Annexure-I

Addendum No-01 A to Tender Documents

FAULT CURRENT LEVEL

Fault current level of HT Cables-
For 11KV Cable-21.5KA: (01) one Sec
& For 3.3KV Cable-13.6KA : (01) one sec.

GAURANTEED TECHNICAL PARTICULARS FOR 11KV {8.7/15 (17.5)kV} XLPE POWER CABLE

Sr. No.		Units	Cable Size to be mention by bidder
1.0	**GENERAL**		**To be mention by bidder**
1.1	Name of manufanurer		**To be mention by bidder**
1.2	Place of Manufacture		**To be mention by bidder**
2.01 to 2.08	**STANDARDS APPLICABLE**		**IEC: 60502 (P-2), IEC- 60228, IEC: 60811, ASTM-D: 2843, ASTM-D: 2863, IEC: 60754-1, SS: 424-1475 (F3), IEC: 60332 (Part-1), IEEE: 60383**
2.10	Current rating of cables conforms to		**IEC: 60502- 2 & IEC: 60287**
2.11	Short circuit rating conforms to		**IEC: 949 & IEC: 724**
2.12	Formula for calculating short circuit current for different durations		**To be mention by bidder**
3.0	**INSTALLATION CONDITION AT SITE**		
3.1	Ambient air temperature	Deg C	45 Deg.C
3.2	Ground temperature	Deg C	30 Deg.C
3.3	Depth of laying of cables buried in ground	mm	800 mm
3.4	Thermal resistivity of soil	Deg.C cm/W	150 deg C. Cm/W
4.0	**CHARACTERISTICS Ofi OR-LSH SHEATH**		
4.1	Orygen Index	%	Min. 29 as per ASTM D-2863
4.2	Temperature Index	%	Min. 250 deg C as per ASTM D- 2863
4.3	Acid gas generation	%	Max. 20% by weight as per IEC: 60754-1
4.4	Smoke density rating	%	Max. 60 % as per ASTM D- 2843
4.S	Flammabilty tests		
4.6	*Flammability test yor single cable*		**Shall be as per IEC: 60502-2/IEC: 60332-1**
4.7	*Swedish Chimney test*		SEN-55-424-1475 (Class-F3)
4.8	*Flammability test*		IEEE: 60383
5.0	**Cable Drum**		
5.1	Tyge & construction		Non returnable Steel drums
5.2	Standard drum length	mtrs	500
5.3	Tolerance on drum length	%	+ - 5%
5.4	*Tolerance on total QuaniLy*	%	(+) 0% to (-)2%
6.0	**(INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE**		
6.1	No. of cores & Size		**To be mention by bidder**
6.2	Voltage grade (Ut/ U)	kV	**8.7/15 (17.5)kV**
6.3	Base current ratings (*) based on Clause 3.0		
	a) In Air @30 °C	Amps	**To be mention by bidder**
	b) In Air @ 45 °C (De-rating 0.87 as per table B.10 of IEC: 60502-2)	Amps	**To be mention by bidder**
	c) In Ground @ 10 °C	Amps	**To be mention by bidder**
	d) In Ground @ 30 °C (De-rating 0.93 as Per table 8.21 of IEC: 60502-2)	Amps	**To be mention by bidder**
	e) In Ducts	Amps	**To be mention by bidder**
6.4	Short Circuit rating for one second	**KA**	**21.5**
6.5	a) D.C. resistance of conductor at 20 deg. C I Max.)	Ohm/km	**To be mention by bidder**
	b) A.C. resistance of Conductor at 90 deg. C (Approx.)	Ohm/km	**To be mention by bidder**
	c) Reactance of cable at normal frequency (Approx.)	Ohm/km	**To be mention by bidder**
	d) Electrostatic capacitance of cable at normal frequency	Ohm/km	**To be mention by bidder**
6.6	**CONDUCTOR**		
	a) Material type & grade		**Annealed plain Copper as per Class-2 of IEC: 60228**
	b) Nominal Cross-sectional Area	Sqmm	**To be mention by bidder**
	c) Scape of conductor		Stranded Compacted Circular
	d) Min. No. of strands	Nos.	18
	e) Nominal Dia af each strand oefore stranding	mm	Suitably selected to meet the DC resistance as per IEC: 60228
6.7	**CONDUCTOR SCREEN**		

