TECHNICAL SPECIFICATION

FOR

HT XLPE POWER CABLES

VOLUME-II

SPECIFICATION NO: PE-TS-405-507-E001

REVISION: 00

3 X 660 MW NORTH KARANPURA

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP (INDIA) – 201301

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS-405-507-E001	
	TECHNICAL SPECIFICATION FOR HT XLPE POWER CABLES	REVISION 0	DATE: 26.02.2024
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1.0 SCOPE

1.1 Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of HT XLPE POWER CABLE conforming to this specification.

1.2 Technical requirements of HT XLPE POWER CABLE are indicated in technical specification.

2.0 BILL OF QUANTITIES

2.1 The bidder to quote for items as per price schedule attached with NIT.

3.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

3.1 Documents shall be submitted after placement of order for BHEL & customer's approval as per the schedule specified below:

BHEL Drawing No.	***Drawing Title***	***Vendor Sub (Days)****	***Bhel comment (Days)***	***Vendor Sub (Days)#***	***Bhel and Customer comment/approval (Days)***
Primary Documents					
PE-V0-441-507-E101	Datasheet and Cross Section Drawings for Power Cables (HT)	2	1	1	2
PE-V0-441-507-E912	QAP for HT Power cables	2	1	1	2
Secondary Documents					
PE-V0-441-507-E104	Type Test Report for Power cable (HT)	2	1	1	2

NOTES:

a) * 1st submission within indicated days from date of purchase order

b) # Submission (within indicated days) after incorporating all BHEL comments

c) Primary documents shall be considered for Delay analysis

3.2 a) The bidder shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. All types and sizes of cables being supplied shall be subjected to type tests, routine tests and acceptance tests as specified in specification.
b) In case the bidder has conducted such specified type test(s) within last ten years from enquiry date he may submit during detailed engineering the type test reports to the owner for waiver of conductance of such type test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the bidder. In case this type

test report is not acceptable, the bidder has to conduct type test as specified in specification free of cost.

3.3 Documents shall be furnished through BHEL's document management system (wrench) portal.

Notes:

1. Vendor shall submit the dates for drawing/document submission/BHEL comments/ resubmission after approval of documents.
2. In BOM each of the item to be uniquely identified with item code no. or item Sl. No. Supplier to ensure that all the items which will find separate mention in the packing list are covered in detailed BOM. Supplier to give following undertaking in BOM: " The BOM provided here completes the scope (in content and intent) of material supply under PO no. ---- dtd ----- Any additional material which may become necessary for the intended application of supplied item/package will be supplied free of cost in most reasonable time."
3. Sub vendor shall be subject to customer approval.

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SPECIFIC TECHNICAL REQUIREMENTS

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TECHNICAL DATSHEET

S.No.	Particulars	Description
1.0	**TYPE OF CABLE**	Flame Retardant-Low Smoke (FR-LSH) HT CABLE
1.1	**VOLTAGE GRADE**	11/11 kV (unearthed) & 3.3/3.3kV (unearthed)
2.0	**STANDARDS APPLICABLE**	
2.1	Standard applicable in general (Latest amendment to be referred if any)	IS:7098 (Part-2)
2.2	Current rating of cables conforms to	As per IS:3961 (P-7)
2.3	Short circuit rating conforms to	IEC 60949
3.0	**INSTALLATION CONDITIONS AT SITE**	
3.1	Ambient air temperature (in deg. C)	50
3.2	Ground temperature (in deg. C)	30
3.3	Depth of laying of cables buried in ground (in cm)	90
3.4	Thermal resistivity of soil (in deg. C cm/W)	150
5.0	**CONDUCTOR**	
5.1	Applicable standard	IS: 8130
5.2	Material type	Aluminium
5.3	Grade	H2
5.4	Class	Class 2 (Stranded)
5.5	Shape	Circular
5.6	Compaction	Compacted
5.7	Cable Size (in sq.mm)	Refer project specific BOQ
6.0	**CONDUCTOR SCREEN**	
6.1	Material	Extruded layer of Semi Conducting Compound
6.2	Minimum thickness (in mm)	0.3
7.0	**XLPE INSULATION**	Extruded XLPE compound
7.1	Nominal thickness of insulation (in mm)	As per IS:7098 (P-2)

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7.2	Extrusion & method of curing	Triple Extrusion (Extruded semi-conducting compound conductor screen and insulation screen shall be applied along with XLPE insulation in a single operation by triple extrusion process) by Gas curing / Steam curing
7.3	Method of extrusion	Pressure extruded / Vacuum extruded
7.4	Method of curing	3.3/3.3 kV & 11/11 kV: Dry curing using Nitrogen/gas curing/steam curing.
8.0	**INSULATION SCREEN**	
8.1	Type of screen	Insulation screen shall consist of two parts: 1. Non-Metallic Part 2. Metallic Part
8.2	Material (Non-Metallic part)	Extruded Cross-linked Semi-conducting compound. Bonded type.
8.3	Minimum thickness (Non-Metallic part) (in mm)	0.3
8.4	Material (Metallic part)	1. Copper Tape. The metallic screen of each core shall be capable of carrying earth fault current of **600A for 2 secs** and shall consist of copper wires or copper tape applied helically on core. 2. Armour shall constitute metallic part of screening for single core armoured cables.
8.5	Minimum thickness (Metallic part) (in mm)	0.1
8.6	No. of tapes and Minimum overlapping	1. No. of tapes and Minimum overlapping 20%
8.7	Earth fault current withstand capacity (calculation to be furnished)	600A, 2 sec (For multi-core cables, screen of each core shall be rated individually for the above value).
8.8	Extrusion & method of curing	Same as that, mentioned for Insulation above.
9.0	**CORE IDENTIFICATION**	Colour coding as per IS:7098 (P-2)
10.0	**INNER SHEATH**	Not applicable for Single Core Cable
10.1	Standard Applicable	IS: 7098 (Part-2) & IS: 5831
10.2	Material	Extruded HRPVC Type ST-2
10.3	Colour	Black
10.4	Whether FR-LSH	No
10.5	Inner sheath applicable for single core cable	No
10.6	Fillers acceptable	Yes
10.7	Material of fillers (if permitted)	Same as inner sheath (Material of filler to be compatible with that of inner sheath)

