

Technical Specifications for Equipment

All materials required to complete the work as per given specifications & drawings etc. must be manufactured and supplied using fresh raw material. Re-moulded, re-circulated materials are not acceptable. The procurement of materials must be made by the contractor directly from manufacturer or through authorized dealer/distributors. Documentary evidence to this effect is to be made available to Employer for necessary checks/verification of source of supply of materials. Second hand materials/ partial used materials/ used materials would not be acceptable.

Climatic condition details are given with various materials specifications however, bidder shall note that materials covered under project specific KSY works shall be utilized in that particular project only. Hence, the geographical location of that particular project site and its associated climatic condition shall be applicable for all the materials of that particular project.

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1. PSC Poles

TECHNICAL TERMS AND CONDITIONS PSC POLE 8 meter long /200 KG

1. SCOPE OF WORK:

The scope of the work covers fabrication and supply PSC Poles of 8 meter long and 200Kgs. working (transverse) load in accordance with the technical terms and drawing of this specification. Alternate design / specifications shall not be considered which may be noted.

2. DIMENSIONS AND TOLERANCES:

| SR NO | DESCRIPTION | STANDARD IN MM | MAXIMUM IN MM | MINIMUM IN MM |
|-------|----------------------------|-----------------|-----------------|-----------------|
| 1 | LENGTH | 8000 | 8015 | 7985 |
| 2 | WIDTH - TOP - BOTTOM | 114.3 336.55 | 117.3 339.55 | 111.3 333.55 |
| 3 | THICKNESS | 139.7 | 142.7 | 136.7 |
| 4 | UP RIGHTNESS | 1 TO 72 | 0.5 % | 0.5 % |
| 5 | PLANTING DEPTH | 1381 | - | - |

NOTE: All dimensions are in mm.

3. WORKMANSHIP:

The contractor will be responsible for the general soundness as well as good finish of each pole. The workmanship should be of high degree and poles having flaws and defects will be rejected.

4. STANDARDS:

The poles shall comply with the relevant provisions made in the following Indian standard specifications with latest amendment.

IS: 1678/1998: Specification for Prestressed concrete poles for overhead

Power traction and telecommunication lines.

IS: 2905/1989: Method of test for concrete poles for Overhead Power and

Telecommunication lines.

IS:1343 & IS: 456:Code of practice for Prestressed and plain/reinforced concrete.

5. MATERIALS:

The materials shall conform to this specification and be in accordance with the guaranteed particulars given.

The Consumption of materials per PSC Pole with minimum limit indicated below:

1. Cement 53 grade/43 grade 1.45/1.61 Bags. For concrete mix
2. 4mm H.T. Steel wire 12 nos. - For tension wire.
3. 4mm H.T. Steel wire 24 Nos. Rings.

The consumption indicated above shall be inclusive of variations inclusive rolling margin. The consumption of cement shall be inclusive of quantity required in finishing work. PSC Pole under destruction test shall be to the Supplier's account.

The quality of materials to be used for manufacturing of PSC poles shall be as under.

[A] CEMENT: The Ordinary Portland Cement used in manufacture of Prestressed concrete poles shall be relevant to IS: 8112/1989 of 43-Grade / 53- Grade to get 28 days strength of 450 Kg/ cm².

[B] STEEL: The 4mm H.T. Steel wire used in manufacture of Prestressed concrete poles shall be conforming to IS 6003/1983 of latest amendment thereof respectively.

[C] AGGREGATE: Aggregate used for the manufacturing of Prestressed concrete poles shall conform to IS: 383-1963. Aggregate shall consist of naturally occurring crushed black metal. They shall be hard, strong, dense, durable, clear and free from veins and adherent coating, and free from injurious amount of disintegrated pieces, alkali, vegetable material, and other deterious substances. As far as possible flaky and Elongated pieces should be avoided. It should not contain organic or other admixture that may cause corrosion of the reinforcement or impair the strength or durability of the concrete.

The coarse aggregate shall consist of trap (preferably black) metal and in no case exceed 20 mm size. The fine aggregate shall be sharp, free from impurities and required fineness modules as specified. The sand shall be washed before use by installing a sand washing machine in the factory and the same shall not contain silt and deterious materials. The grading of fine aggregate shall be in accordance with IS: 2386 - 1963 with latest amendment.

[D] WATER: Water to be used for process of manufacturing PSC poles like concrete mix and curing should be free from chlorides, other salts and organic materials and it should be got tested in Govt. Laboratory at least once in a year by the party. Potable water is preferable.

6. STORAGE OF MATERIALS

The cement shall be stored at the work side in such a manner as to prevent deterioration due to moisture or intrusion of foreign matter.

Steel reinforcement shall ordinary be staggered in such a way so as to avoid distortion and to prevent deterioration and corrosion, it is good practice to coat reinforcement with cement wash before stacking to prevent scale and rust.

The aggregates shall be stored in such a way as to prevent mixing of foreign materials. The heaps of fine and coarse aggregates shall be kept separately. When different sizes of fine or coarse aggregate are procured separately, they shall be stored in separate stockpiles, to prevent the material at the edges of the piles from getting intermixed.

Any material, which has deteriorated or has been damaged or is otherwise considered defective, shall not be used for the concrete.

7. TESTING OF MATERIALS:

The Supplier shall arrange for the necessary testing of the material like Metal, Sand, Water etc. and see that the materials to be used in the manufacturing confirm to relevant IS.

8. METHOD OF MANUFACTURING OF PSC POLES:

The Prestressed concrete poles are generally manufactured by long line multiple bed method for mass production.

(A) BED AND MOULD:

The length and number of rows of concrete casting bed shall be according to the production capacity of pole factory. Preferably one pole bed separately should be provided to minimise wastage of H.T.Steel wire.

The Prestressed poles are to be cast in a steel mould having accurately machined bottom bed and side faces. The steel mould should be strong enough to resist distortion. The bed should be absolutely horizontally levelled and free from any undulation. The mould should be capable of being opened in such a way that edges of the poles are not damaged.

At both the ends of row of concrete casting bed, the anchor blocks are provided for fixing and stretching of H.T.Steel Wire.

(B) STIRRUPS:

The stirrups shall be prepared as per the design / drawing of the PGVCL from 4 MM dia H.T. Steel. The stirrups shall be placed in position as per approved drawing. Stirrups shall have standard lap lengths and be welded to ensure maintaining proper shape and position.

(C) PREPARATION OF REINFORCEMENT:

All the reinforcement and window boxes shall be accurately placed and maintained in position during the fabrication. As per the Design / Drawing all the stirrups made out of H.T.steel, H.T.Steel wire shall be placed in respective position of the mould and thereafter continuous H.T.Steel wires are arranged through holes and plates of the mould. The welded joints in H.T. Steel wire will not be permitted. The H.T.Steel wires are stretched up to the required tension 10% of UTS as specified in relevant I.S. code with the help of Jacks and anchor blocks. All the wires shall be accurately stretched with uniform prestressing in each wire. Each wire shall be anchored positively during the casting. The tension applied shall be checked with the help of suitable Gauge/Meter.

(D) CONCRETE MIX:

The concrete mix to be used for manufacturing of PSC Poles shall be prepared by weight batching only in such a manner and proportion so as to achieve the compressive strength of the concrete mix as per IS: 456 and none of the test specimen shall have strength less than 225 and 450 KG/CM² after 3 and 28 days respectively. The cement concrete shall be mixed only in electrically / mechanically

operated concrete mixer machine. Gradation of the aggregate used in concrete mix shall adhere to the appropriate Mix Design and proportions be checked in regular interval. Water in concrete shall be added with proper measurement to maintain required water cement ratio. The hand broken metal shall not be permitted.

(E) PLACING OF CONCRETE MIX:

The mould should be free from Dust, Dirt and other organic materials and oil is to be applied before placing the concrete mix. The machine mixed concrete is, thereafter poured in the mould and shall be compacted by spinning, vibrating, shocking or other suitable mechanical means. Over-vibration or under-vibration or vibration of very wet mix is harmful and should be avoided. The Hand compaction shall not be permitted.

On application of vibrator the concrete Mix will compact & get to 2 to 3 mm below form/mould level. This gap shall also be filled up with prepared concrete Mix only & re vibrated. The mixture of cement & sand for filling up the gap as well as finishing work will not be permitted. Finishing work shall be done only with cement slurry.

Care should be taken to see that anchorages do not yield before concrete attains necessary strength. Proper cover for concrete should be maintained throughout process of pouring, compacting etc. of concrete mix.

On achieving setting time, the side faces of the mould shall be removed from the bed and watered at intervals to prevent the surface cracking of the pole. The concrete shall be covered with a layer of sacking, canvas, Hessian or similar absorbent materials and kept constantly wet up to the time when the strength of the concrete reaches to the minimum strength of the concrete at transfer of prestress i.e. for about 72 hours.

The Steam curing may be permitted in exigency or emergency cases with the approval of the competent authority only.

(F) DETENSIONING, CUTTING OF WIRE AND REMOVING OF POLES FROM THE BED:

After ascertaining that concrete has attained required strength of min. 225 KG/CM² by checking the cube strength stretched wires are released from the anchor blocks and cut with the help of welding machine. The cutting shall be started only from the centre of the bed length. The pole is then removed from the bed by lifting at 2 points using gantry and moved to the Curing Pond.

(G) CURING:

The curing of the pole shall commence after setting of the concrete. Continuous curing on bed should be done till it is shifted to curing pond, The curing pond shall be full of water and each pole must be immersed in the water for a period of at least 28 days. If required, water sprinkling shall be done at intervals to keep the poles constantly wet as per I.S.No.1678-1998.

(H) STORING OF POLES READY FOR INSPECTION:

The poles prepared vide method stated above shall be stacked in chronological method and indication of the date of manufacturing and number of poles be put before with particular lot so as to identify the lot by inspecting officer.

9. MARKING:

The poles shall be clearly and indelibly marked with the following particulars during manufacture, at a position between 5th (W5) and 6th (W6) window indicated in the drawing so as to easily read after erection in position. The mark shall be done by pressing embossed figures / letters of 50 mm height and 20 mm width with gap of 5 mm between two figures. The sample drawing is attached with the tender.

- (a) Date, month & year of manufacture, (On front face)
- (b) Serial number of pole, and (On front face)
- (c) Maker's serial number or mark (On front faces)
- (d) PGVCL (in words) (above planting depth)

The pole shall also be suitably marked for the planting depth i.e. 1381 mm from bottom. On both the end of pole the anti-corrosive paint i.e. epoxy based bituminous paints two coats are to be applied. One before putting in curing pond and second after removing from the pond.

10. CUBE TESTING:

Total 6 Nos. Cubes of 100mm X 100mm X 100mm size concrete shall be cast daily and tested at release, i.e. after approx. 72 Hours of cast as well as after 28 days, in accordance with Indian Standard specification at Supplier's own expense. The mix for concrete adopted shall be such as to give cube strength not less than 225Kg/cm² at release (after 3 days) and 450 Kg/cm² after 28 days.

Cube testing machine shall always be kept in the working condition and regular cube tests shall be taken and results be recorded in the registers duly signed by engineer-in -charge and representative of the Supplier.

11. SAMPLING AND CONFORMITY

1] LOT:

A. In any batch, all poles of the same class and same dimensions shall be grouped together to constitute a LOT.

B. If the number of poles in a lot exceeds 500 then the lot shall be divided into suitable number of SUB-LOTS such that the number of poles i.e. any sub-lot shall not exceed 500. The acceptance or otherwise of a sub lot shall be determined on the basis of the performance of sample selected from it.

2] Scale of Sampling: The number of poles to be selected from a lot or a sub-lot shall depend upon its size and shall be in accordance with col.1&2 of the table given below.

SAMPLE SIZE AND CRITERIA OF CONFORMITY

| DIMENSIONAL REQUIREMENTS. | | | |
|---------------------------------------|----------------|---|---|
| Size of lot Or Sub-Lot samples. | Sample size | Permissible No. of Defective Transverse Strength test | NO. Of sample Poles (Out of Col.2) for |
| (1) | (2) | (3) | (4) |
| Up to 100 | 10 | 1 | 2 |
| 101 to 200 | 15 | 1 | 3 |
| 201 to 300 | 20 | 2 | 4 |
| 301 to 500 | 30 | 3 | 5 |

- 3] Number of Tests: All the poles as selected as above shall be tested for overall length, cross-section and uprightness. The number of poles to be tested for transverse strength test shall be in accordance with col 4 of table. These poles may be selected from those already tested.
- 4] Criteria of conformity: A lot or sub-lot shall be considered as conforming to the specification if the conditions under are satisfied.

The numbers of poles which do not satisfy the requirements of overall length; cross-section and uprightness shall not exceed the corresponding number given in col.3 of Table. If the number of such poles exceeds the corresponding number, all poles in the lot or sub-lot shall be tested for these requirements, and those not satisfying the requirements shall be rejected.

All the poles tested for transverse strength test shall satisfy the requirements of the test. If one or more poles fail, twice the number of poles originally tested shall be selected from those already selected, and subjected to the test. If there is no failure among these poles, the lot or the sub-lot shall be considered to have satisfied the requirements of this test. If one or more poles of the second samples fail, the lot or the sub-lot represented by the corresponding samples shall be considered not to have passed the test.

12. METHOD OF INSPECTION AND TESTING GENERAL:

The tests on poles shall not be carried out earlier than 28 days from date of manufactured for poles manufactured from ordinary Portland cement. If a chloride free ad mixture is used or rapid hardening Cement of Grade 43 / 53 is used than pole can be tested at 14 days of age. The specimens shall be inspected and any specimen with visible flaws shall be discarded. If any test specimen fails because of mechanical reasons, such as failure of testing equipment of improper specimen preparation, it shall be discarded and another specimen shall be taken.

INSPECTION:

The Tenderer shall offer Ready Made PSC Poles lot for inspection and relevant tests.

(01) DIMENSIONS:

All the Poles shall be manufactured in accordance with the detailed dimensional drawing.

The tolerance on dimension shall be limited to...

- (i) For length - ± 15 mm.
- (ii) For Web thickness - ± 5 mm.
- (iii) Uprightness - 0.5 % (i.e. 72 to 1.005 / 0.995)

(02) METHOD OF TESTING:

The pole shall be tested only in the horizontal position or as specified in I.S. 1678 / latest amendment & I.S. 2905 /1989 latest amendment .While testing in the horizontal position, provision shall be made by suitable supports to compensate for the overhanging weight of the pole; for this purpose the overhanging portion of the pole may be supported on a movable trolley or similar device. The frictional resistance of the supporting devices should be separately determined and deducted from the total final load applied on the pole.

Theoretically the permanent deflection should be as per IS 2905 / 1966 and latest amendment thereof. The recovery of deformations should not be less than 90%.

A] Testing Arrangement -

The pole shall be fixed in the crib longitudinally from butt to its ground line and then it shall be secured firmly in place. Wooden saddles with concave surfaces and other packing shall be placed around the pole to prevent injury to the butt section as specified in IS: 2905/1966 – latest amendment.

To minimize vertical movement at the point of load application and to reduce the stresses due to dead weight of the pole, a rail support shall be provided near the point of load application, or alternately a number of frictionless supports in the form of trolleys may be provided near the end or throughout the length of the pole. The rail support or other forms of support shall be such that any friction associated with the deflection of the pole under load shall not be a significant portion of the measured load on the pole.

B] Loading: The load shall be applied at a point 600 mm from the top of the pole by means of a suitable device, such as a wire rope and winch placed in a direction normal to the direction of the length of the pole, so that the minimum length of the straight rope under pull (excluding the curved portion near the transmitting devices) is not less than two times the length of the pole. If the loading device is set sufficiently far away from the pole to make the angle between the initial and final positions of pulling line small, the error in assuming that the pull is always perpendicular to the original direction of the pole axis will be negligible. The pulling line shall be kept level between the winch position and the point where load is applied to the pole. The load shall be applied at a constant rate of 4 percent of the specified test load per minute and in accordance with procedure.

C] Pulling Line: The pulling line shall be secured around the pole at the load point. Load measuring device shall be placed in a way so as to accurately measure in the tension in the pulling line. The other end of which is attached to the loading equipment (winch).

D] Load Measurement: Load Cell with accuracy of 5 Kg. for measurement may be adopted. Load cell shall be calibrated before every test. The load measuring device shall be supported in such a way that the force required to pull it shall not add to the measured load on the pole and that no damage is caused to the instrument if the pole suddenly breaks under test. No pulleys or any other device in between load application point and load cell will be allowed.

E] Deflections - The deflection of the pole and the load applied shall be measured simultaneously at different stages of loading to provide at least five sets of readings or as specified in I.S.2905 & latest amendment thereof. The measurement of the deflection of the load point shall be made in a direction perpendicular to the unloaded position of the pole axis. The measurement shall be made correct to the nearest 1 mm by use of datum board. A second datum line shall also be established from which the movement of the ground line if any, shall be measured.

F] PROCEDURE: Load shall be applied at a point 600 mm from the top of the pole and shall be steadily and gradually increased to 250 kg. till formation of 1st crack recording deflection at each increment.

The load shall be then reduced to zero and then increased gradually in 50 Kg. increments up to 400Kg load. Then Each load increment be successively increased by 25Kg. up to design ultimate transverse load (i.e. 500 Kgs.). The load shall be increased in steps of 25 Kgs. to measure ultimate transverse load, until failure occurs. Each time the load is applied same shall be held for 2 minutes. The load applied to Prestressed concrete poles at the point of failure shall be measured to the nearest five kilograms.

G]RECORDING OF DATA AND MEASUREMENTS:

(i) Any hair cracks appearing at a stage prior to the application of the design transverse load at first crack shall be measured using feeler gauges & shall be recorded. It should also be recorded, whether the hair cracks, if any, produced on application of the 60 percent of the minimum ultimate transverse load close up on the removal or reduction of the test load.

(ii) The load applied to the pole at the time of failure shall be measured to the nearest 5Kg.

iii) A Prestressed concrete pole shall be deemed not to have passed the test if crack wider than 0.1mm appears at a stage prior to the application of the design transverse load at first crack (200 Kgs.)

(iv) The definition of failure of PSC Pole in test will be (i) permanent set more than 2.5 Cm. at load of 500 Kgs. Or (ii) Deflection of more than 25 Cms at load of 500 Kgs.

H]ULTIMATE FAILURE:

The conditions existing when the pole ceases to sustain a load increment owing to either crushing of concrete or snapping of the Prestressing tension or permanent stretching of the steel in any part of the pole.

In order to access ultimate load carrying capacity of the pole, PGVCL reserves the right to test 1 (One) no. of pole up to destruction test out of total 1000 no. of poles. This one no. of pole shall not form part of quantity to be supplied by the Supplier.

At least one pole shall be subjected to destruction test in the contract in presence of representative from PGVCL, Rajkot.

13. TECHNICAL DATA OF PSC POLES

The Guaranteed Particulars of PSC Poles 8 Mtr. 200 Kg.

- | | | |
|-----|--|--|
| 01. | Working load | : 200 Kg. |
| 02. | Factor of safety | : 2.5 |
| 03. | Ultimate Load | : 500 Kgs. |
| 04. | Dimensions | |
| | (a) Bottom Cross-Section | : 336.55 x 139.7 mm. |
| | (b) Top Cross-Section | : 114.3 x 139.7 mm. |
| | (c) Total height | : 8,000 mm. |
| | (d) Web thickness. | : 57.15 mm (2.25 inch) |
| | (e) Planting Depth | : 1381 mm. |
| 06. | No. of 20mm dia. holes. | |
| | On Front face | : 02 nos. (100 mm apart). |
| | On side face | : 06 nos. (300 mm apart). |
| 07. | Minimum requirement: | |
| | (a) Cube Test (Each Specimen) | : 450 Kg/Cm ² (28 days). |
| | | : 225Kg/Cm ² (3 days)- at release of Prestress. |
| | (b) Initial tension in HT Steel Wire/Pole. | : 70% of 175.00 Kg/mm ² as specified in related I.S. Code |

2. M.S. Beam 116 x 100 mm x 9 Mtrs., 11 Mtrs. & M.S.BEAMS 150 x 150MM - 13Mtr. long

Detailed Technical Specifications for 116 X 100 MM X 9 & 11 Mtrs. long M.S. Beams:

1. SCOPE:

This specifications covers manufacturing / rolling, testing as per IS: 2062 (with latest amendment if any) and supply of M.S. Beams 116 X 100 MM X 9 Mtrs. & 11 Mtrs. Long to DISCOM Destination (within Gujarat State) i.e. F.O.R. Destination.

M.S. Beams shall be conforming to IS: 2062, Grade – A (Fe 410 WA) Quality under B.I.S. Certification Mark Scheme.

2. DIMENSION:

“M.S. Beams (RSJ Girders) of size 116 X 100 MM X 9 Mtrs & 11 Mtrs, with fixed length of 9 & 11 Meters with length tolerance of ± 150 MM. Detailed dimension shall be as per attached Annexure–A.”

3. ROLLING TOLERANCE:

Rolling and cutting tolerance for the material to be supplied will be as per IS: 1852.

4. RAW MATERIALS:

The raw materials to be utilized for rolling the finished goods, must be tested billets/ blooms conforming to IS: 2830 OR IS: 6914. Please note that neither the assistance for raw material viz. recommendations letter on prime producers nor essentiality certificates will be issued nor raw material will be issued by the DISCOM against this tender.

5. EMBOSSING OF BEAMS:

Each Beam must be embossed in the middle of the length along rolling direction with following details.

- (1) Manufacturer's Name or Trade Mark.
- (2) Size of Beam: H - Beam 116 x 100 MM.
- (3) “Property of (Name of DISCOM)”
- (4) AT No. & Date.

6. SECTIONAL WEIGHT:

Sectional Weight of the beams shall be 23.00 Kg. / Mtr.

TECHNICAL SPECIFICATIONS FOR M.S.BEAMS 150 x 150MM - 13Mtr. long
Detailed Technical Specifications ABOVE M.S. Beam:

1. SCOPE:

This specifications covers manufacturing/rolling, testing as per IS 2062 (with latest amendment if any) and Supply of above sizes M.S. Beams to (DISCOM)'s Destination (within Gujarat State) i.e. F.O.R. Destination.

M.S. Beams shall be conforming to IS: 2062, Grade-A (Fe 410 WA) Quality under B.I.S. Certification Mark Scheme.

2. DIMENSION:

Above sizes M.S. Beams with fixed length of 13 Meters with length tolerance of ± 150 MM. Detailed dimension shall be as per attached Annexure-B.

3. ROLLING TOLERANCE:

Rolling and cutting tolerance for the material to be supplied will be as per IS: 1852.

4. RAW MATERIALS:

The raw materials to be utilized for rolling the finished goods, must be tested billets/bloom conforming to IS: 2830 OR IS: 6914. Please note that neither the assistance for raw material viz. recommendation letter on prime producers or essentiality certificates will be issued nor raw material will be issued by the DISCOM against this tender.

5. EMBOSSING OF BEAMS:

Each Beam must be embossed in the middle of the length along rolling direction with following details.

- (1) Manufacturer's Name or Trademark.
- (2) Size of Beam: H-Beam 150 x 150 MM
- (3) "PROPERTY OF (Name of DISCOM)"
- (4) AT No. & Date.

6. SECTIONAL WEIGHT:

Beams should have sectional weight of 34.6 Kg/Mtr for 150 x 150 MM M.S. BEAM

SCHEDULE – “I”

Schedule of Technical Particulars of the Tenderer required for ascertaining technical acceptability of offer.
(This Schedule – I, duly filled and signed should be submitted along with tender)

| Sr No | Description | For items of Steel offered (To be filled up by Tenderer) |
|-------|--|--|
| 1. | Name of the Manufacturer | |
| 2. | Standard applicable. Whether the Tenderer or / principal reroller has valid BIS license to use IS Mark? | |
| 3. | Whether materials will be supplied under BIS Certification Mark Scheme? | |
| 4. | Give details of BIS license held. Notarized copy of BIS license along with latest extension showing validity should be submitted (<u>This is a must</u>) | |
| 5. | Whether the materials will be rolled from tested billets conforming to IS: 2830 / IS: 6914? (Specify quality). | |
| 6. | Whether manufacturer possesses the facility to rolls billets / ingots / bloom slab, as may be required for rolling the Section? | |
| 7. | Whether manufacturing unit possesses well equipped laboratory for testing mechanical and chemical properties of raw and finished steel? | |
| 8. | Details of Quality assurances plan at the works of manufacturers for in house or bought out items | |
| 9. | List of machineries installed / available at the manufacturers' works. | |

SCHEDULE – “II”
(Submit along with Tender Technical Bid.)
Technical details of rolling mills furnace and other equipments.

(A) Details of Remelting Furnace:

| Sr. No. | Particulars | |
|---------|---|--|
| 1. | Type of furnace | Electric Arc Furnace / Oil Fired / Coal Fired. |
| 2. | Capacity of the furnace. | |
| 3. | Inside hearth width of furnace. | |
| 4. | Length of hearth at the entry of furnace. | |
| 5. | Maximum weight of one piece of raw materials that can be entered into furnace. | |
| 6. | Temperature of heated piece of raw materials at the exit of furnace. | |
| 7. | Facilities available at the exit of the furnace to remove scale formed during heating. Details thereof. | |
| 8. | Arrangements made for transfer of hot metal from furnace to rolling mill stand. Details thereof. | |

(B) ROLLING MILL STANDS:

| | | |
|----|--|--|
| 1. | Nos. of stands. | |
| 2. | Operational details of each stand. | |
| 3. | Nos. of passes that are being carried out. | |
| 4. | Whether universal mill stand is provided? If yes, details thereof. | |
| 5. | Details of drive, power of each stand, its capacity, fly wheel and transmission between flywheel and stand. Details thereof. | |

| | | |
|----|--|---|
| 6. | The operational details of rolling mill whether. Details of operation activity of above. | a. Automatic. b. Semi Automatic. c. Manual. |
| 7. | Operational details of transfer of rolling section from one stand to another. Details of above. | . Automatic. . Semi-Automatic. . Manual |

| | | |
|-----|--|--|
| (C) | Details of cooling bed installed adjacent to mill length of cooling bed. | |
| (D) | Straightening facilities available. Whether. | (i) Mechanical. (ii) Hydraulic. (iii) Pneumatic. (iv) Any other type. |
| | Details of above. | |
| (E) | Hot and cold saw facilities available. Details thereof. | |
| (F) | Maximum length of heavy structural section that can be rolled at your mill. | |
| (G) | Raw materials: (i) Size of bloom/slab required for rolling the section. (ii) Source of availability for rolling the section. (iii) Confirmation of raw materials from source to meet requirement in case order is placed may please be submitted. | |

ANNEXURE- A

**[SUBMIT ALONG WITH TENDER TECHNICAL BID DULY STAMPED & SIGNED]
GUARANTEED TECHNICAL PARTICULARS OF BEAMS OFFERED BY THE TENDERER
FOR M.S.BEAM 116X100MM - 9mtr & 11mtr long**

| Sr. No. | Particulars | Unit | Requirement as per DGVCL's specification | Offered by the tenderer (to be filled in by tenderer) |
|---------|--|------------------------------------|--|---|
| 1 | Designation - M.S.BEAM | MM X MM | 116 X 100 | |
| 2 | Weight per Meter Length (i.e. Sectional Weight - Kg/Mtr) | Kg. | 23.00 | |
| 3 | Sectional Area | Cm ² | 29.30 | |
| 4 | Depth of Beam (D) | MM | 116.00 | |
| 5 | Width of Flange (B) | MM | 100.00 | |
| 6 | Thickness of Flange (TF) | MM | 10.00 | |
| 7 | Thickness of Web (TW) | MM | 8.50 | |
| 8 | Radius at Fillet or Root (R1) | MM | 15.00 | |
| 9 | Radius at Tow (RZ) | MM | 3.00 | |
| 10 | Moment of Intertia [i] Ixx [ii] Iyy | Cm ⁴ Cm ⁴ | 643.80 143.50 | |
| 11 | Radius of Gyration - GRxx | Cm | 4.69 | |
| 12 | Modulus of Section [i] Zxx [ii] Zyy | Cm ³ Cm ³ | 111.00 28.70 | |
| 13 | Tolerance in Dimensions (i.e. Rolling Tolerance) | ± | As per IS : 1852 | |
| 14 | Length of Beam | MTR. | 9 & 11 | |
| 15 | Tolerance on Length | MM | ± 150 | |
| 16 | Any other Particulars. | -- -- | | |

3. Common Technical Specifications of Structural Steel Items

1. Scope:

This specification covers the manufacturing and testing at works and supply of structural steel items.

2. Applicable standard:

As per IS: 2062 / 2011 for steel for general structure purpose and other relevant standard mentioned therein with latest amendment up to date of tender.

3. General Requirement:

Material (not re-rolled) of grade “A” E250 (Fe-410WA) should be supplied confirming to IS 2062/2011 with latest amendment if any.

4. Dimension:

The material dimension shall be in accordance with the relevant Indian standard mentioned in table 4 of IS: 2062/2011. The rolling tolerance shall be as per IS: 1852/85.

5. The samples and acceptance criteria:

The Nos. of sample randomly selected from the lot shall be in accordance with and acceptance criteria shall as per IS: 2062/2011.

6. Acceptance test:

The acceptance test as per following are to be carried out on randomly selected Sample.

Verification of dimension.

Yield strength test.

Elongation test.

Bend test.

Chemical composition.

7. ISI License:

The Bidder should submit notarized copy of BIS license of 2062/2011 along with schedule I clearly showing the size of tender / offer item valid at least up to the date of opening of tenders. If applied for renewal of the license, copy of receipt of the fees and / as acknowledge of application from BIS. The offer without the BIS license shall be straight away rejected.

8. MARKING:

As per IS: 2062/2011 each product, except M.S. Flats & M.S. Round bars, shall either carry a tag or be marked with the manufacturer's name or trademark, “Property of (NAME OF DISCOM)” and Year of Manufacture. Bars and Flats shall carry a tag bearing the manufacturing's name of trademark, “Property of (NAME OF DISCOM)” and Year of Manufacture. Designation of steel should also be similarly marked on the product or tag. Each end of rolled product shall be painted with green color as per specified for grade A in IS 2062/2011.

SCHEDULE – “I”

Schedule of Technical Particulars of the Tenderer required for ascertaining technical acceptability of offer. (This Schedule – I, duly filled and signed should be submitted along with tender)

| Sr No | Description | For items of Steel offered (To be filled up by Tenderer) |
|-------|--|---|
| 1. | Name of the Manufacturer | |
| 2. | Standard applicable. Whether the Tenderer or / principal re-roller has valid BIS license to use IS Mark? | |
| 3. | Whether materials will be supplied under BIS Certification Mark Scheme? | |
| 4. | Give details of BIS license held. Notarized copy of BIS license along with latest extension showing validity should be submitted (<u>This is a must</u>) | |
| 5. | Whether the materials will be rolled from tested billets conforming to IS: 2830 / IS: 6914? (Specify quality). | |
| 6. | Whether manufacturer possesses the facility to rolls billets / ingots / bloom slab, as may be required for rolling the Section? | |
| 7. | Whether manufacturing unit possesses well equipped laboratory for testing mechanical and chemical properties of raw and finished steel? | |
| 8. | Details of Quality assurances plan at the works of manufacturers for in house or bought out items | |
| 9. | List of machineries installed / available at the manufacturers' works. | |

SCHEDULE – “II”

(Submit along with Tender Technical Bid.)

Technical details of rolling mills furnace and other equipments.

(A) Details of Remelting Furnace:

| Sr.No. | Particulars | |
|--------|---|--|
| 1. | Type of furnace | Electric Arc Furnace / Oil Fired / Coal Fired. |
| 2. | Capacity of the furnace. | |
| 3. | Inside hearth width of furnace. | |
| 4. | Length of hearth at the entry of furnace. | |
| 5. | Maximum weight of one piece of raw materials that can be entered into furnace. | |
| 6. | Temperature of heated piece of raw materials at the exit of furnace. | |
| 7. | Facilities available at the exit of the furnace to remove scale formed during heating. Details thereof. | |
| 8. | Arrangements made for transfer of hot metal from furnace to rolling mill stand. Details thereof. | |

(B) ROLLING MILL STANDS:

| | | |
|----|--|---|
| 1. | Nos. of stands. | |
| 2. | Operational details of each stand. | |
| 3. | Nos. of passes that are being carried out. | |
| 4. | Whether universal mill stand is provided? If yes, details thereof. | |
| 5. | Details of drive, power of each stand, its capacity, fly wheel and transmission between flywheel and stand. Details thereof. | |
| 6. | The operational details of rolling mill whether. Details of operation activity of above. | a. Automatic. b. Semi Automatic. c. Manual. |
| 7. | Operational details of transfer of rolling section from one stand to another. Details of above. | a. Automatic. b. Semi-Automatic. c. Manual |

| | | |
|-----|--|--|
| (C) | Details of cooling bed installed adjacent to mill length of cooling bed. | |
| (D) | Straightening facilities available. Whether. | (i) Mechanical. (ii) Hydraulic. (iii) Pneumatic. (iv) Any other type. |
| | Details of above. | |
| (E) | Hot and cold saw facilities available. Details thereof. | |
| (F) | Maximum length of heavy structural section that can be rolled at your mill. | |
| (G) | Raw materials: (i) Size of bloom/slab required for rolling the section. (ii) Source of availability for rolling the section. (iii) Confirmation of raw materials from source to meet requirement in case order is placed may please be submitted. | |

SCHEDULE – “A-1”

Manufacture, Test and Supply of New and Un-used Prime Quality Weldable Steel as per IS: 2062 / 2011 Fe 410. (With latest amendments if any)

| Sr No | Description of goods with details of specification | Sectional Weight in Kg/Mtr. | To be filled up by Tenderer |
|----------|--|-----------------------------|-----------------------------|
| A | Supply of M.S. Channel conforming to IS-2062, Gr.–“A” quality, having length of 9 Mtr (+/- 150 MM Tolerance) and under “BIS” Mark Certification Scheme. | | |
| 1 | 100 X 50 X 5 MM | 9.56 | |
| B | Supply of M.S. Angles conforming to IS-2062, Gr.–“A” quality, having length of 09 to 12 Mtrs and under “BIS” Mark Certification Scheme. | | |
| 1 | 65 X 65 X 6 MM | 5.80 | |
| 2 | 50 x 50 x 6 MM | 4.50 | |
| C | Supply of M.S. Flats conforming to IS-2062, Gr.–“A” quality, having length of <u>6.5 to 7 Mtrs.</u> under “BIS” Mark Certification Scheme. | | |
| 1 | 50 X 6 MM | 2.39 | |
| D | Supply of M.S. Round Bars having length of <u>7.0 to 7.5 Mtrs.</u> conforming to IS-2062, Gr.–“A” quality, under “BIS” Mark Certification Scheme. | | |
| 1 | 16 MM | 1.580 | |

Note:

1. Unloading: “Respective DISCOMs will unload all the materials.” If the firms unload the materials at consignees’ end, then maximum Rs.50.00 per MT extra will be given.
2. Tenderer should invariably furnish a Notarized Copy of the BIS license (with Schedules I & II) held by the firm for using IS mark for the tendered items.
IF THE LICENSES ARE NOT FURNISHED THEN THEIR OFFERS FOR THOSE ITEMS WILL NOT BE CONSIDERED. PROVISIONAL CERTIFICATES NOT ALLOWED. NO FURTHER CORRESPONDANCES WILL BE ENTERTAINED IN THIS MATTER.
3. Tenderer should furnish along with Technical Bid all the Tender documents and also Schedules – I & II duly filled in & signed.
4. Tenderer shall have to make his own arrangements for procurement of Raw materials such as Ingots, Billets, Blooms, Slabs, Wire Rods, etc., and Respective DISCOM shall not entertain any requests from Tenderer to inform the raw materials suppliers for allocation of raw materials on this account.
5. This paper should be signed by the Tenderer and should be submitted along with Technical Bid.

4. 11 KV AAAC Covered Conductor (MVCC) and its accessories

1. SCOPE:

- 1.1.** The work is to be executed on turnkey basis, the scope of which includes survey, network design, supply, manufacturer's quality assurance, testing (where specified/ required), transportation, storage, erection, including all civil/ structural works, site testing, commissioning of All Aluminium Alloy (AAA) type 11 KV covered conductor and its relevant accessories including all associated activities though not exclusively specified herein and are required for the completion and satisfactory performance of the entire works as intended.
- 1.2.** The base conductor used to manufacture the covered conductor shall require to confirm the latest standards and its amendments thereof. The AAA Conductor shall be conforming to IS 398(Part-IV), IEC: 104-1987/IS 9997:1991 with the latest amendment and the insulation for covering shall be conforming as per the requirement given in Table-1 of the standard EN50397-1:2006 with the latest amendments. The accessories of the covered conductor shall be conforming to EN50397-2:2009 with the latest amendments.
- 1.3.** The AAA Covered conductor shall conform in all respects to the highest standards of Engineering, design, workmanship, the technical specifications and the latest revisions of relevant standards at the time of offer and the authorized person of DISCOM have the power to reject any work or materials, which his judgment, is not in full accordance therewith.

2. SPECIAL INSTRUCTIONS TO BIDDER:

- 2.1.** The Bidder shall require to design, engineering, & manufacturing of Covered Conductor from the core to finish in-house, testing at manufacturer's works, supply and delivery of 11 kV AAA covered conductor with relevant accessories to the respective store of the DISCOMs.
- 2.2.** The bidder is required to impart training in view of manufacturing, assembly, erection with accessories, operation, and maintenance for the offered item, at his works and, to the person/s identified by the DISCOMs, in the event of an order, free of cost. In the training session, the bidder shall confirm that he has to impart all the important aspects of the tender items, its usage, Installation practice of covered conductor and its accessories, the purpose of the individual components, possible defects, and its remedies at the time of erection and after in service, etc.
- 2.3.** The bidder shall bring out all the technical deviation/s only at the specified annexure.
- 2.4.** The bidder shall submit a Quality Assurance Plan for the manufacturing process and Field Quality Plan with the technical bid.
- 2.5.** The Bidder should be a manufacturer of covered conductors in India.
- 2.6.** The bidder shall have to submit the required type test reports as per the relevant standards at the time of bid submission only and it is required that the type test reports should not be older than 07 years at the time of bid submission. All the required type tests listed in the relevant standard for the covered conductor shall be required to conduct in the span of one year only. A type test shall be performed on every covered conductor type, irrespective of the cross sectional area. The results

will be valid across the whole range of cross sectional areas for that type. The type tests reports shall be submitted as per required type of covered conductor as mentioned in clause No.6.3 of this technical specifications. Non-submission of the type test reports shall be liable to reject the bid itself.

- 2.7. It is not the intent to specify completely here in all the details of the design & construction of material. However, the material shall conform in all respects to high standards of Engineering, design, and workmanship operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble-free operation. Such components shall be deemed to be within the scope of the bidders supply irrespective of whether these are specifically brought out in his specification and/or purchaser order or not.

3. SYSTEM PARTICULARS/DISTRIBUTION NETWORK PARAMETERS :

The normal system parameters of the distribution network are as below.

| | |
|-------------------------------|---------------------|
| Network | 3Phase-3wire |
| Max. System Voltage | 12 kV |
| Nominal System Voltage | 11 KV |
| No of phases | Three |
| System Frequency | 50 Hz \pm 3% |
| Neutral earthing | Solidly Grounded |
| Method of earthing | Effectively earthed |
| Fault Level (Minimum) | 20 KA For 3 sec. |

4. ATMOSPHERIC PARTICULARS:

| | |
|--|---------|
| Maximum Ambient Air Temperature | 50° C |
| Minimum Ambient Air Temperature | 5° C |
| Maximum daily average ambient air temperature | 40°C |
| Maximum temperature attained by an object exposed to sun | 70°C |
| Maximum humidity | 99% |
| Altitude above M.S.L. (maximum) | 1000Mtr |
| Average annual rainfall (mm) | 925 |

| | |
|---|-------|
| Max. wind pressure(Kg/sqm) | 260 |
| Average number of rainy days per Annum | 90 |
| Seismic level (Horizontal accn.) | 0.3 g |
| Iso-ceraunic level(Days per Year) | 50 |
| Average thunder storm days per annum | 50 |
| Note: The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions. | |

5. APPLICABLE STANDARDS:

The conductor shall conform to the following Indian/International Standards, which shall mean latest revisions, with amendments/changes adopted and published, unless specifically stated otherwise in the technical specification.

| Sr. No | Applicable Standard Indian/International | Standard Description |
|---|---|--|
| 1 | IS 398 (Part-IV):1994/ IEC 61089:1991 | Aluminum conductors for overhead transmission purposes, Part 4: Aluminum alloy stranded conductors |
| 2 | IS 10418 (1982) | Drums for electric cables |
| 3 | EN 50397-1:2006 | Covered conductors for overhead lines and the accessories for rated voltages above 1 kV a.c. and not exceeding 36 kV a.c. Part 1: Covered conductors |
| 4 | EN 50397-2:2009 | Covered conductors for overhead lines and the accessories for rated voltages above 1 kV a.c. and not exceeding 36 kV a.c. Part-2: Accessories for Covered conductors: Tests and Acceptance criteria |
| 5 | EN 50397-3:2010 | Covered conductors for overhead lines and the related accessories for rated voltages above 1 kV a.c. and not exceeding 36 kV a.c. Part 3: Guide to Use |
| 1.All Indian Electricity Rules/ Bills amended up to date applicable for clearances, safety and operation of the equipment | | |
| 2.The successful Bidder must consider the general recommendations for selection, storage, | | |

6. Technical requirement:

6.1. Conductor Code as per EN 50397-1: 2006

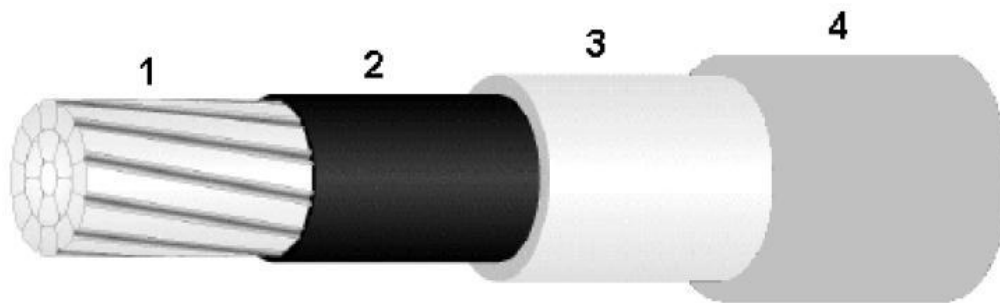
| | | |
|--------------------------------------|--------------------------------|--|
| Type Code | CC | |
| Covering Material | S X T | -for semi-conductive screen -for cross-linked Polyethylene -for thermoplastic polyethylene |
| Conductor material and cross section | According to relevant standard | AAAC |
| Conductor design | W K | -for water tight -for compacted |
| Rated Voltage U in kV | kV | |
| Conductor Code | CCSX ▲-AAAC WK UKV | ▲ = Nominal Conductor Cross Section in mm ² ; U= Rated Voltage (in KV) |

6.2. Covered Conductor Code used in this specifications as per EN 50397-1:2006

| Sr. No. | Description | Covered Conductor Code |
|---------|------------------------------------|------------------------|
| 1 | 11 kV AAA Rabbit Covered Conductor | CCSX 55 AAAC W 11 kV |
| 2 | 11 kV AAA Dog Covered Conductor | CCSX 100 AAAC W 11 kV |

6.3. Constructional requirement:

The covered conductor shall conform in general to EN 50397-1/2006.



- 1- Longitudinally watertight conductor
- 2- Extruded semi-conducting compound
- 3- XLPE insulation
- 4- HDPE having UV protection, erosion resistance and anti-tracking properties

6.3.1. Conductor :

The material offered shall be of the best quality and workmanship. The Insulated / Covered conductor shall be formed longitudinally watertight and constructed from All Aluminium Alloy Stranded Conductor which have the mechanical and electrical properties specified in IS 398 (Part-IV):1994 and its latest amendments. The properties of the Aluminum Alloy wires, the final AAA conductor shall be as per the reference Table-1, Table-2 and Table-3 of this technical specifications.

6.3.1.1. The wire shall be of heat treated aluminum, magnesium silicon alloy having

A composition appropriate to the mechanical & electrical properties as specified in IS 398 (Part-IV):1994.

6.3.1.2. The Aluminum Alloy strands drawn from heat treated aluminum alloy redraw rods conforming to Type B as per IEC: 104:1987/IS 9997:1991 latest amendment. The chemical Composition conforms to clause no 6.1 of IS 9997:1991, as given below:

| Sr. No | Elements | Percent |
|--------|-----------------------|-----------|
| 1 | Si | 0.50-0.90 |
| 2 | Mg | 0.60-0.90 |
| 3 | Fe | 0.50 max |
| 4 | Cu | 0.10 max |
| 5 | Mn | 0.03 max |
| 6 | Cr | 0.03 max |
| 7 | Zn | 0.10 max |
| 8 | B | 0.06 max |
| 9 | Other Element(Each) | 0.03 max |
| 10 | Other Element (Total) | 0.10 max |
| 11 | Al | Remainder |

6.3.1.3. Properties of the Aluminum Alloy wires: The minimum requirement of the properties of Aluminum Alloy wires to be used in the construction of the stranded conductors shall be as mentioned in the Table – I and as per the relevant standard.