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	a) Material		Extruded semi conducting compound (applied on top of semiconducting tape)
	b) Minimum thick ness	mm	0.3
6.8	**XLPE INSULATION**		
	a) Material		Extruded XLPE suitable for Water Tree Test Requirement
	a) Nominal thickness of insulation	mm	4.5
	c) Method of curing		Dry curing/Gas curing/steam curing/sioplas
	d) Whether suitable for Water Tree Test (accelerated) Water Tree Test of XLPE Insulation {accelerated) * Test Voltage - 3 x Uo * Ten frequency = 500 Hy * Core environment = 40 ”C * Duration of test = 4 months *Test after 4 months : Oielectric sEress withstand > 14 kV/mm		**To be mention by bidder**
6.9	**INSULATION SCREEN**		
i)	Non metallic part		
	a) Material		Extruded Cross-linked Semi conducting Compound
	b) Minimum thickness	mm	0.3
ii)	Metallic part		
	a) Material		Copper tape
	b) Dimensions of tape (Width x Thickness)	mm xmm	0.1 (nom) with + - 10% tolerance
	c) No. of tapes & minimum overlapping		One tape with 10% overlap
ili)	Earth fault current withstand capacity		400A for 2 sec. for each core
	Core Identification		Not Applicable
6.10	**PVC ST-2 FR-LSH INNERSHEATH**		
	a) Material		
	b) Thickness (aoprox)	mm	Not Applicable
	c) Method of application		Not Applicable
	1) Multi core cables		
	i} With fillers		Not Applicable
	ii) Without fillers		Not Applicable
	2) Single core cables		
	d) Type of fillers(if used)		Not Applicable
	Shape of fillers (if used)		Not Applicable
	e) Colour		Not Applicable
6.11	**ARMOUR**		
	a) Material		
	b) Size / dimensions of formed wires		
	c) Minlmum No. of formed wires	Nos.	
	d) Tolerance on farmed wlre dlmensions		
	e) Maximum Resistivity of GS formed wire		
	f) Maximum Resistivity of Aluminium Round Wire :		
6.12	**PVC ST-2 FR-LSH OUTERSHEATH**		
	a) Material		Extruded FR-LSH PVC "Type ST 2“ as per IEC:60502(P-2)
	b) Nominal thickness		1.90
	c) Colour		**RED**
6.13	**DIAMETERS**		
	a)Diameter of insulated conductor (Calculated)	mm	**To be mention by bidder**
	b) Cable diameter over laidup (Calculated)	mm	**To be mention by bidder**
	c) Cable diameter over armour (Calculatedl	mm	**To be mention by bidder**
	d) Overall diameter of cable (Approx)	mm	**To be mention by bidder**
6.14	Tolerance on overall diameter	mm	**To be mention by bidder**
6.15	Minimum bending radius	mm	20 x Overall diameter of Length
6.16	Safe pulling force	N /Sqmm	50N / Sqmm (wnen pulled by pulling eye|
6.17	Weight of cable (approx.)	Kg/Km	**To be mention by bidder**
6.18	Dimension of drum		SUITABLE TO CARRY STANDARD/DELIVERY LENGTH IN STEEL DRUM
6.19	Shipping weight (approx.) (for 500 Mtrs. length)	Kg	**To be mention by bidder**
6.20	Cable marking on outer sheath (of Embossing)		**Manufacturer Name, 11kV{ 8.7/15 (17.5) kV} , XLPE, No of Cores & CableSize, IEC: 60502 (P-2)), Year of Mfr., FR-LSH, @ Every 5Mtr**
	Whether incremental running length marked on cables		To be printing at every one mtr.
6.21	Impulse withstand voltage	kVp	95 kV (peak)

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GAURANTEED TECHNICAL PARTICULARS FOR 3.3KV {3.6/6 (7.2)} XLPE POWER CABLE

Sr. No.		Units	Cable Size to be mention by bidder
1.0	**GENERAL**		**To be mention by bidder**
1.1	Name of manufanurer		**To be mention by bidder**
1.2	Place of Manufacture		**To be mention by bidder**
2.01 to 2.08	**STANDARDS APPLICABLE**		**IEC: 60502 (P-2), IEC- 60228, IEC: 60811, ASTM-D: 2843, ASTM-D: 2863, IEC: 60754-1, SS: 424-1475 (F3), IEC: 60332 (Part-1), IEEE: 60383**
2.10	Current rating of cables conforms to		**IEC: 60502 2 & IEC: 60287**
2.11	Short circuit rating conforms to		**IEC: 949 & IEC: 724**
2.12	Formula for calculating short circuit current for different durations		**To be mention by bidder**
3.0	**INSTALLATION CONDITION AT SITE**		
3.1	Ambient air temperature	Deg C	45 Deg.C
3.2	Ground temperature	Deg C	30 Deg.C
3.3	Depth of laying oF cables buried in ground	mm	800 mm
3.4	Thermal resistivity of soil	Deg.C cm/W	150 deg C. Cm/W
4.0	**CHARACTERISTICS Ofi OR-LSH SHEATH**		
4.1	Orygen Index	%	Min. 29 as per ASTM D-2863
4.2	Temperature Index	%	Min. 250 deg C as per ASTM D- 2863
4.3	Acid gas generation	%	Max. 20% by weight as per IEC: 60754-1
4.4	Smoke density rating	%	Max. 60 % as per ASTM D- 2B43
4.S	Flammabilty tests		
4.6	*Flammability test yor single cable*		**Shall be as per IEC: 60502-2/IEC: 60332-1**
4.7	*Sweaish Chimney test*		SEN-55-424-1475 (Class-F3l
4.8	*Flammability test*		IEEE: 60383
5.0	**Cable Drum**		
5.1	Tyge & construction		No returnable Steeldrums
5.2	Standard drum length	mtrs	500
5.3	Tolerance on drum length	%	+ - 5%
5.4	*Tolerance on total QuaniLy*	%	(+) 0% to (-)2%
6.0	**(INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE**		
6.1	No. of cores & Size		**To be mention by bidder**
6.2	Voltage grade (Ut/ U)	kV	**3.6/6 (7.2)kV**
6.3	Base current ratings (*) based on Clause 3.0		
	a) In Air @30 °C	Amps	**To be mention by bidder**
	b) In Air @ 45 °C (De-rating 0.87 as per table B.10 of IEC: 60502-2)	Amps	**To be mention by bidder**
	c) In Ground @ 10 °C	Amps	**To be mention by bidder**
	d) In Ground @ 30 °C (De-rating 0.93 as Per table 8.21 of IEC: 60502-2)	Amps	**To be mention by bidder**
	e) In Ducts	Amps	**To be mention by bidder**
6.4	Short Circuit rating for one second	KA	**13.6**
6.5	a) D.C. resistance of conductor at 20 deg. C I Max.)	Ohm/km	**To be mention by bidder**
	b) A.C. resistance of Conductor at 90 deg. C (Approx.)	Ohm/km	**To be mention by bidder**
	c) Reactance of cable at normal frequency (Approx.)	Ohm/km	**To be mention by bidder**
	d) Electrostatic capacitance of cable at normal frequency	Ohm/km	**To be mention by bidder**
6.6	**CONDUCTOR**		
	a) Material type & grade		**Annealed plain Copper as per Class-2 of IEC: 60228**
	b) Nominal Cross-sectional Area	Sqmm	**To be mention by bidder**
	c) Scape of conductor		Stranded Compacted Circular
	d) Min. No. of strands	Nos.	15
	e) Nominal Dia af each strand oefore stranding	mm	Suitably selected to meet the DC resistance as per IEC: 60228
6.7	**CONDUCTOR SCREEN**		

