



REPORT OF PERFORMANCE

TDT 1418-10

OBJECT	12-core power cable
TYPE	0,6/1 kV, 12x2,5 mm ² Cu/PVC/PVC
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	9 December 2009 until 8 January 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.C.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 3 June 2010

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1 IDENTIFICATION OF THE TEST OBJECT

1.1 Description of the test object

Manufacturer	ELSEWEDY CABLES LTD – Yanbu – KSA
Type	CU/PVC/PVC 12x2,5 mm ²
Year of manufacture	2009
Sampling procedure	by the manufacturer
Rated voltage, U ₀ /U (U _m)	0,6/1 kV
No. of cores	12
Marking on the cable	English
	” EL SEWEDY CABLES KSA 12X2.5 MM2 0.6/1 KV Cu/PVC/PVC PROPERTY OF SAUDI ELECTRICITY COMPANY 2009”

Arabic:

السويدي للكابلات السعوديه ١٢ X ٢,٥ مم² / ٠,٦ / ١ كف كابل نحاس معزول
PVC ملكيه الشركه السعوديه للكهرباء سنه الصنع

Conductor

- material	copper
- cross-section	2,5 mm ²
- approx. diameter	2,01 mm
- type/shape of conductor	round stranded
- maximum conductor temperature in normal operation	70 °C

Insulation

- material	PVC
- nominal thickness	0,8 mm
- material designation	PVC/A
- manufacturer	National Co. for Plastic Industry
- core identification	black

Binder tape

- approx. dimensions	polypropylene 30x0,13 mm
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Oversheath

- material PVC, type ST₁
- nominal thickness 1,8 mm
- outer diameter of cable 19,1 mm
- manufacturer National Co. for Plastic Industry
- colour black

Fire retardant not claimed

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 report:

drawing no./ document no.	revision	date	title
CP1-T112-U06-00-00	1	13-01-2010	12X2.5-0.6/1.0 kV-Cable Cu/PVC/PVC Cable Construction
CP1-T112-U06-00-00-D	1	02-02-2010	4X300-0.6/1.0 kV-Cable Cu/PVC/PVC Cable Drawing

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. B. Vos	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 (2004), clause 5
 Test date 16 December 2009

3.1 Measurement of the resistance of the conductors

item	unit	requirement	measured/determined				
			bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
- resistance	Ω/km	$\leq 7,41$	7,21	7,19	7,20	7,19	7,20

Result

The test was passed.

3.2 Measurement of the number of wires of the conductors

item	unit	requirement	measured/determined				
			bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
- number of wires	-	≥ 6	7	7	7	7	7

Result

The test was passed.

3.3 Measurement of the diameter of circular conductors

item	unit	requirement	measured/determined				
			bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
- diameter	mm	$\leq 2,2$	2,0	2,0	2,0	2,0	2,0

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 (2004), clause 17.1

Test period 16 December 2009 until 17 December 2009

item	unit	requirement	measured/determined				
			bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
volume resistivity, ρ at 20 °C	Ω .cm	$\geq 10^{13}$	$1,2 \times 10^{15}$	$1,2 \times 10^{15}$	$1,2 \times 10^{15}$	$1,1 \times 10^{15}$	$1,1 \times 10^{15}$
insulation resistance constant, K_i at 20 °C	M Ω .km	$\geq 36,7$	4572	4404	4231	4068	4164

Result

The test was passed.

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

Standard and date

Standard IEC 60502-1 (2004), clause 17.2

Test period 17 December 2009 until 18 December 2009

item	unit	requirement	measured/determined				
			bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
volume resistivity, ρ at 70 °C	Ω .cm	$\geq 10^{10}$	$9,1 \times 10^{11}$	$8,8 \times 10^{11}$	$8,5 \times 10^{11}$	$8,3 \times 10^{11}$	$8,7 \times 10^{11}$
insulation resistance constant, K_i at 70 °C	M Ω .km	$\geq 0,037$	3,323	3,232	3,097	3,049	3,193

Result

The test was passed.

