DNV·GL

# KEMA TYPE TEST CERTIFICATE OF COMPLETE TYPE TESTS

**Object** Heat shrinkable indoor termination **1086-16**

**Type** MZDNK-3-15-C

| | | | |
|---|---|---|---|
| Rated voltage, $U_0/U$ ($U_m$) | 8,7/15 (17,5) kV | Conductor material | Cu |
| Conductor cross-section | 3 x 185 mm$^2$ | Insulation material | XLPE |

**Manufacturer** Jiangsu Jiameng Electrical Equipment Co., Ltd. (MELEC), Qidong, China *)

**Client** Jiangsu Jiameng Electrical Equipment Co., Ltd. (MELEC), Qidong, China

**Tested by** KEMA Nederland B.V., Arnhem, The Netherlands

**Date of tests** 16 November 2015 to 25 May 2016

The object, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to the series of proving tests in accordance with the complete type test requirements of

## IEC 60502-4

This Certificate has been issued by DNV GL following exclusively the STL Guides.

The results are shown in the record of proving tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above standard(s) and to justify the ratings assigned by the manufacturer as listed on page 5.

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Date: 2025.02.05 10:14:36 EET
Reason: MoldSign Signature
Location: Moldova
MOLDOVA EUROPEANĂ

This Certificate applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the Manufacturer.
*) as declared by the manufacturer

This Certificate consists of 75 pages in total.

KEMA Nederland B.V.

J.P. Fonteijne
Executive Vice President
KEMA Laboratories

KEMA Laboratories

Arnhem, 22 June 2016

# INFORMATION SHEET

## 1 KEMA Type Test Certificate

A KEMA Type Test Certificate contains a record of a series of (type) tests carried out in accordance with a recognized standard. The object tested has fulfilled the requirements of this standard and the relevant ratings assigned by the manufacturer are endorsed by DNV GL. In addition, the object's technical drawings have been verified and the condition of the object after the tests is assessed and recorded. The Certificate contains the essential drawings and a description of the object tested. A KEMA Type Test Certificate signifies that the object meets all the requirements of the named subclauses of the standard. It can be identified by gold-embossed lettering on the cover and a gold seal on its front sheet.
The Certificate is applicable to the object tested only. DNV GL is responsible for the validity and the contents of the Certificate. The responsibility for conformity of any object having the same type references as the one tested rests with the manufacturer.
Detailed rules on types of certification are given in DNV GL's Certification procedure applicable to KEMA Laboratories.

## 2 KEMA Report of Performance

A KEMA Report of Performance is issued when an object has successfully completed and passed a subset (but not all) of test programmes in accordance with a recognized standard. In addition, the object's technical drawings have been verified and the condition of the object after the tests is assessed and recorded. The report is applicable to the object tested only. A KEMA Report of Performance signifies that the object meets the requirements of the named subclauses of the standard. It can be identified by silver-embossed lettering on the cover and a silver seal on its front sheet.
The sentence on the front sheet of a KEMA Report of Performance will state that the tests have been carried out in accordance with …… The object has complied with the relevant requirements.

## 3 KEMA Test Report

A KEMA Test Report is issued in all other cases. Reasons for issuing a KEMA Test Report could be:

- Tests were performed according to the client's instructions.
- Tests were performed only partially according to the standard.
- No technical drawings were submitted for verification and/or no assessment of the condition of the object after the tests was performed.
- The object failed one or more of the performed tests.

The KEMA Test Report can be identified by the grey-embossed lettering on the cover and grey seal on its front sheet.
In case the number of tests, the test procedure and the test parameters are based on a recognized standard and related to the ratings assigned by the manufacturer, the following sentence will appear on the front sheet. The tests have been carried out in accordance with the client's instructions. Test procedure and test parameters were based on ..... If the object does not pass the tests such behaviour will be mentioned on the front sheet. Verification of the drawings (if submitted) and assessment of the condition after the tests is only done on client's request.
When the tests, test procedure and/or test parameters are not in accordance with a recognized standard, the front sheet will state the tests have been carried out in accordance with client's instructions.

## 4 Official and uncontrolled test documents

The official test documents of DNV GL are issued in bound form. Uncontrolled copies may be provided as a digital file for convenience of reproduction by the client. The copyright has to be respected at all times.

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# 1 IDENTIFICATION OF THE OBJECT TESTED

## 1.1 Ratings/characteristics of the object tested

| | |
|---|---|
| Rated voltage, $U_0/U$ ($U_m$) | 8,7/15 (17,5) kV |
| Rated conductor cross-section | 3 x 185 $mm^2$ |
| Cable type three-core power cable | XLPE |
| Dynamic short-circuit claimed | No |

## 1.2 Description of the indoor termination

| | |
|---|---|
| Manufacturer (as stated by the client) | Jiangsu Jiameng Electrical Equipment Co., Ltd. (MELEC), Qidong, China |
| Type | MZDNK-3-15-C |
| Manufacturing year | 2015 |
| Rated voltage, $U_0/U$ ($U_m$) | 8,7/15 (17,5) kV |
| No. of cores | 3 |
| Cross section-conductor | 185 $mm^2$ |
| Outer diameter of the insulation cable tested | 25,8 mm |
| Construction | see List of documents |
| Electric field stress control (core-XLPE) type | yellow semi-conducting tape |
| Stress control insulation | one heat-shrink tube per phase |
| Earth screen | one earth screen cable connected with three force springs |
| Armour screen | earth screen cable for armouring connected with force spring (insulated from earth screen) |
| Insulation break out | heat shrink three phases breakout |
| Outer sheath | each phase heat-shrink tube track resistrant tube |
| Connector type | crimped cable lug |
| Colour markers | red, yellow, green |
| Sheds | not applicable |
| Solid cable lug | DDT185-16 |
| Hydraulic crimping tool | JM-240B, DT25 (crimping die) |

## 1.3 Description of the MV cable

| | |
|---|---|
| Standard | IEC 60502-2, Clause 5-14 |
| Manufacturer | Jiangsu Far East Cable Co., Ltd., Yixing, China |
| Type | YJV22-8.7/15-3x185 |
| Manufacturing year | 2015 |
| Rated voltage, $U_0/U$ ($U_m$) | 8,7/15 (17,5) kV |
| No. of cores | 3 |
| Core identification | core 1 = red<br>core 2 = yellow<br>core 3 = green |
| Overall diameter | 70,4 mm |
| Marking on the oversheath | YJVZZ 8,7/15 kV 3x 185 YK06-00038-No 414120303 |
| Construction | see List of documents |

**Conductor**

| | |
|---|---|
| • material | copper |
| • cross-section | 185 $mm^2$ |
| • nominal diameter | 16,1 mm |
| • type | stranded |
| • maximum conductor temperature in normal operation | 90 °C |
| • presence and nature of measures to achieve longitudinal watertightness | no |

**Conductor screen**

| | |
|---|---|
| • material | semi-conducting shielding material |
| • nominal thickness | 0,6 mm |
| • material designation | peroxide crosslinking type semi conductive inner shielding material |
| • manufacturer of the material | Jiangsu Dongfang Cable Material Co., Ltd., Yangzhou, China |

**Insulation**

| | |
|---|---|
| • material | XLPE |
| • nominal thickness | 4,5 mm |
| • nominal inner diameter of the insulation | 16,8 mm |
| • nominal outer diameter of the insulation | 25,8 mm |
| • material designation | cross-linked polyethylene |
| • manufacturer of the material | Zhejiang Wanma Macromolecule Material Co., Ltd., Lin'an, China |

**Insulation (core) screen**

| | |
|---|---|
| • material | semi-conducting shielding material |
| • strippable | yes |
| • nominal thickness | 0,6 mm |
| • material designation | peroxide crosslinking type semi conductive inner shielding material |
| • manufacturer of the material | Jiangsu Dongfang Cable Material Co., Ltd., Yangzhou, China |

**Inner coverings and fillers**

| | |
|---|---|
| • material | yes, extruded sheath |

**Longitudinally watertightness**

| | |
|---|---|
| • presence and nature of measures to achieve longitudinal watertightness along insulation screen | no |

**Metal screen**

| | |
|---|---|
| • material | copper tape |
| • nominal thickness and width of tape | 0,1 x 35 mm (overlap 15%) |
| • cross-sectional area | approx. 8,5 $mm^2$ |

**Longitudinally watertightness**

| | |
|---|---|
| • presence and nature of measures to achieve longitudinal watertightness along insulation screen | no |

**Inner coverings and fillers**

| | |
|---|---|
| • material | yes, extruded sheath |

**Separation sheath**

| | |
|---|---|
| • material | PVC, (type: ST2) |
| • nominal thickness | 1,8 mm |
| • manufacturer of the material | Changshu Zhonglian Photoelectric New Material Co., Ltd., Changshu, China |

**Metal armour**

| | |
|---|---|
| • material | two steel tapes |
| • nominal thickness and width of tape | 0,5 x 45 mm (overlap: 50%) |
| • manufacturer of the material | Yixing Tongsheng Metal Strip Co., Ltd., Yixing, China |

**Oversheath**

| | |
|---|---|
| • material | PVC, (type: ST2) |
| • nominal thickness | 3,3 mm |
| • nominal overall diameter of the cable (D) | 70,4 mm |
| • material designation | PVC |
| • manufacturer of the material | Changshu Zhonglian Photoelectric New Material Co., Ltd., Changshu, China |
| • colour | black |
| • graphite coating applied | no |

**Fire retardant** (according to IEC 60332-1) no

**Manufacturing details insulation system**

| | |
|---|---|
| • location of manufacturing | Yixing, China |
| • type of extrusion line | CCV |
| • type of extrusion | triple common extrusion |
| • manufacturer of the extrusion line | Troester GmbH & Co. KG., Hannover, Germany |
| • curing means | Chemical cross linking |
| • cooling means | nitrogen cooling |
| • manufacturing length (where cable sample for testing has been taken from) | 2000 m |
| • length markings on cable sample sent to KEMA | begin: 0 m, end: 800 m |

## 1.4 List of documents

The manufacturer has guaranteed that the object submitted for tests has been manufactured in accordance with the following drawings and/or documents. KEMA Laboratories has verified that these drawings and/or documents adequately represent the object tested. The manufacturer is responsible for the correctness of these drawings and/or documents and the technical data presented.

The following drawings and/or documents have been included in this Certificate:

| Drawing no./document no. | Revision |
|---|---|
| T8MZDNK-3-15-C (indoor termination parts list) 2 pages | 2015-06-25 |
| Installation instruction for 15 kV terminations (5 pages) | - |

# 2 GENERAL INFORMATION

## 2.1 The tests were witnessed by

| Name | Company |
|---|---|
| Kevin Dai (16, 17 November 2015)<br>Zhangjie Tang (25 May 2016)<br>Xuexiang Jiang (25 May 2016)<br>Ivy Cao (25 May 2016) | Jiangsu Jiameng Electrical Equipment Co., Ltd. (MELEC), Qidong, China |

## 2.2 The tests were carried out by

| Name | Company |
|---|---|
| John Mooren<br>Edwin Pultrum<br>Rutger Hensbroek<br>Julian Aditya | KEMA Nederland B.V.,<br>Arnhem, The Netherlands |

## 2.3 Reference to other reports

| Report No | Tests performed |
|---|---|
| 1266-16 | KEMA report of performance<br>Heat shrinkable indoor termination |

## 2.4 Purpose of test

Purpose of the test was to verify whether the material complies with the specified requirements.

## 2.5 Measurement uncertainty

A table with measurement uncertainties is enclosed in this Certificate. Unless otherwise stated, the measurement uncertainties of the results presented in this Certificate are as indicated in that table.

## 2.6 Instruments used

A detailed list with instruments used is enclosed in this Certificate.

# 3 TEST SEQUENCE TABLE 5 COLUMN 1.1 (TWO INDOOR TERMINATIONS)

## 3.1 Test arrangement

### 3.1.1 Determination of the cable conductor temperature

**Standard**

Standard IEC 61442, Subclause 8

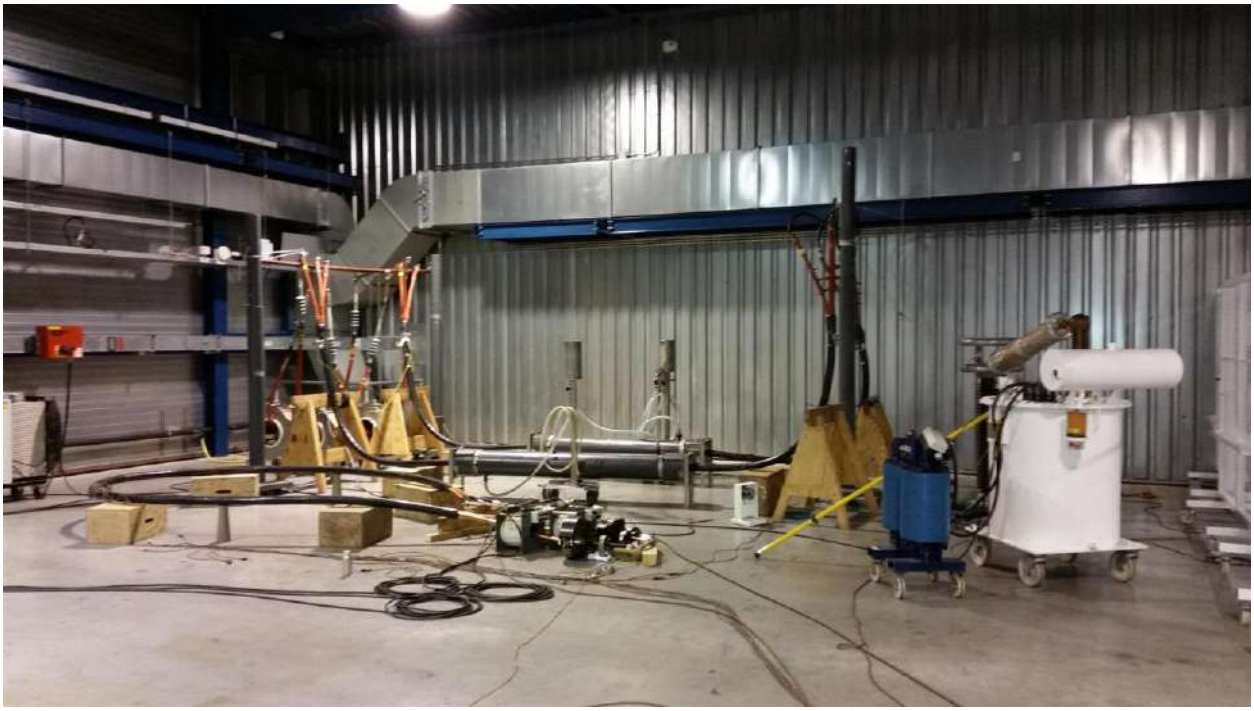
For the tests at elevated temperature, a reference loop for temperature control of the conductor was installed and conductor current was used for heating. The reference cable was cut from the total cable length intended for the type test. This reference loop was installed close to the test loop in order to create the same environmental conditions as for the test loop.

The heating currents in the reference loop and the test loop were kept equal at all times, thus the conductor temperature of the reference loop is representative for the conductor temperature of the test loop. Annex A was used as a guide and Annex A, Subclause A.3.3, method 3 was applied.

The tests at elevated temperature are carried out after the conductor temperature has been within the stated limit for at least 2 hours.

## 3.2 Photograph of test set-up

Test set up main loop first 30 cycles.



Test set up main loop joint in water 30 cycles

Cable oversheath removed according clause 9.3 of IEC 61442.

Test set up outdoor termination in immersion test 10 cycles

## 3.3 DC voltage dry test

**Standard and date**

Standard IEC 60502-4, table 5, test 1
Test date(s) 16 November 2015

**Environmental conditions**

Ambient temperature 22 °C
Temperature of test object 22 °C

| Testing arrangement | | DC voltage applied | | Duration |
|---|---|---|---|---|
| Voltage applied to | Earth connected to | x $U_0$ | (kV) | (min) |
| Conductor 1, 2 and 3 of test loop 1 | Metal screens | 4 | 35 | 15 |
| Conductor 1, 2 and 3 of test loop 2 | Metal screens | 4 | 35 | 15 |

**Requirement**

No breakdown of the insulation shall occur.

**Result**

The object passed the test.

## 3.4 AC voltage dry test

**Standard and date**

Standard IEC 60502-4, table 5, test 1
Test date(s) 16 November 2015

**Environmental conditions**

Ambient temperature 22 °C
Temperature of test object 22 °C

| Testing arrangement | | Voltage applied, 50 Hz | | Duration |
|---|---|---|---|---|
| Voltage applied to | Earth connected to | … x $U_0$ | (kV) | (min) |
| Conductor 1, 2 and 3 of test loop 1 | Metal screens | 4,5 | 39 | 5 |
| Conductor 1, 2 and 3 of test loop 2 | Metal screens | 4,5 | 39 | 5 |

**Requirement**

No breakdown of the insulation shall occur.

**Result**

The object passed the test.

## 3.5 Partial discharge test at ambient temperature

**Standard and date**

| | |
|---|---|
| Standard | IEC 60502-4, table 5, test 2 |
| Test date(s) | 17 November 2015 |

**Environmental conditions**

| | |
|---|---|
| Ambient temperature | 21 °C |

**Characteristic test data**

| | |
|---|---|
| Temperature of test object | 21 °C |
| Circuit | direct |
| Calibration | 5 pC |
| Noise level at 1,73 $U_0$ | 1 pC |
| Sensitivity | 2 pC |
| Required sensitivity | ≤ 5 pC |
| Centre frequency | 300 kHz |
| Bandwidth | 150-450 kHz |
| Test frequency | 50 Hz |
| Coupling capacitor | 2600 pF |

| Conductor | Voltage applied, 50 Hz | | Duration | Partial discharge level |
|---|---|---|---|---|
| | ... x $U_0$ | (kV) | (s) | (pC) |
| 1 of test loop 1 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |
| 2 of Test loop 1 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |
| 3 of test loop 1 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |
| 1 of test loop 2 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |
| 2 of test loop 2 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |
| 3 of test loop 2 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |

**Requirement**

The maximum partial discharge level from the test object at 1,73 $U_0$ shall not exceed 10 pC.

**Result**

The object passed the test.

## 3.6 Impulse voltage test at elevated temperature

**Standard and date**

Standard IEC 60502-4, table 5, test 3
Test date(s) 15 December 2015

**Environmental conditions**

Ambient temperature 20 °C

**Characteristic test data**

Temperature of test object 97 °C
Specified test voltage 95 kV

| Testing arrangement | | Polarity | Voltage applied (% of test voltage) | No. of impulses | See figure on next pages |
|---|---|---|---|---|---|
| Voltage applied to | Earthed | | | | |
| Conductor 1, 2 and 3 of test loop 1 and 2 | Metal screens | Positive | 50 | 1 | 1 (waveshape) |
| | | | 65 | 1 | 2 |
| | | | 80 | 1 | 2 |
| | | | 100 | 10 | 3 and 4 |
| Conductor 1, 2 and 3 of test loop 1 and 2 | Metal screens | Negative | 50 | 1 | 5 (waveshape) |
| | | | 65 | 1 | 6 |
| | | | 80 | 1 | 6 |
| | | | 100 | 10 | 7 and 8 |

**Requirement**

Each core of the cable and accessory shall withstand without failure 10 positive and 10 negative voltage impulses.

**Result**

The object passed the test.

