C O N T E N T S

Isotest II RT-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 **II RT(-F)** stands for tester model **II RT** as well as for model **II RT-F**. Type **II RT-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.	**!**

!	**Important note for wearers of a** **heart pacemaker**	**!**

For safety reasons, wearers of a heart pacemaker should not operate an insulation tester and in particular should avoid contact with the test electrode, the tested pipe and/or the earth cables, irrespective of the type of heart pacemaker or insulation tester.

The influence of insulation testers on heart pacemakers has not yet been scientifically investigated.

CAUTION !!

Before fitting or changing the test electrode
- Turn off the tester at the main switch
- The safety switch on the handle must not be pressed.

Before putting the tester into operation, always check the following parts:
- The handle for dirt and moisture
- The proper function of the safety switch
- 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 II T with a fixed test high voltage and series II RT(-F) testers with infinitely variable test high voltage up to 35 kV are characterised by the following features:

- Efficient, safe and reliable testing of coatings or sheathings of a wide range of different types and thicknesses.
- 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 (see 2.2), 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 II RT(-F), set the desired test voltage (see 1.3.1).

> **!** On tester version II T, the test voltage is fixed so that setting is not necessary. **!**

- Turn on the tester main switch.
- Press the safety switch 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 II RT(-F) testers with variable test voltage. **!**

The required test voltage level is set via a rotary scale Ì Í Î (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 Ê alongside the rotary knob. **Caution!** The scale is different on the II RT-F.

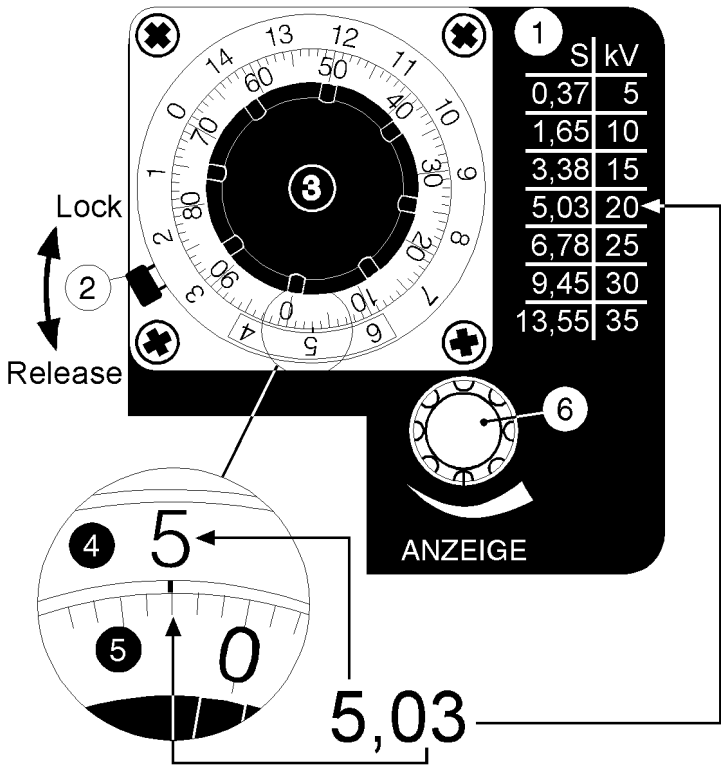
Subsequently release the lock of the rotary knob by moving lever Ë in counter-clockwise direction.

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

After setting, lock the rotary knob again by moving lever Ë 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 20).

> **!** **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

Adjust the display sensitivity to the different load and testing conditions with adjustment knob "Anzeige" Ï . There are four levels for setting.

If, after commissioning the tester and inserting the test electrode, a continuous buzzer sounds, reduce the display sensitivity by turning the adjustment knob in clockwise direction until the continuous buzzer stops (see Checklist point 1.2).

!	The reduction in the display sensitivity has no influence on the level of the set voltage.	**!**

2 Acoustic Signals during the Test Procedure

During examination of the test object, the Isotest tester indicates pores and impermissible operating statuses by means of 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 II T/II RT(-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 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 switch. **!**

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

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.

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:	25 - 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

Checklist

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

1. Test of Readiness for Operation

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).

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.

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.
Fuse blown	Check fuse (VT/VRT only) and replace, if necessary
Technical defect in the tester	Send in tester for inspection

FAULT

Buzzer sounds continuously when the test button is pressed.

CAUSE	REMEDY
No or incorrect earthing connection *(valid only for testers with plug-in earth connection:* *ISOTEST Type II T / II RT from Serial No. 14796* *ISOTEST Type VT / C-VRT from Serial No. 21 000* *or from October 1991*	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.
Idle - no electrode contact with the test specimen	
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!!

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

2 Test Voltage

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.

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.

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.

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.

