

**TECHNICAL SPECIFICATIONS FOR X-LINKED POLYETHYLENE INSULATED  
AND PVC SHEATHED H.T.(11KV) AERIAL BUNCHED CABLES**

<b>1.</b>	<b>SCOPE :</b>
	The specification covers design, manufacture, testing before despatch, transportation, supply and delivery of ISI marked 11 KV Grade XLPE insulated screened armoured all aluminium conductor and PVC sheathed Power Cables suitable for effectively earthed 11KV Overhead Lines.
<b>2.</b>	<b>LOCATION :</b>
	11KV Aerial bunched Cables are composite Cable especially intended for overhead line use in forest areas where tree clearance poses a series problem and in other cases where it is difficult to get clearance for bare conductor lines.  These Cables comprise of 3 XLPE insulated Single Phase Cables twisted around a bare messenger wire, which will carry the weight of composite Cable.
<b>3.</b>	<b>APPLICABLE STANDARDS :</b>
	Unless otherwise stipulated in this specification, the following standard with up to date amendment shall be applicable.
	IS 7098 (Part-II)-1985      Cross linked polyethylene insulated PVC sheathed Cables.
	IS : 8130-1984              Conductors for Insulated Cables.
	IS : 398 (Part-II)-1976      Galvanised Steel Wires.
	IS : 398 (Part-IV)-1979      Aluminium Alloy Conductors.
<b>4.</b>	<b>RATED VOLTAGE :</b>
	The rated Voltage of the Cables shall be 11KV and the maximum operating Voltage shall be 12KV.
<b>5.</b>	<b>CONDUCTORS :</b>
	The Aluminium Conductors shall comply with the requirements as specified in IS-8130-1984 with up to date amendments. The stranded conductor shall be clean & reasonably uniform in size and shape and its surface shall be free from sharp edges. Not more than two joints shall be allowed in any of the wires forming every complete length of conductor and no joint shall be within 300 mm. of any other joint in the same layer. Joints shall be brassed, silver soldered or electric or gas welded. No joint shall be made in the conductor once, it has been stranded.
<b>6.</b>	<b>INSULATION :</b>
	The insulation shall be chemically cross linked polyethylene conforming to the physical, electrical and ageing properties as required in the specification. Cross-linking may be done by exposure to peroxide with nitrogen curing CCV line, method with intention to ensure lowest tree formation. Only natural unfilled compound shall be used for insulation. Thickness when measured in accordance with relevant Clause of the Specification, shall not be less than the standard thickness value specified.
<b>7.</b>	<b>SCREENING :</b>
	The screening of insulated Cables shall consist of conductor screening and insulation screening.
	<b>Screening Materials :</b> Two types of materials may be used for screening of Cables : non-metallic & metallic.
	<b>Conductor Screening :</b> Conductor screening shall be non-metallic and shall consist of a layer of extruded-semi-conducting cross linked polythine compound of thickness no less than 0.5 mm.
	<b>Insulating Screening :</b> The insulation screening shall consist of non-metallic semi-conducting part in combination with a metallic part. Non-metallic part shall be applied either directly over the insulation of each core and shall consist of either a semi-conducting tape or a layer of extruded semi-conducting compound or a combination of these materials. The metallic part shall be applied over the individual core. Metallic screening shall consist of either tape or braid or concentric serving of wires or a sheath and shall be non-magnetic.

