DNV·GL

KEMA TYPE TEST CERTIFICATE OF COMPLETE TYPE TESTS

1086-16

Object Heat shrinkable indoor termination

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.

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.

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KEMA Nederland B.V.

J.P. Fonteijne
Executive Vice President
KEMA Laboratories

KEMA Laboratories

Arnhem, 22 June 2016

Version: 1

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.

TABLE OF CONTENTS

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 core 2 = yellow 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)	Jiangsu Jiameng Electrical Equipment Co., Ltd. (MELEC),
Zhangjie Tang (25 May 2016)	Qidong, China
Xuexiang Jiang (25 May 2016)	
Ivy Cao (25 May 2016)	

2.2 The tests were carried out by

Name	Company
John Mooren	KEMA Nederland B.V.,
Edwin Pultrum	Arnhem, The Netherlands
Rutger Hensbroek	
Julian Aditya	

2.3 Reference to other reports

Report No	Tests performed
1266-16	KEMA report of performance 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

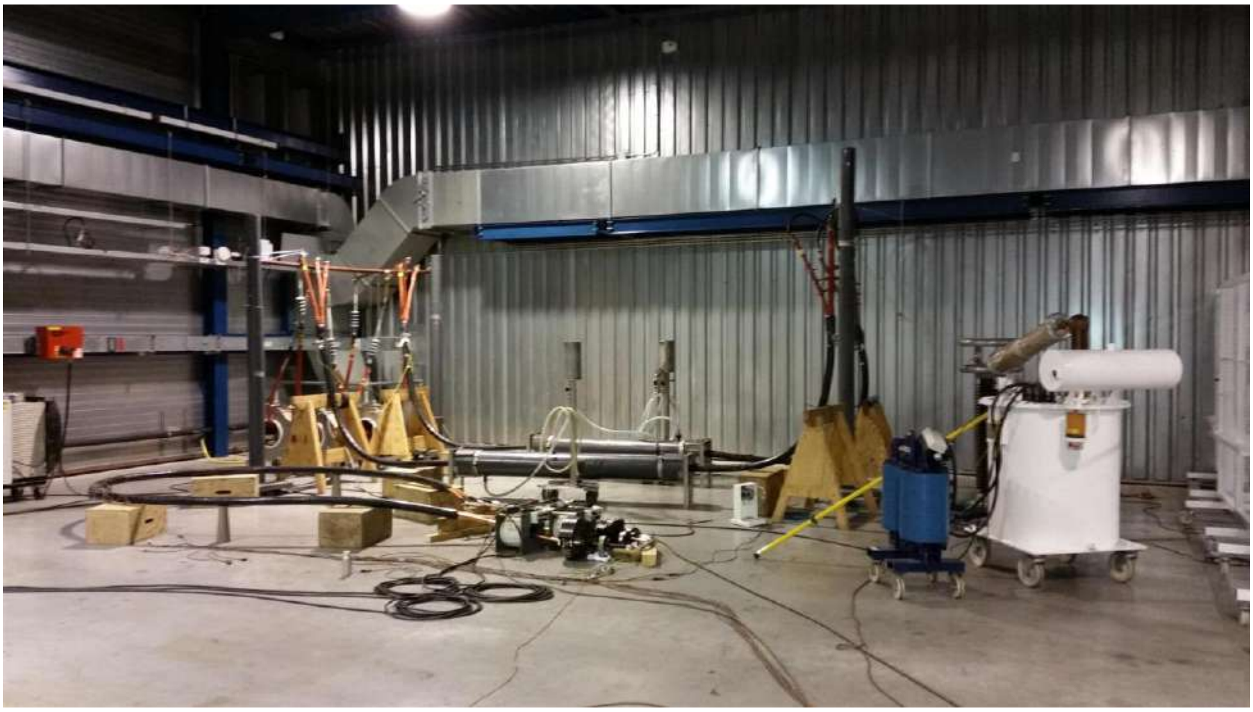
For the tests at elevated temperature, a reference loop for temperature control of the conductor was installed and conductor current was used for heating. The reference cable was cut from the total cable length intended for the type test. This reference loop was installed close to the test loop in order 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	No. of impulses	See figure on next pages
Voltage applied to	Earthed		(% of test voltage)		
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.

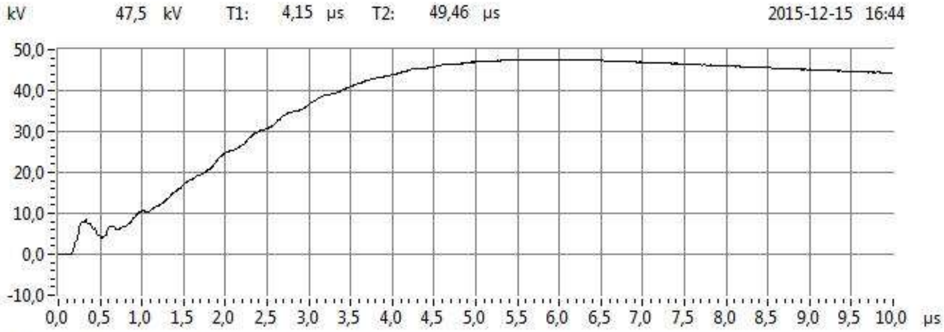


Fig. 1: Waveshape 72124900 Main loop 50% of test voltage

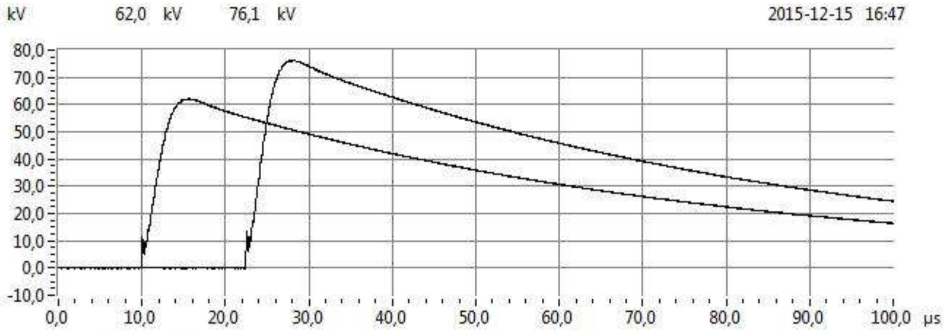


Fig. 2: 72124900 Main loop 65% and 80% of test voltage

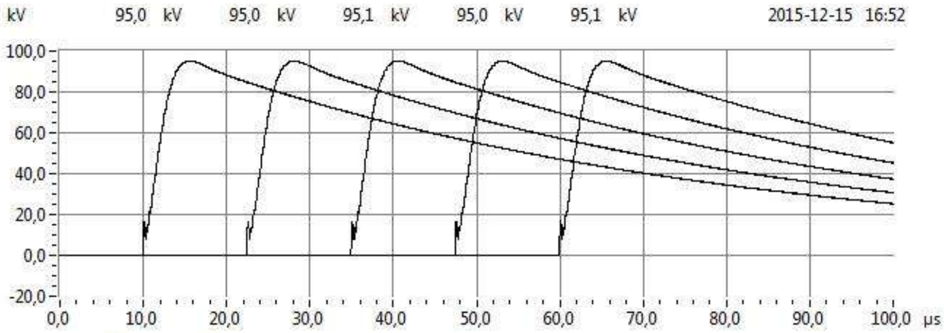


Fig. 3: 72124900 Main loop 100% of test voltage

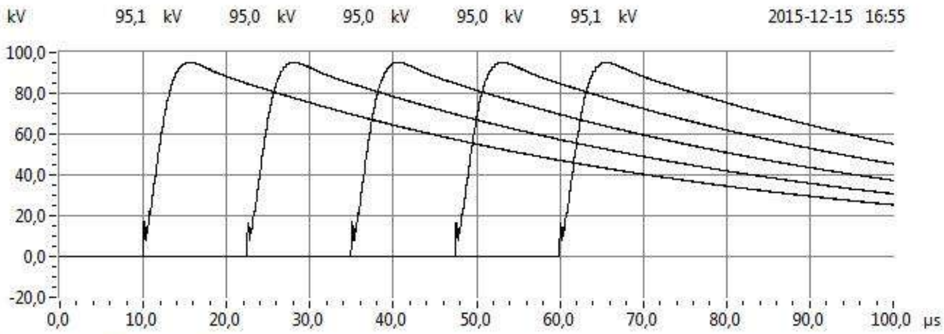


Fig. 4: 72124900 Main loop 100% of test voltage

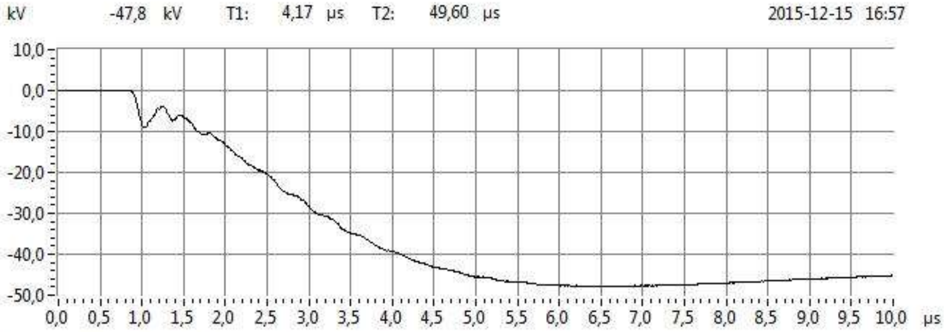


Fig. 5: Waveshape 72124900 Main loop -50% of test voltage

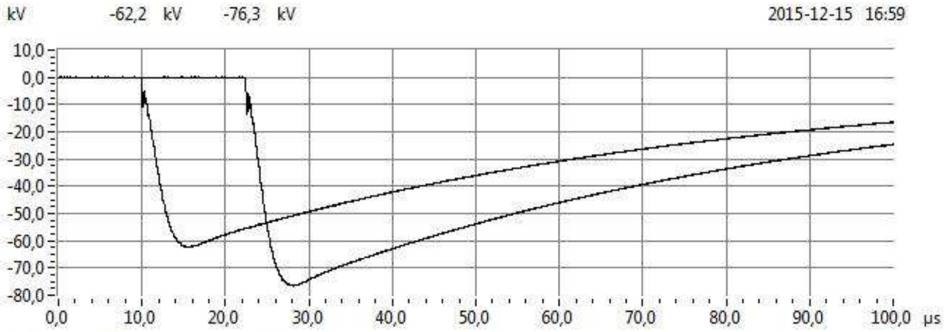


Fig. 6: 72124900 Main loop -65% and -80% of test voltage

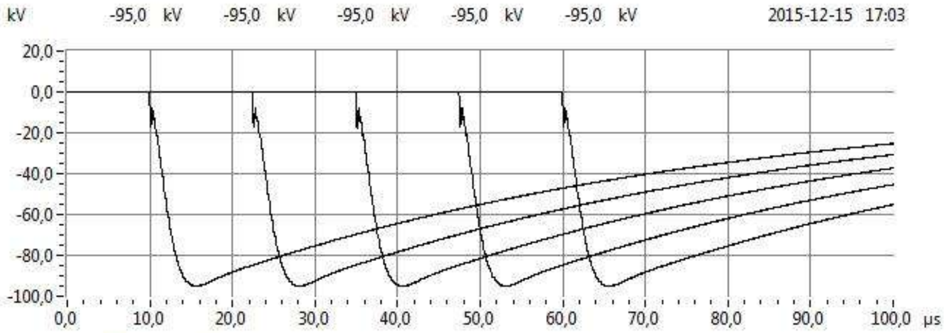


Fig. 7: 72124900 Main loop -100% of test voltage

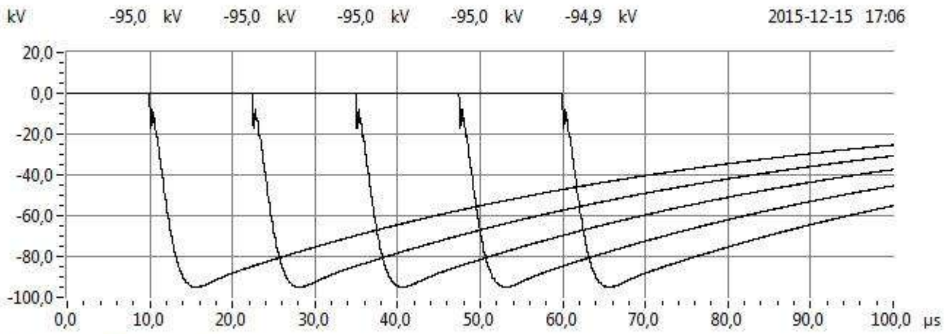


Fig. 8: 72124900 Main loop -100% of test voltage

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	
	(°C)	(A)	Total duration (hours)	Duration of conductor at steady temperature (hours)	Total duration (hours)	Total voltage duration (hours)	Applied voltage 2,5 U_0 (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	Partial discharge level
	... x U_0	(kV)	(s)	(pC)
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	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.

3.10 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.

