

**5 X 800 MW YADADRI STPS
TSGENCO**

**TECHNICAL SPECIFICATION
FOR
EPR INSULATED FIRE SURVIVAL CABLE**

PE-TS-417-507-E004

REVISION: 00



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



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
EPR INSULATED FIRE SURVIVAL
CABLES**

SPECIFICATION NO. PE-TS- 417-507-E004

VOLUME II

SECTION -

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DATE: 01.05.2019

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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:

<u>S.No.</u>	<u>Reference Clause No. of Section- II (if any)</u>	<u>Specific Requirement/ Change</u>
1	4.2 In case of wooden drums, all wooden parts shall be manufactured from seasoned wood treated with copper naphthenates / zinc naphthenates (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.

- 3.2 Quality/ Inspection:



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

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-E82

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).



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DATASHEET A



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**TECHNICAL SPECIFICATION FOR
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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, ASTM D:2843, ASTM D-2863, IEC-60754-1, IEC-60331-1, IEC-60332-3-22, IEC-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 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



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10.0	OUTERSHEATH	
(a)	Material	Heat resistant, oil resistant , flame retardant (HOFR) Elastomer compound
(b)	Grade and type	Extruded Type SE-3
(c)	Colour	Other than 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 ASTM D 2863)
(b)	Temperature Index	≥350. C (as per ASTM D-2863)
(c)	Acid gas generation	≤ 2% by weight (as per IEC-60754-1)
(d)	Smoke density rating	≤ 20% (As per ASTM D 2843)
(e)	Water absorption test	As per IS -6380
(e)	Flammability Test	
(i)	Flammability test for single cable	As per: <i>IEC-60332 Part-1</i> Or <i>IS-10810-61</i>
(ii)	Flammability test for bunched cables	As per: <i>IEC-60332 Part-3</i> <i>CAT-A</i> Or, <i>IS-10810-62</i>
(iii)	Flammability test for complete cable	As per: <i>IEEE-60383</i> Or, <i>IS-10810-53</i>
(iv)	Swedish Chimney test	As per <i>SEN-SS-424-1475-F3</i>
(f)	Fire survival test	As per <i>IEC -60331 min 750 for 3 Hrs</i>
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	-	

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NAME	SIGNATURE	DATE			

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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	IAbsl	
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			SEAL	REV.	
NAME	SIGNATURE	DATE			



**TECHNICAL SPECIFICATION FOR
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2 X 800MW UPPUR TPS

SPECIFICATION NO. PE-TS-425-507-E006

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SECTION-II

STANDARD TECHNICAL SPECIFICATION



**TECHNICAL SPECIFICATION FOR
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2 X 800MW UPPUR TPS

SPECIFICATION NO. PE-TS-425-507-E006

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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 naphthenates / zinc naphthenates (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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ANNEXURE-II

QUALITY PLAN

			STANDARD QUALITY PLAN			CUSTOMER : TSGENCO			PROJECT: 5 X 800 MW YADADRI STPS			SPECIFICATION		
						BIDDER/ : VENDOR			TITLE EPR INSULATED FIRE SURVIVAL CABLE			NUMBER : PE-TS-417-507-E004		
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			ITEM : EPR INSULATED FIRE SURVIVAL CABLES			SECTION			VOLUME II					
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS		
									P	W	V			
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 no. 2. Cable manufacturer to maintain all quality records identified as per all QP stages enumerated below whether it is identified for BHEL verification or witness or not.														
1.0	RAW MATERIALS & BOUGHT OUT ITEMS													
1.1	Aluminium/copper Rods (Conductor/Armour Wire)	GENERAL : 1. Physical properties	MA	Physical Tests	Sample/ Batch	IS 9968 Pt 1, IS 8130 & Appd Datasheet	IS 9968 Pt 1, IS 8130 & Appd Datasheet	Inspection Report/ Test Cert.	2/3	-	1/2			
		2. Elec.Properties	MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	2/3	-	1/2			
		SPECIFIC CHECKS : a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	2/3	-	1			
		b) Grade	MA	-do-	-do-	IS 8130/ Approved datasheet	IS 8130/ Approved datasheet	-do-	2/3	-	1			
		c) Resistivity	MA	Electrical Tests	Manufacturer std.	IS 8130	IS 8130	-do-	2/3	-	1			
1.2	Insulation (EPR) Copmpound	GENERAL : 1. Physical properties	MA	Physical Tests	Sample/ Batch	IS 9968 Pt 1, IS 6380 & Mfs Std./ Approved datasheet	IS 9968 Pt 1, IS 6380 & Mfs Std./ Approved datasheet	Inspection Report/ Test Cert.	2/3	-	1/2			
		2. Elec.Properties	MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	2/3	-	1/2			
		SPECIFIC CHECKS : a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	2/3	-	1			
		b) Type/ Grade	MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	2/3	-	1			
		c) Shelf life/ Storage condition	MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	2/3	-	1			
BHEL			PARTICULARS			BIDDER/VENDOR								
			NAME											
			SIGNATURE											
			DATE						BIDDER'S/VENDORS COMPANY SEAL					

