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Product description

1. Proper Use

ELMED ISOTEST® test equipment has been exclusively designed for mobile testing of non-porosity of non-conducting or semiconducting materials, especially insulation, and may only be used for this purpose.

- The equipment is not designed to be used for the stationary continuous operation.
- Other use than described above is prohibited.

Please note that

operating the equipment in explosion-hazard environments is strictly forbidden.

Proper use extends on reading these operating instructions as well as meeting all relevant requirements, especially safety regulations. Furthermore, all inspection and maintenance should be performed within the specified time intervals.

During the operation of ISOTEST® test equipment, radio equipment or radio services may be affected by radio interference. In these cases, the equipment must not be used. The equipment should always be turned on only for a minimum period of time.

ISOTEST® test equipment may only be operated by trained personnel.

If ISOTEST® test equipment is not used as described above, safe operation cannot be guaranteed.

The manufacturer does not assume any liability for injuries of persons or damage to equipment if the test equipment is not properly used.

These operating instructions apply to all units of the following series: ISOTEST 4S and 4S^{plus}

2. Design

All ELMED ISOTEST® test equipment is designed for maximum safety. The units are designed and manufactured according to acknowledged safety rules and the current state of art.

The high safety standards guarantee that personal is protected from electric shock hazards. Potential hazards resulting from pulse voltages in the ISOTEST® are clearly below the allowable limits of IEC 479-1 and IEC 479-2.

The basic construction of all ISOTEST® test equipment is very similar with respect to the components being used:

Enclosures	Rugged polystyrene enclosure with separate compartment for rechargeable batteries
Carrying Case	A leather carrying case with shoulder and carrying belt as well as transparent pouch with user guide
Power Supply	Easily replaceable lead-acid accumulator (maintenance-free) Lithium battery
Deep discharge protection of rechargeable battery	Acoustic alarm by piezo buzzer when the operating voltage falls below its allowable minimum plus warning indication by LED and automatic partial shut-off after 1 minute
Operation	Rotary Switches
Voltage Generation (test voltage)	Processor-controlled switching power supply with high-voltage transformer
Adjustable Test Voltage (with limits)	Spherical spark gap with stepping-motor control and continuous zero calibration or electronic spark gap
Adjustable Test Voltage	Rotary Switches
Indication Of Test Voltage	Values on membrane-switch front panel

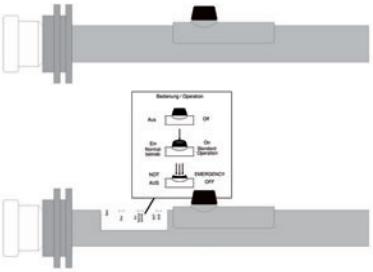
Test Voltage Regulation	Load-dependent, processor-controlled electronic adjustment (continuous)
Load Matching	Freely selectable filter adjustment for optimum matching to individual test conditions
Adjustable Load Matching	Rotary Switches
Evaluation Of Voids	Integral Evaluation Process
Void Indication	Acoustic by piezo buzzer, visual by LED
Safety Button (single-stage)	Switch-on of test voltage
Safety Button (double-stage)	Switch-on of test voltage
(optional)*	Selectable emergency shut-down funkction
Maintenance	LED Indicators

Maintenance and repair of the test equipment may only be performed by qualified personnel authorized by ELMED. Special care should be taken when opening the unit because metal parts may become accessible that carry voltages considerably higher than the unit's supply voltage.

*** Holiday detectors – optionally equipped with the double-stage safety button - are marked with an instruction plate above the safety button on the handle**

Safety Button (single-stage)

Safety Button (double-stage)



3. Functional description

By using a high-voltage tester, even the smallest voids can safely be detected. Voids can be pinholes, cracks or weak spots.

Depending on the grounding method employed, the following tests can be performed:

Recognition of voids in non-conducting or semiconducting coatings on electrically conductive carrier material.

Areas of application, e.g.,:	**Coating material, e.g.:**
Systems for protection of pipelines Coatings applied by the manufacturer (internal and external) Coatings applied in the field Tanks and containers	Polyethylene (PE) Bitumen Butyl rubber bands Petroleum jelly Gummings Rilsan Halar Ceramic Enamel Epoxy resin Powder coatings
	Carrier material, e.g.: Fe-based metals Ne-based metals Electrically conductive fillers Electrically conductive fleece Concrete with sufficient residual moisture

Before testing, the test object as well as the ISOTEST® test equipment must be grounded.
Subsequently, a suitable testing electrode is moved in close distance to the test object across the latter's entire surface. The test voltage applied to the testing electrode should be chosen according to the coating thickness as well as the relevant standards and manufacturer specifications.

A void is detected by sparking between the testing electrodes and the electrically conductive carrier material as well as an acoustic and visual alarm.
Voids and porosity with or without inclusions can be detected in non-conducting material such as welded or glued seams.

Material types, e.g.	All types of plastic Ceramic
Manufacturing types, e.g.	Foils Plates Enclosures Pipelines Hoses

The test object and the ISOTEST® test equipment are grounded by applying the suitable coating of electrically conductive material. Subsequently, a suitable testing electrode is moved in close distance to the test object across the latter's entire surface. The test voltage applied to the testing electrode is to be chosen according to the coating thickness as well as the relevant standards and manufacturer specifications. A void can be detected by sparking between the testing electrode and the electrically conductive ground electrode, and is indicated by an acoustic signal and a red LED on the membrane-switch front panel.

Among others, the following grounding methods can be applied:

- Applying electrically conductive foils and fleeces
- Applying electrically conductive rubber mats
- Filling with electrically conductive liquids or solid matters
- Insertion of a metal wire

Missing or marginal grounding of the ISOTEST® test equipment and/or test object may result in accidents and injury to persons. Chapter "Grounding" contains a detailed description of all possible grounding methods.

