# GUJARAT ENERGY TRANSMISSION CORPORATION LTD.

**Sardar Patel Vidyut Bhavan, Race Course,**
**Vadodara: 390 007**

# TECHNICAL SPECIFICATIONS OF HARDWARE & ACCESSORIES-AL 59 CONDUCTOR FOR 220 KV TRANSMISSION LINE

**GETCO/E/TS–HW017/AL59/R2 July 2022**

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## SECTION – I

## GENERAL TECHNICAL REQUIREMENTS FOR INSULATOR HARDWARE FOR 220 KV TRANSMISSION LINES WITH AL59 CONDUCTOR

1.1 **Scope:**

1.1.1 This section of specification covers design, manufacture, testing at manufacturer's work before dispatch, supply and delivery of complete suspension and tension insulator hardware for AL 59 conductor for transmission lines.

1.2 **Standards:**

1.2.1 The hardware shall comply in all respect with the provisions of IS: 2486, Part-I, II and III/ 1974 (with latest amendment) for insulator fittings.

1.3 **Particulars of the Power System:**

1.3.1 The particulars of power system, in which the hardware required to be used, are given in section–II of this specification.

1.4 **Material and design:**

1.4.1 The materials offered should be first class quality, workmanship, well finished and of approved design. All castings shall be free from blow holes, flaws, cracks or other defects and shall be smooth, close, grained and of true forms and dimensions.

1.4.2 The Ball & Socket designation must be 16 mm for Suspension & 20 mm for Tension clamps. Material & design of hardwares shall be suitable to be used with porcelain / glass insulators, porcelain long rod insulators and / or silicon rubber insulators as per site requirement.

1.4.3 Minimum thickness of the any portion of the forged steel part shall be not less than 12mm.

1.4.4 All the drawings, i.e. elevation, side view, plan, cross sectional view etc., in AutoCAD format and manuals in PDF format, for offered item shall be submitted. Also the hard copies as per specification shall be submitted.

1.4.5 The bidder shall submit Quality Assurance Plan for manufacturing process and Field Quality Plan with the technical bid.

1.4.6 All the points other than GTP, which are asked to confirm in technical specifications must be submitted separately with the bid.

1.5 **Insulator hardware:**

1.5.1 **Suspension and Tension Clamps**:

1.5.1.1 The clamps offered should be light in weight free from corona formation, high corrosion resistant and shall have low power loss. The design, finish and shape of the clamps and the components, shall be such as to avoid all hot spots, kinks, cuts, grooves or projections which are likely to damage the conductor, insulator or fittings or lead to localized pressure. The clamps, body and keeper pieces (wherever required) shall be made of high strength cast aluminum alloys having matching / same Chemical Composition to AL 59 conductor , while cotter pins, cotter bolts, 'U' bolts, eye hooks, twisted shackles, ball eyes and clevis, chain links etc. shall be made of forged high carbon steel hot dip galvanized. Split pins of minimum 4 mm diameter and suitable strength, made of brass shall be used. The security clips shall be 'R' type made of phosphor bronze having 7/8 mm width or R-clip of stainless steel.

1.5.1.2 The suspension clamp shall be Forged Steel hanger type. The clamps shall have sufficient contact surface to minimum damage due to fault currents. The clamps shall be

suitable for use with conductor indicated in Section-II, when wrapped with formed Armour rods. Clamps shall permit the conductor to slip before failure of the conductor occurs and shall have a sufficient slipping strength to resist conductor tension under broken wire conditions. The slipping strength and the minimum failing loads of the clamps shall not be less than specified in Section-II of this specification. All bolts and 'U' bolts shall be provided with check nuts.

1.5.1.3 The tension clamps shall be of the compression type. The tension clamp shall not permit slipping or damage or failure of the conductor at a load less than 90% of the ultimate strength of the conductor. The mechanical efficiency of the tension clamp shall not be affected by any method of erection. The compression sleeve & jumper cone shall be made from extruded aluminum tube with aluminum alloy matching / same Chemical Composition to AL 59 conductor. The aluminum alloy flat matching / same Chemical Composition to AL 59 conductor shall be provided with adequate bolts and nuts as well as check nuts for rigid connection and to avoid the jumper connection becoming loose during service. In absence of steel core in conductor, steel sleeve of dead end shall have sufficient length to provide mechanical strength. Compression zone & direction of compression shall be clearly marked on compression sleeve. The same shall be clearly indicated in drawing also.

