Annexure – ‘B’

**11KV AERIAL BUNCHED XLPE CABLE** (3x185sqmm+1x150sqmm)

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

11KV (E) Grade Aerial Bunched Cable with 3(three) Power Cores Stranded, compacted Circular Aluminium Conductor screened with Black extruded semiconducting Compound, natural coloured XLPE insulated core screened with Black extruded semiconducting 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.

2. RATED VOLTAGE

The rates voltage of the cables shall be 6.35KV/11 KV and the maximum operating voltage shall be 12 KV.

3. APPLICABLE STANDARDS

Unless otherwise stipulated in this Specification, the following standards shall be applicable:

i) IS: 7098 (Part-II)- 1985- Cross linked Polyethylene Insulated PVC Sheathed

Cables.

ii) IS: 8130-1984- Conductors for Insulated cables.

iii) IS: 398 (Part-IV)- 1979- Aluminum Alloy Conductors. iv) IS: 10810/1984: Methods of test of cable.

v) IS: 10418/1982: Drums for electrical cable.

|  |  |
| --- | --- |
| **4.** | **CONDUCTORS :** |
|  | 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. |
|  |  |
| **5.** | **INSULATION :** |
|  | 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. |
|  |  |
| **6.** | **SCREENING :** |
| The screening of insulated Cables shall consist of conductor screening and insulation screening. |
| 1. **Screening Materials :**   Two types of materials may be used for screening of Cables : non-metallic & metallic. |
| 1. **Conductor Screening :**   Conductor screening shall be non-metallic and shall consist of a layer of extruded-semiconducting cross linked polythine compound of thickness no less than 0.5 mm. |
| 1. **Insulating Screening :**   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. |
|  | 1. **Metallic Screen:** The metallic screen shall consist of Copper Tap Applied Helically on core of thickness not less than 0.05mm |

|  |  |
| --- | --- |
| **7.** | **OUTER SHEATH :**  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. |
| **8.** | **CORE IDENTIFICATION :** |
|  | The Core identification shall be done by Ridges one, two and three on PVC covering over core. |

**9. BARE MESSENGER WIRE :**

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 **Aluminium Alloy Wires shall be tested as per IS:398(Part-IV) /1979.** The number of strands and diameter of strand for Steel Wire & Aluminium Alloy Wire for Bare Messenger Wire shall be calculated considering 100 mtrs.

10. There shall be no joints in any wire of the stranded messenger conductor except those made in the base rod or wires before finally drawing.

**DIMENSIONAL AND ELECTRICAL PARAMETERS :**

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

Nominal Sectional Area of Conductors (sq.mm.)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameters | 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 200C (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 :

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Nominal Area of Conductor (sq.mm.) | | | | | |
| Technical Characteristic | 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 (Pa rt-II)/1 979 | | | | | |
| 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 /0C | | | | | |
|  |  | Stranded Compacted Circular | | | | | |

Annexure – ‘B’

ISI marked LT Aerial Bunched Cable of size 3x95+1x70+1x70 mm2

**1 GENERAL PARTICULARS OF THE SYSTEM**

The following are the general particulars governing the design and working of the complete system of which the Works will form a part.

The system will be in continuous operation during the varying atmospheric and climatic conditions occurring at all seasons.

The phase conductor shall be 95 mm², 50 mm², 35 mm, 25 mm² and 16 mm² XLPE insulated and the messenger-cum-neutral conductor of sizes 70 mm², 35 mm² and 25 mm² shall be bare heat treated aluminium-magnesium-silicon alloy wires containing 0.5% magnesium and approximately 0.5% silicon confirming to IS: 398 (Part-IV):1979 and its latest amendment, if any.

**1.1 STANDARDS:**

The cable covered under this specification shall conform in all respect with the latest editions of IS-14255: 1995, IS-398 (part-4)-1979, IS: 10810(series): & IS: 8130-

1984 or IEC equivalent thereof. The alum inium conductor com plying to IS: 8130-1984 shall be used.

