

1 x 660 MW PANKI TPS

**UTTAR PRADESH RAJYA VIDYUT UTPADAN NIGAM
LIMITED**

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

VOLUME-II

SPECIFICATION NO: PE-TS-426-507-E006

REVISION: 01



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

105636/2020/PS-PEM-EL



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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</u>	<u>Specific Requirement/ Change</u>
1.	4.1	Shall be read as: "Cables shall be supplied in non-returnable drums, of heavy construction. Material of cable drums shall be as specified in Datasheet-A."
2.	4.2	Shall be read as follows: "Construction & other details of drums shall be in line with Datasheet-A."
3.	4.4	Shall be read as: "Each drum shall carry following details in printed form: a) UPRVUNL & Manufacturer's name or trade make b) Type of cable & voltage grade c) Year of manufacture d) Type of insulation / sheath e.g. IE2/SE3/FS. e) No. of core and size of cables f) Cable Code g) Single length of cable on drum h) Direction of rotation by arrow i) Approx. gross mass j) ISI mark k) IS number "
	4.5	This clause shall be added as follows- "A label shall be securely attached to each end of the reel indicating the length, type, voltage grade, conductor size and number of core of the cable. A tag containing the same information shall be attached to the



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		leading end of the cable inside. An arrow and necessary instructions shall be marked on the drum indicating the direction in which it should be rolled. Drum numbers shall be indicated on cable drums."
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3.2 Quality/ Inspection:

<u>S.No.</u>	<u>Reference Clause No. of Section- II</u>	<u>Specific Requirement/ Change</u>
1.	ANNEXURE-II: Standard Quality Plan: Note "C: CABLE ENDS SHALL BE SEALED AS PER MANUFACTURERS STANDARD."	Note C shall be read as: "CABLE ENDS SHALL BE SEALED AS PER APPROVED DATASHEET."

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 for EPR INSULATED FIRE SURVIVAL CABLES	PE-V0-426-507-E601
2.	Cross-sectional Drawings for EPR INSULATED FIRE SURVIVAL CABLES	PE-V0-426-507-E602
3.	Manufacturing Quality Plan for EPR INSULATED FIRE SURVIVAL CABLES	PE-V0-426-507-E603*

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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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-16246, IS-8130, IS-6380, IS -10810,IS 10418, IS-3975, ASTMD:2843, ASTMD-2863, IEC-60754-1, IEC-60331, IEC-60332, 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 (for Power Cables having crosssectional area more than 2.5 sq.mm)	Stranded, plain, annealed high conductivity, Class 2
	Grade and Class (for Control Cables having crosssectional area upto and including 2.5 sq.mm)	Stranded, Tinned, annealed high conductivity, Class 2
(b)	Standard Applicable	IS-16246, IS - 8130
(c)	Shape	Non- compacted Circular (upto 6 sq mm) /Compacted Circular / Shaped (for above 6 sq mm)
(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
6.0	INSULATION	
(a)	Material	Heat resistant Elastomer compound , type IE2
(b)	Standard Applicable	IS-16246, 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 Table-3 of IS-16246
(h)	Fire proof tape	Two Layers of plain Glass Fibre Binder Tape
7.0	CORE IDENTIFICATION	Colour coding as per IS-16246
8.0	INNER SHEATH	
(a)	Material	Heat resistant, oil resistant , flame retardant Elastomer compound
(b)	Grade and type	Extruded Type SE-6
(c)	Standard Applicable	IS : 16246
(d)	Colour	Black
9.0	ARMOUR	
(a)	Material:	
(i)	Single core cables	Single layer of Hard Drawn Aluminium Round Wire of H4 grade
	Standard Applicable	IS 8130, IS-16246
(ii)	Multi-core cables	Galvanised Steel Round Wire