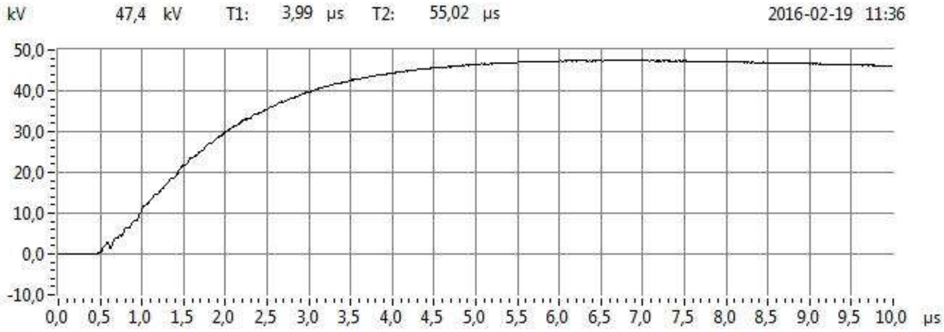


Fig. 1: Waveshape 72124900 Main loop A, phase R, 50% of test voltage

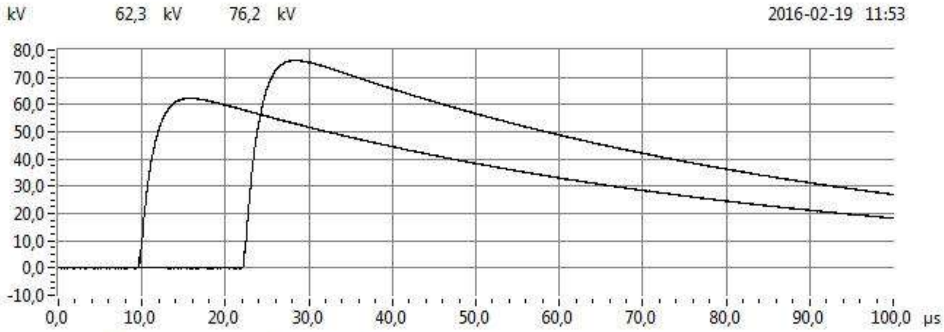


Fig. 2: 72124900 Main loop A, phase R, 65% and 80% of test voltage

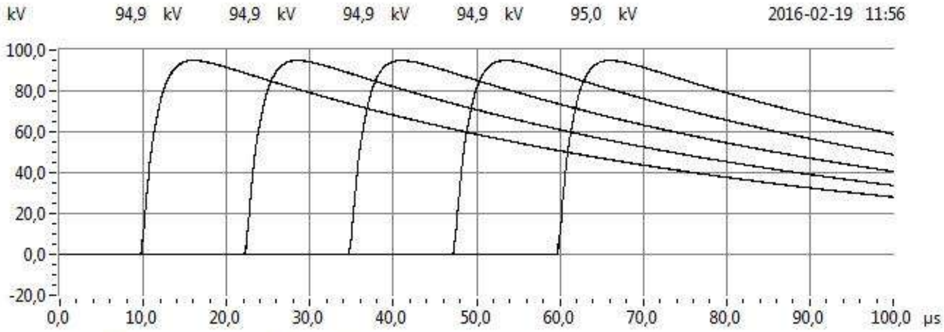


Fig. 3: 72124900 Main loop A, phase R, 100% of test voltage

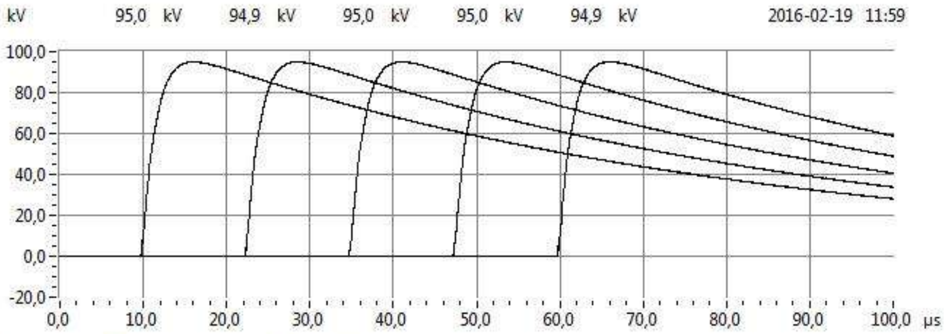


Fig. 4: 72124900 Main loop A, phase R, 100% of test voltage

Version: 1

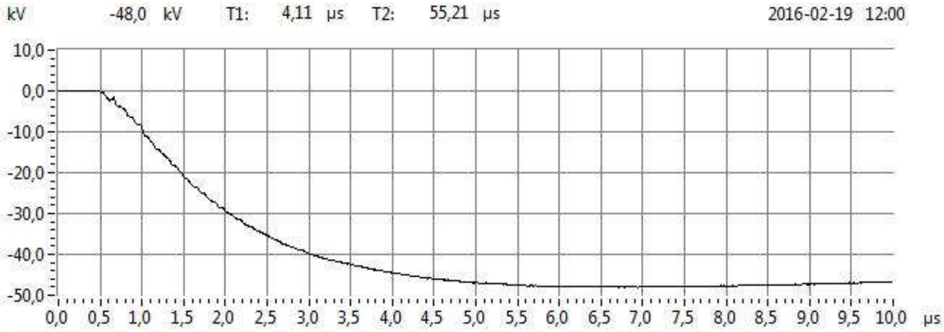


Fig. 5: Waveshape 72124900 Main loop A, phase R, -50% of test voltage

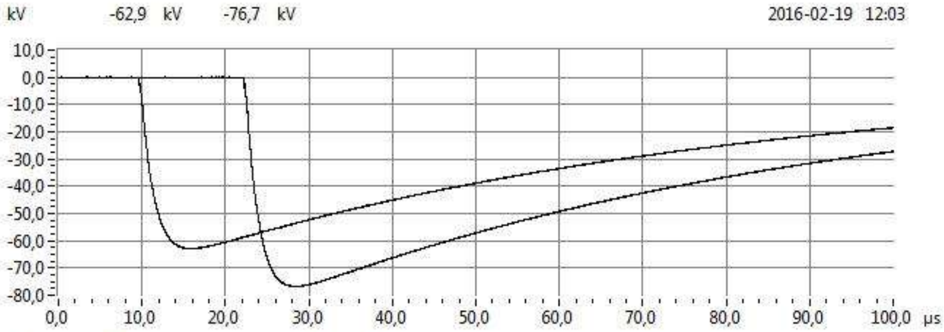


Fig. 6: 72124900 Main loop A, phase R, -65% and -80% of test voltage

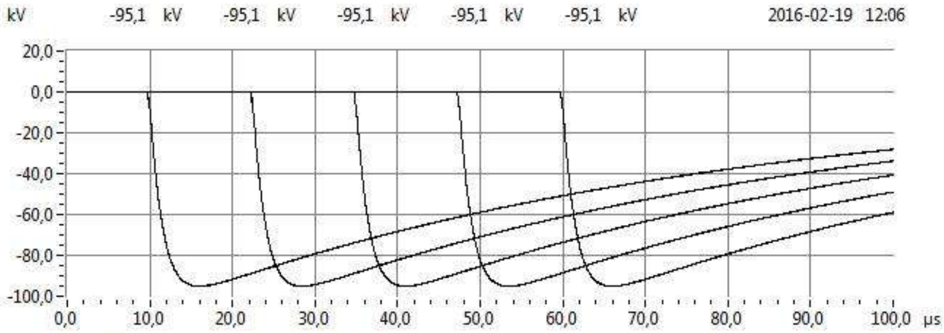


Fig. 7: 72124900 Main loop A, phase R, -100% of test voltage

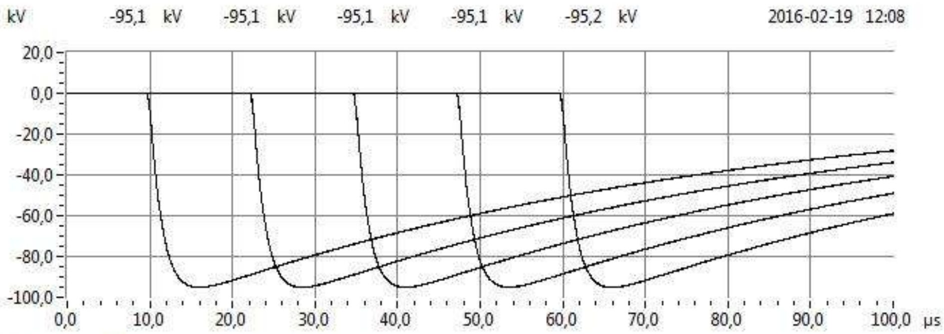


Fig. 8: 72124900 Main loop A, phase R, -100% of test voltage

Version: 1

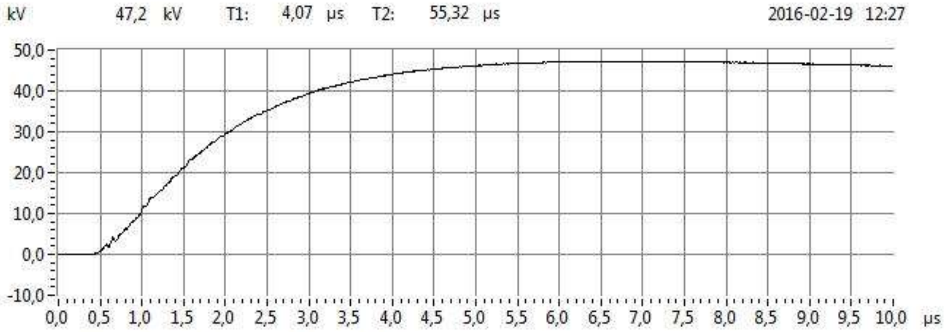


Fig. 9: Waveshape 72124900 Main loop A, phase Y, 50% of test voltage

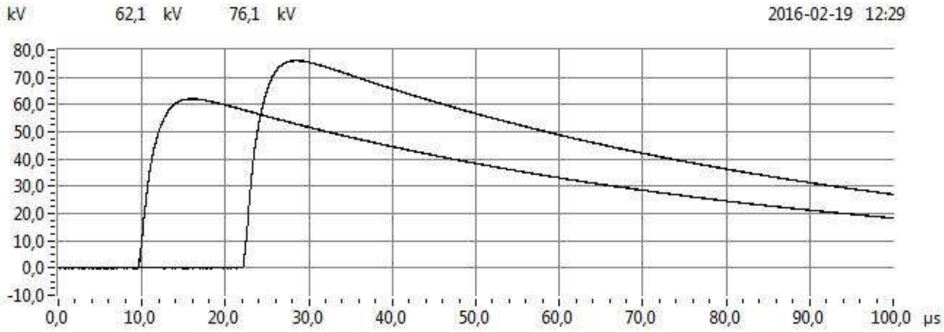


Fig. 10: 72124900 Main loop A, phase Y, 65% and 80% of test voltage

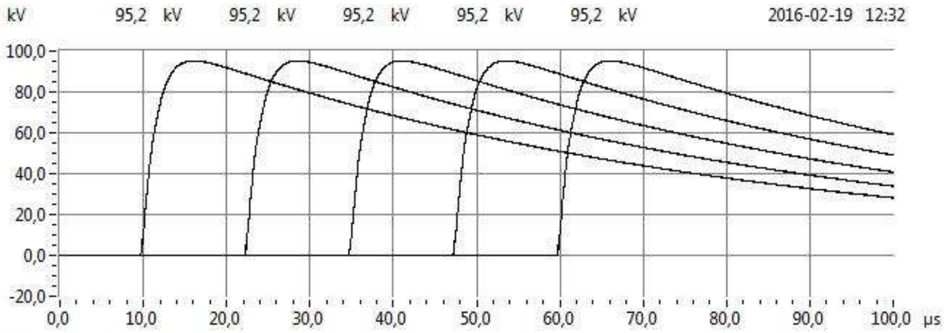


Fig. 11: 72124900 Main loop A, phase Y, 100% of test voltage

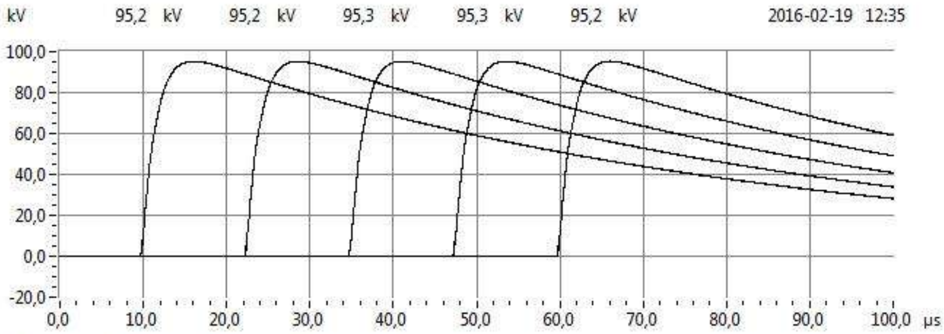


Fig. 12: 72124900 Main loop A, phase Y, 100% of test voltage

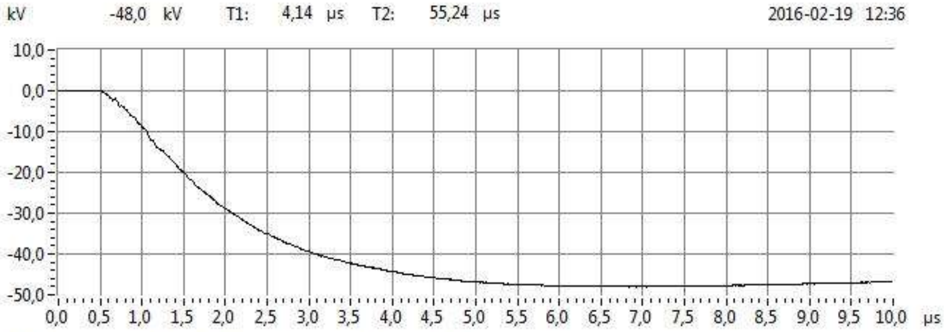


Fig. 13: Waveshape 72124900 Main loop A, phase Y, -50% of test voltage

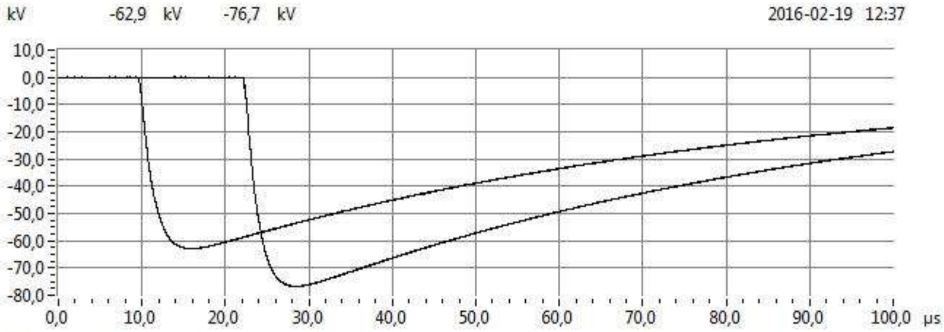


Fig. 14: 72124900 Main loop A, phase Y, -65% and -80% of test voltage

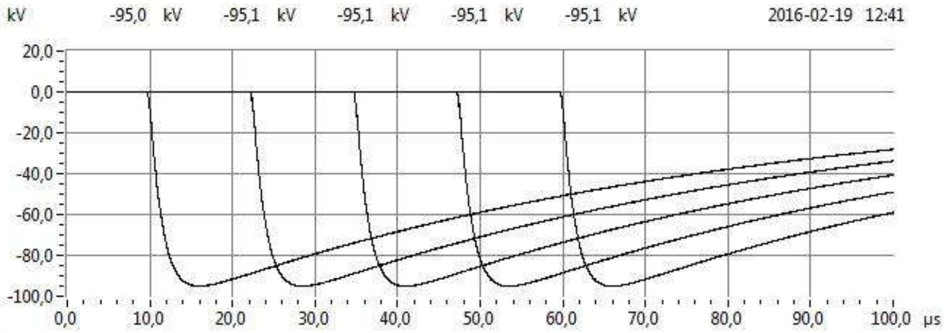


Fig. 15: 72124900 Main loop A, phase Y, -100% of test voltage

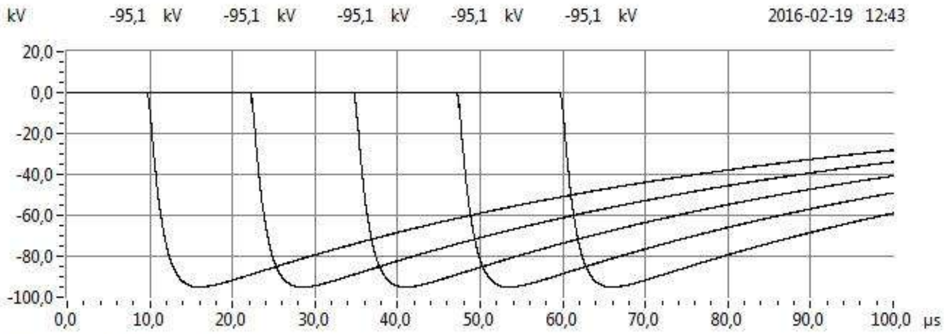


Fig. 16: 72124900 Main loop A, phase Y, -100% of test voltage

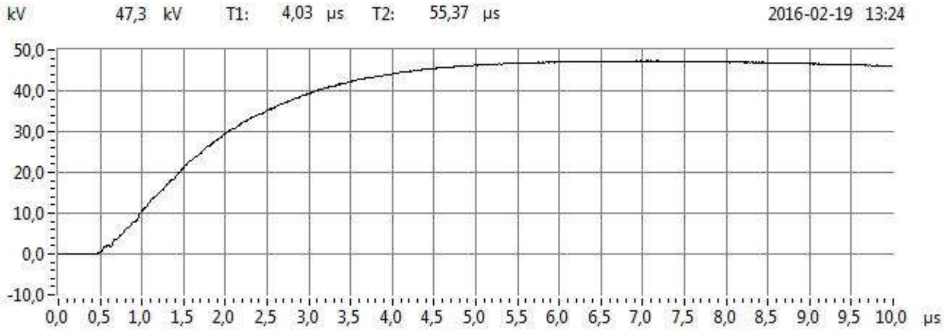


Fig. 17: Waveshape 72124900 Main loop A, phase G, 50% of test voltage

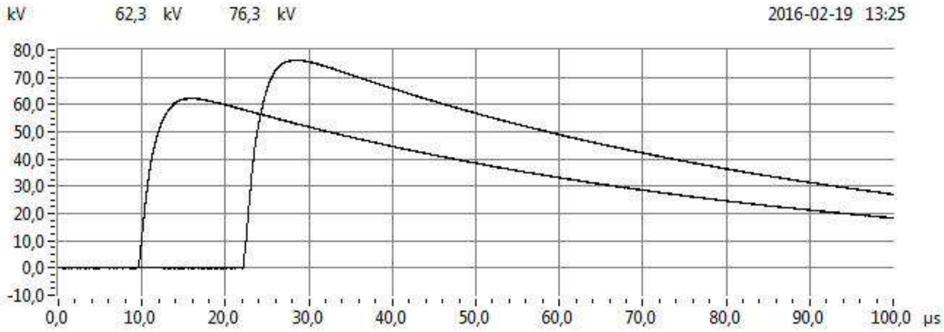


Fig. 18: 72124900 Main loop A, phase G, 65% and 80% of test voltage

