5 X 800 MW YADADRI STPS
TSGENCO

TECHNICAL SPECIFICATION
FOR
EPR INSULATED FIRE SURVIVAL CABLE

PE-TS-417-507-E104

REVISION: 00

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

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS- 417-507-E104	
	TECHNICAL SPECIFICATION FOR EPR INSULATED FIRE SURVIVAL CABLES	VOLUME II	
		SECTION -	
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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

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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 Annexure-A [BOQ-Cum-Price schedule] of the specification shall not be considered (i.e., technical description & quantities as per specification shall prevail).

BIDDER'S STAMP & SIGNATURE

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1.0 SCOPE OF ENQUIRY

1.1 This specification covers the Design, Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of EPR INSULATED FIRE SURVIVAL CABLES.

1.2 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation at site conditions.

1.3 General technical requirements of the EPR INSULATED FIRE SURVIVAL CABLES are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I.

1.4 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.

1.5 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 Annexure for Bill of Quantities (BOQ) enclosed as part of NIT.

3.0 TECHNICAL REQUIREMENTS

3.1 Specific Technical Requirement:

S.No.	***Reference Clause No. of Section- II (if any)***	***Specific Requirement/ Change***
1	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.	To be read as "In case of wooden drums, all wooden parts shall be manufactured from seasoned wood treated **by immersing in copper-nitrate solution**. 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."
2	Test for rodent & termite repulsion property	The test shall be carried out to note the presence of rodent and termite repelling chemical in PVC compound. Normal procedure is that a few chippings of the PVC compound are slowly ignited in a porcelain dish or crucible in a muffle furnace at about 600°C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). A drop of aqueous sodium sulphide solution is placed on a thick filter paper and it is allowed to soak. The spot is touched with a drop of above extract. A black spot indicates the presence of anti-termite & rodent compound.

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3.2 Quality/ Inspection:

S.No.	***Reference Clause No. of Section- II (if any)***	***Specific Requirement/ Change***

4.0. DRAWINGS & DOCUMENTS TO BE SUBMITTED

4.1 Documents/drawings to be submitted as part of technical offer & after placement of order for BHEL & customer's approval shall be as part of NIT.

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

Sl. No.	**Drawings/Document Description**	**Drawings / Document Number**
1.	Technical Data sheet – EPR Insulated Fire Survival Cable	PE-V0-417-507-E181
2.	Cross-sectional Drgs.- EPR Insulated Fire Survival Cable	PE-V0-417-507-E183
3.	Quality Plan - EPR Insulated Fire Survival Cable	PE-V0-417-507-E920*
4.	Type Test Reports for Tests conducted for this contract	PE-V0-417-507-E182

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.

4.3 All drawings/ documents indicated above shall be submitted through Document Management System (DMS).

DATASHEET A

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS- 417-507-E104	
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DATASHEET-A

1.0	Type of Cable	EPR INSULATED FIRE SURVIVAL CABLES
2.0	Standard applicable in general(Latest amendment to be referred if any)	IS-9968(PART-1) in general, IS-6380, IS -10810,IS 10418, IS-3975, ASTMD:2843, ASTMD-2863, IEC-60754-1, IEC-60331-1, IEC-60332-3-22, IE-:60332-3-23, IEEE-60383,SS-424-1475
3.0	Voltage Grade	1.1 KV
4.0	Number of cores, cross sectional area of conductors and quantities	As per BOQ-Cum-Price Schedule
5.0	CONDUCTOR	
(a)	Material	Copper
	Grade and Class	Stranded, Tinned annealed high conductivity, Class 2
(b)	Standard Applicable	IS - 8130
(c)	Shape	*As per IS-9968* (Part-1)
(d)	Min. number and diameter of strands for main and neutral conductor.	As per class -2 of IS 8130
(e)	Fire Barrier tape (separator tape)	Glass Mica tape in two layers with minimum 50% overlap with thickness of 0.06 mm (min.)
6.0	INSULATION	
(a)	Material	Heat resistant Elastomer compound , type IE2
(b)	Standard Applicable	IS : 9968(Part-1),IS -6380
(c)	Continuous withstand temperature	90°C
(d)	Short-circuit withstand temperature	250°C
(e)	Method of application	By Pressure extrusion; sleeve extrusion not permitted.
(f)	Method of curing	Dry/Steam/Gas/Sioplas
(g)	Nominal Thickness of insulation	As per IS : 9968(Part-1)
(h)	Fire proof tape	As per IS : 9968(Part-1)
1.	Applicable	*[√]YES [ ]NO*
7.0	CORE IDENTIFICATION	Colour coding as per IS : 9968(Part-1)
8.0	INNER SHEATH	
(a)	Material	Heat resistant, oil resistant , flame retardant (HOFR) Elastomer compound
(b)	Grade and type	Extruded Type SE-3
(c)	Standard Applicable	IS : 9968(Part-1)
9.0	ARMOUR	
(a)	Material:	
(i)	Single core cables	Aluminium round wire armour.
(ii)	Multi-core cables	Single layer Round Galvanised Steel wire for multi core cable
(b)	Standard Applicable	IS-3975
(c)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/ over-riding)
(d)	Breaking load of joint	95 % of normal armour