4. Technical data

Power Supply		
Supply Voltage		Lead-acid accumulator, 6 V/4.5 Ah, with integrated fuse, connecting cable and two-prong safety plug * Lithium battery
Current consumption (load-dependent)		Approx. 0.8 A (2.0 A maximum)
Test duration (cycle operation)		Approx. 9 h
Test duration (continuous operation)		2.5 to 5.5 h
Test voltage		
Magnitude of test voltage	**ISOTEST 4S**	: adjustable in 4 steps from 10 to 25 kV in steps of 5 kV
	ISOTEST 4S^{plus}	: adjustable in 7 steps in the range of 5 to 35 kV
Signal shape		Unipolar high-voltage pulses
Cycle duration		Approx. 10 µs
Pulse repetition frequency		25 Hz
Current (rms)		Approx. 40 mA
Dimensions and weights (complete unit, including carrying case)		
Length		280 mm
Height		230 mm
Width		120 mm
Length of high-voltage cable		1500 mm
Weight, including handle		4.5 kg
Weight of rechargeable battery		0.9 kg
Type of protection		IP 42
Ambient temperature limit:		-10^{o}C to +50^{o}C (Heat timing constant: > 10 K/h)

* To avoid fire hazards and damage to the rechargeable battery, the pins of the safety plug must not be shorted under all circumstances. Even shorting these pins over a short period of time may cause the fuse to blow and prevent from testing the charge state.
To ensure proper safety and functionality of the rechargeable battery, defective fuses may only be replaced with original fuses.

5. Performance characteristics

ISOTEST® test equipment excel with the following features:

- Maximum safety of personnel by fiber optic controlled safety button and ground connection monitoring
- Significantly reduced hazards for personnel by pulse-shaped test voltage and processor-controlled, load-dependent supply voltage regulation
- The processor-controlled, load-dependent supply voltage regulation guarantees a constant test voltage even under worst-case load conditions
- The test voltage is adjusted using a self-calibrating spherical spark gap according to VDE 0433 or an electronic spark gap
- The high pulse repetition frequency allows testing speeds of up to 300 mm/s
- By making use of extremely short, unipolar high-voltage pulses and a specially designed evaluation circuitry, even the smallest pinholes (channels) and voids can be detected and indicated with only a minimum of material stress
- Residual electrostatic charge on the test object is negligible if the tests are performed correctly
- Pinhole and leakage tests of non-conducting or semiconducting materials
- Testing of completely coated test objects by making use of capacitive grounding
- All ISOTEST® test equipment carries the CE label and meets the requirements of all relevant standards and specifications (DIN EN/ISO, DVGW, etc.)

EC Conformity Declaration

It is herewith confirmed that the products listed below

ISOTEST 4S
ISOTEST 4S plus

meet the safety requirements within the scope of the conformity evaluation procedure of the related competent authority, which are defined in the regulation 2004/108/EG of the European Council for the approximation of laws of the member states with respect to electromagnetic compatibility. The same applies to the provisions of the law on electromagnetic compatibility of electrical equipment (EMVG) as of 9 November 1992.
This declaration applies to all units that are manufactured in accordance with the appropriate manufacturing documentation which is part of this declaration.
For the evaluation of products regarding the electromagnetic compatibility, relevant harmonized standards have been used.

Immunity: **EN 61000-6-2:2005 including:**
EN 61000-4-2:2009; EN61000-4-3:2006 + A1:2008
IEC 61000-4-2:2008
IEC 61000-4-3:2006 + A1:2007

Emission: **EN 55011:2009** (IEC/CISPR 11:2009 modified)

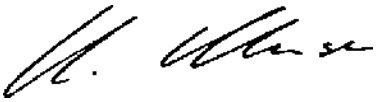
The devices meet the requirements of class A in the standby mode and are designed for operation in industrial environments. In occurrence of radio interference while using the devices in residential or commercial areas, the use must be kept as short as possible or the device must be switched off.

Design-engineering modifications that have such significant effects on both the technical specifications and the proper use defined in this operation manual so as to change the instrument significantly shall nullify this declaration of conformity.

This declaration has been signed for manufacturer

ELMED Dr. Ing. Mense GmbH, Heiligenhaus

by



Claudia Mense

Managing director

Heiligenhaus, 14th February 2012

General safety information

1. User's Responsibility

All ISOTEST® test equipment has been designed and manufactured, considering hazard analyses and compliance with the relevant harmonized standards as well as additional technical specifications. Therefore, ISOTEST® test equipment is state-of-the-art equipment and offers a maximum of safety.

However, this safety level can only be achieved if all required measures have been taken. The user of the test equipment is responsible for planning and performing these measures and for verifying their proper execution.

The user is especially responsible for ensuring that

- ISOTEST® test equipment is only used as intended by the manufacturer (please refer to Chapter "Product Description"),
- the test equipment is only operated if in perfect condition,
- required personal protective equipment is available and being used,
- the operating instructions are always legible and available at the workplaces where the test equipment is used,
- the test equipment is only operated by qualified and authorized personnel,
- this personnel is trained in all aspects of industrial safety and environmental protection, and knows the contents of the operating instructions and the relevant safety regulations,
- no safety labels are removed from the equipment and that all safety labels are clearly legible.

2. Explanation of safety symbols being used in this manual

The following symbols are used in these operating instructions:

- Safety symbols indicate the presence of adjacent safety notes.
- Special symbols indicate important information that should strictly be observed.

This symbol indicates that the relevant action imposes a hazard for life and limb.

Danger

The symbol indicates information provided for improving the understanding of processes.

NOTE

3. Basic safety measures

The basic safety guidelines and regulations of the relevant professional associations apply.

Before turning on the ISOTEST® test equipment, the workplace should be checked for potential obstacles and safety hazards, e.g., tripping hazards.

Intentional or inadvertent touching of a metal part possibly carrying high voltage and an uncontrolled action resulting from this electric shock must not lead to hazard for personnel. This also applies to working on ladders and scaffolds.

Before insertion or removal of testing electrodes, the ISOTEST® test equipment must be turned off using the main switch.
After turning on the unit with the main switch, the area behind the red insulator (electrode clamping device) as well as the testing electrode in the handle must not be touched.

During the tests, suitable work clothes and shoes meeting the requirements of industrial safety regulations should be worn.

If tests are performed in small rooms or containers, the relevant safety regulations and guidelines must be observed
(e.g., safety guards).

High-voltage sparks lead to the formation of ozone. To avoid excessive ozone concentrations in rooms or containers, sufficient ventilation must be provided.

Special care should be taken when using high-voltage extension cords or extension bars as this will tamper safety shielding against accidental contact with hazardous live adjacent to the electrode clamping device.

When using circular electrodes for testing the inner side of cylindrical parts, the ISOTEST® test equipment must be turned off during insertion or removal of the electrode.

By using suitable testing electrodes, a test method should be available that avoids touching of the testing electrodes during the tests.

To maintain the high safety standards, only original ELMED accessories such as testing electrodes may be used.

