DNV·GL

KEMA TEST REPORT

1385-16

Object	Single-core power cable 133/230 (245) kV – 1x2500 mm^2 – Cu – XLPE
Client	Energya Power Cables – ELSEWEDY HELAL, Cairo, Egypt
Manufacturer	Energya Power Cables – ELSEWEDY HELAL, Cairo, Egypt *)
Tested by	KEMA Nederland B.V., Arnhem, the Netherlands
Date of tests	1 June to 16 August 2016
Test specification	The tests have been carried out in accordance with client's instruction. Test procedure and test parameters were based on IEC 62067 (2011).

This report 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 report consists of 35 pages in total.

KEMA Nederland B.V.

J.P. Fonteijne
Executive Vice President
KEMA Laboratories

KEMA Laboratories

Arnhem, 5 September 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 equipment tested has fulfilled the requirements of this standard and the relevant ratings assigned by the manufacturer are endorsed by DNV GL. In addition, the test object's technical drawings have been verified and the condition of the test object after the tests is assessed and recorded. The Certificate contains the essential drawings and a description of the equipment 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 equipment 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 test object's technical drawings have been verified and the condition of the test object after the tests is assessed and recorded. The report is applicable to the equipment 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 page 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 test 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 loose sheets or 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)	133/230 (245) kV
Rated maximum conductor temperature	90 °C
Rated conductor cross-section	2500 mm^2

The test voltages and calculated nominal field stresses were based on U_0 test = 133 kV.

1.2 Description of the object tested

Standard	IEC 62067, Clause 6
Manufacturer	Energya Power Cables – ELSEWEDY HELAL, Cairo, Egypt
Type	U_0 = 133 kV 1x2500 mm^2 XLPE CABLE
Manufacturing year	2016
Quantity submitted	75 m
Rated voltage, U_0/U (U_m)	133/230 (245) kV
Overall diameter (D)	144,6 mm
Calculated nominal electrical stress at conductor screen at U_0 = 133 kV (E_i)	7,1 kV/mm
Calculated nominal electrical stress at insulation screen at U_0 = 133 kV (E_o)	4,1 kV/mm
Nominal capacitance between conductor and metal screen	0,2491 µF/km
Marking on the oversheath	ENERGYA POWER CABLES – ELSEWEDY HELAL 1X2500 MM2 230 KV CU/XLPE/LEAD/HDPE 2016
Construction	see List of drawings

Conductor

• material	annealed copper
• material designation	soft drawn
• DC conductor resistance	0,0072 Ω/km
• cross-section	2500 mm^2
• nominal diameter (d)	61,2 mm
• type	segmental (Milliken)
• number and nominal diameter of wires	305 wires and Ø 3,40 mm
• maximum conductor temperature in normal operation	90°C
• presence and nature of measures to reduce skin effect	non-conductive tapes between segments
• presence and nature of measures to achieve longitudinal watertightness	yes water blocking tapes and yarns inside the conductor
• swelling material	1 non-conductive water-blocking tape and 1 water-blocking yarn over each stranded layer (GECA Tapes) 1 non-conductive water-blocking tape between segments (GECA Tapes) 2 semi-conductive water-blocking tapes over conductor (Lantor)
• material designation	GECA Tapes: GFS1105, GTI1020, GPY/40, GTA5.0JC/P Lantor: 3C1152
• manufacturer of the material	GECA Tapes and Lantor

Conductor screen

• material	extruded semi-conducting XLPE
• nominal thickness	1,5 mm
• material designation	HFDA-0801 BK EHV
• manufacturer of the material	DOW

Insulation

• material	super-clean XLPE
• nominal thickness	25,0 mm
• nominal inner diameter of the insulation	66,6 mm
• nominal outer diameter of the insulation	116,6 mm
• material designation	HFDB-4201 EHV K
• manufacturer of the material	DOW

Insulation (core) screen

• material	extruded semi-conductive XLPE
• nominal thickness	1,5 mm
• material designation	HFDA-0801 BK EHV
• manufacturer of the material	DOW

Longitudinal watertightness

• presence and nature of measures to achieve longitudinal watertightness along insulation screen	yes , under the lead sheath
• number of swelling tapes	3
• material designation	GTC 2040
• manufacturer of the material	GECA Tapes

Metal sheath

• material	lead alloy
• nominal thickness	4,0 mm
• type	smooth, ½ E
• manufacturer of the material	GLENCORE

Oversheath

• material	HDPE type ST_7
• nominal thickness	5,0 mm
• nominal overall diameter of the cable (D)	143,2 mm
• material designation	HE6062
• manufacturer of the material	Borouge – Borealis
• colour	black
• graphite coating applied	yes

Fire retardant no
(acc. IEC 60332-1)

