CENTRAL POWER RESEARCH INSTITUTE

CPRI

TEST CERTIFICATE

Test Certificate Number : CDD- 0082 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 : 3X 500/35 sq.mm, 8.7/15 kV XLPE Cable
Condition of the sample on receipt : New
Type : XLPE Cable
Designation : Conductor Material : Aluminium
Size : 500 mm^2
Number of cores : Three
Insulation : XLPE
Armour : Galvanised Steel Tape (Double Layer)
Outer sheath : Red PVC (ST2)
Voltage Rating : 8.7/15 kV
Embossing : 3X500 /35 mm^2
AL / XLPE / STA / PVC 15 kV NATIONAL CABLES INDUSTRY UAE 2016-PROPERTY OF SAUDI ELECTRICITY COMPANY

Serial Number : 0412024321 SEC/2016/215462
Number of Samples tested : One
Date(s) of Test(s) : 22.08.2016 to 29.09.2016
CPRI Sample Code no(s) : DCCDCAB16S0180
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 report (in words)
Number of sheets : Eleven
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 & DIAGNOSTIC DIVISION
P.B.NO 8066, SADASHIVANAGAR P.O
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TEST RESULTS

I. TESTS ON CONDUCTOR

1. CONDUCTOR RESISTANCE TEST:

Sl.No	Core Identification	Resistance in Ω/Km at 20^0 C	
		Observed values	Specified Value(Max)
1.	Red	0.05833	0.0605
2.	Yellow	0.06032	
3.	Blue	0.05788	

2. CONDUCTOR EXAMINATION:

Sl.No	Core Identification	No. of strands in the Conductor	
		Observed values	Specified Value(Min)
1.	Red	61	53
2.	Yellow	61	
3.	Blue	61	

II TESTS ON INSULATION

1. (a) TEST FOR THICKNESS OF INSULATION:

Sl. No	Core Identification	Observed Values in mm		Specified Values in mm	
		Minimum	Average	Minimum	Average
1.	Red	4.623	4.739	3.95	4.50
2.	Yellow	4.638	4.696		
3.	Blue	4.649	4.735		

1(b). Eccentricity of Insulation:

Sl. No.	Core Identification	Eccentricity	
		Observed values	Specified value(Max)
1	Red	0.042	0.15
2	Yellow	0.050	
3	Blue	0.035	

2. TENSILE STRENGTH AND ELONGATION AT BREAK

A. BEFORE AGEING:

Sl. No	Core Identification	Observed Values		Specified Values(Min)	
		Tensile strength N/mm^2	Elongation At Break (%)	Tensile strength N/mm^2	Elongation at Break(%)
1.	Red	18.83	556.00	12.5	200.0
2.	Yellow	17.42	526.00		
3.	Blue	18.46	507.50		

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TEST RESULTS

B. AGEING:

Sample	Temperature	Duration
Dumb- bell Specimens	135 ± 3^{0} C	168 Hours

C. AFTER AGEING:

Sl.No	Core Identification	Observed Values	
		Tensile Strength N/mm^2	Elongation at Break (%)
1.	Red	20.81	539.00
2.	Yellow	19.70	556.00
3.	Blue	19.58	538.35

D. VARIATIONS OBSERVED FROM BEFORE AGEING SAMPLES

Sl. No.	Core Identification	Observed % Variations		Specified % Variations (Max)	
		Tensile strength (%)	Elongation At Break (%)	Tensile Strength (%)	Elongation at Break (%)
1.	Red	10.49	-3.06	± 25	± 25
2.	Yellow	13.08	5.70		
3.	Blue	6.07	6.08		

E COMPLETED CABLE AGEING:

Sample	Temperature	Duration
200 mm Complete cable	100 ± 2^{0} C	168 Hours

F. AFTER COMPLETED CABLE AGEING:

Sl.No	Core Identification	Observed Values	
		Tensile Strength N/mm^2	Elongation at Break (%)
1.	Red	18.68	528.90
2.	Yellow	17.90	522.50
3.	Blue	18.49	518.80

G. VARIATIONS OBSERVED FROM BEFORE AGEING SAMPLES

Sl. No.	Core Identification	Observed % Variations		Specified % Variations (Max)	
		Tensile strength (%)	Elongation At Break (%)	Tensile Strength (%)	Elongation at Break (%)
1.	Red	-0.78	-4.87	± 25	± 25
2.	Yellow	2.79	-0.67		
3.	Blue	0.13	2.23		

