

KEMA TYPE TEST CERTIFICATE OF COMPLETE TYPE TESTS

Object 2-core power cable **1597-16**

Type 0,6/1 kV - 2x25 mm²
Al/XLPE/PVC/SWA/PVC

Rated voltage, U ₀ /U (U _m)	0,6/1 (1,2) kV	Conductor material	AL
Conductor cross-section	2x25 mm ²	Insulation material	XLPE

Manufacturer El Sewedy Cables,
10th of Ramadan City, Egypt

Client El Sewedy Cables,
10th of Ramadan City, Egypt

Tested by DNV GL Netherlands B.V.,
Arnhem, the Netherlands

Date of tests 25 November to 15 December 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 60502-1 (2009) subclauses 17 & 18

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 25 pages in total.

DNV GL Netherlands B.V.



J.P. Fonteijne
Executive Vice President
KEMA Laboratories



Laboratories

Arnhem, 14 February 2017

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.

TABLE OF CONTENTS

1	Identification of the test object	5
1.1	Ratings/characteristics of the object tested	5
1.2	Description of the test object	5
1.3	List of documents	7
2	General information.....	8
2.1	The tests were witnessed by	8
2.2	The tests were carried out by	8
2.3	Subcontracting	8
2.4	Purpose of test	8
2.5	Measurement uncertainty	8
3	Conductor	9
3.1	Measurement of the resistance of the conductor	9
3.2	Measurement of the number of wires of the conductor	9
3.3	Measurement of the diameter of the conductor	9
4	Electrical type tests	10
4.1	Measurement of insulation resistance at max. conductor temperature	10
4.2	Voltage test for 4 h	11
5	Non-electrical type tests	12
5.1	Measurement of thickness of insulation	12
5.2	Measurement of thickness of non-metallic sheaths	12
5.3	Tests for determining the mechanical properties of insulation before and after ageing	13
5.4	Tests for determining the mechanical properties of non-metallic sheaths before and after ageing	14
5.5	Additional ageing test on pieces of completed cables	15
5.6	Loss of mass test on PVC sheaths of type ST ₂	16
5.7	Pressure test at high temperature on non-metallic sheaths	17
5.8	Test on PVC insulation and sheaths and halogen free sheaths at low temperatures	18
5.9	Test for resistance of PVC insulation and sheaths to cracking (heat shock test)	19
5.10	Hot set test for XLPE insulation and elastomeric sheaths	20
5.11	Water absorption test on insulation	21
5.12	Fire tests	22
5.12.1	Flame spread test on single cables	22
5.13	Shrinkage test for XLPE insulation	22
6	Verification of cable construction	23
7	Drawings.....	24



KEMA Laboratories	-4-	1597-16
8	Measurement uncertainties.....	25

1 IDENTIFICATION OF THE TEST OBJECT

1.1 Ratings/characteristics of the object tested

Rated voltage, U_0/U (U_m)	0,6/1 (1,2) kV
Rated maximum conductor temperature in normal operation	90 °C
Rated conductor cross-section	25 mm ²

1.2 Description of the test object

Manufacturer (as stated by the client)	El Sewedy Cables, 10 th of Ramadan City, Egypt
Type	$U_0 = 0,6$ kV 2 x 25 mm ² XLPE CABLE
Manufacturing year	2016
Quantity submitted	50 m
Rated voltage, U_0/U (U_m)	0,6/1 (1,2) kV
Overall diameter (D)	24,3 mm
Number of cores	2
Marking on the oversheath	DEWA Electric Cable 600/1000 V 2x25 SQMM Al/XLPE/PVC/SWA/PVC IEC 60502-1 El Sewedy Cables EGYPT PO 3411600082

Conductor

- material Al
- cross-section 25 mm²
- nominal diameter (d) 5,8 mm
- type round compacted
(i.e. round compacted, sector shaped)
- class 2
- number and nominal diameter of wires 7 wires and \varnothing 2,2 mm
- maximum conductor temperature in normal operation 90 °C

Insulation

- material XLPE
- nominal thickness 0,9 mm
- manufacturer of the material known in KEMA Laboratories' files.
- Core identification Red, Black

Filler

- material Polypropylene filler
- type (i.e. extruded, yarn) yarn

Binder(s)

- material Polypropylene tape
- type (i.e. tape, extruded) tape

Inner covering(s)

- material (incl. ST-code) PVC, ST₂
- type (i.e. tape, extruded) extruded
- approximate thickness 1 mm