		STANDARD QUALITY PLAN		CUSTOMER : TSGENCO		PROJECT: 5 X 800 MW YADADRI STPS		SPECIFICATION		
				BIDDER/ :		TITLE EPR INSULATED FIRE SURVIVAL CABLE		NUMBER : PE-TS-417-507-E004		
				VENDOR		QUALITY PLAN		SPECIFICATION :		
SHEET 2 OF 10		SYSTEM		ITEM : EPR INSULATED FIRE SURVIVAL CABLES		SECTION		VOLUME II		
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.3	Seathing Compound	GENERAL : 1. Physical properties 2. HOFR properties SPECIFIC CHECKS : 1. Make 2. Type/ Grade 3. Shelf life/ Storage condition	MA	Physical Tests	Sample/ Batch	IS 9968 Pt 1 & Mfs Std./ Approved datasheet	IS 9968 Pt 1 & Mfs Std./ Approved datasheet	Inpection Report/ Test Cert.	2/3	1/2
			MA	Envir/Chemical	Sample/ Batch	ASTMD:2843, ASTMD-2863, IEC-60754-1/ Approved datasheet	ASTMD:2843, ASTMD-2863, IEC-60754-1/ Approved datasheet	Inpection Report/ Test Cert.	2/3	1/2
			MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	2/3	1
			MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	2/3	1
			MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	2/3	1
1.4	Glass Mica Tape (Separator Tape)	GENERAL : 1. Physical properties 2. Elec.Properties	MA	Physical Tests	Sample/ Batch	Mfr. Std./ Approved datasheet	Mfr. Std./ Approved datasheet	Inpection Report/ Test Cert.	2/3	1/2
			MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	2/3	1/2
BHEL			PARTICULARS		BIDDER/VENDOR					
			NAME							
			SIGNATURE							
			DATE				BIDDER'S/VENDORS COMPANY SEAL			

			STANDARD QUALITY PLAN			CUSTOMER : TSGENCO			PROJECT: 5 X 800 MW YADADRI STPS			SPECIFICATION		
						BIDDER/ :			TITLE EPR INSULATED FIRE SURVIVAL CABLE			NUMBER : PE-TS-417-507-E004		
						VENDOR			QUALITY PLAN			SPECIFICATION :		
SHEET 3 OF 10			SYSTEM			ITEM : EPR INSULATED FIRE SURVIVAL CABLES			SECTION			VOLUME II		
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS		
1	2	3	4	5	6	7	8	9	10	11				
1.5	Galvanised steel round wire/Aluminium round wire for Armour (as applicable)	GENERAL : 1. Make 2. Dimension 3. Phy.and Elec. Properties 4. Galvanization Quality	MA	Verify	Manufacturer std.	Manufacturer approved source	Manufacturer approved source	Inspection Report/ Test Cert.	2/3	-	1	* Sample from each armour size/ Batch / Lot		
			MA	Measurement	-do-	IS 3975 & Approved datasheet	IS 3975 & Approved datasheet	-do-	2/3	-	2			
			MA	Physical & Electrical Tests	Sample*	-do-	-do-	-do-	2/3	-	2			
			MA	Galv.Tests	-do-	Relevant. IS & Mfr. Std.	Relevant. IS & Mfr. Std.	-do-	2/3	-	2			
1.6	Wodden Drum	1. Phy. And constructional checks	MA	Meas.	Mfr's Plant Std.	IS10418	IS10418	Inspection Report/ Test Cert. coc	2/3	-	1			
		2. Anti termite treatment	MA	chemical	-do-	Mfr's Plant Std.	Mfr's Plant Std.		2/3		1			
1.7	Steel Drum	1. Dimension	MA	Meas.	Mfr's Plant Std.	Approved drawing of steel drum / BHEL specification	Approved drawing of steel drum / BHEL specification	Inspection Report/ Test Cert.	2/3	-	1			
		2. Surface finish	MA	Meas.	-do-	Surface shall be smooth	Surface shall be smooth	-do-	2/3		1			
BHEL			PARTICULARS			BIDDER/VENDOR								
			NAME											
			SIGNATURE											
			DATE						BIDDER'S/VENDORS COMPANY SEAL					