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TEST RESULTS

3. WATER ABSORPTION TEST:(GRAVIMETRIC)

Sl.No	Core Identification	Water absorbed in mg/cm^2	
		Observed values	Specified Value (Max)
1.	Red	0.038	1.0
2.	Yellow	0.028	
3.	Blue	0.033	

4. SHRINKAGE TEST

Sl.No	Core Identification	Shrinkage in Percentage(%)	
		Observed values	Specified Value(Max)
1.	Red	0.90	4.0
2.	Yellow	1.12	
3.	Blue	0.89	

5. HOT SET TEST:

Sl. No.	Core Identification	Observed Values(%)		Specified Values(Max) (%)	
		Hot set Elongation	Permanent set Elongation	Hot set Elongation	Permanent set Elongation
1.	Red	50.0	1.0	175.0	15.0
2.	Yellow	44.30	0.98		
3.	Blue	44.00	1.1		

III TESTS ON SEMICONDUCTING SCREEN:

1(a). Test for Thickness of conductor Semiconducting screen:

Sl. No	Core Identification	Observed Values(mm)		Specified Values(mm)	
		Minimum	Nominal	Minimum	Nominal
1.	Red	0.918	1.010	-	0.51
2.	Yellow	0.957	1.026		
3.	Blue	0.949	1.016		

1(b). Test for Thickness of insulation Semiconducting screen

Sl. No	Core Identification	Observed Values(mm)		Specified Values(mm)	
		Minimum	Nominal	Minimum	Nominal
1.	Red	1.600	1.693	-	1.40
2.	Yellow	1.797	1.828		
3.	Blue	1.415	1.627		

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TEST RESULTS

2. RESISTIVITY OF SEMICONDUCTING INSULATION SCREEN

Sl.No	Core Identification	Resistivity of insulation screen in Ω-m at 90^0 C			
		Observed Values		Specified Value (max)	
		Unaged Sample	Aged sample	Unaged sample	Aged sample
1.	Red	7.5	5.3	500	500
2.	Yellow	10.2	4.3		
3.	Blue	11.2	6.2		

3. RESISTIVITY OF SEMICONDUCTING CONDUCTOR SCREEN

Sl.No	Core Identification	Resistivity of Conductor screen in Ω-m at 90^0 C			
		Observed Values		Specified Value (Max)	
		Unaged Sample	Aged sample	Unaged Sample	Aged Sample
1.	Red	1.3	5.6	1000	1000
2.	Yellow	1.1	4.8		
3.	Blue	1.1	5.2		

4.STRIPPABILITY TEST FOR INSULATION SCREEN:

a) Specified force required to remove 10 mm strip from the insulation : Between 4N to 45 N

b) Observed values:

Sl.No.	Core Identification	Force required to remove 10 mm strip for a length of 100 mm (N)	
		Unaged Sample	Aged Sample
1	Red	34.2	24.6
2	Yellow	32.7	28.2
3	Blue	32.7	25.8

IV. DIMENSIONS OF GALVANIZED STEEL TAPE ARMOUR:

a) Observed Nominal Width : 59.0 mm
b) specified Nominal Thickness :0.80 mm
c) Observed Nominal Thickness :0.80 mm

V. DIMENSIONS OF PE SEPARATION SHEATH:

a) Declared Nominal Thickness : 2.30 mm
b) Observed Nominal Thickness : 2.36 mm

VI . TESTS ON PVC OUTERSHEATH:

1. Thickness:

i) Specified Nominal : 4.20 mm
ii) Specified Minimum : 3.16 mm
iii) Observed Nominal : 4.49 mm
iv) Observed Minimum : 4.01 mm

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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	:15.64 N/mm^2
d) Observed Elongation at Break	: 250.0 %

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	: 16.87 N/mm^2
d) Elongation at break	: 236.0 %

D. Variations observed from before ageing samples:

a) Specified percentage variations (Max):± 25 %

b) Observed percentage variations:

Tensile strength	: +7.92 %
Elongation at break	: - 5.60 %

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	: 15.56 N/mm^2
d) Elongation at break	: 242.5 %

G) Variations observed from before ageing samples:

a) Specified percentage variations (Max):± 25 %

b) Observed percentage variations:

Tensile strength	: -0.48 %
Elongation at break	: -3.0 %

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)	:15.43 %

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4. LOSS OF MASS TEST:

a) Sample	:Dumb-bell specimens
b) Temperature	: 100 $\pm 2^0$ C
c) Duration	: 168 hours
d) Specified loss of mass (Max)	: 1.5 mg/cm^2
e) Observed loss of mass	: 0.63 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: 127 %

7. IMPACT TEST AT LOW TEMPERATURE:

a) Test Temperature : -15 ± 2 ^{0} C
b) Mass of the Hammer : 1500 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.