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10.8	Method of application	Extrusion
(1)	Multi-core cables:	
(i)	With fillers	Pressure extruded / Vacuum extruded
(ii)	Without fillers	Pressure extruded
10.9	Thickness of inner sheath (in mm)	As per Table-5 of IS: 7098 (Part-2)
11.0	**ARMOUR**	
11.1	Standard Applicable	Dimension as per IS: 7098 (Part-2) Table-6 and tolerance on dimension as per IS:3975
11.2	Material (Single core)	Non-Magnetic hard drawn H4 grade Aluminium Single Round Wire as per IS: 8130 for single core cables.
11.3	Material (Multi core)	Galvanised Steel Round Wire / Galvanised Steel Formed Wire (dimensions as per Sl. No.(ii) of table – 6 of IS 7098 Part-II).
11.4	Minimum coverage	90%.
11.5	Gap between armour wire	Shall not exceed one armour wire space (No cross over / Overriding)
11.6	Breaking load of Joint	>95% of normal armour
11.7	Maximum resistivity of Al round wire (in Ohm-mm^2/km)	28.264
11.8	Armour joint surface	To be applied with Zinc rich paint.
12.0	**OUTERSHEATH**	
12.1	Standard Applicable	IS: 5831
12.2	Material	Extruded HRPVC Type ST2
12.3	Colour	Black
12.4	Whether FR-LSH	Yes
12.5	Method of application	Extruded
12.6	Thickness of outer sheath	As per Table-7 of IS: 7098 (Part-2)
12.7	Marking/ Embossing on Outer sheath @ 5 Mtr.	(i) Owner's name (i.e. NTPC) (ii) Manufacturer's name and trade mark, (iii) Year of manufacture, (iv) Type of cable and voltage grade, (v) Nominal cross section area of conductor and no. of cores, (vi) 'BHEL-PEM'. (vii) Cable shall be marked as having FRLSH. (viii) Cable code. (ix) Screen fault current 600A for 2 sec (for 3.3 kV & 11 kV). (x) Drum no. (The embossing/ printing shall be progressive, automatic, in line and marking shall be legible and indelible)

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12.8	Marking/ Embossing on Outer sheath @ 1 Mtr.	Progressive Sequential length marking, @ 1Mtr (by printing/embossing)
13.0	**FR-LSH CHARACTERISTICS**	
13.1	Oxygen index	Minimum 29 as per IS 7098-2 / Minimum 29 as per ASTMD 2863
13.2	Temperature index	Minimum 250°C as per IS 7098-2 / Minimum 250°C as per ASTMD 2863
13.3	Acid gas generation	Maximum 20% by weight as per IS 7098-2 / Maximum 20% by weight as per IEC-60754-1
13.4	Smoke density rating	Maximum 60% as per IS 7098-2 (i.e. IS 13360 Part 6 Section 9) / Maximum 60% as per ASTMD 2843.
13.5	Flame retardance test for single cable (for cable OD ≤ 35mm)	As per IS 7098 Part 2 (IS 10810 Part 61)
13.6	Flame retardance test for bunched cables	As per IS 7098 Part 2 (IS 10810 Part 63)
14.0	**TYPE TEST CONDUCTION REQUIRED**	Refer sl. no. 3.2(a) & 3.2(b) of scope sheet of Technical specification.
15.0	**FLAMMABILITY**	
15.1	Flammability test for single cable	As per IEC 60332-1
15.2	Flammability test for bunched cables	As per IEC 60332-3 Part 23 (Cat-B)
15.3	Flammability test as per IEEE: 60383	Yes
15.4	As per Swedish Chimney test SEN-SS-424-1475-F3	Yes, as applicable
16.0	Anti-rodent and Termite repulsion Test	No
17.0	Anti-Fungal Test (self-certification by supplier for Anti-fungal properties)	No
18.0	Special Tests	The charges of UV Radiation test & Hydrolytic Stability test (if applicable) shall be reimbursed extra at actual against original money receipt of Govt. Lab. (CPRI/ ERDA etc).
18.1	Hydrolytic Stability as per ASTM D 3137 :81 (Duration: - 14 days)	No
18.2	UV Radiation Test as per BS EN ISO 4892-2 (Duration: - 14 days)	No
18.3	UV Radiation Test as per ASTM G 154 (Duration: - 14 days)	No
19.0	**DIAMETERS**	
19.1	Tolerance on overall diameter	(±) 2 mm. over the declared value.
19.2	Tolerance on eccentricity of core	(+) 10 %