**1.2 CLIM ATIC CONDITIONS:**

The cable shall work satisfactorily under the following clim atic conditions:-

|  |  |  |
| --- | --- | --- |
| **i)** | **Location** | **At various locations in the state of Jharkhand** |
| ii) | M axim um ambient tem perature (oC) | 60 |
| iii) | M inim um am bient air tem perature (oC) | -5 |
| iv) | M axim um average daily am bient tem perature (oC) | 40 |
| v) | M axim um yearly weighed average am bient tem perature (oC) | 32 |
| vi) | M axim um altitude above m ean sea level (m ) | 1000 |
| vii) | M inim um Relative Hum idity (%) | 26 |
| viii) | M axim um Relative Hum idity (%) | 95 |
| ix) | Average no of Rainy days/ year | 120 |
| x) | Average annual rainfall | 900 m m |
| xi) | M axim um wind pressure | 195 kg/m sq. |

The equipm ent shall be for use in m oderately hot and hum id tropical clim ate, conducive to rust and fungus growth

**1.5 TECHNICAL PARTIC UL A R S : -**

Aerial Bunched Cable with cross-linked polyethylene (XLPE) insulation &

bare m essenger wire conductor (for Earthing and neutral) along with one street light phase

for voltages up to & including 1100 volts on solidly earthed system shall be m anufactured in accordance with IS: 14255:1995 with latest am endm ents. The insulated phase conductors shall be twisted around high strength bare Alum inium alloy m essenger wire, which shall carry the m ain weight and take all the m echanical stress. The alum inium conductor shall com ply with requirem ents specified in IS: 8130-1984 with latest am endm ents. The XLPE insulation shall be of Type conform ing to the requirem ents as required in latest edition of IS-14255: 1995.

**1.5.1 PHASE CONDU C T OR : -**

The phase & street lighting conductor shall be provided cross linked poly ethylene insulation applied by extrusion. The thickness of insulation shall not be less than 1.2 mm up to 35mm² and shall not be less than 1.5 mm for above 35mm² at any point and insulation shall be so applied that it fits closely on the conductor and it shall be possible to remove it without damaging the conductor. The insulated conductors shall generally conform to the standards IS-14255:1995

a) The phase conductors shall be provided with one, two and three

‘Ridges’ for quick identification.

b) The tensile strength of the Alum inium wires used in the conductors shall not be less than 90 N/m m ².

c) Not m ore than two joints shall be allowed in any of the wires form ing every com plete length of conductor and no joint shall be within 300 m m of any other joint in the sam e layer. The joint shall be brazed silver soldered or electric or gas welded. No joint shall be m ade in the conductor once it has been stranded.

**1.5.2 M ESSENGER (Neutral Conductor)**

1.5.2.1 The bare m essenger wire shall be m ade of Alum inium alloy containing 0.5% m agnesium and approx. 0.5% silicon conform ing to IS:398 (Part-IV)-1979 com posed of 7 strands and shall be suitably com pacted to have round surface to avoid dam age to the cross-linked polyethylene insulation of the phase conductors twisted around the m essenger.

1.5.2.2 There shall be no joints in any wire of the stranded m essenger conductor except those m ade in the base rod or wires before final drawing. The direction of outer layer of wires in m essenger conductor.

1.5.2.3 The size of the m essenger conductor and its breaking load shall be as per

IS:14255

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Nominal Sectional Area in mm² | | | No. of strands | | | Diameter of compacted conductor in mm | Approx. Mass Kgs/ Kms | Max .DC Resistance | | |
| 1 | | | 2 | | | 3 | 4 | 5 | | |
| 25 | | | 7 | | | 5.8 | 65 | 1.380 | | |
| 35 | | | 7 | | | 6.8 | 95 | 0.986 | | |
|  | 70 |  |  | 7 |  | 9.44 | 196 |  | 0.492 |  |

**1.6 CORE IDENTIFICATION:**

The phase conductors shall be provided with three ‘ridges’ for quick identification. The street lighting conductor & m essenger conductor m ay not have any identification m ark. The m anufacturer shall be identified throughout the length of the cable by m eans of a tape bearing the m anufacturer’s nam e or tradem ark, year of m anufacture, legend ‘XPLE 90’ and with the legend ‘Property of JBVNL.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Nominal Sectional area in mm² | | | No of strands | Diameter of Compacted conductor in mm | | | Approx. Mass Kg/KMs. | | | Max. DC  Résistance at 20ºc  (Ohm/km) | | | Insulation    Thickness in mm | | |
| 1 | | | 2 | 3 | | | 4 | | | 5 | | | 6 | | |
| 16 | | | 7 | 4.4 | | | 42 | | | 1.91 | | | 1.2 | | |
| 25 | | | 7 | 5.5 | | | 65 | | | 1.20 | | | 1.2 | | |
| 35 | | | 7 | 6.8 | | | 95 | | | 0.868 | | | 1.2 | | |
| 50 | | | 7 | 7.9 | | | 127 | | | 0.641 | | | 1.5 | | |
|  | 95 |  | 19 |  | 11.0 |  |  | 266 |  |  | 0.320 |  |  | 1.5 |  |

