note: The above list and comments have been extracted from the documents identified and every effort has been made to ensure that the content is correct. No responsibility can be accepted, however, for the accuracy of the information as these documents are updated, corrected and amended regularly. A copy of the relevant standard or method must be obtained from the source to ensure that it is the current document.

† Elcometer 266 Voltage Setting: VC = Voltage Calculator; M = Manual

APPENDIX B: CALCULATING THE CORRECT TEST VOLTAGE

The Elcometer 266 includes a built-in voltage calculator which will determine and set the correct test voltage based upon the test standard and the thickness of coating you are testing, see Section 9.1 ‘Automatically Setting the Voltage’ on page en-17.

Alternatively, the voltage can be set by the user, see Section 9.2 ‘Manually Setting the Voltage’ on page en-18, using the following guidelines which describe how a safe, but effective, test voltage may be determined.

OVERVIEW

For effective testing, the test voltage must lie between two limits - the upper and lower limits.

- The upper voltage limit is that at which the coating itself would breakdown and be damaged. Therefore, the test voltage should be lower than this value.
- The lower limit is the voltage required to break down the thickness of air equivalent to the coating thickness. If the output voltage is not greater than this value, then a flaw will not be detected.

These two limits can be determined and a voltage approximately half way between them selected as the test voltage.

DIELECTRIC STRENGTH

Whatever the material, if a high enough voltage is applied, it will conduct electricity. However, for insulators, such as paint, the level of voltage required to achieve a current flow usually results in irreversible material damage.

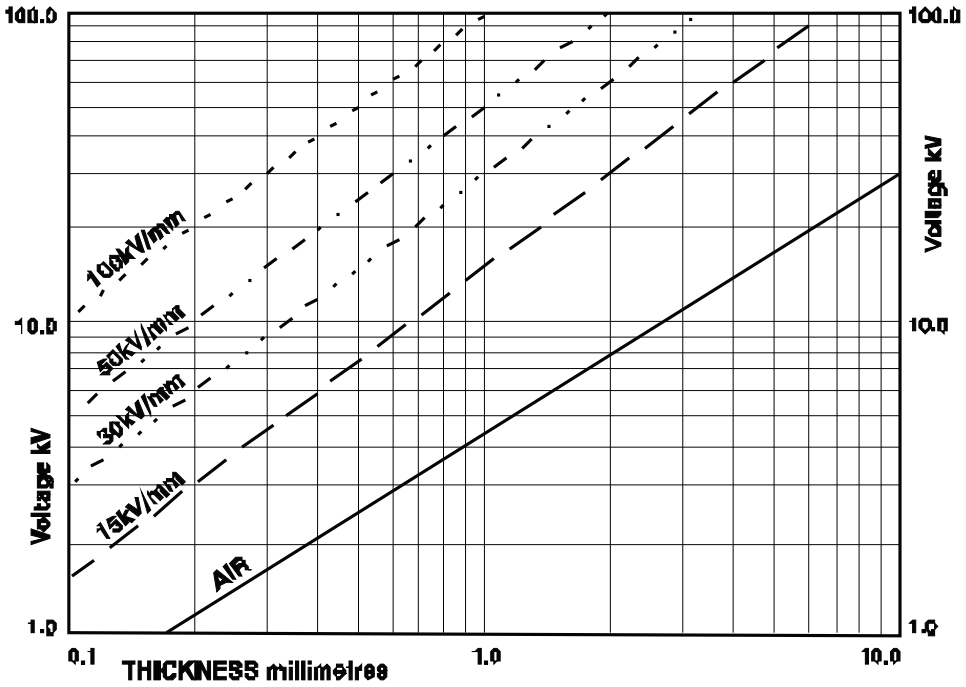
The voltage at which a particular thickness of material breaks down is termed the dielectric strength. This is usually expressed as the voltage per unit distance, e.g. kV/mm.

Its value depends on the type of applied voltage (AC, DC or pulsed), temperature and thickness. The graph on page en-39 shows the relationship between breakdown voltage (DC) and thickness for materials of different dielectric strengths.

APPENDIX B: CALCULATING THE CORRECT TEST VOLTAGE (cont)

The upper voltage limit is the dielectric strength of the material multiplied by its thickness and the lower voltage limit is the dielectric strength of air multiplied by the thickness.

The dielectric strength of coating materials usually lies in the region of 10 kV/mm to 30 kV/mm. The dielectric strength of air ranges from 1.3 kV/mm to 4 kV/mm.



Breakdown voltage against thickness for materials of different dielectric strengths: This graph is useful if you do not have a standard to work to and wish to know more about how to establish a test voltage.

ESTABLISHING THE VOLTAGE LIMITS

The Lower Limit: The lower limit for effective operation is that required to breakdown the thickness of air equivalent to the coating thickness. The breakdown voltage of a given thickness of air varies with humidity, pressure and temperature but is approximately 4 kV/mm (0.1 kV/mil).

If the coating thickness is known, or can be measured, the lower limit value can be read from the graph given above, using the line marked AIR. For instance, if the coating thickness is 1.0mm then the lower limit is approximately 4.5 kV.

APPENDIX B: CALCULATING THE CORRECT TEST VOLTAGE (cont)

If the coating thickness is not known then the minimum value has to be established experimentally. Reduce the voltage setting to minimum and position the probe over an unprotected area of substrate at the normal height of the coating surface. Increase the voltage slowly and steadily until a spark is produced. Make a note of this voltage - it is the lower voltage limit.

The Upper Limit: The upper voltage limit may be determined by:

- *The job specification* - if available and a test voltage is stated.

- *The dielectric strength* - if specified for the applied coating. Measure the thickness of the layer and refer to the graph on page en-39. Alternatively, calculate the maximum voltage, allowing for variations in the coating thickness. Note that 1 kV per mm is equivalent to 25.4 V per mil (thou).

  Note: This method is only suitable if the dielectric strength values were determined for a DC voltage.

- *Experiment* - Touch the probe on an unimportant area of the work piece. Increase the voltage slowly and steadily until a spark passes through the coating. Make a note of this voltage - it is the upper voltage limit. (The dielectric strength can be calculated by dividing this voltage by the coating thickness).

- *Tables and formulae* - from established Codes of Practice, e.g. NACE and ASTM. Examples of tables are given below (see Table 1, Table 2 and Table 3). See also Section 9.1 ‘Automatically Setting the Voltage’ on page en-17 and Appendix A ‘Standards’ on page en-35.

  Once the lower and upper voltage limits have been established, set the voltage approximately halfway between the two values.

APPENDIX B: CALCULATING THE CORRECT TEST VOLTAGE (cont)

TABLE 1: kV values from ASTM G62-87 (up to 1 mm)			
Microns	**Kilovolts (kV)**	**Thou/Mils**	**Kilovolts (kV)**
100	1.04	5	1.17
200	1.47	10	1.66
300	1.80	15	2.03
400	2.08	20	2.34
500	2.33	25	2.63
600	2.55	30	2.88
700	2.76	35	3.11
800	2.95	40	3.32
900	3.12	-	-
1000	3.29	-	-

TABLE 2: kV values from ASTM G62-87 (above 1 mm)			
mm	**Kilovolts (kV)**	**Thou/Mils**	**Kilovolts (kV)**
1	7.84	40	7.91
2	11.09	80	11.18
3	13.58	120	13.69
4	15.69	160	15.81
5	17.54	200	17.68
6	19.21	240	19.36
7	20.75	280	20.92

TABLE 3: kV values from NACE RP0188-99		
mm	**Thou/Mils**	**Kilovolts (kV)**
0.20 to 0.28	8 – 11	1.5
0.30 to 0.38	12 – 15	2.0
0.40 to 0.50	16 – 20	2.5
0.53 to 1.00	21 – 40	3.0
1.01 to 1.39	41 – 55	4.0
1.42 to 2.00	56 – 80	6.0
2.06 to 3.18	81 – 125	10.0
3.20 to 3.43	126 – 135	15.0

用户手册

Elcometer 266

直流电火花检漏仪

目录

避免疑议, 请参考英文版本.

包装尺寸:520 x 370 x 125mm (20.5 x 14.5 x 5”)

重量： 基本装置(含电池): 1.2kg (2.7lb); 手柄: 0.6kg (1.3lb)
基本装置,手柄 &连接线: 2kg (4.4lb)

易高266电池材料安全数据表可通过我们的网站下载：

http://www.elcometer.com/images/stories/MSDS/elcometer_266_280_battery_pack.pdf

1 工作安全

该设备应格外小心使用. 按照本用户手册中的指示. 注意 - 触电的风险.

高电压手柄在探头尖端产生高达30000 V的的电压. 如果用户与探头接触, 有可能会遇到一个温和电击. 由于电流是非常低的, 通常这不是很危险的,但易高不建议使用这种产品,如果您安装了心脏起搏器.

电火花表示检测到涂层裂隙缝;不要在危险的情况和环境使用本仪器, 例如爆炸性的气氛.

由于其操作的方法,当火花在探头产生,易高266将生成宽波段RF排放,当找到在涂层中的缺陷. 这些排放可能干扰附近敏感电子装置的操作.在长度为5mm连续火花的极端情况下,在3米的距离排放的幅度被发现是大约60dBµV/m从30MHz至1000MHz.因此建议该设备不在已知的敏感电子设备30m以内操作, 并且用户不故意产生连续火花.

为了避免伤害和破坏, 下面请务必遵守 :

× 不要 在危险的情况和环境使用本仪器,例如任何可燃,易燃或其他气氛中有电弧或火花可能会导致爆炸的.

× 不要 靠近移动的机械展开测试.

× 不要 在处于不稳定或升高的情况,可能导致坠落,使用仪器.除非使用合适的安全吊带.

× 不要 使用本产品如果您安装了心脏起搏器.

× 不要 在下雨, 在潮湿的环境或仪器是湿时使用这产品.