10.0	OUTERSHEATH	
(a)	Material	Heat resistant, oil resistant , flame retardant (HOFR) Elastomer compound
(b)	Grade and type	Extruded Type SE-3
(c)	Colour	Black
(d)	Marking	Cable size (cross section area and no. of cores) and voltage grade @ 5M (by embossing) *Word "EPR-IE2 Insulation", "FS" etc. @ 5m (by embossing)* Manufacturer's name and/ or trade name, IS No. and year of manufacture @ 5M (by embossing) 'TSGENCO' @ 5M (by printing) Progressive sequential marking @ 1m (by printing)
11.0	HOFR CHARACTERISTICS	
(a)	Oxygen index	≥30 (as per ASTMD 2863)
(b)	Temperature Index	≥350. C (as per ASTMD-2863)
(c)	Acid gas generation	≤ 0.5% by weight (as per IEC-60754-1)
(d)	Smoke density rating	≤ 20% (As per ASTMD 2843)
(e)	Water absorption test	As per IS -6380
(e)	Flammability Test	
(i)	*Flammability test for single cable*	*As per:* *IEC-60332 Part-1* Or *IS-10810-61*
(ii)	*Flammability test for bunched cables*	*As per:* *IEC-60332 Part-3* *CAT-A* *Or,* *IS-10810-62*
(iii)	*Flammability test for complete cable*	*As per:* *IEEE-60383* *Or,* *IS-10810-53*
(iv)	*Swedish Chimney test*	*As per SEN-SS-424-1475-F3*
(f)	*Fire survival test*	*As per IEC -60331 min 750 for 3 Hrs*
12.0	*Anti-rodent and Termite repulsion Test*	*[√]YES [ ]NO*
13.0	Special Tests	
(a)	*UV Radiation Test as per BS EN ISO 4892-2 (Duration:- 14 days)*	*[ ]YES [√]NO*
14.0	CABLE DRUMS	
(a)	General	Cable shall be wound and packed on drums in such a manner that it will be properly sealed and firmly secured to the drum. The ends of each length shall be sealed before shipment
(b)	Type of Drum	Wooden as per IS 10418
(c)	Standard drum length	As specified in BOQ-Cum-Price Schedule

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(d)	Painting	Entire surface to be painted
(e)	Outermost Layer	To be covered with waterproof polyethylene
	Particular information on Drum	The cable drums shall be of heavy construction and should carry the following details in printed form: ▪ TSGENCO ▪ Manufacturer's name or trade make ▪ Type of cable & voltage grade ▪ Year of manufacture ▪ Type of insulation e.g. EPR-IE2 ▪ No. of core and size of cables ▪ Cable code e.g. FS ▪ Length of cable on drum ▪ No. of length on drum ▪ Direction of rotation, by arrow ▪ Approx. gross mass. ▪ IS/IEC number and ISI mark
15.0	SEA WORTHY PACKING	*[ ]YES [√] NO*

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DATASHEET C

GUARANTEED TECHNICAL PARTICULARS
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)