4. Operator requirements

ISOTEST® test equipment must not be used by unqualified or unauthorized personnel. Persons who intend to operate the test equipment must have read the operating instructions, especially Chapter "Safety Information", and observe these instructions.
These persons must have been trained in the basic regulations on industrial safety and accident prevention.

Operating personal still being in the training phase must not operate the ISOTEST® test equipment unless supervised by a sufficiently trained person.
A certificate of a successfully completed training course is required.

5. Special hazards

Important notice for wearers of a

Heart pacemaker

During operation of the ISOTEST® unit it is necessary to take into consideration a fault in the form of switching over of the heart pacemaker into error mode. It is possible to avoid this effect on heart pacemakers by ensuring that patients with implanted pacemakers do not get closer than 3 m to

- the test unit and the spark gap
- the test electrodes
- the test object being tested and all parts connected to it electrically
- and the earthing cable.

Patients with pacemakers must not use this insulation testing equipment!!

Dipl.-Ing. Univ.
Dott./Univ. Bologna
Michael S. Lampadius

Excerpt from the expert opinion of 20.02.1997

Important advice for epileptics

Contact with high voltage or parts which conduct high voltage could lead to epileptic attacks if you are accordingly susceptible to them.

Grounding

To enable safe porosity tests with high voltage, both the ISOTEST® test equipment and the test object shall be grounded.

Independently of the grounding method, all electrical connections should exhibit the lowest resistance possible. The contact surfaces for attaching the clamping tongs should be free from contamination and stain.

To prevent inadvertent pulling of the grounding plug from the ISOTEST® test equipment, the stress relief attached to all grounding cables should be hooked to the snap link at the bag.

When describing the grounding methods, basically both the grounding of the ISOTEST® test equipment and the test object described.

Depending on the test assignment, the following grounding methods can be employed.

1. Direct grounding

Direct grounding is used when the grounding conductor can be connected to a contact surface free from contamination and stain.

Required accessories:
Standard grounding cable with plug and clamping tongs Part number: 0174320000 (supplied)
Grounding cable, length of 15 m, with plug and clamping tongs Part number: 0174200100

Application:

1. Connect the plug of the standard grounding cable to the grounding receptacle of the ISOTEST® test equipment.
   Connect the clamping tongs at the other end of the grounding cable to the test object.
2. Connect a pair of clamping tongs of the second grounding cable (part number 0174200100) to the test object.
   Connect the second pair of clamping tongs to a ground terminal.
3. Turn the ISOTEST® test equipment on and perform the high-voltage test.

alternatively

Required accessories:
Grounding cable Y - type (clamping tongs - clamping tongs/plug)
Part number 0174250010

Application:
1. Connect the plug of the Y grounding cable to the grounding receptacle of the ISOTEST® test equipment.
2. Connect the clamping tongs at the other end of the grounding cable to the test object.
   Connect the second pair of clamping tongs to a ground terminal.
3. Turn the ISOTEST® test equipment on and perform the high-voltage test.

alternatively

Required accessories:
Standard grounding cable with plug and clamping tongs
Part number: 0174320000
(supplied)
Grounding stick with cable, 2 m
Part number 0174200000

Application:
1. Connect the plug of the standard grounding cable to the grounding receptacle of the ISOTEST® test equipment.
   Connect the clamping tongs at the other end of the grounding cable to the test object.
2. Connect the clamping tongs at the cable from the grounding stick to an accessible area of the test object.
3. Deeply bury the grounding stick in the soil. If the soil is dry, thoroughly water the respective area to obtain a low-resistance connection.
4. Turn the ISOTEST® test equipment on and perform the high-voltage test.

2. Special grounding methods
Testing plastic material

In most cases, welding seams will be tested when testing plastic material. To allow using the high-voltage test method, coat the welding seam and/or area with a electrically conductive material (grounding electrode). Attach a grounding electrode to the entire rear of the area to be tested. Pinholes and voids will safely be detected by sparking between the testing electrode and the grounding electrode.
Required accessories:

Grounding foil
Part number 0174500100
Grounding cable Y - type (clamping tongs - clamping tongs/plug)
Part number 0174250010

Application:

1. Cut the grounding foil to the required size.
   Tear off the protective foil by holding at the edges, and fold one corner. Glue the remainder of the grounding foil to the entire rear of the welding seam or area to be tested, press against the test object, and remove all air bubbles by wiping. Remove the protective foil step by step.
2. Connect the plug of the Y grounding cable to the grounding receptacle of the ISOTEST® test equipment.
3. Attach a pair of clamping tongs at the grounding cable to the folded corner of the grounding foil, and attach the second pair of clamping tongs to ground, ensuring a low-resistance path.
   To obtain safe stress relief for the clamping tongs at the folded corner of the grounding foil, secure the grounding foil with adhesive tape, e.g., friction tape.
4. Turn the ISOTEST® test equipment on and perform the high-voltage test. Remove the grounding foil after the test.

As an alternative to the grounding foil described above, you can also use electrically conductive fleeces, grounding mats or grounding collars made of electrically conductive rubber for testing of plastic parts.
The leakage test of containers can be performed using electrically conductive liquids, e.g., saltwater, acids, etc.
Welding seams can also be tested by inserting a wire.
Grounding brushes are available for cylindrical test objects.

3. Indirect grounding through the soil

Indirect grounding is used where the distance between the test object and a suitable grounding terminal is greater than 15 m. Typical examples are completely muffled pipelines.

Required accessories:

Trailing ground wire	Part number 0174120000
Grounding stick with cable, 2 m	Part number 0174200000

Application:

1. Connect the plug of the trailing ground wire to the grounding jack of the ISOTEST® test equipment.
   Spread the bronze spiral of the trailing ground wire (6.5 m) on the soil in full length.
2. Connect the clamping tongs at the cable from the grounding stick to a non-insulated area of the test object.
3. Deeply bury the grounding stick in the soil. If the soil is dry, thoroughly water the respective area to obtain a low-resistance connection.
4. Turn the ISOTEST® test equipment on and perform the high-voltage test.

Indirect grounding can only be used if the following conditions are met:

- the test object is grounded
- because of its characteristics, the soil exhibits the required conductivity
  - all types of moist soil are suitable
  - unsuitable are, e.g., dry sand, asphalt, and flags.

4. Capacitive grounding

Capacitive grounding is used where direct or indirect grounding is not possible.
This is the case when the test object has metal carrier material that is inaccessible or consists of completely coated material.

a) Grounding of coated test objects, using grounding collars

Commonly used test objects are pipelines that have been coated in the field after repair and are subject to high-voltage testing.
As there is normally no possibility of direct or indirect grounding, grounding collars offer the only possibility of proper and safe grounding.