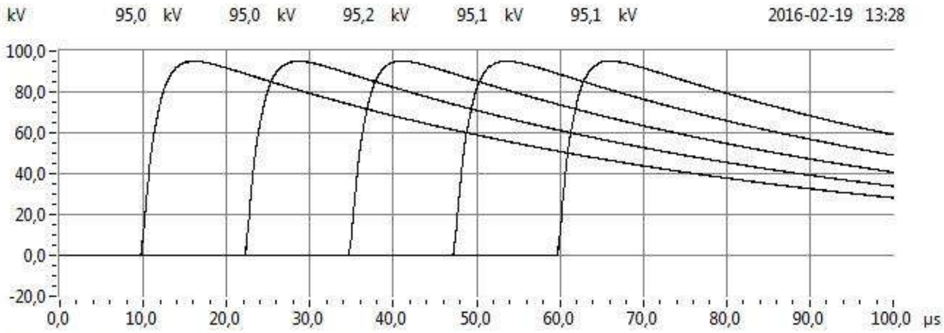


Fig. 19: 72124900 Main loop A, phase G, 100% of test voltage

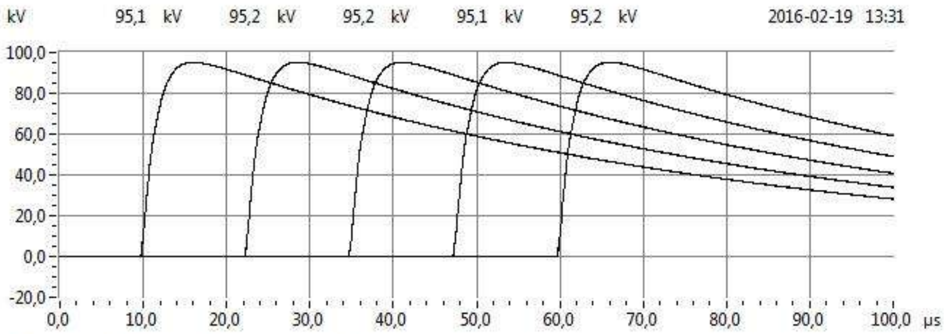


Fig. 20: 72124900 Main loop A, phase G, 100% of test voltage

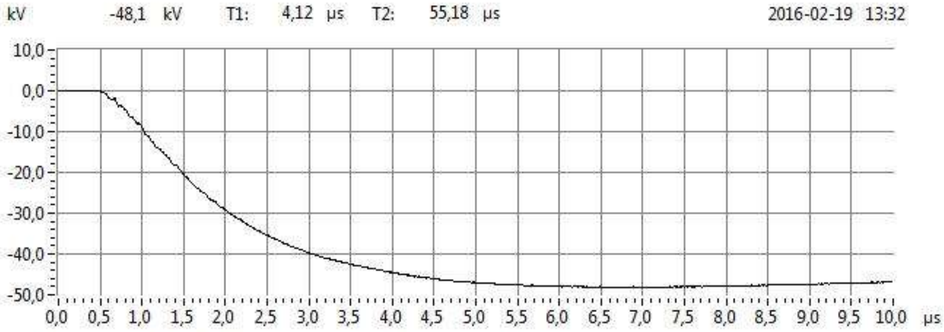


Fig. 21: Waveshape 72124900 Main loop A, phase G, -50% of test voltage

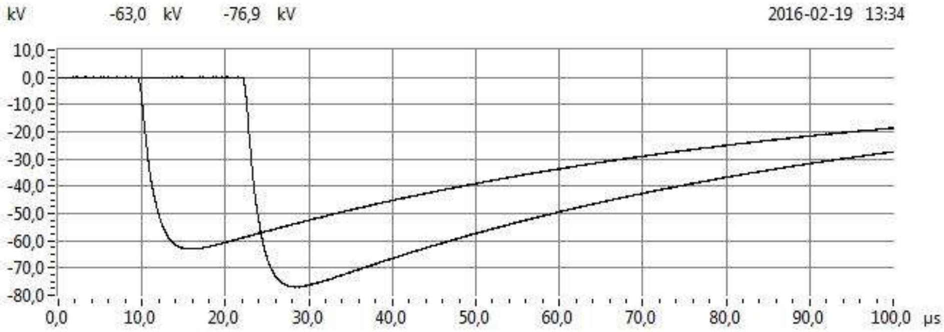


Fig. 22: 72124900 Main loop A, phase G, -65% and -80% of test voltage

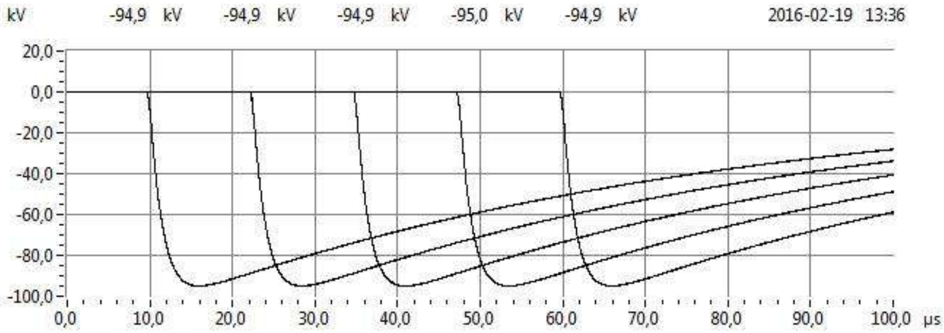


Fig. 23: 72124900 Main loop A, phase G, -100% of test voltage

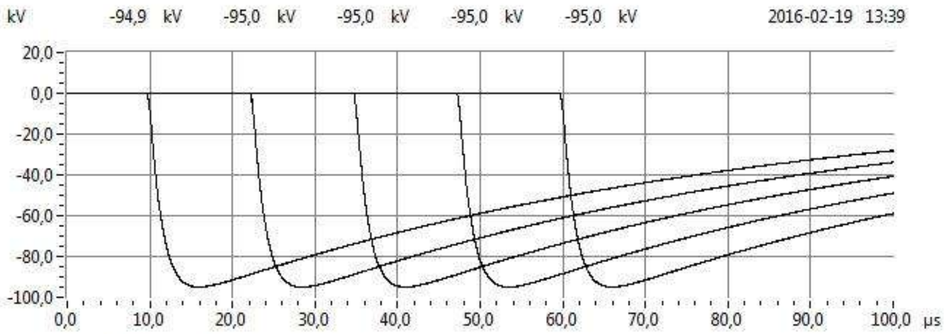


Fig. 24: 72124900 Main loop A, phase G, -100% of test voltage

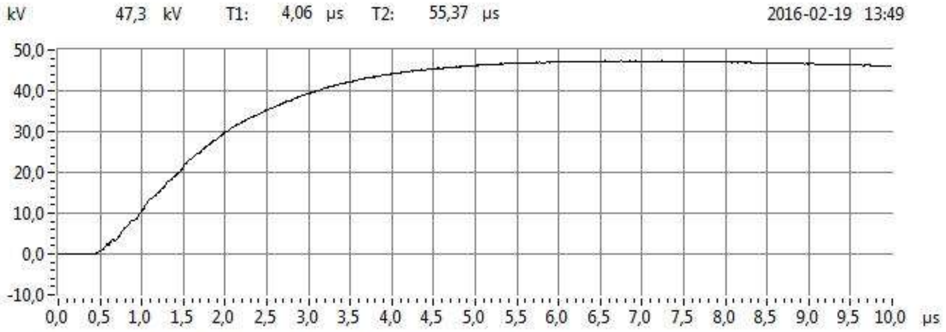


Fig. 25: Waveshape 72124900 Main loop B, phase R, 50% of test voltage

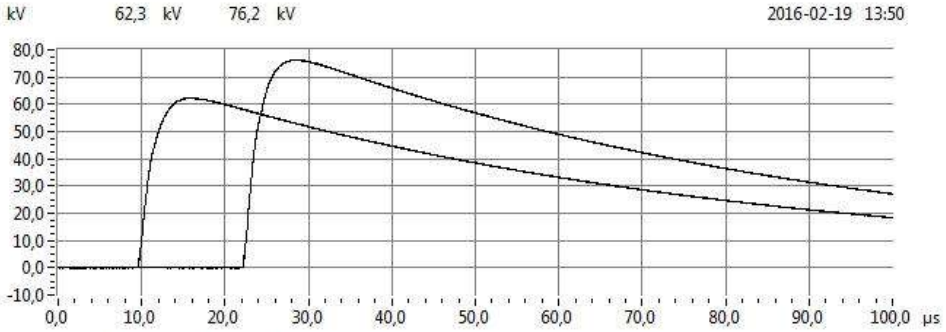


Fig. 26: 72124900 Main loop B, phase R, 65% and 80% of test voltage

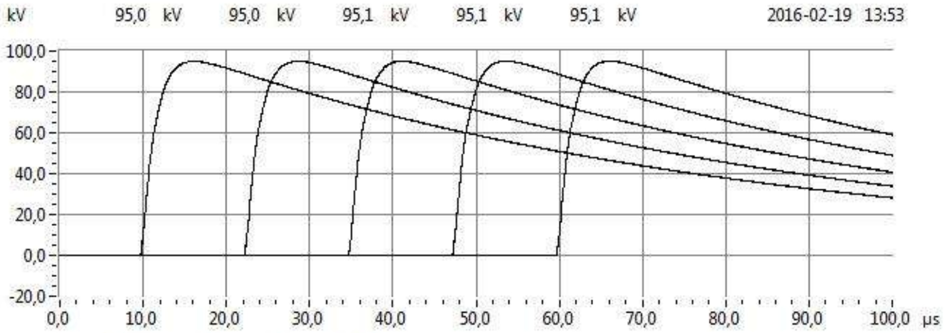


Fig. 27: 72124900 Main loop B, phase R, 100% of test voltage

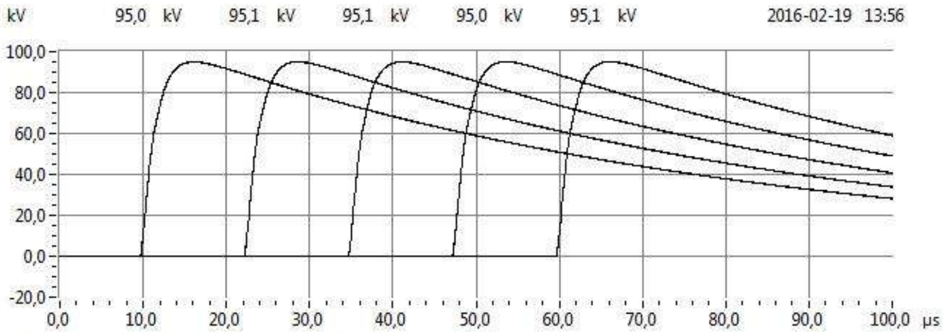


Fig. 28: 72124900 Main loop B, phase R, 100% of test voltage

Version: 1

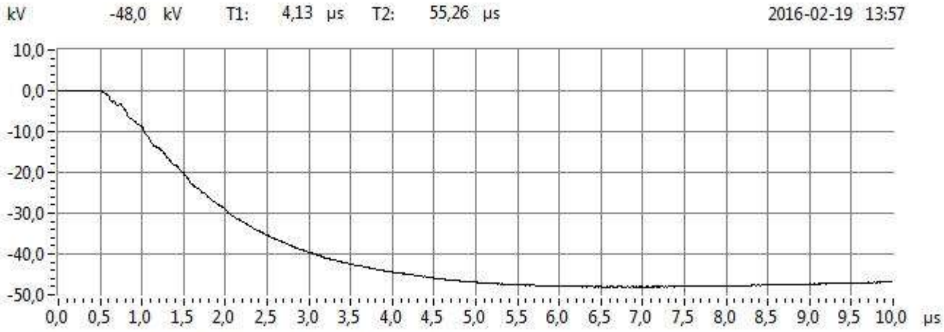


Fig. 29: Waveshape 72124900 Main loop B, phase R, -50% of test voltage

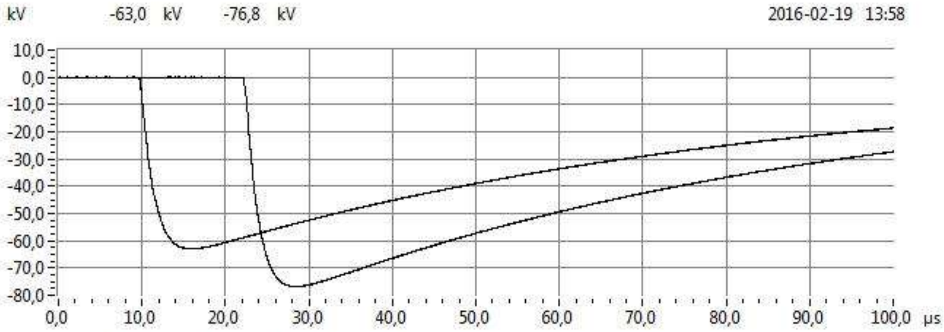


Fig. 30: 72124900 Main loop B, phase R, -65% and -80% of test voltage

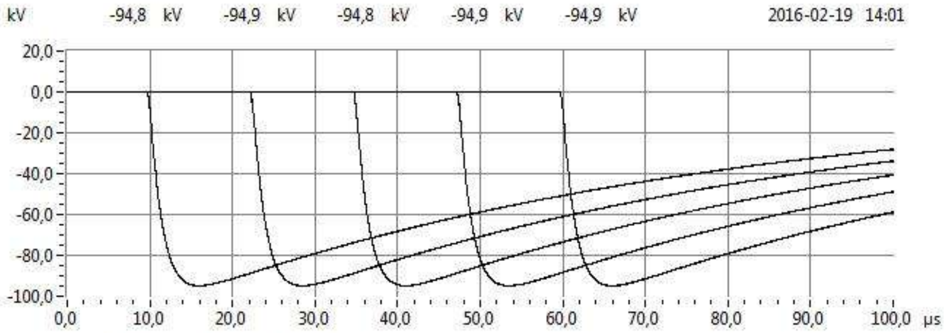


Fig. 31: 72124900 Main loop B, phase R, -100% of test voltage

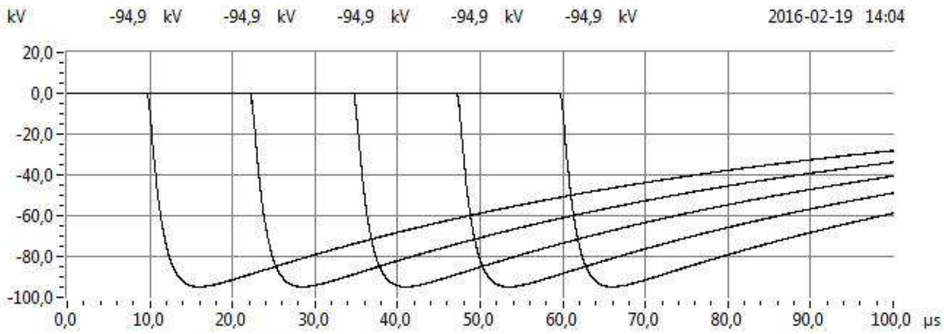


Fig. 32: 72124900 Main loop B, phase R, -100% of test voltage

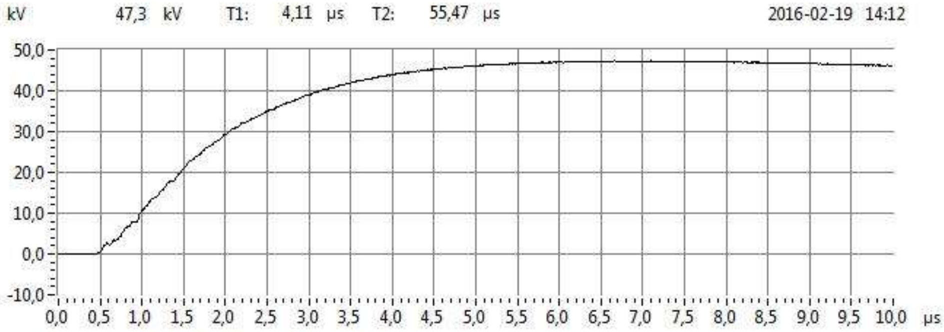


Fig. 33: Waveshape 72124900 Main loop B, phase Y, 50% of test voltage

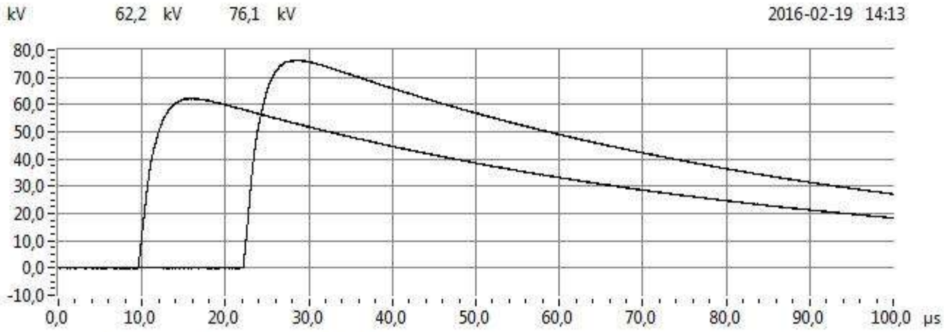


Fig. 34: 72124900 Main loop B, phase Y, 65% and 80% of test voltage

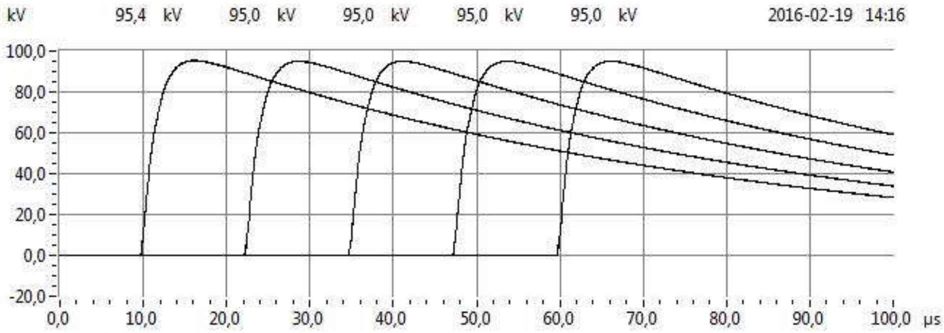


Fig. 35: 72124900 Main loop B, phase Y, 100% of test voltage

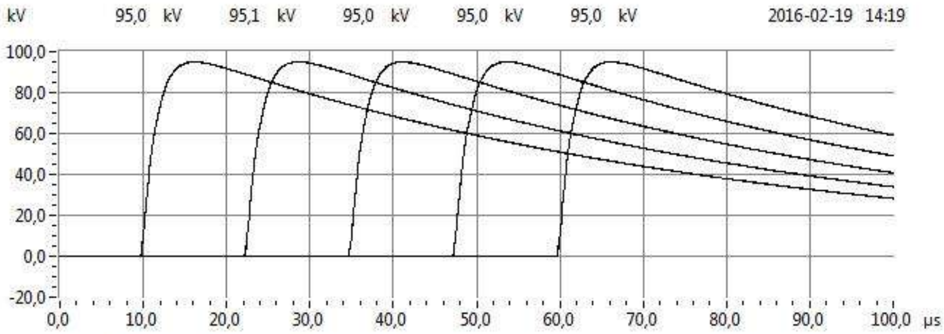


Fig. 36: 72124900 Main loop B, phase Y, 100% of test voltage

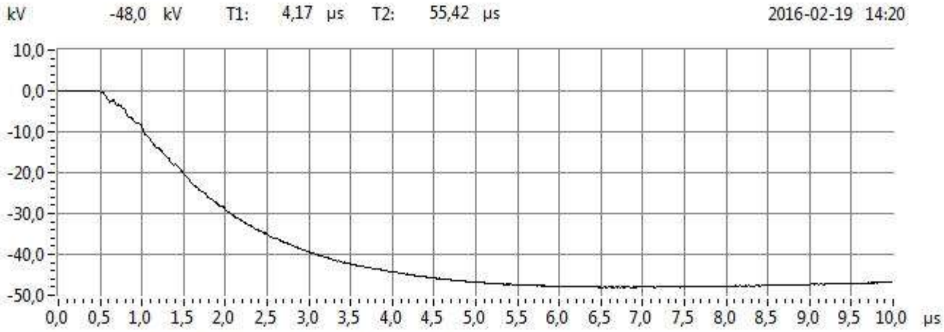


