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TECHNICAL SPECIFICATIONS

FOR

11kV, XLPE, AERIAL BUNCHED CABLES

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Specification No. CE/P&P/SPEC/2022/ABCable/11kV/007		**Date of Issue:** 12/08/2022		**Rev 0**

This is a Tender Specification for procurement of "CROSS LINKED POLYETHYLENE INSULATED AND PVC SHEATHED AERIAL BUNCHED CABLES WITH NEUTRAL CUM MESSENGER CONDUCTOR (11kV)", subject to the modification by the Purchaser as per actual field requirement. Supplier to submit the Guaranteed Technical Particulars (GTP) and Drawings, after the award of the Contract, for approval of the Purchaser.

SECTION A

TECHNICAL SPECIFICATIONS FOR CROSS LINKED POLYETHYLENE INSULATED AND PVC SHEATHED 11kV AERIAL BUNCHED CABLES

1. SCOPE:

1.1 This specification covers design, manufacture, testing at manufacturer's works before dispatch, transportation, supply and delivery of 11 kV grade XLPE insulated, screened all Aluminium conductor and PVC sheathed Power Cables, HT Aerial Bunched Cables for overhead lines.

1.2 It is not the intent to specify completely herein all details of the design and construction of the equipment. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation up to the bidder's guarantee in a manner acceptable to the purchaser, will interpret the meanings of drawings and specifications and shall have the discretion to reject any work or material which, in his judgment, is not in accordance there with.

The Cables shall be suitable for Climatic conditions as listed in Section -B.

2. COMPOSITION OF THE CABLE:

The composite cable shall compose of three single-core cables twisted around a bare aluminium alloy messenger wire, which will carry the weight of the cable.

3. RATED VOLTAGE:

The rated voltage of the cables shall be 11kV and the maximum operating voltage shall be 12kV.

4. APPLICABLE STANDARDS:

Unless otherwise stipulated in this specification, the following standard with up to date amendment shall be applicable.

S.NO	Indian Standards	Title	International standards
1	IS-8130/1984	Specification for conductors for insulated cables	-
2	IS-398 (PART-IV)	Specification for aluminium alloy conductor	-
3	IS -7098 (PART-II)/1979	Specification for cross linked Polyethylene insulated PVC Sheathed cables	-

5. DETAILS OF SINGLE CORE CABLE

5.1 The cable conductors shall be H 4 grade class 2 Aluminium Conductors complying with the requirements as specified in IS-8130-1984 with latest amendments.

The cable conductors shall be of round, stranded and compacted aluminium of nominal cross sectional area 35mm^2,50mm^2,70mm^2,95 mm^2,120 mm^2 ,150 mm^2 and 185 mm^2.Conductor shall be clean & reasonably uniform in size and shape and its surface shall be free from sharp edges. Corresponding number of wires in the conductor shall be as given in the table below:

Nominal cross sectional area of Al. conductor	**Maximum D.C resistance at 20 degree Celsius**	**Minimum no. of strands**	**Nominal thickness of insulation (mm)**	**Max short circuit current for 1 sec (KA)**
35	0.868	6	3.6	3.4
50	0.641	6	3.6	4.72
70	0.443	12	3.6	6.7
95	0.32	15	3.6	8.96
120	0.253	15	3.6	11.32
150	0.206	15	3.6	14.16
185	0.164	30	3.6	17.39

5.2 Conductor Screen

The conductors screen shall be of extruded semi-conducting cross linked polyethylene compound of thickness not less than 0.5 mm.

5.3 Insulation

The insulation shall be of extruded cross linked polyethylene (XLPE) ,Dry gas cured/wet cured process of nominal insulation thickness 3.6 mm conforming to the physical, electrical and ageing properties of IS: 7098 (Part-II)-2011.

