

Operating Instructions

UNION Taping Tester



Article Number: 04601099903

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1 Safety instructions

1.1 Warnings and symbols

In the manual, the following names and symbols are used to denote particularly important information:

	 DANGER
	Immediate danger that can lead to serious physical injury or death.

	 Warning
	Potentially hazardous situations that can lead to serious injury or death.

	 ATTENTION
	Potentially hazardous situations that can lead to minor physical injury. This can also be used for property damage.

	NOTE
	Denotes information that can make it easier to handle the UNION taping tester or help prevent property damage.

2 Technical data

The operating data always refer to the newest version of the insulation tester. If discrepancies occur regarding the design of the technical data, please contact the manufacturer giving the 5-digit device number.

If you want to order spare parts, please also specify the 5-digit device number. This prevents incorrect deliveries.

Mains voltage to charger:	230 Volt 50/60 Hz
Mains current:	21 - 30 mA
Mains power consumption:	6.6 Watt
Battery voltage:	12 - 13 Volt
Charging current battery:	approx. 200 mA
Charging voltage with overcharge protection:	14.5 V
Mains capacity battery:	2.2 Ah
Discharge current:	50 - 300 mA
Operating time without re-charging:	8 - 30 hours (endurance test)
Test high voltage:	5 - 30 kV
Test current:	1.5 - 2 mA (peak value)
Test sound:	2800 Hz / 90 dB
Mains connection:	250 V test voltage 2000 Volt
Weight electronics:	3.2 kg
Weight device complete:	3.9 kg

3 EU declaration of conformity



Der Hersteller / The manufacturer

Union Instruments GmbH
Zeppelinstrasse 42
76185 Karlsruhe

erklärt hiermit, dass folgend bezeichnete Produkte / hereby declares, that following named products:

Produktbezeichnung: UNION Isolationsprüfer
Product name UNION Isolationsprüfer

konform ist mit den Anforderungen, die in der EU – Richtlinie festgelegt sind / is compliant with the requirements as defined in the EU directive:

2014/30/EU Elektromagnetische Verträglichkeit
2014/30/EU Electromagnetic compatibility

Angewandte harmonisierte Normen / Used harmonized standards:

EN 61326-1:2013 Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen -
Teil 1: Allgemeine Anforderungen;
Electrical equipment for measurement, control and laboratory use - EMC
requirements - Part 1: General requirements (

Terms on operation the insulation tester:

Terms:

I. Mobile use (different places of application)

1. The operating time of the device in insulation test mode (hand button actuated) should be kept as short as possible. This refers both to corona discharge and to spark discharge in case of faults.
2. Insulation tests must only be performed in the operating mode "battery operation". It must be ensured that no insulation tests are carried out during the battery charging process (connection to the 230 V power supply network).
3. The amplitude of the test voltage must be set to a minimum.

II. Stationary use (same place of application)

1. The device must only be used within industry sites for the production of pipes and tanks and there only within buildings.
Prevention of radio interference beyond the site boundary.
2. In a test run, the operation must determine whether there is interference to radio services (e.g. radio or tv) beyond the boundaries of the site on which the insulation tester is operated. (Enquiry at users of the radio services beyond the site boundary who are closest to the place of application of the insulation tester). If radio interferences occur, further measures must be taken to remedy the interferences.

Measures:

Increasing the distance between place of operation of the insulation tester and the interfered radio reception system, or if that is not possible due to constructional or other constraints.

Performing the insulation tests in a metallically shielded room (e.g. wire cage closed on all sides).

If the operation location of the insulation tester is not closer than 750 metres (for type insulation tester with readjustment: 900 m) to the site boundaries, the measures described are not required. (Test operation, increasing the distance, shielded space).

To avoid interference within the site boundaries:

In a test run it is to be determined whether radio system in the vicinity of the operation location of the insulation tester are subject to interference. If such interferences occur, the measures listed above (increasing the distance, shielded space) are required.

3. Insulation tests must only be performed in the operating mode "battery operation". It must be ensured that no insulation tests are carried out during the battery charging process (connection to the 230 V power supply network).

Name des Dokumentationsbevollmächtigten:

Schlichter

Name delegate of documentation

Adresse des Dokumentationsbevollmächtigten:

siehe Adresse des Herstellers

address delegate of documentation

see address of manufacturer

Bei einer nicht autorisierten Änderung des Gerätes verliert diese Erklärung ihre Gültigkeit. / Any unauthorized modification of the device results in invalidity of this declaration.

4 Introduction and safety instructions



NOTE

In case of complaints, always hand in the cables and the high voltage coil as well!

4.1 Overview for application

Gas and water pipelines as well as underground containers are subject to corrosive influences. The lifetime of the system must be increased by careful insulation. In order to test such insulation for absolute tightness and absence of pores, the UNION insulation tester is required.

The insulation should be tested directly after applying the insulating layer on tanks and pipelines. On the construction site - before covering the containers and pipelines with soil - a test for porous or damaged spots makes most sense. The damaged spots can be closed with insulating material directly after finding them.

The UNION insulation tester can be used anywhere where coatings on a conductive surface are to be tested for tightness. Even wet concrete is suitable as subsurface. Roof paper seals can also be tested on wet wood. Varnish layers on systems or frames are also tested for tightness.

The handy, robust device can easily be operated. The test voltage can be easily adjusted to the test conditions.

There are 3 device types:

- UNION insulation tester type „V“ with freely adjustable spark gap from 5kV to 30kV. Adjustment is done with an additional peak spark gap calibrated with a ball spark gap. This device is used for testing tanks and pipelines when using test brushes and test rollers with small and medium diameter.
- UNION insulation tester with readjustment type „NR“. This device has a fixed test voltage of e.g. 20 kV which is constantly readjusted, even if a voltage drop occurs at the test electrode with large test coils and humid weather. This voltage drop can be 5% and more for devices without readjustment. Adjusting the device before start of the test is not required. Instead of a selector switch it has an on/off switch. It is constantly controlled to the voltage which limits the high voltage coil by a ball spark gap. For every voltage level, a separate high voltage coil is required (e.g. 10kV, 15kV, 20kV, 30kV). Plugging in the high voltage coil with the desired voltage automatically adjusts the control system. This effectively prevents testing with incorrect voltage.