Required accessories:
Grounding collar, type 1, for DN 100 - 200
Part number 0174401020
Grounding collar, type 2, for DN 200 - 400 (alternative)
Part number 0174402040
Grounding collar, type 3, for DN 300 - 600 (alternative)
Part number 0174403060
Grounding collar, type 4, for DN 500 - 1000 (alternative)
Part number 0174450100
Grounding stick with cable, 2 m
Part number 0174200000

Application:
1. Wrap the grounding collar tightly (without any air gaps) around the pipe and fix it with the lashing strap. The grounding collar must be aligned such that the two connecting bolts can be used for the connection of the grounding cables.
2. Bury the grounding stick deeply in the soil. If the soil is dry, water the respective area thoroughly to obtain a low-resistance connection.
3. Connect the clamping jaw on the cable of the grounding stick to one of the connecting bolts on the grounding collar.
4. Connect the plug of the standard grounding cable to the ground jack of the ISOTEST® test device. The clamping jaw on the other end of the ground cable must be connected to the remaining connection bolt of the grounding collar. The bolts must be metallic bright.
The bolts should be free from contamination and stain.
5. Switch the ISOTEST® holiday detector on and perform the high-voltage test.

b) Grounding of completely coated test objects by using grounding foil

Required accessories:
Grounding cable Y - type (clamping tongs - clamping tongs/plug)
Part number 0174250010
Grounding foil
Part number 0174500100

Application:
1. The ratio of the areas of the testing electrode to the grounding foil is smaller than 1 : 10. This means that the contact area of the electrodes must not exceed 10% of the foil area.
   Cut the grounding foil to the required size.
   Tear off the protective foil by holding at the edges, and fold one corner. Glue the remainder of the grounding foil over the entire surface and remove all air bubbles by wiping. Remove the protective foil step by step.
2. Connect the plug of the Y grounding table to the grounding receptacle of the ISOTEST® test equipment. To prevent inadvertent pulling of the plug, hook up the stress relief attached to the grounding cable to the snap link at the equipment bag.
3. Attach a pair of clamping tongs at the grounding cable to the folded corner of the grounding foil, and attach the second pair of clamping tongs to ground, ensuring a low-resistance path. To obtain safe stress relief for the clamping tongs at the grounding foil, secure the clamping tongs with adhesive tape, e.g., friction tape.
4. Turn the ISOTEST® test equipment on and perform the high-voltage test.
5. Remove the grounding foil after the test.

Safety button

The standard version of the ISOTEST 4S and 4S^{plus} is equipped with a single-stage safety button. The holiday detectors are optionally available with a double-stage safety button. Holiday detectors with a double-stage safety button are marked with an instruction plate above the safety button on the handle.

1. Functional description of the single-stage safety button (standard version)

The singel-stage safety button ensures a high degree of safety in the application of the ISOTEST®. The integrated fiber optic separates the safety button electrically of all high voltage parts.
The test voltage is activated by pressing the safety button. When switching-on the test voltage an acoustic signal is generated and the LED in the membrane-switch front panel flashes yellow.

If the safety button is **already** pressed during power-up of the test equipment, the test voltage is not enabled. An acoustic alarm is generated and the LED in the membrane-switch front panel flashes red. After releasing the safety button, the acoustic alarm is shut off and the LED flashes green. The test equipment is now ready for use.

2. Function of the double-stage safety button (optional version)

The double-stage safety-button ensures the maximum possible safety in the application of the ISOTEST® tester. The integrated fiber optic separates the safety button electrically of all high voltage parts.

The safety button has two switching points, which triggered by different degrees of pressure.

Turn-switch on „filter“ two different different operating modes can be chosen:

Standard mode 

In this mode, the trigger points of the safety switch provide the following functions:
Trigger point "1" enables the test voltage
Trigger point "2" enables the test voltage

Safety mode 

In this mode, the trigger points of the safety switch provide the following functions:
Trigger point "1" enables the test voltage
Trigger point "2" disables the test voltage (emergency stop function)

- The operating mode is to be selected before putting the system into operation, and depending on the working conditions.
  To ensure maximum safety for the user, the safety mode should be selected whenever possible.
- The selected operating mode is indicated by a blue LED adjacent to the corresponding symbol on the membrane-switch front panel.

Switching between the two operating modes is described in Chapter "Startup".

Trigger point "1" **Enabling of test voltage**

By pressing the safety button **after** turning on the test equipment with low pressure to exceed the first trigger point, the test voltage is enabled. Whenever the test voltage is present, an acoustic alarm is generated and the yellow LED in the membrane-switch front panel is lit.

Trigger point "2" **Emergency stop function**
(only available in safety mode)

If the safety button is pressed to activate trigger point "2", the test voltage is immediately shut off as long as the safety button is pressed to exceed trigger point "2".
The safety shut-off function described above protects the user, e.g., from muscular induration caused by electric shock.
Shut-off of the test voltage is indicated by an alarm signal and the red LED flashing in the membrane-switch front panel.

After releasing the safety button, the acoustic alarm is shut off and the LED flashes green. The test equipment is now ready for use.

The test equipment is factory set to the standard mode.
The emergency stop function is **not** enabled.

Startup

To avoid damage to the ISOTEST® test equipment or injuries of persons during power-up, the following precautions must be observed:

- The equipment may only be put into operation by qualified persons observing the safety instructions.

General startup procedure
Before putting the test equipment into operation, the following steps should be performed:

- Insert the fully charged battery into the battery compartment and connect the safety lock to the corresponding jacks of the unit
- Close and lock the battery compartment
- Remove any contamination and moisture from the testing electrode, the handle, the accessories and the as connectors
- Check all parts that may carry high voltage for mechanical damage

Damaged parts must not be used!

- Ground the ISOTEST® test equipment as described in Chapter "Grounding"
- Ground the test object as described in Chapter "Grounding"
- Select a suitable testing electrode
- Insert the testing electrode or the guiding fork into the electrode clamping device at the handle by following the steps below:
  - Loosen the white cap nut by turning CCW
  - Insert the testing electrode or the guiding fork
  - Fasten the white cap nut by turning CW (hand-screwed)

  Insert the extension bars instead of the electrodes into the electrode clamping device at the handle.
  Then insert the testing electrode or the guiding fork at the end of the extension into the electrode clamping device as described above.

