DNV·GL

KEMA TYPE TEST CERTIFICATE OF COMPLETE TYPE TESTS

Object 4-core power cable **1336-16**

Type AL/XLPE/PVC/SWA/PVC

Rated voltage, U_0/U (U_m)	0,6/1 (1,2) kV	Conductor material	AL
Conductor cross-section	4x300 mm^2	Insulation material	XLPE

Manufacturer National Cables Industry,
Sharjah, United Arab Emirates *)

Client National Cables Industry,
Sharjah, United Arab Emirates

Tested by KEMA Nederland B.V.,
Arnhem, the Netherlands

Date of tests 7 to 27 June 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 and 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 27 pages in total.

KEMA Nederland B.V.

J.P. Fonteijne
Executive Vice President
KEMA Laboratories

KEMA Laboratories Arnhem, 24 August 2016

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

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	300 mm^2

1.2 Description of the test object

Manufacturer	National Cables Industry, Sharjah, United Arab Emirates
Type	4x300 mm^2 AL/XLPE/PVC/SWA/PVC
Manufacturing year	2016
Standard	IEC 60502-1 and DEWA specs 1.5.1.3.5.01-Rev.3
Sampling procedure	by the manufacturer
Rated voltage, U_0/U	0,6/1 KV
No. of cores	4
Marking on the cable	DEWA ELECTRIC CABLE 600/1000 V, 4x300 MM2 AL/XLPE/PVC/SWA/PVC, IEC 60502-1, NATIONAL CABLES INDUSTRY, UAE PO 3411600085 (2016)

Conductor

• material	aluminium
• cross-section	300 mm^2
• nominal dimensions	27,5 x 19,6 mm
• type	sector shaped
• maximum conductor temperature in normal operation	90 °C

Insulation

• material	XLPE
• nominal thickness	1,8 mm
• material designation	GP 8
• material supplier	Riyadh Cables and Metals
• core identification	red / yellow / blue / black

Fillers and binders yes

Inner covering

• type	extruded
• material	PVC, type ST_2
• nominal thickness	1,6 mm
• manufacturer of the material	Riyadh Cables and Metals

Binder tape

• material	polypropylene tape
• dimensions	60 x 0,10 mm

Metallic armour

• material	galvanized steel wires
• number and nominal diameter	68 wires of Ø 2,5 mm
• material supplier	Link middle east

Oversheath

• material	PVC, type ST_2
• nominal thickness	3,2 mm
• outer diameter of cable	69 mm
• material designation	PVC ST_2 / Type 9 (RCS 90) Sheath
• material supplier	Riyadh Cables and Metals
• colour	black

Manufacturing details insulation system

• location of manufacturing	Sharjah, United Arab Emirates
• factory identification of extrusion line	National Cables Industry, United Arab Emirates
• manufacturer of the extrusion line	Nextrom LP – 150
• identification of the production batch	51324898
• manufacturing length (where cable sample for testing has been taken from)	500 m
• length markings on cable sample sent to KEMA Laboratories	begin: 53 m, end: 103 m

1.3 List of documents

On request of the manufacturer the following drawings and/or documents have been included in this report.
KEMA Laboratories has not verified these drawings and/or documents.

Drawing no./document no.	Revision
4x300 mm^2, 0.61 kV AL/XLPE/SWA/PVC POWER CABLE	-

2 GENERAL INFORMATION

2.1 The tests were witnessed by

Name	Company
Humaid Bakhit Humaid Al Shamsi (7 to 24 June 2016)	Dubai Electricity and Water Authority, Dubai, United Arab Emirates
Mazin Aziz (23 to 4 June 2016)	Dubai Electricity and Water Authority, Dubai, United Arab Emirates
Altaf Ahmed (24 to 30 June 2016)	National Cables Industry, Sharjah, United Arab Emirates

2.2 The tests were carried out by

Name	Company
E.F. Rijpstra	KEMA Nederland B.V., 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 9 June 2016

3.1 Measurement of the resistance of the conductor

Item	Unit	Requirement	Measured/determined			
			Red	Yellow	Blue	Black
Resistance	Ω/km	≤ 0,100	0,097	0,098	0,097	0,097

Result
The object passed the test.