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	a) Material		Extruded semi conducting compound (applied on top of semiconducting tape)
	b) Minimum thick ness	mm	0.3
6.8	**XLPE INSULATION**		
	a) Material		Extruded XLPE suitable for Water Tree Test Requirement
	a) Nominal thickness of insulation	mm	2.5
	c) Method of curing		Dry curing/Gas curing/steam curing/sioplas
	d) Whether suitable for Water Tree Test (accelerated) Water Tree Test of XLPE Insulation {accelerated) * Test Voltage - 3 x Uo * Ten frequency = 500 Hy * Core environment = 40 ”C * Duration of test = 4 months *Test after 4 months : Oielectric sEress withstand > 14 kV/mm		**To be mention by bidder**
6.9	**INSULATION SCREEN**		
i)	Non metallic part		
	a) Material		Extruded Cross-linked SemT conducting Compound
	b) Minimum thickness	mm	0.3
ii)	Metallic part		
	a) Material		Copper tape
	b) Dimensions of tape (Width x Thickness)	mm xmm	0.1 (nom) with + - 10% tolerance
	c) No. of tapes & minimum overlapping		One tape with 10% overlap
ili)	Earth fault current withstand capacity		400A for 2 sec. for each core
	Core Identification		Not Applicable
6.10	**PVC ST-2 FR-LSH INNERSHEATH**		
	a) Material		Not Applicable
	b) Thickness (aoprox)	mm	Not Applicable
	c) Method of application		
	1) Multi core cables		
	i} With fillers		Not Applicable
	ii) Without fillers		Not Applicable
	2) Single core cables		Not Applicable
	d) Type of fillers(if used)		Not Applicable
	Shape of fillers (if used)		Not Applicable
	e) Colour		Not Applicable
6.11	**ARMOUR**		
	a) Material		
	b) Size / dimensions of formed wires		
	c) Minlmum No. of formed wires	Nos.	
	d) Tolerance on farmed wlre dlmensions		
	e) Maximum Resistivity of GS formed wire		
	f) Maximum Resistivity of Aluminium Round Wire :		
6.12	**PVC ST-2 FR-LSH OUTERSHEATH**		
	a) Material		Extruded FR-LSH PVC "Type ST 2“ as perIEC: 60502(P-2)
	b) Nominal thickness		1.67
	c) Colour		**RED**
6.13	**DIAMETERS**		
	a)Diameter of insulated conductor (Calculated)	mm	**To be mention by bidder**
	b) Cable diameter over 1aidup (Calculated)	mm	**To be mention by bidder**
	c) Cable diameter over armour (Calculatedl	mm	**To be mention by bidder**
	d) Overall diameter of cable (Approx)	mm	**To be mention by bidder**
6.14	Tolerance on overall diameter	mm	**To be mention by bidder**
6.15	Minimum bending radius	mm	15 x Overall diameter of Length
6.16	Safe pulling force	N /Sqmm	50N / Sqmm (wnen pulled by pulling eye|
6.17	Weight of cable (approx.)	Kg/Km	**To be mention by bidder**
6.18	Dimension of drum		SUITABLE TO CARRY STANDARD/DELIVERY LENGTH IN STEEL DRUM
6.19	Shipping weight (approx.) (for 500 Mtrs. length)	Kg	
6.20	Cable marking on outer sheath (of Embossing)		**Manufacturer Name, 3.3kV {3.6/6 (7.2) kV} , XLPE, No of Cores & Cable Size, IEC: 60502 (P-2)), Year of Mfr., FR-LSH, @ Every 5Mtr**
	Whether incremental running length marked on cables		To be printing at every one mtr.
6.21	Impulse withstand voltage	kVp	60 kV (peak)