Manufacturing details insulation system

• location of manufacturing	10th of Ramadan City A1, Egypt
• type of extrusion line	CCV Line
• type of extrusion	triple extrusion
• factory identification of extrusion line	EHV line code “CCV2”
• manufacturer of the extrusion line	Maillefer
• identification of production batch	45671/16
• curing means	dry nitrogen
• cooling means	dry nitrogen
• manufacturing length (where cable sample for testing has been taken from)	500 m
• length of cable sent to KEMA Laboratories	75 m

1.3 List of drawings

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 report:

Drawing no./document no.	Revision
P-MT34-XB-01-PH	-

2 GENERAL INFORMATION

2.1 The tests were witnessed by

Name	Company
Mohammad Said Minkara Waleed Abdel Shafy (9 to 11 August 2016)	Energya Power Cables – ELSEWEDY HELAL, Cairo, Egypt
Samia Zaghlool Ahmed Mamdouh (9 to 11 August 2016)	EETC, Cairo, Egypt
Mustafa Rashwan Ahmed Mohamed Rashad ((9 to 11 August 2016)	Shaker Consultancy Group, Cairo, Egypt

2.2 The tests were carried out by

Name	Company
Edwin Pultrum Hong He	KEMA Nederland B.V., Arnhem, the Netherlands

2.3 Subcontracting

The following tests were subcontracted to DNV GL – New Energy Technologies, Arnhem, the Netherlands:

- measurement of resistivity of semi-conducting screens in accordance with subclause 12.4.9
- non-electrical type tests in accordance with subclause 12.5, with the exception of the water penetration test of subclause 12.5.14.

2.4 Purpose of the tests

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

2.5 Measurement uncertainty

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

3 ELECTRICAL TYPE TESTS ON COMPLETE CABLE SYSTEM

3.1 Test arrangement

3.1.1 Determination of the cable conductor temperature

Standard

Standard IEC 62067, Annex A, subclause A.3.1

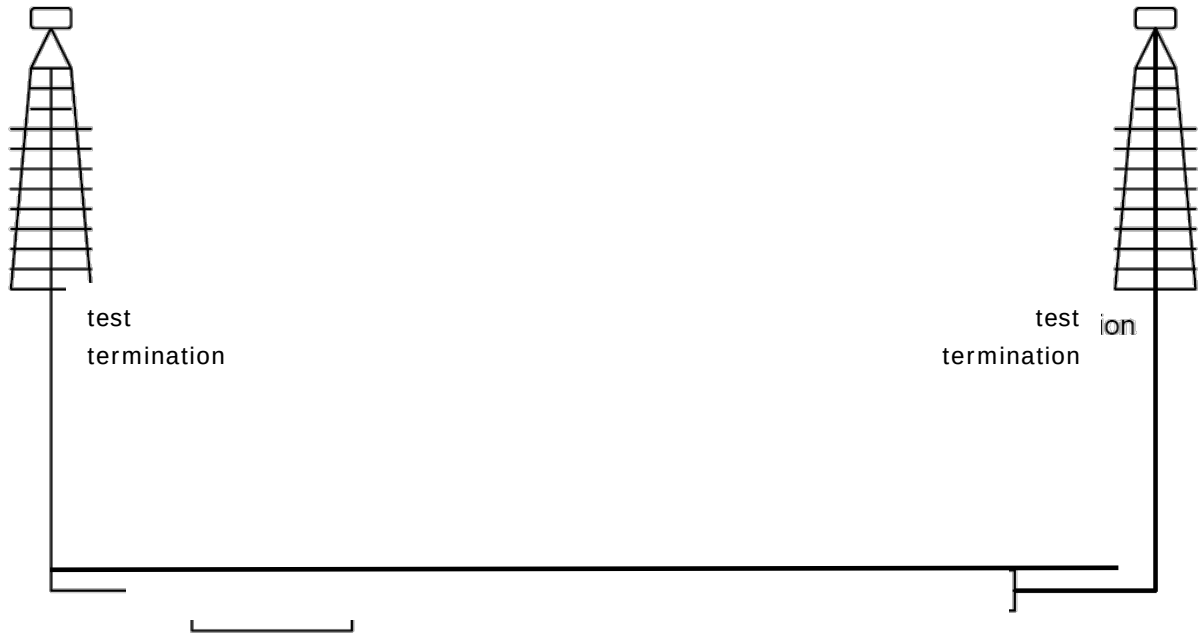
For the tests with the cable system at elevated temperature, a reference loop for temperature control of the conductor was installed and conductor current was used for heating. The reference cable was cut from the total cable length intended for the type test. This reference loop was installed close 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 subclause A.3.1, method 1 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.