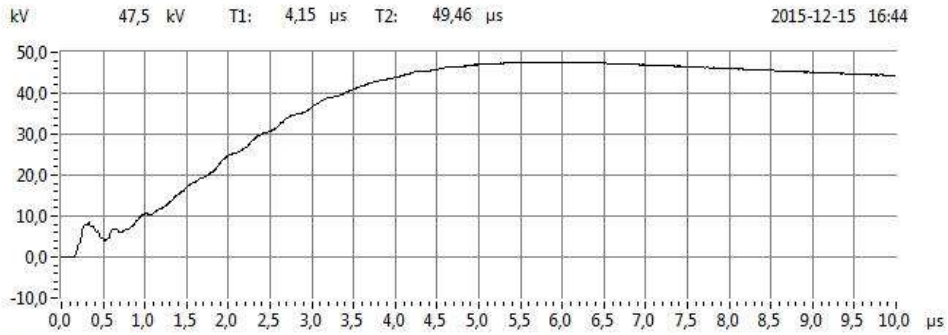



**Fig. 1: Waveshape 72124900 Main loop 50% of test voltage**

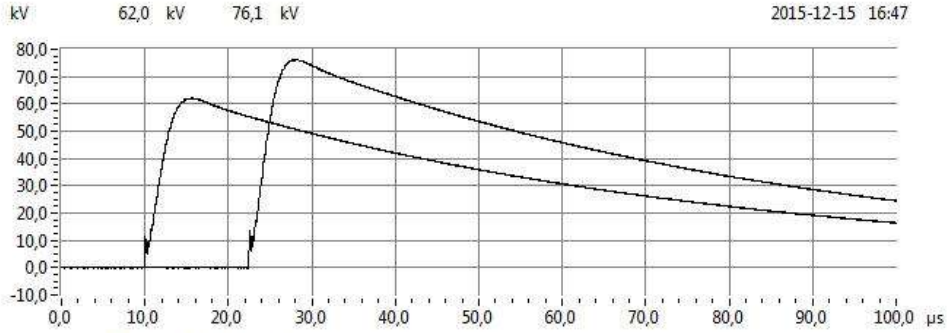



**Fig. 2: 72124900 Main loop 65% and 80% of test voltage**

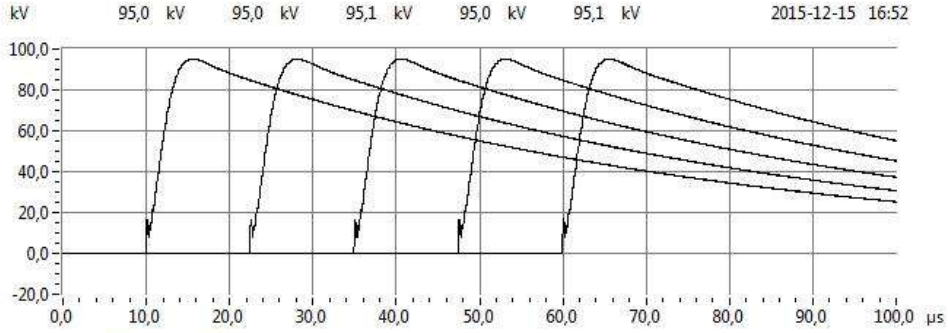



**Fig. 3: 72124900 Main loop 100% of test voltage**

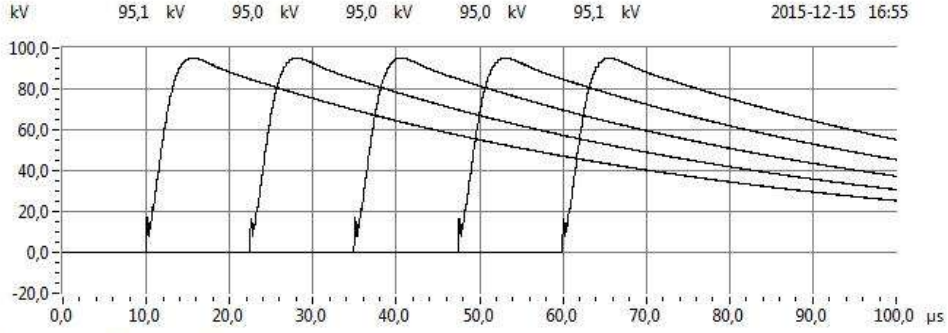



**Fig. 4: 72124900 Main loop 100% of test voltage**

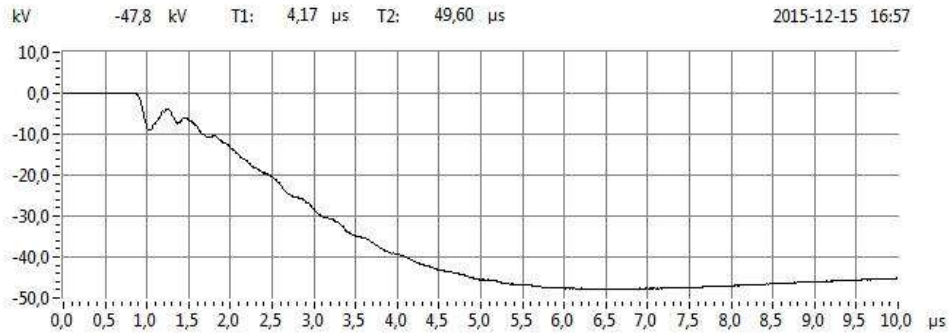



**Fig. 5: Waveshape 72124900 Main loop -50% of test voltage**

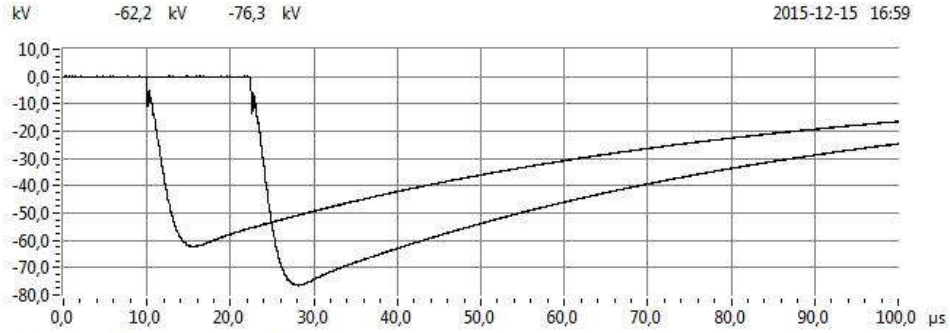



**Fig. 6: 72124900 Main loop -65% and -80% of test voltage**

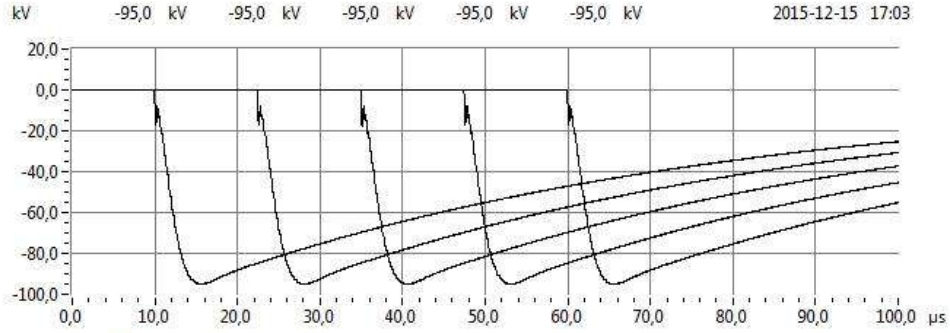



**Fig. 7: 72124900 Main loop -100% of test voltage**

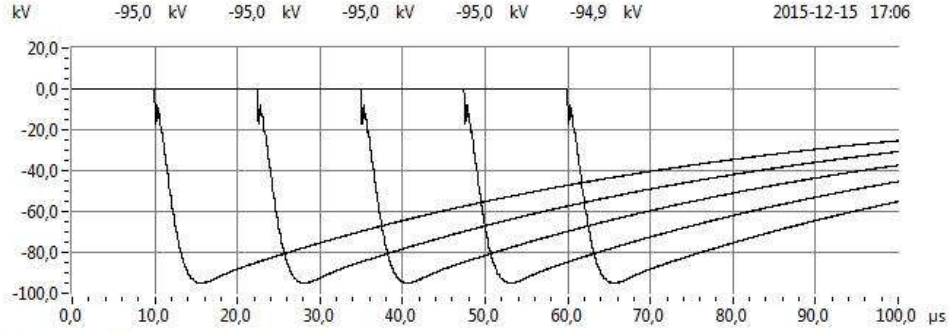



**Fig. 8: 72124900 Main loop -100% of test voltage**

## 3.7 Heating cycle voltage tests in air

**Standard and date**

Standard IEC 60502-4, table 5, test 4

Test date(s) 16 to 27 December 2015 and 11 to 22 January 2016

**Environmental conditions**

Ambient temperature 20-22 °C

**Characteristic test data**

Heating method conductor current

Stabilized temperature 97 °C

| No. of heating-cycles | Required steady conductor temperature | Heating current at stable condition | Heating per cycle | | Cooling per cycle | Voltage per cycle | |
|---|---|---|---|---|---|---|---|
| | | | Total duration | Duration of conductor at steady temperature | Total duration | Total voltage duration | Applied voltage 2,5 $U_0$ |
| | (°C) | (A) | (hours) | (hours) | (hours) | (hours) | (kV) |
| 60 | 95-100 | approx. 490 | 5 | 2 | 4 | 9 | 22 |

**Requirement**

No breakdown shall occur.

**Result**

The object passed the test.

## 3.8 Partial discharge test at elevated temperature

**Standard and date**

| | |
|---|---|
| Standard | IEC 60502-4, table 5, test 6 |
| Test date(s) | 10 February 2016 |

**Environmental conditions**

| | |
|---|---|
| Ambient temperature | 20 °C |

**Characteristic test data**

| | |
|---|---|
| Temperature of test object | 97 °C |
| Circuit | direct |
| Calibration | 20 pC |
| Noise level at 1,73 $U_0$ | 6 pC |
| Sensitivity | 6 pC |
| Required sensitivity | ≤ 5 pC |
| Centre frequency | 172 kHz |
| Bandwidth | 40 kHz |
| Test frequency | 50 Hz |
| Coupling capacitor | 2600 pF |

| Conductor | Voltage applied, 50 Hz | | Duration (s) | Partial discharge level (pC) |
|---|---|---|---|---|
| | ... x $U_0$ | (kV) | | |
| Conductor 1, 2 and 3 of test loop 1 and 2 | 1,73 | 15 | >10 | not detectable |

**Requirement**

The maximum partial discharge level from the test object at 1,73 $U_0$ shall not exceed 10 pC.

**Result**

The object passed the test.

## 3.9 Partial discharge test at ambient temperature

**Standard and date**

Standard IEC 60502-4, table 5, test 6
Test date(s) 17 February 2016

**Environmental conditions**

Ambient temperature 20 °C

**Characteristic test data**

Temperature of test object 20 °C
Circuit direct
Calibration 20 pC
Noise level at 1,73 $U_0$ 2 pC
Sensitivity 4 pC
Required sensitivity ≤ 5 pC
Centre frequency 140 kHz
Bandwidth 90-190 kHz
Test frequency 50 Hz
Coupling capacitor 2600 pF

| Conductor | Voltage applied, 50 Hz | | Duration (s) | Partial discharge level (pC) |
|---|---|---|---|---|
| | ... x $U_0$ | (kV) | | |
| 1 of test loop 1 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |
| 2 of Test loop 1 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |
| 3 of test loop 1 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |
| 1 of test loop 2 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |
| 2 of test loop 2 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |
| 3 of test loop 2 | 2,5 | 22 | 10 | - |
| | 1,73 | 15 | - | not detectable |

**Requirement**

The maximum partial discharge level from the test object at 1,73 $U_0$ shall not exceed 10 pC.

**Result**

The object passed the test.

## 3.10 Impulse voltage at ambient temperature

**Standard and date**

Standard IEC 60502-4, table 5, test 10
Test date(s) 19 February 2016

**Environmental conditions**

Ambient temperature 20 °C

**Characteristic test data**

Temperature of test object 20 °C
Specified test voltage 95 kV

| Testing arrangement | | Polarity | Voltage applied | No. of | See figure on |
|---|---|---|---|---|---|
| Voltage applied to | Earthed | | (% of test voltage) | impulses | next pages |
| Conductor 1 test loop 1 | Metallic screens and conductors 2 and 3 | Positive | 50 | 1 | 1 (waveshape) |
| | | | 65 | 1 | 2 |
| | | | 80 | 1 | 2 |
| | | | 100 | 10 | 3 and 4 |
| Conductor 1 test loop 1 | Metallic screens and conductors 2 and 3 | Negative | 50 | 1 | 5 (waveshape) |
| | | | 65 | 1 | 6 |
| | | | 80 | 1 | 6 |
| | | | 100 | 10 | 7 and 8 |
| Conductor 2 test loop 1 | Metallic screens and conductors 1 and 3 | Positive | 50 | 1 | 9 (waveshape) |
| | | | 65 | 1 | 10 |
| | | | 80 | 1 | 10 |
| | | | 100 | 10 | 11 and 12 |
| Conductor 2 test loop 1 | Metallic screens and conductors 1 and 3 | Negative | 50 | 1 | 13 (waveshape) |
| | | | 65 | 1 | 14 |
| | | | 80 | 1 | 14 |
| | | | 100 | 10 | 15 and 16 |
| Conductor 3 test loop 1 | Metallic screens and conductors 1 and 2 | Positive | 50 | 1 | 17 (waveshape) |
| | | | 65 | 1 | 18 |
| | | | 80 | 1 | 18 |
| | | | 100 | 10 | 19 and 20 |
| Conductor 3 test loop 1 | Metallic screens and conductors 1 and 2 | Negative | 50 | 1 | 21 (waveshape) |
| | | | 65 | 1 | 22 |
| | | | 80 | 1 | 22 |
| | | | 100 | 10 | 23 and 24 |

| Testing arrangement | | Polarity | Voltage applied | No. of | See figure on |
|---|---|---|---|---|---|
| Voltage applied to | Earthed | | (% of test voltage) | impulses | next pages |
| Conductor 1 test loop 2 | Metallic screens and conductors 2 and 3 | Positive | 50 | 1 | 25 (waveshape) |
| | | | 65 | 1 | 26 |
| | | | 80 | 1 | 26 |
| | | | 100 | 10 | 27 and 28 |
| Conductor 1 test loop 2 | Metallic screens and conductors 2 and 3 | Negative | 50 | 1 | 29 (waveshape) |
| | | | 65 | 1 | 30 |
| | | | 80 | 1 | 30 |
| | | | 100 | 10 | 31 and 32 |
| Conductor 2 test loop 2 | Metallic screens and conductors 1 and 3 | Positive | 50 | 1 | 33 (waveshape) |
| | | | 65 | 1 | 34 |
| | | | 80 | 1 | 34 |
| | | | 100 | 10 | 35 and 36 |
| Conductor 2 test loop 2 | Metallic screens and conductors 1 and 3 | Negative | 50 | 1 | 37 (waveshape) |
| | | | 65 | 1 | 38 |
| | | | 80 | 1 | 38 |
| | | | 100 | 10 | 39 and 40 |
| Conductor 3 test loop 2 | Metallic screens and conductors 1 and 2 | Positive | 50 | 1 | 41 (waveshape) |
| | | | 65 | 1 | 42 |
| | | | 80 | 1 | 42 |
| | | | 100 | 10 | 43 and 44 |
| Conductor 3 test loop 2 | Metallic screens and conductors 1 and 2 | Negative | 50 | 1 | 45 (waveshape) |
| | | | 65 | 1 | 46 |
| | | | 80 | 1 | 46 |
| | | | 100 | 10 | 47 and 48 |

**Requirement**

Each core of the cable shall withstand without failure 10 positive and 10 negative voltage impulses.

**Result**

The object passed the test.

