CENTRAL POWER RESEARCH INSTITUTE

CPRI

TEST CERTIFICATE

Test Certificate Number : CDD- 0081 Dated : 13.10.2016

Name & Address of the Customer : M/s. National Cables Industry.,
P.O.Box 27472,ALSajaa Industrial Area,
Al Dhaid Road, Sharjah, UAE.,

Name & Address of the Manufacturer : M/s. National Cables Industry.,
P.O.Box 27472,ALSajaa Industrial Area,
Al Dhaid Road, Sharjah, UAE

Particulars of sample tested : 1X500/35 sq.mm, 33 kV XLPE Cable
Condition of the sample on receipt : New
Type : XLPE Cable
Designation : Conductor Material : Copper
Size : 500 mm^2
Number of cores : One
Insulation : XLPE
Screen :Copper Wires+ Copper Tape (Open Helix)
Outer sheath : PVC (Black)
Voltage Rating : 33 kV
Embossing : 1X500 /35 mm^2
CU / XLPE / PVC 33 kV NATIONAL CABLES INDUSTRY UAE 2016-PROPERTYOF SAUDI ELECTRICITY COMPANY
Serial Number : 0602020121SEC/2016/215462
Number of Samples tested : One
Date(s) of Test(s) : 18.08.2016 to 29.09.2016
CPRI Sample Code no(s) : DCCDCAB16S0181

Particulars of test conducted : Type Test
Test in accordance with
Standard /Specification : As per IEC 60502-2-2014 & SEC SPEC 11-SDMS-03
Sampling plan : Not Applicable
Customer's requirement : Nil
Deviation if any : Nil

Name of the witnessing persons
Customer's representatives : Nil
Other than customer's representatives : None.
Test subcontracted with address
of the laboratory : Nil

Documents constituting this Certificate (in words)
Number of sheets : Nine
Number of oscillogram/s : Twelve (Three sheets)
Number of graphs : Nil
Number of photos : Nil
Number of test circuit diagrams : Nil
Number of drawings : One

(Thirumurthy)
Test Engineer

(Dr . B. Nageshwara Rao)
Additional Director

CABLES & DIAGNOSTICS DIVISION
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TEST RESULTS

I. TESTS ON CABLE CONDUCTOR

1. Conductor Resistance Test:

a) Specified value (max) : 0.0366 Ω/Km at 20 ^{0} C
b) Observed value : 0.03573 Ω/Km at 20 ^{0} C

2. Conductor Examination:

a) Specified No. of strands: 53 (Min)
b) Observed No. of strands : 61

II. TESTS ON INSULATION

i). Test for Thickness of insulation:

Nominal Thickness (mm)		Minimum Thickness (mm)	
Specified	Observed	Specified	Observed
8.0	8.517	7.10	8.326

ii) Eccentricity of Insulation: ((T_{max} -TD_{min})/ T_{max})

a) Specified : 0.15 (max)
b) Observed : 0.05 mm

2. Tensile strength and Elongation at Break:

A) Before Ageing:

Tensile Strength in N/ mm^2		Elongation at break (%)	
Specified (Min)	Observed	Specified(Min)	Observed
12.5	16.19	200	515.0

B) Ageing:

Sample	Temperature	Duration
Dumb-bell specimens	135 ± 3 ^{0}C	168 hours

C) After Ageing:

Observed Tensile Strength in N/mm^2	Observed Elongation at break (%)
16.24	505.0

D) Variations observed from before ageing samples:

Percentage variations in Tensile Strength (%)		Percentage variations in Elongation at break (%)	
Specified (Max)	Observed	Specified(Max)	Observed
± 25	+0.29	± 25	-1.94

E) After Completed Cable Ageing:

a) Ageing conditions:

Sample	Temperature	Duration
200 mm of Completed cable	100 ± 2°C	168 hours

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TEST RESULTS

b) Observed Values:

Observed Tensile Strength in N/mm^2	Observed Elongation at break (%)
18.66	495.0

c) Variations Observed from Before Ageing Samples:

Percentage variations in Tensile Strength (%)		Percentage variations in Elongation at break (%)	
Specified (Max)	Observed	Specified(Max)	Observed
± 25	+15.26	± 25	-3.88

3. Shrinkage Test:

Sample Length	Test Temperature	Duration	Shrinkage (%)	
			Specified(Max)	Observed
200 mm	130 ± 2 ^{0} C	One Hour	4.0	1.08

4. Hot Set Test:

Test Temperature	Mechanical Stress	Time under Load
200 ± 3 ^{0} C	0.2 MPa	15 minutes