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GAURANTEED TECHNICAL PARTICULARS FOR LT XLPE POWER CABLE(Arm & Unarmoured)

Sr. No.		Units	Cable Size to be mention by bidder
1.0	**GENERAL**		**To be mention by bidder**
1.1	Name of manufanurer		**To be mention by bidder**
1.2	Place of Manufacture		**To be mention by bidder**
2.01 to 2.10	**STANDARDS APPLICABLE**		**IEC: 60502 (P-1), IEC- 60228, IEC: 60811, ASTM-D: 2843, ASTM-D: 2863, SS: 424-1475 & IEC:332-III-Cat-B, IEC:332-1/IEEE-383, IEC:754-1 & other relevant IEC**
2.11	Current rating of cables conforms to		**IEC: 60502-1 & IEC: 60287**
2.12	Short circuit rating conforms to		**IEC: 60949**
2.13	Formula for calculating short circuit current for different durations		**To be mention by bidder**
2.14	Cable Type		**To be mention by bidder**
2.15	Permissible Conductor Temperature		
	(a)Maximum Contineous rating		90 Deg.C
	(b)Short Circuit rating		250 Deg.C
3.0	**INSTALLATION CONDITION AT SITE**		
3.1	Ambient air temperature	Deg C	45 Deg.C
3.2	Ground temperature	Deg C	30 Deg.C
3.3	Depth of laying of cables buried in ground	mm	750
3.4	Thermal resistivity of soil	Deg.C cm/W	150 deg C. Cm/W
4.0	**CHARACTERISTICS of FR-LSH SHEATH**		
4.1	Orygen Index	%	Min. 29 as per ASTM D-2863
4.2	Temperature Index	%	Min. 250 deg C as per ASTM D- 2863
4.3	Acid gas generation	%	Max. 20% by weight as per IEC: 60754-1
4.4	Smoke density rating	%	Max. 60 % as per ASTM D- 2843
4.5	Flammabilty tests		
4.6	*Flammability test on single core cable*		**Shall be as per IEC: 60332-1, IEC: 60332-3(Cat-B)**
4.7	*Swedish Chimney test*		SS: 424-1475 (Class-F3)
4.8	*Flammability test*		IEEE: 383
5.0	**Cable Drum**		
5.1	Tyge & construction		Steel drums(Non returnable)
5.2	Standard drum length	mtrs	500/1000
5.3	Tolerance on drum length	%	+ - 5%
5.4	*Tolerance on total QuaniLy*	%	(+) 0% to (-)2%
6.0	**(INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE**		
6.1	No. of cores & Size		**To be mention by bidder**
6.2	Voltage grade (Ut/ U)	kV	**0.6/1.0(1.2)KV**
6.3	Base current ratings (*) based on Sl.(A) 7.0		
	a) In Air @40 °C	Amps	**To be mention by bidder**
	b) In Air @ 45 °C (De-rating 0.95)	Amps	**To be mention by bidder**
	c) In Ground @ 30 °C	Amps	**To be mention by bidder**
	e) In Ducts @ 30 °C	Amps	**To be mention by bidder**
6.4	Short Circuit rating for one second	KA for 1Sec	**To be mention by bidder for different sizes of cable**
6.5	a) D.C. resistance of conductor at 20 deg. C I Max.)	Ohm/km	**To be mention by bidder**
	b) A.C. resistance of Conductor at 90 deg. C (Approx.)	Ohm/km	**To be mention by bidder**
	c) Reactance of cable at normal frequency (Approx.)	Ohm/km	**To be mention by bidder**
	d) Electrostatic capacitance of cable at normal frequency	Ohm/km	**To be mention by bidder**
6.6	**CONDUCTOR**		
	a) Material type & grade		**Annealed plain Copper as per Class-2 of IEC: 60228**
	b) Nominal Cross-sectional Area-Main	Sqmm	**To be mention by bidder**
	c) Nominal Cross-sectional Area-Neutral	Sqmm	**To be mention by bidder**
	d) No of strands & nominal dia of each strand(Before stranding) - Main		

