

TYPE TEST CERTIFICATE OF COMPLETE TYPE TEST

OBJECT three-core power cable

TYPE Al/XLPE/STA/PVC

Rated voltage, U_0/U (U_m)	8,7/15 (17,5) kV	Conductor material	Al
Conductor cross-section	3x300 mm ²	Insulation material	XLPE

MANUFACTURER Elsewedy Cables Ltd,
Yanbu, Kingdom of Saudi Arabia

CLIENT Elsewedy Cables,
Cairo, Egypt

TESTED BY KEMA HIGH-VOLTAGE LABORATORY
Arnhem, the Netherlands

DATE OF TESTS 22 April to 3 June 2010

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

IEC 60502-2

This Type Test Certificate has been issued by KEMA following exclusively the STL Guides.

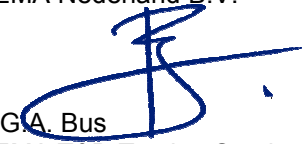
The results are shown in the record of Proving Tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above Standard and to justify the ratings assigned by the manufacturer as listed on page 4.

The Certificate applies only to the object tested. The responsibility for conformity of any object having the same designations with that tested rests with the Manufacturer.

This Certificate consists of 38 pages in total.

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KEMA Nederland B.V.


P.G.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 13 August 2010

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1 IDENTIFICATION OF THE TEST OBJECT

1.1 Description of the test object

Manufacturer	Elsewedy Cables Ltd., Yanbu, Kingdom of Saudi Arabia
Type	Al/XLPE/STA/PVC
Year of manufacture	2010
Sampling procedure	by the manufacturer
Quantity submitted	60 m
Rated voltage, U_0/U (U_m)	8,7/15 (17,5) kV
No. of cores (core identification)	3 (red, yellow, blue)
Marking on the cable	English: EL SEWEDY KSA 3 X 300 MM ² 8.7/15 kV Al/XLPE/STA/PVC Property of Saudi Electricity Company Manufacturing Year

Arabic:

السويدى للكابلات السعوديه 3 X 300 مم² 8,7 / 15 كف كابل الومنيوم
معزول XLPE ملكيه الشركه السعوديه للكهرباء سنه الصنع

Conductor

- material	aluminium
- cross-section	300 mm ²
- nominal diameter	20,5 mm
- type	compacted
- maximum conductor temperature in normal operation	90 °C

Conductor screen

- material	semi-conducting PE
- nominal thickness	0,7 mm
- material designation	LE 0595
- manufacturer	Borealis

Insulation

- material	XLPE
- nominal thickness	4,5 mm
- material designation	CLNB 8141S
- manufacturer	Hahwha Chemicals Co.

Insulation screen

- material	semi-conducting PE
- strippable	yes
- nominal thickness	1,2 mm
- material designation	LE 0511
- manufacturer	Borealis

Metallic screen

- material	copper
- number and nominal diameter of wires	34 wires of Ø 0,67 mm
- nominal thickness and width of tape	15 x 0,1 mm (open helix)

Binder/Filling material

polyester tape / PP filler

Inner sheath

- material	MDPE, type ST ₇
- nominal thickness	2,0 mm
- material designation	ME 6052
- manufacturer	Borouge

Metallic armour

- material	double galvanized steel tape
- nominal thickness and width	2 tapes 0,8 x 60 mm
- manufacturer	Al Qahtani Nails & G.I.Wires

Oversheath

- material	PVC, type ST ₂
- nominal thickness	3.7 mm
- nominal overall diameter of cable	90,1 mm approx.
- material designation	VS39 red
- manufacturer	Arabian plastic Compounds Co
- colour	red

Longitudinally watertightness

- along insulation screen	not claimed
- along the conductor	not claimed

Fire retardant (IEC 60332-1-2)

no

1.2 List of documents

The manufacturer has guaranteed that the object submitted for tests has been manufactured in accordance with the following documents.

KEMA has verified that these documents adequately represent the object tested.

The following documents are included in this Certificate:

drawing no./ document no.	revision	date	title
AX3-T103-G30-01-00-D	1	31 July 2010	3X300-8.7 / 15 kV Cable AL/XLPE/STA/PVC Cable Drawing
AX3-T103-G30-01-00	1	31 July 2010	3X300-8.7 / 15 kV Cable AL/XLPE/STA/PVC Cable Construction

2 GENERAL INFORMATION

2.1 The tests were witnessed by

The tests were not witnessed.

2.2 The tests were carried out by

Name	Company
Mr Th.H.P. Ariaans	KEMA Nederland B.V.,
Mr R.T. Menger	Arnhem, the Netherlands

2.3 Subcontracting

The following tests were subcontracted to KEMA Quality:

- measurement of resistivity of semi conducting screens in accordance with clause 18.1.9 of IEC 60502-2
- non-electrical type tests in accordance with clause 19 of IEC 60502-2
- verification of cable construction in accordance with clauses 5-14 of IEC 60502-2
- measurement of semi conducting conductor and insulation screen in accordance with clauses 3 and 5 of AEIC CS8-06

2.4 Purpose of the 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 appendix A. Unless otherwise indicated in the report, the measurement uncertainties of the results presented are as indicated in this table.

2.6 Applicable standards

When reference is made to a standard and the date of issue is not stated, this applies to the latest issue, including amendments, which have been officially published prior to the date of the tests.

3 ELECTRICAL TYPE TESTS

3.1 General

3.1.1 Tests at elevated conductor temperature

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

The heating currents in both 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. All three phases of both the reference loop and the test loop carried the same level three-phase current. Annex A, method 1 of IEC 60840 was used as a guide.