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	Standard Applicable	IS-3975, IS-16246
(b)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/ over-riding)
(c)	Minimum Coverage	90%
(d)	Breaking load of joint	95 % of normal armour
		Zinc rich paint shall be applied on armour joint surface of GS wire
10.0	OUTERSHEATH	
(a)	Material	Heat resistant, oil resistant , flame retardant Elastomer compound
(b)	Grade and type	Extruded Type SE-6
(c)	Colour	Black
(d)	Standard Applicable	IS : 16246
(e)	Marking	Cable size (cross section area and no. of cores) and voltage grade, ISI mark @ 1m (by embossing) Type of insulation & sheath(IE2/SE3), Word "EPR" "FS" etc, @ 1m (by embossing) Manufacturer's name and/ or trade name, and year of manufacture @ 1m (by embossing) 'BHEL-PEM' and 'UPRVUNL' Name @1m (by embossing) Progressive sequential marking @ 1m (by embossing)
11.0	ELASTOMERIC INNER & OUTER SHEATH CHARACTERISTICS	
(a)	Oxygen index	≥30 (as per ASTM D 2863/ IS-16246)
(b)	Temperature Index	≥350°C (as per ASTM D-2863)
(c)	Acid gas generation	< 2% by weight (as per IEC-60754-1/is-16246)
(d)	Smoke density rating	≤ 20% (As per ASTM D 2843 / IS 16246)
(e)	Water absorption test	IS 10810-28
(e)	Flammability Test	
(i)	Flammability test for single cable	As per IEC-60332 Part-1/ IS 16246
(ii)	Flammability test for bunched cables	As per IEC-60332 Part-3 CAT-B / IS 16246
(iii)	Flammability test for complete cable	As per IEEE-60383
(iv)	Swedish Chimney test	As per SEN-SS-424-1475-F3
(f)	Fire survival test	As per IEC-60331 / IS 16246 for min 3 Hrs at 750°C
12.0	Allowable Tolerance on OD	±2 mm (max.)
13.0	CABLE DRUMS	
(a)	Type of Drum	Wooden Drum as per IS 10418
(b)	Standard drum length	500m , 1000m (±) 5% (as specified in BOQ-Cum-Price Schedule)
(c)	Painting	Entire surface to be painted. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden drum shall be treated by immersing in copper nitrate solution.. Drum number shall be indicated on each drum.
(d)	Outermost Layer	To be covered with water-proof polyethylene followed by complete drum covering with wooden plank of suitable thickness across flanges. (Pls refer typical drawing of cable drum packing, attached in section -II)
(e)	Particular information on Drum	Both the end of cables shall be properly sealed with heat

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		shrinkable PVC / rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage & erection.
(f)	Construction Details	All wooden parts from seasoned wood and ferrous parts shall be treated with suitable rust preventive finish or coating. Wooden drum shall be treated by immersing in copper nitrate solution.

NOTE: 1. Suitable fire retardant material fillers shall be used for filling in the interstices. Two layers of plain glass binder tape should be applied over the laid up cores.

2. Minimum value of 'Tensile Strength' and 'Percentage elongation rate rupture' for inner sheath and outer sheath shall be 8 Newton/Sq. mm and 250% respectively.

3. If the ISI marking is not available with the bidder, discretion for acceptance or rejection of bid lies on BHEL based on BHEL customer requirement

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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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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		
a)	Voltage variation	%	
b)	Frequency Variation	%	
c)	Combined voltage & frequency	IAbsl	
5.0	CHARACTERISTICS OF 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	Minimum Tensile strength	N/mm ²	
17.0	Minimum elongation percentage at rupture		
18.0	Weight of cable / components	kg./m	

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a)	Weight of conductor	-	
b)	Weight of fire barrier tape	-	
c)	Weight of insulation	-	
d)	Weight of polymeric material	-	
e)	Weight of Armour (GS/Aluminium)	-	
f)	Total weight of cable	-	
19.0	Shipping Weight	kg	
20.0	Cable marking on outer sheath	-	

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SECTION-II

STANDARD TECHNICAL SPECIFICATION



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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

