TESTREPORT

IEC 60502-1

Power cables with extruded insulation and their accessories for rated voltages from 1kV up to 30 kV.

Report reference No..... :	2236358.51-CAT
Compiled by (+ signature) ..... :	A.A. Mackenbach
Approved by (+ signature) ..... :	R. van Daalen
Date of issue ..... :	2019-08-22
Testing laboratory ..... :	DEKRA Certification B.V.
Address..... :	Meander 1051, 6825 MJ Arnhem, The Netherlands
Testing location..... :	as above
Applicant ..... :	National Cables Industry Sharjah U.A.E.
Address..... :	Plot #6, between 7th and 8th interchange,
..... :	PO Box 27472, Al Saja'a Industrial Area, Sharjah U.A.E.
Standards..... :	IEC 60502-1:2004/A1:2009
Test Report Form No. ..... :	IEC 60502-1b
TRF originator..... :	DEKRA
Master TRF ..... :	dated 2009-09
Type of test object..... :	Cable
Trademark..... :	NATIONAL CABLES INDUSTRY
Model/type reference ..... :	CU/XLPE/SWA/MDPE 4x150 mm²
Manufacturer ..... :	National Cables Industry Sharja U.A.E.
Rating ..... :	0,6/1kV

Possible test case verdicts:

- test case does not apply to the test object .....: N(A)
- test object does meet the requirement..... ….:P(ass)
- test object does not meet the requirement .....:F(ail)

Remarks:

The tested cable meets the requirements.

TABLE OF CONTENTS

1 IDENTIFICATION OF THE TEST OBJECT

1.1 Description of the test object

Manufacturer	National Cables Industry
Type	CU/XLPE/SWA/MDPE
Year of manufacture	2019
Sampling procedure	By the manufacturer
Rated voltage, U_0/U (U_m)	0,6/1 kV
No. of cores	4
Marking on the cable	NATIONAL CABLES INDUSTRY U.A.E. 2019 600/1000 V 4X150 MM2 CU/XLPE/SWA/MDPE 0,6/1kV IEC 60502
Conductor	
- material	Copper
- cross-section	150 mm^2
- type/shape of conductor	Shaped
- maximum conductor temperature in normal operation	90 °C
Insulation	
- material	XLPE
- nominal thickness	1,4 mm
- core identification	Red, yellow, blue, black
Inner covering	
- type	Extruded
- material	PVC
- nominal thickness	1,4 mm
Filling material	Polypropelene yarns
Binder tape	Polypropelene

Metallic armour	
- material	Galvanized steel wires
- nominal diameter / dimensions	46,9 mm, ø 2,5 mm
Oversheath	
- material	MDPE, type ST_7
- nominal thickness	2,6 mm
- outer diameter of cable	52,0 mm
- colour	Black
Fire retardant	Not claimed

2 CONDUCTORS

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 5
Test date 16 July 2019

2.1 Measurement of the resistance of the conductors

item	unit	requirement	measured/determined			
			Red	Yellow	Blue	Black
- resistance	Ω/km	≤ 0,124	0,116	0,117	0,116	0,116

Result

The object passed the test.

2.2 Measurement of the number of wires of the conductors

item	unit	requirement	measured/determined			
			Red	Yellow	Blue	Black
- number of wires	-	≥ 18	37	37	37	37

Result

The object passed the test.

3 ELECTRICAL TYPE TESTS

3.1 Measurement of XLPE insulation resistance at ambient temperature

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 17.1

Test date 19 July 2019

item	unit	requirement	measured/determined			
			Red	Yellow	Blue	Black
volume resistivity, ρ at 20 °C	Ω.cm	–	$3{,}1 \cdot 10^{17}$	$3{,}0 \cdot 10^{17}$	$2{,}5 \cdot 10^{17}$	$2{,}5 \cdot 10^{17}$
insulation resistance constant, K_i at 20 °C	MΩ.km	–	$11{,}5 \cdot 10^{5}$	$11{,}0 \cdot 10^{5}$	$9{,}1 \cdot 10^{5}$	$9{,}2 \cdot 10^{5}$

Result

The test results are for information only.

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

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 17.2
Test date 22 July 2019

item	unit	requirement	measured/determined			
			Red	Yellow	Blue	Black
volume resistivity, ρ at 90 °C	Ω.cm	≥ 10^{12}	2,2 . 10^{16}	1,6 . 10^{16}	1,9 . 10^{16}	1,5 . 10^{16}
insulation resistance constant, K_i at 90 °C	MΩ.km	≥ 3,67	8,1 . 10^{3}	5,8 . 10^{3}	6,9 . 10^{3}	5,4 . 10^{3}

Result

The object passed the test.

3.3 Voltage test for 4 h

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 17.3
Test date 22 July 2019

Environmental conditions

Temperature 20 ± 2 °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.

4 NON-ELECTRICAL TYPE TESTS

4.1 Measurement of thickness of XLPE insulation

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.1

Test date 23 July 2019

insulation thickness	unit	requirement	specified	measured/determined			
				Red	Yellow	Blue	Black
- nominal	mm	1,4	1,4	-	-	-	-
- average	mm	-	-	2,2	2,4	2,1	2,0
- minimum (t_m)	mm	≥ 1,16	≥ 1,16	1,83	1,74	1,81	1,67

Result

The object passed the test.