- Turn the ISOTEST® test equipment on

  Check the settings according to the corresponding testing requirements and readjust, if necessary
  (refer to Chapter "Checking And Adjusting Equipment Settings").
  - Observe the safety instructions

Safe choice of accessories and testing electrodes
In order to provide for a safe and trouble-free testing it is compulsory to consider all testing conditions and procedures before choosing the necessary accessories and the right size and type of the testing electrodes. The user is responsible for the right choice of accessories and electrode size, for their proper use as well as their related maintenance.

Functional Test:
Before beginning with the tests, establish contact between the testing electrodes and the grounding terminal with the test voltage enabled. When approaching the grounding terminal, sparking should be observed. The distance at which sparking occurs depends on the adjusted magnitude of the test voltage. Alternatively, the functional verification can be performed on a test pore. At the moment of the flashover the acoustic alarm must be audible and the LED on the membrane-switch front panel must be lit in red.

Check the settings and modify, if required

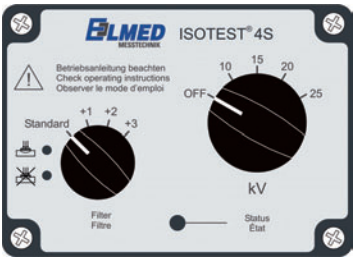
All settings can be made easily and safely by means of the two rotary switches on the front panel.

Possible settings:

- "Test voltage"
  the test voltage is adjusted with rotary switch "KV".
  You can select the voltage values indicated on the membrane-switch front panel.

- "Filter settings"
  for optimum matching of the measurement sensitivity to the various load conditions. Rotary switch "Filter" allows to select four settings, "Standard" to "Standard+3". The filter function is described in Chapter "Additional Information".

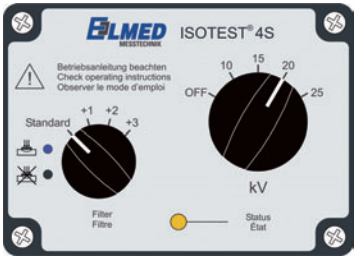
- Operating mode "Safety button"
  - only for testers with double-stage safety button **(optional)**
  switching between the operating modes "Standard" and "Safety" is made with the rotary switch labeled "Filter". The function of the safety button is detailed in Chapter "Safety Button".



Test equipment turned off.

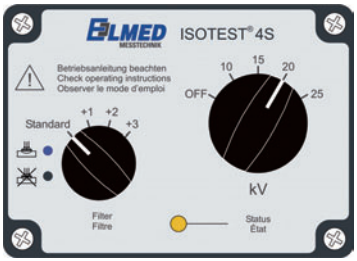
The indication of voltage values is subject to the type of equipment/unit

1. Turn the ISOTEST® test equipment on



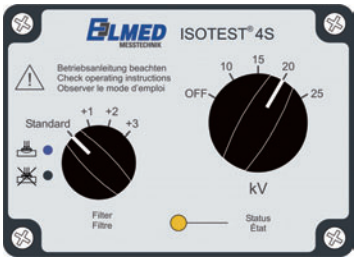
The test equipment is automatically turned off by selecting the test voltage with rotary switch "KV"
(in this example: 20 kV).
If the unit is turned on, this is indicated by a hooter.
After internal calibration to the adjusted voltage, a hooter sound and the green LED on the membrane-switch front panel indicate that the unit is operational.

2. Operating mode of the safety button



After a unit is turned on, a blue LED adjacent to the symbol for operating mode "Safety" indicates the current mode of the safety button.
(in this example: safety shut-off enabled)

3. Filter settings

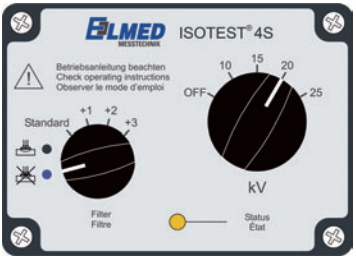


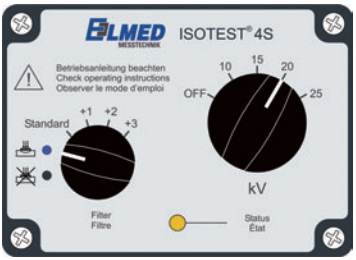
The current filter settings can be seen from the position of rotary switch "Filter"
(in this example: Standard)

Changing the operating mode of the safety button

- only for testers with double-stage safety button (optional)

Enabling and disabling the safety shut-off function



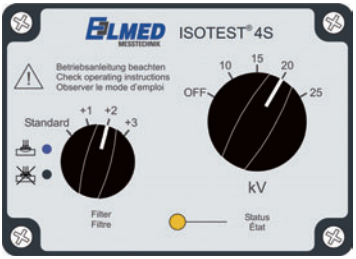


After the test equipment is turned on, turn rotary switch "Filter" to the position with the symbol for the desired operating mode of the safety button.
The blue LED adjacent to the symbol for indicating the actual operating mode flashes.
Press and hold the safety button at the handle.
After a short and a long hooter alarm, the new operating mode is enabled.
Now, the blue LED adjacent to the corresponding symbol for the newly selected operating mode flashes.
Release the safety button and turn rotary switch "Filter" to its position "Standard". The blue LED adjacent to the symbol for the selected operating mode is lit. The test equipment is now ready for use.

Press the safety button with low pressure
(Trigger point „1“)

Changing Filter Settings

Increasing or decreasing filter settings



Use rotary switch "Filter" to select the required filter setting.
(in this example: "Standard+2")

The filter function is described in Chapter "Additional Information".

Error messages and troubleshooting (Checklist)

Error message: No acoustic signal after the unit is turned on

Possible Causes	Remedy
No rechargeable battery inserted	Insert the rechargeable battery
Discharge the rechargeable battery to below the unit's shut-off threshold	Replace or charge the rechargeable battery
The rechargeable battery is defective	Replace the rechargeable battery or its fuse

Error message: Acoustic signal approx. 3 seconds after power up

Error Message	Possible Causes	Remedy
●↔○ **The LED flashes green**	Low battery charge	Replace or charge the rechargeable battery
●↔● **The LED alternately flashes yellow/green**	Missing or incorrectly connected grounding plug	The grounding plug should be inserted until it reaches a stop
●↔○ **The LED flashes red (safety shut-off)**	The safety button was pressed during power-up	Release the safety button during power-up. After the LED has changed its color from red to green, the unit is ready for use.
●↔● **The LED alternately flashes yellow/red**	Automatic integration of the spark gap is not possible	Turn the unit off. If the error message is still displayed after the unit was turned on again, ship the unit to the manufacturer for inspection.

