



ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
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TEST REPORT

SHEET: 1 of 10

NAME & ADDRESS OF CUSTOMER: KEC INTERNATIONAL LTD. (Cables Division) Plot No. 803, Samlaya-Savli Road, Village Godampura, Taluka - Savli, Vadodara, Gujarat - 391520	REPORT NO.: HCCT/05/2980 DATE : 02.03.2013	
	CUSTOMER REF.NO Nil	DATE 07.01.2013
	DATE OF SAMPLE RECEIPT	DATE OF TESTING
	08.01.2013	23.01.2013 to 28.02.2013
SAMPLE DESCRIPTION: 3 Core X 120 sq. mm. HT XLPE insulated and black coloured PVC outer sheathed armoured cable Voltage Grade : 6.35/11 kV(E) Cable code : A2XFY(T) Class of Aluminium conductor : 2 Type of insulation : XLPE Type of PVC inner sheath : ST-2 Type of PVC outer sheath : ST-2	SAMPLE IDENTIFICATION: ERDA SAMPLE CODE NO. : HCCT-1308 EMBOSSING: KEC INTERNATIONAL LTD RPG CABLES 6.35/11 kV ELECTRIC CABLE 3 C X 120 mm ² XLPE A2XFY(T) 2012, UID NO. - 1129	
TEST DETAILS As per sheet No. 2 of 10	TEST SPECIFICATION IS : 7098 (Part 2) - 1985	
TEST RESULTS: As per sheet No. 3 of 10 to 10 of 10.		
ENCLOSURE: Annexure - 1 Impulse Waveforms (Sheet 1 of 4 to 4 of 4)		
REMARKS: The sample conforms to the requirement of the above mentioned test specification with respect to the tests carried out.		
 PREPARED BY	 CHECKED BY	 APPROVED BY
Note: 1. This report relates only to the particular sample received for testing in good condition at ERDA. 2. This report cannot be reproduced in part under any circumstances. 3. Publication of this report requires prior permission in writing from Director, ERDA 4. Only the tests asked for by the customer have been carried out. 5. In case of any dispute, Vadodara will be the exclusive jurisdiction & shall be construed as where the cause has arisen.		



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TEST DETAILS : IS : 7098 (Part 2) - 1985

SR. NO.	CL. NO.	TEST PARTICULARS
1.	18.1.a	Test on conductor
2.	18.1 b	Tests for formed steel wire(strip) armour
3.	18.1.c	Test for thickness of insulation and sheath
4.	18.1.d	Physical tests for insulation
5.	18.1.e	Physical tests for outer sheath
6.	18.1.k	Insulation resistance (volume resistivity) test
7.	18.1.q	Flammability test
8.	18.1.g	Partial discharge test
9.	18.1.h	Bending test
10.	18.1.j	Dielectric power factor test
11.	18.1.m	Heating cycle test
12.	18.1.n	Impulse Withstand test
13.	18.1.p	High Voltage test

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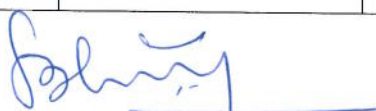
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**REPORT NO. : HCCT/05/2980****SHEET: 3 of 10****DATE : 02.03.2013****TEST RESULTS:**

SR. NO.	PARTICULARS OF TESTS AND CL. NO.	REQUIREMENT AS PER SPECIFICATIONS	OBTAINED VALUE	REMARKS
1.	Test on conductor: [Cl. No. 18.1.a of IS:7098 (Part 2) - 1985] (iv) Resistance test (Corrected at 20°C), ohm/km	Max. 0.253	Red 0.247 Yellow 0.245 Blue 0.251	Conforms
2.	Tests for formed steel wire(strip) armour : [Cl. No. 18.1.b of IS : 7098 (Part 2) - 1985] 1) Dimensions, mm 2) Physical tests on formed wire: (i) Tensile strength, N/mm ² (ii) Elongation , % (iv) Winding test (v) Uniformity of zinc coating (vi) Mass of zinc coating, gm/m ² (vii) Resistivity, ohm-cm (Corrected at 20°C)	A 4.0 ± 0.4 C 0.8 ± 0.08 Max. 580 Min. 250 Min. 6 The zinc coating shall not show any crack and shall not flake off on rubbing by the bare finger. No red scale shall be observed Min. 105 Max. 14.5 X 10 ⁻⁶	3.99 0.79 440 8.1 The zinc coating did not show any crack and did not flake off on rubbing by the bare finger. No red scale was observed 129 13.2 X 10 ⁻⁶	Conforms Conforms Conforms Conforms Conforms Conforms Conforms