3.2 Bending test followed by a partial discharge test

3.2.1 Bending test

Standard and date

Standard IEC 60502-2, clause 18.1.3

Test date 22 April 2010

Environmental conditions

Ambient temperature 14 °C

Temperature of test object 14 °C

Characteristic test data

Bending diameter:

Three core cable ("others") 15 (d + D) ±5%

measured outer diameter of cable D (mm)	measured diameter of cable conductor d (mm)	required bending diameter D _r (mm)	diameter of test cylinder D _t (mm)
92,2	20,6	$1607 \leq D_r \leq 1777$	1660

Procedure

The test sample shall be bent around a test cylinder at ambient temperature for at least one complete turn. It shall then be unwound and repeated, except that the sample shall be bent in the reverse direction without axial rotation. This cycle of operation shall be carried out three times.

Observation

The test was carried out successfully.

3.2.2

Partial discharge test

Standard and date

Standard IEC 60502-2, clause 18.1.4
Test date 3 May 2010

Environmental conditions

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

Characteristic test data

Circuit direct
Calibration 5 pC
Noise 2,5 pC
Sensitivity 5 pC
Required sensitivity ≤ 5 pC
Bandwidth 188-228 kHz
Test frequency 50 Hz

core	voltage applied, 50 Hz		duration (s)	partial discharge level (pC)
	... x U_0	(kV)		
1	2	17,4	10	-
1	1,73	15	-	not detectable
2	2	17,4	10	-
2	1,73	15	-	not detectable
3	2	17,4	10	-
3	1,73	15	-	not detectable

Requirement

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

Result

The test was passed.

3.3 Tan δ measurement

Standard and date

Standard IEC 60502-2, clause 18.1.5
Test date 6 May 2010

Environmental conditions

Ambient temperature 22 °C

Characteristic test data

Temperature of test object 97 °C
Length of test object 17,02 m
Standard capacitor 100 pF

core	voltage applied, 50 Hz (kV)	core capacitance ¹⁾ (μ F/km)	tan δ
1, 2 and 3	5	0,345	$1,8 \times 10^{-4}$
1) for information only			

Requirement

The measured value shall not be higher than 40×10^{-4} .

Result

The test was passed.

3.4 Heating cycle test followed by a partial discharge test

3.4.1 Heating cycle test

Standard and date

Standard IEC 60502-2, clause 18.1.6

Test period 7 to 15 May 2010

Environmental conditions

Ambient temperature 20-22 °C

Characteristic test data

Stabilized temperature 97 °C

no. of heating-cycles	required stable conductor temperature (°C)	heating current during stable condition (A)	heating per cycle		cooling per cycle
			total duration (h)	duration of conductor at stable temperature (h)	total duration (h)
20	95-100	approx. 510	5	2	5

Procedure

The heating cycles duration shall be at least 8 h. The conductor temperature shall be maintained within the stated temperature limits for at least 2 h of each heating period. This shall be followed by at least 3 h of natural cooling in air to a conductor temperature within 10 K of the ambient temperature.

Observation

The test was carried out successfully.

3.4.2 Partial discharge test

Standard and date

Standard IEC 60502-2, clause 18.1.4

Test date 17 May 2010

Environmental conditions

Ambient temperature 21 °C

Temperature of test object 21 °C

Characteristic test data

Circuit direct

Calibration 5 pC

Noise 2,5 pC

Sensitivity 5 pC

Required sensitivity ≤ 5 pC

Bandwidth 158-258 kHz

Test frequency 50 Hz

core	voltage applied, 50 Hz		duration (s)	partial discharge level (pC)
	... x U_0	(kV)		
1	2	17,4	10	-
1	1,73	15	-	not detectable
2	2	17,4	10	-
2	1,73	15	-	not detectable
3	2	17,4	10	-
3	1,73	15	-	not detectable

Requirement

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

Result

The test was passed.

3.5 Impulse test followed by a voltage test

3.5.1 Impulse test

Standard and date

Standard IEC 60502-2, clause 18.1.7
Test date 18 May 2010

Environmental conditions

Ambient temperature 22 °C

Characteristic test data

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

testing arrangement		polarity	voltage applied (% of test voltage)	no. of impulses	see figure
voltage applied to	earthed				
conductors	metallic screens	positive	50 65 80 100	1 1 1 10	1 (waveshape) 2 2 3 and 4
conductors	metallic screens	negative	50 65 80 100	1 1 1 10	5 (waveshape) 6 6 7 and 8

Note

The three cable cores were tested simultaneously.

Requirement

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

Result

The test was passed.