Hot Set Elongation (%)		Permanent Set Elongation (%)	
Specified(Max)	Observed	Specified(Max)	Observed
175.0%	49.0	15.0 %	0.90

5..Water Absorption Test:

Test Temperature	Duration	Water Absorbed (mg/cm^2)	
		Specified(Max)	Observed
85 ± 2 ^{0} C	336 Hours	1.0	0.033

III. TEST ON SEMICONDUCTING LAYERS

1. Dimensions:

Sl. No.	Sample	Specified Values(mm)		Observed Values (mm)	
		Minimum	Nominal	Minimum	Nominal
1	Conductor Screen	0.51	--	1.429	1.521
2	Insulation screen	1.40	--	1.525	1.760

2. Resistivity Test for Semiconducting layers:

a) Temperature during measurement: 90 ^{0} C

b) Observed values:

Sl. No.	Sample	Observed Resistivity in Ω-metre		Specified Resistivity in Ω-metre(Max)	
		Unaged	After completed cable ageing at 100 Deg.C for 168 Hours	Unaged	After completed cable ageing at 100 Deg.C for 168 Hours
1	Conductor Screen	2.16	3.51	1000	1000
2	Insulation screen	32.6	36.9	500	500

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3.STRIPPABILITY TEST FOR INSULATION SCREEN:

a) Specified force required to remove 10 mm strip from the insulation : Between 4N to 45 N
b) Observed value for unaged::33.1 N
c) Observed value for aged : 24.5 N

IV. TESTS ON PVC OUTERSHEATH:

1. Thickness:

a) Specified Nominal : 2.60 mm
b) Specified Minimum : 1.88 mm
c) Observed Nominal : 2.75 mm
d) Observed Minimum : 2.69 mm

2. Tensile Strength & Elongation at Break:

A. Before Ageing

a) Specified Tensile Strength (Min) : 12.5 N/mm^2
b) Specified Elongation at Break (Min) : 150 %
c) Observed Tensile Strength :15.34 N/mm^2
d) Observed Elongation at Break : 240.0 %

B. Ageing:

a) Sample : Dumb-bell specimens
b) Temperature : 100 ± 2^0 C
c) Duration : 168 Hours

C. After Ageing:

a) Specified Tensile Strength (Min) : 12.5 N/mm^2
b) Specified Elongation at Break (Min) : 150 %
c) Observed Tensile Strength : 14.06 N/mm^2
d) Elongation at break : 245.0 %

D. Variations observed from before ageing samples:

a) Specified percentage variations (Max):± 25 %
b) Observed percentage variations:
Tensile strength : -8.34 %
Elongation at break : +2.08 %

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TEST RESULTS

E. Completed Cable Ageing:

Ageing conditions:

a) Sample : 200 mm of Completed cable
b) Duration : 168 hours
c) Temperature : 100 ± 2^{0} C

F) After Completed Cable Ageing:

a) Specified Tensile Strength (Min) : 12.5 N/mm^2
b) Specified Elongation at Break (Min) : 150 %
c) Observed Tensile Strength : 17.78 N/mm^2
d) Elongation at break : 250.0 %

G) Variations observed from before ageing samples:

a) Specified percentage variations (Max):± 25 %
b) Observed percentage variations:
Tensile strength :+15.90 %
Elongation at break : +4.17 %

3. PRESSURE TEST AT HIGH TEMPERATURE:

a) Test temperature :90 ± 2^{0} C
b) Duration : 6 hours
c) Depth of indentation (specified) : 50 % (Max)
d) Depth of indentation (Observed) :18.39 %

4. LOSS OF MASS TEST:

a) Sample :Dumb-bell specimens
b) Temperature : 100 ± 2^{0} C
c) Duration : 168 hours
d) Specified loss of mass (Max) : 1.5 mg/cm^2
e) Observed loss of mass : 0.62 mg/cm^2

5. HEAT SHOCK TEST;

a) Temperature : 150 ± 3 Deg.C
b) Duration : One hour
c) REQUIREMENT : No Cracks or any other abnormalities should be observed after test.
d) RESULT : No Cracks or any other abnormalities were observed after test.

6. ELONGATION TEST AT LOW TEMPERATURE:

a) Specified Elongation at Break at -15± 2°C: 20 % (min)
b) Observed Elongation at Break at -15± 2°C: 145 %

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7. IMPACT TEST AT LOW TEMPERATURE:

a) Test Temperature : -15 ± 2^{0} C
b) Mass of the Hammer : 1250 gms
c) REQUIREMENT : No cracks to be observed after test on both outer and inner surface of sheath
d) RESULT : No cracks or any other abnormalities were observed on both outer and inner surface of the Bedding.