Fig. 37: Waveshape 72124900 Main loop B, phase Y, -50% of test voltage

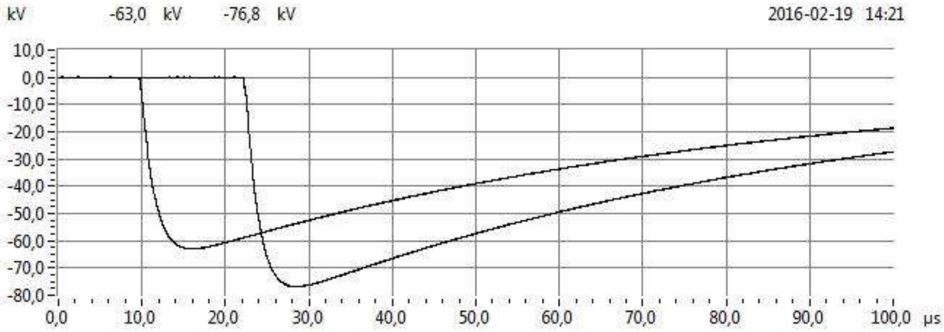


Fig. 38: 72124900 Main loop B, phase Y, -65% and -80% of test voltage

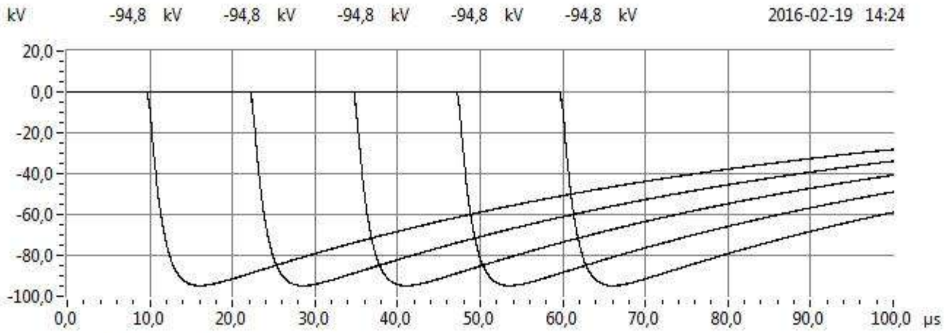


Fig. 39: 72124900 Main loop B, phase Y, -100% of test voltage

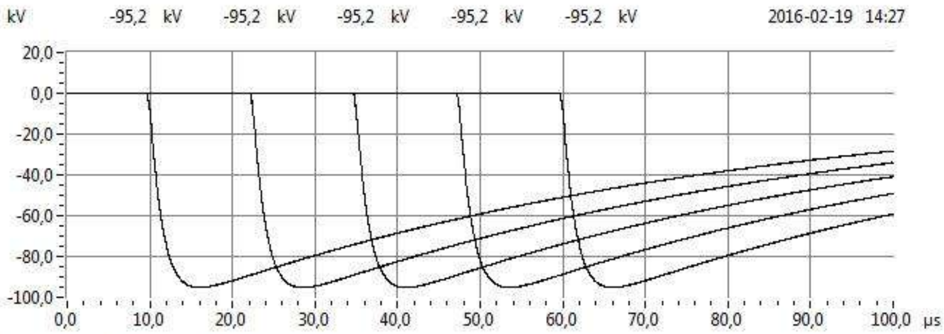


Fig. 40: 72124900 Main loop B, phase Y, -100% of test voltage

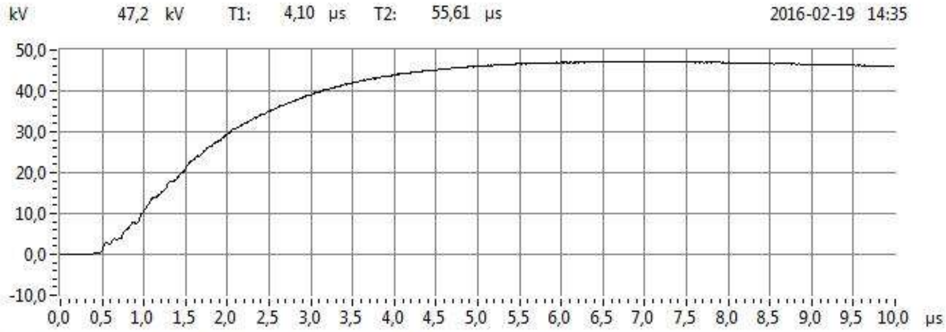


Fig. 41: Waveshape 72124900 Main loop B, phase G, 50% of test voltage

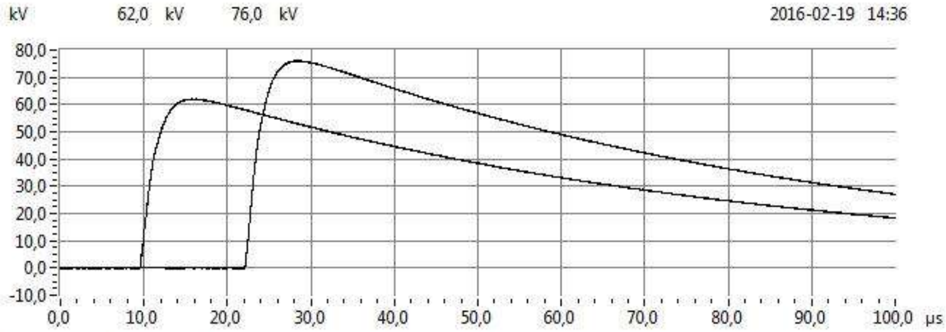


Fig. 42: 72124900 Main loop B, phase G, 65% and 80% of test voltage

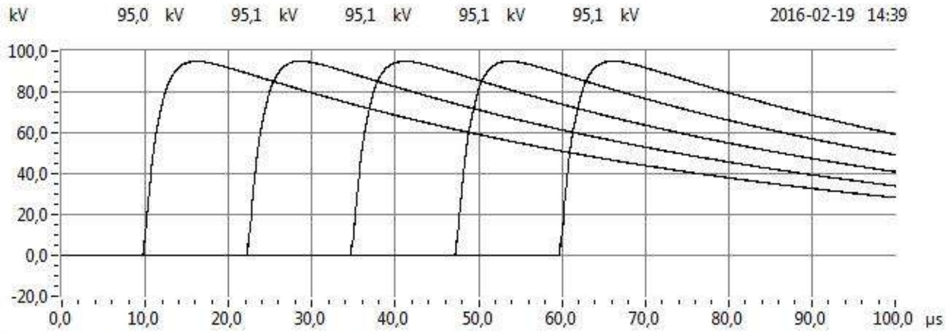


Fig. 43: 72124900 Main loop B, phase G, 100% of test voltage

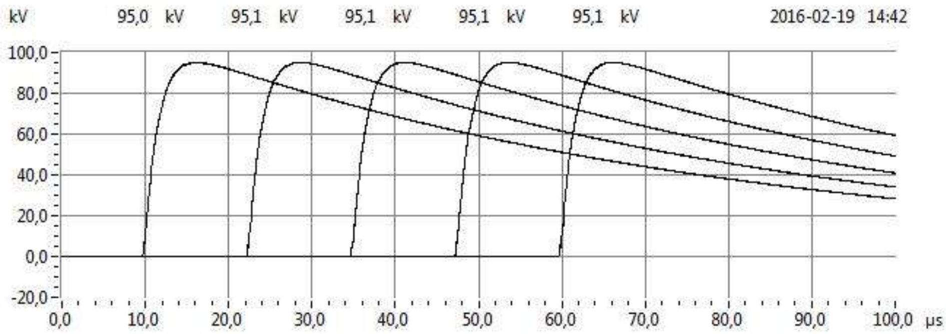


Fig. 44: 72124900 Main loop B, phase G, 100% of test voltage

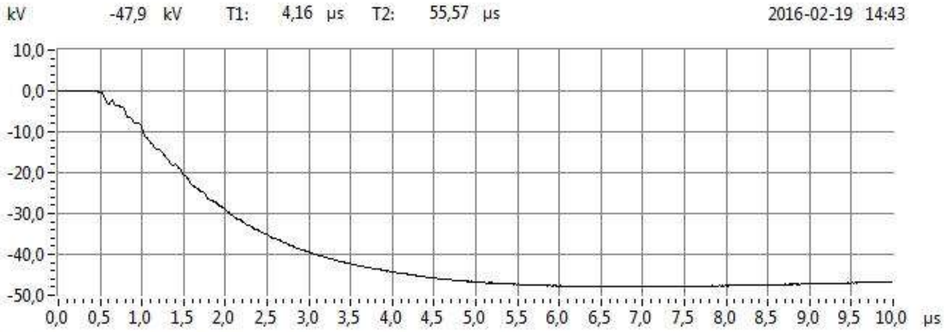


Fig. 45: Waveshape 72124900 Main loop B, phase G, -50% of test voltage

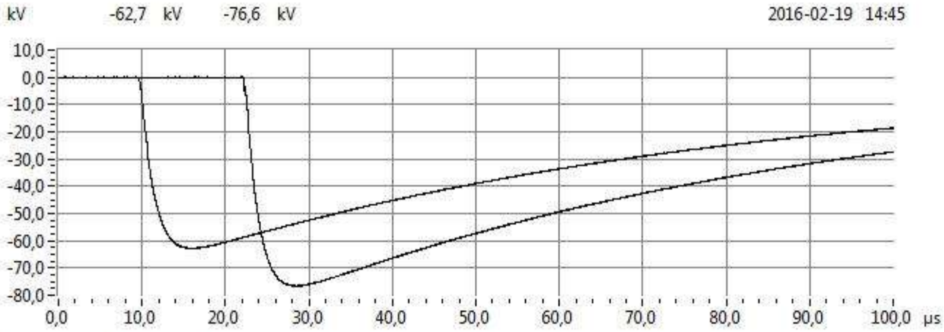


Fig. 46: 72124900 Main loop B, phase G, -65% and -80% of test voltage

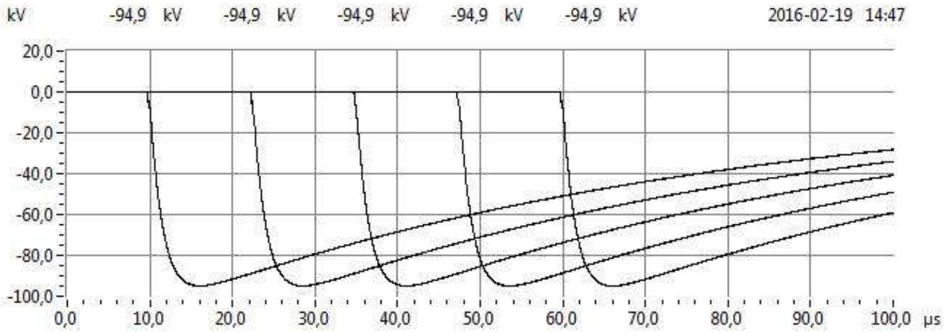


Fig. 47: 72124900 Main loop B, phase G, -100% of test voltage

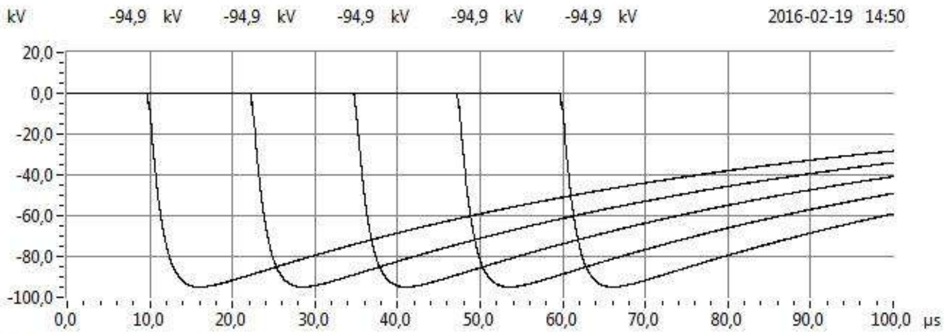


Fig. 48: 72124900 Main loop B, phase G, -100% of test voltage

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: • cracking in the filling material and/or tape or tubing components • a moisture path bridging a primary seal • corrosion and/or tracking and/or erosion which would, in time, lead to a failure of the accessory • leakage of any insulating material
Sample 2	None of the following has been detected: • cracking in the filling material and/or tape or tubing components • a moisture path bridging a primary seal • corrosion and/or tracking and/or erosion which would, in time, lead to a failure of the accessory • 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 θ (°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.

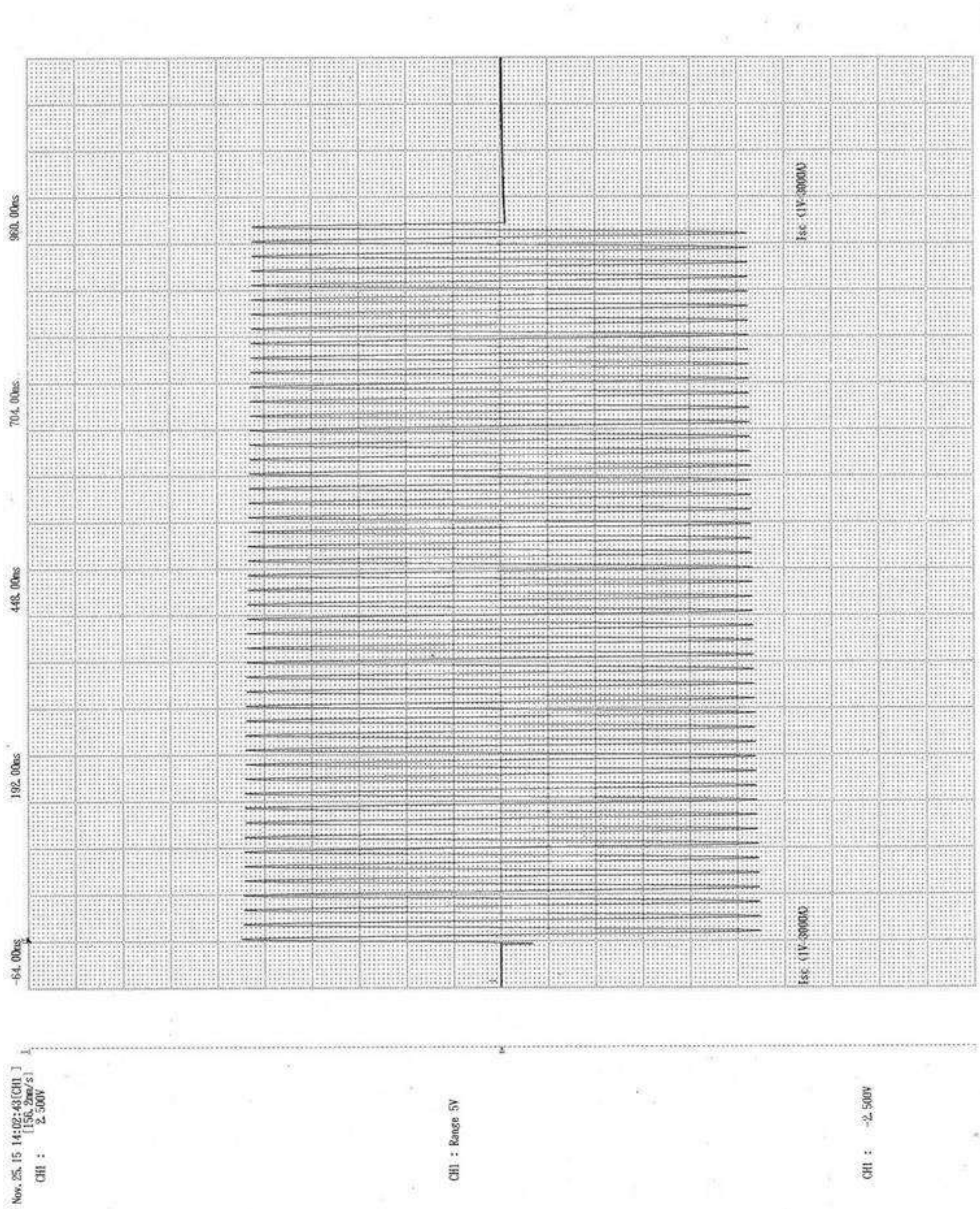
Result

The object passed the test.

