केन्द्रीय विद्युत अनुसंधान संस्थान
(भारत सरकार की सोसाइटी, विद्युत मंत्रालय)
प्रो सर सी. वी. रामन रोड़, सदाशिवनगर डाक घर, पो. बा. सं. 8066, बंगलूर - 560 080
CENTRAL POWER RESEARCH INSTITUTE
(A Govt of India Society under Min. of Power)
Prof. Sir C.V. Raman Road, Sadashivanagar P.O., P.B. No. 8066, Bangalore - 560 080, India
वेबसाइट/website : http://www.cpri.in

E-mail: mallik@cpri.in

DIAGNOSTIC, CABLES & CAPACITORS DIVISION

CABLES LAB

No. 2/1/CABLES/15-16

Date: 13.07.2015

KEC INTERNATIONAL LTD., (Cables Division)
Plot No. 803, Samlaya Savli Road
Village-Godampura Taluka-Savli, Vadodara
Gujarat-391520.

Dear Sir,

Sub: Test on 1x240 sq.mm, 26/45(52) kv XLPE insulated FRLS PVC sheathed and FRLSOH sheathed Armoured cable.
Ref: Letter dated 12/02/2015

With reference to the above, test has been completed and our Test Report No DCCD-14644 & 14645 is enclosed.

In order to prevent tampering of test report, CPRI has introduced hologram on the first page of the test report with effect from 01.10.2007.

Any discrepancy in these test reports may be brought to notice with in forty five days from the date of issue of test reports. Please acknowledge the receipt of the test report.

Thanking you,
Yours faithfully,

(K.Mallikarjunappa)
Joint Director

CPRI

TEST REPORT

Central Power Research Institute
(A Govt.of India Society,)
P.B. No.8066, Sadashivanagar Post Office
Prof. Sir.C.V. Raman Road,
Bangalore - 560 080(INDIA)

CENTRAL POWER RESEARCH INSTITUTE

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TEST REPORT

Test Report Number	: DCCD-14644 **Dated:** 24.06.2015
Name & Address of the Customer	: M/s. KEC INTERNATIONAL LTD., (Cables Division) Plot No. 803, Samlaya Savli Road, Village-Godampura Taluka-Savli, Vadodara, Gujarat-391520.
Name & Address of the Manufacturer	: M/s. KEC INTERNATIONAL LTD., (Cables Division) Plot No. 803, Samlaya Savli Road, Village-Godampura Taluka-Savli, Vadodara, Gujarat-391520
Particulars of sample tested	: 1X240 sq. mm., 26/45(52) kV, XLPE Insulated, FRLS PVC Sheathed Armoured Cable
Condition of the sample on receipt	: New
Type	: XLPE insulated, FRLS PVC sheathed Armoured Cable
Designation	: Conductor Material : Copper Size : 240 mm^2 Number of cores : One Insulation : XLPE Metallic Screen: Copper Wires + Open helix copper tape Armour: Aluminium Tape (Double Layer) Outer sheath : BLACK FRLS PVC Voltage Rating : 26/45(52) kV Declared Capacitance : 0.201 μF/km (Max) Embossing: DMRC ELECTRIC CABLE 1X 240 mm^2 COPPER XLPE FRLS 26/45 KV KEC INTL LTD RPG CABLES 2014
Serial Number	: Nil
Number of Samples tested	: One
Date(s) of Test(s)	: 11.05.2015 to 18.06.2015
CPRI Sample Code no(s)	: DCCDCAB15S0029
Particulars of test conducted	: Type Test
Test in accordance with Standard /Specification	: As per IEC 60840-2011 Oxygen Index Test & Temperature Index as per ASTM D 2863-2012, Smoke Density Test as per ASTM D 2843-2010, Smoke Emission Test as per IEC 61034 Flammability Test as per IEC 60332-1-2 & IEC 60332-3-23 (Cat B) Acid Gas Generation Test as per IEC 60754-1-2011
Sampling plan	: Not Applicable
Customer's requirement	: Nil
Deviation if any	: Nil

(Thirumurthy)
Test Engineer

(K.Mallikarjunapa)
Joint Director

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TEST REPORT

Test Report No.: DCCD-14644 **Date: 24.06.2015**

Name of the witnessing persons	
Customer's representatives	: None
Other than customer's representatives	: None
Test subcontracted with address of the laboratory	: Nil
Documents constituting this report	**(in words)**
Number of sheets	: Fifteen
Number of oscillogram/s	: Four (One sheet)
Number of graphs	: Nil
Number of photos	: Nil
Number of test circuit diagrams	: Nil
Number of drawings	: One. Drg no. EN1415-05481 L&T (A/c, DMRC)/Double Tape/FRLS (Rev. 05)

(Thirumurthy)
Test Engineer

(K.Mallikarjunapa)
Joint Director

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CENTRAL POWER RESEARCH INSTITUTE

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TEST REPORT

Test Report No.: DCCD-14644 **Date: 24.06.2015**

TEST RESULTS

I. TESTS ON CONDUCTOR

1. Conductor Resistance Test:

Specified value (Max) : 0.0754 Ω/km at 20^0 C
Observed value : 0.07378 Ω/km at 20^0 C

2. Conductor Examination:

Specified number of Wires in Conductor : 34 (minimum)
Observed number of Wires in Conductor : 34

II. TESTS ON INSULATION:

1. (i) Test for Thickness of insulation

Observed Values(mm)		Specified Values(mm)	
Minimum	Nominal	Minimum	Nominal
10.097	10.298	9.0	10.0

(ii) Variation of thickness $((t_{max} - t_{min})/t_{max})$ X100

a) Specified : 10 % (max)
b) Observed : 4.51 %

2. Tensile Strength and Elongation at Break

A. Before Ageing:

Observed Values		Specified Values(Min)	
Tensile Strength N/mm^2	Elongation at Break (%)	Tensile Strength N/mm^2	Elongation at Break (%)
16.58	505.00	12.5	200

B. Ageing:

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

C. After Ageing:

Observed Values	
Tensile Strength N/mm^2	Elongation at Break (%)
18.44	510.00

D. Variations Observed From Before Ageing Samples:

Observed % Variations		Specified % Variations (Max)	
Tensile Strength (%)	Elongation at Break (%)	Tensile Strength (%)	Elongation at Break (%)
11.24	0.99	± 25	± 25

(Thirumurthy)
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E. After Completed Cable Ageing:

(i) Ageing:

Sample	Temperature	Duration
200 mm of completed Cable	100 ± 2 ^{0} C	168 Hours

(ii) Tensile Strength & Elongation at Break after completed cable ageing:

Observed Values	
Tensile Strength N/mm^2	Elongation at Break (%)
16.06	525.0

(iii) Variations Observed from Before Ageing Samples:

Observed % Variations		Specified % Variations (Max)	
Tensile Strength (%)	Elongation At Break (%)	Tensile Strength (%)	Elongation at Break (%)
-3.12	+3.96	± 25	± 25

3. Shrinkage Test:

Temperature: 130±3^0 C, Duration: Six hours

Shrinkage in Percentage (%)	
Observed values	Specified Value (Max)
2.90	4.5

4. Hot Set Test:

Temperature: 200±3^0 C, Duration: 15 Minutes.

Observed Values (%)		Specified Values (Max) (%)	
Hot set Elongation at 200^0 C	Permanent set Elongation	Hot set Elongation at 200^0 C	Permanent set Elongation
84.5	0.80	175	15

III. TESTS ON SEMICONDUCTING SCREEN:

1. (a) Test for Thickness of Conductor Semiconducting Screen:

Observed Values(mm)		Specified Values(mm)	
Minimum	Nominal	Minimum	Nominal
1.021	1.073	--	0.70

(Thirumurthy)
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TEST RESULTS

(b) Test For Thickness of Insulation Semiconducting Screen:

Observed Values(mm)		Specified Values(mm)	
Minimum	Nominal	Minimum	Nominal
0.819	0.927	--	0.80

2. Resistivity of Semiconducting Insulation Screen:

Resistivity of insulation screen in Ω-m at 90^0 C			
Observed Values		Specified Value (max)	
Unaged Sample	Aged sample	Unaged sample	Aged sample
0.78	1.18	500	500

3. Resistivity of Semiconducting Conductor Screen:

Resistivity of Conductor screen in Ω-m at 90^0 C			
Observed Values		Specified Value (Max)	
Unaged Sample	Aged sample	Unaged Sample	Aged Sample
0.83	1.74	1000	1000

IV. DIMENSIONS OF ARMOUR: (AIUMINIUM TAPE)

1. Thickness:

a) No. of Layers : Two
b) Width of Tape : 50 mm
c) Thickness of Tape : 0.51 mm

V. TEST ON COPPER SCREEN

a) Thickness of Copper Helix Tape : 0.11 mm
b) Diameter of copper wire : 1.61 mm
c) Number of copper screen wires : 66

VI. TESTS ON OUTER SHEATH: (FRLS PVC)

1. Thickness:

a) Specified Minimum : 2.28 mm
b) Observed Minimum : 2.78 mm
c) Specified Average : 2.80 mm
d Observed Average : 3.035 mm

2. Tensile Strength and Elongation at Break

A. Before Ageing:

Tensile Strength in N/mm^2		% Elongation	
Specified (min)	Observed	Specified (min)	Observed
12.5	14.14	150.0	204.0