**1.7 CROSS LINKED POLYE T H Y L E N E INSULATION:**

The conductor shall be provided with weather resistant cross-linked polyethylene insulation applied by extrusion. The average thickness of insulation shall not

be less than 1.5 mm .The insulation shall generally confirm to IS-7098(Part-II):85 and details as given in table below :-

|  |  |  |  |
| --- | --- | --- | --- |
|  | Sr.No. | Property | Requirement |
|  | 1 | Tensile Strength 12.5 N / mm² Min | 12.5 N / mm² Min |
|  | 2 | Elongation at break 200 % Min. | 200 % min |
|  | 3 | Ageing in air over |  |
|  |  | 1. Treatment: Temperature & duration 135 ± 3ºC & 7 days | 135­+3ºC & 7 days |
|  | b | Tensile strength variation | ± 25% Max. |
|  | c | Elongation variation | ± 25% Max. |
|  | 4 | Hot Set |  |
|  |  | Treatment temperature, | 200 ± 3ºC, |
|  | a | Time | 15 minutes |
|  |  | Under load, mechanical stresses | 20 N /cm². |
|  | b | Elongation under load | 175 % max. |
|  | c | Permanent elongation (set) after cooling | 15 % Max |
|  | 5 | Shrinkage |  |
|  | a | Treatment temperature duration | 130 ± 3ºC |
|  | 6 |  | For 1 hour |
|  | b | Shrinkage | 4% Max |
|  | a | Treatment– Temp.  Duration | 85 ± 2ºC  14 days |
|  | 7 | Duration | 14 days |
|  | 8 | Water absorbed | 1 mg. / cm² max. |

The insulation shall be so applied that it fits closely on the conductor and it shall be possible to rem ove without dam age to the conductor. The above m entioned values shall not fall below the nom inal values ti m m by m ore than 0.1 m m + 0.1( tI ). The colour of insulation shall be Black. The XPLE insulation param eters should conform to IS:

14255 : 1995. The insulation shall be stablised against deterioration caused by exposure to direct sunlight & UV radiation.

**1.8 ASSEM BLY (Laying Up)**

1.8.1 The core shall be laid as per relevant IS over the neutral conductor. Three insulated phase conductors, one neutral conductor and a street lighting conductor shall be twisted around the bare m essenger conductor without fillers with a lay not exceeding 35 tim es the diam eter of the insulated phase conductor.

1.8.2 The direction of lay shall be right hand.

**1.9.0 TESTS FOR PHAS E /ST R E E T LIGHT CONDUCTORS**

**1.9.1 Type Tests: -**

The m aterial offered should be type tested. Type test report (not m ore than five years old reckoned from the date of bid opening) in respect of the following tests, carried out in accordance with IS:14 2 55 - 19 9 5 , IS-8130-1984, IS:3989 (part-4)

1979 & IS:10810 (series), from Govt./Govt. approved test house, shall be subm itted along with bid:

**a) Test on phase/s tr e e t light conductor**

1. Tensile Test (for Aluminium ).
2. Wrapping Test (for Aluminum ).
3. Conductor resistance test

**b) Test on M essenger conductor**

1. Breaking Load
2. Elongation test
3. Resistance test

**c) Physical tests for XLPE Insulation**

i) Tensile strength and elongation at break ii) Ageing in air oven

iii) Hot set test

iv) Shrinkage test

v) Water absorption (Gravim etric)

**d) Test for thickness insulation**

**e) Insulation resistance (Volume resistivity) test**

**f) High voltage test**

**1.9.2 Acceptance tests**

The following shall constitute acceptance test in addition to check of diam eter values as per relevant ISS:-

a) Tensile tests (for phase/street light conductor) b) Wrapping test (for phase/street light conductor) c) Breaking load test for m essenger conductor

d) Elongation test for m essenger conductor e) Conductor resistance test

f) Test for thickness of insulation

g) Tensile strength and elongation at break test h) Hot set test for XLPE insulation

i) Insulation resistance test

j) High voltage test including water im m ersion test

**1.9.3 Routine Tests**

a) Conductor resistance test b) High voltage test

All routine and acceptance tests shall be carried out as per relevant IS in the presence of Nigam ’s representative.

# 1.9.4 Optional Test:

Bending test on the completed cable:

Bending test shall be performed on a sample of complete cable. The sample shall be bent around a test mandrel at room temperature for at least one complete turn. It shall then be unwound and the process shall be repeated after turning the sample around its axis 1800. The cycle of this operation shall be then repeated twice.

The diameter of mandrel shall be 10 (D+d).