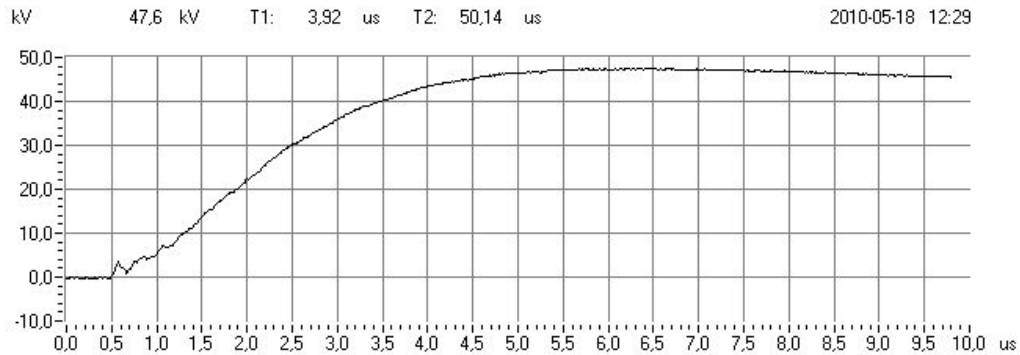


Fig. 1: Waveshape +50% of test voltage

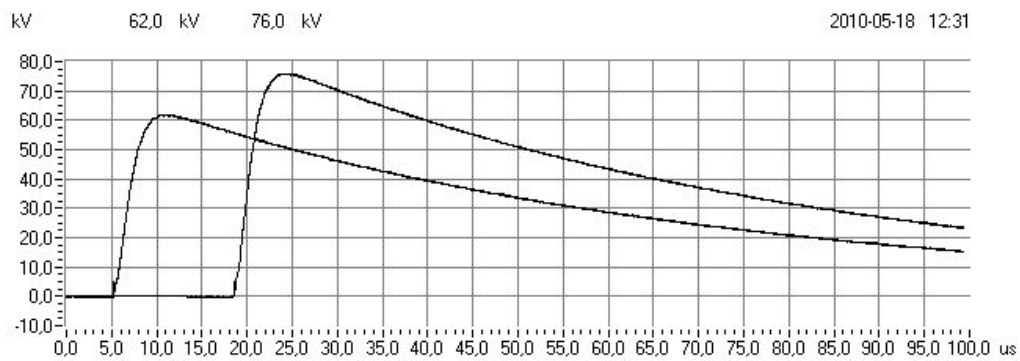


Fig. 2: +65% and +80% of test voltage

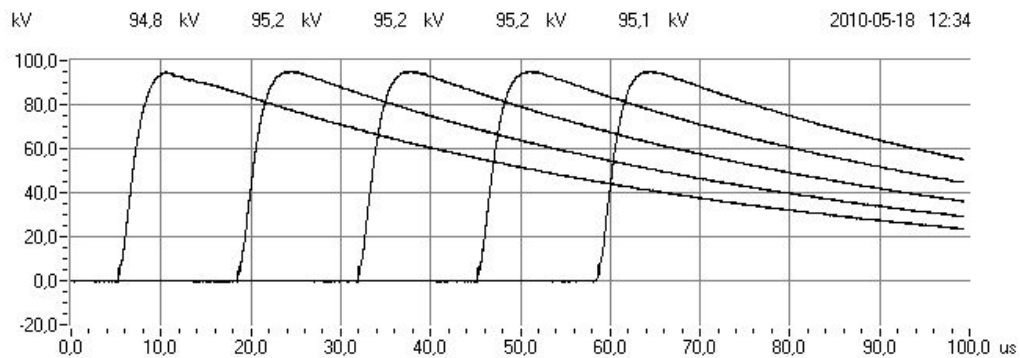


Fig. 3: +100% of test voltage

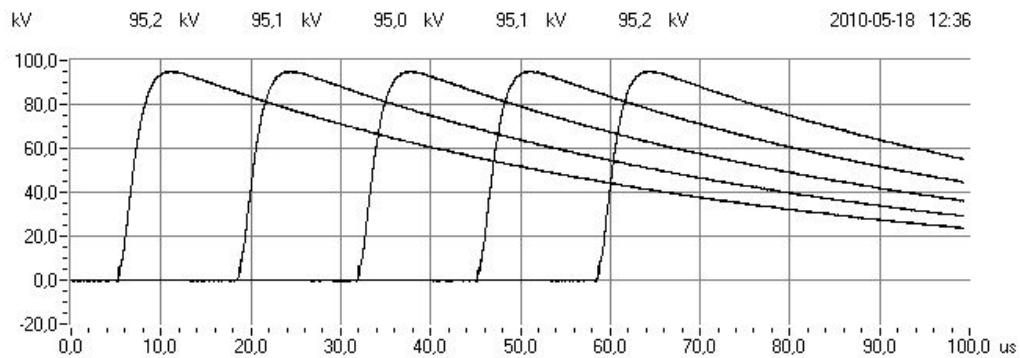


Fig. 4: +100% of test voltage

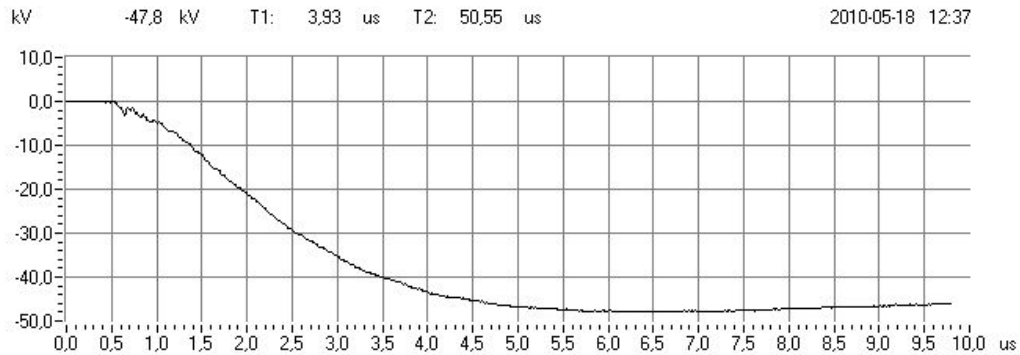


Fig. 5: Waveshape -50% of test voltage

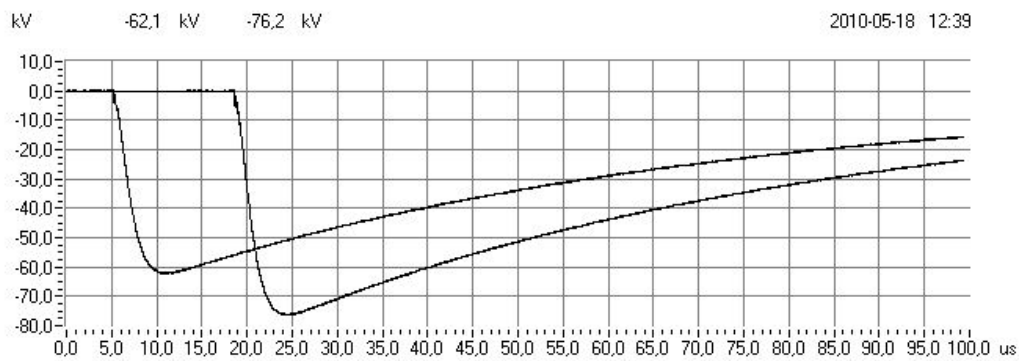


Fig. 6: -65% and -80% of test voltage

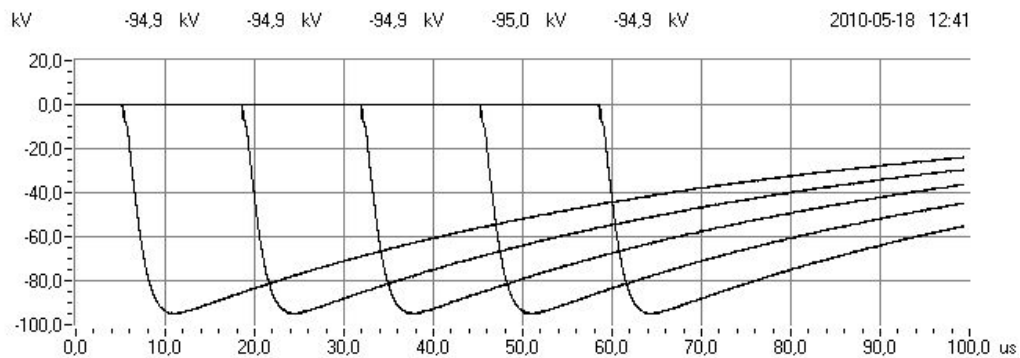


Fig. 7: -100% of test voltage

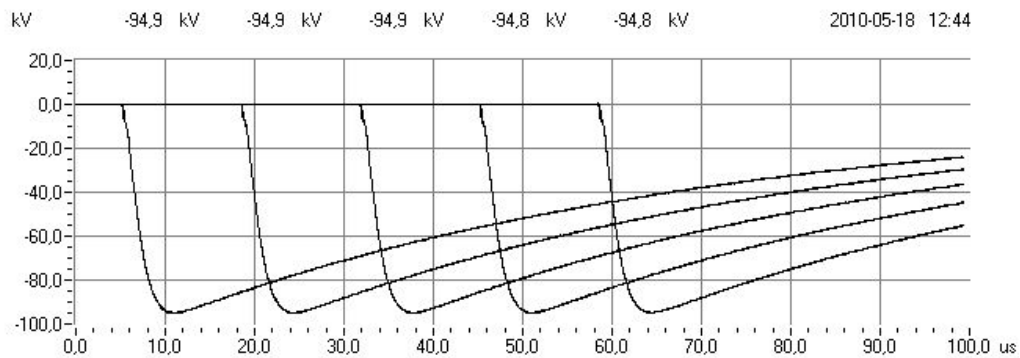


Fig. 8: -100% of test voltage

3.5.2 Voltage test

Standard and date

Standard IEC 60502-2, clause 18.1.7

Test date 19 May 2010

Environmental conditions

Ambient temperature 20 °C

Temperature of test object 20 °C

testing arrangement		voltage applied, 50 Hz		duration
voltage applied to	earth connected to	xU_0	(kV)	(min)
conductors	metallic screens	3,5	30,5	15

Note

The three cable cores were tested simultaneously.

Requirement

No breakdown of the insulation shall occur.

Result

The test was passed.

3.6 Voltage test for 4 hours

Standard and date

Standard IEC 60502-2, clause 18.1.8
Test date 19 May 2010

Environmental conditions

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

testing arrangement		voltage applied, 50 Hz		duration
voltage applied to	earth connected to	xU_0	(kV)	(h)
conductors	metallic screens	4	34,8	4

Note

The three cable cores were tested simultaneously.

Requirement

No breakdown of the insulation shall occur.

Result

The test was passed.

3.7 Resistivity of semi-conducting screens

Standard and date

Standard IEC 60502-2, clause 18.1.9
Test period 4 to 11 May 2010

Characteristic test data

Temperature during ageing 100 ± 2 °C
Duration 7 days
Resistivity measured at 90 °C

item	unit	requirement	measured/determined		
			red	yellow	blue
conductor screen					
- without ageing	Ωm	≤ 1000	90	68	83
- after ageing	Ωm	≤ 1000	10	11	18
insulation screen					
- without ageing	Ωm	≤ 500	5	3	4
- after ageing	Ωm	≤ 500	3	2	2

Note

The measurement of resistivity shall be at a temperature within ± 2 °C of the maximum conductor temperature in normal operation.

Result

The test was passed.