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	i) Minimum no. of strands	Nos.	
	ii) Nominal dia. Of each strand	mm	**Nominal dia. of each strand shall be such that to meet the DC resistance of conductor as per table -2 of IEC :60228**
	e) No of strands & nominal dia of each strand(Before stranding) - Neutral		
	i) Minimum no. of strands	Nos.	
	ii) Nominal dia. Of each strand	mm	
	f) Shape of conductor		Stranded Compacted Circular
	g) Direction of Lay of conductor	mm	Outermost layer shall be right handed lay
6.7	**XLPE INSULATION**		
	a) Material		Extruded XLPEas per IEC : 60502(P-1)
	b) Nominal thickness of insulation-Main	mm	To be mention by bidder
	c) Nominal thickness of insulation-Neutral	mm	To be mention by bidder
	d) Minimum thickness of insulation-Main	mm	To be mention by bidder
	e) Nominal thickness of insulation-Neutral	mm	To be mention by bidder
	f) Minimum Volume resistivity at 27 deg C	Ohm-cm	To be mention by bidder
	g) Minimum Volume resistivity at 90 deg C	Ohm-cm	To be mention by bidder
	h)Tensile strength(Minimum)	N/Sq.mm	To be mention by bidder
	i)Elongation of break(Minimum)	%	To be mention by bidder
	j) Method of curing		Sioplas(steam curing)
	i)Tolerance on thickness of insulation		To be mention by bidder
6.8	**Core Identification**		For 1Core-Insulation Shall be Neutral Coloured, For 2Core- Red & Black coloured, For 3Core- Red, Yellow & Blue Coloured, For 3.5 & 4Core-Red, Yellow, Blue & Black coloured
6.90	**PVC ST-2 FR-LSH INNERSHEATH**		
	a) Material		To be mention by bidder
	b) Thickness (aoprox)	mm	To be mention by bidder
	c) Method of application		To be mention by bidder
	1) Multi core cables		To be mention by bidder
	i} With fillers		To be mention by bidder
	ii) Without fillers		To be mention by bidder
	2) Single core cables		To be mention by bidder
	d) Type of fillers(if used)		To be mention by bidder
	Shape of fillers (if used)		To be mention by bidder
	e) Colour		Black
6.11	**ARMOUR**		
	a) Material		To be mention by bidder for Armour cable
	b)Type of Armour		To be mention by bidder for Armour cable
	i)Single core cable		To be mention by bidder for Armour cable
	ii)Multi core cable		To be mention by bidder for Armour cable
	c) Size / dimensions of formed wires	mm	To be mention by bidder for Armour cable
	d) Minimum No. round/formed wires	Nos.	To be mention by bidder for Armour cable
	e) Tolerance on formed wire dimensions	%	To be mention by bidder for Armour cable
	f) Maximum Resistivity of GS formed/round wire wire	Ohm-cm	To be mention by bidder for Armour cable
	g) Maximum Resistivity of Aluminium Round Wire :	Ohm-cm	To be mention by bidder for Armour cable
	h)Minimum Coverage	%	To be mention by bidder for Armour cable
6.12	**PVC ST-2 FR-LSH OUTERSHEATH**		
	a) Material		Extruded FR-LSH PVC "Type ST 2" as perIEC: 60502(P-1)
	b)Whether FRLS		Yes
	c) Nominal thickness	mm	To be mention by bidder for different sizes of cable
	d) Colour		**Black**
	e)Method of application		**Extruded**
	f)Tensile Strength(Minimum)	N/Sq.mm	**To be mention by bidder**
	g) Elongation at break(minimum)	%	**To be mention by bidder**
6.13	**DIAMETERS**		
	a)Diameter of insulated conductor (Main/Neutral))	mm	**To be mention by bidder**

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	b)Diameter of insulated conductor (Main/Neutral)-Actual	mm	**To be mention by bidder**
	c) Cable diameter over laidup (Main/Neutral))	mm	**To be mention by bidder**
	d) Cable diameter over laidup (Main/Neutral))-Actual		**To be mention by bidder**
	e) Cable diameter Outer sheath	mm	**To be mention by bidder**
	f) Cable diameter Outer sheath-Actual	mm	**To be mention by bidder**
	g)Overall diameter of Cable		**To be mention by bidder**
6.14	Tolerance on overall diameter	mm	**To be mention by bidder**
6.15	Minimum bending radius	mm	15 x Overall diameter of Length
6.16	Safe pulling force	N /Sqmm	50N / Sqmm (wnen pulled by pulling eye|
6.17	Weight of cable (approx.)	Kg/Km	**To be mention by bidder**
6.18	Dimension of drum		SUITABLE TO CARRY STANDARD/DELIVERY LENGTH IN STEEL DRUM
6.19	Shipping weight (approx.) (for 500 Mtrs. length)	Kg	
6.20	Cable marking on outer sheath (of Embossing)		**Manufacturer Name, 0.6/1 (1.2) kV , XLPE, No of Cores & Cable Size, Year of Mfr., FR-LSH, @ Every 5Mtr**
	Whether incremental running length marked on cables		To be printing at every one mtr.