3.1 Methods of Earthing

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

3.1.1 Direct connection (earthing) between test objective and Isotest

With this method of earthing, the earthing cable supplied (15 m) is connected to the tester via the earthing plug (see section 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

3.1.2 Indirect earthing with the earthing rod and trailing earth

With this method of earthing, the test specimen is connected to the ground at an accessible and metallically bare point using the earthing rod. (Push the earthing rod as far into the ground as possible.) Connect the earthing clip to a metallically bare part of the test specimen (pipe, tank, etc.). Ensure that the section to be tested and the earthing point are electrically conductive, i.e. are not connected e.g. via insulators. The connection between the ground and the insulation tester is effected via the trailing earth, whereby the earthing plug of the trailing earth is connected to the earthing socket of the Isotest.

As, from experience, we know that problems are frequently encountered with the indirect earthing method, the following table contains a list of the possible faults and their remedies:

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 3.1.1, or draw trailing earth over conductive ground (see figure on page 17). Bridge the poorly conductive ground with a second earthing rod and earthing cable (see sketch, page 5).
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.

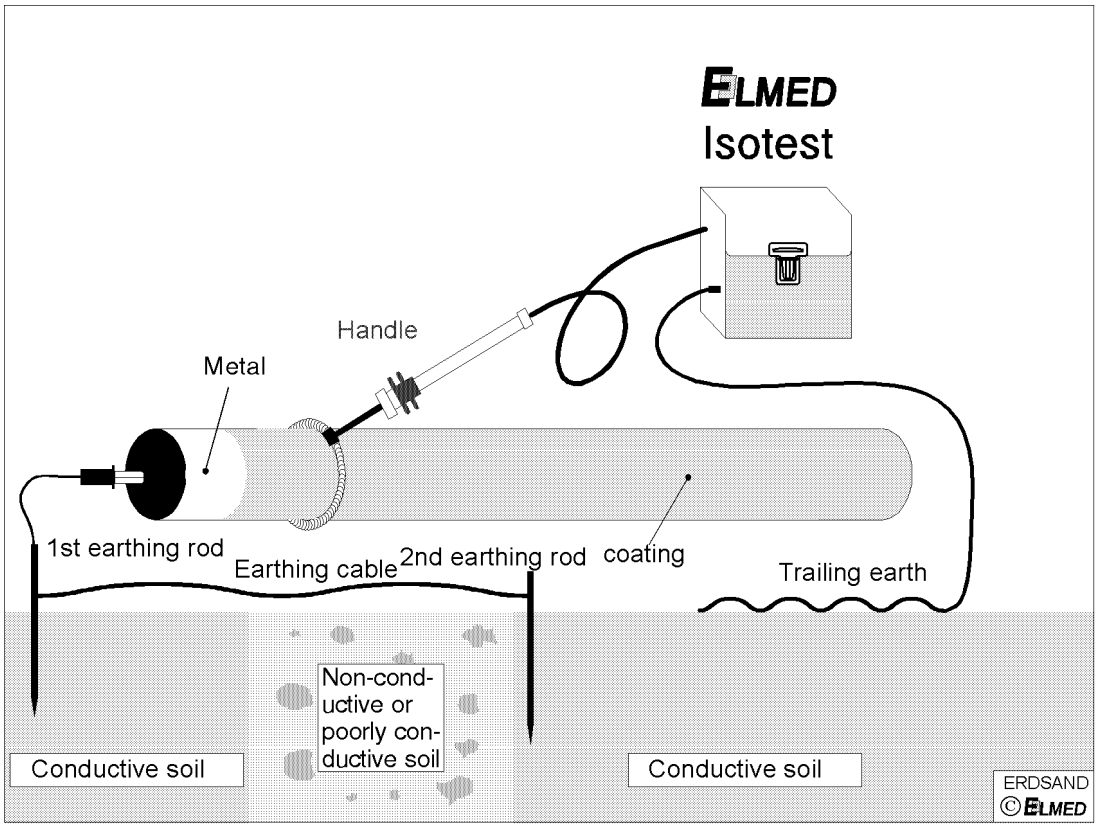


Figure: Trailing earth for non-conductive or poorly conductive soil

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.

3.1.3 Special forms of earthing

If, due to the confines of the process, earthing as described in section 3.1.1 and 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.

4 Test Procedure

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.

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

4.2.1 Has the 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.

4.2.2 Has the 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.

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.

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!

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.

4.3 Special Tests

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.

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 3.1.3).

C Tables for Intermediate Values of the Test Voltage

! For standard model only !

II RT

kV	S	kV	S	kV	S	kV	S
5.0	0.37	10.5	1.84	16.0	3.71	26.0	7.26
5.5	0.47	11.0	2.02	17.0	4.02	27.0	7.77
6.0	0.56	11.5	2.19	18.0	4.35	28.0	8.30
6.5	0.67	12.0	2.36	19.0	4.71	29.0	8.86
7.0	0.79	12.5	2.54	20.0	5.03	30.0	9.45
7.5	0.92	13.0	2.71	21.0	5.37	31.0	10.04
8.0	1.05	13.5	2.88	22.0	5.69	32.0	10.70
8.5	1.20	14.0	3.05	23.0	6.03	33.0	11.45
9.0	1.35	14.5	3.22	24.0	6.39	34.0	12.35
9.5	1.51	15.0	3.38	25.0	6.78	35.0	13.55
10.0	1.65						

! For testers with micro-drive only !

II RT-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		