<b>8.</b>	<b>OUTER SHEATH :</b> Over the armouring/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. The colour of the outer sheath shall be black. The average thickness of the sheath shall not be less than the standard values specified in the IS when measured as laid in IS-7098(Part-II)/1985. The smallest thickness of the measured values of sheath shall not fall below the standard value(s) specified with tolerance. Outer surface of the Cable shall be ultra-violet Ray resistant.
<b>9.</b>	<b>CORE IDENTIFICATION :</b> The Core identification shall be done by Ridges one, two and three on PVC covering over core.
<b>10.</b>	<b>BARE MESSENGER WIRE :</b> Bare messenger wire shall consist of combination of galvanised steel wires and aluminium alloy wires. Central layer(s) shall be of galvanized steel wires and outer layer(s) shall be of Aluminium Alloy Wires. Galvanised Steel Wires shall be tested as per IS:398(Part-II)/1978 and <b>Aluminium Alloy Wires shall be tested as per IS:398(Part-IV) /1979.</b> The number of strands and diameter of strand for Steel Wire & Aluminium Alloy Wire for Bare Messenger Wire shall be calculated considering 100 mtrs. Span Length on 9 mtrs. PCC Pole Support and Breaking Load of Messenger Wire.
<b>11.</b>	<b>LAYING UP :</b> Three Power Cores having Ridges one, two and three shall be twisted over bare messenger wire with right hand direction of lay. This will from the Aerial Bunched Cable.
<b>12.</b>	<b>TESTS :</b>
1.	Copies of the type test certificates in respect of all the type tests as per IS:7098 (Part-II) 1985 for similar type of XLPE Cables from any Government recognised Testing Labs, shall be submitted along with the Tender.
	LIST OF TYPE TESTS :
a)	i) Annealing test (for Copper)
	ii) Tensile Test (for Aluminium)
	iii) Wrapping Test (for Aluminium)
	iv) Resistance Test.
b)	Tests for armouring wires/strips.
c)	Test for thickness of insulation and sheath.
d)	Physical tests for insulation.
	i) Tensile strength and elongation at break.
	ii) Ageing in air oven.
	iii) Hot test.
	iv) Shrinkage test.
	v) Water absorption (Gravimetric)
e)	Physical Test for outer sheath :
	i) Tensile Strength and elongation at break.
	ii) Ageing in on even.
	iii) Shrinkage Test.
	iv) Hot deformation.
f)	i) Bleeding and Blooming test (for outer sheath)
	ii) Loss of mass in air oven, heat shock and thermal stability tests will be carried out as per IS:7098, Part-II/1985.
g)	Partial discharge test.
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)	Heating cycle test.
l)	Impulse withstand test.
m)	High Voltage test.
n)	Flammability test.
o)	Cold Impact test.
p)	List of type test for messenger wire :
	i) Breaking load test on individual galvanised steel wire.
	ii) Breaking load test on individual aluminium alloy wire.