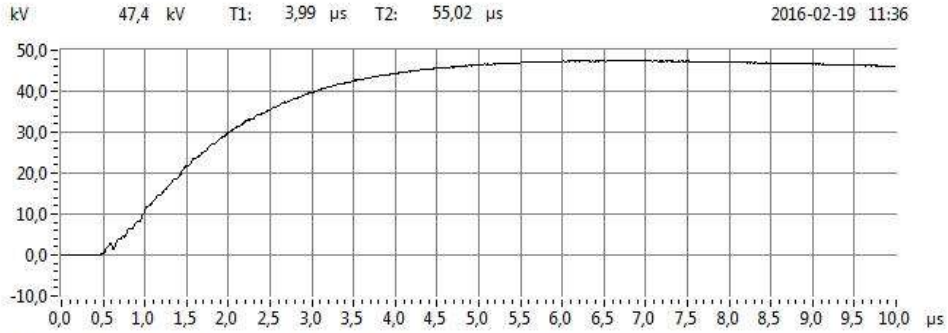



**Fig. 1: Waveshape 72124900 Main loop A, phase R, 50% of test voltage**

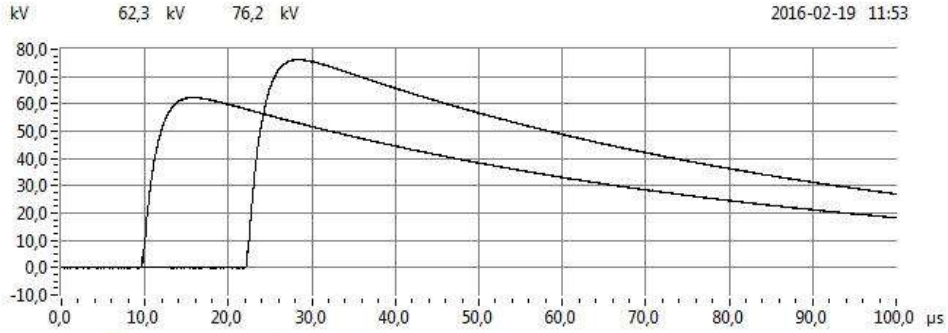



**Fig. 2: 72124900 Main loop A, phase R, 65% and 80% of test voltage**

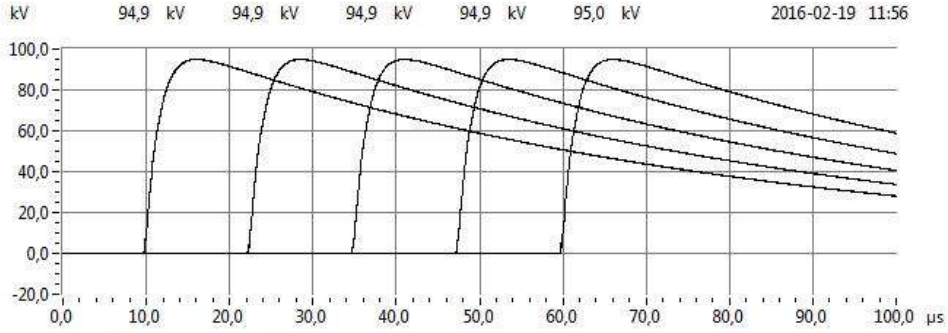



**Fig. 3: 72124900 Main loop A, phase R, 100% of test voltage**

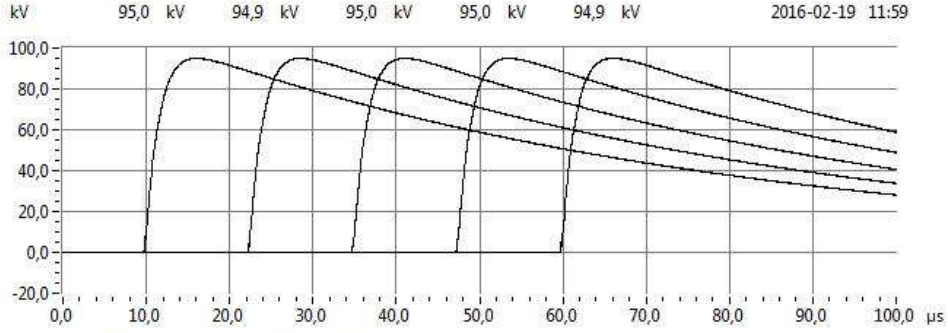



**Fig. 4: 72124900 Main loop A, phase R, 100% of test voltage**

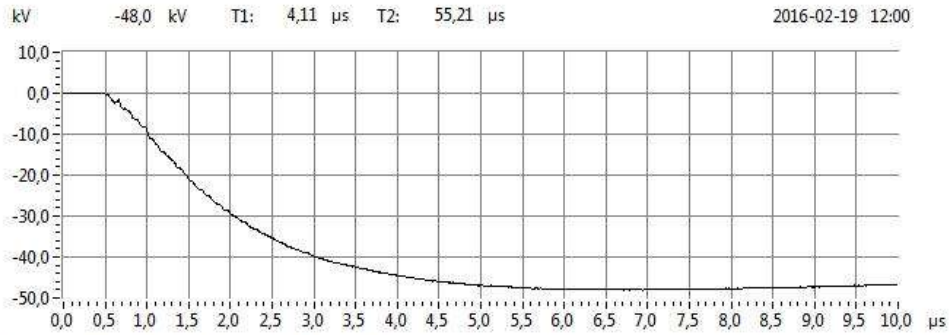



**Fig. 5: Waveshape 72124900 Main loop A, phase R, -50% of test voltage**

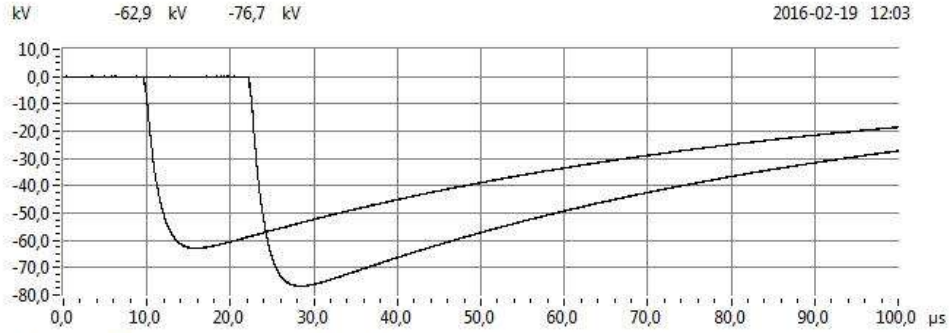



**Fig. 6: 72124900 Main loop A, phase R, -65% and -80% of test voltage**

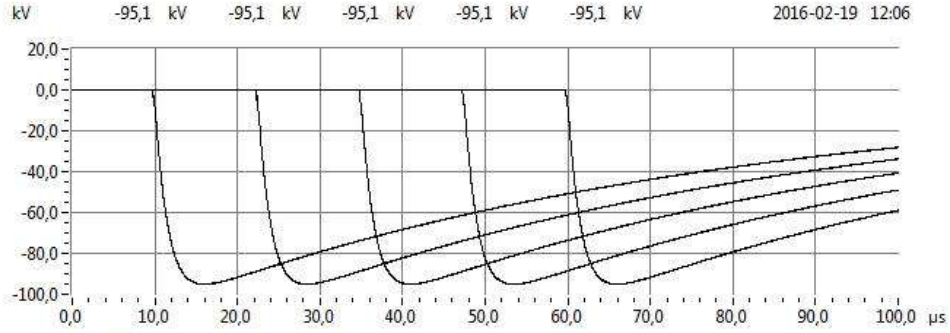



**Fig. 7: 72124900 Main loop A, phase R, -100% of test voltage**

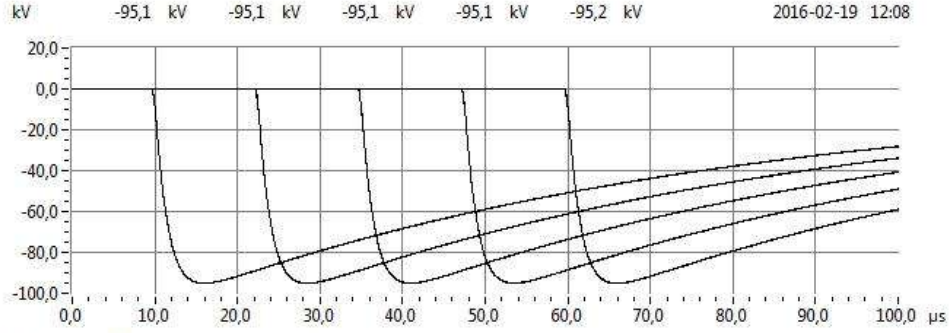



**Fig. 8: 72124900 Main loop A, phase R, -100% of test voltage**

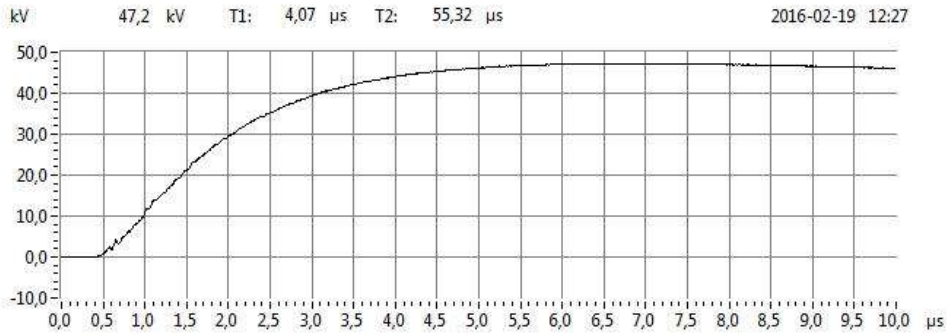



**Fig. 9: Waveshape 72124900 Main loop A, phase Y, 50% of test voltage**

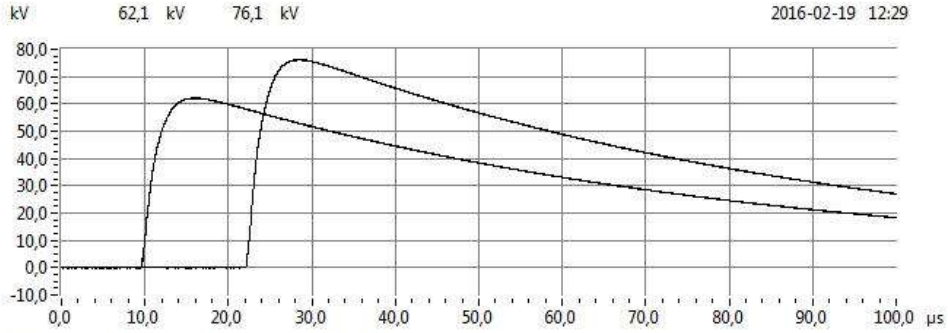



**Fig. 10: 72124900 Main loop A, phase Y, 65% and 80% of test voltage**

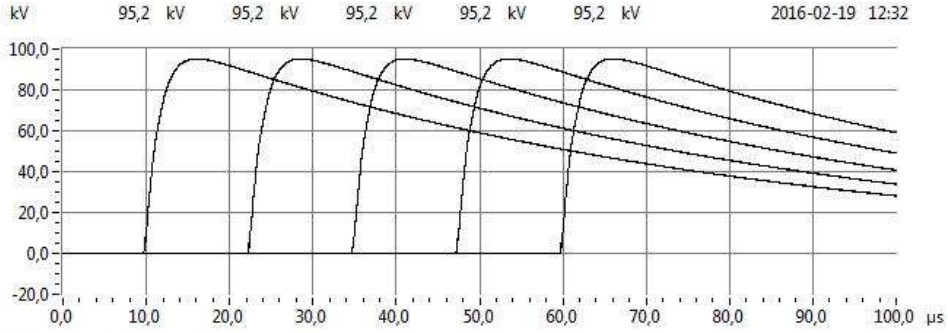



**Fig. 11: 72124900 Main loop A, phase Y, 100% of test voltage**

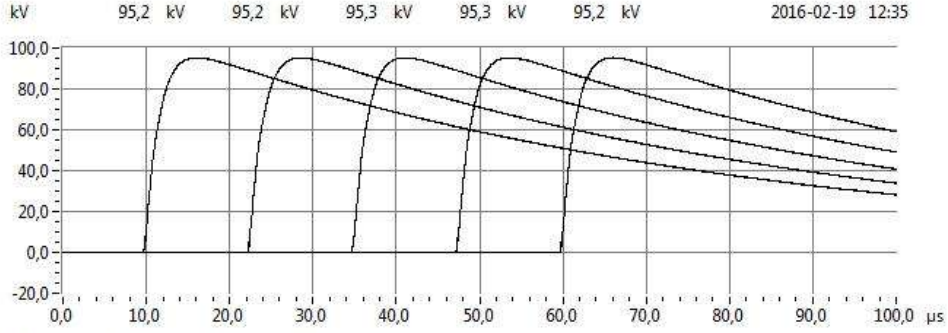



**Fig. 12: 72124900 Main loop A, phase Y, 100% of test voltage**

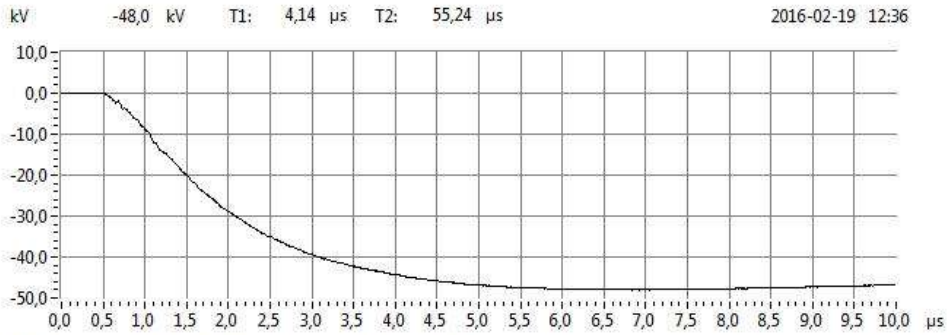



**Fig. 13: Waveshape 72124900 Main loop A, phase Y, -50% of test voltage**

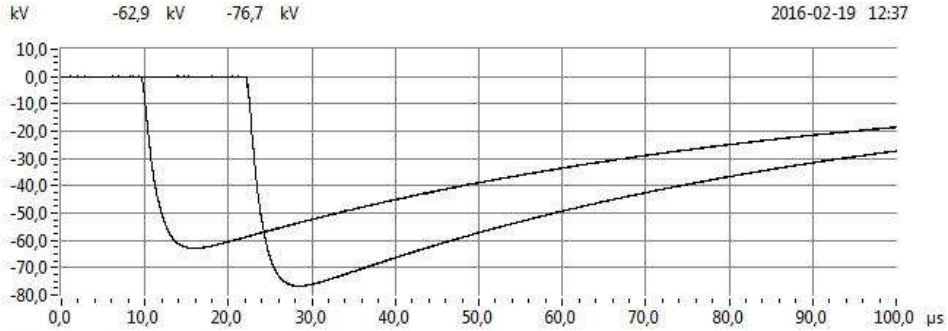



**Fig. 14: 72124900 Main loop A, phase Y, -65% and -80% of test voltage**

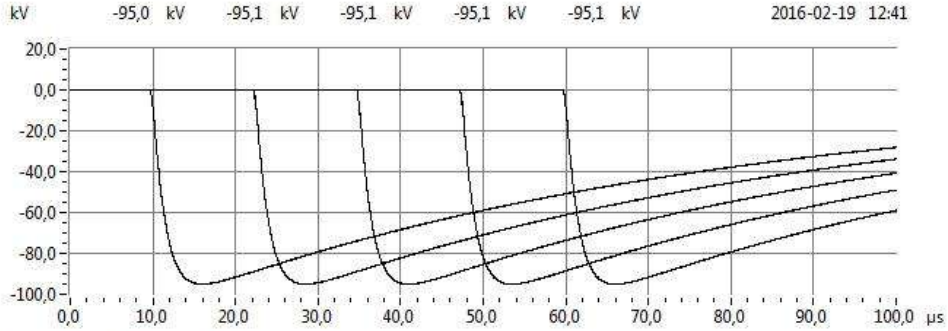



**Fig. 15: 72124900 Main loop A, phase Y, -100% of test voltage**

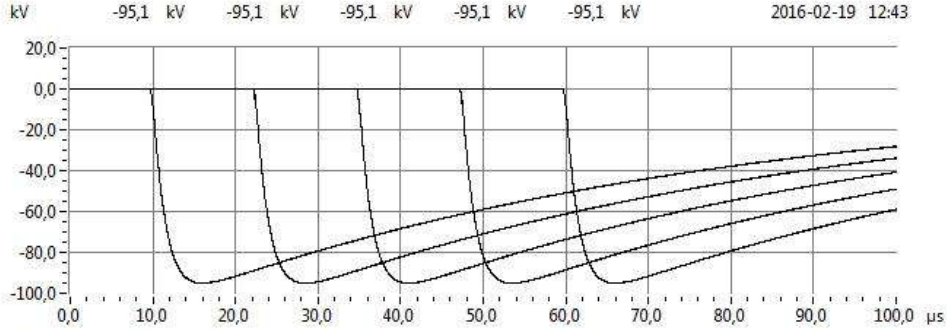



**Fig. 16: 72124900 Main loop A, phase Y, -100% of test voltage**

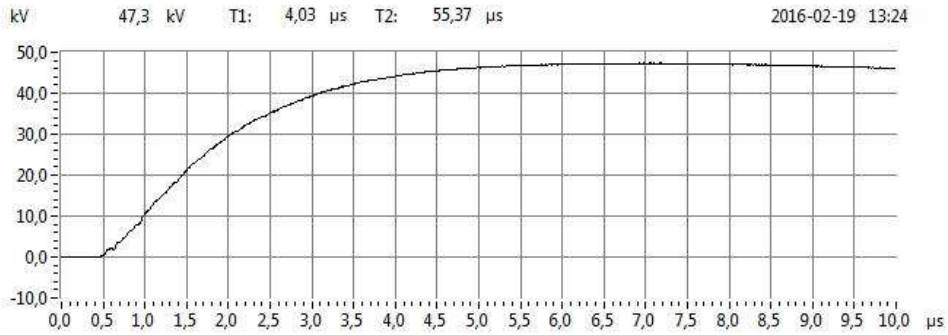



**Fig. 17: Waveshape 72124900 Main loop A, phase G, 50% of test voltage**

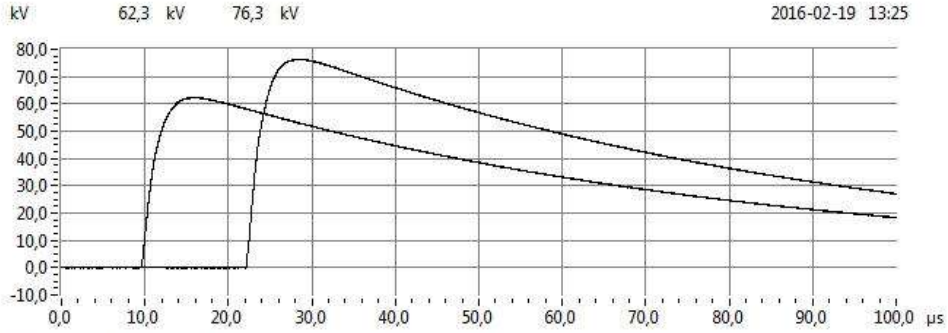



**Fig. 18: 72124900 Main loop A, phase G, 65% and 80% of test voltage**

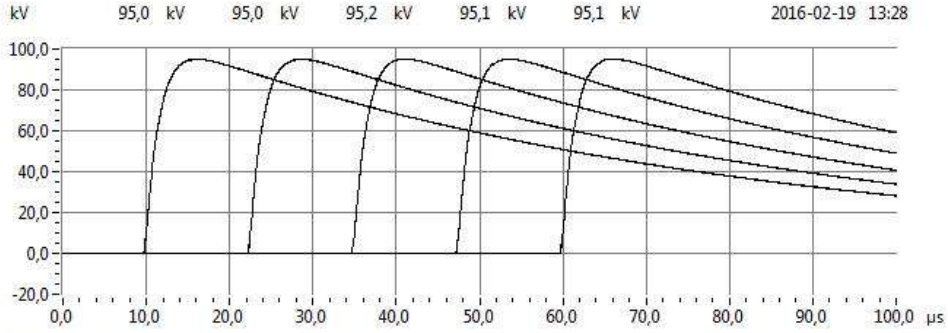



**Fig. 19: 72124900 Main loop A, phase G, 100% of test voltage**

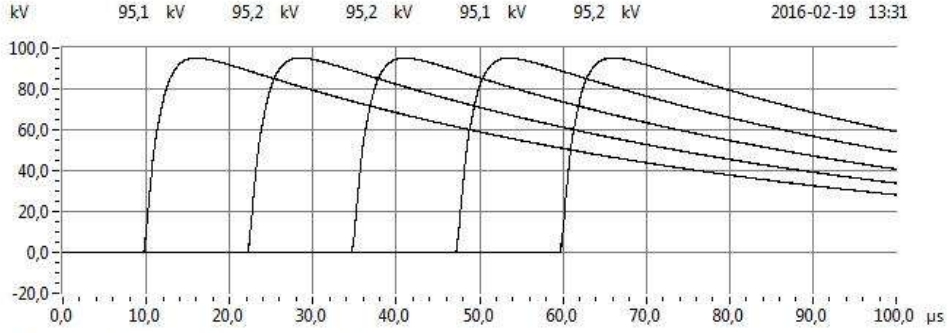



**Fig. 20: 72124900 Main loop A, phase G, 100% of test voltage**

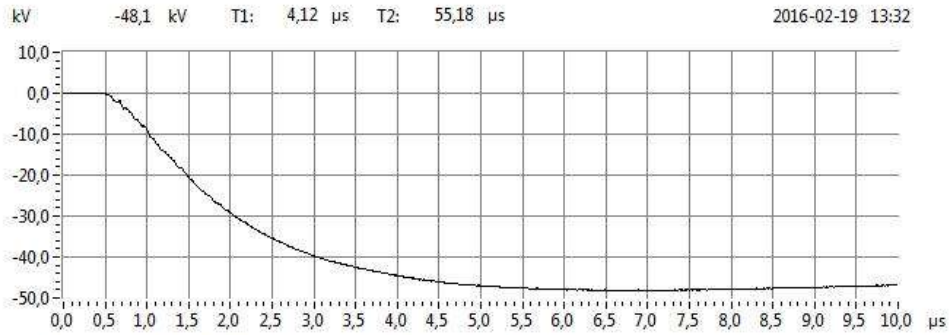



**Fig. 21: Waveshape 72124900 Main loop A, phase G, -50% of test voltage**

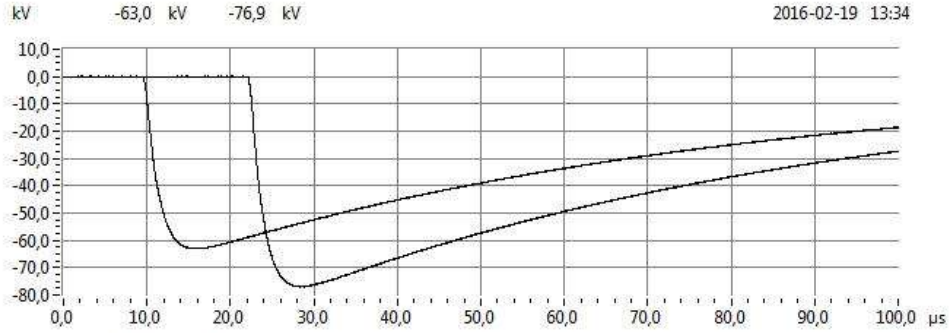



**Fig. 22: 72124900 Main loop A, phase G, -65% and -80% of test voltage**

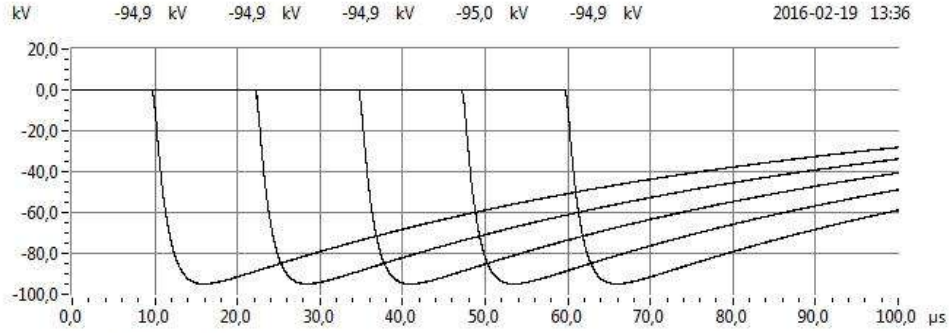



**Fig. 23: 72124900 Main loop A, phase G, -100% of test voltage**

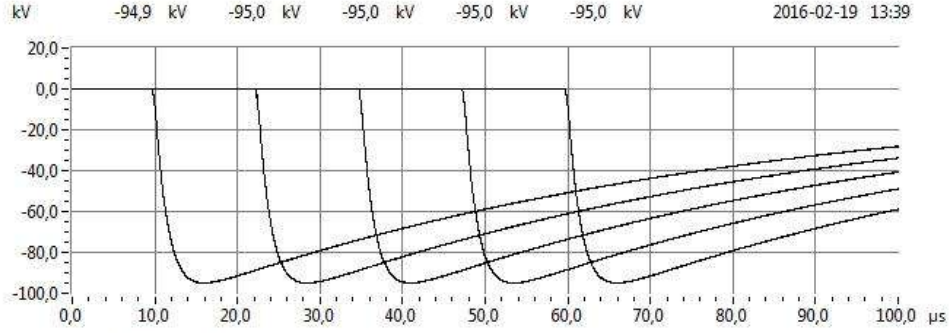



**Fig. 24: 72124900 Main loop A, phase G, -100% of test voltage**

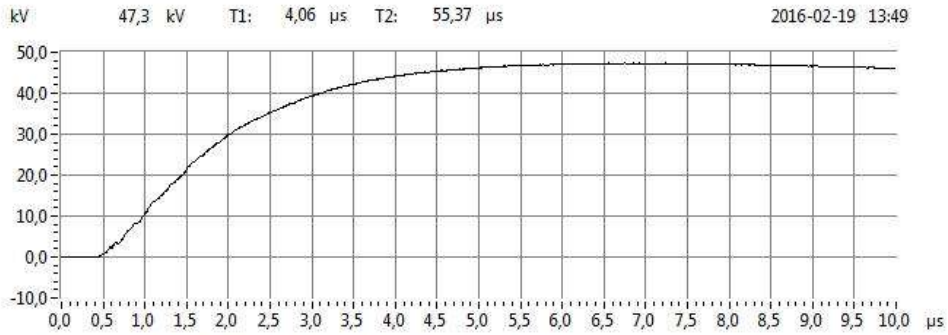



**Fig. 25: Waveshape 72124900 Main loop B, phase R, 50% of test voltage**

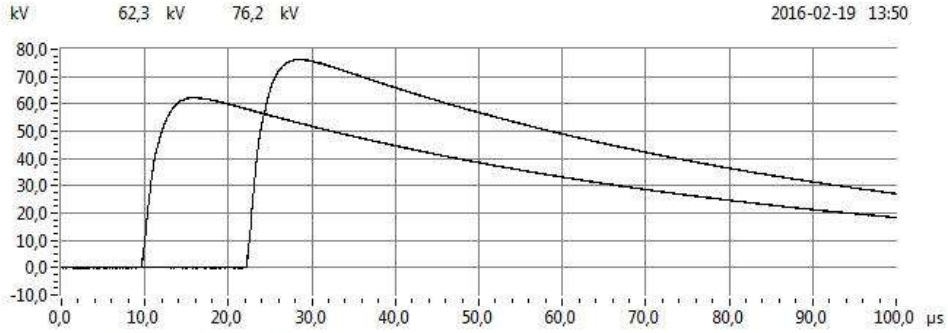



**Fig. 26: 72124900 Main loop B, phase R, 65% and 80% of test voltage**

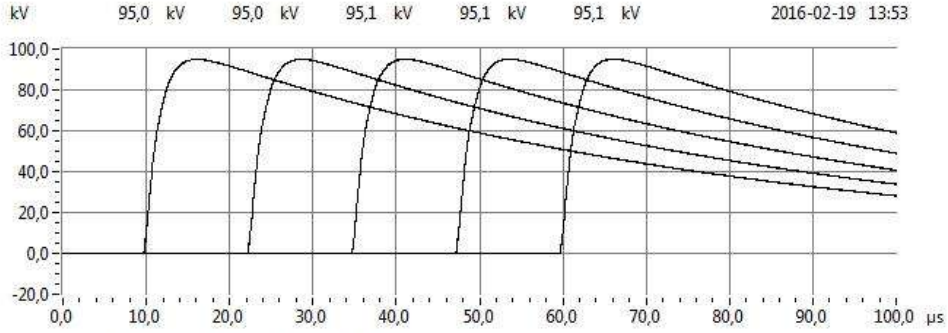