- UNION insulation tester with adjustable readjustment type „VNR“. By a robust mechanic system within the high voltage coil, 6 different readjusted voltages can be set manually. (5kV to 30 kV in steps of 5 kV)

4.2 Important note on operation of the insulation tester

4.3 General safety notes

	 ATTENTION Only trained personnel may work with the insulation tester!
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	 ATTENTION Terms of the EC Certificate of Conformity must be observed without fail! See chapters 4.2, 5 and 3!
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4.4 Notes on specific hazards

	 Warning For safety reasons, persons with a heart pace maker must not work with the insulation tester! Especially they must stay clear from the high voltage handle, the test electrode, the pipe or tank to be tested and the earth cable. This refers to insulation testers with and without readjustment. The impact of insulation testers on heart pace makers has not yet been investigated scientifically.
---	---

	 Warning
	Before every startup of the insulation tester, perform the following checks: • Check handle, electronic parts and test electrode for rough dirt and wetness. • Check the cables of the high voltage coil and earth cable for mechanic damage. • Check that the insulation tester and the object to be tested are correctly grounded.

	 Warning
	Only switch on the device switch immediately before the insulation test. Switch off the device when screwing in the test rod or inserting the test electrode!

4.5 Regular operator training

	NOTE
	Country-specific regulations about regular user training by the operator must be observed, in particular training on handling electrical equipment!

4.6 Workplace hazard analysis



NOTE

Depending on the national regulations, the operator must perform a workplace hazard analysis, if applicable independent of the CE mark for this insulation tester.

Technical developments can give rise to deviations from these operating instructions. If you require additional information or if particular problems arise that are not fully addressed in this manual, please contact the following address:

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5 Terms of operation of the insulation tester

5.1 Terms insulation tester without readjustment type „V“

I. Mobile use (different places of application)

1. The operating time of the device in insulation test mode (hand button actuated) should be kept as short as possible. This refers both to corona discharge and to spark discharge in case of faults.
2. Insulation tests must only be performed in the operating mode "battery operation". It must be ensured that no insulation tests are carried out during the battery charging process (connection to the 230 V power supply network).
3. The amplitude of the test voltage must be set to a minimum.

II. Stationary use (same place of application)

1. The device must only be used within industry sites for the production of pipes and tanks and there only within buildings.

Prevention of radio interference beyond the site boundary.

In a test run, the operation must determine whether there is interference to radio services (e.g. radio or tv) beyond the boundaries of the site on which the insulation tester is operated. (Enquiry at users of the radio services beyond the site boundary who are closest to the place of application of the insulation tester). If radio interferences occur, further measures must be taken to remedy the interferences.

Measures:

Increasing the distance between place of operation of the insulation tester and the interfered radio reception system, or if that is not possible due to constructional or other constraints.

Performing the insulation tests in a metallically shielded room (e.g. wire cage closed on all sides).

If the operation location of the insulation tester is not closer than 750 metres to the site boundaries, the measures described are not required. (Test operation, increasing the distance, shielded space).

To avoid interference within the site boundaries:

In a test run it is to be determined whether radio system in the vicinity of the operation location of the insulation tester are subject to interference. If such interferences occur, the measures listed above (increasing the distance, shielded space) are required.

2. Insulation tests must only be performed in the operating mode "battery operation". It must be ensured that no insulation tests are carried out during the battery charging process (connection to the 230 V power supply network).

5.2 Terms insulation tester with readjustment type „NR“ and type "VNR"

I. Mobile use (different places of application)

1. The operating time of the device in insulation test mode (hand button actuated) should be kept as short as possible. This refers both to corona discharge and to spark discharge in case of faults.
2. Insulation tests must only be performed in the operating mode "battery operation". It must be ensured that no insulation tests are carried out during the battery charging process (connection to the 230 V power supply network).
3. The amplitude of the test voltage must be set to a minimum.

II. Stationary use (same place of application)

1. The device must only be used within industry sites for the production of pipes and tanks and there only within buildings.

Prevention of radio interference beyond the site boundary.

In a test run, the operation must determine whether there is interference to radio services (e.g. radio or tv) beyond the boundaries of the site on which the insulation tester is operated. (Enquiry at users of the radio services beyond the site boundary who are closest to the place of application of the insulation tester). If radio interferences occur, further measures must be taken to remedy the interferences.

Measures:

Increasing the distance between place of operation of the insulation tester and the interfered radio reception system, or if that is not possible due to constructional or other constraints.

Performing the insulation tests in a metallically shielded room (e.g. wire cage closed on all sides).

If the operation location of the insulation tester is not closer than 900 metres to the site boundaries, the measures described are not required. (Test operation, increasing the distance, shielded space).

To avoid interference within the site boundaries:

In a test run it is to be determined whether radio system in the vicinity of the operation location of the insulation tester are subject to interference. If such interferences occur, the measures listed above (increasing the distance, shielded space) are required.

2. Insulation tests must only be performed in the operating mode "battery operation". It must be ensured that no insulation tests are carried out during the battery charging process (connection to the 230 V power supply network).

	 Warning
	Before every startup of the insulation tester, perform the following checks: • Check handle, electronic parts and test electrode for rough dirt and wetness. • Check the cables of the high voltage coil and earth cable for mechanic damage. • Check that the insulation tester and the object to be tested are correctly grounded.

	 Warning
	Only switch on the device switch immediately before the insulation test. Switch off the device when screwing in the test rod or inserting the test electrode!