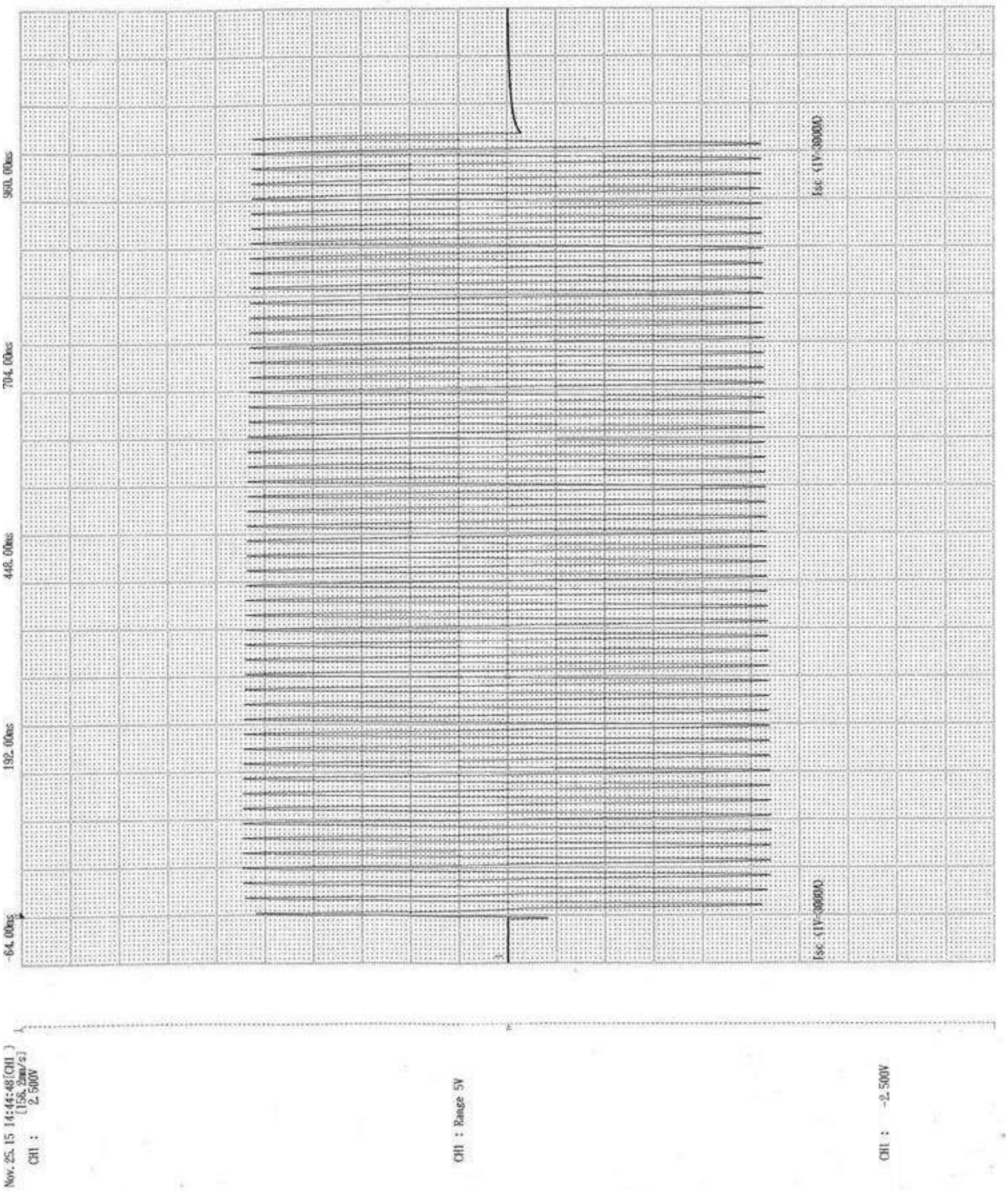
4.4.1 Test circuit

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

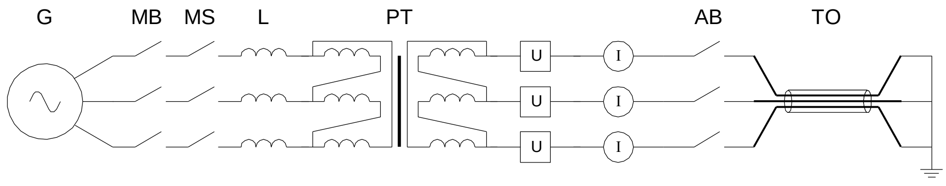
Procedure

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

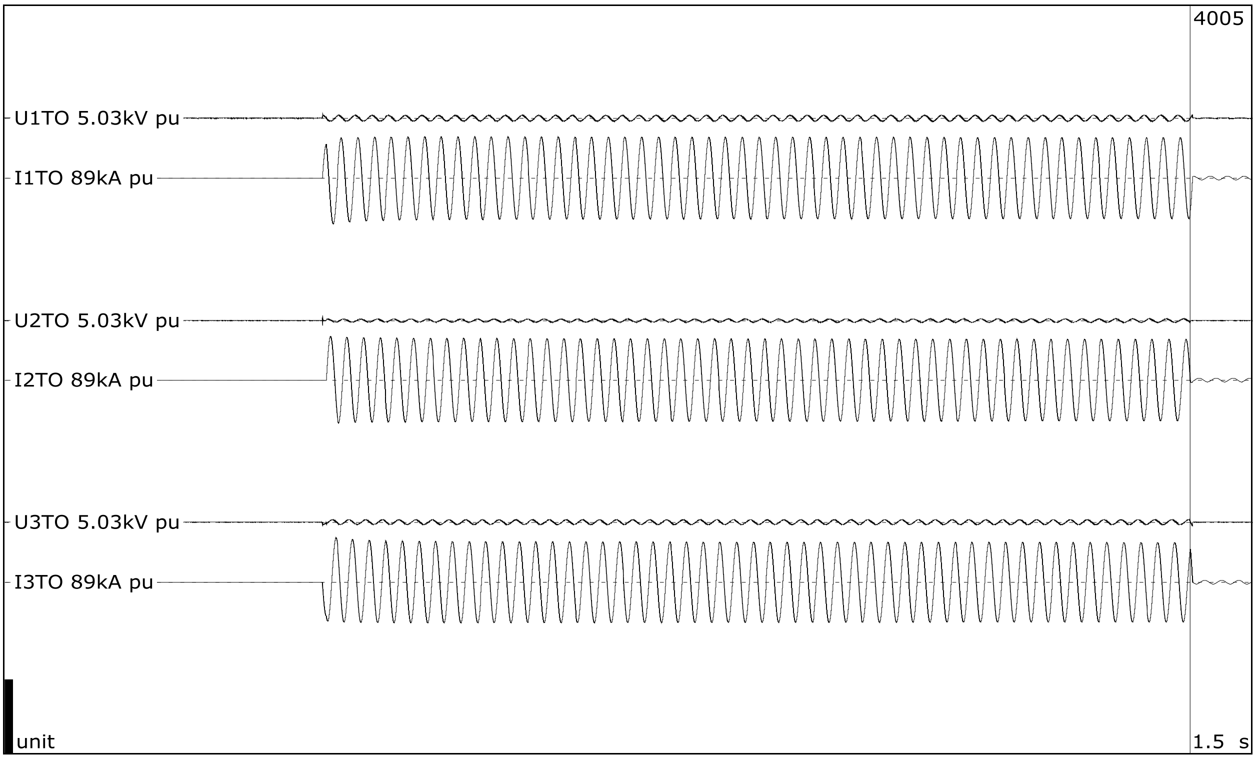
Remarks: -

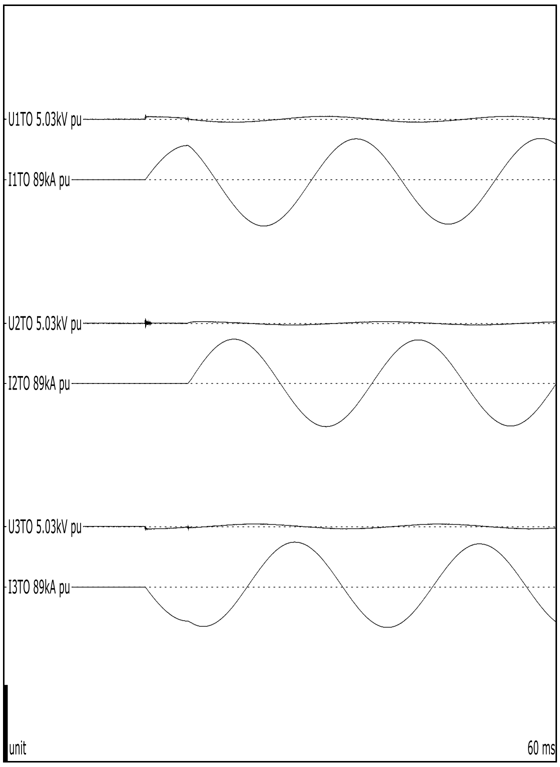
Photograph before test

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

4.5.2 Test results and oscillograms

Thermal short-circuit test





Test number: **151203-4005**

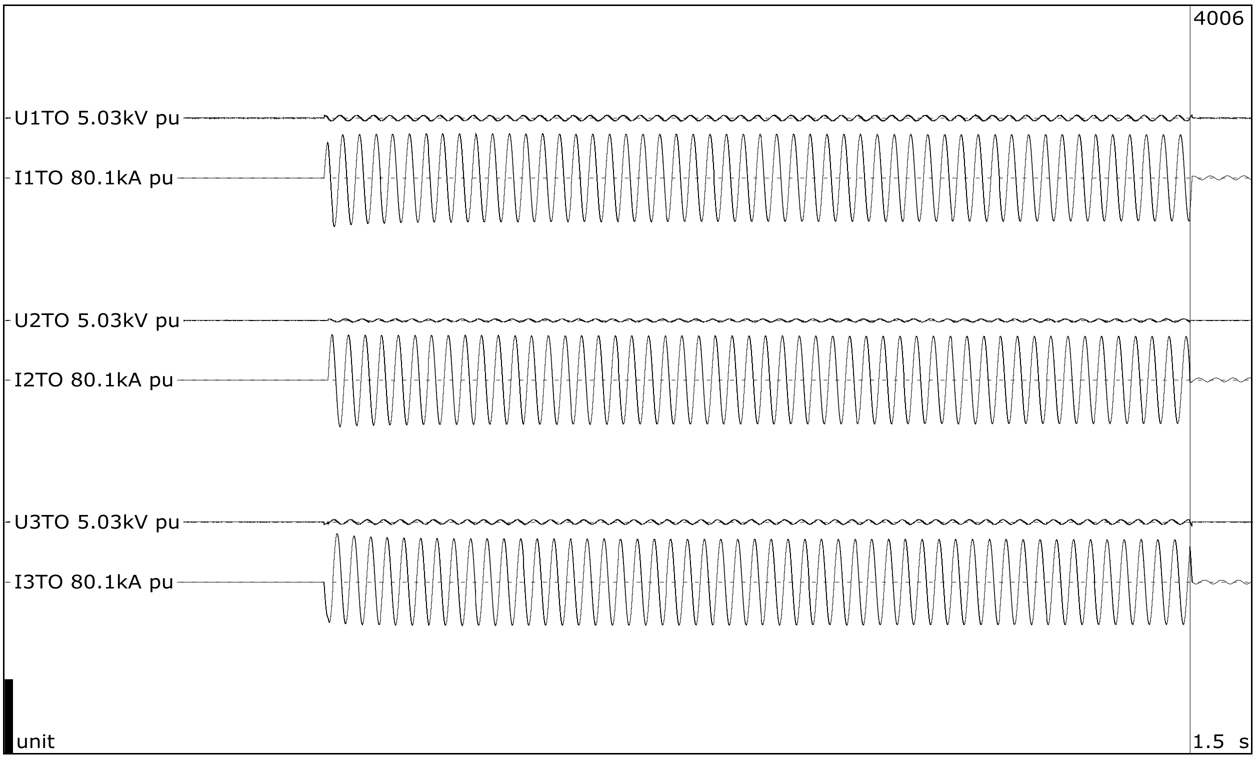
Phase		R	G	Y
Peak value of current	kA	-54,9	51,9	52,9
Symmetrical current, beginning	kA	35,4	35,6	35,2
Symmetrical current, middle	kA	34,5	34,8	34,1
Symmetrical current, end	kA	34,2	34,5	33,9
Symmetrical current, average	kA	34,6	35,1	34,5
Average current, three phase	kA	34,7		
Current duration	s	1,04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

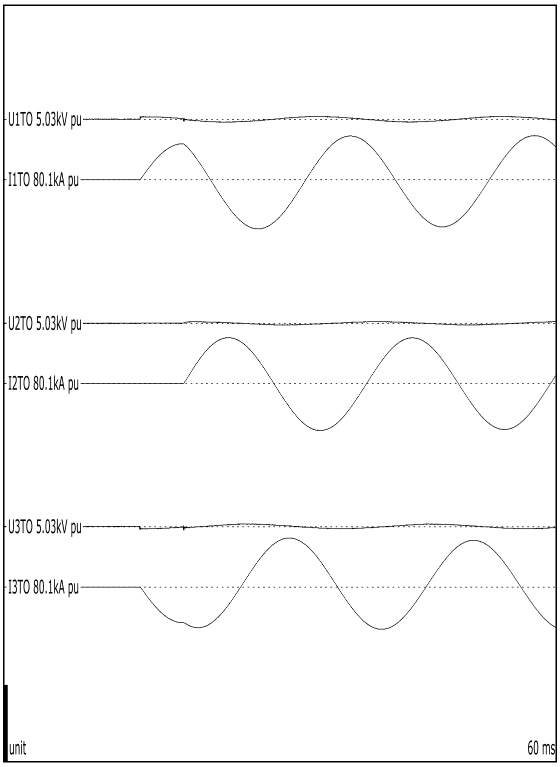
Gas pressure at 20 °C	- MPa	Ambient temperature	11,3 °C

Remarks: -

Version: 1

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.