			STANDARD QUALITY PLAN			CUSTOMER : TSGENCO			PROJECT: 5 X 800 MW YADADRI STPS TITLE: EPR INSULATED FIRE SURVIVAL CABLE			SPECIFICATION NUMBER : PE-TS-417-507-E004		
						BIDDER/ : VENDOR			QUALITY PLAN NUMBER: PE-QP-999-507-E006, R0			SPECIFICATION : TITLE: TECHNICAL SPECIFICATION FOR EPR INSULATED FIRE SURVIVAL CABLE		
SHEET 4 OF 10			SYSTEM			ITEM : EPR INSULATED FIRE SURVIVAL CABLES			SECTION			VOLUME II		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS		
1	2	3	4	5	6	7	8	9	P	W	V	11		
2.0	IN PROCESS													
2.1	Wire Drawing	1. Size	MA	Dimensional	Plant Mfg. Std.	IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet	Inspection Report	2	-	1	* Sample from each armour size/ Batch / Lot		
		2. Surface finish	MA	Visual	-do-	Surface shall be smooth	Surface shall be smooth	-do-	2	-	1			
		3. Phy.and Elec. Properties	CR	Physical & Electrical Tests	Sample*	IS 8130 & Mfr. Std.	IS 8130 & Mfr. Std.	-do-	2/3	-	2			
2.2	Stranding of wires	1. No. of wires	MA	Counting	Plant Mfg. Std.	IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet	Inspection Report	2	-	-			
		2. Resistance	CR	Electrical	-do-	-do-	-do-	-do-	2	-	-			
		3. Sequence, lay length & Direction	MA	Visual, Meas.	One Sample of each size/ 100%	Mfrs Std. / Appd. Datasheet	Mfrs Std. / Appd. Datasheet	-do-	2	-	-			
		4. Surface Finish	MA	Visual	One Sample of each size/ 100%	Surface shall be smooth	Surface shall be smooth	-do-	2	-	-			
		5. Dimension	MA	Measurement	One Sample of each size/ 100%	IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet	-do-	2	-	-			
2.3	Glass Mica tape	1. Dimensions	MA	Measurement	100%	Appd. datasheet	Appd. datasheet	Inspection Report	2	-	-			
		2. Dia over tape	MA	Measurement	Sample	Mfrs Std.	Mfrs Std.	-do-	2	-	-			
		3.Mica tape overlap	MA	Measurement	Sample	Appd. datasheet	Appd. datasheet	-do-	2	-	-			
2.4	Core Insulation (EPR) (No repair permitted)	1. Surface finish	MA	Visual	100%	Free from bulging, burnt particles, lumps, cuts & scratches	Free from bulging, burnt particles, lumps, cuts & scratches	Inspection Report	2	-	1	# To be checked at starting & finished end of extruded length.		
		2. Concentricity#	CR	Measurement	One Sample of each size/ lot	IS 9968 Pt 1 & Appd. Datasheet	IS 9968 Pt 1 & Appd. Datasheet	-do-	2	-	1			
		3. Insulation Thickness	CR	Measurement	-do-	-do-	-do-	-do-	2	-	-			
		4. Dia over insulation	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-			
		5. Tensile Strength & % Elongation	MA	Mechanical	100%	-do-	-do-	-do-	2	-	-			
		6. Water absorption test	CR	Electrical	100%	IS 6380 ,Mfrs Std.	IS 6380 ,Mfrs Std.	Inspection Report	2	-	1			
BHEL			PARTICULARS			BIDDER/VENDOR								
			NAME											
			SIGNATURE											
			DATE						BIDDER'S/VENDORS COMPANY SEAL					

