C O N T E N T S

ISOTEST 3P-F - Special Model

In this special model, the test voltage is set with a micro-drive. This gives a higher degree of precision, particularly with low test voltages. For technical reasons, the test voltage is limited to 25 kV.

In this manual, the designation **3P(-F)** stands for tester model **3P** as well as for model **3P-F**. Type **3P-F** is mentioned specifically only where there are deviations between the two models.

1 Introduction

1.1 Safety Instructions

The following instructions are given for **your** safety.

Due to the fact that operation of the ELMED ISOTEST is so simple, there is a great temptation to use the tester without reading the operating manual.

!	Nevertheless, **for your own safety**, take a few minutes to read the manual before switching on the tester for the first time.	**!**

Failure to follow the operating instructions, and especially any information concerning safety, can lead to accidents and resulting injuries.
Before starting up the ISOTEST unit for the first time, check the working area for possible obstacles and sources of danger (e.g., risk of tripping over). Accidental contact with a high voltage and consequent uncontrollable behaviour should not lead to the tester being placed at risk. This applies in particular when working from ladders and scaffolding.
When checking coatings within narrow tank or containers be sure to follow the safety orders (e.g. safety guard).
Additional precaution is necessary when working with high voltage extension cables and extensions rods, which do not have a contact protection against electric shock hazard at the coupling link.

It is necessary to ensure through the use of suitable test electrodes a test procedure which does not require any further contact of the test electrodes during the test operation (e.g. guiding the test electrodes ”by hand” when testing drilled holes).

ATTENTION

It is possible that radio equipment or mobile phones will not work properly or are subject to interference if they are in the vicinity of an ISOTEST high voltage test unit that is in operation. In such a case it is necessary to cease operation.

In general, ISOTEST units should be switched on only for as short a time as possible.

Only suitably instructed personnel may work with the ISOTEST unit.

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 item 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

CAUTION !!

Before fitting or changing the test electrode

- Turn off the tester at the main switch
- The safety button on the handle must not be pressed.

Do not reach beyond the red safety insulator after the tester is turned on.
The same applies to electrodes plugged into the handle. As an unintentional activating of the safety button (e.g. when changing the electrode) would cause the risk of an electric shock.

Before putting the tester into operation, always check the following parts:

- The handle for dirt and moisture
- The proper function of the safety button
- The high-voltage cable for mechanical damage

On no account may the plugs on the battery leads be short-circuited in order to avoid

- The risk of fire, and
- Destroying the battery

Even a brief short-circuit can result in the destruction of the battery and is not a suitable method for checking the state of battery charge.

CAUTION !!

Should any work be necessary on the tester, this should only be carried out by trained specialist personnel.
Particular care is necessary as opening the tester exposes the user to voltages which are considerably higher than the supply voltage.

1.2 General Characteristics

Both tester series 3P with a fixed test high voltage and series 3P(-F) testers with infinitely variable test high voltage up to 35 kV are characterised by the following features:

- Maximum safety by safety buttom and patented ground plug control.
- The possibility of testing all non-conductive and barely conductive materials for leaks and pores.
- The extremely short high-voltage pulses ensure that even the smallest pore (channels) and flaws are reliably detected and indicated.
- Thanks to the high pulse repetition frequency, testing speeds of up to 250 mm/s are possible.
- The test high voltage is set using a sphere gap in accordance with VDE 0433.
- The constant adaptation of the power supply by the control electronics guarantees a constant output voltage even under widely differing load conditions.
- Assuming proper use of the tester, residual charges on the test object can be neglected thanks to the very brief unipolar pulses.
- Material testing is completely non-destructive. The load on the sheath material is minimised by the very brief pulses.
- Thanks to the sturdy design in conjunction with proven technology, the tester is suitable for use under the arduous working conditions on construction sites.
- More than 40 years of experience in the field of high-voltage testing are your guarantee of proven and advanced technology.

1.3 First Steps

The following steps are necessary when switching on the tester:

- Insert the battery into the battery compartment and connect the plugs to the corresponding sockets.

> **!** Connection of the incorrect plugs and sockets is ruled out by the different plug diameters **!**

- Close the battery compartment.
- Make the earth connection between tester and test specimen (otherwise the tester will emit a continuous buzzer tone and will not function, see 2.3 and Checklist point 3.
- Insert the test electrode into the screw fitting on the handle.
- On tester version 3P(-F) with variable test voltage, set the desired test voltage (see 1.3.1).

> **!** On tester version 3P with fixed test voltage, the test voltage is fixed so that setting is not necessary. **!**

- Turn on the tester main switch (short buzzer tone).
- Press the safety buttom on the handle.

> **!** **CAUTION!** **!**
> The buzzer now sounds briefly to indicate that the set high voltage is now connected to the test electrode.

