



REPORT OF PERFORMANCE

TDT 1413-10

OBJECT	2-core power cable
TYPE	0,6/1 kV, 2x6 mm ² Cu/XLPE/PVC
MANUFACTURER	EI Sewedy Cables Ethiopia PLC Dukem, Ethiopia
CLIENT	EI Sewedy Cables New Cairo, Egypt
TESTED BY	KEMA HIGH-VOLTAGE LABORATORY Arnhem, the Netherlands
DATE OF TESTS	27 April to 17 May 2010
TEST PROGRAMME	Type tests in accordance with IEC 60502-1 (2004) including Amendment 1 (2009).
SUMMARY AND CONCLUSION	The tests were passed.

This Report of Performance 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 report consists of 22 pages in total.

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KEMA Nederland B.V.


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

Arnhem, 21 July 2010

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1 IDENTIFICATION OF THE TEST OBJECT

1.1 Description of the test object

Manufacturer	EI Sewedy Cables Ethiopia PLC Dukem, Ethiopia
Type	2x6mm ² CU/XLPE/PVC
Year of manufacture	2010
Sampling procedure	by the manufacturer
Rated voltage, U ₀ /U (U _m)	0,6/1 kV
No. of cores	2
Marking on the cable	Elsewedy Cables Eth 2x6mm ² 0,6/1kV
<u>Conductor</u>	
- material	CU/soft (CR03)
- cross-section	6 mm ²
- approx. diameter/dimensions	2,72 mm
- type/shape of conductor	Circular solid
- maximum conductor temperature in normal operation	90 °C
<u>Insulation</u>	
- material	XLPE/LV
- nominal thickness	0,7 mm
- material designation	XL 01
- manufacturer	Borealis
- core identification	red, black
<u>Filling material</u>	Polypropylene filler
<u>Binder tape</u>	
- approx. dimensions	1 x 30 x 0,13 mm polypropylene tape
<u>Oversheath</u>	
- material	ST ₂ (VS1A)
- nominal thickness	1,8 mm
- outer diameter of cable (approximately)	12,3 mm
- manufacturer	Egyplast
- colour	black
<u>Fire retardant</u>	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
CX1-S102-U09-00-00	0	29 June 2010
2X6 mm 2 -0.6 / 1 kV Cable CU / XLPE / PVC S	-	-

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. R. van Daalen	KEMA Quality B.V., Arnhem, the Netherlands

2.3 Subcontracting

All tests were subcontracted to KEMA Quality B.V.

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 CONDUCTOR

Standard and date

Standard IEC 60502-1, clause 5

Test date 27 April 2010

3.1 Measurement of the resistance of the conductors

item	unit	requirement	measured/determined	
			red	black
resistance	Ω/km	$\leq 3,08$	3,00	3,01

Result

The test was passed.

3.2 Measurement of the diameter of circular conductors

item	unit	requirement	measured/determined	
			red	black
diameter	mm	$\leq 2,9$	2,7	2,7

Result

The test was passed.

4 ELECTRICAL TYPE TESTS

4.1 Measurement of insulation resistance at ambient temperature

Standard and date

Standard IEC 60502-1, clause 17.1
 Test date 27 April 2010

item	unit	requirement	measured/determined	
			red	black
volume resistivity, ρ at 20 °C	Ω .cm	–	$1,5 \cdot 10^{16}$	$1,6 \cdot 10^{16}$
insulation resistance constant, K_i at 20 °C	M Ω .km	–	55170	59044

Result

The test results are for information only.

4.2 Measurement of insulation resistance at max. conductor temperature in normal operation

Standard and date

Standard IEC 60502-1, clause 17.2
 Test date 27 April 2010

item	unit	requirement	measured/determined	
			red	black
volume resistivity, ρ at 90 °C	Ω .cm	$\geq 10^{12}$	$1,7 \cdot 10^{15}$	$1,6 \cdot 10^{15}$
insulation resistance constant, K_i at 90 °C	M Ω .km	$\geq 3,67$	6561	5983

Result

The test was passed.