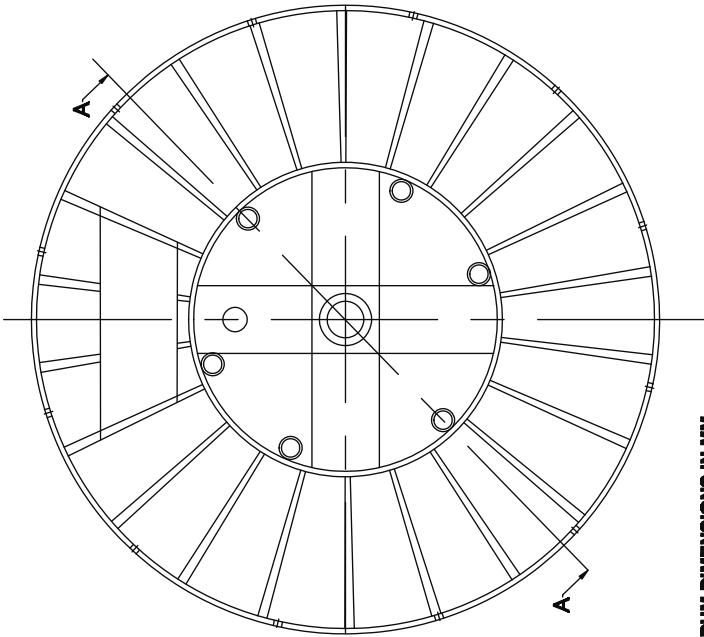
- 3.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-507-E006 as attached with the specification without any deviations. At contract stage, the successful bidder shall submit the same QP for BHEL/ultimate customer's approval. In case bidder has reference QP agreed with 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.

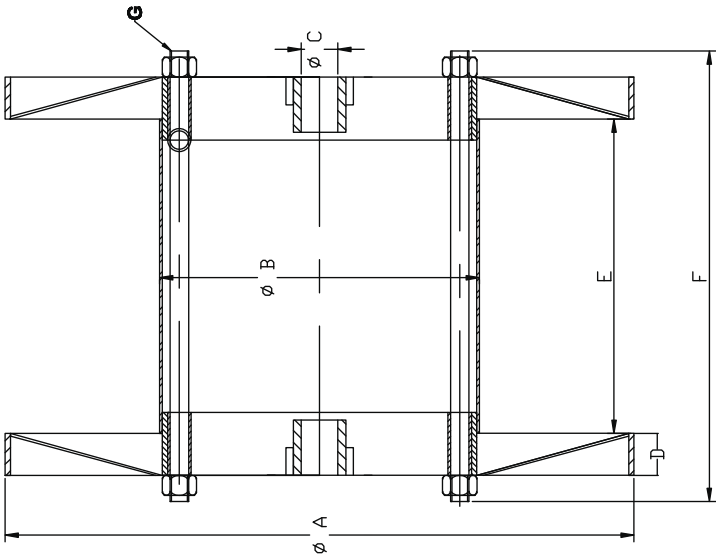
ANNEXURE-I TO SECTION-II

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



APPROXIMATE DRUM DIMENSIONS IN MM
ALL DIMENSIONS AND VALUES ARE
TYPICAL AND ARE DEPENDENT ON
CABLE WEIGHT.

A	FLANGE	2200
B	BARREL	1200
C	CENTRAL HOLE	100
D	FLANGE	50
E	TRAVERSE	1400
F	GROSS WIDTH	1600
G	STUD SIZE	16 MM.