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DATE : 02.03.2013

SHEET: 4 of 10

SR. NO.	PARTICULARS OF TESTS AND CL. NO.	REQUIREMENT AS PER SPECIFICATIONS	OBTAINED VALUE	REMARKS
3.	Test for thickness of insulation & sheath: [Cl. No. 18.1.c of IS : 7098 (Part 2) - 1985] -Thickness, mm A] Insulation B] Inner sheath C] Outer sheath	 Nom. / Min. 3.6 / 3.14 Min. 0.6 Min. 2.20	 Red 3.6/3.26 Yellow 3.6/3.29 Blue 3.6/3.38 0.7 2.32	 Conforms Conforms Conforms
4.	Physical tests for insulation: [Cl. No. 18.1.d of IS : 7098 (Part 2) - 1985] (i) Tensile strength and elongation at break - Tensile strength, N/mm ² - Elongation at break, % (ii) Ageing in air oven (At 135 ± 3°C for 7 days) Variation, % - Tensile strength - Elongation at break	 Min. 12.5 Min. 200 Max. ± 25 Max. ± 25	 Red 16.8 Yellow 16.6 Blue 16.9 Red 505 Yellow 468 Blue 470 Red + 13 Yellow + 12 Blue + 12 Red + 6 Yellow + 6 Blue + 4	 Conforms Conforms Conforms Conforms

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DATE : 02.03.2013

SR. NO.	PARTICULARS OF TESTS AND CL. NO.	REQUIREMENT AS PER SPECIFICATIONS	OBTAINED VALUE	REMARKS
	(iii) Hot set test (at $200 \pm 3^\circ\text{C}$ for 15 minutes) - Elongation under load, %	Max. 175	Red 50 Yellow 75 Blue 63	Conforms
	- Permanent Elongation (set), %	Max. 15	Red 0.0 Yellow 0.0 Blue 0.0	Conforms
	(iv) Shrinkage test (At $130 \pm 3^\circ\text{C}$ for 1 hour) - Shrinkage, %	Max. 4	Red 0.4 Yellow 0.3 Blue 0.4	Conforms
	(v) Water absorption test (Gravimetric) (at $85 \pm 2^\circ\text{C}$ for 14 days) - Water absorbed, mg/cm^2	Max. 1	Red 0.02 Yellow 0.03 Blue 0.02	Conforms
5.	Physical tests for outer sheath: [Cl. No. 18.1.e of IS : 7098 (Part 2) -1985]			
	(i) Tensile Strength and Elongation at break			
	- Tensile strength, N/mm^2	Min. 12.5	17.3	Conforms
	- Elongation at break, %	Min. 150	265	Conforms

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REPORT NO. : HCCT/05/2980 .
DATE : 02.03.2013

SHEET: 6 of 10

SR. NO.	PARTICULARS OF TESTS AND CL. NO.	REQUIREMENT AS PER SPECIFICATIONS	OBTAINED VALUE	REMARKS
	(ii) Ageing in air oven (at $100 \pm 2^\circ\text{C}$ for 7 days)			
	- Tensile strength, N/ mm^2	Min. 12.5	17.5	Conforms
	- Elongation at break, %	Min. 150	225	Conforms
	Variation, %			
	- Tensile strength	Max. ± 25	+ 1	Conforms
	- Elongation at break	Max. ± 25	- 15	Conforms
	(iii) Shrinkage test (At $150 \pm 2^\circ\text{C}$ for 15 min.)			
	- Shrinkage, %	Max. 4	0.71	Conforms
	(iv) Hot deformation test (At $80 \pm 2^\circ\text{C}$ for 6 hours)			
	- Depth of indentation, %	Max. 50	33.3	Conforms
	(v) Loss of Mass in air oven (At $100 \pm 2^\circ\text{C}$ for 7 days)			
	- Loss of mass, mg/cm^2	Max. 2	0.99	Conforms
	(vi) Heat shock test (at $150 \pm 2^\circ\text{C}$ for 1 hour)	No sign of crack or scale shall be observed	No sign of crack or scale was observed	Conforms
	(vii) Thermal stability test (At 200°C), minutes	Min. 80	135	Conforms