**Fig. 27: 72124900 Main loop B, phase R, 100% of test voltage**

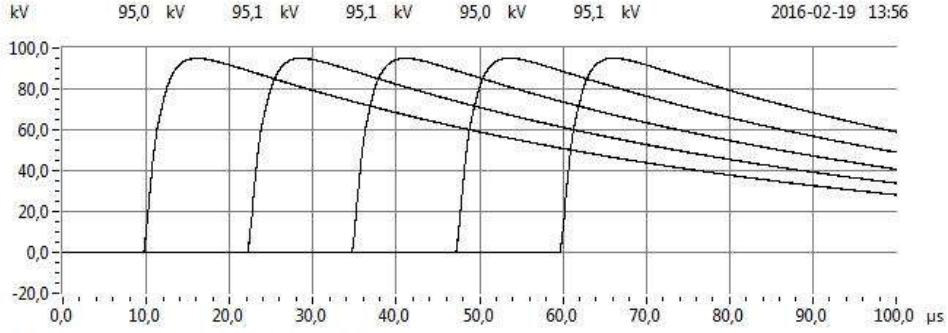



**Fig. 28: 72124900 Main loop B, phase R, 100% of test voltage**

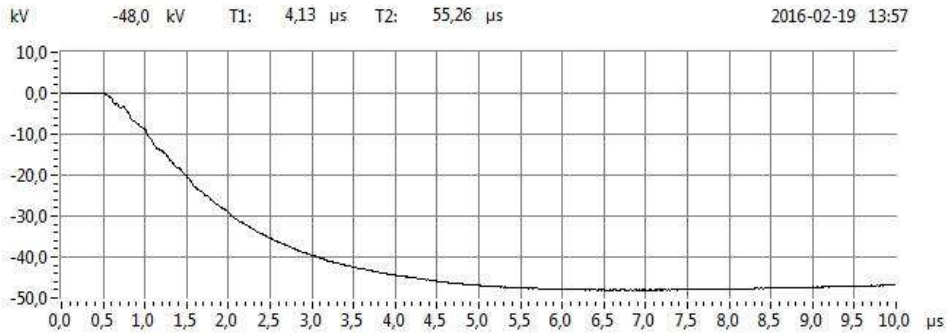



**Fig. 29: Waveshape 72124900 Main loop B, phase R, -50% of test voltage**

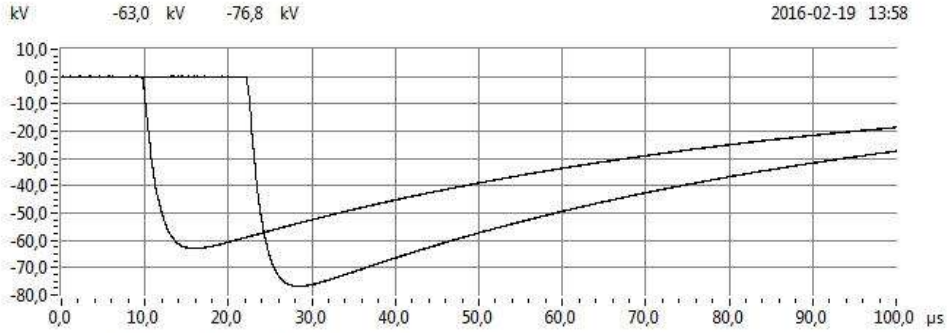



**Fig. 30: 72124900 Main loop B, phase R, -65% and -80% of test voltage**

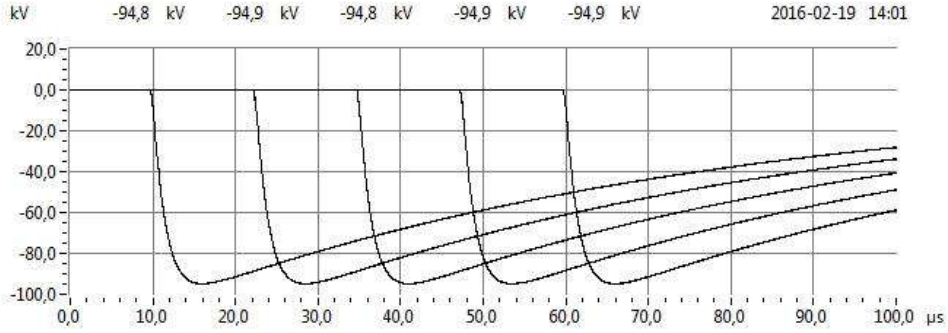



**Fig. 31: 72124900 Main loop B, phase R, -100% of test voltage**

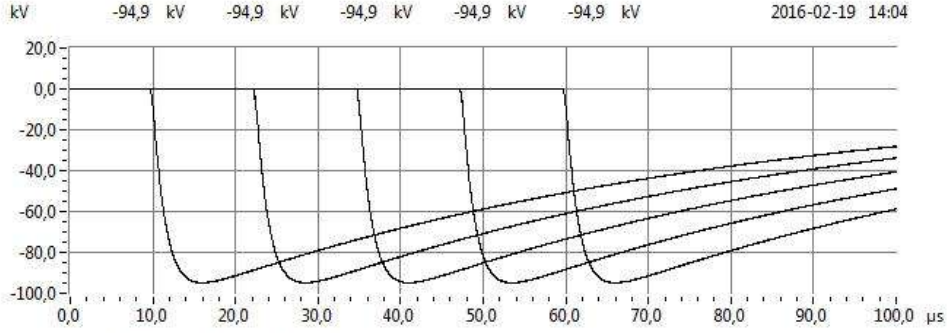



**Fig. 32: 72124900 Main loop B, phase R, -100% of test voltage**

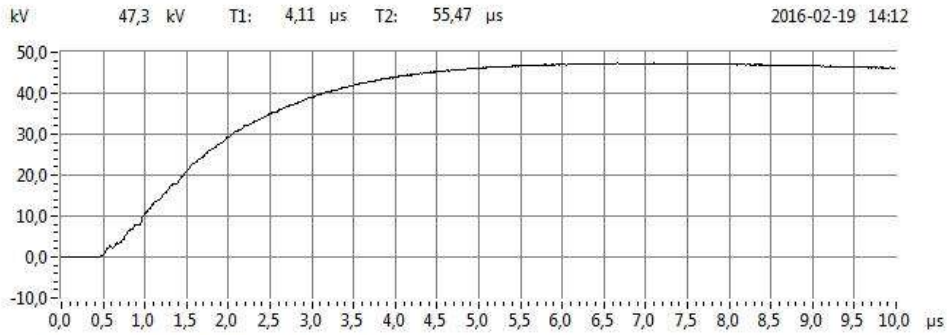



**Fig. 33: Waveshape 72124900 Main loop B, phase Y, 50% of test voltage**

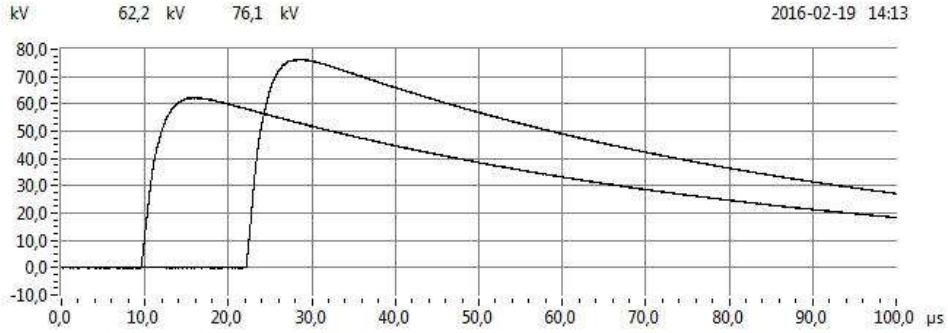



**Fig. 34: 72124900 Main loop B, phase Y, 65% and 80% of test voltage**

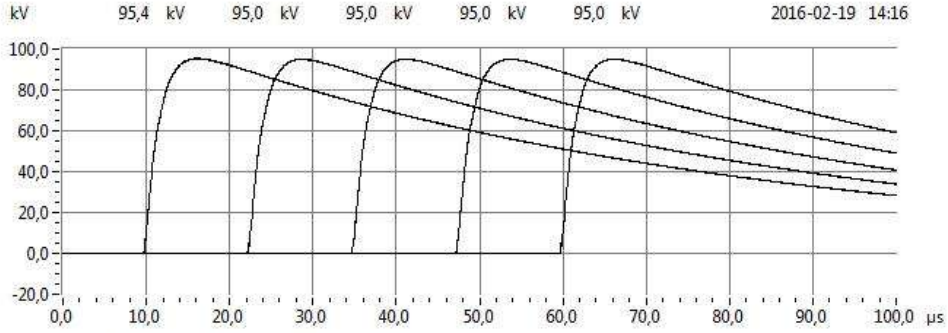



**Fig. 35: 72124900 Main loop B, phase Y, 100% of test voltage**

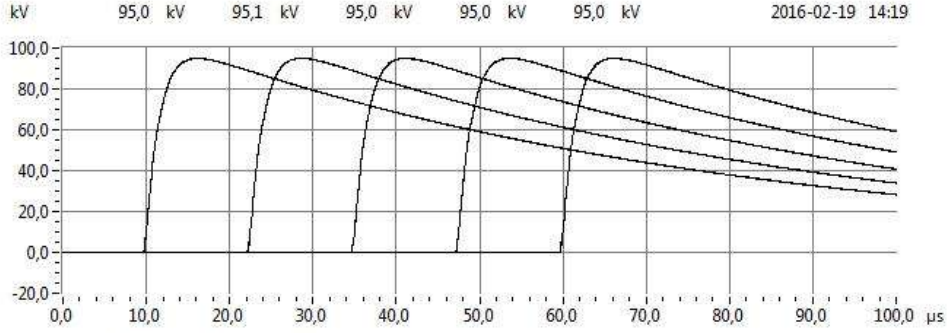



**Fig. 36: 72124900 Main loop B, phase Y, 100% of test voltage**

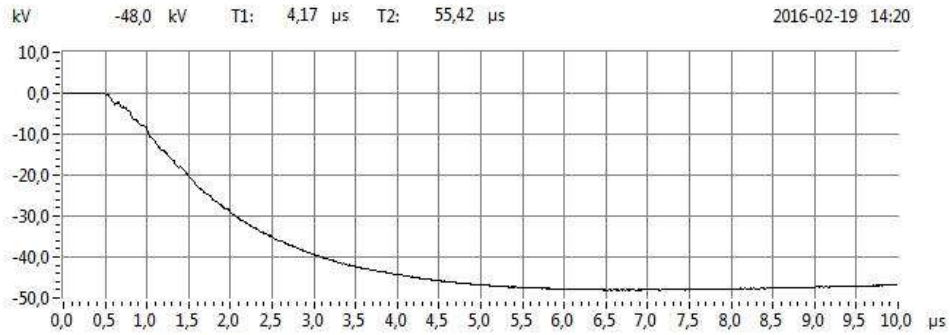



**Fig. 37: Waveshape 72124900 Main loop B, phase Y, -50% of test voltage**

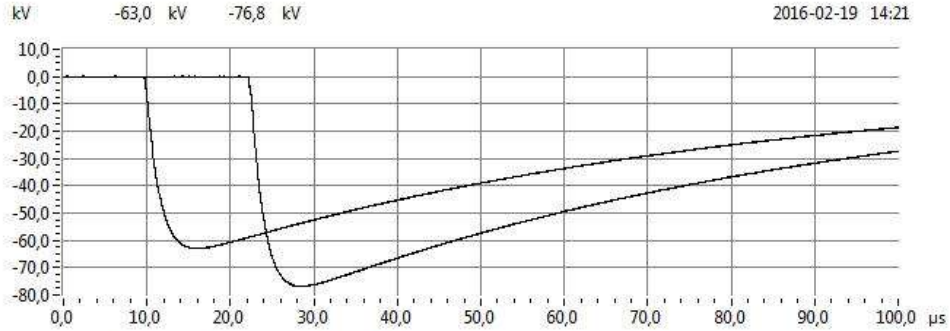



**Fig. 38: 72124900 Main loop B, phase Y, -65% and -80% of test voltage**

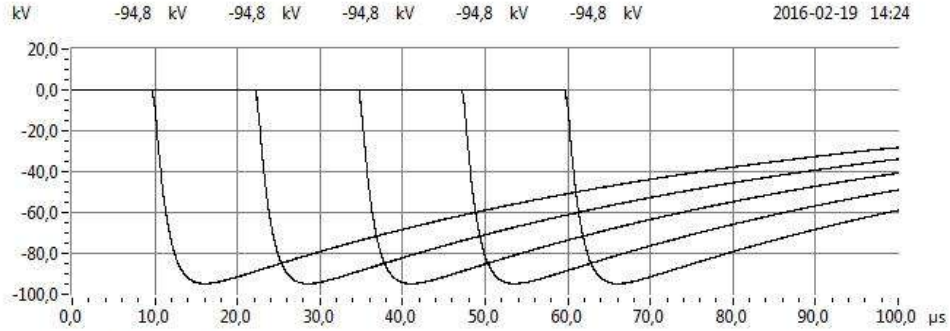



**Fig. 39: 72124900 Main loop B, phase Y, -100% of test voltage**

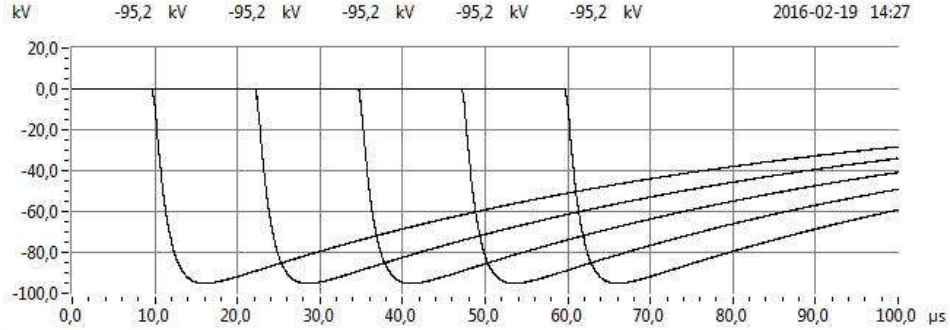



**Fig. 40: 72124900 Main loop B, phase Y, -100% of test voltage**

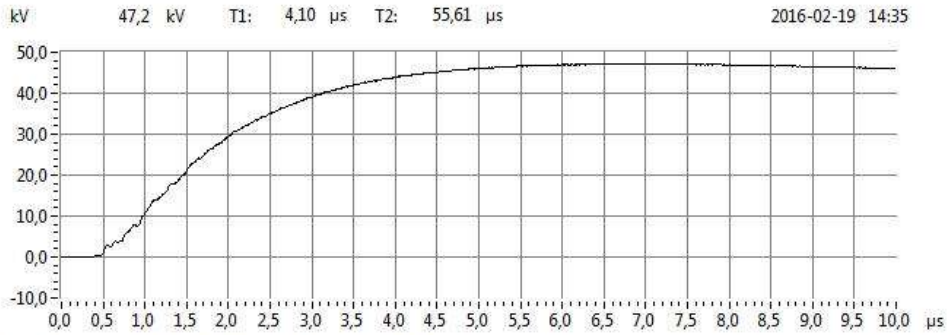



**Fig. 41: Waveshape 72124900 Main loop B, phase G, 50% of test voltage**

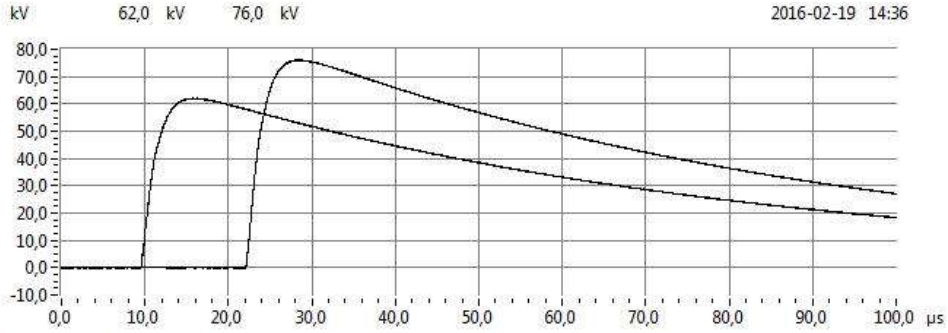



**Fig. 42: 72124900 Main loop B, phase G, 65% and 80% of test voltage**

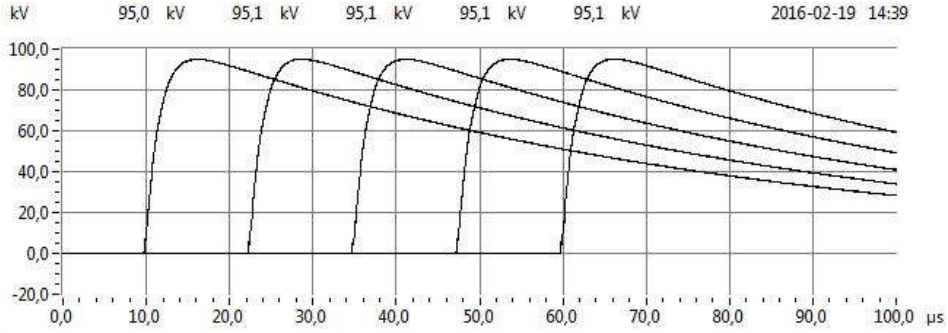



**Fig. 43: 72124900 Main loop B, phase G, 100% of test voltage**

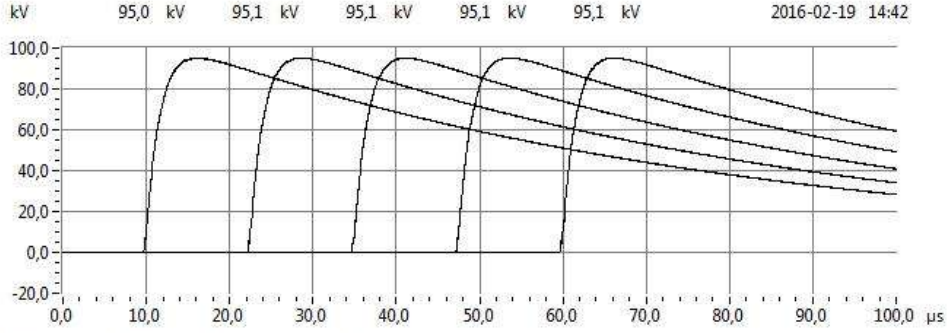



**Fig. 44: 72124900 Main loop B, phase G, 100% of test voltage**

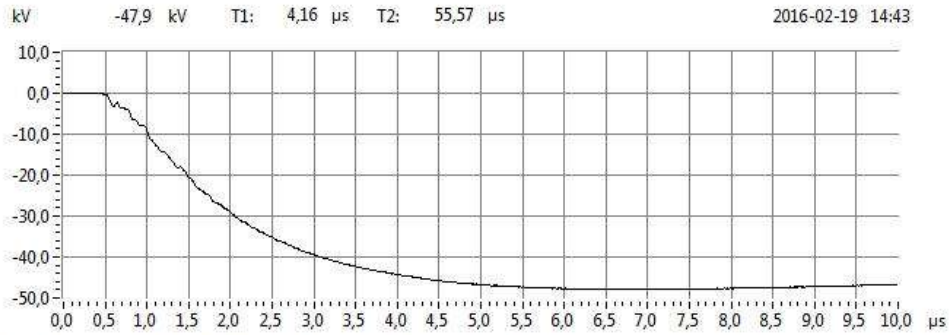



**Fig. 45: Waveshape 72124900 Main loop B, phase G, -50% of test voltage**

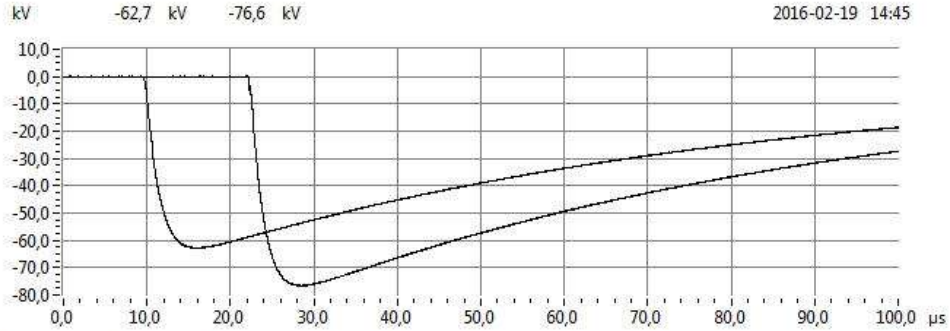



**Fig. 46: 72124900 Main loop B, phase G, -65% and -80% of test voltage**

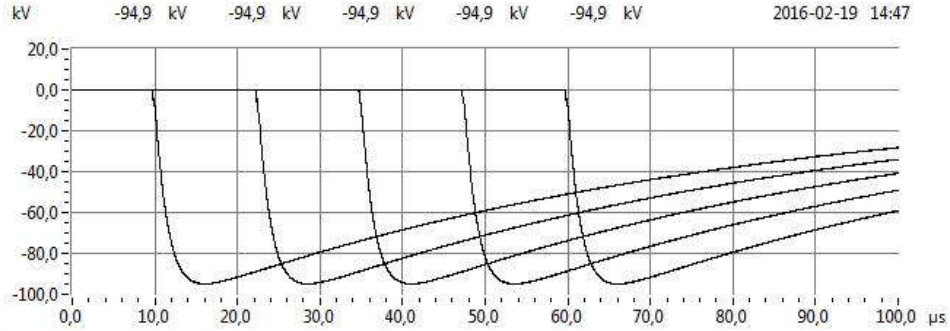



**Fig. 47: 72124900 Main loop B, phase G, -100% of test voltage**

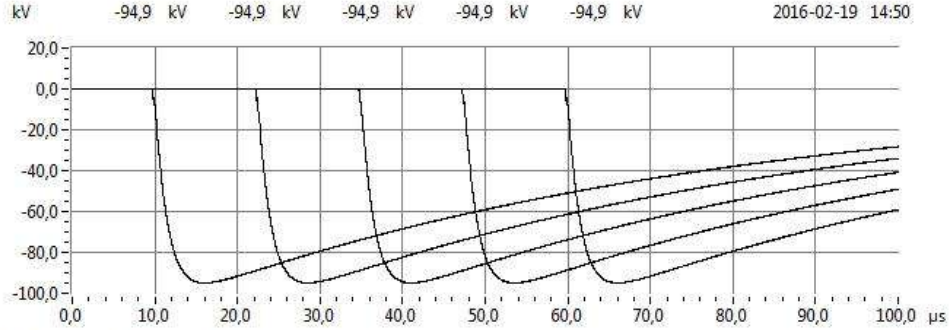



**Fig. 48: 72124900 Main loop B, phase G, -100% of test voltage**

## 3.11 AC voltage dry test

**Standard and date**

Standard IEC 60502-4, table 5, test 11
Test date(s) 19 February 2016

**Environmental conditions**

Ambient temperature 20 °C

**Characteristic test data**

Temperature of test object 20 °C

| Testing arrangement | | Voltage applied, 50 Hz | | Duration |
|---|---|---|---|---|
| Voltage applied to | Earth connected to | … x $U_0$ | (kV) | (min) |
| Conductor 1, 2 and 3 of test loop 1 | Metal screens | 2,5 | 22 | 15 |
| Conductor 1, 2 and 3 of test loop 2 | Metal screens | 2,5 | 22 | 15 |

**Requirement**

No breakdown of the insulation shall occur.