3.2 Measurement of the number of wires of the conductor

Item	Unit	Requirement	Measured/determined			
			Red	Yellow	Blue	Black
Number of wires	-	≥ 30	37	37	37	37

Result
The object passed the test.

3.3 Measurement of the dimensions of the conductor

Item	Unit	Requirement	Measured/determined			
			Red	Yellow	Blue	Black
Dimensions	mm	-	26,40 x 19,64	26,68 x 19,50	26,17 x 20,05	26,67 x 19,64

Result
The result is for information only.

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 9 June 2016

Item	Unit	Requirement	Measured/determined			
			Red	Yellow	Blue	Black
Volume resistivity, ρ						
at 20 °C	Ω.cm	-	$7,84 * 10^{16}$	$7,25 * 10^{16}$	$6,70 * 10^{16}$	$8,07 * 10^{16}$
Insulation resistance constant, K_i						
at 20 °C	MΩ.km	-	287635	265943	246004	296220

Result

The test results are for information only.

4.2 Measurement of insulation resistance at max. conductor temperature

Standard and date

Standard IEC 60502-1, clause 17.2
Test date 10 June 2016

Item	Unit	Requirement	Measured/determined			
			Red	Yellow	Blue	Black
Volume resistivity, ρ						
at 90 °C	Ω.cm	≥ 10^{12}	2,58 * 10^{15}	2,65 * 10^{15}	2,37 * 10^{15}	2,16 * 10^{15}
Insulation resistance constant, K_i						
at 90 °C	MΩ.km	≥ 3,67	9478	9720	8696	7924

Result

The object passed the test.

4.3 Voltage test for 4 h

Standard and date

Standard IEC 60502-1, clause 17.3
Test date 13 June 2016

Environmental conditions

Temperature 20 ± 15 °C
Temperature of test object 22 °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 10 June 2016

Thickness	Unit	Requirement	Specified	Measured/determined			
				Red	Yellow	Blue	Black
Nominal	mm	1,8	1,8	-	-	-	-
Average	mm	-	-	2,41	2,71	2,70	2,49
Minimum (t_m)	mm	≥ 1,52	-	1,98	2,30	2,08	2,05

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 10 June 2016

Inner covering

Thickness	Unit	Requirement	Specified	Measured/determined
Nominal	mm	-	1,6	-
Average	mm	-	-	2,01
Minimum (t_m)	mm	≥ 1,08	-	1,69

Oversheath

Thickness	Unit	Requirement	Specified	Measured/determined
Nominal	mm	-	3,2	-
Average	mm	-	-	2,96
Minimum (t_m)	mm	≥ 2,36	-	2,90

Note

The nominal thickness of the Inner covering and oversheath is specified by customer 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 dates 10 to 17 June 2016

Characteristic test data

Temperature during ageing 135 ± 3 °C
Duration 7 days

Item	Unit	Requirement	Measured/determined			
			Red	Yellow	Blue	Black
Without ageing						
Tensile strength	N/mm²	≥ 12,5	26,0	27,7	25,0	27,6
Elongation	%	≥ 200	630	724	693	719
After ageing						
Tensile strength	N/mm²	-	25,4	25,1	26,1	26,1
Variation with samples without ageing	%	± 25 max.	-2	-9	4	-5
Elongation	%	-	584	597	612	616
Variation with samples without ageing	%	± 25 max.	-7	-18	-12	-14

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 dates 10 to 23 June 2016

Characteristic test data Inner covering

Temperature during ageing 100 ± 2 °C
Duration 7 days

Inner covering

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm²	≥ 12,5	21,3
Elongation	%	≥ 150	230
After ageing			
Tensile strength	N/mm²	≥ 12,5	20,7
Variation with samples without ageing	%	± 25 max.	-3
Elongation	%	≥ 150	195
Variation with samples without ageing	%	± 25 max.	-15