The XLPE conductor shall be suitable for use where the combination of ambient temperature and temperature rise due to load, including temperature on exposure to direct sunlight results in conductor temperature not exceeding the following:

Normal continuous operation	Short circuit operation
90°C	250°C

5.4 Insulation screen

The insulation screening shall consist of two parts; namely metallic & non metallic. Non metallic part shall consist of a layer of extruded semi-conducting compound and shall be applied directly over the insulation of each core. Thickness of non-metallic part should be 0.6 mm.

The metallic part shall be non magnetic and shall be applied over the non-metallic part of insulation screening of individual core. Metallic screening material shall be annealed Copper tape. Thickness of Copper tape should be minimum 0.06 mm.

5.5 Outer –Sheath :-

Over the metallic screen the Cable shall be provided with extruded PVC outer sheath. The composition of the PVC compound for outer sheath shall be Type ST2 of IS-5831-1984 with latest amendments. The colour of the outer sheath shall be black. The nominal & minimum thickness of the sheath shall not be less than the standard values specified in the table No. 7 of IS-7098(Part-II)/2011. Outer surface of the Cable shall be ultra-violet Ray resistant.

6. MESSENGER (NEUTRAL CONDUCTOR)

6.1 The bare messenger wire shall consist of aluminium alloy wires, generally conforming to IS:398 (Part IV)– 1979.Messasnger conductor shall be stranded, compacted ,circular and shall have smooth round surface to avoid damage to the outer insulating sheath of single-core phase cables twisted around the messenger.

6.2 There shall be no joints in any wire of the stranded messenger conductor except thosemade in the base rod or wire before finally drawing.

6.3 The technical characteristics of messenger wire shall be as follows:

Nominal Cross sectional Areaof Phase Conductor (sq. mm)	**Messenger Conductor (Stranded Al Alloy IS 398 Part-4)**		
	Nominal Area of Aluminium Alloy in Messenger Wire (sq. mm)	**No. of Strand of Aluminium Alloy**	**Maximum DC resistance at20^{o}C (ohm/km)**
35	70	7	0.493
50	70	7	0.493
70	70	7	0.493

95	70	7	0.493
120	95	19	0.351
150	120	19	0.283
185	150	19	0.229

6. TESTS

The cables offered should have been fully type tested as per the relevant standards at any NABL accredited laboratory of National repute. The bidder shall furnish the type test reports along with the bid, which shall not be more than ten years prior to the date of publication of tender.

The following tests shall be carried out on the single-core cables as per IS-7098 (Part-II).

7.1 Type Tests

a) Tests on conductor:
   i) Tensile test
   ii) Wrapping test
   iii) Resistance test

b) Tests for thickness of insulation and sheath

c) Physical tests for insulation:
   i) Tensile strength and elongation at break
   ii) Agency in air oven
   iii) Degree of cross linking
   iv) Hot set test
   v) Shrinkage test
   vi) Water absorption test (gravimetric)

d) Physical tests for outer sheath:
   i) Tensile strength and elongation at break
   ii) Ageing in air oven
   iii) Shrinkage test
   iv) Hot deformation
   v) Loss of mass in air oven
   vi) Heat shock.
   vii) Thermal stability
   viii) Carbon black content of polythene sheath

e) Partial discharge test

f) Test on extruded semi-conducting screens
   i) Test for strippability of semiconducting strippable insulation screen(when applicable)
   ii) Volume resistivity
g) Thermal ageing test for complete cable
h) Bending test
i) Dielectric Power factor test:
   i) As a function of voltage
   ii) As a function of temperature
j) Insulation resistance (volume resistivity) test
k) Heat cycle test
l) High voltage test
m) Flammability test for PVC Sheathed cables

7.2 Acceptance Test

a. Tensile Test
b. Wrapping Test
c. Conductor resistance test
d. Test for thickness of insulation and sheath
e. Hot set test for insulation
f. Tensile strength and elongation at break test for insulation and sheath
g. Partial discharge test (for screened cables only)
h. High voltage test
i. Insulation resistance (volume resistivity) test
j. Tests for cross linking for extruded semi conducting screen