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

a) Time of application of flame : 480 Seconds
b) Length of the unaffected portion of cable from the bottom of the top clamp
Specified : 50 mm (min)
Observed : 400 mm
c) Length of the charred portion of cable downwards from the bottom of the top clamp
Specified : 540 mm (max)
Observed : 500 mm

VIII. ELECTRICAL TESTS:

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

1. Bending Test :

a) Outer Dia of conductor	: 29.34 mm
b) Outer Dia. Of Cable	: 107.61 mm
c) Diameter of test cylinder	: 2100 mm
d) Number of bending cycles	: Three

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2. Partial Discharge Test:

a) Length of the sample : 11.30 metres
b) Sensitivity of the detector : 5 pC
c) Method of connection : High voltage applied to test core conductor and other cores shorted to grounded screen and armour.
d) Measuring voltage (1.73 Uo) :15 kV ac
e) Specified discharge magnitude at 1.73 Uo (Max) : 5 pC
f) Observed Discharge magnitude :

Sl.No.	Core Identification	Discharge magnitude in pC
1.	Red	Less than 5 pC
2.	Yellow	Less than 5 pC
3.	Blue	Less than 5 pC

3. Tan Delta measurement as a function of Temperature

a) Temperature of the conductor during test : 95 -100^0 C
b) Test Voltage during measurement : 2 kV ac
c) Specified Tan delta(Max) : 0.004
d) Observed Values:-

Sl.No.	Core Identification	Capacitance in pF	Tan deltaAt 98^0 C
1.	Red	4420.00	0.000756
2.	Yellow	4469.20	0.000754
3.	Blue	4358.80	0.000738

4. Heating Cycle Test:

a) Conductor Temperature during Heating Cycle : 95 -100^0 C
b) Total Duration of Heating cycle : 5 hours
c) Heating period after attaining Temperature : 2 hours
d) Natural Cooling Period : 3 hours
e) Number of heating cycles : 20 Only

5. Partial Discharge Test:

a) Length of the sample : 11.30 metres
b) Sensitivity of the detector : 5 pC
c) Method of connection : High voltage applied to test core conductor and other cores shorted to grounded screen and armour
d) Measuring voltage (1.73 Uo) :15 kV ac
e) Specified discharge magnitude at 1.73 Uo (Max) : 5 pC
f) Observed Discharge magnitudes :

Sl.No.	Core Identification	Discharge magnitude in pC
1.	Red	Less than 5 pC
2.	Yellow	Less than 5 pC
3.	Blue	Less than 5 pC

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TEST RESULTS

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	
95	95-100	29.0	27.0	10 Positive & 10 Negative

Test Connection	The impulse source was connected to the conductor of the particular core (ends shorted) under test and the screen connected to ground. The conductors of the other two cores which were not under test were shorted together with screen and connected to ground.
Test Result	The three cores of cable withstood ten positive and ten negative polarity lightning impulse voltage applications of 95 kV peak.

Core	Polarity	Shot Number	Oscillogram Number
Red	Positive	First	1
		Tenth	10
	Negative	First	12
		Tenth	21
Yellow	Positive	First	23
		Tenth	32
	Negative	First	34
		Tenth	43
Blue	Positive	First	45
		Tenth	54
	Negative	First	56
		Tenth	65

(OSCILLOGRAMS ENCLOSED)

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7. High Voltage Test: (After Impulse Test)

a) Test connection : High voltage connected to test core conductor & other cores shorted to grounded shield and armour
b) Test Voltage : 30.5 kV ac
c) Duration of test : Fifteen Minutes
d) Ambient Temperature : 29 ^{0}C
e) Length of Sample : 11.30 metres
f) Result

Sl.No.	Core Identification	Remarks
1.	Red	WITHSTOOD
2.	Yellow	WITHSTOOD
3.	Blue	WITHSTOOD

8. High Voltage Test: (Type Test)

a) Test connection : High voltage connected to test core conductor & other cores shorted to grounded shield and armour
b) Test Voltage : 35 kV ac
c) Duration of test : Four Hours
d) Ambient Temperature : 29 ^{0}C
e) Length of Sample : 11.30 metres
f) Result