S.No.	Particulars	Unit	Description
1.0	**GENERAL**		
1.1	Name of Manufacturer	-	
1.2	Place of Manufacture	-	
2.0	**STANDARDS APPLICABLE**		
2.1	For general specification of EPR Cables	-	
2.2	For conductor material	-	
2.3	For material of inner-sheath & outer-sheath	-	
2.4	For method of tests	-	
2.5	For cable drums	-	
2.6	For oxygen index test	-	
2.7	For flammability test	-	
2.8	For acid gas generation test	-	
2.9	For smoke generation test	-	
2.10	For fire survival test	-	
2.11	Current rating of cables conforms to	-	
2.12	Short circuit rating conforms to	-	
3.0	**INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE**		
3.1	No. of cores x size	-	
3.2	Voltage grade (Uo/U)	kV	
3.3	Base current ratings as per standard		
a)	In air	Amp	
b)	In ground	Amp	
c)	ducts	Amp	
3.4	Short circuit rating	kA, sec	
3.5	CONDUCTOR		
a)	Applicable Standard	-	

NAME OF VENDOR				REV.	
NAME	SIGNATURE	DATE	SEAL		

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b)	Material type & grade	-	
c)	No & dia of wires in each core before stranding	no x mm	
d)	Shape	-	
e)	D.C. resistance of conductor at 20 deg. C	ohm/km	
f)	A.C. resistance of conductor at 85 deg. C	ohm/km	
g)	A.C. resistance of conductor at 90 deg. C	ohm/km	
h)	Reactance of cable at normal frequency	ohm/km	
i)	Electrostatic capacitance of cable at normal frequency	mF/km	
j)	Maximum conductor temperature	deg. C	
k)	Maximum short circuit temperature	deg. C	
3.6	HEAT BARRIER TAPE		
a)	Applicable Standard	-	
b)	Material	-	
c)	Thickness of tape	mm	
d)	No. of layers, overlap	-	
3.7	INSULATION		
a)	Applicable Standard	-	
b)	Material	-	
c)	Method of cross linking	-	
e)	Method of curing	-	
f)	Process of extrusion	-	
g)	Nominal thickness	mm	
h)	Minimum thickness	mm	
i)	Minimum insulation resistance constant at 27 deg. C	mega ohm/km	
j)	Minimum volume resistivity at 27 deg. C	ohm.cm	
k)	Minimum volume resistivity at 85/90 deg. C	ohm.cm	
l)	Dielectric strength of insulation		
m)	Resistivity of insulation		
n)	Acid gas generation of insulation & tape	%	
3.8	CORE IDENTIFICATION		
a)	Applicable Standard	-	

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3.9	INNERSHEATH		
a)	Material & type	-	
b)	Nominal Thickness	mm.	
c)	Minimum Thickness	mm.	
d)	Process of Extrusion	-	
e)	Type & Shape of fillers (if used)	-	
f)	Colour	-	
3.10	ARMOUR		
a)	Applicable Standard	-	
b)	Material	-	
c)	Size/ dimensions	-	
d)	Minimum no. of wires/ formed wires	-	
e)	Maximum DC resistance of armour	-	
f)	Maximum AC resistance of armour	-	
g)	Minimum coverage	-	
3.11	OUTERSHEATH		
a)	Material & type	-	
b)	Nominal Thickness	mm.	
c)	Minimum Thickness	mm.	
d)	Process of Extrusion	-	
e)	Colour	-	
4.0	**PERMISSIBLE VARIATION (PROJECT SPECIFIC)**		
a)	Voltage variation	%	
b)	Frequency Variation	%	
c)	Combined voltage & frequency	lAbsl	
5.0	**CHARACTERISTICS OF HOFR SHEATH (Inner & Outer)**		
a)	Oxygen index at 50 deg. C.	-	
b)	Temperature index	-	
c)	Acid gas generation	-	
d)	Smoke density rating	-	
6.0	**APPLICABLE TESTS UNDER FIRE CONDITIONS FOR SINGLE**		