7.3 Routine Tests

a. Conductor resistance test
b. Partial Discharge Test
c. High voltage test

7.4 The following tests shall be carried out on the bare messenger wire in accordance with IS: 398 (Part-IV).

Type Tests/Acceptance Test

a) Breaking Load Test (on finished wire)
b) Elongation Test
c) Resistance Test

7.5 CHALLENGE CLAUSE:

Purchase reserves the right to have the material, received after the inspection by the authorized inspecting officer, again tested for any parameter(s) from approved/NABL Accredited testing house/in house technique of the Purchaser. The results if found deviating/unacceptable or in non-compliance with the approved GTP's, the lot shall be rejected and bidder shall arrange to replace the rejected LOT within **thirty (30) days** of such detection at his cost including to and fro transportation.

8. GUARANTEED TECHNICAL PARTICULARS:

The manufacturer shall furnish the guaranteed technical particulars of the cable offered in the GTP format provided in section C.

9. CABLE IDENTIFICATION

The Cable shall be identified throughout its length by the following information by means of a printed tape as per IS-7098(part-II) Identification shall be given on any one of the insulated conductor of cables.

i. Manufacturer's name or trade mark.
ii. Voltage grade.
iii. Year of manufacture
iv. Name of Purchaser

The Cables shall also be marked with the Standard Mark (BIS/ISI Mark). The requisite BIS license corresponding to IS -7098(part-II) shall also be furnished along with the bid without which the bid shall be treated as non-responsive.

The identification shall repeat after every 1000 mm along the length of the cable.

10. PACKING

The cables, as per specified delivery lengths, shall be securely wound /packed in non- returnable wooden drums, capable of withstanding rough handling during transport by Rail, Road, etc. The packing should withstand storage conditions in open yards. The cable drums shall conform to IS-10418:1982. The dimensional drawings of wooden drums shall be furnished after Purchase order both as hard copy and soft copy (PDF format and AutoCAD format). The drum shall be provided with circumferential lagging of strong wooden planks. The end of the cable shall be sealed with good quality heat shrink sealing caps. The sufficiently required additional sealing caps shall be supplied for use of testing during laying and jointing

at site and to seal spare lengths of cable. The packing should be able to withstand the rigorous of transport. Wood preservative shall be applied to the entire drum. Each drum shall have the following information in bold letters in English stenciled on it.

a. Ref: IS-7098(part-II)
b. Name & Address of the manufacturer, Trade name/Trade mark/Brand
c. ISI Marking
d. Type of Cable & Voltage Grade
e. Nominal Cross Section area of phase conductor
f. Length of Cable on drum (Meters)
g. Number of lengths on the drum (if more than one)
h. Direction of rotation of drum (by means of an arrow)
i. Gross weight (in Kg)
j. Country of Manufacture
k. Year of Manufacture
l. Owners purchase order reference.

11. CABLE LENGTHS:

The cables shall be supplied in continuous lengths of 500 m with ±5% tolerance. Where the ordered quantity is not multiple of 500 m and the incremental quantity is very small, the same may be included in one of the drums. Otherwise, an additional length for the incremental quantity will be supplied.

12. INSPECTION AND QUALITY CONTROL:

The Manufacturer shall furnish a complete and detailed quality plan for the manufacturing process of the cable. All raw materials shall conform to relevant applicable standards and tested for compliance to quality and requirement. During the manufacturing process, at all stages, inspections shall be made to check the physical and dimensional parameters, for verification to compliance to the standards. The Manufacturer shall arrange, for inspection by the purchaser, during manufacture with one month advance notice for verifying the various stage inspections as specified in the quality assurance plan enclosed to verify the quality control process of the Manufacturer.