Metal armour

- material galvanized steel wires
- number of wires 33
- nominal diameter of wires 1.6 mm
- cross-sectional area 66 mm²
- manufacturer of the material known in KEMA Laboratories' files

Oversheath

- material PVC, ST₂
- nominal thickness 1,8 mm
- nominal overall diameter of the cable (D) 24,3 mm
- material designation known in KEMA Laboratories' files
- manufacturer of the material known in KEMA Laboratories' files
- colour black
- graphite coating applied no

Fire retardant

(acc. IEC 60332-1)

yes

Manufacturing details insulation system

- location of manufacturing 10th of Ramadan City, Egypt
- type of extrusion line low voltage horizontal extrusion line
- type of extrusion single extrusion head
- factory identification of extrusion line EX20
- manufacturer of the extrusion line known in KEMA Laboratories' files
- identification of production batch batch 3
- curing means air
- cooling means water
- length markings on cable sample sent to KEMA Laboratories begin: 17 m, end: 67 m

1.3 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
G-1-A	0

2 GENERAL INFORMATION

2.1 The tests were witnessed by

Name	Company
Humaid Al Shamsi 28 November to 2 December 2016	Dubai Electricity & Water Authority, Dubai, U.A.E.
Mazin Aziz 5 to 9 December 2016	

2.2 The tests were carried out by

Name	Company
E.F. Rijpstra	DNV GL Netherlands B.V.,
H.G. van Zuilen	Arnhem, the Netherlands
F.B. Rasing	

2.3 Subcontracting

All tests were subcontracted to DNV GL – New Energy Technology, Arnhem, the Netherlands.

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.

3 CONDUCTOR

Standard and date

Standard IEC 60502-1 clause 5

Test date 29 November 2016

3.1 Measurement of the resistance of the conductor

Item	Unit	Requirement	Measured/determined	
			Red	Black
Resistance	Ω/km	$\leq 1,2$	1,18	1,18

Result

The object passed the test.

3.2 Measurement of the number of wires of the conductor

Item	Unit	Requirement	Measured/determined	
			Red	Black
Number of wires	-	≥ 6	7	7

Result

The object passed the test.

3.3 Measurement of the diameter of the conductor

Item	Unit	Requirement	Measured/determined	
			Red	Black
Diameter	mm	-	5,87	5,87

Result

The test results are for information only.

4 ELECTRICAL TYPE TESTS

4.1 Measurement of insulation resistance at max. conductor temperature

Standard and date

Standard IEC 60502-1, clause 17.2

Test date 30 November 2016

Item	Unit	Requirement	Measured/determined	
			Red	Black
Volume resistivity, ρ				
at 90 °C	Ω .cm	$\geq 10^{12}$	$6,87 \cdot 10^{15}$	$1,26 \cdot 10^{16}$
Insulation resistance constant, K_i				
at 90 °C	M Ω .km	$\geq 3,67$	25208	46346

Result

The object passed the test.

4.2 Voltage test for 4 h

Standard and date

Standard IEC 60502-1, clause 17.3

Test date 6 December 2016

Environmental conditions

Temperature 20 ± 15 °C

Temperature of test object 23 °C

Applied voltage kV	Frequency Hz	Duration h	Measured/determined
2,4	50	4	no breakdown

Requirement

No breakdown of the insulation shall occur.

Result

The object passed the test.

5 NON-ELECTRICAL TYPE TESTS

5.1 Measurement of thickness of insulation

Standard and date

Standard IEC 60502-1, clause 18.1

Test date 2 December 2016

Thickness	Unit	Requirement	Specified	Measured/determined	
				Red	Black
Nominal	mm	0,9	0,9	-	-
Average	mm	-	-	1,43	1,38
Minimum (t_m)	mm	$\geq 0,71$	-	1,34	1,24

Result

The object passed the test.

5.2 Measurement of thickness of non-metallic sheaths

Standard and date

Standard IEC 60502-1, clause 18.2

Test date 2 December 2016

Oversheath

Thickness	Unit	Requirement	Specified	Measured/determined
Nominal	mm	$\geq 1,8$	1,8	-
Average	mm	-	-	1,74
Minimum (t_m)	mm	$\geq 1,24$	-	1,55

Note

The nominal thickness of the separation sheath is specified according to clause 12.3.3 and Annex A of IEC 60502-1.

Result

The object passed the test.