4.3 Voltage test for 4 h

Standard and date

Standard IEC 60502-1 (2004), clause 17.3

Test date 21 December 2009

Environmental conditions

Temperature 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 (2004), clause 18.1

Test date 16 December 2009

insulation thickness	unit	requirement	specified	measured/determined				
				bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
- nominal	mm	-	0,8	-	-	-	-	-
- average	mm	≥ 0,8	-	1,0	0,9	1,0	1,0	1,0
- minimum (t_m)	mm	≥ 0,62	-	0,90	0,85	0,93	0,92	0,93

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 16 December 2009

Oversheath

thickness	unit	requirement	specified	measured/determined
- nominal	mm	$\geq 1,8$	1,8	-
- average	mm	-	-	1,9
- minimum (t_{\min})	mm	$\geq 1,43$	-	1,64

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 9 December 2009 until 18 December 2009

Characteristic test data

Temperature during ageing 100 ± 2 °C

Duration 7 days

item	unit	requirement	measured/determined				
			bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
without ageing							
- tensile strength	N/mm ²	≥ 12,5	16,3	16,4	17,0	17,4	17,7
- elongation	%	≥ 150	177	183	184	187	196
after ageing							
- tensile strength	N/mm ²	≥ 12,5	16,4	16,4	18,0	17,3	17,5
- variation with samples without ageing	%	± 25 max.	1	0	6	-1	-1
- elongation	%	≥ 150	176	185	192	179	201
- variation with samples without ageing	%	± 25 max.	-1	1	4	-4	3

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 9 December 2009 until 18 December 2009

Characteristic test data (oversheath)

Temperature during ageing 100 ± 2 °C

Duration 7 days

Oversheath

item	unit	requirement	measured/determined
without ageing			
- tensile strength	N/mm ²	≥ 12,5	17,6
- elongation	%	≥ 150	246
after ageing			
- tensile strength	N/mm ²	≥ 12,5	17,1
- variation with samples without ageing	%	± 25 max.	-3
- elongation	%	≥ 150	234
- variation with samples without ageing	%	± 25 max.	-5

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 9 December 2009 until 18 December 2009

Characteristic test data

Temperature during ageing 80 ± 2 °C
 Duration 7 days

Insulation

item	unit	requirement	measured/determined				
			bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
- tensile strength	N/mm ²	-	16,2	16,3	17,9	17,0	17,8
- variation with samples without ageing	%	± 25 max.	-1	-1	5	-2	1
- elongation	%	-	190	182	190	189	207
- variation with samples without ageing	%	± 25 max.	7	-1	3	1	6

Oversheath

item	unit	requirement	measured/determined
- tensile strength	N/mm ²	-	16,8
- variation with samples without ageing	%	± 25 max.	-5
- elongation	%	-	239
- variation with samples without ageing	%	± 25 max.	-3

Result

The test was passed.

5.6 Pressure test at high temperature on insulation and non-metallic sheaths

Standard and date

Standard IEC 60502-1, clause 18.7
 Test period 6 January 2010 until 7 January 2010

Characteristic test data (PVC insulation)

Temperature during ageing 80 ± 2 °C
 Duration 4 h
 Load 1,5 N

PVC insulation

item	Unit	requirement	measured/determined				
			bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
- depth of indentation	%	≤ 50	35	23	30	33	33

Characteristic test data (oversheath)

Temperature during ageing 80 ± 2 °C
 Duration 6 h
 Load 5,5 N

Oversheath

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

Result

The test was passed.

5.7 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 4 January 2010 until 5 January 2010

Characteristic test data (PVC insulation)

Temperature -15 ± 2 °C
 Diameter of mandrel 18,5
 Number of turns 6

PVC insulation

item	unit	requirement	measured/determined				
			bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
- cold bending test	-	no cracks	no cracks	no cracks	no cracks	no cracks	no cracks

Characteristic test data (oversheath)

Temperature -15 ± 2 °C
 Mass of hammer 1250 g

Oversheath

item	unit	requirement	measured/determined
- cold elongation	%	≥ 20	260
- cold impact test	-	no cracks	no cracks

Result

The test was passed.