Error message: No acoustic signal after pressing the safety button

Possible Causes	Remedy
The unit is not turned on	Turn the unit on
Automatic shut-off for energy savings was enabled ●↔○ **The LED flashes green over a short period of time**	The unit must be turned on again
Low voltage of the battery in the handle	Replace the battery (refer to Chapter "Replacing The Lithium Battery")

Error message: Acoustic signal approx. 3 seconds after pressing the safety button without contacting the test object with the electrode

Error Message	Possible Causes	Remedy
●↔○ **The LED flashes green**	Low battery charge	Replace or charge the rechargeable battery
●↔○ **The LED flashes red (safety shut-off)**	The safety mode is enabled	Press the safety button to exceed the first trigger point, or select the standard mode for the safety button.
●↔○ **The LED flashes red (safety shut-off)**	Readjusting the magnitude of the test voltage with the safety button depressed	Release the safety button After calibrating to the newly adjusted voltage, the LED illuminates green and the unit is ready for use.

Error message: Acoustic signal after pressing the safety button and contacting the test object with the electrode

Error Message	Possible Causes	Remedy
●↔○ **The LED flashes yellow**	Overload	Clean and dry the test object Use a testing electrode with a smaller contact area The coating is electrically conductive and cannot be tested
●↔○ **The LED flashes red (safety shut-off)**	Continuous sparking over more than 5 seconds	Turn the unit off and on Avoid continuous sparking
●↔○ **The LED flashes red (safety shut-off)**	Readjusting the magnitude of the test voltage with the safety button depressed	Release the safety button After calibrating to the newly adjusted voltage, the LED illuminates green and the unit is ready for use.
●↔○ **The LED flashes red (safety shut-off)**	The safety mode is enabled	Press the safety button to exceed the first trigger point, or select the standard mode for the safety button.
● **The LED illuminates red**	Void in the test object	Desired result

Repair

1. Storage

If the test equipment is not used over more than 1 week, the following measures should be taken:

- Remove the rechargeable battery from the test equipment and connect to the battery charger. Complete discharge can be avoided by connecting the rechargeable battery to the battery charger.
- Clean the test equipment and the accessories.
- Protect the test equipment and the accessories from damage by storing in a dry room.
  The optimum solution for avoiding damage to the test equipment and the accessories is to use an ELMED transportation box (part number 0177200002).
- To avoid condensation at temperatures below the dew point, ensure that the equipment is stored at normal ambient temperature.
  Storage temp.: -20°C bis +50°C (Heat timing constant: > 10 K/h)

2. Maintenance

Because of its matured and rugged design, ISOTEST® test equipment from ELMED requires only a minimum of maintenance efforts.
However, the following maintenance should always be performed:

- Clean all connectors from contamination.
  Clean the test equipment and the accessories, using a soft, dampened or dry cloth. Use only mild detergents.
- Do not touch the high-voltage cable with hot parts and/or parts having sharp edges.
- Always close the carrying case to protect the unit from mechanical damage.
- Do not throw the ISOTEST® test equipment or expose to heavy impact or vibration.

3. Inspections/Calibration

To maintain the high reliability and the high quality standard of ISOTEST® test equipment as long as possible, the equipment should be inspected and calibrated by the manufacturer each year.
Observing recommended inspection intervals contributes to continuous functional safety of the equipment and avoids expensive repair.

During inspections, all equipment functions are checked and the unit is calibrated. The results of an inspection are stored in a database and documented in a manufacturer certificate traceable to the PTB (Physikalisch-Technische Bundesanstalt, the German Bureau of Standards).
A clearly visible label indicates the due date of the next inspection.

To assist your company's quality assurance system, the LED will change its color from red to green by flashing three times after power-up of the ISOTEST® test equipment, indicating that the next inspection will be due within the next 4 weeks.
If the schedule for routine maintenance was not observed, this information will also be displayed after turning on the ISOTEST® test equipment. The information "Maintenance required" is indicated by 6 flashes of the LED with simultaneous changing of its color from red to green.

4. Repairs

Damaged components or components that do not perform to their specifications must be replaced immediately. To ensure the unit's safety and functionality, only original spare parts may be used for repair.

ISOTEST® test equipment, accumulators and batteries must be disposed of according to legal requirements.

If your ISOTEST® test equipment requires inspection or repair, please send the unit with all transportation fees prepaid to:

ELMED Dr.-Ing. Mense GmbH
ISOTEST Service
Weilenburgstrasse 39
42579 Heiligenhaus, Germany

Proper maintenance work and repairs in accordance with the regulations can only be ensured if such work is carried out by the manufacturer or by qualified and authorized service centres.

Additional information

Below, please find a list of terms with explanations that allows better understanding of the operation of the ISOTEST® test equipment

1. Definitions of terms

Terms	Explanations
Test object	The object that is to be subject to testing.
Voids	Pinholes or connects in the material to be tested. During tests, voids are indicated by an acoustic and a visual (red LED on the membrane-switch front panel) alarm.
Testing electrodes	Electrically conductive spiral or fan brushes applying the test voltage to the test object.
Capacitive load	The capacitive load depends on the type and thickness of the coating as well as on the contact area of the testing electrode. Thin coatings and large contact areas result in high capacitive load. Whenever the maximum allowable capacitive load is exceeded, the LED on the membrane-switch front panel illuminates yellow.
Ground potential	The reference potential for testing. Ground potential is available through: - all parts of a building electrically connected to foundation ground - all building parts electrically connected to the potential compensation bus - PE power line conductor - Separate grounding stick (part number 0174200000)
Low-resistance	Contact resistance of less than 10 Ohm. Prerequisite: - Contact surfaces should be free from contamination and stain - Short grounding cable (length of less than 15 m) - Cable a cross-section equal to or greater than 2.5 mm^2

To earth	Applying ground potential to the ISOTEST® test equipment and the test object.
Grounding	is establishing a low-resistance connection between a point of ground potential to the ISOTEST® test equipment and the test object.
Capacitive grounding	Grounding of completely coated test objects by employing the capacitor method. In combination with suitable accessories, the pulse-shaped voltage in the ISOTEST® test equipment allows grounding of the test object without a galvanic connection.
Test voltage	The magnitude of the high voltage in kV used to perform the tests. It depends on the type and the thickness of the material to be tested. The following documents contain information about the magnitude of the test voltage: - DIN standards - EN standards - Worksheets - Documentation of coating manufacturers
Pulse voltage	is a gated DC voltage. Unipolar high-voltage pulses ensure maximum testing safety with minimum materials stress and without electrostatic charge of the test object.
Filter	Electronic matching to different, capacitive loads. The load conditions depend on: - Type and thickness of the material to be tested - Environmental effects such as humidity - Type and size of the testing electrode The tests should be started with filter stage "Standard". If a continuous acoustic alarm is audible after touching a non-porous test object with the testing electrode, a higher filter stage should be selected until the continuous acoustic alarm is stopped. If the filter is set to its maximum and the continuous acoustic alarm is still audible, the load conditions should be changed by using a different testing electrode or by drying the test object. Selecting the filter stage does not affect the magnitude of the adjusted test voltage.