Sl.No.	Core Identification	Remarks
1.	Red	WITHSTOOD
2.	Yellow	WITHSTOOD
3.	Blue	WITHSTOOD

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

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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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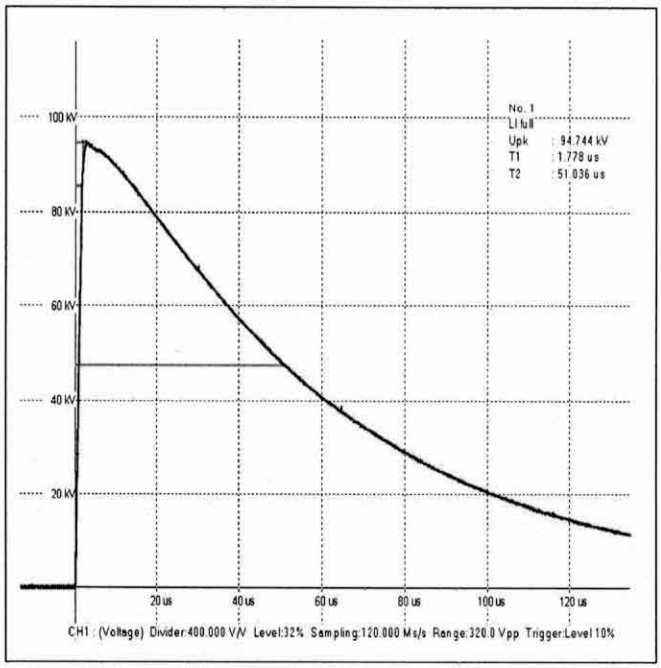
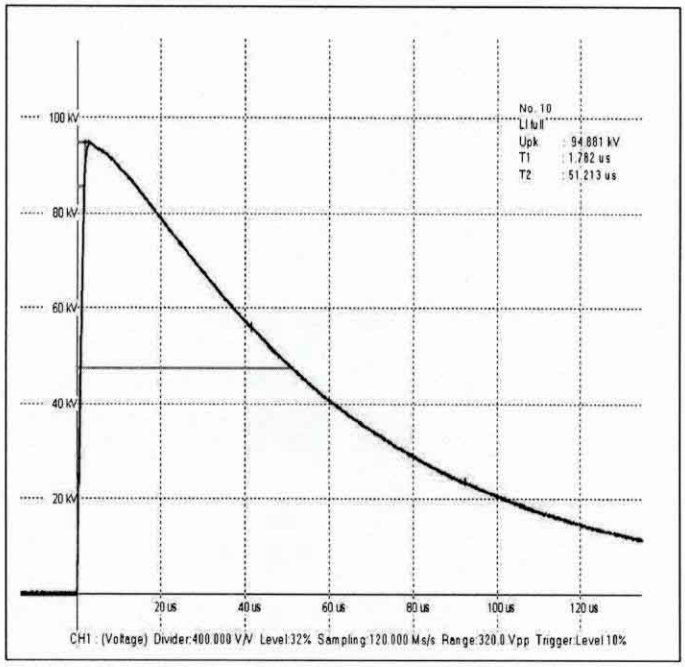
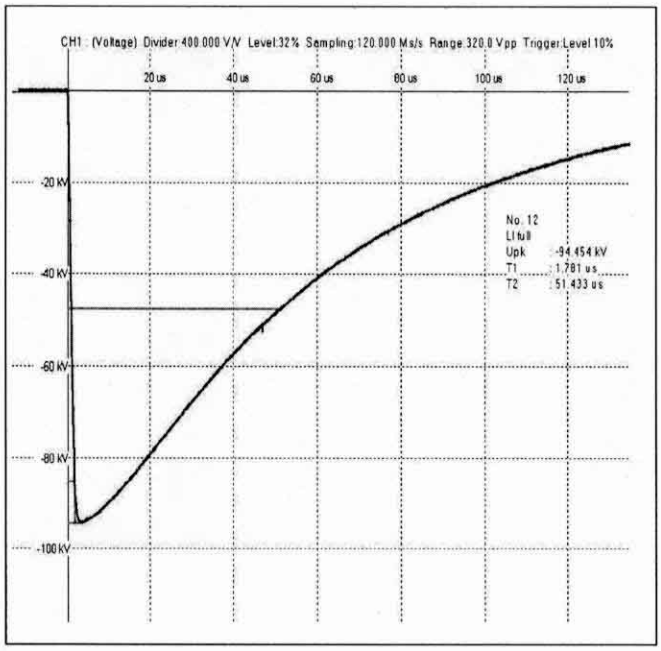
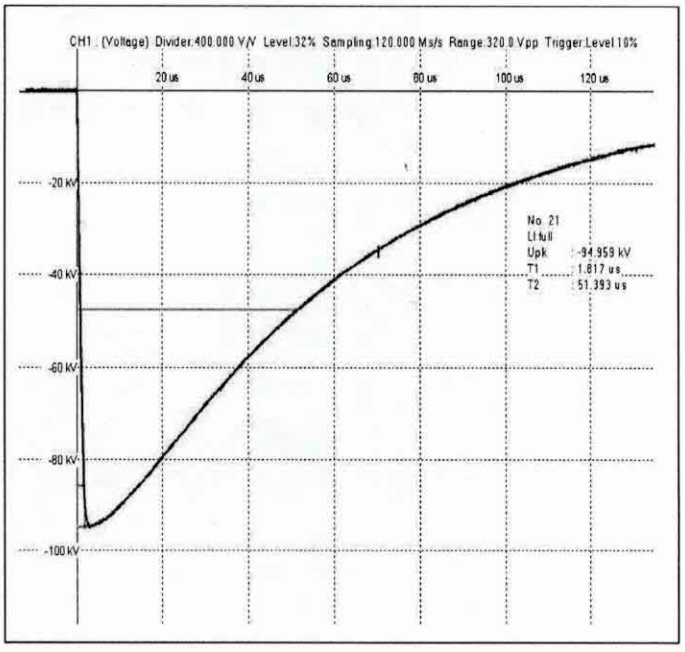
CPRI