Where

D = Actual diameter of cable (i.e. the min. circumscribing diameter in mm) d = Actual diameter of the phase conductor in mm

No cracks visible to the naked eye are allowed.

**1.10. PACKING & M ARKING: -**

The cable shall be supplied in non-returnable wooden drum s as per IS:

10418:1982, so constructed, as to enable the cable to be transported on each drum . The drum s shall be of such construction as to assure delivery of conductor in the field free from displacem ent & dam age and should be able to withstand all stresses due to handling and the stringing operation so that cable is not dented, scratched or dam aged in any way during transport & erection. The cable shall be properly lagged on the drum s. The cable wound on such drum shall be one continuous length. The ends of cables shall be sealed by m eans of non- h y g ros c o pi c sealing m aterial.

The m arking on the drum shall have the following inform ation:

(a) Reference to Indian standard & cable code.

(b) Nam e of the manufac tu r e r & trade nam e / brand nam e.

(c) Nom inal cross section area of phase conductor for the cable.

(d) Type of the cable & voltage grade.

(e) Length of Cable on the drum .

(f) Direction of rotation of drum (by m eans of an arrow)

(g) Appr o xi m at e gross weight.

(h) Running end of cable

(i) Net weight of the cable.

(j) Drum identi fi ca ti o n num ber.

(k) P.O. No. & Date

(l) Year of m anufacture

**1.11 SAM PLING: -**

1.11.1 In any consignm ent the cables of the sam e size m anufactured under essentially sim ilar conditions of production shall be grouped together to constitute a lot.

1.12.2 Sam ples shall be taken and tested from each lot for ascertaining the conform ity of the lot to the require m ent s of the specification.

1.13.3 The num ber of drum (n) to be selected from the lot of drum s (N) of consignm ent of cables shall be in accordance with the following Table. The sam ples shall be taken at random .

Suitable length of test sam ple shall be taken from each of the drum s selected. These test sam ples shall be subjected to each of the acceptance tests. A test sam ple shall be called defective if it fails in any of the acceptance tests. If the num ber of defectives is less than or equal to the corresponding perm issible num ber (a) the lot shall be declared as conform ing to the requirem ents of acceptance tests, otherwise not.

|  |  |  |
| --- | --- | --- |
| **No. of Drums in the Lot (N)** | **Number of Drums to be taken as Sample (n)** | **Permis s ib le number of**  **Defectives (a)** |
| Up to 50 | 2 | 0 |
| 51 to 100 | 5 | 0 |
| 101 to 300 | 13 | 0 |
| 301 to 500 | 20 | 1 |
| 501 and above | 32 | 2 |

The standard length of drum will be 500 meter with + 5% tolerance

Annexure – ‘B’

Technical Specification for ISI marked LT XLPE Single phase A B Cable (1Cx16+1x25) sqmm

***(1) SCOPE***

This specification covers design, engineering, manufacture, inspection and testing before supply of ISI marked LT XLPE Single phase A B Cable (1Cx16+1x25) sqmm.