4.3 Voltage test for 4 h

Standard and date

Standard IEC 60502-1, clause 17.3

Test date 29 April 2010

Environmental conditions

Temperature 20 ± 1 °C

Temperature of test object 20 °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 test was passed.

5 NON-ELECTRICAL TYPE TESTS

5.1 Measurement of thickness of insulation

Standard and date

Standard IEC 60502-1, clause 18.1
 Test date 27 April 2010

insulation thickness	unit	requirement	specified	measured/determined	
				red	black
- nominal	mm	-	0,7	-	-
- average	mm	≥ 0,7	-	0,8	0,8
- minimum (t_m)	mm	≥ 0,53	-	0,73	0,68

Result

The test was passed.

5.2 Measurement of thickness of non-metallic sheaths

Standard and date

Standard IEC 60502-1, clause 18.2
 Test date 27 April 2010

Oversheath

thickness	unit	requirement	specified	measured/determined
- nominal	mm	≥ 1,8	1,8	-
- average	mm	-	-	2,0
- minimum (t_{min})	mm	≥ 1,43	-	1,53

Result

The test was passed.

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

Standard and date

Standard IEC 60502-1, clause 18.3

Test period 27 April to 7 May 2010

Characteristic test data

Temperature during ageing 135 ± 3 °C

Duration 7 days

item	unit	requirement	measured/determined	
			red	black
without ageing				
- tensile strength	N/mm ²	≥ 12,5	13,5	13,4
- elongation	%	≥ 200	312	311
after ageing				
- tensile strength	N/mm ²	-	15,2	16,6
- variation with samples without ageing	%	± 25 max.	13	24
- elongation	%	-	296	307
- variation with samples without ageing	%	± 25 max.	-5	-1

Result

The test was passed.

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 period 27 April to 6 May 2010

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	≥ 12,5	13,6
- elongation	%	≥ 150	252
after ageing			
- tensile strength	N/mm ²	≥ 12,5	13,2
- variation with samples without ageing	%	± 25 max.	-3
- elongation	%	≥ 150	234
- variation with samples without ageing	%	± 25 max.	-7

Result

The test was passed.

5.5 Additional ageing test on pieces of completed cables

Standard and date

Standard IEC 60502-1, clause 18.5
 Test period 27 April to 10 May 2010

Characteristic test data

Temperature during ageing 100 ± 2 °C
 Duration 7 days

Insulation

item	unit	requirement	measured/determined	
			red	black
- tensile strength	N/mm ²	-	12,5	12,7
- variation with samples without ageing	%	± 25 max.	-7	-5
- elongation	%	-	245	248
- variation with samples without ageing	%	± 25 max.	-21	-20

Oversheath

item	unit	requirement	measured/determined
- tensile strength	N/mm ²	-	12,8
- variation with samples without ageing	%	± 25 max.	-6
- elongation	%	-	246
- variation with samples without ageing	%	± 25 max.	-2

Result

The test was passed.

5.6 Loss of mass test on PVC sheaths of type ST₂

Standard and date

Standard IEC 60502-1, clause 18.6
Test period 26 April to 6 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	≤ 1,5	0,2

Result

The test was passed.

5.7 Pressure test at high temperature on non-metallic sheaths

Standard and date

Standard IEC 60502-1, clause 18.7
Test period 6 May 2010

Characteristic test data

Temperature during ageing 90 ± 2 °C
Duration 4 h
Load 4,1 N

Oversheath

item	unit	requirement	measured/determined
depth of indentation	%	≤ 50	18

Result

The test was passed.

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 period 28 and 29 April 2010

Characteristic test data

Temperature -15 ± 2 °C
 Mass of hammer 500 g

Oversheath

item	unit	requirement	measured/determined
- cold elongation	%	≥ 20	180
- cold impact test	-	no cracks	no cracks

Result

The test was passed.

