VOLUME II

NTPC LIMITED

3 X 660 MW BARH STPP STAGE I FGD PROJECT

TECHNICAL SPECIFICATION

FOR

HT XLPE POWER CABLES

SPECIFICATION NO: ***PE-TS-442-507-E001***

REVISION: **0**

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP (INDIA) – 201301

CONTENTS

COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same

2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'

3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

BIDDER'S STAMP & SIGNATURE

SECTION –I

SPECIFIC TECHNICAL REQUIREMENTS

1.0 SCOPE OF ENQUIRY

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

1.2 General technical requirements of the HT XLPE Power cables are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I.

1.3 The stipulations of Section-I, followed by those of Data Sheet-A shall prevail in case of any conflict between the stipulations of Section-I, Data Sheet - A & Section-II.

1.4 The documents shall be in English Language and MKS system of units.

2.0 BILL OF QUANTITIES:

2.1 Quantity requirements shall be as per 'BOQ-cum-price schedule' as part of NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

3.1 The quality plan no. 0000-999-QOE-S-042 R0 shall be read in conjunction with Annexure B (Quality Assurance & Inspection).

4.0 Type test

4.1 Successful bidder shall submit the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening i.e. 24.07.18. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent lab or should have witnessed by a client.

4.2 In addition to Sl. No. 4.1 above, type test are required to be conducted. Bidder shall indicate the unit price of cables inclusive of type test charges. No separate Type Test charges are to be quoted by bidder.

4.3 Type test requirement shall be as per Annexure A to QAP.

5.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

5.1 Following documents/drawings shall be submitted after placement of order for BHEL & customer's approval: -

Sl. No.	Drawings/Document Description	Drawings/ Document Number	Vendor Sub (Days)*	Bhel comment (Days)	Vendor Sub (Days)#	Bhel and Customer comment/ approval (Days)	Total Engg Time (Days)
1.	Technical Data sheet & Cross section drawings for HT XLPE Power Cables	9558-109-PEM-PVE-Y-004	7	3	2	18	30
2.	Manufacturing Quality Plan for HT XLPE Power Cables	9558-109-PEM-QVE-Q-001	7	3	2	18	30

Sl. No.	Drawings/Document Description	Drawings/ Document Number	Vendor Sub (Days)*	Bhel comment (Days)	Vendor Sub (Days)#	Bhel and Customer comment/ approval (Days)	Total Engg Time (Days)
3.	Type test reports for HT cables (as per clause 4.1 above)	9558-109-PEM-PVE-W-014	7	3	2	18	30
4.	Type Test Reports – HT XLPE Power Cables (Conducted for this contract)	PE-V0-442-507-E105	Within 1 week after conduction of type test	3	2	18	30

NOTES:-

a) * 1st submission within indicated days from date of purchase order.
b) b) # Submission (within indicated days) after incorporating all BHEL comments.
c) c) Primary documents shall be considered for Delay analysis.
d) Drawing/documents mentioned in S. No. 1 & 2 are primary document.
e) Drawing/documents mentioned in S. No. 3 is primary document (if available with supplier) & drawing/document mentioned in S. No. 4 shall be NA.
f) Drawing/documents mentioned in S. No. 4 is secondary document in case & drawing/document mentioned in S. No. 3 is not available with supplier.

Note:

Standard Quality Plan as enclosed in the technical specification is to be appended with cover sheet bearing document number and description as stated above. The signed and stamped copy of the same shall be submitted to BHEL without making any changes in the contents of the document.

5.2 All drawings/documents shall be submitted though BHEL DMS system.

6.0 IEEMA PRICE VARIATION CLAUSE

6.1 For 3.3kV cable, Variation factors for 6.6kV(E) shall be considered wherever 3.3kV (UE) Variation factors are not available.

6.2 For 3 core, 3.3kV Unarmoured cable Variation factor for Polymer shall be considered same as 3 core, 3.3kV Armoured cable.