1.3.1 Setting the Test High Voltage

> **!** This section applies only to 3P(-F) testers with variable test voltage. **!**

The required test voltage level is set via a rotary scale ③ ④ ⑤ (see figure). The display on the rotary scale is given in millimetres (corresponding to the distance between the spheres in the sphere gap). In order to set a given *voltage* (in kV), the corresponding *distance* (S in mm) must be read off from the chart ① alongside the rotary knob. **Caution!** The scale is different on the 3P-F.

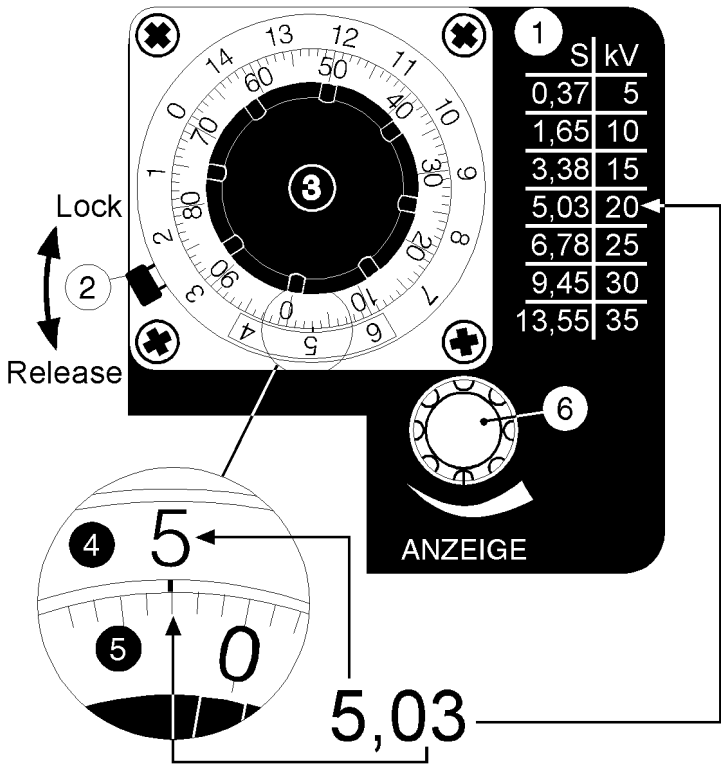
Subsequently release the lock of the rotary knob by moving lever ② in a counter-clockwise direction.

Setting is now carried out with the black inner part of rotary knob ③. The numeric value before the comma (decimal point) must appear in the window ④ of the rotary knob, the numeric value after the comma must be set with the inner ring ⑤ (linked to the black knob).

After setting, lock the rotary knob again by moving lever ② in clockwise direction.

If a voltage value is to be set which is not listed in the chart on the tester, the corresponding setting can be determined from the tables in the Annex (see page 26).

> **!** **CAUTION!** **!**
> The setting range of the rotary scale is limited mechanically below the value 0.0 and above the value 13.55. Forcible turning beyond these values will result in destruction of the rotary scale.



1.3.2 Setting the Display Sensitivity

Reducing the display sensitivity has no effect on the voltage set.

The ”Display” setting knob ⑥ allows the display sensitivity to be adjusted to match the various load and test conditions. This also allows barely conductive coatings or damp and dirty surfaces to be tested in safety. The setting can be made continuously or in four steps, according to the configuration.

Before starting testing, the ”Display” setting knob ⑥ should be set to the most sensitive level (counter-clockwise). If a continuous tone is heard after starting up and when the electrode is applied, the display sensitivity can be reduced by turning the setting knob clockwise until the continuous tone stops (see Checklist section C.1.2.).

1.4 Functions of the Safety Button

The safety button has two switching points:

- **Switching point - 1 -**

Pressing the safety button after switching on the main switch with ”normal” pressure activates the high voltage. The operating state is indicated by a short buzzer tone. If the safety switch is pressed while switching on the main switch, the alarm signal is given and the high voltage is not activated. Operation is only possible once the main switch has been turned off and back on again.

- **Switching point - 2 – (If safety function activated)**

If the safety button is pressed harder than usual (e.g. due to the tester squeezing it convulsively as a result of contact with the high voltage), the unit is switched off at once. This switching off is indicated by an alarm signal and can only be stopped by

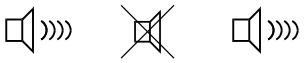
turning the unit off at the main switch.

Do not wrap adhesive tape around the safety button, as this will cause the extra battery in the handle to discharge itself.

1.5. Activating / deactivating of the safety function ” second switch step” of the safety switch at the handle

Depending on the specific operating conditions the ISOTEST can be run in two different operating modes.