SECTION -B

CLIMATIC AND ISOCERAUNIC CONDITIONS (CIC)

1. **The climatic and isoceraunic conditions at the site of work are approximately given as under:**

S.No.	Description	Values
i.	Max. temp of air in shade	30.6^0C
ii.	Min. temp of air in shade	-20^0C
iii.	Max. temp of air in sun	45^0C
iv.	Height above sea level (Approx.)	1600 m
v.	Max. relative humidity	90%
vi.	Min. relative humidity	15%
vii.	Average no. of thunder storm days per year	54
viii.	Average rainfall	80 cm
ix.	Wind Zone	WZ – 3
x.	Average number of rainy days per year	106
xi.	Seismic Zone	SZ – 5
xii.	Area of installation	HSZ

HSZ = Heavy Snow Zone, LSZ = Light Snow Zone

2. Communication and Transport

The nearest railway station is Jammu/Udhampur on the broad gauge line and is connected to the Divisional Stores by a metal road. The equipment is required to pass en-route through various Tunnels on NH-44. The weights and maximum dimension of the packages suitable for transportation through tunnel route are as follows:

i.	Length	7.0m
ii.	Width	3.0m
iii.	Height	4.55m
iv.	Weight	40 Ton (Metric)

The supplier shall get the permissible weight and dimensions confirmed from the Highway Authorities before proceeding with the manufacture of the equipment. It will be the responsibility of the supplier to ensure timely and proper delivery of the equipment on door delivery at Srinagar, through road transport. The supplier shall also ensure that the weights and dimensions of the packages which are suitable to be carried by road transport up to Srinagar.

SECTION –C

Guaranteed Technical Particulars for 11 kV, Aerial Bunched Cable

(To be filled in by the tenderer/bidder)

S.No	Description	Tenderer Response
	Manufacturer's Name	
	Class of Power Cable	
1	Name of the Manufacturer and country of origin	
2	Country of Manufacture	
3	Type of cable/ cable code	
4	Applicable standard	
5	**Voltage**	
	a) Rated Nominal voltage	
	b) Rated Maximum voltage	
6	**Suitability for**:	
	Earthed system	
7	**Phase Conductor**	
	a) Nominal cross section(sq.mm)	
	b) Material	
	c) Shape	
	d) Diameter of conductor(mm)	
	e) Number of wires per conductor(Nos.)	
	f) Nominal diameter of wire in conductor(mm)	
	g) Weight of Phase Conductor per kilometer(Kg/km)	
8	**Messenger Conductor**	
	a) Nominal cross section(sq.mm)	
	b) Material	
	c) Shape	
	d) Diameter of conductor(mm)	
	e) Number of wires per conductor(Nos.)	
	f) Nominal diameter of wire in conductor(mm)	
	g) Weight of Messenger Conductor per kilometer(Kg/km)	
9	**Insulation XLPE**	
	a) Curing process	
	b) Material/Composition	
	c) Minimum average XLPE Insulation thickness for AB Cable	
	i) 35 mm^2 (mm)	
	ii) 50 mm^2 (mm)	
	iii) 70 mm^2 (mm)	

	iv) 95 mm^2 (mm)	
	v) 120 mm^2 (mm)	
	vi) 150 mm^2 (mm)	
	vii)185 mm^2 (mm)	
10	Conductor screening	
	a) Material	
	b) Minimum thickness	
	c) Method of application	
11	Insulation screen	
A	Non metallic part	
	a) Material	
	b) Minimum thickness	
	c) Method of application	
B	Metallic part	
	a) Material	
	b) Minimum thickness	
12	Outer sheath	
	a) Material	
	b) Minimum thickness	
	c) Method of application	
	d) Colour	
13	Volume resistivity of insulation	
	a) At 27 degree Celsius (ohm-cm)	
	b) At 90 degree Celsius(ohm-cm)	
14	Tensile strength of insulation and sheath (N/mm^2)	
15	Elongation at break of insulation and sheath (%)	
16	Completed cable	
	a) Approx overall dia	
	b) Approx weight (Kg/KM)	
17	Cable drums	
	a) Drum size and material (as per IS -10418/1982)	
	b) Standard drum length and tolerance of each drum	
	c) Dimensions of drum	