DATASHEET A

1.0	Type of Cable	Flame Retardant-Low Smoke (FRLS)
2.0	Standard applicable in general (Latest amendment to be referred if any)	IS:7098 (Part-2), IS:8130, IS:5831, IS:10810, IS:3975, ASTMD:2843, ASTMD:2863, IEC-754-1, IEC:60332 (Part-1), IEC:60332-3-23, IEEE:60383
3.0	Voltage Grade	11/11kV(UE) & 3.3/3.3kV(UE)
4.0	Number of cores, cross sectional area of conductors and quantities	11 kV – Unarmoured - 01C X 500 SQ. MM 11 kV – Unarmoured - 03C X 150 SQ. MM 11 kV – Armoured - 03C X 150 SQ. MM 3.3 kV – Unarmoured - 03C X 150 SQ. MM 3.3 kV – Armoured - 03C X 150 SQ. MM As per BOQ cum price schedule (part of NIT)
5.0	**CONDUCTOR**	
(a)	Material	Aluminium
	Grade and Class	Multi-Stranded, H2, Class 2
(b)	Standard Applicable	IS: 8130
(c)	Shape	Compacted Circular
(d)	Min. number and diameter of strands	As per Class-2 of IS: 8130
(e)	Conductor screen	
(i)	Material	Extruded Cross-linked Semi-conducting compound
(ii)	Minimum thickness	0.3 mm
6.0	**INSULATION**	
(a)	Material	Cross-Linked Polyethylene (XLPE)
(b)	Standard Applicable	IS: 7098 (Part-2)
(c)	Continuous withstand temperature	90°C
(d)	Short-circuit withstand temperature	250°C
(e)	Nominal Thickness of Insulation	As per Table – 4 of IS 7098 Part-2
7.0	**INSULATION SCREEN**	**For both SINGLE CORE & MULTI CORE cables**
(a)	Non-metallic	
(i)	Material	Extruded Cross-linked Semi-conducting compound
(ii)	Type of Semiconducting compound	Bonded
(iii)	Minimum thickness	0.3 mm
(b)	Metallic	
(i)	Material	Copper
(ii)	Type	Tape
(iii)	Size	Nominal thickness 0.1mm with tolerance (±) 10%
(iv)	Minimum Overlap	20%
(c)	Earth fault current withstand capacity	600A, 2 sec (For multi-core cables, screen of each core shall be rated individually for the above value).
8.0	**EXTRUSION (Insulation and Screens)**	
(a)	Process	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).
(b)	Method of Curing	For 11 kV & 3.3 kV - Dry curing/gas curing/steam curing
9.0	**CORE IDENTIFICATION**	Colour coding as per IS:7098(Part-2)
10.0	**INNER SHEATH**	**(Not applicable for Single Core Unarmoured Cable)**
(a)	Material	PVC Type ST-2
(b)	Standard Applicable	IS: 7098 (Part-2) & IS: 5831
(c)	Colour	Black
(d)	Whether **FR-LSH**	NO
(e)	Inner sheath applicable for single core cable	NO
(f)	Fillers	Acceptable
(g)	Material of fillers (if permitted)	Same as inner sheath (Material of filler to be compatible with that of inner sheath)
(h)	Method of application	
(1)	Multi-core cables:	
(i)	With fillers	[√]Pressure extruded [√]Vacuum extruded
(ii)	Without fillers	Pressure extruded
(i)	Thickness of inner sheath	As per Table-5 of IS: 7098 (Part-2)
11.0	**ARMOUR**	Applicable, as per BOQ cum price schedule (part of NIT)
a)	Material	Galvanised Steel
(i)	Multicore cables	Strip Armour (Armour dimensions as per Sl. No.(ii) of table – 6 of IS 7098 Part-II.
(ii)	Single core cables	Not applicable as per BOQ cum price schedule (part of NIT)
b)	Minimum coverage	90%
c)	Gap between armour wires	Shall not exceed one armour wire space (No core-over/over-riding)
d)	Breaking load of joint	95% of normal armour
e)	Armour joint surface	To be applied with Zinc rich paint
12.0	**OUTERSHEATH**	
(a)	Material	PVC Type ST2 as per IS: 5831
(b)	Colour	Black
(c)	Whether **FR-LSH**	Yes
(d)	Method of application	Extruded
(e)	Thickness of outer sheath	As per Table-7 of IS: 7098 (Part-2)
(f)	Marking	(A) Following shall be marked @ 5m (by embossing): 'FR-LSH', Manufacturer's name and trade mark, Year of manufacture, cable code, Type of cable and Voltage grade, cross section area of conductor and number of cores, Screen fault current 600A for 2 sec, "BHEL-PEM", "NTPC"