Table-1

| Sr No | Type of Conductor | No of strands and its dia. (mm) | Diameter of wire (mm) | | | Cross sectional Area of nom.wire (mm ²) | Calculated Resistance@20 ^o C (Max) Ω/kM | Approx. Calculated Breaking Load (kN) |
|-------|-------------------|---------------------------------|-----------------------|------|------|---|--|---------------------------------------|
| | | | Nominal | Min | Max | | | |
| 1 | AAAC-Rabbit | 7/3.15 | 3.15 | 3.12 | 3.18 | 7.79 | 4.29 | 2.29 |
| 2 | AAAC-Dog | 7/4.26 | 4.26 | 4.22 | 4.3 | 14.25 | 2.345 | 4.18 |

6.3.1.4. The properties of the conductor: The general requirement of the stranded All Aluminum Alloy Conductor shall be as per the table-2 below and as per the relevant standards.

Table-2

| Sr No | Type of conductor | Nominal Cross sectional Area of conductor (mm ²) | Approx. overall dia. (mm) | Approx. mass (Kg/Km) | Calculated Resistance@20 ^o C (Max) Ω /kM | Approx. Calculated Breaking Load without Insulation (kN) | Reactance per kM (Ω /kM) | Continuous Current Rating without covering Amp | Lay Ratio |
|-------|-------------------|--|---------------------------|----------------------|--|--|----------------------------------|--|-----------|
| 1 | AAAC Rabbit | 55 | 9.45 | 149.2 | 0.621 | 16.03 | 0.102 | 186 | 10 to 14 |
| 2 | AAAC DOG | 100 | 12.78 | 272.86 | 0.339 | 29.26 | 0.094 | 270 | |

6.3.1.5. **Tolerance on normal sizes:** The tolerance in diameter of Aluminium wires used in the manufacture of Covered AAA Conductor shall be allowed as per IS 398 Part-IV, amended up to date.

6.3.1.6. **Stranding:** The wires used in the construction of All Aluminum Alloy Conductor shall before stranding, satisfy all the relevant requirements of this specification and relevant IS.

6.3.1.7. **Freedom from all Defects:** The wire shall be smooth and free from all imperfections such as spills, splits, slag inclusion, dia. marks scratches, fittings, blow holes, projections, looseness, overlapping of strands, chipping of aluminium layers etc. and all such other defects which may hamper the mechanical and electrical properties of the conductor. Special care should be taken to keep away dirt, grit etc. during stranding. There shall be no joint in any wire of a stranded conductor.

6.3.2. Filling (Water Blocking):

The Stranded Conductor shall be longitudinally watertight by means of water blocking material incorporated during the extrusion process. The use of grease /water-swellable tape / water-swellable powder etc. is not permitted. The water blocking material shall be stable at a maximum operating conductor temperature of 90^o C. The water-blocking compound shall be compatible with the conductor material as well as the semiconducting polymer screen layer above it and not adversely affect its electrical or mechanical properties.

6.3.3. Conductor screen

The conductor shall be provided with a semi conducting screen by extruded semi-conducting Compound.

6.3.4. Insulation

The insulation shall be as per standard EN 50397 -1 comprising of two layers. The Average thickness of the covering insulation shall not be less than that stipulated in the Technical

requirements. The physical and electrical properties of insulating compounds shall be as specified in the EN 50397-1.

The inner layer of main XLPE insulation shall be unfilled and shall not contain Carbon black.

The outer covering of HDPE insulation which also serves as protective covering shall be UV Stabilized, weather resistant and Track resistant.

Properties of covering material shall meet the requirements specified in Table-1 & 2 of EN 50397-1:2006. Tracking resistance as per EN 50397-1 shall be applicable. Manufacturer should have in-house test facility to conduct tracking resistance test as per EN 50397-1. This test during the acceptance of the manufactured lot shall be conducted on one sample of each size of covered conductor and test report shall be required to submit.

Conductor screen, inner XLPE insulation and outer HDPE insulation shall be manufactured simultaneously using triple extrusion process in a single operation to ensure a good, permanent bond between the three layers and also with the conductor.

6.4. Principal Parameters Of Covered Conductor:

6.4.1. The GTP of 11 kV Covered All Aluminum Alloy conductor are tabulated below:

| Sr. no. | Particulars | Unit | Conductor Type | |
|---------|---|-----------------|--|--------------------------|
| | | | CCSX 55 AAAC W 11 kV | CCSX 100 AAAC W 11 kV |
| 1 | Applicable Standard | - | EN 50397-1 for Covered Conductor & IS 398-4 for Base Conductor | |
| 2 | Conductor Material | | All Aluminum Alloy Conductor as per IS 398-IV | |
| 3 | Conductor shape | | Non-Compacted Watertight stranded | |
| 4 | Nos of strand and diameter of aluminum wire | Nos/mm | 7/3.15 | 7/4.26 |
| 5 | Nominal Cross Sectional area of conductor | mm ² | 55 | 100 |
| 6 | Nominal Conductor diameter | mm | 9.45 | 12.78 |
| 7 | Lay ratio of Al. wire Outermost layer | Min | 10 | 10 |
| | | max | 14 | 14 |
| 8 | Calculated resistance at 20°C (max) | Ω/kM | 0.621 | 0.339 |
| 9 | Approximate breaking load(without insulation) | KN | 16.03 | 29.26 |
| 10 | Continuous current | Amp | 172 | 265 |

| | | | | |
|------|--|-----------|--|--------|
| | carrying capacity in air at 40°C ambient & 80 °C operating temp. | | | |
| 11 | Approx. Weight without Insulation | Kg/ Km | 149.2 | 272.86 |
| 11 | conductor screen | | | |
| 11.1 | Material | - | Extruded Semi-Conducting Compound | |
| 11.2 | Nominal thickness | mm | 0.3 | |
| 12 | Inner insulation Layer | | -- | |
| 12.1 | Material | | XLPE | |
| 12.2 | Nominal thickness | mm | 1.2 | |
| 13 | outer insulation layer | | -- | |
| 13.1 | Material | | UV stabilized, Erosion resistant and Tracking resistant HDPE | |
| 13.2 | Nominal thickness | mm | 1.1 | |

6.5. IDENTIFICATION MARKS ON COVERED CONDUCTOR:

The following particulars shall be properly legible embossed/Printing on the covered conductor at the intervals of not exceeding one meter throughout the length of the covered conductor. The covered conductor with poor and illegible embossing/Printing shall be liable for rejection.

- a) Manufactures name and/or Trade name.
- b) Voltage grade.
- c) Year of manufacture.
- d) Name of the DISCOM
- e) Successive Length.
- f) Identification of Covered Conductor as per Standard EN 50397-1: 2006

Also the following information be marked on each drum package:

- a) Manufacturer's name
- b) Trade mark ,if any
- c) Drum or identification number
- d) Size of conductor Number and lengths of conductors
- e) Gross mass of the package
- f) Net mass of conductor
- g) EN 50397-1: 2006.

7. ACCESSORIES:

- 7.1.** The Accessories which shall be used with Medium Voltage Covered Conductor (MVCC) are specified as per the below Table-A. The bidder shall furnish valid and authenticated type test certificates as per relevant standard & technical specifications and not older than 07 years at the time of bid submission, from NABL Accredited laboratory within India. The type test shall be considered valid for similar rating and design of tendered items. The proto-type materials / products must fulfil all the Technical requirements like Technical Specifications, specified Drawings, guaranteed Technical parameters, manufacturing quality plan, etc.
- 7.2.** The offered Accessories shall be suitable to all typed of AAA Covered conductor as specified in clause no 6.4.1 of this technical specifications.

Table-A

| Sr.No | Description | Application |
|-------|--|--|
| 1 | Wedge type Tension Assembly (TA) | For fitting onto a pole for tensioning at the beginning or end of a length of MVCC, or for anchoring while a major change in direction. The Tension assembly consists of one wedge type Tension / anchoring clamp and one Tracking protection IPC. |
| 2 | Insulator Clamp / Helical Tie (IC) | For supporting and aligning MVCC at an intermediate pole in a length, with small angle of deviation. The Insulator Clamp hold the MVCC in its position on top of the pin or post insulator. Insulator Tie shall be made of an “Insulated Plastic” only.” |
| 3 | Suspension Clamp (SC) | For supporting a length of MVCC at an intermediate pole in a length, with large angle of deviation with a disc insulator. The suspension clamp consists of an “Assembly with one locking type Suspension clamp with provision to fix in Insulators. |
| 4 | Insulation Piercing Connector for “Bare to Covered interconnection” (IPC – Type 1) | For main (Bare) to main (MVCC) networking connection. This connector is to ensure the electrical characteristics with in the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC. |
| 5 | Insulation Piercing Connector for Networking / Branching / Looping (IPC – Type 2) | For main (MVCC) to main (MVCC) networking or branching of MVCC to another MVCC Or Branch Cable or Looping for transformer junctions. This connector is to ensure the electrical characteristics with in the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC. |
| 6 | Insulation Piercing | For Temporary Earthing Provision from MVCC Cable for |

| | | |
|---|---|--|
| | Connector with Aluminum Bail for earthing (IPC – Type 3) | maintenance purpose. This connector is to ensure the electrical characteristics with in the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC. |
| 7 | Tension Joints (TJ) | Mid-span tension joints for jointing MVCC over a span |
| 8 | Lightning / Surge Arrestor Kit (with provision to connect with Covered Conductor) | Protection for the Network and transformer under lighting condition. |

7.3. INSULATION PIERCING CONNECTORS :

- 7.3.1.** Piercing Connectors (IPC) are used for making Tee / Tap-off/ connections to an MVCC / Bare Overhead Line. The main purpose of a connector is to transmit electricity from one conductor to another. From the electrical point of view the connector should transmit electricity with smallest possible losses. From the mechanical point of view the connector should be able to hold conductors together without causing damages to them and sustain climatic loading. Connectors shall be UV Resistant, corrosion resistant and inert to bimetallic electrochemical reactions. It endures varying mechanical tensions and other forces detrimental to the connection. Connectors shall be capable of carrying the load current, and fault current if any.
- 7.3.2.** The connector shall be water proof and the water tightness shall be ensured by appropriate elastomer materials and not by grease, gel or paste alone.
- 7.3.3.** Insulation Piercing Connector should have a design such that there is no stripping of insulation on the covered conductor. It shall be able to get the lowest contact resistance & Superior insulation as well as sealing performance.
- 7.3.4.** The superior material and process technology ensure operation regularity in corrosive environment.
- 7.3.5.** Each IPC should be provided with a rigid end cap made of mechanical, weather resistant, UV resistant and tracking resistant insulation plastic polymer material to seal the cut end of the Branch cable to ensure proper water sealing and avoid tracking. 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.
- 7.3.6.** The following type tests, acceptance tests and routine tests shall be conducted on connector as per relevant standard EN 50397-2:2009, with latest amended.

| Sr. No. | Test | Type test | Acceptance Test | Routine Test |
|---------|--------------------|-----------|-----------------|--------------|
| 1 | Visual examination | X | X | X |

| | | | | |
|---------------------------|---------------------------------------|---|---|---|
| 2 | Dimensional and material verification | X | X | X |
| 3 | Marking | X | X | X |
| 4 | Mechanical tests | X | | |
| 4.1 | Clamp bolt tightening test | X | X | X |
| 4.2 | Shear head function test | X | X | X |
| 4.3 | Damage to the main conductor test | X | X | X |
| 4.4 | Branch cable pull out test | X | | |
| 5 | Hot dip galvanizing test | X | X | |
| 6 | Water tightness test | X | | |
| 7 | Electrical ageing test | X | | |
| 8 | Environmental tests for connectors | X | | |
| 8.1 | Corrosion ageing test | X | | |
| 8.2 | Climatic ageing test | X | | |
| X : tests to be conducted | | | | |

7.4. Alignment Ties:

The Alignment ties shall be designed suitably to hold the MVCC in its position on top of the insulator. The Alignment ties preferred to be made of Insulating Plastic materials only to ensure tracking resistance and to avoid any insulation damage to the covered conductor due to abrasion while mechanical or wind induce vibration.

7.4.1. The following type tests, routine tests, and Acceptance tests shall be conducted on Alignment Ties as per relevant standard EN 50397-2:2009, with the latest amended.

| Sr. No. | Test | Type test | Acceptance Test | Routine Test |
|---------------------------|---|-----------|-----------------|--------------|
| 1 | Visual Examination | x | x | x |
| 2 | Dimension Verifications | x | x | x |
| 3 | Check For Marking | x | x | x |
| 4 | Mechanical test | x | x | x |
| 4.1 | Failure Load Test | x | x | x |
| 4.2 | Slip Load Test | x | x | x |
| 4.3 | Lift/Side Load test | x | x | x |
| 4.4 | Thermal Test under load | x | | |
| 5 | Environmental tests | x | | |
| 5.1 | Corrosion test | x | | |
| 5.2 | Climate ageing test | x | | |
| 5.3 | Resistance against tracking in heavy Polluted Areas | x | | |
| X : tests to be conducted | | | | |

7.5. Suspension Clamps :

- 7.5.1.** The Metallic type Suspension Clamps with IPC shall be provided to ensure tracking resistance and to avoid any insulation damage to covered conductor due abrasion while mechanical or wind induce vibration. The following type tests, acceptance test, and routine test shall be conducted on Suspension clamp as per relevant standard EN 50397-2:2009, with latest amended.

| Sr. No. | Test | Type test | Acceptance Test | Routine Test |
|---------------------------|---------------------------------------|-----------|-----------------|--------------|
| 1 | Visual Examination | x | x | x |
| 2 | Dimension Verifications | x | x | x |
| 3 | Check For Marking | x | x | x |
| 4 | Mechanical test | x | x | |
| 4.1 | Damage and failure load test | x | x | |
| 4.2 | Slip test at ambient temperature | x | x | |
| 4.3 | Slip test at high and Low temperature | x | | |
| 4.4 | Thermal Test Under Load | x | | |
| 4.5 | Lift/Side Load test | x | x | x |
| 4.6 | Clamp bolt tightening test | x | x | |
| 4.7 | Shear head function test | x | x | |
| 5 | Hot dip galvanizing test | x | x | |
| 6 | Water tightness test | x | | |
| 7 | Environmental tests | x | | |
| 7.1 | Corrosion test | x | | |
| 7.2 | Climate ageing test | x | | |
| X : tests to be conducted | | | | |

7.6. Wedge type Tension Clamp

- 7.6.1.** Tension clamp used For the purpose of terminating covered conductors over the covering fitting shall include, but are not limited to, the following:
- 7.6.2.** The clamp shall be of the fully insulating type of mechanical and weather resisting thermoplastic wedges to anchor/hold the cable. All metal parts of tension type wedge clamp shall have anti-corrosion Property.
- 7.6.3.** The IPC shall be provided with wedge type anchor clamp to maintain the metallic part of clamp and the conductor at equipotential. The fittings shall be able to withstand the specific minimum failure load (SMFL), shall not damage the covering, and shall be designed to prevent the ingress of moisture during service.
- 7.6.4.** Rigid Bail: The Anchoring assembly shall be supplied with a rigid bail to connect the Wedge type Tension Clamp to the Insulator hardware. The Rigid Bail forming part of clamp shall have sufficient length and sufficient mechanical strength to withstand the all test criteria as per this specifications. The Flexible bail is not allowed.

7.6.5. The following type tests, routine tests and Acceptance tests shall be conducted on Wedge type Tension clamp as per relevant standard EN 50397-2:2009, with latest amended.

| Sr. No. | Test | Type test | Acceptance Test | Routine Test |
|---------------------------|-------------------------------------|-----------|-----------------|--------------|
| 1 | Visual Examination | x | x | x |
| 2 | Dimension Verifications | x | x | x |
| 3 | Check For Marking | x | x | x |
| 4 | Mechanical test | x | x | |
| 4.1 | Damage and failure load test | x | x | x |
| 4.2 | Tensile test at ambient temperature | x | x | x |
| 4.3 | Tensile test at low temperature | x | | |
| 4.4 | Tensile test at high temperature | x | | |
| 4.5 | Clamp bolt tightening test | x | x | x |
| 4.6 | Shear head function test | x | x | x |
| 5 | Hot dip galvanizing test | x | x | x |
| 6 | Water tightness test | x | | |
| 7 | Environmental tests | x | | |
| 7.1 | Corrosion test | x | | |
| 7.2 | Climate ageing test | x | | |
| X : tests to be conducted | | | | |

7.7. Tension Joints (Mid Span Jointing Sleeves)

7.7.1. The mid-span Insulated jointing sleeves should be Pre-Insulated type. The sleeve should be made of Aluminum and their current rating shall not be less than that of the covered conductors, insulated with an Anti-UV black thermoplastic tube hermetically sealed two ends with 2 flexible rings. Strip length, Hexagonal crimping die reference, and size to be marked on the outer surface of the plastic sleeve Reference standard, type test, and design requirements as per EN 50397-2. The tensile strength of the mid-span jointing sleeve after crimping/compression shall not be less than 95% of the strength of the covered conductors.

7.7.2. The Mid span joint shall be suitable for the covered conductor for which they are designed. The joint shall have the same basic insulation properties as the conductor covering which shall be confirmed by acceptance test of ‘‘High voltage ‘’ as mentioned in the relevant standard.

| Sr. No. | Test | Type test | Acceptance Test | Routine Test |
|---------|-------------------------|-----------|-----------------|--------------|
| 1 | Visual Examination | x | x | x |
| 2 | Dimension Verifications | x | x | x |
| 3 | Check For Marking | x | x | x |
| 4 | Mechanical test | x | x | x |
| 4.1 | Damage and failure load | x | | |

| | | | | |
|--|----------------------------------|---|---|---|
| | test | | | |
| 4.2 | Slip test at ambient temperature | x | x | x |
| 6 | Water tightness test | x | | |
| 7 | Electrical Ageing test | x | | |
| 8 | Environmental tests | x | | |
| 8.1 | Corrosion test | x | | |
| 8.2 | Climate ageing test | x | | |
| 9 | High Voltage Test* | | X | |
| X : tests to be conducted | | | | |
| * As per Clause No 4.2.6 of EN 50397-2 & Test method shall be as per EN 50397-1 (Table-2). | | | | |

7.8. Lightning / Surge Arrestors :

- 7.8.1.** The Lightning Arrestors shall be capable of discharging Lightning and switching surges and temporary power frequency over voltages. The Surge Arrestor shall be capable of discharging overvoltage occurring during switching of unloaded transformers and long lines.
- 7.8.2.** The surge arrestor shall be of Metal Oxide, gapless, polymer housed along with Disconnector and mounting bracket. Arresters shall be suitable for vertical and horizontal mounting. The surge arresters shall conform in general to IEC-60099-4:2014 and IS: 3070 part-3.
- 7.8.3.** A surge arrester having one or several non-linear metal-oxide resistors with highly non-linear voltage-current characteristics, connected in series, but having no integrated series or parallel spark gaps .
- 7.8.4.** Disconnectors: The earth end shall get connected to the earth terminal of the arrester through the disconnector. The function of the disconnector is that in the event of, operation of the surge arrester, the current shall pass to earth and the disconnector shall disconnect (isolate) the earth terminal and it shall remain suspended on the mounting of the arrester. Thereby it will be disconnected from the earth and shall provide a visual indication to the patrolling personnel. The line can be recharged without isolating the damaged arrester.
- 7.8.5.** The reference current of the arrester shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage
- 7.8.6.** The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.
- 7.8.7.** The adhesion between the polymeric housing and the metal-oxide resistors or any other metallic or non-metallic parts inside the housing must be strong enough, homogeneous, robust and resistant to thermal cycles and environmental stresses.
- 7.8.8.** The arrester housing shall be made up of porcelain/silicon polymeric housing and shall be homogenous, free from laminations, cavities, and other flaws of imperfections that might affect

the mechanical and dielectric quality. The polymer material which is used for the arrester housing must be tracking and erosion resistant, stabilized against UV radiation.

7.8.9. GTP of Surge Arrestor

| Sr. No | Particulars | Value |
|--------|---|--|
| 1 | Type | Gapless metal Oxide and polymer housed |
| 2 | Arrester Max. Cont. Operating Voltage U_c | 7.65 KV rms |
| 3 | Arrester Rated Voltage U_r | 9 KV rms |
| 4 | Nominal Discharge Current I_n | 5 KAp (8x20 micro impulse shape) |
| 5 | Maximum residual voltage at 5 KA (KV peak) | 32 KV |
| 6 | Line discharge class | Distribution Class |
| 7 | Insulation withstand capacity of arrestor housing | |
| 7.1 | Power frequency withstand Voltage | 28 KV |
| 7.2 | 1.2/50 micro seconds impulse wave Peak | 75 KV |
| 8 | Minimum Creepage distance-Housing | 320 mm |

7.8.10. Following type tests of surge arrester shall be carried out in accordance with the latest version of specified standard at Govt. approved / NABL accredited lab /International Lab. Accredited Cooperation (ILAC) and test reports should not be older than 7 years as on date of opening the tender.

- I. Insulation withstand test.
- II. Residual voltage test
- III. Long duration current impulse withstand test.
- IV. Operating duty test.
- V. Pressure relief test (when fitted with relief device)
- VI. Tests of arrester disconnecter or (when fitted)
- VII. Artificial pollution test on porcelain housed arrestors.
- VIII. For porcelain housed arrestors
 - 1) Temperature cycle test on hollow porcelain housings.
 - 2) Porosity test.
- IX. Galvanizing test on exposed ferrous metal parts

7.8.11. The manufacturer shall carry out the following Acceptance test/ routine tests in accordance with Latest IEC 60099-4/ IS: 3070 part-3 Standard.

- I. Visual and Dimensional Check
- II. Measurement of reference voltage
- III. Residual voltage test
- IV. Leakage Current Test
- V. Partial Discharge Test

7.9. Arc protection devices :

7.9.1. The arc protection devices shall be supplied to protect insulator sets and covered conductors against damage caused by power arcs (arcing horns, arcing rings). It shall withstand maximum short-circuit current 10 kA for 1 s (As per clause 4.2.4 of En 50397-2:2009). It shall withstand a mechanical load in order to support the installation strengths.

7.9.2. The protection device includes two horns, which are fixed to the metal parts of the tension insulator so that the peaks are towards each other and the distance between the peaks is adjustable

7.9.3. The following type tests shall be conducted on Arc protection as per relevant standard EN 50397-2:2009, with latest amended.

- 1) Clamp bolt tightening test
- 2) Shear head function test
- 3) Hot dip galvanizing test
- 4) Damage to the main conductor test
- 5) Water tightness test
- 6) Short circuit test
- 7) Power arc test(only in connection with a complete insulation set)
- 8) Corrosion ageing test
- 9) Climate Ageing Test
- 10) Dimensional and Material Verification

7.9.4. The following routine/acceptance tests shall be arc protection device on connector as per relevant standard EN 50397-2:2008, with latest amended.

- 1) Visual examination
- 2) Dimension and material verification.
- 3) Clamp bolt tightening test
- 4) Shear head function test

- 5) Damage to the main conductor test
- 6) Hot dip galvanizing test

7.10. Earth parking Device/Insulation Piercing Connector with Aluminum Bail for earthing :

The earth parking device shall be capable of carrying the short circuit current. The maximum short circuit current shall be 10 kA for 1 s.

These fittings shall withstand a mechanical load in order to support the installation strengths.

7.10.1. The following type tests shall be conducted on Earth parking device as per relevant standard EN 50397-2:2009, with latest amended.

- 1) Clamp bolt tightening test
- 2) Shear head function test
- 3) Hot dip galvanizing test
- 4) Damage to the main conductor test
- 5) Water tightness test
- 6) Short circuit test
- 7) Mechanical test
- 8) Corrosion ageing test
- 9) Climate Ageing Test
- 10) Dimensional and Material Verification

7.10.2. The following routine/acceptance tests shall be Earth parking device on connector as per relevant standard EN 50397-2:2008, with latest amended.

- 1) Visual examination
- 2) Dimension and material verification.
- 3) Clamp bolt tightening test
- 4) Shear head function test
- 5) Damage to the main conductor test
- 6) Hot dip galvanizing test
- 7) Mechanical test

7.10.3. Marking of accessories:

All accessories mentioned above shall mark with the following:

- Manufacturer's trade mark or logo;
- AT No & date

- product code or reference;
- The minimum and maximum cross section area/diameter of the Covered Conductor for which the accessory is used.
- Batch number & Year of manufacturing.
- Property of _____

8. TESTS Requirements FOR 11 kV Covered Conductor with All Aluminum Alloy Conductor :

8.1. TYPE TESTS:

The Type test requirements of the Medium Voltage Covered Conductor shall be as per the clause No: 2.6 of this technical specifications. Which is required to be type tested as per relevant standards IS 398 Part-IV and & EN 50397-1:2006, with latest amended thereof. All the type tests as under shall be carried out at the laboratories accredited by National Accreditation Board of Testing and Calibration Laboratories (NABL) within India of each type of Covered conductor in accordance with technical specifications and relevant standard latest amended. Type tests shall not be more than 7 years old at the time of bid submission. The type test carried out on covered conductor made of watertight conductor and HDPE as the outer insulation layer, irrespective of the size of the base conductor shall only be considered valid. The proto-type material / product must fulfil all the Technical requirements like Technical Specifications, specified Drawings, guaranteed Technical parameters, manufacturing quality plan, etc.

- 1) Visual Inspection test.
- 2) UTS test on stranded conductor
- 3) Dimensional Check of individual aluminum wires.
- 4) Measurement of lay ratio.
- 5) Breaking load of individual wires.
- 6) Elongation test.
- 7) Wrapping test.
- 8) D.C Resistance Test on Stranded Conductor.
- 9) Chemical analysis of aluminium alloy

Beside this, the following type tests as per the requirement mentioned in the Table No.02 of the relevant standard EN 50397-1:2006, with latest amended, are also required to be submitted for covered conductor.

- 1) High voltage test(No.1.2 of Table -2)
- 2) Leakage current test (No.1.4 of Table -2)
- 3) Tracking resistance test (No.1.5 of Table -2)

- 4) Rated tensile strength (No.3.1 of Table -2)
- 5) Construction and dimensions Check (No.2 of Table -2)
- 6) Mechanical properties (No.4.1 of Table -2)
- 7) Before ageing of sample
- 8) After ageing of sample
- 9) Carbon black content test, (if carbon black used for UV stabilization ,No.4.2 of Table -2)
- 10) Resistance to UV rays test(If other than carbon black is used for UV-stabilization ,No.4.3 of Table -2)
- 11) Test of compatibility(No.5 of Table -2)
- 12) Ageing of complete product sample
- 13) Pressure test at high temperature(No.6.3 of Table -2)
- 14) Hot-set-test(No.6.2 of Table -2)
- 15) Shrinkage test(No.6.1 of Table -2)
- 16) Water absorption(No.7.1 of Table -2)
- 17) Test of the longitudinal water tightness(No.8 of Table -2)
- 18) Marking-Content, legibility and Durability test (No.9 of Table -2)
- 19) Slippage test(No.10 of Table -2)

8.2. ROUTINE TEST:

The following routine tests shall be conducted after covering as per sampling plan of QAP/Relevant specifications of the Covered conductor by the manufacturer at their works as per relevant standards.

- 1) Visual & dimensional check on drum as per specification.
- 2) Visual check for joints, scratches etc. and length of conductor by re-winding of conductor on empty drum as per Specification.
- 3) Measurement of dimensions of individual Aluminum Alloy wires .
- 4) Measurement of Lay Ratio
- 5) Breaking load of individual wires
- 6) Elongation Test
- 7) Wrapping Test
- 8) D.C. resistance Test

Beside this the following routine tests as per the requirement of relevant standard EN 50397-1:2006, with latest amended, shall also be conducted for covered conductor.

- 9) Spark Test on the Covering.
- 10) Construction and Dimension as per the No. 2 of Table 2)
 - a. Compliance with design requirement (No. 2.1 of Table 2)
 - b. Thickness of covering (No. 2.2 of Table 2)
- 11) Marking. (No. 9 of Table 2)
 - a. Content, legibility (No. 9.1 of Table 2)

8.3. ACCEPTANCE TESTS:

The following tests shall be conducted on samples taken at random from a lot as per relevant standard in presence of purchaser's representative.

- 1) Visual & dimensional check on drum as per specification.
- 2) Visual check for joints, scratches etc. and length of covered conductor by re-winding of conductor on empty drum as per Specification / IS.
- 3) Measurement of dia-meter of individual Aluminium wires.
- 4) Measurement of Lay Ratio
- 5) Breaking load of individual wires
- 6) Elongation Test
- 7) Wrapping Test
- 8) Resistance Test

Beside this the following test as per requirement of EN 50397-1:2006, with latest amended, shall also be conducted for covered conductor.

- 9) High Voltage Test
- 10) Construction and Dimension (No. 2 of Table 2)
 - a. Compliance with design requirement (No. 2.1 of Table 2)
 - b. Thickness of covering (No. 2.2 of Table 2)
 - c. Construction and Mechanical Properties of the conductor.
 - d. Tensile and elongation at break of Insulation and outer layer Construction and Dimension
- 11) Hot Set Test for insulation and outer layer
- 12) Tracking resistance test
- 13) Test of the Longitudinal water tightness
- 14) Leakage Current test

15) Marking. Content, legibility

8.4. SAMPLING PLAN:

Samples for Acceptance Tests: Samples shall be taken as per relevant EN 50397-1:2006 with the latest version as the case may be.

Apart from the sample selected for carrying out Acceptance Tests at the works of the firm during the inspection, one more sample from offered lot also selected under re-winding for carrying out various Acceptance Tests as per relevant ISIEC/EN. If any of the sample so selected from each length failed in any acceptance test the entire lot under inspection is not acceptable.

8.5. TOLERANCE ON TEST RESULTS:

Tolerance on test results shall be allowed as per relevant IS/IEC/EN/Spec. whichever is more stringent.

9. INSPECTION:

- 9.1.** The conductor shall be manufactured in accordance with the latest edition of EN 50397-1:2006 & respective GTPs as separately given in this technical specifications. with all subsequent amendments issued from time to time for Covered AAAC of various sizes . All the tests as mentioned in the relevant technical specifications shall be carried out on individual wires. The testing shall also include the tests on a manufactured finished conductor. Moreover, the supplier shall also furnish test certificate(s) of raw materials to the inspecting officer at the time of inspection.
- 9.2.** The Manufacturer shall provide all adequate facilities at his works for inspection of at least one number conductor drum or 5% conductor drums offered for inspection whichever is higher selected at random by the authorized representative of the purchaser for checking/verification of conductor length/ manufacturing defects by transferring the conductor from one drum to the another empty drum and at the same time measuring the length and lay ratio of each conductor length so transferred by means of the standard calibrated and sealed meter.
- 9.3.** The supplier shall provide adequate facilities for weighment of all the drums offered for inspection.
- 9.4.** The supplier shall present the latest Calibration Certificate(s) of testing instruments / equipment to be used for the testing of the material covered in the Purchase Order to the authorized inspecting officer / inspecting agency of the purchaser. The testing instruments / meters/ apparatus etc. should be got calibrated by the supplier from time to time from Govt. Lab or Independent test laboratory / house having valid accreditation from National Accreditation Board for Testing and Calibrating Laboratories for the testing equipment or original manufacturer having traceability to NABL / NPL or equivalent accredited lab.
- 9.5.** The calibration certificate(s) should not in any case be older than one year at the time of presenting the same to the inspecting officer / inspecting agency of the purchaser. The testing

instruments / equipment should be duly sealed by the Calibrating Agency and mention thereof shall be indicated in the calibration certificate(s).

9.6. All tests and inspections shall be made at the place of manufacturer unless otherwise specifically agreed upon by the purchaser. The manufacturers 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. The purchaser has the right to have the tests carried out at his own cost by an independent agency whenever in dispute regarding the quality of supply.

9.7. The supplier shall furnish the following documents as proof of purchase of RAW material along with each inspection offer.

a) Invoice of the supplier b) Supplier Test Certificate c) Packing List d) Bill of Landing e) Description of material, electrical analysis, physical inspection, certificate of surface defects, thickness and width of material wherever applicable.

10. End Sealing:

Heat Shrinkable end Caps with sealant shall be used for effectively sealing the end terminals of the covered conductor. The inner diameter range of the cap shall be such that it shall tightly fit to the covered conductors to prevent moisture ingress.

11. Standard length & variation in lengths :

11.1. The Covered All Aluminum Alloy conductor shall be supplied in the standard length. The standard length of Covered / Insulated AAA Conductor shall not less than the value specified below with a tolerance of (-) 5%. More than the standard length shall be acceptable.

a) 11 KV Covered AAAC of various sizes - 1000 Meters.

Short length(s), if any shall not measure less than 80% of standard length as specified above in any case. The total quantity of such short length(s) shall not exceed 5% of the quantity of the lot offered for inspection.

11.2. The maximum permissible length per drum shall be as under subject to condition that the manufacturer while packing the conductor in drum shall ensure that after winding complete quantity of conductor in drum a uniform space of not less than 100 mm. remains between outer layer of conductor and inner surface of the external protective lagging of the drum. This is essential to ensure that the conductor does not get closer to the lagging and to avoid damaged during transportation/ reeling / unreeling or rolling on the undulated ground / fields:

11.3. The Company shall ascertain the length of AAA COVERED Conductor at supplier's works and at the receiving store centers by measuring the actual length by length measuring machine used for the purpose. The supplier should ensure that length measuring machine is available for measurement of the length by our inspecting officer.

11.4. Both ends of the AAA COVERED Conductor will be sealed by the supplier and seals will be contained in the drum and not exposed out of drum.

- 11.5.** The declared length will be measured between manufacturer's seals at both ends of AAA COVERED Conductor.
- 11.6.** The weight of AAA COVERED Conductor will also be checked for ensuring correct lay and length of the AAA COVERED Conductor.
- 11.7.** For the verification of the length of the conductor, 10 % of total lot (in Drums) should be selected at the works. The physical verification of the length of the conductor should be carried out for maximum up to 5 (five) drums. If there are any more drums left for verification, then weight of each verified drum should be carried out and average weight may be calculated. Then the weight of each of all the remaining selected drums may be taken and if these weights are matching with the average weight, then that particular lot may be accepted otherwise rejected.
- 11.8.** Verification of length of conductor will also be carried out at each stores center for two drums out of each lot. If the average length is found correct or more, the lot will be accepted. If the average length is found to be less than the declared, the percentage of such short length will be applied for reduction for the entire quantity supplied in the lot at respective stores for acceptance.
- 11.9.** In case of dispute, joint inspection along with the representative of the supplier shall be carried out after giving 10 (ten) days' notice to the supplier to remain present at stores center for the purpose. If the representative fails to attend on stipulated date for joint inspection, the decision of the consignee shall be final and binding.

12. REJECTION:

While measuring the length, the sample piece from each length shall be taken for carrying out the test as per IS: 398 (Part IV) / 1994 (amended up to date) & EN 50397-1 : 2006 . All the values of each sample should not exceed the value as per the relevant specification. In case of deviation, whole lot will be rejected at works.

13. QUALITY ASSURANCE PLAN:

The successful bidder shall submit following information along with the bid:

- 13.1.** Test certificates of the raw materials and bought out accessories.
- 13.2.** Statement giving list of important raw material, their grades along with names of sub-suppliers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative.
- 13.3.** List of manufacturing facilities available.
- 13.4.** Level of automation achieved and lists of areas where manual processing exists.
- 13.5.** List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- 13.6.** List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports.

- 13.7.** The manufacturer shall submit Manufacturing Quality Assurance Plan (QAP) for approval & the same shall be followed during manufacture and testing.
- 13.8.** The successful bidder shall submit the routine test certificates of bought out raw materials/accessories and central excise passes for raw material at the time of inspection.
- 13.9.** The Company may at its option order the verification of these plans at manufacturer's works as a pre-qualification for technically accepting the bid. During verification if it is found that the firm is not meeting with the quality assurance plan submitted by the firm, the offer shall be liable for rejection.
- 13.10.** The material for final inspection shall be offered by the Supplier only under packed condition. The owner shall select samples at random from the packed lot for carrying out acceptance tests.
- 13.11.** The Supplier shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.

No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the owner in writing waives off the inspection. In the later case also the material shall be dispatched only after satisfactory testing specified here in has been completed.

14. PACKING AND MARKING :

- 14.1.** The packing shall have to be done as per standard practice worthy of road transport. The covered conductor shall be wound in strong wooden drums so as to withstand all stresses due to transportation, handling and stringing operation so that the conductor surface is not cut, dented, scratched or damaged in any way during manufacture, Transport & Stringing. The wooden drums shall be non-returnable and shall generally conform IS: 10418/1982 with latest amendments. The packing of accessories shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage.
- 14.2.** The covered conductor drum should be suitable for wheel mounting, before reeling, the cardboard or other suitable material shall be secured to the drum and inside flanges of the drums. After reeling, the exposed surface area of conductor shall be nearly wrapped with suitable soft material to protect the conductor from dirt and grit.
- 14.3.** However, use of seasoned wood shall not be insisted, provided wood used should be of good quality to withstand transportation hazards. The drums shall be having inside flanges painted with Aluminium Paint and with Ordinary White Enamel paint from outside. The conductor on each drum shall be securely fastened at each end. The outer end of the covered conductor shall be fastened inside the drum against one of the sides of the flanges while it is under tension and shall be such that no looseness is transmitted to the internal layers. The covered conductor shall be snugly, tightly and uniformly spooled on the drums. The wrapping of

covered conductor on the drums shall be laid snugly against side of the preceding wrap and the first and last wrap in each layer shall fit snugly against the sides of the flanges. Drums shall be lagged with sufficient strong wooden laggings to support the full drum without crushing. The wooden drums after providing lagging shall be fastened by two steel tapes over the lagging on the two sides of adequate size to keep the lagging intact and to prevent the drum from crushing/ damage.

- 14.4.** Although the various dimension of the drums such as flanges, stretches, traverse and barrel diameter shall depend on the quantity of covered conductor as offered and agreed upon, on one drum. The manufacturer while packing the covered conductor in drum shall ensure that after winding complete quantity of covered conductor in drum a uniform space of not less than 100 mm. remains between outer layer of covered conductor and inner surface of the external protective legging of the drum. This is essential to ensure that the covered conductor does not get closer to the legging and to avoid damaged during transportation/ reeling / unreeling or rolling on the undulated ground / fields.
- 14.5.** Water proof material shall be wrapped round the barrel and inner surface of flange before winding the covered conductor and also wrapped round over the covered conductor completely wounded and under the laggings.
- 14.6.** The drums shall be marked clearly in block letters with water proof mark having the marking attached to them so that there is no possibility of goods being lost or wrongly dispatched due to faulty marking. The marking shall constitute the following:-
- i. Name & full address of the consignee.
 - ii. Destination station.
 - iii. Serial number of drum/ Drum Identification number
 - iv. Voltage Grade and Size of covered conductor
 - v. Total length of Conductor in drum, with individual length (s).
 - vi. Number of length(s) in each drum.
 - vii. Gross mass of drum including the tare mass of drum.
 - viii. Net mass of conductor.
 - ix. Name of the supplier.
 - x. Purchase order reference/TN number.

Month and year of manufacturing besides above, an arrow shall be put on the drum so as to indicate the direction in which the drum can be unwound.

Beside this covered conductor shall also carry marking at regular interval as below:

Name of Manufacture or Trade Mark, Voltage Grade Covered AAA Conductor size in sq. mm. Year of Mfg., Standard EN 50397-P1.

15. Drawings shall be submitted as per EN 50397-Part-2 for approval conforming to technical specifications and standard requirements for the following.

1. Wedge type Tension clamp and one tracking protection IPC
2. Insulator Clamp / Helical Tie (IC)
3. Suspension Clamp (SC)
4. Mid span Joints (TJ)
5. Insulation Piercing Connector for Bare to Covered interconnection
6. Insulation Piercing Connector for Cover to Covered interconnection
7. Power arc devices – (PAD)
8. Surge Arrestor
9. Earth parking Device

Annexure –I

Guaranteed technical particulars

To be submitted along with Tender documents in triplicate as per format annexed herewith Technical characteristic shall be guaranteed by the bidder. In case of failure of materials to meet the GTPs, the Purchaser shall have right to reject the material.

| Sr. No | Parameter Name | Parameter Value / Name | |
|-----------|---|-------------------------|--------------------------|
| | | CCSX 55 AAAC W 11 kV | CCSX 100 AAAC W 11 kV |
| 1. | GENERAL: | | |
| 1.1 | Brand Name or Trade Mark | | |
| 1.2 | Manufacturer's Name & Address | | |
| 1.3 | Size of the Conductor | | |
| 1.4 | Lists of Standard applicable for conductor and Covered Conductor. | | |
| 1.5 | Manufactured as per reference standards (Yes/No) | | |
| 2. | BASE CONDUCTOR: | | |
| 2.1 | Material | | |
| 2.2 | Nos of strands | | |
| 2.3 | Diameter of strand-mm A) Nominal B) Max C) Min | | |
| 2.4 | Cross section are strand-mm ² | | |
| 2.5 | Overall Diameter of Conductor (mm) | | |
| 2.6 | Cross section area of Conductor(mm ²) | | |
| 2.7 | Class / Grade | | |
| 2.8 | Nominal cross section area of conductor (mm Sq.) | | |
| 2.9 | Maximum DC resistance at 20° C Ohm /KM | | |
| 2.10 | Maxi Inductive reactance OHM /KM | | |
| 2.11 | Lay ratio | | |
| 2.12 | Maximum allowable Continuous Conductor Temperature (in °C) | | |
| 2.13 | Maximum allowable Short time Conductor Temperature (in °C) | | |
| 2.14 | Breaking Load of conductor (KN) | | |
| 2.15 | Conductor is compacted (Yes/No) | | |
| 2.16 | Longitudinally water tight Conductor (Yes/No) | | |

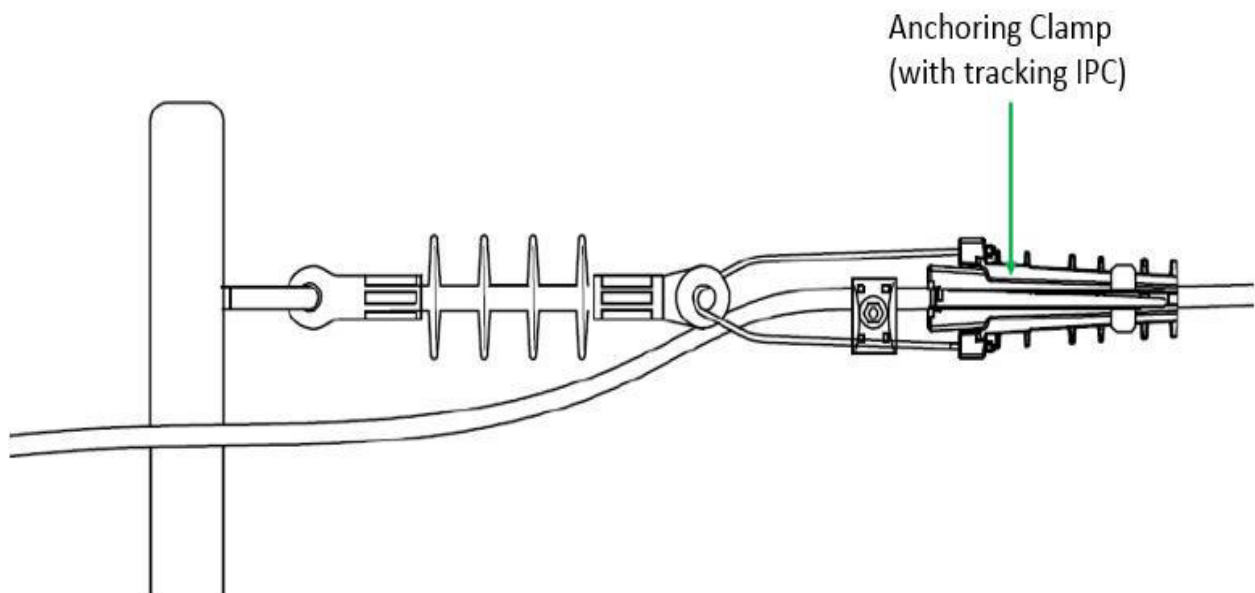
| | | | |
|------|---|--|--|
| 3. | CONDUCTOR SCREENING: | | |
| 3.1 | Material | | |
| 3.2 | Nominal thickness (mm) | | |
| 4. | INSULATION: | | |
| 4.1 | Insulation Material (Inner Layer) | | |
| 4.2 | Insulation Material (Outer Layer) | | |
| 4.3 | Nominal thickness–Inner layer(mm) | | |
| 4.4 | Nominal thickness Outer Layer (mm) | | |
| 4.5 | Tolerance on thickness (Inner/Outer) | | |
| 4.6 | Color of Insulation (Inner/Outer) | | |
| 4.7 | Method of application of Insulation | | |
| 4.8 | Type of curing of XLPE Insulation. | | |
| 4.9 | Outer insulation layer is UV Protected, Weather resistance and tracking resistance HDPE(Yes/No) | | |
| 5. | Complete Covered Conductor: | | |
| 5.1 | Maximum operating voltage of the Cable | | |
| 5.2 | Rated Voltage of the Cable | | |
| 5.5 | Continuous current carrying capacity in air at Ambient Temp.40° C (Amp) & 80 °C operating temp. | | |
| 5.6 | Maximum short circuit current for 1 Sec. (KA) | | |
| 5.7 | Approximate overall diameter of cable(mm) | | |
| 5.8 | Approximate overall cross section area of cable (mm ²) | | |
| 5.9 | Approximate Total weight of cable KG / KM. | | |
| 5.10 | Allowable sag as a percentage of span length at 40°C ambient temperature & permissible span length for 8 meter PSC pole and with planting length of 1.5 MTR | | |
| 5.11 | Permissible maximum span length in MTR with above allowable sag calculations for 8 MTR PSC pole network | | |
| 5.11 | Marking on Cable (Write text) | | |
| 5.12 | Max. continuous operating conductor temperature (°C) | | |
| 5.13 | Max. Leakage current (mA) | | |
| 6. | DRUM: | | |

| | | | |
|-----|--|--|--|
| 6.1 | Standard drum length (Mtr.) & tolerance of each drum | | |
| 6.2 | Dimension of Drum | | |
| 6.3 | Shipping Weight. | | |
| 6.4 | Bending radius of the cable | | |
| 6.5 | Overall quantity tolerance | | |
| 6.6 | Drum material | | |

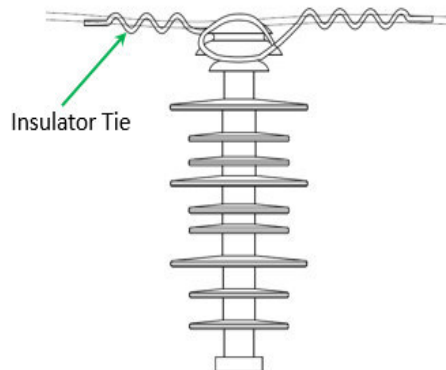
1. ANNEXURE II: - GENERAL ARRANGEMENT AND INDICATIVE DRAWINGS

1. Tension Assembly (TA) with Anchoring clamp and one Tracking protection IPC

Anchoring with protection against Tracking.