(Thirumurthy)
Test Engineer

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TEST REPORT

Test Report No.: DCCD-14644 Date: 24.06.2015

TEST RESULTS

B. Ageing:

Sample	Temperature	Duration
Dumb-bell Sample	100 ± 2 ^{0} C	168 Hours

C. After Ageing

Tensile Strength in N/mm^2		% Elongation	
Specified (min)	Observed	Specified (min)	Observed
12.5	14.45	150.0	180.95

D. Variations Observed from Before Ageing samples

Specified % Variations (Max)	Observed % Variations	
	Tensile Strength	%Elongation
±25%	+2.21	-11.30

E. Completed Cable Ageing:

(i) Ageing

Sample	Temperature	Duration
200 mm of completed Cable	100 ± 2 ^{0} C	168 Hours

(ii) Tensile Strength & Elongation at Break after Completed Cable Ageing:

Tensile Strength in N/mm^2		%Elongation	
Specified (min)	Observed	Specified (min)	Observed
12.5	13.21	150.0	180.45

(iii) Variations Observed from Before Ageing samples

Specified % Variations (Max)	Observed % Variations	
	Tensile Strength	% Elongation
±25 %	-6.53	-11.54

3. Pressure Test at High Temperature:

a) Temperature: 80±2 ^{0}C
b) Duration : 6Hrs
c) Specified Percentage depth of indentation : 50 % (Max)
d) Observed Percentage depth of indentation : 28.45 %

4. Loss of Mass Test:

a) Sample : Dumb-bell specimens
b) Temperature : 80 ±2^0 C
c) Duration : 168 hours
d) Specified loss of mass (Max) : 2 mg/cm^2
e) Observed loss of mass : 0.66 mg/cm^2

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Date: 24.06.2015

TEST RESULTS

5. 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 : 126.5 %

6. Impact Test at Low Temperature:
a) Test Temperature : -15 ± 2 °C
b) Mass of the Hammer : 1000 gms
c) Requirement: No cracks shall be observed on the outer and inner surface of the sheath after test.
d) Result: No Cracks were observed on the outer and inner surface of the sheath after test

7.. Heat Shock Test:
a) Temperature: 150±3 °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.

8. Thickness of Inner sheath :
a) Specified Minimum : 1.0 mm
b) Observed Minimum : 1.26 mm

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

1. Bending Test :
a) Diameter of conductor : 18.45 mm
b) Diameter of Cable : 57.1 mm
c) Diameter of test cylinder : 1550 mm
d) Number of bending cycles : Three
After bending test, the cable was provided with two Heat Shrink outdoor Terminations at both ends and Subjected to the following tests

2. Partial Discharge Test:
a) Length of the sample : 15.20 metres (Including terminations)
b) Sensitivity of the detector : 5 pC
c) Status of the sample : Cable with Heat Shrink Terminations
d) Method of connection : High voltage applied to conductor , metallic screen grounded
e) Pre stressed voltage for 10 sec (1.75 Uo) : 46 kV ac
f) Measuring voltage (1.5 Uo) : 39 kV ac
g) Specified discharge magnitude at 1.5 Uo (Max) : 5 pC
h) Observed Discharge magnitude : Less than 5 pC

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TEST RESULTS

3. Tan Delta Measurement:

a) Temperature during Measurement	: 95 to 100 ^{0}C
b) Test Voltage	: 26 kV ac
c) Specified tan delta at Uo (Max) absolute	: 0.0010
d) Observed tan delta at Uo absolute	: 0.00073

4. Measurement of Capacitance:

a) Ambient Temperature	: 28 ^{0}C
b) Test Voltage	: 26 kV ac
c) Declared Capacitance (Max)	: 0.201 μF/km
d) Observed Capacitance at Uo	: 0.194 μF/km

5. Heating Cycle Voltage Test:

The following test conditions were maintained during each heating cycle voltage test on the cable sample installed with two Heat Shrink terminations.

The test sample was laid on the floor with an U- bend of 1550 mm diameter.

a) Duration of heating cycle voltage test	: 24 hours
b) Duration of heating period	: 8 hours
c) Duration of natural cooling period	: 16 hours
d) Temperature of the conductor during heating cycle	: 95-100 ^{0}C
e) AC voltage applied throughout the heating cycle voltage test	: 52 kV ac
f) Total number of heating cycle voltage test	: 20
g) Result: No Breakdown occurred during the heating cycle test	: withstood.

6. Partial Discharge Test at ambient Temperature:

a) Length of the sample	: 15.20 metres (Including terminations)
b) Sensitivity of the detector	: 5 pC
c) Status of the sample	: Cable with Heat Shrink terminations
d) Method of connection	: High voltage applied to conductor, metallic screen grounded
e) Temperature of Conductor during test	: 28 ^{0}C
f) Pre stressed voltage for 10 sec (1.75 Uo)	: 46 kV ac
g) Measuring voltage (1.5 Uo)	: 39 kV ac
h) Specified discharge magnitude at 1.5 Uo (Max)	: 5 pC
i) Observed Discharge magnitude	: Less than 5 pC

(Thirumurthy)
Test Engineer

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Test Report No.: DCCD-14644

TEST REPORT

TEST RESULTS

Date: 24.06.2015

7. Impulse Withstand Test:

Test Voltage kV peak	Temperature of Conductor During Test(°C)	Ambient Temperature (°C)		No. of Impulses
		Dry Bulb	Wet Bulb	
250	95 to 100	29	22	10 Positive & 10 Negative

Test Connection	The impulse source was connected to the conductor and the screen connected to ground.

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

(OSCILLOGRAMS ENCLOSED)

8. High Voltage Test after Impulse Withstand Test:

a) Test connection : High voltage applied to conductor and metallic screen grounded.
b) Test Voltage : 65 kV ac
c) Duration of test : 15 minutes
d) Ambient Temperature : 29 °C
e) Length of the sample : 15.20 metres
f) Result : Withstood

9. Visual Examination of Cable after completing electrical type tests:

Requirement: No deterioration or abnormalities shall be observed to affect the performance of the cable.
Result: No deterioration or abnormalities were observed to affect the performance of the cable.

(Thirumurthy)
Test Engineer

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TEST REPORT

Test Report No.: DCCD-14644 Date: 24.06.2015

TEST RESULTS

VIII. FRLS TESTS:

The following tests are conducted on FRLS PVC Outer sheath.

1. OXYGEN INDEX TEST (As per ASTM-D-2863-2012):

Test Method	:	Procedure-B
Ignition Procedure	:	Method A
Measurement and control device	:	Type A
No. of specimen tested	:	Three
Type	:	Self-supporting material.
Conditioning	:	Samples were conditioned at 23±2°C & 50±5% R.H for 88 Hours

Sample Number	Sample Dimensions (in mm) Length 150 mm		Period of Burning (in Sec)	Extent of Burning (in mm)	Oxygen Index At 25°C (in %)
	Width	Thickness			
1.	6.5	3.0	180	≤ 50	34.2
2.	6.5	3.0	180	≤ 50	34.2
3.	6.5	3.0	180	≤ 50	34.2

Observed Oxygen Index : 34.2 %
Customer's Requirement : 30% (Min)

Observation : No charring, dripping, severe shrinkage or erratic burning, after glow was observed during the test.

Note: The test results relate only to the behaviour of the test specimens under the conditions of this Test method and that these results must not be used to infer the fire hazards of the material in other forms or under other conditions

2. OXYGEN INDEX AT ELEVATED TEMPERATURE (ASTM D 2863 – 2012) (TEMPERATURE INDEX TEST):

No. of specimen tested	:	Three
Type	:	Self-supporting material.
Ignition Procedure	:	Method A
Test Method	:	Procedure-B
Measurement and control device	:	Type A
Conditioning	:	Samples were conditioned at 23±2°C & 50±5% R.H for 88 Hours.

(Thirumurthy)
Test Engineer

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CENTRAL POWER RESEARCH INSTITUTE

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TEST REPORT

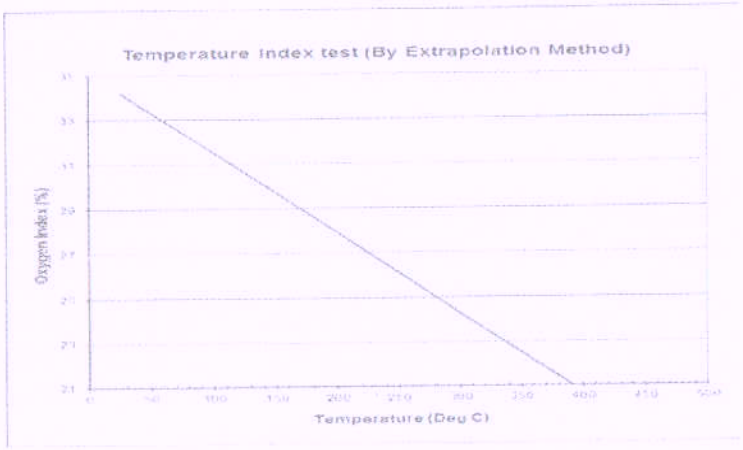
Test Report No.: DCCD-14644 **Date: 24.06.2015**

TEST RESULTS

Sample Number	Sample Dimensions (in mm) Length 150 mm		Temperature In degree C	Period of Burning (in Sec)	Extent of Burning (in mm)	Oxygen Index value (Avg) in %
	Width	Thickness				
1	6.51	3.01	50	180	≤ 50	33.3
2	6.51	3.00	75	180	≤ 50	32.4
3	6.52	3.01	100	180	≤ 50	31.5

Observed Temperature index at 21% of Oxygen Index (By extrapolation method) : 390 °C
Customer's Requirement : 260 °C (Min)

Observation: None of charring, dripping, severe shrinkage or erratic burning, after glow was observed during the test.