		(B) Progressive sequential marking of length of the cable in metres @ 1m (by embossing/ printing)
13.0	**FR-LSH CHARACTERISTICS**	
(a)	Oxygen index	Min 29 (As per IS 7098-2 /ASTMD 2863)
(b)	Temperature index	Min. 250°C(As per IS 7098-2 /ASTMD 2863)
(c)	Acid gas generation	Max. 20% by weight (As per IS 7098-2 /IEC-60754-1)
(d)	Smoke density rating	Max. 60% (As per IS 7098-2 /ASTM D 2843)
(e)	**Flammability Test**	
(i)	Flammability test for single cable	YES As per: IEC-60332 Part-1
(ii)	Flammability test for bunched cables	YES As per IEC-60332 Part-3, CAT-B
14.0	**TOLERANCE ON OUTER DIAMETER**	(±)2 mm. over the declared value
15.0	**CABLE DRUMS**	
(a)	Type of Drum	[√] Wooden as per IS 10418 [√] Steel as per relevant IS
(b)	Standard drum length	1000M (±) 5% for Single core cables 750M (±) 5% for Multi-core cables
(c)	Painting	Entire surface to be painted
(d)	Outermost Layer	To be covered with waterproof polyethylene
(e)	Others	Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum.
(f)	Particular information on Drum	Each drum shall carry manufacturer's name, owner's name, address and contract no., item no. & type, size & length of cable and net gross weight stencilled on both sides of drum. A tag containing same information shall be attached to the leading end of the cable. An arrow & suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

SECTION -II

HT CABLES

TECHNICAL INFORMATION & DATA TO BE SUBMITTED

AFTER THE AWARD OF CONTRACT

The following technical data, drawings and test certificates shall be submitted by successful bidder to the Employer. The actual schedule of submission of these data/drawings/test reports shall be mutually discussed and agreed to between the Employer and successful bidder before the issue of award contract.

1.1 **Technical Particulars and Drawings**

a) Sectional drawings of cables : ……

b) Approx. Weight of metallic and non metallic items of each cable size (Kgs)

Metallic (Kgs/Km) : ……

Non Metallic (Kgs/Km) : ……

c) Rating factors for variation in ambient air temp. : ……

d) Rating factors for vibration in amb. In ambient air temp. : ……

e) Rating factors for variation depth of laying in ground : ……

f) Rating factors for variation in thermal resistivity of soil : ……

g) Grouping factors for cables laid in open air racks : ……

h) Grouping factors for cables in build up concrete trenches with restricted air circulation : ……

i) Grouping factors for cables laid in ground : ……

j) Particulars of cable drums : ……

	k) Grouping factors for cables laid in ducts/pipes	:	……
1.2	Test Certificates		
	Complete test reports including Type Tests, Routine tests and Acceptance Tests	:	……
1.3	Instruction manual for storage for prolonged duration, unpacking, handling at site, erection, pre-commissioning test etc.	:	……
1.4	Technical Data		
1.4.1	The following technical data shall be submitted by the contractor for each type and and size of the cable for Employer's approval.		
	1. Make	:	……
	2. Country of manufacturer	:	……
	3. Type designation	:	……
	4. Applicable standard	:	……
	5. Cable size (No. of Cores x mm2)	:	……
	6. Rated Voltage	:	……
	7. 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)	:	……
	8. Continuous current rating for max. conductor temp. when buried in soil having thermal resistivity of		

150 deg. C Cm/N at a depth of 1 mtr. and at ground ambient temp. of 40 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) : .....

9. Short circuit withstand capacity and duration for :

a) Conductor : .....

b) Metallic screen : .....

c) Armour : .....

10. Conductor

a) Material (Copper or Aluminium) : .....

b) Grade : .....

c) Nominal cross sectional area (Sq. mm) : .....

d) Number and diameter of wire before compacting of conductor strands

i) No. of wires (min.) : .....

ii) Dia of wires in mm : .....

e) Shape of conductor : .....

f) Diameter over conductor (mm) : .....

i) Fictitious (as per IS 10462 (Part-1)-1983) : .....

ii) Approximate : .....

g) Direction of lay of stranded layers : .....

h) Conductor resistance (DC) At 20 deg C in Ohm/Km (max.) : ……

i) Conductor resistance (AC)

a) at 20 deg. C ohm/Km (Approx) : ……

b) at 90 deg. C in ohm/Km (Approx) (for XLPE cables) : ……

j) Reactance per phase at 50 Hz in ohm/km : ……

k) Capacitance at 50 hz in micro Farads / Km : ……

l) Conductor screening (wherever applicable)

a) Material and type : ……

b) Thickness of extruded layer (mm) : ……

12. Insulation

a) Composition of insulation : ……

b) Nominal thickness of insulation (mm) : ……

c) Tolerance on thickness of Insulation (mm) : ……

d) Filled or unfilled (for XLPE only) : ……

e) Type of curing (for XLPE only) : ……

f) Min. insulation resistance at 20 deg. C (Mega Ohm/Km) : ……

g) Identification of cores : ……

13. Insulation screening (wherever applicable : ……

a) Material & type : ……

b) Thickness of extruded layer (mm) : ……..