GAURANTEED TECHNICAL PARTICULARS FOR LT PVC CONTROL CABLE(Armoured & Unarmoured)

Sr. No.		Units	Cable Size to be mention by bidder
1.0	**GENERAL**		**To be mention by bidder**
1.1	Name of manufanurer		**To be mention by bidder**
1.2	Place of Manufacture		**To be mention by bidder**
2.0	**STANDARDS APPLICABLE**		**IEC: 60502 (P-1) & Customer Specification**
2.1	Current rating of cables conforms to		**IEC: 60502-1 & IEC: 60287**
2.2	Short circuit rating conforms to		**IEC: 60949**
2.3	Formula for calculating short circuit current for different durations		**To be mention by bidder**
2.4	Cable Type		**To be mention by bidder**
2.5	Permissible Conductor Temperature		
	(a)Maximum Contineous rating		70 Deg.C
	(b)Short Circuit rating		160 Deg.C
3.0	**INSTALLATION CONDITION AT SITE**		
3.1	Ambient air temperature	Deg C	45 Deg.C
3.2	Ground temperature	Deg C	30 Deg.C
3.3	Depth of laying oF cables buried in ground	mm	750
3.4	Thermal resistivity of soil	Deg.C cm/W	150 deg C. Cm/W
4.0	**CHARACTERISTICS O FRLS SHEATH**		
4.1	Orygen Index	%	Min. 29 as per ASTM D-2863
4.2	Temperature Index	%	Min. 250 deg C as per ASTM D- 2863
4.3	Acid gas generation	%	Max. 20% by weight as per IEC: 60754-1
4.4	Smoke density rating	%	Max. 60 % as per ASTM D- 2843
4.5	*Flammability test on completed cable*		**Swedish Chimney test as per SS:424-1475-F3, IEC 60332-1**
5.0	**Cable Drum**		
5.1	Tyge & construction		Steel drums(Non returnable)
5.2	Standard drum length	mtrs	1000
5.3	Tolerance on drum length	%	+ - 5%
6.0	**(INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE**		
6.1	No. of cores & Size		**To be mention by bidder**
6.2	Voltage grade (Ut/ U)	kV	**0.6/1.0(1.2)KV**
6.3	Base current ratings		
	a) In Air @40 °C	Amps	**To be mention by bidder**
	c) In Ground @ 30 °C	Amps	**To be mention by bidder**
	e) In Ducts @ 30 °C	Amps	**To be mention by bidder**
6.4	Short Circuit rating for one second	KA for 1Sec	**To be mention by bidder for different cable sizes**
6.5	a) D.C. resistance of conductor at 20 deg. C I Max.)	Ohm/km	**To be mention by bidder**
	b) A.C. resistance of Conductor at 90 deg. C (Approx.)	Ohm/km	**To be mention by bidder**
	c) Reactance of cable at normal frequency (Approx.)	Ohm/km	**To be mention by bidder**
	d) capacitance per core	miroF/km	**To be mention by bidder**
6.6	**CONDUCTOR**		
	a) Material type & grade		**Annealed bare stranded Copper conductor as per Class-2 of IEC: 60228**
	b)Grade		**Electrolyte Grade**
	c) Cross-sectional area	Sqmm	**To be mention by bidder different cable sizes**
	i) Minimum no. of strands	Nos.	**7**
	ii) Nominal dia. Of each strand(before stranding)	mm	**Nominal dia. Of each strand shall be such that to meet the DC resistance of conductor as per table -2 of IEC :60228**
	d) Shape of conductor		Stranded Circular
	e) Direction of Lay of conductor	mm	Outermost layer shall be right handed lay
6.7	**INSULATION**		
	a) Material		Extruded PVC compound Type A as per IEC : 60502(P-1)
	b) Nominal thickness of insulation-Main	mm	To be mention by bidder