Note: The test results relate only to the behaviour of the test specimens under the conditions of this Test method and that these results must not be used to infer the fire hazards of the material in other forms or under other conditions

3. HALOGEN ACID GAS GENERATION TEST (IEC 60754 Part I -2011):

Temperature during the test : 800 deg.C
Duration of Test after attaining 800 °C : 20 minutes

Results:

Observed Amount of Acid Gas Generation : 17.25 % by weight (Max)
Specified Amount of Acid Gas Generation : 20.0 % by weight

(Thirumurthy)
Test Engineer

CENTRAL POWER RESEARCH INSTITUTE

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TEST REPORT

Test Report No.: DCCD-14644

Date: 24.06.2015

TEST RESULTS

4. SMOKE DENSITY TEST (As per ASTM-D-2843-2010:

No. of specimen tested : Three
Sample Dimensions : Length: 25.4 mm, Width: 25.4 mm,
Conditioning : Samples were conditioned for 48 hours at 23±2°C & 50 ± 5% RH

Time in		Absorbance in percent			
Mts.	Secs.	Sample 1 (Thickness 6.0 mm)	Sample 2 (Thickness 6.0mm)	Sample 3 (Thickness 6.0 mm)	Average Absorbance in percent
00	15	0.49	0	0	0.16
00	30	3.4	1.94	3.41	2.92
00	45	7.28	5.83	6.83	6.65
01	00	12.14	9.71	10.73	10.86
01	15	16.99	14.56	14.15	15.23
01	30	20.87	17.96	17.56	18.80
01	45	25.73	22.33	22.44	23.50
02	00	29.61	25.24	28.29	27.71
02	15	33.01	28.64	32.19	31.28
02	30	37.86	34.94	38.54	37.12
02	45	36.89	37.44	43.41	39.25
03	00	40.78	42.35	44.34	42.49
03	15	43.20	45.84	44.34	44.46
03	30	43.20	45.84	44.34	44.46
03	45	44.66	45.84	46.05	45.52
04	00	44.66	46.92	46.05	45.88

Maximum smoke density in Percent light Absorption : 45.88 %
Customer Requirement : 50 % (Max)
Area in percent under the light absorption
Time curve (Smoke density rating) : 25.56 %
Observation of time taken for sample to burst into flame : 30 seconds
Obscurement of 'EXIT' sign : 'EXIT' sign was visible throughout the test

NOTE: This standard should be used to measure & describe the response of the materials, products or assemblies to heat & flame under controlled laboratory conditions & should not be used to describe or appraise the fire hazard or fire risk of materials, products or assemblies under actual fire conditions However, results of this test may be used as elements of a fire hazards assessment or a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard or fire risk of a particular end use.

(Thirumurthy)
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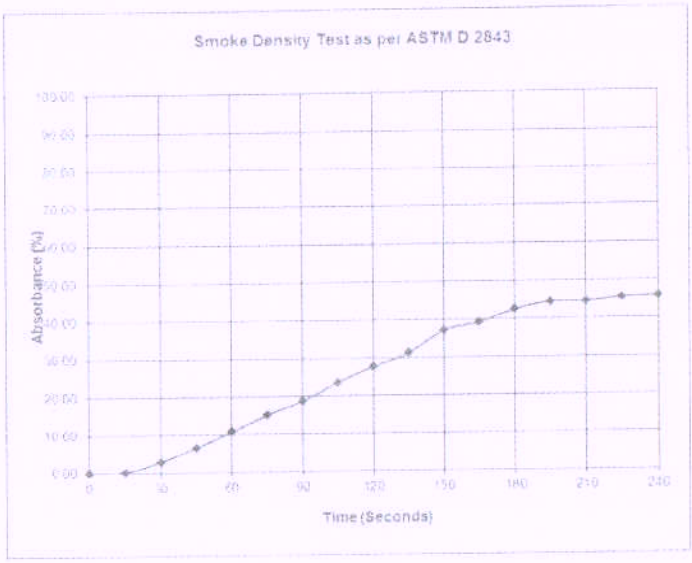
CPRI

TEST REPORT

Test Report No.: DCCD-14644

Date: 24.06.2015

TEST RESULTS



5. TEST FOR VERTICAL FLAME SPREAD OF VERTICALLY MOUNTED BUNCHED CABLES – CATEGORY B (As Per IEC 60332-3-23/ 2000, Am1-2008):

a) No. of test pieces	:	2 Nos.
b) Total Volume of non-metallic material/metre	:	3.5 litres / metre
c) The method of mounting	:	Untouched (spaced)
d) The number of layers	:	One
e) Ignition Source	:	Mixture of Propane and Air
Air Flow Rate	:	77.7 ± 4.8 litres/min
Propane Flow Rate	:	13.5 ± 0.5 litres/min
f) Time of Application of flame	:	40 minutes
g) No of Burners used	:	One
h) The extent of damage		
Specified	:	2.5 metres (Maximum)
Observed	:	0.432 metres

(Thirumurthy)
Test Engineer

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TEST REPORT

Test Report No.: DCCD-14644 Date: 24.06.2015

TEST RESULTS

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

Time of application of flame : 240 ± 2 Seconds
Length of the unaffected portion of cable
from the bottom of the top clamp
Specified : 50 mm (min)
Observed : 320 mm

Length of the charred portion of cable
downwards from the bottom of the top clamp
Specified : 540 mm (max)
Observed : 490 mm

7. SMOKE EMISSION TEST (3 m^3 Test)

Reference Specification	: IEC 61034 (Part-1) & (Part-2) /2005
Diameter of the Cable	: 57.55 mm
Length of the cable	: 1 metre
No of cable lengths	: One
Conditioning	: Samples were conditioned for 16 hours at 23±5°C
Duration of the test	: 40 minutes
Blank test	: Blank test was conducted with 1 litre of alcohol to attain a temperature of 25±5°C

Observed minimum light Transmittance
Specified : 60 % (Min)
Observed : 69 %

IX. Conclusion: The cable sample submitted meets the requirement of all type tests as per IEC 60840-2011 &additional FRLS tests.

(Thirumurthy)
Test Engineer

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CPRI

TEST REPORT

Test Report No.: DCCD-14644 Date: 24.06.2015

NOTE

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

b) Publication or reproduction of this test report in any form other than by complete set of the whole report and in the language written, is not permitted without the written consent of CPRI.

c) Any Correction/erasure invalidates the test report.

d) Any anomaly/discrepancy in this test report should be brought to the notice of CPRI within 45 days from the date of issue.

(Thirumurthy)
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CENTRAL POWER RESEARCH INSTITUTE

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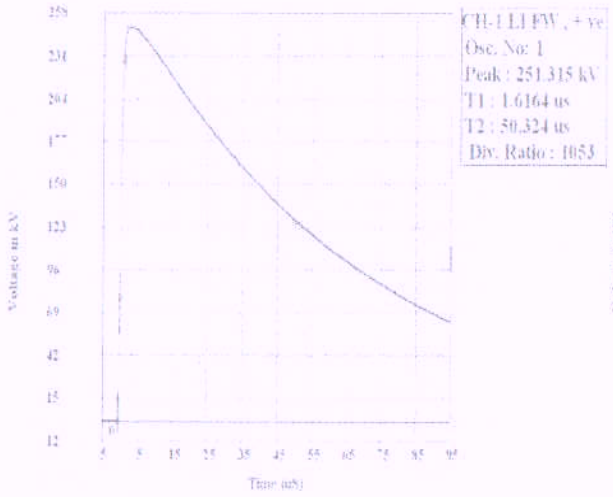
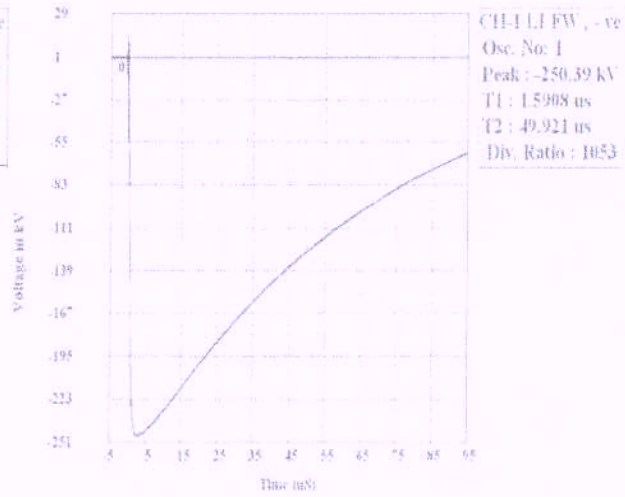
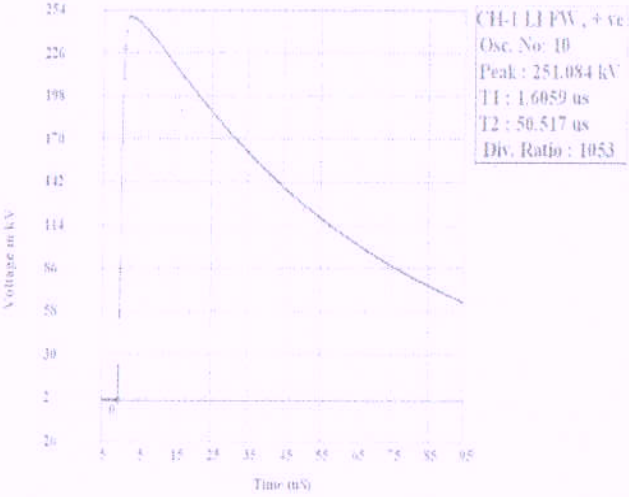
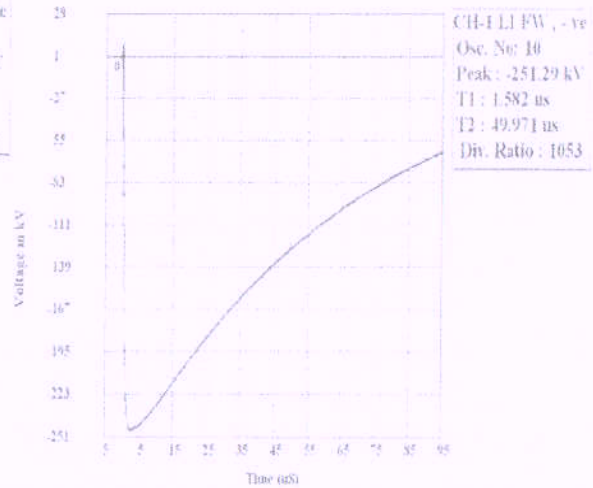
Customer : M/s. KEC International Limited(Cables Division),Gujarat.
Test Report No. & Date : DCCD-14644 Dated: 24.06.2015
Sample Code : DCCDCAB15S0029