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	CABLE & MULTIPLE CABLES		
7.0	**High Voltage Test Voltage**	kV	
8.0	**Water Absorption Test Voltage**	kV	
9.0	**CIRCUIT INTEGRITY TEST**		
a)	Applicable Standard	-	
b)	Temperature	Deg. C.	
c)	Duration	hrs	
10.0	**CABLE DRUMS**		
a)	Type & construction	-	
b)	Standard drum length (as per BOQ)	-	
c)	Tolerance on drum length	(+/-) 5%	
11.0	**DIAMETERS**		
a)	Overall diameter of conductor	mm	
b)	Overall diameter over taped conductor	mm	
c)	Approximate cable diameter of insulated conductor	mm	
d)	Approximate Cable diameter over inner sheath		
e)	Approximate overall diameter of cable		
12.0	**Tolerance on overall diameter**	**(±) mm**	
13.0	**Minimum bending radius**	**x O.D.**	
14.0	**Safe pulling force**	**kg.**	
15.0	**Maximum Charging current at nominal voltage (approx.)**	**amps/km**	
16.0	**Weight of cable / components**	**kg./m**	
a)	Weight of conductor	-	
b)	Weight of fire barrier tape	-	
c)	Weight of insulation	-	
d)	Weight of polymeric material	-	

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e)	Weight of Armour (GS/Aluminium)	-	
f)	Total weight of cable	-	
17.0	**Shipping Weight**	**kg**	
18.0	**Cable marking on outer sheath**	**-**	

NAME OF VENDOR				REV.	
NAME	SIGNATURE	DATE	SEAL		

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SECTION-II

STANDARD TECHNICAL SPECIFICATION

1.0 TECHNICAL REQUIREMENTS

1.1 Technical requirements for EPR INSULATED FIRE SURVIVAL 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 EPR INSULATED FIRE SURVIVAL 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 BHEL Standard Quality Plan (PE-QP-999-507-E006) 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 to QAP. Charges for all these tests for all the equipment & components shall be deemed to be included in the bid price (except UV Radiation test).

3.4 The charges of UV Radiation 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.

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-I 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 EPR INSULATED FIRE SURVIVAL CABLES.

4.4 Each drum shall carry manufacturer's name, purchaser'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.

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MANUFACTURER'S NAME & ADDRESS			MANUFACTURING QUALITY PLAN					PROJECT :				
			CABLE TYPE: ELASTOMERIC FLEXIBLE CABLE 1100 VOLTS					CUSTOMER : M/s. BHEL				
Sr. No.		CHARACTERISTICS	CATEGORY OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS / REF. STANDARDS	FORMAT OF RECORD	TESTING M	TESTING C	TESTING A	REMARKS
1	2	3	4	5	6	7	8	9	10			11
A.	RAW MATERIAL RECEIVING INSPECTION & TESTING											
1	COPPER ROD	a) Resistivity at 20°C	Cr	Elect.	1 Sample / Lot	IS 8130 / ASTM B-49	IS 8130 / ASTM B-49	Incoming inspection test report	P	--	--	
		b) Tensile Strength	Maj	Phy.	----do----	IS:12444/ IS 8130	IS:12444/ IS 8130		P	--	--	
		c) Elongation at Break	Maj	Phy.	----do----	----do----	----do----		P	--	--	
		d) Surface Appearance	Maj	Vis.	----do----	----do----	----do----		P	--	--	
		e) Conductivity	Maj	Elect.	----do----	----do----	----do----		P	--	--	
		f) Purity of Copper/ Chemical composition	Maj	Chem.	----do----	Supplier TC	Supplier TC		P	--	--	
2	Sepatator TAPE (Polyester Tape)	a) Dimensions	Maj	Meas.	1 Sample / Lot	Data Sheet	Data Sheet		P	--	--	
3	INSULATION (EPR IE 2) (on moulded sheet)	a) T.S. & Elong.(Without Ageing)	Maj	Phy.	1 Sample / Lot	IS 6380	IS 6380		P	--	--	
4	SHEATH (HOFR SE 3)	a) T.S. & Elong.(Without Ageing)	Maj	Phy.	1 Sample / Lot	IS 6380	IS 6380		P	--	--	
5	TEST ON ARMOUR WIRE FOR (Multi core & single core copper Cable) (GI WIRE OR AL WIRE as applicable)	a) Measurement of dimensions	Maj.	Phy.	1 Sample / Lot	IS:3975	IS:3975		P	--	--	
		b) Tensile Strength	Maj.	Phy.	----do----	----do----	----do----		P	V	--	
		c) Elongation test (As applicable)	Maj.	Phy.	----do----	----do----	----do----		P	V	--	
		d) Torsion test (As applicable)	Maj.	Phy.	----do----	----do----	----do----		P	V	--	
		e) Resistance test (As applicable)	Cr	Elect	----do----	----do----	----do----		P	V	--	
		f) Zinc coating test (As applicable)	Maj.	Chem.	----do----	----do----	----do----		P	--	--	
6	MICA TAPE	a) Thickness of tape	Maj.	Phy.	----do----	Supplier TC	Supplier TC/T.P.		P	V	--	
		b) Width of tape	Maj.	Meas.	----do----	----do----	----do----		P	--	--	
		c) Tensile Strength	Maj.	Phy.	----do----	----do----	----do----		P	--	--	
7	WOODEN DRUM	a) Dimension	Maj	Meas.	100%	IS:10418/84, PDS	IS:10418/84, PDS	Reg./Sheet	P	--	--	