Ground connection monitoring	If the grounding plug is not connected to the grounding jack of the ISOTEST® test equipment, this will be detected electronically and indicated by an acoustic alarm as well as the LED on the membrane-switch front panel that will alternately flash yellow and green. The test voltage cannot be enabled.
Turn-off reminder	Automatic partial shut-off if the unit was not turned off within 5 minutes after the last depression of the safety button. Partial shut-off is indicated by short flashing of the LED on the membrane-switch front panel in green and an acoustic alarm. If the unit should be used again, it must be powered off and on again.
Load adjustment	To achieve a maximum operating time per battery charge, the ISOTEST® holiday detectors work with a load-dependent processor-controlled energy control. By a continuous monitoring of the applied load, the energy content of the test voltage is regulated to a value that guarantees a reliable signal when detecting a pore / void. The energy control is reflected in the fact that the audible flashover of the internal spark gap softens under a lower load. Depending on the load, the intensity of the spark varies in its degree in the event of a pore / void. The energy control has no effect on the level of the set test voltage.
Overload	If the yellow flashing of the LED indicates an unsafe load on the ISOTEST® holiday detector, it is no longer guaranteed that the chosen test voltage is applied on the test object. The user has to decide whether the level of the applied test voltage is sufficient for a reliable signal in the event of a pore / void. For the evaluation a sample pore could be helpful. Measures to reduce the load, see checklist „Error messages and troubleshooting“
LED	is an abbreviation of "Light-Emitting Diode" (a small electronic indicator light on the membrane-switch front panel). Current operating conditions and error messages are indicated by the LED being lit in various colors.

2. Rechargeable battery

- Lead-acid accumulator (6 V/4.5 Ah)
  with integrated fuse, connecting cable and two-prong safety plug

Lead-acid accumulators must never be discharged completely.
ISOTEST® test equipment provides visual ("Battery empty") and acoustic alarm whenever there is a risk of complete discharge of the rechargeable battery. If this alarm is generated, the rechargeable battery should be replaced with a charged battery and recharged as soon as possible.
To protect the lead-acid accumulator from short circuit, a fuse holder with suitable fuse is mounted on the rechargeable battery, adjacent to the terminal block. Shorting of the plug results causes the fuse to blow.

Blown fuses must not be shunted by wires, nails or similar as this may irreversibly damage the rechargeable battery, should a short circuit occur again. **Fire hazard!**
Damaged rechargeable batteries can only be repaired by the manufacturer.

3. Battery chargers

Charger types

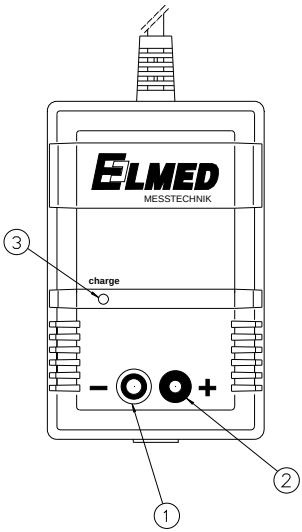
For charging of rechargeable batteries used in the test equipment, 3 different battery chargers are available.

• universal charger	100-240 VAC / 50-60 Hz	6 V / ~ 700 mA
• charger	12 VDC	6 V / ~ 700 mA
• charger	24 VDC	6 V / ~ 700 mA

Connecting the battery to the universal charger unit

The single plug of the Pb battery have contacts of different sizes to prevent them being connected incorrectly.
The two-pole plug of the Pb battery can only be connected to the cable outlet ① and ② on the charger unit.

In order to prevent damage to the fuse of the battery, ensure that the pins of the plug are never shorted or brought into contact with conductive parts of the battery itself.



The battery should be put back into the unit once it has been tested or charged. The cables are to be connected to the ISOTEST® unit in the same way as described above for connection to the charger unit.

The connection of the accumulators to the chargers 12 VDC / 24 VDC as well as technical specifications are to be found in the manual instructions that accompany each charger.

Charging the Battery

Connect the charger unit with the battery connected to the power source (mains or 24 V source); the red *Charge* ③ indicator light comes on and the charging process begins. The red indicator light goes out at the end of the charging. The battery now has only a very low charging current applied to it to counteract self-discharge.
If a fully-charged battery is connected to the charger, the red *Charge* ③ indicator light lights up only for a short moment or is possibly not perceivable at all.

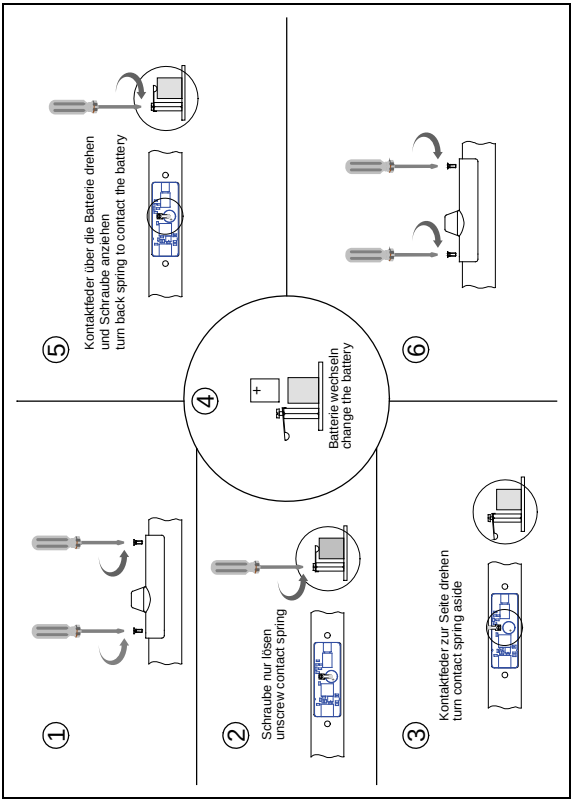
Technical Data

Power supply:	see type label
Final charge voltage:	7,10 VDC ±2%
Battery full detection:	IUOU
Charging current:	max. 700 mA ±10%
Restart voltage:	6,8 VDC ±3%
Protection class:	IP 20
Protection class:	II
Operation temperature:	0°C..+40°C
Storage temperature:	-25°C..+60°C
Dimensions:	106 x 68 x 51mm
Weight:	app. 200 g

While charging, the maximum ambient temperature of 40° C must not be exceeded.