Customer : M/s. NATIONAL CABLES INDUSTRY, UAE
Test Report No. & Date : CDD – 0082 Dt. 13.10.2016
Sample Code : DCCDCAB16S0180
Core : Red









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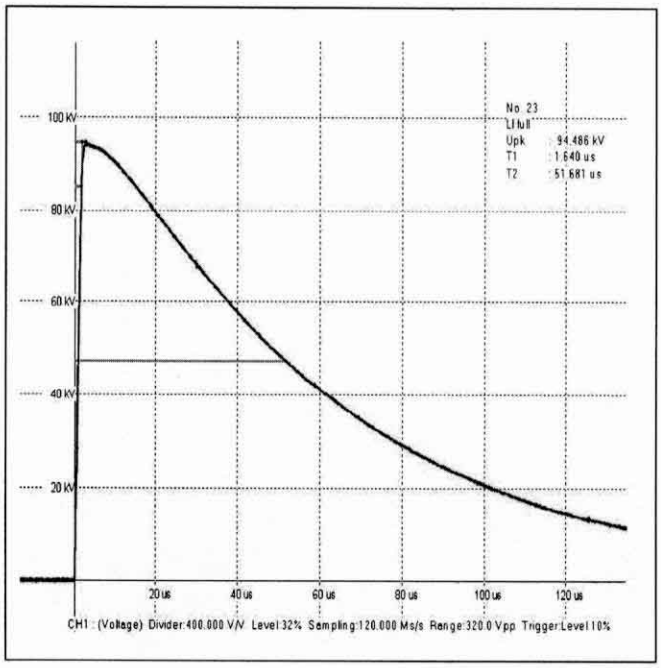