**(2) Rated Voltage**

The rated voltage of the cables should be 1100 Volts

(3) **Technical specification for 1C x 16 + 25 Sq. mm ABC Cables for Working upto 1100 Volts**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Description** | **Unit.** | **1Cx16+25 mm2** |
| 01 | Name of the Manufacturer |  |  |
| 02 | Normal Size of Conductor Bundle | mm2 | 1Cx16+25 mm2 |
| 03 | Manufacture Standard |  | IS: 14255/1995 |
| 04 | Voltage Rating | Volt | 1100 volt |
| 05 | No. of Wire in PhaseCond. |  | 7 |
| 06 | Diameter of Wire in Phase Cond. | mm | 1.71 mm |
| 07 | Cross Sectional area of Phase Cond. | mm2 | 16 mm2 |
| 08 | Diameter over Bundle | mm | 14.80 mm (Approx) |
| 09 | Min. Tensile strength of each strand (mm) in N/mm2 | N/mm2 | 150 N/mm2 (Min) |
| 10 | Diameter of compacted phase conductor alongwith tolerance (mm) | mm | 4.70 ± 5% |
| 11 | Weight of an Insulated Phase Cond. | Kg/Km | 62 kgs (Approx) |
| 12 | material of insulation |  | XLPE by Extrution |
| 13 | Insulation thickness | mm | 1.20 |
| 14 | Maximum Dc Registance of Phase Cond. |  | 1.91 ohm/km |
| 15 | Maximum Dc Registance of Neutral Cond. |  | 1.38 ohm/km |
| 16 | Current rating Phase Cond. At 10, 20, 30, 40, 500C | amps | 100C 200C 300C 400C 500C |
|  |  |  | 98 92 81 70 56 |
| 17 | Material of neutral Conductor (messenger) |  | Aluminium, Silicon, magnesium type |
| 18 | Manufacturer Standard of messenger conductor |  | IS: 398 (Part-4)/94 |
| 19 | Form of neutral Cantenary Conductor |  | Compacted Round |
| 20 | Cross Sectional area of neutral Cond. | mm2 | 25 mm2 |
| 21 | Dia of neutral Cantenary | mm | 5.80 (approx) |
| 22 | No. of Wire in neutral |  | 7 |
| 23 | Diameter of each strand | mm | 2.14 ± 1% |
| 24 | Weight of neutral Cantenary | Kg/Km | 65 kgs (Approx)/Km |
| 25 | Material of insulation of neutral conductor |  | Bare |
| 26 | Thickness of insulation ( Nominal) | mm | NA |
| 27 | Total weight of Bundle | Kg/Km | 150 Kgs-160 Kgs (AP) |
| 28 | Length of bunched Cable/Drum |  | 1000 mtrs ± 5% |
| 29 | AC Resistance at 75/900C | ohm/km | AT-75 - 2.3255 , AT-90 - 2.44 |
| 30 | Material of Phase Conductor |  | H4 Grade Aluminium as per IS: 8130 |
| 31 | Dia of Compacted Messenger wire | mm | 5.80 mm ± 5% |
| 32 | Min Breaking load | KN | 7.0 (min) |
| 33 | Colour of Insulation & Identification |  | Black/Rigid |
| 34 | Overall diameter of Phase | mm | 7.10 mm (Approx) |
| 35 | Overall diameter | mm | 14.80 (Approx) |
| 36 | Overall weight | Kg/Km | 127 kgs (Approx) |
| 37 | Short circuit current for 1 sec (maxi) | KA | 1.50 |
| 38 | Max. Solar Radiator/ Min. Wind velocity |  | Solar Radiator - - 985 watts/sq.mm |
|  |  |  | wind velocity - 2200 mtr./hr. |
| 39 | Bending Radius of Cable |  | 218 mm |
| 40 | Direction of Lay |  | Right hand |
| 41 | Embossing of cable |  | As per IS : 14255 |

**4. Type Tests:** The material offered shall be fully type tested as per the relevant standards. The bidder shall furnish NABL Accredited Lab type test reports along with bid. The bids received without type test reports shall be treated as non-responsive.

***5) PACKING & FORWARDING:***

a. The AB Cable shall be wound on non-returnable wooden drums conforming to IS-I 1778 / 1982 with latest amendments thereof. The ends of the cable shall be sealed by means of non-hygroscopic sealing material. The drum shall be marked with the following.

• Manufacturers name

• Trademark, if any

• Drum number

* Identification marked - RE

• Size of conductors

• Size of messenger

• Voltage grade

• Number and lengths of pieces of cable in each drum

• Gross mass including packing

• ISI mark if any

• Direction of rotation of the drum by marking an arrow

b. The drums shall be of such construction as to assure delivery of cable in the field free from displacement and damage and should be able to withstand all stresses due to handling and the stringing operation so that cable surface is not dented, scratched or damaged in any way during transport and erection. The cable shall be properly lagged on the drums.

c. The cable drum should be suitable for wheel mounting

d. The mass of finished cable in a drum (without mass of drum) of various designations shall not exceed by more than 10% of the following values.

***7) MARKING OF CABLES: -***

A) All the cable shall have the following marking embossed on the insulated phase conductor for identification **JBVNL**  in intervals of not more than 1 meter.

i. The packing shall be done as per the manufacturers standard practice. However, he should ensure the packing is such that the material should not get damaged during transit by Rail/ Road.

ii. The marking on each package shall be as per the relevant IS

***B)*** A Goldspot marking of size atleast 05 cm at every consecutive interval 100 mtr. on the cable which can be visible from naked eye.

8**) *Identification of phases (R,Y,B***):

There should be certain marking on each phases, so that the same may be identified easily.

***GUARANTEED TECHNICAL PARTICULARS***

The tenderers shall furnish the guaranteed technical particulars (Annex- ‘E’) and submit the same along with tender.

Annexure – ‘B’

Aerial bunched cable of size (I) 3Cx50+1\*35+1\*16 sq. mm. (II) 3Cx50+1\*35 (III)3Cx35+1Cx25 (IV) 1Cx16+1Cx25.