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ANNEXURE-II

QUALITY PLAN

		STANDARD QUALITY PLAN		CUSTOMER :			PROJECT:			SPECIFICATION		
				BIDDER/ :			TITLE			NUMBER :		
		SHEET 1 OF 10		VENDOR			QUALITY PLAN NUMBER: PE-QP-999-507-E006, R01			SPECIFICATION/ TECHNICAL SPECIFICATION FOR TITLE EPR INSULATED FIRE SURVIVAL		
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY			VOLUME II
1	2	3	4	5	6	7	8	9	P	W	V	REMARKS
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 2. Elec.Properties SPECIFIC CHECKS : a) Make b) Grade c) Resistivity	MA	Physical Tests	Sample/ Batch	IS 16246,IS 8130 & Appd Datasheet	IS 16246,IS 8130 & Appd Datasheet	Inspection Report/ Test Cert.	2/3	-	1/2	
			MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	2/3	-	1/2	
			MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	2/3	-	1	
			MA	-do-	-do-	IS 8130/ Approved datasheet	IS 8130/ Approved datasheet	-do-	2/3	-	1	
			MA	Electrical Tests	Manufacturer std.	IS 8130	IS 8130	-do-	2/3	-	1	
1.2	Insulation (EPR) Copmpound	GENERAL : 1. Physical properties 2. Elec.Properties SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	MA	Physical Tests	Sample/ Batch	IS 16246,IS 6380 & Appd Datasheet	IS 16246, IS 6380 & Mfs Std./ Approved datasheet	Inspection Repor/ Test Cert.	2/3	-	1/2	
			MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	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	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		STANDARD QUALITY PLAN		CUSTOMER : 0		PROJECT: 0		SPECIFICATION			
				BIDDER/ : VENDOR		TITLE		NUMBER : 0			
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 (Inner & Outer Sheath)	<u>GENERAL :</u> 1. Physical properties 2. HOFR properties <u>SPECIFIC CHECKS :</u> 1. Make 2. Type/ Grade 3. Shelf life/ Storage condition	MA	Physical Tests	Sample/ Batch	IS 16246 & Mfs Std./ Approved datasheet	IS 16246 & Mfs Std./ Approved datasheet	Inpection Report/ Test Cert.	2/3	-	1/2
			MA	Envir/Chemical	Sample/ Batch	IS 16246, ASTMD:2843, ASTMD-2863, IEC-60754-1/ Approved datasheet	IS 16246, 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)	<u>GENERAL :</u> 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 : 0		PROJECT: 0		SPECIFICATION			
				BIDDER/ :		TITLE		NUMBER : 0			
				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/ formed wire strip/ 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
			MA	Measurement	-do-	IS 16246, IS 3975 & Approved datasheet	IS 16246, 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 (as applicable)	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 (as applicable)	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 : 0		PROJECT TITLE 0		SPECIFICATION : NUMBER : 0		
						BIDDER/ VENDOR :		QUALITY PLAN NUMBER: PE-QP-999-507-E006, R01		SPECIFICATION/ TECHNICAL SPECIFICATION FOR TITLE EPR INSULATED FIRE SURVIVAL		
		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
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	Wire Drawing	1. Size	MA	Dimensional	Plant Mfg. Std.	IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet	Inpection 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	Inpection Report	2	-	-	
		2. Resistance	CR	Electrical	-do-	-do-	-do-	-do-	2	-	-	
		3. Sequence, lay length & Direction	MA	Visual, Meas.	One Sample of each size/ lot	Mfrs Std. / Appd. Datasheet	Mfrs Std. / Appd. Datasheet	-do-	2	-	-	
		4. Surface Finish	MA	Visual	100%	Surface shall be smooth	Surface shall be smooth	-do-	2	-	-	
		5. Dimension	MA	Measurement	One Sample of each size/ lot	IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet	-do-	2	-	-	
2.3	Glass Mica tape	1. Dimensions	MA	Measurement	100%	Appd. datasheet	Appd. datasheet	Inpection 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	Inpection Report	2	-	1	# To be checked at starting & finished end of extruded length.
