**Annexure – ‘A’**

**TECHNICAL SPECIFICATION FOR** **INSULATION PIERCING CONNECTORS FOR LT AERIAL BUNCHED CABLES FOR WORKING VOLTAGE UPTO AND INCLUDING 1100 VOLTS.**

# 1. 0) SCOPE

This specification covers the design, manufacture, assembly, testing and supply of Accessories for anchoring & suspending Aerial Bunched Cables, rated 1100 volts and insulated with cross-linked polyethylene and aluminium alloy messenger which may be bare or insulated.

# 2.0) CLIMATIC CONDITIONS

The material shall work satisfactorily under the following climatic conditions:-

|  |  |  |
| --- | --- | --- |
| **i)** | **Location** | **At various locations** |
| ii) | Maximum ambient temperature (oC) | 60 |
| iii) | Minimum ambient air temperature (oC) | -5 |
| iv) | Maximum averagedaily ambient temperature (oC) | 40 |
| v) | Maximum yearly weighed average ambient temperature (oC) | 32 |
| vi) | Maximum altitude above mean sea level (m) | 1000 |
| vii) | Minimum Relative Humidity (%) | 26 |
| viii) | Maximum Relative Humidity (%) | 95 |
| ix) | Average no of Rainy days/ year | 120 |
| x) | Average annual rainfall | 900 mm |
| xi) | Maximum wind pressure | 195 kg/m sq. |

**Table :1**

The material shall be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth

# 3.0) REFERENCE STANDARDS

The design, performance and test requirements shall confirm to this specification and the following standards. However in case of any conflict, the requirements of this specification shall prevail.

1. NFC 33-020, REC 83 / 2010 Insulation Piercing Connectors.
2. NFC 33-003 Corrosion Resistance
3. NFC 20-540 Climatic Ageing
4. IS 14255 LV Aerial Bunched Cables
5. IS 8130: Conductors for Insulated cables
6. IS 7098 Part 1: XLPE Insulated Cables for working voltages upto 3.3 KV
7. IS 398 Part IV : aluminium alloy conductors
8. ASTM A 480 : Stainless Steel

The material shall also be compatible with the cables of sizes & dimensions as defined in the Cable Specifications for the cables with which they are intended to be used, and this specification.

# 4.0) CABLE DATA

The standard sizes and characteristics of the phase and street lighting conductors, messenger wires shall be as specified in IS: 14255-1995.

|  |  |
| --- | --- |
| **Sr. No.** | **Description of Aerial Bunched Cable (Insulated Neutral Messeger)** |
| 1 | 1Cx16 (Phase) + 1x25 (Insulated or Bare neutral Messenger) |
| 2 | 3Cx25 (Phase) + 1x25 (Insulated or Bare neutral Messenger) + 1x16 mm² (Street Lighting Cable) |
| 2 | 3Cx35(Phase) + 1x25 (Insulated or Bare neutral Messenger) + 1x16 mm² (Street Lighting Cable) |
| 3 | 3Cx50 (Phase) + 1x35 (Insulated or Bare neutral Messenger) + 1x16 mm² (Street Lighting Cable) |
| 4 | 3Cx70 (Phase) + 1x50 (Insulated or Bare neutral Messenger) + 1x16 mm² (Street Lighting Cable) |
| 5 | 3Cx95 (Phase) + 1x70 (Insulated or Bare neutral Messenger) + 1x16 mm² (Street Lighting Cable) |
| 6 | 3Cx120(Phase) + 1x70 (Insulated or Bare neutral Messenger) + 1x16 mm² (Street Lighting Cable) |

**Table :2**

# 5.0) TYPE OF INSULATION PIERCING CONNECTORS FOR ABC

Insulation Piercing Connectors (IPC) are used for making Tee / Tap-off/Service connections to an ABC / Bare Overhead Line.

Insulation Piercing Connectors are designed to make a connection between the uncut main conductor and a branch cable conductor without having to strip either cable to expose the conductor. Instead, the tightening action of the IPC will first pierce the Insulation, then make good electrical contact between the main and branch conductor while simultaneously insulating and sealing the connection.

The insulation piercing connectors shall be of the following type(s) depending on the applications.

|  |  |  |
| --- | --- | --- |
| **Type** | **Description** | **Application** |
| **A** | Insulation Piercing Connector for networking | For main to main networking or branching of ABC to another ABC |
| **B** | Insulation Piercing Connector for Branching | For main to main networking or branching of ABC to another ABC Or Branch Cable |
| **C** | Insulation Piercing Connector for Street Lighting/earthing | For street lighting/earthing connection from AB Cable |
| **D** | Insulation Piercing Connector for Earthing Connection | Insulation Piercing Connector for Earthing Connection |

Standard size ranges for Type B insulation piercing connectors for main to main networking or branching of ABC shall be as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Application** | **Main Cable Size Range** **(mm2)** | **Branch Cable Size range (mm2)** |
| **B (i)** | For Main to Main network connections connections from Smaller size and Capacity AB Cable | 16 - 95 | 16 – 95 |

**Table : 6**

Standard size range for Type C, insulation piercing connector for Branching.

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Application** | **Main Cable Size Range (mm2)** | **Branch Cable Size range (mm2)** |
| **C (ii)** | For Main to Main network connections connections from Smaller size and Capacity AB Cable | 16 - 95 | 4 - 35 |

**Table : 7**

Standard size range for Type D, insulation piercing connector for street lighting

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Application** | **Main Cable Size Range** (mm2) | **Branch Cable Size range** (mm2) |
| **D** | For Street Lighting or earthing connections | 10 - 95 | 1.5 – 10 (16) |

**Table : 8**

# 6.0 INSULATION PIERCING CONNECTORS FOR ABC

The following features of Insulation piercing connectors for Type I – IPC, Type II shall be met for the qualification criteria.