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DATE : 02.03.2013

SR. NO.	PARTICULARS OF TESTS AND CL. NO.	REQUIREMENT AS PER SPECIFICATIONS	OBTAINED VALUE	REMARKS
6.	Insulation resistance: [Cl. No. 18.1.k of IS : 7098 (Part 2) - 1985] Volume Resistivity, ohm-cm - At 27°C - At 90°C	Min. 1×10^{14} Min. 1×10^{12}	Red 4.5×10^{16} Yellow 1.9×10^{17} Blue 1.4×10^{17} Red 1.0×10^{16} Yellow 5.0×10^{15} Blue 7.3×10^{15}	Conforms Conforms
7.	Flammability test: [Cl. No. 18.1.q of IS : 7098 (Part 2) - 1985] - Period of burning after removal of flame, seconds - Unaffected portion from the lower edge of the top Clamp, mm.	Max. 60 Min. 50	0 370	Conforms Conforms
8.	Partial discharge test: [Cl. No. 18.1.g of IS : 7098 (Part 2) - 1985] - At 1.5U _o (i.e.: 9.5 kV) Where, U _o = 6.35 kV	Max. 20 pC	Red 1 pC Yellow 1 pC Blue 1 pC	Conforms

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DATE : 02.03.2013

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SR. NO.	PARTICULARS OF TESTS AND CL. NO.	REQUIREMENT AS PER SPECIFICATIONS	OBTAINED VALUE	REMARKS
9.	Bending test: [Cl. No. 18.1.h of IS : 7098 (Part 2) - 1985] -Partial discharge test after bending test : [Cl. No. 18.1.g of IS : 7098 (Part 2) - 1985] - At 1.5U ₀ (i.e.: 9.5 kV) Where, U ₀ = 6.35 kV	The sample shall be subjected to 3 bending cycles. The sample shall conform the partial discharge test after bending test. Max. 20 pC	The sample was subjected to 3 bending cycles. After completion of bending test, sample was subjected to Partial discharge test Red 1 pC Yellow 1 pC Blue 1 pC	Conforms Conforms
10.	Dielectric power factor test: [Cl. No. 18.1.j of IS : 7098 (Part 2) - 1985] [i] As a function of voltage: - At U ₀ (i.e : 6.35 kV) - Rise from 0.5 U ₀ to 2 U ₀ Where, U ₀ = 6.35 kV	Max. 0.004 Max. 0.002	Red 0.001062 Yellow 0.001228 Blue 0.001346 Red 0.001046 Yellow 0.001060 Blue 0.001048	Conforms Conforms
	[ii] As a function of temperature: - At an ambient temp. & At 2 kV - At max. Conductor temp. (90°C) at 2 kV	Max. 0.004 Max. 0.008	Red 0.000442 Yellow 0.000532 Blue 0.000559 Red 0.000842 Yellow 0.000938 Blue 0.000994	Conforms Conforms

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12.	Impulse withstand test: [Cl. No. 18.1.n of IS : 7098 (Part 2) - 1985]	Sample shall withstand 75 kV without breakdown for 10 +ve & 10 -ve shots	Please refer Annexure - 1 for detail results.	Conforms
13.	High voltage test: [Cl. No. 18.1.p of IS : 7098 (Part 2) - 1985]	Sample shall withstand power frequency voltage of 3U _o (i.e.: 19.05 kV) for 4 hours without any breakdown	All the three cores withstood the applied voltage of 3U _o (i.e.: 19.05 kV) for 4 hours satisfactorily.	Conforms
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ANNEXURE - 1

TEST REPORT No.: HCCT/05/2980

SHEET No.: 1 OF 4

DATE : 02/03/2013

LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST ON H. T. XLPE CABLE

TEST PARAMETERS:

SIZE OF CABLE : 3C X 120 sq. mm

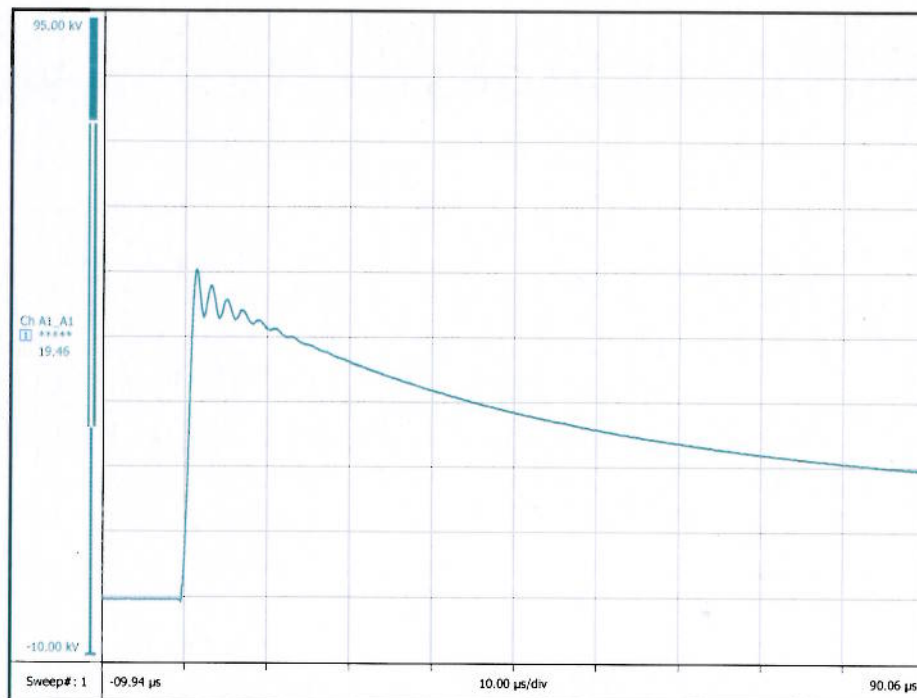
VOLTAGE GRADE : 6.35/11 kV

TEST VOLTAGE : 75 kVp

No. OF SHOTS APPLIED : 10 +VE & 10 -VE POLARITY SHOTS/PHASE

SHOTS RECORDED : CALIBRATION PULSE, FIRST & LAST SHOT BOTH POLARITY EACH PHASE

CALIBRATION PULSE



T1 1.381 μs

T2 57.90 μs

Up 51.38 kV

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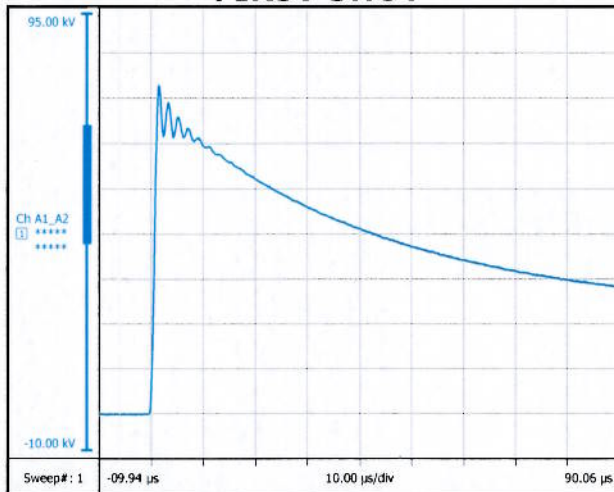
TEST REPORT No.: HCCT/05/2980
DATE : 02/03/2013

SHEET No.: 2 OF 4

LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST ON H. T. XLPE CABLE (R-PHASE)