4 NON-ELECTRICAL TYPE TESTS

4.1 Measurement of thickness of insulation

Standard and date

Standard IEC 60502-2, clause 19.1

Test date 6 May 2010

insulation thickness	unit	requirement	specified	measured/determined		
				red	yellow	blue
- nominal	mm	-	4,5	-	-	-
- average	mm	-	-	4,5	4,5	4,5
- minimum (t_{\min})	mm	$\geq 3,95$	$\geq 3,95$	4,46	4,34	4,44
- maximum (t_{\max})	mm	-	-	4,64	4,66	4,58
- ($t_{\max} - t_{\min}$) / t_{\max}		$\leq 0,15$	-	0,04	0,07	0,03

Result

The test was passed.

4.2 Measurement of thickness of non-metallic sheaths

Standard and date

Standard IEC 60502-2, clause 19.2

Test date 3 May 2010

Inner sheath

thickness	unit	requirement	specified	measured/determined
- nominal	mm	-	2,0	-
- average	mm	-	-	3,1
- minimum (t_{\min})	mm	-	$\geq 1,4$	2,68

Oversheath

thickness	unit	requirement	specified	measured/determined
- nominal	mm	$\geq 1,8$	3,7	-
- average	mm	-	-	4,6
- minimum (t_{\min})	mm	$\geq 2,76$	$\geq 2,96$	3,95

Result

The test was passed.

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

Standard and date

Standard IEC 60502-2, clause 19.3

Test period 4 to 12 May 2010

Characteristic test data

Temperature during ageing 135 ± 3 °C

Duration 7 days

item	unit	requirement	measured/determined		
			red	yellow	blue
without ageing					
- tensile strength	N/mm ²	$\geq 12,5$	23,2	22,1	23,5
- elongation	%	≥ 200	566	548	557
after ageing					
- tensile strength	N/mm ²	-	26,2	26,7	24,7
- variation with samples without ageing	%	± 25 max.	13	21	5
- elongation	%	-	603	597	585
- variation with samples without ageing	%	± 25 max.	7	9	5

Result

The test was passed.

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

Standard and date

Standard IEC 60502-2, clause 19.4

Test period 4 to 18 May 2010

Characteristic test data

Temperature during ageing 110 ± 2 °C

Duration 10 days

Inner sheath

item	unit	requirement	measured/determined
without ageing			
- tensile strength	N/mm ²	$\geq 12,5$	29,1
- elongation	%	≥ 300	775
after ageing			
- tensile strength	N/mm ²	-	28,5
- variation with samples without ageing	%	-	-2
- elongation	%	≥ 300	783
- variation with samples without ageing	%	-	1

Characteristic test data

Temperature during ageing 100 ± 2 °C

Duration 7 days

Oversheath

item	unit	requirement	measured/determined
without ageing			
- tensile strength	N/mm ²	$\geq 12,5$	17,3
- elongation	%	≥ 150	269
after ageing			
- tensile strength	N/mm ²	$\geq 12,5$	17,1
- variation with samples without ageing	%	± 25 max.	-1
- elongation	%	≥ 150	266
- variation with samples without ageing	%	± 25 max.	-1

Result

The test was passed.

4.5 Additional ageing test on pieces of completed cable

Standard and date

Standard IEC 60502-2, clause 19.5
Test period 4 to 18 May 2010

Characteristic test data

Temperature during ageing 100 ± 2 °C
Duration 7 days

Insulation

item	unit	requirement	measured/determined		
			red	yellow	blue
- tensile strength	N/mm ²	-	26,2	24,3	24,6
- variation with samples without ageing	%	± 25 max.	12	10	5
- elongation	%	-	603	562	563
- variation with samples without ageing	%	± 25 max.	7	3	1

Inner sheath

item	unit	requirement	measured/determined
- tensile strength	N/mm ²	-	27,4
- variation with samples without ageing	%	-	-6
- elongation	%	-	797
- variation with samples without ageing	%	-	3

Oversheath

item	unit	requirement	measured/determined
- tensile strength	N/mm ²	-	17,0
- variation with samples without ageing	%	± 25 max.	-2
- elongation	%	-	288
- variation with samples without ageing	%	± 25 max.	7

Result

The test was passed.

4.6 Loss of mass test on PVC sheaths of type ST₂

Standard and date

Standard IEC 60502-2, clause 19.6

Test period 3 to 12 May 2010

Characteristic test data

Temperature during ageing 100 ± 2 °C

Duration 7 days

Oversheath

item	unit	requirement	measured/determined
- loss of mass	mg/cm ²	$\leq 1,5$	0,8

Result

The test was passed.

4.7 Pressure test at high temperature on non-metallic sheaths

Standard and date

Standard IEC 60502-2, clause 19.7
Test date 7 to 10 May 2010

Characteristic test data (inner sheath)

Temperature 110 ± 2 °C
Duration 6 h
Load 15,5 N

Inner sheath

item	unit	requirement	measured/determined
- depth of indentation	%	≤ 50	5

Characteristic test data (oversheath)

Temperature 90 ± 2 °C
Duration 6 h
Load 20,1 N

Oversheath

item	unit	requirement	measured/determined
- depth of indentation	%	≤ 50	19

Result

The test was passed.

4.8 Test on PVC insulation and sheaths at low temperatures

Standard and date

Standard IEC 60502-2, clause 19.8
Test date 6 and 7 May 2010

Characteristic test data (oversheath)

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

Oversheath

item	unit	requirement	measured/determined
- elongation	%	≥ 20	225
- cold impact test	-	no cracks	no cracks

Result

The test was passed.

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

Standard and date

Standard IEC 60502-2, clause 19.9
Test date 6 May 2010

Characteristic test data (oversheath)

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

Oversheath

item	unit	requirement	measured/determined
- soundness	-	no cracks	no cracks

Result

The test was passed.