6 Principle

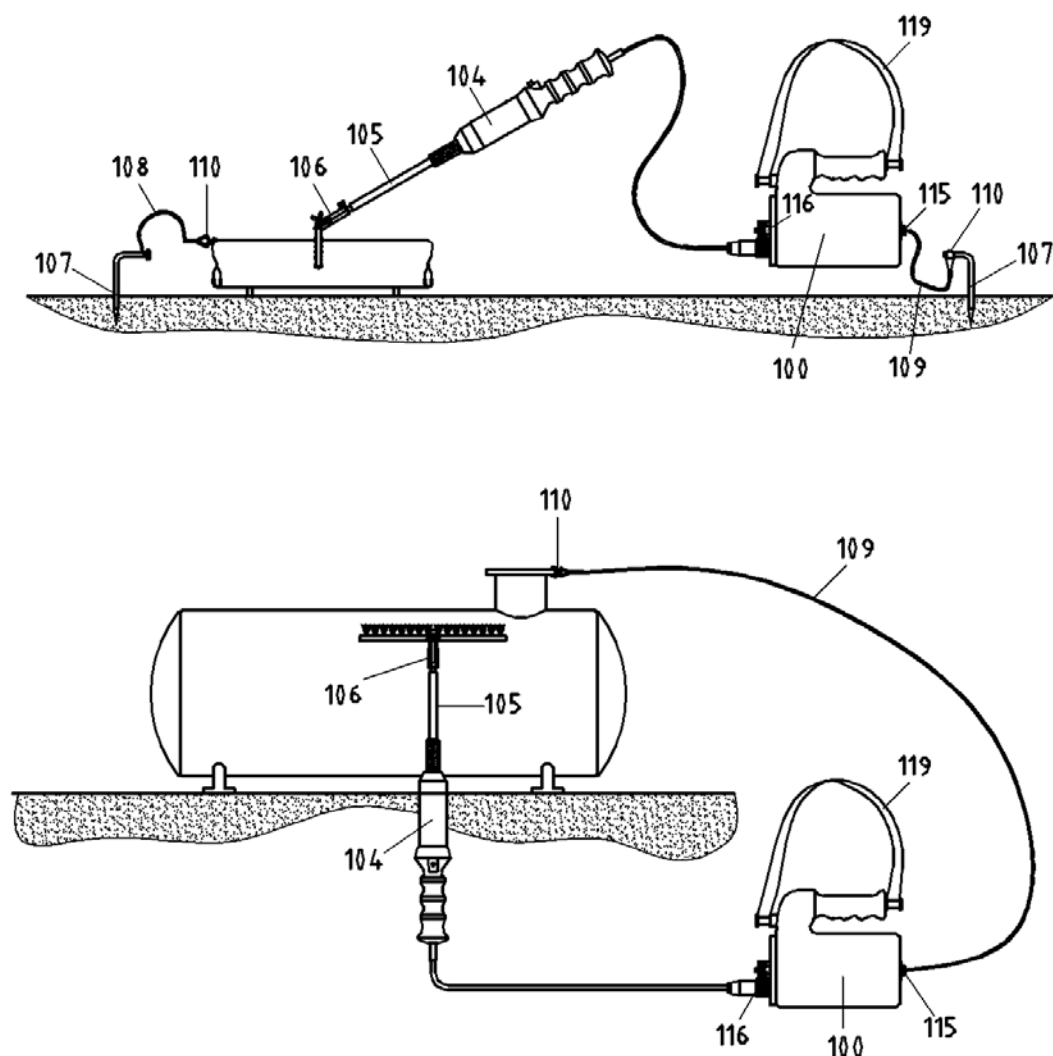


Fig. 6.1: Principle drawing

100	PU coated enclosure	104	High voltage coil
105	Test rod extension	106	Test bracket holder
107	Peg	109	Earth cable 10 m
110	Earth terminal	115	Earth connection
116	On-Off potentiometer	119	Carrier strap

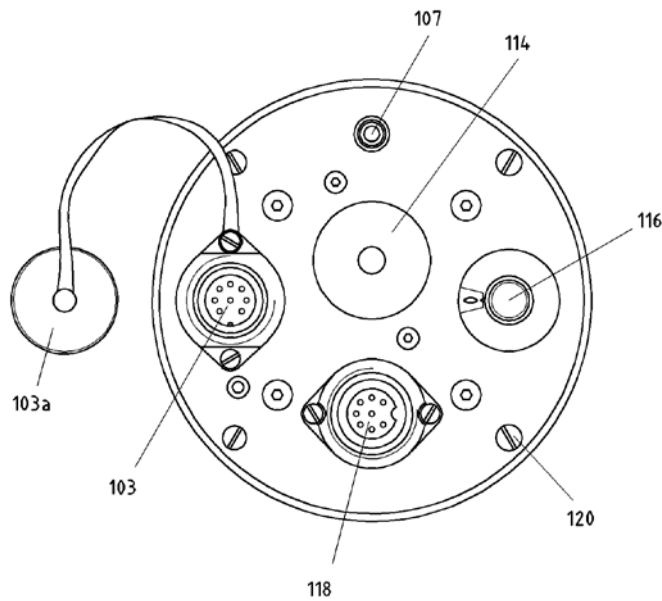


Fig. 6.2: Front view without readjustment

- | | | | |
|------|----------------------------------|-----|---------------------------|
| 103 | Installation plug (charger plug) | 117 | LED display |
| 103a | Bush cover | 118 | Bush of high voltage coil |
| 114 | Horn | 120 | Fastening screws |
| 116 | On/Off potentiometer | | |

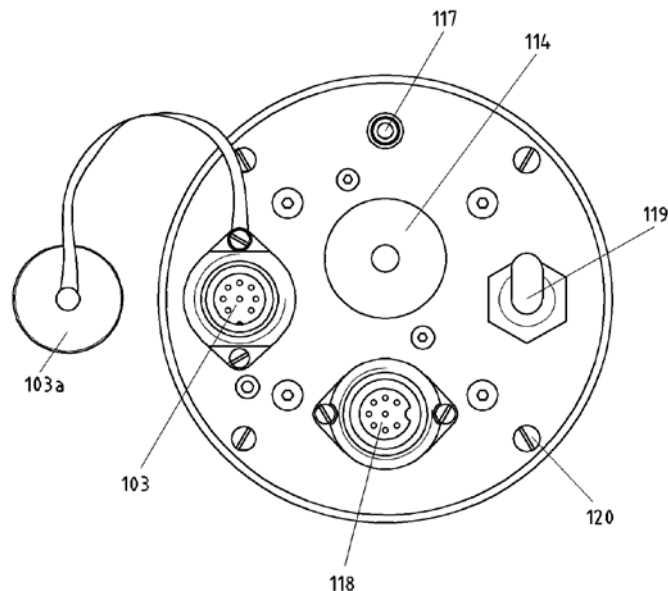


Fig. 6.3: Front view with readjustment

- | | | | |
|------|----------------------------------|-----|---------------------------|
| 103 | Installation plug (charger plug) | 117 | LED display |
| 103a | Bush cover | 118 | Bush of high voltage coil |
| 114 | Horn | 120 | Fastening screws |
| 116 | On/Off potentiometer | | |

The test equipment consists of the insulation tester with selector switch for the test voltage or with On/Off switch, high voltage coil with cast-on pluggable cable, test

rod extension, test bracket holder, spark test track, earth cable, 1 pair of pegs (trailing earth) and the charger cable for 230 Volt 50 Hz as well as the earth line.

Other cables and test brushes as well as test coils are delivered upon request, they are not part of the standard scope of delivery.

6.1 High voltage

The measurement principle is as follows: A low frequency high voltage generates a spark gap which strikes through the insulating layer to the conductive sub-surface if the specimen is faulty. (Insulating layer, e.g. pipe jacket, conductive sub-surface, e.g. steel tube). In order to be independent from a voltage source, the voltage is generated electronically in a NiMH cell block. (12 Volt direct current). In the device itself, a direct voltage of 300 Volt is generated and transformed in a cast-on high voltage coil to a maximum of 30 kV. The high voltage coil is located at the front of the test handle. The path to the test brush is short in order to keep the voltage drop low. By this arrangement, the test voltage is quite remote from the testing person.