POSITIVE POLARITY

FIRST SHOT

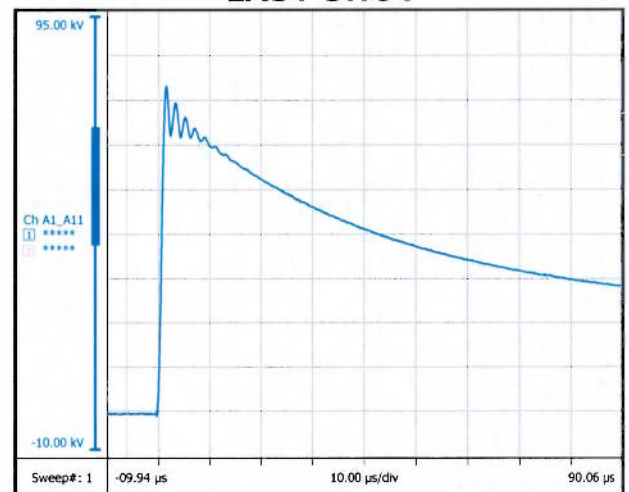


T1 1.376 μs

T2 57.30 μs

Up 73.88 kV

LAST SHOT



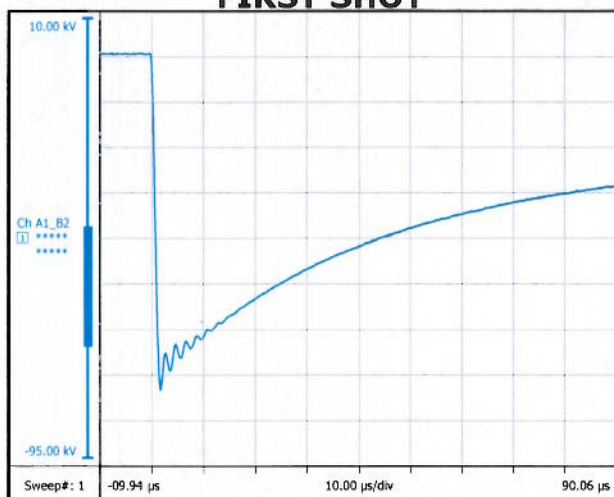
T1 1.377 μs

T2 57.33 μs

Up 74.27 kV

NEGATIVE POLARITY

FIRST SHOT

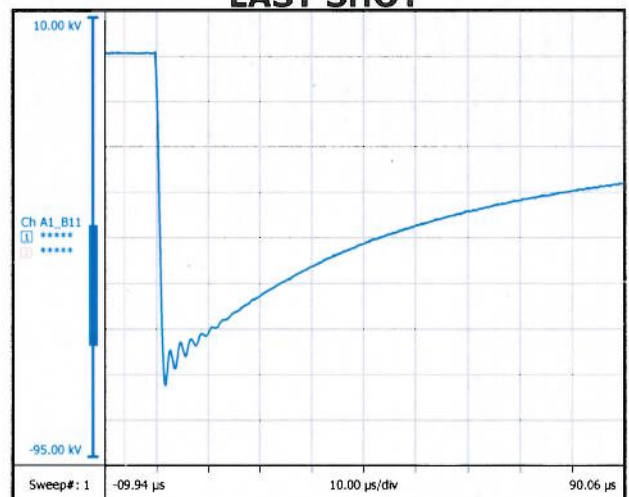


T1 1.508 μs

T2 57.92 μs

Up -75.72 kV

LAST SHOT



T1 1.519 μs

T2 58.20 μs

Up -74.96 kV

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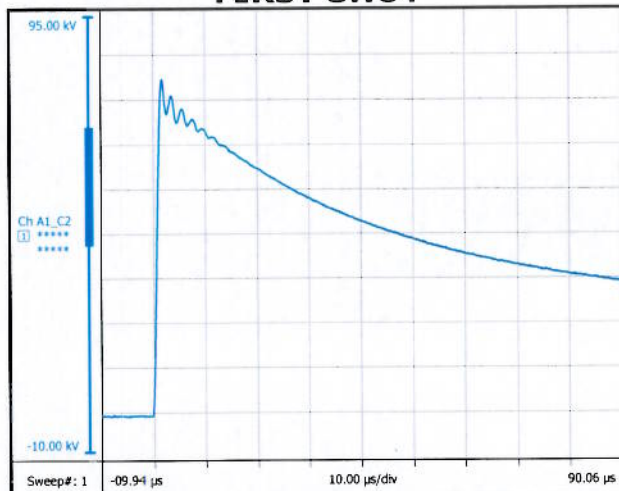
TEST REPORT No.: HCCT/05/2980
DATE : 02/03/2013