1 工作安全（续前节）

- ✓ 要 在使用设备之前,阅读和了解这些使用说明.
- ✓ 要 在第一次使用该设备之前充电电池.这将需要大约4个小时,见第zh-7页5.1节'电池充电'.
- ✓ 要 进行试验过程之前咨询工厂或安全人员.
- ✓ 要 开展测试工作,其他人员离开.
- ✓ 要 与助理合作, 以保持试验区肃清和帮助测试程序.
- ✓ 要 检查是否有没有溶剂或其它易燃材料从涂层活动留在试验区,特别是在狭窄区域如槽中.
- ✓ 要 当工作已经完成时和在无人值守起身离开之前,关闭仪器并断开导线.
- ✓ 要 确保接地信号返回线连接并在你打开仪器前延长.
- ✓ 要 只用在固化的涂料,厚度已测试和目视检查并接受.
- ✓ 要 只使用在具有至少200µm(0.008“)的干膜厚度的涂层.对于200µm至500µm的厚度(0.008”至0.020“),确保一个适当的低电压被施加(以防止涂层损坏), 或使用湿海绵方法(使用易高270).
- ✓ 要 粘接工件接地, 势要尽量减少静电的积聚潜力,见第zh-21页第11节“静电”.
- ✓ 要 当使用本产品与潮湿或湿润的涂料时要小心.
- ✓ 要 如果受潮湿擦干设备,要特别注意棱纹区.

2 仪器概览

易高266检测在防护涂层的缺陷至最多7mm(25mils)的厚度,非常适用于检验在管道的涂层和其他保护涂层.

被测涂层可以是不导电的或部分导电(如含有金属或碳颗粒涂层).该涂层必须至少为200µm(0.008“)厚,最好超过500µm(0.020”)厚.

底层基板必须是导电材料, 例如金属或混凝土(混凝土是合理导电的因为其含水量).

典型缺陷是针孔(非常窄的孔从涂层表面延伸到基板),漏孔(未涂覆小区域),内含物(截留在涂层的物体,例如来自喷砂清理的砂),气泡,裂纹和薄斑.

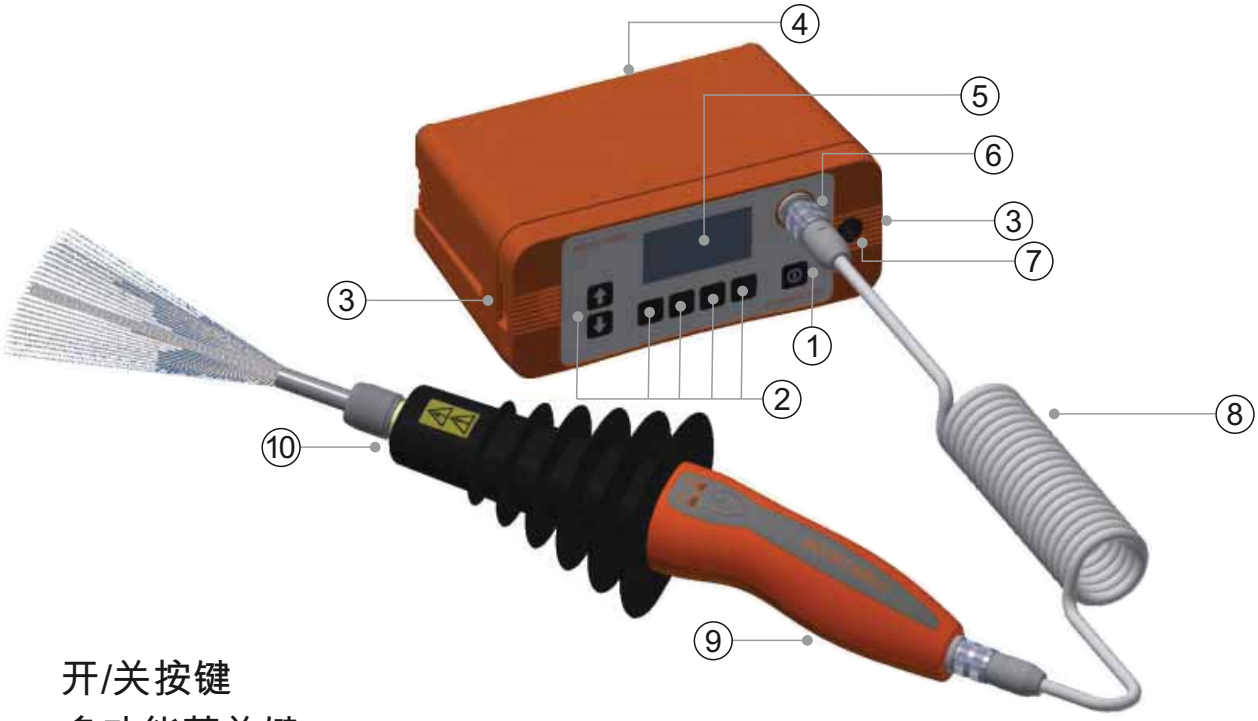
易高266探头手柄产生被通过探头施加到涂层的表面上的高直流电压.接地信号反馈线连接在仪器和基板之间. 当探头越过涂层裂缝, 电路完成, 电流从探头流动到基板.其结果是该仪器给出声音和可视警报和火花可以在缺陷产生。

使用内置的电压计算器,用户可以执行测试到若干国际测试标准中的任何一个.

易高266拥有一个易于使用的菜单驱动的图形界面, 在仪器的安装过程和测量过程中引导用户.

该仪器将在三种电压范围之一进行操作; 0.5kV至5kV,0.5kV至15kV和0.5kV至30k. 电压范围是由高压探头手柄型号安装在仪器来确定-不是仪器本身.

2 仪器概览（续前节）



1 开/关按键
2 多功能菜单键
3 肩带连接
4 可充电锂离子电池包
5 液晶显示屏
6 高电压探头手柄连接
7 接地信号反馈线连接
8 高电压探头手柄连接线
9 高电压探头手柄
10 探头附件连接

3 包装清单

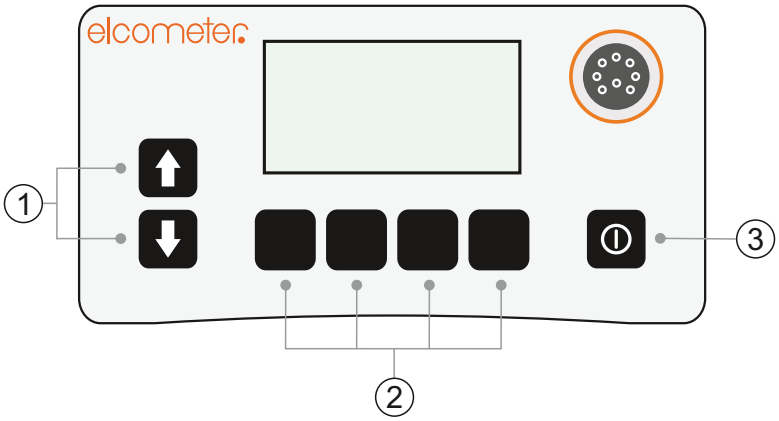
- Elcometer 266直流电火花检漏仪
- 接地信号反馈线,10m (32 ft)
- 高电压探头手柄的连接线[a]
- 带状刷
- 可充电锂离子电池包
- 电池充电器(英国, 欧洲, 美国和澳大利亚插头包括在内)
- 肩带
- 手提箱
- 校准证书(如果订购）
- 用户手册

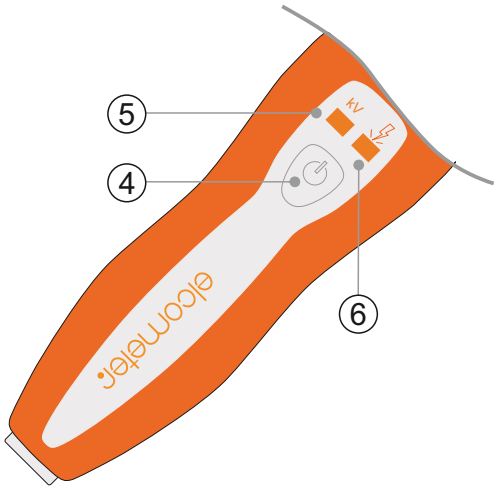
[a] 高压探头手柄必须单独订购 - 见第zh-11页第6节'高压探头手柄'

4 仪器使用

4.1 控件

易高266是使用仪器上的按键和高电压探头手柄按钮进行操作.





1 通过功能表和列表值向上/向下滚动
增加/减少 值

2 这些按键的功能各不相同并且显示在屏幕上

3 仪器开/关按键

4 按键以切换高压探头手柄开/关

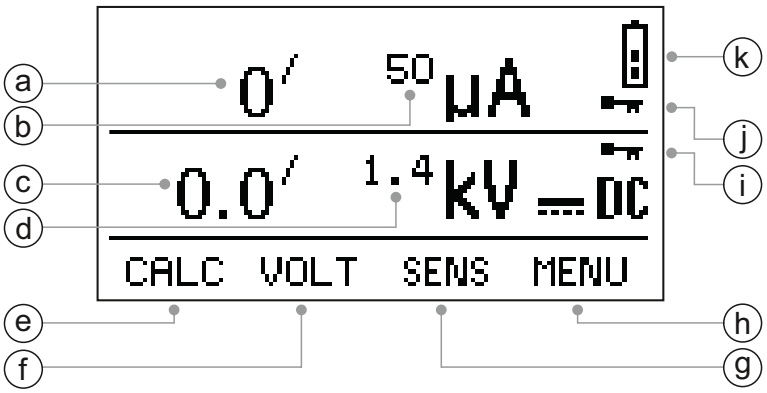
5 红灯：探头电压是开启的

6 蓝灯：检测到裂缝

4.2 显示屏

主屏幕显示(进行测量时)是读数窗口.

a 电流: 测量值
b 电流: 设定值
c 电压：测量值
d 电压：设定值
e 电压计算器
f 调整电压
g 调整灵敏度
h 查看功能表
i 电压锁定 (请参阅第zh-11页)
j 灵敏度锁定 (请参阅第zh-11页)
k 电池寿命指示器



5 启动

5.1 给电池充电

易高266是由一个可充电的锂离子电池[b] 供电,可在仪器里面还是外面进行充电.

每个仪器在出厂时电池没有充电.在第一次利用之前充分对电池充电.

注意: 只有一个电池与每个仪器提供. 为了提高现场工作效率, 我们建议购买备用电池, 仪器在使用时,同时可以充电,见zh-28页16.3节“电池, 充电器与接地信号反馈线”.

在你开始之前:

- 只可使用易高266提供的充电器给电池充电. 任何其他类型的充电器的使用是一个潜在的危险 , 可能会损坏仪器, 并会导致保修失效.不要尝试任何其他电池与随附的充电器充电.
- 始终在室内将电池充电.
- 为了防止过热, 确保充电器没有被盖住.
- 该仪器打开或关闭时可被充电.如果开启时被充电,高压电源的探头会自动断开连接和电池充电图标将显示在显示屏上. 如果关闭时充电, 显示屏会保持空白.