- The second step of the safety switch is **not** activated. When turning on the ISOTEST at the main switch you will hear the following acoustic signal:



long short long

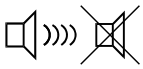
- The second step of the safety switch is activated (additional safety function). When turning on the ISOTEST you will hear the following acoustic signal:

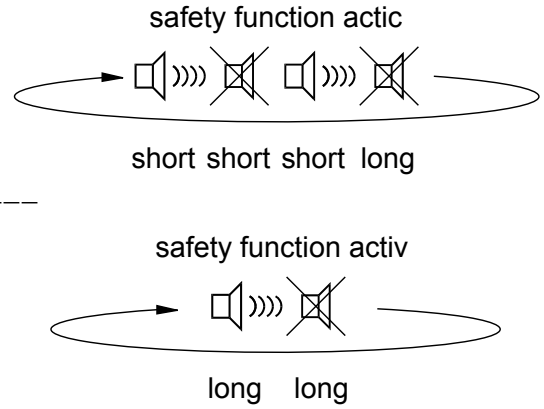
long short short short short

! When delivered ex works the second switch step of the safety switch is *not* activated !

How to change the operating mode:

The earthing plug must be pushed into the earthing socket up to the stop.
Switch off the Isotest at the main switch
Keep the safety switch pressed (switch step one (1)) while turning the Isotest on again.


As soon as the acoustic signal stops stop pressing the safety switch immediately.
As a receipt you will hear the acoustic code of the activ operation mode.
Keep the switch pressed (switch step one (1)) for app. three seconds. 
 signal stops
Stop pressing the safety switch
Now you will hear the acoustic code of the newly chosen operating mode.
Switch off the Isotest at the main switch
The Isotest will stay at the last chosen mode even when turning it off and on.



2 Acoustic Signals during the Test Procedure

During examination of the test object, the ISOTEST tester indicates pores and impermissible operating statuses by distinctive acoustic signals.

2.1 Flaw (Pore)

A flaw (pore) detected during scanning of the test object with the test electrode is signalled by a buzzer sounding. A flaw can also be clearly recognised optically by the bundling of the high voltage sparks.

The duration for which the buzzer sounds depends on the size of the flaw and the test speed.

2.2 Exhaustive Discharge Protection of the Battery

All Type 3P(-F) testers have a special electronic system which detects when the battery voltage has dropped below a preset value and indicates this by the buzzer sounding continuously when the tester is switched on.

The measure prevents a damaging exhaustive discharge of the battery and ensures a reliable function (see Checklist point C.1.2).

2.3 Lack of Earth Connection

> **!** This section must be read particularly carefully as the safe operation and reliable function of the tester are dependent on correct earthing! **!**

The safest and most reliable method of earthing is a direct conductive connection from the metal sheath of the test object to the earth connection of the ISOTEST tester. Wherever possible, direct earthing should always be preferred to all other methods of earthing.

With this method of earthing, first connect the plug of the earthing cable supplied (15 m) to the earthing socket of the tester. In order to prevent unintentional removal of the plug, hook the trigger snap attached to the earthing cable to the metal loop on the leather carrying case.

> **!** In order to minimise the possibility of errors when earthing, the lack of an earthing plug in the earthing socket will be signalled by the buzzer sounding continuously. **!**

The earthing clip on the other end of the cable is now attached to a conducting part of the test specimen. Ensure that the point to which the earthing clip is fastened is metallically bare in order to ensure a reliable connection.

!	A poor of lack of earthing connection can result not only in incorrect measurements but also spark-overs at the safety buttom.	**!**

The test item must be earthed.

Options:
- a conductive connection with earth potential (e.g. the earthed parts of a building)
- an earthing connection by means of an earthing rod

Alternative methods of earthing and possible faults are described in detail in the Checklist under point C.3.1.

2.4 Load Exerted by the Test Specimen

The wide range of possible applications of the ELMED insulation tester can necessitate an adaptation of the display sensitivity to the different loads (see 1.3.2).

Factors for the load area e.g.:

- Type and coat thickness of the insulation
- Different test electrodes
- Size of the test specimen, or
- Moisture.

If an adaptation to the test sensitivity cannot be achieved as described under 1.3.2 (continuous sounding of the buzzer without pore), the load should be reduced by using a different electrode or drying the test object.

2.5 Reminder to Switch Off

The reminder to switch off is activated if the unit is not switched off at the main switch on the unit within 5 minutes of the last operation of the safety button. The buzzer is sounded for 5 seconds and the unit switches into power-saving mode. It can only be used again by turning the main switch off and on again.

2.6 Alarm Signals

The alarm signal is given if:

- the safety buttom (see 1.4) is pressed harder than usual than normal (convulsive movement).

- the safety button was already being pressed when the main switch was turned on.
- a continuous high voltage flash-over lasting for more than 5 seconds occurs.

The alarm signal can only be turned off by turning the main switch off.

2.7 Unique Display of All Operating States

Normal operation:

Unit is switched on (safety switch is **not** activated) 

Unit is switched on (safety switch is activated) 

Test voltage is switched on 

Reminder to switch off after 5 minutes  5 sec.

Continuous tone 

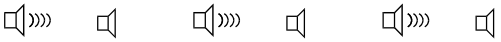
- If the display sensitivity has not been matched to the load and test conditions.
- If there is a flaw (pore).