**1. SCOPE:**

This specification covers XLPE insulated Aluminum cable twisted over a **central bare Aluminum Alloy messenger** wire for use of L.T. Over-Head lines in Rural Electrification System. The Aerial Bunched cable and messenger wire should be confirming to IS.

(Sizes: of the cable)

(i) 3 x 50 sq. mm+ 1 x 35 sq. mm bare messenger + 1 x 16 sq. mm insulated neutral/street light

**2. RATED VOLTAGE:**

The rated voltage of the AB cables shall be 1100 volts

**3. APPLICABLE STANDARDS:**

Unless otherwise stipulated in this specification the following Standards shall be applicable. i) IS – 14255/1995 : ABC cables 1100 volts.

ii) IS – 8130/1984 : Conductors for insulated cables. iii) IS – 398/Pt.IV/1994: Aluminium alloy conductor. iv) IS – 10418/1982 : Drums for electric cables

**4. GENERAL:**

The AB cable covered under this specification should be suitable for useon three phase, 4 wire earthed system for working voltage up to 1100 V. It should confirm the relevant standards stated above and others if applicable.

The phase conductor shall be 50 mm², 35 mm²,25 mm² and 16 mm² XLPE insulated and the neutral conductor should be 35 mm²,25 mm² and 16 mm² XLPE insulated whereas messenger conductor should be Bare heat treated aluminium silicon containing 0.5% magnesium and approximately 0.5% silicon confirming to IS: 398 (Part-IV):1979 and its latest amendment, if any.

**5. PHASE & NEUTRAL CONDUCTORS:**

5.1 The phase & neutral conductor shall be provided cross linked poly ethylene insulation applied by extrusion. The thickness of insulation shall not be less than 1.2 mm up to 35mm² and shall not be less than 1.5 mm for above 35mm² at any point and insulation shall be so applied that it fits closely on the conductor and it shall be possible to remove it without damaging the conductor. The insulated conductors shall generally conform to the standards IS-14255:1995.

5.2 The phase conductors shall be provided with one, two & three ‘ridges’ for easy identification.

5.3 The tensile strength of the aluminum wire used in the conductor shall not be less 90 N/mn².

5.4 The standard size and technical characteristics of the phase conductors shall be as shown in the Table-

1.

**TABLE-I**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Nominal Sectional area inmm² | No. of  Strands | Diameter ofCompactedconductor inmm | Approx.MassK  g/KMs. | Max. DCRésistanceat  20ºc(Ohm/km) | InsulationThickn essin mm |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 16 | 7 | 4.4 | 42 | 1.91 | 1.2 |
| 25 | 7 | 5.5 | 65 | 1.20 | 1.2 |
| 35 | 7 | 6.8 | 95 | 0.868 | 1.2 |
| 50 | 7 | 7.9 | 127 | 0.641 | 1.5 |

NOTE: 1) The resistance values given in col.5 are the max. permissible.

Tolerance of + 5% is allowable on dimension.

**6. MESSENGER WIRE:**

6.1 The bare messenger wire shall be of aluminium alloy generally confirming to IS–398/Pt.IV/94 composed of 7 strands and shall be suitable compacted to have smooth round surface to avoid damages to the overall insulation of phase & neutral conductor twisted around the messenger.

6.2 There shall be no joint in any wire of the stranded messenger Conductor except these made in the base rod or wires before final drawing.

6.3 The sizes and other technical characteristics of the messenger wire shall be as given in the Table No.2.

TABLE –2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Nominal Sectional  Area in mm² | No. of strands | Diameter of Compacted conductor in mm | Approx. Mass  Kgs/KMs | Max .DC Resistance |
| 1 | 2 | 3 | 4 | 5 |
| 25 | 7 | 5.8 | 65 | 1.380 |
| 35 | 7 | 6.8 | 95 | 0.986 |

NOTE: while limiting values in col. 3 is to be guaranteed a tolerance of + 5% will be permissible.

**7. XLPE INSULATION:**

The insulation shall generally confirm to IS-7098(Part-II):85

|  |  |  |
| --- | --- | --- |
| Sr.No. | Property | Requirement |
| 1 | Tensile Strength | 12.5 N / mm² Min |
| 2 | Elongation at break | 200 % Min. |
| 3 | Ageing in air over |  |
| a | Treatment:Temperature & duration | 135 ± 3ºC & 7 days |
| b | Tensile strength variation | ± 25% Max. |

Sr.No. Property Requirement

c Elongation variation ± 25% Max.