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

Standard and date

Standard IEC 60502-1, clause 18.3

Test date 9 December 2016

Characteristic test data

Temperature during ageing $135 \pm 3 \text{ }^\circ\text{C}$

Duration 7 days (1 to 8 December 2016)

Item	Unit	Requirement	Measured/determined	
			Red	Black
Without ageing				
Tensile strength	N/mm ²	$\geq 12,5$	14,4	16,8
Elongation	%	≥ 200	378	428
After ageing				
Tensile strength	N/mm ²	-	11,8	15,3
Variation with samples without ageing	%	$\pm 25 \text{ max.}$	-18	-9
Elongation	%	-	320	440
Variation with samples without ageing	%	$\pm 25 \text{ max.}$	-15	3

Result

The object passed the test.

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

Standard and date

Standard IEC 60502-1, clause 18.4

Test date 13 December 2016

Characteristic test data (oversheath)

Temperature during ageing 100 ± 2 °C

Duration 7 days (5 to 12 December 2016)

Oversheath

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm ²	≥ 12,5	16,2
Elongation	%	≥ 150	252
After ageing			
Tensile strength	N/mm ²	≥ 12,5	15,1
Variation with samples without ageing	%	± 25 max.	-7
Elongation	%	≥ 150	189
Variation with samples without ageing	%	± 25 max.	-25

Result

The object passed the test.

5.5 Additional ageing test on pieces of completed cables

Standard and date

Standard IEC 60502-1, clause 18.5

Test date 7 December 2016

Characteristic test data

Temperature during ageing $100 \pm 2 \text{ }^\circ\text{C}$

Duration 7 days (29 November to 6 December 2016)

Insulation

Item	Unit	Requirement	Measured/determined	
			Red	Black
Tensile strength	N/mm ²	-	13,8	14,0
Variation with samples without ageing	%	$\pm 25 \text{ max.}$	-5	-16
Elongation	%	-	305	354
Variation with samples without ageing	%	$\pm 25 \text{ max.}$	-19	-17

Oversheath

Item	Unit	Requirement	Measured/determined	
Tensile strength	N/mm ²	-	15,3	
Variation with samples without ageing	%	$\pm 25 \text{ max.}$	-5	
Elongation	%	-	256	
Variation with samples without ageing	%	$\pm 25 \text{ max.}$	2	

Result

The object passed the test.

5.6 Loss of mass test on PVC sheaths of type ST₂

Standard and date

Standard IEC 60502-1, clause 18.6
Test date 13 December 2016

Characteristic test data

Temperature during ageing 100 ± 2 °C
Duration 7 days (5 to 12 December 2016)

Oversheath

Item	Unit	Requirement	Measured/Determined
Loss of mass	mg/cm ²	≤ 1,5	0,53

Result

The object passed the test.

5.7 Pressure test at high temperature on non-metallic sheaths

Standard and date

Standard IEC 60502-1, clause 18.7
Test date 6 December 2016

Characteristic test data

Temperature during ageing 90 ± 2 °C
Duration 6 h
Load 5 N

Oversheath

Item	Unit	Requirement	Measured/Determined
Depth of indentation	%	≤ 50	27

Result

The object passed the test.

5.8 Test on PVC insulation and sheaths and halogen free sheaths at low temperatures

Standard and date

Standard IEC 60502-1, clause 18.8
Test date 29 November and 1 December 2016

Characteristic test data

Temperature $-15 \pm 2 \text{ }^{\circ}\text{C}$
Period of application $> 16 \text{ h}$
Mass of hammer 750 g

Oversheath

Item	Unit	Requirement	Measured/Determined
Cold elongation	%	≥ 20	84
Cold impact test	-	no cracks	no cracks

Result

The object passed the test.

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

Standard and date

Standard IEC 60502-1, clause 18.9
Test date 5 December 2006

Characteristic test data

Temperature 150 ± 3 °C
Period of application 1 h
Diameter of mandrel 4 mm
Number of turns 6

Oversheath

Item	Unit	Requirement	Measured/Determined
Soundness	-	no cracks	no cracks

Result

The object passed the test.

5.10 Hot set test for XLPE insulation and elastomeric sheaths

Standard and date

Standard IEC 60502-1, clause 18.11

Test date 6 December 2016

Characteristic test data

Temperature 200 ± 3 °C

Time under load 15 min

Mechanical stress 20 N/cm²

Item	Unit	Requirement	Measured/determined	
			Red	Black
Elongation under load	%	≤ 175	26	23
Permanent elongation	%	≤ 15	-4	-4

Result

The object passed the test.