Characteristic test data oversheath

Temperature during ageing 100 ± 2 °C
Duration 7 days

Oversheath

Item	Unit	Requirement	Measured/determined
Without ageing			
Tensile strength	N/mm²	≥ 12,5	20,9
Elongation	%	≥ 150	238
After ageing			
Tensile strength	N/mm²	≥ 12,5	19,5
Variation with samples without ageing	%	± 25 max.	-7
Elongation	%	≥ 150	202
Variation with samples without ageing	%	± 25 max.	-15

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 dates 10 to 20 June 2016

Characteristic test data

Temperature during ageing 100 ± 2 °C
Duration 7 days

Insulation

Item	Unit	Requirement	Measured/determined			
			Red	Yellow	Blue	Black
Tensile strength	N/mm²	-	20,2	21,3	20,5	24,2
Variation with samples without ageing	%	± 25 max.	-22	-23	-18	-12
Elongation	%	-	608	625	630	649
Variation with samples without ageing	%	± 25 max.	-4	-14	-9	-10

Inner covering

Item	Unit	Requirement	Measured/determined
Tensile strength	N/mm²	-	21,7
Variation with samples without ageing	%	± 25 max.	-2
Elongation	%	-	194
Variation with samples without ageing	%	± 25 max.	-16

Oversheath

Item	Unit	Requirement	Measured/determined
Tensile strength	N/mm²	-	20,1
Variation with samples without ageing	%	± 25 max.	-4
Elongation	%	-	211
Variation with samples without ageing	%	± 25 max.	-11

Result

The object passed the test.

5.6 Loss of mass test on PVC sheaths of type ST_2

Standard and date

Standard IEC 60502-1, clause 18.6
Test dates 10 to 24 June 2016

Characteristic test data

Temperature during ageing 100 ± 2 °C
Duration 7 days

Inner covering

Item	Unit	Requirement	Measured/Determined
Loss of mass	mg/cm^2	≤ 1,5	1,09

Oversheath

Item	Unit	Requirement	Measured/Determined
Loss of mass	mg/cm^2	≤ 1,5	1,05

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 dates 17 to 21 June 2016

Characteristic test data Inner covering

Temperature during ageing	90 ± 2	°C
Duration	6	h
Load	11	N

Inner covering

Item	Unit	Requirement	Measured/Determined
Depth of indentation	%	≤ 50	21,1

Characteristic test data Oversheath

Temperature during ageing	90 ± 2	°C
Duration	6	h
Load	14	N

Oversheath

Item	Unit	Requirement	Measured/Determined
Depth of indentation	%	≤ 50	21,2

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	10 June to 17 June

Characteristic test data Inner covering

Temperature	-15 ± 2	°C
Period of application	16	h
Mass of hammer	1250	g

Inner covering

Item	Unit	Requirement	Measured/Determined
Cold elongation	%	≥ 20	72
Cold impact test	-	no cracks	no cracks

Characteristic test data Oversheath

Temperature	-15 ± 2	°C
Period of application	16	h
Mass of hammer	1250	g

Oversheath

Item	Unit	Requirement	Measured/Determined
Cold elongation	%	≥ 20	99
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 21 June 2016

Characteristic test data Inner covering

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

Inner covering

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

Characteristic test data Oversheath

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

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

Standard and date

Standard IEC 60502-1, clause 18.11
Test date 14 June 2016

Characteristic test data

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

Item	Unit	Requirement	Measured/determined			
			Red	Yellow	Blue	Black
Elongation under load	%	≤ 175	58	65	68	60
Permanent elongation	%	≤ 15	0	1	0	0

Result

The object passed the test.