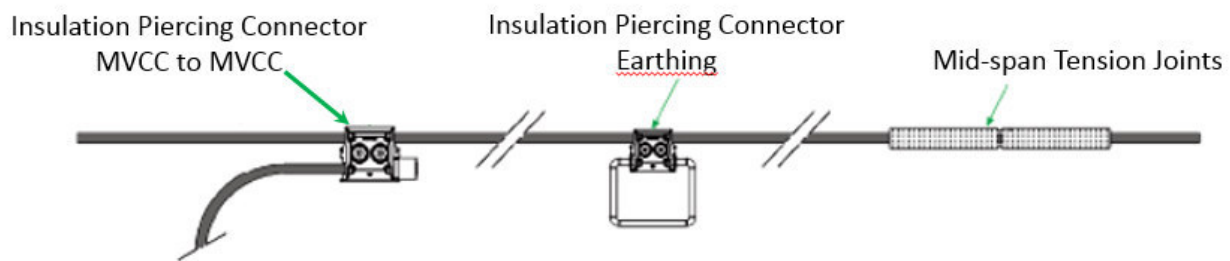
2. Insulator Clamp / Tie (IC):



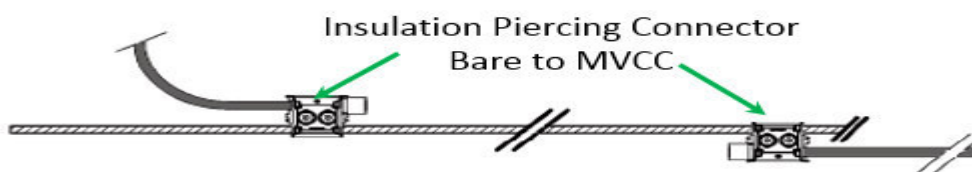
3. Suspension Clamp (SC):



4. TYPE-1: Insulation Piercing Connector for Networking / Branching /Looping, TYPE -3: Insulation Piercing Connector with Aluminum Bail for earthing and Tension Joints (TJ)



5. Insulation Piercing Connector for Bare to Covered interconnection



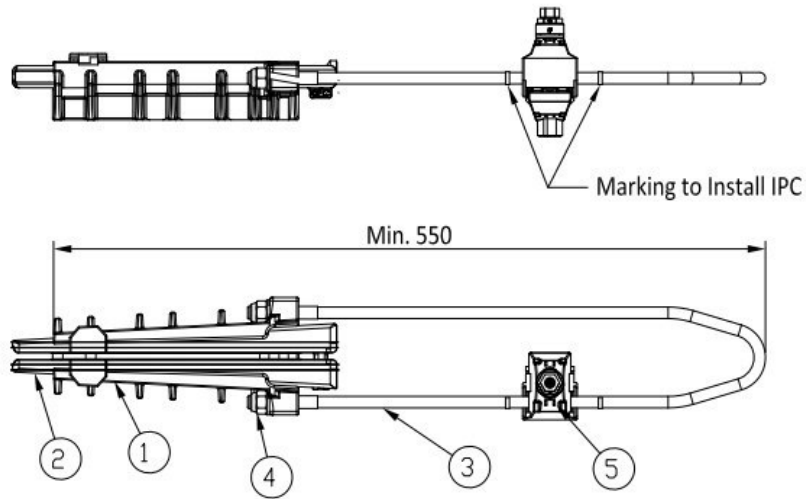
INDICATIVE DRAWINGS

1. Tension Assembly (TA) with Anchoring clamp and one Tracking protection IPC

STANDARD: EN 50397-2

MARKING: Manufacturer Name/Logo

Manufacturing period (Month and Year)



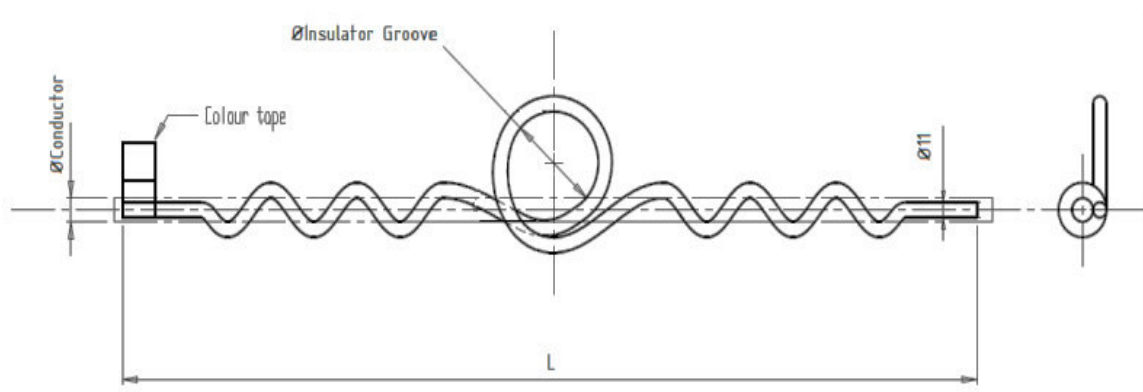
| | | | |
|-------|-----|-------------------------------|--------------------------------------|
| 5 | 1 | INSULATION PIERCING CONNECTOR | |
| 4 | 2 | LOCK NUT | STAINLESS STEEL |
| 3 | 1 | RIGID BAIL | GALVANISED STEEL |
| 2 | 2 | WEDGES | HEAT AND UV STABILIZED THERMOPLASTIC |
| 1 | 1 | ALUMINIUM BODY | ALUMINIUM ALLOY |
| SL.NO | QTY | DESCRIPTION | MATERIAL |

DEAD END CLAMP

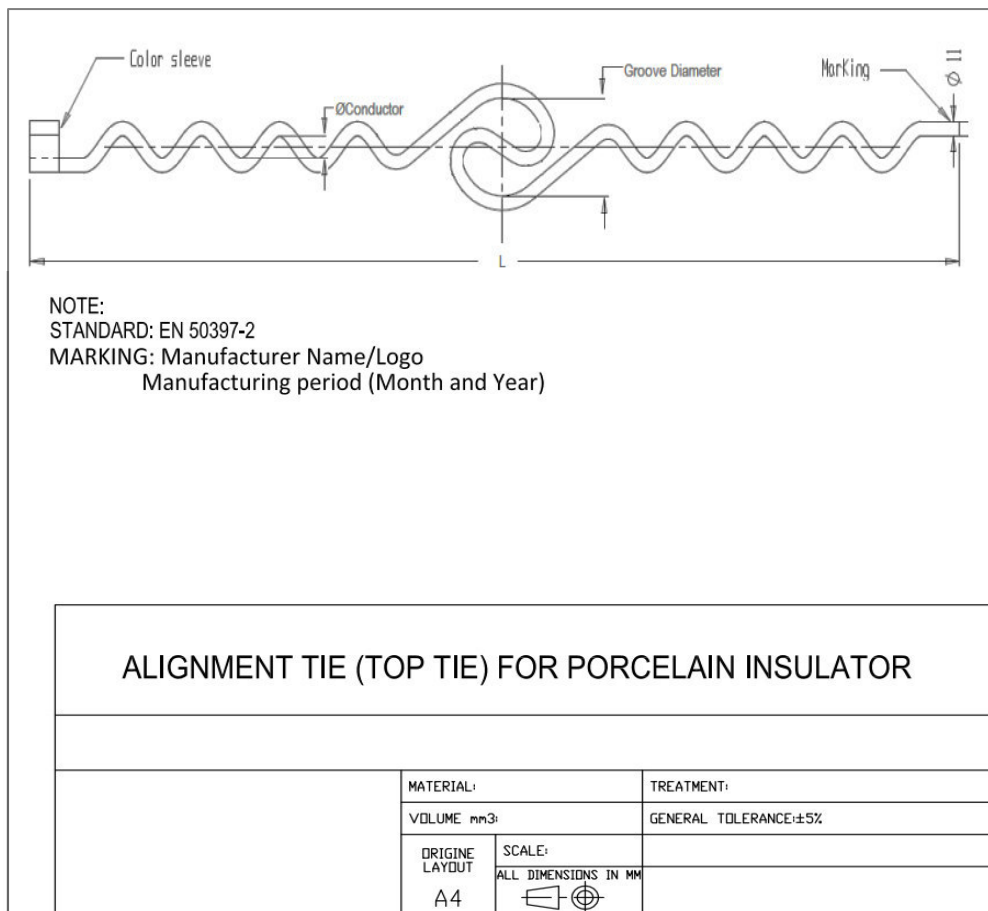
| | | | |
|-----------------------------|----------------------|--------------------|-----|
| MATERIAL: | | TREATMENT: | |
| VOLUME mm ³ : | | GENERAL TOLERANCE: | ±5% |
| ORIGINE LAYOUT A4 | SCALE: | | |
| | ALL DIMENSIONS IN MM | | |

2. Insulator Clamp / Tie (IC)

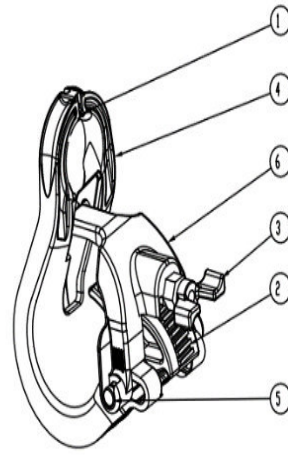
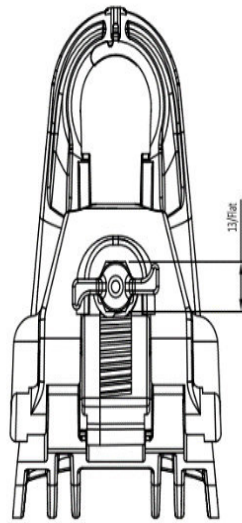
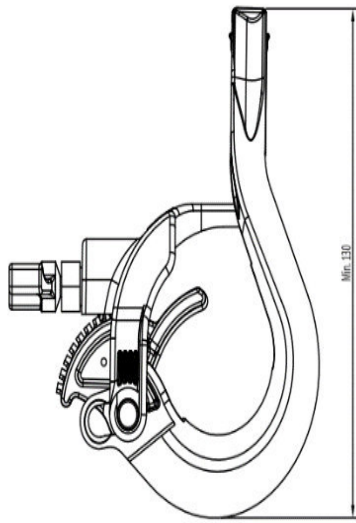
Alignment Tie (Side Tie) for Porcelain Insulator



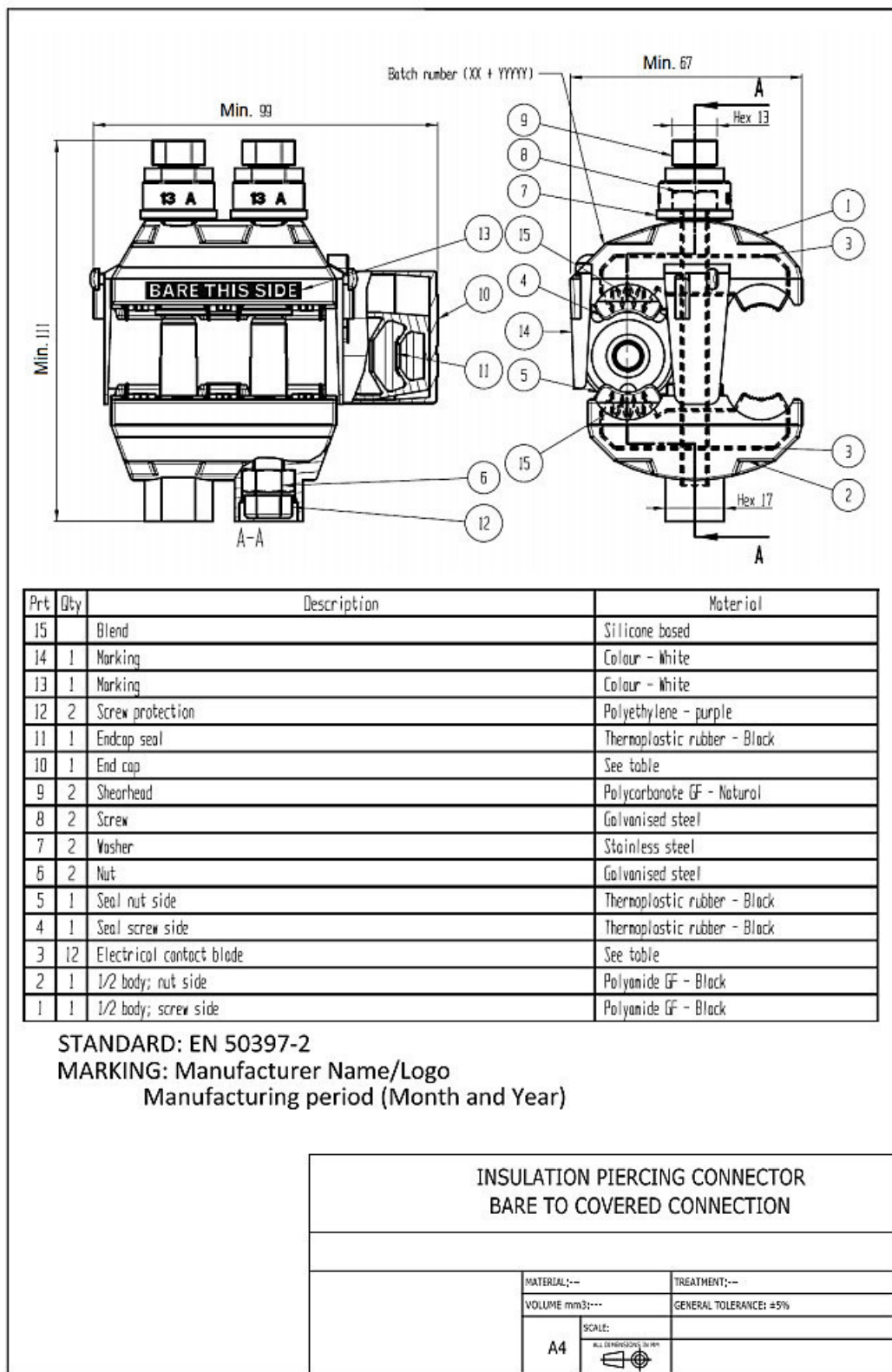
Alignment Tie (Top Tie) for Porcelain Insulator



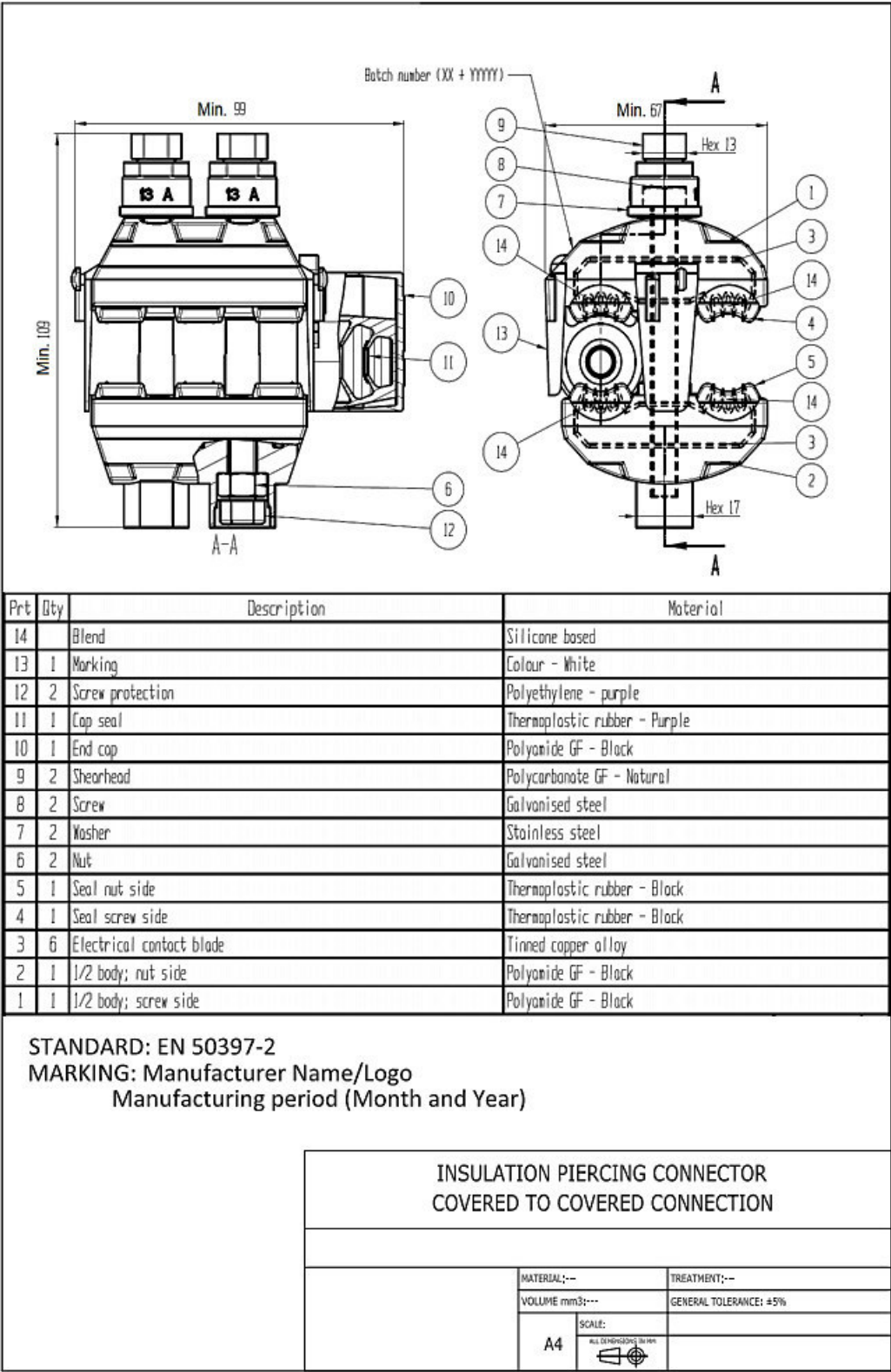
3. Suspension Clamp (SC)



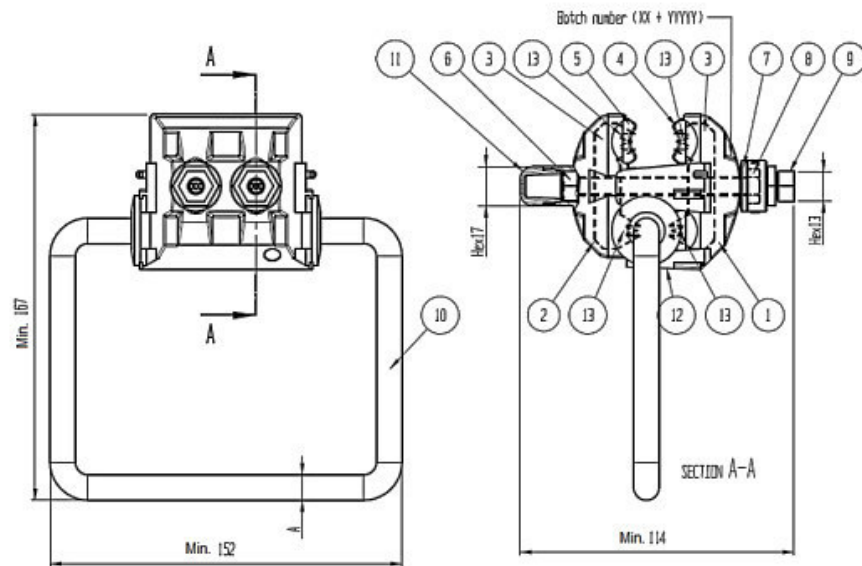
4. Insulation Piercing Connector for Bare to Covered interconnection



5. Insulation Piercing Connector for Networking / Branching /Looping



6. Insulation Piercing Connector with Aluminum Bail for earthing

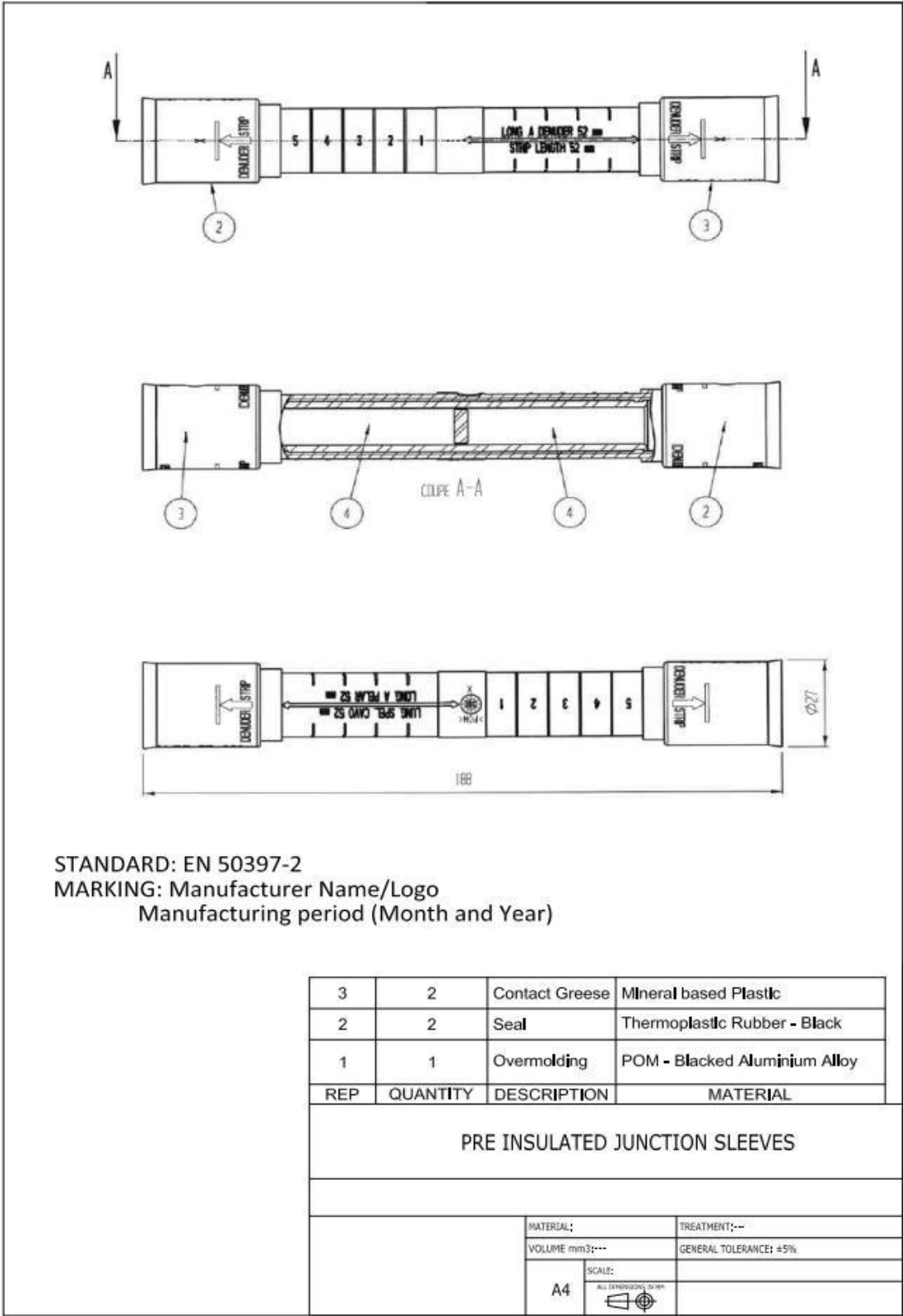


| Prt | Qty | Description | Material |
|-----|-----|--------------------------|------------------------------|
| 13 | | Lubricant | Silicone based |
| 12 | 1 | Marking | Colour - White |
| 11 | 2 | Screw Protection | Polyethylene - Purple |
| 10 | 1 | Bail (See table) | See table |
| 9 | 2 | Shearhead | Polycarbonate GF - Natural |
| 8 | 2 | Screw | Galvanised steel |
| 7 | 2 | Washer | Stainless steel |
| 6 | 2 | Nut | Galvanised steel |
| 5 | 1 | Seal; nut side | Thermoplastic rubber - Black |
| 4 | 1 | Seal; screw side | Thermoplastic rubber - Black |
| 3 | 6 | Electrical contact blade | Tinned copper alloy |
| 2 | 1 | 1/2 body; nut side | Polyamide GF - Black |
| 1 | 1 | 1/2 body; screw side | Polyamide GF - Black |

STANDARD: EN 50397-2
MARKING: Manufacturer Name/Logo
Manufacturing period (Month and Year)

| INSULATION PIERCING CONNECTOR EARTHING | | |
|---|----------------|------------------------|
| | | |
| | MATERIAL:-- | TREATMENT:-- |
| | VOLUME mm3:--- | GENERAL TOLERANCE: ±5% |
| | SCALE: A4 | |

7. Tension Joints (TJ)



ANNEXURE-III - Guaranteed Technical Particular of accessories

1) GTP for Wedge type Tension Clamp

| Sr. No. | Description | Particulars |
|---------|--|--|
| 1 | Name of the Supplier | |
| 2 | Type of Design | |
| 3 | Weight | |
| 4 | Cable Range (Range shall be in line with this specification) | |
| 5 | Material | |
| 6 | Ultimate Tensile Strength | For conductor range of 50 – 70 sqmm = 20 KN For conductor range of 70 - 120 sqmm = 30 KN For conductor range of 120 - 200 sqmm = 60 KN |
| 7 | Installation(With/Without disassembly) | Ready- to-use (Without disassembling) |
| 8 | Marking | |
| 9 | Dimensions | |
| 10 | Wedge Clamp with IPC (YES/NO) | |
| 11 | Type tests confirming to EN50397-2:2009? (Yes/No) | |

2) GTP for Alignment Tie

| Sr. No. | Description | Particulars |
|---------|--|-------------|
| 1 | Name of the Supplier | |
| 2 | Name of Model No | |
| 3 | Length | |
| 4 | Weight | |
| 5 | Cable Range (Range shall be in line with this specification) | |
| 7 | Material | |

| | | |
|----|--|---|
| 8 | Installation(With/Without disassembly) | Ready- to-use (Without disassembling) |
| 9 | Marking | |
| 10 | Insulator Groove range (mm) | |
| 11 | Type tests confirming to EN50397-2:2009? (YES/No) | |

3) **GTP for Suspension Clamp**

| Sr. No. | Description | Particulars |
|---------|--|---|
| 1 | Name of the Supplier | |
| 2 | Cable Range (Range shall be in line with this specification) | |
| 3 | Material | |
| 4 | Minimum Breaking Load – Vertical (80 % of conductor tensile load as per EN 50397-2) for Each size of Covered Conductor | |
| 5 | Installation(With/Without disassembly) | Ready- to-use (Without disassembling) |
| 6 | Marking | |
| 7 | Dimensions | |
| 8 | Weight | |
| 9 | Type tests confirming to EN50397-2:2009 (YES/No) | |

4) **GTP for INSULATION PIERCING CONNECTOR**

| Sr. No | Particulars | |
|--------|---|--|
| 1 | Name of supplier | |
| 2 | Type of connection required | Bare to Covered conductor Covered conductor to Covered conductor Tapping connector |
| 3 | Are torque limiting shear heads provided to tightening bolts? | |

| | | |
|----|--|--|
| 4 | Range of cable sizes accommodated for Main & Branch | |
| 5 | Tightening Torque | |
| 6 | Torque for establishing connection between main and Tap (Nm) as per EN 50397-2 | |
| 7 | Marking and embossing on the connector | |
| 8 | Dimensions and weight | |
| 9 | Continuous current carrying capacity at 40 Deg. Ambient temperature without derating (Amp) | |
| 10 | Short time withstand rating (KA/1 Sec) | |
| 11 | Type Tests confirming to EN50397-2:2009 : YES/No | |

5) GTP for INSULATED MIDPSAN JOINTS

| Sr. No | PARTICULARS | |
|--------|--|-----------------------------------|
| 1 | Name of Supplier. | |
| 2 | IS manufacturer of Accessories an ISO 9001-2000 Company? | |
| 3 | Type No & Size Range | |
| 4 | Is any metallic part carrying potential in operation exposed during installation | |
| 5 | Installation | Crimping by Hexagonal Compression |
| 6 | Continuous current carrying capacity at 40 Deg. Ambient temperature without derating (Amp) | |
| 10 | Short time withstand rating (KA/1 Sec) | |
| 11 | Type Tests confirming to EN50397-2:2009 : YES/No | |

6) GTP for EARTH PARKING DEVICE

| Sr. No | Particulars | |
|--------|---|--|
| 1 | Name of supplier | |
| 2 | List of subcomponents of Earth Parking Device | |
| 3 | Are torque limiting shear heads provided to | |

| | | |
|----|--|-----------------------------|
| | tightening bolts? | |
| 4 | Range of cable sizes | |
| 5 | Tightening Torque | |
| 6 | Torque for establishing connection | 70% of min torque specified |
| 7 | Marking and embossing on the connector | |
| 8 | Dimensions and weight | |
| 9 | Short time withstand rating (KA/1 Sec) | |
| 10 | Type Tests confirming to EN50397-2:2009 : YES/No | |

7) 11 KV Surge Arrestor:

| Sr. No | Particulars | Value |
|---------------|---|--------------|
| 1 | Manufacturer Name | |
| 2 | Type | |
| 3 | Arrester Max. Cont. Operating Voltage Uc | |
| 4 | Arrester Rated Voltage Ur | |
| 5 | Nominal Discharge Current In | |
| 6 | Maximum residual voltage at 5 KA (KV peak) | |
| 7 | Line discharge class | |
| 8 | Insulation withstand capacity of arrester housing | |
| 8.1 | Power frequency withstand Voltage | |
| 8.29 | 1.2/50 micro seconds impulse wave Peak | |
| 9 | Minimum Creepage distance-Housing | |
| 10 | Housing Type | |
| 11 | Housing Material | |

8) Arc Protection Device:

| Sr no | Particulars | Value |
|--------------|--------------------------|--------------|
| 1 | Name of the Manufacturer | |
| 2 | Applicable standard | |
| 3 | Type of Design | |
| 3 | Type No & Size Range | |

| | | |
|---|---|--|
| 4 | Horn material | |
| 5 | Main body material | |
| 6 | Aluminium thread size | |
| 7 | Recommended Gap size (mm) | |
| 8 | Type Tests confirming to EN50397-2:2009 : YES/No | |

5. 11 KV AL59 ACS Covered Conductor (MVCC) and its accessories

1. SCOPE:

- 1.1.** The work is to be executed on turnkey basis, the scope of which includes survey, network design, supply, manufacturer's quality assurance, testing (where specified/ required), transportation, storage, erection, including all civil/ structural works, site testing, commissioning of AL59 ACS type 11 KV covered conductor and its relevant accessories including all associated activities though not exclusively specified herein and are required for the completion and satisfactory performance of the entire works as intended.
- 1.2.** The base conductor used to manufacture the covered conductor shall require to confirm the latest standards and its amendments thereof. The AL59 ACS Conductor shall be conforming to SS 424 08 13, SS 424 08 14 & IEC 61232:1993 with the latest amendment and the insulation for covering shall be conforming as per the requirement given in Table-1 of the standard EN50397-1:2006 with the latest amendments. The accessories of the covered conductor shall be conforming to EN50397-2:2009 with the latest amendments.
- 1.3.** The AL59 ACS Covered conductor shall conform in all respects to the highest standards of Engineering, design, workmanship, the technical specifications and the latest revisions of relevant standards at the time of offer and the authorized person of DISCOM have the power to reject any work or materials, which his judgment, is not in full accordance therewith.

2. SPECIAL INSTRUCTIONS TO BIDDER:

- 2.1.** The Bidder shall require to design, engineering, & manufacturing of Covered Conductor from the core to finish in-house, testing at manufacturer's works, supply and delivery of 11 kV AL59 ACS covered conductor with relevant accessories to the respective store of the DISCOMs.
- 2.2.** The bidder is required to impart training in view of manufacturing, assembly, erection with accessories, operation, and maintenance for the offered item, at his works and, to the person/s identified by the DISCOMs, in the event of an order, free of cost. In the training session, the bidder shall confirm that he has to impart all the important aspects of the tender items, its usage, Installation practice of covered conductor and its accessories, the purpose of the individual components, possible defects, and its remedies at the time of erection and after in service, etc.
- 2.3.** The bidder shall bring out all the technical deviation/s only at the specified annexure.
- 2.4.** The bidder shall submit a Quality Assurance Plan for the manufacturing process and Field Quality Plan with the technical bid.
- 2.5.** The Bidder should be a manufacturer of covered conductors in India.
- 2.6.** The bidder shall have to submit the required type test reports as per the relevant standards at the time of bid submission only and it is required that the type test reports should not be older than 07 years at the time of bid submission. All the required type tests listed in the relevant standard for the covered conductor shall be required to conduct in the span of one year only. A type test shall be performed on every covered conductor type, irrespective of the cross sectional area. The

results will be valid across the whole range of cross sectional areas for that type. The type tests reports shall be submitted as per required type of covered conductor as mentioned in clause No.6.3 of this technical specifications. Non-submission of the type test reports shall be liable to reject the bid itself.

- 2.7.** It is not the intent to specify completely here in all the details of the design & construction of material. However, the material shall conform in all respects to high standards of Engineering, design, and workmanship operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble-free operation. Such components shall be deemed to be within the scope of the bidders supply irrespective of whether these are specifically brought out in his specification and/or purchaser order or not.

3. SYSTEM PARTICULARS/DISTRIBUTION NETWORK PARAMETERS :

The normal system parameters of the distribution network are as below.

| | |
|-------------------------------|---------------------|
| Network | 3Phase-3wire |
| Max. System Voltage | 12 kV |
| Nominal System Voltage | 11 KV |
| No of phases | Three |
| System Frequency | 50 Hz \pm 3% |
| Neutral earthing | Solidly Grounded |
| Method of earthing | Effectively earthed |
| Fault Level (Minimum) | 20 KA For 3 sec. |

4. ATMOSPHERIC PARTICULARS:

| | |
|--|---------|
| Maximum Ambient Air Temperature | 50° C |
| Minimum Ambient Air Temperature | 5° C |
| Maximum daily average ambient air temperature | 40°C |
| Maximum temperature attained by an object exposed to sun | 70°C |
| Maximum humidity | 99% |
| Altitude above M.S.L. (maximum) | 1000Mtr |
| Average annual rainfall (mm) | 925 |
| Max. wind pressure(Kg/sqm) | 260 |
| Average number of rainy days per Annum | 90 |
| Seismic level (Horizontal accn.) | 0.3 g |
| Iso-ceraunic level(Days per Year) | 50 |
| Average thunder storm days per annum | 50 |

Note: The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.

5. APPLICABLE STANDARDS:

The conductor shall conform to the following Indian/International Standards, which shall mean latest revisions, with amendments/changes adopted and published, unless specifically stated otherwise in the technical specification.

| Sr. No | Applicable Standard Indian/International | Standard Description |
|---|---|--|
| 1 | SS 424 08 13 & SS 424 08 14 | Aluminum alloy wire for stranded Conductors for over headlines- Al 59 wires & Aluminum alloy stranded AL59 Conductors for overhead lines specifications |
| 2 | IS 1521 :1972 | Method of Tensile testing of steel wire |
| 3 | IS 10418 (1982) | Drums for electric cables |
| 4 | EN 50397-1:2006 | Covered conductors for overhead lines and the accessories for rated voltages above 1 kV a.c. and not exceeding 36 kV a.c. Part 1: Covered conductors |
| 5 | EN 50397-2:2009 | Covered conductors for overhead lines and the accessories for rated voltages above 1 kV a.c. and not exceeding 36 kV a.c. Part-2: Accessories for Covered conductors: Tests and Acceptance criteria |
| 6 | EN 50397-3:2010 | Covered conductors for overhead lines and the related accessories for rated voltages above 1 kV a.c. and not exceeding 36 kV a.c. Part 3: Guide to Use |
| 7 | IEC 61232:1993/ IEC 63248:2022 | Aluminum-clad steel wires for electrical purposes/ cladded metallic wire for concentric lay stranded conductors |
| 1.All Indian Electricity Rules/ Bills amended up to date applicable for clearances, safety and operation of the equipment 2.The successful Bidder must consider the general recommendations for selection, storage, transportation of the covered conductor and the related accessories as per EN 50397-3:2010 | | |

6. Technical requirement:

6.1. Conductor Code as per EN 50397-1: 2006

| Type Code | CC | |
|-------------------|----|---------------------------------|
| Covering Material | S | -for semi-conductive screen |
| | X | -for cross-linked Polyethylene |
| | T | -for thermoplastic polyethylene |

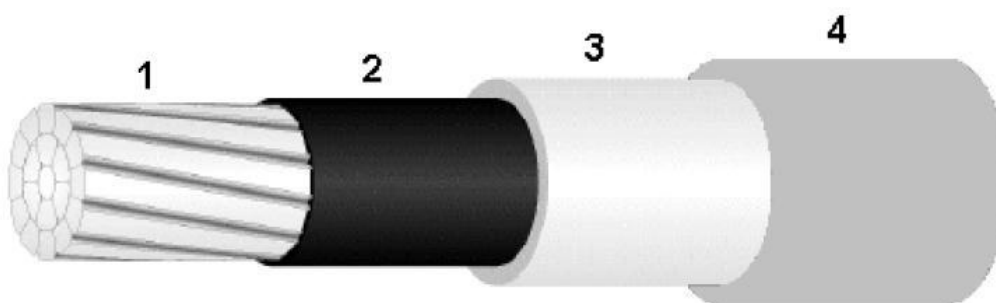
| | | |
|--------------------------------------|--------------------------------|--|
| Conductor material and cross section | According to relevant standard | AL59 ACS |
| Conductor design | W K | -for water tight -for compacted |
| Rated Voltage U in kV | kV | |
| Conductor Code | CCSX ▲-AL59 ACS WK UKV | ▲ = Nominal Conductor Cross Section in mm ² ; U= Rated Voltage (in KV) |

6.2. Covered Conductor Code used in this specifications as per EN 50397-1:2006

| Sr. No. | Description | Covered Conductor Code |
|---------|---|---------------------------|
| 1 | 11 kV AL59 ACS Rabbit Covered Conductor | CCSX 55 AL59 ACS W 11 kV |
| 2 | 11 kV AL59 ACS Dog Covered Conductor | CCSX 100 AL59 ACS W 11 kV |

6.3. Constructional requirement:

The covered conductor shall conform in general to EN 50397-1/2006.



- 1- Longitudinally watertight conductor
- 2- Extruded semi-conducting compound
- 3- XLPE insulation
- 4- HDPE having UV protection, erosion resistance and anti-tracking properties

6.3.1. Conductor :

The material offered shall be of the best quality and workmanship. The Insulated / Covered conductor shall be formed longitudinally watertight and constructed from AL59 Aluminum alloys & Aluminum Clad Steel Reinforced (AL59 ACS) which have the mechanical and electrical properties specified in SS4240813 for AL-59 alloy wires and, SS4240814 for AL59 conductor & IEC 61232/ IEC 63248:2022 for Aluminum clad steel wire. The properties of the Aluminum Alloy AL-59 wires, Aluminum Clad Steel wire and the final AL59-ACS

conductor shall be as per the reference table-1, table-2 and Table-3 of this technical specifications.

6.3.1.1. Properties of the Aluminum Alloy AL-59 wires: The minimum requirement of the properties of Aluminum Alloy AL-59 wires and Aluminum Clad Steel wire to be used in the construction of the stranded conductors shall be as mentioned in the Table – I and as per the relevant standard.

Table – I

| Sr No | No of strands and its dia. (mm) | Diameter of wire (mm) | | Cross sectional Area of nom.wire (mm ²) | Approx. mass (Kg/Km) | Calculated Resistance@20 ⁰ C (Max) Ω/kM | Approx. Calculated Breaking Load (kN) |
|----------|---------------------------------|-----------------------|------|---|-------------------------|--|---------------------------------------|
| | | Nominal | Max | | | | |
| 1 | Alu. 6/3.35 + ACS 1/3.35 | 3.31 | 3.38 | 8.81 | Alu. 23.82 + ACS 58.08 | 3.465 | Alu. 2.20 + ACS 10.40 |
| 2 | Alu. 6/4.72 + ACS 1/4.72 | 4.67 | 4.77 | 17.49 | Alu. 47.30 + ACS 115.31 | 1.745 | Alu. 4.02 + ACS 17.50 |

6.3.1.2. The properties of the conductor: The general requirement of the stranded non compacted Aluminum Alloy AL-59 with ACS conductor shall be as per the table-2 below and as per the relevant standards.

Table – 2

| Sr No | Type of conductor | Cross sectional Area of conductor (mm ²) | Approx. overall dia. (mm) | Approx. mass (Kg/Km) | Calculated Resistance@20 ⁰ C (Max) Ω/kM | Approx. Calculated Breaking Load (kN) | Reactance per kM | Continuous Current Rating without covering Amp | Lay Ratio |
|-------|-------------------|--|---------------------------|----------------------|--|---------------------------------------|------------------|--|-----------|
| 1 | AL59 ACS Rabbit | 52.88 | 10.05 | 203 | 0.5272 | 22.55 | 0.27 | 230 | 10 to 14 |
| 2 | AL59 ACS DOG | 104.98 | 14.16 | 403 | 0.2740 | 41.60 | 0.2485 | 345 | |

6.3.2. Filling (Water Blocking):

The Stranded Conductor shall be longitudinally watertight by means of water blocking material incorporated during the extrusion process. The use of grease /water-swellable tape / water-swellable powder etc. is not permitted. The water blocking material shall be stable at a maximum operating conductor temperature of 90⁰ C. The water-blocking compound shall be

compatible with the conductor material as well as the semiconducting polymer screen layer above it and not adversely affect its electrical or mechanical properties.

6.3.3. Conductor screen

The conductor shall be provided with a semi conducting screen by extruded semi-conducting Compound.

6.3.4. Insulation

The insulation shall be as per standard EN 50397 -1 comprising of two layers. The Average thickness of the covering insulation shall not be less than that stipulated in the Technical requirements. The physical and electrical properties of insulating compounds shall be as specified in the EN 50397-1.

1- The inner layer of main XLPE insulation shall be unfilled and shall not contain Carbon black.

2- The outer covering of HDPE insulation which also serves as protective covering shall be UV Stabilized, weather resistant and Track resistant.

Properties of covering material shall meet the requirements specified in Table-1 & 2 of EN 50397-1:2006. Tracking resistance as per EN 50397-1 shall be applicable. Manufacturer should have in-house test facility to conduct tracking resistance test as per EN 50397-1. This test during the acceptance of the manufactured lot shall be conducted on one sample of each size of covered conductor and test report shall be required to submit.

Conductor screen, inner XLPE insulation and outer HDPE insulation shall be manufactured simultaneously using triple extrusion process in a single operation to ensure a good, permanent bond between the three layers and also with the conductor.

6.4. Principal Parameters Of Covered Conductor:

6.4.1. The GTP of 11 kV Covered All Aluminum Alloy conductor are tabulated below:

| Sr. no. | Particulars | Unit | Conductor Type | |
|---------|---|--------|---|------------------------------|
| | | | CCSX 55 AL59 ACS W 11 kV | CCSX 100 AL59 ACS W 11 kV |
| 1 | Applicable Standard | - | EN 50397-1 for Covered Conductor & SS 424 08 13 , SS 424 08 14 & IEC 61232 for base Conductor | |
| 2 | Conductor Material | | AL59 as per SS 4240814 & ACS Class 20SA/Grade A | |
| 3 | Conductor shape | | Non-Compacted Watertight stranded | |
| 4 | Nos of strand and diameter of aluminum Alloy AL59 | Nos/mm | 6/3.35 | 6/4.72 |
| | Nos of strand and diameter of aluminum | | 1/3.35 | 1/4.72 |

| | | | | |
|------|---|-----------------|--|--------|
| | clad steel (ACS) | | | |
| 5 | Nominal Cross Sectional area of conductor | mm ² | 52.88 | 104.98 |
| 6 | Nominal Conductor diameter | mm | 10.05 | 14.16 |
| 7 | Lay ratio of Al. wire Outermost layer | Min | 10 | 10 |
| | | max | 14 | 14 |
| 8 | Calculated resistance at 20°C (max) | Ω/ kM | 0.5272 | 0.274 |
| 9 | Approximate breaking load(without insulation) | KN | 22.55 | 41.6 |
| 10 | Continuous current carrying capacity in air at 40°C ambient & 80 °C operating temp. | Amp | 211 | 300 |
| 11 | conductor screen | | | |
| 11.1 | Material | - | Extruded Semi-Conducting Compound | |
| 11.2 | Nominal thickness | mm | 0.3 | |
| 12 | Inner insulation Layer | | -- | |
| 12.1 | Material | | XLPE | |
| 12.2 | Nominal thickness | mm | 1.2 | |
| 13 | outer insulation layer | | -- | |
| 13.1 | Material | | UV stabilized, Erosion resistant and Tracking resistant HDPE | |
| 13.2 | Nominal thickness | mm | 1.1 | |

6.5. IDENTIFICATION MARKS ON COVERED CONDUCTOR:

The following particulars shall be properly legible embossed/Printing on the covered conductor at the intervals of not exceeding one meter throughout the length of the covered conductor. The covered conductor with poor and illegible embossing/Printing shall be liable for rejection.