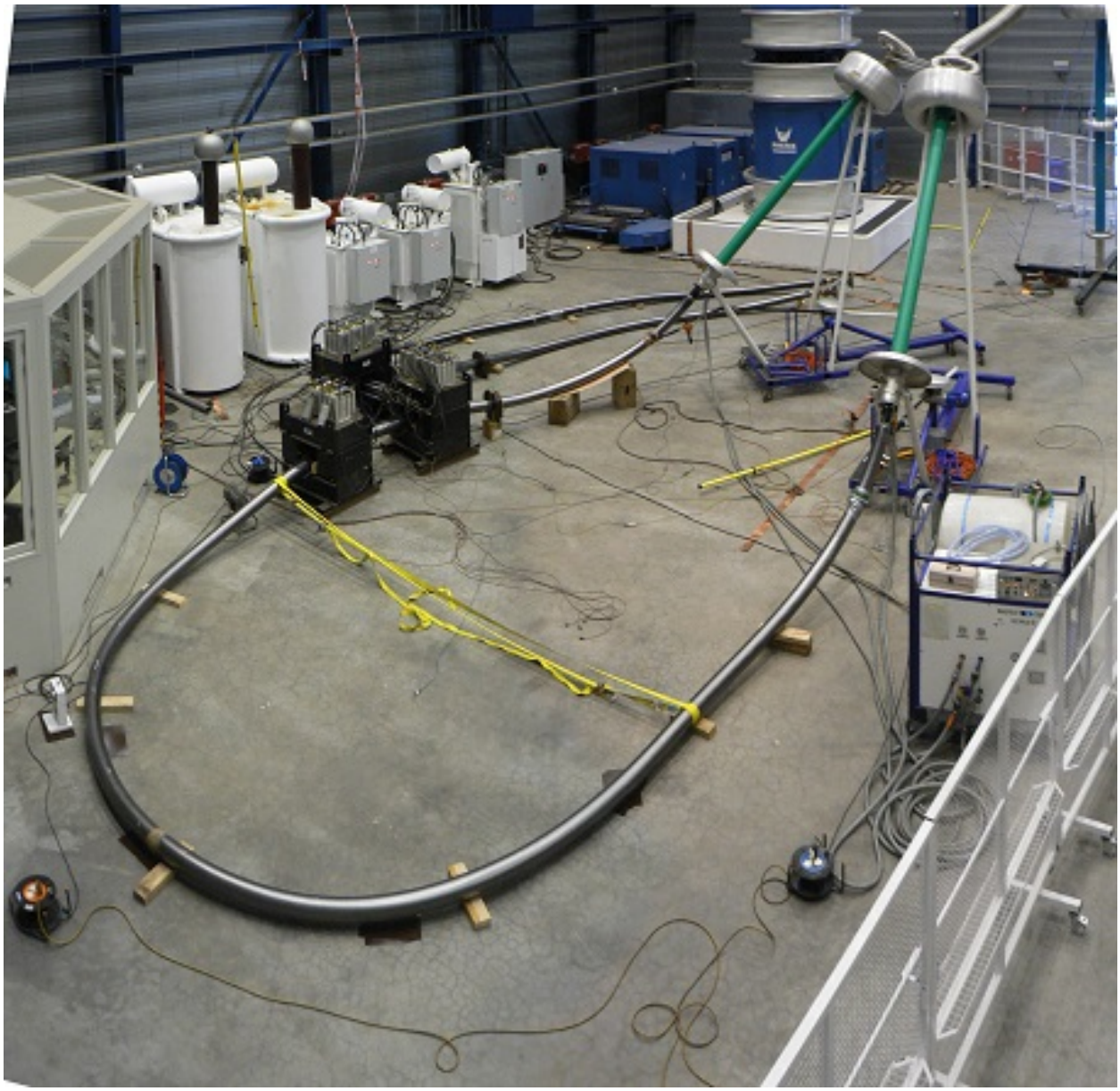
3.1.2 Test set-up

In order to perform the test, the following test loop was prepared by the manufacturer's representatives in the manner specified by the manufacturer's instructions:



One piece of power cable type 133/230 (245) kV XLPE, 1x2500 mm^2 Cu , 21,5 meters long with two test water terminations..

3.1.3 Photograph of test set-up



3.2 Test voltage values

Standard and date

Standard IEC 62067, subclause 12.4.1
Test date 1 July 2016

Characteristic test data

Length of cable sample 0,5 m

Nominal insulation thickness (mm)	Measured average insulation thickness (mm)	Deviation of measured average insulation thickness from nominal insulation thickness (%)
25,0	25,77	3,1

Requirement

If the average thickness of the insulation does not exceed the nominal value by more than 5%, the test voltages shall be the values specified in Table 4 for the rated voltage of the cable.
If the average thickness of the insulation exceeds the nominal value by more than 5% but by not more than 15%, the test voltage shall be adjusted to give an electrical stress at the conductor screen equal to that applying when the average thickness of the insulation is equal to the nominal value, and the test voltages are the normal values specified for the rated voltage of the cable.
The cable length used for the electrical type tests shall not have an average thickness exceeding the nominal value by more than 15%.