4.10 Hot set test for XLPE insulation

Standard and date

Standard IEC 60502-2, clause 19.11
Test date 7 May 2010

Characteristic test data

Air temperature 200 ± 3 °C
Time under load 15 min
Mechanical stress 20 N/cm²

item	unit	requirement	measured/determined		
			red	yellow	blue
- elongation under load	%	≤ 175	60	65	70
- permanent elongation	%	≤ 15	1	1	2

Result

The test was passed.

4.11 Water absorption test on insulation

Standard and date

Standard IEC 60502-2, clause 19.13
Test period 12 May to 3 June 2010

Characteristic test data

Temperature 85 ± 2 °C
Duration 14 days

item	unit	requirement	measured/determined		
			red	yellow	blue
- variation of mass	mg/cm ²	≤ 1	< 0,1	< 0,1	< 0,1

Result

The test was passed.

4.12 Shrinkage test for XLPE insulation

Standard and date

Standard IEC 60502-2, clause 19.16
Test date 6 May 2010

Characteristic test data

Temperature 130 ± 3 °C
Duration 1 h

item	unit	requirement	measured/determined		
			red	yellow	blue
- shrinkage	%	≤ 4	3	3	3

Result

The test was passed.

4.13 Strippability test for insulation screen

Standard and date

Standard IEC 60502-2, clause 19.21
Test period 4 to 12 May 2010

item	unit	requirement	measured/determined		
			red	yellow	blue
- before ageing	N	$4 \leq F \leq 45$	25 / 28 / 24	22 / 24 / 21	23 / 25 / 25
- after ageing	N	$4 \leq F \leq 45$	20 / 21 / 19	20 / 22 / 21	19 / 20 / 22

Requirement (additional)

The insulation surface shall not be damaged and no trace of the insulation screen shall remain on the insulation.

Result

The test was passed.

5 VERIFICATION OF CABLE CONSTRUCTION

Verification of cable construction was carried out in accordance with clauses 5-14 of IEC 60502-2. The results are presented below.

item	unit	requirement	specified	measured/ determined
conductor				
- diameter of conductor d	mm	$19,7 \leq d \leq 21,6$	20,5 approx	20,6
- number of wires		≥ 30	34	34
- diameter of wires	mm	-	-	3,4 approx
- resistance at 20°C	Ω/km	$\leq 0,1000$	-	red yellow blue 0,0963 0,0964 0,0959

	observed/determined
construction	<ul style="list-style-type: none"> - conductor of aluminium wires - construction 1-6-11-16 - semi conducting conductor screen - XLPE insulation - semi conducting insulation screen - copper wire screen 34 x Ø 0,67 mm approx. each core - copper tape 14,8 x 0,1 mm approx. open helix each core - PP filler - binder tape - PE inner sheath of type ST₇ - Armour of double steel galvanized tape 60 x 0,8 mm approx. - oversheath of PVC type ST₂
marking	ELSEWEDY CABLES KSA 3 x 300 mm ² 8.7/15 kV AL/XLPE/STA/PVC Property of Saudi Electricity Company 2010 in Arabic and English
outer diameter of the cable, average (mm)	92,2
outer diameter of the core, average (mm)	red: 34,1 yellow: 34,0 blue: 34,2

Result

No significant deviations from the specified requirements were found.

6 ADDITIONAL TESTS AS PER AEIC CS8-06

6.1 Extruded conductor shield thickness

Standard and date

Standard AEIC CS8-06, clause 3.1

Test date 6 May 2010

item	unit	requirement	specified	measured/determined		
				red	yellow	blue
- nominal	mm	-	0,7	-	-	-
- minimum	mm	$\geq 0,51$	$\geq 0,51$	0,77	0,80	0,79

Result

The test was passed.

6.2 Conductor shield contact surface protrusions

Standard and date

Standard AEIC CS8-06 clause 3.2

Test date 27 April to 3 June 2010

item	unit	requirement	measured/determined		
			red	yellow	blue
- protrusions into the insulation	mm	$\leq 0,076$	$< 0,076$	$< 0,076$	$< 0,076$
- protrusions into the conductor shield	mm	$\leq 0,18$	$< 0,18$	$< 0,18$	$< 0,18$

Result

The test was passed.

6.3 Conductor shield irregularities

Standard and date

Standard AEIC CS8-06 clause 3.3

Test date 27 April to 3 June 2010

item	unit	requirement	measured/determined		
			red	yellow	blue
- strand convolutions	mm	$\leq 0,18$	$< 0,18$	$< 0,18$	$< 0,18$

Result

The test was passed.

6.4 Extruded insulation shield thickness

Standard and date

Standard AEIC CS8-06 clause 5.1

Test date 27 April 2010

item	unit	requirement	specified	measured/determined		
				red	yellow	blue
- nominal	mm	-	1,6	-	-	-
- minimum	mm	$\geq 1,02$	$\geq 1,02$	1,24	1,22	1,27
- maximum	mm	$\leq 1,91$	$\leq 1,91$	1,40	1,34	1,41

Result

The test was passed.

6.5 Insulation shield contact surface protrusions

Standard and date

Standard AEIC CS8-06 clause 5.2
Test date 27 April to 3 June 2010

item	unit	requirement	measured/determined		
			red	yellow	blue
- protrusions and irregularities into the insulation	mm	$\leq 0,13$	< 0,13	< 0,13	< 0,13
- protrusions and irregularities into the insulation shield	mm	$\leq 0,18$	< 0,18	< 0,18	< 0,18

Result

The test was passed.