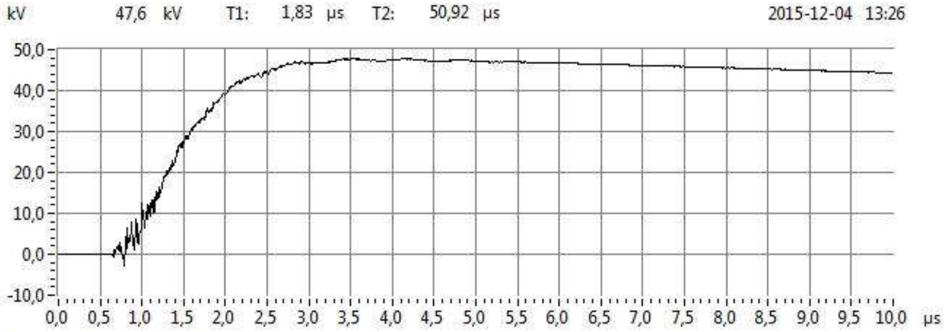


Fig. 1: Waveshape 72124900 SC loop Red 50% test voltage

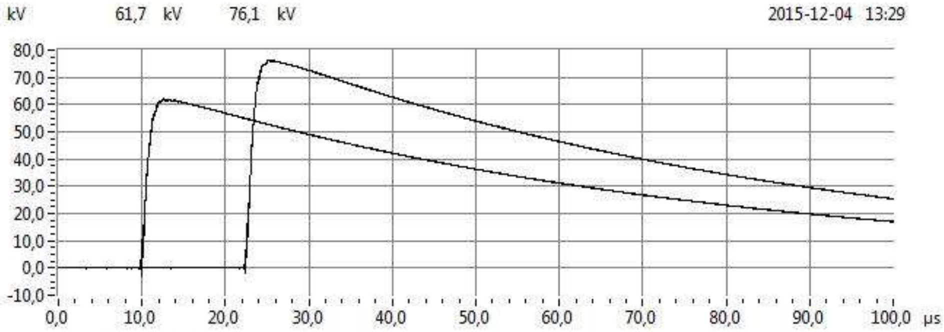


Fig. 2: 72124900 SC loop Red 65% and 80% test voltage

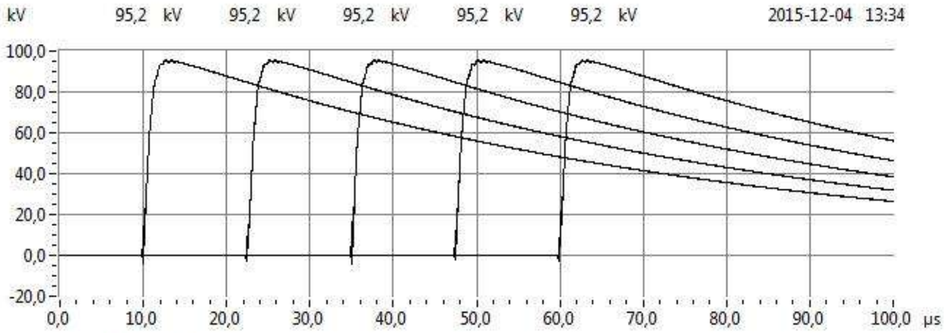


Fig. 3: 72124900 SC loop Red 100% test voltage

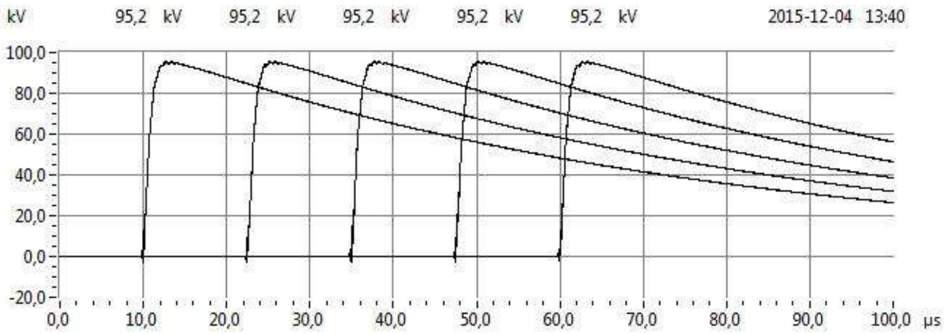


Fig. 4: 72124900 SC loop Red 100% test voltage

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

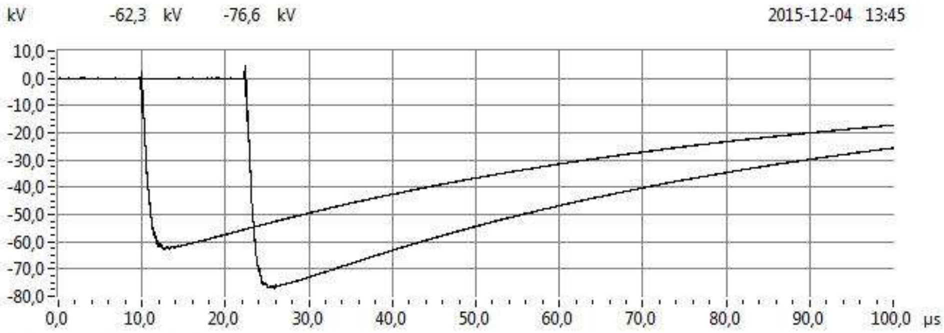


Fig. 6: 72124900 SC loop Red -65% and -80% test voltage

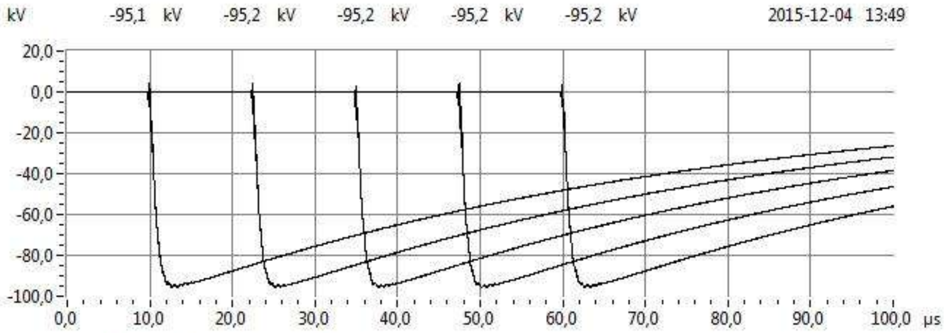


Fig. 7: 72124900 SC loop Red -100% test voltage

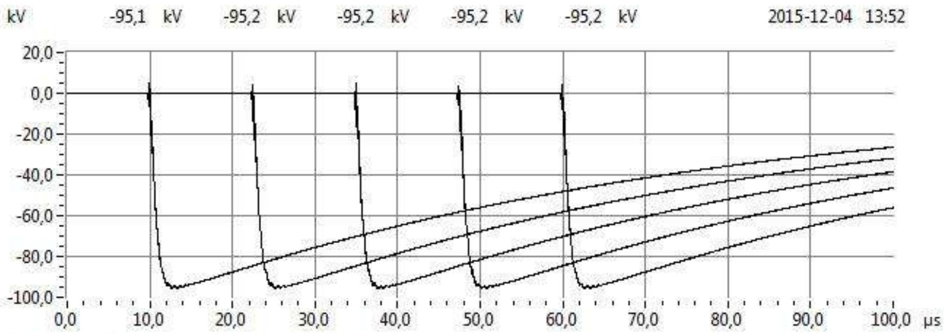


Fig. 8: 72124900 SC loop Red -100% test voltage

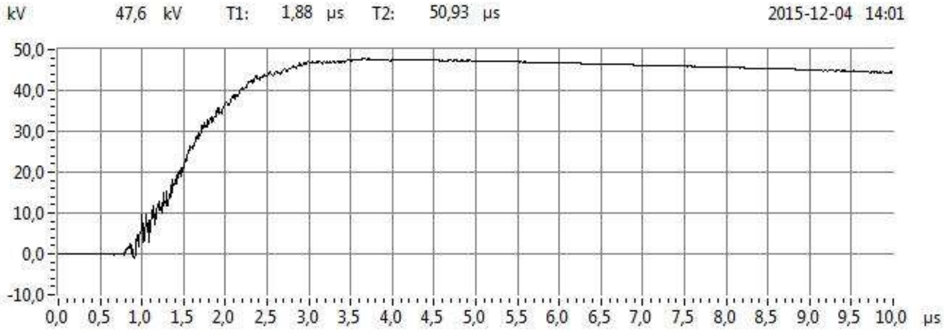


Fig. 9: Waveshape 72124900 SC loop Yellow 50% test voltage

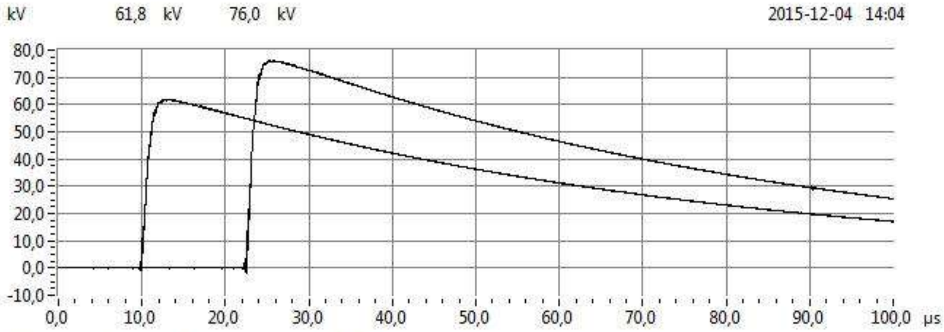


Fig. 10: 72124900 SC loop Yellow 65% and 80% test voltage

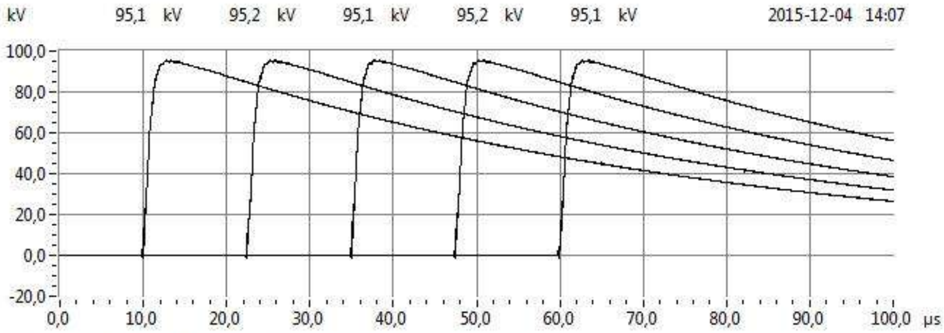


Fig. 11: 72124900 SC loop Yellow 100% test voltage

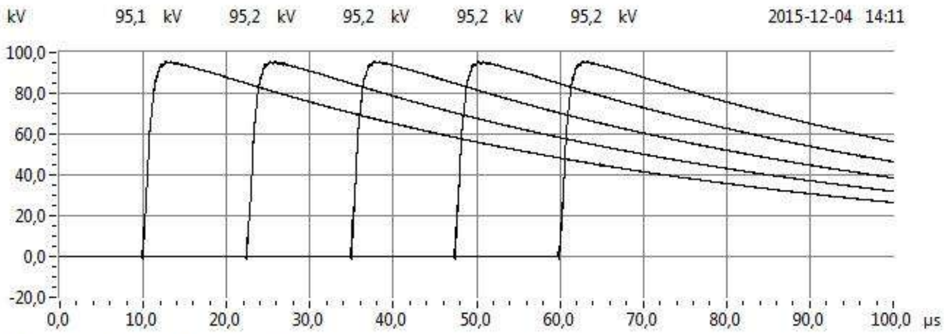


Fig. 12: 72124900 SC loop Yellow 100% test voltage

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

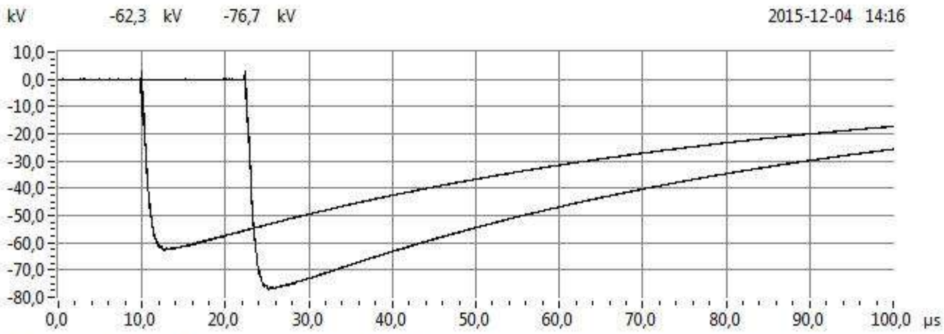


Fig. 14: 72124900 SC loop Yellow -65% and -80% test voltage

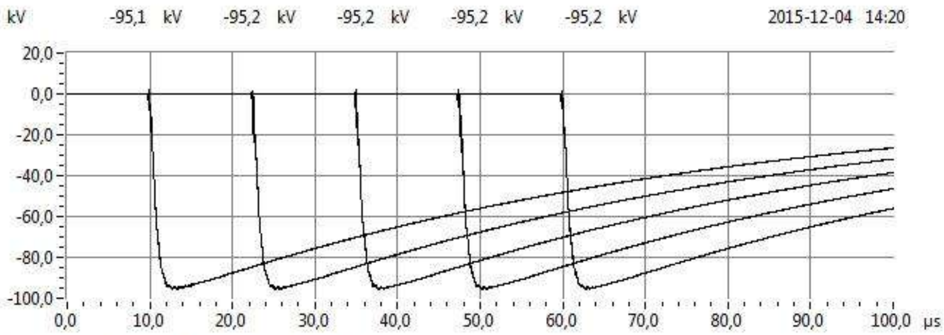