Result

The measured average insulation thickness did not exceed the nominal value by more than 5%. The voltage tests can be performed with the values specified before.

3.3 Bending test

Standard and date

Standard IEC 62067, subclause 12.4.3
Test date 1 June 2016

Environmental conditions

Ambient temperature 12 °C

Characteristic test data

Temperature of test object 12 °C
Maximum bending diameter 25(d + D) + 5%
Length of cable bended 40 m

Nominal outer diameter of cable D (mm)	Nominal diameter of cable conductor d (mm)	Maximum required bending diameter D_r (mm)	Diameter of test cylinder D_t (mm)
143,2	61,2	5366	4300

Result

The test was carried out successfully.

3.4 Partial discharge test at ambient temperature

Standard and date

Standard	IEC 62067, subclause 12.4.4
Test date	8 July 2016

Environmental conditions

Ambient temperature	19 °C

Characteristic test data

Temperature of test object	19 °C
Circuit	direct
Calibration	20 pC
Noise level at 1,5 U_0	2,5 pC
Declared sensitivity	5 pC
Required sensitivity	≤ 5 pC
Centre frequency	130 kHz
Bandwidth (Δf)	40 kHz
Test frequency	50 Hz
Coupling capacitor	877 pF

Assembly	Voltage applied, 50 Hz		Duration	Partial discharge level
	… x U_0	(kV)	(s)	(pC)
Cable	1,75	233	10	-
	1,5	199,5	-	Not detectable

Requirement

There shall be no detectable discharge exceeding the declared sensitivity from the test object at 1,5 U_0.

Result

The object passed the test.

3.5 Tan δ measurement

Standard and date

Standard IEC 62067, Subclause 12.4.5
Test date 15 July 2016

Environmental conditions

Ambient temperature 20,5 °C

Characteristic test data

Temperature of test object 97 °C
Length of test object 21,5 m
Standard capacitor 57,38 pF

Assembly	Voltage applied, 50 Hz (kV)	Capacitance of main loop [1] (µF/km)	Tan δ
Cable	133	0,216	≤ 1 x 10^{-4}

[1] for information only

Requirement

The measured value shall not be higher than 10 x 10^{-4} at U_0.

Result

The object passed the test.

3.6 Heating cycle voltage test

Standard and date

Standard IEC 62067, subclause 12.4.6
Test dates 19 July to 9 August 2016

Environmental conditions

Ambient temperature 21-25 °C

Characteristic test data

Heating method conductor current
Stabilized temperature 97 °C
Diameter of U-bend 5300 mm

No. of heating cycles	Required steady conductor temperature	Heating current during steady condition	Heating cycle			Voltage, 50 Hz	
			Heating		Cooling		
			Total duration	Duration of conductor at steady temperature	Total duration	Total duration	Voltage applied 2 U_0
	(°C)	(A)	(h)	(h)	(h)	(h)	(kV)
20	95-100	approx. 3000	8	2	16	480	266

Requirement

No breakdown shall occur.

Result

The object passed the test.

3.7 Partial discharge test at ambient temperature

Standard and date

Standard	IEC 62067, subclause 12.4.4
Test date	10 August 2016

Environmental conditions

Ambient temperature	20 °C

Characteristic test data

Temperature of test object	20 °C
Circuit	direct
Calibration	20 pC
Noise level at 1,5 U_0	3 pC
Declared sensitivity	5 pC
Required sensitivity	≤ 5 pC
Centre frequency	130 kHz
Bandwidth (Δf)	160 kHz
Test frequency	50 Hz
Coupling capacitor	877 pF

Assembly	Voltage applied, 50 Hz		Duration (s)	Partial discharge level (pC)
	... x U_0	(kV)		
Cable	1,75	233	10	-
	1,5	200	-	Not detectable

Note

Clearly identifiable interference pulses were present. In accordance with IEC 60885-3, these pulses were disregarded.

Requirement

There shall be no detectable discharge exceeding the declared sensitivity from the test object at 1,5 U_0.

Result

The object passed the test.

3.8 Lightning impulse voltage test

Standard and date

Standard IEC 62067, subclause 12.4.7.2
Test date 11 August 2016

Environmental conditions

Ambient temperature 21 °C

Characteristic test data

Temperature of test object 97 °C
Specified test voltage 1050 kV

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

Requirement

The assembly shall withstand without failure or flashover 10 positive and 10 negative voltage impulses.

Result

The object passed the test.