警告: 不要尝试为电池充电器的侧面电源连接到发电机或者任何其他媒介到高档电源,除了批准和安全主配电板供电的单相50Hz A.C.交流电源插座. 连接到其它电源,例如发电机或逆变器可以损坏充电器的可能性, 电池和/或仪器保修失效.

仪器内部充电电池:

1 拧下固定螺钉(a)并打开在仪器背面的入口盖

2 将充电器连接到入口盖后面标有“Charger Input”的插槽。

[b] 易高266没有设计使用干电池进行操作.

5 启动（续前节）

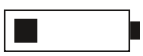
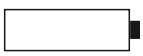
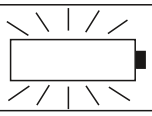
3 插入附带的充电器到主电源.充电器上的LED指示灯会亮起橙色.
4 让仪器充电至少4个小时. 充电完成后,LED指示灯从橙色改变为绿色.
5 充电完成后, 从仪器上取下线之前,从主电源除去充电器.

仪器之外充电电池:

1 在仪器背面拧下两个电池组固定螺丝滑出电池.
2 将充电器连接到电池包的插座.
3 插入附带的充电器到主电源.充电器上的LED指示灯会亮起橙色.
4 让电池包充电至少4个小时. 充电完成后,LED指示灯从橙色改变为绿色.
5 充电完成后, 从电池包上取下线之前,从主电源除去充电器.

虽然电池包从仪器上取下,不要让金属物体接触到电池端子;这可能会导致短路并导致对电池的永久损坏.

电池状况由显示器上的符号表示：

符号	电池充电/需要采取行动
	70% 到 100%
	40% 到 70%
	20% 到 40%
	10% 到 20% - 推荐充电
	<10%时,每10秒仪器发出蜂鸣和符号闪烁 - 需要立即充电
	5响亮的蜂鸣声,仪器会自动关闭

5 启动 (续前节)

5.2 开/关仪器

要打开: 按开/关按钮 ‘⏻’.

注意: 要延长(充电之间的时间)电池的使用寿命,仪器可以设置为闲置1至15分钟之间的用户定义时间后自动关闭. 默认设置为15分钟.

5.3 选择语言

1 按功能表键显示主菜单.
- ▸ 当仪器从易高工厂发运后开启的第一次,语言选择将显示.继续执行步骤2.

2 使用↑↓键选择语言.
3 按选择激活所选语言.

当选用外语时，进入语言菜单:

1 关闭仪器.
2 按住左手键及开启仪器.显示屏将显示语言选择屏幕与光标突出显示当前的语言.
3 使用↑↓键选择语言.
4 按选择激活所选语言.

5.4 配置仪器

1 按功能表键显示主菜单.
2 使用↑↓键上下滚动功能表项目.
3 按选择激活所选的选项或进入子菜单,见图表1.
4 按返回或退出键退出主功能表或子功能表.

图表1

选项	需要采取行动
背光灯	按选择打开或关闭显示屏背光.
蜂鸣声量	按选择其次是↑或↓设定声量; 1 (最小)至5 (最大). 完成后按对.
单位	按选择接着是↑或↓选择单位; µm, mm, mil, thou 或 inch. 完成后按对.
语言	按选择接着是↑或↓选择显示的语言. 完成后按对.

5 启动（续前节）

图表1	
选项	需要采取行动.
关于	按选择查看关于菜单.
重新设定	按选择查看重新设定菜单
自动关闭	按选择接着+或 - 设定自动关闭延迟; 1至15分钟或关闭(X).完成后按对.
打开屏幕	按选择打开或关闭打开屏幕.
电压锁定	按选择打开或关闭电压锁定,见zh-11页上第5.6节的“电压和灵敏度锁定”.
灵敏度已锁定	按选择打开或关闭灵敏度(电流)已锁定,见zh-11页上第5.6节的“电压和灵敏度锁定”.

5.5 点击声, 哔音,警报及灯光

在同时使用中,易高266发射范围内的声音和灯,见下面图表2.

图表2		
声音	灯光	表示
单哔声 - 高音调	红灯亮起,高压探头手柄发光	开启高压探头手柄
双哔声 - 高音调	红灯亮起,高压探头手柄闪烁开/关	在高压探头手柄的安全联锁没有被的你手握住
点击声 - 连续系列	红灯亮起,高压探头手柄发光	高电压存在于探头
嗡嗡的警报	蓝色灯亮起,高压探头手柄闪烁开/关	检测到缺陷

5 启动（续前节）

5.6 电压和灵敏度锁定

在易高266的电压和灵敏度设置包括“锁定”功能,这有助于防止对这些值的意外改变,一旦他们已经确定.

- 电压锁定可以从功能表开启或关闭进,参见页zh-9第5.4节'配置仪器'. 电压锁定也自动开启,一旦使用计算器设置电压.
- 灵敏度锁定可以从功能表开启或关闭进,参见页zh-9第5.4节'配置仪器'.

如果一个电压或灵敏度锁定开启时,在设定值的期间通过按下开锁键它可以被重改.一旦值已设置了,锁定将自动重新.

6 高压探头手柄

一系列易高266可更换高压探头手柄可供.在手柄下侧的标签指示所述手柄(5 kV, 15 kV或30 kV)的最大工作电压.

选择要使用的高电压探头手柄取决于所需要的最大测试电压,而这又取决于被测试涂层的厚度和任何测试标准可被遵循的建议.

易高266不与探头手柄提供的,这些都必须单独订购.

描述	电压	部件编号
易高266探头手柄, DC5	0.5 - 5 kV	T26620033-1
易高266探头手柄, DC15	0.5 - 15 kV	T26620033-2
易高266探头手柄, DC30	0.5 - 30 kV	T26620033-3
易高266探头手柄, DC30S (连续电压)	0.5 - 30 kV	T26620033-4

注: DC30S连续电压探头手柄是跟易高266仪器序列号”SC16119“开始起兼容.在较老仪器的软件必须由易高或当地易高经销商被更新以识别新的DC30S手柄.

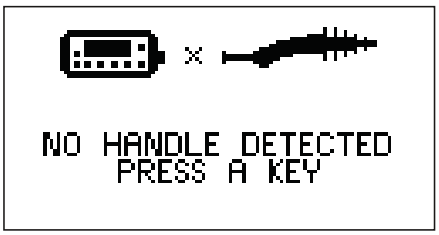
6 高压探头手柄（续前节）

6.1 连接高压探头手柄

当安装或移除高压探头手柄,该仪器必须关闭.

使用附带的连接线(灰色卷曲线)连接高压探头手柄到仪器.连接电线在每一端有装配一个金属螺旋式连接器.为了装配连接器,对准键槽,将连接器插入到位,然后拧紧金属项圈.

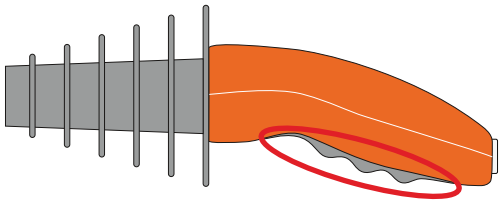
如果无高压手柄安装,仪器开机时会显示一条警告消息.



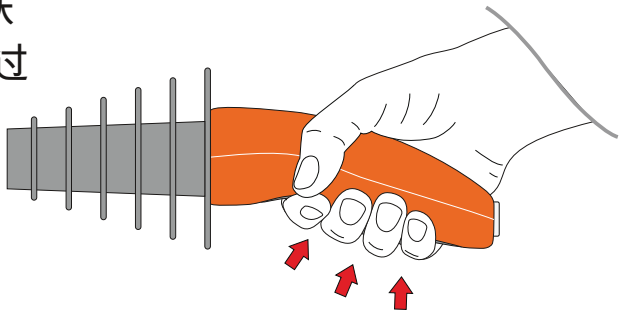
6.2 高压探头手柄安全联锁

所有高压探头手柄(除了DC30S连续电压探头手柄,见zh-13页6.3节)都配有安全联锁装置.

安全联锁装在高电压探头手柄下侧的黑橡胶把手内.



当手柄的这一部分是由手握如图所示,联锁开关被释放,电压到探头可以接通(通过按手柄上的按钮).



如果探头是在高电压时,握把被释放：

- 在探头上的电压将立即下降到零
- 该仪器会发出高音调哔声，
- 手柄上的红灯会闪烁

6 高压探头手柄（续前节）

如果握把大约在两秒钟内再次把持,在探头上的电压将立即恢复.此功能允许用户根据需要,无中断调整自己的握把.

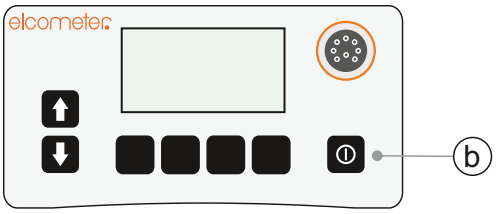
如果握把不是在两秒钟间隔内掌握,高压探头手柄会自动关闭.要继续进行测试,再握手柄并按下手柄上的按钮.

6.3 DC30S 连续电压探头手柄

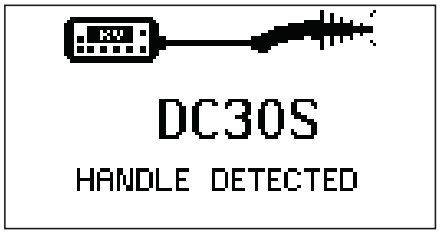
DC30S探头手柄不具有安全联锁功能.

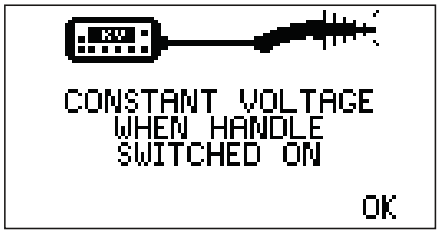
要关闭电压输出,在手柄顶部按下开/关键(a).或者使用开/关键(b)关闭易高266仪器.

连接手柄到仪器, 按照zh-12页6.1节“连接高压探头手柄”的说明.



当一个DC30S探头手柄连接到仪器上,在每次仪器开机时显示警告信息.按对键确认并继续正常运行.