- a) Manufactures name and/or Trade name.
- b) Voltage grade.
- c) Year of manufacture.
- d) Name of the DISCOM
- e) Successive Length.
- f) Identification of Covered Conductor as per Standard EN 50397-1: 2006

Also the following information be marked on each drum package:

- a) Manufacturer's name
- b) Trade mark ,if any
- c) Drum or identification number
- d) Size of conductor Number and lengths of conductors
- e) Gross mass of the package
- f) Net mass of conductor
- g) EN 50397-1: 2006.

7. ACCESSORIES:

7.1. The Accessories which shall be used with Medium Voltage Covered Conductor (MVCC) are specified as per the below Table-A. The bidder shall furnish valid and authenticated type test certificates as per relevant standard & technical specifications and not older than 07 years at the time of bid submission, from NABL Accredited laboratory within India. The type test shall be considered valid for similar rating and design of tendered items. The proto-type materials / products must fulfil all the Technical requirements like Technical Specifications, specified Drawings, guaranteed Technical parameters, manufacturing quality plan, etc.

7.2. The offered Accessories shall be suitable to all typed of AL59 ACS Covered conductor as specified in clause no 6.4.1 of this technical specifications.

Table-A

| Sr.No | Description | Application |
|-------|------------------------------------|---|
| 1 | Wedge type Tension Assembly (TA) | For fitting onto a pole for tensioning at the beginning or end of a length of MVCC, or for anchoring while a major change in direction. The Tension assembly consists of one wedge type Tension / anchoring clamp and one Tracking protection IPC. |
| 2 | Insulator Clamp / Helical Tie (IC) | For supporting and aligning MVCC at an intermediate pole in a length, with small angle of deviation. The Insulator Clamp hold the MVCC in its position on top of the pin or post insulator. Insulator Tie shall be made of an “Insulated Plastic” only.” |
| 3 | Suspension Clamp (SC) | For supporting a length of MVCC at an intermediate pole in a length, with large angle of deviation with a disc insulator. The suspension clamp consists of an “Assembly with one locking type Suspension clamp with provision to fix in Insulators. |

| | | |
|---|--|--|
| 4 | Insulation Piercing Connector for “Bare to Covered interconnection” (IPC – Type 1) | For main (Bare) to main (MVCC) networking connection. This connector is to ensure the electrical characteristics with in the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC. |
| 5 | Insulation Piercing Connector for Networking / Branching / Looping (IPC – Type 2) | For main (MVCC) to main (MVCC) networking or branching of MVCC to another MVCC Or Branch Cable or Looping for transformer junctions. This connector is to ensure the electrical characteristics with in the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC. |
| 6 | Insulation Piercing Connector with Aluminum Bail for earthing (IPC – Type 3) | For Temporary Earthing Provision from MVCC Cable for maintenance purpose. This connector is to ensure the electrical characteristics with in the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC. |
| 7 | Tension Joints (TJ) | Mid-span tension joints for jointing MVCC over a span |
| 8 | Lightning / Surge Arrestor Kit (with provision to connect with Covered Conductor) | Protection for the Network and transformer under lighting condition. |

7.3. INSULATION PIERCING CONNECTORS :

- 7.3.1.** Piercing Connectors (IPC) are used for making Tee / Tap-off/ connections to an MVCC / Bare Overhead Line. The main purpose of a connector is to transmit electricity from one conductor to another. From the electrical point of view the connector should transmit electricity with smallest possible losses. From the mechanical point of view the connector should be able to hold conductors together without causing damages to them and sustain climatic loading. Connectors shall be UV Resistant, corrosion resistant and inert to bimetallic electrochemical reactions. It endures varying mechanical tensions and other forces detrimental to the connection. Connectors shall be capable of carrying the load current, and fault current if any.
- 7.3.2.** The connector shall be water proof and the water tightness shall be ensured by appropriate elastomer materials and not by grease, gel or paste alone.
- 7.3.3.** Insulation Piercing Connector should have a design such that there is no stripping of insulation on the covered conductor. It shall be able to get the lowest contact resistance & Superior insulation as well as sealing performance.

- 7.3.4.** The superior material and process technology ensure operation regularity in corrosive environment.
- 7.3.5.** Each IPC should be provided with a rigid end cap made of mechanical, weather resistant, UV resistant and tracking resistant insulation plastic polymer material to seal the cut end of the Branch cable to ensure proper water sealing and avoid tracking. 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.
- 7.3.6.** The following type tests, acceptance tests and routine tests shall be conducted on connector as per relevant standard EN 50397-2:2009, with latest amended.

| Sr. No. | Test | Type test | Acceptance Test | Routine Test |
|---------------------------|---------------------------------------|-----------|-----------------|--------------|
| 1 | Visual examination | X | X | X |
| 2 | Dimensional and material verification | X | X | X |
| 3 | Marking | X | X | X |
| 4 | Mechanical tests | X | | |
| 4.1 | Clamp bolt tightening test | X | X | X |
| 4.2 | Shear head function test | X | X | X |
| 4.3 | Damage to the main conductor test | X | X | X |
| 4.4 | Branch cable pull out test | X | | |
| 5 | Hot dip galvanizing test | X | X | |
| 6 | Water tightness test | X | | |
| 7 | Electrical ageing test | X | | |
| 8 | Environmental tests for connectors | X | | |
| 8.1 | Corrosion ageing test | X | | |
| 8.2 | Climatic ageing test | X | | |
| X : tests to be conducted | | | | |

7.4. Alignment Ties:

The Alignment ties shall be designed suitably to hold the MVCC in its position on top of the insulator. The Alignment ties preferred to be made of Insulating Plastic materials only to ensure tracking resistance and to avoid any insulation damage to the covered conductor due to abrasion while mechanical or wind induce vibration.

The following type tests, routine tests, and Acceptance tests shall be conducted on Alignment Ties as per relevant standard EN 50397-2:2009, with the latest amended.

| Sr. No. | Test | Type test | Acceptance Test | Routine Test |
|---------|-------------------------|-----------|-----------------|--------------|
| 1 | Visual Examination | X | X | X |
| 2 | Dimension Verifications | X | X | X |

| | | | | |
|---------------------------|---|---|---|---|
| 3 | Check For Marking | X | X | X |
| 4 | Mechanical test | X | X | X |
| 4.1 | Failure Load Test | X | X | X |
| 4.2 | Slip Load Test | X | X | X |
| 4.3 | Lift/Side Load test | X | X | X |
| 4.4 | Thermal Test under load | X | | |
| 5 | Environmental tests | X | | |
| 5.1 | Corrosion test | X | | |
| 5.2 | Climate ageing test | X | | |
| 5.3 | Resistance against tracking in heavy Polluted Areas | X | | |
| X : tests to be conducted | | | | |

7.5. Suspension Clamps :

7.5.1. The Metallic type Suspension Clamps with IPC shall be provided to ensure tracking resistance and to avoid any insulation damage to covered conductor due abrasion while mechanical or wind induce vibration. The following type tests, acceptance test, and routine test shall be conducted on Suspension clamp as per relevant standard EN 50397-2:2009, with latest amended.

| Sr. No. | Test | Type test | Acceptance Test | Routine Test |
|---------|---------------------------------------|-----------|-----------------|--------------|
| 1 | Visual Examination | X | X | X |
| 2 | Dimension Verifications | X | X | X |
| 3 | Check For Marking | X | X | X |
| 4 | Mechanical test | X | X | |
| 4.1 | Damage and failure load test | X | X | |
| 4.2 | Slip test at ambient temperature | X | X | |
| 4.3 | Slip test at high and Low temperature | X | | |
| 4.4 | Thermal Test Under Load | X | | |
| 4.5 | Lift/Side Load test | X | X | X |
| 4.6 | Clamp bolt tightening test | X | X | |
| 4.7 | Shear head function test | X | X | |
| 5 | Hot dip galvanizing test | X | X | |
| 6 | Water tightness test | X | | |
| 7 | Environmental tests | X | | |
| 7.1 | Corrosion test | X | | |
| 7.2 | Climate ageing test | X | | |

7.6. Tests to be conducted

edge type Tension Clamp

- 7.6.1.** Tension clamp used For the purpose of terminating covered conductors over the covering fitting shall include, but are not limited to, the following:
- 7.6.2.** The clamp shall be of the fully insulating type of mechanical and weather resisting thermoplastic wedges to anchor/hold the cable. All metal parts of tension type wedge clamp shall have anti-corrosion Property.
- 7.6.3.** The IPC shall be provided with wedge type anchor clamp to maintain the metallic part of clamp and the conductor at equipotential. The fittings shall be able to withstand the specific minimum failure load (SMFL), shall not damage the covering, and shall be designed to prevent the ingress of moisture during service.
- 7.6.4.** Rigid Bail: The Anchoring assembly shall be supplied with a rigid bail to connect the Wedge type Tension Clamp to the Insulator hardware. The Rigid Bail forming part of clamp shall have sufficient length and sufficient mechanical strength to withstand the all test criteria as per this specifications. The Flexible bail is not allowed.
- 7.6.5.** The following type tests, routine tests and Acceptance tests shall be conducted on Wedge type Tension clamp as per relevant standard EN 50397-2:2009, with latest amended.

| Sr. No. | Test | Type test | Acceptance Test | Routine Test |
|---------------------------|-------------------------------------|------------------|------------------------|---------------------|
| 1 | Visual Examination | X | X | X |
| 2 | Dimension Verifications | X | X | X |
| 3 | Check For Marking | X | X | X |
| 4 | Mechanical test | X | X | |
| 4.1 | Damage and failure load test | X | X | X |
| 4.2 | Tensile test at ambient temperature | X | X | X |
| 4.3 | Tensile test at low temperature | X | | |
| 4.4 | Tensile test at high temperature | X | | |
| 4.5 | Clamp bolt tightening test | X | X | X |
| 4.6 | Shear head function test | X | X | X |
| 5 | Hot dip galvanizing test | X | X | X |
| 6 | Water tightness test | X | | |
| 7 | Environmental tests | X | | |
| 7.1 | Corrosion test | X | | |
| 7.2 | Climate ageing test | X | | |
| X : tests to be conducted | | | | |

7.7. Tension Joints (Mid Span Jointing Sleeves)

7.7.1. The Midspan joint shall be suitable for the covered conductor for which they are designed. The joint shall have the same basic insulation properties as the conductor covering which shall be confirmed by the acceptance test of ‘High voltage ‘ as mentioned in the relevant standard.

| Sr.No. | Test | Type test | Acceptance Test | Routine Test |
|--|----------------------------------|-----------|-----------------|--------------|
| 1 | Visual Examination | X | X | X |
| 2 | Dimension Verifications | X | X | X |
| 3 | Check For Marking | X | X | X |
| 4 | Mechanical test | X | X | X |
| 4.1 | Damage and failure load test | X | | |
| 4.2 | Slip test at ambient temperature | X | X | X |
| 6 | Water tightness test | X | | |
| 7 | Electrical Ageing test | X | | |
| 8 | Environmental tests | X | | |
| 8.1 | Corrosion test | X | | |
| 8.2 | Climate ageing test | X | | |
| 9 | High Voltage Test* | | X | |
| X : tests to be conducted | | | | |
| * As per Clause No 4.2.6 of EN 50397-2 & Test method shall be as per EN 50397-1 (Table-2). | | | | |

7.8. Lightning / Surge Arrestors :

- 7.8.1.** The Lightning Arrestors shall be capable of discharging Lightning and switching surges and temporary power frequency over voltages. The Surge Arrestor shall be capable of discharging overvoltage occurring during switching of unloaded transformers and long lines.
- 7.8.2.** The surge arrester shall be of Metal Oxide, gapless, polymer housed along with Disconnecter and mounting bracket. Arresters shall be suitable for vertical and horizontal mounting. The surge arresters shall conform in general to IEC-60099-4:2014 and IS: 3070 part-3.
- 7.8.3.** A surge arrester having one or several non-linear metal-oxide resistors with highly non-linear voltage-current characteristics, connected in series, but having no integrated series or parallel spark gaps .
- 7.8.4.** Disconnectors: The earth end shall get connected to the earth terminal of the arrester through the disconnector. The function of the disconnector is that in the event of, operation of the surge arrester, the current shall pass to earth and the disconnector shall disconnect (isolate) the earth terminal and it shall remain suspended on the mounting of the arrester. Thereby it will be disconnected from the earth and shall provide a visual indication to the patrolling personnel. The line can be recharged without isolating the damaged arrester.
- 7.8.5.** The reference current of the arrester shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage
- 7.8.6.** The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.

7.8.7. The adhesion between the polymeric housing and the metal-oxide resistors or any other metallic or non-metallic parts inside the housing must be strong enough, homogeneous, robust and resistant to thermal cycles and environmental stresses.

7.8.8. The arrester housing shall be made up of porcelain/silicon polymeric housing and shall be homogenous, free from laminations, cavities, and other flaws of imperfections that might affect the mechanical and dielectric quality. The polymer material which is used for the arrester housing must be tracking and erosion resistant, stabilized against UV radiation.

7.8.9. GTP of Surge Arrester

| Sr. No | Particulars | Value |
|--------|---|--|
| 1 | Type | Gapless metal Oxide and polymer housed |
| 2 | Arrester Max. Cont. Operating Voltage U_c | 7.65 KV rms |
| 3 | Arrester Rated Voltage U_r | 9 KV rms |
| 4 | Nominal Discharge Current In | 5 KAp (8x20 micro impulse shape) |
| 5 | Maximum residual voltage at 5 KA (KV peak) | 32 KV |
| 6 | Line discharge class | Distribution Class |
| 7 | Insulation withstand capacity of arrester housing | |
| 7.1 | Power frequency withstand Voltage | 28 KV |
| 7.2 | 1.2/50 micro seconds impulse wave Peak | 75 KV |
| 8 | Minimum Creepage distance-Housing | 320 mm |

7.8.10. Following type tests of surge arrester shall be carried out in accordance with the latest version of specified standard at Govt. approved / NABL accredited lab /International Lab. Accredited Cooperation (ILAC) and test reports should not be older than 7 years as on date of opening the tender.

- I. Insulation withstand test.
- II. Residual voltage test
- III. Long duration current impulse withstand test.
- IV. Operating duty test.
- V. Pressure relief test (when fitted with relief device)
- VI. Tests of arrester disconnector or (when fitted)
- VII. Artificial pollution test on porcelain housed arrestors.

- VIII. For porcelain housed arrestors
- 1) Temperature cycle test on hollow porcelain housings.
 - 2) Porosity test.

IX. Galvanizing test on exposed ferrous metal parts

7.8.11. The manufacturer shall carry out the following Acceptance test/ routine tests in accordance with Latest IEC 60099-4/ IS: 3070 part-3 Standard.

- I. Visual and Dimensional Check
- II. Measurement of reference voltage
- III. Residual voltage test
- IV. Leakage Current Test
- V. Partial Discharge Test

7.9. Arc protection devices :

7.9.1. The arc protection devices shall be supplied to protect insulator sets and covered conductors against damage caused by power arcs (arcing horns, arcing rings). It shall withstand maximum short-circuit current 10 kA for 1 s (As per clause 4.2.4 of En 50397-2:2009). It shall withstand a mechanical load in order to support the installation strengths.

7.9.2. The protection device includes two horns, which are fixed to the metal parts of the tension insulator so that the peaks are towards each other and the distance between the peaks is adjustable

7.9.3. The following type tests shall be conducted on Arc protection as per relevant standard EN 50397-2:2009, with latest amended.

- 1) Clamp bolt tightening test
- 2) Shear head function test
- 3) Hot dip galvanizing test
- 4) Damage to the main conductor test
- 5) Water tightness test
- 6) Short circuit test
- 7) Power arc test(only in connection with a complete insulation set)
- 8) Corrosion ageing test
- 9) Climate Ageing Test
- 10) Dimensional and Material Verification

7.9.4. The following routine/acceptance tests shall be arc protection device on connector as per relevant standard EN 50397-2:2008, with latest amended.

- 1) Visual examination
- 2) Dimension and material verification.
- 3) Clamp bolt tightening test
- 4) Shear head function test
- 5) Damage to the main conductor test
- 6) Hot dip galvanizing test

7.10. Earth parking Device/Insulation Piercing Connector with Aluminum Bail for earthing :

The earth parking device shall be capable of carrying the short circuit current. The maximum short circuit current shall be 10 kA for 1 s.

These fittings shall withstand a mechanical load in order to support the installation strengths.

7.10.1. The following type tests shall be conducted on Earth parking device as per relevant standard EN 50397-2:2009, with latest amended.

- 1) Clamp bolt tightening test
- 2) Shear head function test
- 3) Hot dip galvanizing test
- 4) Damage to the main conductor test
- 5) Water tightness test
- 6) Short circuit test
- 7) Mechanical test
- 8) Corrosion ageing test
- 9) Climate Ageing Test
- 10) Dimensional and Material Verification

7.10.2. The following routine/acceptance tests shall be Earth parking device on connector as per relevant standard EN 50397-2:2008, with latest amended.

- 1) Visual examination
- 2) Dimension and material verification.
- 3) Clamp bolt tightening test
- 4) Shear head function test
- 5) Damage to the main conductor test
- 6) Hot dip galvanizing test
- 7) Mechanical test

7.10.3. Marking of accessories:

All accessories mentioned above shall mark with the following:

- Manufacturer's trade mark or logo;
- AT No & date
- product code or reference;
- The minimum and maximum cross section area/diameter of the Covered Conductor for which the accessory is used.
- Batch number & Year of manufacturing.
- Property of _____

8. TESTS Requirements FOR 11 kV Covered Conductor with AL59 ACS Conductor :

8.1. TYPE TESTS:

The Type test requirements of the Medium Voltage Covered Conductor shall be as per the clause No: 2.6 of this technical specifications. Which is required to be type tested as per relevant standards SS 424 08 13 & SS 424 08 14 and & EN 50397-1:2006, with latest amended thereof. All the type tests as under shall be carried out at the laboratories accredited by National Accreditation Board of Testing and Calibration Laboratories (NABL) within India of each type of Covered conductor in accordance with technical specifications and relevant standard latest amended. Type tests shall not be more than 7 years old at the time of bid submission. The type test carried out on covered conductor made of watertight conductor and HDPE as the outer insulation layer, irrespective of the size of the base conductor shall only be considered valid. The proto-type material / product must fulfil all the Technical requirements like Technical Specifications, specified Drawings, guaranteed Technical parameters, manufacturing quality plan, etc.

The following Type tests shall be carried out on AL 59 ACS Conductor only

- 1) Surface condition test.
- 2) Measurement of diameter of individual aluminum and steel wires.
- 3) Measurement of lay ratio.
- 4) Breaking load of individual wires.
- 5) Elongation test.
- 6) Wrapping test.
- 7) Resistance test.
- 8) Minimum aluminium thickness test for ACS wire
- 9) Stress at 1 % extension for ACS wire

Beside this, the following type tests as per the requirement mentioned in the Table No.02 of the relevant standard EN 50397-1:2006, with latest amended, are also required to be submitted for covered conductor.

- 1) High voltage test(No.1.2 of Table -2)
- 2) Leakage current test (No.1.4 of Table -2)
- 3) Tracking resistance test (No.1.5 of Table -2)
- 4) Rated tensile strength (No.3.1 of Table -2)
- 5) Construction and dimensions Check (No.2 of Table -2)
- 6) Mechanical properties (No.4.1 of Table -2)
- 7) Before ageing of sample
- 8) After ageing of sample
- 9) Carbon black content test, (if carbon black used for UV stabilization ,No.4.2 of Table -2)
- 10) Resistance to UV rays test(If other than carbon black is used for UV-stabilization ,No.4.3 of Table -2)
- 11) Test of compatibility(No.5 of Table -2)
- 12) Ageing of complete product sample
- 13) Pressure test at high temperature(No.6.3 of Table -2)
- 14) Hot-set-test(No.6.2 of Table -2)
- 15) Shrinkage test(No.6.1 of Table -2)
- 16) Water absorption(No.7.1 of Table -2)
- 17) Test of the longitudinal water tightness(No.8 of Table -2)
- 18) Marking-Content, legibility and Durability test (No.9 of Table -2)
- 19) Slippage test(No.10 of Table -2)

8.2. ROUTINE TEST:

The following routine tests shall be conducted after covering as per sampling plan of QAP/Relevant specifications of the Covered conductor by the manufacturer at their works as per relevant standards.

- 1) Visual & dimensional check on drum as per specification.
- 2) Visual check for joints, scratches etc. and length of conductor by re-winding of conductor on empty drum as per Specification.
- 3) Measurement of dimensions of individual Aluminum Alloy wires .

- 4) Measurement of Lay Ratio
- 5) Breaking load of individual wires
- 6) Elongation Test
- 7) Wrapping Test
- 8) D.C. resistance Test

Beside this the following routine tests as per the requirement of relevant standard EN 50397-1:2006, with latest amended, shall also be conducted for covered conductor.

- 9) Spark Test on the Covering.
- 10) Construction and Dimension as per the No. 2 of Table 2)
 - a. Compliance with design requirement (No. 2.1 of Table 2)
 - b. Thickness of covering (No. 2.2 of Table 2)
- 11) Marking. (No. 9 of Table 2)
 - a. Content, legibility (No. 9.1 of Table 2)

8.3. ACCEPTANCE TESTS:

The following tests shall be conducted on samples taken at random from a lot as per relevant standard in presence of purchaser's representative.

- 1) Visual & dimensional check on drum as per specification.
- 2) Visual check for joints, scratches etc. and length of covered conductor by re-winding of conductor on empty drum as per Specification / IS.
- 3) Measurement of dia-meter of individual Aluminium wires.
- 4) Measurement of Lay Ratio
- 5) Breaking load of individual wires
- 6) Elongation Test
- 7) Wrapping Test
- 8) Resistance Test

Beside this the following test as per requirement of EN 50397-1:2006, with latest amended, shall also be conducted for covered conductor.

- 9) High Voltage Test
- 10) Construction and Dimension (No. 2 of Table 2)
 - a. Compliance with design requirement (No. 2.1 of Table 2)
 - b. Thickness of covering (No. 2.2 of Table 2)

- c. Construction and Mechanical Properties of the conductor.
 - d. Tensile and elongation at break of Insulation and outer layer Construction and Dimension
- 11) Hot Set Test for insulation and outer layer
 - 12) Tracking resistance test
 - 13) Test of the Longitudinal water tightness
 - 14) Leakage Current test
 - 15) Marking. Content, legibility

8.4. SAMPLING PLAN:

Samples for Acceptance Tests: Samples shall be taken as per relevant EN 50397-1:2006 with the latest version as the case may be.

Apart from the sample selected for carrying out Acceptance Tests at the works of the firm during the inspection, one more sample from offered lot also selected under re-winding for carrying out various Acceptance Tests as per relevant IS/IEC/EN/ SS. If any of the sample so selected from each length failed in any acceptance test the entire lot under inspection is not acceptable.

8.5. TOLERANCE ON TEST RESULTS:

Tolerance on test results shall be allowed as per relevant IS/SS/IEC/EN/Spec. whichever is more stringent.

9. INSPECTION:

- 9.1.** The conductor shall be manufactured in accordance with the latest edition of EN 50397-1:2006 & respective GTPs as separately given in this technical specifications. with all subsequent amendments issued from time to time for Covered AL59 ACS of various sizes . All the tests as mentioned in the relevant technical specifications shall be carried out on individual wires. The testing shall also include the tests on a manufactured finished conductor. Moreover, the supplier shall also furnish test certificate(s) of raw materials to the inspecting officer at the time of inspection.
- 9.2.** The Manufacturer shall provide all adequate facilities at his works for inspection of at least one number conductor drum or 5% conductor drums offered for inspection whichever is higher selected at random by the authorized representative of the purchaser for checking/verification of conductor length/ manufacturing defects by transferring the conductor from one drum to the another empty drum and at the same time measuring the length and lay ratio of each conductor length so transferred by means of the standard calibrated and sealed meter.
- 9.3.** The supplier shall provide adequate facilities for weighment of all the drums offered for inspection.

- 9.4.** The supplier shall present the latest Calibration Certificate(s) of testing instruments / equipment to be used for the testing of the material covered in the Purchase Order to the authorized inspecting officer / inspecting agency of the purchaser. The testing instruments / meters/ apparatus etc. should be got calibrated by the supplier from time to time from Govt. Lab or Independent test laboratory / house having valid accreditation from National Accreditation Board for Testing and Calibrating Laboratories for the testing equipment or original manufacturer having traceability to NABL / NPL or equivalent accredited lab.
- 9.5.** The calibration certificate(s) should not in any case be older than one year at the time of presenting the same to the inspecting officer / inspecting agency of the purchaser. The testing instruments / equipment should be duly sealed by the Calibrating Agency and mention thereof shall be indicated in the calibration certificate(s).
- 9.6.** All tests and inspections shall be made at the place of manufacturer unless otherwise specifically agreed upon by the purchaser. The manufacturers 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.
- 9.7.** The purchaser has the right to have the tests carried out at his own cost by an independent agency whenever in dispute regarding the quality of supply.
- 9.8.** The supplier shall furnish the following documents as proof of purchase of RAW material along with each inspection offer.
- a) Invoice of the supplier b) Supplier Test Certificate c) Packing List d) Bill of Landing e) Description of material, electrical analysis, physical inspection, certificate of surface defects, thickness and width of material wherever applicable.

10. End Sealing:

Heat Shrinkable end Caps with sealant shall be used for effectively sealing the end terminals of the covered conductor. The inner diameter range of the cap shall be such that it shall tightly fit to the covered conductors to prevent moisture ingress.

11. Standard length & variation in lengths :

- 11.1.** The Covered All Aluminum Alloy conductor shall be supplied in the standard length. The standard length of Covered AL59 ACS Conductor shall not less than the value specified below with a tolerance of (-) 5%. More than the standard length shall be acceptable.
- a) 11 KV AL59 ACS Covered conductor of various sizes - 1000 Mtrs.

Short length(s), if any shall not measure less than 80% of standard length as specified above in any case. The total quantity of such short length(s) shall not exceed 5% of the quantity of the lot offered for inspection.

- 11.2.** The maximum permissible length per drum shall be as under subject to condition that the manufacturer while packing the conductor in drum shall ensure that after winding complete

quantity of conductor in drum a uniform space of not less than 100 mm. remains between outer layer of conductor and inner surface of the external protective lagging of the drum. This is essential to ensure that the conductor does not get closer to the lagging and to avoid damaged during transportation/ reeling / unreeling or rolling on the undulated ground / fields:

- 11.3.** The Company shall ascertain the length of AL59 ACS COVERED Conductor at supplier's works and at the receiving store centers by measuring the actual length by length measuring machine used for the purpose. The supplier should ensure that length measuring machine is available for measurement of the length by our inspecting officer.
- 11.4.** Both ends of the AL59 ACS COVERED Conductor will be sealed by the supplier and seals will be contained in the drum and not exposed out of drum.
- 11.5.** The declared length will be measured between manufacturer's seals at both ends of AL59 ACS COVERED Conductor.
- 11.6.** The weight of AL59 ACS COVERED Conductor will also be checked for ensuring correct lay and length of the AL59 ACS COVERED Conductor.
- 11.7.** For the verification of the length of the conductor, 10 % of total lot (in Drums) should be selected at the works. The physical verification of the length of the conductor should be carried out for maximum up to 5 (five) drums. If there are any more drums left for verification, then weight of each verified drum should be carried out and average weight may be calculated.

Then the weight of each of all the remaining selected drums may be taken and if these weights are matching with the average weight, then that particular lot may be accepted otherwise rejected.

- 11.8.** Verification of length of conductor will also be carried out at each stores center for two drums out of each lot. If the average length is found correct or more, the lot will be accepted. If the average length is found to be less than the declared, the percentage of such short length will be applied for reduction for the entire quantity supplied in the lot at respective stores for acceptance.
- 11.9.** In case of dispute, joint inspection along with the representative of the supplier shall be carried out after giving 10 (ten) days' notice to the supplier to remain present at stores center for the purpose. If the representative fails to attend on stipulated date for joint inspection, the decision of the consignee shall be final and binding.

12. REJECTION:

While measuring the length, the sample piece from each length shall be taken for carrying out the test as per SS 424 08 14 (amended up to date) & EN 50397-1 : 2006 . All the values of each sample should not exceed the value as per the relevant specification. In case of deviation, whole lot will be rejected at works.

13. QUALITY ASSURANCE PLAN:

The successful bidder shall submit following information along with the bid:

- 13.1.** Test certificates of the raw materials and bought out accessories.
- 13.2.** Statement giving list of important raw material, their grades along with names of sub- suppliers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative.
- 13.3.** List of manufacturing facilities available.
- 13.4.** Level of automation achieved and lists of areas where manual processing exists.
- 13.5.** List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- 13.6.** List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports.
- 13.7.** The manufacturer shall submit Manufacturing Quality Assurance Plan (QAP) for approval & the same shall be followed during manufacture and testing.
- 13.8.** The successful bidder shall submit the routine test certificates of bought out raw materials/accessories and central excise passes for raw material at the time of inspection.
- 13.9.** The Company may at its option order the verification of these plans at manufacturer's works as a pre-qualification for technically accepting the bid. During verification if it is found that the firm is not meeting with the quality assurance plan submitted by the firm, the offer shall be liable for rejection.
- 13.10.** The material for final inspection shall be offered by the Supplier only under packed condition. The owner shall select samples at random from the packed lot for carrying out acceptance tests.
- 13.11.** The Supplier shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.

No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the owner in writing waives off the inspection. In the later case also the material shall be dispatched only after satisfactory testing specified here in has been completed.

14. PACKING AND MARKING :

- 14.1.** The packing shall have to be done as per standard practice worthy of road transport. The covered conductor shall be wound in strong wooden drums so as to withstand all stresses due to transportation, handling and stringing operation so that the conductor surface is not cut, dented, scratched or damaged in any way during manufacture, Transport & Stringing. The wooden drums shall be non-returnable and shall generally conform IS: 10418/1982 with latest amendments. The packing of accessories shall be sufficient to withstand, without limitation,

rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage.

- 14.2.** The covered conductor drum should be suitable for wheel mounting, before reeling, the cardboard or other suitable material shall be secured to the drum and inside flanges of the drums. After reeling, the exposed surface area of conductor shall be nearly wrapped with suitable soft material to protect the conductor from dirt and grit.
- 14.3.** However, use of seasoned wood shall not be insisted, provided wood used should be of good quality to withstand transportation hazards. The drums shall be having inside flanges painted with Aluminium Paint and with Ordinary White Enamel paint from outside. The conductor on each drum shall be securely fastened at each end. The outer end of the covered conductor shall be fastened inside the drum against one of the sides of the flanges while it is under tension and shall be such that no looseness is transmitted to the internal layers. The covered conductor shall be snugly, tightly and uniformly spooled on the drums. The wrapping of covered conductor on the drums shall be laid snugly against side of the preceding wrap and the first and last wrap in each layer shall fit snugly against the sides of the flanges. Drums shall be lagged with sufficient strong wooden laggings to support the full drum without crushing. The wooden drums after providing lagging shall be fastened by two steel tapes over the lagging on the two sides of adequate size to keep the lagging intact and to prevent the drum from crushing/ damage.
- 14.4.** Although the various dimension of the drums such as flanges, stretches, traverse and barrel diameter shall depend on the quantity of covered conductor as offered and agreed upon, on one drum. The manufacturer while packing the covered conductor in drum shall ensure that after winding complete quantity of covered conductor in drum a uniform space of not less than 100 mm. remains between outer layer of covered conductor and inner surface of the external protective legging of the drum. This is essential to ensure that the covered conductor does not get closer to the legging and to avoid damaged during transportation/ reeling / unreeling or rolling on the undulated ground / fields.
- 14.5.** Water proof material shall be wrapped round the barrel and inner surface of flange before winding the covered conductor and also wrapped round over the covered conductor completely wounded and under the laggings.
- 14.6.** The drums shall be marked clearly in block letters with water proof mark having the marking attached to them so that there is no possibility of goods being lost or wrongly dispatched due to faulty marking. The marking shall constitute the following:-
 - i. Name & full address of the consignee.
 - ii. Destination station.
 - iii. Serial number of drum/ Drum Identification number
 - iv. Voltage Grade and Size of covered conductor
 - v. Total length of Conductor in drum, with individual length (s).

- vi. Number of length(s) in each drum.
- vii. Gross mass of drum including the tare mass of drum.
- viii. Net mass of conductor.
- ix. Name of the supplier.
- x. Purchase order reference/TN number.

Month and year of manufacturing besides above, an arrow shall be put on the drum so as to indicate the direction in which the drum can be unwound.

Beside this covered conductor shall also carry marking at regular interval as below:

Name of Manufacture or Trade Mark, Voltage Grade Covered AL59 ACS Conductor size in sq. mm. Year of Mfg., Standard EN 50397-P1.

15. Drawings & Manuals: Drawings shall be submitted as per EN 50397-Part-2 for approval conforming to technical specifications and standard requirements for the following.

1. Wedge type Tension clamp and one tracking protection IPC
2. Insulator Clamp / Helical Tie (IC)
3. Suspension Clamp (SC)
4. Mid span Joints (TJ)
5. Insulation Piercing Connector for Bare to Covered interconnection
6. Insulation Piercing Connector for Cover to Covered interconnection
7. Power arc devices – (PAD)
8. Surge Arrestor
9. Earth parking Device
10. Sectional View of Cable
11. Drawing of cable drums with details of material dimension and paint etc.

15.1. The Covered conductor & Accessories Handling, Installation manual/ Catalogue/Video literature shall be submitted along with bid as well as in a soft copy.

Annexure –I

Guaranteed Technical Particulars

To be submitted along with Tender documents in triplicate as per format annexed herewith Technical characteristic shall be guaranteed by the bidder. In case of failure of materials to meet the GTPs, the Purchaser shall have right to reject the material.

| Sr. No | Parameter Name | Parameter Value / Name | |
|-----------|--|-----------------------------|------------------------------|
| | | CCSX 55 AL59 ACS W 11 kV | CCSX 100 AL59 ACS W 11 kV |
| 1. | GENERAL: | | |
| 1.1 | Brand Name or Trade Mark | | |
| 1.2 | Manufacturer's Name & Address | | |
| 1.3 | Size of the Conductor | | |
| 1.4 | Lists of Standard applicable for conductor and Covered Conductor. | | |
| 1.5 | Manufactured as per reference standards (Yes/No) | | |
| 2. | BASE CONDUCTOR: | | |
| 2.1 | Material of strands & Chemical composition | | |
| 2.2 | Applicable standard | | |
| 2.3 | Nos of strands of aluminium alloy | | |
| 2.3 | Nos of strands of ACS wire | | |
| 2.4 | Diameter of strand-mm- aluminium alloy A) Nominal B) Max C) Min Diameter of strand-mm- ACS A) Nominal B) Max C) Min | | |
| 2.5 | Cross section area aluminium alloy strand-mm ² | | |
| 2.6 | Cross section area ACS strand-mm ² | | |
| 2.7 | Overall Diameter of Conductor (mm) | | |
| 2.8 | Minimum thickness of aluminium covering on ACS wire | | |
| 2.9 | Minimum thickness of aluminium covering on ACS wire confirms IEC 61232? (Yes/No) | | |
| 2.10 | Conductivity of ACS wire (IACS) | | |
| 2.11 | Cross section area of Conductor(mm ²) | | |
| 2.12 | Class / Grade | | |

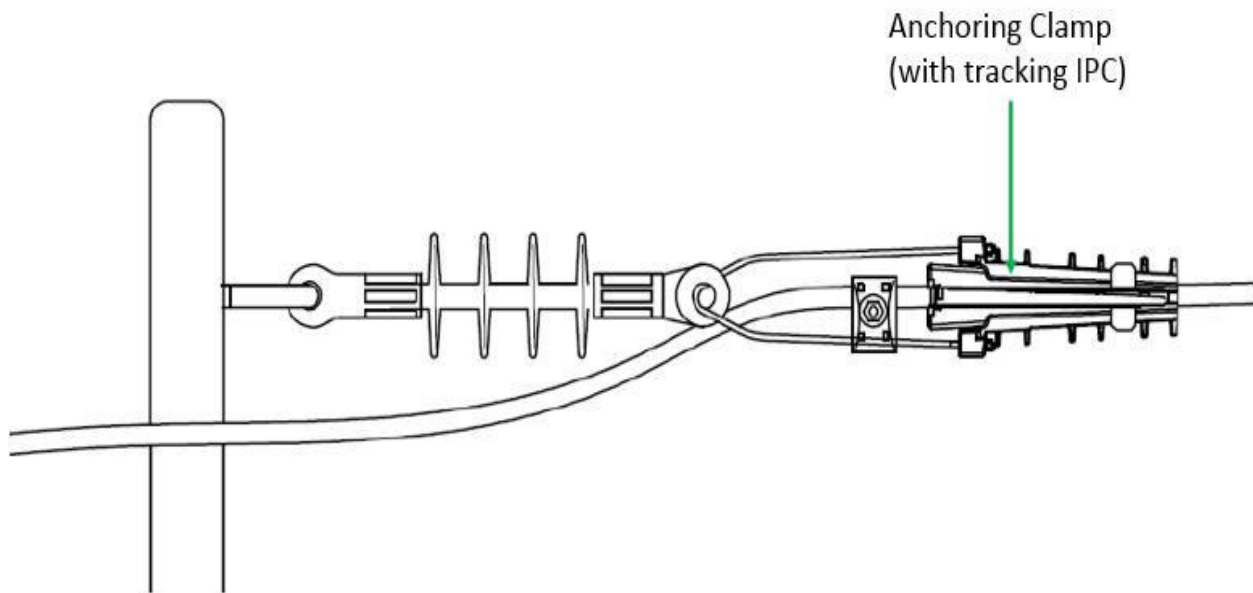
| | | | |
|------|--|--|--|
| 2.13 | Nominal cross section area of conductor (mm Sq.) | | |
| 2.14 | Maximum DC resistance at 20° C Ohm /KM of conductor | | |
| 2.15 | Maxi Inductive reactance OHM /KM of conductor | | |
| 2.16 | Lay ratio of most outer layer Min Max | | |
| 2.17 | Maximum allowable Continuous Conductor Temperature (in °C) | | |
| 2.18 | Maximum allowable Short time Conductor Temperature (in °C) | | |
| 2.19 | Breaking Load of conductor (KN) | | |
| 2.20 | Weight (Kg/Km) | | |
| 2.21 | Longitudinally water tight Conductor (Yes/No) | | |
| 2.22 | Continuous minimum current rating of conductor in still air at ambient Temperature (40°C) | | |
| 2.23 | Continuous minimum current rating of conductor in still air at 95°C corresponding of ambient temperature of 40°C | | |
| 3. | CONDUCTOR SCREENING: | | |
| 3.1 | Material | | |
| 3.2 | Nominal thickness (mm) | | |
| 4. | INSULATION: | | |
| 4.1 | Insulation Material (Inner Layer) | | |
| 4.2 | Insulation Material (Outer Layer) | | |
| 4.3 | Nominal thickness–Inner layer(mm) | | |
| 4.4 | Nominal thickness Outer Layer (mm) | | |
| 4.5 | Tolerance on thickness (Inner/Outer) | | |
| 4.6 | Color of Insulation (Inner/Outer) | | |
| 4.7 | Method of application of Insulation | | |
| 4.8 | Type of curing of XLPE Insulation. | | |
| 4.9 | Outer insulation layer is UV Protected, Weather resistance and tracking resistance HDPE(Yes/No) | | |
| 4.10 | Method of UV Stabilization of Outer layer of insulation (Carbon Black or Other material)? | | |
| 5. | Complete Covered Conductor: | | |

| | | | |
|-----------|---|--|--|
| 5.1 | Maximum operating voltage of the Cable | | |
| 5.2 | Rated Voltage of the Cable | | |
| 5.5 | Continuous current carrying capacity in air at Ambient Temp.40° C (Amp) & 80 °C operating temp. | | |
| 5.6 | Maximum short circuit current for 1 Sec. (KA) | | |
| 5.7 | Approximate overall diameter of cable(mm) | | |
| 5.8 | Approximate overall cross section area of cable (mm ²) | | |
| 5.9 | Approximate Total weight of cable KG / KM. | | |
| 5.10 | Approx. Breaking load of Conductor (KN) | | |
| 5.11 | Allowable sag as a percentage of span length at 40°C ambient temperature & permissible span length for 8 meter PSC pole and with planting length of 1.5 MTR | | |
| 5.11 | Permissible maximum span length in MTR with above allowable sag calculations for 8 MTR PSC pole network | | |
| 5.12 | Marking on Cable (Write text) | | |
| 5.13 | Max. continuous operating conductor temperature (°C) | | |
| 5.15 | Max. Leakage current (mA) | | |
| 6. | DRUM: | | |
| 6.1 | Standard drum length (Mtr.) & tolerance of each drum | | |
| 6.2 | Dimension of Drum | | |
| 6.3 | Shipping Weight. | | |
| 6.4 | Bending radius of the cable | | |
| 6.5 | Overall quantity tolerance | | |
| 6.6 | Drum material | | |

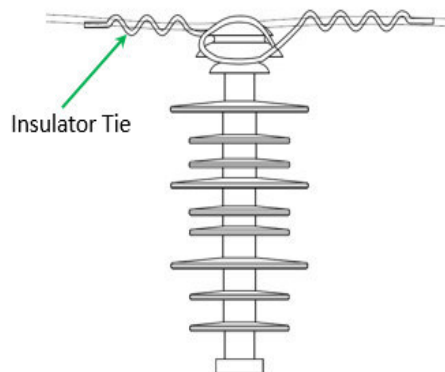
ANNEXURE II: - GENERAL ARRANGEMENT AND INDICATIVE DRAWINGS

1. Tension Assembly (TA) with Anchoring clamp and one Tracking protection IPC

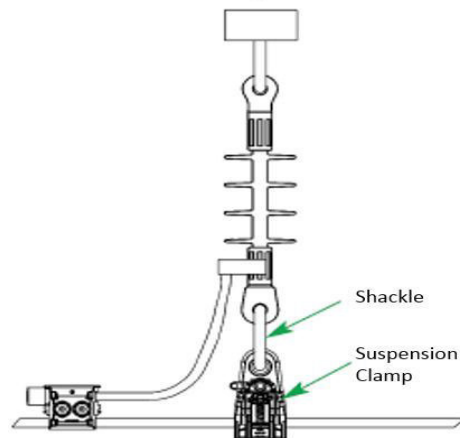
Anchoring with protection against Tracking.