			STANDARD QUALITY PLAN			CUSTOMER : TSGENCO			PROJECT: 5 X 800 MW YADADRI STPS TITLE: EPR INSULATED FIRE SURVIVAL CABLE			SPECIFICATION NUMBER : PE-TS-417-507-E004		
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER: PE-QP-999-507-E006, R0			SPECIFICATION : TITLE: TECHNICAL SPECIFICATION FOR EPR INSULATED FIRE SURVIVAL CABLE					
SHEET 5 OF 10			SYSTEM			ITEM : EPR INSULATED FIRE SURVIVAL CABLES			SECTION			VOLUME II		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS		
									P	W	V			
1	DCS CRE PANEL-47	3	4	5	6	7	8	9	10				11	
2.5	Core Laying	1. Dia over laid up core 2. Sequence of lay & direction 3. Lay Length	MA MA MA	Measurement Visual & Meas. Measurement	One Sample of each size/ -do- -do-	IS 9968 Pt 1 & Approved datasheet IS 9968 Pt 1 & Mfs Std. -do-	IS 9968 Pt 1 & Approved datasheet IS 9968 Pt 1 & Mfs Std. -do-	Inpection Report -do- -do-	2 2 2	- - -	- - -			
2.6	InnerSheath Extrusion	1. Surface finish 2. Thickness 3. Dia over inner sheath	MA CR MA	Visual Measurement -do-	100% One Sample of each size/ -do-	Surface shall be smooth Appd. Datasheet -do-	Surface shall be smooth Appd. Datasheet -do-	Inpection Report -do- -do-	2 2 2	- - -	- - -	(Pimple, fish eye, porosity & burnt particles not permitted.)		
2.7	Armour	1. No.of wires/Strips 2. Lay length & Direction 3. Dia over armouring 4. Coverage	MA MA MA MA	Counting Visual & Meas. Measurement Measurement	At the start of the process -do- -do- -do-	Mfrs Std. / Appd. Datasheet -do- Appd. Datasheet -do-	Mfrs Std. / Appd. Datasheet -do- Appd. Datasheet -do-	Inpection Report -do- -do- -do-	2 2 2 2	- - - -	- - - -			
BHEL			PARTICULARS			BIDDER/VENDOR								
			NAME											
			SIGNATURE											
			DATE						BIDDER'S/VENDORS COMPANY SEAL					

			STANDARD QUALITY PLAN			CUSTOMER : TSGENCO			PROJECT: 5 X 800 MW YADADRI STPS			SPECIFICATION		
						BIDDER/ : VENDOR			TITLE EPR INSULATED FIRE SURVIVAL CABLE			NUMBER : PE-TS-417-507-E004		
			SHEET 6 OF 10			SYSTEM			QUALITY PLAN NUMBER: PE-QP-999-507-E006, R0			SPECIFICATION : TITLE TECHNICAL SPECIFICATION FOR EPR INSULATED FIRE SURVIVAL CABLE		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION VOLUME II			REMARKS		
1	2	3	4	5	6	7	8	9	10			11		
2.8	Over Sheath Extrusion (No repair permitted)	1. Surface finish 2. Sheath Thickness 3. Dia over outer sheath 4. Embossing/ Sequential Marking	MA CR MA MA	Visual Measurement -do- Visual	100% One Sample of each size/ lot -do- 100%	Surface shall be smooth Appd. Datasheet -do- -do-	Surface shall be smooth Appd. Datasheet -do- -do-	Inspection Report -do- -do- -do-	2 2 2 2	- - - -	- - - -	(Pimple, fish eye, porosity & burnt particles not permitted.)		
3.0	Finished Cable (INTERNAL)	1. Routine Test (Refer Note-G)	CR	Electrical Tests & Measurement	100%	IS 9968 Pt 1 & Approved datasheet	IS 9968 Pt 1 & Approved datasheet	Test Report	2	-	1			
4.0	Final Inspection (EXTERNAL)	1. Finish 2. Dimension 3. Armouring - Coverage No.of Wires	MA MA MA	Visual Measurement Visual & Meas.	One drum in each Lot -do- -do-	IS 9968 Pt 1 & Approved datasheet -do- -do-	Free from Porosity, Bulging, Burnt particles,lumps, cuts & Approved Data Sheet -do- -do-	Test Report -do- -do-	2 2 2	1 1 1	- - -			
BHEL			PARTICULARS			BIDDER/ VENDOR								
			NAME											
			SIGNATURE											
			DATE						BIDDER'S/VENDORS COMPANY SEAL					