注: DC30S连续电压探头手柄是跟易高266仪器序列号”SC16119“开始起兼容.在较老仪器的软件必须由易高或当地易高经销商被更新以识别新的DC30S手柄.

7 准备测试

使用设备前请参阅zh-2页第1节“工作安全”的信息. 如有疑问,请联系易高或当地易高供应商.

7.1 将电线连接

1 连接高压探头手柄到使用灰色卷曲线的仪器(图1).

2 连接夹紧接地信号反馈线到基底的暴露部分.将电缆的另一端插入仪器(图2).

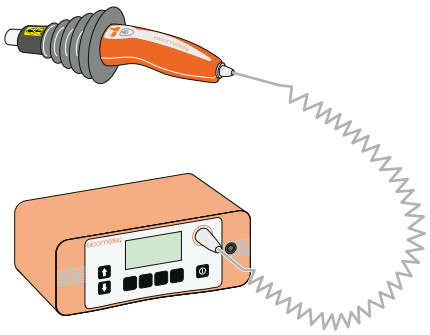


图1

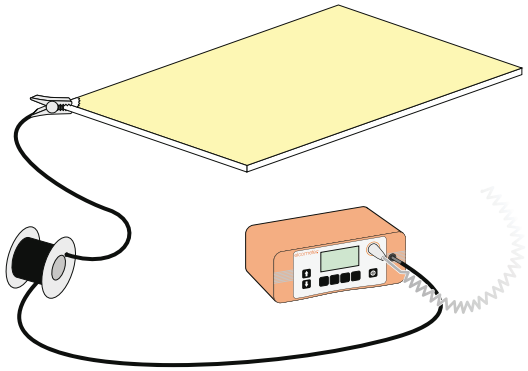


图2

7.2 装置探头附件

选择最适合的探头附件给正在开展的工作, 参阅第zh-22页12节'探头附件选择“,并将其连接到高压探头手柄(图3).

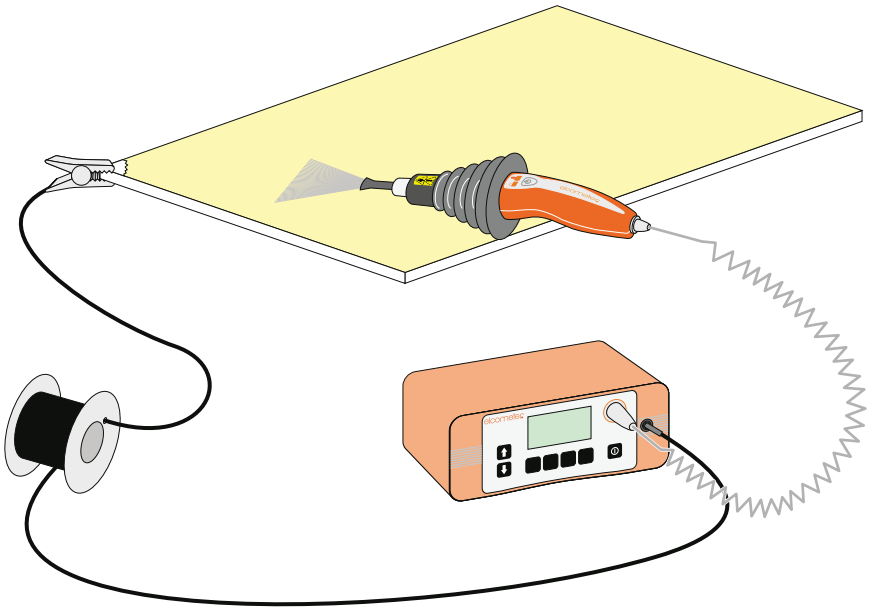


图3

7.3 检查电线连接

1 按开/关按钮,打开仪器.

2 降低电压设定到最低值,见第zh-17页第9节“设置探头手柄电压”.

3 降低电流设定为最低值, 见第zh-19页第10节“设置灵敏度”.

4 在空气中牢牢抓住高压探头手柄及探头,并按下手柄上的按钮开启.

5 用探头触摸光秃基板并检查仪器获得一个裂缝信号.

(a) 如果仪器获得裂缝信号,仪器是运行正常的,并准备用于测试.

(b) 如果仪器没有信号裂缝, 检查所有连接,然后再试一次.
如果仍无法获得仪器的裂缝信号,请联系易高或当地易高供应商咨询.

6 完成后,请按探头手柄按钮关掉.

7.4 设置探头手柄电压

见zh-17页第9节“设置探头手柄电压”.

7.5 设置灵敏度

见zh-19页第10节“设置灵敏度”.

7.6 检查其是否操作

1 要么找到或作出裂缝在涂层中.

2 使用在第zh-16页第8节“测试程序”列出的步骤, 测试该裂缝可以被检测.

3 如果没有检测到的裂缝,确认所有前面的步骤已经正确地进行再检查.

4 如果仍未检测到裂缝,请联系易高或当地易高供应商咨询意见.

8 测试程序

8.1 测试在一个位置

1 紧紧拿着高压探头手柄, 确保您的手指捏在手柄底部的黑色橡胶握把,像(图4).

2 探头在空气中,按和释放手柄上的按钮来启动高电压.手柄上的红灯会亮起,仪器将发出一个普通点击声,说明该探测器是在高电压.

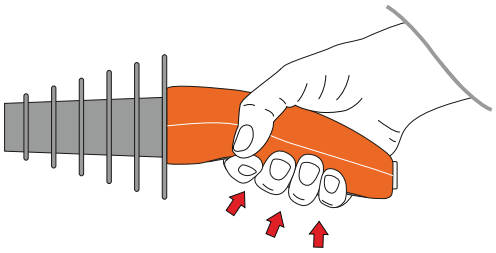


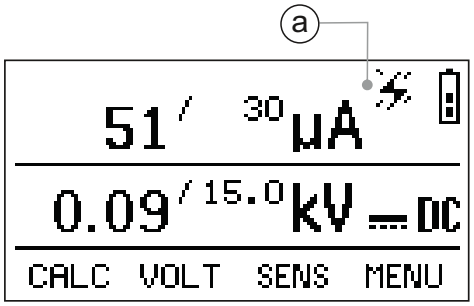
图4

3 将探头放在测试表面上.

4 保持探头与表面接触[c] ,以大约每四秒一米,0.25米/秒(10“/秒)的速度移动到工作区.

在该涂层的任何裂缝将被一个或多个以下指示：

(a) 火花在探头与表面之间看到
(b) 在高压手柄的蓝灯闪烁
(c) 警报声响起
(d) 警报图标显示在屏幕上(a)
(e) 显示屏背光闪烁



8.2 移动到新的测试位置

如果需要在一个以上的位置测试：

1 拔下电线之前,请务必关闭仪器.

2 在新的测试位置重新连接电线后和重新开始测试之前, 重复第zh-15页第7.3,7.4和7.5节给出的步骤.

[c] 探头必须始终触及表面.探头和涂层之间的间隙会导致不能被检测到真正的缺陷.

8 测试程序 (续前节)

8.3 测试结束后

当您完成测试和无人看管时,务必关闭仪器,并拔下电缆.

9 设置探头手柄电压

探头手柄电压可自动或手动设置.

9.1 自动设置电压

易高266包括一个内置的电压计算器,这将确定和设置基于所述测试标准和您正在测试的涂层厚度正确的测试电压.

使用电压计算器是一个两阶段的过程;

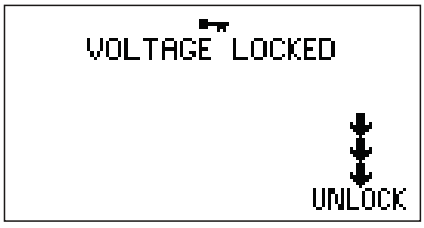
- 首先选择你的测试标准;
- 然后选择您的涂层厚度.

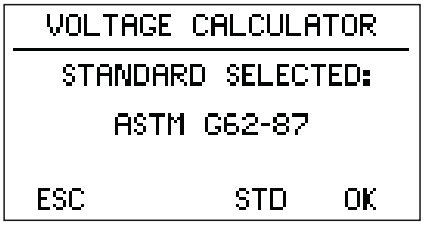
选择测试标准 :

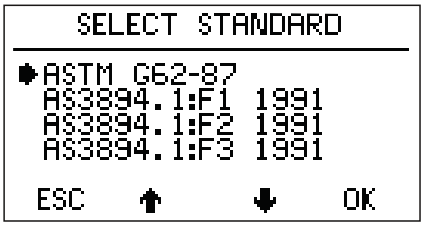
1 在显示阅读屏幕,按计算器键.'电压计算器“屏幕将显示.当前的测试标准选择将显示.
   - 如果电压已被锁定,请参阅第zh-11页第5.6节“电压和灵敏度锁定',一个警告将显示在屏幕上;按开锁以允许所要的电压调整 - 电压已经由计算器设置后,锁将自动重新介入.

2 按标准显示测试标准清单,见zh-35页附录A“标准”.

3 使用↑↓键,移动箭头到所需的测试标准,然后按对.选择的测试标准将被显示.



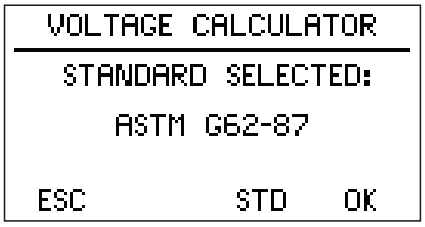




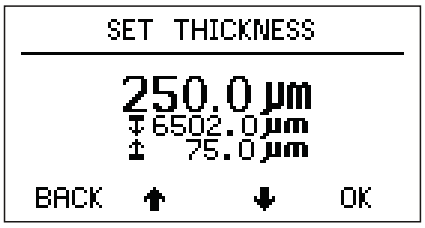
9 设置探头手柄电压（续前节）

选择涂层厚度：

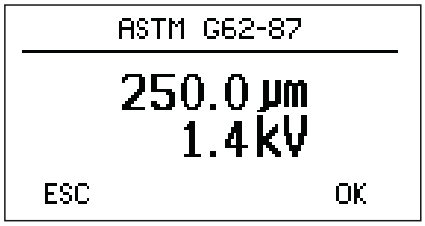
1 随着电压计算器显示选定的测试标准,按对.“设定厚度”屏幕将显示选择的测试标准的最后一次使用的涂层厚度和上部和下部的厚度值.