Lightning impulse test with positive voltage

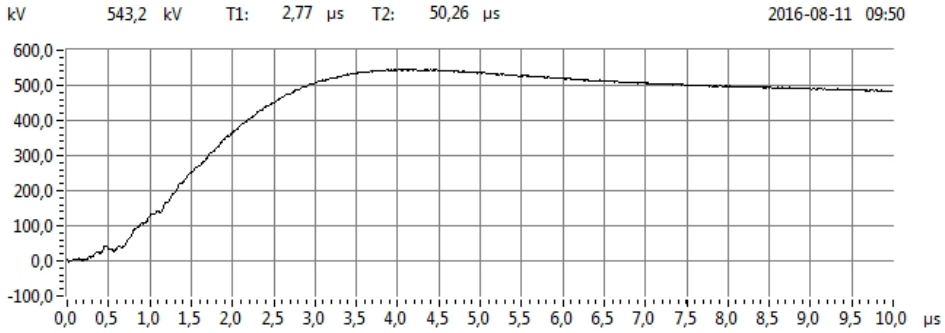


Fig. 1: Waveshape 72125126, +50%

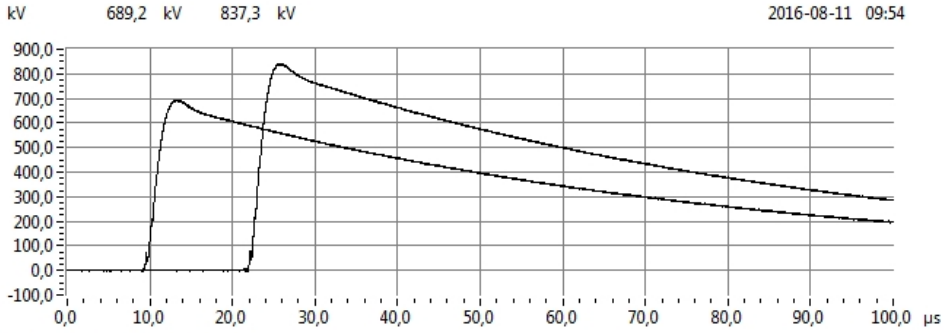


Fig. 2: 72125126, +65% and +80%

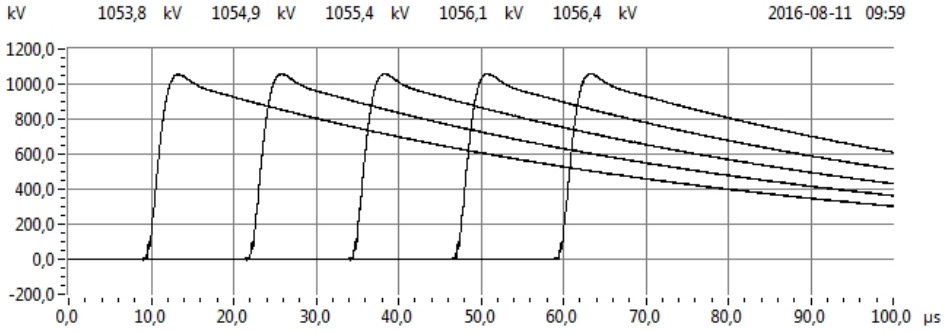


Fig. 3: 72125126, +100%

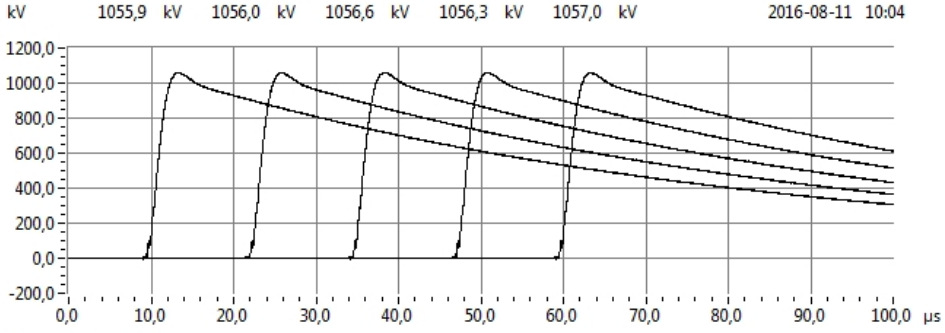


Fig. 4: 72125126, +100%

Lightning impulse test with negative voltage

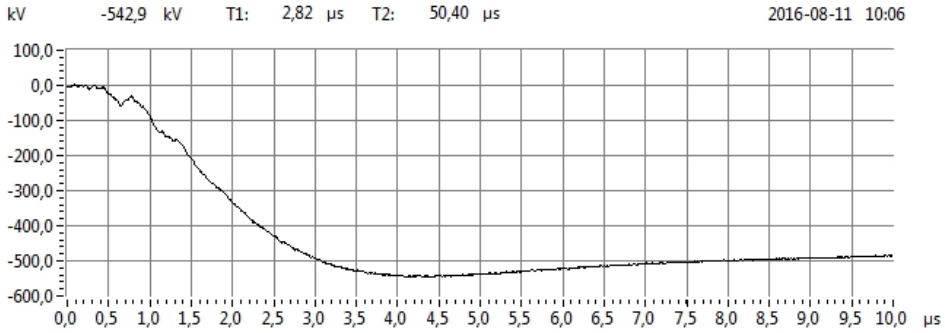


Fig. 5: Waveshape 72125126, -50%

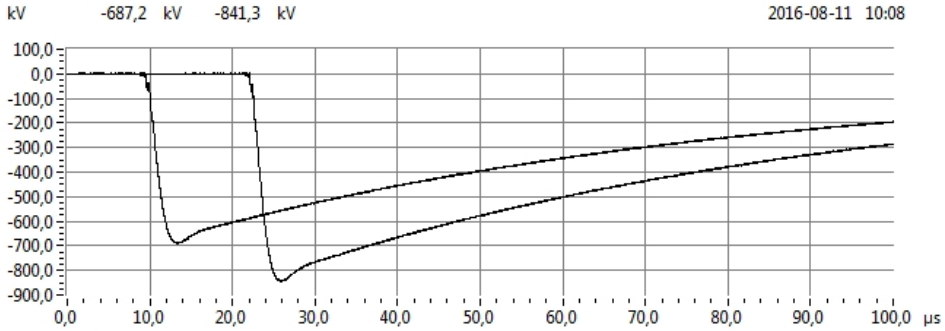


Fig. 6: 72125126, -65% and -80%

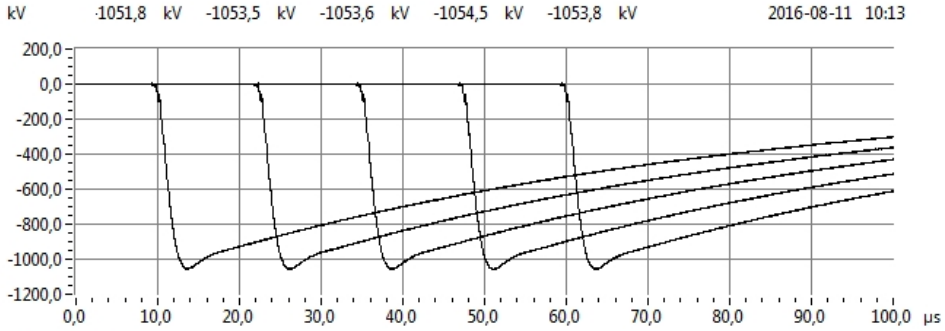


Fig. 7: 72125126, -100%

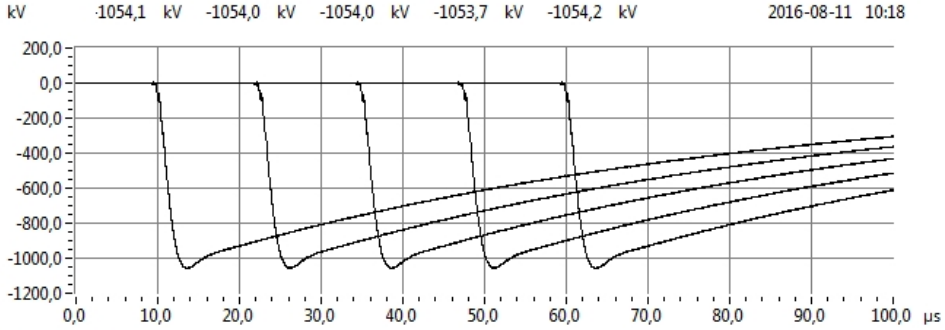


Fig. 8: 72125126, -100%

3.9 Power frequency voltage test

Standard and date

Standard IEC 62067, subclause 12.4.7.2
Test date 11 August 2016

Environmental conditions

Ambient temperature 21 °C

Characteristic test data

Temperature of test object 39 - 40 °C

Testing arrangement		Voltage applied, 50 Hz		Duration
Voltage applied to	Earth connected to	... x U_0	(kV)	(min)
Conductor	Metal screen	2	266	15

Requirement

No breakdown of the insulation shall occur.

Result

The object passed the test.

3.10 Examination

3.10.1 Examination of cable

Standard and date

Standard	IEC 62067, subclause 12.4.8.1
Test date	11 August 2016

Requirement

Examination of the cable shall reveal no signs of deterioration (e.g. electrical degradation, leakage, corrosion or harmful shrinkage) which could affect the system in service operation.

Result

No signs of electrical degradation, leakage, corrosion or harmful shrinkage which could affect the system in service operation were detected.

3.10.2 Photograph

Cable

3.11 Resistivity of semi-conducting screens

Standard and date

Standard IEC 62067, subclause 12.4.9
Test date 16 August 2016

Characteristic test data

Temperature during ageing 100 °C
Duration 7 x 24 h (17 June to 24 June 2016)
Resistivity measured at 90 ± 2 °C

Item	Unit	Requirement	Measured/determined
Conductor screen			
• without ageing	Ωm	≤ 1000	11
• after ageing	Ωm	≤ 1000	45
Insulation screen			
• without ageing	Ωm	≤ 500	2
• after ageing	Ωm	≤ 500	1

Result

The object passed the test.