5.11 Water absorption test on insulation

Standard and date

Standard IEC 60502-1, clause 18.13
Test dates 7 to 27 June 2016

Characteristic test data

Temperature 85 ± 2 °C
Duration 14 days

Item	Unit	Requirement	Measured/determined			
			Red	Yellow	Blue	Black
Variation of mass	mg/cm^2	≤ 1	0,02	0,00	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 14 June 2016

Characteristic test data

Duration 240 s

Item	Unit	Requirement	Measured/determined
Length free of charring	mm	> 50	398
Downward limit charred surface	mm	< 540	521

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 21 June 2016

Characteristic test data

Temperature 130± 2 °C
Duration 1 h

Item	Unit	Requirement	Measured/determined			
			Red	Yellow	Blue	Black
Shrinkage	%	≤ 4	2,1	2,4	2,2	2,2

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, 4x300 MM2 AL/XLPE/PVC/SWA/PVC, IEC 60502-1, NATIONAL CABLES INDUSTRY, UNITED ARAB EMIRATES PO 3411600085 (2016)
Construction	Aluminium Conductor
	XLPE Insulation
	Filler
	Binding tape
	PVC Inner covering
	Steel wire armour
	Binding tape
	PVC Oversheath
Outer diameter of the cable, average	69 mm
Outer diameter of the cores, average	Red: 31,11 x 24,17 mm Yellow: 31,26 x 24,17 mm Blue: 31,19 x 24,00 mm Black: 31,18 x 24,06 mm

Result

No significant deviations from the specified requirements are found.

7 DRAWINGS

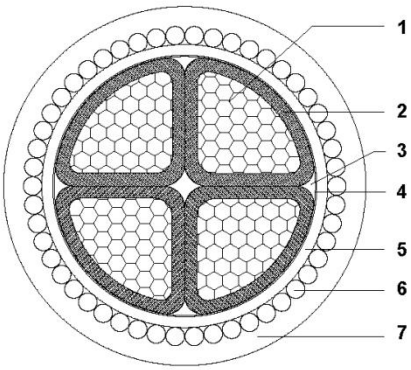
الوطنيـــة لصناعـــة الكابلات
NATIONAL CABLES INDUSTRY

Cross Sectional Drawing

4x300 mm², 0.6/1 kV AL/XLPE/SWA/PVC POWER CABLE

REFERENCE STANDARD : DEWA Specs. 1.5.1.3.5.01-Rev.3 and IEC 60502-1.

1. Conductor	:	Aluminium, Sectoral Stranded Compacted
2. Insulation	:	Cross-Linked Polyethylene (XLPE)
3. Fillers	:	Polypropylene Strings
4. Binding Tape	:	Polypropylene Tapes
5. Inner Sheath	:	Extruded Polyvinyl Chloride (PVC, Type ST2)
6. Armour	:	Galvanized Steel Wire Armour
7. Outer Sheath	:	Extruded Polyvinyl Chloride (PVC, Type ST2), Color: BLACK



Size	A1	A2	A3	A4	t1	t2	d3	t4
mm²	mm	mm	mm	mm	mm	mm	mm	mm
4x300	54.2	57.4	62.4	69.0	1.8	1.6	2.5	3.2

A1 = Approx. dia over assembled cores
A2 = Approx. diameter over bedding
A3 = Approx. diameter over armour
A4 = Approx. overall diameter

t1 = Nominal thickness of insulation
t2 = Nominal thickness of bedding
d3 = Nominal diameter of armour wire
t4 = Nominal thickness of outer sheath

Color Code: **Red, Yellow, Blue & Black**

Embossing on the Outer Sheath in Max 150 mm spacing along TWO lines :

DEWA ELECTRIC CABLE 600/1000 V, 4x300 MM² AL/XLPE/PVC/SWA/PVC, IEC 60502-1
NATIONAL CABLES INDUSTRY, UAE, PO 3411600085 (2016)

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FORM # TE01/F06 Rev. 02

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 °c
Measurement in heating cabinets	0,1 °c
Voltage test	2.10^{-3}.u + 20v 2.10^{-3}.i + 0,2%