KEMA Labs

KEMA TYPE TEST CERTIFICATE OF COMPLETE TYPE TESTS

Object	Three-core power cable	**1145-20**
Type	19/33(36) kV 3x185 mm^2 Cu/XLPE/SWA/PVC CABLE	

Rated voltage, U_0/U (U_m)	19/33(36) kV	Conductor material	Cu
Conductor cross-section	3x185 mm^2	Insulation material	XLPE

Manufacturer	Energya Power Cable – Elsewedy Helal Industrial Zone A, 10th of Ramadan City, Egypt$^{*)}$
Client	Energya Power Cable – Elsewedy Helal Industrial Zone A, 10th of Ramadan City, Egypt$^{*)}$
Tested by	KEMA B.V., Klingelbeekseweg 195, Arnhem, The Netherlands
Date of tests	5 March to 13 May 2020

The test 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

IEC 60502-2014

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 Standards 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 41 pages in total.

KEMA B.V.

Bas Verhoeven
Director, High-Voltage Laboratory

Arnhem, 2 June 2020

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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 KEMA Labs. 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. KEMA Labs 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 KEMA Labs' Certification procedure applicable to KEMA Labs.

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 KEMA Labs 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.

5 Accreditation of KEMA Laboratories

The KEMA Labs are accredited in accordance with ISO/IEC 17025 by the respective national accreditation bodies. KEMA Labs Arnhem, The Netherlands, is accredited by RvA under nos. L020, L218, K006 and K009. KEMA Labs Chalfont, United States, is accredited by A2LA under no. 0553.01. KEMA Labs Prague, the Czech Republic, is accredited by CAI as testing laboratory no. 1035.

REVISION OVERVIEW

Rev. No	Date of issue	Reason for issue
0	2 June 2020	First issue

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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)	19/33 (36) kV
Rated maximum conductor temperature in normal operation	90 °C
Rated conductor cross-section	3x185 mm^2

1.2 Description of the object tested

Standard	IEC 60502-2, Clauses 5 to 14
Manufacturer	Energya Power Cables – Elsewedy Helal Industrial Zone A, 10th of Ramadan City, Egypt
Type	19/33 kV 3x185 mm^2 Cu/XLPE/SWA/PVC Cable
Manufacturing year	2019
Quantity submitted	95 m
Rated voltage, U_0/U (U_m)	19/33 (36) kV
Nominal capacitance between conductor and metal screen	0,19 µF/km
No. of cores	3
Core identification	core 1 = brown core 2 = gray core 3 = black
Overall diameter	104,6 mm
Marking on the oversheath	ENERGYA POWER CABLES-ELSEWEDY HELAL ELECTRIC CABLE Cu/XLPE/SWA/PVC 33000 V 3 X 185 MM2 2019 Meter marking Line 2 ELECTRIC CABLE 33000 V
Construction	see List of drawings

Conductor

• material	copper
• cross-section	185 mm^2
• nominal diameter	15,8 mm
• type	compacted stranded
• maximum conductor temperature in normal operation	90°C
• presence and nature of measures to achieve longitudinal watertightness	no

Conductor screen

• material	semi-conducting PE
• nominal thickness	0,5 mm
• material designation	known in KEMA Labs' files
• manufacturer of the material	known in KEMA Labs' files

Insulation

- material XLPE
- nominal thickness 8,0 mm
- nominal inner diameter of the insulation 16,8 mm
- nominal outer diameter of the insulation 32,8 mm
- material designation known in KEMA Labs' files
- manufacturer of the material known in KEMA Labs' files

Insulation (core) screen

- material semi-conduction PE
- strippable no
- nominal thickness 0,5 mm
- material designation known in KEMA Labs' files
- manufacturer of the material known in KEMA Labs' files

Metal screen

- material copper tape
- number of wires/tapes one tape
- thickness and width of binder tapes 0,075 x 40 mm (overlap 10%)
- cross-sectional area 5 mm^2

Inner coverings and fillers

- material polypropylene filler

Separation sheath

- material PVC
- nominal thickness 1,48 mm (minimum)
- manufacturer of the material known in KEMA Labs' files

Metal armour

- material galvanized steel wires
- number of wires 83
- nominal diameter of wires 3,15 ± 5% mm
- manufacturer of the material known in KEMA Labs' files