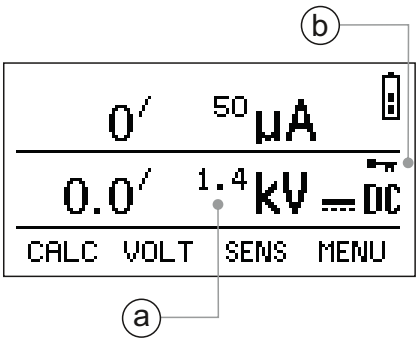
2 使用↑↓键,调整涂层厚度为所需的值,然后按对.确认屏幕显示所选择的测试标准,涂层厚度和所计算的测试电压.



3 按对设置仪器电压到计算出的值,否则返回到阅读屏幕而不进行任何更改,请按退出键.



计算的电压值将被显示在阅读屏幕(a)与一个键图标会出现以指示该电压已被锁定(b).

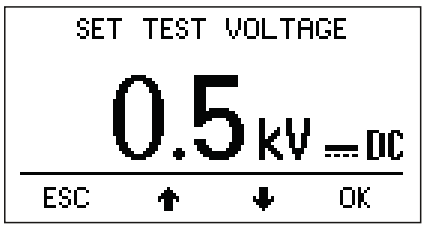


9.2 手动设置电压

在开始之前,请在zh-38页阅读附录B“计算正确的测试电压”的说明.

1 在显示阅读屏幕,按电压键.“设定测试电压”屏幕将显示.

- 如果电压已被锁定,请参阅第zh-11页第5.6节“电压和灵敏度锁定",将一个警告显示在屏幕上;按开锁以允许所要的电压调整 - 电压已经由计算器设置后,锁将自动重新介入.

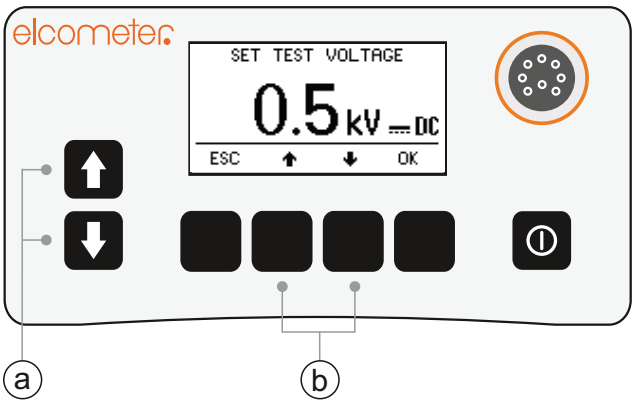


9 设置探头手柄电压（续前节）

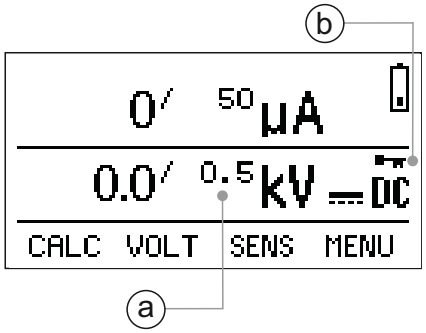
2 使用↑↓键，调整电压到所需的值. 在屏幕上左侧的键(a)在1kV的增量调整;屏幕(b)所示的按键在0.1kV的增量调整

- 按住任何这些键快速前进.

3 完成后按对.



探头新的电压设置显示在屏幕上.如果电压锁定处于活动状态时,见zh-11页第5.6节“电压和灵敏度锁定”,一个键图标表示电压被锁定.



10 设置灵敏度

灵敏度可自动或手动设置.

10.1 自动设置灵敏度

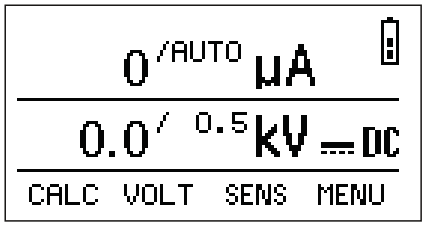
当易高266设置为自动灵敏度模式下,仪器通过接地信号反馈线测量返回的电流.

如果检测到电流的显著变化,仪器分析这些变化 - 寻找涂层裂缝的电子“标志”.

当检测到这样的'标志',该仪器将信号裂缝的存在.

当导电涂层被测试,自动模式是有益的.

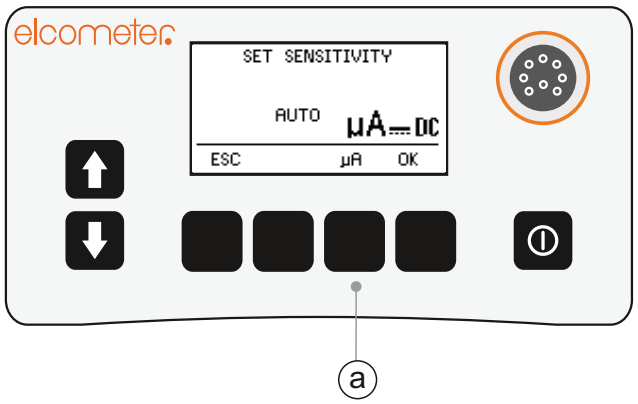
如果屏幕上显示电流的设定值为“自动µA”,该仪器已设置为自动灵敏度模式,你不需要做什么.



10 设置灵敏度（续前节）

如果“自动”不显示：

1 按灵敏度键.“设定灵敏度”屏幕将显示.
2 按自动(a)切换到自动灵敏度模式.
3 按对键返回到阅读屏幕.
4 检查“自动”显示为电流的设定值.



10.2 手动设置灵敏度

灵敏度的手动设置可能在某些情况下需要,并遵守一些测试标准.设置手动仪器的灵敏度,设定的电流值必须进行调整.

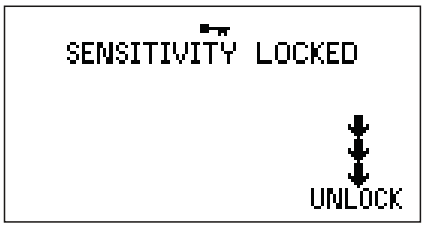
设定电流值是以1µA增量在5µA和99µA之间可调.

- 当值朝向其最大(99 µA)的增加,该仪器变得不太敏感.
- 当值朝向其最小(5µA)降低,仪器变得更加敏感.

通常情况下,在高电压检测部分导电涂层时手动调整可能是必需的.

探头放置到已知不包含任何缺陷的涂层部分.测得的“背景”的电流流动是明显的,并设定的电流值再调节到一个值,几µA电流以上.由于背景电流流过错误警报,因此避免了在此实例.

1 在显示屏幕上,按灵敏度键.在“设定灵敏度”屏幕将显示.
   - 如果灵敏度已被锁定,请参阅第zh-11页第5.6节“电压和灵敏度锁定",一个警告将显示在屏幕上;按开锁以允许所要的灵敏度调整 - 电流设置后,锁将自动重新介入.

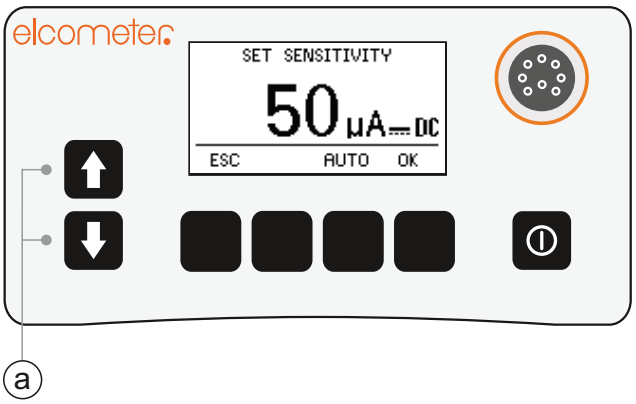


10 设置灵敏度（续前节）

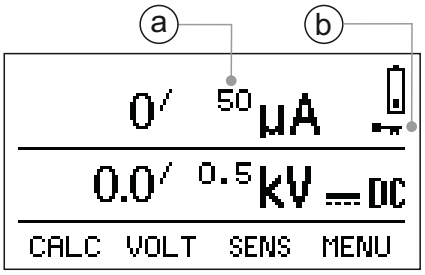
2 如果灵敏度设置为“自动μA”,按下“μA”.将显示最近使用的设定电流值.

3 使用↑↓键,调节设定电流到所需的值;每按一次由1μA改变显示.
- 按住其中一个键快速前进.

4 完成后按对.



新的设定电流显示在屏幕上.如果灵敏度锁定处于活动状态时,见zh-11页第5.6节“电压和灵敏度锁定”,一个键图标表示灵敏度被锁定.



11 静电

探头在涂层的表面上移动,一个静电积聚从而可以：

- 在物体与表面接触引起以相同的极性被充电.
- 诱导附近的物体相反的电荷,从表面电绝缘.

充电的表面(或相邻的物体)可通过关闭高压和与探头涂刷表面排出.

在操作者静电感应由耗散接触点上的高电压探头手柄(橡胶把手)来减少.简单地握住手柄确保了操作者总是处于相同的电位接地信号反馈线,因此测试基板.

建议在被测试的基板键合到地电位,从而防止充电的任何整体积聚,否则测试已经完成之后可以保持在一个孤立的试验片几分钟.

11 静电（续前节）

穿着橡胶手套和绝缘鞋类不是必需的,尽管在某些特殊的情况下可能有好处.

有关尽量减少静电的效果进一步指导，请联系易高或易高供应商.

12 探头附件选择

图表3根据被测试表面的特性,示出了最合适的探头附件,例如内部和外部的管表面,大的表面和复杂的形状.

此外,长距离应用可以使用延长件,适合于与所有的探头类型的使用.

所有这些探头附件可从易高或当地易高的供应商提供,请参阅第zh-27页16节'备件和附件'细节部分.

图表3

表面类型	推荐探头	注释
小面积,复杂表面,一般应用	带状刷探头	提供低接触压力
大的表面面积	线刷探头/橡胶探头	可提供不同的宽度.使用橡胶探头轻轻接触和线刷探头介质接触.
管的内侧40mm至300mm(1.5“至12”)直径	环线刷探头	包括250mm(9.8“)延长杆
管的外面,50mm至1000mm(2“到36”)直径	滚动弹簧探头	磷青铜和不锈钢弹簧可提供

13 铺助手柄

辅助手柄是一个可选附件,可提高该仪器的使用.