Sr. No.		CHARACTERISTICS	CATEGORY OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS / REF. STANDARDS	FORMAT OF RECORD	TESTING			REMARKS
									M	C	A	
1	2	3	4	5	6	7	8	9	10			11
B.	INPROCESS INSPECTION & TESTING											
1	CONDUCTOR											
	A) WIRE DRAWING	a) Wire Dia	Maj	Meas	1 Sample / Setting	Data Sheet /T.P.	PDS/T.P.	Reg./Sheet	P	V	--	
	B) ANNEALING	b) Annealing Test	Maj	Phy	-----do-----	IS 8130	IS 8130	Reg./Sheet	P	V	--	
	C) TINNING	c) Persulphate Test (Continuity check of tinnned coating)	Maj	Chem	-----do-----	IS 8130	IS 8130	Reg./Sheet	P	V	--	
2	BUNCHING	a) No & Dia of Wire (Cross section)	Maj	Count	At the time of M/C Setting and twice in each shift	Data Sheet /T.P.	PDS/T.P.	Reg./Sheet	P	V	V	
		b) Dia. Over Bunch	Maj	Meas	-----do-----	PDS/T.P.	PDS/T.P.	Reg./Sheet	P	V	V	
3	STRANDING (Whereas applicable)	a) No. of Bunch	Maj	Count	-----do-----	PDS/T.P.	PDS/T.P.	Reg./Sheet	P	V	--	
		b) Conductor Dia	Maj	Meas	-----do-----	PDS/T.P.	PDS/T.P.	Reg./Sheet	P	V	--	
		c) Lay Length & Direction	Maj	Meas	-----do-----	PDS/T.P.	PDS/T.P.	Reg./Sheet	P	V	--	
		d) Surface appearance	Maj	Vis	100%	PDS/T.P.	PDS/T.P.	----		--	--	
		e) C.R. at 20°C	Cr	Elect	At the time of M/C Setting and twice in each shift	IS 8130	IS 8130	Reg./Sheet	P	V	--	
4	SEPARATOR TAPE ON CONDUCTOR (PTP/MICA Tape)	a) Thickness	Maj	Meas	-----do-----	PDS/T.P.	PDS/T.P.	Reg./Sheet	P	V	--	
		b) Dia over Separator	Maj	Meas	-----do-----	PDS/T.P.	PDS/T.P.	Reg./Sheet	P	V	--	
		c) Overlap & Coverage	Maj	Meas	-----do-----	PDS/T.P.	PDS/T.P.	Reg./Sheet	P	V	--	
5	INSULATION (TYPE - EPR)	a) Thickness of insulation	Maj	Meas	-----do-----	IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	Reg./Sheet	P	V	--	
		b) Diameter over insulation	Maj	Meas	-----do-----	IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	Reg./Sheet	P	V	--	
		c) Core Colour	Maj	Vis	-----do-----	IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	Reg./Sheet	P	V	--	
		d) T.S. & E.B. (Without Ageing)	Maj	Phy	1 Sample/Shift	IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	Reg./Sheet	P	V	--	
		e) Spark test/HV test	Cr.	Elect.	100%	IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	Reg./Sheet	P	V	V	
		f) Hot set & permanet Set	Maj/	Phy.	100%	IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	Reg./Sheet	P	V	--	
		g) Surface Finish	Visual	Visual	100%	IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	Reg./Sheet	P	V	--	
6	CORE IDENTIFICATION (Whereas appliable)	a) Coloured R.C. tape	Maj.	Vis.	100%	PDS/T.P.	PDS/T.P.	Reg./Sheet	P	V	--	