6.1.1 Device without readjustment type „V“

The UNION insulation tester without automatic readjustment has an On-Off switch combined with a potentiometer. The potentiometer settings 1 to 10 represent the different test voltages that can be tested and controlled via a calibrated spark gap track. As the spark length depends on the humidity, the barometric pressure and also on the shape of the test brush, a check run with the spark gap track should be done before every insulation test.

The length of the test spark must be at least 1.5 to 2 times longer than the layer thickness of the material to be tested.

If the test voltage is too high, there is no risk of damaging the specimen because only low currents flow and modern insulation materials resist a voltage two or three times the maximum voltage of the device. This assumes that the insulating layer is in perfect condition.

The device without automatic readjustment is used in tests with any kind of test brushes or in test with test coils with small to medium rated widths. This device proves advantageous if tests with different voltages are often required.

6.1.2 Device with readjustment type „NR“ and „VNR“

Different electrodes at the test coil (helixes, test brushes, test wire rakes, etc.), climatic conditions and different test conditions generate a voltage drop at the test electrode which can hardly be checked precisely. Very large electrode surfaces consequently react more sensitively. Therefore it makes sense to measure and readjust the prescribed test voltage. In tests with segment brushes or small to medium coils, the voltage drop to the test electrode is so small that no readjustment is necessary. Only with large pipe diameters, such a device is recommended.

Device with automatic readjustment, fixed set type "NR"

The UNION insulation tester with automatic readjustment is set to a fixed voltage (e.g. 20 kV) which remains stable despite ambient conditions and test brushes. Voltage fluctuations are permanently controlled out. The control point is constantly measured at a ball spark gap.

Depending on the desired voltage, the coil with the fixed spark gap track is plugged on. This can be done easily directly on site.

The device with automatic readjustment is used if a specific test voltage (e.g. 20 kV) is used for the tests or if large pipelines are tested with helixes. The On/Off switch only puts the device into operation. A different voltage will be achieved by using a different coil. The voltage is marked on the coil.

Device with automatic readjustment, variable type "NVR"

The high voltage coil with variable readjustment is equipped with an adjustment unit that can be set to different voltage levels. For this purpose, you release the plastic ring at the coil and set the desired voltage at the lower ring. The current setting can be read on the red plastic ring.

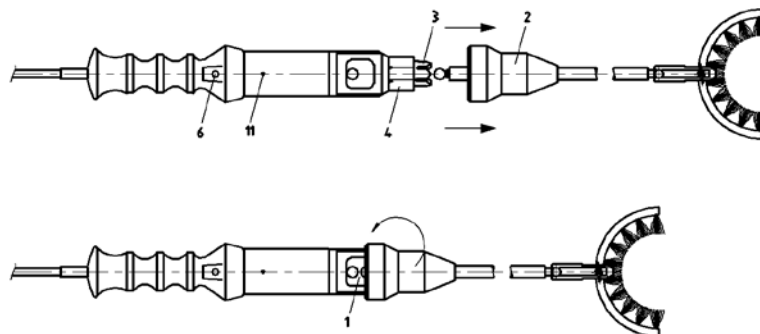


Fig. 6.4: Coil with variable adjustment of the readjustment, type „VNR“

- | | | | |
|---|-------------------------|---|----------------------|
| 1 | Ball spark gap | 4 | Voltage scaling ring |
| 2 | Protective cap | 5 | Overload indicator |
| 3 | Voltage adjustment ring | 6 | Start button |

6.2 Charging

The fully charged insulation tester has a testing capacity of several hours. The charging time for a completely discharged device is 14 hours.

Downstream connected to the NiMH cell block is a power supply unit with overload protection. It is charged with 230V 50 Hz alternate current with the provided power cable. The integrated charger is automatically switched on.

6.3 Check functions

The UNION insulation tester is equipped with different check functions ensuring high operational safety.

6.3.1 Charge control

An LED on the front plate of the device lights up in green when the device is in operation and the NiMH cell block is sufficiently charged. When the charge falls below the sufficient limit, the LED changes from green to red. After re-charging, the diode is green again. The diode goes off when the On-Off switch is set to "OFF". This should always be done after finishing a test because else the device would use power unnecessarily.

6.3.2 Flashover control

A spark flashover can be seen and heard. In addition, a horn is triggered that signals the fault unmistakably. In case of a direct control with the conductor below the insulation, a short-circuit is closed but not signalled. Only when the test brush is lifted from the conductive sub-surface, a spark gap can be generated and trigger the signal tone.

Maximum available for readjustment is the capacity of the battery, it is not possible to readjust any high voltage drop, therefore it must be ensured that the readjustment reaches the rated voltage. Else the control diode lights up. Of course, the diode lights up in case of spark flashover because then the

readjustment briefly does not reach the rated voltage. A flashover is always a short voltage collapse.

Important: If the diode at the head of the ignition coil lights up without spark flashover, the readjustment does not reach the set rated value.

The battery is too low or the test conditions are unsuitable. (Pipe too wet, rain, ...)

6.3.3 Low voltage of the battery

The undervoltage of the NiMH block is not only indicated by the LED changing from green to red, a low permanent sound also starts after some time. Batteries discharged down to that level have a charge time of approx. 14 hours.

As the current consumption of devices with readjustment is higher, more attention is required to the charge status of the batteries.

7 Startup

	 Warning Before every startup, the earth clamp (110) must be attached to the specimen! See Fig. 6.1
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For tests of longer pipe lines, the clamp (110) is grounded at the end of the pipe via cable (108) and peg (107). The insulation tester is also grounded via cable (109) and peg (107).

For container tests, the earth cable (109) is guided directly from the clamp (110) to the earth clamp (115) of the insulation tester. Grounding is important as not discharge the high voltage through the testing person during operation. Due to the low power output, however, there is no real danger. The short-circuit current is just uncomfortable.

7.1 Charging the device

The insulation tester has a rechargeable NiMH cell block with a life span of 800 - 1000 charging processes. Three to five years of service life can thus be considered normal. The power supply is integrated; an overload protection prevents the batteries from being overcharged. The charging time is 12 to 14 hours for completely charging a completely discharged device.

7.2 Adjustment of the test voltage (without readjustment, type „V“)

This description only refers to insulation testers without automatic readjustment type „V“. (There is no voltage information marked on the high voltage coil, and the On-Off switch on the front plate of the device has a scale of 1-10 serving for adjustment of the test voltage.)