把手装配在高压探头手柄和探头附件之间,使高电压探头手柄由双手进行,而不是只有一个:

- 允许用户拿重探头附件或延长杆,更轻松和更长的时间.
- 高度绝缘 - 不影响安全使用仪器.
- 作为0.5m延长杆.

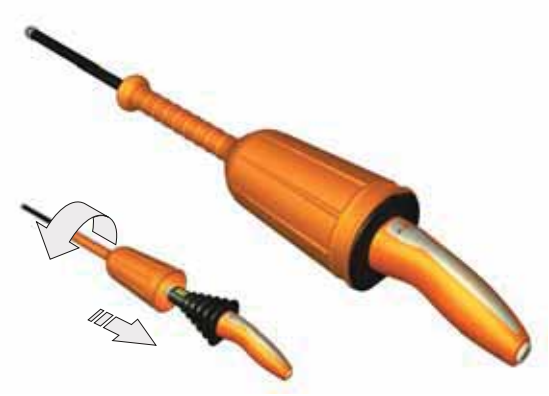
描述	部件编号
辅助手柄	T26620081

安装辅助手柄:

1 滑动把手到高压手柄的端部.

2 逆时针旋转直到拧紧到位.

然后使用标准偶联连接探头附件到辅助手柄的端部.



14 特殊注意事项

14.1 导电涂料

如果在探头施加到测试表面或警报声连续显示电压急剧下降,则该涂层可以是导电的.通常出现导电涂层在以下进行描述:

- 金属,碳或在其它涂料存在导电粒子 ：在正常使用中,在这种类型的涂层的颗粒不相连.然而当涂层经受高电压,材料之间的粒子可以分解.这导致涂层变得导电和检漏仪指示缺陷的存在.

14 特殊注意事项（续前节）

- 表面的水分或污染:某些水溶性盐从大气中吸引水分,这和其他形式的表面污染可对高电压形成在表面上的路径,不是因为涂层缺陷.在这些条件下检漏仪指示不存在缺陷.当这些情况发生时,表面应该使用合适的布或用不导电的清洁剂清洗或不会损坏涂层的溶剂擦拭干燥.

  注意：重新开始测试前,确保任何清洁剂或溶剂的容器从测试区被移除.

- 水分渗透或吸收:湿气可进入材料,例如玻璃强化塑料沿着强化玻璃纤维,如果表面被侵蚀或刮伤,然后浸入水中.在这种情况下,允许有足够的时间对涂层测试前干燥.

- 橡胶衬片：这些可以是稍微导电的,因为它们含碳量.其他导电涂层,降低灵敏度使得检漏仪指示一个已知的缺陷,但当探头被放置在健全涂层不发声.这也可能必要增加测试电压以补偿电流流过涂层.

- 涂层可能不完全固化：在这种情况下,涂层仍含有溶剂,允许为高电压的形成路径即使一个裂缝是不存在.为了克服这个问题,允许该涂层在进行试验前固化.

14.2 混凝土基材

如果混凝土或水泥基体含有足够的水分,然后将导电和检漏仪可以用于检测在其涂层裂缝.

该程序一般是zh-14页“准备测试”和zh-16页“测试程序”描述的相同,但以下几点应注意.锤击砖石钉,或类似的钉,进入混凝土或水泥使得接地信号反馈线接触.

14 特殊注意事项（续前节）

混凝土用于与检漏仪使用的适宜性可以使用下列检查：

1 锤击钉子或类似的进入混凝土使高压恢复接触.
2 装上接地信号反馈线到钉子,为涂层的厚度设置测试电压,或者在范围3kV - 6kV如果不知道测试电压,并设置最大的灵敏度(5μA电流).
3 将探头放置在无涂层混凝土从钉子4m左右(13ft).

如果警报声响,那么混凝土是有足够的导电性.如果混凝土过于干燥,即不发出警报声,那检漏仪将不是一个合适的检查方法.

14.3 延长接地信号反馈线

通过几条线连接在一起延长反馈线可能会使设备的EMC性能失效.

15 故障信息

在某些情况下,仪器会显示故障信息.这些信息通过按下其中之一的键,通常被清除.故障的原因将被信息注明,并在继续之前予以纠正,见图表4.

图表4

故障信息	原因	要采取的行动
火花到外壳	从接地信号反馈线途径以外,电流由探头返回到仪器.	检查所有的电线连接正确.如果仪器是与被测试的物体接触,将其移动到从物体分离的位置.确保您不会接触探头到高压手柄的末端电线的金属.
00	高压探头手柄设备错误.	拆下高压探头手柄和重置.如果故障仍然存在,请联系易高[d].

[d] 或者您当地易高供应商.

15 故障信息（续前节）

图表4		
故障信息	原因	要采取的行动
01, 02 和 03	高压探头手柄ADC故障.	拆下高压探头手柄和重置.如果故障仍然存在,请联系易高[d].
04, 05 和 06	高压探头手柄DAC故障.	拆下高压探头手柄和重置.如果故障仍然存在,请联系易高[d].
07 和 08	高压探头手柄EEPROM故障.	拆下高压探头手柄和重置.如果故障仍然存在,请联系易高[d].
09	高压探头手柄CRC故障.	拆下高压探头手柄和重置.如果故障仍然存在,请联系易高[d].
10	高压探头手柄连接线(卷曲电线)故障.	高压探头手柄返回到易高[d].
11	漏电流.	返回易高软件升级[d].
12	手柄不兼容.	拆下高压探头手柄和重置.如果故障仍然存在,请联系易高[d].
13	手柄数据无效.	拆下高压探头手柄和重置.如果故障仍然存在,请联系易高[d].
14	无法识别手柄.	拆下高压探头手柄和重置.如果故障仍然存在,请联系易高[d].
15, 16 和 17	手柄开关无法识别.	拆下高压探头手柄和重置.如果故障仍然存在,请联系易高[d].

[d] 或者您当地易高供应商.

16 备件和附件

16.1 高压探头手柄

根据所需的电压,提供一系列可互换高电压探头手柄.易高266不与探头手柄提供的,这些都必须单独订购.

有关连接和使用高压探头手柄的详细信息,请参阅第zh-11页第6节'高压探头手柄'.

描述	电压	部件编号*
易高266探头手柄, DC5	0.5 - 5 kV	T26620033-1
易高266探头手柄, DC15	0.5 - 15 kV	T26620033-2
易高266探头手柄, DC30	0.5 - 30 kV	T26620033-3
易高266探头手柄, DC30S (连续电压)	0.5 - 30 kV	T26620033-4

* 添加'C'到部件编号的末尾, 提供一个有完整校准证书的探头手柄.

注: DC30S连续电压探头手柄是跟易高266仪器序列号”SC16119“开始起兼容.在较老仪器的软件必须由易高或当地易高经销商被更新以识别新的DC30S手柄.

16.2 辅助手柄

适合于用两只手测试管道和水箱地板 - 而不会影响安全性。

有关辅助手柄的详细信息,请参阅第zh-23页第13节.

描述	部件编号
辅助手柄	T26620081

16 备件和附件（续前节）

16.3 电池，充电器与接地信号反馈线

描述	部件编号
充电锂离子电池包	T99923482
电池充电器(带英国, 欧洲, 美国和澳大利亚插头)	T99919999
接地信号反馈线; 4m (13’)	T99916954
接地信号反馈线; 10m (32’)	T99916996

16.4 探头延长杆

描述	部件编号
探头延长杆; 250mm (9.8")	T99919988-3
探头延长杆; 500mm (20")	T99919988-1
探头延长杆; 1000mm (39")	T99919988-2

16.5 附件适配器

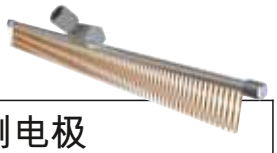
允许其他厂家生产的附件与易高266使用.

型号的适配器	部件编号
AP, APS, AP/S1, AP/S2, AP/W, 10/20, 14/20, 10, 20 & 20S	T99920084
P20, P40, P60, 780, 785 & 790	T99920083
PHD 1-20 & PHD 2-40	T99920252
易高266同旧易高配件	T99920082

16.6 带状刷探头

描述	部件编号
带状刷探头	T99919975
带状刷探头;磷青铜	T99922751

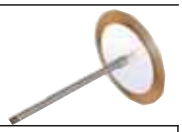
16.7 直角线刷探头



完整的组装		只有备用线刷电极	
部件编号	宽度	部件编号	宽度
T99920022-1	250mm (9.8")	T99926621	250mm (9.8")
T99920022-2	500mm (19.7")	T99926622	500mm (19.7")
T99920022-3	1000mm (39")	T99926623	1000mm (39")

16 备件和附件（续前节）

16.8 内部环线管刷探头



完整的组装		只有备用线刷电极	
部件编号	直径	部件编号	直径
T99920071-1	38mm (1.5")	T9993766-	38mm (1.5")
T99920071-2	51mm (2.0")	T9993767-	51mm (2.0")
T99920071-3	64mm (2.5")	T9993768-	64mm (2.5")
T99920071-4	76mm (3.0")	T9993769-	76mm (3.0")
T99920071-5	89mm (3.5")	T9993770-	89mm (3.5")
T99920071-6	102mm (4.0")	T9993771-	102mm (4.0")
T99920071-7	114mm (4.5")	T9993772-	114mm (4.5")
T99920071-8	127mm (5.0")	T9993773-	127mm (5.0")
T99920071-9	152mm (6.0")	T9993774-	152mm (6.0")
T99920071-10	203mm (8.0")	T9993775-	203mm (8.0")
T99920071-11	254mm (10")	T9993776-	254mm (10")
T99920071-12	305mm (12")	T9993777-	305mm (12")
T99920071-13	356mm (14")	T9993778-	356mm (14")
T99920071-14	406mm (16")	T9993779-	406mm (16")
T99920071-15	508mm (20")	T9993780-	508mm (20")
T99920071-16	610mm (24")	T9993781-	610mm (24")

16.9 “C型”线刷

“C型”线刷不与线刷托标配.请单独订购线刷托

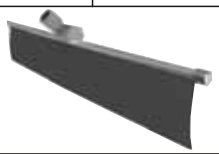
也提供线刷支撑柄-当使用更大直径的线刷时,非常适合双手使用或第二人.