Oversheath

- material PVC, ST_2
- nominal thickness 3,3 mm (minimum)
- nominal overall diameter of the cable (D) 104,6 mm
- material designation known in KEMA Labs' files
- manufacturer of the material known in KEMA Labs' files
- colour black
- graphite coating applied no

Fire retardant (according to IEC 60332-1) yes

Manufacturing details insulation system

• location of manufacturing	Industrial Zone A, 10th of Ramadan City, EGYPT
• type of extrusion line	CCV
• type of extrusion	triple common extrusion
• factory identification of extrusion line	CCV1
• manufacturer of the extrusion line	known in KEMA Labs' files
• identification of production batch	247/19
• curing means	dry
• cooling means	water
• manufacturing length (where cable sample for testing has been taken from)	300 m
• length markings on cable sample sent to KEMA Labs	begin: 069 m, end: 164 m

1.1 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 Labs 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
CT19X503W1	1

2 GENERAL INFORMATION

2.1 The tests were witnessed by

The tests were carried out without a representative of the client present.

2.2 The tests were carried out under responsibility of

Name	Company
A. Kumar	KEMA B.V.,
H. van Zuilen	Arnhem, The Netherlands
S. van der Weiden	

2.3 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.

3 ELECTRICAL TYPE TESTS

3.1 Test arrangement

3.1.1 Determination of the cable conductor temperature

Standard
Standard IEC 60502-4, subclause 15.4

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.

This reference loop was connected in series with the test loop, thus the conductor temperature of the reference loop is representative for the conductor temperature of the test loop. Annex G was used as a guide and Annex G, subclause G.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 Photograph of test set-up

3.2 Bending test

Standard and date

Standard IEC 60502-2, subclause 18.2.4
Test date 5 March 2020

Environmental conditions

Ambient temperature 8 °C

Characteristic test data

Temperature of test object 8 °C
Maximum bending diameter 15(d + D) + 5%
Length of cable bended 19 m

Actual external diameter of cable D mm	Actual diameter of cable conductor d mm	Maximum bending diameter D_r mm	Diameter of test cylinder D_t mm
106,5	15,8	≤ 1926	1370

Result

The test was carried out successfully.

3.3 Partial discharge test

Standard and date

Standard	IEC 60502-2, subclause 18.2.5
Test date	16 March 2020

Environmental conditions

Ambient temperature	20 °C

Characteristic test data

Temperature of test object	20 °C
Circuit	direct
Calibration	10 pC
Noise level at 1,73 U_0	2 pC
Declared sensitivity	4 pC
Required sensitivity	≤ 5 pC
Centre frequency	2,1 MHz
Bandwidth (Δf)	650 kHz
Test frequency	50 Hz
Coupling capacitor	2,6 nF

Core	Voltage applied, 50 Hz		Duration	Partial discharge level
	... x U_0	kV	s	pC
1	2,0	38	10	-
	1,73	33	-	Not detectable
2	2,0	38	10	-
	1,73	33	-	Not detectable
3	2,0	38	10	-
	1,73	33	-	Not detectable

Requirement

There shall be no detectable discharge exceeding the declared sensitivity from the test object at 1,73 U_0.

Result

The object passed the test.

3.4 Tan δ measurement

Standard and date

Standard IEC 60502-2, subclause 18.2.6
Test date 18 March 2020

Environmental conditions

Ambient temperature 20 °C

Characteristic test data

Temperature of test object 97 °C
Length of test object 16,8 m
Standard capacitor 99,918 pF

Core	Voltage applied, 50 Hz	Capacitance of core [1] µF/km	Tan δ
1+2+3	5	0,18	$5,5 \times 10^{-4}$
[1] for information only			

Requirement

The measured value shall not be higher than 40×10^{-4} U_o at ≥ 2 kV.

Result

The object passed the test.

3.5 Heating cycle test

Standard and date

Standard IEC 60502-2, subclause 18.2.7
Test date 20 March to 2 April 2020

Environmental conditions

Ambient temperature 20 °C

Characteristic test data

Heating method conductor current

No. of heating cycles	Steady conductor temperature	Heating current during steady condition	Heating cycle		
			Heating		Cooling
			Total duration	Duration of conductor at steady temperature	Total duration
	°C	A	h	h	h
20	97	approx. 500	5	2	6

Requirement

The test shall be carried out succesfully.

Result

The object passed the test.