6.6 Insulation shield removability

Standard and date

Standard AEIC CS8-06 clause 5.4
Test period 6 and 7 May 2010

item	requirement	measured/determined		
		red	yellow	blue
- removability at $-10\text{ °C} \pm 3\text{ °C}$	removable without tearing or leaving residual conductive material on the insulation surface	no tearing or residue	no tearing or residue	no tearing or residue
- removability at $40\text{ °C} \pm 3\text{ °C}$	removable without tearing or leaving residual conductive material on the insulation surface	no tearing or residue	no tearing or residue	no tearing or residue

Result

The test was passed.

APPENDIX A MEASUREMENT UNCERTAINTIES

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

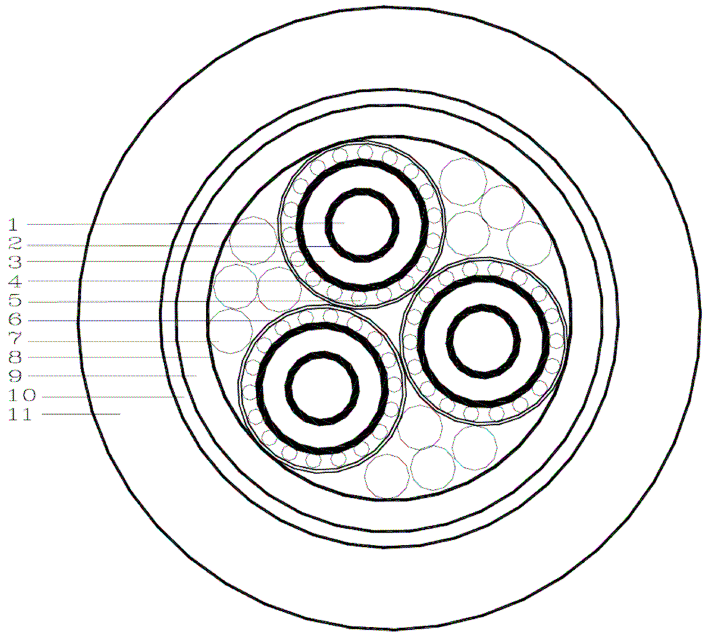
measurement	measurement uncertainty
dielectric tests and impulse current tests	peak value: $\leq 3\%$ time parameters: $\leq 10\%$
capacitance measurement	0,3%
$\tan \delta$ measurement	$\pm 0,5\% \pm 5 \times 10^{-5}$
partial discharge measurement	$< 10 \text{ pC} : 2 \text{ pC}$ 10 - 100 pC : 5 pC $> 100 \text{ pC} : 20\%$
measurement of impedance ac-resistance measurement	$\leq 1\%$
measurement of losses	$\leq 1\%$
measurement of insulation resistance	$\leq 10\%$
measurement of dc resistance	$1 \mu\Omega - 5 \mu\Omega : 1\%$ $5 \mu\Omega - 10 \mu\Omega : 0,5\%$ $10 \mu\Omega - 200 \mu\Omega : 0,2\%$
radio interference test	2 dB
calibration of current transformers	$2,2 \times 10^{-4} \text{ li/lu}$ and $290 \mu\text{rad}$
calibration of voltage transformers	$1,6 \times 10^{-4} \text{ Ui/Uu}$ en $510 \mu\text{rad}$
measurement of conductivity	5%
measurement of temperature	$-50^\circ\text{C} - -40^\circ\text{C} : 3 \text{ K}$ $-40^\circ\text{C} - 125^\circ\text{C} : 2 \text{ K}$ $125^\circ\text{C} - 150^\circ\text{C} : 3 \text{ K}$
tensile test	1%
sound level measurement	type 1 meter as per IEC 651 and ANSI S1.4.1971
measurement of voltage ratio	0,1%

APPENDIX B MANUFACTURER'S DRAWING(S)/DATA SHEET

4 pages (including this page)

drawing no./ document no.	revision	date	title
AX3-T103-G30-01-00-D	1	31 July 2010	3X300-8.7 / 15 kV Cable AL/XLPE/STA/PVC Cable Drawing
AX3-T103-G30-01-00	1	31 July 2010	3X300-8.7 / 15 kV Cable AL/XLPE/STA/PVC Cable Construction

**ELSEWEDY
CABLES**



Size : 3 x 300 mm ²		Type : AL/XLPE/STA/PVC
Voltage: 8.7/15 kV		Standard: IEC 60502-2:2005
Code : AX3-T103-G30-01-00		EL SEWEDY CABLES
Sr.	Description	
1.	Aluminum Conductor	
2.	Inner Semi-conductor	
3.	XLPE Insulation	
4.	Outer Semi-conductor (strippable)	
5.	Copper Wire Screen	
6.	Copper Tape (Open Helix)	
7.	P.P. Filler	
8.	Binder Tape	
9.	PE Bedding	
10.	Double Galvanized Steel Tape Armoured	
11.	PVC Sheath	
Not to Scale	Drawn by Mr. Nabil Abdallah	Approved by Eng. Waleed Abdel Azeem

Only the inner and outer Semi-conductor will be tested in accordance with AEIC CS8

El Sewedy Cables KSA

Technical Department

3X300-8.7 / 15 kV Cable

AL/XLPE/STA/PVC

Cable Construction

1. Conductor

Material		Aluminum
Size	mm ²	300
No. of wires		34
Conductor Diameter	mm	20.5 (Approx.)

2. Conductor Screen

Material		Extruded semi-conducting material
Thickness	mm	0.51 (minimum point)
Diameter	mm	21.9 (Approx.)