Warning messages:

Battery empty 

Earthing plug missing 

Safety:

Alarm signal 

- If the safety button is held down harder than normal (convulsive movement).
- If the safety buttom is pressed when the main switch is turned on.
- If a continuous high-voltage flash-over lasts for more than 5 seconds.

The alarm signal can only be stopped by turning the main switch off.


Buzzer


No buzzer

3 Maintenance

In order to ensure the reliability and high standard of quality of your ELMED ISOTEST tester over a prolonged period, it should receive regular maintenance.

The observation of the prescribed maintenance intervals is a major factor in ensuring the functional reliability of the tester and in many cases can prevent the need for expensive repairs. As a reminder, the date of the next inspection is marked on the test label.

Although thanks to their sturdy and proven design, ELMED ISOTEST testers are relatively unsusceptible to faults, the following points should nevertheless be observed:

- Do not expose the tester to high humidity or to wetness.
- Clean the plugs and sockets regularly to avoid dirt.
- Do not allow the high-voltage cable to come into contact with hot or sharp objects.
- Always close the cover of the carrying case to protect the tester.
- Do not throw the ISOTEST tester or expose it to severe knocks or impacts.

3.1 Replacing the Battery in the Handle

Even in case of regularly use the battery inside de the handle should last several years.
Before changing this battery be sure to check the following: Do you hear an acoustic signal when turning the ISOTEST on at the main switch?
If that signal is missing not the little battery but the power supply accumulator has to be changed instead. Only if you receive a signal when switching the ISOTEST on but no second signal when pressing the black safety button on the handle (and therefore no high voltage for testing) the battery has to be changed. A detailed description how to change the battery is included within each spare battery set.

A Annex

A.1 Technical Data

A.1.1 Power Supply

Supply voltage:	NC battery 6 V / 6 Ah Pb battery 6 V / 6.5 Ah
Power consumption:	1 - 2 amperes

Test duration

- During continuous operation: approx. 3 hours
- During cyclic operation: approx. 9 hours

A.1.2 Test Voltage

Voltage form:	unipolar pulses
Pulse repetition period:	approx. 10 µs
Pulse repetition frequency:	30 Hz
Current (effective value):	approx. 40 mA

A.1.3 Dimensions and Weights

Length:	280 mm
Height:	235 mm
Width:	100 mm
Length of high-voltage cable:	1500 mm
Weight incl. handle:	4.5 kg
Weight of the battery:	1.0 kg

B Accessories

High quality accessories suitable for the job in question form the basis of safe and rational testing.

In our price list you can find, in addition to the components described below, test electrodes and other accessories for (almost) every application.

We would be glad to advise you for both easy and difficult cases,

02056
9329-0

call us - we are well known for being knowledgeable and flexible

Overview of accessories (more in our illustrated price list)

Test electrodes	Flat brush electrodes (brass / stainless steel / conductive rubber)
	Bristle-type brush electrodes in high-quality stainless steel
	Stainless steel spiral electrodes
	Semi-circular brush electrodes
	Insulated handle for large semi-circular brush electrodes
	Round electrodes for internal insulation
	Round brush electrodes
	Extension rods
	High voltage extension cable
Earthing accessories	Trailing grounding cables
	Earthing stick
	Earthing collar
Power supply	Spare battery
	Charger units

Transport boxes for ISOTEST and accessories

High-voltage pulse-type voltmeter HV40

ISO AUTOMAT P2 for stationary tests

B.1 Charger Units

B.1.1 Forms of Charger Units Available

A number of different charger units are available to recharge the batteries of the units. These only differ in the type of power supply

- Universal charger 6 V / 600 mA for main voltage 220/230 V ~
- Universal charger LG24 6 V / 600 mA for DC 24 V =

B.1.2 Types of Battery

Two different types of battery can be used as power sources for ISOTEST units:

- Nickel-cadmium (NiCd) battery 6 V / 6 Ah (no longer supplied!)
  Connection with two separate plugs
- Lead-acid (Pb) battery 6 V / 6.5 Ah
  Connection with two-pole plug

The various types of batteries are substantially equivalent to each other, Lead-acid batteries are, however, less complicated in terms of charging: unlike NiCd batteries, an already charged lead-acid battery is not harmed by multiple charging operations. The well-known effect of a loss of capacity in the case of NiCd batteries if they are constantly recharged after partial discharge does not occur with lead-acid batteries.

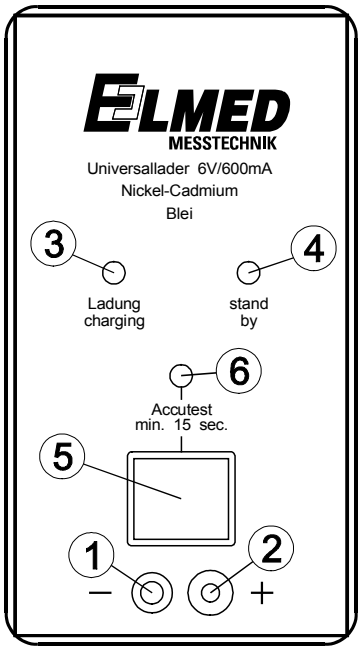
However, lead-acid batteries should never be fully discharged. If the buzzer on the ISOTEST unit is sounded to indicate that the battery voltage is too low, the battery should either be replaced immediately by a fully charged one or else the battery in use must be recharged.