## 6.1 Type –I & II – Insulation Piercing Networking/Branching Connectors and Street Lighting/Earthing

1. The connector bodies shall be made entirely of mechanical and weather resistant plastic insulation material made of weather & UV resistant reinforced polymer and no metallic part outside the housing is acceptable except for the tightening bolt or nuts.
2. Any metallic part that is exposed must be free from potential during or after connector installation.
3. Screws or nuts assigned for fitting with IPC (Insulating Piercing connector), must be fitted with torque limiting shear heads to prevent over tightening or under tightening. While the min & max torque values are to be specified by Manufacturer, these should not exceed 20 N mtr for IPC for main conductor < 95 sq mm, and 30 Nmtr for main conductor >95, but < 150 sq mm.
4. It is not necessary that the earthing connectors are fitted with a shear off nut.
5. The IPC must perform piercing and connection on Main and Branch cable simultaneously using single bolt for tightening as multiple bolts do not ensure even tightening. The shear bolt/nut shall be suitable for tightening with a hexagonal socket / spanner of 13 mm.
6. The contact teeth or blade of the connector is made of tinned copper/aluminium alloy with equivalent cross section with respect to %IACS to suit the max branch cable size declared.
7. The IPCs shall be water proof and the water tightness shall be ensured by appropriate elastomer materials and not by grease, gel or paste alone. Grease can be applied to protect the contact blade alone and shall not be visible on the outer surface of the connector. Connector should not be dipped in grease.
8. Each IPC should be provided with a cap to seal the cut end of the Branch cable. It should be of a design that once the connector is installed, it shall not be possible to remove the cap without dismantling the connector.
9. Design of IPC should be in such a way not to cause damage to insulation of adjacent conductors due to vibration and relative movement during service.
10. All the metallic parts of the connector should be corrosion resistant and there should not be any appreciable change in contact resistance & temperature after overloads & load cycling and should conform to the long duration tests specified in this standard.

# 7. TESTING REQUIREMENTS OF INSULATION PIERCING CONNECTORS

# (Type –I & II)

The following tests (type, acceptance and routine) as per NFC 33 020 are intended to establish performance Characteristics of insulation piercing connectors and categorized as follows.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl No.** | **Clause** | **Test** | **Type Test** | **Acceptance Test** | **Routine Test** |
| 1 | 6.2.1 | Visual |  | Y | Y |
| 2 | 6.2.2 | Dimensional | Y | Y | Y |
| 3 | 6.2.3  6.2.3.1  6.2.3.2  6.2.3.3 | Mechanical   * + - Electrical Continuity and Shear head & mechanical behaviour.   + Effect of tightening the mechanical strength of main core.   + Checking mechanical strength of tap core. | Y | Y | Y |
| 4 | 6.2.4.1 | Di-electric Voltage test | Y | Y | Y |
| 5 | 6.2.5 | Climatic Ageing Test | Y |  |  |
| 6 | 6.2.6 | Corrosion Test | Y |  |  |
| 7 | 6.2.7 | Electrical ageing test | Y |  |  |

# 9.0 Qualification test reports

For all accessories, the Qualification Test Report should be from CPRI, ERDA or International Laboratory Accreditation Corporation, Mutual Recognitions Arrangement ( ILAC,MRA) signatory Laboratory like COFRAC.

# 10.0 QULIFICATION CRITEREA FOR MANUFACTURER

The manufacturer is to be approved as vendor for supply of these items, with relevant supply record.

# 11.0 TYPICAL GENERAL DIAGROM OF INSTALLATION

The full guaranteed technical particulars as specified shall be guaranteed and shall be given as **Annexure-I**.

# 12.0 GUARANTEED TECHNICAL PARTICULARS :

The full guaranteed technical particulars as specified shall be guaranteed and shall be given in the proforma(s) given as **Annexure-I**I

# 13.0 Sampling plan for Acceptance tests

Sampling Plan for acceptance tests on all type of connectors mentioned are as per ISO 2859-1

**13.1 For Visual and Dimensional**

Sampling Level: General Inspection Level 1

AQL: 4% Rejection in sample size acceptable

|  |  |  |
| --- | --- | --- |
| **SL NO** | **LOT SIZE** | **SAMPLE SIZE** |
| 1 | 51 to 90 | 5 |
| 2 | 91 to 150 | 8 |
| 3 | 151 to 280 | 13 |
| 4 | 281 to 500 | 20 |
| 5 | 501 to 1200 | 32 |
| 6 | 1201 to 3200 | 50 |
| 7 | 3201 to 10000 | 80 |
| 8 | 10001 to 35000 | 125 |
| 9 | 35001 to 150000 | 200 |
| 10 | 150001 to 500000 | 315 |
| 11 | 500001& above | 500 |

## 

## 13.2 For Mechanical and Voltage Tests

Sampling Level: Special Inspection Level S-2

AQL: 0.1% Rejection in sample size acceptable

|  |  |  |
| --- | --- | --- |
| **SL NO** | **LOT SIZE** | **SAMPLE SIZE** |
| 1 | 51 to 90 | 3 |
| 2 | 91 to 150 | 3 |
| 3 | 151 to 280 | 5 |
| 4 | 281 to 500 | 5 |
| 5 | 501 to 1200 | 5 |
| 6 | 1201 to 3200 | 8 |
| 7 | 3201 to 10000 | 8 |
| 8 | 10001 and above | 13 |