		2. Concentricity#	CR	Measurement	One Sample of each size/ lot	IS 16246, IS 6380 & Appd. Datasheet	IS 16246, IS 6380 & 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.	Inpection Report	2	-	1	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		STANDARD QUALITY PLAN		CUSTOMER : 0		PROJECT TITLE 0		SPECIFICATION : NUMBER : 0				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER: PE-QP-999-507-E006, R01		SPECIFICATION TECHNICAL SPECIFICATION FOR TITLE EPR INSULATED FIRE SURVIVAL				
		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
1	2	3	4	5	6	7	8	9	10	11	12	13
2.5	Core Laying	1. Dia over laid up core	MA	Measurement	One Sample of each size/ lot	IS 16246 & Approved datasheet	IS 16246 & Approved datasheet	Inpection Report	2	-	-	(Pimple, fish eye, porosity & burnt particles not permitted.)
		2. Sequence of lay & direction	MA	Visual & Meas.	-do-	IS 16246 & Mfs Std.	IS 16246 & Mfs Std.	-do-	2	-	-	
		3. Lay Length	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
2.6	InnerSheath Extrusion	1. Surface finish	MA	Visual	100%	Surface shall be smooth	Surface shall be smooth	Inpection Report	2	-	-	
		2. Thickness	CR	Measurement	One Sample of each size/ lot	IS 16246 & Appd. Datasheet	IS 16246 & Appd. Datasheet	-do-	2	-	-	
		3. Dia over inner sheath	MA	-do-	-do-	-do-	-do-	-do-	2	-	-	
2.7	Armour	1. No.of wires/Strips	MA	Counting	At the start of the process	IS 16246 & Appd. Datasheet	IS 16246 & Appd. Datasheet	Inpection Report	2	-	-	
		2. Lay length & Direction	MA	Visual & Meas.	-do-	-do-	-do-	-do-	2	-	-	
		3. Dia over armouring	MA	Measurement	-do-	Appd. Datasheet	Appd. Datasheet	-do-	2	-	-	
		4. Coverage	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		STANDARD QUALITY PLAN		CUSTOMER : 0		PROJECT TITLE 0		SPECIFICATION : NUMBER : 0				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER: PE-QP-999-507-E006, R01		SPECIFICATION/ TECHNICAL SPECIFICATION FOR TITLE EPR INSULATED FIRE SURVIVAL				
		SHEET 6 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	P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.8	Outer Sheath Extrusion (No repair permitted)	1. Surface finish	MA	Visual	100%	Surface shall be smooth	Surface shall be smooth	Inspection Report	2	-	-	(Pimple, fish eye, porosity & burnt particles not permitted.)
		2. Sheath Thickness	CR	Measurement	One Sample of each size/ lot	IS 16246 & Appd. Datasheet	IS 16246 & Appd. Datasheet	-do-	2	-	-	
		3. Dia over outer sheath	MA	-do-	-do-	-do-	-do-	-do-	2	-	-	
		4. Embossing/ Sequential Marking	MA	Visual	100%	Appd. Datasheet	Appd. Datasheet	-do-	2	-	-	
3.0	Finished Cable (INTERNAL)	1. Routine Test (Refer Note-G)	CR	Electrical Tests & Measurement	100%	IS 16246 & Approved datasheet	IS 16246 & Approved datasheet	Test Report	2	-	1	
4.0	Final Inspection (EXTERNAL)	1. Finish	MA	Visual	One drum in each Lot	IS 16246 & Approved datasheet	Free from Porosity, Bulging, Burnt particles,lumps, cuts & Approved Data Sheet	Test Report	2	1	-	
		2. Dimension	MA	Measurement	-do-	-do-	-do-	-do-	2	1	-	
		3. Armouring - Coverage No.of Wires	MA	Visual & Meas.	-do-	-do-	-do-	-do-	2	1	-	
	BHEL		PARTICULARS		BIDDER/ VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		STANDARD QUALITY PLAN SHEET 7 OF 10		CUSTOMER : 0		PROJECT TITLE 0		SPECIFICATION : NUMBER : 0				
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER: PE-QP-999-507-E006, R01		SPECIFICATION TECHNICAL SPECIFICATION FOR TITLE EPR INSULATED FIRE SURVIVAL				
				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		
5.0	Packing	4. Marking & Colour coding	MA	Visual	IS 16246	IS 16246 & Approved datasheet	IS 16246 & Approved datasheet	-do-	2	1	-	# Refer Annexure to QAP enclosed
		5. Acceptance Tests (Refer Note-G)	CR	Phy, Elect. Tests FRLS Tests	Sample #	-do-	-do-	-do-	2	1	-	
		6. Type Tests (Refer Note-G)	CR	Physical & Electrical Tests	Sample #	-do-	-do-	-do-	2	1	-	
		Sealing Identification	MA	Visual	100%	As per IS	As per Mfr. Std.	-do-	2	1	-	
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 MANUFACTURERS 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 & ACCEPTANCE TESTS, REFER ANNEXURE TO QAP ENCLOSED.												
LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER 1- BHEL/ CUSTOMER 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												