<b>13.</b>	<b>ACCEPTANCE TESTS :</b>
	The following tests shall be carried out as acceptance tests :
a)	Annealing test (for copper)
b)	Tensile test (for aluminium)
c)	Wrapping test (for aluminium)
d)	Conductor resistance test.
e)	Test for thickness of insulation and sheath.
f)	Partial discharge test (for screened cables only)
g)	High Voltage test.
<b>14.</b>	<b>ROUTINE TEST ;</b>
	The following tests shall be carried out as routine tests :
a)	Conductor resistance test (for aluminium and copper)
b)	Partial discharge test (for screened cables only)
c)	High Voltage Test.
	Type test/acceptance test/Routine tests and any other tests required as per relevant Indian Standards shall also be got conducted.
<b>15.</b>	<b>INSPECTION :</b>
	The Cable shall be inspected at manufacturer's works before despatch as per IS-7098 (Part-II)/1985 (with upto date amendments). All the acceptance tests embodied in the above shall be performed by the Inspecting Officer. The Manufacturer shall arrange without making any extra charges with all the necessary machinery, apparatus and labour requirement for the testing purpose. The cost requirement for testing shall be to Firm's Account.
<b>16.</b>	<b>SEQUENTIAL MARKING :</b>
	Supplier shall provide non-erasable sequential marking of length on the Cable for each metre of length with sequential marking machine having automatic length measuring meter. The Cable supplied without sequential marking will not be accepted and no deviation shall be allowed under any circumstances.
<b>17.</b>	<b>PACKING &amp; MARKING :</b>
	The Cable shall be supplied in suitable non-returnable wooden drums of suitable size in standard lengths subject to a tolerance of $\pm 5\%$ . The Cable shall be wrapped with polythene under wooden covering. Each metre length shall be embossed with the Trade Name of Manufacturer and the work 'ELECTRIC WBSEDCL'. ISI mark Cable shall be preferred.
	The ends of the Cable shall be sealed by means of non-hygroscopic sealing material. Each drum shall carry the following information either stenciled on flange or label attached to it :
a)	Manufacturer's Name
b)	Trade Mark, if any.
c)	A reference to ISS i.e. IS-7098 (Part-II)/1985.
d)	Length of the Cable on the drum.
e)	Voltage Grade and type of the Cable.
f)	Colour of outer sheath.
g)	Nominal cross-sectional area of the Cable Conductor.
h)	Purchase Order No. & date.
i)	Name and address of Consignee - WBSEDCL.
j)	Number of Cores.
k)	Gross Weight of packed and net weight of the composite Cable.
l)	Drum No. & its direction of rotation (with an arrow)
m)	Year of Manufacture.
	The standard Drum Length will be 250 mtrs. in each Drum for all sizes subject to a maximum tolerance of $\pm 5\%$
<b>18.</b>	<b>LITERATURE AND MANUAL :</b>
	To be submitted as per General Terms & Conditions of Contract.
<b>19.</b>	<b>GUARANTEED TECHNICAL PARTICULARS :</b>
	<b>To be submitted along with Tender documents.</b>

**A. DESCRIPTION OF 11 KV AERIAL BUNCHED CABLES :**

Description	Size		
		Power Core	Messenger Wire
11KV (E) Grade Aerial Bunched Cable with 3(three) Power Cores Stranded, compacted Circular Aluminium Conductor screened with Black extruded semi-conducting Compound, natural coloured XLPE insulated core screened with Black extruded semi-conducting compound and one layer of copper tape and covered with Black extruded PVC (Core identification by ridges one, two and three over PVC covering) and one bare Messenger wire : combination of galvanized steel wire and Al. Alloy wires conforming to IS 3130/1984, IS-398(Part-II)/1976, IS-398(Part-IV)/1979 and IS-7098(Part-II)/1985 with upto date amendments, if any.	1)	3x35 mm. +	1x105 mm.
	2)	3x50 mm. +	1x105 mm.
	3)	3x70 mm. +	1x180 mm.
	4)	3x95 mm. +	1x180 mm.
	5)	3x120 mm. +	1x180 mm.
	6)	3x150 mm. +	2x210 mm.
	7)	3x185 mm. +	1x210 mm.
[ Sizes of Power Conductor & Messenger Wire may vary as per requirement ]			

**B. ACCESSORIES REQUIRED FOR DRAWAL OF OVERHEAD LINE WITH HT (11KV) AERIAL BUNCHED CABLES ON PCE POLE SUPPORT**

Sl. No. Description

1. Anchor Clamp
2. Suspension clamp assembly.
3. Pole mounted support clamps.
4. Pole clamps.
5. Insulation piercing connectors with cover or P.G. connectors with insulation cover.
6. Facade hooks.
7. Cable Jointing Kit for straight through & end joints.

**NOTE :** Offer for 11KV A B Cables should cover required accessories with details of dimensions, materials and provisional quantity per K.M. of 11KV O/H Line.

**DIMENSIONAL AND ELECTRICAL PARAMETERS :**

**HTABC :** The standard sizes and technical characteristics for Single Core Cable.

Parameters	Nominal Sectional Area of Conductors (sq.mm.)						
	35	50	70	95	120	150	185
Nominal Conductor dia (mm)	6.8	8	10	11.3	12.7	14.1	15.8
Max. DC resistance at 20°C (ohm/km.)	0.868	0.641	0.443	0.320	0.253	0.206	0.164
Nominal thickness of insulation (mm)	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Max. Short Circuit Current for 1 sec. (KA)	3.4	4.72	6.7	8.96	11.32	14.16	17.46
Max. continuous Load (Amps.)	106	150	190	230	265	300	345

Note : The resistance values given in the Table are the max. permissible one.