**Result**

The object passed the test.

## 3.12 Examination

**Standard and date**

Standard IEC 60502-4, table 5, test 14
Test date(s) 25 May 2016

**Environmental conditions**

Ambient temperature 20 °C
Temperature of test object 20 °C

| Object | Observations |
|---|---|
| Sample 1 | None of the following has been detected:<br>• cracking in the filling material and/or tape or tubing components<br>• a moisture path bridging a primary seal<br>• corrosion and/or tracking and/or erosion which would, in time, lead to a failure of the accessory<br>• leakage of any insulating material |
| Sample 2 | None of the following has been detected:<br>• cracking in the filling material and/or tape or tubing components<br>• a moisture path bridging a primary seal<br>• corrosion and/or tracking and/or erosion which would, in time, lead to a failure of the accessory<br>• leakage of any insulating material |

**Note**

The results are for information only.

**Photographs**

Indoor termination

Removal tube


Detail stress control

Two indoor terminations

# 4 TEST SEQUENCE TABLE 5 COLUMN 1.2 (ONE INDOOR TERMINATION)

## 4.1 Test arrangement

### 4.1.1 Determination of the cable conductor temperature

**Standard**

Standard IEC 61442, Subclause 8

For the tests at elevated temperature, a reference loop for temperature control of the conductor was installed and conductor current was used for heating. The reference cable was cut from the total cable length intended for the type test. This reference loop was installed close to the test loop in order to create the same environmental conditions as for the test loop.

The heating currents in the reference loop and the test loop were kept equal at all times, thus the conductor temperature of the reference loop is representative for the conductor temperature of the test loop. Annex A was used as a guide and Annex A, Subclause A.3.3, method 3 was applied.

The tests at elevated temperature are carried out after the conductor temperature has been within the stated limit for at least 2 hours.

## 4.2 DC voltage dry test

**Standard and date**

Standard IEC 60502-4, table 5, test 1
Test date(s) 16 November 2015

**Environmental conditions**

Ambient temperature 22 °C
Temperature of test object 22 °C

| Testing arrangement | | DC voltage applied | | Duration |
|---|---|---|---|---|
| Voltage applied to | Earth connected to | x $U_0$ | (kV) | (min) |
| Conductor 1, 2 and 3 of test loop 3 | Metal screens | 4 | 35 | 15 |

**Requirement**

No breakdown of the insulation shall occur.

**Result**

The object passed the test.

## 4.3 AC voltage dry test

**Standard and date**

Standard IEC 60502-4, table 5, test 1
Test date(s) 16 November 2015

**Environmental conditions**

Ambient temperature 22 °C
Temperature of test object 22 °C

| Testing arrangement | | Voltage applied, 50 Hz | | Duration |
|---|---|---|---|---|
| Voltage applied to | Earth connected to | … x $U_0$ | (kV) | (min) |
| Conductor 1, 2 and 3 of test loop 3 | Metal screens | 4,5 | 39 | 5 |

**Requirement**

No breakdown of the insulation shall occur.

**Result**

The object passed the test.

## 4.4 Thermal short-circuit test (screen)

**Standard and date**

Standard IEC 60502-4, table 5, test 7
Test date(s) 25 November 2015

**Environmental conditions**

Ambient temperature 21 °C

**Characteristic test data**

Stabilized conductor temperature 97 °C

| Conductor heating | | |
|---|---|---|
| Required conductor temperature $\theta$ (°C) | Applied 3-phase heating current (A) | Conductor stable at 97 °C before short-circuit application (h) |
| $95 \leq \theta \leq 100$ | 495 | 2 |

| Short-circuit application on screen (see figures on the next pages) | | | |
|---|---|---|---|
| Specified short-circuit current (kA) | Frequency (Hz) | Duration (s) | Number of short-circuit applications |
| 2,5 | 50 | 1 | 2 |

**Procedure**

The conductor temperature shall be maintained within the stated temperature limits for at least 2 hours before carrying out the short-circuit test. Between the two short-circuit applications, the cable screen shall be allowed to cool down to a temperature less than 10 K above its temperature prior to the first short-circuit application.

**Requirement**

No visible deterioration may occur.

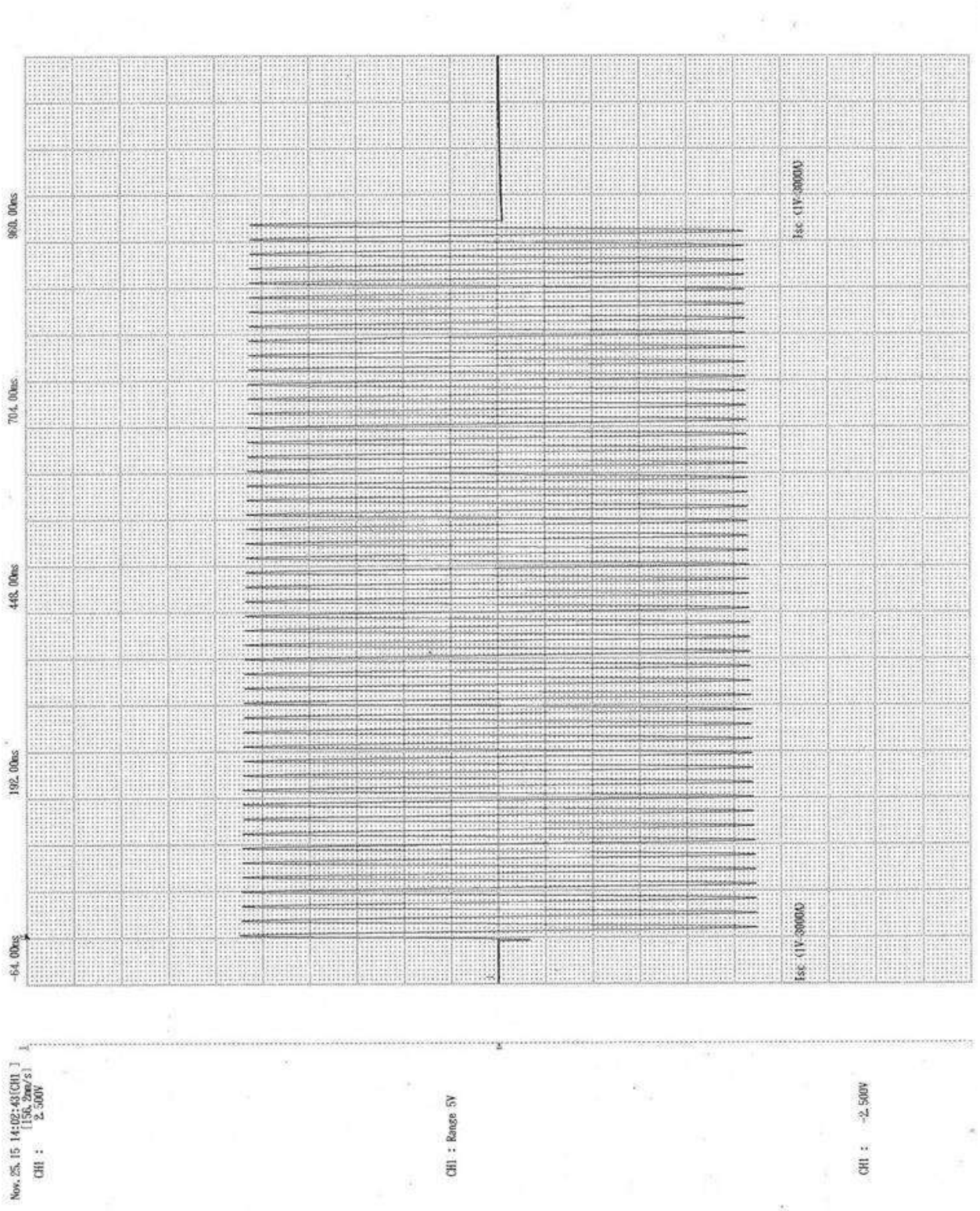
**Result**

The object passed the test.

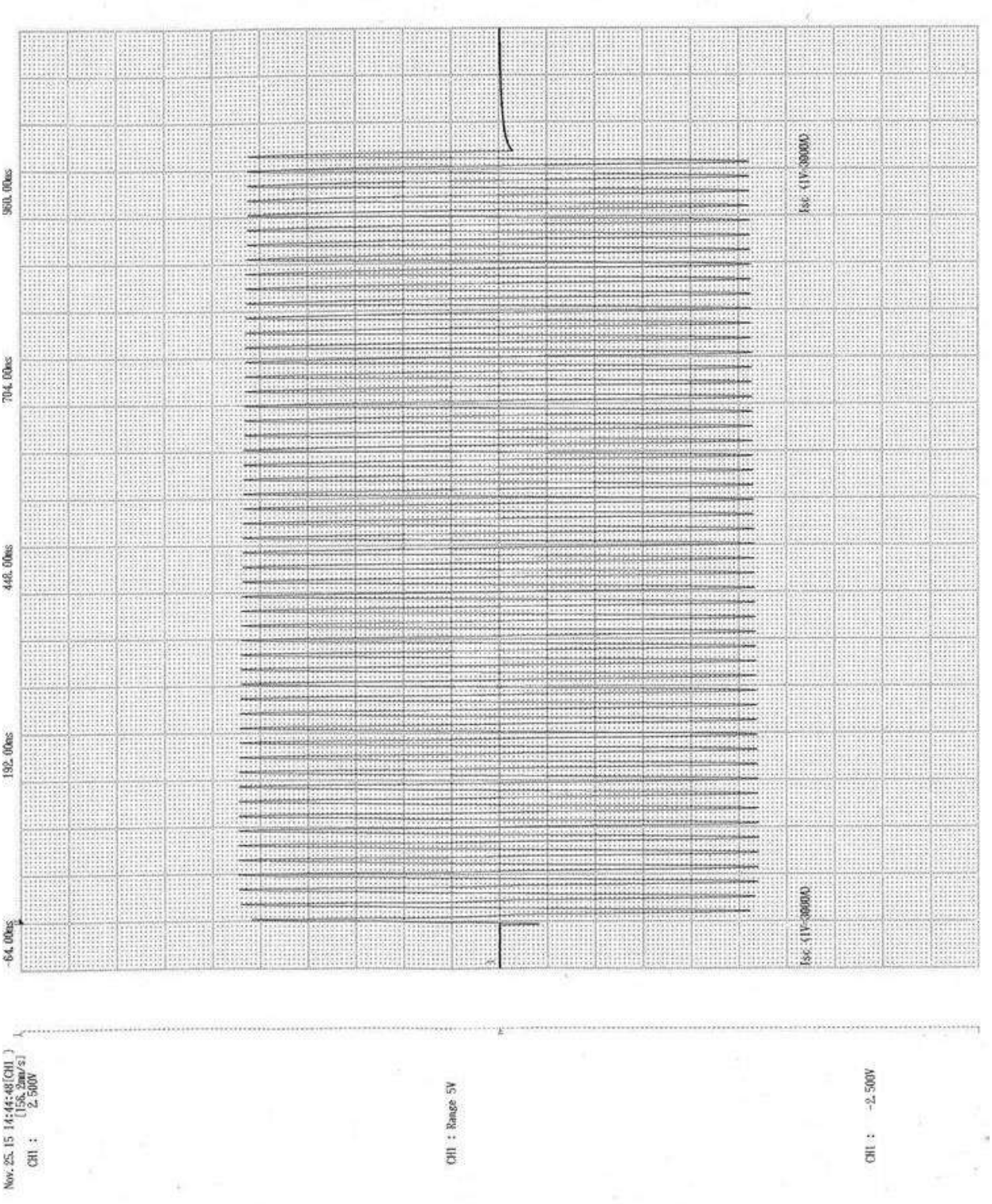
### 4.4.1 Test circuit

**Photograph test circuit**

## 4.4.2 Test results and oscillograms




First short-circuit current 2,8 kA during 1,06 s.




Second short-circuit current 2,8 kA during 1,06 s.

## 4.5 Thermal short-circuit test (conductor)

**Standard and date**

| | |
|---|---|
| Standard | IEC 60502-4, table 5, test 8 |
| Test date(s) | 3 December 2015 |

**Environmental conditions**

| | | |
|---|---|---|
| Ambient temperature | 10 | °C |

**Characteristic test data**

| | | |
|---|---|---|
| Conductor material | copper | |
| Cross section conductor | 185 | $mm^2$ |
| Maximum short circuit conductor temperature | 250 | °C |

**First short circuit application**

| | | |
|---|---|---|
| Start temperature of test object (measured value) | 18 | °C |
| Selected duration of short circuit current | 1 | s |
| Calculated short circuit current | 33,8 | kA |
| Thermal current, three phase | 34,5 | kA |
| Duration | 1,05 | s |

**Second short circuit application**

| | | |
|---|---|---|
| Start temperature of test object (measured value) | 27 | °C |
| Selected duration of short circuit current | 1 | s |
| Calculated short circuit current | 32,9 | kA |
| Thermal current, three phase | 33,0 | kA |
| Duration | 1,05 | s |

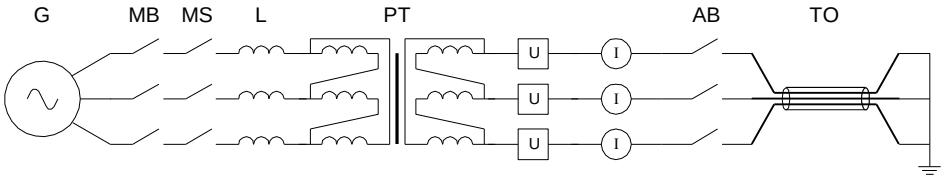
**Procedure**

Two short-circuits shall be applied to raise the conductor temperature to the maximum permissible short-circuit temperature of the cable within 5 s. Between the two short-circuits, the test loop shall be allowed to cool to a temperature less than 10 K above its temperature prior to the first short-circuit.

**Result**

The object passed the test.

## 4.5.1 Test circuit



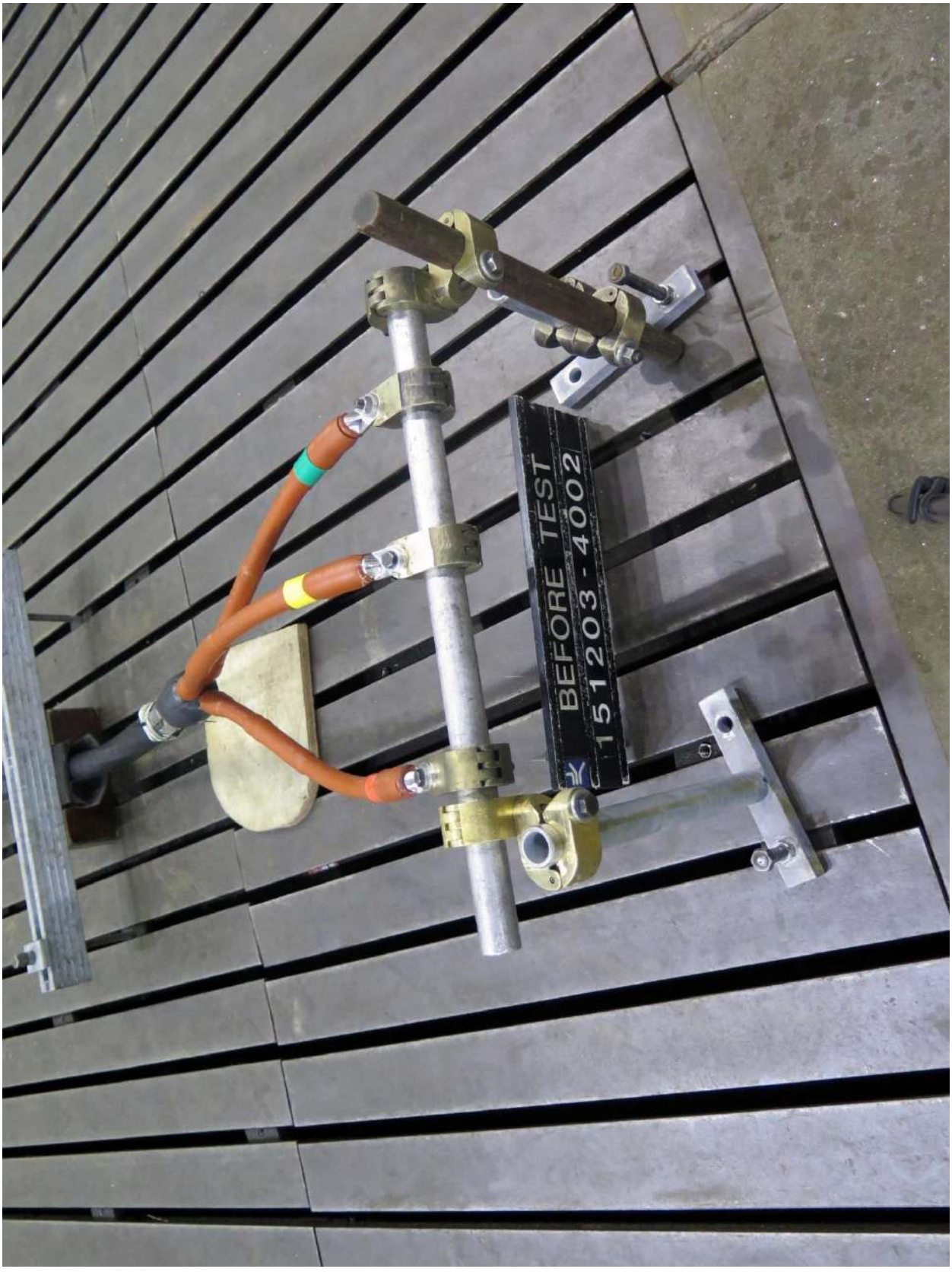

| | | | | | |
|---|---|---|---|---|---|
| G | = Generator | TO | = Test Object | U | = Voltage Measurement to earth |
| MB | = Master Breaker | L | = Reactor | I | = Current Measurement |
| MS | = Make Switch | | | AB | = Auxiliary Breaker |
| PT | = Power Transformer | | | | |

| **Supply** | | |
|---|---|---|
| Power | MVA | 173 |
| Frequency | Hz | 50 |
| Phase(s) | | 3 |
| Voltage | kV | 2.9 |
| Current | kA | 34.5 |
| Impedance | Ω | 0.049 |
| Power factor | | < 0,1 |
| Neutral | | not earthed |

| **Load** | |
|---|---|
| Short-circuit point | earthed |

Remarks: -

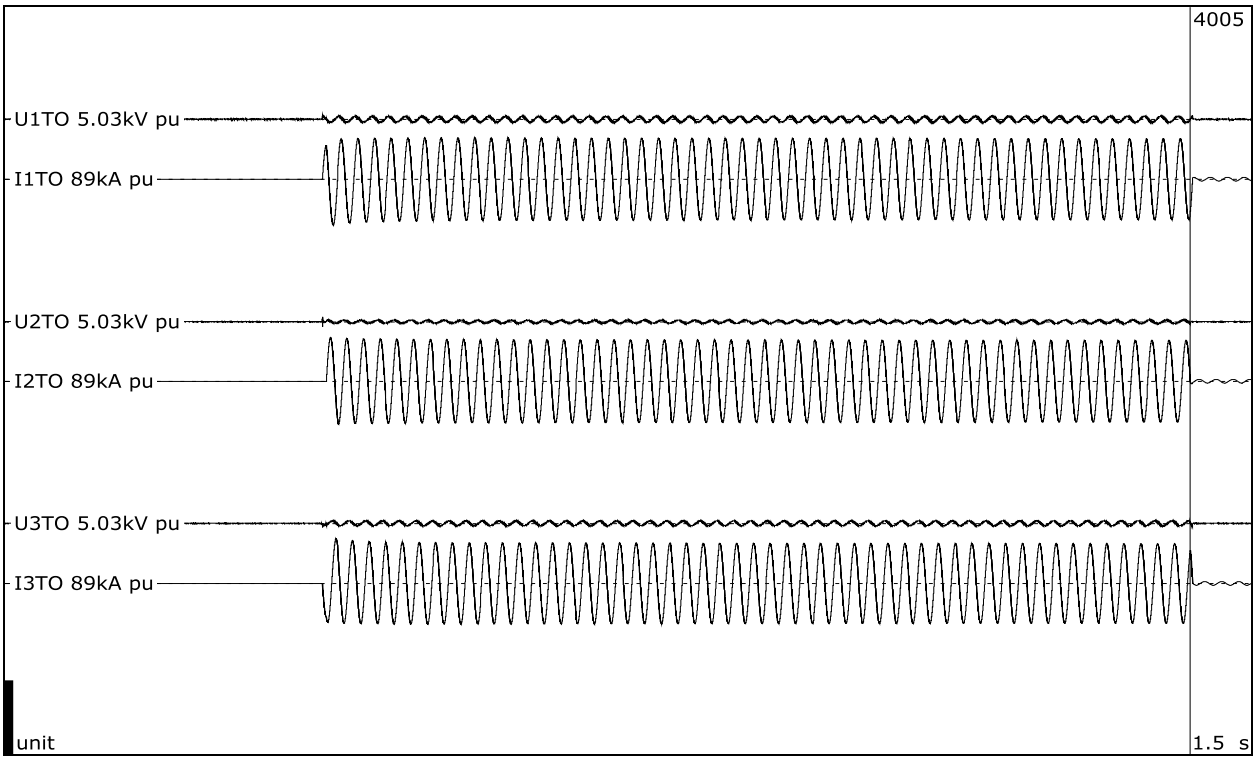
**Photograph before test**

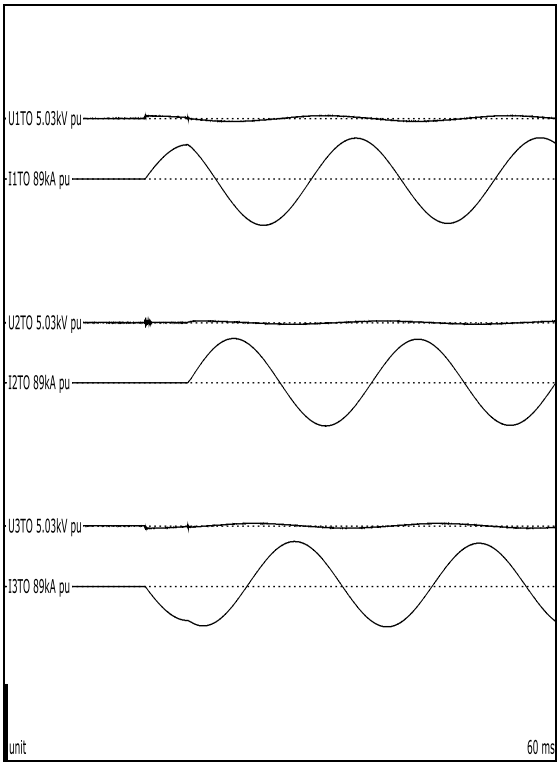



"4002" is incorrect, please read "4005".