1.5.2 **Arcing Horns for Suspension and Tension Clamp:**

1.5.2.1 Each hardware assembly shall be provided with arcing horns on the line side of suspension and tension strings.

1.5.2.2 In the approach spans, upto a distance of 1.6 km from the sub-station adjustable arcing horns on line and tower end sides shall be provided with suitable gap, so as to give better insulation co-ordination and ensure effective operations under actual conditions. The range setting of arcing horns should be given in the bid.

1.6 **Galvanization:**

1.6.1 All ferrous parts of insulator hardware of power conductors shall be galvanized in accordance with IS: 2629/1966 (with latest amendment) 'Recommended practice for hot dip galvanizing of iron and steel'. The method for testing weight, thickness and uniformity of coating of hot dip galvanized articles shall be in accordance with IS: 2633/1972 (with latest amendment). The hardware shall have Zinc coating of 610 gm/$m^2$.

1.6.2 The Zinc used for galvanizing shall conform to IS: 209 (with latest amendment).

1.6.3 The threads in nuts and tapped holes shall be cut after galvanizing and shall be well lubricated or greased. All other threads shall be cut before galvanizing. The bolt threads shall be under out to take care of increase in diameter due to galvanizing.

1.6.4 Spring washers shall be electro-galvanized.

1.7 **Inspection of lot offered:**

1.7.1 The firm may offer the lot of hardware for inspection at works prior to dispatch. The minimum lot size shall be 100 Nos. or the full quantity of the order, whichever is less. The firm shall give minimum 15 days advance notice to the purchaser to enable the purchaser to depute his representative for witnessing the Acceptance Tests.

1.7.2 Depending upon the lot size offered, number of samples may be selected randomly as per Annexure–B of IS under reference.

1.7.3 On each selected sample, all the acceptance tests mentioned in clause No. 1.7.4 shall be carried out in accordance with the provisions of IS: 2486 (Part-I/1971) with latest amendments and GETCO specifications.

1.7.4 **Acceptance Tests:**

The following acceptance tests may be carried out:

(i) Visual examination
(ii) Dimensional check
(iii) Galvanizing test
(iv) Mechanical test for clamps and fittings
(v) Electrical resistance test (Only for Tension clamps)
(vi) Slip strength test
(vii) Chemical Composition Test
(viii) Magnetic Particle Inspection (NDT) test for forgings as per ASTM E 709
(ix) Any other test as per latest relevant IS

1.7.5 The above acceptance tests are to be carried out either at the firm's works or at Govt. Approved laboratory (in case of adequate testing facilities are not available at the firm's works) in the presence of inspector deputed by the GETCO. However, all the testing charges for such testing shall be borne by the firm only. Unless the acceptance tests are successfully completed and approval thereof is issued by the GETCO or waiver of inspection is obtained in writing from GETCO by the firm, the firm shall not dispatch any material to GETCO.

For performing Chemical Composition Test and Magnetic Particle Inspection test on forging, sampling plan shall be 1 number each type on offered lot of inspection

1.7.6 **Routine Tests:**

1.7.6.1 The following routine tests shall be carried out on all the hardwares offered in the lot:
(i) Visual examination test
(ii) Routine mechanical test

1.7.6.2 The firm may keep ready the certificates for routine tests for handing over the same to The inspector deputed during inspection of lot.

1.8 **Hot Line Maintenance:**

1.8.1 The hardware fittings, offered shall be suitable for employing hot line maintenance techniques, with requisite speed, ease and safety.

1.9 **Submission of Drawings and Type Test certificates:**

1.9.1 The Bidder shall submit full detailed dimensional drawings including Part Darwings indicating the materials of each part and test certificates thereof for the materials composition for the items of hardwares offered. In absence of the same, the offer shall be out rightly ignored. The approved drawings must be submitted in soft copy in Auto CAD format.

1.9.2 The Bidder shall submit with Technical Bid the type tests certificates (along with certified copy of dimensional drawing of hardware tested) for the entire type test as listed below issued by independent Govt. approved NABL laboratories.