B.1.3 Connecting the Battery to the Charger Unit

The battery must be taken out of the unit to allow it to be charged or its capacity to be checked. Do this by opening the battery compartment, undo the plug(s) and lift the battery out of the unit by the loop (Pb battery) or **carefully** by the connecting cables (NiCd battery).

Both the single plug of the NiCd battery and the two-pole plug of the Pb battery have contacts of different sizes to prevent them being connected incorrectly. In the case of the NiCd battery, connect the minus cable (blue) with the left bare metal socket ①, and the pulse cable with the right-hand red socket ② of the charger. In the same way, the two-pole plug of the Pb battery can only be connected to the cable outlet on the charger unit.

In order to prevent damage to 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.

B.1.4 Charging the Battery

Connect the charger unit with the battery connected to the power source (mains or 24 V source); the red *Ladung/charging* ③ indicator light comes on and the charging process begins. The red indicator light goes out at the end of the charging time and the green *stand by* ④ light comes on. The battery now has only a very low charging current applied to it to counteract self-discharge.

Warning: the charging process starts again (14 hours) if the charger unit is disconnected from the power source, if the battery is taken out of the charger unit or if there are any interruptions in the power supply.

B.1.5 Testing the Current State of Charge

The charging state of the battery can be tested by pressing the *Accutest* ⑤ button. The button must be held down for at least 15 sec. to give reliable results. The yellow indicator light ⑥ (in the battery symbol) shows the state of charge as follows:

Yellow indicator light	does not come on	flashes or comes on continuously
State of charge	discharged, <90% capacity	charged, >90% capacity
Charging recommendation	charge for 14 hours	charging is not necessary

Further charging of an already charged battery is less harmful for lead-acid batteries than for nickel-cadmium batteries. Unnecessary charging should be avoided in any case.

B.1.6 Technical Data

Charger Unit	Standard for mains use	LG24 for low voltage use
Power supply:	230 V/50 Hz	24 V =
Power rating:	4.3 VA	max. 1 A
Charging:	600 mA max. 7.2 V for 14 hours	600 mA max. 7.2 V for 14 hours
Holding charge:	50 mA	50 mA
Types of battery:	Nickel-cadmium and lead-acid batteries 6 V/6.5 Ah	Nickel-cadmium and lead-acid batteries 6 V/6.5 Ah

B.3 Extension Rod

Extension rods 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.

Warning !

There is **NO PROTECTION** against flash-overs, neither in the area of the screwed section on the handle of the ISOTEST unit nor in the area of the screwed section of the extension rod.

If for technical reasons it is not possible to exclude the possibility that the tester could come into contact with the extension rod, then only the hand protection ⑥ that is delimited by two plastic rings is to be used. (See Fig. 4.3.a)

Important !

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

The extension rods 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 rods must be checked for mechanical damage each time before they are used.

In the simplest case, an extension rod 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 rod is firmly attached to the plastic nut of the handle. A locator tube ④ must be screwed into the extension rod.

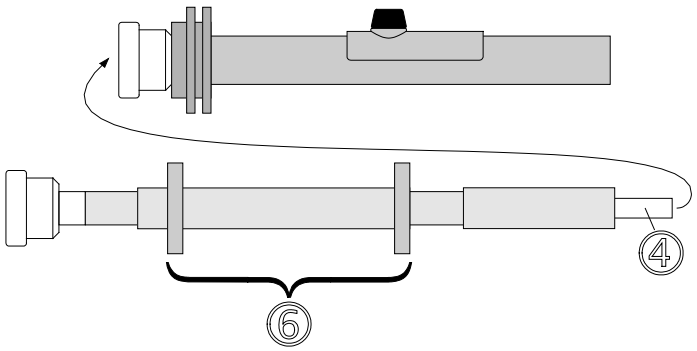


Fig. 4.3.a

Extension rods 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 rod 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 rods and can be changed easily.

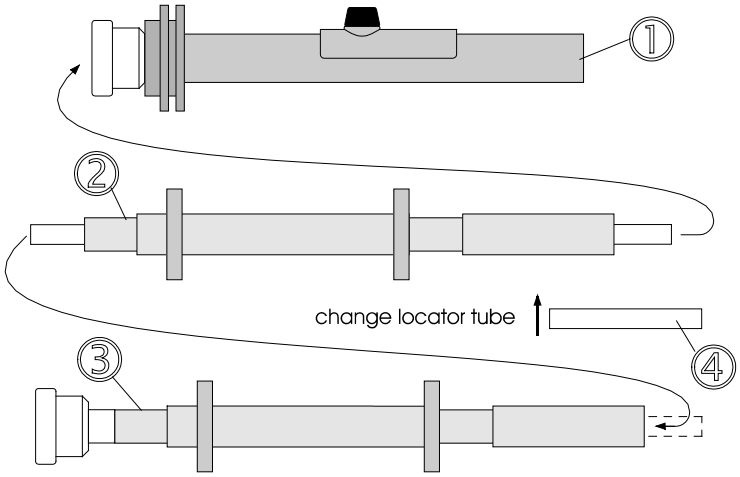


Fig. 4.3.b

Checklist

for the Supervision of Insulation Tests
(to DIN 30 672) using the ELMED ISOTEST.