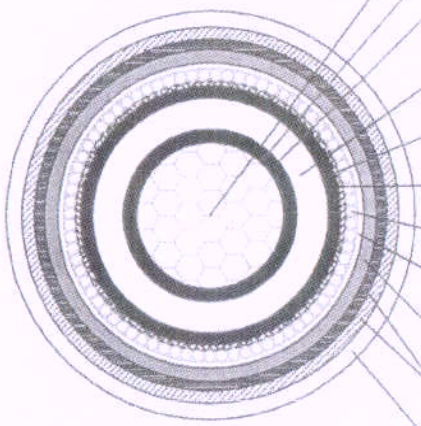






(Thirumurthy)
Test Engineeer

CROSS-SECTIONAL SKETCH OF 1C X 240sq.mm XLPE DOUBLE AL TAPE ARMOURED CABLE (FRLS)



Conductor: Stranded compacted circular copper (approx. Ø 18.05mm)

Semiconducting tape

Conductor Screen: Semiconducting XLPE compound (Nom. thick. 0.7 mm)

Insulation: XLPE Insulation (Nom. thick. 10.0 mm)

Insulation Screen: Semiconducting XLPE compound (Nom. thick. 0.8 mm)

Semiconducting tape

Helically applied plain copper wires (66 wires / nom dia 1.6 mm)

Polyster Tape Binder (Approx. thick. 0.075 mm)

Inner Sheath: Extruded FRLS PVC Type ST-2 (Min. thick. 1.0 mm)

Double Aluminium Tape Armour (Nom. thick. 0.5 mm)

Outer Sheath: Extruded FRLS PVC Type ST-2 (Nom. thick. 2.80 mm)

Size:- **1C x 240 mm² x 26/45 kV**	SCALE: N. T. S.	**KEC International Ltd. (BRAND NAME: RPG CABLES)**
	DATE : 08/11/2014	
	DRAWN BY : **Bhoopendra**	Dwg No. : EN1415-0548/L&T (A/C; DMRC)/ Double Tape/ FRLS (Rev 05)
	CHECKED BY : **YS Tiwari**	

यह ड्राइंग सीपीआरई की परीक्षण रिपोर्ट से संबंधित है।
THIS DRAWING PERTAINS TO CPRI TEST REPORT
सं. डीसीसीडी/No. DCCD: 14649
दिनांक/Dated : 24.06.2015

परीक्षण इंजीनियर/Test Engineer

CENTRAL POWER RESEARCH INSTITUTE

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TEST REPORT

Test Report Number	: DCCD-14645 **Dated:** 29.06.2015
Name & Address of the Customer	: M/s. KEC INTERNATIONAL LTD., (Cables Division) Plot No. 803, Samlaya Savli Road, Village-Godampura Taluka-Savli, Vadodara, Gujarat-391520.
Name & Address of the Manufacturer	: M/s. KEC INTERNATIONAL LTD., (Cables Division) Plot No. 803, Samlaya Savli Road, Village-Godampura Taluka-Savli, Vadodara, Gujarat-391520
Particulars of sample tested	: 1X240 sq. mm., 26/45(52) kV , XLPE insulated, FRLSOH sheathed Armoured Cable
Condition of the sample on receipt	: New
Type	: XLPE insulated, FRLSOH sheathed Cable
Designation	: Conductor Material : Copper Size : 240 mm^2 Number of cores : One Insulation : XLPE Metallic Screen :Copper Wires + Open helix Copper tape Outer sheath : BLACK FRLSOH (Low Smoke, Zero Halogen) Voltage Rating : 26/45(52) kV Declared Capacitance : 0.201 μF/km (Max) Embossing: DMRC ELECTRIC CABLE 1X 240 mm^2 COPPER XLPE FRLSOH 26/45 KV KEC INTL LTD RPG CABLES 2014
Serial Number	: Nil
Number of Samples tested	: One
Date(s) of Test(s)	: 11.05.2015 to 24.06.2015
CPRI Sample Code no(s)	: DCCDCAB15S0040
Particulars of test conducted	: Type Test, Short circuit Test for combined metallic screen and armour
Test in accordance with Standard /Specification	: As per IEC 60840-2011 Oxygen Index Test & Temperature Index as per ASTM D 2863-2012, Smoke Density Test as per ASTM D 2843-2010, Smoke Emission Test as per IEC 61034 Flammability Test as per IEC 60332-1-2 , IEC 60332-3-23 (Cat B) Acid Gas Generation Test as per IEC 60754-1-2011 Zero Halogen Acid Test (PH & Conductivity Test)
Sampling plan	: Not Applicable
Customer's requirement	: LSOH sheath requirement s as per ST8 of IEC 60502-1- 2004, Am1,2009
Deviation if any	: Nil

(Thirumurthy)
Test Engineer

(K.Mallikarjunappa)
Joint Director

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GRAMS : "PRI" PH: 091-80-2360 3333

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TEST REPORT

Test Report No.: DCCD-14645 **Date: 29.06.2015**

Name of the witnessing persons	
Customer's representatives	: None
Other than customer's representatives	: None
Test subcontracted with address of the laboratory	: Nil
Documents constituting this report (in words)	
Number of sheets	: Fifteen + One Test Report of Four Sheets
Number of oscillogram/s	: Four (One sheet)
Number of graphs	: Nil
Number of photos	: Nil
Number of test circuit diagrams	: Nil
Number of drawings	: One. Drg no. EN1415-0548/L&T(A/c: DMRC/Double Tape/ZHLS (Rev. 05)

(Thirumurthy)
Test Engineer

(K.Mallikarjunapp a)
Joint Director

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TEST REPORT

Test Report No.: DCCD-14645 Date: 29.06.2015

TEST RESULTS

I. TESTS ON CONDUCTOR

1. Conductor Resistance Test:

Specified value (Max) : 0.0754 Ω/km at 20° C
Observed value : 0.07257 Ω/km at 20° C

2. Conductor Examination:

Specified number of Wires in Conductor : 34 (minimum)
Observed number of Wires in Conductor : 34

II. TESTS ON INSULATION:

1. (i) Test for Thickness of insulation

Observed Values(mm)		Specified Values(mm)	
Minimum	Nominal	Minimum	Nominal
9.887	10.182	9.0	10.0

(ii) Variation of thickness $((t_{max} - t_{min})/t_{max})$ X100

a) Specified : 10 % (max)
b) Observed : 5.8 %

2. Tensile Strength and Elongation at Break

A. Before Ageing:

Observed Values		Specified Values(Min)	
Tensile Strength N/mm^2	Elongation at Break (%)	Tensile Strength N/mm^2	Elongation at Break (%)
17.45	502.95	12.5	200

B. Ageing:

Sample	Temperature	Duration
Dumb- bell Specimens	135 ± 3 ° C	168 Hours

C. After Ageing:

Observed Values	
Tensile Strength N/mm^2	Elongation at Break (%)
17.23	491.0

D. Variations Observed From Before Ageing Samples:

Observed % Variations		Specified % Variations (Max)	
Tensile Strength (%)	Elongation at Break (%)	Tensile Strength (%)	Elongation at Break (%)
-1.26	-2.38	± 25	± 25

(Thirumurthy)
Test Engineer

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TEST REPORT

Test Report No.: DCCD-14645 Date: 29.06.2015

TEST RESULTS

E. After Completed Cable Ageing:

(i) Ageing:

Sample	Temperature	Duration
200 mm of completed Cable	100 ± 2 ^{0} C	168 Hours

(ii) Tensile Strength & Elongation at Break after completed cable ageing:

Observed Values	
Tensile Strength N/mm^2	Elongation at Break (%)
16.96	505.0

(iii) Variations Observed from Before Ageing Samples:

Observed % Variations		Specified % Variations (Max)	
Tensile Strength (%)	Elongation At Break (%)	Tensile Strength (%)	Elongation at Break (%)
-2.79	+0.61	± 25	± 25

3. Shrinkage Test:

Temperature: 130±3^0 C, Duration: Six hours

Shrinkage in Percentage (%)	
Observed values	Specified Value (Max)
3.01	4.5

4. Hot Set Test:

Temperature: 200±3^0 C, Duration: 15 Minutes.