4.2 Measurement of thickness of non-metallic sheaths

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.2
Test date 23 July 2019

Inner sheath

thickness	unit	requirement	specified	measured/determined
- nominal	mm	≥ 1,2	≥ 1,4	-
- average	mm	-	-	1,9
- minimum (t_{min})	mm	≥ 0,92	-	1,68

Oversheath

thickness	unit	requirement	specified	measured/determined
- nominal	mm	≥ 1,8	2,6	-
- average	mm	-	-	2,9
- minimum (t_{min})	mm	≥ 1,88	-	2,08

Result

The object passed the test.

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

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.3
Test period 22 July 2019 until 5 August 2019

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	22,8	24,5	24,9	24,2
- elongation	%	≥ 200	536	581	579	557
after ageing						
- tensile strength	N/mm²	-	24,8	27,8	23,3	24,6
- variation with samples without ageing	%	± 25 max.	9	13	-6	2
- elongation	%	-	568	589	562	566
- variation with samples without ageing	%	± 25 max.	6	1	-3	2

Result

The object passed the test.

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

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.4
Test period 22 July 2019 until 5 August 2019

Characteristic test data (inner sheath)

Temperature during ageing 100 ± 2 °C
Duration 7 days

Inner sheath

item	unit	requirement	measured/determined
without ageing			
- tensile strength	N/mm²	≥ 12,5	13,5
- elongation	%	≥ 150	367
after ageing			
- tensile strength	N/mm²	≥ 12,5	13,0
- variation with samples without ageing	%	± 25 max.	-4
- elongation	%	≥ 150	338
- variation with samples without ageing	%	± 25 max.	-8

Characteristic test data (oversheath)

Temperature during ageing 110 ± 2 °C
Duration 10 days

Oversheath

item	unit	requirement	measured/determined
without ageing			
- tensile strength	N/mm²	≥ 12,5	32,8
- elongation	%	≥ 300	760
after ageing			
- tensile strength	N/mm²	-	29,8
- variation with samples without ageing	%	-	-9
- elongation	%	≥ 300	769
- variation with samples without ageing	%	-	1

Result

The object passed the test.

4.5 Additional ageing test on pieces of completed cables

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.5
Test period 18 July 2019 until 5 August 2019

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	-	24,3	23,8	26,6	22,8
- variation with samples without ageing	%	± 25 max.	7	-3	3	-6
- elongation	%	-	543	545	570	539
- variation with samples without ageing	%	± 25 max.	1	-6	-2	-3

Inner sheath

item	unit	requirement	measured/determined
- tensile strength	N/mm²	-	12,5
- variation with samples without ageing	%	± 25 max.	7
- elongation	%	-	348
- variation with samples without ageing	%	± 25 max.	-5

Oversheath

item	unit	requirement	measured/determined
- tensile strength	N/mm²	-	31,1
- variation with samples without ageing	%	-	-5
- elongation	%	≥ 300	799
- variation with samples without ageing	%	-	5

Result

The object passed the test.

4.6 Loss of mass test on PVC inner sheath of type ST_2

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.6
Test period 25 July 2019 until 5 August 2019

Characteristic test data

Temperature during ageing	100 ± 2	°C
Duration	7	days

Inner sheath

item	unit	requirement	measured/determined
- loss of mass	mg/cm^2	≤ 1,5	0,1

Result

The object passed the test.

4.7 Pressure test at high temperature on inner sheath

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.7
Test date 31 July 2019

Characteristic test data

Temperature during ageing	90 ± 2	°C
Duration	6	h
Load	7,7	N

Inner sheath

item	unit	requirement	measured/determined
- depth of indentation	%	≤ 50	8

Result

The object passed the test.

4.7.1 Pressure test at high temperature on oversheath type ST_7

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.7
Test date 31 July 2019

Characteristic test data

Temperature during ageing	110 ± 2	°C
Duration	6	h
Load	10,4	N

Over sheath

item	unit	requirement	measured/determined
- depth of indentation	%	≤ 50	3

Result

The object passed the test.

4.8 Test on PVC inner sheath at low temperatures

Standard and date

Standard	IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.8
Test period	22 July 2019 until 23 July 2019

Characteristic test data

Temperature	-15 ± 2	°C
Period of application	16	h
Diameter of mandrel	-	mm
Number of turns	-	
Mass of hammer	1000	g

Inner sheath

item	unit	requirement	measured/determined
- cold bending test	-	no cracks	N/A
- cold elongation	%	≥ 20	125
- cold impact test	-	no cracks	no cracks

Result

The object passed the test.

4.9 Test for resistance of PVC inner sheath to cracking (heat shock test)

Standard and date

Standard	IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.9
Test date	13 July 2019

Characteristic test data (inner sheath)

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

Inner sheath

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

Result

The object passed the test.