## 4.5.2 Test results and oscillograms

**Thermal short-circuit test**



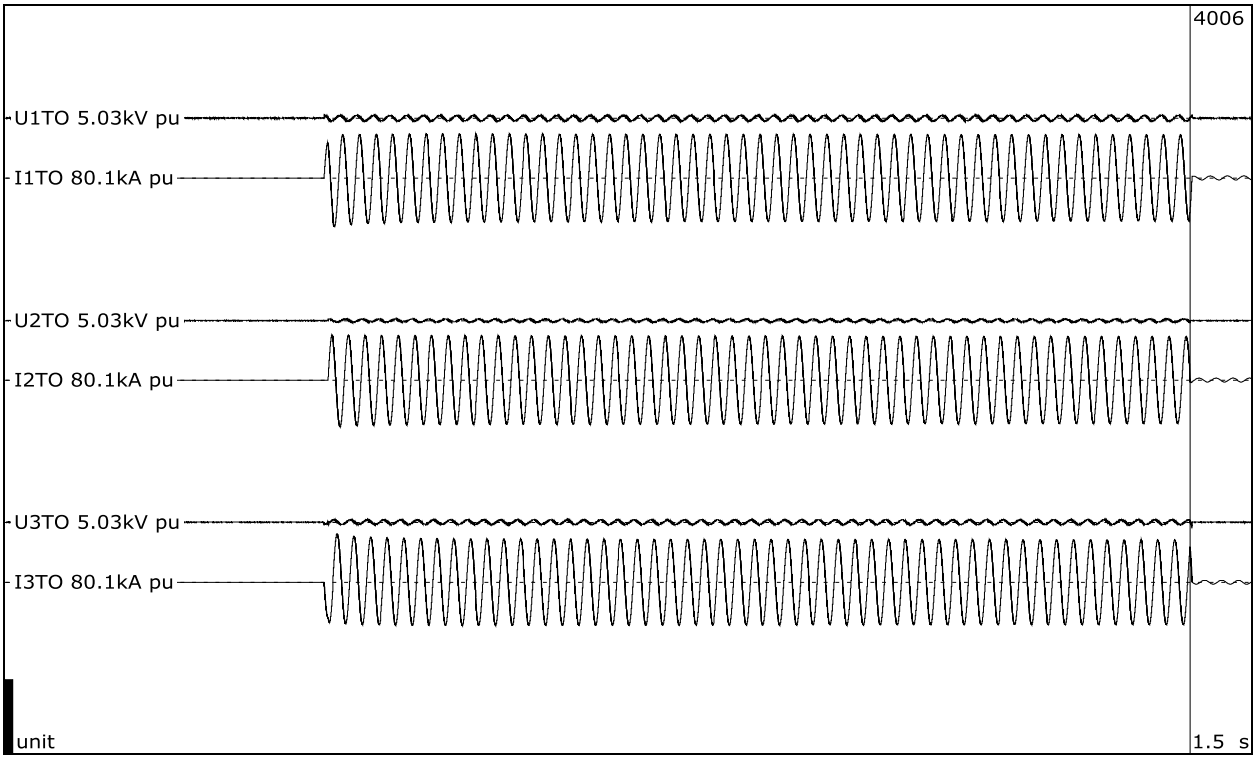

**Test number:** **151203-4005**

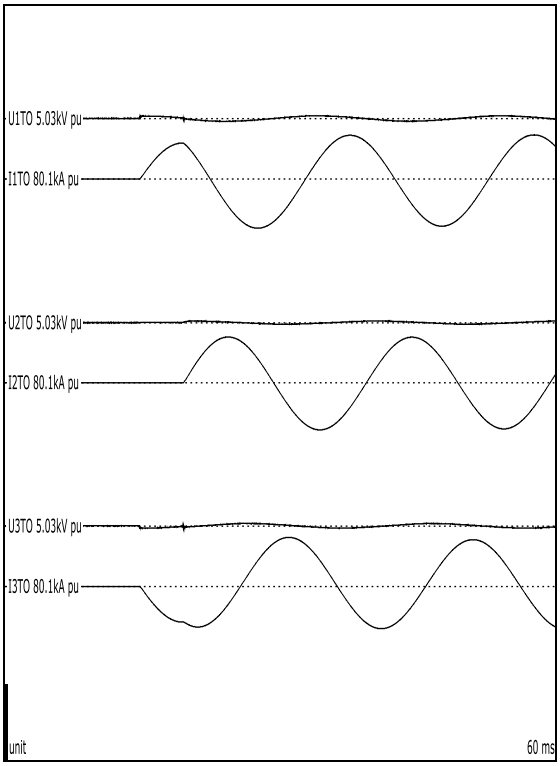
| Phase | | R | G | Y |
|---|---|---|---|---|
| Peak value of current | kA | -54,9 | 51,9 | 52,9 |
| Symmetrical current, beginning | kA | 35,4 | 35,6 | 35,2 |
| Symmetrical current, middle | kA | 34,5 | 34,8 | 34,1 |
| Symmetrical current, end | kA | 34,2 | 34,5 | 33,9 |
| Symmetrical current, average | kA | 34,6 | 35,1 | 34,5 |
| Average current, three phase | kA | 34,7 | | |
| Current duration | s | 1,04 | 1,04 | 1,04 |
| Thermal equivalent | | 34,5 kA during 1,05 s | | |

Gas pressure at 20 °C - MPa Ambient temperature 11,3 °C

Remarks: -

**Thermal short-circuit test**




**Test number:** **151203-4006**

| Phase | | R | G | Y |
|---|---|---|---|---|
| Peak value of current | kA | -52,5 | -50,3 | 51,9 |
| Symmetrical current, beginning | kA | 33,9 | 34,2 | 33,3 |
| Symmetrical current, middle | kA | 33,1 | 33,4 | 32,5 |
| Symmetrical current, end | kA | 32,8 | 33,1 | 32,2 |
| Symmetrical current, average | kA | 33,2 | 33,7 | 32,8 |
| Average current, three phase | kA | 33,2 | | |
| Current duration | s | 1,04 | 1,04 | 1,04 |
| Thermal equivalent | | 33 kA during 1,05 s | | |

Gas pressure at 20 °C - MPa Ambient temperature 11,3 °C

Remarks: -

**Photograph after test**

## 4.6 Impulse voltage test at ambient temperature

**Standard and date**

Standard IEC 60502-4, table 5, test 10
Test date(s) 4 December 2015

**Environmental conditions**

Ambient temperature 20 °C

**Characteristic test data**

Temperature of test object 20 °C
Specified test voltage 95 kV

| Testing arrangement | | Polarity | Voltage applied | No. of | See figure on |
|---|---|---|---|---|---|
| Voltage applied to | Earthed | | (% of test voltage) | impulses | next pages |
| Conductor 1 test loop 3 | Metallic screens and conductors 2 and 3 | Positive | 50 | 1 | 1 (waveshape) |
| | | | 65 | 1 | 2 |
| | | | 80 | 1 | 2 |
| | | | 100 | 10 | 3 and 4 |
| Conductor 1 test loop 3 | Metallic screens and conductors 2 and 3 | Negative | 50 | 1 | 5 (waveshape) |
| | | | 65 | 1 | 6 |
| | | | 80 | 1 | 6 |
| | | | 100 | 10 | 7 and 8 |
| Conductor 2 test loop 3 | Metallic screens and conductors 1 and 3 | Positive | 50 | 1 | 9 (waveshape) |
| | | | 65 | 1 | 10 |
| | | | 80 | 1 | 10 |
| | | | 100 | 10 | 11 and 12 |
| Conductor 2 test loop 3 | Metallic screens and conductors 1 and 3 | Negative | 50 | 1 | 13 (waveshape) |
| | | | 65 | 1 | 14 |
| | | | 80 | 1 | 14 |
| | | | 100 | 10 | 15 and 16 |
| Conductor 3 test loop 3 | Metallic screens and conductors 1 and 2 | Positive | 50 | 1 | 17 (waveshape) |
| | | | 65 | 1 | 18 |
| | | | 80 | 1 | 18 |
| | | | 100 | 10 | 19 and 20 |
| Conductor 3 test loop 3 | Metallic screens and conductors 1 and 2 | Negative | 50 | 1 | 21 (waveshape) |
| | | | 65 | 1 | 22 |
| | | | 80 | 1 | 22 |
| | | | 100 | 10 | 23 and 24 |

**Requirement**

Each core of the cable shall withstand without failure 10 positive and 10 negative voltage impulses.

**Result**

The object passed the test.