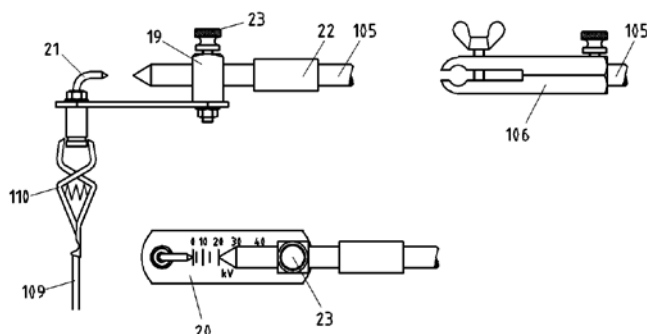


Fig. 7.1: Spark gap track

19	Fixation pin	105	Test rod extension
20	Adjustment scale	106	Test bracket holder
21	Retaining pin	109	Earth cable
22	Test tip	110	Earth clamp
23	Knurled screw		

Remove the test bracket holder (106) from the test rod extension (105) and insert the test tip (22) into the fixation pin (19) until the test tip (22) matches the desired voltage on the test scale (20). Tighten the knurled screw (23). Clamp the earth clamp (110) of the earth cable (109) to the retaining pin (21). Connect the device to the earth cable (110).

Turn the potentiometer button (116) to switch on the insulation tester. Then press down the red button at the high voltage coil and turn the potentiometer button in direction 10 until sparking is visible. The spark must flash over continuously, then the desired test voltage has been reached.

Then clamp the earth clamp (110) to the object to be tested and pull off the entire spark gap track from the test rod extension (105). Plug on and tighten the test bracket holder (106) and plug in the test brush.

The device is now ready for operation.

The scaling 1 - 10 is not linear. The voltage increase at the end of the scale is much higher than at the beginning. Therefore it is possible to adjust small voltages below 10 000 Volt very precisely.

7.3 Test voltage devices with automatic readjustment type „NR“ and „VNR“

Devices with automatic readjustment always adjust themselves to the voltage printed on the high voltage coil. The On-Off switch has no potentiometer function. To achieve other test voltages, a different high voltage coil must be plugged in. Exceeding the test voltage is impossible because the high voltage coil acts as voltage limiter. If the voltage falls below the controlled voltage value, the LED at the high voltage coil lights up.

8 Service and adjustment of the insulation tester

Servicing the insulation tester mainly consists of checking electric safety according to BGV A3 and ensuring proper functionality of the device. The manufacturer performs annual checks upon request. In these checks, the safety, proper adjustment of the high voltage parameters and the battery status are tested and documented for the user by issuing a factory certificate.

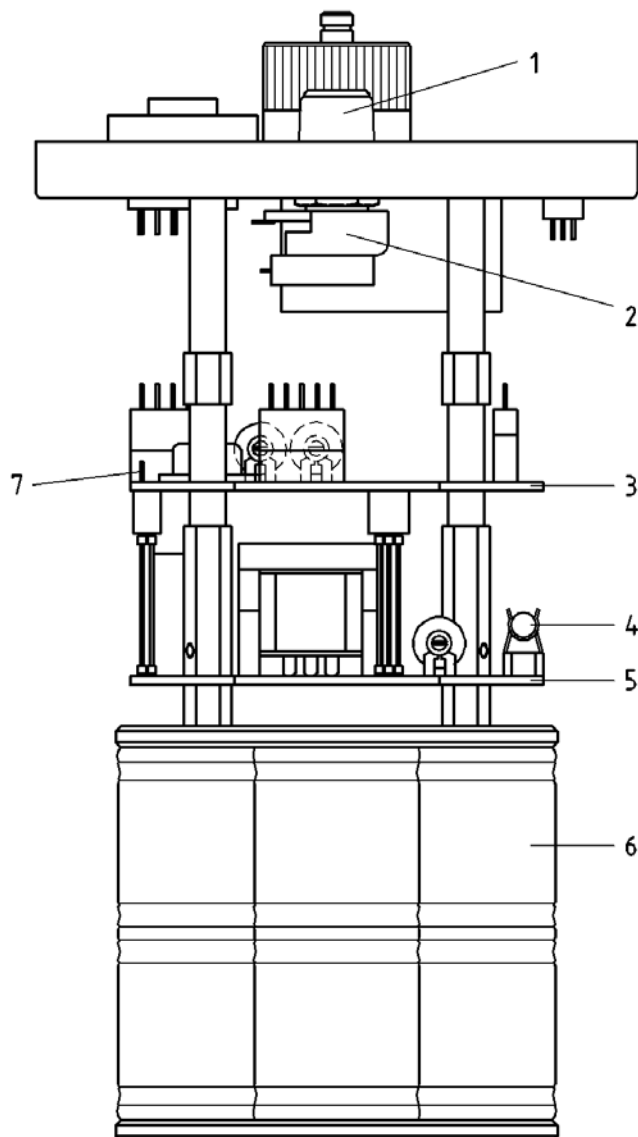


Fig. 8.1: Insulation tester without readjustment type „V“

- | | | | |
|---|-------------------------------|---|-----------------|
| 1 | Controller with On-Off switch | 2 | Potentiometer |
| 3 | Board of insulation tester | 4 | Fuse of charger |
| 5 | Board of charger | 6 | Battery |
| 7 | Test pin | | |