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19.3	Tolerance on ovality of core	(+) 2 %
23.0	**CABLE DRUM DETAILS**	
23.1	Type of Drum	Wooden (as per IS 10418) / Steel
23.2	Construction Details	All wooden parts from seasoned wood and ferrous parts shall be treated with suitable rust preventive finish or coating. Wooden drum shall be treated by immersing in copper nitrate solution. Both the end of cables shall be properly sealed with heat shrinkable seal secured by 'U' nails so as to eliminate ingress of water during transportation, storage & erection.
23.3	Painting	Entire surface to be painted. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden cable drums shall be treated with copper naphthenates or zinc naphthenates for preserving the wood. Drum number shall be indicated on each drum.
23.4	Standard drum length	As specified in BOQ-Cum-Priced Schedule
23.5	Tolerance on drum length	(±) 5%
23.6	Details of marking on Drum	The cable drums shall carry the following details in printed form: a) Manufacturer's name or trade make b) Address & contract no. c) Type of cable & voltage grade. d) Year of manufacture. e) Type of insulation. f) No. of core and sizes of cables. g) Cable code – FRLS. h) Single length of cable on drum i) Direction of rotation, by arrow. j) Approx. net/gross weight stencilled on both side of drum. A tag containing same information shall be attached to the leading end of the cable.
24.0	Packing details	Normal.
24.1	Outermost Layer	The outer most cable layer shall be covered with water proof cover polythene followed by complete drum covering with wooden plank of suitable thickness across flanges.

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DATA TO BE FURNISHED BY SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT

0.0	**NAME & ADDRESS OF MANUFACTURER**	
4.0	**TECHNICAL PARAMETER (SIZE WISE INFORMATION TO BE FURNISHED)**	
4.1	Base current ratings (*) based on Clause No. 2.0 (in Amp)	
(a)	In air	
(b)	In ground	
(c)	ducts	
4.2	Continuous current rating for maximum conductor temp. when laid in air at ambient of 50 deg. C.	
a)	When metallic screen /armour is earthed at one end (Amps)	
b)	When metallic screen/armour is earthed at both the ends (Amps)	
c)	For unscreened, unarmoured Cables (Amps)	
5.0	**CONDUCTOR**	
5.8	No & dia of wires in each core before stranding (in no x mm)	
5.9	Properties:	
(a)	D.C. resistance of conductor at 20 deg. C (in ohm/km)	
(b)	A.C. resistance of conductor at 20 deg. C (in ohm/km)	
(c)	A.C. resistance of conductor at 90 deg. C (in ohm/km) (for XLPE cables)	
(d)	Reactance per phase at 50 Hz (in ohm/km)	
(e)	Capacitance at 50 Hz (in micro Farads /km)	
7.0	**XLPE INSULATION**	
7.5	Nominal thickness of insulation (in mm)	
7.6	Min. insulation resistance at 20 deg. C (Mega Ohm/Km)	
8.0	**INSULATION SCREEN**	
8.9	Cross sectional area of screen (sq. mm)	
8.10	Dia below metallic screen i.e. below copper tape/wire (mm)	
10.0	**INNER SHEATH**	
10.10	Minimum thickness of inner sheath (in mm)	
10.11	Tolerance in thickness of inner sheath (mm)	

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11.0	**ARMOUR**	
11.7	Size/ dimensions (in mm)	
11.8	Minimum no. of wires/ formed wires	
11.9	Resistivity of GS round/ strip armour at 20 deg. C (ohm- cm.)	
11.10	Direction of lay of armour	
12.0	**OUTERSHEATH**	
12.8	Nominal thickness (in mm) of outer sheath (Unarmoured cable)	
12.9	Minimum thickness (in mm) of outer sheath (Unarmoured & Armoured cable)	
12.10	Tolerance on Nominal thickness of sheath (mm)	
19.0	**DIAMETERS (in mm)**	
19.2	Nominal Diameter of insulated conductor	
19.3	Nominal Cable diameter under armour	
19.4	Nominal Cable diameter over armour	
19.5	Nominal Overall diameter of cable	
20.0	**WEIGHTS**	
20.1	Weight of cable (in kg/km)	
20.2	Weight of conductor (in MT/km)	
20.3	Weight of XLPE insulation (in MT/km)	
20.4	Weight of PVC (Inner Sheath & Fillers) (in kg/km)	
20.5	Weight of Aluminium Round Wire / GS formed Wire (Approx.) (in kg/km)	
20.6	Weight of PVC (Outer Sheath) (in kg/km)	
21.0	Minimum bending radius (x O.D.)	
22.0	Safe pulling force (in Kg)	
23.0	**CABLE DRUM DETAILS**	
23.7	Dimension of drum (F X B X T) (Approx. in mm)	
23.8	Shipping weight (Approx. in Kg)	
25.0	Voltage developed in the screen/armour per 100 mt run with screen / armour earthed at one end when cables is carrying (for single core cables only)	
a)	Rated current (Volts):	
b)	Short circuit current (Volts) (i) in the screen:	

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	(ii) in the armour:	
26.0	Circulating current developed in the screen/armour for 100 mt. run, with screen/armour earthed at both ends when cable is carrying (for single core cables only)	
a)	Rated current (Volts):	
b)	Short circuit current (Volts) (i) in the screen: (ii) in the armour:	

NOTE:
A) The intent of specification is not to specify all details of design & construction of material. The material shall, however, conform in all aspects to high standard of design, engineering and workmanship and be capable of performing in continuous operation up to & after bidder's guarantee period in manner acceptable to purchaser who will interpret the drawings & specification and shall have power to reject any work or material which in his judgement is not in full accordance with this specification.
B) The material, construction, manufacture, inspection and testing of HT XLPE POWER CABLES shall conform to the latest revision of relevant standards
C) Bidder shall confirm compliance with the BHEL's Standard Quality Plan (PE-QP-999-507-E001) & NTPC standard Quality plan (0000-999-QOE-S-042 REV-02) as attached with the specification without any deviations. At contract stage, the successful bidder shall submit the Quality Plan for BHEL/ ultimate customer's approval. In case bidder has reference, Quality Plan agreed with ultimate customer, same can be submitted for specific project after award of contract for BHEL/ ultimate customer's approval. There shall be no commercial implication to BHEL on account of Quality plan approval.