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									M	C	A	
1	2	3	4	5	6	7	8	9	10			11
7	LAYING UP OF CORES (Whereas appliable)	a) No. of cores/ Core Sequence	Maj	Count	100%	Data Sheet	PDS/T.P.	Reg./Sheet	P	V	--	
		b) Dia of Laid up Cores	Maj	Meas	-----do-----	Data Sheet	PDS/T.P.	Reg./Sheet	P	V	--	
		c) Size of fillers (wherever applicable)	Min	Meas	-----do-----	Data Sheet	PDS/T.P.	Reg./Sheet	P	V	--	
		d) Coverage & Overlapp	Maj	Meas	As per plant manufacturing std	As per plant manufacturing std	PDS/T.P.	Reg./Sheet	P	V	--	
8	MICA TAPE (As applicable)	a) Coverage	Maj	Meas	100%	Data Sheet	PDS/T.P.	Reg./Sheet	P	V	--	
		b) Overlap - 10 %	Maj	Meas	100%	Data Sheet	PDS/T.P.	Reg./Sheet	P	V	--	
9	INNER / OUTER SHEATH	a) Colour	Maj	Vis	100%	IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	---	P	--	--	
		b) Radial Thickness	Maj	Meas	At the time of M/C Setting and once in each shift	Data Sheet	PDS/T.P.	Reg./Sheet	P	V	--	
		c) Dia Over outersheath	Maj	Meas	-----do-----	Data Sheet	PDS/T.P.	Reg./Sheet	P	--	--	
10	CABLE IDENTIFICATION	a) Embossing on Outer Sheath	Maj	Vis	100%	Data Sheet	Data Sheet / TP	---	P	--	--	
11	REWINDING	a) Surface	Maj	Vis	100%	Data Sheet	Data Sheet / TP	---	P	--	--	
C.	FINAL INSPECTION & TESTING											
1	ROUTINE TEST	a) High Voltage Test on full drum length	Cr	Elect	100%	IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	Reg./Sheet	P	W	W	
		b) C.R. at 20°C on full drum length	Cr	Elect	100%	IS 8130	IS 8130	Reg./Sheet	P	W	W	
2	TYPE TEST											
	A) CONDUCTOR	a) C.R. at 20°C	Cr	Elect	One size / Lot	IS 8130	IS 9968/Pt-1/1988	TTR AIL	P	W	W	
		d) Annealing Test	Maj	Phy		IS 8130	IS 9968/Pt-1/1988	TTR AIL	P	W	W	
		c) Persulphate Test (Continuity check of tinnned coating)	Maj	Chem		IS 8130	IS 9968/Pt-1/1988	TTR AIL	P	W	W	
		d) Resistance of drain wire	Maj.	Elect		IS 8130	IS 9968/Pt-1/1988	TTR AIL	P	W	W	

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									M	C	A	
1	2	3	4	5	6	7	8	9	10			11
	B) INSULATION (EPR IE - 2)	a) Radial Thickness	Maj	Meas	One size / Lot	IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	Type Test once conducted shall be remain valid for 05 years
		b) T.S. & E.B. without Ageing	Maj	Phys		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		c) Variation in T.S. & E.B. After Ageing in air oven	Maj	Phys		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		d) Ageing in air Bomb	Maj	Phys		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		e) Hot Set Test & Permanent Set	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		f) Water Absorption (Electrical)	C-	Elect		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
	C) SHEATH (HOFR SE 3)	a) Radial Thickness	Maj	Meas		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		b) Overall dia	Min	Meas		Data Sheet	Data Sheet	TTR AIL	P	W	W	
		c) T.S. & E.B. without Ageing	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		d) Ageing test at air Bomb	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		e) Oil Resistance Test	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		f) Hot Set Test & Permanent Set	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
	D) HOFR CHARACTERSTISTICS	a) Oxygen Index	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		b) Temparature Index	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		c) Acid Gas Generation	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		d) Smoke density rating	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		e) Flammability test - IEEE 383	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		f) Flammability test - IEC 331-21 (750 Deg C for 03 Hours)	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		h) Flammability test - Swedish Standard SS-424-1475 (1977)	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
	E) ELECTRICAL TEST	a) High Voltage Test	Cr	Elect		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	TTR AIL	P	W	W	
		b) I. R.Constant at R.T. & at 90°C	Cr	Elect		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	TTR AIL	P	W	W	
	F) TEST ON ARMOUR for Multi core & single core cables	Measurement of dimensions	Maj.	Phy.		IS:3975	IS:3975	TTR AIL	P	W	W	
		Tensile Strength	Maj.	Phy.		----do----	----do----	TTR AIL	P	W	W	
		Elongation test (As applicable)	Maj.	Phy.		----do----	----do----	TTR AIL	P	W	W	
		Torsion test (As applicable)	Maj.	Phy.		----do----	----do----	TTR AIL	P	W	W	
		Resistance test (As applicable)	Cr	Elect		----do----	----do----	TTR AIL	P	W	W	
		Zinc coating test (As applicable)	Maj.	Chem.		----do----	----do----	TTR AIL	P	W	W	