3.6 Partial discharge test

Standard and date

Standard	IEC 60502-2, subclause 18.2.5
Test date	2 April 2020

Environmental conditions

Ambient temperature	20 °C

Characteristic test data

Temperature of test object	28 °C
Circuit	direct
Calibration	10 pC
Noise level at 1,73 U_0	3 pC
Declared sensitivity	5 pC
Required sensitivity	≤ 5 pC
Centre frequency	175 kHz
Bandwidth (Δf)	160 kHz
Test frequency	50 Hz
Coupling capacitor	2,6 nF

Core	Voltage applied, 50 Hz		Duration	Partial discharge level
	... x U_0	kV	s	pC
1	2,0	38	10	-
	1,73	33	-	Not detectable
2	2,0	38	10	-
	1,73	33	-	Not detectable
3	2,0	38	10	-
	1,73	33	-	Not detectable

Requirement

There shall be no detectable discharge exceeding the declared sensitivity from the test object at 1,73 U_0.

Result

The object passed the test.

3.7 Impulse test

Standard and date

Standard IEC 60502-2, subclause 18.2.8
Test date 3 April 2020

Environmental conditions

Ambient temperature 20 °C

Characteristic test data

Temperature of test object 98 °C
Specified test voltage 194 kV

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

Note
In accordance with IEC 60502-2 the specified test voltage is 170 kV. On request of the client, the test was performed at 194 kV.

Requirement

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

Result

The object passed the test.

Lightning impulse test with positive voltage

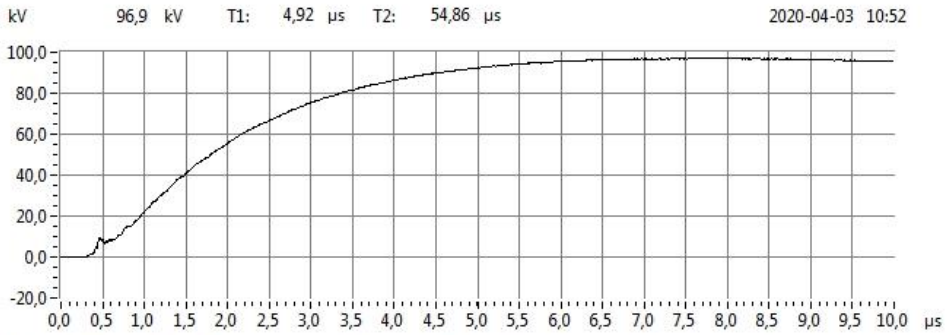


Fig. 1: Waveshape 72220709 Energya Cable 3X185 mm2 RFW 50% (+)

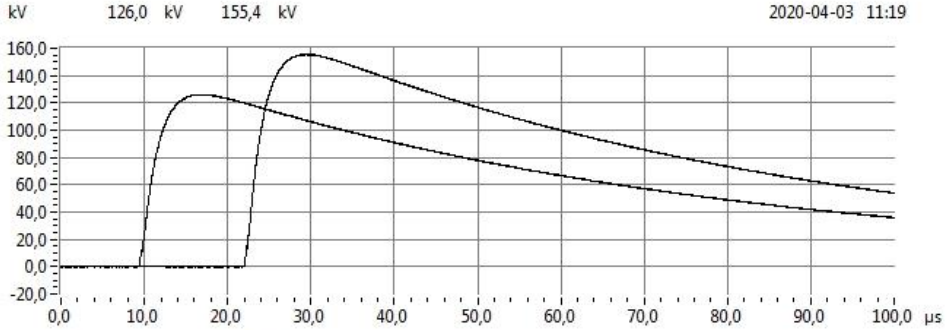


Fig. 2: 72220709 Energya Cable 3X185 mm2 RFW 65% and 80% (+)

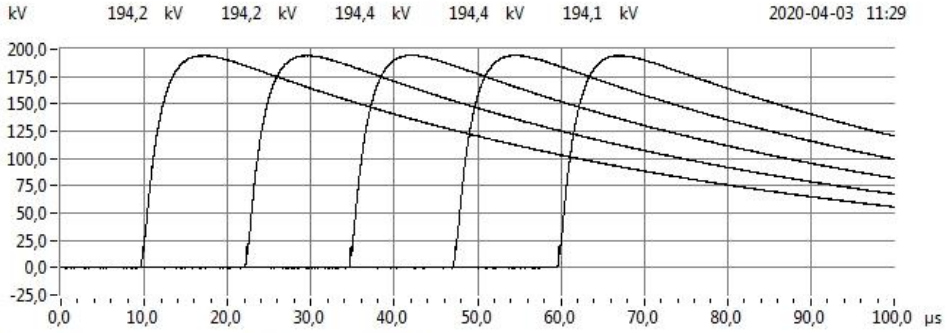


Fig. 3: 72220709 Energya Cable 3X185 mm2 FW 100% (+)