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QUALITY PLAN

NTPC	Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)	STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)	QP. NO. 0000-999- QOE- S-042 REV-02 DATE : 03/12/2018 Page 1 of 9	REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR	APPROVED BY K K OJHA	1

Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11

Instructions: 1) Cable manufacturer to maintain records to show co- relation of raw materials to finished cables i.e. raw material batch/ lot no. should be traceable to the final cable drum number or batch number.
2) Cable manufacturer to maintain all quality control records identified as per all QP stages enumerated below whether it is identified for NTPC verification or witness or not.
3) Sources of raw material shall be submitted at the time of submission of endorsement sheet for approval by NTPC.

A	Raw material/ Brought out Items													
1.01	Aluminum rod for conductor	1.Make	MA	Verify	100%	---	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	QCR		V	--	--	
		2. Grade	MA	--do--	--do--	--	NTPCADS	NTPC ADS	--do--		V	--	---	
		3. Resistivity	MA	Elect	As per cable mnfr std.	--	IS 5082	IS 5082	-do--		P	--	--	
1.02	Aluminum rod for Armouring (as applicable)	1. Make	MA	Verify	100%	--	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	Q.C.R		V	--	--	
		2. Grade	MA	Verify	As per mnfr std.	--	NTPC ADS	NTPC ADS	Manuf. TC		V	--	--	
		3. Resistivity	MA	Verify	-do-	-	IS 5082	IS 5082	-do--		P	--	--	
1.03	Copper rod (If applicable)	1. Make	MA	Verify	100%	--	Manufacturer approved vender	Manufacturer approved vender	QCR		V	--	--	
		2. Resistivity	MA	Verify	As per cable mnfr std.	--	IS 613	IS 613	--do--		P			
1.04	XLPE compound for insulation	1. Make	MA	Verify	--do--	100%	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	--do--		V	V	V	
		2. Type/ Grade	MA	Verify	100%	100%	NTPC ADS	NTPC ADS	--do--		V	V	V	
		3. Shelf life/ Storage condition	MA	Verify	100%	100%-	Compound manuf. Std	Compound manuf. Std	QCR		V	V	V	
		4. All acceptance test as per manufacturer norms	MA	Verify	As per manufacturer norms	As per manufacturer norms	NTPC ADS	NTPC ADS	Supplier TC		V	V	V	Refer note 1
1.05	PVC Compound for Inner sheath	1. Make	MA	Verify	As per manufacturer norms	--	MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	Supplier TC		V	V	--	
		2 Type/ Grade	MA	Verify	--do--	--	NTPC ADS	NTPC ADS	--do--		V	V	--	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

NTPC	Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)	STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)	QP. NO. 0000-999- QOE- S-042 REV-02 DATE : Page 2 of 9	REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR	APPROVED BY K K OJHA	2

Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
1.06	Semi Conducting Compound	1.Make	MA	Verify	100%	100%	NTPC Approved sources	NTPC Approved sources	--do--	√	P	V	V	
		2. Resistivity	MA	--do--	100%	100%	NTPCADS	NTPCADS	--do--		P	V	V	
		3. Shelf Life / Storage condition	MA	Verify	100%	100%	Compound manuf. recommendation	Compound manuf. recommendations	--do--		P	V	V	
1.07	Copper tape (Electrolytic High Conductivity Copper Foils)	1. Make	MA	Verify	100%	100%	NTPC Approved sources	NTPC Approved sources	--do--	√	P	V	V	
		2. Dimension	MA	Measu	As per cable mnfr std.	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		3. Resistivity	MA	Verify	100%	----	IS 613	IS 613	Supplier TC		V	V	V	
		4. Chem.& Phy. properties	MA	Elec & Mech.	As per cable mnfr std.	--	As per cable mnfr std.	As per cable mnfr std.	--do--		V	V	-	
1.08	Polyester Tape (As applicable)	1.Make	MA	Verify	100%	100%	Manufacturer approved vendor	Manufacturer approved vendor	--do--		P	V	V	
		2. Dimension	Phy.	Meas	As per cable mnfr std.	--	Manuf. Data sheet	Manuf. Data sheet	--do--		P	-	-	
		3. T.S & Elongation	Phy.	Phy.	-do--	--	--do--	--do--	--do--		V	--	--	
1.09	Steel wire / Formed Wire (As applicable)	1. Make	MA	Verify	As per cable mnfr std.	100%	MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	QCR		V	V	V	BIS licensees only
		2. Dimension	MA	Meas	1 sample from each size / lot	--	NTPC APPROVED DATA SHEET & IS 3975	NTPC APPROVED DATA SHEET & IS 3975	QCR		P	--	--	
		3. All acceptance tests as per IS 3975	MA	Verify	As per IS 3975	--	IS 3975	IS 3975	Supplier TC		V	V	--	
1.10	PVC compound for Sheath	1. Make	MA	Verify	As per manufacturer norms	100%	MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	QCR		V	V	V	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