Observed Values (%)		Specified Values (Max) (%)	
Hot set Elongation at 200^0 C	Permanent set Elongation	Hot set Elongation at 200^0 C	Permanent set Elongation
64.8	0.80	175	15

III. TESTS ON SEMICONDUCTING SCREEN:

1. (a) Test for Thickness of Conductor Semiconducting Screen:

Observed Values(mm)		Specified Values(mm)	
Minimum	Nominal	Minimum	Nominal
1.162	1.208	--	0.70

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TEST REPORT

Test Report No.: DCCD-14645 Date: 29.06.2015 CPRI

TEST RESULTS

(b) Test For Thickness of Insulation Semiconducting Screen:

Observed Values(mm)		Specified Values(mm)	
Minimum	Nominal	Minimum	Nominal
0.898	0.941	–	0.80

2. Resistivity of Semiconducting Insulation Screen:

Resistivity of insulation screen in Ω-m at 90^0 C			
Observed Values		Specified Value (max)	
Unaged Sample	Aged sample	Unaged sample	Aged sample
1.07	0.91	500	500

3. Resistivity of Semiconducting Conductor Screen:

Resistivity of Conductor screen in Ω-m at 90^0 C			
Observed Values		Specified Value (Max)	
Unaged Sample	Aged sample	Unaged Sample	Aged Sample
2.18	5.05	1000	1000

IV. DIMENSIONS OF ARMOUR: (Aluminium TAPE)

1. Thickness:

a) No. of Layers : Two
b) Width of Tape : 50 mm
c) Thickness of Tape : 0.51 mm

V. TEST ON COPPER SCREEN

a) Thickness of Copper Helix Tape : 0.105 mm
b) Diameter of copper wire : 1.608 mm
c) Number of copper screen wires : 66

VI. TESTS ON OUTER SHEATH: (FRLSOH) – Low Smoke Zero Halogen

1. Thickness:

a) Specified Minimum : 2.28 mm
b) Observed Minimum : 2.66 mm
c) Specified Average : 2.80 mm
d) Observed Average : 2.80 mm

2. Tensile Strength and Elongation at Break

A. Before Ageing:

Tensile Strength in N/mm^2		% Elongation	
Specified (min)	Observed	Specified (min)	Observed
9.0	11.40	125.0	191.0

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TEST REPORT

Test Report No.: DCCD-14645 Date: 29.06.2015

TEST RESULTS

B. Ageing:

Sample	Temperature	Duration
Dumb-bell Sample	100 ± 2 ^{0} C	168 Hours

C. After Ageing

Tensile Strength in N/mm^2		% Elongation	
Specified (min)	Observed	Specified (min)	Observed
9.0	12.56	100.0	168.3

D. Variations Observed from Before Ageing samples

Specified % Variations (Max)	Observed % Variations	
	Tensile Strength	%Elongation
±40%	+10.19	-11.88

E. Completed Cable Ageing:

(i) Ageing

Sample	Temperature	Duration
200 mm of completed Cable	100 ± 2 ^{0} C	168 Hours

(ii) Tensile Strength & Elongation at Break after Completed Cable Ageing:

Tensile Strength in N/mm^2		%Elongation	
Specified (min)	Observed	Specified (min)	Observed
9.0	11.78	100.0	155.0

(iii) Variations Observed from Before Ageing samples

Specified % Variations (Max)	Observed % Variations	
	Tensile Strength	% Elongation
±40 %	+3.42	-18.85

3. Pressure Test at High Temperature:

a) Temperature: 80±2 ^{0}C
b) Duration : 6Hrs
c) Specified Percentage depth of indentation : 50 % (Max)
d) Observed Percentage depth of indentation : 12.18 %

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TEST REPORT

Test Report No.: DCCD-14645 Date: 29.06.2015

TEST RESULTS

4. 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 : 149 %

5. Impact Test at Low Temperature:

a) Test Temperature : $-15 \pm 2\ ^{0}C$
b) Mass of the Hammer : 1000 gms
c) Requirement: No cracks shall be observed on the outer and inner surface of the sheath after test.
d) Result: No Cracks were observed on the outer and inner surface of the sheath after test

6, **Thickness of Innersheath**:

a) Specified Minimum : 1.0 mm
b) Observed Minimum : 1.55 mm

VII . ELECTRICAL TESTS

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

1. Bending Test :

a) Diameter of conductor : 18.50 mm
b) Diameter of Cable : 56.70 mm
c) Diameter of test cylinder : 1550 mm
d) Number of bending cycles : Three

After bending test, the cable was provided with two Heat Shrink outdoor Terminations at both ends and Subjected to the following tests

2. Partial Discharge Test:

a) Length of the sample : 15.20 metres (Including terminations)
b) Sensitivity of the detector : 5 pC
c) Status of the sample : Cable with Heat Shrink Terminations
d) Method of connection : High voltage applied to conductor , metallic screen grounded
e) Pre stressed voltage for 10 sec (1.75 Uo) : 46 kV ac
f) Measuring voltage (1.5 Uo) : 39 kV ac
g) Specified discharge magnitude at 1.5 Uo (Max) : 5 pC
h) Observed Discharge magnitude : Less than 5 pC

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TEST REPORT

Test Report No.: DCCD-14645 Date: 29.06.2015

TEST RESULTS

3. Tan Delta Measurement:

a) Temperature during Measurement	: 95 to 100 ^{0}C
b) Test Voltage	: 26 kV ac
c) Specified tan delta at Uo (Max) absolute	: 0.0010
d) Observed tan delta at Uo absolute	: 0.00070

4. Measurement of Capacitance:

a) Ambient Temperature	: 28 ^{0}C
b) Test Voltage	: 26 kV ac
c) Declared Capacitance (Max)	: 0.201 µF/km
d) Observed Capacitance at Uo	: 0.196 µF/km

5. Heating Cycle Voltage Test:

The following test conditions were maintained during each heating cycle voltage test on the cable sample installed with two Heat Shrink terminations.

The test sample was laid on the floor with an U- bend of 1500 mm diameter.

a) Duration of heating cycle voltage test	: 24 hours
b) Duration of heating period	: 8 hours
c) Duration of natural cooling period	: 16 hours
d) Temperature of the conductor during heating cycle	: 95-100 ^{0}C
e) AC voltage applied throughout the heating cycle voltage test	: 52 kV ac
f) Total number of heating cycle voltage test	: 20
g) Result: No Breakdown occurred during the heating cycle test	: withstood.

6. Partial Discharge Test at ambient Temperature:

a) Length of the sample	: 15.20 metres (Including terminations)
b) Sensitivity of the detector	: 5 pC
c) Status of the sample	: Cable with Heat Shrink terminations
d) Method of connection	: High voltage applied to conductor, metallic screen grounded
e) Temperature of Conductor during test	: 29 ^{0}C
f) Pre stressed voltage for 10 sec (1.75 Uo)	: 46 kV ac
g) Measuring voltage (1.5 Uo)	: 39 kV ac
h) Specified discharge magnitude at 1.5 Uo (Max)	: 5 pC
i) Observed Discharge magnitude	: Less than 5 pC

(Thirumurthy)
Test Engineer

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TEST REPORT

TEST RESULTS

Date: 29.06.2015

7. 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	
250	95 to 100	28	25	10 Positive & 10 Negative

Test Connection	The impulse source was connected to the conductor and the screen connected to ground.

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

(OSCILLOGRAMS ENCLOSED)

8. High Voltage Test after Impulse Withstand Test:

a) Test connection : High voltage applied to conductor and metallic screen grounded.
b) Test Voltage : 65 kV ac
c) Duration of test : 15 minutes
d) Ambient Temperature : 29 ^{0}C
e) Length of the sample : 15.20 metres
f) Result : Withstood

9. Visual Examination of Cable after completing electrical type tests:

Requirement: No deterioration or abnormalities shall be observed to affect the performance of the cable.
Result: No deterioration or abnormalities were observed to affect the performance of the cable.

10. **Thermal Short circuit test on metallic screen & Armour:**

As per SC lab Test Report No. SC 15347A Dated 29.06.2015. (Enclosed).

(Thirumurthy)
Test Engineer

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CPRI

TEST REPORT

Test Report No.: DCCD-14645

Date: 29.06.2015

TEST RESULTS

VIII. FRLS TESTS:

The following tests were conducted on FRLSOH Outer sheath.

1. OXYGEN INDEX TEST (As per ASTM-D-2863-2012):

Test Method	:	Procedure-B
Ignition Procedure	:	Method A
Measurement and control device	:	Type A
No. of specimen tested	:	Three
Type	:	Self-supporting material.
Conditioning	:	Samples were conditioned at 23±2°C & 50±5% R.H for 88 Hours

Sample Number	Sample Dimensions (in mm) Length 150 mm		Period of Burning (in Sec)	Extent of Burning (in mm)	Oxygen Index At 25°C (in %)
	Width	Thickness			
1.	6.52	3.0	180	≤ 50	35.5
2.	6.52	3.0	180	≤ 50	35.5
3.	6.52	3.0	180	≤ 50	35.5

Observed Oxygen Index : 35.5 %
Customer's Requirement : 30% (Min)

Observation : No charring, dripping, severe shrinkage or erratic burning, after glow was observed during the test.