V TEST FOR VERTICAL FLAME PROPAGATION: (IEC 60332-1-2 /2004)

a) Time of application of flame : 240 Seconds
b) Length of the unaffected portion of cable from the bottom of the top clamp
Specified : 50 mm (min)
Observed : 410 mm
c) Length of the charred portion of cable downwards from the bottom of the top clamp
Specified : 540 mm (max)
Observed : 500 mm

VI. ELECTRICAL TESTS:

The following electrical tests were carried out in the order of sequence.

1. Bending Test :

a) Outer Dia of conductor : 26.99 mm
b) Outer Dia. Of Cable : 58.01 mm
c) Diameter of test cylinder : 1750 mm
d) Number of bending cycles : Three

2. Partial Discharge Test:

a) Length of the sample : 11.30 metres
b) Sensitivity of the detector : 5 pC
c) Status of the sample : Cable with two ends in oil terminations
d) Method of connection : High voltage applied to conductor and metallic screen grounded.
e) Measuring voltage (1.73 Uo) : 33 kV ac
f) Specified discharge magnitude : 5 pC (Max)
g) Observed Discharge magnitude : Less than 5 pC

3. Tan Delta Measurement As A Function Of Temperature:

a) Temperature of the conductor during test : 95 to 100 ^{0}C
b) Test Voltage during measurement : 2 kV ac
c) Specified Tan delta at 95 to 100 Deg. C(Max) : 0.008
d) Observed Tan delta at 95-100 Deg.C : 0.000782
e) Observed Capacitance (pF) : 2726.32 pF

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TEST RESULTS

4. Heating Cycle Test:

a) Conductor Temperature during Heating Cycle : 95 to 100^0 C
b) Heating period after attaining Temperature : 2 hours
c) Natural Cooling Period : 3 hours
d) Number of heating cycles : 20 Only

5. Partial Discharge Test after 20 Heating Cycle Test:

a) Length of the sample :11.30 metres
b) Sensitivity of the detector : 5 pC
c) Status of the sample : Cable with two ends in oil terminations
d) Method of connection : High voltage applied to conductor and metallic screen grounded.
e) Measuring voltage (1.73 Uo) : 33 kV ac
f) Specified discharge magnitude : 5 pC (Max)
g) Observed Discharge magnitude : Less than 5 pC

6. Impulse Withstand Test:

Test Voltage kV peak	Temperature of Conductor During Test(^{0}C)	Ambient Temperature (^{0}C)		No.of Impulses
		Dry Bulb	Wet Bulb	
170.0	95-100 Deg.C	29.0	27.0	10 Positive & 10 Negative

Test Connection	The impulse source was connected to the conductor (ends shorted) and the screen connected to ground.

Polarity	Shot Number	Oscillogram Number	Test Result
Positive	First	1	Withstood
	Tenth	10	
Negative	First	12	
	Tenth	21	

(OSCILLOGRAMS ENCLOSED)

7. HIGH VOLTAGE TEST: (After Impulse Test)

a) Test connection : High Voltage connected to conductor & Metallic screen grounded.
b) Test Voltage (3.5 Uo) : 66.5 kV ac
c) Duration of test : Fifteen minutes
d) Ambient Temperature : 29^0 C
e) Length of Sample : 11.30 metres
f) Result : Withstood

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TEST RESULTS

8. HIGH VOLTAGE TEST: (Four Hour)

a)	Test connection	: High Voltage connected to conductor & Metallic screen grounded.
b)	Test Voltage (4 Uo)	: 76 kV ac
c)	Duration of test	: 4 Hours
d)	Ambient Temperature	: 29^0 C
e)	Length of Sample	: 11.30 metre
f)	Result	: Withstood

VII. Conclusion: The cable sample submitted meets the requirement of all type tests as per IEC 60502-2 -2014 .

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Test Certificate No.: CDD-0081 **Date: 13.10.2016**

NOTE

a) The Test results relate only to the item(s) tested.

b) Publication or reproduction of this certificate in any form other than by complete set of the Whole Certificate and in the language written is not permitted without the written consent of CPRI.

c) Any Corrections/erasure invalidates this test Certificate.

d) NABL has Accredited this laboratory as per ISO 17025-2005, Vide Certificate No. T-0010 for the tests carried out.

e) Any anomaly/discrepancy in this test Certificate should be brought to our notice within 45 days from the date of issue.