14. Metallic Screen

a) Material : ……..

b) Size of tape /wire (mm) : ……..

c) No. of wires / tapes : ……..

d) Short circuit capacity of metallic screen : ……..

e) Cross sectional area of screen (sq. mm) : ……..

f) Dia below metallic screen i.e. below copper tape/wire (mm) : ……..

15. Inner sheath

a) Material : ……..

b) Diameter over the laid up cores (mm)

i) Calculated (By fictitius calculations as per IS 10462 (part-1)-1983) : ……..

ii) Approximate : ……..

c) Thickness of sheath (Min) (mm) : ……..

d) Colour of sheath : ……..

e) Tolerance in thickness of inner sheath (mm) : ……..

16. Type of filler material : ……..

17. Armour (in case of armoured cables)

a) Type of material of armour : ……..

b) Formed wire / wire : ……..

c) Diameter of cable over inner sheath (under armour) mm

i) Calculated (By Fictitious calculations as per IS 10462 (part-1)-1983) : ……..

ii) Approximate : ……..

d) Dimension of formed wire / wire in mm : ……..

e) No. of armour formed wires /wires : ……..

f) Approx. cross sectional area of armour (Sq. mm) : ……..

g) Resistivity of armour wire at 20 deg. C (ohm- cm.) : ……..

h) Direction of lay of armour : ……..

18. Outer Sheath

a) Material and type : ……..

b) Diameter under the sheath (mm)

i) Calculated (By Fictitious calculations as per IS 10462 (part-1) - 1983) : ……..

ii) Approximate : ……..

c) Thickness of sheath (mm) : ……..

d) Tolerance on Nominal thickness of sheath (mm) : ……..

e) Colour of sheath : ……..

19. a) Overall diameter of cable (mm) : ……..

b) Tolerance on overall diameter (mm) : ……..

c) Eccentricity : ……..

d) Ovality : ……..

20. Weight per 1000 mtrs (Kg) : ……..

21. Recommended min installation radius (mm) : ……..

22. Safe pulling force when pulled by pulling eye on the conductor (kg) : ……..

23. Cable Drums

    a) Type (Wooden/steel) : ……..

    b) Dimensions (Approx) : ……..

        i) Flange diameter (mm) : ……..

        ii) Barrel diameter (mm) : ……..

        iii) Traverse (mm) : ……..

    c) Weight of cable drum with Cables (Kgs) : ……..

24. Max. / standard length per drum for each size of cable (mtr.) and tolerance (%) : ……..

25. Guaranteed value of min. oxygen index of outer sheath : ……..

26. Max. acid gas generation by weight (%): ……..

27. Maximum smoke density rating (%) : ……..

28. 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 : ……..

        ii) in the armour : ……..

29. 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(Amps) : ……..

    b) Short circuit current (amps) : ……..

        i) in the screen : ……..

        ii) in the armour : ……..

SECTION – II

GENERAL TECHNICAL SPECIFICATION

1.0 TECHNICAL REQUIREMENTS

1.1 Technical requirements for HT XLPE POWER CABLES shall be as indicated in this section, in addition to those specified in Section I & Datasheet-A.

2.0 CODES & STANDARDS

2.1 The design, material, construction, manufacture, inspection, testing and performance of HT XLPE POWER CABLES shall conform to the latest revision of relevant standards and codes of practices mentioned in Data Sheet - A.

2.2 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.0 QUALITY ASSURANCE REQUIREMENTS

3.1 Bidder shall confirm compliance with the Standard Quality Plan as attached with the specification without any deviations. At contract stage, the successful bidder shall submit the same QP for BHEL/ ultimate customer's approval. In case bidder has reference QP 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 minor changes in QP during contract stage.

3.2 All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved Quality Plan.

3.3 Type testing requirements, routine / acceptance testing and special testing requirements shall be as per Annexure –A to QP. Charges for all these tests for all the equipment & components shall be deemed to be included in the bid price (except UV Radiation & Hydraulic Stability test).

3.4 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.).

3.5 Cost of cables consumed for testing shall be to bidder's account.

4.0 Packing

4.1 Cables shall be supplied in non-returnable drums. Material of cable drums shall be as specified in Datasheet-A.

4.2 In case of wooden drums, all wooden parts shall be manufactured from seasoned wood treated with copper napthenates / zinc napthenates (refer IS: 401). Dimensions of wooden drums shall be as per IS 10418. All ferrous parts shall be treated with suitable rust protective finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum. Over the cables polyethylene sheet shall be wrapped and then sealed properly.