5.11 Water absorption test on insulation

Standard and date

Standard IEC 60502-1, clause 18.13
Test date 25 November to 15 December 2016

Characteristic test data

Temperature 85 ± 2 °C
Duration 14 days (28 November to 12 December 2016)

Item	Unit	Requirement	Measured/determined	
			Red	Black
Variation of mass	mg/cm ²	≤ 1	0,01	0,02

Result

The object passed the test.

5.12 Fire tests

5.12.1 Flame spread test on single cables

Standard and date

Standard IEC 60502-1, clause 18.14.1

Test date 30 November 2016

Characteristic test data

Overall diameter of test piece 24,3 mm

Duration 60 s

Flame type 1 kW pre-mixed flame

Item	Unit	Requirement	Measured/determined
Length free of charring	mm	> 50	342
Downward limit charred surface	mm	< 540	494

Result

The object passed the test.

5.13 Shrinkage test for XLPE insulation

Standard and date

Standard IEC 60502-1, clause 18.16

Test date 5 December 2016

Characteristic test data

Temperature 130 ± 3 °C

Duration 1 h

Item	Unit	Requirement	Measured/determined	
			Red	Black
Shrinkage	%	≤ 4	1,5	1

Result

The object passed the test.

6 VERIFICATION OF CABLE CONSTRUCTION

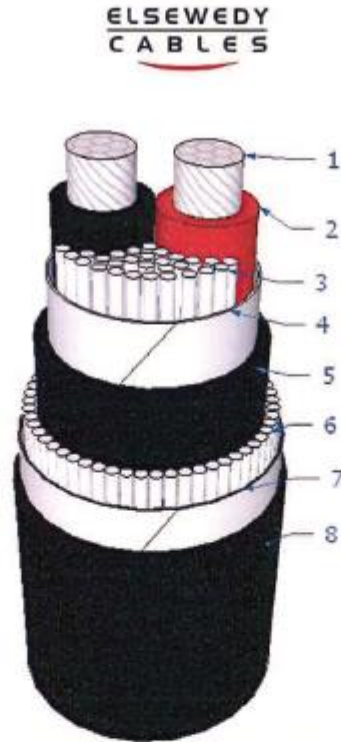
Verification of cable construction was carried out in accordance with clauses 5-13 of IEC 60502-1. The results are presented below.

	Observed/determined
Marking on the cable	DEWA Electric Cable 600/1000 V 2x25 SQMM Al/XLPE/PVC/SWA/PVC IEC 60502-1 EI Sewedy Cables EGYPT PO 3411600082
Construction	Aluminium conductor
	XLPE insulation
	Filler and Binder
	Inner covering
	Steel wire armour
	Binder
	PVC oversheath
Outer diameter of the cable, average	24,3 mm
Outer diameter of the cores, average	Red: 8,52 mm Black: 8,30 mm

Result

No significant deviations from the specified requirements are found.

7 DRAWINGS



Drawing No. G - 1 - a		
Size :	2 x 25 mm ²	Type : AL/XLPE/SWA/PVC
Voltage:	0.6 / 1 kV	Standard: IEC 60502-1:2004
Code :	AX1-T102-W12-00-00	EL-SEWEDY CABLES
Sr.	Description	Approx. Diameter (mm)
1.	Aluminum Conductor (Compact)	5.8
2.	XLPE Insulation	7.6
3.	Polypropylene Filler	
4.	Polypropylene Tape	15.7
5.	PVC Bedding	17.7
6.	Galvanized Steel Wire Armoured	21.6
7.	Polypropylene Tape (if required)	
8.	PVC Sheath	24.6
Not to Scale	Drawn by Mr. Nabil Abdallah	Approved by Eng. Ahmed FARAG

Monday, 23 March, 2015

Rev. No. (0) Tech. Offer No.: /AX1-T102-W12-00-00-D.docx



8 MEASUREMENT UNCERTAINTIES

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

Measurement	Measurement uncertainty
Tensile strength test	1%
Measurement of dimensions	5 μm
Measurement loss of mass	0,11 mg : 8,0 gr
Measurement of conductor resistance	0,03% of measured value
Measurement at low temperature	0,1 $^{\circ}\text{C}$
Measurement in heating cabinets	0,1 $^{\circ}\text{C}$
Voltage test	$2 \cdot 10^{-3} \cdot u + 20\text{v}$ $2 \cdot 10^{-3} \cdot i + 0,2\%$