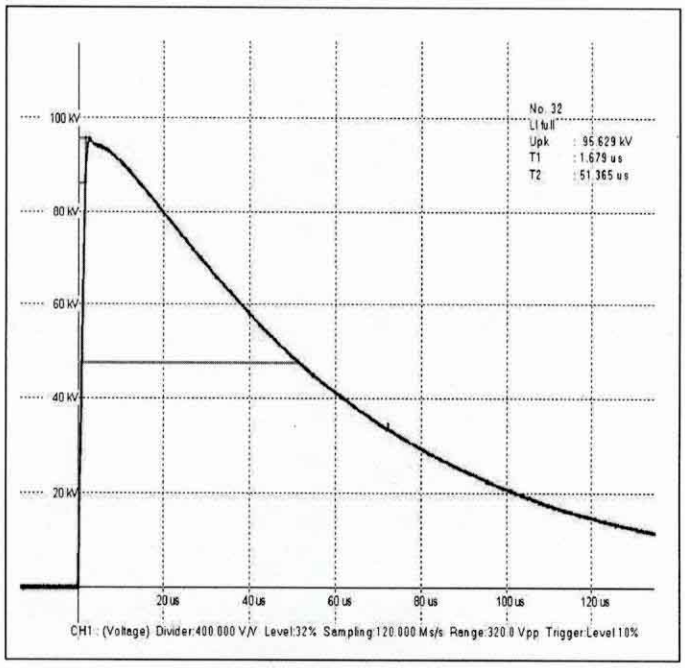
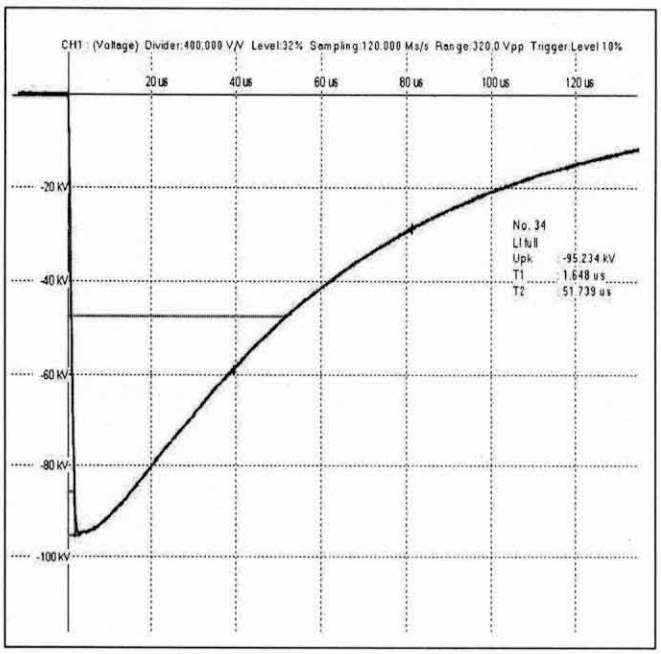
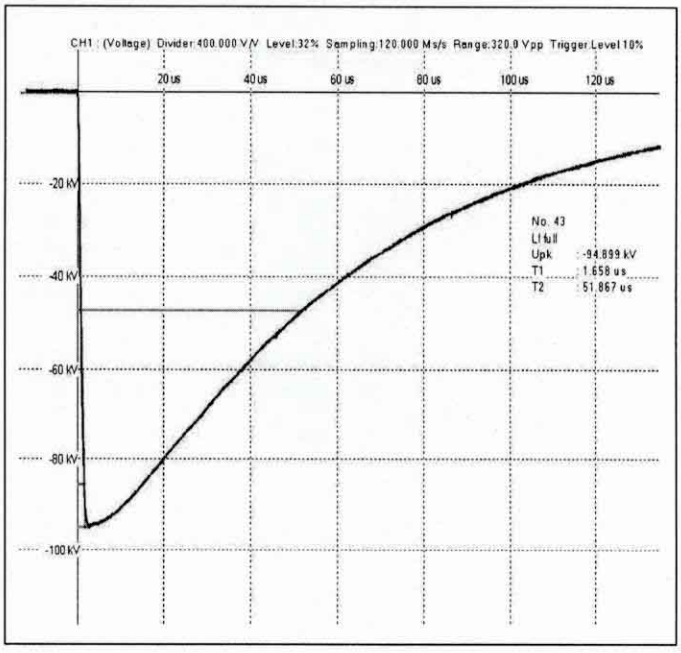
CPRI

Customer : M/s. NATIONAL CABLES INDUSTRY,UAE
Test Report No. & Date : CDD –0082 Dt. 13.10.2016
Sample Code : DCCDCAB16S0180
Core : Yellow