SHEET No.: 3 OF 4

LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST ON H. T. XLPE CABLE (Y-PHASE)

POSITIVE POLARITY

FIRST SHOT

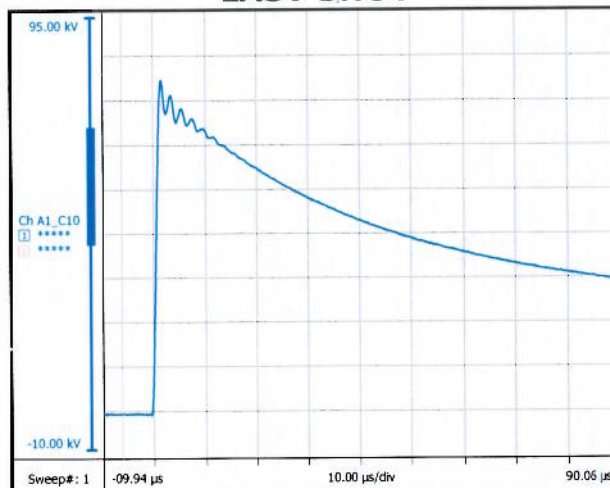


T1 1.511 μs

T2 58.72 μs

Up 76.64 kV

LAST SHOT



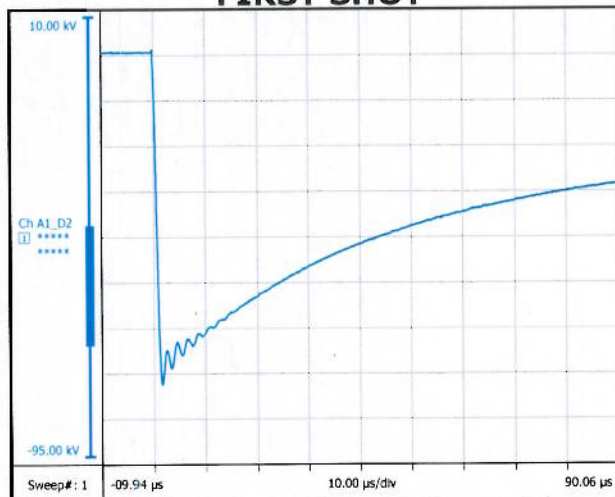
T1 1.512 μs

T2 58.42 μs

Up 74.75 kV

NEGATIVE POLARITY

FIRST SHOT

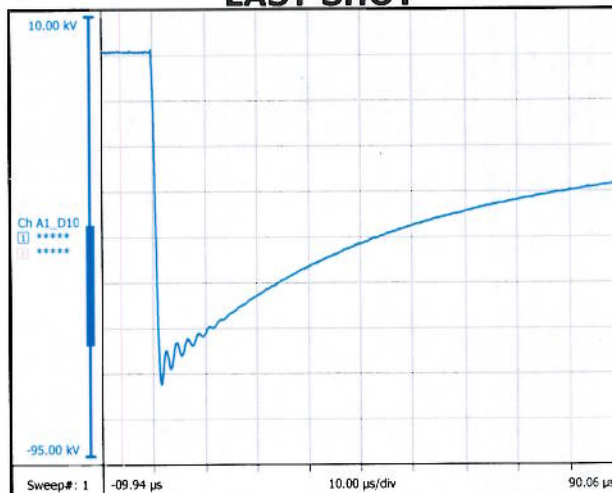


T1 1.515 μs

T2 58.55 μs

Up -74.94 kV

LAST SHOT



T1 1.512 μs

T2 58.13 μs

Up -74.05 kV

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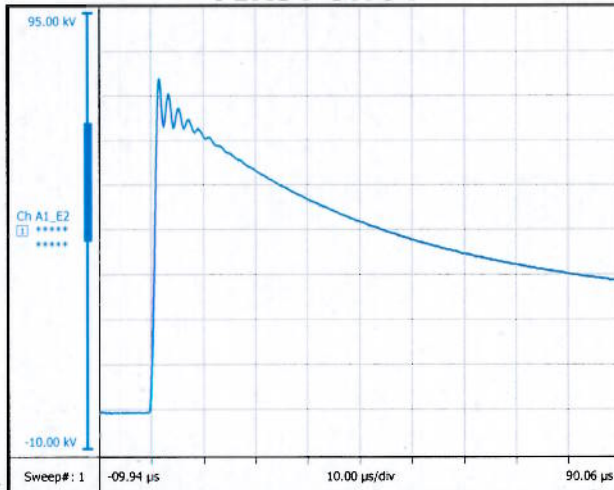
SHEET No.: 4 OF 4