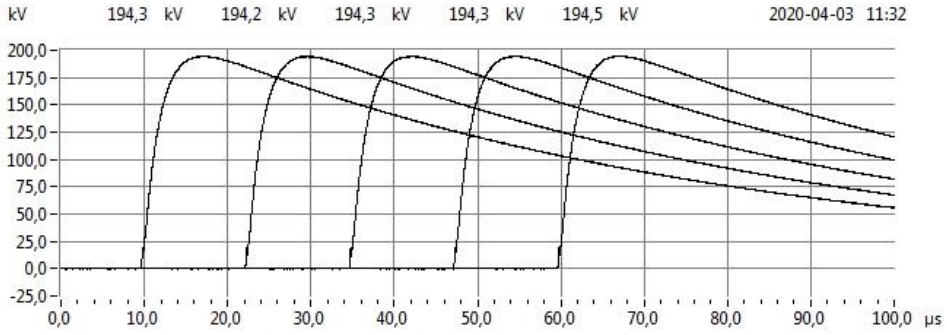


Fig. 4: 72220709 Energya Cable 3X185 mm2 FW 100% (+)

Lightning impulse test with negative voltage

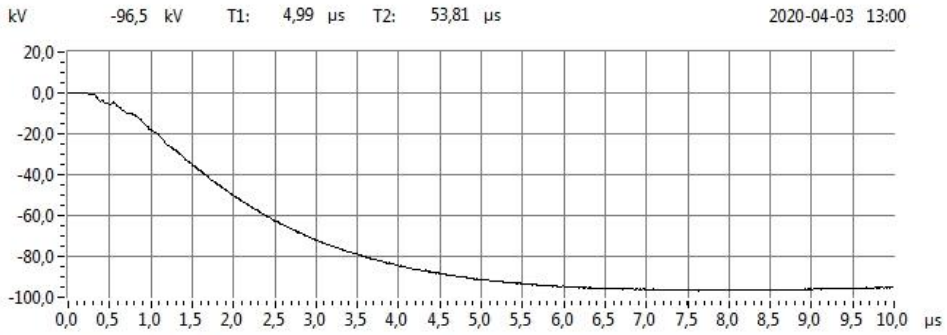


Fig. 5: Waveshape 72220709 Energya Cable 3X185 mm2 RFW 50% (-)

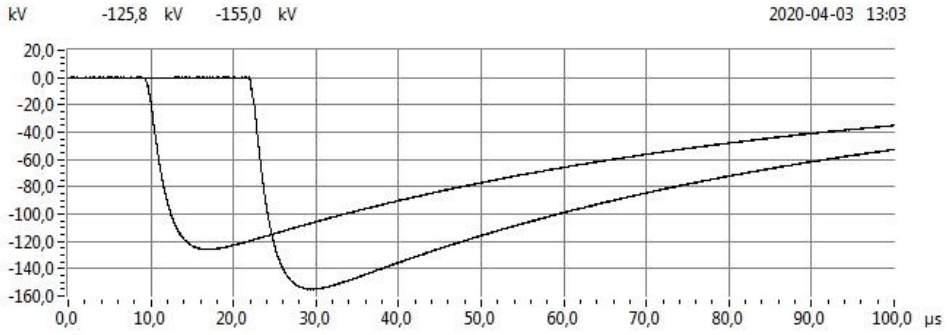


Fig. 6: 72220709 Energya Cable 3X185 mm2 RFW 65% and 80% (-)