When and how to change the battery inside the testing handle

Under standard operating conditions the battery inside the testing handle of the ISOTEST® will last several years.
So **before** changing the battery please check if you can hear an acoustic signal after switching the ISOTEST® on.
If this signal is missing not the battery in the handle but the main supply accumulator
inside the device has to be loaded or changed.
In case you can hear an acoustic signal when you first switch on the main switch but you do not hear one if you second press the safety test button you have to change the battery in the handle.
To change the battery please proceed as described on the back page (step 1 to step 6).



4. Extension bars

Extension bars can be supplied in the following forms:

- With electrode clamping device (Fig. 4.3.b ③) and without electrode clamping device (Fig. 4.3.b ②).
- In lengths of 500 mm and 1000 mm.

There is **NO PROTECTION** against flash-overs, neither in the area of the screwed section on the handle of the ISOTEST® unit not in the area of the screwed section of the extension bar.
If for technical reasons it is not possible to exclude the possibility that the tester could come into contact with the extension bar, then only the hand protection ⑥ that is delimited by two plastic rings is to be used. (See Fig. 4.3.a)

Dampness and dirt on the extension bars and the handle can cause flash-overs.

The extension bars and the handle of the ISOTEST® unit must therefore be kept completely clean and dry. This applies in particular if contact by the tester cannot be excluded completely.

In addition, the extension bars must be checked for mechanical damage each time before they are used.

In the simplest case, an extension bar is connected with an electrode clamping device to the handle of the ISOTEST® unit (Fig. 4.3.a). When doing this, it is necessary to ensure that the plastic tube at the end of the extension bar is firmly attached to the plastic nut of the handle. A locator tube ④ must be screwed into the extension bar.

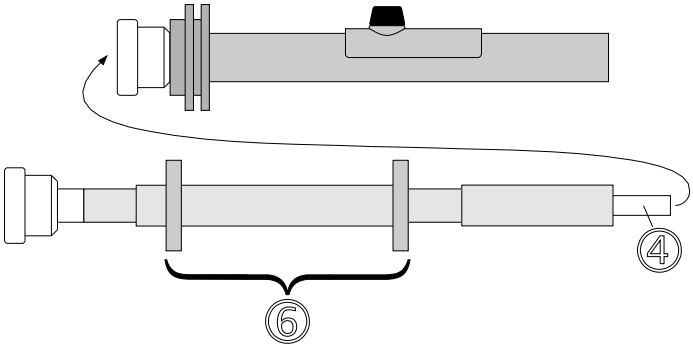


Fig. 4.3.a

Extension bars are connected **to each other** without a locator tube by screwing them inside each other (② and ③ in Fig. 4.3.b). The extension bar ② coupled to the handle ① only requires to be provided with a locator tube ④. The locator tube is only screwed into the extension bars and can be changed easily.

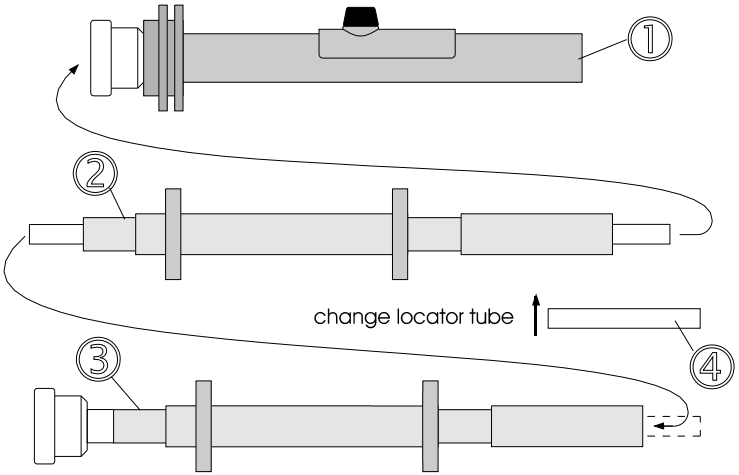
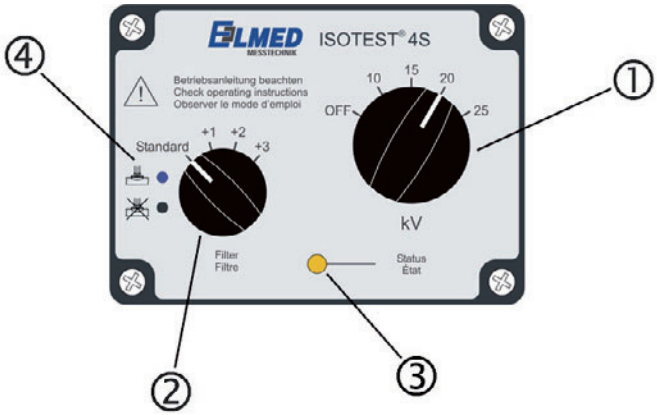
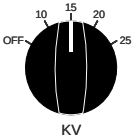


Fig. 4.3.b

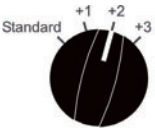
Overview of controls



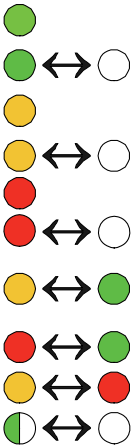
① Test voltage



② Filter settings

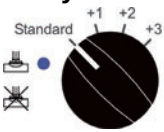


③ Operating condition

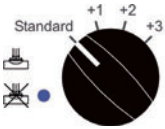


- **Unit turned on**
- **Battery discharged**
- **High voltage enabled**
- **Overload**
- **Pinhole**
- **Error (refer to checklist)**
- **Missing grounding plug**
- **Maintenance schedule**
- **Spark gap error**
- **Energy saving mode**

④ Safety mode



ON



OFF

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