4.3 In case of Steel drums, New or practically new cable drums made of steel and painted with epoxy resin paint are to be used. Cable ends are carefully protected before packing. Over the cables polyethylene sheet shall be wrapped and then sealed properly. For Typical details of Steel drums, Annexure-B to Section-II, may be referred by the bidder. Bidder may modify, to choose appropriate dimensions of steel drums to suite various sizes/weight/ lengths of HT XLPE POWER CABLES. BIS certification mark shall be stamped on each cable drum.

QUALITY PLAN

एनटीपीसी 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-00 DATE : 12-04-12 Page 1 of 12 VALID UP TO: 11-04-15	REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG	APPROVED BY अनुमोदित A.K. Garg Dt.	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

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

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
1.05	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	--	
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	--	--	

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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
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	
		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 1
		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	--	--	

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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
		3. Tensile test	CR	Mech	One sample/Setting of each size	One sample / Setting of each size	IS 8130	IS 8130	QCR		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 ADS	--do--		P	--	--	
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

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एनटीपीसी 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-00 DATE : 12-04-12 Page 5 of 12 VALID UP TO: 11-04-15	REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG	APPROVED BY A.K. Garg Approved Date	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
2.04	Copper Taping	1. Thickness	CR	Mech	One sample/Setting of each size	--	NTPC ADS	NTPCADS	QCR		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	--	--	
		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		--do--		P	--	--	

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					M	C/ N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
							extruder by suction method.							
		2.Colour of sheath	MA	Visual	One sample/Setting of each size	--	NTPC ADS	NTPC ADS	QCR		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: (1).Batch number or Drum number (2) IS 7098-II (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		--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
		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	

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					M	C/ N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		4. Colour of outer sheath	MA	Visual	Each type & size of cables as per sampling plan of IS 7098- Part II		NTPC ADS	NTPC ADS	QCR	✓	P	W	W	
		5. Inner sheath thickness	CR	Meas	- do -		--do--	--do--	--do--	✓	P	W	W	
		6. Inner sheath colour	MA	Visual	- do -		- do -	- do -	--do--	✓	P	W	W	
		7. 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	W	W	
		4. Elongation test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		5.Torsion test (for round wires only)	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		6. Wrapping test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		7. Resistance test	CR	Mech	--do--		--do--	--do-	--do-	✓	P	W	W	
		8.Mass of Zinc coating	CR	Meas	--do--		--do--	--do--	--do--	✓	P	W	W	
		9. Uniformity of Zinc Coating	CR	Chem.	--do--		--do--	--do--	--do--	✓	P	W	W	
		10.Adhesion test	CR	Mech	--do--		--do--	--do-	--do--	✓	P	W	W	
		11.Freedom from defects	CR	Visual	--do--		--do--	--do--	--do--	✓	P	W	W	
3.03 (iii)	Conductor	1.Resistance Test	CR	Elect	--do--		--do--	--do--	--do--	✓	P	W	W	
		2.Tensile test	CR	Mech	Each type & size of cables as per sampling plan of IS 7098-Part-II		IS 8130	IS 8130	Test Certific ate	✓	P	W	W	Test report of manufactur er to be reviewed as per Sl. No. 2.01 for Tensile test & wrapping test

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					M	C/ N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		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 ageing)	CR	Mech	--do--		IS 7098-Part II	IS 7098-Part II		✓	P	W	W	Refer Note 3 Also
		3.Tensile strength & elongation at break of insulation & outer sheath (after Ageing)	CR	Mech	Refer Note 3		IS 7098-Part II	IS 7098-Part II	Test Certifi cate	✓	P	W	W	Refer Note 3
		4. 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	
		5. Partial Discharge test	CR	Elect.	--do--		--do--	--do--	--do--	√	P	W	W	For Screened cable only
		6.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	
		7.Thermal stability on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		-do--	--do--	--do--	✓	P	W	W	

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					M	C/ N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		8. Hot Set Test for inculation	CR	Mech	Each type & size of cables as per sampling plan of IS 7098-Part II		IS 7098-Part II	IS 7098-Part II	QCR	✓	P	W	W	For XLPE insulation only
		9.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	
		10.Acid gas generation test on outer sheath	CR	Chem	--do--		NTPC ADS & IEC 60754-1	'NTPC ADS	--do--	✓	P	W	W	
		11. Oxygen Index	CR	Chem	--do--		NTPC ADS/ IS 10810 Part 58	--do--	--do--	√	P	W	W	
		12.Flammability test on completed cable	CR	Chem	One sample irrespective of size per voltage grade		NTPC ADS & IEC 60332 Part-3 (Category-B)	--do--	--do--	✓	P	W	W	
		13.Surface finish & length measurement.	CR	Visual & Meas	One length of each size	One length of each size	A) Following shall be embossed or printed on outer sheath at every 5 meter length of cable: (1).Batch number or Drum number (2) IS 7098-II (3) Cable size (4) Voltage grade (5) word "FRLS" (marking shall be legible & indelible). B) 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		Test Certificate	✓	P	W	W	Pimple, Fish Eye, Burnt particles, Blow Hole etc. not permitted. Repairing on outer sheath not permitted.
		14. 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. Zn rich paint shall be applied on armour joint surface of G.S. Wire /formed wire		--do-	√	P	W	W	
		15. 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	