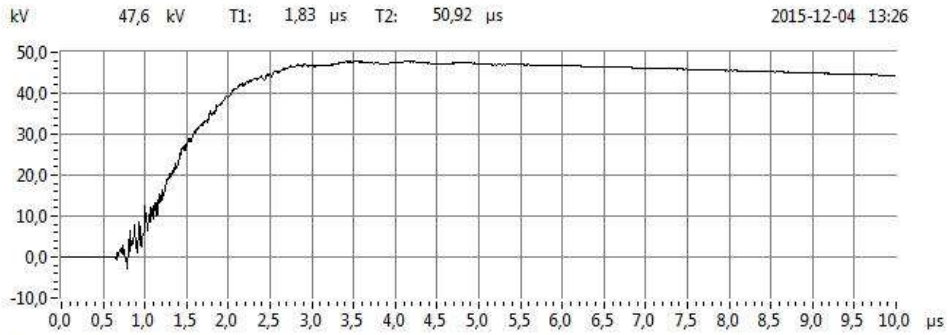



**Fig. 1: Waveshape 72124900 SC loop Red 50% test voltage**

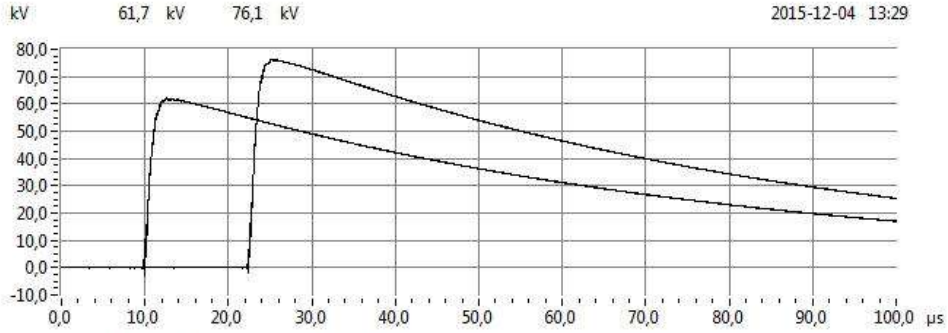



**Fig. 2: 72124900 SC loop Red 65% and 80% test voltage**

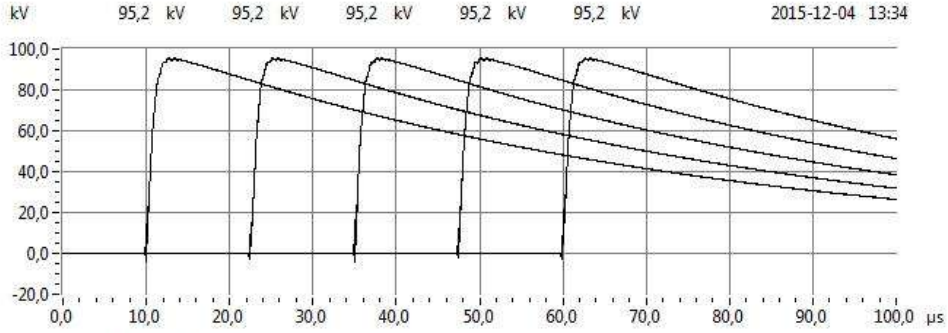



**Fig. 3: 72124900 SC loop Red 100% test voltage**

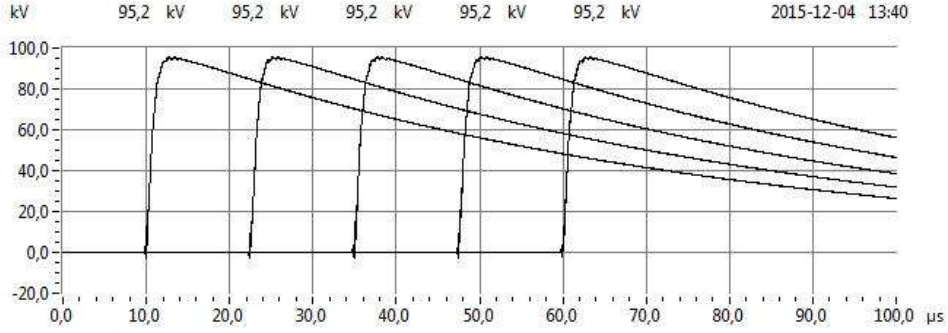



**Fig. 4: 72124900 SC loop Red 100% test voltage**


**Fig. 5: Waveshape 72124900 SC loop Red -50% test voltage**

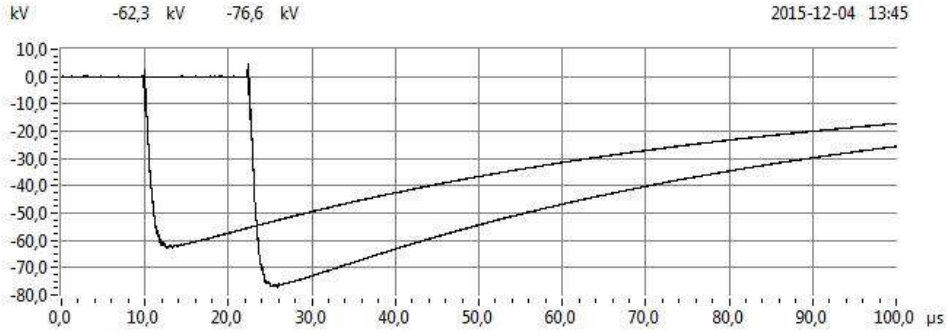



**Fig. 6: 72124900 SC loop Red -65% and -80% test voltage**

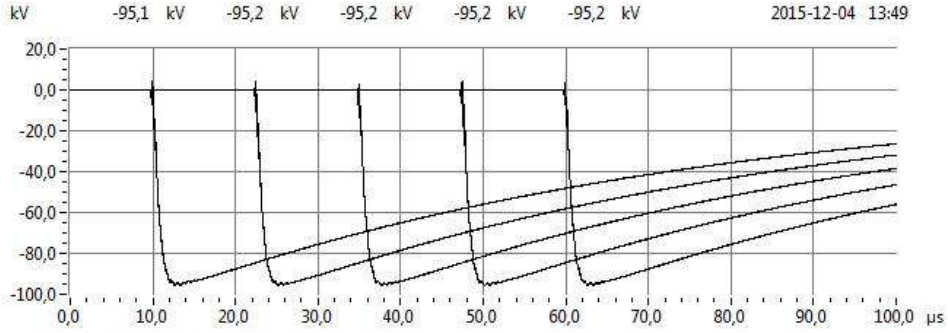



**Fig. 7: 72124900 SC loop Red -100% test voltage**

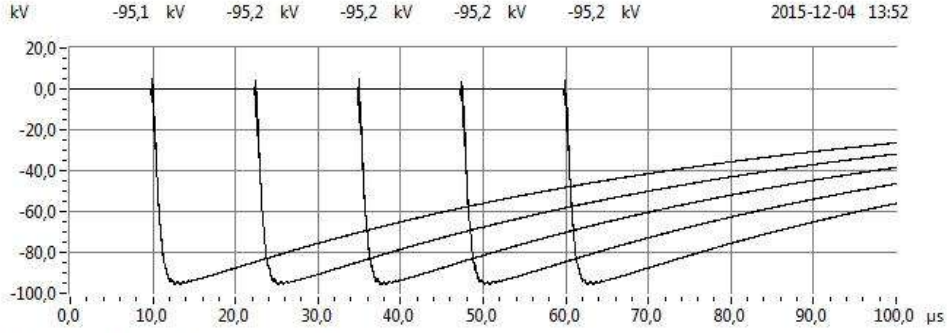



**Fig. 8: 72124900 SC loop Red -100% test voltage**

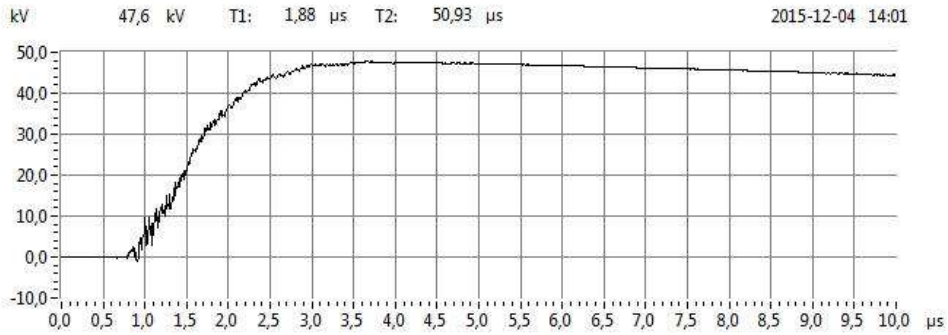



**Fig. 9: Waveshape 72124900 SC loop Yellow 50% test voltage**

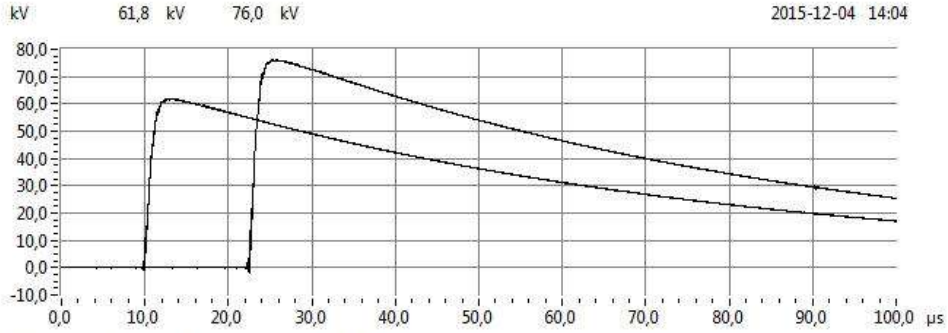



**Fig. 10: 72124900 SC loop Yellow 65% and 80% test voltage**

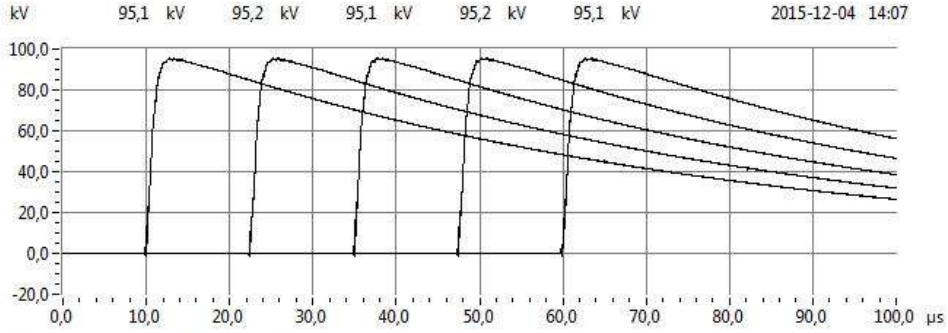



**Fig. 11: 72124900 SC loop Yellow 100% test voltage**

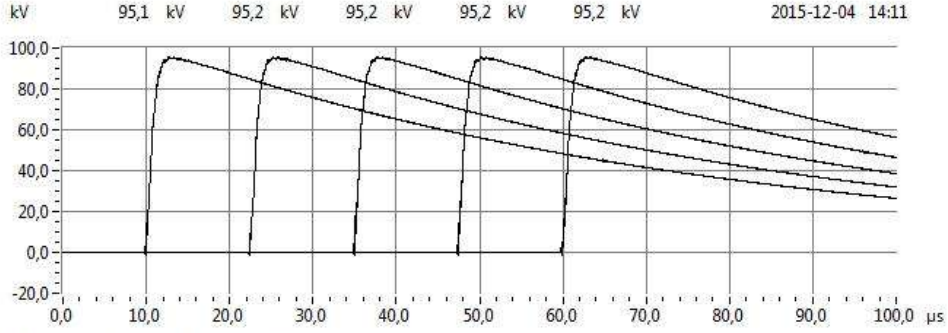



**Fig. 12: 72124900 SC loop Yellow 100% test voltage**


**Fig. 13: Waveshape 72124900 SC loop Yellow -50% test voltage**

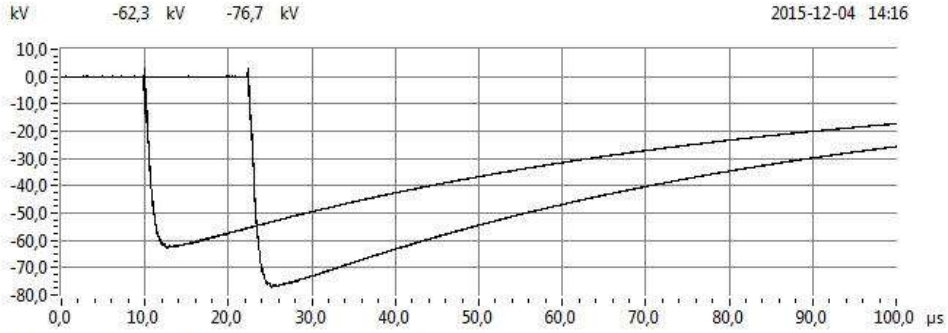



**Fig. 14: 72124900 SC loop Yellow -65% and -80% test voltage**

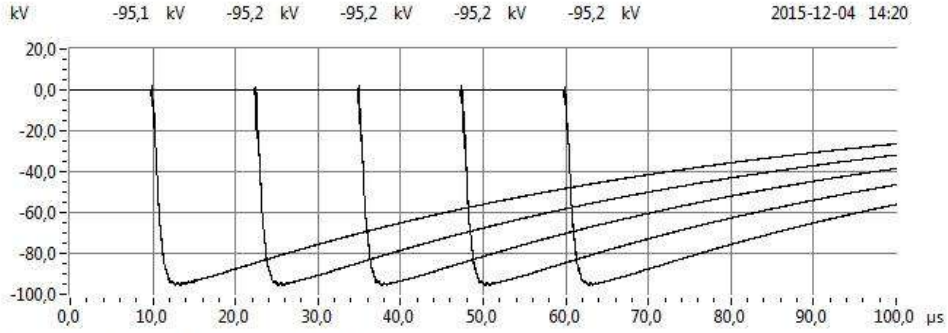



**Fig. 15: 72124900 SC loop Yellow -100% test voltage**

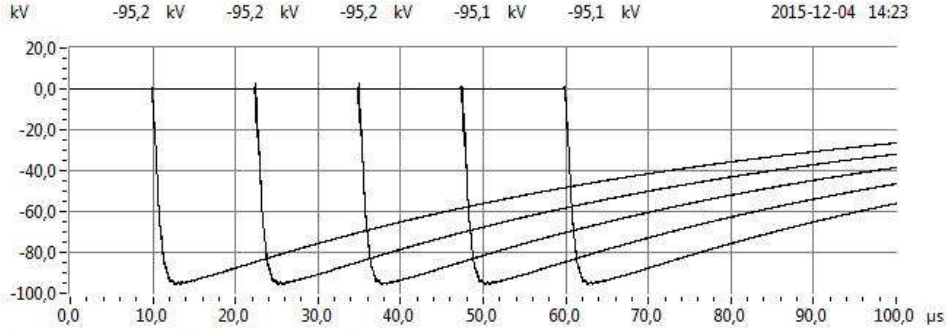



**Fig. 16: 72124900 SC loop Yellow -100% test voltage**

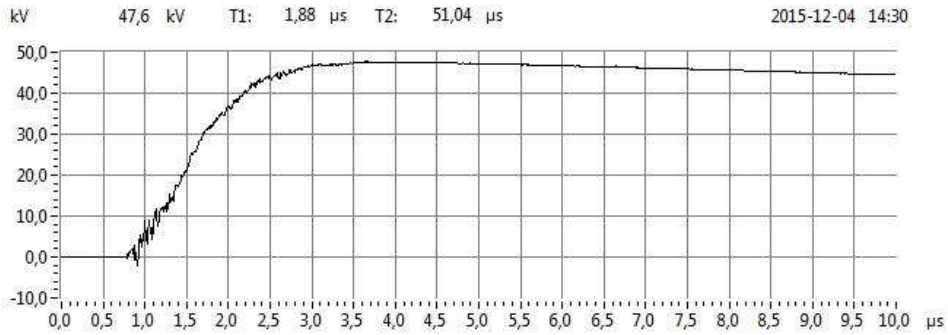



**Fig. 17: Waveshape 72124900 SC loop Green 50% test voltage**

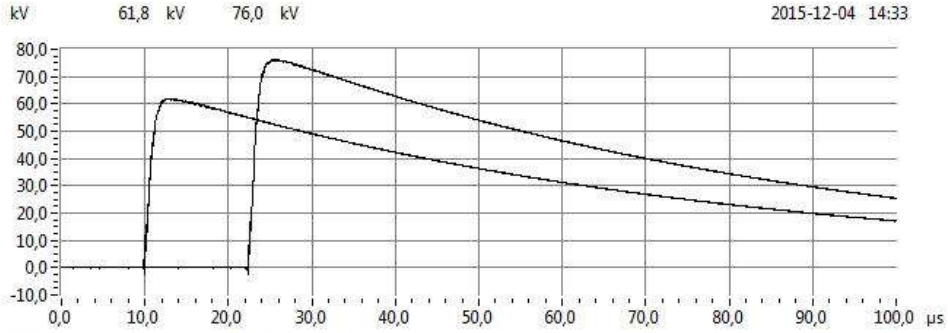



**Fig. 18: 72124900 SC loop Green 65% and 80% test voltage**

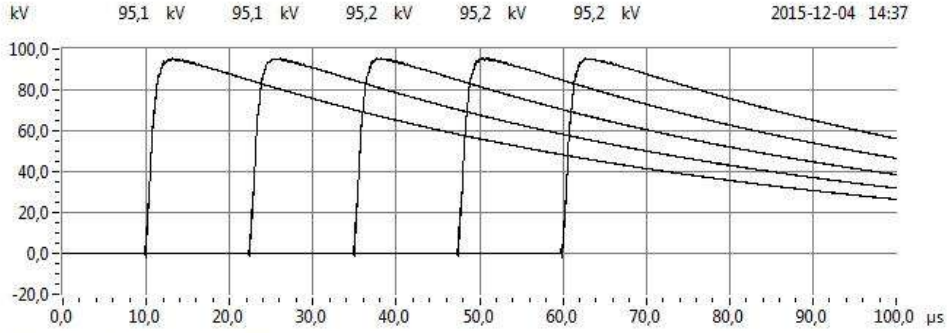



**Fig. 19: 72124900 SC loop Green 100% test voltage**

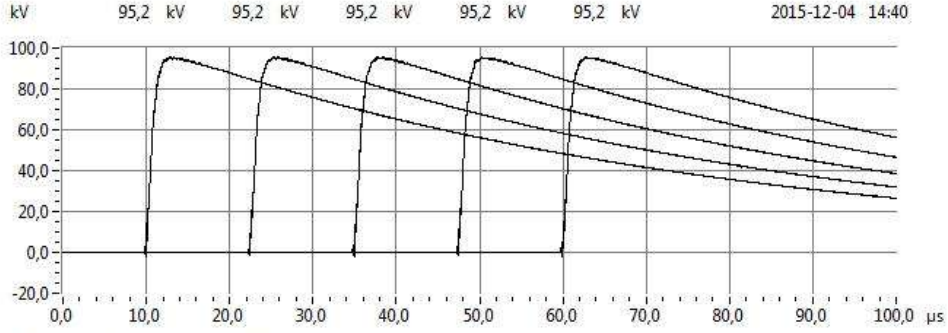



**Fig. 20: 72124900 SC loop Green 100% test voltage**


**Fig. 21: Waveshape 72124900 SC loop Green -50% test voltage**

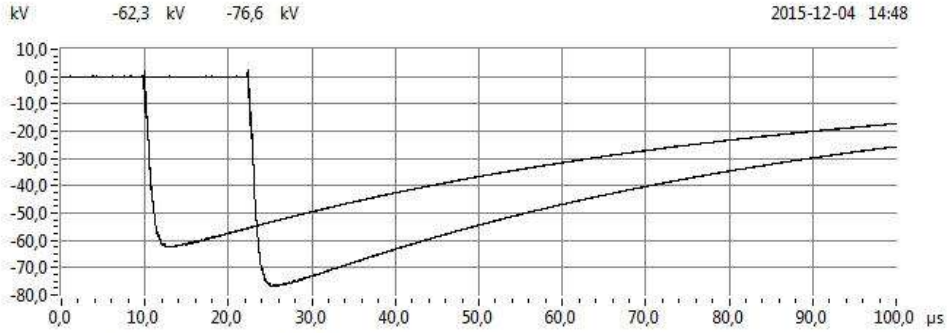



**Fig. 22: 72124900 SC loop Green -65% and -80% test voltage**

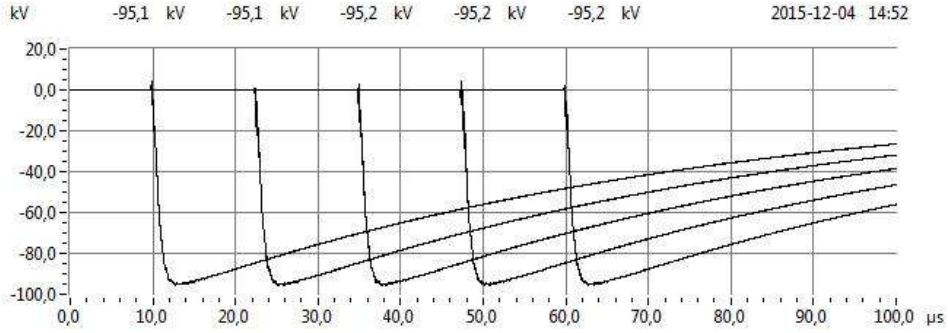



**Fig. 23: 72124900 SC loop Green -100% test voltage**

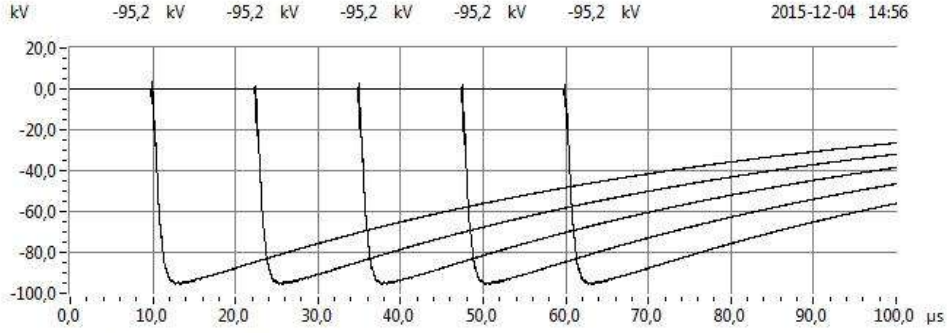



**Fig. 24: 72124900 SC loop Green -100% test voltage**

## 4.7 AC voltage dry test

**Standard and date**

Standard IEC 60502-4, table 5, test 11
Test date(s) 4 December 2015

**Environmental conditions**

Ambient temperature 20 °C

**Characteristic test data**

Temperature of test object 20 °C

| Testing arrangement | | Voltage applied, 50 Hz | | Duration |
|---|---|---|---|---|
| Voltage applied to | Earth connected to | … x $U_0$ | (kV) | (min) |
| Conductor 1, 2 and 3 of test loop 3 | Metal screens | 2,5 | 22 | 15 |

**Requirement**

No breakdown of the insulation shall occur.

**Result**

The object passed the test.

## 4.8 Examination

**Standard and date**

| | |
|---|---|
| Standard | IEC 60502-4, table 5, test 14 |
| Test date(s) | 25 May 2016 |

**Environmental conditions**

| | | |
|---|---|---|
| Ambient temperature | 20 | °C |
| Temperature of test object | 20 | °C |

| Object | Observations |
|---|---|
| Sample 1 | None of the following has been detected:<br>• cracking in the filling material and/or tape or tubing components<br>• a moisture path bridging a primary seal<br>• corrosion and/or tracking and/or erosion which would, in time, lead to a failure of the accessory<br>• leakage of any insulating material |

**Note**

The results are for information only.

**Photographs**

Indoor termination loop 3

Indoor termination loop 3 sample

# 5 TEST SEQUENCE TABLE 5 COLUMN 1.4 (ONE INDOOR TERMINATION)

## 5.1 Humidity

**Standard and date**

Standard IEC 60502-4, table 5, test 12
Test date(s) 2 to 16 December 2015

**Environmental conditions**

Ambient temperature 15 °C
Temperature of test object 15 °C

**Characteristic test data**

Leakage current protection ($I_{max}$) 1 ± 0,1 A
Conductivity 70 ± 10 mS/m
Rate of flow 0,4 ± 1 l/h/m$^3$

| Testing arrangement | | Applied Voltage, 50 Hz | | Duration |
|---|---|---|---|---|
| Voltage applied to conductor | Earth connected to | ... x $U_0$ | (kV) | (h) |
| 1, 2 and 3 | Metallic screen | 1,25 | 11 | 300 |

**Note**

Three core terminations subject to three phase voltage.

**Requirement**

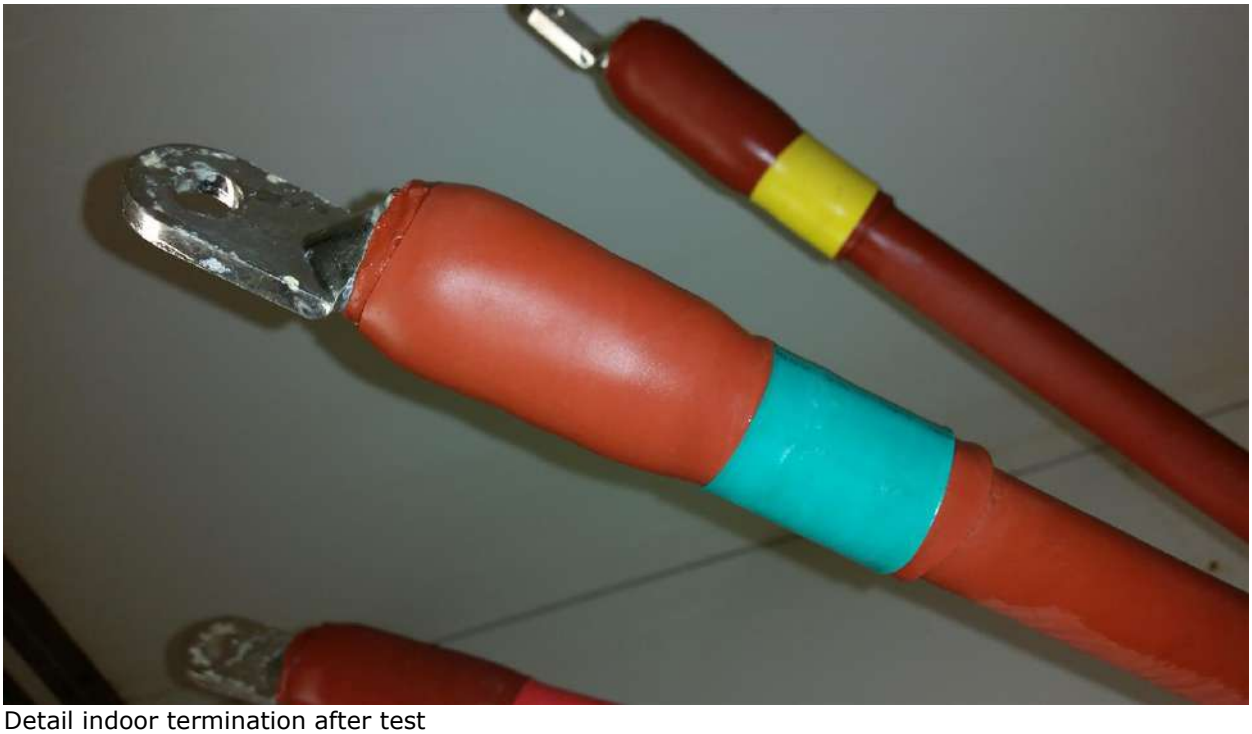
No breakdown or flashover, no more than 3 trips, no substantial damage of the insulation shall occur (table 14).

| Pass/fail criteria | Observation |
|---|---|
| More than three overcurrent trip-outs | No |
| Loss of dielectric quality due to tracking | No |
| Erosion to a depth of 2 mm or 50% of the wall thickness of the insulating material | No |
| Splitting of the material | No |
| Puncture of the material | No |

**Result**

The object passed the test.

Indoor termination after test



Detail indoor termination after test

Detail indoor termination after test

Detail indoor termination after test

## 5.2 Examination

**Standard and date**

Standard IEC 60502-4, table 5, test 14
Test date(s) 25 May 2016

**Environmental conditions**

Ambient temperature 20 °C
Temperature of test object 20 °C

| Object | Observations |
|---|---|
| Sample 1 | None of the following has been detected:<br>• cracking in the filling material and/or tape or tubing components<br>• a moisture path bridging a primary seal<br>• corrosion and/or tracking and/or erosion which would, in time, lead to a failure of the accessory<br>• leakage of any insulating material |

**Note**

The results are for information only.

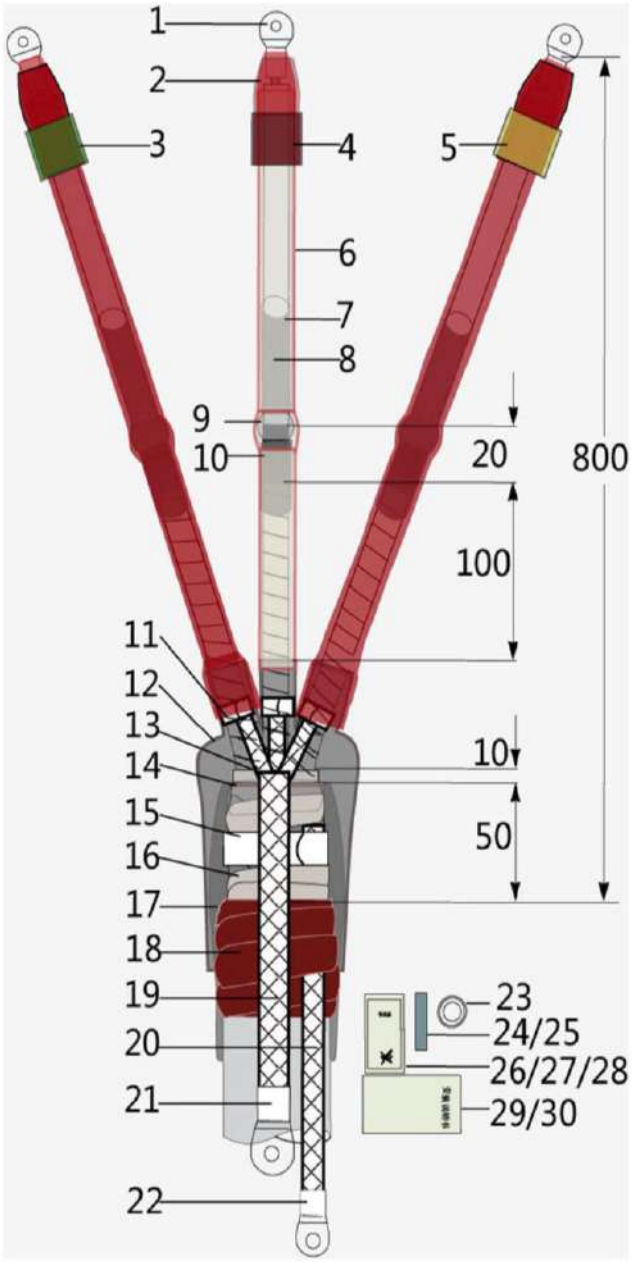
**Photographs**

Indoor termination humidity sample

Indoor termination humidity sample

# 6 PARTS LIST AND INSTALLATION INSTRUCTION

| Rev. | Change Description | Designed by | Checked by | Approved by |
|---|---|---|---|---|
| B1 | Original Release | | | |
| | | | | |




| | | | | |
|---|---|---|---|---|
| MELEC www.melec.com.cn | | JIANGSU JIAMENG ELECTRICAL EQUIPMENT CO.,LTD | | |
| Material | / | Undefined Tolerance | | Title: |
| Approved by | 於海燕 2015/06/25 | 0~30 | ±1 | 15KV HEAT SHRINKABLE INDOOR TERMINATION ACCESSORIES |
| Checked by | 刁雪峰 2015/06/25 | >30~120 | ±2 | Product No.: |
| Designed by | 唐张杰 2015/06/25 | >120 | ±3 | MZDNK-3-15-C |
| Size A4 / Scale / | Sheet 1 of 2 | Unit mm | | Drawing No.:T8MZDNK-3-15-C |

| Rev. | Change Description | Designed by | Checked by | Approved by |
|---|---|---|---|---|
| B1 | Original Release | | | |
| | | | | |

| No. | Quantity | Unit | Item | Product No |
|---|---|---|---|---|
| 1 | 3 | pcs | Cable lug | AUS185-12/L8 |
| 2 | 3 | pcs | Heat shrinkable track-resistant tubing | MWNT-60/21/RD/0.15M |
| 3 | 1 | pcs | Colorimetric tube | M1-50/25/GN/0.05M |
| 4 | 1 | pcs | Colorimetric tube | M1-50/25/RD/0.05M |
| 5 | 1 | pcs | Colorimetric tube | M1-50/25/YE/0.05M |
| 6 | 3 | pcs | Heat shrinkable track-resistant tubing | MWNT-60/21/RD/0.7M |
| 7 | 3 | pcs | Heat shrinkable stress control tubing | MSCT-47/18/BK/0.2M |
| 8 | 3 | pcs | Silicone grease | MGZ-295-3 |
| 9 | 3 | pcs | Stress control tape(yellow) | MYLJ-1.2X25X100YL |
| 10 | 1 | pcs | Semi conducting tape | MBDD-25X600 |
| 11 | 3 | pcs | Constant force spring | MTH-D24X0.3X15X7 |
| 12 | 1 | pcs | Heat shrinkable insulation breakout | MIB3-125/57-55/20/BK |
| 13 | 1 | pcs | Triangular wedge | MSJX |
| 14 | 1 | pcs | Copper binding-wire | MTZX-1.4X1000 |
| 15 | 1 | pcs | Constant force spring | MTH-D45X0.5X20X7 |
| 16 | 2 | pcs | Void filling tape(black) | MTCJ-3X50X500BK |
| 17 | 1 | pcs | Heat shrinkable medium wall tubing (adhesive sealing ) | MRA2-115/35/BK/0.2M |
| 18 | 9 | pcs | Sealing tape(red) | MMFJ-2X30X360RD |
| 19 | 1 | pcs | Ground wire | MDX-25X800 |
| 20 | 1 | pcs | Ground wire | MDX-16X800 |
| 21 | 1 | pcs | Cable lug | JGB35-10/L |
| 22 | 1 | pcs | Cable lug | JGB25-10/L |
| 23 | 1 | pcs | PVC tape | MPJD-20X5000BK |
| 24 | 4 | pcs | Sandcloth paper | MSZ-P180X20X500 |
| 25 | 5 | pcs | Sandcloth paper | MSZ-P400X15X500 |
| 26 | 6 | pcs | Cleaner | MQJB |
| 27 | 1 | pcs | Cleaning cloth | MMB-300X300mm |
| 28 | 1 | pcs | Glove | MST |
| 29 | 1 | ea | Installation instructions | GSM-MZDW/MZDWK-15KV |
| 30 | 1 | ea | Contents | / |