C.1. Test of Readiness for Operation

C.1.1 Battery (Varta 5M6 6 V/6 Ah or Sonnenschein 6 V/6.5 Ah)

Has the battery state of charge been checked correctly?
This test can be performed using the ELMED battery charger (see operating manual for the battery charger).

C.1.2 Meaning of the Acoustic Signals

A brief buzzer sound when the test button is pressed indicates that the tester is ready for operation. A brief buzzer sound is heard when the main switch of the ISOTEST 3P is turned on.

FAULT

Buzzer does not sound when the test button is pressed.

CAUSE	REMEDY
Main switch on tester has not been turned on.	Turn main switch to ON or I
No battery installed in tester	Install battery
Battery discharged	Replace battery or inspect old battery and recharge.
Defective fuse in battery	Replace fuse.
Fuse blown	Check fuse (VT/VRT only) and replace, if necessary
Technical defect in the tester	Send in tester for inspection

Only for the ISOTEST 3P

Battery in handle is flat	Replace battery
..., if the unit had not been switched off within 5 minutes of the last time that the safety bottom was operated. It can only be put back into operation by switching the unit off and then on again.	

FAULT

A warning sound is given when the safety button is pressed	
CAUSE	REMEDY
Idle - no electrode contact with the test specimen	
No or incorrect earthing connection	The earthing plug must be pushed into the earthing socket up to the stop. There must be no material from the leather carrying case between plug and socket.
Battery charge too low ELMED ISOTEST testers are equipped with exhaustive discharge protection	Replace battery or inspect old battery and recharge.
During the test - with test electrode in contact with the test specimen	
Excessive energy flow e.g. due to moisture	Reduce the display sensitivity at the adjustment knob until the continuous signal stops. The reduction in the display sensitivity has no effect on the level of the set voltage!!

Only for the ISOTEST 3P

If the safety button is pressed while the main switch was being turned on	• Turn off main switch • Switch on again without pressing the safety switch.
If the safety button is pressed too hard.	• Switch the unit off and on again. • Only press the safety buttom after the first pressure point.
Continuous high-voltage flash-over lasting more than 5 s.	• Switch the unit off and on again. • Avoid continuous flash-overs.

In other cases, a "continuous buzzer" is the signal for a detected flaw in the test specimen!

C.2 Test Voltage

C.2.1 Check whether the test electrode has high voltage as follows:

Switch on the tester and hold the test button depressed. When the electrode is now earthed, a continuous spark-over must occur. The buzzer sounds continuously.

C.2.2 Is the test voltage correctly set?

DIN 30 672, section 5.5.5, prescribes:
The test voltage is 5 kV + 5 kV per mm of coat thickness.
Caution: Beware of overlapping areas of resheathings or works sheathings.
In the case of polyurethane-tar or epoxy resin coatings, observe DIN 30 667 and the manufacturer's instructions.

C.2.3 Is the test voltage monitored with a sphere gap?

DIN 30 672, section 5.5.5, prescribes a sphere gap as obligatory. Point gaps are particularly susceptible to changes in atmospheric pressure and humidity and can, under certain circumstances, result in seriously incorrect settings of the test voltage. ELMED testers have an automatic control system with integral sphere gap. The function of the sphere gap can be heard as a light tapping sound in the tester or test rod. Monitoring of the test voltage using a separate measuring spark gap is not necessary thanks to the continuous self-calibration of the test voltage.

C.3 Earthing

In general, a safe and reliable test is only possible with proper earthing. An incorrect or faulty earth can, under certain circumstances, result in electrisation of the tester. This can be ruled out with proper use and earthing of the tester.

Earthing requires in general a good conductive connection to the ground!

- The test object must be earthed. If in doubt, an earth connection must be made by means of an earthing rod.
- The ISOTEST unit also must be earthed, either by connecting it to an earthed test object or by means of a trailing earthing cable.

C.3.1 Methods of Earthing

The conductive connection between the object to be tested and the ISOTEST can be created in various ways.

C.3.1.1 Direct Connection (Earthing) Between Test Object and ISOTEST

With this method of earthing, the earthing cable supplied (15 m) is connected to the tester via the earthing plug (see section C.3.1.2). The earthing clip at the other end of the earthing cable is now attached to a conductive part of the test specimen. Ensure that the point to which the earthing clip is fastened is metallically bare in order to ensure a reliable connection.