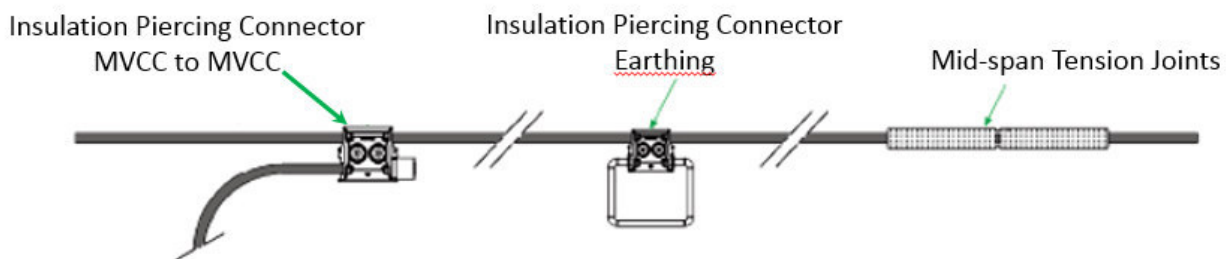
2. Insulator Clamp / Tie (IC)



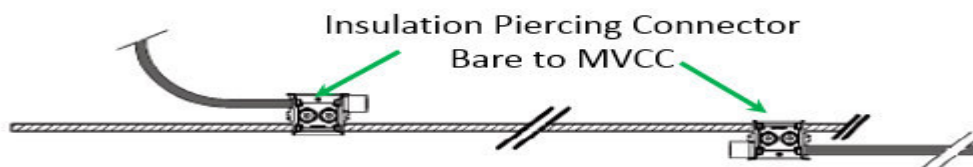
3. Suspension Clamp (SC)



4. TYPE-1: Insulation Piercing Connector for Networking / Branching / Looping, TYPE -3: Insulation Piercing Connector with Aluminum Bail for earthing and Tension Joints (TJ)



5. Insulation Piercing Connector for Bare to Covered interconnection



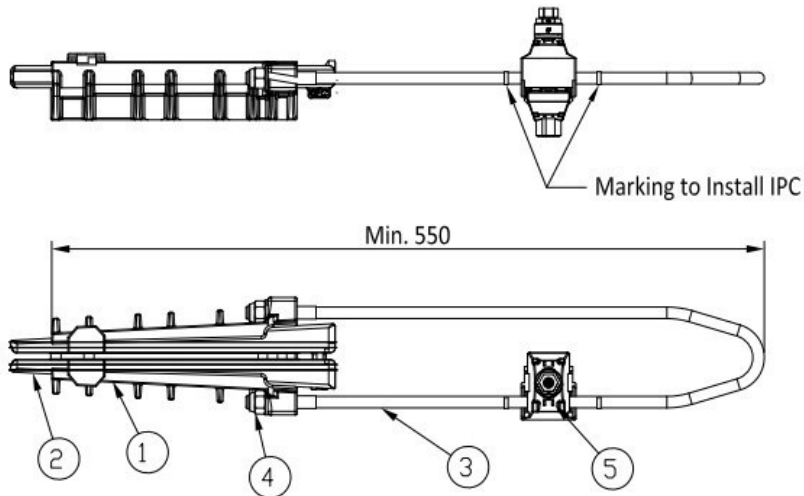
INDICATIVE DRAWINGS

1. Tension Assembly (TA) with Anchoring clamp and one Tracking protection IPC

STANDARD: EN 50397-2

MARKING: Manufacturer Name/Logo

Manufacturing period (Month and Year)



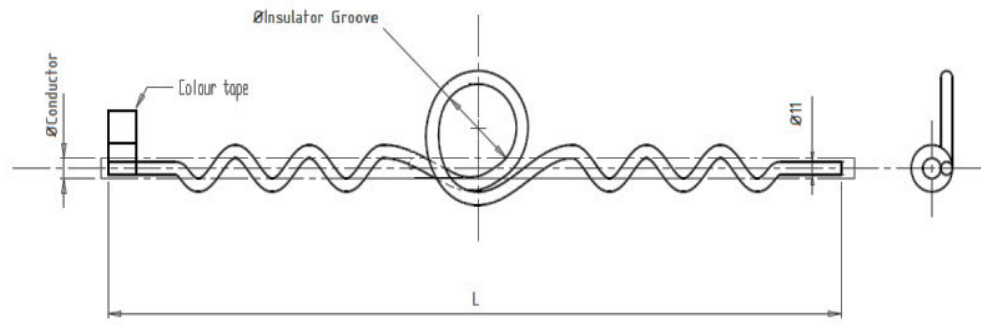
| | | | |
|-------|-----|-------------------------------|--------------------------------------|
| 5 | 1 | INSULATION PIERCING CONNECTOR | |
| 4 | 2 | LOCK NUT | STAINLESS STEEL |
| 3 | 1 | RIGID BAIL | GALVANISED STEEL |
| 2 | 2 | WEDGES | HEAT AND UV STABILIZED THERMOPLASTIC |
| 1 | 1 | ALUMINIUM BODY | ALUMINIUM ALLOY |
| SL.NO | QTY | DESCRIPTION | MATERIAL |

DEAD END CLAMP

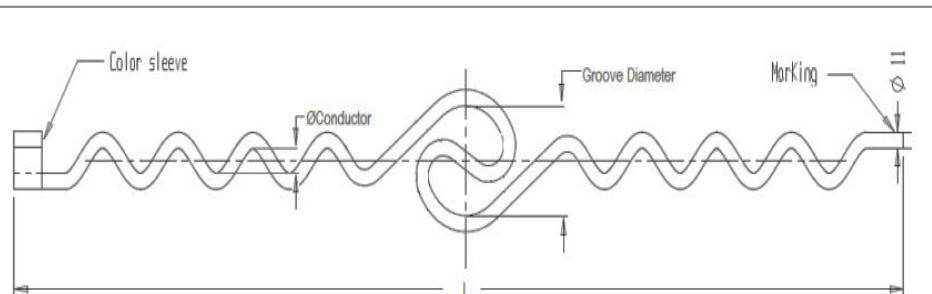
| | | | |
|-----------------------------|----------------------|--------------------|-----|
| MATERIAL: | | TREATMENT: | |
| VOLUME mm ³ : | | GENERAL TOLERANCE: | ±5% |
| ORIGINE LAYOUT A4 | SCALE: | | |
| | ALL DIMENSIONS IN MM | | |

2. Insulator Clamp / Tie (IC)

Alignment Tie (Side Tie) for Porcelain Insulator




Alignment Tie (Top Tie) for Porcelain Insulator

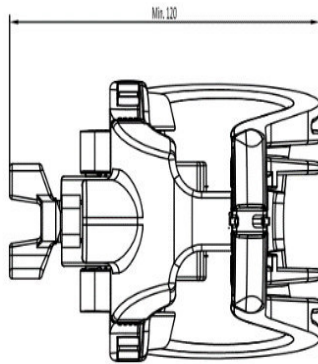
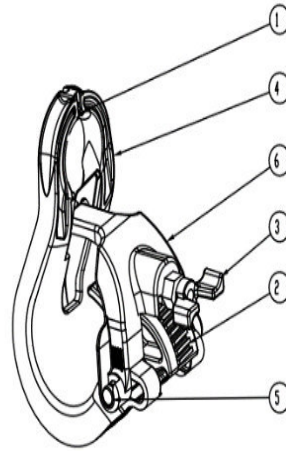
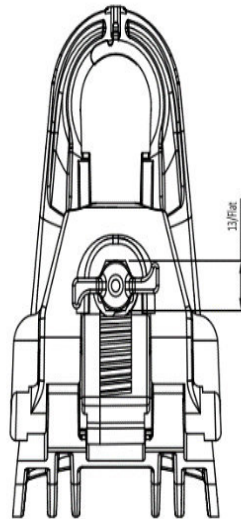
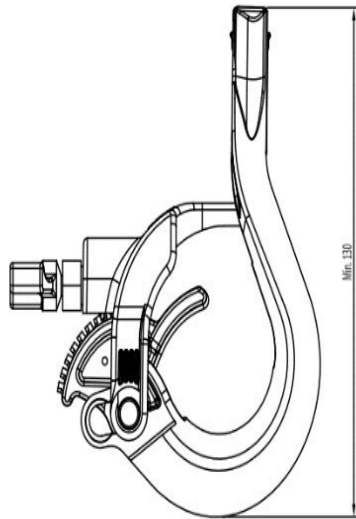


NOTE:
STANDARD: EN 50397-2
MARKING: Manufacturer Name/Logo
Manufacturing period (Month and Year)

ALIGNMENT TIE (TOP TIE) FOR PORCELAIN INSULATOR

| | | |
|--|--------------------------|---|
| | MATERIAL: | TREATMENT: |
| | VOLUME mm ³ : | GENERAL TOLERANCE:±5% |
| | ORIGINE LAYOUT | SCALE: |
| | A4 | ALL DIMENSIONS IN MM  |

3. Suspension Clamp (SC)



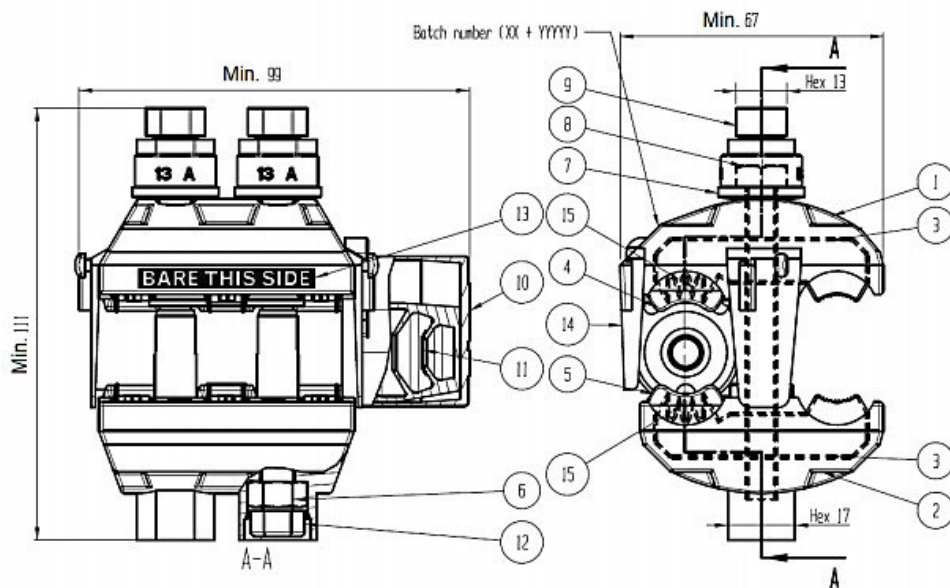
| SLNo | Qty | DESCRIPTION | MATERIAL |
|------|-----|-----------------------|-------------------------------------|
| 6 | 1 | BRIDE | Heat and UV resistant thermoplastic |
| 5 | 1 | PIN | Aluminium Alloy |
| 4 | 1 | SUSPENSION CLAMP BODY | Heat and UV resistant thermoplastic |
| 3 | 1 | SHEAR HEAD | Heat and UV resistant thermoplastic |
| 2 | 1 | LEVER | Heat and UV resistant thermoplastic |
| 1 | 1 | SELLE | Stainless Steel |

SUSPENSION CLAMP

Note:-
Standard : EN 50397-2
Marking : Manufacturer Name/Logo
Manufacturing period (Month and Year)

| | | |
|----------------------|----------------------|-----|
| MATERIAL: | TREATMENT: | \ |
| VOLUME mm3 | GENERAL TOLERANCE: | ±5% |
| ORIGINE LAYOUT A3 | SCALE: | |
| | ALL DIMENSIONS IN MM | |

4. Insulation Piercing Connector for Bare to Covered interconnection



| Prt | Qty | Description | Material |
|-----|-----|--------------------------|------------------------------|
| 15 | | Blend | Silicone based |
| 14 | 1 | Marking | Colour - White |
| 13 | 1 | Marking | Colour - White |
| 12 | 2 | Screw protection | Polyethylene - purple |
| 11 | 1 | Endcap seal | Thermoplastic rubber - Black |
| 10 | 1 | End cap | See table |
| 9 | 2 | Shearhead | Polycarbonate GF - Natural |
| 8 | 2 | Screw | Galvanised steel |
| 7 | 2 | Washer | Stainless steel |
| 6 | 2 | Nut | Galvanised steel |
| 5 | 1 | Seal nut side | Thermoplastic rubber - Black |
| 4 | 1 | Seal screw side | Thermoplastic rubber - Black |
| 3 | 12 | Electrical contact blade | See table |
| 2 | 1 | 1/2 body; nut side | Polyamide GF - Black |
| 1 | 1 | 1/2 body; screw side | Polyamide GF - Black |

STANDARD: EN 50397-2

MARKING: Manufacturer Name/Logo

Manufacturing period (Month and Year)

INSULATION PIERCING CONNECTOR BARE TO COVERED CONNECTION

MATERIAL:--

TREATMENT:--

VOLUME mm3:---

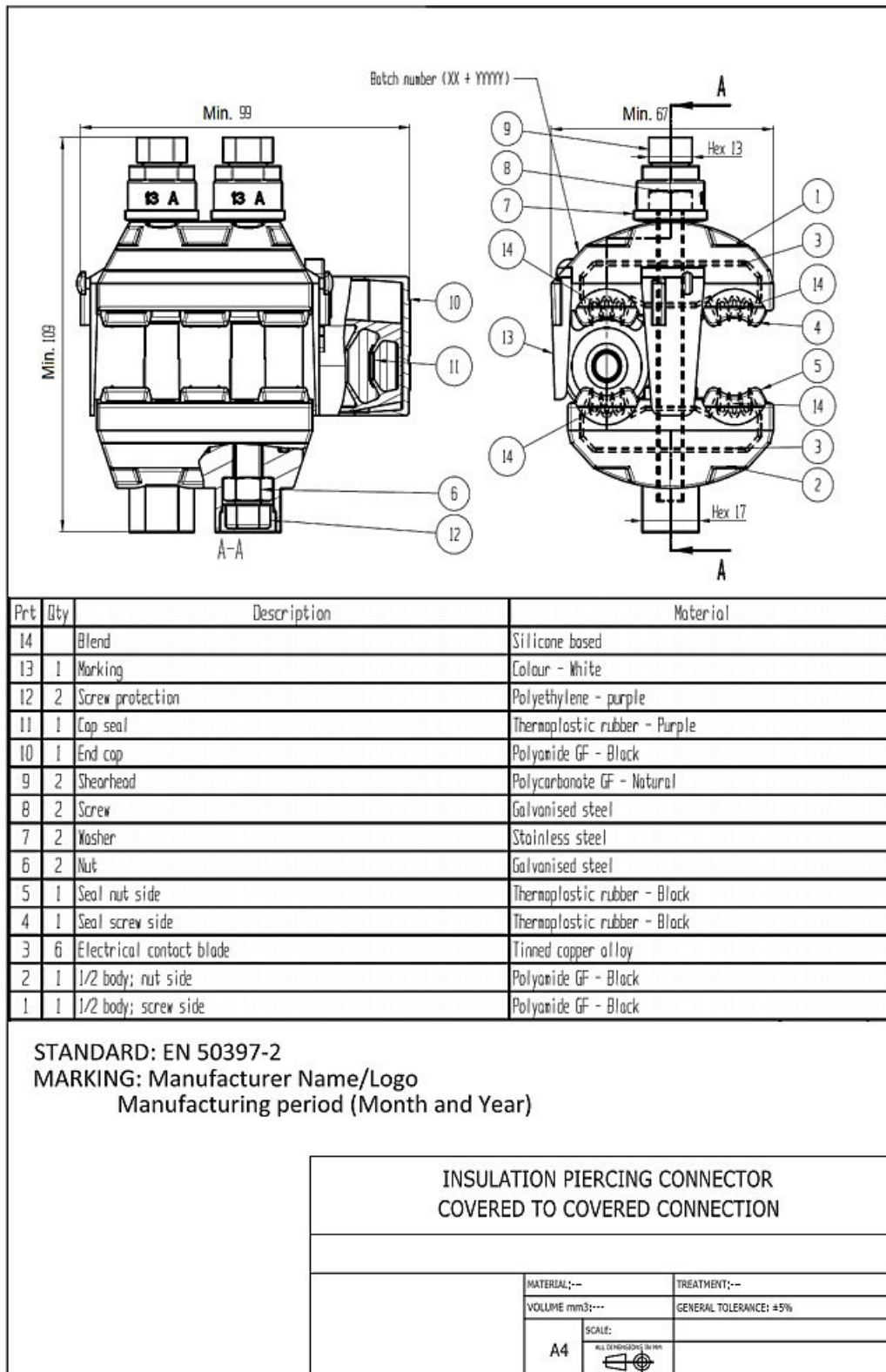
GENERAL TOLERANCE: ±5%

SCALE:

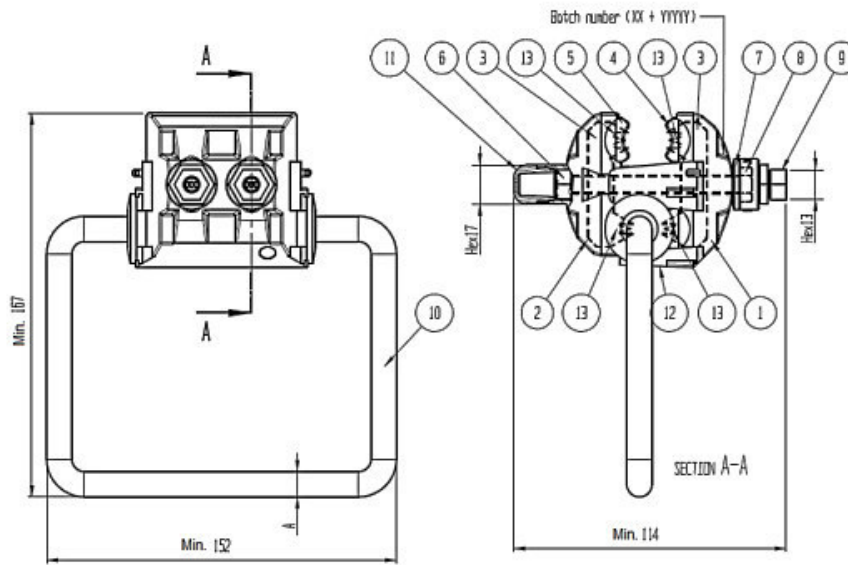
A4



5. Insulation Piercing Connector for Networking / Branching /Looping



6. Insulation Piercing Connector with Aluminum Bail for earthing



| Prt | Qty | Description | Material |
|-----|-----|--------------------------|------------------------------|
| 13 | | Lubricant | Silicone based |
| 12 | 1 | Marking | Colour - White |
| 11 | 2 | Screw Protection | Polyethylene - Purple |
| 10 | 1 | Bail (See table) | See table |
| 9 | 2 | Shearhead | Polycarbonate GF - Natural |
| 8 | 2 | Screw | Galvanised steel |
| 7 | 2 | Washer | Stainless steel |
| 6 | 2 | Nut | Galvanised steel |
| 5 | 1 | Seal; nut side | Thermoplastic rubber - Black |
| 4 | 1 | Seal; screw side | Thermoplastic rubber - Black |
| 3 | 6 | Electrical contact blade | Tinned copper alloy |
| 2 | 1 | 1/2 body; nut side | Polyamide GF - Black |
| 1 | 1 | 1/2 body; screw side | Polyamide GF - Black |

STANDARD: EN 50397-2

MARKING: Manufacturer Name/Logo
Manufacturing period (Month and Year)

INSULATION PIERCING CONNECTOR EARTHING

MATERIAL:--

TREATMENT:--

VOLUME mm3:---

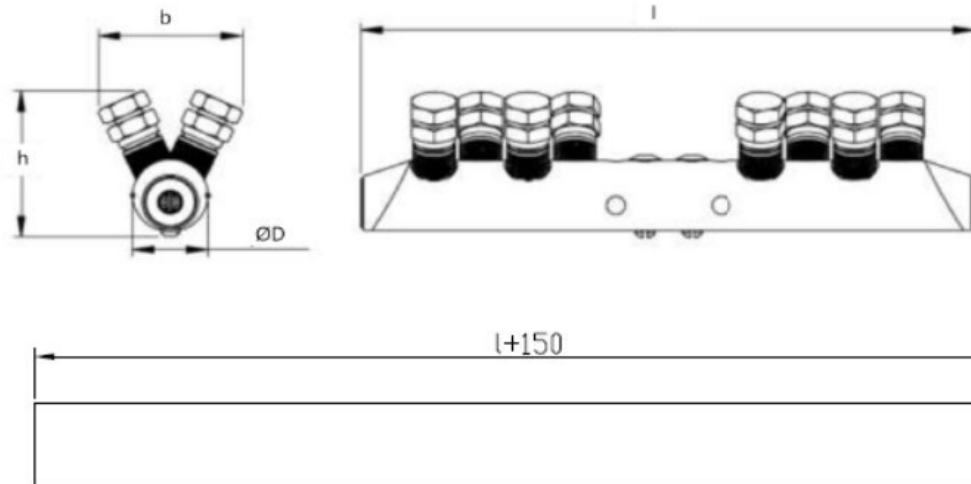
GENERAL TOLERANCE: ±5%

SCALE:

A4



7. Tension Joints (TJ)



| 4 | 1 | Heat Shrink Sleeve | UV Resistant Polymer |
|-----|----------|--------------------|----------------------|
| 3 | 2 | Pressure Pads | Steel |
| 2 | Min. 8 | Shear Off Bolt | Aluminium Alloy |
| 1 | 1 | Body | Aluminium Alloy |
| REP | QUANTITY | DESCRIPTION | MATERIAL |

Note 1
STANDARD: EN 50397-2
CABLE RANGE: SUITABLE COVERED CONDUCTOR
MARKING: PRODUCT REFERENCE,
MANUFACTURER LOGO,
BATCH CODE, MANUFACTURING PERIOD
GENERAL TOLERANCE: $\pm 5\%$

NAME OF THE CUSTOMER :

A/T . NO :

QUANTITY :

DETAILS OF COVERED CONDUCTOR ACCESSORIES :

NAME OF THE MANUFACTURE & SYMBOL

| | |
|------|------------|
| DATE | 01/06/2018 |
| DRN | |
| CHD | |
| APPD | |

SCALE
NTS

DRG. NO.

ANNEXURE-III - Guaranteed technical particular of accessories

1) GTP for Wedge type Tension Clamp

| Sr. No. | Description | Particulars |
|----------------|--|--|
| 1 | Name of the Supplier | |
| 2 | Type of Design | |
| 3 | Weight | |
| 4 | Cable Range (Range shall be in line with this specification) | |
| 5 | Material | |
| 6 | Ultimate Tensile Strength | For conductor range of 50 – 70 sqmm = 20 KN For conductor range of 70 - 120 sqmm = 30 KN For conductor range of 120 - 200 sqmm = 60 KN |
| 7 | Installation(With/Without disassembly) | Ready- to-use (Without disassembling) |
| 8 | Marking | |
| 9 | Dimensions | |
| 10 | Wedge Clamp with IPC (YES/NO) | |
| 11 | Type tests confirming to EN50397-2:2009? (Yes/No) | |

2) GTP for Alignment Tie

| Sr. No. | Description | Particulars |
|----------------|--|---|
| 1 | Name of the Supplier | |
| 2 | Name of Model No | |
| 3 | Length | |
| 4 | Weight | |
| 5 | Cable Range (Range shall be in line with this specification) | |
| 7 | Material | |
| 8 | Installation(With/Without disassembly) | Ready- to-use (Without disassembling) |

| | | |
|----|--|--|
| 9 | Marking | |
| 10 | Insulator Groove range (mm) | |
| 11 | Type tests confirming to EN50397-2:2009? (YES/No) | |

3) GTP for Suspension Clamp

| Sr. No. | Description | Particulars |
|---------|--|---|
| 1 | Name of the Supplier | |
| 2 | Cable Range (Range shall be in line with this specification) | |
| 3 | Material | |
| 4 | Minimum Breaking Load – Vertical (80 % of conductor tensile load as per EN 50397-2) for Each size of Covered Conductor | |
| 5 | Installation(With/Without disassembly) | Ready- to-use (Without disassembling) |
| 6 | Marking | |
| 7 | Dimensions | |
| 8 | Weight | |
| 9 | Type tests confirming to EN50397-2:2009 ? (YES/No) | |

4) GTP for INSULATION PIERCING CONNECTOR

| Sr. No | Particulars | |
|--------|---|--|
| 1 | Name of supplier | |
| 2 | Type of connection required | Bare to Covered conductor Covered conductor to Covered conductor Tapping connector |
| 3 | Are torque limiting shear heads provided to tightening bolts? | |
| 4 | Range of cable sizes accommodated for Main & Branch | |
| 5 | Tightening Torque | |

| | | |
|----|--|--|
| 6 | Torque for establishing connection between main and Tap (Nm) as per EN 50397-2 | |
| 7 | Marking and embossing on the connector | |
| 8 | Dimensions and weight | |
| 9 | Continuous current carrying capacity at 40 Deg. Ambient temperature without derating (Amp) | |
| 10 | Short time withstand rating (KA/1 Sec) | |
| 11 | Type Tests confirming to EN50397-2:2009 : YES/No | |

5) GTP for INSULATED MIDPSAN JOINTS

| Sr. No | PARTICULARS | |
|--------|--|-----------------------------------|
| 1 | Name of Supplier. | |
| 2 | IS manufacturer of Accessories an ISO 9001-2000 Company? | |
| 3 | Type No & Size Range | |
| 4 | Is any metallic part carrying potential in operation exposed during installation | |
| 5 | Installation | Crimping by Hexagonal Compression |
| 6 | Continuous current carrying capacity at 40 Deg. Ambient temperature without derating (Amp) | |
| 10 | Short time withstand rating (KA/1 Sec) | |
| 11 | Type Tests confirming to EN50397-2:2009 : YES/No | |

6) GTP for EARTH PARKING DEVICE

| Sr. No | Particulars | |
|--------|---|-----------------------------|
| 1 | Name of supplier | |
| 2 | List of subcomponents of Earth Parking Device | |
| 3 | Are torque limiting shear heads provided to tightening bolts? | |
| 4 | Range of cable sizes | |
| 5 | Tightening Torque | |
| 6 | Torque for establishing connection | 70% of min torque specified |
| 7 | Marking and embossing on the connector | |
| 8 | Dimensions and weight | |
| 9 | Short time withstand rating (KA/1 Sec) | |
| 10 | Type Tests confirming to EN50397-2:2009 : YES/No | |

7) 11 KV Surge Arrestor:

| Sr. No | Particulars | Value |
|--------|---|-------|
| 1 | Manufacturer Name | |
| 2 | Type | |
| 3 | Arrester Max. Cont. Operating Voltage U_c | |
| 4 | Arrester Rated Voltage U_r | |
| 5 | Nominal Discharge Current I_n | |
| 6 | Maximum residual voltage at 5 KA (KV peak) | |
| 7 | Line discharge class | |
| 8 | Insulation withstand capacity of arrester housing | |
| 8.1 | Power frequency withstand Voltage | |
| 8.29 | 1.2/50 micro seconds | |

| | | |
|----|-----------------------------------|--|
| | impulse wave Peak | |
| 9 | Minimum Creepage distance-Housing | |
| 10 | Housing Type | |
| 11 | Housing Material | |

8) Arc Protection Device:

| Sr no | Particulars | Value |
|--------------|---|--------------|
| 1 | Name of the Manufacturer | |
| 2 | Applicable standard | |
| 3 | Type of Design | |
| 3 | Type No & Size Range | |
| 4 | Horn material | |
| 5 | Main body material | |
| 6 | Aluminium thread size | |
| 7 | Recommended Gap size (mm) | |
| 8 | Type Tests confirming to EN50397-2:2009 : YES/No | |

6. 11KV Polymeric PIN Insulator

Technical Specification for 11 KV, 5KN, 340 Creepage Distance Pin type Composite (Polymer) Insulator with rod

1. SCOPE:

This specification covers design, manufacture, testing, inspection, packing and supply of composite insulators for use in the 11 KV overhead transmission lines situated in any part of Gujarat State. The composite polymer insulators shall be of following type:

- 1.1 **Pin Insulators with rod** for AAAC/ACSR conductors for straight line point/angle/cut point.
- 1.2 The Bidder should be original manufacturer of the composite insulators and shall have all the facilities to manufacturing and in house testing of their product.

This will be pre-qualifying requirement as a “Bidder”.

2. SERVICE CONDITIONS

The composite insulators to be supplied against this specification shall be suitable for satisfactory continuous operation under following tropical conditions.

- 2.1 Maximum Ambient Air Temperature ° C : 50
- 2.2 Minimum Ambient Air Temperature ° C : 0
- 2.3 Average daily ambient Air Temperature ° C : 40
- 2.4 Relative humidity (%) : 10 to 100
- 2.5 Average rainfall per annum (mm) : 1150
- 2.6 Maximum altitude above mean sea level – Mtr : 1000
- 2.7 Isoceraunic level (Days/Year) (i.e. Average number of Thunderstorm): 30
- 2.8 Maximum wind pressure (Kg/Sq. meters) : 200
- 2.9 Seismic level i.e. Earthquake Acceleration
 - a) Horizontal Seismic Co-efficient (acceleration – g (Zone-5) 0.08
 - b) Vertical Seismic Co-efficient (acceleration – g (Zone-5): 0.08
- 2.10 Climate: Moderately hot, saline and humid and polluted by dust & smoke and conductive to rust and fungus. **As Gujarat state is having largest coastal area having saline & humid atmosphere, the insulators if installed in such area shall be able to function satisfactorily.**

3. SYSTEM PARTICULARS

| | | |
|---|--------------------------------|----------------------|
| A | Nominal system voltage | 11 KV (rms) |
| B | Highest System voltage | 12 KV (rms) |
| C | Visible discharge test voltage | 9 KV (rms) |
| D | Normal Frequency | 50 HZ |
| E | Maximum Frequency | 51.5 HZ |
| F | Minimum Frequency | 47 HZ |
| G | Neutral Earthing | Effectively Grounded |

| | | |
|---|------------------|---|
| H | Number of phases | 3 |
|---|------------------|---|

4. **STANDARDS:**

Following Indian/International Standards, which shall mean latest revision, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification, shall be referred while accessing conformity of Insulators with these specifications.

| Sr. No. | Indian Standard | Title | International Standard |
|---------|-----------------|--|------------------------|
| 1 | | Definition, test methods and acceptance criteria for composite Insulators for a. c. overhead lines above 1000V. | IEC:61109 |
| | | Composite Insulators for a. c. overhead lines above 1000V. Definition, test methods and acceptance criteria | IEC 1109 |
| 2 | IS: 731 | Porcelain insulators for overhead power lines with a nominal voltage greater than 1000V. | IEC: 60383 |
| 3 | IS:2071 | Methods of High Voltage Testing. | IEC:60060-1 |
| 4 | IS:2486 | Specification for Insulator fittings for overhead power lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements locking devices. | IEC:60120 IEC:60372 |
| 5 | - | Thermal Mechanical performance test and mechanical performance test on string Insulators units. | IEC:60575 |
| 6 | IS: 13134 | Guide for the selection of insulators in respect of polluted condition. | IEC: 60815 |
| 7 | - | Characteristics of string insulator units of the long rod type. | IEC: 60433 |
| 8 | - | Hydrophobicity Classification Guide. | STRI guide 1.92/1 |
| 9 | - | Radio interference characteristics of overhead power lines and high voltage equipment. | CISPR 18.2 Part 2 |
| 10 | IS:8263 | Methods of RI Test of HV Insulators. | IEC:60437 |
| 11 | | Standard for Insulators- Composite- Distribution Dead-end Type. | ANSI C 29.13-2000 |
| 12 | IS:4759 | Hot dip zinc coatings on structural steel & other allied products. | ISO:1459 |
| 13 | IS:2629 | Recommended practice for Hot Dip galvanization for iron and steel | ISO:1461(E) |

| | | | |
|----|---------|---|-----------------|
| 14 | IS:6745 | Determination of weight of zinc coating on zinc coated Iron and steel articles. | ISO:1460 |
| 15 | IS:3203 | Methods of testing of local thickness of electroplated coatings. | ISO:2178 |
| 16 | IS:2633 | Testing of Uniformity of coating of zinc coated articles. | |
| 17 | - | Standard specification for glass fiber standards. | ASTM D 578-05 |
| 18 | - | Standard test method for compositional analysis by Thermo gravimetry | ASTM E 1131- 08 |
| 19 | IS:4699 | Specification for refined secondary zinc | |
| 20 | | Rubber - Identification - Infrared spectrometric methods | ISO 4650:2012 |

5. GENERAL REQUIREMENTS

- 5.1 The Composite insulators will be used on lines on which the conductor will be AAAC/ACSR of size up to 100 Sq.mm. The insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.
- 5.2 Insulator shall be suitable for 3-ph 50 Hz effectively earthed 11KV Overhead distribution system in a moderately/heavily polluted atmosphere.
- 5.3 Bidder must be an indigenous manufacturer and supplier of composite insulators of rating 11KV or above OR must have developed proven in house technology and manufacturing process for composite insulators of above rating OR possess technical collaboration /association with a manufacturer of composite insulators of rating 11KV or above. The Bidder shall furnish necessary evidence in support of the above along with the bid, which can be in the form of certification from the utilities concerned, or any other documents to the satisfaction of the owner.
- 5.4 Insulator shall be suitable for the pin type of load. The distance between conductor and metal part at bottom shall be min 200mm for 11KV pin type composite insulator.
- 5.5 Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc. and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC- 60815/IS: 13134.
- 5.6 The type/size of composite insulator, minimum Creepage distance and mechanical strength along with hardware fittings shall be as follows

| | | |
|---|--------------------------------|--|
| A | Type of Composite insulators | Pin type Insulators with rod, washer & nut |
| B | Nominal system voltage | 11 KV (rms) |
| C | Highest System voltage | 12 KV (rms) |
| D | Visible discharge test voltage | 9 KV (rms) |
| E | Mechanical characteristic | Min. bending load :5 KN |

| | | |
|---|---|--|
| F | Minimum Creepage distance (mm) | 340mm(Min) |
| G | Wet power frequency withstand voltage | ≥ 45 KV(rms) |
| H | Dry lightning Impulse withstand voltage | a) Positive: ≥ 110 KV (Peak) b) Negative: >110 KV (Peak) |

5.7 Dimensional Tolerance of Composite Insulators :-

The tolerances on all dimensions e.g. diameter, length and creepage distance shall be allowed as follows in line with IEC 61109:

$\pm \{0.04d+1.5\}$ mm when $d \leq 300$ mm,

$\pm (0.025d+6)$ mm when $d > 300$ mm.

Where, d being the dimensions in millimeters for diameter, length or Creepage distance as the case may be. However, no negative tolerance shall be applicable to Creepage distance.

5.8 Interchangeability

The composite insulators including the end fitting connection shall be of standard design suitable for use with the hardware fittings of any other indigenous make conforming to relevant IEC/IS standards.

5.9 Corona and RI Performance:-

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The insulator and metal parts shall be so designed and manufactured that it shall avoid local corona formation and not generate any radio interference beyond specified limit under the operating conditions.

6 TECHNICAL DESCRIPTION OF COMPOSITE INSULATORS

6.1 Composite Insulators shall be designed to meet the light quality, safety and reliability and are capable of withstanding a wide range of environmental conditions.

(a). Core- the internal insulating part

(b). Housing – the external insulating part.

(c). Metal end fittings – for directly fitting in to fabricated support and to support Conductor with bindings

6.2 CORE

It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber or Boron free E-Glass and shall exhibit both high electrical integrity and high resistance to acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP shall be manufactured through Pultrusion process. The FRP rod shall be void free. **No joint in core material is allowed.**

6.3 HOUSING (Sheath)

The FRP rod shall be covered by a seamless sheath of a silicone Elastomer compound of a thickness of 3 mm minimum. It shall be one-piece housing using injection Molding Principle to cover the core. The elastomer housing shall be designed to provide the necessary creepage distance and protection against environmental influences, external pollution and humidity. Housing shall conform to the requirement of IEC 61109:2008 with latest amendments.

It shall be directly molded on core and shall have chemical bonding with the FRP rod. The strength of the bond shall be greater than the tearing strength of the polymer. Sheath material in the bulk as well as in the sealing/bonding area shall be free from voids. Manufacturer should furnish a description of its quality assurance programme including fabrication; testing and inspection for any material (i.e. rubber), components (i.e. rod) or hardware (i.e. end filings). If the manufacturer has had fabricated these components by other manufacturer, quality plan of that other manufacturer should also be included.

Manufacturing methods and material composition documentation will be a part of Technical Bid to be submitted along with offer.

6.4 WEATHERSHEDS

The composite polymer Weather sheds made of silicone elastomer compound shall be molded as part of the sheath and shall be free from imperfections. The weather sheds should have silicone rubber content of minimum 30% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

6.5 METAL END FITTINGS

There shall be two type of metal end fittings namely, Top metal end fitting and Bottom metal end fitting. Top metal end fitting transfers the mechanical load of conductor to core of the insulator; it shall be a one-piece and tightly fitted with top end of the core of the insulator. Top metal end fitting shall be made of S.G. Iron or malleable cast iron or forged steel.

Bottom metal end fitting shall be in one-piece and tightly fitted with bottom end of core of the insulator. Bottom threaded end of the bottom metal end fitting shall be suitable to fix the insulator on the DISCOM's fabrication with respective specified mechanical load. Bottom metal end fitting shall be made up of Forged steel in single piece.

The Top and Bottom metal end fittings shall be hot dip galvanized in accordance with IS 2629. The material used in fittings shall be corrosion resistant. Metal end fittings shall be uniform and without sharp edges or corners and shall be free of cracks, flakes, silvers, slag, blow-holes shrinkages defect and localized porosity.

They shall be connected to the rod by means of a controlled compression technique. As the main duty of the end fittings is the transfer of mechanical loads to the core the fittings should be property attached to the core by a coaxial or hexagonal compression process and should not damage the individual fibers or crack the core.

The gap between fittings and sheath shall be sealed by RTV silicone sealant. System of attached of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath and metal connection. The sealing must be moisture proof.

Nominal dimension of the pin insulator shall be strictly in accordance with the dimensions shown in tender drawing.

Outer portion of pin should be Zinc Sleeved with minimum 99.95% purity of electrolytic high grade Zinc.

The finished surface shall be smooth and shall have a good performance. The surface shall not crack or get chipped due to ageing effect under normal and abnormal service conditions or while handling during transit or erection.

The design of the fittings and the insulators shall be such that there is no local corona formation or discharges likely to cause the interference to either should or vision transmission.

Length of thread on shank should be 100 mm and Shank diameter is 20 mm. Minimum Collar diameter should be 40 mm and its minimum thickness should be of 5 mm. Nuts as per IS 1363 (P-III) and 4 mm thick Spring Washer shall be as per IS 3063 with latest amendments if any, Nuts and spring washer shall be hot dip galvanized. Length of unthreaded portion of the rod should be 50 mm. **For Top fitting conductor groove radius should be 10 ± 1 mm (R10) as shown in Tender Drawing.**

7 WORKMANSHIP:

- 7.0** All the materials shall be of latest design and conform to the best engineering practices adopted in the high voltage field. Bidders shall offer only such Insulators as are guaranteed by them to be satisfactory and suitable for continued good service in power transmission lines.
- 7.1** The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.
- 7.2** The design of the Insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
- 7.3** The core shall be sound and free of cracks and voids that may adversely affect the Insulators.
- 7.4** Weather sheds shall be uniform in quality. They shall be clean, sound, smooth and shall be free from defects and excessive flashing at parting lines.
- 7.5** End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth without projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.

7.6 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/Sq.m, or 87 μ m thickness and shall be in accordance with the requirement of IS: 4759, The zinc used for galvanizing shall be of purity 99.5% as per IS: 4699. The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

8 TESTS AND STANDARDS:

Insulators offered shall be manufactured with the same configuration & raw materials as used in the Insulators for which design & type test reports are submitted. The manufacturer shall submit a certificate for the same. **The type test reports submitted shall not be more than 07 years old.**

8.1 Design tests/Type test (As per Clause 9.1 & 10 of IEC: 61109: 2008)

For polymeric insulators it is essential to carry out design test as per clause 9.1 & 10 of IEC 61109:2008 with latest amendments.

These tests are intended to verify the suitability of the design, materials and method of manufacture (technology). A composite suspension insulator design is defined by the following elements:

- materials of the core, housing and their manufacturing method;
- material of the end fittings, their design and method of attachment (excluding the coupling);
- layer thickness of the housing over the core (including a sheath where used);
- Diameter of the core.

When changes in the design occur, re-qualification shall be carried out in accordance with Table 1 of IEC 61109:2008.

When a composite suspension insulator is submitted to the design tests, it becomes a parent insulator for a given design and the results shall be considered valid for that design only. This tested parent insulator defines a particular design of insulators which have all the following characteristics:

- a) Same materials for the core and housing and same manufacturing method;
- b) Same material of the fittings, the same connection zone design, and the same housing-to fitting Interface geometry;
- c) Same or greater minimum layer thickness of the housing over the core (including a sheath where used);
- d) Same or smaller stress under mechanical loads;
- e) Same or greater diameter of the core;

f) Equivalent housing profile parameters, see Note (a) in Table 1 of IEC 61109:2008.

Manufacturer should submit test reports for Design Tests as per IEC-61109: 2008 along with the bid.

8.2 Type Tests:-

The type tests are intended to verify the main characteristics of a composite insulator. The type tests shall be applied to composite insulators, the class of which has passed the design tests.

Following type test shall be conducted on a suitable number of individual insulator units, components, materials or complete strings.

| SN | Description of type test | Test procedure/standard |
|-----------|---|---|
| 1. | Dry lightning impulse withstand voltage test | As per IEC 61109 : 2008 (clause 11.1) |
| 2. | Wet power frequency test | As per IEC 61109 : 2008 (clause 11.1) |
| 3. | Bend test | As per IS:731 (Clause- 10.8.2) |
| 4. | Radio interference test | As per IS:8263/ IEC:437/CISPR 18-2. |
| 5. | Recovery of Hydrophobicity test | Annexure-B (As per STRI guide) This test may be repeated every 3 yrs by the manufacturer |
| 6. | Test for presence of silicone rubber content and test for percentage content of silicone. | Annexure-B : As per Infrared Spectroscopy / As per EDX / thermo-gravimetric method |
| 7. | Water Diffusion test on FRP rod | As per IEC 1109 C.lno.5.4.2 |
| 8. | Brittle fracture resistance test | Annexure – B |
| 9. | Dry power frequency test | As per IEC 61109 : 2008 (clause 11.1) |
| 10. | UV test: | Clause 7.2 of ANSI C29.13. |

The bidder shall submit type test reports as per IEC 61109 (with latest amendments, if any) from NABL approved laboratory along with the bid. Additional type tests required if any shall be carried out by the manufacturer, after award of contract for which no additional charges shall be payable. In case, the tests have already been carried out, the manufacturer shall submit reports for the same.

8.3 TENDER SAMPLE:

Four (04) nos of sample of tender item and six (06) nos of FRP rod min length **30 mm** are required to be submitted. The submission of sample is mandatory and should be submitted on or before due date and time of physical submission of bid.

Sample submitted with bid will be sent for test at ERDA/Any NABL lab and shall be considered for lot supply. No further change in dimension or drawing shall be allowed in lot supply. Tender samples not conform at NABL/ERDA Lab will not be considered for opening of price bid & will be technically disqualified.

Tender sample should be tested with reference to tender drawing only and not with supplier's drawing.

8.4 Routine Tests:-

| Sr. No. | Description | Standard |
|---------|------------------------------------|---|
| 1. | Dry Power-Frequency withstand test | As per IEC:61109: 2008 & requirement as per GTP |
| 2. | Visual Examination | As per IEC: 61109:2008 Clause 13.2 |
| 3 | Bend Test | As per IS:731 (Clause- 10.8.2) |

8.5 Tests during Manufacture

Following tests shall also be carried out on all components as applicable:-

- Chemical analysis of zinc used for galvanizing
- Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
- Chemical analysis, hardness tests and magnetic particle inspection for forgings.

8.6 Acceptance Tests On Tender Sample/Audit sample:

8.6.1 Test shall be carried out for audit test / Tender samples submitted with the bid at ERDA/ CPRI or any other NABL accredited laboratory.

The test samples after having withstood the routine test shall be subjected to the following acceptance tests. However, company may carry out any type test, if required, on sample his discretion:-

| | | |
|----|--|---|
| a. | Verification of dimensions | Clause 12.2 IEC: 61109 |
| b. | Galvanizing test | IS:2633/IS:6745 |
| c. | Bend test | As per IS:731 (Clause- 10.8.2) |
| d. | Dry Power-Frequency withstand | As per IEC:61109: 2008 & requirement as per GTP |
| e. | Water diffusion test on FRP rod | As per IEC 1109 C.Ino.5.4.2 |
| f. | Wet Power-Frequency withstand | As per IEC:61109: 2008 & requirement as per GTP |
| g. | Test for identification of presence of Silicon rubber content and test for percentage content of silicon rubber. | Annexure-B: As per Infrared Spectroscopy/ As per EDX/ thermo-gravimetric Method |

8.6.2 Acceptance Test shall be carried out during lot inspection.

The test samples after having withstood the routine test shall be subjected to the following acceptance tests:-

| | | |
|----|--------------------------------------|---|
| a. | Verification of dimensions & Sealing | Dimension as per cl.no 5.7 & Sealing as |
|----|--------------------------------------|---|

| | | |
|----|------------------------------------|---|
| | | per cl.no 6.5 |
| b. | Galvanizing test | IS:2633/IS:6745 |
| c. | Bend test | As per IS:731 (Clause- 10.8.2) |
| d. | Dry Power-Frequency withstand test | As per IEC:61109: 2008 & requirement as per GTP |

Inspecting officer will randomly pick up six nos. of FRP rods each of min. 30 mm, at the time of lot inspection for purpose of water diffusion test at ERDA

8.7 Additional Tests:-

The Purchaser reserves the right of getting done any other test(s) of reasonable nature carried out at Purchaser's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the specifications. In such case all the expenses will be to Suppliers account.

8.8 AUDIT TESTING:

8.8.1 The testing for lot may be carried out at NABL approved laboratory over & above tests carried out at firm's works. Minimum 8 nos. samples from each lot offered will be tested for type tests/ acceptance tests (as per clause: 8.6.1) / any test confirming to Specification & GTP as specified in Specification.

8.8.2 The necessary charges will be borne by the company. In the event of failure of Sample, charges will be borne by supplier.

9 Quality assurance plan:-

9.1 The successful bidder shall submit following information along with the bid:

- 9.1.1 Test Certificates of the raw materials and bought out accessories.
- 9.1.2 Statement giving list of important raw materials, their grades along with names of sub- suppliers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative.
- 9.1.3 List of manufacturing facilities available.
- 9.1.4 Level of automation achieved and lists of areas where manual processing exists.
- 9.1.5 List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- 9.1.6 List of testing equipments available with the bidder for final testing of equipments along with valid calibration reports.
- 9.1.7 The manufacturer shall submit Manufacturing Quality Assurance Plan (QAP) for approval and the same shall be followed during manufacture and testing.

- 9.2 The successful bidder shall submit the routine test certificates of bought out raw materials/accessories and central excise passes for raw material at the time of inspection.
- 9.3 The owner's representative shall all times be entitled to have access to the works and all places of manufacture, where insulator, and its component parts shall be manufactured and the representative shall have full facilities for unrestricted inspection of the Supplier's and Sub-supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.
- 9.4 The material for final inspection shall be offered by the Supplier only under packed condition. The owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot offered for inspection shall be homogeneous and shall contain insulators manufactured in 3-4 consecutive weeks.
- 9.5 The supplier shall keep the owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.
- 9.6 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived of by the owner in writing in the later case also the material shall be dispatched only after satisfactory testing specified herein has been completed.
- 9.7 The acceptance of any quantity of material shall in no way relieve the supplier at his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

10 TEST CERTIFICATE:

The tenderer shall furnish detailed type test reports of the offered composite Insulators as per clause 8.2 of the Technical Specifications from the NABL laboratory to prove that the composite Insulators offered meet the requirements of the specification. **These type Tests should have been carried out within Seven (7) years prior to the date of opening of this tender.**

(i) The offered composite Insulators are already fully type tested at approved Laboratory within five years prior to the date of opening of this tender.