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 29 April 2010

Characteristic test data

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

Oversheath

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

Result

The test was passed.

5.10 Hot set test for XLPE insulation

Standard and date

Standard IEC 60502-1, clause 18.11
 Test date 28 April 2010

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	50	50
- permanent elongation	%	≤ 15	0	0

Result

The test was passed.

5.11 Water absorption test on insulation

Standard and date

Standard IEC 60502-1, clause 18.13
 Test period 28 April to 17 May 2010

Characteristic test data

Temperature 85 ± 2 °C
 Duration 14 days

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

Result

The test was passed.

5.12 Shrinkage test for XLPE insulation

Standard and date

Standard IEC 60502-1, clause 18.16

Test date 28 April 2010

Characteristic test data

Temperature 130 ± 3 °C

Duration 1 h

item	unit	requirement	measured/determined	
			red	black
shrinkage	%	≤ 4	3	3

Result

The test was passed.

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
construction	<ul style="list-style-type: none">- conductor of solid copper wire- insulation of XLPE- polypropylene filler- binder tape- oversheath PVC ST₂
marking	ELSEWEDY CABLES ETH 2x6mm ² 0,6/1kV CU/XLPE/PVC
outer diameter of the cable, (average)	12,9 mm
outer diameter of the cores, (average)	red: 4,3 mm black: 4,3 mm

Result

No deviations from the specified requirements were found.

APPENDIX A MEASUREMENT UNCERTAINTIES

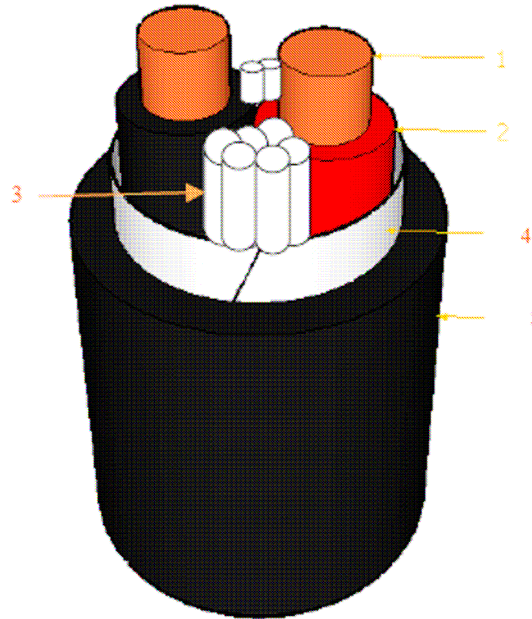
The measurement uncertainties in the results presented are as specified below unless otherwise indicated.

measurement	measurement uncertainty
tensile strenght test	1%
measurement of dimensions	$\pm 5 \mu\text{m}$
measurement loss of mass	0,11 mg : 8,0 gr
measurement of conductor resistance	$\pm 0,03\%$ of measured value
measurement at low temperature	0,1 °C
measurment in heatingcabinets	0,1 °C
voltage test	$2 \cdot 10^{-3} \cdot U + 20V$ $2 \cdot 10^{-3} \cdot I + 0,2\%$

APPENDIX B MANUFACTURER'S DRAWINGS

3 pages (including this page).

drawing no./ document no.	revision	date
CX1-S102-U09-00-00	0	29 June 2010
2X6 mm 2 -0.6 / 1 kV Cable CU / XLPE / PVC S	-	-



<i>Size</i> :	2 x 6	<i>mm²</i>	<i>Type</i> :	Cu/XLPE/PVC
<i>Voltage</i> :	0.6/1	<i>KV</i>	<i>Standard</i> :	IEC 60502-1:2004
<i>Code</i> :	CX1-S102-U09-00-00		EL-SEWEDY CABLES	
<i>Sr.</i>	Description			
1	Copper Conductor (Solid)			
2	XLPE Insulation			
3	Polypropylene Filler			
4	Polypropylene Tape			
5	PVC Sheath			
<i>Not to Scale</i>				