C.3.1.2 Indirect Earthing With an Earthing Rod and Trailing Earth

Sometimes it is not possible to produce a direct connection between the ISOTEST and conductive parts of the test object.

If the earth connection to the test object is a very long way away or is very difficult to gain access to, as in the case of a train of pipes that is completely covered in cladding, the earthing connection to the ISOTEST can probably be produced indirectly via the ground:

Test object ➔ (conductive) ground ➔ ISOTEST

Indirect earthing can only be used if there is no doubt at all that the section of the test object to be checked is genuinely well connected conductively to the earthed end.
In the case of insulated sections between individual pipes it is only possible to use indirect earthing if the segment to be tested is connected to the ground!

The individual steps for indirect earthing

- The test object is connected to the ground at a convenient point by means of an earthing rod. Clamp the earthing pincers of the earthing rod to a bare metal point on the test object and drive the earthing rod into the ground as far as possible.
- Connect a trailing earthing cable to the ISOTEST. Insert the plug on the end of the trailing earth cable into the earthing socket of the ISOTEST and spread the entire length of the trailing earth cable out on the ground.

FAULT	REMEDY
Reduced conductivity of the ground due to wooden boards, insulating materials, asphalt surfacing or extremely dry soil.	If possible employ "direct earthing", see C.3.1.1, or draw trailing earth over conductive ground (see figure on next page). Bridge the poorly conductive ground with a second earthing rod and earthing cable
Insufficient contact area between the trailing earth and the ground.	Use *ELMED* trailing earths. They consist of 6.5 m long bronze double coils for optimum earthing. Do not use "home-made" earths!
The ISOTEST tester is earthed, but not the test specimen.	Connect the test specimen to the ground using the earthing rod. Use only *ELMED* earthing rod supplied. Do not use "home-made" earths!
Poor conductive link between the test specimen and the ground.	In view of the ground conditions (sand, extremely dry or stony soil) it can be expedient to soak the point at which the earthing rod is inserted into the ground with water. Clean point at which the earthing clip of the earthing rod is connected to the test specimen (metallically bare).
Pipe, tank, etc. is supported on blocks or suspended on lifting belts.	Connect the pipe or tank from a metallically bare point to the ground using the earthing rod.
Lines with cathodic protection can be interrupted by insulators.	Earth behind the last insulator or: Direct earthing.
No conductive parts accessible.	Capacitive earth with earthing sleeve.

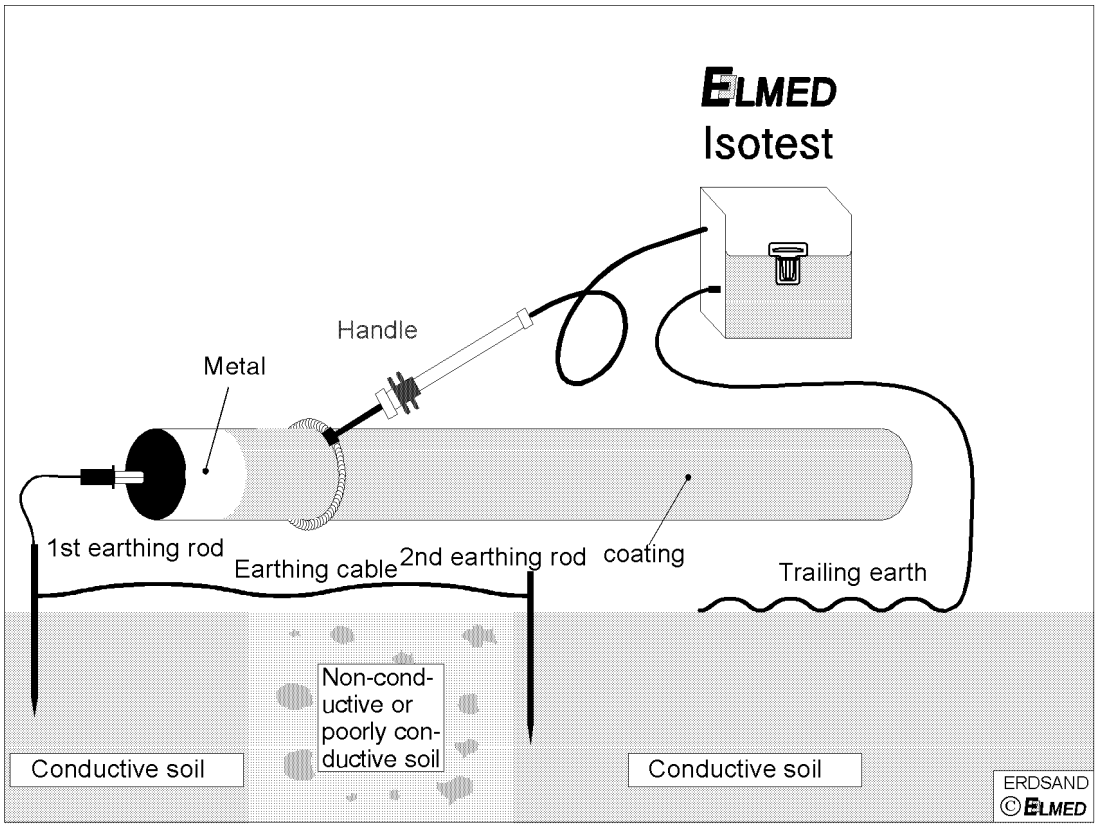


Figure: Trailing earth for non-conductive or poorly conductive soil

All insulated cables (e.g. the supplied earthing cable) are quite unsuitable as trailing earths. This applies even if an iron chain or large nut is attached to the end.