4 NON-ELECTRICAL TYPE TESTS ON CABLE COMPONENTS AND ON COMPLETE CABLE

4.1 Check of cable construction

Standard and date

Standard IEC 62067, subclause 12.5.1

Test date 1 July 2016

Item	Unit	Requirement	Specified	Measured/determined
Conductor				
Diameter of conductor	mm	-	61,2	62,0
Number of segments	-	-	5	5
Number of wires	-	-	305	305 (5x(24-18-12-6-1))
Resistance at 20 °C	Ω/km	≤ 0,0072	-	0,0071
Swelling tapes	1x non-conductive water-blocking tape and 1x water-blocking yarn over each stranded layer			present
	1x non conductive water-blocking tape between segments			present
	2x semi conductive water-blocking tapes over conductor			present
Semi-conducting conductor screen				
Nominal thickness	mm	-	1,5	-
Average thickness	mm	-	-	2,87
Minimum thickness	mm	-	-	2,29
Outer diameter of conductor screen	mm	-	-	67,7
Insulation				
Nominal thickness	mm	-	25,0	-
Average thickness	mm	-	-	25,78
Minimum thickness [t_{min}]	mm	≥ 22,50	-	25,22
Maximum thickness [t_{max}]	mm	-	-	26,13
($t_{max} - t_{min}$) / t_{max}	-	≤ 0,10	-	0,03
Semi-conducting insulation screen				
Nominal thickness	mm	-	1,5	-
Average thickness	mm	-	-	2,31
Minimum thickness	mm	-	-	2,08
Outer diameter of insulation screen	mm	-	-	124,6
Semi-conducting water blocking layer				
Number of layers	-	-	3	3
Overlap	%	-	30	32

Item	Unit	Requirement	Specified	Measured/determined
Lead alloy sheath				
Nominal thickness	mm	-	4,0	-
Average thickness	mm	-	-	4,60
Minimum thickness	mm	≥ 3,70	-	4,31
Oversheath				
Nominal thickness	mm	-	5,0	-
Average thickness	mm	≥ 5,0	-	5,75
Minimum thickness	mm	≥ 4,15	-	5,20
Outer diameter	mm	-	144,6	146,4
Graphite coating	-	-	yes	yes
Colour of the oversheath	-	-	black	black
Marking on oversheath	ENERGYA POWER CABLES ELSEWEDY HELAL 1x2500mm2 230KV CU/XLPE/LEAD/HDPE 2016			

Result

The object passed the test.

4.2 Tests for determining the mechanical properties of insulation before and after ageing

Standard and date

Standard IEC 62067, subclause 12.5.2
Test date 15 August 2016

Characteristic test data

Temperature during ageing 135 ± 3 °C
Ageing duration 7 x 24 h (23 June to 30 June 2016)

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm^2	≥ 12,5	30,5
Elongation at break	%	≥ 200	561
After ageing in air oven			
Tensile strength			
• value after ageing	N/mm^2	-	33,0
• variation	%	± 25 max.	8
Elongation at break			
• value after ageing	%	-	655
• variation	%	± 25 max.	17

Result

The object passed the test.

4.3 Tests for determining the mechanical properties of oversheaths before and after ageing

Standard and date

Standard IEC 62067, subclause 12.5.3
Test date 15 August 2016

Characteristic test data

Temperature during ageing 110 ± 2 °C
Ageing duration 10 x 24 h (24 June to 4 July 2016)

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm^2	≥ 12,5	31,2
Elongation at break	%	≥ 300	757
After ageing in air oven			
Tensile strength			
• value after ageing	N/mm^2	-	27,1
• variation	%	-	-13
Elongation at break			
• value after ageing	%	≥ 300	776
• variation	%	-	3

Result

The object passed the test.

4.4 Ageing tests on pieces of complete cable to check compatibility of materials

Standard and date

Standard IEC 62067, subclause 12.5.4
Test date 28 June 2016

Characteristic test data

Temperature during ageing 100 ± 2 °C
Ageing duration 7 x 24 h (17 June to 24 June 2016)

Insulation

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm^2	≥ 12,5	30,5
Elongation at break	%	≥ 200	561
After ageing in air oven			
Tensile strength			
• value after ageing	N/mm^2	-	27,2
• variation	%	± 25 max.	-11
Elongation at break			
• value after ageing	%	-	591
• variation	%	± 25 max.	5

Oversheath

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm^2	≥ 12,5	31,2
Elongation at break	%	≥ 300	757
After ageing in air oven			
Tensile strength			
• value after ageing	N/mm^2	-	33,4
• variation	%	-	7
Elongation at break			
• value after ageing	%	≥ 300	841
• variation	%	-	11

Result

The object passed the test.