	c) Nominal thickness of insulation-Neutral	mm	To be mention by bidder
	d) Minimum thickness of insulation-Main	mm	To be mention by bidder
	e) Nominal thickness of insulation-Neutral	mm	To be mention by bidder
	f) Minimum Volume resistivity at 27 deg C	Ohm-cm	To be mention by bidder
	g) Minimum Volume resistivity at 90 deg C	Ohm-cm	To be mention by bidder
	h)Tensile strength(Minimum)	N/Sq.mm	To be mention by bidder
	i)Elongation of break(Minimum)	%	To be mention by bidder
	i)Tolerance on thickness of insulation		To be mention by bidder
6.8	**Core Identification**		To be mention by bidder for different sizes of cable
6.9	**PVC ST-2 FR-LSH INNERSHEATH**		
	a) Material		Extruded PVC compound Type ST-1 as per IEC : 60502(P-1)
	b) Thickness (aoprox)	mm	To be mention by bidder
	c) Colour		Black
6.10	**ARMOUR**		
	a) Material		To be mention by bidder for Armour cable
	b)Type of Armour		To be mention by bidder for Armour cable
	ii)Multi core cable		To be mention by bidder for Armour cable
	c) Size / dimensions of formed wires	mm	To be mention by bidder for Armour cable
	d) Minlmum No. round/formed wires	Nos.	To be mention by bidder for Armour cable
	e) Tolerance on formed wlre dlmensions	%	To be mention by bidder for Armour cable
	f) Maximum Resistivity of GS formed/round wire wire	Ohm-cm	To be mention by bidder for Armour cable
	g) Maximum Resistivity of Aluminium Round Wire :	Ohm-cm	To be mention by bidder for Armour cable
	h)Minimum Coverage	%	To be mention by bidder for Armour cable
6.11	**PVC ST-2 FR-LSH OUTERSHEATH**		
	a) Material		Extruded PVC compound Type ST-1 as per IEC : 60502(P-1) with FRLS properties
	b)Whether FRLS		Yes
	c) Nominal thickness	mm	To be mention by bidder for different sizes of cable
	d) Colour		**Black**
	e)Method of application		**Extruded**
	f)Tensile Strength(Minimum)	N/Sq.mm	**12.5**
	g) Elongation at break(minimum)	%	**150**
6.12	**DIAMETERS**		
	a)Diameter of insulated conductor (m/n) approx.	mm	**To be mention by bidder**
	b) Approx. Cable diameter over laidup cores	mm	**To be mention by bidder**
	c) Fict. diameter over laidup Cores	mm	**To be mention by bidder**
	e) Approx. Cable diameter Outer sheath	mm	**To be mention by bidder**
	f) Fict. Cable diameter Outer sheath	mm	**To be mention by bidder**
	g)Aprox. Overall diameter of Cable	mm	**To be mention by bidder**
6.13	Tolerance on overall diameter	mm	**To be mention by bidder**
6.14	Minimum bending radius	mm	12 x Overall diameter of Length
6.15	Safe pulling force	N /Sqmm	50N / Sqmm (wnen pulled by pulling eye|
6.16	Weight of cable (approx.)	Kg/Km	**To be mention by bidder**
6.17	Dimension of drum		SUITABLE TO CARRY STANDARD/DELIVERY LENGTH IN STEEL DRUM
6.18	Shipping weight (approx.) (for 100 Mtrs. length)	Kg	**To be mention by bidder**
6.19	Cable marking on outer sheath (of Embossing)		**Manufacturer Name, 0.6/1 (1.2) kV , No of Cores & Cable Size, PVC, FRLS, IEC 60502-1,Year of Mfr., @ Every 5Mtr**
6.2	Sequential marking		Sequential length marking shall be provided on outer sheath at every one mtr.

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TECHNICAL REQUIREMENTS

CODES & STANDARDS APPLICABLE:

- All standards, specifications, and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as of the date of opening of bid. In case of conflict between this specification and those (IEC: codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:
- IEC 60502-2(Part-II): HT Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) - Part 2: Cables for rated voltages from 6 kV (Um = 7,2 kV) up to 30 kV (Um = 36 kV).
- IEC 60502-1(Part-I) : LT Power Cable with extruded XLPE Insulation and their accessories for rated voltages from 0.6KV to 1.2KV & LT control Cable with extruded PVC Insulation and their accessories for rated voltages from 0.6KV to 1.2KV
- IEC : 60502-2 & 60502-1 & IEC : 60287 Confirms to current rating of cable.
- IEC: 949 & IEC: 724: Conforms to short circuit rating.
- IEC 17025: 2005: Low Carbon Galvanized steel wires, formed wires and tapes for armoring cables.
- IEC-754: (Part-I) Tests on gases evolved during combustion of electric cables.
- IEC-332: Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B & Other applicable standard relevant IEC: IEC 60228, IEC 60949, ASTMD:2843, ASTMD:2863, IEC-60754-1, IEC 60383, IEC:60332 Part-1, IEC:60332 Part-3-23 & IEEE: 60383).

TECHNICAL REQUIREMENTS:

- The cables shall be suitable for laying on racks, in ducts, trenches, conduits and underground (buried) installation with chances of flooding by water.
- Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.
- The copper conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be multi-stranded.
- XLPE insulation shall be suitable for continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C.
- The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831/ IEC 60189-3.
- The outer sheath shall be of PVC red color for HT cable & black color for LT cable. In addition to meeting all the requirements of Indian standards referred to, the outer sheath of all the cables shall have the following FRLS properties. (a.) Oxygen index of min. 29 (Test method as per IS 10810/IEC 60840 Part-58). (b) Acid gas emission of max. 20% as per IEC-754 (Part-I). (C) Smoke density rating shall not be more than 60% during the Smoke Density Test as per ASTMD-2843.
- The cores of three core & four cables shall be identified by coloring of insulation or by providing colored tapes helically over the cores, with Red, Yellow blue and black colors.

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- In addition to the manufacturer's identification on cables as per IEC, the following marking shall also be provided over the outer sheath: (a) Cable size and voltage grade - To be embossed, (b) The word 'FRLS' at every 5 metre - To be embossed.(c) Screen Fault current _ _ _KA for _ _ _ Sec. (Value of current & time shall be indicated) (d) Sequential marking of the length of the cable in meters at every one metre- To be embossed/printed.
- The embossing/printing shall be progressive, automatic, and in line and marking shall be legible and indelible.
- All cables shall meet the fire resistance requirement as per Category-B of IEC-332 Part -3.
- Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum over the declared value in the technical data sheets.
- In-plant repairs to the cables shall not be accepted. Pimples, fisheye, blow holes, etc. are not acceptable during manufacturing.
- The cables shall be resistant to solar radiation, the effect of oil, seawater, bacterial action, insects, and rodents.