C.3.1.3 Special Forms of Earthing

If, due to the confines of the process, earthing as described in section C.3.1.1 and C.3.1.2 is not possible, it is possible to use a capacitive earth. Since in such cases, conditions specific to the particular application have to be taken into consideration, please contact *ELMED* beforehand in order to enable us to recommend a solution tailored to your particular application.

If no conductive parts are accessible on the test object, a capacitive earth can be produced by means of earthing sleeves.

C.4 Test Procedure

C.4.1 Is an Automatic Controller Installed in the Tester?

If the tester does not have an automatic controller, the test voltage set under no-load can drop to extremely low values due to capacitor effect, creeping discharges and pipe moisture.
The fact that individual flaws may nevertheless be indicated does not mean that all the flaws are actually being detected. ELMED ISOTEST testers have an integral

sphere gap and an automatic controller which hold the preset voltage constant even under load.

C.4.2 Are the Test Electrodes in Order as per DIN 30 672, Section 5.5.5?

C.4.2.1 Has a spiral electrode appropriate to the pipe diameter been selected?

The electrode must be flush on all sides. It must not sag, as this will result in incorrect measurements.

C.4.2.2 Has a test brush appropriate to the pipe diameter been selected?

The electrode must be in contact with the pipe over the full brush surface. Gaps between pipe and brush will result in incorrect measurements.

C.4.2.3 Are the brush electrodes solid brushes?

Thanks to their higher stability, solid brushes with continuous brush cover can ensure the necessary full contact with the pipe surface over a long period of operation. Electrodes with only individual bunches of bristles can easily result in incorrect measurements due to bent bristles.

C.4.2.4 Are the brushes still in order?

Even the best brushes wear after a time. Worn or severely bent bristles lead to the above-mentioned gaps and thus to incorrect measurements. Install new brushes!

C.4.2.5 Do not use brush electrodes with plastic guide wheels!

Non-conductive plastic guide wheels can mask point flaws and thus result in incorrect measurements.

C.4.3 Special Tests

C.4.3.1 Subsequent Testing of Contact Surfaces, Slide Valves, etc.

Spirals or round brushes cannot be used to test contact surfaces of supporting belts, supports, branches, slide valves, etc. A separate test with flat brush electrodes is necessary here.

C.4.3.2 Correct Testing of Socket Pipes

The insulation of the insertion end of pipes for socket connections applied at the factory mean that there is no conductive connection between the two pipes. The last pipe laid can be easily earthed with the earthing cable of the tester, but not the last pipe but one. This is of significance particularly during the examination of the subsequent socket insulation. In such cases, capacitive earthing can be expediently employed (see section C.3.1.3).

D Tables for Intermediate Values of the Test Voltage

! For standard model only !

3P

kV	S	kV	S	kV	S	kV	S
5.0	0.37	10.0	1.65	20.0	5.03	30.0	9.45
5.5	0.47	11.0	2.02	21.0	5.37	31.0	10.04
6.0	0.56	12.0	2.36	22.0	5.69	32.0	10.70
6.5	0.67	13.0	2.71	23.0	6.03	33.0	11.45
7.0	0.79	14.0	3.05	24.0	6.39	34.0	12.35
7.5	0.92	15.0	3.38	25.0	6.78	35.0	13.55
8.0	1.05	16.0	3.71	26.0	7.26		
8.5	1.20	17.0	4.02	27.0	7.77		
9.0	1.35	18.0	4.35	28.0	8.30		
9.5	1.51	19.0	4.71	29.0	8.86		

! For testers with micro-drive only !

3P-F

kV	S	kV	S	kV	S
2.5	0.36	10.0	2.78	20.0	8.43
3.0	0.41	10.5	3.07	21.0	8.99
3.5	0.46	11.0	3.36	22.0	9.58
4.0	0.52	11.5	3.65	23.0	10.21
4.5	0.57	12.0	3.93	24.0	10.87
5.0	0.62	12.5	4.23	25.0	11.58
5.5	0.78	13.0	4.52		
6.0	0.93	13.5	4.80		
6.5	1.12	14.0	5.08		
7.0	1.32	14.5	5.36		
7.5	1.53	15.0	5.64		
8.0	1.75	16.0	6.18		
8.5	2.00	17.0	6.70		
9.0	2.25	18.0	7.25		
9.5	2.52	19.0	7.85		