(ii) There is no change in the design of type-tested composite Insulators and those offers against this tender.

11 TESTING FACILITIES:

The following additional facilities shall be available at Supplier's works:-

- (a) The tenderer must clearly indicate what testing facilities are available in the works of the manufacturer and whether facilities are adequate to carry out all Routine & acceptance Tests. These facilities should be available to Discom's Engineers if deputed or carry out or witness the tests in the manufacturer works. If any test cannot be carried out at the manufacturer's work, the reasons should be clearly stated in the tender.
- (b) The insulators shall be tested in accordance with the procedure detailed in IEC 61109:2008 with

latest amendments.

- (c) Calibration Reports from NABL approved testing laboratory of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burette, thermometer, barometer etc.
- (d) Finished insulator shall be checked for dimension verification and surface finish separately.

Manufacturers of foreign origin shall, in addition to the above, also have arrangements in India, either at works of their authorized representative/ licenses or in the NABL laboratory for conducting sampling test in accordance with IEC 81109/92-93 with latest amendments.

12 DRAWINGS:

The drawing of the composite Pin insulator is attached herewith and bidder has to supply material as per tender drawing and specifications. The bidder has to submit DISCOM tender drawing duly signed and stamped with bid submission.

- 12.1 The Bidder shall furnish full description and illustration of the material offered.
- 12.2 The Bidder shall furnish along with the bid the outline drawing (3 copies) of each insulator unit including a cross sectional view of the pin insulator unit. The drawing shall include but not be limited to the following information.
 - (a) Long Rod diameter with manufacturing tolerances.
 - (b) Minimum Creepage distance with positive tolerance.
 - (c) Unit mechanical and electrical characteristics.
 - (d) Size and weight of pin rod.
 - (e) Weight of composite pin rod units.
 - (f) Materials
 - (g) Identification mark.
 - (h) Manufacturer's catalogue number
 - (i) Outer diameter of FRP Rod with sheath
- 12.3 After placement of awards, the Supplier shall submit full dimensioned manufacturing insulator drawings containing all the details in four (4) copies to owner for approval. After getting approval from owner and successful completion of all the type tests, the supplier shall submit 10 more copies of the drawing to the owner for further distribution and field use.
- 12.4 After placement of order, the Supplier shall also submit fully dimensioned insulator crate drawing for different type of insulators for approval of the owner.

13 RETEST AND REJECTION:

General Rules (Clause 12.1 of IEC: 61109: 2008)

For the sample tests, two samples are used, E1 and E2. The sizes of these samples are indicated in Table below. If more than 10000 insulators are concerned, they shall be divided into an optimum number of lots comprising between 2000 and 10000 insulators. The results of the tests shall be evaluated separately for

each lot. The insulators shall be selected from the lot at random. The purchaser has the right to make the selection. The samples shall be subjected to the applicable sampling tests.

The sampling tests are as follows:

- a) Verification of dimensions. (E1 + E2)
- b) Galvanizing test. (E2)
- c) Bend Test. (E2)
- d) Dry Power Frequency Voltage Withstand Test (E1 + E2)
- e) Verification of water diffusion test on FRP road shall be carried out as per IEC: 61109 Cl.no.5.4.2 (E1 –Any one sample)
- f) Wet Power Frequency Voltage Withstand Test (E1 + E2)
- g) Chemical composition test for identification of presence of Silicon rubber content and its percentage content by weight (E1 –Any one sample).

This test shall be performed as per Annexure-B (As per infrared Spectrometric method/As per EDX/Thermo-gravimetric Method)

In the event of a failure of the sample to satisfy a test, the re-testing procedure shall be applied as prescribed in 12.6 of IEC 61109:2008.

Insulators of sample E2 only can be used in service and only if the galvanizing test is performed with the magnetic method.

| Lot Size (N) | Sample Size | |
|------------------|----------------------|----|
| | E1 | E2 |
| N < 300 | Subject to agreement | |
| 300 < N ≤ 2000 | 4 | 3 |
| 2000 < N ≤ 5000 | 8 | 4 |
| 5000 < N ≤ 10000 | 12 | 6 |

The samples shall be subjected to the applicable sampling tests as per clause 12.2 to 12.6 of IEC:61109:2008

The Audit tests are as per clause 12.2 to 12.5 of IEC:61109:2008 as under:

- 12.1 Verification of dimensions – (E1+E2)
- 12.2 Galvanizing test. (E2)
- 12.3 Bend Test (E2)
- 12.4 Dry Power Frequency Voltage Withstand Test (E1 + E2)
- 12.5 Verification of water diffusion test on FRP road shall be carried out As per IEC 61109 Cl. no.5.4.2) (E 1-Any one sample)
- 12.6 Wet Power Frequency Voltage Withstand Test (E1 + E2)

12.7 Chemical composition test for identification of presence of Silicon rubber content and its percentage content by weight (E1 –Any one sample)

In the event of a failure of the sample to satisfy a test, the retesting procedure shall be as per clause 12.6 of IEC: 61109:2008 as follows:

Verification of dimensions (E1 + E2) (Clause 12.2 of IEC:61109:2008)

The dimensions given in the drawings shall be verified. The tolerances given in the drawings are valid. If no tolerances are given in the drawings the values mentioned in Clause 8 shall be used.

Galvanizing test (E2) (Clause IS: 2633/IS: 6745)

This test shall be performed on all galvanized parts in accordance with **IS: 2633/IS: 6745**.

Verification of the Bend Test (E2) (Clause 12.3 of IEC:61109:2008)

The Test sample should withstand minimum bending load of 5 KN.

Dry Power Frequency Voltage Withstand Test

This test shall be performed as per IEC:61109: 2008 & requirement as per GTP

Verification of water diffusion test on FRP road shall be carried out as per IEC:61109:2008)

This test shall be performed as per IEC 1109 C.Ino.5.4.2

Wet Power Frequency Voltage Withstand Test

This test shall be performed as per IEC:61109: 2008 & requirement as per GTP

Chemical composition test for identification of presence of Silicon rubber content and its percentage content by weight (E1 –Any one sample)

This test shall be performed as per Annexure-B (As per Infrared Spectroscopy / As per EDX/ thermo-gravimetric Method)

Re-testing procedure:

In general DISCOM will not allow Retesting & Re-sampling.

14 MARKINGS:

Each insulator unit shall be legibly and indelibly Emboss/Engrave with the following details as per IEC-61109.

- (a) Name or trademark of the manufacture.
- (b) A/T No, Month and Year of manufacturing.
- (c) Guaranteed mechanical strength in kilo Newton followed by the word ‘KN’ to facilitate easy identification.
- (d) Name of DISCOM

15 PACKING:

- 15.1 **All insulators shall be packed in strong corrugated box of minimum 7 ply duly plated in good quality Polythene Plastic bag with max.10 nos of insulators .** The gross weight of the crates along with the material shall not normally exceed 15 Kg. to avoid handling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.
- 15.2 The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- 15.3 Suitable cushioning, protective padding of dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
- 15.4 All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings.

Each crate shall have all the markings stenciled on it in indelible ink.

- 15.5 The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

16 INSPECTION:

Party has to offer the materials for inspection duly packed in crates as mentioned in GTP. The inspection approval is valid for a period of 15 days from the date of inspection to enable the firm to dispatch the materials by arranging transportation at destination allotted thereof within the said period. After this period of 15 days, the validity of the inspection will lapse. Thereafter, the inspection approval will be revalidated by competent authority on furnishing written application explaining therein the valid reasons for delay in affecting dispatches.

The firms shall not dispatch the offered lot unless the same is inspected by the inspector of PGVCL and accepted by him after passing in all acceptance tests, and/or receipt of waiver of inspection in writing from competent authority of PGVCL.

17 Deviation:

Bidder shall submit deviations from this specification if any, in Annexure-D

18 GUARANTEE:

If the material found defective due to bad design or workmanship the same should be repaired or replaced by you free of charge if reported within 36 months from the date of supply of material.

The bidder will be responsible for the proper performance of the equipments/material for the respective guarantee period.

ANNEXURE: A-1

Guaranteed Technical Particulars of 11KV Composite, 5KN, Insulator (Pin Type).

Name of the Manufacturer:

Address of works: BIDDER HAS TO CONFIRM FOLLOWING IMPORTANT REQUIREMENT

| Sr. No. | Description | Unit | Min. requirement for 11 kV Pin Insulator | As per firm offer |
|---------|---|------|--|-------------------|
| 1. | Type of Insulator | | Polymeric Composite | |
| 2. | Standard according to which the insulators manufactured and tested. | | IEC 61109:2008 (with latest amendments if any) | |
| 3. | Name of material used in manufacture of the insulator with class/grade) | | SILICONE Wacker-Germany Dow Corning-USA | |
| (a) | Material of core(FRP rod) (i) E-glass of ECR-glass. (ii) Boom content | | ECR or BORRON FREE | |
| (b) | Material of housing & weather sheds (silicon rubber contentby weight) | | SILICONE RUBBER 30 % | |
| (c) | Material of bottom end fittings | | FORGED STEEL (Single piece only) | |
| (d) | Top fitting | | SGI/MCI/FORGED STEEL | |
| (e) | Sealing compound for end fittings | | RTV SILICONE | |
| 4 | Colour | | GREY | |
| 5 | Electrical characteristics | | | |
| (a) | Nominal system voltage | | 11 KV (rms) | |
| (b) | Highest system voltage | | 12 KV (rms) | |
| (c) | Dry Power frequency withstand Voltage | | ≥ 70 KV (rms) | |
| (d) | Wet Power frequency withstand Voltage | | ≥ 45 KV (rms) | |
| (e) | Dry lighting impulsewithstand voltage a) Positive b) Negative | | ≥ 110 KV (Peak) ≥ 110 KV (Peak) | |
| (f) | Dry lighting impulse flashover voltage a) Positive b) Negative. | | ≥ 120 KV (Peak) ≥ 120 KV (Peak) | |
| (g) | RIV at 1 MHz when energized at 10 kV/30kV (rms) under dry condition. | | <100 micro volts | |
| (h) | Creepage distance (Min.) | | ≥ 340 MM(min) | |
| 6(a) | Mechanical characteristics : Minimum bending | | | |

| | | | | |
|-------|---|-----|--|--|
| | load. | | 5 KN Bending | |
| 7 | Dimensions of insulator | | | |
| (i) | Weight | Kg. | 1.20 KG(Approx.) | |
| (ii) | Dia of FRP rod | mm | 21.7 MM (Min) | |
| (iii) | Outer Dia of FRP rod with sheath | mm | 27.7 MM (Min) | |
| (iv) | length of FRP rod | Mm | Min 200 MM | |
| (v) | Dia of weather sheds | mm | ≥ 90 mm | |
| (vi) | Thickness of housing | mm | 3 MM | |
| (vii) | Dry arc distance Dimensioned drawings of insulator (including weight with tolerances in weight) enclosed. | mm | 165 MM (+ ve tolerance shall be allowed & no negative tolerance shall be allowed) | |
| 8 | Method of fixing of sheds to housing (specify).Single mould or Modular construction(injection Moulding) | | Injection moulding | |
| 9 | No of weather sheds | | 3 (Min.) | |
| 10 | Type of sheds- Aerodynamic | | Aerodynamic | |
| 11 | Packing details | | | |
| (a) | Type of packing | | Strong corrugated box of minimum 7 ply duly palletted in good quality Polythin Plastic bag with 10 nos of insulators | |
| (b) | No. of insulators in each pack | | 10 nos. (Maximum) | |
| (c) | Gross weight of package. | | 15KG.(Maximum) | |
| 12. | Any other particulars which the bidder may like to give. | | | |
| 13. | Length of Crimping dye for both end of FRP Rod should be minimum. | mm | 25 MM | |
| 14 | Each Insulator unit shall have legibly and indelibly Emboss/Engrave Following parameters. | | 1. Name or Trademark of the Manufacture. 2. AT no. (i.e. AT outward no.) 3. Month and Year of Manufacturing. 4. Word-“Name of DISCOM” | |

ANNEXURE: B

Test on Insulator units

1. RIV Test (Dry)

The insulator string along with complete hardware fittings shall have a radio interference voltage level below 100 micro volts at one MHz when subjected to 50 Hz voltage of 10 kV & 30 kV for 11 kV & 33 kV class insulators respectively under dry condition. The test procedure shall be in accordance with IS : 8263/IEC:437/CISPR 18- 2.

2. Brittle Fracture Resistance Test

Brittle fracture test shall be carried out on naked rod along with end fittings by applying “1N HNO₃ acid” (63 g conc.HNO₃ added to 937 g water) to the rod. The rod should be held at 80% of SML for the duration of the test. The rod should not fail within the 96 Hour test duration. Test arrangement should ensure continuous wetting of the rod with Nitric acid.

3. Recovery of Hydrophobicity & Corona Test.

The test shall be carried out on 4 mm thick samples of 5 cm x 7 cm.

- (i) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the Hydrophobicity classification in line with STRI guide for Hydrophobicity classification (Extract enclosed at Annexure-D) Dry the sample surface.
- (ii) The sample shall subjected to mechanical stress by bending the Sample over a ground electrode. Corona is continuously generated by applying 12 kV to a needle like electrode placed 1 mm above the sample surface. Tentative arrangement shall be as shown in Annexure-E. The test shall be done for 100 hrs.
- (iii) Immediately after the corona treatment, spray the surface with Water and record the HC classification. Dry the surface and repeat The corona treatment as at Clause-2 above. Note HC classification. Repeat the cycle for 1000 Hrs. or until an HC of 6 or 7 is obtained Dry the sample surface.
- (iv) Allow the sample to recover and repeat hydrophobicity Measurement at several time intervals. Silicone rubber should recover to HC 1 – HC 2 within 24 to 48 hours, depending on the Material and the intensity of the corona treatment.

4. Chemical composition test for Silicone content :

The identification of presence of silicone rubber and its content by weight in the composite polymer part of insulator shall be evaluated by Infrared Spectroscopy / EDX (Energy Dispersion X-ray) Analysis or Thermo-gravimetric analysis. The test may be carried out at CPRI or any other NABL accredited laboratory.

ANNEXURE: C

Enclosures:

Bidder has to enclosed following documents and has to confirm for the same.

| Sr. No. | Particulars | Confirmation |
|----------------|---|---------------------|
| 1 | PGVCL Tender Drawing with detailed dimension duly signed & stamped | Yes/No |
| 2 | Type test certificate covering all the tests as per CL. No. 8.2 along with attested drawing from Govt. approved laboratory. | Yes/No |
| 3 | List of Plant & Machinery at firms works | Yes/No |
| 4 | List of Testing Equipments at firms works | Yes/No |
| 5 | List of orders pending/executed at least for past three years for the items offered. (a). With GUVNL or its DISCOMs. (b). With the other DISCOMs. (c). With Private Parties. | Yes/No |
| 6 | Performance Certificate | Yes/No |

ANNEXURE: D

Bidder has to mention below deviation if any, quoting relevant Clause of specification

| |
|----------------|
| DEVIATION : |
|----------------|

7. Common Technical Specifications For M. S. Bolts and Nuts

1. REQUIREMENT:

M.S. Bolts Black Hexagonal Head Round Neck with Hexagonal Nuts with two washers confirming to IS: 1363/2002 with latest amendments if any. The bolts and nuts shall be ISI marked and Washers shall conform to IS: 2016/1967 with latest amendments if any.

2. PACKING:

The bolts and nuts with two washers duly assembled shall be packed in new sound, double jute / woven polythene bags and each pack shall contain maximum 50 Kgs. Net weight.

3. BIS LICENSE:

Notarized Xerox copy of valid license for I.S. marking shall be submitted with the tender. If BIS License is not submitted, the offer of the tenderer will be ignored. If validity of license has expired and if tenderer has applied for extension in validity, the Xerox copy duly attested by Govt. Gazette Officer of acknowledgement of Bureau of Indian Standards for application in validity shall be submitted with the tender.

4. EXPERIENCE:

Tenderers should give the list of orders executed at least during last two years invariably.

5. TYPE TEST CERTIFICATE:

The Bidders have to submit notarized copy of all type test certificate as per IS: 1363/2002 with latest amendments time to time if any, along with Offer.

6. INSPECTION:

Inspection shall be offered at manufacturer's works only. All relevant Acceptance tests as per IS shall be carried out. A sample criterion for the acceptance test is to be considered as per relevant IS.

7. TENDER SAMPLE:

Three nos. of samples should be submitted to DISCOM's Store as mentioned in tender, prior to due time and date of opening of the tender.

Note:

- There must be some symbolic impression on Nut Bolts to identity the same having ISI properties.
- Bidder shall have to emboss Company's name on the head of bolts i.e. Name of DISCOM.

8. TENDER DRAWING:

The bidders has to submit 03 no. of copies of tender Items drawings duly signed and sealed along with offer.

**GURANTEED TECHNICAL PARTICULARS
FOR SUPPLY OF VARIOUS SIZE M.S. BLACK BOLTS AND NUTS**

PART – “A”

Bidder has to confirm following important requirements:

| Sr. No. | Particulars | Confirmation Please tick YES or NO |
|----------------|---|---|
| 1 | M. S. Bolts Black hexagonal head round neck with hexagonal nuts with two washers shall be manufactured and supplied conforming to IS: 1363/2002 and Washers shall conform to IS: 2016/1967 with latest amendments if any and PGVCL's specifications | YES / NO |
| 2 | M. S. Bolts – Nuts with two washers shall bear ISI mark (Wherever applicable). | YES / NO |
| 3 | ISI license shall remain valid till order is completed. | YES / NO |
| 4 | Size of M.S. Bolts and Nuts with washers conforming the IS: 2016 - 1967 | |
| 5 | I. 300mm x 16mm (Length x Diameter) (Thread as per relevant IS) (Washers-3.15mm thick, O.D.-30mm, I.D.-18mm) | YES / NO |
| | II. 180mm x 16mm (Length x Diameter) (Thread as per relevant IS) (Washers-3.15mm thick, O.D.-30mm, I.D.-18mm) | YES / NO |
| | III. 65mm x 16mm (Length x Diameter) (Thread as per relevant IS) (Washers-3.15mm thick, O.D.-30mm, I.D.-18mm) | YES / NO |
| | IV. 65mm x 12mm (Length x Diameter) (Thread as per relevant IS) (Washers-3.15mm thick, O.D.-30mm, I.D.-14mm) | YES / NO |
| 6 | Packing shall be in new double jute / woven polythene bags and each pack shall contain maximum 50 Kgs. Net weight of Bolts & Nuts with 2 washers duly assembled. | YES / NO |

PART-'B'

Bidders have to furnish below mentioned documents and have to confirm the requirements:

| Sr.No. | Particulars | Confirmation Yes/No |
|---------------|--|--------------------------------|
| 1. | Type Test Certificate of Govt. approved/NABL Laboratory Name of Laboratory : Test Report Number : Date : | |
| 2 | Submission of Tender items drawing as per IS duly signed with supplier's seal | |
| 3 | List of Plant and Machinery | |
| 4 | List of Testing Facility. | |
| 5 | List of orders pending/executed a) With GUVNL (formerly GEB) & their subsidiary Companies Viz. MGVCL /UGVCL /DGVCL /PGVCL/ GETCO /GSECL b) With the agencies other than mentioned at (a) above | |
| 6 | 3 (Three) nos. of samples of offered items to be sent with tender | |

PART – “C”

Bidder has to mention technical deviation if any, quoting relevant clause of specifications of tender annexure only. Any deviation given elsewhere will not be considered and will be ignored.

8. Guy Strain Insulators

SPECIFICATION OF HT-LT STAY (GUY) INSULATORS:

1. SCOPE:

This specification covers the details of the Guy (Strain) insulators Porcelain White/Brown glazed insulators suitable for G.I. Stay Wire 7/3.15mm and to supply to any **Regional Store / Division Store / Any Destination within the territory of Gujarat State.**

2. APPLICABLE STANDARDS:

IS-5300/1969 (Fourth Reprint May-1989) and its latest amendment if any.

3. GENERAL REQUIREMENT:

3.1 The porcelain shall be sound and free from defects, thoroughly verified and smoothly glazed.

3.2 The glazes, shall be (Brown colour for type 'C' of Table of IS-5300/69 Fig-3 and 'White' colour for type 'B' of Table of IS-5300/69 Fig.2, except the parts on which the porcelain is supported during firing, which may please be left unglazed, all other surfaces of the insulators shall be effectively glazed.

The drawings as per Fig. 2 and Fig. 3 of IS-5300:1969 and its latest amendments are attached with specifications.

3.3 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.

3.4 The insulator shall be in one piece.

4. BASIC INSULATOR CHARACTERISTICS:

The test voltage of the insulators shall be as per IS-5300/69 (Fourth Reprint May-1989)

NOTE: The withstand and flashover voltages are referred to the references atmospheric conditions.

5. MECHANICAL FAILING LOAD:

- | | |
|---|-------|
| 1. Type 'B' of Table-I of IS-5300/69 Fig.2. | 53 KN |
| 2. Type 'C' of Table-I of IS-5300/69 Fig.3. | 88 KN |

6. TESTS:

The Insulator shall comply with the following routine, type and acceptance tests as per IS: 5300 complying latest amendments and revisions, if any.

6.1 ROUTINE TEST:

Visual Examination

6.2 **TYPE TEST:**

The firm shall submit the **notarized copy** of type test report from Govt./**NABL** approved laboratory not more than **seven** years old along with offer. The following type tests are to be carried out on sample in the order mentioned bellow as per IS 5300/69.

- a) Visual examination.
- b) Verification of dimensions.
- c) Temperature Cycle test.
- d) Dry one-minute power frequency withstand test.
- e) Wet one-minute power frequency withstand test.
- f) Mechanical strength test
- g) Porosity test.

NOTE: The identification marks of firm provided on the insulator should be invariably mentioned in the type test certificate.

6.3 **ACCEPTANCE TESTS:** (to be conducted in the following order)

- a) Visual examination.
- b) Verification of dimensions.
- c) Temperature Cycle test.
- d) Mechanical strength test.
- e) Porosity test.

The number of insulators to be selected at random from the lot for acceptance tests shall be in accordance with following Table.

| Lot Size | Sample Size |
|-----------------|---|
| (1) | (2) |
| Up to 500 | As agreed to between the purchaser and the supplier |
| 501 to 800 | 12 |
| 801 to 3200 | 16 |
| 3201 to 8000 | 18 |
| 8001 and above | 20 |

7. **MARKING:**

7.1 Each insulator shall be legibly and indelibly marked to show the following.

- a) Name or Trade mark of manufacturer.
- b) Year of manufacture.

- c) Name of DISCOM i.e. DGVCL/MGVCL/PGVCL/UGVCL
- d) Minimum failing load in KN.

7.2 Marking on porcelain shall be applied before firing.

8. PACKING:

Each Insulator should be wrapped with dry grass. This shall be then packed in either polythene or double gunny bags. No. of insulator should not be more than 50 Nos. per bag for type 'B' and 30 Nos. per bag for type 'C'.

Manufacturer's Name and Address:

GUARANTEED TECHNICAL PARTICULARS (GTP)

Technical information and guaranteed technical information for LT-HT stay (guy) insulators.

PART – ‘A’

Bidder has to confirm following important requirement:

| Sr.no. | Particulars | | | Confirmation | |
|--------|--|-------|-------|--------------|------------|
| | | | | HT | LT |
| 1 | Type & Designation a) HT Type C of Table-I of IS-5300/69 Fig-3. b) LT Type B of Table-I of IS-5300/69 Fig-2. | | | Yes --- | --- Yes |
| 2 | Overall Dimensions | HT | LT | | |
| | Length | 140mm | 110mm | Yes | Yes |
| | Diameter | 85mm | 75mm | Yes | Yes |
| | Cable hold | 25mm | 22mm | Yes | Yes |
| 3 | Minimum failing load HT 88KN LT 53KN | | | Yes --- | --- Yes |
| 4 | Colour of insulator HT Brown LT White | | | Yes --- | --- Yes |
| 5 | Tolerance of insulator as per IS-5300/69 (4th reprint May-89) | | | Yes | |
| 6 | Dry power frequency/withstand HT- 27 KV LT – 22 KV | | | Yes --- | --- Yes |
| 7 | Wet power frequency withstand HT-13 KV LT- 9 KV | | | Yes --- | --- Yes |
| 8 | Marking on insulator DISCOM, Name of manufacturer, Year and Min. failing load. | | | Yes | Yes |
| 9 | Packing of insulator as per Clause No. 8.0 under heading packing. | | | Yes | Yes |

Signature & Seal of Tenderer.

PART-'B'

Bidder has to furnish below mention details about material

1. Type of firing the insulator.
2. Details of test conducted on raw materials.
3. Quality assurance plan which are being implemented.

Signature & Seal of Tenderer.

PART-'C'

ENCLOSURES:

Bidder has to enclose following documents and has to confirm for the same.

| Sr.No. | Particulars | Confirmation |
|---------------|--|---------------------|
| 1 | 3 nos. (Three) of samples for HT & LT Stay Insulators to be sent with tender. | Yes |
| 2 | Type test certificate covering all the tests as per Cl.no. 6.2 of specification under heading type test from Govt. approved laboratory. | Yes |
| 3 | List of Plant & Machinery | Yes |
| 4 | List of Testing equipments | Yes |
| 5 | List of orders pending/executed at least for past two years for the items offered a) With GUVNL & subsidiary company b) With the purchases other than GUVNL & subsidiary company | Yes Yes |

Manufacturer's Name
and Address:

Signature & seal of Tenderer.

PART-'D'

Bidder has to mention below deviation if any, quoting relevant clause of specification.

Manufacturer's Name and Address

Signature & seal of Tenderer.

9. Earthing Coil

Earthing Coils shall be fabricated from soft GI Wire Hot Dip Galvanized. The Hot Dip galvanized wire shall have clean surface and shall be free from paint enamel or any other poor conducting material. The coil shall be made as per REC constructions standard (Refer tender drawing No. REC-XI Plan-Gen-005). The Hot Dip galvanizing shall conform to IS:2629/1966, 2633/1972 and 4826/1969 with latest amendments. Galvanizing should be heavily coated and should stand for the following tests.

Galvanizing Tests

- i) Minimum Mass of Zinc
 - a) ON GI Wire used 280 cm/m^2
 - b) After Coiling – 266 gm/m^2 . The certificate from recognized laboratory shall be submitted towards mass of zinc.
- ii) Dip Test Shall stand 3 dips of 1 minute and one dip of $\frac{1}{2}$ minute before coiling and 43 dips of 1 minute after coiling as per IS : 4826/1979.

THE DIMENSIONAL REQUIREMENT SHALL BE AS FOLLOWS

- a) Nominal dia of GI Wire 4 mm (Tolerance $\pm 2.5\%$)
- b) Minimum no. of turns – 115 Nos.
- c) External dia of Coil (Min) – 50 mm
- d) Length of Coil (Min) – 460 mm
- e) Free length of GI Wire at one end coil (Min.) – 2500 mm

The turns should be closely bound. Weight of one finished Earthing Coils (min.) – 1.850 Kg.

Adhesion test – As per ISS 4826 – 1979.

10. G.I. Earthing Bolts & Nuts with Washer & Spring Washer for Earthing of HT/LT Distribution System

SCOPE :-

This specification covers the details of G.I. Bolts and Nuts (With washer and spring washer) of size 40mmx16mm for Earthing purpose. The same are to be used to connect G.I. Wire.

APPLICABLE STANDARD :-

Except when it complies with specific requirement in this specification, the bolts and nuts shall comply with IS: 1363/1992 Part-I and Part-III & the zinc coating shall comply with IS: 2633/86 with latest amendments. Plain washer as per IS: 2016 /1967 suitable for M-16 Bolts and Spring Washers as per IS: 3063/1994 suitable for M-16 bolts.

Applicable Drg. : Drg. No. Tech - 321 Rev. 4.

TESTS :-

The bolts, nuts, washers and spring washers shall be hot dip galvanized and shall withstand following acceptance test:

- i) Visual Inspection.
- ii) Dimension check.
- iii) Galvanizing test (Uniformity) (Four dips)

SAMPLING :-

Sampling for each lot shall be 32 Nos. for the above acceptance tests.

PACKING :-

The bolts shall be packed in lots of 250 Nos. duly assembled in standard double gunny bags or double woven polythene bag, packing. Supplier should keep the material duly packed in double gunny bag or double polythene bags with lead seal provided for sealing of materials after inspection.

TENDER SAMPLES :-

Three Nos. of samples should be submitted so as to reach Deputy Engineer, Regional Store Office, PGVCL, Rajkot prior to due time & date of opening of the tender. Bidder shall have to Emboss Company's name on the head of bolts i.e. PGVCL.

SUBMISSION OF DRAWING :-

The successful bidders will have to submit the three Nos. of drawing within 7 days from the date of receipt of the order for our approval.

Name of Manufacturer

and Address:

GUARANTEED TECHNICAL PARTICULARS

PART 'A'

Technical Information and Guaranteed Technical Particulars for supply of G.I.Earthng Bolts & Nuts size 40X16 mm:

| Sr. No. | Particulars | Confirmation |
|----------------|--|---------------------|
| 1 | The G.I.Earthng Bolts & Nuts size 40X16 mm with plain Washer & Spring Washer shall confirm to- 1) IS:1363 (P.I & III), IS: 2633/86, IS: 2016/67 & IS: 3063/94 2) Company Specification & 3) Drawing No. Tech X 321 (Rev. 4) | Yes |
| 2 | Size 40X16 mm | Yes |
| 3 | Dimension of Bolts & Nuts shall be as per IS:1363/92 full thread M-16, except slot dimension, as per Drg. No. Tech - 321 (Rev. 4). | Yes |
| 4 | Dimension of Washer shall be as per IS: 2016/67 | Yes |
| 5 | Dimension of Spring Washer shall be as per IS: 2016/67 | Yes |
| 6 | Bolt, Nut, Washer, Spring Washer shall be hot dip galvanized. | Yes |
| 7 | Tolerance in dimension as per relevant IS and as mentioned in Drawing No. Tech X 321 (Rev. 4) | Yes |
| 8 | Galvanizing Test as per IS: 2633/86 | Yes |
| 9 | Packing shall be in double gunny bags / polythene bags containing 250 Nos. per bag. | Yes |

PART 'B' : (ENCLOSURES)

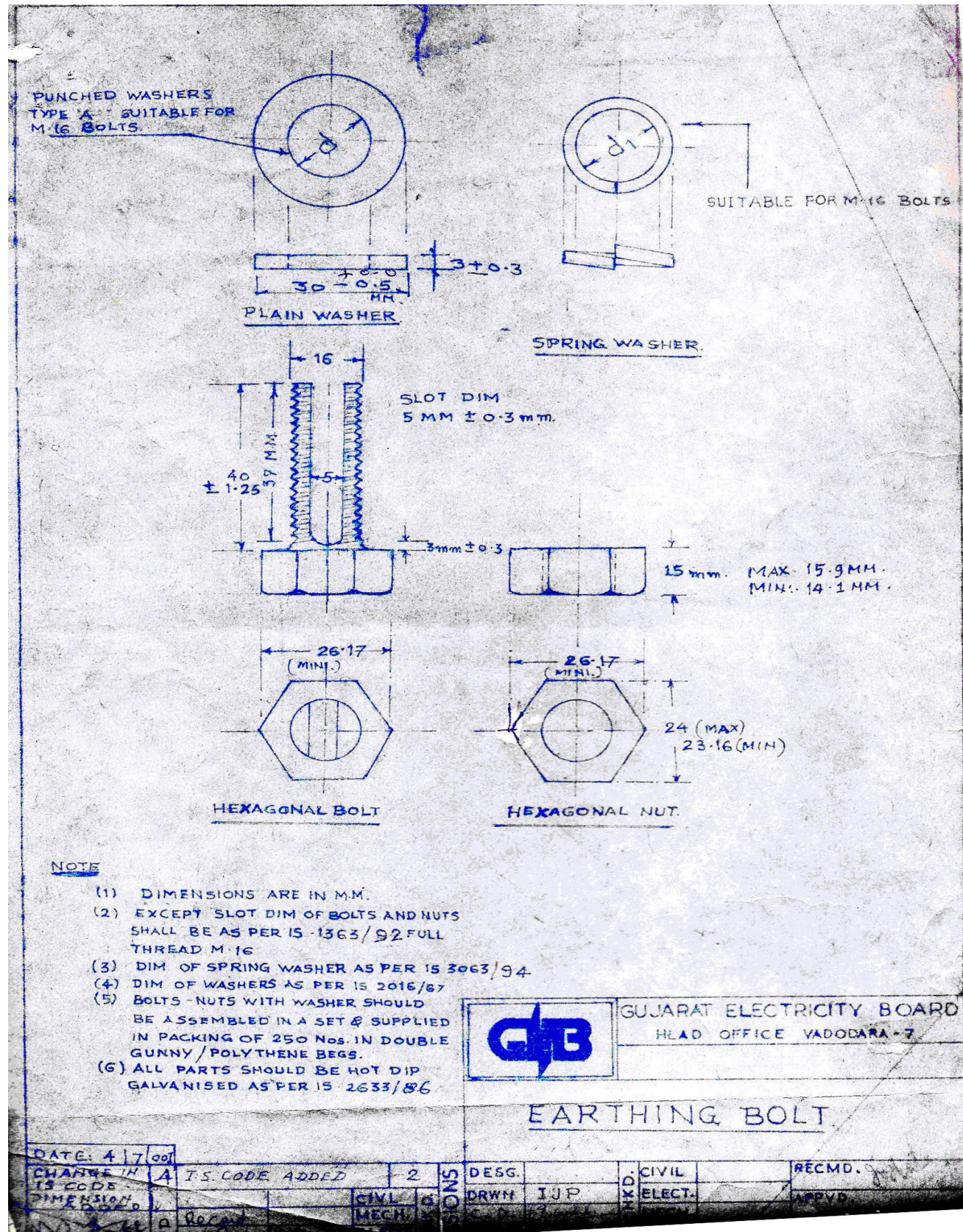
Bidders have to furnish below documents and have to confirm the requirements:

| Sr. No. | Particulars | Confirmation |
|----------------|---|---------------------|
| 1 | Submission of own drawing duly signed & seal in line with Drawing No. Tech X 321 (Rev. 4) | Yes |
| 2 | List of Plant & Machinery available. | Yes |
| 3 | List of testing facilities. | Yes |
| 4 | List of orders pending / executed: a) With GUVNL (Formerly GEB) and/or their subsidiary companies i.e. PGVCL/MGVCL/DGVCL/UGVCL b) With agencies other than GUVNL (Formerly GEB) and/or their subsidiary companies i.e. PGVCL/MGVCL/DGVCL/ UGVCL | Yes |
| 5 | 3 nos. (Three) of samples to be sent before due time & Date of the tender. | Yes |

PART 'C'

Bidder has to mention technical deviation if any, quoting relevant clause of specifications, in respective Annexure only. Any deviation given elsewhere will not be considered and will be ignored.

Drawing:



11. Earthing Conductors

All conductors buried in earth and concrete and above ground level shall be galvanised steel. Galvanised steel shall be subject to four one minute dips in copper sulphate solution as per IS:2633.

12. Earthing

(AS PER IS 3043-1987)

Earthing shall generally be carried out in accordance with the requirements of Indian Electricity Rules 2003 amended from time to time and relevant regulations under Electricity Supply Authority concerned.

In case of high and extra high voltages, the neutral points shall be earthed by not less than two separate distinct connections with earth, each having its own electrodes sub-station and will be earthed at any other point provided no interference is caused by such earthing. If necessary, the neutral may be earthed through suitable impedance.

As far as possible, all earth connections should be visible for inspection. Each earthing system shall be so designed, that, the testing of individual earth electrodes is possible. It is recommended that the value of any earth system resistance shall be such as to conform to the degree of shock protection desired.

It is recommended, that a drawing showing the main earth connections and earth electrodes be prepared for each installation and submitted to Employer.

No addition to the current carrying system, either temporary or permanent, shall be made which will increase the maximum available fault current on its duration until it has been ascertained that the existing arrangement of earth electrodes, earth bus-bar etc., are capable of carrying the new value of earth fault current which may be obtained by this addition.

All materials, fittings etc., used in earthing shall conform to Indian Standard Specifications, wherever they exist.

GENERAL REQUIREMENTS AND PROCEDURES FOR EARTHING AT SUB-STATIONS.

The ground resistance for sub-stations should not exceed a value 2(two) ohms. The joints/connections in the earthing, system shall be welded only, except the connections, which require opening for testing/maintenance. Such connections should be bolted tightly, using spring and ring washers for proper contact pressure. The G.S. flats to be provided for the horizontally laid earth grid should have overlap welded joints, with length of welding at least twice the width of the flat, e.g., 100 MM for 50x6 MM G.S. flats. There should not be any dirt, grease, oil, enamel, paint or any such non-conductive coatings on the surfaces being joined/ connected. Only the finished joints/connections above ground may be provided with red-oxide or any other protective coating. Underground earth electrodes and earth grid elements, when laid, should have a clean metallic surface, free from paint, enamel, grease or any such non-conductive coatings.

As far as possible, all earth connections should be accessible for visual inspection. No cut-outs, links or switches, other than linked switches arranged to operate simultaneously on the earthed or earthed neutral conductor and the live wire shall be inserted in the supply system. Earth electrodes or mate should not be installed in close proximity to metal fence to avoid possibility of fence becoming live.

Separate earth electrodes, isolated from the earth grid, are to be provided for grounding the fence wires.

Pipes or rods used as electrodes should be in one piece, as far as possible, with a minimum allowable length of 3 mtrs. Except where rock or hard stratum is encountered, the pipe/rod electrodes should be driven into the ground to a minimum depth of 3 mtrs. The strip electrodes, forming the horizontal grid, should be buried underground to a minimum depth of 0.5 mtrs. The path of earth wire should be out of normal reach of any person, as far as possible.

For high resistivity soils, above 100 Ohm-mtrs., attempts should be made to bring the soil resistivity in the range of 50 to 60 Ohm-mtrs. By digging and treating the soil mass around the earth grid/electrodes with a mixture of salt and charcoal.

In case of rocky top soil and sub-stratum, having very high resistivity, with no scope of improvement by other means, the procedure given below should be followed:

1. At least two bores of diameter little less than 40 mm, with a minimum distance of 10 mtrs. between them, should be made in the ground at suitable locations inside the S/S yard. The boring should be done until soil sub-stratum rich in moisture and low in resistivity is encountered. G.I. pipes of 40 MM dia. should be descended in each bore, such that, the soil mass around the pipes grips them tightly, Back – filling of bores, if required, with wet soil/clay may be done to ensure this condition. The G.I. pipes in these deep bores should be interconnected with the main earthing grid of the S/S through 50x6 mm G.S. flat, with all the joints/connections and terminations being either fully welded, or clamped/bolted and welded simultaneously. The G.I. pipes in the bores should also be interconnected with each other. In extreme cases, the bores may have to be made at remote locations i.e. outside the S/S yard, with inter-connections, through 50x6 MM flats, as explained before.
2. The procedures to be observed stringently for making connections and joints between various elements of the earthing system are as follows:
 - a. G.S. flat to Structure/flat - The G.S. flat should be welded to the metallic portion (leg) of the structure after thoroughly cleaning the surfaces to be welded. The length of the welding should be at least twice the width of the G.S. flat, e.g.-minimum 100 mm for 50x6 mm G.S. flat. Exactly similar procedure is to be adopted for joints between two G.S. flats.
 - b. G.I. wire to structure. The G.I. wire should be bolted to the structure after making an eye formation and kept tight with the help of spring and ring washer. Then, the entire arrangement should be welded.
 - c. G.I. wire to G.S. flat- The G.I. wire should be bolted and then welded to G.S. flat, as explained above.
 - d. G.I. rod to G.S. flat- The G.I. rod should be securely clamped to the G.S. flat with the help of bolts and washers and the entire arrangement should then be welded.
 - e. G.I. wire to G.I. pipe – GI wire should be bolted to the G.I. pipe and then welded, keeping in view the relevant precautions, mentioned before.

- f. G.I. flat to G.I pipe – The GI flat should be bolted tightly to the G.I. pipe and then the connection should be welded.

Before making connections and joints, it should be ensured that, the elements to be joined have a clean metallic contact surface without any non-conductive coating.

EARTH GRID SYSTEM

Grid system of interconnected conductors forming a closed loop mesh is to be installed using 75x8 mm MS flat for peripheral and branch conductors. Interconnections are made by welding them. This earth grid will be laid at a depth of about 0.5 mtr. bonded to general mass of the earth by 3 mtrs. long earth electrode of solid MS rod (or pipe) of dia 25mm. The G.I. pipe 40 mm. dia 3 mtrs. long in the earthing pits, driven vertically.

It is to this earth grid that the transformer neutral, apparatus, frame work and other non-current carrying metal work associated like transformer tank, switchgear frame etc. are to be connected. All these connections should be made in such a way that reliable and good electrical connection is ensured. Aluminum/ other paint, enamel, grease and scale should be removed from the point of contact before connections are made. No part of the ground connection leads should be embedded in concrete.

Arrangement of connection of earth connection shall be as follow:

1. STRUCTURES:

Structures including frames, metal supports within the substation grid at least two legs, preferably diagonally opposite (where more than two legs are provided) on each metal structure shall be connected to earth grid with GI wire of 4mm dia or 6 mm dia.

2. ISOLATORS/ SWITCHES:

The operating handle shall be connected to earth grid independent of the structure earthing or through the steel mounting structure, through 4 mm dia G.I. wire.

3. LIGHTNING ARRESTOR:

The bases of lightning arrestors shall be directly connected to the earth electrodes by 4 or 6 SWG G.I. wires as short and as straight as practicable, to ensure minimum impedance. Separate earth leads should be used for L.A. in each phase. In addition there shall be as direct connections as practicable from the earthed side of the lightning arrestors to the frame of the apparatus being protected. Surge counters, could also be inserted in the circuit where lightning incidences are high, but in such cases, the lightning arrestor should be mounted on insulated base. Invariably, earth connections for lightning arrestors should be separate, and in no case should they be joined looped or meshed with other conductors. For lightning arrestors mounted near transformers, earthing connections shall be done with the earthing pits and earthing leads shall be laid clear of the tank and collars in order to avoid possible oil leakage caused by arcing. The earth connection should not pass through iron pipes, as it would increase the reactive impedance of the connection.

4. POWER TRANSFORMER:

- The tank of the transformer shall be directly connected to the main earth grid. In addition there shall be a separate and as direct a connection as practicable from the tank to the earth side of protecting LA using 4 or 6 SWG GI wire.
- The earthing of the neutral shall be by two separate, distinct and direct connections of 50x6 mm GS flat to earth pits, which form a part of the earth grid, and shall be run clear of the tank and collars.
- The transformer track rails shall be connected to earth

5. OUT DOOR VCB:

At least two legs, preferably diagonally opposite of the supporting structure frame work of each circuit breaker unit shall be connected to the earth grid, through 50x6 mm G.S. flats.

6. FENCING:

Fencing and gate should be earthed separately.

7. CURRENT TRANSFORMERS / POTENTIAL TRANSFORMERS:

The bases of the current transformers should be directly connected to the earth grid through 4 or 6 SWG G.I. wires. The base (neural side) of the P.Ts. should be directly connected to the earth grid through 4 or 6 SWG G.I. wires. Separate earth leads should be used for P.Ts. in each phase. The termination of leads on the P.T. neutral should be bolted/clamped and not welded, to facilitate opening of the earth connection for testing purposes. In addition, all bolted cover plates to which bushings are attached, should be connected to the earth grid, both in case of C.Ts. and P.Ts.

- 8.** Armoring of armored metal-sheathed cables within the station grid area shall be connected to the earth grid.

Substation L.T. Supply Transformer: Same as above except that the neutral earthing conductor used shall be 4 or 6 SWG G.I. wire.

13. GS Stay Sets (16 mm and 20 mm)

1. 16MM DIA STAY SETS (GALVANIZED)

The stay sets (Line Guy set) will consist of the following components:-

- a) **ANCHOR ROD WITH ONE WASHER AND NUT:** Overall length of rod should be 1800 mm to be made out of 16 mm dia GS Rod, one end threaded upto 40mm length with a pitch of 5 threads per cm and provided with one square GS washer of size 40x40x1.6mm and one GS hexagonal nut conforming to IS:1367:1967 & IS:1363:1967. Both washer and nut to suit threaded rod of 16mm dia. The other end of the rod to be made into a round eye having an inner dia of 40mm with best quality welding.
- b) **ANCHOR PLATE SIZE 200x200x6MM:** To be made out of GS plate of 6mm thickness. The anchor plate should have at its centre 18mm dia hole.
- c) **TURN BUCKLE & EYE BOLT WITH 2 NUTS:** To be made of 16mm dia GS Rod having an overall length of 450 mm, one end of the rod to be threaded upto 300 mm length with a pitch of 5 threads per cm and provided with two GS Hexagonal nuts of suitable size conforming to IS:1363:1967 & IS:1367:1967. The other end of rod shall be rounded into a circular eye of 40mm inner dia with proper and good quality welding.
- d) **BOW WITH WELDED ANGLE:** To be made out of 16mm dia GS rod. The finished bow shall have an overall length of 995mm and height of 450 mm, the apex or top of the bow shall be bent at an angle of 10 R. The other end shall be welded with proper and good quality welding to a GS angle 180mm long having a dimension of 50x50x6mm. The angle shall have 3 holes of 18mm dia each.
- e) **THIMBLE:** To be made on 1.5 mm thick GS sheet into a size of 75x22x40mm and shape as per standard shall be supplied.
- f) **GALVANIZING:** The complete assembly shall be hot dip galvanized.
- g) **WELDING:** The minimum strength of welding provided on various components of 16mm dia stay sets shall be 3100 kg. Minimum 6 mm fillet weld or its equivalent weld area should be deposited in all positions of the job i.e. at any point of the weld length. The welding shall be conforming to relevant IS: 823/1964 or its latest amendment. Minimum length of weld to be provided at various places in the stay sets shall be indicated by the bidder. Welding if, found short in lengths as per final approved drawings shall be rejected.
- h) **THREADING:** The threads on the Anchor Rod, Eye Bolt & Nuts shall be as per specification IS: 4218:1967 (ISO Metric Screw Threads). The nuts shall be conforming to the requirement of IS: 1367:1967 & have dimensions as per IS; 163:1967. The mechanical property requirement of fasteners shall conform to property clause 4.6 each for anchor rod & Eye bolt and property clause 4 for nuts as per IS: 1367:1967.