4 Hot Set

Treatment temperature, 200 ± 3ºC, a Time 15 minutes Under load, mechanical stresses 20 N /cm².

b Elongation under load 175 % max. c Permanent elongation (set) after cooling 15 % Max

5 Shrinkage

a Treatment temperature duration

130 ± 3ºC

For 1 hour

b Shrinkage 4% Max

6 Water absorption (Gravimetric)

Treatment– Temp. 85 ± 2ºC

a

Duration 14 days

b Water absorbed 1 mg. / cm² max.

**8. TYPE TEST:**

**A. Test for Phase/Street Light Conductors**

(i) Tensile Test (IS-8130)

(ii) Wrapping Test (IS-8130)

(iii) Conductor Resistance Test (IS-8130)

**B. Test for Messenger:**

(i) Breaking load test (to be made on finished conductor) -(IS-398/ Pt.IV/ 1994 with latest revision)

(ii) Elongation test (IS - 398 / Pt.IV/1994) (iii) Resistance test (IS - 398 / Pt. IV /1994)

(iv) If insulated , the test of insulation as per relevant IS will be applicable

**C. Physical test for XLPE insulation**

(i) Tensile strength and Elongation at break

(ii) Ageing in air oven

(iii) Hot set test

(iv) Shrinkage test

(v) Water absorption (Gravimetric)

(vi) Carbon black 1. Content & 2. Dispersion

**D.** Test for thickness of insulation

**E.** Insulation Resistance (Volume Resistivity ) Test

**F.** High Voltage Test

Note: The Manufacturer should submit the entire above type test of Govt. of India’s approved

Laboratory along with their offer.

**Optional Test:**

Bending test on the completed cable:

Bending test shall be performed on a sample of complete cable. The sample shall be bent around a

test mandrel at room temperature for at least one complete turn. It shall then be unwound and the process shall be repeated after turning the sample around its axis 1800. The cycle of this operation shall be then repeated twice.

The diameter of mandrel shall be 10 (D+d). Where

D = Actual diameter of cable (i.e. the min. circumscribing diameter in mm) d = Actual diameter of the phase conductor in mm

No cracks visible to the naked eye are allowed.

**9. ACCEPTANCE TESTS:**

Tests for Phase / Street Light Conductors:

a. Tensile test (for Phase / Street light conductor)

b. Wrapping test (for Phase / Street light conductor)

c. Breaking load test for messenger conductor d. Elongation test for messenger conductor

e. Conductor Resistance test

f. Test for thickness of insulation

g. Tensile strength and elongation at break test h. Hot set test ( For XLPE insulation)

i. Insulation Resistance test j. High voltage test

**10. PACKING MARKING:**

10.1 The LT AB cable shall be wound in non returnable drums conforming to IS-10418/1982 “Specification for Reels and Drums for bare wire” of the latest version thereof. The drums shall be marked with the following:

a) Manufacturers name b) Trade mark if any

c) Drum number

d) Size of Conductor e) Size of Messenger f) Voltage grade

g) Number of lengths of pieces of Cable in each drum h) Gross mass of the packing

i) Net mass of Cable j) ISI mark

10.2 The drums shall be of such a construction as to assure delivery of conductor in field free from displacement and damage and should be able to withstand all stresses due to handling and the stringing operation so that cable surface not dented, scratched or damaged in any way during transport and erection. The cable shall be properly lugged on the drums

10.3 The cable drums should be suitable for wheel mounting.

**11. STANDARD LENGTH:**

The standard length of drum will be 500 metre with + 5%

**Non-standard Length:**

Non standard length not less than 50% of the standard length shall be accepted to the extent of 10%

of the ordered quantity.

**12. INSPECTION:**

All tests and inspections shall be made at the place of manufacturer unless otherwise especially agreed upon by the manufacturer andpurchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities, without charge, to satisfy him that the

material is being furnished in accordance with this specification.

**13. EXPERIENCE:**

The manufacturer must have some experience of manufacturer and supply of this cable to any Electricity Board. Copy of order executed and performance report may be submitted along with the offer.

**14. TYPE TEST CERTIFICATES:**

The duly attested copy of Type Test Certificate of the offered sizes of AB cable, as per IS: 14255/1995 with latest amendment/revision be submitted from any Govt. approved laboratory along with the offer. In absence of type test certificate, offer will be liable to be ignored/rejected without any further correspondence [at Purchaser’s (Employer) discretion]. Type Test Certificate shall not be more than Five Years Oldfrom Date of supply.

**15. SUBMISSION OF ISI LICENSE FOR IS14255:1995**

The Manufacturer are required to submit duly attested photo copy of the valid ISI License up to the date of delivery for supply of these AB cables/wires and they should also submit GTP failing which, the offer would be ignored.