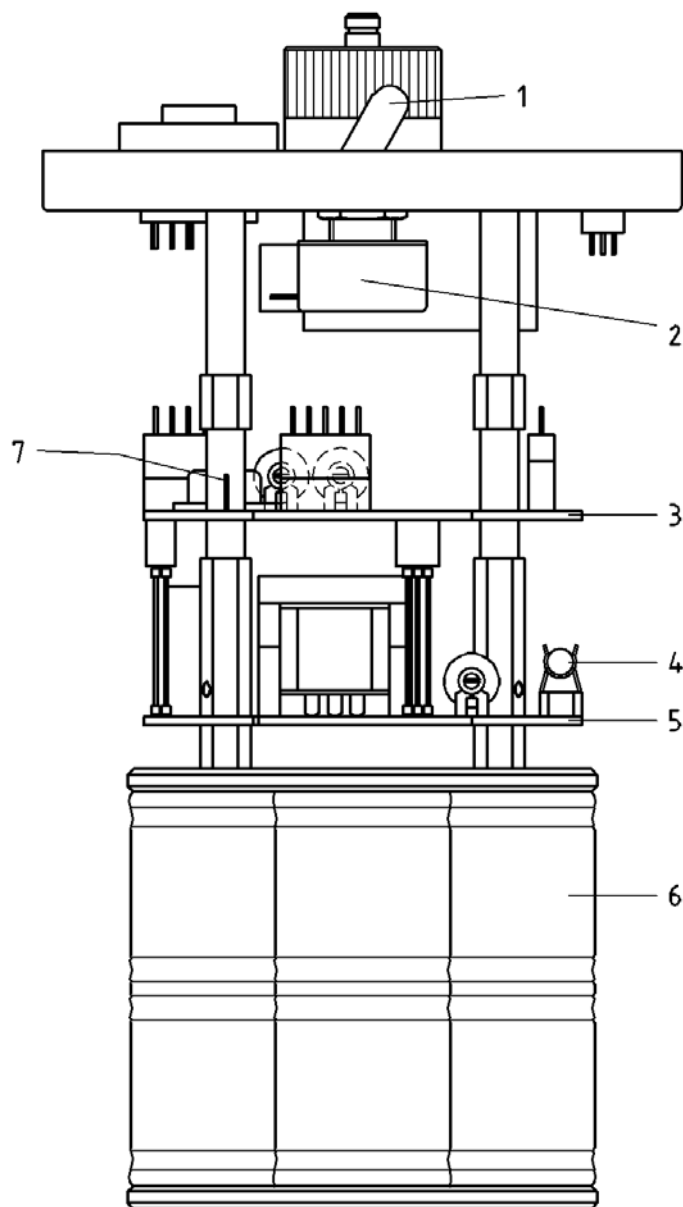


Fig. 8.2: Insulation tester with readjustment type „NR“ or "NVR"

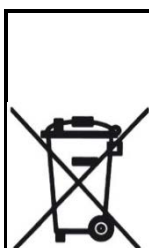
- | | | | |
|---|----------------------------|---|-----------------|
| 1 | On-Off switch | 2 | Potentiometer |
| 3 | Board of insulation tester | 4 | Fuse of charger |
| 5 | Board of charger | 6 | Battery |
| 7 | Test pin | | |

8.1 Replacing the battery

The NiMH block is located below the electronic system and the power supply and can be easily replaced after removing the entire electronics. Take into account that only the outer 4 fastening screws (120) of the front plate are unscrewed. Then the electronic insert is still firmly attached to the front plate and can be taken out as a whole. The batteries have a plug connection. Mechanically, the entire block is fastened with 4 screws. It is always required to replace the complete block so that the individual cells cannot discharge mutually.

In general, replaying the NiMH cell block is required every 3-5 years. First indications for the need for replacement are:

- 1 short test time
- 2 LED does not or only briefly light up in green
- 3 Permanent sound
- 4 Batteries are empty after short storage time



NOTE

The NiCd batteries used in earlier versions must not be used.

Only NiMH batteries are permitted. Disposal of defective batteries must be done according to legal regulations as stated in the Ordinance on Batteries, in an environmentally friendly way in proper collection centres.

Union Instruments GmbH will also take back batteries free of charge.

8.2 Replacing the high voltage coil

The high voltage coil is cast on the connection cable and can only be replaced together with connection cable and pushbutton. The unit is screwed into the front plate of the device with a screw-in plug. A new coil can be screwed in without any further measures. The device is immediately ready for operation again.

	 ATTENTION
	Destruction of the device! Devices with automatic readjustment (type „NR“ or type „VNR“) must never be operated with a high voltage coil without readjustment (type „V“). Likewise, devices with freely selectable voltage adjustment (type „V“) must not be operated with a fixed set high voltage coil (type „NR“ or type „VNR“).

8.3 Troubleshooting

Horn sounds continually

- Device must be charged. Diode lights in red
- Device does not charge because fuse is defective
- High voltage coil has a short-circuit, must be replaced
- Test rod extension not correctly screwed in. Fake spark gap.
- Very humid weather. Fake spark flashover. The test does not make sense physically.

LED on the front plate permanently illuminated in red

- Battery must be charged
- Batteries cannot be charged because powder fuse is defective. Powder fuse must be replaced
- Batteries are too old. Charging is not possible any more (over 3-5 years). The entire NiMH cell block must be replaced.

LED on the front plate does not illuminate

- Actuate On-Off switch
- If the diode does not light up after switching on the device, maybe the connecting cable from the battery to the electronic system is interrupted or the connections of the individual batteries to each other.
- Batteries are completely discharged or defective. They must be replaced. If the NiMH block remains completely discharge over longer time, it becomes unusable and must be replaced.

Insulation tester cannot be charged

- Check if the charger cable with the special plug is defective. Check soldered connections in the plug.
- Fuse on the power supply board blown. This is possible if a completely discharged device is immediately connected to a power source for recharging (within 1-2 minutes).

If faults occur that are not listed here, send in the device specifying the 5-digit manufacturer number. It is important to send in the device with the high voltage coil because else the reason of the fault cannot be determined unambiguously.

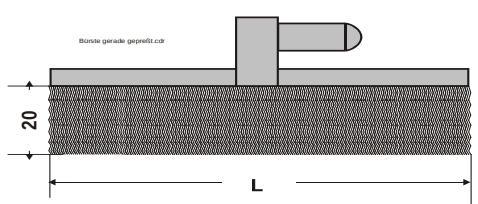
The header level 7 is alphabetically sorted and has an indent left of 0.63 cm. It serves for subdivision within an operation / service step e.g. for different designs of a device or assembly groups.
For example:

9 Accessories and spare parts

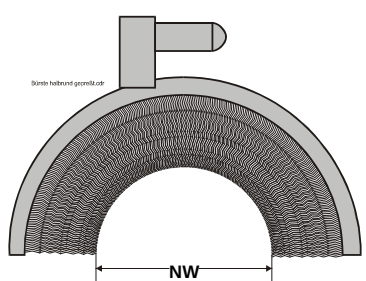
9.1 Test brushes

9.1.1 Test brushes for outer insulation

Straight:

	Test brushes in trapezoid frame with holder. Available length: 300, 400, 500, 600 mm Special lengths upon request.
Order text: Test brush in pressed design, straight L = mm Order number 200 mm: 04301199937 300 mm: 04301199971 400 mm: 04300199995 500 mm: 04301199970 600 mm: 04301199930	

Semi-circular

	Test brushes semi-circular in trapezoid frame with holder. Available inner diameters: DN 20, 30, 40, 50 DN 60, 70, 80, DN 125, 150, 200 DN 250, 300 Special inner diameters upon request.
Order text: Test brush as pressed brush, semi-circular, DN XXX Order number DN 20: 04301199946 DN 30: 04301199945 DN 40: 04301199944 DN 50: 04301199943 DN 60: 04301199952 DN 70: 04301199942 DN 80: 04301199941 DN 100: 04301199951 DN 125: 04301199940 DN 150: 04301199950 DN 200: 04301199939 DN 250: 04301199949 DN 300: 04301199938	

Segment:

Test brushes as pressed brushes in trapezoid frame with holder.