AVERAGE WEIGHT OF FINISHED 16MM STAY SETS 7.702 KG. (MINIMUM) (EXCLUDING NUTS THIMBLES AND WASHERS) 8.445 KG. (MAXIMUM)

2. 20 MM DIA STAYS SETS FOR 33KV LINES (GALVANIZED)

THE STAY SET (LINE GUY SET) WILL CONSIST OF THE FOLLOWING COMPONENTS:

- a) **ANCHOR ROD WITH ONE WASHER AND NUT:** Overall length of Rod should be 1800mm to be made out of 20mm dia GS Rod, one end threaded upto 40mm length with a pitch of 4 threads per cm. And provided with one square G.S. Washer of Size 50x50x1.6mm and one GS Hexagonal nut conforming to IS:1367:1967 & IS:1363:1967. Both washer & nut to suit the threaded rod of 20mm. The other end of the rod to be made into a round eye having an inner dia of 40mm with best quality welding. Dimensional and other details are indicated and submitted by bidders for owner's approval before start of manufacturing.
- b) **ANCHOR PLATE:** Size 300x300x8mm: To be made out of G.S. Plate of 8mm thickness. The anchor plate to have at its centre 22mm dia hole.
- c) **TURN BUCKLE, EYE BOLT WITH 2 NUTS:** To be made of 20mm dia G.S. Rod having an overall length of 450 mm. One end of the rod to be threaded upto 300mm length with a pitch of 4 threads per cm. The 20mm dia bolt so made shall be provided with two G.S. Hexagonal nuts of suitable size conforming to IS:1637/1967 & IS:1363/1967.

The other end of the rod shall be rounded into a circular eye of 40mm inner dia with proper and good quality of welding. Welding details are to be indicated by the bidder separately for approval.

- d) **BOW WITH WELDED CHANNEL:** To be made out of 16mm dia G.S. Rod. The finished bow shall have an overall length of 995 mm and height of 450 mm. The apex or top of the bow shall be bent at an angle of 10°. The other end shall be welded with proper and good quality welding to a G.S. Channel 200mm long having a dimension of 100x50x4.7 mm. The Channel shall have 2 holes of 18 mm dia and 22 mm dia hole at its centre.
- e) **THIMBLE 2 Nos.:** To be made of 1.5mm thick G.S. sheet into a size of 75x22x40mm and shape as per standard.
- f) **GALVANISING:** The complete assembly shall be hot dip galvanised.
- g) **WELDING:** The minimum strength of welding provided on various components of 20mm dia stay sets shall be 4900 kg. Minimum 6mm fillet weld or its equivalent weld area should be deposited in all positions of the job i.e. at any point of the weld length. The welding shall be conforming to relevant IS: 823/1964 or its latest amendment.
- h) **THREADING:** The threads on the Anchor Rods, Eye Bolts and Nuts shall be as per specification IS: 4218:1967 (ISO Metric Screw Threads). The Nuts shall be conforming to the requirements of IS: 1367:1967 and have dimension as per IS 1363:1967. The mechanical property requirement of fasteners shall conform to the properly clause 4.6 each for anchor rods and Eye bolt and property clause 4 for nuts as per IS: 1367:1967.

AVERAGE WEIGHT OF FINISHED 20MM STAYS SET: 14.523 KG. (MIN.) (EXCLUDING NUTS THIMBLE & WASHER): 15.569 KG. (MAX.)

3. **TEST CERTIFICATE:** The contractor shall be required to conduct testing of materials at Govt./Recognized testing laboratory during pre – dispatch inspection for Tensile Load of 3100 Kg/4900 Kg. applied for one minute on the welding & maintained for one minute for 16 mm and 20 mm dia stay sets respectively.

4. **IDENTIFICATION MARK:** All stay sets should carry the identification mark of word RDSS and size of the stay set. This should be engraved on the stay plate and on stay rods to ensure proper identification of the materials.

The nuts should be of a size compatible with threaded portion of rods and there should be no play or slippage of nuts.

Welding wherever required should be perfect and should not give way after erection.

5. **TOLERANCES:** The tolerances for various components of the stay sets are indicated below subject to the condition that the average weight of finished stay sets of 16mm dia excluding nuts, thimbles and washers shall not be less than the weight specified above :-

| No. Item | Section Tolerances | Fabrication Tolerances | Material |
|-------------------|---------------------------|---|----------------------------|
| 1 Anchor Plate | 6mm thick + 12.5% - 5% | 200x200mm + 1% | GS plate 6mm thick |
| | 8mm thick + 12.5% - 5% | 300x300mm + 1% | GS plate 8mm thick |
| 2 Anchor Rod | 16mm dia + 5%- 3% | Length 1800mm + 0.5% | GS Round 16mm dia |
| | | Rounded Eye 40 mm inside dia + 3%. Threading 40mm+11% - 5 | GS Round 16mm dia |
| | 20mm dia + 3%- 2% | Length 1800mm + 0.5% | GS Round 20mm dia |
| | | Round Eye 40mm inside dia + 3%. Threading 40mm +11% -5% | GS Found 20mm dia |
| 3 Turn Buckle Bow | 16 mm dia + 5%- 3% | Length 995mm + 1% 16mm dia | GS Round 16mm dia |
| | | Length 180mm + 1% 50x50x6mm | GS Angle |
| | | Channel length 200mm + 1% | GS Channel 100x50x4.7mm |
| 4 Eye Bolt Rod | 16mm dia + 5%- 3% | Length 450mm + 1% Threading 300mm + 1% Round Eye 40mm inside dia + 3% | GS Round 16mm dia |
| | 20mm dia + 3%- 2% | Length 450mm + 1% Threading 300mm + 1% Round Eye 40mm inside dia + 3% | GS Round 20mm dia |

14. GI Stay Wires

(SECTION – I)

TECHNICAL SPECIFICATION

TECHNICAL SPECIFICATION FOR GI STAY WIRE SIZE 7/2.50MM (7/12SWG)

1. SCOPE:

This specification provides for manufacture, testing before dispatch at manufacturers work, supply and delivery of the 7/2.50mm stranded wire to any of our Regional/ Divisional Store/Destination, in Gujarat State as intimated by the PGVCL from time to time.

2. STANDARDS:

The G.I. Stranded wires shall comply with the specific requirement of IS-2141/2000, IS-4826/1979 and latest amendment if any.

3. MATERIAL:

The wires shall be drawn from steel made by the open hearth basic oxygen or electric furnace process and of such quality that when drawn to the size of wire specified and coated with zinc, the finished strand and the individual wires shall be of uniform quality and have the properties and characteristics as specified in this specification. The wires shall not contain sulphur and phosphorus exceeding 0.060 percent each.

4. TENSILE GRADE:

The wires shall be grade 4 having minimum tensile strength of 700 N/mm² confirming to IS-2141/2000 and latest amendment if any.

5. GENERAL REQUIREMENT:

The lay length of wire strands shall be 12 to 18 times the strand diameter.

6. MINIMUM BREAKING LOAD:

The minimum breaking load of the wires before and after stranding shall be as follows.

| No. of wires and Const. | Wire Dia (mm) | Min. breaking load of Single Wire before Strand (KN) | Min. breaking load of the Stranding wire (KN). |
|-------------------------|---------------|--|--|
| 7(6/1) | 2.50mm | 3.44 | <u>21.4</u> |

7. CONSTRUCTION:

7.1 The stay wire shall be of 7 wire construction. The wires shall be so stranded together that when as even distributed pull is applied at the end of completed stand, each wire shall take an equal share of the pull.

7.2 Joints are permitted in the individual wires during stranding but such joints shall not be less than 15 meters part in the finished strands.

7.3 The wire shall be circular and free from scale, irregularities, imperfection, flows, splits and other defect. The zinc coating shall confirm to IS: 4826/1979.

8. TOLERANCE:

A tolerance of ± 2.5 % on the diameter of wires before stranding shall be permitted.

9. SAMPLING CRITERIA:

The sampling criteria shall be in accordance with Table-3 Annexure-A of (clause no. 10.1 & 10.2) IS: 2141/2000 and latest amendment if any.

10. TESTS ON WIRES BEFORE MANUFACTURE:

The wire shall be subjected to the follow as tests in accordance with IS: 2141/2000 and its latest amendment if any.

(1) Ductility test.

(2) Tolerance on wire diameter.

11. TESTS ON COMPLETED STRAND:

The sampling criteria shall be in accordance with Table-3, Ann—A of IS 2141/2000 and its latest amendments if any.

a) Tensile and Elongation test.

The percentage elongation of the stranded wire shall not be less than 6 % (Grade-4) as per IS: 2141/2000 and latest amendment if any.

b) Chemical Analysis:

The manufacturer shall have to submit test certificate with every lot for the chemical composition of the steel rods from which the wires are drawn.

c) Galvanizing test.

The zinc coating shall confirm to "heavy coating" as laid down in IS 4826/1979 and latest amendment if any.

12. PACKING:

The G. I. Stay wire shall be supplied in coils. Each coil should be weighing 50 to 70 Kgs. Each coil shall be wrapped in hessian to avoid surface damage to wire during transport and for protection against pollution. Each coil shall be supplied with a metallic tag of aluminum with on the following particulars shall be printed/embossed/engraved with water-proof ink/itched.

1) Name of Manufacturer.

2) Size of G. I. Stay wire.

- 3) Coil Serial No.
- 4) Weight of Coil (in Kg.)
- 5) Tensile designation.
- 6) Coating.
- 7) A/T No. & Date.
- 8) ISI Mark if any.
- 9) Property of PGCCL

The Metallic tag should be of Aluminum Strip of size as below;

1. Thickness: 0.5mm, 80mm * 40 mm rectangular strip

13. SEALING:

The manufacturer shall keep all the coils ready with seal wire and lead seal so as to enable the respective company's inspectors to seal the inspected material immediately. Coils shall then be wrapped with hessian before dispatch.

14. GUARANTEED TECHNICAL PARTICULAR (G.T.P.)

The guaranteed Technical particulars (G.T.P.) given below. Bidders shall submit the details in guaranteed technical particulars (G.T.P.) in Section-II along with the offer.

15. DEVIATION FROM SPECIFICATION:

Deviation in the above specification shall not be allowed.

16. Bidders are requested to submit the following documents along with the offer:

- i) Guaranteed Technical particular (G.T.P.) given below.
- ii) List of Testing Equipments.
- iii) List of plant & machinery and production capacity.
- iv) List of order executed with erstwhile "GEB/DISCOM under GUVNL".
- v) The tenderers are required to submit duly Notarized copy of the valid ISI license up to date of delivery for supply of GI wire with the tender, failing which the offer would be rejected.

17. SUBMISSION OF TEST CERTIFICATES:

The bidder has to submit the Notarized copy of type test certificates of following tests from any Govt. approved / NABL accredited test lab along with the bid, not more than seven years old as per IS-2141/2000 and latest amendment if any. The type test certificate shall cover the entire tests as per IS 2141 with latest amendment/ revision in operation on date of submission of bid.

Manufacturers Name:

& Address:

(SECTION-II)

GUARANTEED TECHNICAL PARTICULARS

G. I. Stay wire 7/2.50 mm (7/12 SWG)

Technical information and guaranteed technical particulars for supply of G. I. Stay wire 7/2.50mm (7/12 SWG) size.

PART - A

Bidder has to conform following important requirements:

| Sr. No | Particulars. | Confirmation |
|--------|---|--------------|
| 1 | The G. I. Stay wire 7/2.50mm shall confirm to IS: 2141/ <u>2000</u> and 4826/1979 and PGVCL's Specification and latest amendment if any. | Yes/No |
| 2 | Quality of Wire shall be hard. | Yes/No |
| 3 | The wire shall not contain Sulphur and phosphorous exceeding 0.060 % each. | Yes/No |
| 4 | The wire shall be of Grade-4 having minimum tensile strength 700 N/MM2 | Yes/No |
| 5 | The wire shall be of 2.50mm diameter qirt + or - 2.5 % tolerance. | Yes/No |
| 6 | The wire shall be circular and free from scale, irregularities, imperfection, flows, splits and other defect. | Yes/No |
| 7 | Minimum breaking load of Single wire shall be 3.44 KN. | Yes/No |
| 8 | Minimum breaking load of the stranded wire shall be 21.4 KN. | Yes/No |
| 9 | Lay Ratio shall be 12 to 18 (RHS) | Yes/No |
| 10 | The percentage elongation of the stranded wire shall be 6 % minimum (Grade-4) | Yes/No |
| 11 | The wire shall be heavily zinc coated | Yes/No |
| 12 | The wire shall be hot dip galvanized as per IS:4826/79 | Yes/No |
| 13 | The mass of zinc coating shall be 218.5 Gms/m2 (Minimum) | Yes/No |
| 14 | 2 Nos. of 1 minutes dips guaranteed for uniformity test. | Yes/No |
| 15 | Weight of each coil shall be from 50 Kg. to 70 Kg. | Yes/No |
| 16 | Each coil shall be wrapped in hessian to avoid surface damage. | Yes/No |
| 17 | Each coil shall be supplied with a metallic tag with following particular shall be printed with water proof ink/itched. a) Name of Manufacturer. b) Size of G. I. Stay wire. c) Coil Serial No. d) Weight of Coil (in Kg.) e) Tensile designation. f) Coating. g) A/T No. & Date. h) ISI Mark if any. i) Property of PGVCL | Yes/No |

PART – B

Bidder has to enclose following documents and has to confirm for the same.

| Sr. No | Particulars. | Bidder Confirmation. (Yes/No) |
|--------|--|----------------------------------|
| 1 | ISI License for IS 2141/2000 and latest amendment if any. a) No. & Date. | |
| 2 | Proof if applied for renewal of ISI License | |
| 3 | Notarized copy of type test certificates from Govt. Approved/NABL laboratory a) Name of Lab & City b) T.R. No c) Valid up to date | |
| 4 | List of Plants & Machinery. | |
| 5 | List of order executed / pending at least for past two years for the item offered. | |
| 6 | Notarized copy of the BIS License (with schedules ((FIRST) & II (SECOND) held by the firm for using IS mark for the tendered items | |

PART – C

Bidder has to mention technical deviation if any, quoting relative clause of specification, in Annexure 12 of the tender document only.

Signature & Seal of Tenderer.

15. GI Wires

SECTION-I (G.I.PLAIN WIRE) TECHNICAL SPECIFICATION FOR G. I. WIRE

1. SCOPE:-

This Specification provides for manufacture, testing before dispatch at manufacturer's work and supply and delivery of 3.15mm and 4mm solid heavily coated Galvanized solid steel wire to any of our Regional Stores in Gujarat State as intimated by the PGVCL time to time.

2. STANDARD:-

The G. I. wires shall comply with the following Indian standards (subject in all cases to latest revision/amendments currently in force)

| | | |
|----|--------------------------------|--|
| a) | IS: 280/1978 (IIIrd revision). | Specification for Mild Steel Wire for general engineering purpose. |
| b) | IS: 4826/1979 (Ist revision). | "Specification for Hot Dipped Galvanized coating on round steel wires." |
| c) | IS: 1867/1967 (Ist revision). | 'General requirements for the supply to metallurgical materials.' |
| d) | IS : 7887/1992 | Specification for Mild Steel Wire Rods for general engineering purpose. |
| e) | IS : 1521/1972 (Ist revision) | 'Method for tensile testing of steel wires. |
| f) | IS : 1755/1983 | 'Method for wrapping test of wire'. |
| g) | IS : 2633/1986 (Ist revision) | 'Methods for testing uniformity of coating on zinc coated articles'. |
| h) | IS : 6745/1972 | 'Methods of determination of weight of zinc coating on zinc coated iron and steel articles'. |
| i) | IS : 209/1992 (IVth revision) | 'Specification for zinc.' |
| j) | IS : 2629/1985 | 'Recommended practice for hot dip galvanising of steel and iron'. |

3. MATERIAL:-

General requirement relating to the supply of Mild Steel Wire shall be as per IS: 1387/1967. The wire shall be drawn from the Wire rods confirming to IS: 7887/1992. The wire shall be sound-free from splits, surface flares rough, jagged and imperfect edges and other harmful surface defect.

4. SIZES: -

- (a) 3.15 mm dia.
- (b) 4.00 mm dia.

5. QUALITY:-

Both the sizes of G. I. wires shall be of soft drawn quality confirming to IS: 280/1978.

6. TENSILE STRENGTH.

The tensile strength of the G. I. wire when tested in accordance with IS: 1821/1972 shall be between 450.550N/mm².

7. ZINC COATING:-

The wire shall be galvanized in accordance with IS: 2629/1986 and the zinc to be used for Hot dip galvanizing shall confirm to grade Zn-98, specified in IS: 209/1992. The coating shall be uniform, smooth and free from visual defect.

Such as flash and dress inclusion bare patches black spots, pimples, lumpiness, rust strains, bulky white deposit and bistro. The coating shall be "HEAVELY COATED QUALITY".

8. TESTS:-

The following acceptance tests shall be carried out on each and every lot at manufacturers premises at the manufacturer's cost. The manufacturer must be fully equipped to carry out the tests at his premises in presence of PGVCL's Inspectors.

- a) Visual examination.
- b) Checking of diameters of wires.
- c) Tensile Strength. As per relevant ISS specified
- d) Wrapping test. Para -2 hereof.
- e) Mass of zinc coating.
- f) Uniformity of zinc coating.
- g) Adhesion of zinc coating.

The manufacturer shall have to submit Test Certificates with every lot for the Chemical composition of the Steel rods from which the wires are drawn.

9. SAMPLES:

The sampling for Acceptance Test shall be carried out as per Appendix 'A' of IS: 280/1978 (Third revision)

10. PACKING:-

The G. I. Wire shall be supplied in coils. The weight of the coil shall be 50 Kg. to 80 Kg. Each coil shall be wrapped in hessian to avoid surface damage to the wire during transport and for protection against pollution. Each coil shall be supplied with a metallic tag on which the following particulars shall be printed/etched with waterproof ink/etched.

- (1) Name of Manufacturer.

- (2) Size of Wire.
- (3) Weight of Coil (approx.) Kg.
- (4) Coil Serial No.
- (5) A/T No. & Date,.
- (6) ISI Mark if any.
- (7) Property of PGVCL.

11. SEALING:

The manufacturer shall keep coils ready with seal wire and lead seal so as to enable the PGVCL's inspectors to seal the inspected material immediately. Wrapping of coils with hession shall be done after inspection but before dispatch.

12. GUARANTEED TECHNICAL PARTICULARS. :-

The tenderers shall submit the Guaranteed Technical Particulars as per the proforma SECTION-II attached herewith only. The offers without technical particulars shall be ignored.

13. DEVIATION FROM SPECIFICATION:-

No deviation in the above specification shall be allowed.

**Name of Manufacturer:
& Address.**

**SECTION-II
(G.I. PLAIN WIRE)**

GUARANTEED TECHNICAL PARTICULARS.

Technical information and guaranteed Technical Particulars for supply of G. I. Wire size 3.15mm dia and 4.00 mm dia.

PART -A

BIDDER HAS TO CONFIRM FOLLOWING IMPORTANT REQUIREMENT:

| Sr. No. | Particulars. | Confirmation |
|----------------|---|---------------------------------|
| 1) | The G I. Wire of 3.15mm dia x 4.00mm dia with tolerance of +or- 2.5 % in dia as per IS:280/1978 with latest amendment/revision if any. | Yes |
| 2) | The G. I. Wire shall drawn from soft wire having tensile strength 450-550 N/mm ² | Yes |
| 3) | Breaking Load shall be as under : for G. I. Wire 3.15mm dia x 339.3 to 459.2 for G. I. Wire 4.00 mm dia 544 to 740.54 | Yes Yes |
| 4) | Zinc coating shall be as under i) Heavy coating IS : 4826/78 ii) Hot dip galvanizing, weight of zinc coating when tested IS : 4826/79 iii) The quality of zinc shall be as per IS : 209/1992 iv) No. of dip guaranteed. 3 Nos. of 1 minute dips & 1 No. 1/2 minute dip as per IS:2633/1986 | Yes Yes Yes Yes Yes |
| 5) | Weight of coils shall be from 50 Kg. to 80 Kg. | Yes |
| 6) | Packing condition as per clause No. 10 of Tender specification. | Yes |

PART - B (ENCLOSERS)

BIDDER HAS TO ENCLOSE FOLLOWING DOCUMENTS AND HAS TO CONFIRM FOR THE SAME:

| Sr. No. | Particulars. | Confirmation |
|----------------|---|-------------------------|
| 1) | List of Plant and Machinery. | Yes |
| 2) | List of Testing Equipments. | Yes |
| 3) | List of Orders pending / executed at least for past two years for the item offered: (A) With GUVNL. (B) With the purchase other than GUVNL. | Yes Yes. |

PART - C

BIDDERS HAS TO MENTION BELOW DEVIATION IF ANY, QUATING RELEVANT CLAUSE OF SPECIFICATION.

16. HD PVC Rigid Pipe

TECHNICAL SPECIFICATIONS OF HD PVC RIGID PIPE

1. SCOPE:

This specification covers the manufacture, testing at works and supply of HD Rigid PVC Pipe.

2. APPLICABLE STANDARD: IS-9537 (Part-I & III) 1983 and latest amendment of it if any.

3. GENERAL CONSTRUCTION REQUIREMENT OF HD RIGID PVC PIPE MATERIAL:

Material should be strictly supplied confirming IS-9537/1983 Part-I & III and latest amendment of it if any.

Colour : White.

Dimensions. : Inside diameter 10 MM + or – 1 MM.

Wall thickness. : 3.0 MM to 3.5 MM

Length. : 2.5 Meter with tolerance + 10 MM

4. MARKING:

“Name of DISCOM”, trade mark of supplier and Nominal size of conduits should be screen printed & embossed on the pipe at every half meter length preferably at 50 MM from one end.

5. TYPE TEST CERTIFICATE:

The Firm has to submit notarized copy of type test certificate not more than 7 years older HD Rigid PVC pipe for all the tests as per clause No. 14.1 of IS-9537 Part-III/1983 and latest amendment of it if any except bending test (Clause No. 9.2) and collapse test (Clause No. 9.5) as both the tests not applicable for 10 MM HD PVC Pipe.

6. ACCEPTANCE OF LOT:

6.1 Sampling and acceptance criteria. The numbers of samples selected randomly from the lot shall be in accordance with acceptance criteria in assurance with Appendix-A (A-2.1) of IS-9537 Part-III/1983 and latest amendment of it if any as under:

Scale of Sampling

| Lot Size | For Dimensional Requirements | | Other Acceptance Tests |
|--------------|------------------------------|-------------------------------|------------------------|
| | Sample Size | Permissible No. of Defectives | |
| Up to 300 | 13 | 0 | 2 |
| 301 to 500 | 20 | 0 | 3 |
| 501 to 1000 | 32 | 1 | 4 |
| 1001 to 3000 | 50 | 2 | 5 |
| 3001 & above | 80 | 3 | 7 |

The conformity criteria would be as per IS-9537 Part-III/1983 and latest amendment of it if any.

6.2 Acceptance Tests:

The selected sample shall be subject to the acceptance test in following order as per IS-9537 (Part-III 1983) and latest amendment of it if any

- A. Visual inspection.
- B. Verification of dimension as per company's requirement.
- C. Compression test (Clause No. 9.3)
- D. Resistance to burning (Clause No. 11).
- E. Electrical characteristics (Clause No. 12).

7. TENDER SAMPLE:

Tenderer should submit 2 Nos. of samples along with the offer. Offer without sample will be straight way rejected. Sample should be submitted at R.S.O./Divisional Stores of respective DISCOMs on or before last date of submission of offer. Tenders without sample are liable to be rejected.

8. GUARANTEED TECHNICAL PARAMETERS (GTP):

Tenderer should submit the required details in attached guaranteed technical parameters (GTP) offer without GTP will be straight way rejected.

ANNEXURE-A

Manufacturer's name :

Address :

GUARANTEED TECHNICAL PARTICULARS (GTP)

Technical information and guaranteed technical information for supplier of HD Rigid PVC Pipe.

Part-A: Bidder has to confirm following important requirement.

| Sr. No. | Particulars. | Confirmation. |
|----------------|---|----------------------|
| 1 | HD Rigid PVC Pipe shall be supplied as per confirming IS No. 9537/1983 (Part-I & III) and latest amendment of it if any | Yes/No |
| 2 | Dimension shall be as under. | |
| | Inside diameter 10 MM (+) or (-) 1 MM | Yes/No |
| | Wall thickness 3.0 MM to 3.5 MM. | Yes/No |
| | Length. 2.5 Mtr with tolerance + 10 MM | Yes/No |
| 3 | Marking shall be as under. | |
| | "PGVCL" & Trade Mark of supplier, Nominal size of conduits shall be screen printed & embossing on pipe at every half meter length preferably at 50 MM from one end. | Yes/No |

Part-B: Bidder has to furnish below detail for above material.

| Sr. No. | Particulars. | Confirmation. |
|----------------|-------------------------------|----------------------|
| 1 | Colour of pipe - white | Yes/No |
| 2 | Manufacturer Trade Mark name. | |

Part-C: Bidder has to enclose following documents and has to confirm for the same.

| Sr. No. | Particulars. | Confirmation. |
|----------------|--|----------------------|
| 1 | The notarized copy of type test certificate as per specification Clause No.5 at any Govt. Approved laboratory is submitted as under. | |
| | The name of laboratory. | |
| | Laboratory Test Report. | |

| | | |
|---|---|--------|
| | Date of report. | |
| 2 | Two (2) Nos. of samples to be sent with tender. | Yes/No |
| 3 | List of plant & machinery. | Yes/No |
| 4 | List of testing equipment. | Yes/No |

Part-D: Bidder has to mention below deviation if any quoting relevant clause of specification.

| |
|--|
| |
|--|

Signature and Seal of Tenderer

17. Clamps & Connectors

CLAMPS & CONNECTORS: Clamps & connectors shall conform to IS: 5561. The clamps and connectors shall be made of materials listed below:

| | |
|---|--|
| For connecting ACSR conductors | Aluminium alloy casting, conforming to designation A6 of IS: 617 and shall be tested for all tests as per IS: 617 |
| For connecting equipment terminals made of copper with ACSR conductor | Bimetallic connectors made from aluminium alloy casting conforming to designation A6 of IS:617 with 2mm thick Bimetallic liner and shall be tested as per IS:617 |
| For connecting GS shield wire | Galvanised mild steel |
| Bolts, Nuts & plain washers | Hot dip galvanised mild steel for sizes M12 and above, and electro-galvanised for sizes below M12 |
| Spring washers for items 'a' to 'c' | Electro-galvanised mild steel suitable for at least service condition 4 as per IS:1573 |

All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

No current carrying part of a clamp or connector shall be less than 10 mm thick. They shall be designed and manufactured to have minimum contact resistance.

For Bimetallic clamps or connectors, copper alloy liner of minimum 2 mm thickness shall be provided.

Flexible connectors, braids or laminated strips made up of copper/ aluminium for the terminal clamps for equipment shall be suitable for both expansion or through (fixed/ sliding) type connection of IPS Aluminium tube as required. In both the cases the clamp height (top of the mounting pad to center line of the tube) should be same.

Size of the terminal/conductor for which the clamp/connector is suitable shall be embossed/punched (i.e. indelibly marked) on each components of the clamp/ connector, except on the hardware.

Clamp shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified ambient temperature. The rated current for which the clamp/ connector is designed with respect to the specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on the hardware.

Clamps and connector shall be designed corona controlled.

Clamps & connectors shall conform to type tests and shall be subjected to routine and acceptance tests on minimum 3 samples per lot as per IS: 5561. Type tests report for all clamps and connectors for temperature rise test, tensile test, shall be furnished by the Contractor.

18. Wiring

All wiring shall be carried out with 1100 V grade stranded copper wires. The minimum size of the stranded conductor used for internal wiring shall be as follows:

1. All circuits except CT circuits 2.5 sq.mm
2. CT circuits 2.5 sq. mm (minimum number of strands shall be 3 per conductor).

All internal wiring shall be securely supported, neatly arranged readily accessible and connected to equipment terminals and terminal blocks.

Wire terminations shall be made with solderless crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires shall not fall off when the wires and shall not fall off when the wire is disconnected from terminal blocks.

All wires directly connected to trip circuit breaker shall be distinguished by the addition of a red coloured unlettered ferrule. Number 6 & 9 shall not be included for ferrules purposes.

All terminals including spare terminals of auxiliary equipment shall be wired upto terminal blocks. Each equipment shall have its own central control cabinet in which all contacts including spare contacts from all poles shall be wired out. Inter-pole cabling for all equipment's shall be carried out by the Contractor.

19. Epoxy Based Protective Paint

1. SCOPE

This specification covers the requirement of self-priming epoxy-based protective paint both for new and old steel structures such as poles, sub-station structures etc.

2. COMPOSITION

The paint shall be epoxy-based with metallic zinc as an essential component. The paint shall be supplied in two components and shall be suitable for a single coat application. It shall have such composition as to satisfy the requirements of this standard. The mixing ratio (base-to-accelerator) shall be specified by the manufacturer.

3. REQUIREMENTS

| | | |
|------|--|---|
| 3.1 | Volume Solids | 85% (\pm)3% |
| 3.2 | Theoretical covering Capacity | 6.5 sq. mtrs. per litre at 125 microns dry film thickness |
| 3.3 | Weight per 10 litres of mixed paint | 14 to 15 Kg. (\pm) 0.3 kg |
| 3.4 | Drying time (at 30 OC) dry | Surface : Not more than 4 hours Hard Dry : 16-18 hours Recoating Time : 16-18 hours Curing time : 7 days |
| 3.5 | Scratch hardness (with 1.5 kg.load) | No such scratch as to show the base metal |
| 3.6 | Finish | Smooth and semi-glossy |
| 3.7 | Colour | Ash Grey or Aluminium (as required) |
| 3.8 | Dry Film Thickness | The paint shall develop a dry film of minimum 100-125 microns in a single coat(measured by Elcometer) |
| 3.9 | Flash point | Not below 40 OC |
| 3.10 | Flexibility and adhesion | The paint shall not show damage, detachment or cracking. |
| 3.11 | Resistance to humidity | Shall pass 1000 hours (minimum) at 125 microns D.F.T |
| 3.12 | Resistance to lubricating oil petroleum, hydrocarbon solvent,petrol and heat | Shall show no sign of permanent injury |

4. STORAGE LIFE & POT LIFE

| | | |
|-----|--------------------|--|
| 4.1 | Storage life | Minimum 6 months from the date of manufacture in original sealed container under normal covered storage conditions |
| 4.2 | Pot life (at 30OC) | Not less than 4 hours |

5. DURABILITY

Under severe surface conditions, paint shall protect the substrate at least for 5 years, if it is wire-brushed/power tool cleaned and 7 years for commercially grit-blasted steel sub-strate.

6. SURFACE PREPARATION

If possible, the surface on which the paint has to be applied shall be cleaned by grit blasting, otherwise manual wire brushing or power tool cleaning process may be used as convenient.

7. METHOD OF APPLICATION

Brushing, rollers or spraying.

8. TESTS

The following tests shall be carried out in accordance with the procedure given in the Indian Standard quoted against each, except requirements stipulated in clauses 3.1 and 3.2 which shall be tested in accordance with the procedure indicated in Annexure-II; preparation of painted panels for conducting different tests shall be done as given in Annexure-I.

8.1 Requirement stipulated in clauses 3.3 to 3.12 - **IS:101**

8.2 **Resistance to Salt Spray**

Shall pass 1000 hours (minimum with 200 microns D.F.T.) - **IS:2074**

8.3 **Chemical Resistance**

Shall be resistant to acid/alkaline chemicals or solvents - **IS:8662**

9. PACKAGE

Unless otherwise specified by the purchaser, the paint shall be normally supplied in 2 litre packs.

Annexure – I

DETAILS OF PREPARATION OF PAINTED PANELS FOR TESTING EPOXY BASED

PROTECTIVE PAINT (TWO PACKS)

| S. N . | Test | Type of Metal | Size in mm | Painting Details | Dry Film Thickness | Method of Application | Duration of air drying before commencement of test | Special Instructions |
|--------|---|---------------|---------------|--|--------------------|-----------------------|--|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | Drying Time | Mild Steel | 150x100x1.25 | One coat of Epoxy based protective paint | 100□ | Brush /Spray | - | - |
| 2 | Finish | -do - | -do- | -do - | -do - | -do - | 48 hours | - |
| 3 | Colour | -do - | -do - | -do - | -do - | -do - | 24 hours | - |
| 4 | Dry Film Thickness | -do - | -do - | -do - | -do - | -do - | 24 hours | - |
| 5 | Flexibility and adhesion | Tinned | 150x150x0.315 | -do- | -do- | -do- | 7 days | - |
| 6 | Scratch Hardness | -do - | -do - | -do - | -do - | -do - | -do - | - |
| 7 | Resistance to Salt Spray | Mild Steel | 150x150x1.25 | -do- | 200□ | -do - | 7 days | Apply a load of 1.5 Kgs. |
| 8 | Protection against corrosion under conditions of condensation | - do - | - do - | -do - | 125□ | - do - | - do - | Instead of 1 kg. As specified in Col.15.1 of IS: 101 – 64 |
| | | | | -do- | | | | - |

ANNEXURE-II

Procedure for determining volume solids

1. Scope :

This method is applicable to the determination of the volume non-volatile matter of paint coatings.

2. Significance :

This method is intended to provide a measure of the volume of dry coating obtainable from a given volume of liquid coating. This volume is considered to be the most equitable means of comparing the coverage (square metre of surface covered at a specific film thickness per unit volume) and also for calculating the wet film thickness of the given paint.

3. Apparatus

- i) Analytical Balance
- ii) Steel disc : Preferably stainless steel, 60mm dia, and 0.70mm thickness with a small hole 2 to 3mm from the edge. A fine wire such as chromel is attached through the hole and made of the appropriate length for suspending the disc in a liquid.
- iii) Weight Box
- iv) Beaker : 1 litre for weighing the disc in liquid.
- v) Weight per litre cup for determining the specific gravity of the paint material and of the suspending liquid if not known.
- vi) Oven

4. Procedure

- i) Dry the disk in an oven at 105°C for 10 minutes and cool.
- ii) Weigh the disk in air, let it be W_1 grams.
- iii) Suspend the disk in water and weigh again. Let it be W_2 grams.
- iv) Calculate the volume of disk 'V' as follows:
$$V = (W_1 - W_2) / d$$
 where 'd' is the density of the water at room temperature
- v) Determine the weight of non-volatile content per gram of the liquid coating material by drying a known amount of paint at 105°C for 3 hours. Let it be 'W' grams.
- vi) Determine the specific gravity of the paint to the nearest 0.001 g/ml. by using weight per liter cup. Let it be 'p'.
- vii) Dip the disk in the paint sample for 10 minutes, and take out the disc and allow the excess coating material to drain off. Blot the coating material off the bottom edge of the disc so that beads or drops do not dry on the bottom edge of the disc.

viii) Dry the disc in oven for 3 hours at 105⁰ C and cool.

ix) Weigh the coated disc in air. Let it be W3 grams.

x) Suspend the coated disc in water and weigh it. Let it be W4 grams.

xi) Calculate the volume of the coated disc as follows:

$V_1 = W_3 - W_4/d$, where 'd' is the density of the water at room temperature.

xii) Calculate the volume of the dried coating as follows:

Volume of dried coating (Vd) = $V_1 - V$

xiii) Calculate the volume of the wet coating as follows:

$V_w = W_3 - W_1/W \times P$, where W = grams of non volatile matter in one gram of wet coating

P= Specific gravity of the paint.

xiv) Calculate the percentage volume solids of the paints as follows:

$$= \frac{V_1 - V \times 100}{V_w} \quad \text{or} \quad \frac{V_d \times 100}{V_w}$$

The volume of non volatile matter or the percentage volume solids of a paint is related to the covering capacity and film thickness in the following manner:

a) Theoretical Coverage (m^2/l) = $\frac{\% \text{ volume solids} \times 10}{\text{Dry film thickness (in microns)}}$

b) Wet film thickness (in microns) = $\frac{\text{Dry Film thickness} \times 100}{\% \text{ volume solids}}$

% volume solids.

20. Equipment Erection Notes

All support insulators, circuit breaker and other fragile equipment shall preferably be handled with cranes with suitable booms and handling capacity.

The slings shall be of sufficient length to avoid any damage to insulator due to excessive swing, scratching by sling ropes etc.

For cleaning the inside and outside of Hollow insulators only muslin or leather cloth shall be used.

Handling equipment, sling ropes etc. should be tested before erection and periodically for strength.

Bending of compressed air piping should be done by a bending machine and through cold bending only. Bending shall be such that inner diameter of pipe is not reduced.

Cutting of the pipes wherever required shall be such as to avoid flaring of the ends, and only a proper pipe cutting tool shall be used. Hack-saw shall not be used.

The Contractor shall arrange at site all the equipments, instruments and auxiliaries required for testing and commissioning of equipment.

STORAGE OF EQUIPMENTS

The Contractor shall provide and construct adequate storage shed for proper storage of equipments. Weather sensitive equipment shall be stored indoor. All equipments during storage shall be protected against damage due to acts of nature or accidents. The storage instruction of the equipment manufacturer/Owner shall be strictly adhered to.

21. Danger Notice Plates

1. SCOPE

This Specification covers Danger Notice Plates to be displayed in accordance with rule No. 35 of Indian Electricity Rules, 2003.

2. APPLICABLE STANDARDS

Unless otherwise modified in this specification, the Danger Notice Plates shall comply with IS:2551-1982 or the latest version thereof.

3. DIMENSIONS

3.1 Two sizes of Danger Notice Plates as follows are recommended:

- a) For display at 415 V installations - 200x150mm
- b) For display at 11 KV (or higher voltages) installations - 250x200mm

3.2 The corners of the plate shall be rounded off.

3.3 The location of fixing holes as shown in Figs. 1 to 4 is provisional and can be modified to suit the requirements of the purchaser.

4. LETTERINGS

All letterings shall be centrally spaced. The dimensions of the letters, figures and their respective position shall be as shown in figs. 1 to 4. The size of letters in the words in each language and spacing between them shall be so chosen that these are uniformly written in the space earmarked for them.

5. LANGUAGES

5.1 Under Rule No. 35 of Indian Electricity Rules, 2003, the owner of every medium, high and extra high voltage installation is required to affix permanently in a conspicuous position a danger notice in Hindi or English and, in addition, in the local language, with the sign of skull and bones.

5.2 The type and size of lettering to be done in Hindi is indicated in the specimen danger notice plates shown in Fig. 2 and 4 and those in English are shown in Figs. 1 and 3.

5.3 Adequate space has been provided in the specimen danger notice plates for having the letterings in local language for the equivalent of 'Danger', '415', '11000' and 'Volts'.

6. MATERIAL AND FINISH

The plate shall be made from mild steel sheet of at least 1.6mm thick and vitreous enameled white, with letters, figures and the conventional skull and cross-bones in signal red colour (refer IS:5-1978) on the front side. The rear side of the plate shall also be enamelled.

7. TESTS

The following tests shall be carried out :

- i) Visual examination as per IS:2551-1982
- ii) Dimensional check as per IS:2551-1982
- iii) Test for weather proofness as per IS:8709-1977 (or its latest version)

8. MARKING

Maker's name and trade mark and the purchaser's name shall be marked in such a manner and position on the plates that it does not interfere with the other information.

9. PACKING

The plates shall be packed in wooden crates suitable for rough handling and acceptable for rail/road transport.

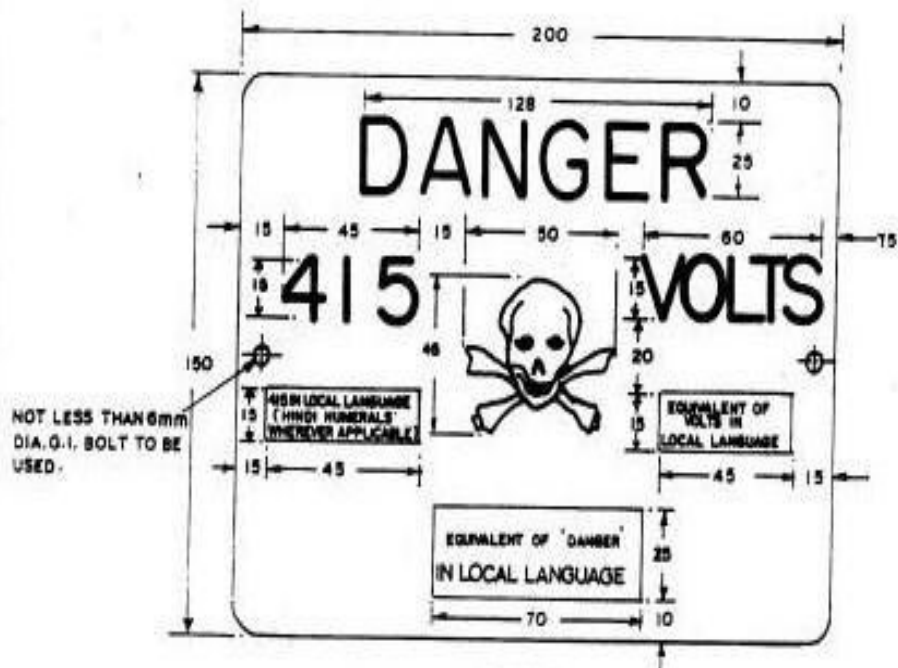


FIG. - 1

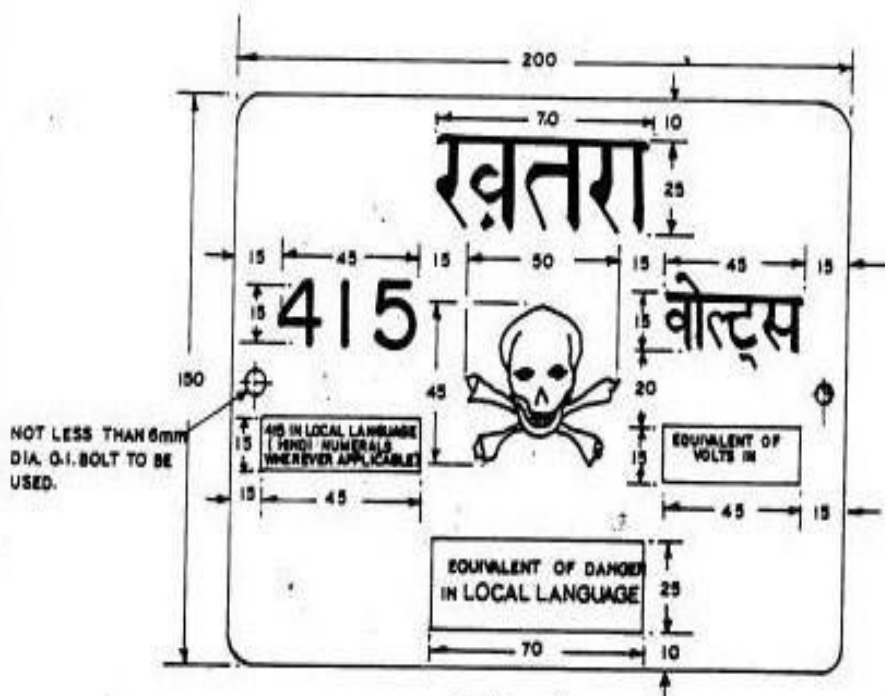


FIG. - 2

ALL DIMENSIONS ARE IN MM.