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					M	C/ N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
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	

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/ Regional Offices** :- Routine Test of manufacturer internal test report are to be verified by NTPC at the time of final inspection. NTPC will also witness routine tests on cables on 10% sample basis on 1.9 KV/ 3.3 KV and 3.3KV/ 3.3 KV cables , other HT cables will be witnessed on 100% basis. 2(b) **In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre/ Regional Offices**,:- Routine Test of manufacturer internal test report are to be verified by NTPC at the time of final inspection. NTPC will also witness routine tests on cables for the first order on 100% basis.
3)	**Refer table on page 11& 12 of 12 for Sampling & Acceptance criteria.**

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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

Sampling & Acceptance Criteria

Criteria	Manufacturer experience prerequisite	Condition	Testing procedure	Remarks
Samples as per relevant IS from every size/ type of cable in the offered lot shall be tested for Tensile Strength & Elongation (before ageing). The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/ - 15% tolerance (final values should be more than the minimum values indicated in relevant standard) of the Type Test report	In case of Manufacturers/ Supplier who have supplied cables in the past through Corporate Centre / Regional offices	In case of sizes/ type which meet the criteria	1 Sample per size/ type out of sizes which have met the criteria, will be put on accelerated ageing test (refer IRS specification no. IRS: S-63/2007 Rev 3.0). The samples shall be aged in air oven at temperature of 130°c+/- 2°c for 5 hours. 1 Sample of XLPE insulation per type of cables offered which have met the criteria, will be put on ageing test as per IS 7098 –II . After wards the samples shall be tested for Tensile Strength & Elongation. Acceptance norms shall be as per relevant IS. **This test shall be witnessed by NTPC.**	In case the samples do not meet the requirement in accelerated ageing test **then 1 sample of that size/ type will be put on ageing test as per IS.**
		In case of size /type which do not meet the criteria	Particular size/ type will be put on ageing test as per IS. **This test shall be witnessed by NTPC.**	----

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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
		In case of Manufacturers/ Supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre / Regional offices		In case of size /type which meet the criteria			1 Sample per sizes/ type out of all sizes which have met the criteria, will be put on aging test and **witnessed by NTPC as per relevant IS**							----
				In case of size/ type which do not meet the criteria			Particular size / type will be put on ageing test as per IS. **This test shall be witnessed by NTPC**							----

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

1. Following tests as per table below shall be conducted as Type Test.

2. Sampling:
   a) Type test to be conducted on one size of each voltage grade per lot.
   b) FRLS test & Electrical tests to be conducted on every size & voltage grade of cables.
   c) Flammability Test to be conducted only on one sample/ lot/voltage grade.

B. **Acceptance Test Conduction:** Refer QP & Annexure-B to QP.

C. **Routine Test Conduction:** Refer QP & Annexure-B to QP.

S. No.	TEST	APPLICABLE FOR	REFERENCE STANDARD	REMARKS
1.0	**Tests for Conductor**			
I.	Resistance test	For Al	IS 10810 Pt 5	
2.0	**Tests for Armour Wires/ Strips**			
i.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/ strip	IS 10810 PT 36	
ii.	Tensile test	Applicable for Aluminium wire & GS wire/ strip	IS 10810 PT 37	
iii.	Elongation at break test	Applicable for GS wire/ strip only	IS 10810 PT 37	
iv.	Torsion test	For GS round wire only	IS 10810 PT 38	
v.	Winding test	For GS strip only	IS 10810 PT 39	
vi.	Resistance test	Applicable for Aluminium wire & GS wire	IS 10810 PT 42	
vii.	Uniformity of Zinc coating test	For GS wires/strip only	IS 10810 PT 40	
viii.	Mass of Zinc coating test	For GS wires/strip only	IS 10810 PT 41	
ix.	Adhesion test	For GS wires/strip only	IS 3975	
x.	Wrapping Test	For aluminium wires only	IS 10810 PT 3	
2.0	**Physical Tests for XLPE Insulation & PVC sheath**			
I.	Test for thickness & Eccentricity	Applicable for XLPE insulation, PVC inner sheath & PVC outer sheath	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for XLPE insulation & PVC outer sheath		
(a)	Before ageing		IS 10810 Pt 7	
(b)	After ageing		IS 10810 Pt 7	
III.	Ageing in air oven	Applicable for XLPE insulation & PVC outer sheath	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For PVC outer sheath only	IS 10810 Pt 10	