105636/2020/PS-PEM-EL

	ANNEXURE TO QAP	CUSTOMER: UPRVUNL	PROJECT TITLE: 1 X 660MW PANKI TPS	SPECIFICATION NUMBER: PE-TS-426-507-E006, R01
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E006, R01	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR EPR INSULATED FIRE SURVIVAL CABLES
	SHEET 8 of 11	SYSTEM	ITEM: EPR INSULATED FIRE SURVIVAL CABLE	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 to be conducted on each size & type of cable on 1 drum out of every 10 drums. The type tests may be witnessed by BHEL/ Owner, for which due notice shall be given by the vendor

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 1 drum out of every 10 drums chosen at random for acceptance of lot of every 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.	Conductor Resistance test	For Cu	T, A, R	IS 10810 Pt 5	
2.0	Tests for Armour Wires/Strips				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T,A	IS 10810 Pt 36	
II.	Test for measurement of DC resistance of armour		T	Relevant IS	

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

105636/2020/PS-PEM-EL

	ANNEXURE TO QAP	CUSTOMER: UPRVUNL	PROJECT TITLE: 1 X 660MW PANKI TPS	SPECIFICATION NUMBER: PE-TS-426-507-E006, R01
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E006, R01	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR EPR INSULATED FIRE SURVIVAL CABLES
	SHEET 9 of 11	SYSTEM	ITEM: EPR INSULATED FIRE SURVIVAL CABLE	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
III.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 37	
IV.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 10810 Pt 37	
V.	Torsion test	For GS round wire only	T, A	IS 10810 Pt 38	
VI.	Winding test	For GS strip only	T, A	IS 10810 Pt 39	
VII.	Resistivity test	Applicable for Aluminium wire & GS wire	T, A,R	IS 10810 Pt 42	
VIII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 40	
IX.	Mass of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 41	
X.	Wrapping Test	For Aluminium wires only	T, A	IS 10810 Pt 3	
3.0	<u>Test for Fire Barrier Tape</u>				
I.	Test for minimum thickness	Fire barrier tape	T,A	IS 10810 Pt 6	
4.0	<u>Physical Tests for EPR insulation & sheath</u>				
I.	Material	Applicable for insulation, elastomeric inner & outer sheath	T,A	IS 16246	
II.	Test for thickness	Applicable for insulation, elastomeric inner & outer sheath	T,A	IS 10810 Pt 6	
III.	Tensile strength and elongation test at break	Applicable for insulation, 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, elastomeric inner & outer sheath	T	IS 10810 Pt 56	
VI.	Aging in O ₂ bomb	Insulation, elastomeric inner & outer sheath (if applicable as per IS)	T	IS 10810 Pt 16	
VII.	Hot set test	Applicable for insulation, elastomeric inner & outer sheath	T,A	IS 10810 Pt 30	
VIII.	Oil resistance	Applicable for insulation, elastomeric inner & outer sheath	T	IS 16246	
5.0	<u>Electrical Tests</u>				
I.	Insulation resistance	Applicable for EPR insulation	T,A	IS 10810 Pt 43	
II.	High voltage (Water immersion) test	Applicable for elastomeric Inner & outer sheath	T,A,R	IS 10810 Pt 45	

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

105636/2020/PS-PEM-EL

	ANNEXURE TO QAP	CUSTOMER: UPRVUNL	PROJECT TITLE: 1 X 660MW PANKI TPS	SPECIFICATION NUMBER: PE-TS-426-507-E006, R01
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E006, R01	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR EPR INSULATED FIRE SURVIVAL CABLES
	SHEET 10 of 11	SYSTEM	ITEM: EPR INSULATED FIRE SURVIVAL CABLE	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
III.	Water absorption test	Applicable for EPR insulation	T	IS 10810 Pt 28	
IV.	Measurement of Insulation Resistance constant (K-value)		T	IS:6380/1984	
V.	Spark test high voltage test		T	As per relevant IS	<i>Internal in process Test Report to be furnished for type test</i>
6.0	<u>HOFR Tests (On complete cable)</u>				
I.	Oxygen Index test	Applicable for elastomeric Inner & outer sheath	T, A	ASTMD-2863	
II.	Temperature index test	Applicable for elastomeric Inner & outer sheath	T, A	ASTMD-2863	
III.	Smoke density test	Applicable for 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 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	IEC-60332 (Part-3) CAT-B	Refer Notes 1,2 & 3
II.	Flammability test for single cable	For complete cable	T	IEC:60332 Part-1	
III.	Flammability test	For complete cable	T	IEEE: 60383	
8.0	<u>Fire Survival Test (3 hr)</u>	For complete cable	T, A	IEC-60331/IS 16246	Withstanding 750deg C temperature for 3 hours

Notes:

1. This test shall generally be carried out as per IEEE 383. The cable installation to be tested shall consist of as many cables as are necessary to give at least 10 kg of organic material per metre run.
2. The following cable installation shall be tested: Installation with single / multi core cables in touching formation.
3. Size of cables, number of cables, number of layers and laying arrangements for each installation shall be subject to BHEL / Customer's approval.

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