1.9.2.1 Bidder shall submit following tests from NABL accredited/Government Laboratory. The test shall be carried out in accordance with latest /amended / up to date IS. The bidder has to submit the all type test reports as stated hereunder for the offered item along with the technical bid. The type test reports from NABL accredited/Government Laboratory shall not be older than Seven years. Type test reports shall be valid as on the last date of submission of bid.

**Type tests for clamps**

a) Visual examination
b) Verification of dimensions
c) Slip strength tests
d) Ultimate strength tests
e) Electrical resistance test (for tension clamps only)
f) Heating cycle test with AL 59 conductor (for tension clamps only)
g) Temperature rise test with AL59 conductor(@1250 Ampere for Tension clamp only)
h) Galvanizing / electroplating tests
i) Chemical Composition test

In case of piece meal of Type Tests, tests mentioned as a) & b) above shall be repeated every time.

**1.9.2.2 Type tests on total insulator string fittings**

a) Visual examination
b) Verification of dimensions
c) Mechanical tests
d) Galvanizing tests
e) Chemical composition test
f) Vibration test (as per Annx. A)

In case of piece meal of Type Tests, tests mentioned as a) & b) above shall be repeated every time.

**1.9.2.3 Type tests on non-tension components**

a) Visual examination
b) Verification of dimensions
c) Mechanical tests

1.9.3 In case of non-submission of type test reports, the evaluation shall be carried out accordingly.

1.9.3 The purchaser reserves the right to ask the supplier to arrange type tests on samples selected from any of offered lot for inspection in presence of GETCO representative. The testing charges for the same shall be borne by the GETCO if the sample withstands the tests successfully otherwise Bidder have to bear the same.

**Important Note:**

In case of non-submission / partial submission or type test reports of which validity is over, the bidder shall submit pending type test report/s from NABL accredited/Government Laboratory, in the event of an order, before commencement of supply without affecting delivery schedule, free of cost to GETCO. Confirmation for above shall be invariably submitted along with technical bid. Furthermore, purchaser reserve right to select the sample from Manuf. Works & recommend the NABL lab to carry out type tests in case of non-submission/ partial submission or type test reports of which validity is over.

1.9.5 **Quality Assurance Plan (QAP)**

The bidder shall invariably furnish following information along with his offer, failing which his offer shall be rejected.

i) Statement giving list of important raw materials names of sub suppliers for the 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 supplier's representative and as routine and / or acceptance during production and on finished goods, copies of test certificates.

ii) Information and copies of test certificates as in (i) above in respect of bought out accessories.

iii) List of manufacturing facilities available.

iv) Level of automation achieved and lists of areas where manual processing exists.

v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

vi) List of testing equipment available with the Supplier for final testing.

vii) The GETCO reserves the right for factory inspection to verify the facts quoted in the offer. If any of the facts are found misleading or incorrect the offer of that Bidder will be out rightly rejected and he may be black listed.

viii) Special features provided to make it maintenance free.

1.10 **Interchangeability:**

1.10.1 Corresponding parts of hardwares should be made to gauge or jig and shall be interchangeable in every respect.

1.11 **Marking:**

1.11.1 The item shall be legibly and indelibly marked with following details on each of main component of hardware.

(a) Name or Trademark of the manufacturer
(b) 'GETCO'

1.11.2 The packages containing fittings may also be marked with ISI certificates and mark.

1.12 **Packing:**

1.12.1 All hardware and accessories shall be supplied in strong wooden boxes/ crates with steel hoop and hands to withstand rough handling during the transits and transportation.

However, the Stores may be packed in double gunny bags with proper packing filters if delivered by road transport on door delivery basis.

The gross weight of wooden packing shall not normally exceed 500 Kg. Different fittings with the accessories shall be packed in different packings. All nuts should be hand tightened to the maximum possible point.

1.12.2 All parts shall be adequately and clearly marked for safe delivery and proper identification at destination.

## 1.13 Guaranteed Technical Particulars (GTP):

1.13.1 The Bidder shall fill in the guaranteed technical particulars of accessories given in Schedule–A, Section–III of this specification. All the columns must be filled in clearly. Tenders incomplete in this respect shall be out rightly ignored.