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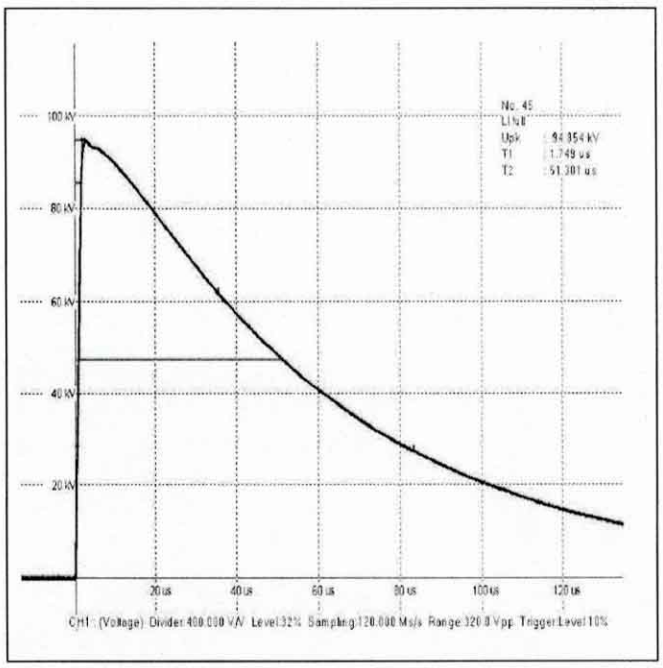
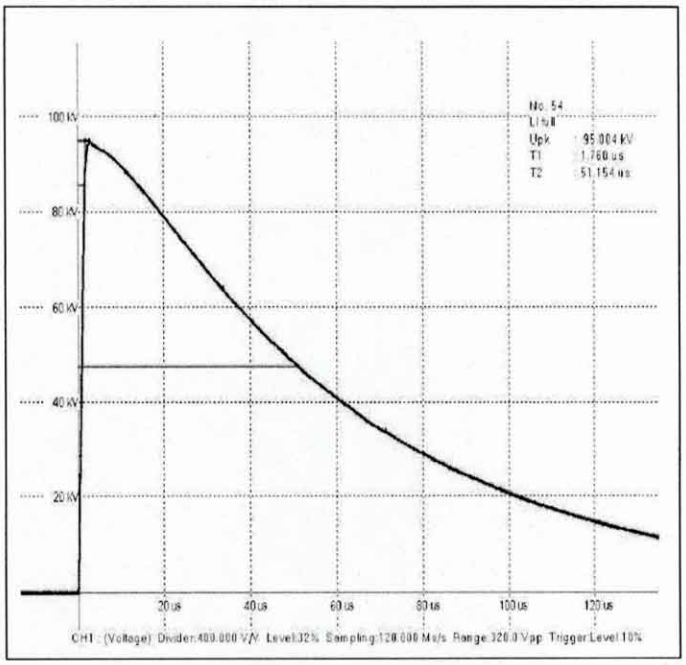
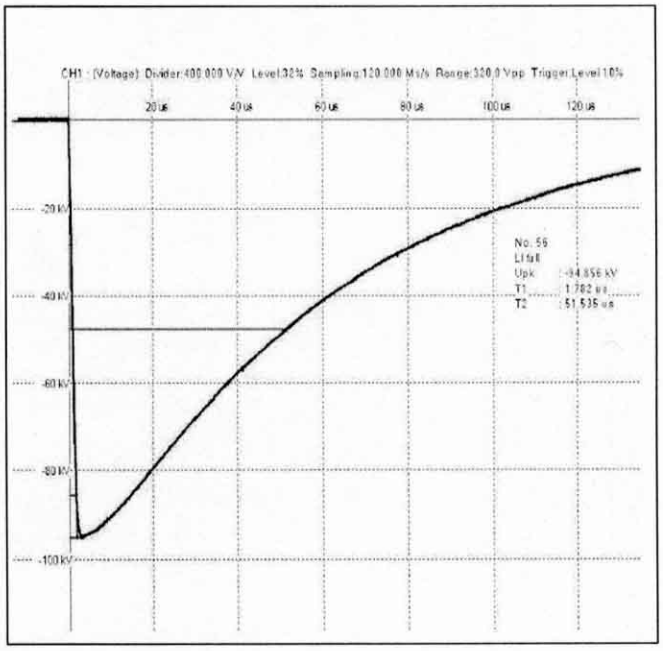
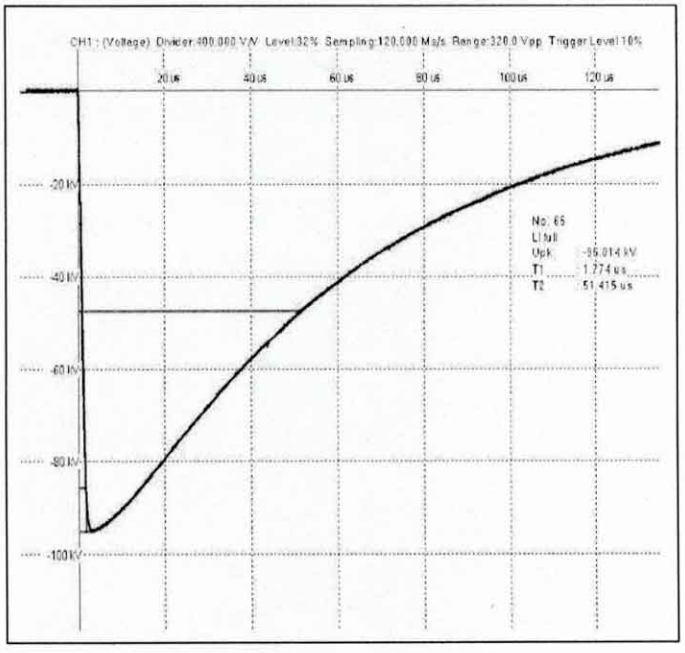
Customer : M/s. NATIONAL CABLE INDUSTRY, UAE
Test Report No. & Date : CDD – 0082 Dt. 13.10.2016
Sample Code : DCCDCAB16S0180
Core : Blue