LIGHTNING IMPULSE VOLTAGE WITHSTAND TEST ON H. T. XLPE CABLE (B-PHASE)

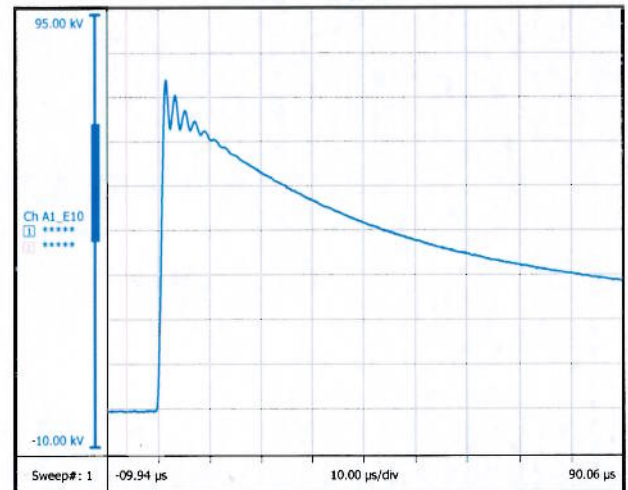
FIRST SHOT

POSITIVE POLARITY

LAST SHOT



T1 1.511 μs	T2 58.72 μs
Up 76.64 kV	

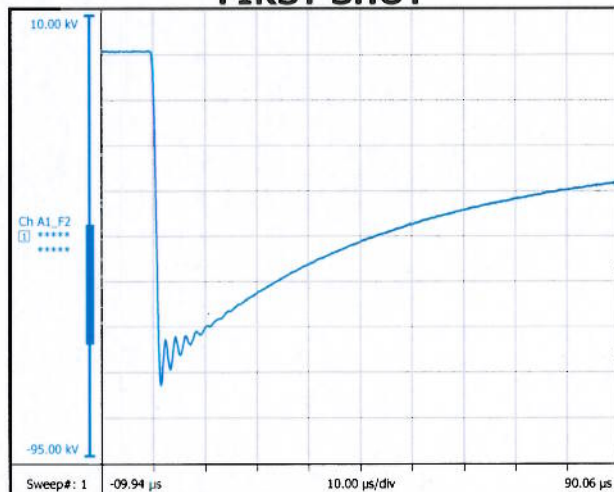


T1 1.511 μs	T2 58.31 μs
Up 76.31 kV	

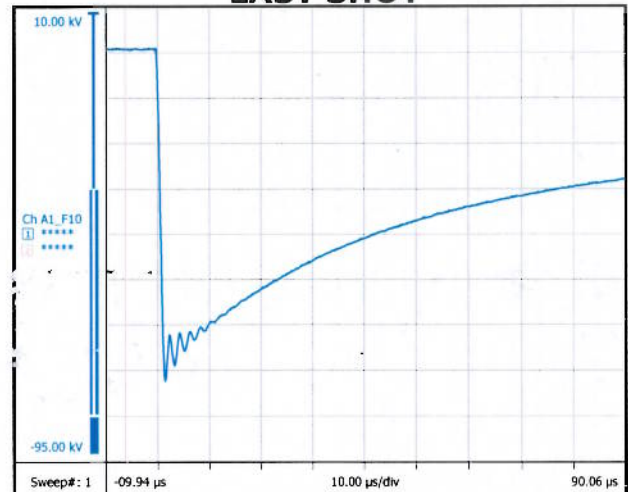
NEGATIVE POLARITY

FIRST SHOT

LAST SHOT



T1 1.410 μs	T2 58.22 μs
Up -74.60 kV	



T1 1.411 μs	T2 57.95 μs
Up -74.35 kV	

REMARKS: The above sample "**CONFORMS**" to the requirements of aforesaid reference standard with respect to the test carried out.

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