Available inner diameters:

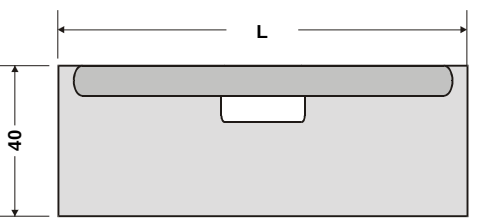
DN	Length	DN	Length
125		550	
150		600	
200		700	
250		800	
300		900	
350		1000	1000
400		1200	1000
450		1400	1000
500			

Order text: Test brush as pressed brush, segment, DN XXX

Order number	DN 125: 04301199923	DN 550: 04301199906
	DN 150: 04301199922	DN 600: 04301199915
	DN 200: 04301199921	DN 700: 04301199909
	DN 250: 04301199920	DN 800: 04301199914
	DN 300: 04301199919	DN 900: 04301199908
	DN 350: 04301199918	DN 1000: 04301199913
	DN 400: 04301199917	DN 1200: 04301199912
	DN 450: 04301199907	DN 1400: 04301199911
	DN 500: 04301199916	

9.1.2 Test brush made of conductive rubber

Straight:

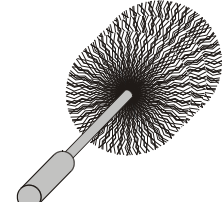
	Test brush made of conductive rubber Available lengths: 50, 100, 200, 300 mm
Order text: Test brush made of conductive rubber Order number: 04301199935 (length 50 mm) 04301199968 (length 100 mm) 04301199967 (length 200 mm) 04301199966 (length 300 mm)	

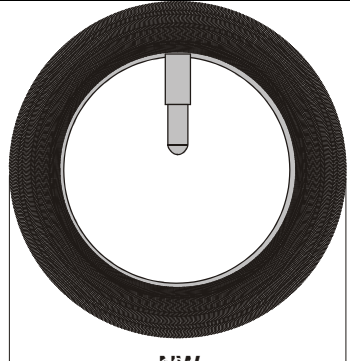
9.1.3 Brush electrode

	Brush electrode with adapter for direct plugging onto the test rod extension Length of the fibres approx. 130 mm Widths of the fan shape approx. 135 mm
Order text: Brush electrode 135 mm Order number: 04301199969	

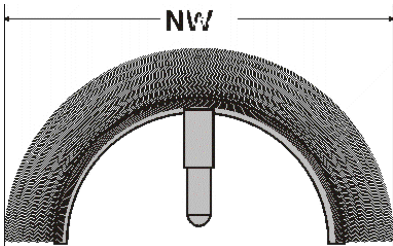
9.1.4 Test brushes for inner insulation

Full radius:

	Test brushes as pressed brushes with holder. Available inner diameters / mm 30, 40, 50, 60
Order text: Test brush for inner testing, brush shape DN 30 DN Order number DN 30: 04301199904 DN 60: 04301199901 DN 40: 04301199903 DN 50: 04301199902	

	Test brushes as pressed brushes in trapezoid frame with holder. Available inner diameters DN / mm 80, 100, 125, 150, 200, 250
Order text: Test brush inner insulation round, pressed brush DN	

Semi-radius:

Order text: Pressed brush, inner, semi-radius DN 	Test brush with pressed brushes Available inner diameters DN / mm 80, 100, 125, 150, 200, 300, 350												
<table><tr><td>Order number</td><td>DN 80: 04301199900</td><td>DN 100: 04301199899</td></tr><tr><td></td><td>DN 125: 04301199898</td><td>DN 150: 04301199897</td></tr><tr><td></td><td>DN 200: 04301199896</td><td>DN 250: 04301199895</td></tr><tr><td></td><td>DN 300: 04301199894</td><td>DN 350: 04301199893</td></tr></table>		Order number	DN 80: 04301199900	DN 100: 04301199899		DN 125: 04301199898	DN 150: 04301199897		DN 200: 04301199896	DN 250: 04301199895		DN 300: 04301199894	DN 350: 04301199893
Order number	DN 80: 04301199900	DN 100: 04301199899											
	DN 125: 04301199898	DN 150: 04301199897											
	DN 200: 04301199896	DN 250: 04301199895											
	DN 300: 04301199894	DN 350: 04301199893											

Segment:

Segment:

Test brushes with pressed brushes

Available inner diameters:

DN	Length	DN	Length
		350	185
400	210	450	235
500	265	600	315
800	420	1000	520

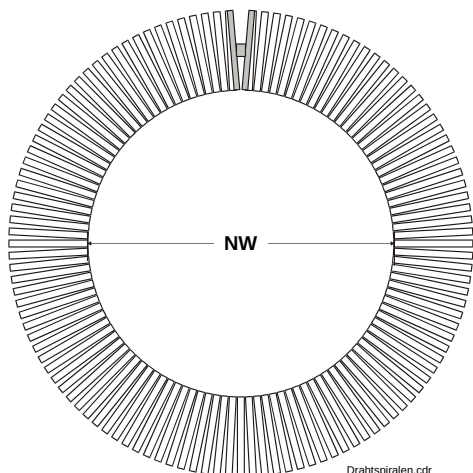
Order text: Pressed brush, inner, segment DN

Order number DN 350: 04301199892
 DN 450: 04301199890
 DN 600: 04301199888
 DN 1000: 04301199886