1.14 ISI Mark:

1.14.1 Materials having ISI mark shall be preferred.

## 1.15 Note to the Bidders:

1.15.1 The purchaser reserves the right to award contract item-wise basis or to reject the offer without assigning any reasons.

1.15.2 The offers without samples will be out rightly rejected. The samples submitted shall not be returned back. If desired, the GETCO will carry the testing of sample at GETCO's cost as per relevant IS before accepting the offer.

# SECTION: HARDWARE – II

## SPECIFIC TECHNICAL REQUIREMENT

2.1 **Scope:**

2.1.1 This section covers the specific technical particulars, requirement and desired delivery etc. for the insulator hardware for 220 KV transmission line with AL59 conductor. The equipment shall also conform to the general technical requirements covered under section-I of this specification.

2.2 **System and Climatic Particulars:**

| | | |
|---|---|---|
| (i) | Line voltage: | 220 KV |
| (ii) | Frequency: | 50 c/s |
| (iii) | No. Of Circuits: | Single Circuit and Double Circuit |
| (iv) | Tower Configuration: | Barrel type |
| (v) | Normal Span: | 350 Mtrs. |
| (vi) | Wind Pressure on: Conductor and Earth Wire | 150 kg/$m^2$ on 2/3$^{rd}$ projected area |
| (vii) | Temperature Range: | |
| | (a) Minimum: | $0^0$ C |
| | (b) Maximum: | $95^0$ C |
| | (c) Everyday: | $32^0$ C |

2.3 **Technical Particulars:**

2.3.1 **Conductor:**

| | | | |
|---|---|---|---|
| (i) | Type | : | AL 59 having equivalent weight to ACSR ‘Zebra’ |
| (ii) | Stranding & Wire Dia. | : | |
| | (a) Aluminum Alloy | : | 61/3.50 mm. |
| (iii) | Overall Diameter | : | 31.50 mm. |
| (iv) | Sectional Area | : | 587 sq. mm. |
| (v) | Approximate Total Weight | : | 1621 Kg/km. |
| (vi) | Ultimate Strength | : | 14395 Kg. |

2.3.2 **Insulators hardware:**

(Ref. Drg. No.GETCO/E/2L-STD/AL59HW/SSN/001, GETCO/E/2L-STD/AL59HW/DSN/002, GETCO/E/2L-STD/AL59HW/STN/003 & GETCO/E/2L-STD/AL59HW/DTN/004)

| | | |
|---|---|---|
| (i) | Slipping Strength | : |
| | (a) Suspension Clamps | : 8 to 15% of ultimate strength of conductor i.e. 2160 Kg. max. |
| | (b) Tension Clamps | : 90% of ultimate strength of conductors i.e. 12956 Kg. |
| (i) | Minimum Failing Load: | |
| | (a) Suspension Fittings | : 50% of ultimate strength of conductor i.e. 7197 Kg. |
| | (b) Tension Fittings | : 90% of ultimate strength of conductor i.e. 12956 Kg. |
| (i) | Type: | |
| | (a) Suspension Clamps | : Forged Steel Hanger free center type without bolt only |
| | (b) Tension Clamp | : compression type |
| (i) | Material | : As stated above in Section I & II |

| | | | |
|---|---|---|---|
| (ii) | Ele. Resis. At $20^0$ C of conductor | : | 75% of measured resistance of equal length |
| (iii) | Ferrous Parts | : | Hot dip galvanized |
| (iv) | No. Of insulators to be used | : | 14-15 for Suspension<br>15-16 for Tension |

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# GUARANTEED TECHNICAL PARTICULARS

# FOR

# HARDWARE AL 59 CONDUCTOR

## SECTION – III

## BIDDING SCHEDULES

(To be filled in and signed by Bidder)

The bidder must fill up all the point of GTP for offered item/s. Instead of indicating "refer drawing, or as per IS/IEC", the exact value/s must be filled in.