			STANDARD QUALITY PLAN			CUSTOMER : TSGENCO BIDDER/ : VENDOR			PROJECT: 5 X 800 MW YADADRI STPS TITLE: EPR INSULATED FIRE SURVIVAL CABLE QUALITY PLAN NUMBER: PE-QP-999-507-E006, R0			SPECIFICATION : NUMBER : PE-TS-417-507-E004 SPECIFICATION : TITLE : TECHNICAL SPECIFICATION FOR EPR INSULATED FIRE SURVIVAL CABLE		
SHEET 7 OF 10			SYSTEM			ITEM : EPR INSULATED FIRE SURVIVAL CABLES			SECTION VOLUME II					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS		
1	2	3	4	5	6	7	8	9	10	P	W	V	11	
5.0	Packing	4. Marking & Colour coding 5. Sample Tests (Refer Note-G) 6. Type Tests (Refer Note-G) Sealing Identification	MA CR CR MA	Visual Phy. Elect. Tests FRLS Tests Physical & Electrical Tests Visual	IS 9968 Pt 1 & Approved datasheet Sample # Sample # 100%	-do- -do- -do- As per IS	IS 9968 Pt 1 & Approved datasheet -do- -do- As per Mfr. Std.	-do- -do- -do- -do-	2	1	-	2	1	-
# Refer Annexure to QAP enclsod														

NOTES:-

- (A) JOINTS IN WIRE SHALL BE AS PERMITTED BY IS / BHEL SPECIFICATION, VENDOR TO CERTIFY THE SAME.
 (B) NO REPAIR OF CORE INSULATION PERMITTED
 (C) CABLE ENDS SHALL BE SEALED AS PER MANUFACTRERS STANDARD
 (D) RECORD OF RAW MATERIAL, PROCESS & ALL STAGES SHALL BE CERTIFIED BY VENDORS QC. AND ARE LIABLE TO AUDIT CHECK BY PURCHASER.
 (E) FILLERS/DUMMY CORES ETC. SHALL BE AS PER APPROVED DATA SHEET
 (F) VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER BHEL SPECIFICATION.
 (G) **FOR LIST OF ROUTINE, TYPE & SAMPLE TESTS, REFER ANNEXURE TO QAP ENCLOSED.**

LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER 1- BHEL/TSGENCO 2-VENDOR 3- SUB VENDOR CHP:CUSTOMER HOLD POINT WHICH WILL BE DECIDED AT CONTRACT STAGE

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

	ANNEXURE TO QAP	CUSTOMER:	PROJECT TITLE:	SPECIFICATION NUMBER: PE-TS-417-507-E004
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-V0-417-507-E913, R0	SPECIFICATION TITLE:
	SHEET 8 of 10	SYSTEM	ITEM: EPR INSULATED FS CABLES	DOC. NO.

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

- Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test.
- Sampling:
 - Type test shall be carried out on each type and size of cable, inclusive of measurement of armour DC resistance of power cables on one drum out of every 10 drums of cable.
 - Fire Survival tests at sl.no. 8 to be conducted on all sizes / lot.

B. Acceptance Test Conduction:

- Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.
- Sampling: Acceptance tests shall be carried out on Acceptance Tests on 1 drum out of every 10 drums chosen at random for acceptance of the lot for every type & size.