4.10 Hot set test for XLPE insulations

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.11
Test date 14 August 2019

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	75	80	75	75
- permanent elongation	%	≤ 15	0	0	0	0

Result

The object passed the test.

4.11 Water absorption test on XLPE insulations

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.13
Test period 18 July 2019 until 8 August 2019

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	0,3	0,3	0,3	0,3

Result

The object passed the test.

4.12 Measurement of carbon black content of black MDPE oversheath

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.15
Test date 16 August 2019

item	unit	requirement	measured/determined
- carbon black content	%	2,5±0,5	2,2

Result

The object passed the test.

4.13 Shrinkage test for XLPE insulation

Standard and date

Standard IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.16
Test date 14 August 2019

Characteristic test data

Temperature 130 ± 2 °C
Duration 1 h

item	unit	requirement	measured/determined			
			Red	Yellow	Blue	Black
- shrinkage	%	≤ 4	2	2	2	2

Result

The object passed the test.

4.14 Shrinkage test for MDPE oversheaths

Standard and date

Standard	IEC 60502-1 (2004) + Amd. 1 (2009), clause 18.20
Test period	22 July 2019 until 29 July 2019

Characteristic test data

Temperature	80 ± 2	°C
Duration	5	h
Heating cycles	5	

item	unit	requirement	measured/determined
- shrinkage	%	≤ 3	2

Result

The object passed the test.

5 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	ROADS AND TRANSPORT AUTHORITY STREET LIGHTING 600/1000 V NATIONAL CABLES INDUSTRY U.A.E. 2019 4X150 MM2 CU/XLPE/SWA/MDPE 0,6/1kV IEC 60502
construction	- conductor of copper wires sector shaped stranded - XLPE insulations (red, yellow, blue and black) - polypropylene filler and binder tape - innersheath of extruded PVC compound - armour of galvanized steel wires - outersheath of extruded MDPE
outer diameter of the cable, average	54,5 mm

Result

No deviations from the specified requirements are found.

6 DRAWING

TECHNICAL & QC DEPARTMENT

الوطنية لصناعة الكابلات
NATIONAL CABLES INDUSTRY NCI

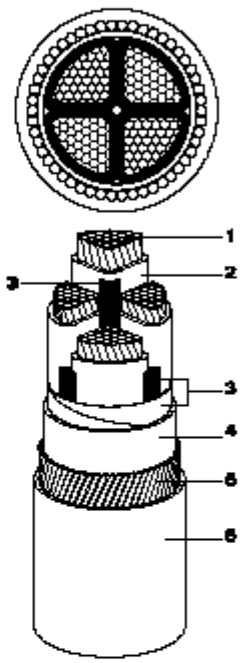
TECHNICAL DATA SHEET

Cable Size : 4x150 mm²	Rated Voltage : 0.6/1 (1.2) kV	Cable Code: 0104042416R
Cable Type : CU/XLPE/SWA/MDPE	Ref. Standards : IEC 60502-1 & RTA Specs	

DIMENSION DATA:

S.NO	DESCRIPTION	UNIT	OFFER DETAILS
1	**CONDUCTOR:**		
	Material		Copper
	Form of stranding		Sectoral Shaped
	Type of conductor		Class 2 to IEC 60228
	D.C. Resistance at 20°C	Ω/km	0.124
2	**INSULATION:**		
	Material		Extruded XLPE
	Thickness of insulation	mm	1.4 (Avg.) / 1.16 (Min.)
	Colors		Red, Yellow, Blue, Black
3	**ASSEMBLY:**		
	Approximate diameter	mm	39.1
	Fillers		Polypropylene yarns
	Binding tape		Polypropylene tape
4	**INNER SHEATH:**		
	Material		Extruded PVC
	Thickness of inner sheath	mm	1.4 (Nom.) / 0.92 (Min.)
	Approximate diameter	mm	41.9
5	**ARMOUR:**		
	Material		Galvanized Round Steel Wire
	Wire diameter	mm	2.5
	Approximate diameter	mm	46.9
6	**OUTER SHEATH:**		
	Material		Extruded MDPE (Type ST7)
	Thickness of outer sheath	mm	2.6 (Nom.) / 1.88 (Min.)
	Approximate overall diameter	mm	52.0
	Color		Black

DRAWING:



CABLE MARKING:

Embossing on the Outer Sheath in Max 50 cm Spacing along TWO lines :

First Line :

ROADS AND TRANSPORT AUTHORITY STREET LIGHTING, 600/1000 VOLTS

Second Line :

NATIONAL CABLES INDUSTRY, U.A.E., "YEAR", 4x150 mm², CU/XLPE/SWA/MDPE, 0.6/1 kV, IEC 60502

PACKAGING:

Approximate weight of complete cable	: 8175 kg/km
Nominal cutting length	: 500 m (± 5%)
Drum type	: Steel or Wooden
Drum dimensions (Approx.):	
• Outer diameter	: 2050 mm
• Outer width	: 1200 mm

All diameters and weights are approximate.

***Prepared by:** Naimuddin* ***Checked by:** Rajasree* ***Approved by:** Altaf Ahmed*

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FORM # TE01/F06 Rev. 02