Note: The test results relate only to the behaviour of the test specimens under the conditions of this Test method and that these results must not be used to infer the fire hazards of the material in other forms or under other conditions

2. OXYGEN INDEX AT ELEVATED TEMPERATURE (ASTM D 2863 – 2012) (TEMPERATURE INDEX TEST):

No. of specimen tested	:	Three
Type	:	Self-supporting material.
Ignition Procedure	:	Method A
Test Method	:	Procedure-B
Measurement and control device	:	Type A
Conditioning	:	Samples were conditioned at 23±2°C & 50±5% R.H for 88 Hours.

(Thirumurthy)
Test Engineer

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CENTRAL POWER RESEARCH INSTITUTE

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TEST REPORT

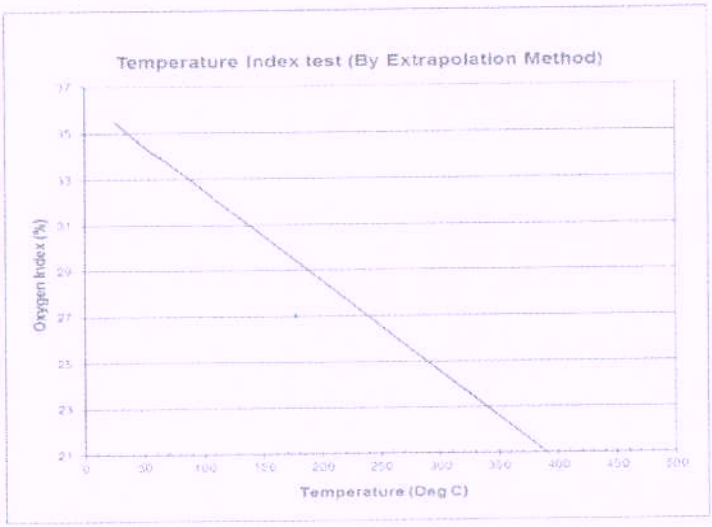
Test Report No.: DCCD-14645 **Date: 29.06.2015**

TEST RESULTS

Sample Number	Sample Dimensions (in mm) Length 150 mm		Temperature In degree C	Period of Burning (in Sec)	Extent of Burning (in mm)	Oxygen Index value (Avg) in %
	Width	Thickness				
1.	6.52	3.01	50	180	≤ 50	34.4
2.	6.51	3.00	75	180	≤ 50	33.5
3.	6.51	3.01	100	180	≤ 50	32.5

Observed Temperature index by extrapolation method at 21% Oxygen Index : 390 °C
Customer's Requirement : 260 °C (Min)

Observation: None of charring, dripping, severe shrinkage or erratic burning, after glow was observed during the test.



Note: The test results relate only to the behaviour of the test specimens under the conditions of this Test method and that these results must not be used to infer the fire hazards of the material in other forms or under other conditions

3. HALOGEN ACID GAS GENERATION TEST (IEC 60754 Part I -1994):

Temperature during the test : 800 deg.C
Duration of Test after attaining 800 °C : 20 minutes

Results:

Specified Amount of Acid Gas Generation : 0.50 % by weight (Max)
Observed Amount of Acid Gas Generation : 0.0 % by weight

(Thirumurthy)
Test Engineer

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TEST REPORT

Test Report No.: DCCD-14645 **Date: 29.06.2015**

TEST RESULTS

4. SMOKE DENSITY TEST (As per ASTM-D-2843-2010:

No. of specimen tested : Three
Sample Dimensions : Length: 25.4 mm, Width: 25.4 mm,
Conditioning : Samples were conditioned for 48 hours at 23±2°C & 50 ± 5% RH

Time in		Absorbance in percent			
Mts.	Secs.	Sample 1 (Thickness 6.0 mm)	Sample 2 (Thickness 6.0mm)	Sample 3 (Thickness 6.0 mm)	Average Absorbance in percent
00	15	0	0	0	0.00
00	30	0	0	0	0.00
00	45	0	0	0	0.00
01	00	0.49	0.49	0	0.33
01	15	0.98	0.98	0.49	0.82
01	30	1.95	2.81	0.49	1.75
01	45	3.41	4.88	0.97	3.09
02	00	3.90	4.88	0.97	3.25
02	15	4.88	5.69	1.46	4.01
02	30	4.39	6.83	2.43	4.55
02	45	5.37	6.83	3.88	5.36
03	00	6.34	8.34	12.14	8.94
03	15	6.83	10.09	14.08	10.33
03	30	8.29	12.21	14.56	11.69
03	45	10.24	13.66	15.50	13.13
04	00	12.20	13.66	15.50	13.79

Maximum smoke density in Percent light Absorption : 13.79 %
Customer Requirement : 20 % (Max)
Area in percent under the light absorption
Time curve (Smoke density rating) : 4.32 %
Observation of time taken for sample to burst into flame : 60 seconds
Obscurement of 'EXIT' sign : 'EXIT' sign was visible throughout the test

NOTE: This standard should be used to measure & describe the response of the materials, products or assemblies to heat & flame under controlled laboratory conditions & should not be used to describe or appraise the fire hazard or fire risk of materials, products or assemblies under actual fire conditions However, results of this test may be used as elements of a fire hazards assessment or a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard or fire risk of a particular end use.

(Thirumurthy)
Test Engineer

DIAGNOSTIC CABLES & CAPACITORS DIVISION
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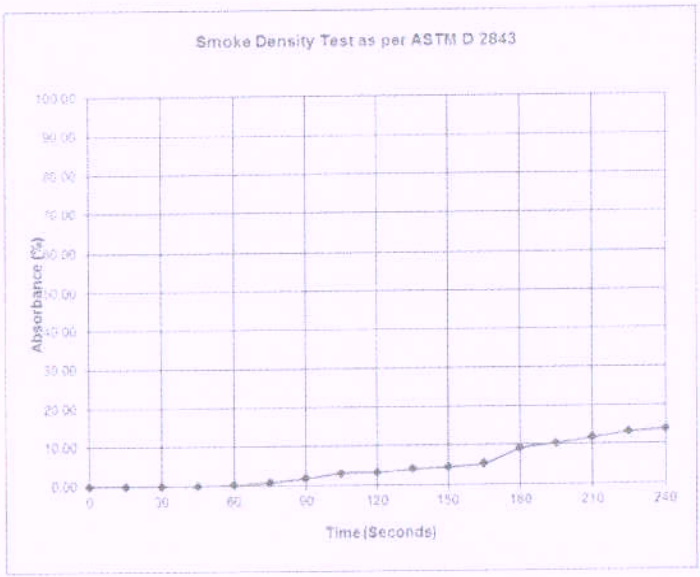
CPRI

Test Report No.: DCCD-14645

TEST REPORT

TEST RESULTS

Date: 29.06.2015



5. TEST FOR VERTICAL FLAME SPREAD OF VERTICALLY MOUNTED BUNCHED CABLES – CATEGORY B (As Per IEC 60332-3-23/ 2000, Am1-2008):

a) No. of test pieces	:	2 Nos.
b) Total Volume of non-metallic material/metre	:	3.5 litres / metre
c) The method of mounting	:	Untouched (spaced)
d) The number of layers	:	One
e) Ignition Source	:	Mixture of Propane and Air
Air Flow Rate	:	77.7 ± 4.8 litres/min
Propane Flow Rate	:	13.5 ± 0.5 litres/min
f) Time of Application of flame	:	40 minutes
g) No of Burners used	:	One
h) The extent of damage		
Specified	:	2.5 metres (Maximum)
Observed	:	0.51 metres

(Thirumurthy)
Test Engineer

HEAVY POWER CABLES & CAPACITORS DIVISION
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CPRI

TEST REPORT

Test Report No.: DCCD-14645 Date: 29.06.2015

TEST RESULTS

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

Time of application of flame : 240 ± 2 Seconds
Length of the unaffected portion of cable from the bottom of the top clamp
Specified : 50 mm (min)
Observed : 325 mm

Length of the charred portion of cable downwards from the bottom of the top clamp
Specified : 540 mm (max)
Observed : 490 mm

7. SMOKE EMISSION TEST (3 m^3 Test)

Reference Specification	: IEC 61034 (Part-1) & (Part-2) /2005
Diameter of the Cable	: 57.49 mm
Length of the cable	: 1 metre
No of cable lengths	: One
Conditioning	: Samples were conditioned for 16 hours at 23±5°C
Duration of the test	: 40 minutes
Blank test	: Blank test was conducted with 1 litre of alcohol to attain a temperature of 25±5°C

Observed minimum light Transmittance
Specified : 70% (Min)
Observed : 83 %

8. ZERO HALOGEN ACID TEST (PH & CONDUCTIVITY TEST):

Reference Specification	: As per IEC-60754-2 /1991-07, Am1 : 1997
Conditioning	: Samples were conditioned at 23±2°C Temp. and 50±5% R.H for 16 Hours.
Temperature during the test	: 935 deg.C
Duration of Test after attaining 935 °C	: 30 minutes
Mass of the sample	: 1.0 g
Result :	
Specified values of pH	: 4.3 (Min)
Observed Average pH value	: 5.4
Specified value of Conductivity	: 10 µS/mm (Max)
Observed Average Conductivity value	: 8.1 µS/mm

IX. Conclusion: The cable sample submitted meets the requirement of all type tests as per IEC 60840-2011 &additional FRLSOH tests.

(Thirumurthy)
Test Engineer

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CENTRAL POWER RESEARCH INSTITUTE

CPRI

TEST REPORT

Test Report No.: DCCD-14645 **Date: 29.06.2015**

NOTE

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

b) Publication or reproduction of this test report in any form other than by complete set of the whole report and in the language written, is not permitted without the written consent of CPRI.