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Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/ N				D*	M	C	N*	
1	2	3	4	5	6		7	8	9	10				11
		2. Type / Grade	MA	Verify	100%	100%	NTPC ADS	NTPC ADS	QCR		V	V	V	
		3. All acceptance test as per manufacturer norms	MA	Verify	As per manufacturer norms	As per manufacturer norms	Compound Mnfr standard	IS 5831	QCR		V	V	V	Refer note I
		4. Thermal Stability	MA	Chem	One sample / Batch	--	IS 5831	IS 5831	QCR		P	--	--	
		5. Oxygen Index	MA	Chem	--do--	--	NTPC ADS/ IS 10810 Part 58	NTPC ADS	--do--		P	---	--	
1.11	Filler Material (As applicable	1.Type	MA	Verfy	As per manuf. Std.	----	NTPC ADS	NTPC ADS	QCR	-	P	--	- -	
1.12	Wooden Drum	1. Dimension	MI	Meas	Manuf. Std.	--	IS 10418	IS10418	--do--		P	--	--	
		2. Anti termite treatment	MI	Chem	Cable manuf. std	--	CABLE MANUF. STD.	CABLE MANUF. STD.	COC		V	V	V	COC from drum manuf.
1.13	Steel Drum	1. Dimension	MI	Meas	--do--	--	--do--	--do--	QCR		P	--	--	
		2. Surface finish	MI	Meas	--do--	--	--do--	--do--	--do-		P	--	--	
B	Process & Stage Inspection													
2.01	Wire Drawing	1.Surface finish	MA	Visual	One sample/Setting of each size	--	SHOULD BE SMOOTH & FREE FROM SCRATCHES	SHOULD BE SMOOTH & FREE FROM SCRATCHES	QCR		P	--	--	
		2. Wire Diameter	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do-		P	--	--	
		3. Tensile test	CR	Mech	--do--	One sample / Setting of each size	IS 8130	IS 8130	--do--		P	V	V	Refer Sl. No.3.03(iii)
		4. Wrapping test	CR	Mech	--do--	--do--	--do--	--do--	--do--		P	V	V	--do--
		5. Annealing Test	CR	Mech	--do--	--do--	--do--	--do--	-do--		P	V	V	--do--
2.02	Bunching / stranding	1. No. of wires	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do-		P	--	--	
		2.Dia of wire	MA	Meas	-do--	--	--do--	--do--	--do--		P	--	--	
		3. Dimension of Conductor	MA	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
		4.Direction of lay	MA	Visual	--do--	--	--do-	--do--	--do--		P	--	--	
		5.Records of strand breakage / welding during conductor stranding	MA	Verify	--do--	--	IS 8130	IS8130	--do--		P	--	--	
		6.Surface finish	MA	Visual	--do--	--	--do--	--do--	--do--		P	--	--	
		7. DC Resistance	CR	Meas	--do--	--	IS8130/NTPC ADS	IS8130/ NTPC	--do--		P	--	--	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

NTPC	Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)	STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)	QP. NO. 0000-999- QOE- S-042 REV-02 DATE : Page 4 of 9	REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR	APPROVED BY S K KOTHA Dt.	4

Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M	Quantum of check C/N	Reference Document	Acceptance Norms	Record Format	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
								ADS						
2.03	Insulation extrusion (Conductor screen, XLPE Insulation & Insulation screen)	1. Surface Finish	MA	Visual	One sample / Setting of each size	--	Extrusion should be by triple extrusion technique Method of curing for cables shall be "dry curing / gas curing/ steam curing" up to 11KV & " dry curing/ gas curing " for 19/33 KV Insulation extrusion area should be preferably clean & dust free. Extrusion Should be smooth. No porosity is permitted	QCR-		P	-	--	
		2.Thickness	CR	Meas	--do--	--	NTPC ADS	NTPC ADS	QCR	P	--	--	
		3. Eccentricity & Ovality	CR	Meas	--do--	--	Eccentricity of core shall not exceed 10% and Ovality not to exceed 2%	Eccentricity of core shall not exceed 10% and Ovality not to exceed 2%	--do--	P	-- -	--	
		3.Hot Set	CR	Mech	One sample/Setting of each size	--	IS 7098- Part II	IS 7098- Part II	--do--	P	--	--	Sample is to be taken from both top & bottom end
2.04	Copper Taping	1. Thickness	CR	Mech	--do--	--	NTPC ADS	NTPCADS	--do-	P	--	--	
		2. No. of tape	CR	Meas	--do--	--	--do--	--do-	--do--	P	--	--	
		3. Tape application overlap	CR	Meas	--do--	--	--do--	---do--	--do--	P	--	--	
		4. Core identification tape	CR	Visual	--do--	--	--do--	---do--	--do--	P	--	--	
2.05	Laying up	1. Core sequence	MA	Visual	--do--	--	IS 7098- Part II	IS 7098- Part II	--do--	P	--	--	
		2. Direction of lay	MA	Visual	--do--	--	-do-	--do--	--do--	P	--	--	
		3. Lay Length	MA	Meas	--do--	--	Manuf. Std.	Manuf. Std	--do-				
		4. Dia over laid up core	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--	P	--	--	
2.06	Inner Sheath	1.Colour	MA	Visual	-do--	-	--do--	--do--	--do--	P	--	--	
		2.Thickness	MA	Meas	One sample/Setting of each size	-	NTPC ADS	NTPC ADS	--do--	P	--	--	
		3.Dia over inner sheath	MI	Meas	--do--.	-	--do--	---do--	--do--	P	--	--	
2.07	Armouring (As Applicable)	1.Dimension	MA	Meas	--do--	-	--do--	--do--	--do--	P	--	--	
		2.No. of wires / strip	MA	Meas.	--do--	-	--do--	--do--	--do--	P	--	--	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

NTPC	Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)	STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)	QP. NO. 0000-999- QOE- S-042 REV-02 DATE : Page 5 of 9	REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR	APPROVED BY K K OJHA	5

Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/ N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		3. Direction of lay	MA	Visual	--do--	--	IS 7098- Part II	IS 7098- Part II	QCR		P	--	--	
		4.Coverage & Quality of armouring	MA	Meas.	100%	--	Min. area of coverage of armouring shall be 90%. The gap between amour wires / formed wires shall not exceed one amour wire/ formed wire space & there shall be no cross over/ over riding of amour wire / formed wire. Zn rich paint shall be applied on amour joint surface of G.S. Wire /formed wire. The breaking load of amour wire joint shall not be less than 95% of that amour wire / formed wire. (As per NTPC specification)		QCR		P	--	--	
		5 Dia over armouring	MA	Meas.	One sample/Setting of each size	--	NTPC ADS		--do--		P	--	--	--
2.08	Outer Sheath	1. Surface finish	MA	Visual	100%	--	Pimple, Fish Eye, Burnt particles, Blow Hole not permitted. Repairing on outer sheath not permitted. (As per NTPC specification) PVC FRLS compound shall be preferably loaded in to extruder by suction method.		--do--		P	--	--	
		2.Colour of sheath	MA	Visual	One sample/Setting of each size	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		3. Dia over outer sheath	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		4.Thickness of outer sheath	CR	Meas	--do--	-	--do--	--do--	--do--		P	--	--	
		5. Embossing quality	MA	Visual	100%	-	Following shall be embossed or printed on outer sheath at every 5 meter length of cable in addition to identification as per IS:(1).Batch number or Drum number (2) IS 1554 –Part-I (3) Cable size, (4) Voltage grade (5) word "FRLS" (marking shall be legible & indelible).		--do--		P	--	--	
		6. Sequencial marking	MA	.Visual	Full length	--	Sequential marking of length of cable in meters at every one meter is to be embossed or printed. Embossing or printing shall be progressive, automatic, in line & marking shall be legible & indelible. In addition, Drum No. is also to be embossed/printed on full cable length		--do--		P	--	--	
C	Finished Cables													
3.01	Type Test clearance from NTPC Engineering to be verified at the time of final inspection.													
3.02	Routine Tests	1.High Voltage test at room temperature	CR	Elect	100%	100%	NTPC ADS / IS 7098- Part II	NTPC ADS	Test certificate	✓	P	W	W	Refer note 2

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

NTPC	Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)	STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)	QP. NO. 0000-999- QOE- S-042 REV-02 DATE : Page 6 of 9	REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR	APPROVED BY K K OJHA	6

Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/ N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		2.Conductor Resistance	CR	Elect	100%	100%	NTPC ADS / IS 7098- Part II	NTPC ADS	--do--	✓	P	W	W	Refer note 2
		3. Partial Discharge Test	CR	Elect	100%	100%	NTPC ADS / IS 7098- Part II	NTPC ADS	-do--	√	P	W	W	For Screened cable only/ Refer note 2
3.03	Acceptance Tests													
3.03 (i)	Construction of finished Cable	1. OD of Cable	MA	Meas.	Each type & size of cables as per sampling plan of IS 7098- Part II		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
		2. Laying of core	CR	Visual	--do--		NTPC ADS / IS 7098- Part II	NTPC ADS / IS 7098- Part II	--do--	✓	P	W	W	
		3. Core Identification	CR	Visual	--do--		--do--	--do--	--do--	✓	P	W	W	
		4. Colour of outer sheath & Inner sheath	MA	Visual	Each type & size of cables as per sampling plan of IS 7098- Part II		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
		5. Inner sheath thickness	CR	Meas	- do -		--do--	--do--	--do--	✓	P	W	W	
		6. Copper tape / Wire dimension with overlap (As applicable)	CR	Phy	--do--		NTPC ADS/ Min overlap 20%	NTPC ADS/ Min. overlap 20%	--do--	√	P	W	W	
3.03 (ii)	Armour wires/ Formed wires	1.Dimensions	CR	Meas	Each type & size of cables as per sampling plan of IS 7098- Part II		NTPC ADS/ IS7098-II	NTPC ADS	Test Certific	✓	P	W	W	Test as applicable for Galvanized wires/ strips / Al wires
		2. No. of wires/ formed wire	CR	Mech	-- do --		--do--	--do--	--do--	✓	P	W	W	
		3. Tensile test	CR	Mech	--do--		IS 3975	IS 3975	--do--	✓	P	V	V	
		4. Elongation test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	
		5.Torsion test (for round wires only)	CR	Mech	--do--		--do--	--do--	--do--	√	P	V	V	
		6. Wrapping test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	
		7. Resistance test	CR	Mech	--do--		--do--	--do-	--do-	✓	P	V	V	
		8.Mass of Zinc coating	CR	Meas	--do--		--do--	--do--	--do--	✓	P	V	V	
		9. Uniformity of Zinc Coating	CR	Chem.	--do--		--do--	--do--	--do--	✓	P	V	V	
		10.Adhesion test	CR	Mech	--do--		--do--	--do-	--do--	✓	P	V	V	
		11.Freedom from defects	CR	Visual	--do--		--do--	--do--	--do--	✓	P	V	V	
3.03	Conductor	1.Resistance Test	CR	Elect	--do--		--do--	--do--	--do--	✓	P	W	W	

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NTPC	Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)	STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)	QP. NO. 0000-999- QOE- S-042 REV-02 DATE : Page 7 of 9	REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR	APPROVED BY K K OJHA	7

Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
(iii)		2.Tensile test	CR	Mech	Each type & size of cables as per sampling plan of IS 7098(Part-II		IS 8130	IS 8130	Test Certificate	✓	P	W	W	Test report of manufacturer to be reviewed as per Sl. No. 2.01 for Tensile test & wrapping test
		3.Wrapping test	CR	Mech	--do--		--do--	--do--	-do--	√	P	P	W	--do--
3.03 (iv)	XLPE Insulation & PVC Sheath	1.Thickness of insulation & sheath	CR	Meas.	--do-		NTPC ADS & IS 7098-Part II	NTPC ADS	--do--	✓	P	W	W	
		2.Tensile strength & elongation at break of insulation & outer sheath (before & after ageing)	CR	Mech	One sample per batch of offered lot irrespective of sizes		IS 7098-Part II	IS 7098-Part II		✓	P	V	V	MTR for Ageing Test of the offered lot shall be verified
		2(A).Tensile strength & elongation at break of insulation & outer sheath	CR	Mech	Each type & size of cables as per sampling plan of IS 7098(Part-II)		IS 7098-Part II	IS 7098-Part II		✓	P	W	W	
		3. Insulation resistance (Volume resistivity method)	CR	Elect	Each type & size of cables as per sampling plan of IS 7098-Part II		--do--	--do--	--do--	✓	P	W	W	
		4. Partial Discharge test	CR	Elect.	--do--		--do--	--do--	--do--	√	P	W	W	For Screened cable only
		5.High voltage test at room temperature	CR	Elect	Each type & size of cables as per sampling plan of IS 7098-Part II		--do--	--do--	--do--	✓	P	W	W	
		6.Thermal stability on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		-do--	--do--	--do--	✓	P	W	W	
		7. Hot Set Test for insulation	CR	Mech	Each type & size of cables as per sampling plan of IS 7098-Part II		IS 7098-Part I	IS 7098-Part II	--do--	✓	P	W	W	For XLPE insulation only
		8.Smoke density test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS & ASTMD2843	NTPC ADS	-do--	✓	P	W	W	Refer Note 3
		9.Acid gas generation test on	CR	Chem	--do--		NTPC ADS & IEC 60754-1	NTPC ADS	--do--	✓	P	W	W	Refer Note 3

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Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/ N				D*	M	C.	N	
1	2	3	4	5	6		7	8	9	10				11
		outer sheath												
		10. Oxygen Index	CR	Chem	--do--		NTPC ADS/ IS 10810 Part 58	--do--	--do--	√	P	W	W	Refer Note 3
		11.Flammability test on finished cable	CR	Chem	One sample irrespective of sizes		NTPC ADS & IEC 60332 Part-3 (Category-B)	--do--	--do--	✓	P	W	W	
		12.Surface finish & length measurement.	CR	Visual & Meas	100% (COC from Manufacturer to be submitted for surface finish as per specification's requirement)	one length of each offered lot of 25 drums of all sizes	(1) Drum number / Outer sheath extrusion batch number (2) IS 7098-Part II (3)Cable size, Voltage grade , Words " FRLS" & Screen Fault Current & duration at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (3) Sequential marking of length of cable at every meter length is to be embossed / printed. .(4) Manufacturer's identification as per IS . Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible.	Test Certificate	✓	P	W	W	Pimple, Fish Eye, Burnt particles, Blow Hole etc. not permitted. Repairing on outer sheath not permitted.
		13. Sequence of cores armour coverage, gap between two consecutive armour/ formed wire	CR	Visual & Meas	One length of each size	One length of each size	Min. area of coverage of armouring shall be 90%. The gap between armour wires / formed wires shall not exceed one armour wire/ formed wire space & there shall be no cross over/ over riding of armour wire / formed wire.	--do-	√	P	W	W	Zn rich paint shall be applied on armour joint surface of G.S. Wire /formed wire
		14. Measurement of Eccentricity & Ovality	CR	Meas.	--do--	--do--	Eccentricity of core shall not exceed 10% and Ovality not to exceed 2%	-do--	√	P	W	W	
4	Packing	1. Sealing	MA	Visual	100%	100%	(1) IS 7098-Part II (2) The surface of the drum and the outer most cable layer shall be covered with water proof cover. (3) Both the ends of cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by "U" nails.	QCR	✓	P	–	--	
4.01	Identification	NTPC Sealing	MA	Visual	100%	100%	Sealing shall be visible	QCR	√	P	V	V	

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NTPC	Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)	STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)	QP. NO. 0000-999- QOE- S-042 REV-02 DATE : Page 9 of 9	REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR	APPROVED BY K K OJHA	9

Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/ N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11