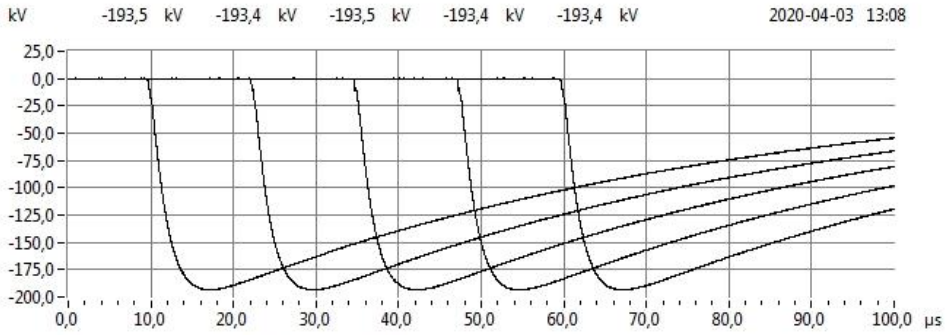


Fig. 7: 72220709 Energya Cable 3X185 mm2 FW 100% (-)

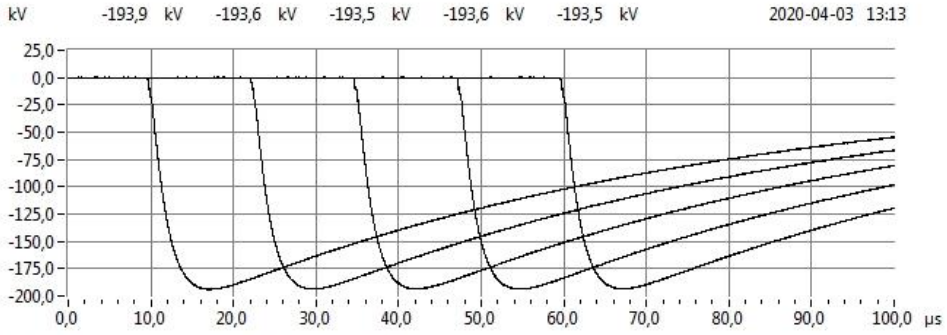


Fig. 8: 72220709 Energya Cable 3X185 mm2 FW 100% (-)

3.8 Voltage test for 15 min

Standard and date

Standard IEC 60502-2, subclause 18.2.8
Test date 4 April 2020

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 U0	kV	min
Conductors	Metal screens	3,5	66,5	15

Requirement

No breakdown of the insulation shall occur.

Result

The object passed the test.

3.9 Voltage test for 4 h

Standard and date

Standard IEC 60502-2, subclause 18.2.9
Test date 4 April 2020

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	h
Conductors	Metal screens	4	76	4

Requirement

No breakdown of the insulation shall occur.

Result

The object passed the test.

3.10 Resistivity of semi-conducting screens

Standard and date

Standard IEC 60502-2, subclause 18.2.10
Test date 20 April and 01 May 2020

Characteristic test data

Temperature during ageing 100 °C
Ageing duration 7 x 24 h (19 to 26 March 2020)
Resistivity measured at 90 ± 2 °C

Item	Unit	Requirement	Measured/determined		
			Core 1	Core 2	Core 3
Conductor screen					
without ageing	Ωm	≤ 1000	172	121	232
after ageing	Ωm	≤ 1000	210	131	182
Insulation screen					
without ageing	Ωm	≤ 500	6	4	5
after ageing	Ωm	≤ 500	2	2	2

Result

The object passed the test.

4 NON-ELECTRICAL TYPE TESTS

4.1 Measurement of thickness of insulation

Standard and date

Standard IEC 60502-2, subclause 19.2
Test date 7 April 2020

Item	Unit	Requirement	Specified	Measured/determined		
				Core 1	Core 2	Core 3
Nominal	mm	8,0	8,0	-	-	-
Average	mm	-		9,23	9,21	9,33
Minimum [t_{min}]	mm	≥ 7,10	-	9,05	9,06	9,19
Maximum [t_{max}]	mm	-	-	9,48	9,39	9,53
($t_{max} - t_{min}$) / t_{max}	-	≤ 0,15	-	0,05	0,03	0,04

Result

The object passed the test.

4.2 Measurement of thickness of non-metal sheaths (including extruded separation sheaths, but excluding inner coverings)

Standard and date

Standard IEC 60502-2, subclause 19.3
Test date 7 April 2020

Separation sheath

Item	Unit	Requirement	Specified	Measured/determined
Nominal	mm	≥ 1,2	2,1	-
Average	mm	-	-	3,91
Minimum	mm	≥ 1,48	-	3,18

Oversheath

Item	Unit	Requirement	Specified	Measured/determined
Nominal	mm	≥ 1,8	4,4	-
Average	mm	-	-	4,90
Minimum	mm	≥ 3,30	-	3,98

Note

The nominal thickness of the separation sheath and oversheath is calculated according to subclause 13.3.3 and Annex A.