**TECHNICAL CHARACTERISTIC OF BARE MESSENGER WIRE FOR HT ABC :**

Technical Characteristic	Nominal Area of Conductor (sq.mm.)						
	35	50	70	95	120	150	185
Nominal Sectional Area (mm)	105	105	180	180	180	210	210
Approx. mass with finished Cable (Kg/Km.)	1800	2000	2600	3000	3300	3800	4200
Breaking Load (KN)	As per IS: 398 (Part-II)/1979						
Earth fault current carrying capacity for 1 sec.(KA)	8	8	14	14	14	16	16
Modulus of Elasticity (KN/mm.)	59						
Efficient of linear expansion (approx.)Shape	23 x 10 /°C						
	Stranded Compacted Circular						

**SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 11KV AB CABLES**

Sl.No.	Description	Size-1	Size-2	Size-3
1.	Manufacturer's Name & Address			
2.	Lists of Standard applicable.			
3.	Power/Messenger Core Conductors.			
3.1	A. Nominal cross sectional area, no. of standards and strand dia.			
	i) Power Cross(mm.)n/mm.			
	ii) Messenger Core(mm)/n/mm.			
	B. Max. DC resistance of conductor at 20°C			
	i) Power Cross (Ohm/Km.)			
	ii) Messenger Core (Ohm/Km.)			
	C. Approximate diameter of Conductor.			
	i) Power Cross (mm.)			
	ii) Messenger Core (mm.)			
	D. Approximate dia over insulation.			
	i) Power Cores.			
3.2	Insulation			
	i) Power Cross (mm.)			
	a) Material.			
	b) Nominal thickness.			
	c) Method of application.			
3.3	Conductor Screening ;			
	a) Material.			
	b) Nominal thickness			
	c) Method of application.			
3.4	Insulation Screening :			
	a) Material			
	b) Nominal thickness.			
	c) Method application.			
3.5	Metallic Screening :			
	a) Material.			
	b) Nominal thickness.			
3.6	Outer Sheath :			
	a) Material.			
	b) Nominal thickness			
4.	Messenger Wire (Bare)			
	i) Nom. Cross Sectional area (sq.mm.)			
	ii) Approx. breaking load (KN)			
5.	Current ratings			
	i) Continuous current carrying capacity of Cable in Air at Ambient Temp. 40°C (Amp.)			
6.	Approx. Weight (Kg./Km.)			
7.	No. of Cores			
	i) Power Core (No.)			
	ii) Bare Messenger (No.)			
8.	Derating factor			
	Derating factors for variation in Air Temp.			
	Air Temp. °C			

9.	Rating Factor.			
9.1	Identification of Power Cores			
9.2	Laying.			
10.	Details of Power/Messenger Core			
10.1	Conductor :			
	a)	Material		
	b)	Flexibility Class as per IS : 8130/84		
	c)	Form of Conductor.		
10.2	Insulation			
	a)	Material.		
	b)	Form of Conductor		
11.	Voltage Grade of Power Cable.			
	a)	Service Voltage.		
	b)	Neutral Earthing.		
12.	Maximum Conductor Temperature.			
	a)	Continuous (in Deg.C)		
	b)	Short time (in Deg.C)		
13.	Type of curing of XLPE Insulation			
14.	Completed Cable :			
	Approx. overall diameter.			
	Approx. Weight/KM			
15.	Cable Drums :			
	a)	Length/Drum/		
	b)	Dimension of Drum.		
	c)	Shipping Weight.		
	d)	Marking of Cable Drums as per IS		Yes/No.

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