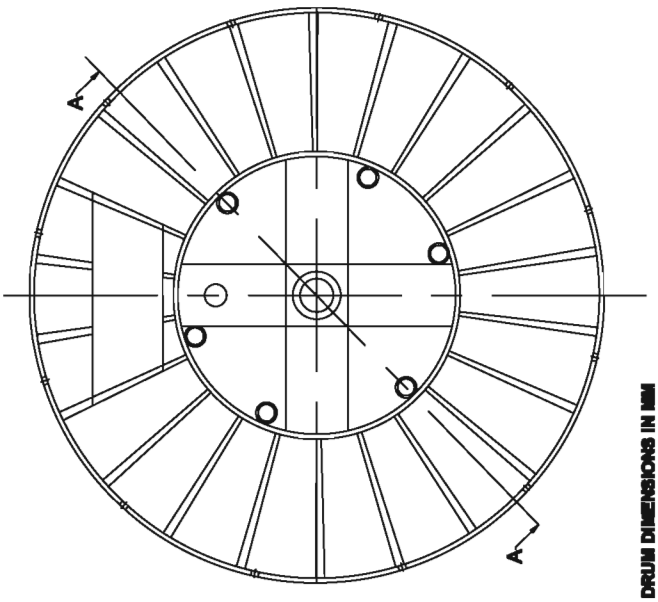
Notes:	
1)	If the compound manufacturer is carrying out Ageing test , test report of compound manufacturer is to be reviewed. If the compound manufacturer is not carrying out ageing test, then cable manufacturer will carry out ageing test & the test report will be reviewed by NTPC (quantum of ageing test sample shall be one sample /batch)
2)	(a) In case of manufacturers / supplier who have supplied cables in the past through Corporate Centre:- Routine Test of manufacturer internal test report are to be verified by NTPC and Main Contractor at the time of final inspection. NTPC and Main Contractor will also witness routine tests on cables on 10% sample basis. (b) In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre:- Routine Test of manufacturer internal test report are to be verified by NTPC at the time of final inspection. NTPC will witness routine tests on cables for the first order on 10% sample basis and Main Contractor will witness routine tests on cables for the first order on 100% basis.
3)	1. For Smoke Density rating test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection. 2. For Acid Gas Generation test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection. 3. For Oxygen Index test: if the test result without conditioning is within (+)7% of the minimum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection. 4. In case the test results without conditioning do not meet the maximum/minimum specified value, the manufacturer may exercise the option of retesting the samples after conditioning as per standard.
LEGEND:	**NTPC ADS: NTPC approved data sheet, QCR: quality control records of cable manufacturer, CABLE MANUF STD- cable manufacturer's internal plant standard, MI: minor, MA: major, CR: critical, COC- certificate of conformance**

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

STEEL DRUM DRAWING (TYPICAL) , IF APPLICABLE

ANNEXURE-B

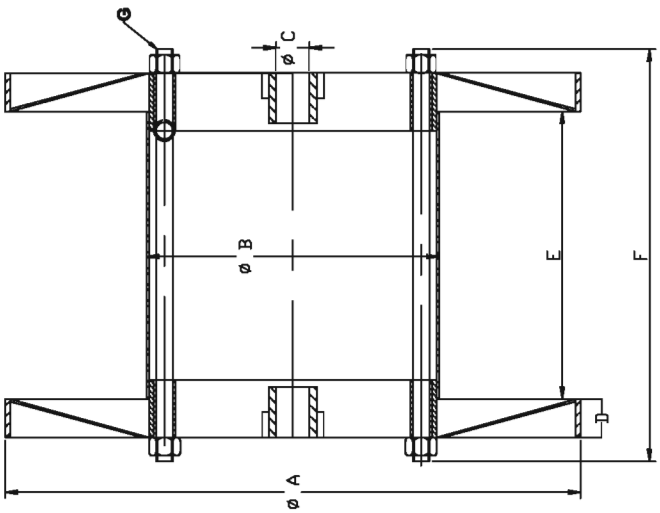
- Drg. not to scale.
- ALL DIMENSIONS ARE IN MM.



APPROXIMATE DRUM DIMENSIONS IN MM

ALL DIMENSIONS AND VALUES ARE TYPICAL AND ARE DEPENDENT ON CABLE WEIGHT.

A	FLANGE	2200
B	BARREL	1200
C	CENTRAL HOLE	100
D	FLANGE	80
E	TRAVERSE	1400
F	GROSS WIDTH	1600
G	STUD SIZE	16 MM.



266680/2024/PS-PEM-EL

TYPICAL DRAWING OF WOODEN PLANKS ACROSS FLANGE(S)

3X660 MW NORTH KARANPURA
HT XLPE POWER CABLE

11KV , HT XLPE UNARMOURED CABLE

SR. NO.	ITEM CODE	ITEM DESCRIPTION	ORDERED QUANTITY	DRUM LENGTH	UNIT PRICE	TOTAL PRICE	Quote/Unquote	Freight in terms of total Ex-works price in %	GST rate in %
11/11 KV AL. CONDUCTOR/ XLPE INSULATED/ UNARMOURED/ UNEARTHED GRADE POWER CABLE									
1	507-27026-A	11KV , 01C X 630 XLPE-Al FRLS(UA)	2000	1000					
2	507-27034-A	11KV , 03C X 185 XLPE-Al FRLS(UA)	3000	750					

3.3KV , HT XLPE ARMOURED CABLE

SR. NO.		CABLE DESCRIPTION	ORDERED QUANTITY	DRUM LENGTH	UNIT PRICE	TOTAL PRICE	Quote/Unquote	Freight in terms of total Ex-works price in %	GST rate in %
3.3/3.3 KV AL. CONDUCTOR/ XLPE INSULATED/ ARMOURED/ UNEARTHED GRADE POWER CABLE.									
1	507-27069-A	3.3KV , 01C X 630 XLPE-Al FRLS(A)	2000	1000					

Notes

1. Tolerance on individual drum length shall be ±5%.
2. Overall tolerance on total dispatched quantity of each size shall be (-) 2% and (+) 0% . Cables consumed for testing and inspection shall be to bidder's account.
3. For each individual cable size, one short length of not less than 200m may be accepted only in the final drum length to complete the supply (except where the total ordered quantity is one single drum length). The overall tolerance limits stipulated above shall continue to apply (in case short lengths are accepted).
4. In case of the quantities cleared by BHEL for manufacturing are manufactured and offered for inspection by successful bidder in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implications.
5. Unit price of cables quoted by bidder shall be inclusive of type test charges. No separate charges shall be payable for type tests.