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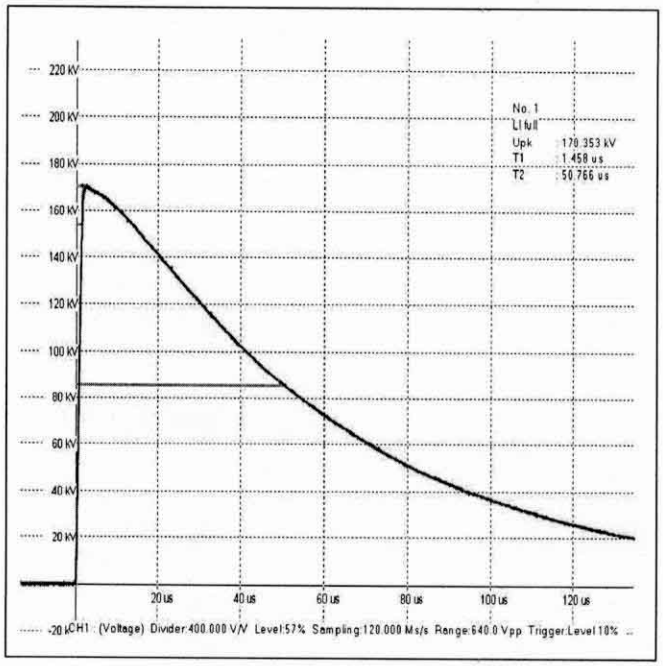
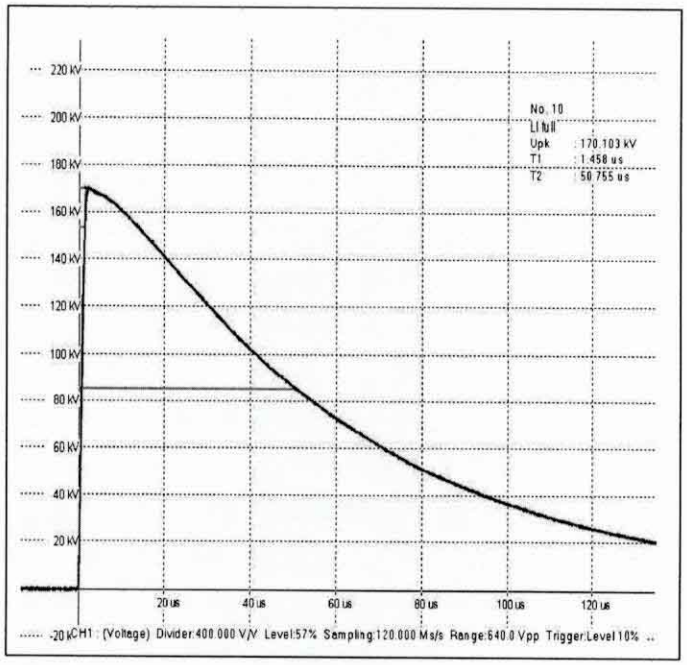
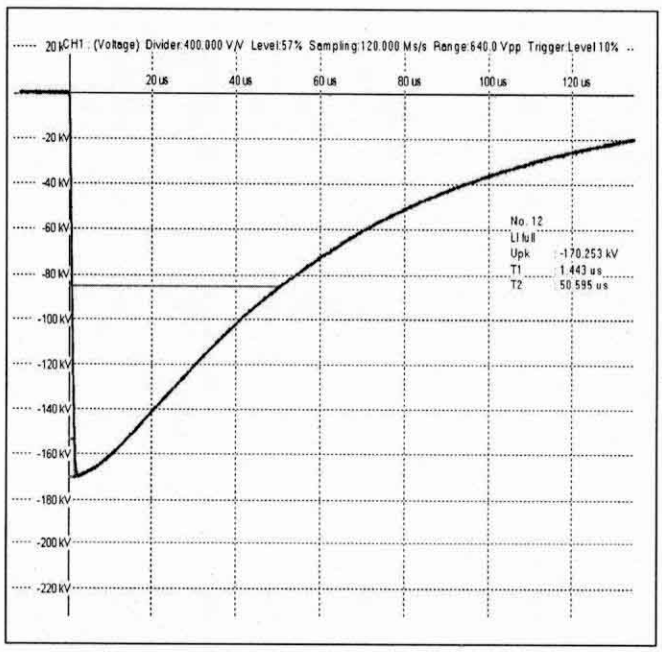
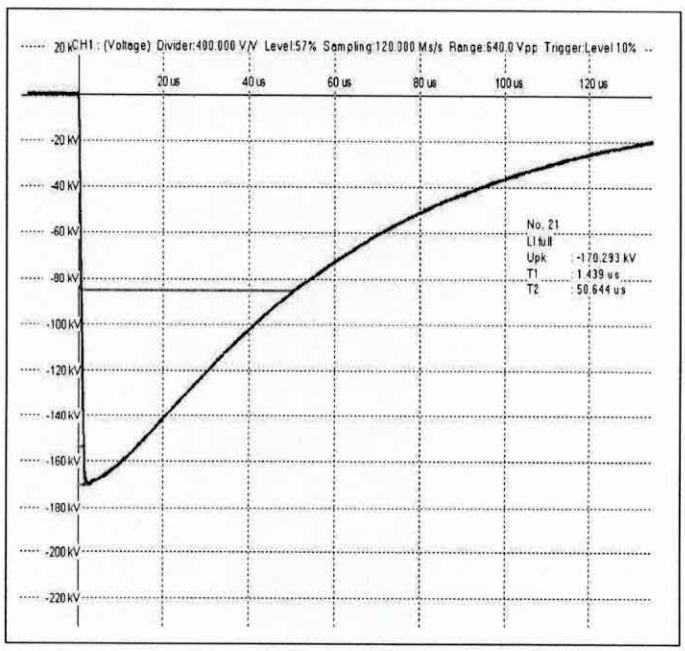
Customer : M/s. NATIONAL CABLES INDUSTRY,UAE
Test Report No. & Date : CDD –0081 Dt. 13.10.2016
Sample Code : DCCDCAB16S0181