描述	部件编号
“C型”线刷托	T99922752
“C型”线刷支撑柄	T99922907

16 备件和附件（续前节）

“C型”线刷					
部件编号	外径		部件编号	外径	
	DN	NPS		DN	NPS
T99922745-1	150 - 250mm	6 - 9"	T99922745-6	650 - 750mm	24 - 28"
T99922745-2	250 - 350mm	9 - 12"	T99922745-7	750 - 850mm	28 - 32"
T99922745-3	350 - 450mm	12 - 16"	T99922745-8	850 - 950mm	32 - 36"
T99922745-4	450 - 550mm	16 - 20"	T99922745-9	950 - 1050mm	36 - 40"
T99922745-5	550 - 650mm	20- 24"	T99922745-10	1050 - 1150mm	40 - 44"

16.10 导电橡胶探头



完整的组装		只有备用线刷电极	
部件编号	宽度	部件编号	宽度
T99920022-11	250mm (9.8")	T99926731	250mm (9.8")
T99920022-12	500mm (19.7")	T99926732	500mm (19.7")
T99920022-13	1000mm (39")	T99926733	1000mm (39")
T99920022-14	1400mm (55")	T99926734	1400mm (55")

16.11 滚动弹簧

提供磷青铜或不锈钢,每个弹簧随供一个易拆卸的耦合件，用户可以迅速连接或断开支柱上的滚动弹簧.

滚动弹簧不与弹簧托标配.请单独订购合适的弹簧托.

直径19mm (0.75”)的磷青铜弹簧比直径34mm (1.33”) 的不锈钢弹簧轻几乎3倍.

描述	部件编号
磷青铜滚动弹簧托	T99920086
不锈钢滚动弹簧托	T99922746

16 备件和附件（续前节）

部件编号		管道名义尺寸		管道外径（OD)			
磷青铜	不锈钢	DN (mm)	NPS (inches)	最小 (mm)	最大 (mm)	最小 (inches)	最大 (inches)
T99920438-15A	-	40	1.5	48	54	1.9	2.1
T99920438-15B	-			54	60	2.1	2.4
T99920438-20A	-	50	2.0	60	66	2.4	2.6
T99920438-20B	-			66	73	2.6	2.9
T99920438-25A	T99922744-25A	65	2.5	73	80	2.9	3.1
T99920438-25B	T99922744-25B			80	88	3.1	3.5
T99920438-30A	T99922744-30A	80	3.0	88	95	3.5	3.7
T99920438-30B	T99922744-30B			95	100	3.7	3.9
T99920438-35A	T99922744-35A	90	3.5	100	108	3.9	4.3
T99920438-35B	T99922744-35B			108	114	4.3	4.5
T99920438-40A	T99922744-40A	100	4.0	114	125	4.5	4.9
T99920438-45A	T99922744-45A	114	4.5	125	136	4.9	5.4
T99920438-45B	T99922744-45B			136	141	5.4	5.6
T99920438-50A	T99922744-50A	125	5.0	141	155	5.6	6.1
T99920438-50B	T99922744-50B			155	168	6.1	6.6
T99920438-60A	T99922744-60A	152	6.0	168	180	6.6	7.1
T99920438-60B	T99922744-60B			180	193	7.1	7.6
T99920438-70A	T99922744-70A	178	7.0	193	213	7.6	8.4
T99920438-70B	T99922744-70B			213	219	8.4	8.6
T99920438-80A	T99922744-80A	203	8.0	219	240	8.6	9.4
T99920438-90A	T99922744-90A	229	9.0	240	264	9.4	10.4
T99920438-100A	T99922744-100A	254	10.0	264	290	10.4	11.4
T99920438-110A	T99922744-110A	279	11.0	290	320	11.4	12.6
T99920438-120A	T99922744-120A	305	12.0	320	350	12.6	13.8
T99920438-140A	T99922744-140A	356	14.0	350	375	13.8	14.8
T99920438-140B	T99922744-140B			375	400	14.8	15.7
T99920438-160A	T99922744-160A	406	16.0	400	435	15.7	17.1
T99920438-160B	T99922744-160B			435	450	17.1	17.7

16 备件和附件（续前节）

部件编号		管道名义尺寸		管道外径（OD)			
磷青铜	不锈钢	DN (mm)	NPS (inches)	最小 (mm)	最大 (mm)	最小 (inches)	最大 (inches)
T99920438-180A	T99922744-180A	457	18.0	450	500	17.7	19.7
T99920438-200A	T99922744-200A	508	20.0	500	550	19.7	21.7
T99920438-220A	T99922744-220A	559	22.0	550	600	21.7	23.6
T99920438-240A	T99922744-240A	610	24.0	600	650	23.6	25.6
T99920438-260A	T99922744-260A	660	26.0	650	700	25.6	27.6
T99920438-280A	T99922744-280A	711	28.0	700	750	27.6	29.5
T99920438-300A	T99922744-300A	762	30.0	750	810	29.5	31.9
T99920438-320A	T99922744-320A	813	32.0	810	860	31.9	33.9
T99920438-340A	T99922744-340A	864	34.0	860	910	33.9	35.8
T99920438-360A	T99922744-360A	914	36.0	910	960	35.8	37.8
T99920438-380A	T99922744-380A	965	38.0	960	1010	37.8	39.8
T99920438-400A	T99922744-400A	1016	40.0	1010	1060	39.8	41.7
T99920438-420A	T99922744-420A	1067	42.0	1060	1110	41.7	43.7
T99920438-440A	T99922744-440A	1118	44.0	1110	1160	43.7	45.7
T99920438-460A	T99922744-460A	1168	46.0	1160	1210	45.7	47.6
T99920438-480A	T99922744-480A	1219	48.0	1210	1270	47.6	50.0
T99920438-500A	T99922744-500A	1270	50.0	1270	1320	50.0	52.0
T99920438-520A	T99922744-520A	1321	52.0	1320	1370	52.0	53.9
T99920438-540A	T99922744-540A	1372	54.0	1370	1425	53.9	56.1

17 保修声明

易高266 DC电火花检漏仪和高电压探头手柄提供对制造缺陷12个月的保修期,不包括污染和磨损.

保修可以通过www.elcometer.com被延长至两年在60天购买内.

18 技术规格

输出电压[e]	0.5 kV到5 kV 0.5 kV到15 kV 0.5 kV到30 kV	
高电压输出精确度	±5% 或 ±50 V 1 kV以下	
测到的电流精确度 (灵敏度)	满刻度的±5%	
显示分辨率	电压 - 测到的:	10 kV以下0.01 kV ; 10 kV以上0.1 kV
	电压 - 设定:	1 kV以下0.05 kV ; 1 kV以上0.1 kV
	电流 - 测到的:	1µA
	电流 - 设定:	1µA
输出电流	99µA 最大	
操作温度	0至50°C (32至122°F)	
电源[f]	内置可充电锂离子电池	
电池寿命[g]	8/10 小时连续使用在30 kV 15/20 小时连续使用在15 kV 20/40 小时连续使用在5 kV	
电池充电器保险丝额定值 (如果已安装)	3 A	
重量	基本装置: (含电池)	1.2kg (2.7lb)
	手柄:	0.6kg (1.3lb)
	基本装置,手柄 &连接线:	2kg (4.4lb)
包装尺寸	520 x 370 x 125mm (20.5 x 14.5 x 5")	
可按照使用: 见zh-35页的附录A“标准”		

[e] 取决于装配哪个高压手柄.
[f] 电池必须小心处理以免污染环境.请咨询您所在地区当地的环境管理机构关于处置信息。请勿将电池丢弃在火中.
[g] 典型电池寿命带或不带背光.

19 维护与保养

- 该仪器包括一个液晶显示屏(LCD).如果显示屏加热到50℃(120°F)以上,它可能会损坏.如果仪器放置在阳光直射的汽车里面这个可能发生.
- 保持仪器,高压探头手柄,连接电缆和探头附件的清洁.清洁之前,关闭仪器并断开所有电缆.为了干净,用湿布擦,然后在使用前有足够的时间风干.不使用任何溶剂清洁仪器.
- 每隔一段时间,检查仪器,高压探头手柄,探头和高压回报导线和连接器是否损坏.更换已经磨损或有可疑状况的任何部位,见zh-27页上第16节“备件和附件”.
- 仪器的使用寿命通过定期校准检查是质量管理程序要求,例如ISO9000,以及其他类似的标准.对于检查和认证,联系易高或易高供应商.

该仪器不包含任何用户可维修的部件.在出现故障的事件时,仪器应退还到您的本地易高供应商或直接到易高.如果仪器已经打开,保修将失效.

20 法律提示 & 法规信息

该产品符合电磁兼容指令和低电压指令.

本产品为A级,1组ISM设备按照CISPR 11.

第1组ISM产品：A类产品产生的/或使用的导电耦合射频能量, 是设备内部本身运作所必需的.

A级产品: , 除了国内适用于所有机构中使用,直接连接到为作住宅用的建筑物提供的低压供电网络.

注: 更多信息在zh-2页第1节“工作安全”.

产品描述:	易高266 直流电火花检漏仪
制造:	Elcometer Limited, Manchester, England.
elcometer	是Elcometer Limited公司的注册商标, Edge Lane, 曼彻斯 , M43 6BU,英国

所有其他商标承认.

易高266 直流电火花检漏仪装在纸箱和塑料包装.请确保此包装是在环境敏感的方式进行处理.请咨询当地的环境管理局进一步的指导.

附录A：标准

包括在易高266直流电火花检漏仪的电压计算器被编程下列标准：

ASTM G6-83	AS3894.1:F3 1991	NACE SP0188-2006
ASTM G62-87	AS3894.1:F4 1991	NACE SP0490-2007
AS3894.1:F1 1991	ANSI/AWWA C213-91	NACE RP0274-04
AS3894.1:F2 1991	EN14430:2004	

不直接从涂层厚度推导出测试电压的其它标准,不提供在电压计算器功能内.测试这些标准仍然是可能的,但是通过手动设置的测试电压 - 见zh-18页9.2节“手动设置电压”.