S. No.	TEST	APPLICABLE FOR	REFERENCE STANDARD	REMARKS
V.	Hot deformation test	For PVC outer sheath only	IS 10810 Pt 15	
VI.	Heat shock test	For PVC outer sheath only	IS 10810 Pt 14	
VII.	Shrinkage test	For XLPE insulation & PVC outer sheath only	IS 10810 Pt 12	
VIII.	Thermal stability test	For PVC outer sheath only	IS 10810 Pt 60	
IX.	Hot set test	For XLPE insulation only	IS 10810 Pt 30	
X.	Water absorption (gravimetric) test	For XLPE insulation only	IS 10810 Pt 33	
XI.	Degree of cross-linking	For XLPE insulation only	IS 7098-II	
3.0	**Improved Fire performance (FR-LSH) Tests**			
I.	Oxygen index test	For outer sheath only	IS 10810 Pt 58 / ASTMD 2863	
II.	Smoke density test	For outer sheath only	ASTMD 2843	
III.	Acid gas generation test	For outer sheath only	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	For outer sheath only	IS 10810 Pt 64 / ASTMD 2863	
4.0	**Flammability Tests**			
I.	Flammability test for bunched cables	For complete cable	IS 10810 Pt 62/ IEC-60332 (Part-3) Cat-B	
II.	Flammability test for single cable	For complete cable	IS: 10810 Pt 61 / IEC:60332 Part-1	
5.0	**Electrical Tests**			
I.	High Voltage Test	For complete cable	IS 10810 Pt 45	
II.	Insulation Resistance Test (Volume resistivity method)	For complete cable	IS 10810 Pt 43	
III.	Partial discharge test (shall be carried out on full drum length)		IS 10810 Pt 46	
IV.	Bending Test followed by Partial Discharge test		IS 10810 Pt 50	
V.	Dielectric Power Factor Test (i) As a function of voltage (ii) As a function of temperature		IS 10810 Pt 48	
VI.	Heat Cycle Test		IS 10810 Pt 49	
VII.	Impulse Withstand Test		IS 10810 Pt 47	
VIII.	Thermal ageing test	For complete cable	IS 7098-II	
IX.	Flammability Test	For PVC sheathed cable	IS 10810 Pt 53	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

CLAUSE NO.	QUALITY ASSURANCE	NTPC

MV (3.3 kV / 6.6. kV / 11 kV / 33 kV) Cables

Attributes / Characteristics / Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Hot Set Test/ Eccentricity & Ovality	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two wires	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability on outer sheath	Metallic (Cu) Screening (If applicable)	Anti termite coating on wooden drums	Constructional requirements feature as per NTPC specification	Routine & Acceptance Test as per relevant standard & NTPC specification	FRLS Test
Aluminum (IS-8130)	Y	Y	Y	Y		Y											
Semiconducting Compound	Y		Y			Y											
XLPE Compound (IS-7098 Part-II)	Y		Y			Y					Y						
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58) ,IEC-60754 Part-1)	Y		Y								Y	Y					Y
Triple Extrusion & curing /Manufacturing of Core		Y			Y		Y										
Copper Tape	Y	Y	Y			Y											
Polyster tape	Y	Y															
Core Laying								Y									
Armour wire/strip	Y	Y	Y														
Copper tapping	Y	Y											Y				
Inner sheath	Y	Y															
Armouring		Y							Y								
Outer Sheathing		Y								Y							
Power Cable (Finished)								Y	Y	Y	Y	Y			Y	Y	Y
Wooden drum(IS-10418) /Steel Drum		Y												Y	Y		

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major Bought out items will be subject to NTPC approval.

ROUTINE TESTS	**Following routine tests shall be carried out on each drum of finished cables for all types & sizes.**	
1)	Conductor Resistance test	
2)	High voltage test	
3)	Partial discharge test **(for Screened cables only)**	
ACCEPTANCE TESTS	**Following Acceptance tests shall be carried out on each size of each type (voltage rating) of cables, in the offered lot.**	
A) For Conductor (as per sampling plan mentioned in IS: 7098 Part II)		
	1)	Annealing test (Copper)
	2)	Tensile Test (Aluminum)
	3)	Wrapping Test (Aluminum)
	4)	Resistance test
B) For copper tape / Wires (as per sampling plan mentioned in IS: 7098 Part II)		
	1)	Measurement of Dimensions
	2)	Conductivity check
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 7098 Part II)		
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test For Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test For G S wires / Formed wires only
	10.	Freedom from surface defects