(Thirumurthy)
Test Engineer

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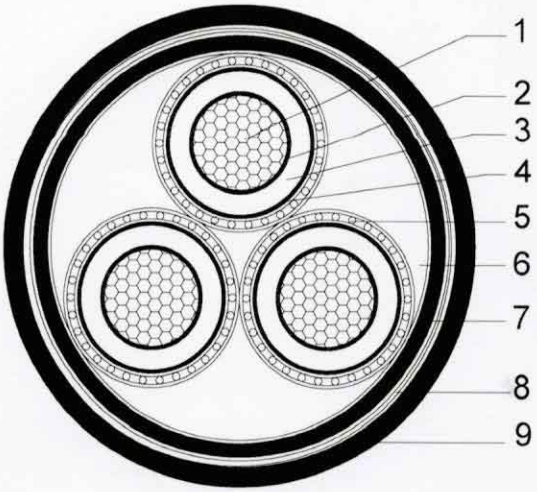
الوطنيـــة لصناعـــة الكابلات
NATIONAL CABLES INDUSTRY

8.7/15 (17.5) kV, 3 CORES, XLPE INSULATED, COPPER WIRES SCREENED GALVANIZED STEEL TAPE ARMOURED AND PVC SHEATHED (AL/XLPE/STA/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
सं. सीडीडी / No. CDD.....0082.....
दिनांक / Dated :.....13.10.2016.....
परीक्षण इंजीनियर/Test Engineer

Size:3x500/35 mm², AL/XLPE/STA/PVC - 15 kV

1. **Conductor**	:	**Aluminium, Circular Stranded Compacted**	
Approximate diamete		*27.0 mm*	
2. **Conductor Screen**	:	**Extruded semi-conductive compound**	
Minimum thickness:		*0.51 mm / Approximate diameter:*	*29.2 mm*
3. **Insulation**	:	**Extruded Cross linked Polyethylene (XLPE)**	
Nominal thickness:		*4.5 mm / Approximate diameter:*	*38.2 mm*
4. **Insulation Screen**	:	**Extruded semi-conductive compound**	
Min. / Max. thickness:		*1.4 / 2.29 mm / Approximate diameter:*	*41.4 mm*
5. **Metallic Screen**	:	**Plain annealed copper wires + copper tape (open helix)**	
Nominal cross section:		*35 mm² / Approximate diameter:*	*43.1 mm*
6. **Filler**	:	**Non-Hygroscopic Polypropylene Strings**	
7. **Separation Sheath**	:	**Extruded Polyethylene (PE)**	
Nominal thickness:		*2.3 mm / Approximate diameter:*	*98.0 mm*
8. **Armour**	:	**Double layers of Galvanized Steel Tapes (STA)**	
Nominal tape's thickness:		*0.8 mm / Approximate diameter:*	*101.2 mm*
9. **Outer Sheath**	:	**Extruded Polyvinyl Chloride (PVC, Type ST2), color: RED**	
Nominal thickness:		*4.2 mm / Approximate diameter:*	*110 mm*

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

3x500/35 MM², AL/XLPE/STA/PVC, 15 kV, NATIONAL CABLES INDUSTRY, UAE, 2016
PROPERTY OF SAUDI ELECTRICITY COMPANY

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