CONSTRUCTIONAL FEATURES

11kV XLPE Power Cable :

- **Conductor** : Cables shall confirm to IEC 60502-2 Part - II These cables shall be multi-stranded, compacted circular Copper conductors (*annealed plain copper as per class-2 of IEC 60228*), XLPE-insulated, metallic screened, PVC outer sheathed. Voltage grade- 8.7/15 (17.5)kV.
- **Conductor screen & XLPE Insulation :** The conductor screen and Insulation screen shall both be of extruded semiconducting compound and shall be applied along with the XLPE insulation in a single operation of a triple extrusion process to as to obtain continuously smooth interfaces. The method of curing shall be dry curing/gas curing/Steam curing..
- **Insulation Screen :** The metallic screen of each core shall be capable of carrying earth fault current.

3.3kV XLPE Power Cables:

- **Conductor** : Cables shall confirm to IEC 60502-2 Part - II These cables shall be multi-stranded, compacted circular Copper conductors (*annealed plain copper as per class-2 of IEC 60228*), XLPE-insulated, metallic screened, PVC outer sheathed. Voltage grade- 3.6/6(7.2)kV.
- **Conductor screen & XLPE Insulation :** The conductor screen and Insulation screen shall both be of extruded semiconducting compound and shall be applied along with the XLPE insulation in a single operation of a triple extrusion process to as to obtain continuously smooth interfaces. The method of curing shall be dry curing/gas curing/Steam curing..
- **Insulation Screen :** The metallic screen of each core shall be capable of carrying earth fault current.

LT XLPE Power Cable :

- **Conductor** : Cables shall be confirm to IEC 60502-1(Part-I). These cable shall be multistrand, Compacted circular Copper Conductor((*annealed plain copper as per class-2 of IEC 60228*),
- **Conductor Screen & XLPE Insulation** : XL insulated, metallic screened, PVC outer sheathed. The metallic screen of each core shall consists of copper wires or tape with minimum overlap of 20%.
- **Voltage grade**- 0.6/1(1.2)kV.

LT PVC Control Cable :

- **Conductor** : Cables shall be confirm to IEC 60502-1(Part-I). These cable shall be multistrand, Compacted circular multistrand Copper Conductor((*annealed plain copper as per class-2 of IEC 60228*),
- **Conductor Screen & PVC Insulation** : PVC insulated & PVC outer sheathed.
- **Voltage grade**- 0.6/1(1.2)kV.

TYPE, ROUTINE AND ACCEPTANCE TESTS

- Bidder shall submit type test report of similar cable for the specified type test(s) & report should not be earlier than ten years prior to the date of bid opening, they may submit during detail engineering the type test report to the owner for waiver of conductance of such type test(s). Specified test should have been either conducted at an independent laboratory or should have been witness by client. The owner reserves the right to waive conducting of any or all the specified test(s) under this contract.
- All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be included in the cable price.
- Cable shall b\e manufactured as per the approved manufacturing quality plan (MQP).
- All types and sizes of cables being supplied shall be subjected to type tests, routine tests and acceptance tests as specified below and according to relevant standards

The following type tests shall be carried out on one size each of 11KV,3.3kV & LT Power & control cables

Type Test :

Conductor

1. Resistance test

For Armour Wires / Formed Wires

1. Measurement of Dimensions
2. Tensile Test
3. Elongation test
4. Torsion test
5. Wrapping test
6. Resistance test

8(a) Mass & uniformity of Zinc Coating tests 8(b) Adhesion test

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For XLPE, PVC insulation & PVC Sheath

9. Test for thickness
10. Tensile strength and elongation test before ageing and after ageing
11. Ageing in air oven
12. Loss of mass test
13. Hot deformation test
14. Heat shock test
15. Shrinkage test
16. Thermal stability test
17. Hot set test
18. Water absorption test
19. Oxygen index test
20. Smoke density test
21. Acid gas generation test
22 Flammability test as per IEC-332 Part-3 (Category -B)
23. Insulation resistance test
24. High voltage test
25. * Partial discharge test
26. * Bending test
27. * Dielectric power factor test
    a) As a function of voltage
    b) As a function of temperature

28* Heating cycle test

29* Impulse withstand test

***Applicable test shall be conducted**

ACCEPTANCE TEST:

The following test shall be carried out as an Acceptance Test in the presence of a representative of BIFPCL Inspecting Engineer on samples taken from the delivery lot. One drum out of every 10 number of drums or less shall be selected at a random sampling basis in each lot for the Acceptance Tests which shall be carried out at the manufacturer's/supplier's cost.

1. High Voltage Test
2. Conductor Resistance Test
3. Tensile / wrapping test.
4. Partial discharge test (In screened cables).
5. Insulation Resistance/Volume resistivity test
6. Measurement of thickness of insulation and sheath and other dimensions
7. Tensile strength & elongation at break for insulation & sheath.
8. Hot set test on XLPE insulation
9. Flammability test as per Swedish standard SS:424-15-75

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Class-F-3 (Swedish Chimney test)
10. Acid gas generation test as per IEC-754-1.
11. Smoke density test as per ASTM-D-2843/1977
12. Oxygen index test as per ASTM-D 2863/1977

Temp. index test as per ASTM-2863/77