4.5 Pressure test at high temperature on oversheath

Standard and date

Standard IEC 62067, subclause 12.5.6
Test date 1 July 2016

Characteristic test data

Temperature 110 ± 2 °C
Heating time 6 hours

Item	Unit	Requirement	Measured/determined
Depth of indentation	%	≤ 50	2

Result

The object passed the test.

4.6 Hot set test for XLPE insulation

Standard and date

Standard IEC 62067, subclause 12.5.10
Test date 22 June 2016

Characteristic test data

Air temperature 200 ± 3 °C
Time under load 15 min
Mechanical stress 20 N/cm^2

Item	Unit	Requirement	Measured/determined
Elongation under load	%	≤ 175	50
Permanent elongation after cooling	%	≤ 15	-5

Result

The object passed the test.

4.7 Measurement of carbon black content of black PE oversheaths

Standard and date

Standard IEC 62067, subclause 12.5.12

Test date 21 July 2016

Item	Unit	Requirement	Measured/determined
Carbon black content	%	2,5 ± 0,5	2,3

Result

The object passed the test.

4.8 Water penetration test

Standard and date

Standard IEC 62067, subclause 12.5.14
Test dates 28 July to 9 August 2016

Environmental conditions

Ambient temperature 20 °C

Characteristic test data

Length of cable sample 8 m
Water height 1 m above cable centre
Heating method conductor current

No. of heating cycles	Required steady conductor temperature (°C)	Heating current during steady condition (A)	Heating cycle		
			Heating		Cooling
			Total duration (h)	Duration of conductor at steady temperature (h)	Total duration (h)
10	95 - 100	approx. 3000	8	2	16

Item	Unit	Requirement	Measured/determined
Water penetration under lead sheath side 1	cm	≤ 400	4
Water penetration under lead sheath side 2	cm	≤ 400	4
Water penetration in conductor side 1	cm	≤ 400	15
Water penetration in conductor side 2	cm	≤ 400	28

Note

The manufacturer has claimed that barriers have been included, which prevents longitudinal water penetration in the region of the metallic layers and along the conductor.

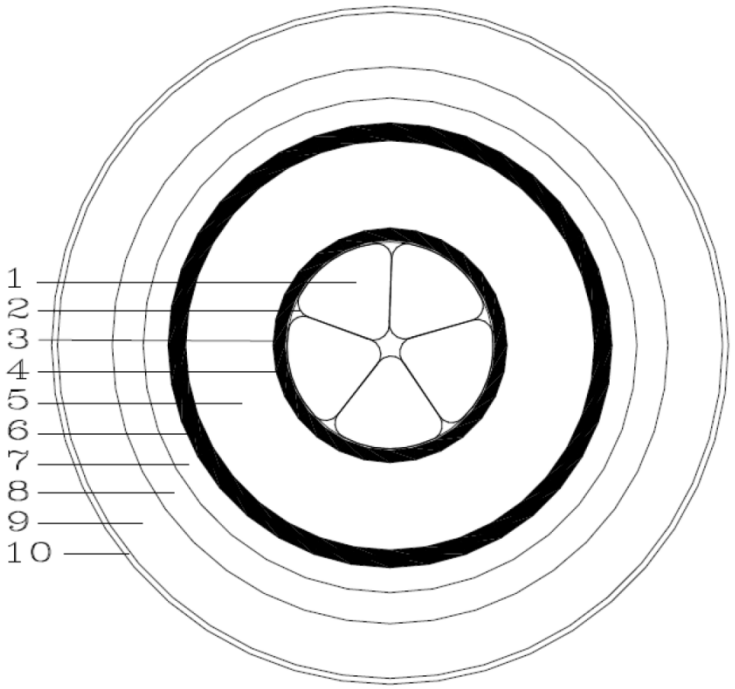
Result

The object passed the test.

5 DRAWINGS

Cable code : P-MT34-XB-01-PH **Date : December 5, 2015**

TECHNICAL DRAWING



ENERGYA CABLES (HELAL ELSEWEDY)					
1	Conductor Diameter	**61.2**	6	Insulation Screen Thickness	**1.5**
2	N.C.W.B Tape	**Yes**	7	S.C.W.B Tape Thickness	**Nom. 2.0 (overall thickness)**
3	S.C.W.B Tape Thickness	**Min. 0.18**	8	Lead Sheath Thickness	**4.0**
4	Conductor Screen Thickness	**1.5**	9	HDPE Sheath Thickness	**5.0**
5	Insulation Thickness	**25.0**	10	Graphite Powder	**Yes**
Type		**CU / XLPE / LEAD / HDPE**			
Size		**1 x 2500**			mm^2
Voltage		**230**			kV
Standard		**EETC**			

All dimensions are in mm

Mohammed Said Minkara

Energya Group Engineering Director

6 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%