Fig. 15: 72124900 SC loop Yellow -100% test voltage

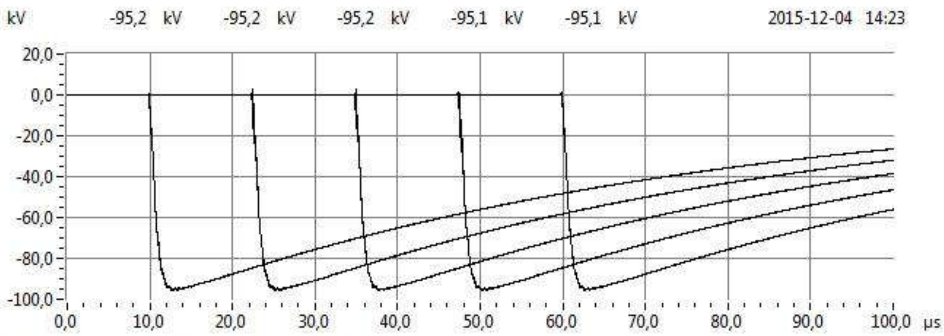


Fig. 16: 72124900 SC loop Yellow -100% test voltage

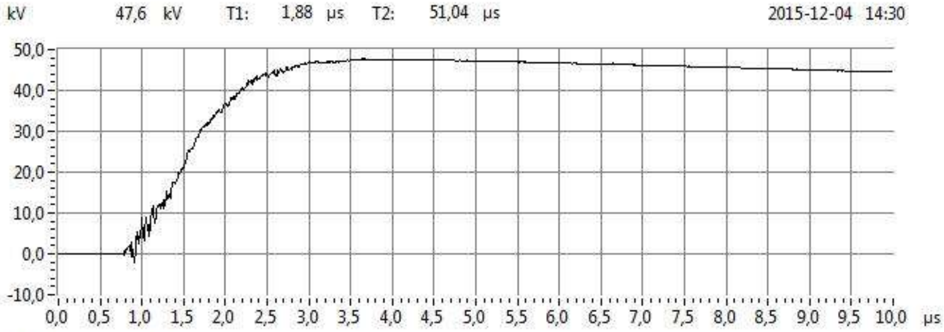


Fig. 17: Waveshape 72124900 SC loop Green 50% test voltage

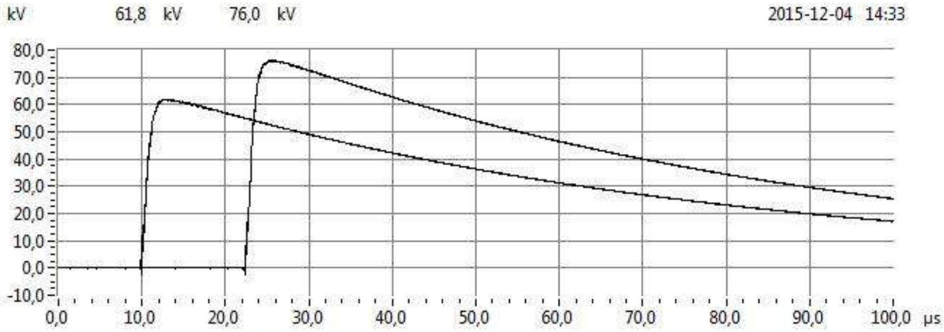


Fig. 18: 72124900 SC loop Green 65% and 80% test voltage

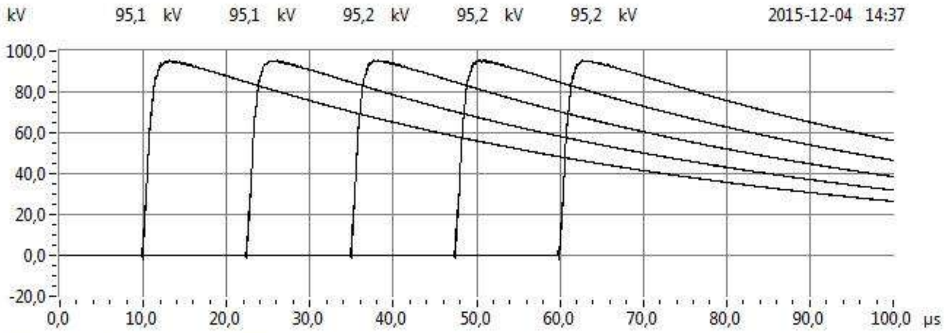


Fig. 19: 72124900 SC loop Green 100% test voltage

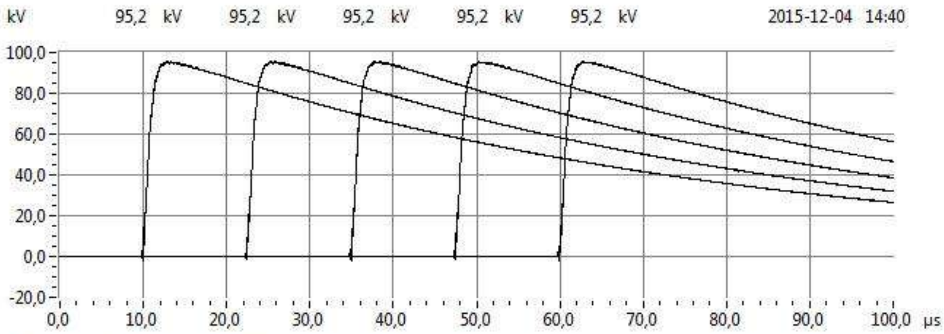


Fig. 20: 72124900 SC loop Green 100% test voltage

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

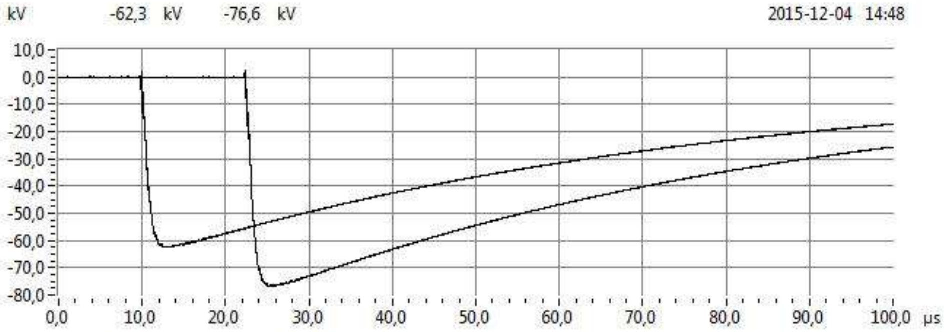


Fig. 22: 72124900 SC loop Green -65% and -80% test voltage

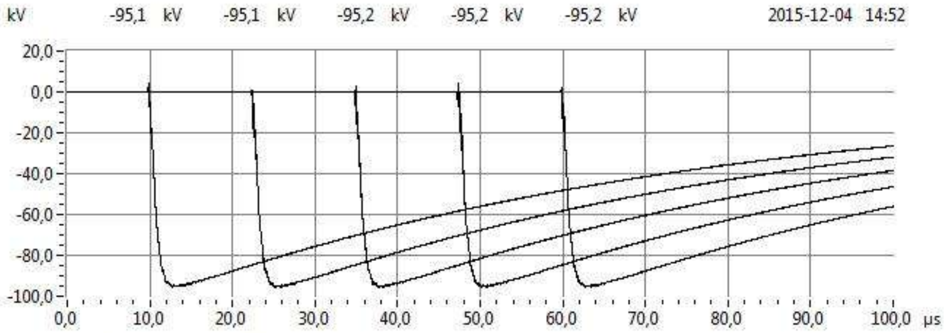


Fig. 23: 72124900 SC loop Green -100% test voltage

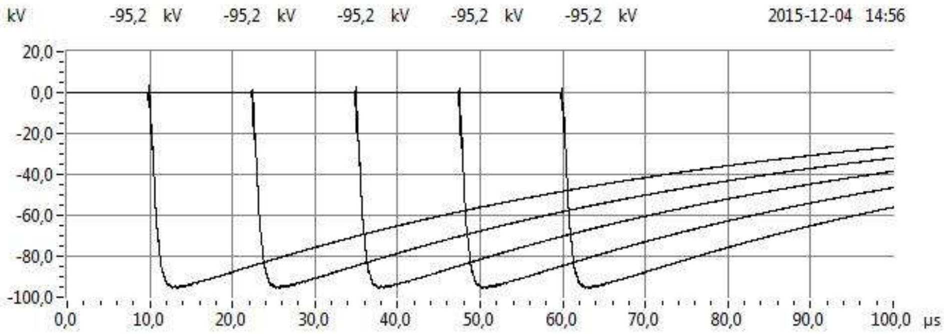


Fig. 24: 72124900 SC loop Green -100% test voltage

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: • cracking in the filling material and/or tape or tubing components • a moisture path bridging a primary seal • corrosion and/or tracking and/or erosion which would, in time, lead to a failure of the accessory • 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

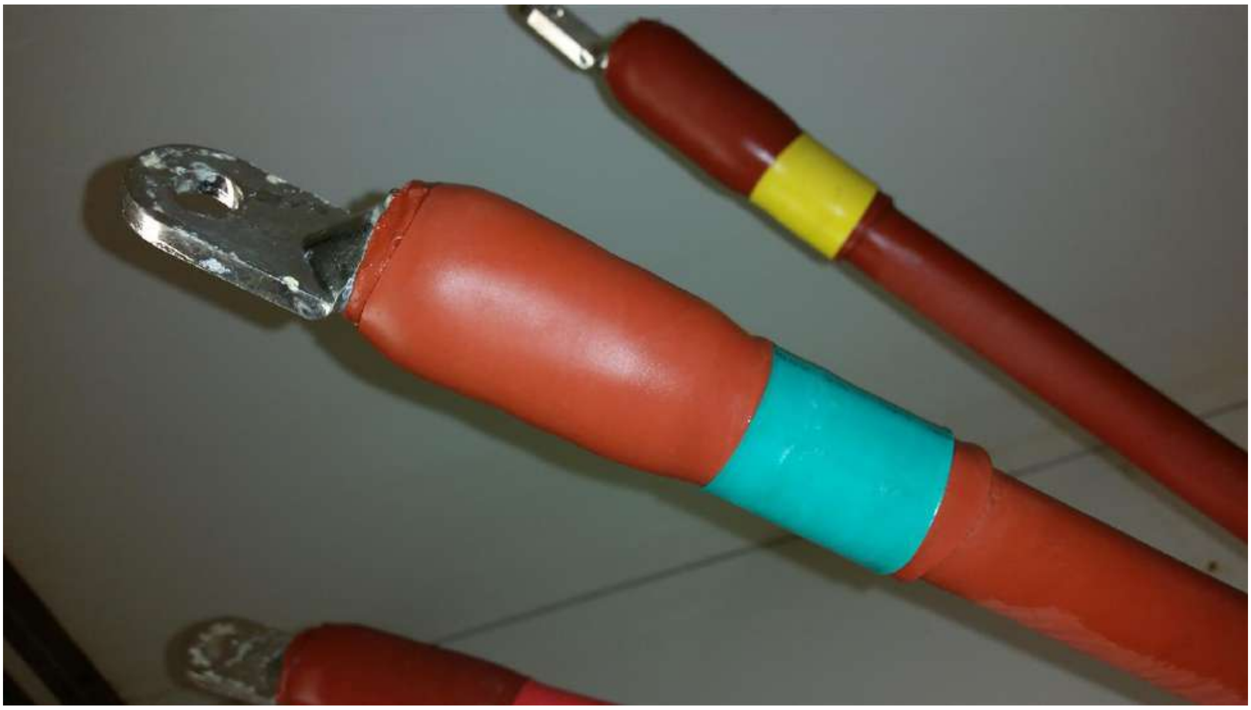
No breakdown or flashover, no more than 3 trips, no substantial damage of the insulation shall occur (table 14).