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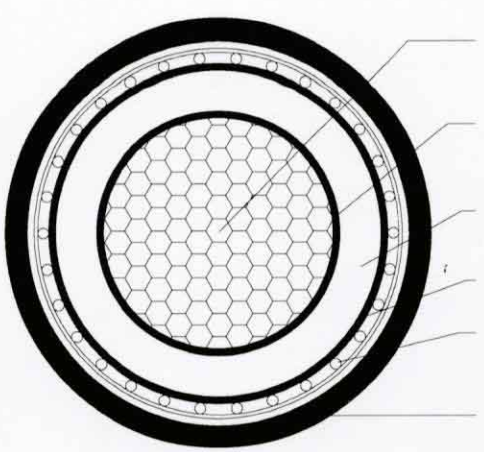
19/33 (36) kV, 1 CORE, XLPE INSULATED, COPPER WIRES SCREENED AND PVC SHEATHED (CU/XLPE/PVC) POWER CABLE

Applicable Standard : IEC 60502-2 and SEC Specification 11-SDMS-03



यह ड्राइंग सीपीआरई की परीक्षण रिपोर्ट से संबंधित है।
THIS DRAWING PERTAINS TO CPRI TEST REPORT
सीडीडी / No. CDD...0081.....
दिनांक / Dated :...13.10.2016.....
परीक्षण इंजीनियर/Test Engineer

Size:1x500/35 mm², CU/XLPE/PVC - 33 kV

1. **Conductor**	:	**Plain annealed Copper, Circular Stranded Compacted**	
Approximate diameter		*26.7 mm*	
2. **Conductor Screen**	:	**Extruded semi-conductive compound**	
Minimum thickness:		*0.51 mm / Approximate diameter:*	*29.5 mm*
3. **Insulation**	:	**Extruded Cross linked Polyethylene (XLPE)**	
Nominal thickness:		*8.0 mm / Approximate diameter:*	*45.5 mm*
4. **Insulation Screen**	:	**Extruded semi-conductive compound**	
Min. / Max. thickness:		*1.4 / 2.29 mm / Approximate diameter:*	*48.7 mm*
5. **Metallic Screen**	:	**Plain annealed copper wires + copper tape (open helix)**	
Nominal cross section:		*35 mm² / Approximate diameter:*	*50.6 mm*
6. **Outer Sheath**	:	**Extruded Polyvinyl Chloride (PVC, Type ST2), color: Black**	
Nominal thickness:		*2.6 mm / Approximate diameter:*	*57.0 mm*

Embossing on Outer Sheath in Max 100 cm Spacing (English & Arabic):

1x500/35 MM², CU/XLPE/PVC, 33 kV, NATIONAL CABLES INDUSTRY, UAE, 2016
PROPERTY OF SAUDI ELECTRICITY COMPANY

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