3. Insulation

Material		Cross Linked Poly Ethylene (XLPE)
Thickness	mm	4.5 (nominal)
	mm	3.95 (minimum at any point)
Diameter	mm	30.9 (Approx.)

4. Insulation Screen

Material		Extruded semi-conducting material (Strippable Type)
Thickness	mm	1.02 (minimum point)
	mm	1.91 (maximum point)
Diameter	mm	33.3 (Approx.)

5. Metallic Screen

Material		Copper Wire Screen + Copper Tape
Wires (no. x Dia.)	mm	34 X 0.67
Tapes (no. x Thickness)	mm	1 X 0.1
Total C.S.A	mm ²	35
Diameter	mm	34.8 (Approx.)

6. Assembly

Filler		Poly propylene Filler
Binder	mm	Polyester Tape
Diameter	mm	75.5 (Approx.)

7. Inner covering

Material		Medium Density Poly Ethylene (MDPE)
Thickness	mm	2 (nominal)
	mm	1.4 (minimum at any point)
Diameter	mm	79.5 (Approx.)

El Sewedy Cables KSA

Technical Department

3X300-8.7 / 15 kV Cable

AL/XLPE/STA/PVC

Cable Construction

8. Armouring

Material		Galvanized Steel Tapes
Tapes (Thickness)	mm	0.8
Diameter	mm	82.5 (Approx.)

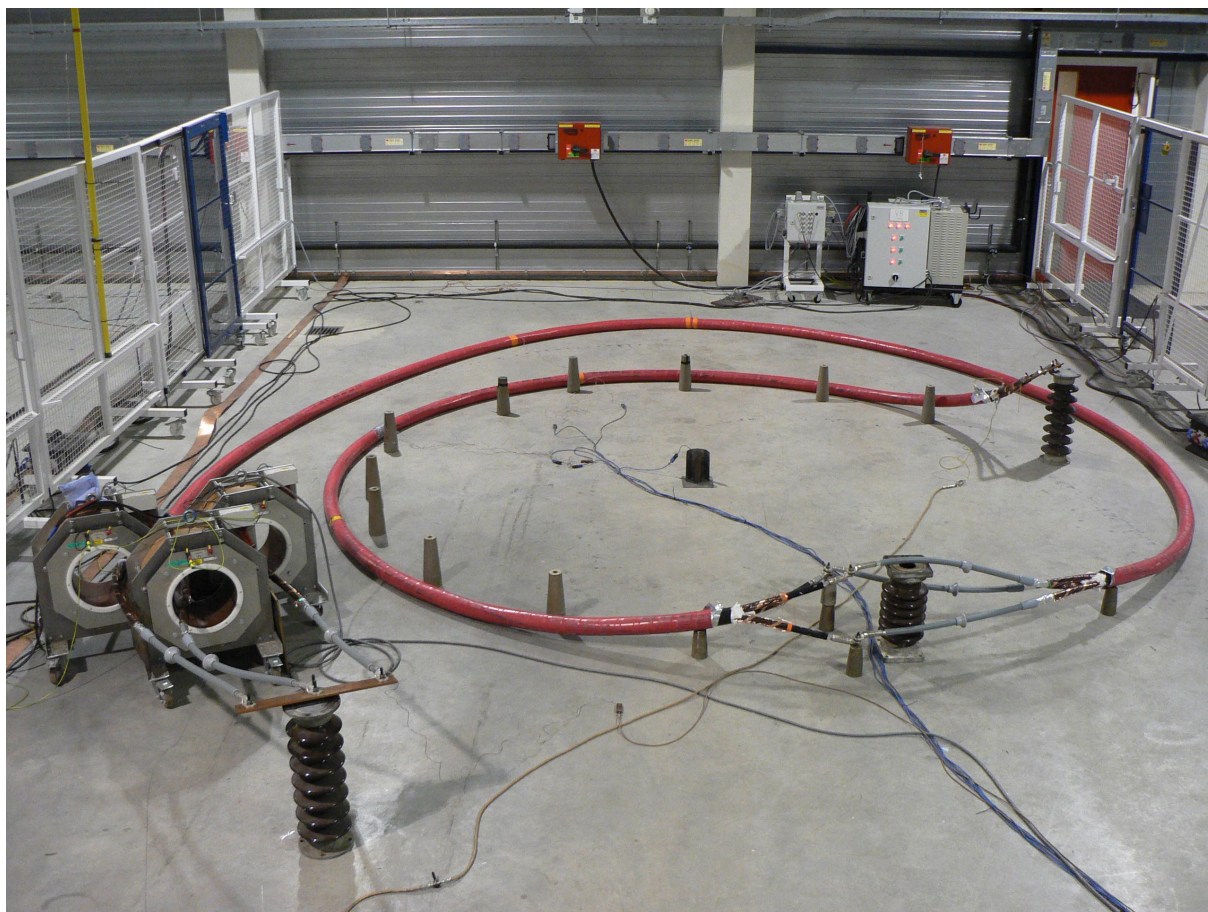
9. Sheath

Material		Polyvinyl Chloride (PVC)
Color		Red
Thickness	mm	3.7 (nominal)
		2.96 (minimum at any point)
Outer Diameter	mm	90.1 (Approx.)

Applicable Standards :

- IEC 60502-2
- Only Semi-conductive conductor screen and insulation screen is according to American standard AEIC CS8.

APPENDIX C PHOTOGRAPH OF THE TEST OBJECT



Photograph 1: Test set up in KEMA High Voltage Laboratory.