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d) Any anomaly/discrepancy in this test report should be brought to the notice of CPRI within 45 days from the date of issue.

(Thirumurthy)
Test Engineer

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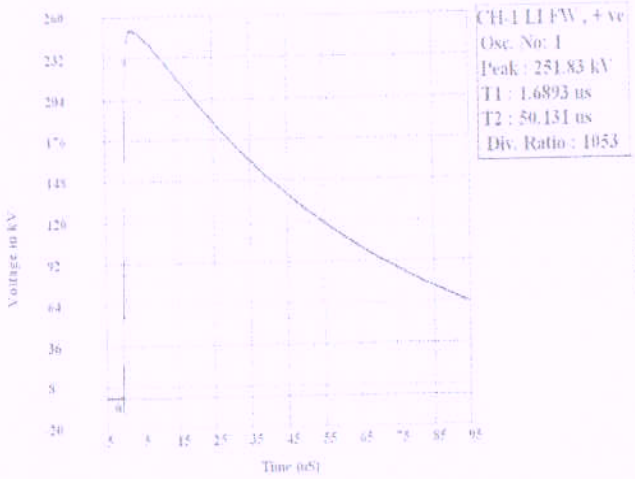
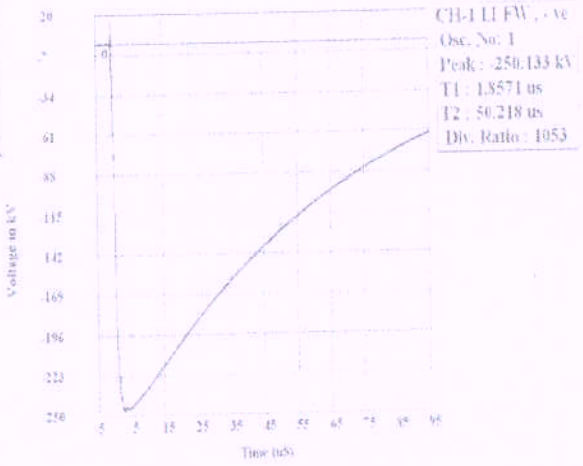
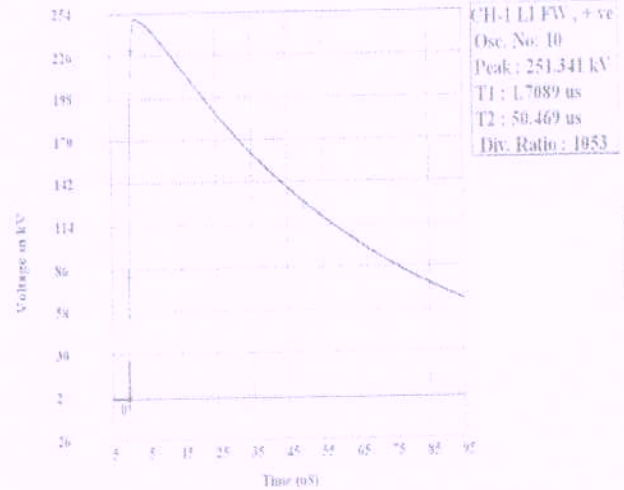
CENTRAL POWER RESEARCH INSTITUTE

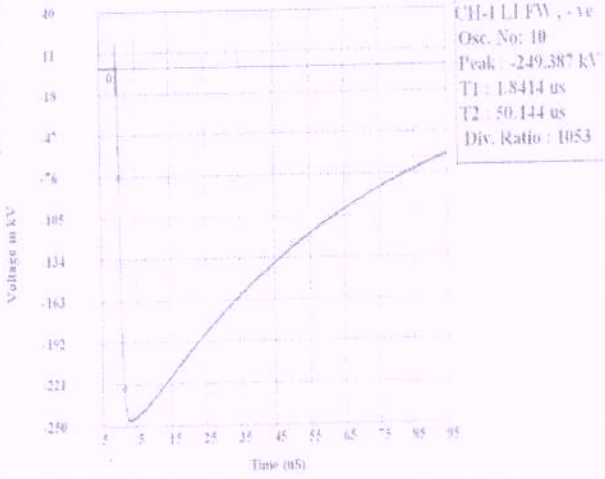
CPRI

Customer : M/s. KEC International Limited(Cables Division),Gujarat.
Test Report No. & Date : DCCD-14645 Dated: 24.06.2015
Sample Code : DCCDCAB15S0040









(Thirumurthy)
Test Engineeer

DIAGNOSTIC CIRCUITS & CAPACITORS DIVISION
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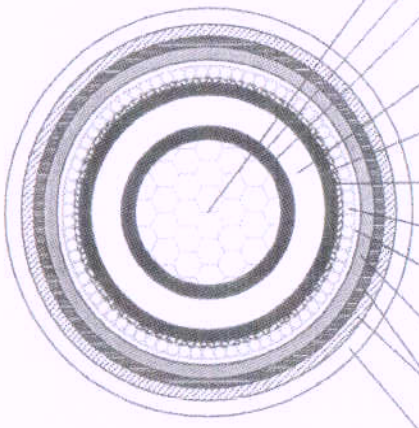
CROSS-SECTIONAL SKETCH OF 1C X 240 XLPE DOUBLE AL TAPE ARMOURED CABLE (FRLSOH)



Conductor: Stranded compacted circular copper (approx. Ø 18.05mm)

Semiconducting tape

Conductor Screen: Semiconducting XLPE compound (Nom. thick. 0.7 mm)

Insulation: XLPE Insulation (Nom. thick. 10.0 mm)

Insulation Screen: Semiconducting XLPE compound (Nom. thick. 0.8 mm)

Semiconducting tape

Helically applied plain copper wires (66 wires / nom dia 1.6 mm)

Polyster Tape Binder (Approx. thick. 0.075 mm)

Inner Sheath: Extruded ZHLS Type ST-8 (Min. thick. 1.0 mm)

Double Aluminium Tape Armour (Nom. thick. 0.5 mm)

Outer Sheath: Extruded ZHLS Type ST-8 (Nom. thick. 2.80 mm)

Size:-	SCALE: N. T. S.	**KEC International Ltd. (BRAND NAME: RPG CABLES)**
	DATE : 08/11/2014	
1C x 240 mm² x 26/45 kV	DRAWN BY : **Bhoopendra**	Dwg No. : EN1415-0548/L&T (A/C; DMRC/ Double Tape/ ZHLS (Rev 05)
	CHECKED BY : **YS Tiwari**	

यह ड्राइंग सीपीआरआई की परीक्षण रिपोर्ट से संबंधित है।
THIS DRAWING PERTAINS TO CPRI TEST REPORT
सं. डीसीसीडी/No. DCCD: 14645
दिनांक/Dated : 29.06.2015

परीक्षण इंजीनियर/ Test Engineer

CPRI

TEST REPORT

Central Power Research Institute

(A Govt. of India Society)
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Bengaluru - 560 080 (INDIA)

CENTRAL POWER RESEARCH INSTITUTE
(Member of STL)

CPRI

TEST REPORT

Test Report Number	SC15347A **Dated** 29th June, 2015
Name & Address of the Customer	M/s. KEC International Ltd., (Cables Division), Plot No.803, Samlaya Savli Road, Village-Godampura, Taluka-Savli, Vadodara, Gujarat-391 520
Name & Address of the Manufacturer	M/s. KEC International Ltd., (Cables Division), Plot No.803, Samlaya Savli Road, Village-Godampura, Taluka-Savli, Vadodara, Gujarat-391 520
Particulars of sample tested	1x240 Sq. mm Copper conductor, XLPE insulated Aluminium Tape armoured FRLS OH Sheathed 26 / 45 kV Cable
Condition of the sample on receipt	Good
Type	---
Designation	---
Serial number	---
Number of samples tested	One
Date (s) of test (s)	24th June, 2015
CPRI sample code no(s).	DCCDCAB15S0040
Particulars of tests conducted	Thermal short circuit test through combined screen and armour
Test in accordance with	
Standard / specification	Customer's instructions
Sampling plan	Not applicable
Customer's requirement	14 kA rms for 3.0 s
Deviations if any	---
Name of the witnessing persons	
Customer's representative	Mr. B. P. Bhagavan
Other than customer's representatives	Mr. Rajeshkumar Singh, Senior Electrical Engineer, DMRC, New Delhi & Mr.T.P.N. Ravichandra, PSI Engg - L & T Ltd., New Delhi
Test subcontracted with address of the laboratory	None
Documents constituting this report (in words)	
Number of sheets	Four
Number of oscillograms	One
Number of graphs	Nil
Number of photos	Nil
Number of test circuit diagrams	One
Number of drawings	Nil

(H.S.Lokeshappa)
Test Engineer

(Swaraj Kumar Das)
Joint Director

CENTRAL POWER RESEARCH INSTITUTE
(Member of STL)

CPRI

Test Report Number: SC15347A

Dated: 29th June, 2015

Description of sample tested (Ratings as assigned by the manufacturer)

Test sample	1x240 Sq. mm Copper conductor XLPE insulated Aluminium Tape armoured FRLS OH Sheathed 26 / 45 kV Cable
Type	---
Designation	---
Serial number	---
Rated voltage	26 / 45 kV
Rated current	600 A
Frequency	50 Hz
Number of cores	One
Type of outer sheath	FRLS OH
Type of armour	Aluminium tape
Conductor cross-section	240 sq. mm
Conductor material	Copper
Length of the cable	10 m
Temperature of the screen prior to short-circuit current	75 °C
Maximum temperature when carrying short-circuit current	250 °C