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| | | | | |
|---|---|---|---|---|
| Material | / | Undefined Tolerance | | Title: |
| Approved by | 於海燕 2015/06/25 | 0~30 | ±1 | 15KV HEAT SHRINKABLE INDOOR TERMINATION ACCESSORIES |
| Checked by | 刁雪峰 2015/06/25 | >30~120 | ±2 | Product No.: |
| Designed by | 唐张杰 2015/06/25 | >120 | ±3 | MZDNK-3-15-C |
| Size A4 / Scale / | Sheet 2 of 2 | Unit mm | | Drawing No.:T8MZDNK-3-15-C |

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# Installation Instruction For 15KV Terminations

## Step 1

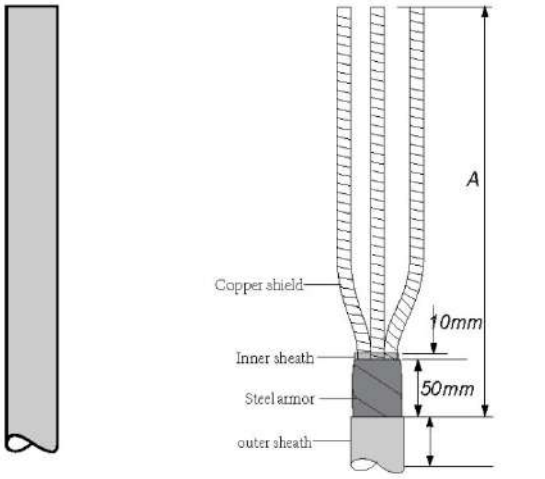
### Preparation

1. Check the consistency of contents and packing list.
2. Check tools are complete.

## Step 2

### Strip cable sheath and steel armor

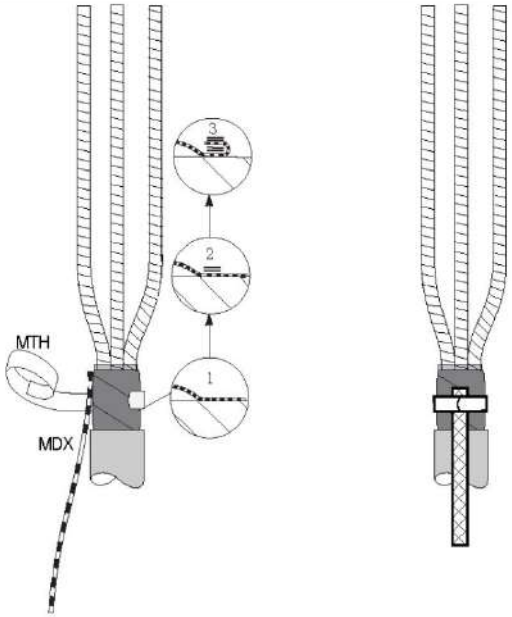
1. Straighten the cable
2. Even cable port
3. Measure dimensions as shown in the right picture , Strip cable outside sheathing, steel armor and inside sheathing A=800mm
4. Cleanup cable filler and wrap tape
5. Use PVC tape to fixate copper shieldng in the top end of each core.
6. Use copper binding wire to fixate end of steel armor
7. Sand the outer sheath at 100mm of each end of the cable.
8. Use cleaner to Clean the steel armor and outer sheath




## Step 3

### Install ground wire MDX

1. As shown on the right, use constant force ring MTH to fixate a ground wire MDX in the middle of steel armor



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Step 4

## Install ground wire MDX

1. Wind sealing tape MMFJ 2-3 layer on 50mm down the port of outer sherth of cable,Lift theground when wind the first layer.Wind sealing tape MMFJ on the outer sheath completely, Wrapp The armored ground in them in the following wound.

2. Strech the void filling tape MTCJ by 1/2 width, wind ground wire ,constant force spring, armor layer completely 2-3 laps.

3、As shown on the right, wind heat shrinkable medium wall tubing MRA2 in order of 1,2,3.

**Shrink description :**

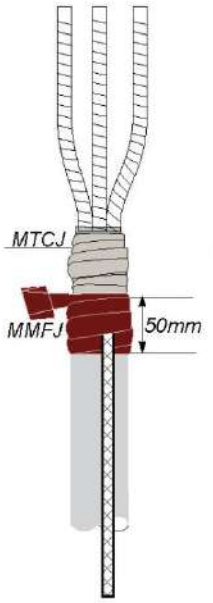
1. Use yellow outer flame of about 100~300mm to heat the heat shrinkable products.
2. Unless otherwise stated, use flame to heat outer heat shrinkable products uniformly.
3. When heating, keep the flame moving and the local stop time shall not exceed 3 seconds, so as to avoid burning caused by hot parts.

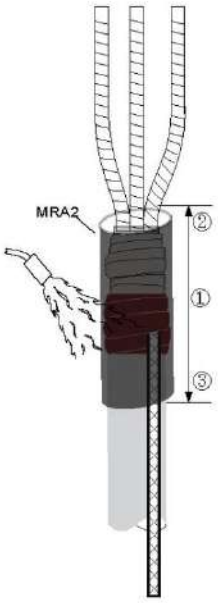
**Instructions for combustor:**

Adjust voltage stabilizer and combustor. When heating, yellow outer flame is suggested. Select a working environment with sound ventilation,so as to avoid the influence on installation caused by smog

### Warning:

Use gas burner strictly in accordance with instructions provided by suppliers. Check if there is any connection leakage before turned on. Failure to observe the instructions could cause fire or explosion, even critical damage.

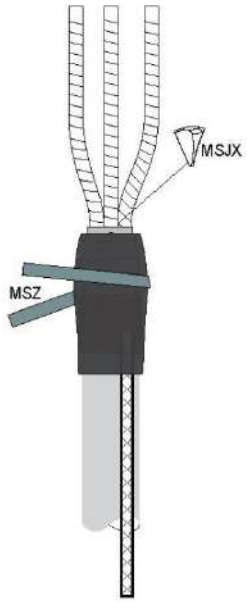


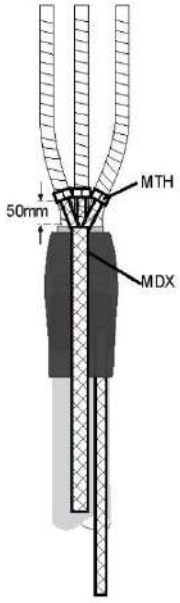



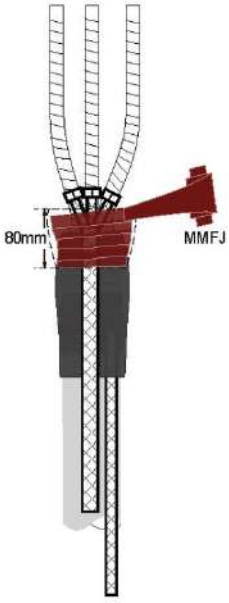

Step 5

## Install copper shield ground MDX

1. As shown right , hit the triangular wedge MSJX to the cable core and even it with the inner sheath.
2. Sand heat shrinkable medium wall tubing MRA2
3. Use cleaner to clean MRA2 and cable wire.
4. Use constant force ring MTH to fix MDX, specific operation see Step 3.
5. Wind sealing tape MMFJ on the cable core, inner cover of cable, MRA2 should be winded.

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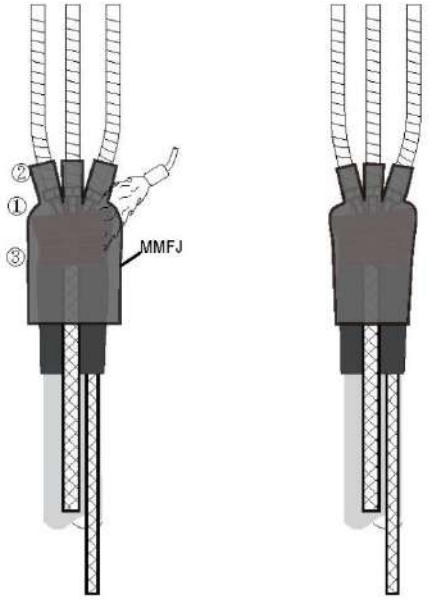
## Step 6

### Shrink heat shrinkable insulation breakout MIB

1. Put heat shrinkable insulation breakout MIB well down into the cable crutch.
2. Shrink it in the order of 1,2,3.

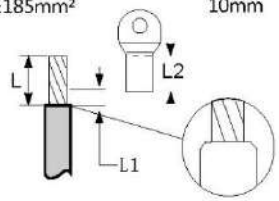



## step 7

### Strip copper shield and insulation

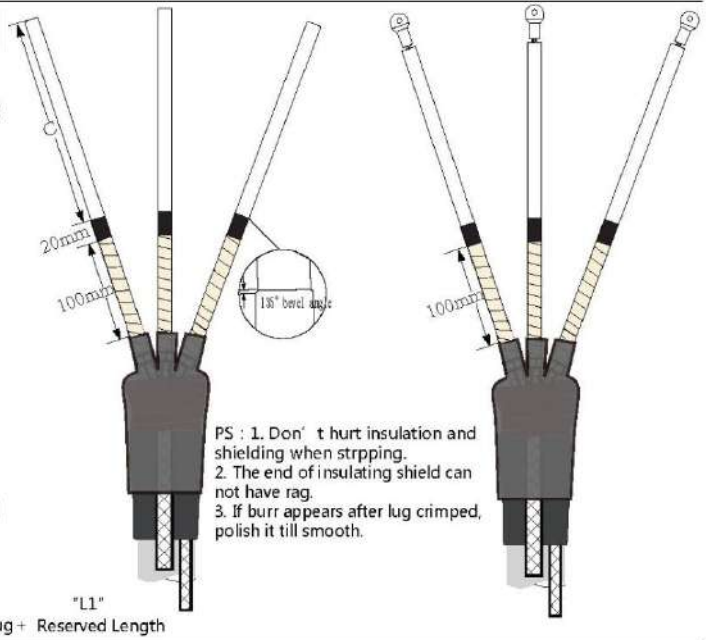
1. Strip the length Cof the copper shield,and C≥250mm for inside, ≥500mm for outside
2. Use PVC tape one circle to fixate the end of copper shield.
3. Sand the insulation and chamfer the Shielding cut in a 135°.
4. Measure the length of the insulation and strip it in the picture below.
5. Chamfer the insulation end edge in the picture below.
6. Install metal lug.

| cross-sectional area | L1 |
|---|---|
| ≤185mm² | 5mm |
| ≥185mm² | 10mm |




"L" "L2" "L1"

Length of insylation stripped= length of lug + Reserved Length




PS : 1. Don' t hurt insulation and shielding when strpping.
2. The end of insulating shield can not have rag.
3. If burr appears after lug crimped, polish it till smooth.

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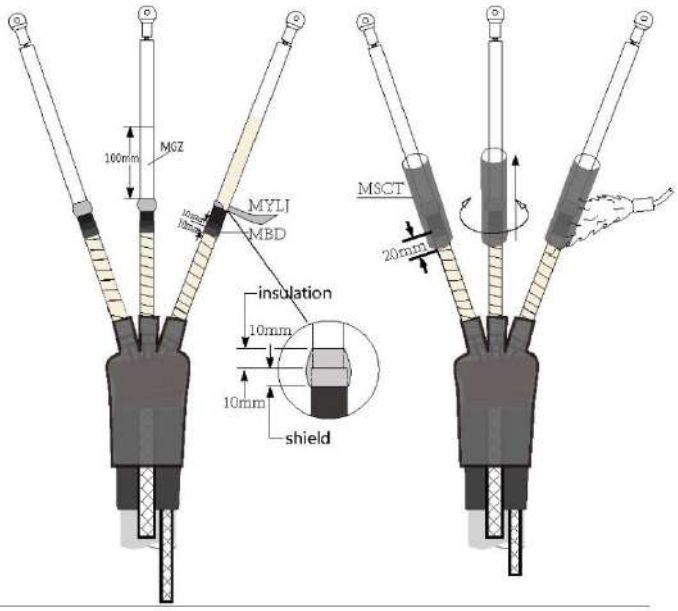
step 8

Wind stress control tape MYLJ
Wind semi-conduct tape MBD
Shrink heat shrinkable stress control tubing MSCT

1. Strech stress control tape MYLJ to5-10mm width, and wind the insulation and shield, the mastic should overlap 10mm onto the insulation and shield.
2. Strech the semi-conductive tape MBD to 1/2 width, wind cooper shield, overlap shield and cooper shield 5-10mm each.
3. Apply insulation silicon grease MGZ evenly on the length 100mm from the end of the mastic.
4. Place heat shrinkable stress control tubing MSCT to the position of 20mm under section of cooper shield,then shrink surround uniformly according to the direction of the arrow marked.

**PS :** 1. When winding stress tape, the gap between the insulation and the shield should be filled entirely.
2. Apply unifomly when applying grease paste, ensure non-omission.
3. Shrink instructions are required according to step 4.



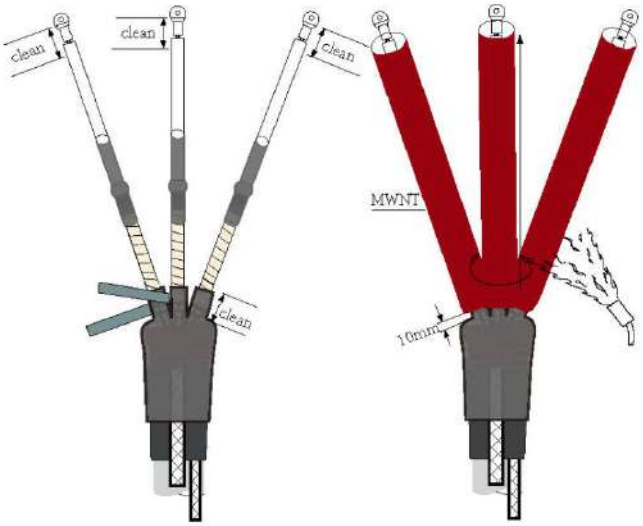

step 9

Shrink heat shrinkable track-resistant tubing MWNT

1. Polish the tip of heat shrinkable insulation breakout MIB.
2. Clean tip of MIB and end of lug.
3. wrap sealing mastic on breakout end
4. Place MWNT to the position of 10mm beyond the breakout body.Then shrink MWNT from the bottom up surroundly.

**PS :** 1. Heat the whole part almost one minute after shrinking finished.
2. Check if the tube shrinked entirely after the shrink finished.check if the surface of tube smooth, no bump、cool wall、unentirely shrinking.

Shrink instructions are required according to step 4.



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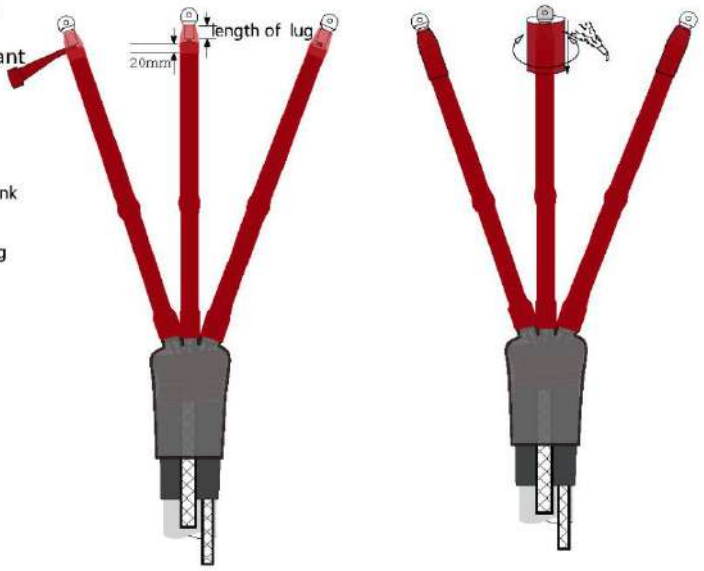
step 10

Wind sealing tape MMFJ
Shrink heat shrinkable track-resistant tubing MWNT

1. Wind sealing tape MMFJ to cover the lug body till down MWNT 20mm.
2. Position MWNT on the matel lug, and shrink them.

PS: Shrink instructions are required according to step 4.

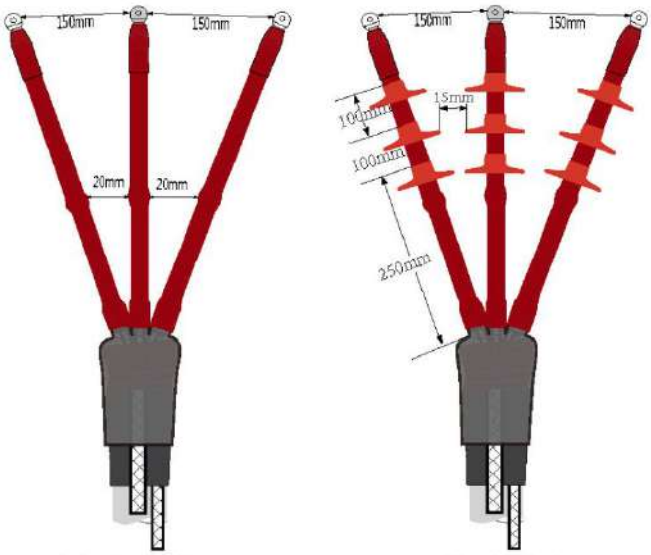



step 11

Shrink heat-shrink skirt MCES

1. Position the heat-shrink skirt MCES to every wire according to the length marked, and shrink them.
2. When it' s cold, installation is finished

**PS:**
1. When installing, phase/phase distance、phase/ground≥20mm Air gap≥30mm.
2. Minimum longth between skirt≥15mm.
3. When installing, the minimum bend radius=outer diameter of the cable core X 15




indoor termination outdoor termination

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# 7 MEASUREMENT UNCERTAINTY

The measurement uncertainties in the results presented are as specified below unless otherwise indicated.

| Measurement | Measurement uncertainty |
|---|---|
| Dielectric tests and impulse current tests: | |
| – peak value | ≤ 3% |
| – time parameters | ≤ 10% |
| Capacitance measurement | 0,3% |
| Tan δ measurement | ± 0,5% ± 5 x $10^{-5}$ |
| Partial discharge measurement: | |
| – < 10 pC | 2 pC |
| – 10 to 100 pC | 5 pC |
| – > 100 pC | 20% |
| Measurement of impedance AC-resistance measurement | ≤ 1% |
| Measurement of losses | ≤ 1% |
| Measurement of insulation resistance | ≤ 10% |
| Measurement of DC resistance: | |
| – 1 to 5 µΩ | 1% |
| – 5 to 10 µΩ | 0,5% |
| – 10 to 200 µΩ | 0,2% |
| Radio interference test | 2 dB |
| Calibration of current transformers | 2,2 x $10^{-4}$ $I_i/I_u$ and 290 µrad |
| Calibration of voltage transformers | 1,6 x $10^{-4}$ $U_i/U_u$ and 510 µrad |
| Measurement of conductivity | 5% |
| Measurement of temperature: | |
| – -50 to -40 °C | 3 K |
| – -40 to125 °C | 2 K |
| – 125 to 150 °C | 3 K |
| Tensile test | 1% |
| Sound level measurement | type 1 meter as per IEC 60651 and ANSI S1,4,1971 |
| Measurement of voltage ratio | 0,1% |