Result

The object passed the test.

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

Standard and date

Standard IEC 60502-2, subclause 19.5
Test date 30 March and 1 April 2020

Characteristic test data

Temperature during ageing 135 ± 3 °C
Ageing duration 7 x 24 h (27 March to 3 April 2020)

Item	Unit	Requirement	Measured/determined		
			Core 1	Core 2	Core 3
Without ageing					
Tensile strength	N/mm²	≥ 12,5	25,3	25,4	27,1
Elongation at break	%	≥ 200	546	574	571
After ageing in air oven					
Tensile strength					
• value after ageing	N/mm²	-	31,3	29,9	30,0
• variation	%	± 25 max.	24	18	11
Elongation at break					
• value after ageing	%	-	592	584	576
• variation	%	± 25 max.	8	2	1

Result

The object passed the test.

4.4 Tests for determining the mechanical properties of non-metal sheaths before and after ageing

Standard and date

Standard IEC 60502-2, subclause 19.6
Test date 30 March 2020

Characteristic test data

Temperature during ageing 100 ± 2 °C
Ageing duration 7 x 24 h (27 March to 3 April 2020)

Separation sheath

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm^2	≥ 12,5	17,8
Elongation at break	%	≥ 150	263
After ageing in air oven			
Tensile strength			
• value after ageing	N/mm^2	≥ 12,5	17,9
• variation	%	± 25 max.	1
Elongation at break			
• value after ageing	%	≥ 150	262
• variation	%	± 25 max.	-1

Characteristic test data

Temperature during ageing 100 ± 2 °C
Ageing duration 7 x 24 h (27 March to 3 April 2020)

Oversheath

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm^2	≥ 12,5	18,6
Elongation at break	%	≥ 150	253
After ageing in air oven			
Tensile strength			
• value after ageing	N/mm^2	≥ 12,5	18,7
• variation	%	± 25 max.	1
Elongation at break			
• value after ageing	%	≥ 150	231
• variation	%	± 25 max.	-9

Result

The object passed the test.

4.5 Additional ageing test on pieces of completed cable

Standard and date

Standard IEC 60502-2, subclause 19.7
Test date 30 March 2020

Characteristic test data

Temperature during ageing 100 ± 2 °C
Ageing duration 7 x 24 h (19 March to 26 March 2020)

Insulation

Item	Unit	Requirement	Measured/determined		
			Core 1	Core 2	Core 3
Without ageing					
Tensile strength	N/mm^2	≥ 12,5	25,3	25,4	27,1
Elongation at break	%	≥ 200	546	574	571
After ageing in air oven					
Tensile strength					
• value after ageing	N/mm^2	-	31,5	28,7	29,8
• variation	%	± 25 max.	25	13	10
Elongation at break					
• value after ageing	%	-	613	606	573
• variation	%	± 25 max.	12	6	0

Separation sheath

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm^2	≥ 12,5	17,8
Elongation at break	%	≥150	263
After ageing in air oven			
Tensile strength			
• value after ageing	N/mm^2	≥ 12,5	17,9
• variation	%	± 25 max.	1
Elongation at break			
• value after ageing	%	≥150	262
• variation	%	± 25 max.	-1

Oversheath

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm^2	≥ 12,5	18,6
Elongation at break	%	≥ 150	253
After ageing in air oven			
Tensile strength			
• value after ageing	N/mm^2	≥ 12,5	18,2
• variation	%	± 25 max.	-2
Elongation at break			
• value after ageing	%	≥ 150	297
• variation	%	25 max.	17

Result

The object passed the test.

4.6 Loss of mass test on PVC sheaths of type ST_2

Standard and date

Standard IEC 60502-2, subclause 19.8
Test date 24 March to 1 April 2020

Characteristic test data

Temperature treatment 100 ± 2 °C
Duration 7 x 24 h

Separation sheath

Item	Unit	Requirement	Measured/determined
Loss of mass	mg/cm^2	≤ 1,5	0,17

Oversheath

Item	Unit	Requirement	Measured/determined
Loss of mass	mg/cm^2	≤ 1,5	0,15

Result

The object passed the test.