**16. IMPORTANT:**

In absence of valid ISI License/GTP duly filled in/and copy of type test certificate of Govt. approved Laboratory, duly attested by authorized person, offer will be liable to be ignored without any further correspondence.

**17. ISI MARKING:**

The material supplied shall be conforming to Indian Standard Specification and also with ISI marking as applicable and even after inspection of the lot, if the materials received at site is found without ISI marking, the lot shall be rejected and no further correspondence shall be entertained in this regard.

**GUARANTEED TECHNICAL PARTICULARS (G.T.P.)**

Technical information and Guaranteed Technical Particulars (G.T.P.) for LT Aerial Bunched Cable (XLPE

insulated only) of sizes:

(i) 3 x 50 sq. mm+ 1 x 35 sq. mm insulated neutral cum messenger+ 1 x 16 sq. mm

(ii) 3 x 35 sq. mm + 1 x 35 sq. mm insulated neutral cum messenger + 1 x 16 sq. mm (iii) 3 x 25 sq. mm + 1 x 35 sq. mm insulated neutral cum messenger + 1 x 16 sq. mm (iv) 3 x 16 sq. mm + 1 x 25 sq. mm insulated neutral cum messenger + 1 x 16 sq. mm (v) 2 x 35 sq. mm + 1 x 16 sq. mm

(vi) 2 x 25 sq. mm + 1 x 16 sq. mm

**PART – A**

Manufacturer has to confirm following important requirements:

|  |  |  |
| --- | --- | --- |
| Sr.  No. | Particulars | confirmation |
| 1 | AB Cable shall be manufactured and suppliedConfirming to IS: 14255/1995 with latestAmendment if any | Yes |
| 2 | Cable drums/label shall bear ISI Mark | Yes |
| 3 | ISI License shall remain valid till order is Completed | Yes |
| 4 | Colour of XLPE Insulation – Black |  |
| 4a | 3 x 50 + 1 x 35 + 1 x 16 | Yes |
| 5 | Shape – compacted | Yes |
| 6 | Standard length in case 500 mtrs+ 5 % tolerancelonger length acceptable | Yes |
| 7 | Non-Standard length 50% of Std. length up to 10%of ordered quantity | Yes |
| 8 | Packing shall contain only one Length. | Yes |
| 9 | Packing material: Wooden drums as per IS: 10418/1982 duly painted | Yes |
| 9a | 3 x 50 + 1 x 35 + 1 x 16 | Yes |
| 10 | Following shall be embossed on cable & Markingon drum shall be as per IS:  14255/1995 | Yes |
| 10a | Purchaser (Employe) | Yes |
| 10b | 1100 Volts | Yes |
| 10c | IS:14255/1995 | Yes |
| 10d | Year of manufacture | Yes |
| 10e | Trade Mark | Yes |
| 11 | Conductor – |  |
| 11a | For Phase 16 mm² ,25 mm², 35 mm² & 50 mm² Alluminium as per  IS8130/1984 | Yes |
| 11b | For Messenger wire 25 mm² & 35 mm²AlluminiumAlloy as per IS  398/Pt.IV/1994 | Yes |
| 12 | Maximum Conductor resistance at 20ºCFor Phase Conductor |  |
| 12a | 16 mm² Conductor – 1.91 Ohm/KM | Yes |
| 12b | 25 mm² Conductor – 1.20 Ohm/KM | Yes |
| 12c | 35 mm² Conductor – 0.868 Ohm/KM | Yes |
| 12d | 50 mm² Conductor – 0.641 Ohm/KM | Yes |
|  | For messenger conductor |  |
| 12e | 25 mm² Conductor – 1.380 Ohm/KM | Yes |
| 12f | 35 mm² Conductor – 0.986 Ohm/KM | Yes |
| 13 | XLPE Insulation thickness for AB Cable |  |
| 13a | 3 x 50 mm² + 1 x 35 mm² + 1 x 16 mm²-1.5 mm | Yes |
| 14 | Volume resistivity of insulation |  |
| 14a | At 27ºC – 1 x 10^13 Ohm-cm. Min | Yes |
| 14b | At 70°C – 1 x 10^11 Ohm-cm. Min | Yes |
| 15 | Tensile strength of Insulation & sheath -12.5 N/mm² Min. | Yes |
| 16 | Elongation at break of Insulation and Sheath –200% Min. | Yes |
| 17 | Overall tolerance in supply of ordered total quantity shall be + 2 %( Plus and minus two %) | Yes |