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									M	C	A	
1	2	3	4	5	6	7	8	9	10			11
3	ACCEPTANCE TEST											
		a) Conductor resistance at 20°C	Cr	Elect	Three Samples / Lot	IS 9968/Pt-1/1988	IS 8130	ATR	P	W	W	
		b) Radial Thickness of Insulation & Sheath	Maj	Meas		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	ATR	P	W	W	
		c) Overall diameter	Maj	Meas		IS 9968/Pt-1/1988/Data Sheet	IS 9968/Pt-1/1988/Data Sheet	ATR	P	W	W	
		d) T.S. & E.B. for Insulation & Sheath without ageing	Maj	Phy		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	ATR	P	W	W	
		e) Hot Set & Permanent Set test (Insulation & Sheath)	Maj	Phy		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	ATR	P	W	W	
		f) Flammability Test	Maj	Phy		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	ATR	P	W	W	
		g) High Voltage Test (Routine)	Maj	Elect		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	ATR	P	W	W	
		h) Volume Resistivity/ I.R. Constant	Maj	Elect		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	ATR	P	W	W	
		i) Colour of insulation & Sheath	Visual	Visual		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	ATR	P	W	W	
		j) Embossing on cable	Visual	Visual		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	ATR	P	W	W	
		k) Marking on cable	Visual	Visual		IS 9968/Pt-1/1988	IS 9968/Pt-1/1988	ATR	P	W	W	
	HOFR CHARACTERSTISTICS	a) Oxygen Index	Maj	Phy	Any One sample per Lot	IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		b) Temparature Index	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		c) Acid Gas Generation	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		d) Smoke density rating	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		e) Flammability test (IEEE 383)	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		f) Flammability test - (IEC 331-21) 750 Deg C for 3 hrs.	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	
		g) Flammability test - Swedish Standard SS-424-1475 (1977)	Maj	Phy		IS 9968 / Data sheet	IS 9968 / Data sheet	TTR AIL	P	W	W	

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									M	C	A	
1	2	3	4	5	6	7	8	9	10			11
D.	PACKING & MARKING											
	A) PACKING & MARKING	a) End Sealing	Maj	Vis	100%	Customer's Tech Spec.,PO	Customer's Tech Spec.,PO	---	P	V	V	
		b) Packing	Maj	Vis	100%	----do----	----do----	---	P	V	V	
		c) Marking/Stencilling Drum painting	Maj	Vis	100%	Customer's Tech Spec.,PO	Customer's Tech Spec.,PO	---	P	V	V	

LEGENDS: M: Manufacturer, C : Client, A : Client
P = PERFORM, W = WITNESSE, V = VERIFICATION, R- REVIEW, TTR AIL= Internal Type Test Report , ATR - Acceptance Test Report
Maj=Major, Elect.=Electrical, Phy.=Physical, Chem.=Chemical, Cr.=Critical, Vis.=Visual, PDS= Product Data Sheet, T.P.= Approved Technical DATA SHEET

Note: This is to declare that necessary additive will be added in the outer sheath compound to develop the anti termite and anti rodent properties of sheath and to make the cable termite and rodent resistant. The inclusion of this additive will not hamper any other properties of the cable.