DN 400: 04301199891
DN 500: 04301199889
DN 800: 04301199887

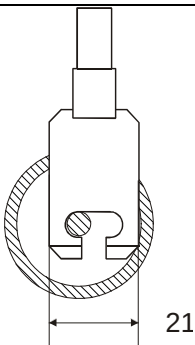
9.2 Wire coils and accessories

9.2.1 Wire coils

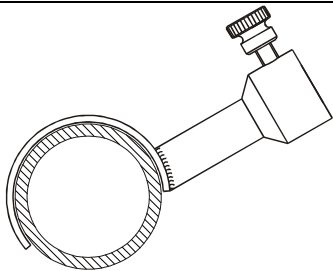
	Wire coils with square wire cross-section and bayonet lock. Available inner diameters with a bayonet lock: DN 80, 100, 125, 150 DN 200, 250, 300, 350 DN 400, 500, 600, 700 Available inner diameters with two bayonet locks: DN 750, 800, 900, 1000 DN 1100, 1200, 1300, 1500 Special inner diameters upon request.																														
Order text: Wire coils square version DN..... <table><tr><td>Order number:</td><td>DN 80: 04301199993</td><td>DN 600: 04301199962</td></tr><tr><td></td><td>DN 100: 04301199992</td><td>DN 700: 04301199994</td></tr><tr><td></td><td>DN 125: 04301199991</td><td>DN 750: 04301199929</td></tr><tr><td></td><td>DN 150: 04301199990</td><td>DN 800: 04301199995</td></tr><tr><td></td><td>DN 200: 04301199989</td><td>DN 900: 04301199996</td></tr><tr><td></td><td>DN 250: 04301199981</td><td>DN 1000: 04301199984</td></tr><tr><td></td><td>DN 300: 04301199988</td><td>DN 1100: 04301199878</td></tr><tr><td></td><td>DN 350: 04301199987</td><td>DN 1200: 04301199947</td></tr><tr><td></td><td>DN 400: 04301199986</td><td>DN 1300: 04301199879</td></tr><tr><td></td><td>DN 500: 04301199985</td><td>DN 1400: 04301199948</td></tr></table>		Order number:	DN 80: 04301199993	DN 600: 04301199962		DN 100: 04301199992	DN 700: 04301199994		DN 125: 04301199991	DN 750: 04301199929		DN 150: 04301199990	DN 800: 04301199995		DN 200: 04301199989	DN 900: 04301199996		DN 250: 04301199981	DN 1000: 04301199984		DN 300: 04301199988	DN 1100: 04301199878		DN 350: 04301199987	DN 1200: 04301199947		DN 400: 04301199986	DN 1300: 04301199879		DN 500: 04301199985	DN 1400: 04301199948
Order number:	DN 80: 04301199993	DN 600: 04301199962																													
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	DN 150: 04301199990	DN 800: 04301199995																													
	DN 200: 04301199989	DN 900: 04301199996																													
	DN 250: 04301199981	DN 1000: 04301199984																													
	DN 300: 04301199988	DN 1100: 04301199878																													
	DN 350: 04301199987	DN 1200: 04301199947																													
	DN 400: 04301199986	DN 1300: 04301199879																													
	DN 500: 04301199985	DN 1400: 04301199948																													

9.2.2 Guide bracket for wire coil

9.2.2.1 Guide bracket for wire coil

	Guide bracket to guide the wire coil, fork-shaped
Order text: Guide bracket wire coil, fork-shaped Order number: 04301199983	

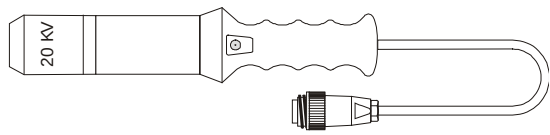
9.2.2.2 Guide bracket for wire coil, shell-shape

 A technical line drawing of a guide bracket. It consists of a circular shell-shaped wire coil with a central hole. A rectangular bracket is attached to one end of the coil, and a small cylindrical component with a threaded top is attached to the other end of the bracket.	Guide bracket to guide the wire coil, shell-shaped
Order text: Guide bracket for wire coil, shell-shape Order number: 04301199982	

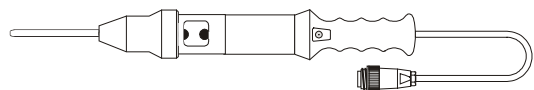
9.3 Electronics

9.3.1 High voltage

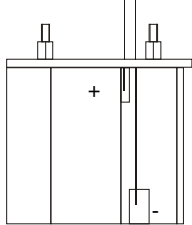
9.3.1.1 High voltage coil with NR fixed voltage type "NR"

	High voltage coil with NR fixed voltage The high voltage coil has an integrated fixed set ball spark gap. The following fixed voltages are available: 10 KV, 15 KV, 20 KV, 25 KV. Other voltages upon request. When ordering, specify the test voltage.
Order text: High voltage coil with NR KV Order number: 04402199997	

9.3.1.2 High voltage coil with NR variable type "VNR"

	High voltage coil with NR variable The high voltage coil has an integrated variable ball spark gap. The test voltages can be set in steps of 5 kV. 5 -10 -15 - 20 -25 - 30 KV.
Order text: High voltage coil with NR variable Order number: 04402199998	

9.3.2 NIMH set

	NIMH set for insulation tester 12 Volt/2Ah - completely mounted set
Order text: NIMH set for insulation tester Order number: 04302199999	

9.4 Cables

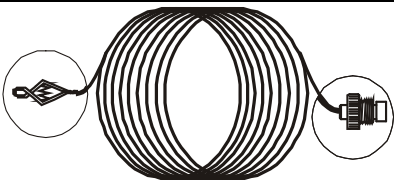
9.4.1 Charger cable

9.4.1.1 Charger cable 230 V

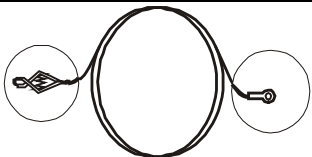
	Charger cable 230 Volt
Order text: Charger cable 230 Volt Order number: 04302199994	

9.4.2 Earth cable

9.4.2.1 Earth cable 10 m

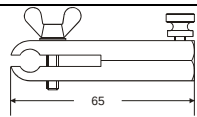
	Earth cable 10 m with connection - Battery clip - Knurled screw (for the earth connection at the device)
Order text: Earth cable 10 m Order number: 04302199993	

9.4.2.2 Earth cable 2 m

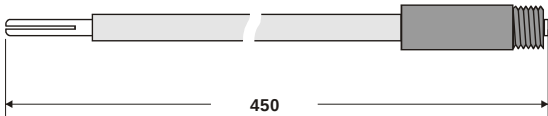
	Earth cable 2 metres with cable eye for peg and battery clip
Order text: Earth cable 2 m Order number: 04302199992	

9.5 Mechanic parts

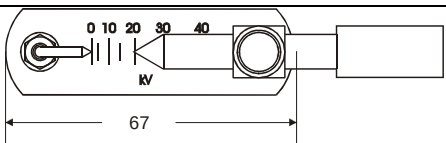
9.5.1 Test bracket holder

	Test bracket holder for attaching the test brushes to the test rod extension
Order text: Test bracket holder Order number: 04301199961	

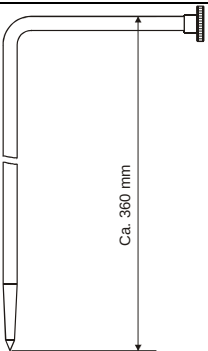
9.5.2 Test rod extension

	Test rod extension
Order text: Test rod extension Order number: 04301199960	

9.5.3 Spark gap track

	Spark gap track for insulation tester without readjustment 5-30 KV
Order text: Spark gap track Order number: 04301199959	

9.5.4 Peg

	Peg with knurled screw Material: galvanised steel
Order text: Peg Order number: 04301199958	