C. Routine Test Conduction:

- Tests for which "R" is indicated in the 'Test Conduction Required As' column below shall be conducted as Routine tests.
- Sampling:
Routine tests shall be conducted on 100% drums.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.0	Tests for Conductor				
I.	Persulphate test	For copper conductor only	T	IS 10810 Pt 4	
II.	Annealing test	For copper conductor only	T, A	IS 10810 Pt 1	<i>Internal in process Test Report to be furnished for acceptance test</i>
III.	Tensile test	For aluminium conductor only <i>(Not applicable for compacted circular or shaped conductor)</i>	T, A	IS 10810 Pt 2	Not Applicable
IV.	Wrapping test	For aluminium conductor only <i>(Not applicable for compacted circular or shaped conductor)</i>	T, A	IS 10810 Pt 3	Not Applicable
V.	Conductor Resistance test	For Al/Cu	T, A, R	IS 10810 Pt 5	
2.0	Tests for Armour Wires/Strips				
BHEL		PARTICULARS	BIDDER/ VENDOR		
		NAME			
		SIGNATURE			
		DATE			BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE TO QAP	CUSTOMER:	PROJECT TITLE:	SPECIFICATION NUMBER: PE-TS-417-507-E004
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-V0-417-507-E913, R0	SPECIFICATION TITLE:
	SHEET 9 of 10	SYSTEM	ITEM: EPR INSULATED FS CABLES	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T,A	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	T, A	IS 10810 Pt 38	
V.	Winding test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	T, A,R	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 41	
IX.	Wrapping Test	For Aluminium wires only	T, A	IS 10810 Pt 3	
3.0	Test for Fire Barrier Tape				
I.	Test for minimum thickness	Fire barrier tape	T,A	IS 10810 Pt 6	
4.0	Physical Tests for EPR insulation & sheath				
I.	Material	Applicable for insulation, HOFR elastomeric inner & outer sheath	T,A	IS 9968 Pt 1	
II.	Test for thickness	Applicable for insulation, HOFR elastomeric inner & outer sheath	T,A	IS 10810 Pt 6	
III.	Tensile strength and elongation test at break	Applicable for insulation, HOFR elastomeric inner & outer sheath	T,A	IS 10810 Pt 7	
IV.	Ageing in air oven	Applicable for insulation	T	IS 10810 Pt 11	
V.	Ageing in air bomb	Applicable for insulation, HOFR elastomeric inner & outer sheath	T	IS 10810 Pt 56	
VI.	Hot set test	Applicable for insulation, HOFR elastomeric inner & outer sheath	T,A	IS 10810 Pt 30	
VII.	Oil resistance	Applicable for insulation, HOFR elastomeric inner & outer sheath	T	IS 10810 Pt 31	
VIII.	Tear resistance	Applicable for insulation, HOFR elastomeric inner & outer sheath	T	IS 10810 Pt 17	
5.0	Electrical Tests				
I.	Insulation resistance	Applicable for EPR insulation	T,A	IS 10810 Pt 43	
II.	High voltage (Water immersion) test	Applicable for HOFR elastomeric Inner & outer sheath	T,A,R	IS 10810 Pt 45	
III.	Water absorption test	Applicable for EPR insulation	T	IS 10810 Pt 28	

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

	ANNEXURE TO QAP	CUSTOMER:	PROJECT TITLE:	SPECIFICATION NUMBER: PE-TS-417-507-E004
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-V0-417-507-E913, R0	SPECIFICATION TITLE:
	SHEET 10 of 10	SYSTEM	ITEM: EPR INSULATED FS CABLES	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
6.0	<u>HOFR Tests (On complete cable)</u>				
I.	Oxygen Index test	Applicable for HOFR elastomeric Inner & outer sheath	T, A	ASTMD-2863	
II.	Temperature index test	Applicable for HOFR elastomeric Inner & outer sheath	T, A	ASTMD-2863	
III.	Smoke density test	Applicable for HOFR elastomeric Inner & outer sheath	T, A	ASTMD 2843	
IV.	Swedish chimney test	For complete cable	T, A	SEN SS 424 1475 (Class F3)	
V.	Acid Gas Generation test	Applicable for HOFR elastomeric Inner & outer sheath	T, A	IEC 60754-1	
7.0	<u>Flammability Tests</u>				
I.	Flammability test for bunched cables	For complete cable	T	IS 10810 Pt 62 / IEC-60332 (Part-3)	As indicated in Datasheet-A
II.	Flammability test for single cable	For complete cable	T	IS: 10810 Pt 61 / IEC:60332 Part-1	
III.	Flammability test	For complete cable	T	IS 10810 Pt 53 / IEEE: 60383	
8.0	<u>Fire Survival Test</u>	For complete cable	T	IEC-60331-1	
9.0	<u>Anti-rodent and Termite Repulsion test</u>	For outer sheath only	A	--	As indicated in Datasheet-A & Section-I
10.0	<u>Special Tests</u>				
I.	Ultraviolet Test	For complete cable	**	BS EN ISO 4892-2/ ASTM G 154	Test applicable if indicated in Datasheet-A

**** These tests shall be conducted on one sample for the entire contract and duration of these tests shall be 14 days.**

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

**5X800 MW YADADRI STPS
TSGENCO**

DOCUMENT SUBMISSION SCHEDULE

SI No	DOCUMENT TITLE	DWG. / DOCUMENT No.	SUBMISSION SCHEDULE	DOCUMENT TYPE
1	Technical Data sheet - LT XLPE power cables	PE-V0-405-507-E181	Within two weeks from the date of LOI	PRIMARY
2	Cross-sectional Drgs.- LT XLPE Power Cables	PE-V0-405-507-E183	Within two weeks from the date of LOI	PRIMARY
3	Quality Plan - LT XLPE Power Cables	PE-V0-405-507-E920	Within two weeks from the date of LOI	PRIMARY
4	Type Test Reports for Tests conducted for this contract	PE-V0-405-507-E182	Within one week after conduction of Type test	SECONDARY