5.8 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 4 January 2010

Characteristic test data (PVC insulation)

Temperature 150 ± 3 °C
 Duration 1 h
 Diameter of mandrel 9 mm
 Number of turns 6

PVC insulation

item	unit	requirement	measured/determined				
			bl/wh 2	bl/wh 4	bl/wh 6	bl/wh 8	bl/wh 10
- soundness	-	no cracks	no cracks	no cracks	no cracks	no cracks	no cracks

Characteristic test data (oversheath)

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.

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"> - 12 circular stranded copper conductors - 7 copper wires \varnothing 0,67 mm approx. - construction 1-6 - insulation PVC/A - polypropylene binder tape - oversheath PVC ST₁
outer diameter of the cable, average	19,7 mm
outer diameter of the cores, average	2: 4,0 mm 4: 3,9 mm 6: 3,9 mm 8: 4,0 mm 10: 3,9 mm

Result

No deviations from the specified requirements are found.

APPENDIX A MEASUREMENT UNCERTAINTIES

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

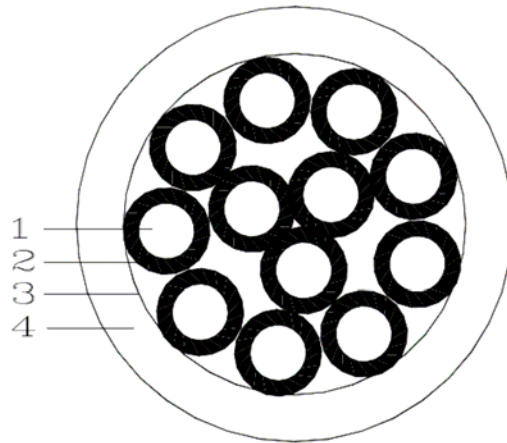
measurement	measurement uncertainty
tensile strength test	1%
measurement of dimensions	$\pm 5 \mu\text{m}$
measurement loss of mass	0,11 mg : 8,0 gr
measurement of conductor resistance	$\pm 0,03 \%$ of measured value
measurement at low temperature	0,1 °C
measurement in heating cabinets	0,1 °C
voltage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



APPENDIX B MANUFACTURER'S DRAWING AND DATA SHEET

2 pages

**ELSEWEDY
CABLES**



<i>Size</i> : 12 x 2.5 mm ²		<i>Type</i> : Cu/PVC/PVC	
<i>Voltage</i> : 0.6/1 kV		<i>Standard</i> : IEC 60502-1:2004	
<i>Code</i> : CPI-T112-U06-00-00		EL SEWEDY CABLES	
<i>Sr.</i>	Description		
1.	Copper Conductor		
2.	PVC Insulation		
3.	Polypropylene Tape		
4.	PVC Sheath		
<i>Not to Scale</i>	<i>Drawn by</i> Mr. Nabil Abdallah	<i>Approved by</i> Eng. Waleed Abdel Azeem	

E1 Sewedy CabLes KSA

Technical Department

12X2.5-0.6 / 1.0 kV- Cable

Cu / PVC / PVC

Cable Construction

1. Conductor

Material		Copper
Size	mm ²	2.5
No. of wires		7
Conductor Diameter	mm	2.01

2. Insulation

Material		Poly Venial Chloride (PVC)
Thickness	mm	0.8 (nominal)
	mm	0.62 (minimum at any point)
Diameter	mm	3.6 (approx.0)
Core Identification		Black+ white No.

3. Assembly

Binder		Poly Propylene Tape
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4. Sheath

Material		Polyvinyl Chloride (PVC)
Color		Black
Thickness	mm	1.8 (nominal)
		1.44 (minimum at any point)
Outer Diameter	mm	19.1 (Approx.)

Applicable Standards :

- IEC 60502-1

Prepared by

Eng. Waleed Abdel Azeem