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: • cracking in the filling material and/or tape or tubing components • a moisture path bridging a primary seal • corrosion and/or tracking and/or erosion which would, in time, lead to a failure of the accessory • leakage of any insulating material

Note

The results are for information only.

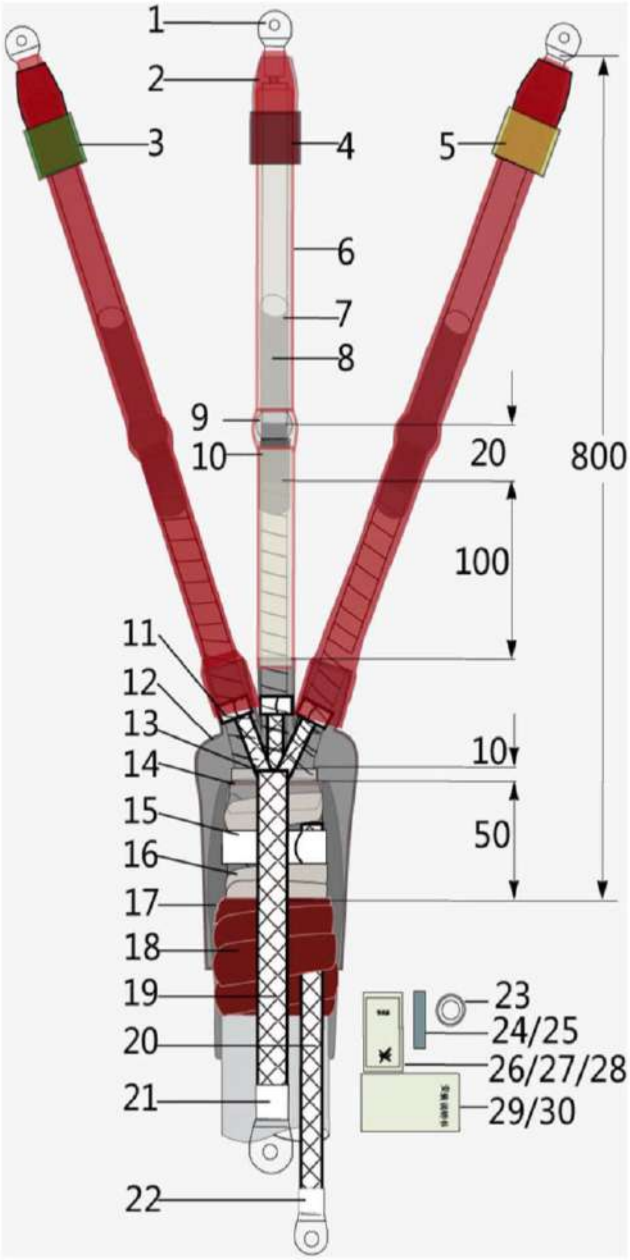
Photographs

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	唐张杰 2015.6.25	刁雪峰 15.6.25	於海燕 2015.6.25



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	[signature]	[signature]	[signature]

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	/

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

Installation Instruction For 15KV Terminations

Step 1

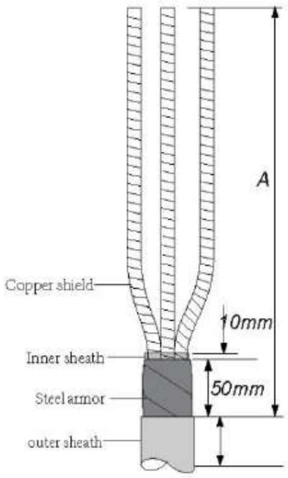
Preparation

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

Step 2

Strip cable sheath and steel armor

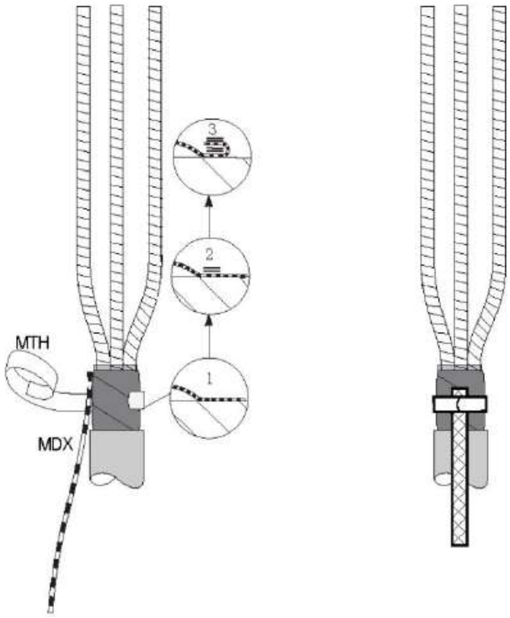
1. Straighten the cable
2. Even cable port
3. Measure dimensions as shown in the right picture , Strip cable outside sheathing, steel armor and inside sheathing A=800mm
4. Cleanup cable filler and wrap tape
5. Use PVC tape to fixate copper shieldng in the top end of each core.
6. Use copper binding wire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



Version: 1

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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 :

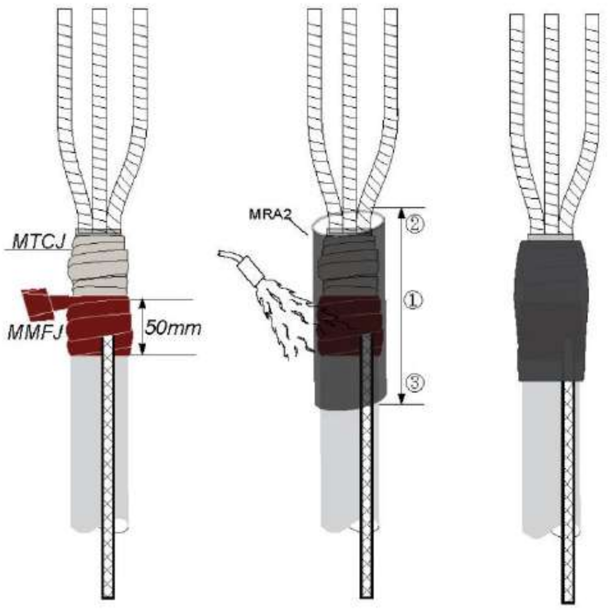
1. Use yellow outer flame of about 100~300mm to heat the heat shrinkable products.
2. Unless otherwise stated, use flame to heat outer heat shrinkable products uniformly.
3. When heating, keep the flame moving and the local stop time shall not exceed 3 seconds, so as to avoid burning caused by hot parts.

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:

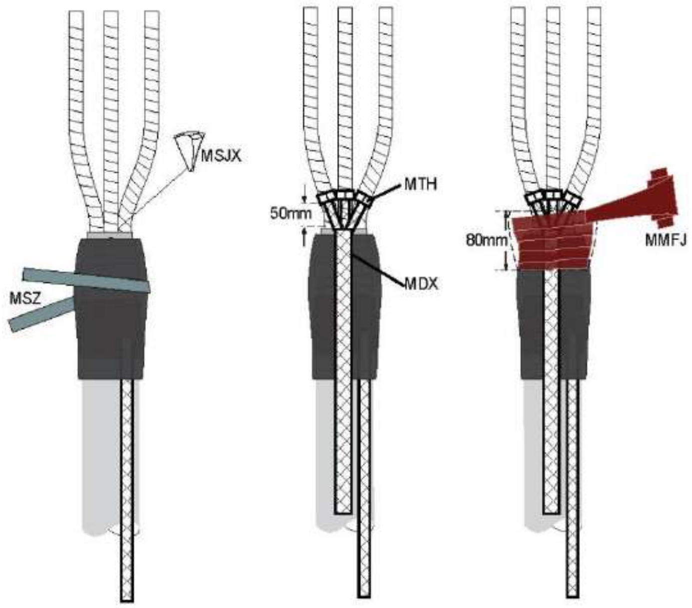
Use gas burner strictly in accordance with instructions provided by suppliers. Check if there is any connection leakage before turned on. Failure to observe the instructions could cause fire or explosion, even critical damage.



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.



Version: 1

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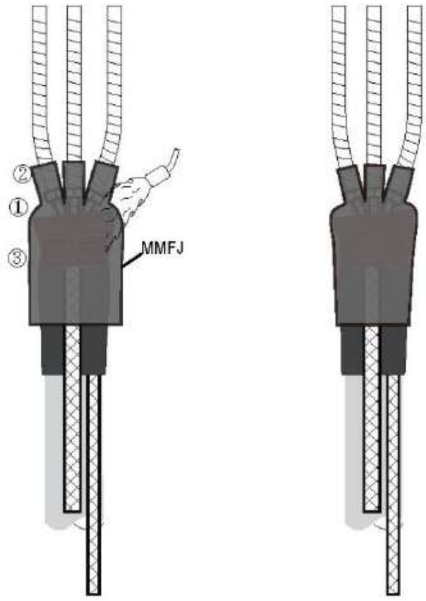
Step 6

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.

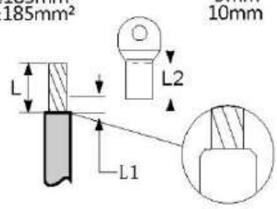


step 7

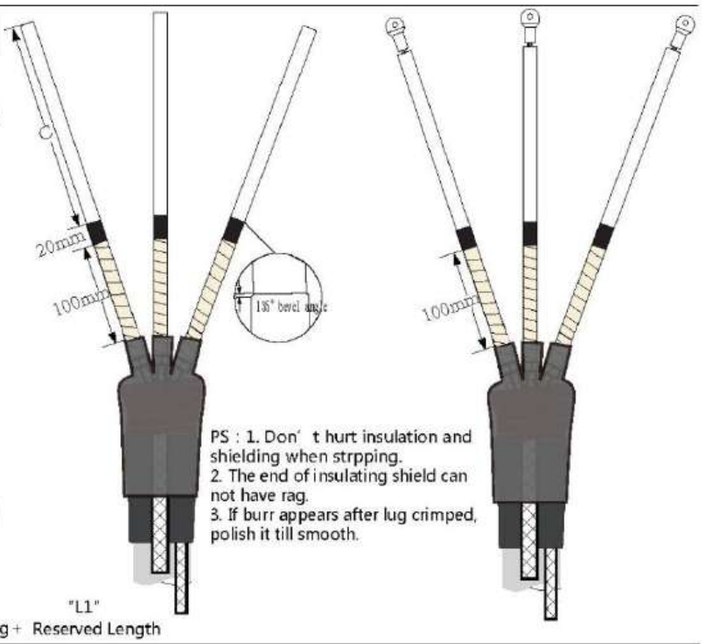
Strip copper shield and insulation

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.

Version: 1

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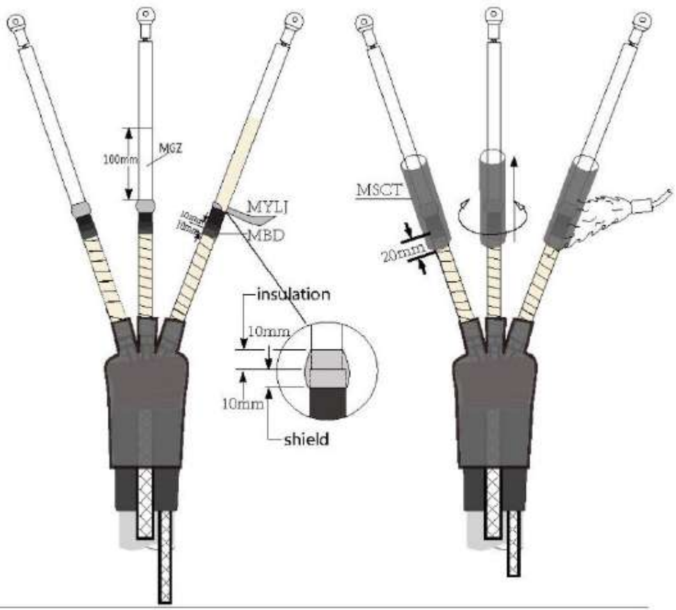
step 8

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.

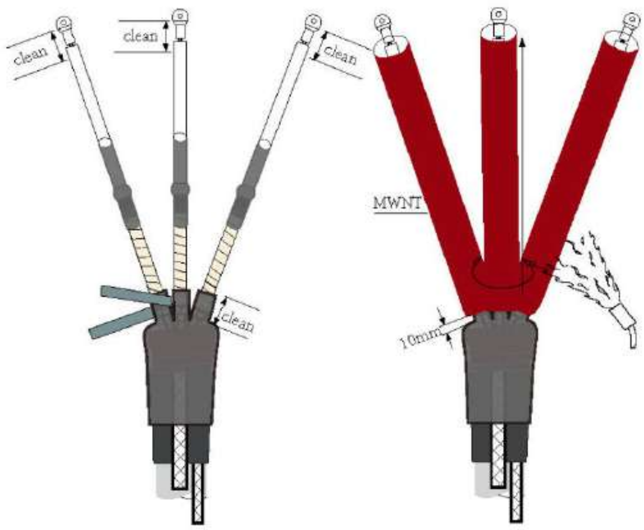
step 9

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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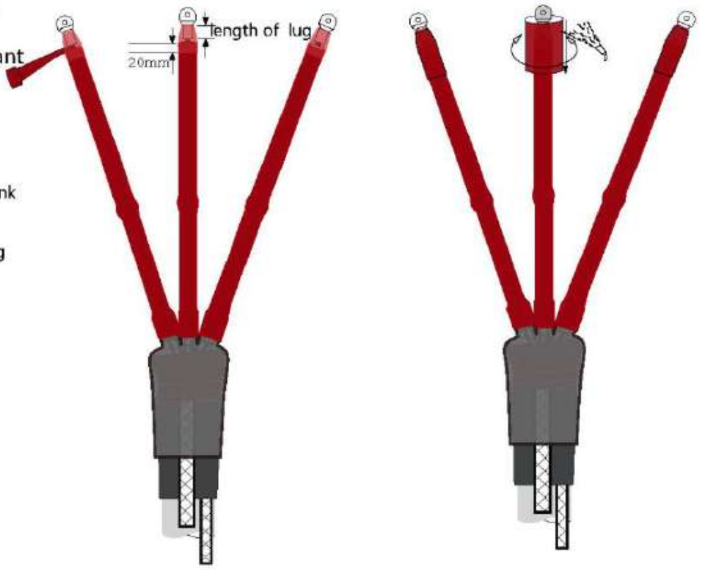
step 10

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.

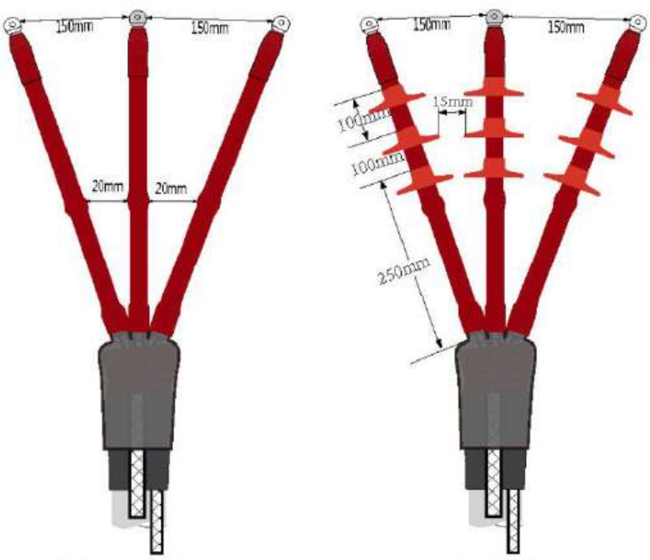


step 11

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



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%