CLAUSE NO.	QUALITY ASSURANCE	NTPC

C) For XLPE insulation & PVC Sheath (as per sampling plan mentioned in IS: 7098 Part II)		
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see "D")
	3)	Hot set test (For XLPE insulation)

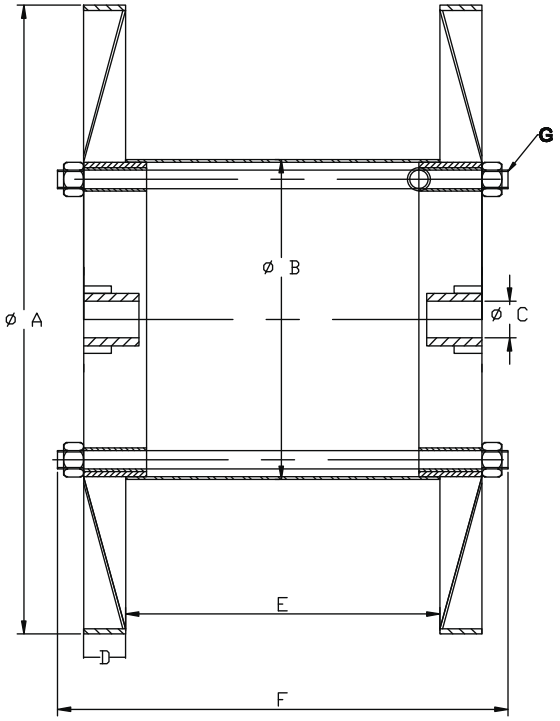
D) Ageing test:				
	Criteria	**Condition**	**Test Requirements**	**Remarks**
PVC outer sheath :	Samples as per relevant IS, from each size of each type (voltage rating) of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). **Tensile & elongation testing shall preferably be done with a computerized machine.** The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/ - 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	For PVC: The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°c+/- 2°c for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test **then all sizes (which had met the criteria) will be put on ageing test as per IS.**
		Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----
XLPE Insulation	Samples as per relevant IS, from each size of each type (voltage rating) of cables in the offered lot, will be put on ageing test as per IS.			

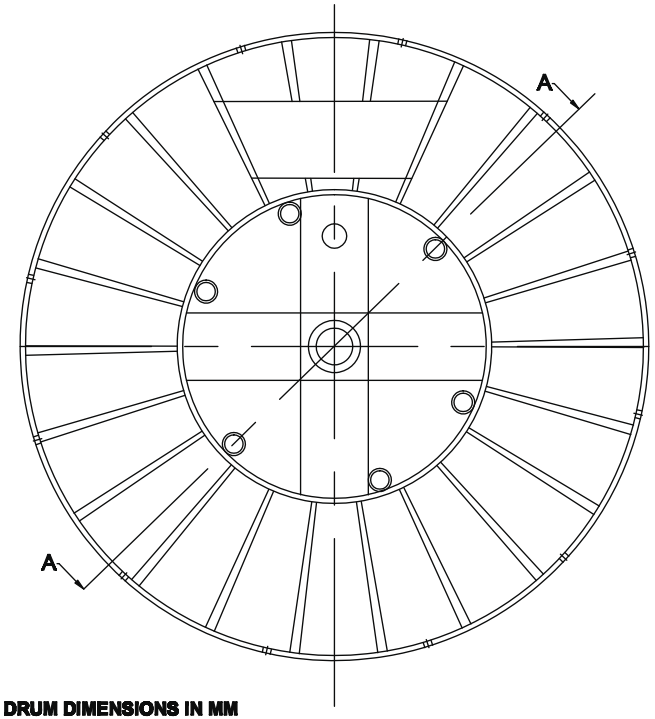
E) Following tests will be carried out on completed cables as per IS on each size of each type		
	1)	Insulation resistance test (Volume resistivity method)
	2)	High voltage test
	3)	Partial discharge test (for Screened cables only)

F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes & types)		
	1)	Thermal stability test on outer sheath
	2)	Oxygen index test on outer sheath
	3)	Smoke density rating test on outer sheath
	4)	Acid gas generation test on outer sheath
	5)	Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable
G) Following tests shall be carried on one length of each size of each type of offered lot:		
	1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, marking of drum no. / Batch number of outer sheath extrusion
	2)	Measurement of Eccentricity & Ovality

STEEL DRUM DRAWING (TYPICAL)

ANNEXURE-C TO SECTION-II





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	50
E	TRAVERSE	1400
F	GROSS WIDTH	1600
G	STUD SIZE	16 MM.

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