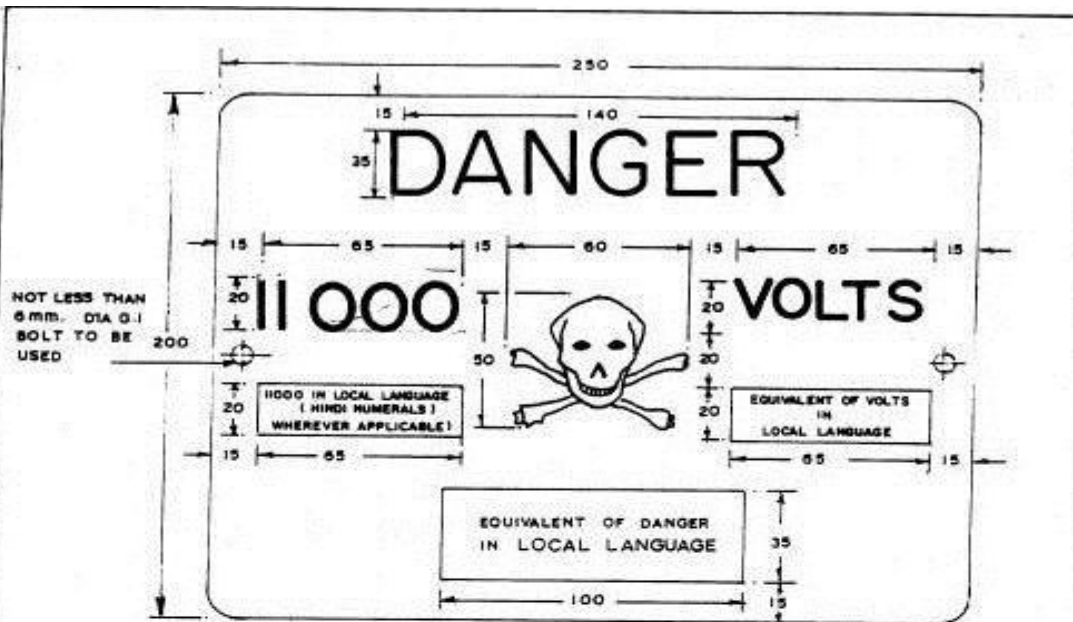


FIG:- 3

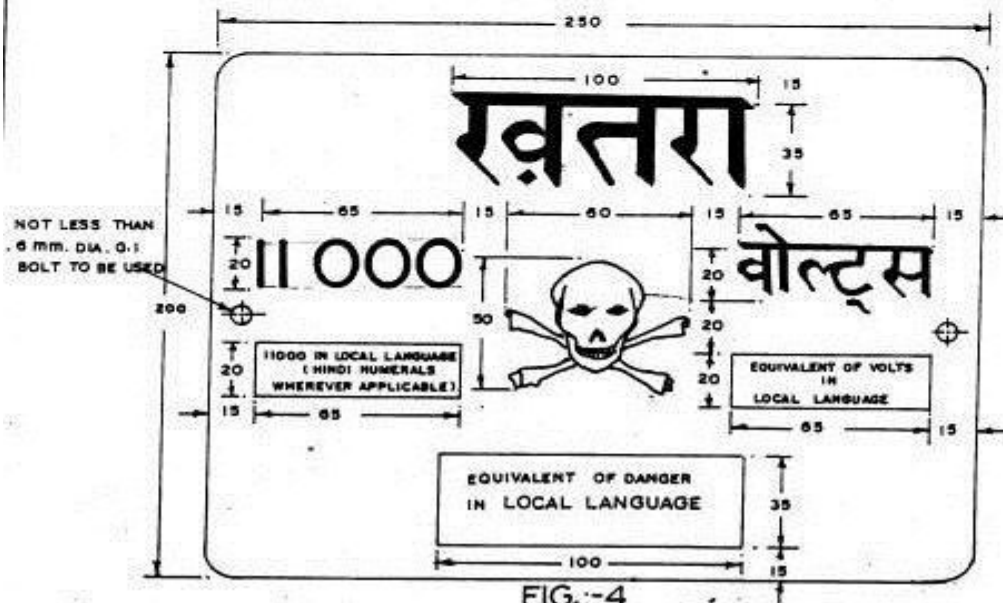


FIG:-4

NOTE: 11000 SHALL BE REPLACED BY 33000, 66000 ETC. AS REQUIRED.

ALL DIMENSIONS ARE IN MM.

22. Number Plate (Support)

Weather proof number plate shall have unique name are to be installed on the pole support. The plate shall be made from mild steel sheet of at least 1.6mm thick and vitreous enameled white, with letters in signal red color (refer IS: 5-1978) on the front side. The rear side of the plate shall also be enameled. The digits shall be as under:

110121

000001

226

Digits shall be displayed as detailed above having at-least 25mm height. The over all size of the plate shall be 200x250mmx1.6mm. The corners of the plate shall be rounded off. All lettering shall be centrally spaced. The dimensions of the letters, figures and their respective position shall be as shown above. The size of digits and spacing between them shall be so chosen that these are uniformly written in the space earmarked for them. The type and size of digits to be written in English as indicated above. The plate should be provided with 6mm dia holes in horizontal alignment for fixing to the pole by means of Galvanized MS flat clamp of 25x3 mm size. The nut & bolts used for fixing of plate should be of galvanized and washers of electro-plated. The bolt should be used of at-least 6mm diameter.

TESTS: The following tests shall be carried out:

- i) Visual examination as per IS:2551-1982
- ii) Dimensional check as per IS:2551-1982
- iii) Test for weather proof-ness as per IS 8709-1977 (or its latest version).

Numbering Transformer/ Feeders/ Equipments (in Grid Sub-Station):

All augmented/ new power transformer, Breakers, Outgoing feeders, respective control panels, Kiosks are to be named. Base should be painted with yellow paint and black digits should be displayed of at-least 25mm height. Experienced painter should be used to provide this work. LT and HT bushing should be colour coded, CT and PT panels are to be named. The Yellow base plate should be encircled by a black strip. Naming shall be in the local as well as English language.

Numbering of control panel:

Name of Feeder should be displayed on front end and at rear end along with serial number of the panel. Yellow base paint and 25mm high black digits are to be used for this purpose. The base paint should be encircled by a black strip. Naming shall be in the local as well as English language.

Strip
25mm Height



23. Cable Glands and Lugs

Cable glands shall be Double compression type, tinned/Nickel plated (coating thickness not less than 20 microns in case of tin and 10 to 15 microns in case of nickel) brass cable glands for all power and control cables. They shall provide dust and weather proof terminations. They shall comprise of heavy duty brass casting, machine finished and tinned to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and of tested quality. Required number of packing glands to close unused openings in gland plates shall also be provided.

The cable glands shall be tested as per BS: 6121. The cable glands shall also be duly tested for dust proof and weather proof termination.

Cables lugs shall be tinned copper solder less crimping type conforming to IS: 8309 and 8394 suitable for aluminum or copper conductor (as applicable). The cable lugs shall suit the type of terminals provided. The cable lugs shall be of Dowell make or equivalent.

24. Cables Tags and Markers

Each cable and conduit run shall be tagged with numbers that appear in the cables and conduit schedule.

The tag shall be of aluminum with the number punched on it and securely attached to the cable conduit by not less than two turns of 20 SWG GI wire conforming to IS: 280. Cable tags shall be of rectangular shape for power cables and of circular shape for control cables.

Location of cables laid directly underground shall be clearly indicated with cable marker made of galvanized iron plate.

Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint".

The marker shall project 150 mm above ground and shall be spaced at analysis interval 30 meters and at every change in direction. They shall also be located on both sides of road and drain crossings.

Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing and on each duct/ conduit entry. Cable tags shall be provided inside the switchgear, motor control centers, control and relay panels, etc., wherever required for cable identification, such as where a number of cables enter together through a gland plate.

The price of cable tags and markers shall be included in the installation rates for cables/ conduits quoted by the contractor.

Specific requirements for cabling for cabling, wiring, ferrules as covered in respective equipment section shall also be complied with.

CABLE GLANDS

Double compression type cable glands shall be provided by the Contractor for all power and control cables to provide dust and weather proof termination. Required number of packing glands to close unused openings in gland plates shall also be provided.

CABLE LUGS

Solderless crimping of terminals shall be done by using corrosion inhibitory compound. The cable lugs shall suit the type of terminals provided. Crimping tool used shall be of approved design and make.

Storage and handling of cable drums

Cable drums shall be unloaded, handled and stored in an approved manner. Rolling of drums shall be avoided as far as practicable. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication the drums may be rolled in the same direction it was rolled during taking up the cables.

CABLE SUPPORTS AND CABLE TRAY MOUNTING ARRANGEMENTS

Cable trenches in the control room are normally provided with embedded steel inserts on concrete floors/ walls. The Contractor shall secure supports by welding to these inserts or available building steel structures.

Insert plates will be provided at an interval of 600 mm wherever cables are to be supported without the use of cable trays, while at all other places these will be at an interval of 2000 mm.

CABLE TERMINATIONS AND CONNECTIONS

The termination and connection of cables shall be done strictly in accordance with cable and termination kit manufacturer's instructions, drawing and/ or as directed by the Owner.

The work shall include all clamping, fittings, fixing, plumbing, soldering, drilling, cutting, taping, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job.

The equipment will be generally provided with un-drilled gland plates for cables/ conduit entry. The Contractor shall be responsible for drilling of gland plates, painting, and touching up. Holes shall not be made by gas cutting.

The Contractor shall tag/ferrule the control cable cores at all terminations, as instructed by the Owner. In panels where a large number of cables are to be terminated and cable identification may be difficult, each core ferrule may include the complete cable number as well. Spare cores shall be similarly tagged with cable numbers and coiled up.

Control cables shall have stranded copper conductor. Bare portion of the solid conductors shall be tinned after removing the insulation and shall be terminated directly without using cable lugs.

All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively closed.

If the cable-end box or terminal enclosure provided on the equipment is found unsuitable and requires modification, the same shall be carried out by the Contractor with the approval of the Owner.

DIRECTLY BURIED CABLES

The Contractor shall construct the cable trenches required for directly buried cables. The scope of work and unit rates for construction of cable trenches for cables shall include excavation, preparation of sand bedding, soil cover, supply and installation of brick or concrete protective cover, back filling and reaming, supply and installation of route markers and joint markers. The Contractor/Supplier shall ascertain the soil conditions prevailing at site, before quoting the unit rates. Laying the cable and providing protective covering shall be as per approved drawing.

Installation of cables

Power and control cables shall be laid in separate tiers. The order of laying of various cables shall be as follows:

- Power cables on top tiers.
- Control, instrumentation and other service cables in bottom tiers.

Single core cable in trefoil formation shall be laid with a distance of three times the diameter of cables between trefoil center lines. All power cables shall be laid with a minimum center to center distance equal to twice the diameter of the cable.

Power and control cables shall be securely fixed to the trays/ supports. Trefoil clamps for single core cables shall be pressure die-cast aluminum (LM-6). Nylon-6 or fiber glass and shall include necessary fixing nuts, bolts, washer, etc. These are required at every 2 meter of cable run. Vertical and inclined cable runs shall be secured with 25 mm wide and 2 mm thick aluminum strip clamps at every 2 m. Horizontal runs in cable trays and trenches shall be secured using 4 mm nylon cord at every 2 m.

Cables shall not be bent below the minimum permissible limit. The minimum bending radius of power cables shall be $12D$ and that of control cables shall be $10D$, where D is overall diameter of cable.

Where cables cross roads, drains and rail tracks, the cables shall be laid in reinforced spun concrete or steel pipes, buried at not less than one meter depth.

In each cable run some extra length shall be kept at a suitable point to enable one (for LT Cables) or two (for H.T. cables) straight through joints to be made, should the cable develop fault at a later date.

Selection of cable drums for each run shall be so planned as to avoid using straight through joints. Cable splices will not be permitted except where called for by the drawings, unavoidable or where permitted by the Owner.

Control cable terminations inside equipment enclosures shall have sufficient lengths so that switching of termination in terminal blocks can be done without requiring any splicing.

Metal screen and armour of the cable shall be bonded to the earthing system of the station, wherever required.

Rollers shall be used at intervals of about 2.0 meters, while pulling cables.

All due care shall be taken during unreeling, laying and termination of cable to avoid damage due to twist, kink, sharp bends, etc.

Cable ends shall be kept sealed to prevent damage.

Inspection on receipt, unloading and handling of cables shall generally be in accordance with IS:1255 and other Indian Standard codes or practices.

Wherever cables pass through floor or through wall openings or other partitions, wall sleeves with bushes having a smooth curved internal surface so as not to damage the cables shall be supplied, installed and properly sealed at no extra charges.

The erection work shall be carried out in a neat workmanlike manner and the areas of work shall be cleaned of all scrap materials after the completion of work in each area every day. Contractor shall remove the RCC/steel trench covers before taking up the work and shall replace all the trench covers after the erection work in that particular area is completed or when further work is not likely to be taken up for some time.

Contractor shall furnish three copies of the report on work carried out in a particular week, such as cable numbers and a date on which laid, actual length and route, testing carried out, terminations carried out, along with the marked up copy of the cable schedule and interconnection drawing wherever the modifications are made.

In case the outer sheath of a cable is damaged during handling/ installation, the Contractor shall repair it at his own cost, and to the satisfaction of the Engineer-in- Charge. In case any other part of a cable is damaged, the same shall be replaced by a healthy cable, at no extra cost i.e. the Contractor shall not be paid for supply, installation and removal of the damaged cable.

All cable terminations shall be appropriately tightened to ensure secure and reliable connections. The Contractor shall cover the exposed part of all cable lugs whether supplied by him or not with insulating type, sleeve or paint.

25. Installation

1. Earthing

The earthing shall be done in accordance with requirements. Earthing of panels shall be done in line with the requirements given in respective equipment section of this specification.

2. Civil Works

The civil works shall be done in accordance with requirements stipulated under Section-17 of this specification.

3. Structural Steel Works

The structural steel works shall be done in accordance with requirements stipulated under Section-17 of this specification.

4. Bay Equipment

- 4.1 The disposition of equipment to be supplied is shown in enclosed single line diagrams and layout drawings.
- 4.2 The Bidder shall prepare layout drawings and submit the same for approval of the EMPLOYER. The approval of drg. shall not absolve Bidder from his responsibility regarding designing & engineering of Sub-Station and Bidder shall be fully responsible for all works covered in the scope of this specification.

5. Lightning Protection

Detailed drawings shall be submitted for approved locations on Sub-Station towers provision of lightning rod electrode at suitable Location.

- 5.1 Lightning protection System down conductors shall not be connected to other conductors above ground level. Also no intermediate earthing connection shall be made to Surge arrester, Voltage Transformer, earthing leads for which they shall be directly connected to rod electrode.
- 5.2 Every down conductor shall be provided with a test joint at about 150 mm above ground level. The test joint shall be directly connected to the earthing system.
- 5.3 The lightning protection system shall not be in direct contact with underground metallic service ducts and cables.

6. Equipment Erection Notes

- a. All support insulators, circuit breaker interrupters and other fragile equipment shall be handled with cranes with suitable booms and handling capacity.
- b. Where, assemblies are supplied in more than one section, Bidder shall make all necessary mechanical and electrical connections between sections including the connection between buses. Bidder shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and

commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Bidder at his own expense. The Bidder shall strictly follow manufacturer's recommendations for handling and erection of equipment.

- c. The slings shall be of sufficient length to avoid any damage to insulator due to excessive swing, scratching by sling ropes etc. Handling equipment, sling ropes etc. should be tested before erection and periodically thereafter for strength.
- d. Bending of piping should be done by a bending machine and through cold bending only. Bending shall be such that inner diameter of pipe is not reduced. The pipes shall be thoroughly cleaned before installation.
- e. Cutting of the pipes wherever required shall be such as to avoid flaring of the ends. Hence only a proper pipe cutting tool shall be used. Hack saw shall not be used.
- f. For cleaning the inside and outside of hollow insulators only Muslin or leather cloth shall be used.

7. Storage Of Equipment

Bidder is responsible for the proper storage and maintenance of all materials/equipment to be supplied by him for the work. The Bidder shall provide & construct adequate storage shed for proper storage of equipment. Sensitive equipment shall be stored indoors. All equipment during storage shall be protected against damage due to acts of nature or accidents. Bidder shall take all required steps to carryout subsequent inspection of materials/equipment stored as well as erected until the same is taken over by the EMPLOYER. The storage instruction of the equipment manufacturers/ Engineer-in-Charge shall be strictly adhered to.

8. Cabling

- 8.1 Cabling shall be in trenches, excavated trenches for direct burial, pulled through pipes and conduits run clamped on steel structures etc.
- 8.2 Cables inside the Sub-Station shall be laid on angle supports at 600mm spacing with separate tiers for control and power cables.
- 8.3 All interpole cables (both power & control circuit) for equipments shall be laid in cable trenches/G.I. Conduit Pipe of NB 50/100mm which shall be buried in the ground at a depth of 300mm.

9. Conduits, Pipes And Accessories

- 9.1 The bidder shall supply and install all rigid conduits, mild steel pipes, flexible conduits, hume pipes etc. including all necessary sundry materials, such as tees, elbows, check nuts, bushings, reducers, enlargers, wooden plugs, coupling caps, nipples, gland sealing fittings, pull boxes etc. The size of the conduit/pipe shall be selected on the basis of maximum 40% fill criterion. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed in an approved manner, to prevent damage to threaded portion and entrance of moisture and foreign material.

- 9.2 Rigid conduits shall be flow-coat metal conduits of XXX (name) Coated Tubes or equivalent make. The outer surface of the conduits shall be coated with hot-dip zinc and chromate coatings. The inner surface shall have silicone epoxy ester coating for easy cable pulling. Mild steel pipes shall be hot-dip galvanised. All rigid conduits/pipes shall be of a reputed make.
- 9.3 The hume pipes and accessories shall be of reinforced concrete conforming to class NP2 of IS: 458. All tests on hume pipes shall be conducted as per IS: 458.

10. Cable Tags And Marker

- 10.1 Each cable and conduit run shall be tagged with numbers that appear in the cable and conduit schedule.
- 10.2 The tag shall be of aluminium with the number punched on it and securely attached to the cable conduit by not less than two turns of 20 SWG GI wire conforming to IS:280. Cable tags shall be of rectangular shape for power cables and of circular shape for control cables.
- 10.3 Location of cables laid directly underground shall be clearly indicated with cable marker made of galvanised iron plate.
- 10.4 The marker shall project 150mm above ground and shall be spaced at an interval 30 meters and at every change in direction. They shall be located on both sides of road and drain crossings.
- 10.5 Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry. Cable tags shall be provided inside the switchgear, motor control centres, control and relay panels etc., wherever required for cable identification, such as where a number of cables enter together through a gland plate.
- 10.6 Specific requirements for cabling, wiring ferrules as covered in respective equipment section shall also be complied with.

11. Storage And Handling Of Cable Drums

Cable drums shall be unloaded, handled and stored in an approved manner and rolling of drums shall be avoided as far as practicable. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication the drums may be rolled in the same direction it was rolled during taking up the cables.

12. Cable Supports And Cable Tray Mounting Arrangements

- 12.1 In cases where no embedded steel inserts are available, the Bidder shall have to secure the supports on wall or floors by suitable anchoring at no extra cost to the Employer. Details of fixing steel plates by anchor fasteners shall be decided during detailed engineering stage.
- 12.2 The cable supports shall conform to the requirements of this Specification.
- 12.3 Insert plates will be provided at an interval of 600mm wherever cables are to be supported without the use of cable trays, while at all other places these will be at an interval of 2000mm.

13. Cable Terminations And Connections

- 13.1 The termination and connection of cables shall be done strictly in accordance with cable and termination kit manufacturer's instructions, drawing and/or as directed by the Employer.
- 13.2 The work shall include all clamping, fittings, fixing, plumbing, soldering, drilling, cutting, taping, heat shrinking, (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job.
- 13.3 Cost of all consumable material shall be included in the erection rates quoted.
- 13.4 The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Bidder shall be responsible for drilling of gland plates, painting and touching up. Holes shall not be made by gas cutting.
- 13.5 The Bidder shall tag/ferrule the control cable cores at all terminations, as instructed by the Employer. In panels where a large number of cables are to be terminated and cable identification may be difficult, each core ferrule may include the complete cable number as well.
- 13.6 Spare cores shall be similarly tagged with cable numbers and coiled up.
- 13.7 Control cables shall have stranded copper conductor. Bare portion of the solid conductors shall be tinned after removing the insulation and shall be terminated directly without using cable lugs.
- 13.8 All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively closed.
- 13.9 If the cable end box or terminal enclosure provided on the equipment is found unsuitable and requires modification, the same shall be carried out by the Bidder as directed by the Employer.

14. Directly Buried Cables

The Bidder shall construct the cable trenches required for directly buried cables. The scope of work and unit rates for construction of cable trenches for cables shall include excavation, preparation of sand bedding, soil cover, supply and installation of brick or concrete protective covers, back filling and reaming, supply and installation of route markers and joint markers. The bidder shall ascertain the soil parameters prevailing at site, before quoting the unit rates. Laying the cable and providing protective covering shall be as per approved drawing.

15. Installation of Cables

- 15.1 Power and control cables shall be laid in separate tiers. The order of laying of various cables shall be as follows, for cables other than directly buried.
 - a) Power cables on top tiers.
 - b) Control, instrumentation and other service cables in bottom tiers.

15.2 Single core cables in trefoil formation shall be laid with a distance of three times the diameter of cable between trefoil centre lines. All power cables shall be laid with a minimum centre to centre distance equal to twice the diameter of the cable.

15.3 Power and control cables shall be securely fixed to the supports. Trefoil clamps for single core cables shall be pressure die-cast aluminium (LM-6), Nylon-6 or fibre glass and shall include necessary fixing GI nuts, bolts, washer, etc. these are required at every 2 metre of cable runs.

15.4 Cables shall not be bent below the minimum permissible limit. The permissible limits are as follows:

| a) | Type of cable & voltage grade | Minimum bending radius |
|----|-------------------------------|------------------------|
| b) | Power cable | 12 D |
| c) | Control cables | 10 D |

Where D is overall diameter of cable.

15.5 Where cables cross roads, drains and rail tracks, the cables shall be laid in reinforced spun concrete or steel pipes, buried at not less than one metre depth.

15.6 In each cable run some extra length shall be kept at a suitable point to enable one (for LT Cables) or two (for H.T cables) straight through joints to be made, should the cable develop fault at a later date.

15.7 Selection of cable drums for each run shall be so planned as to avoid using straight through joints. In case joints are necessary the same shall be supplied by the Bidder. Cable splices will not be permitted except where called for by the drawings, unavoidable or where permitted by the Employer.

15.8 Control cable terminations inside equipment enclosures shall have sufficient lengths so that switching of termination in terminal blocks can be done without requiring any splicing.

15.9 Metal screen and armour of the cable shall be bonded to the earthing system of the station, wherever required.

15.10 Rollers shall be used at intervals of about 2.0 metres, while pulling cables.

15.11 All due care shall be taken during unreeling, laying and termination of cable to avoid damage due to twist, kink, sharp bends etc.

15.12 Cable ends shall be kept sealed to prevent damage.

15.13 Inspection on receipt, unloading and handling of cables shall generally be in accordance with IS: 1255 and other Indian Standard Codes of practices.

- 15.14 Wherever cables pass through floor or through wall openings or other partitions, wall sleeves with bushes having a smooth curved internal surface so as not to damage the cables, shall be supplied, installed and properly sealed by the Bidder at no extra charges.
- 15.15 The erection work shall be carried out in a neat workmanlike manner and the areas of work shall be cleaned of all scrap materials, etc. after the completion of work in each area every day. Bidder shall remove the RCC/steel bench covers before taking up the work and shall replace all the trench covers after the erection work in that particular area is completed or when further work is not likely to be taken up for some time.
- 15.16 Bidder shall furnish three copies of the report on work carried out in a particular week, such as cable numbers and a date on which laid, actual length and route, testing carried out, along with the marked up copy of the cable schedule and interconnection drawing wherever any modifications are made.
- 15.17 In case the outer sheath of a cable is damaged during handling/installation, the Bidder shall repair it at his own cost, and to the satisfaction of the Engineer-in-Charge. In case any other part of a cable is damaged, the same shall be replaced by a healthy cable, at no extra cost i.e. the Bidder shall not be paid for installation and removal of the damaged cable.
- 15.18 All cable terminations shall be appropriately tightened to ensure secure and reliable connections. The Bidder shall cover the exposed part of all cable lugs whether supplied by him or not with insulating tape, sleeve or paint.

16. Conduits, Pipes Installation

- 16.1 Bidder shall supply all conduits, pipes and ducts as specified and to be shown in detailed engineering drawing. Flexible conduit should be used between fixed conduit and equipment terminal boxes. Where vibration is anticipated, the flexible conduit shall be as per the relevant IS.
- 16.2 Bidder shall have his own facility for bending, cutting and threading the conduits at site. Cold bending should be used. All cuts & threaded ends shall be made smooth without leaving any sharp edges. Anti corrosive paint shall be applied at all field threaded portions. The Bidder shall supply and apply this protective material.
- 16.3 All conduit/pipes shall be extended on both sides of wall/floor/openings. Exposed conduits/pipes shall be adequately clamped at an interval of about 2m. The fabrication and installation of supports and the clamping shall be included in the scope of work by Bidder.
- 16.4 When two lengths of conduits are joined together through a coupling, running threads equal to twice the length of coupling shall be provided on any length to facilitate easy dismantling of two conduits.
- 16.5 Conduit installation shall be permanently connected to earth by means of special approved type of earthing clamps. G.I. Pull wire of adequate size shall be laid in all conduits before installation.

- 16.6 Each conduit run shall be painted with its designation as indicated on the drawings, such that it can be identified at each end.
- 16.7 Embedded conduits shall have a minimum concrete cover of 50mm. Positioning and ensuring proper alignment during concrete by other agencies shall be the responsibility of the Bidder.
- 16.8 Conduit runs sleeves shall be provided with the bushings at each end.
- 16.9 Metallic conduit runs at termination shall have two locknuts and a bushing for connection. Flexible conduits shall also be suitably clamped at each end. Bushings shall have rounded edges so as not to damage the cables.
- 16.10 Where embedded conduits turn upwards from a slab or fill, the termination dimensions shown on the drawings, if any, shall be taken to represent the position of the straight extension of the conduit external to and immediately following the bend. At least one half the arc length of the bend shall be embedded.
- 16.11 For underground runs, Bidder shall excavate and back fill as necessary.

ANNEXURE-I : Earthing Notes

1. General

- 1.1 Neutral points of systems of different voltages, metallic enclosures and frame works associated with all current carrying equipments and extraneous metal works associated with electric system shall be connected to a single earthing system unless stipulated otherwise.
- 1.2 Earthing system installation shall be in strict accordance with the latest editions of Indian Electricity Rules/CEA Regulations, relevant Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.
- 1.3 Bolts and nuts required for earthing all main equipment structures and for connecting with earthing system shall be in the scope of the Bidder.

2. Details Of Earthing System

| Item | Size | Material |
|---|--|------------------|
| Main Earthing conductor | Suitable for a system | Mild Steel |
| | current of 31.5 KA/1s as | |
| | per IS | |
| Conductor above ground & earthing leads (for equipment) | To be submitted by the the vendor as per above | Galvanized Steel |
| Rod Electrode | Suitable for a system | Mild steel |
| | current of 31.5 kA/ 1s as | |
| | per IS | |
| G.I. Earthwire | 7/8 SWG | GI |

3. Earthing Conductor Layout

- 3.1 Earthing conductors in outdoor areas shall be buried at least 600mm below finished grade level unless stated otherwise.
- 3.2 Minimum 3000 mm spacing between rod electrodes shall be provided unless stipulated otherwise.
- 3.3 Wherever earthing conductors cross cable trenches, underground service ducts, pipes, tunnels, railway tracks etc., it shall be laid at least 300 mm below them and shall be re-routed in case it fouls with equipment/structure foundations.
- 3.4 Tap connections from the earthing grid to the equipment/structure to be earthed, shall be terminated on the earthing terminals of the equipment/structure, if the equipment is available at the time of laying the grid. Otherwise, “earth insert” with temporary wooden cover or “earth riser” shall be provided near the equipment foundation / pedestal for future connections to the equipment earthing terminals.
- 3.5 Earthing conductor along their run on cable trench ladder columns, beams, walls, etc. shall be supported by suitable welding/cleating at intervals of 750 mm. Earthing conductors along cable trenches shall be on the wall nearer to the equipment. Wherever it passes through walls, floors etc. galvanized iron sleeves shall be provided for the passage of the conductor. Both ends of the sleeves shall be sealed to prevent the passage of water through the sleeves.
- 3.6 Earthing conductor around the building shall be buried in earth at a minimum distance of 1500mm from the outer boundary of the building. In case high temperature is encountered at some location, the earthing conductor shall be laid minimum 1500mm away from such location.
- 3.7 In outdoor areas, tap connections shall be brought 300mm above ground level for making connections in future, in case equipment is not available at the time of grid installations.
- 3.8 Earthing conductors crossing the road shall be either installed in hume pipes or laid at greater depth to suit the site conditions.
- 3.9 Earthing conductors embedded in the concrete fibre shall have approximately 50mm concrete cover.

4. Equipment And Structure Earthing

- 4.1 The connection between earthing pads and the earthing grid shall be made by short and direct earthing leads free from kinks and splices. In case earthing pads are not provided on the item to be earthed, same shall be provided in consultation with engineer. The equipments shall be earthed at two distinctive points on panels.
- 4.2 Metallic pipes, conduits and cable tray sections for cable installation shall be bonded to ensure electrical continuity and connected to earthing conductors at regular interval. Apart from intermediate connections, beginning points shall also be connected to earthing system.
- 4.3 Metallic conduits shall not be used as earth continuity conductor.

- 4.4 A separate earthing conductor shall be provided for earthing lighting fixtures, lighting poles, receptacles, switches, junction boxes, lighting conduits, etc.
- 4.5 Wherever earthing conductor crosses or runs along metallic structures such as gas, water, steam, conduits, etc. and steel reinforcement in concrete it shall be bonded to the same.
- 4.6 Cable and cable boxes/glands, lockout switches etc. shall be connected to the earthing conductor running along with the supply cable which, in turn, shall be connected to earthing grid conductor at minimum two points, whether specifically shown or not.
- 4.7 Railway tracks within Sub-Station area shall be bonded across fish plates and connected to earthing grid at several locations.
- 4.8 Earthing conductor shall be buried 2000mm outside the Sub-Station fence. Every post of the fence and gates shall be connected to earthing loop by one lead.
- 4.9 Flexible earthing connectors shall be provided where flexible conduits are connected to rigid conduits to ensure continuity.

5. Jointing

- 5.1 Earthing connections with equipment earthing pads shall be of bolted type. Contact surfaces shall be free from scales, paint, enamel, grease, rust or dirt. Two bolts shall be provided for making each connection. Equipment bolted connections, after being checked and tested, shall be painted with anti-corrosive paint/compound.
- 5.2 Connection between equipment earthing lead and between main earthing conductors shall be welded/brazed type. For rust protections, the welds should be treated with red lead and afterwards thickly coated with bitumen compound to prevent corrosion.
- 5.3 Steel to copper connections shall be brazed type and shall be treated to prevent moisture ingress.
- 5.4 Resistance of the joint shall not be more than the resistance of the equivalent length of the conductor.
- 5.5 All ground connections shall be made by electric arc welding. All welded joints shall be allowed to cool down gradually to atmospheric temperature before putting any load on it. Artificial cooling shall not be allowed.
- 5.6 Bending of large diameter rod/thick conductor shall be done preferably by gas heating.
- 5.7 All arc welding with large diameter conductors shall be done with low hydrogen content electrodes.

6. Power Cable Earthing

Metallic sheaths and armour of all multi core power cables shall be earthed at both equipment and switchgear end. Sheath and armour of single core power cables shall be earthed at switchgear end only.

7. Specific Requirement For Earthing Systems

- 7.1 Earthing terminal of each surge arrester, capacitor voltage transformer and lightning down conductors shall be directly connected to rod electrode which in turn, shall be connected to station earthing grid.
- 7.2 Earthing mat comprising of closely spaced (300mm x 300mm) conductors shall be provided below the operating handles of the isolators.
- 7.3 For specific requirements for earthing at panel refer to Section-Control and Relay Panel of this specification.

8. Specific Requirements For Lightning Protection System

- 8.1 Conductors of the lightning protection system shall not be connected with the conductors of the safety earthing system above ground level.
- 8.2 Down conductors shall be cleated on the structures at 2000mm interval.
- 8.3 Connection between each down conductor and rod electrodes shall be made via test joint located approximately 150mm above ground level.
- 8.4 Lightning conductors shall not pass through or run inside G.I. conduits.
- 8.5 Lightning protection system installation shall be in strict accordance with the latest editions of Indian Electricity Rules/CEA regulations, Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.

9. Procedure For Non Destructive Testing

- A) LIQUID PENETRANT EXAMINATION OF WELDED JOINTS
 - a) Evaluation of indications – As per standard Test Procedure.
- B) RADIOGRAPHIC EXAMINATION OF WELDED JOINTS to be carried out as per standard test procedure on 10% welded joint.

26. Provision for Grouting/Support for HT & LT Lines

33kV Lines

Support foundation:

Cement concrete in mixture 1 part cement, 3-part coarse sand, 6 part 40mm size aggregate stone chips (1:3:6) shall be used in all the types of 33 kV line supports.

While erecting supports (poles), shuttering must be used for concreting so that proper quantity of cement concrete mixture be used and assessed during inspection. During concreting proper compaction by means of mobile vibrator be provided. While starting work of support erection, gang wise shuttering and mobile vibrator shall be offered for inspection to Project Manager. While erecting support, mercury level gauge must be used to ensure vertical erection of support.

250mm dia X 12" inch size muffing shall be provided on steel tubular and H-Beam poles to prevent direct entry of rainwater along the poles. Cement Concrete of 1:2:4 (1 part Cement, 2 parts coarse sand and 4 parts 20mm aggregate stones chips) shall be used for individual poles.

Steel plate shall be used in steel tubular poles and cement concrete reinforced plate shall be used as base plate for PCC poles.

11kV Lines

Support foundation:

Cement concrete in mixture 1 part cement, 3-part coarse sand, 6 part 40 mm size aggregate stone chips (1:3:6) shall be used in steel tubular poles and H-Beam 11 kV line supports.

In rural areas, PCC pole pit shall be refilled with 200 mm average size of bolder mixed with excavated earth. Proper ramming shall be performed for better compaction. All Double pole (DP), Triple pole (TP), cut point poles, Distribution Transformer substation poles and poles erected on water logging area shall be grouted using cement concrete mixture similar to H-Beam & Tubular poles. Prior approval of Project Manager shall be obtained for concreting of PCC poles in water logging area. While preparing route survey report, water logging areas shall be earmarked.

While erecting supports (poles), shuttering must be used for concreting so that proper quantity of cement concrete mixture be used and assessed during inspection. During concreting proper compaction by means of mobile vibrator be provided. While starting work of support erection, gang wise shuttering and mobile vibrator shall be offered for inspection to Project Manager. While erecting support, mercury level gauge must be used to ensure vertical erection of support.

250mm dia X 12" inch size muffing shall be provided on steel tubular and H-Beam poles to prevent direct entry of rainwater along the poles. Cement Concrete of 1:2:4 (1 part Cement, 2 parts coarse sand and 4 parts 20mm aggregate stones chips) shall be used for individual poles.

Steel plate shall be used in steel tubular poles and cement concrete reinforced plate shall be used as base plate for PCC poles.

LT Lines

Support foundation:

Cement concrete in mixture 1 part cement, 3-part coarse sand, 6 part 40 mm size aggregate stone chips (1:3:6) shall be used in steel tubular poles and H-Beam LT line supports.

In rural areas, PCC pole pit shall be refilled with 200 mm average size of bolder mixed with excavated earth. Proper ramming shall be performed for better compaction. PCC pole at cut point and PCC poles erected on water logging area shall be grouted using cement concrete mixture similar to H-Beam & Tubular poles. Prior approval of Project Manager shall be obtained for concreting of PCC poles in water logging area. While preparing route survey report, water logging areas shall be earmarked.

While erecting supports (poles), shuttering must be used for concreting so that proper quantity of cement concrete mixture be used and assessed during inspection. During concreting proper compaction by means of mobile vibrator be provided. While starting work of support erection, gang wise shuttering and mobile vibrator shall be offered for inspection to Project Manager. While erecting support, mercury level gauge must be used to ensure vertical erection of support.

250mm dia X 12" inch size muffing shall be provided on steel tubular and H-Beam poles to prevent direct entry of rain water along the poles. Cement Concrete of 1:2:4 (1 part Cement, 2 parts coarse sand and 4 parts 20mm aggregate stones chips) shall be used for individual poles.

Steel plate shall be used in steel tubular poles and cement concrete reinforced plate shall be used as base plate for PCC poles.

27. Minimum Guarantee/Warranty Required for supplied Materials

Notwithstanding any of the specifications above, the minimum Guarantee/Warranty requirement for major materials shall be as per below table:

| Sr. No. | Material | Gurantee / Warranty |
|----------------|---|------------------------------|
| 1 | 11 KV AAAC Covered Conductor (MVCC) | 36 months from Commissioning |
| 2 | 11 KV AL59 ACS Covered Conductor (MVCC) | 36 months from Commissioning |

28. Letters for Amendment in Technical Specification

The bidder shall ensure that due attention has been given in supply of materials and erection works as per latest amendments issued by REC/GUVNL/PGVCL from time to time. Some amendment letters are attached herewith for reference of the bidder.

PASCHIM GUJARAT VIJ COMPANY LTD

TECHNICAL SPECIFICATION OF GI EARTHING STRIPS

SCOPE:

This specification covers the supply, testing and delivery of Galvanizes Iron Earthing Strips for distribution network.

Applicable Standard:

The galvanizing and testing of materials shall conform to the latest edition of the following standards.

| | |
|--|-----------------|
| Recommended Practice for hot dip galvanized of iron earthing strips | IS:2629 (1966) |
| Methods of testing uniformity of coating on zinc coated articles | IS:2633 (1972) |
| Hot dip Zinc coatings on Structural steel and other allied products | IS:4759 (1996) |
| Zinc for galvanizing | IS:13229 (1992) |
| Steel plates, sheets, strips and flats for structural and general engineering purpose - DIMENSIONS | IS:1730 (1989) |
| General requirements for the supply of metallurgical materials | IS 1387 (1993) |
| Methods for determination of mass of zinc coating on zinc coated iron and steel articles. | IS 6745 |

Size:

GI strip of 25 mm wide, 3 mm thick having hot dip galvanized zinc coating of 80-100 microns. Average weight should be minimum 0.589 KG per meter without coating based on density of steel 7.85 gm/cm³ confirm with IS 1730 (1989). The length of strip shall be 7.5 meter.

Material:

Supplier has to purchase raw material MS flat as per relevant IS 2062-2011.

Zinc Coating:

MS flat shall be galvanized in accordance with IS:2629-1986. The zinc required for galvanizing shall be quality Zn-98 and shall confirm to IS 209-1966 and its latest amendments. The coating should be uniform, smooth and free from visual defects.

Tensile Strength:

Tensile strength should be minimum 410 MPa and internal bending diameter should be minimum 2t (Thickness) confirms with IS 2062 (2011).

Tests:

The following acceptance test shall be carried out on each and every lot at manufacturer premises at manufacturer's cost. The manufacturer must be fully equipped to carry out the tests at his premises in presence of PGVCL's inspector.

1. Visual examination
2. Dimension check
3. Tensile strength.
4. Mass of zinc coating (As per IS 4759)
5. Uniformity of zinc coating (As per IS 2633)
6. Adhesion of zinc coating

Manufacturer shall have to submit Test certificates with every lot for Chemical Composition.

Sample:

As mentioned in IS 4759 & IS 2633.

Packing:

Packing shall be bundle of 50 no of strips.

Guaranteed Technical Particulars:

Tender shall submit the Guaranteed Technical Particulars as per Performa attached here with only. The offer without technical particulars shall be ignored.

Deviation from specification:

No deviation in the above specification shall be allowed.

ANNEXURE – A

Name of Manufacturer: -

Address:-

Guaranteed Technical Particulars

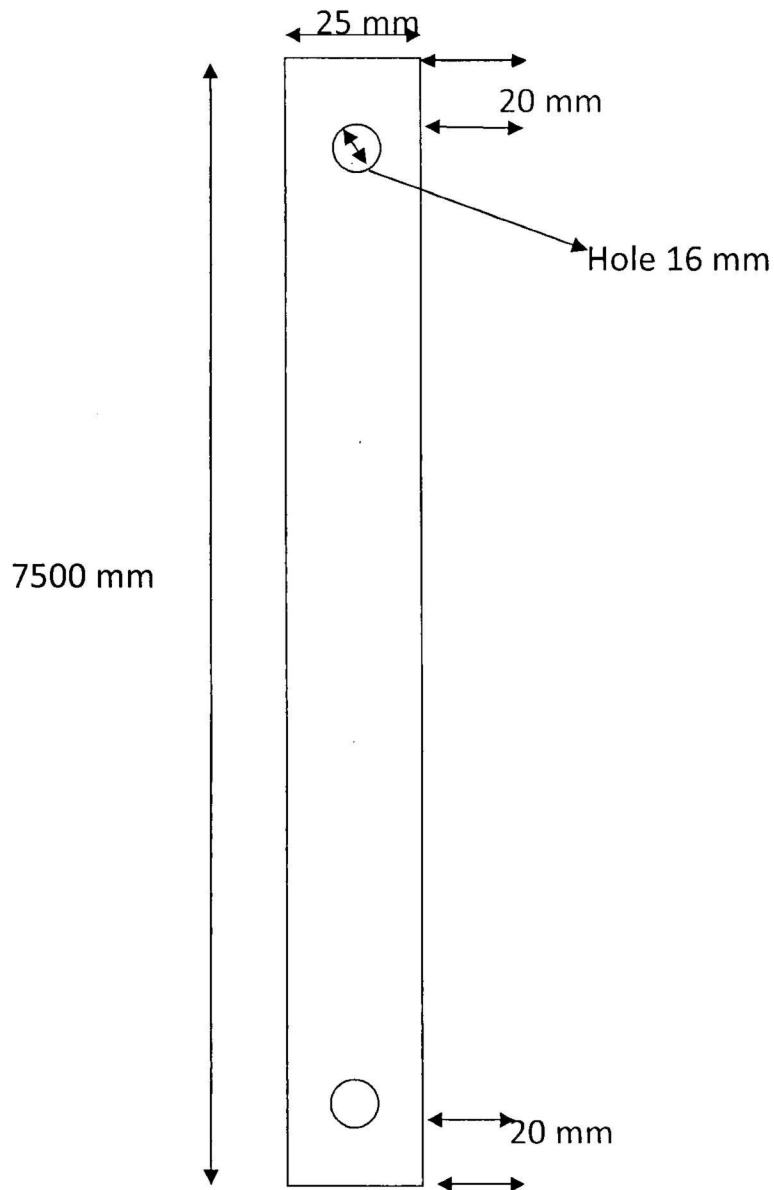
| SR NO | PARTICULARS | CONFIRMATION |
|-------|--|-------------------------------------|
| 1 | MS Earthing Strip :- 25 mm x 3 mm with tolerance of 5 % in width | Yes |
| 2 | Tensile strength – 410 MPa | Yes |
| 3 | Minimum bending diameter – 2 t | Yes |
| 4 | Length of MS Earthing strip – 7.5 Meter | Yes |
| 5 | Zinc coating shall be as under | |
| | <ul style="list-style-type: none">• Visual check as per IS 4759 | Free from ash, dross and black spot |
| | <ul style="list-style-type: none">• Adhesion Test as per IS 2629 | No flaking of zinc coating |
| | <ul style="list-style-type: none">• Knife Test (Sharp edge) IS 2629 | No peeling of zing coating |
| | <ul style="list-style-type: none">• Mass of Zing Coating Test | 610 GM/m ² , 90 micron |
| | <ul style="list-style-type: none">• Prece Test as per IS 2633 | No Copper effect |
| 6 | Holes of 16 mm diameter shall be provided at both ends as per drawing in Annexure-1. | Yes |
| 7 | Packing :- Bundle of 50 strips | Yes |

dt. 06.02.2023

ANNEXURE -1

Drawing showing holes of 16 mm diameter are to be provided at both end of MS STRIP

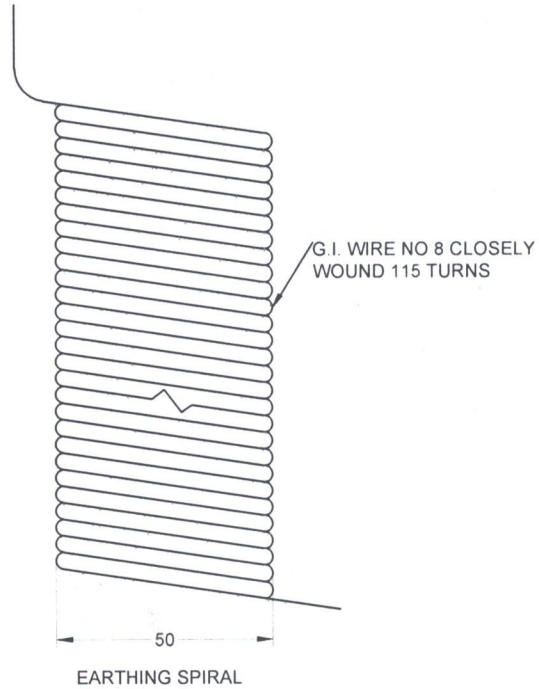
Thickness of MS Earthing Strip – 3 mm



Release

Add. Chief Engineer (Tech)
PGVCL, Corporate Office, Rajkot


EARTHING COIL FROM G.I.WIRE NO. 8



Remarks :-

- Tolerance in total length :- ± 2 mm.

[Signature]
Addl. Chief Engineer (Project)
PGVCL, Corp. Office
Rajkot.

| No. | Material Description | Length (mm) | Min. Weight | Remarks |  Paschim Gujarat Vij Company Limited Laxminagar, off nana Mava Main Road, Rajkot |
|--|----------------------|-------------|-------------|--------------------------------|---|
| 1. | G.I.Wire No. 8 | 17500 | 1.70 kg | Total weight of finished goods | |
| | | | | | |
| | | | | | |
| | | | | | |
| Notes :- | | | | | Item Description :- EARTHING COIL (OF G.I.WIRE NO. 8) |
| 1. All Dimensions are in mm unless or otherwise specified & illustration is not to be scale. 2. G.I.Wire No. 8 is as per IS : 280 with respective amendments & as per PGVCL specifications. | | | | | Item Code :- 0901000024 |
| | | | | | Drawing No :- PGVCL/PROJECT/EARTHING COIL/28 |