Documents attached to this report

Oscillogram number(s)	SC15347A.S01
Test circuit diagram number(s)	CRTL/SC/STC-02B

Test Engineer

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CPRI

Test Report Number: SC15347A

Dated: 29th June, 2015

Schedule of test

THERMAL SHORT CIRCUIT TEST THROUGH COMBINED SCREEN AND ARMOUR
(Customer's instructions)

Test conditions

Source	Short-circuit generator
Test on screen &sheath	Single
Frequency	50 Hz
Test sample	
Condition before test	Good
No. of phases	Single; one end of the screen & armour connected to the source
Test details	
Test on screen & sheath	CRTL/SC/STC-02B
Short-circuit applied	On the other end of the screen & armour
Short-circuit point	Grounded

Test on screen & armour

Ambient Temperature: 30.0°C

Oscillogram No.	Rms Current (kA)	Duration (s)	Screen& armour temperature prior to the short circuit test (°C)	Observation
SC15347A.S01	14.91	3.13	75 °C	During test: No abnormality

Physical Inspection: No visible external damage to the cable, conductor, screen & armour

Test Engineer

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Test Report Number: SC15347A Dated: 29th June, 2015

NOTE

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c) Any Corrections / erasure invalidate the test Report/Certificate.
d) Any anomaly / discrepancy in the test report / Certificate should be brought to notice of CPRI within 45 days from the date of issue.

Additional Information:
This is not a certificate of rating. A certificate of rating is not issued as only limited tests as requested by the customer were carried out.

CPRI issues following types of reports/certificates:

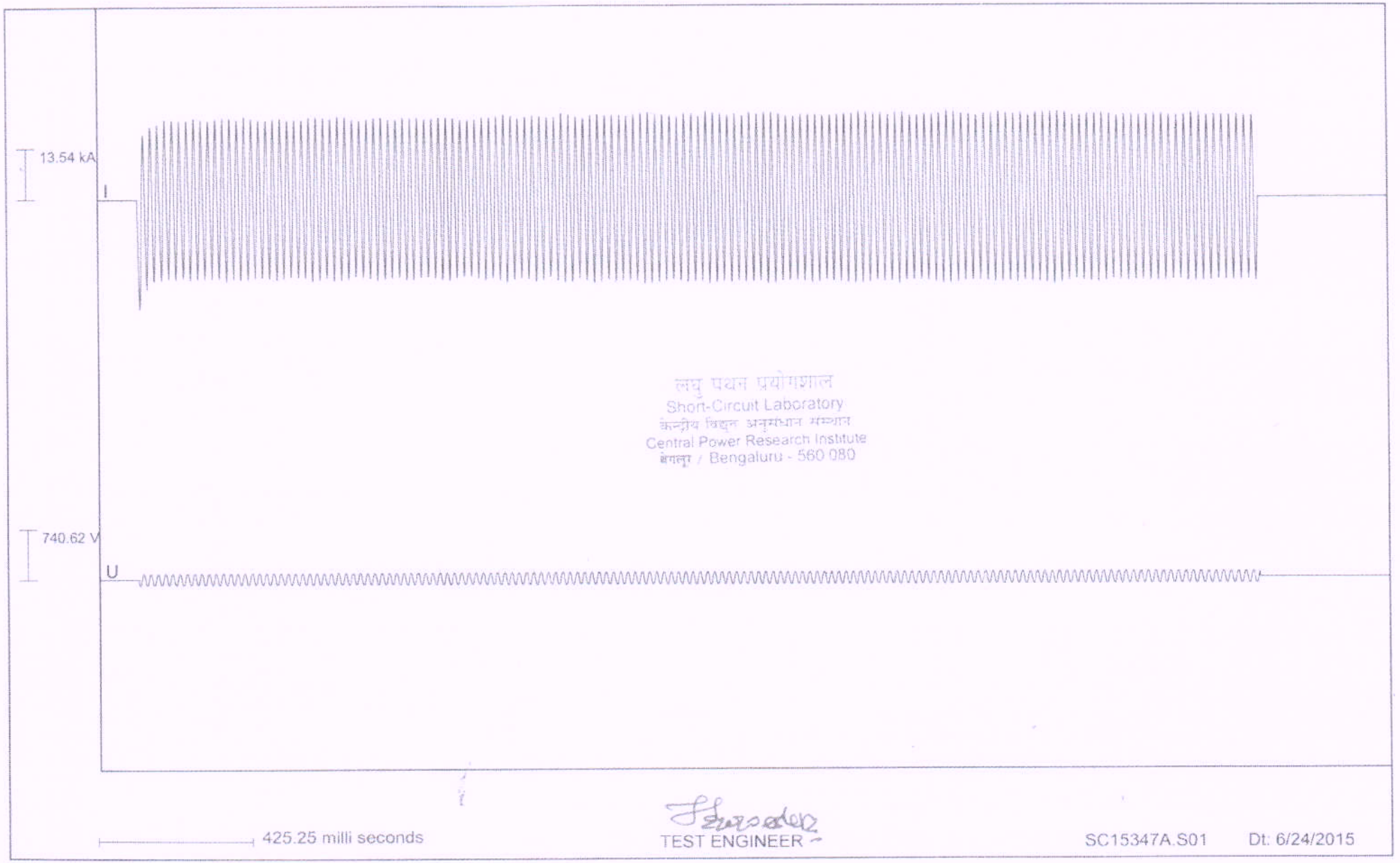
Test Report:
The test report contains the record of the values of test parameters as obtained during testing, the physical condition of the sample during / after the test(s) and copy of oscillogram(s). Test report is issued when partial tests are performed as against the complete test requirement for proving specific ratings.

Sealed Certificate:
The sealed certificate is issued, on request and payment of the prescribed charges thereof only when the sample of particular type and rating has satisfactorily passed all the specified tests in compliance with the condition stipulated in a published National / International standard.

CPRI issues the following type test certificates based generally on STL Guidelines:

I. Type test certificate of Short Circuit Performance.
II. Type test certificate of Switching Performance.
III. Type test certificate of Temperature Rise Performance.
IV. Type test certificate of Dielectric Performance.
V. Type test certificate of complete type test.

Test Engineer



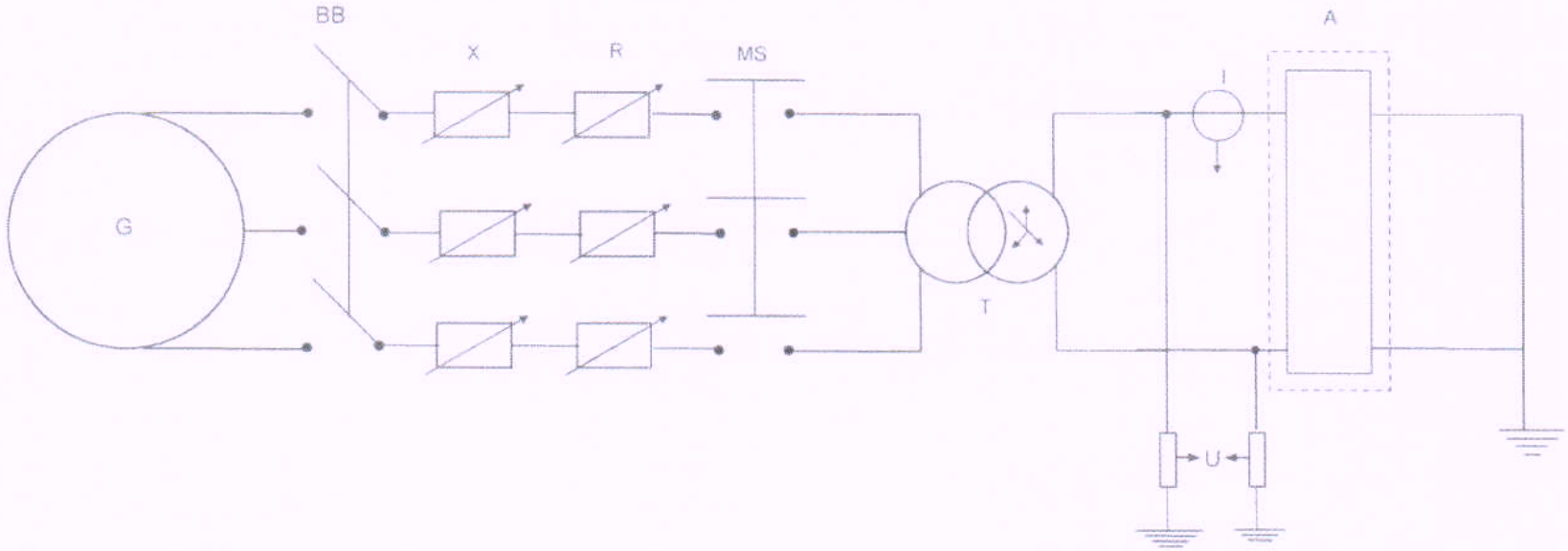
TEST ENGINEER

SC15347A.S01 Dt: 6/24/2015

CPRI

Schematic of main & measurement circuits - Single phase test

Circuit Number: CRTL/SC/STC-02B



G	Short-circuit Generator	T	Transformer
BB	Back Up Circuit Breaker	A	Sample Under Test
X	Reactor	I	Current Sensor
R	Resistor	U	Voltage Sensor
MS	Make Switch		

Test Engineer