4.7 Pressure test at high temperature on insulation and non-metal sheaths

Standard and date

Standard	IEC 60502-2, subclause 19.9
Test date	10 April 2020

Characteristic test data

Temperature	90 ± 2 °C
Heating time	6 h
Mandrel diameter	83 mm
Load	18 N

Separation sheath

Item	Unit	Requirement	Measured/determined
Depth of indentation	%	≤ 50	19

Characteristic test data

Temperature	90 ± 2 °C
Heating time	6 h
Mandrel diameter	110 mm
Load	23 N

Oversheath

Item	Unit	Requirement	Measured/determined
Depth of indentation	%	≤ 50	20

Result

The object passed the test.

4.8 Test on PVC insulation and sheaths at low temperature

Standard and date

Standard IEC 60502-2, subclause 19.10
Test date 30 April 2020

Characteristic test data

Temperature -15 ± 2 °C
Cooling time ≥ 16 h
Mass of hammer 1500 g

Separation sheath

Item	Unit	Requirement	Measured/determined
Cold elongation test	%	≥ 20	114
Cold impact test	-	No cracks	No cracks

Characteristic test data

Temperature -15 ± 2 °C
Cooling time ≥ 16 h
Mass of hammer 1500 g

Oversheath

Item	Unit	Requirement	Measured/determined
Cold elongation test	%	≥ 20	120
Cold impact test	-	No cracks	No cracks

Result

The object passed the test.

4.9 Test for resistance of PVC insulation and sheaths to cracking (heat shock test)

Standard and date

Standard IEC 60502-2, subclause 19.11
Test date 16 April 2020

Characteristic test data

Temperature 150 ± 3 °C
Duration 1 h
Diameter of mandrel 8 mm
Number of turns 4

Inner sheath/Separation sheath

Item	Unit	Requirement	Measured/determined
Visual examination	-	No cracks	No cracks

Characteristic test data

Temperature 150 ± 3 °C
Duration 1 h
Diameter of mandrel 10 mm
Number of turns 2

Oversheath

Item	Unit	Requirement	Measured/determined
Visual examination	-	No cracks	No cracks

Result

The object passed the test.

4.10 Hot set test for XLPE insulation and elastomeric sheaths

Standard and date

Standard IEC 60502-2, subclause 19.13
Test date 26 March 2020

Characteristic test data

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

Insulation

Item	Unit	Requirement	Measured/determined		
			Core 1	Core 2	Core 3
Elongation under load	%	≤ 175	47	46	45
Permanent elongation after cooling	%	≤ 15	-2	-1	-3

Result

The object passed the test.

4.11 Water absorption test on insulation

Standard and date

Standard IEC 60502-2, subclause 19.15
Test date 24 March to 13 April 2020

Characteristic test data

Temperature of water 85 ± 2 °C
Duration 14 x 24 h
Test method Gravimetric

Insulation

Item	Unit	Requirement	Measured/determined		
			Core 1	Core 2	Core 3
Increase of mass	mg/cm^2	≤ 1,00	< 0,01	0,02	0,04

Result

The object passed the test.

4.12 Flame spread on single cables

Standard and date

Standard IEC 60502-2, subclause 19.16
Test date 21 April 2020

Characteristic test data

Overall diameter of test piece 107,3 mm
Time for flame application 480 s
Flame type 1 kW pre-mixed flame

Complete cable	Unit	Requirement	Measured/determined
The distance between the lower edge of the top support and the onset of charring	mm	≥ 50	395
The distance between the lower edge of the top support and charring extends downwards to a point	mm	≤ 540	510

Result

The object passed the test.

4.13 Shrinkage test for XLPE insulation

Standard and date

Standard IEC 60502-2, subclause 19.18
Test date 17 April 2020

Characteristic test data

Distance L between marks 200 mm
Temperature 130 ± 3 °C
Duration 1 h

Item	Unit	Requirement	Measured/determined		
			Core 1	Core 2	Core 3
Shrinkage	%	≤ 4	1,7	1,7	1,5

Result

The object passed the test.