易高266直流电火花检漏仪可以根据以下列表中的标准和试验方法使用:

标准或方法编号	日期	标题	注释	电压设定†
ANSI/AWWA C214-89	1990	钢水管外部的卷带涂层系统	最低电压是6kV. 使用NACE RP0274	M
ANSI/AWWA C214-89	1992	钢水管内部和外部的地熔融粘合环氧涂层	$V = 525 \cdot \sqrt{\text{厚度 (mil)}}$	VC, M
AS3894.1	1991	保护涂层的现场测试. 方法1:不导电涂料 - 连续性测试 - 高电压(刷)方法	测试涂料 >150µm在电压>500V $V = 250 \cdot \sqrt{\text{厚度 (µm) / 因素}}$	VC, M
ASTM D4787	1988	液体或片状衬里的连续性验证应用到混凝土	高压(高于900 V)测试. 设定电压在衬里的介电分解强度以下.在最大0.3m/s(1ft/s)移动探头	M

† 易高266电压设置: VC=电压计算器; M =手动

附录A：标准（续前节）

标准或方法编号	日期	标题	注释	电压设定†
ASTM F423	1975	PTFE 塑料内衬铁基金属管和管件	静电测试:10kV,于缺陷火花是拒收的理由	M
ASTM G6	1983	管道涂层的耐磨性	耐磨试验之前孔隙测试.测试电压的计算为: $V = 1250 \cdot \sqrt{\text{厚度 (mil)}}$	VC, M
ASTM G62-B	1987	孔隙检测在管道涂层	方法B. 厚度<1.016mm $= 3294 \cdot \sqrt{\text{厚度 (mm)}}$ 厚度>1.041mm $= 7843 \cdot \sqrt{\text{厚度 (mm)}}$	VC, M
BS 1344-11	1998	玻璃搪瓷饰面的测试方法第二部分: 高压测试给高腐蚀性条件下使用的物品	同ISO 2746一样(2kV以上的试验电压给比220μm厚的搪瓷）	M
EN 14430	2004	玻璃体和搪瓷 - 高压测试	DC或脉冲测试电压。 V =1.1kV至8.0kV给100μm到2000μm的厚度	VC, M
ISO 2746	2014	玻璃体和搪瓷 - 对于强腐蚀条件下使用的搪瓷物品 -高压测试	2kV以上的试验电压给比220μm厚的搪瓷	M
ISO 29601	2011	由防护涂料系统防腐蚀 - 在干膜评估孔隙度	低压和高压设备和测试	M
JIS G-3491	1993	在水管道上的沥青涂层	内壁:8-10kV 浸涂层: 6-7 kV 外壁: 10-12 kV	M

† 易高266电压设置: VC=电压计算器; M =手动

附录A：标准（续前节）

标准或方法编号	日期	标题	注释	电压设定†
JIS G-3492	1993	在水管道上的煤焦油搪瓷涂层	内壁:8-10kV 浸涂层: 6-7 kV 外壁: 10-12 kV 焊接领域的内壁	M
NACE SP0188	2006	在导电基体的新保护涂料的间断性(孔隙)测试	低压和高压设备和测试	VC, M
NACE RP0274	1974	安装之前的管道涂层高压电气检验	DC或脉冲测试电压 $V = 1250 \cdot \sqrt{\text{厚度 (mil)}}$	VC, M
NACE SP0490	2007	地熔融粘合环氧外部管道涂层10-30mils (0.25 - 0.76mm)的孔隙测试	DC在干燥状态下 $V = 525 \cdot \sqrt{\text{厚度 (mil)}}$ 尾随9米接地导线是允许的,如果管道连接到2-3ft接地钉和土壤不干燥	VC, M

注: 以上列表和评论已经从确定的文档中提取并尽一切努力以确保内容是正确的.没有责任可以接受信息的准确性,因为这些文件被更新,修正并定期修改.相关标准或方法的副本必须从来源获得,以确保它是当前文档。

† 易高266电压设置: VC=电压计算器; M =手动

附录B：计算正确的测试电压

易高266包括一个内置的电压计算器,根据测试标准和您正在测试的涂层厚度,这将确定和设置正确电压,参见zh-17页第9.1节“自动设置电压”.

另外电压可以由用户来设置,参见zh-18页第9.2节“手动设置电压',使用下列准则其中描述了如何一个安全但有效的测试电压可确定.

概览

有效的测试,测试电压必须在两个极限之间-上限和下限.

- 电压上限是在该涂层本身会分解并损坏.因此测试电压应低于该值.
- 下限是所需的电压分解空气厚度等同于涂层厚度.如果输出电压不大于这个值,则裂缝将不会被检测到.

这两个极限可确定与电压之间近似中间选择作为测试电压.

介电强度

不管是什么材料,如果施加足够高的电压时,它会导电.然而对于绝缘子,如油漆,所需要的电压水平以达到电流流动,通常导致不可逆的物质损失.

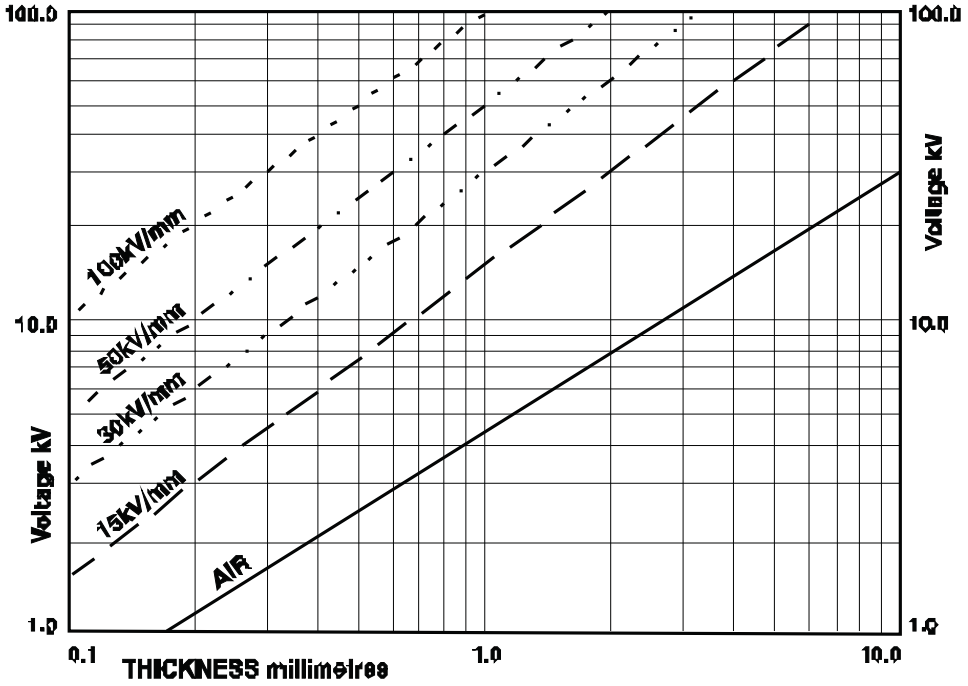
在该材料的特定厚度分解的电压被称为介电强度.这通常表示为每单位距离的电压,例如kV/mm.

其值取决于施加电压的类型(AC,DC或脉冲),温度和厚度.zh-39页上的图显示了不同介电强度的材料击穿电压(DC)和厚度之间的关系.

附录B：计算正确的测试电压（续前节）

电压上限是材料介电强度乘以其厚度,和电压下限是空气的介电强度乘以厚度.

涂层材料的介电强度通常在于10kV/mm到30kV/mm的区域.空气范围的介电强度为1.3kV/mm到4kV/mm.



对厚度不同的介电强度材料击穿电压：如果你没有一个标准的合作,并希望更多地了解如何建立一个测试电压,此图是非常有用的.

建立电压限制

下限:有效操作的下限需要到分解空气厚度等同于涂层厚度.空气的给定厚度的击穿电压与湿度,压力和温度而变化,但约4kV/mm(0.1kV/mil).

如果涂层厚度是已知的,或可以测量的,该下限值可以由上面给出的图表中读取,使用线条标志为空气.例如,如果涂层厚度为1.0mm则下限为大约4.5kV.

附录B：计算正确的测试电压（续前节）

如果涂层厚度并不知,那么最小值必须通过实验确定.减少电压设置到最小,在涂层表面正常的高度,将探头定位在基板的一个非保护区.缓慢而稳定地增加电压,直到产生火花.记下此电压 - 这是电压下限.

上限:电压上限可能由以下确定：

- 工作规范 - 如果可提供以及一个规定测试电压.
- 介电强度- 如果指定所施加的涂层.测量该层的厚度并参考zh-39页上的图.另外可以计算出最大电压,允许涂层厚度变化.需要注意的是每毫米1kV相当于25.4 V 每mil(thou).

  注意:只适用这种方法,如果介电强度值被确定为一个直流电压.
- 实验 - 探头触摸在工件上的一个不重要的区域.缓慢而稳定地增加电压直到火花穿过涂层.记下此电压-这是电压上限.(介电强度可以通过涂层厚度除以该电压来计算).
- 图表和公式 - 从确立的守则,例如NACE和ASTM.图表的例子如下(见图表1,图表2和图表3).见zh-17页9.1节“自动设置电压”和zh-35页附录A“标准”.

  一旦下限和上限电压极限已经建立,设置的电压在这两个值之间的近似中间.

附录B：计算正确的测试电压（续前节）

图表1: kV值从ASTM G62-87(高达1mm)			
Microns	**Kilovolts (kV)**	**Thou/Mils**	**Kilovolts (kV)**
100	1.04	5	1.17
200	1.47	10	1.66
300	1.80	15	2.03
400	2.08	20	2.34
500	2.33	25	2.63
600	2.55	30	2.88
700	2.76	35	3.11
800	2.95	40	3.32
900	3.12	-	-
1000	3.29	-	-

图表2: kV值从ASTM G62-87(1mm以上)			
mm	**Kilovolts (kV)**	**Thou/Mils**	**Kilovolts (kV)**
1	7.84	40	7.91
2	11.09	80	11.18
3	13.58	120	13.69
4	15.69	160	15.81
5	17.54	200	17.68
6	19.21	240	19.36
7	20.75	280	20.92

图表3: kV值从NACE RP0188-99		
mm	**Thou/Mils**	**Kilovolts (kV)**
0.20至0.28	8 – 11	1.5
0.30至0.38	12 – 15	2.0
0.40至0.50	16 – 20	2.5
0.53至1.00	21 – 40	3.0
1.01至1.39	41 – 55	4.0
1.42至2.00	56 – 80	6.0
2.06至3.18	81 – 125	10.0
3.20至3.43	126 – 135	15.0