5 CHECK OF CABLE CONSTRUCTION

Standard and date

Standard IEC 60502-2, subclauses 5 to 14
Test date 8 April 2020

Item	Unit	Requirement	Specified	Measured/determined		
				Core 1	Core 2	Core 3
Conductor						
Diameter of conductor (d)	mm	15,4 ≤ d ≤ 18,0 [1)]	15,8 ± 0,4	15,75	15,75	15,75
Number of wires	-	≥ 30	-	37	37	37
Diameter of wires (after compaction)	mm	-	-	2,45	2,45	2,45
Resistance at 20 °C	Ω/km	≤ 0,0991	-	0,0980	0,0983	0,0981
Water blocking yarns between conductor layers		-	no	no	no	no
Conductor screen						
Diameter over conductor screen	mm	-	-	18,11	18,22	18,06
Thickness	mm	-	0,5	1,09	1,16	1,07
Insulation						
Diameter over insulation	mm	-	-	36,63	36,72	36,82
Thickness	mm	>7,10	8,0	9,23	9,21	9,33
Insulation screen						
Diameter over insulation screen	mm	-	-	38,83	38,94	39,02
Thickness	mm	-	0,5	1,05	1,07	1,06
Metal screen						
Thickness x width of tape	mm	-	0,075 x 40	0,095 x 39,90	0,095 x 39,90	0,095 x 39,90

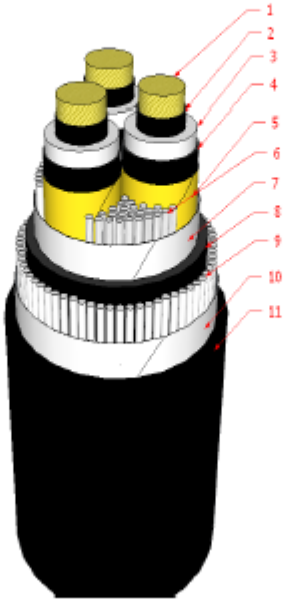
Item	Unit	Requirement	Specified	Measured/determined
Fillers				
Filler material			present	present
Binder tape	mm	-	-	57,7 x 0,1 (approx.)
Separation sheath				
Diameter over covering	mm	-	-	90,6
Thickness	mm	≥ 1,2	2,1	3,91
Steel armour wires				
Number of wires	-		83	85
Thickness of wires	mm	-	3,15 ± 5%	3,11
Steel tape				
Number of tapes	-	-	1	1
Thickness of tape	mm	-	-	0,318
Width of tapes	mm		-	30,13
Gap	mm		-	110 (approx.)
Binder tape	mm	-		
Tapes			-	2
Width en thickness	mm		-	59,1 x 0,1 (approx.)
Oversheath				
Diameter over oversheath	mm	-	104,6	107,34
Thickness	mm	-	4,4	4,90
Colour	-	-	Black	Black
Marking on the cable	Line 1: ENERGYA POWER CABLES-ELSEWEDY HELAL ELECTRIC CABLE Cu/XLPE/SWA/PVC 33000 V BS 6622 3 X 185 MM2 2019 Meter marking Line 2: ELECTRIC CABLE 33000 V BS 6622			
[1)] Dimensional limits do not have the status of a requirement but as a guideline only				

Result

The object passed the test.

6 DRAWING

energya POWER CABLES
A Company of Energya Cables



Size :	3 x 185	mm^2	*Type :*	CU/XLPE/CT/SWA/PVC	
Voltage:	19/33	*kV*	*Standard:*	IEC 60502-2	
Item Code :	**CT19X503W1**				
Sr.	*Description*		*Thickness mm*		*Diameter (Approx.) Mm*
1.	Compacted Circualr Copper Conductor				15.8 ± 0.4
2.	Inner Semi-Conductive		0.5 (Nominal)		
3.	XLPE *Insulation*		8 (Nominal)		
4.	Outer Semi-Conductive (Bonded)		0.5 (Nominal)		
5.	Copper Tape Screen With 10% Overlap		0.075 (Nominal)		
6.	P.P Filler		Applicable		
7.	Binder Tape		Applicable		
8.	PVC Bedding		1.48 (Minimum)		
9.	Galvanized Steel Wires Armour		3.15 ± 5%		
10.	Binder Tape		Applicable		
11.	PVC Sheath		3.3 (Minimum)		
Not to Scale					
Prepared By			Eng. Ahmed Adel		

Sunday, 17 May, 2020 Issue.1 Technical Offer No. 3X185 MM2 19/33 KV

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%