## SCHEDULE – A

## SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

**Hardwares:**

**(i)** **Item/Part** **Materials:**

1) Ball hook
2) Socket eye
3) Arcing horn on line side
4) Arcing horn on tower side (fixed or adjustable)
5) Suspension clamp
6) Tension clamp
7) Eye hook
8) Clevis
9) Yoke
10) Ball clevis
11) Socket clevis
12) Clevis eye
13) Horn holder ball hook
14) Anchor shackle
15) Ball link
16) Horn holder ball link
17) Twisted shackle
18) Chain link
19) 'R' type security clip and split pin

(ii)

1) Minimum failing load
2) Weight
3) Slipping strength

(iii) Angle of inclination of clamp to jumper terminal

(iv) Electrical conductivity of clamp

(a) Results of heating cycle test carried out
(b) Value of electrical resistance

(v) Power loss of clamps

(vi) Make of bolts and nuts used

(vii) Specification/Standard to which galvanizing conforms

**Signature of the Bidder: _____**
**Name: _____**
**Designation: _____**
**Date: _____**

**Authorized common rubber**
**Stamp / seal of the bidder: _____**

# SECTION: ACCESSORIES – I

## GENERAL TECHNICAL REQUIREMENTS FOR POWER CONDUCTOR ACCESSORIES FOR 220 KV TRANSMISSION LINES WITH AL 59 CONDUCTOR

1.1 **Scope:**

1.1.1 This section of specification covers design, manufacture, testing at manufacturer's works before dispatch, supply and delivery of complete accessories for power conductor for transmission lines.

1.2 **Standards:**

1.2.1 The accessories for ACSR conductor for overhead line with the provisions of ISS: 2121/1981 and IS: 9708-1980 (with latest amendment, if any).

1.3 **Particulars of the Power System:**

1.3.1 The particulars of power system, in which the accessories are required to be used, are given in section–II of this specification.

1.4 **Materials and Design:**

1.4.1 The material offered should be first class quality, workmanship, well finished and of approved design. All castings shall be free from blow holes, flows, cracks or other defects and shall be smooth, close, grained and of true forms and dimensions.

1.5 **Accessories for Power Conductors:**

1.5.1 **Compression type Mid–span Straight Joints:**

1.5.1.1 Compression type mid-span straight joints offered should be suitable for making joints in the AL 59 conductor, details of which are given in Section-II of this specification. The joints offered should conform to IS: 2121/1981 (with latest amendment).

1.5.1.2 The joint shall be so designed, that when installed, no air space is left within the finished joint. The joint shall have conductivity as specified but the mechanical strength shall not be less than 90% of the ultimate tensile strength of the conductor.

1.5.1.3 The sleeve shall be made from high strength extruded aluminum alloy tube of aluminum alloy having matching / same chemical composition with AL 59.

1.5.1.4 Compression zone & direction of compression shall be clearly marked on compression sleeve. The same shall be clearly indicated in drawing also.

1.5.2 **Repair Sleeve:**

1.5.2.1 Compression type repair sleeves shall be offered to provide reinforcement of conductor with broken or damaged aluminum strands. The repair sleeves shall be designed to make good a conductor, of which not more than $1/6^{th}$ of the strands, in the outermost layer, are damaged or severed. The repair sleeves after compression should present a smooth surface. The repair sleeves offered should conform to IS: 2121/1981 (with latest amendment).

1.5.2.2 Compression zone & direction of compression shall be clearly marked on compression sleeve. The same shall be clearly indicated in drawing also.

1.5.3 **Preformed Armour Rods:**

1.5.3.1 Helically – twisted formed Armour rods shall be suitable for AL 59 conductor, the details of which are given in Section-II of this specification, to provide rigidity and protection to the conductor at all suspension points, as also to eliminate the fatigue on the conductor due to vibration.

1.5.3.2 Armour rods shall be made of aluminium alloys. The Armour rods shall be marked in the center, to facilitate its identification and application on conductor. No joint shall be permitted in the rods, except those made in base rods before drawing.

1.5.3.3 The preformed Armour rods shall be capable of being fixed by hand on the conductor, without the aid of any tools or implements. The direction of spiral shall be same as that of conductor. The wire of the outermost layer of strands of the conductor shall have right-hand lay. The loading stress of Armour rods on the conductor shall be evenly distributed over the entire length and there shall be no tendency of loosening at the ends. The preformed Armour rods shall not loose their resilience, even after two or three applications. The rods should be capable of providing high self-retaining strength and protection against vibration, damage, fatigue and failure of conductor. The ends should be properly ball ended so that the danger of corona formation is avoided.

1.5.3.4 The surface of the Armour rods when fitted on the conductor shall be smooth and free from projections, cuts and abrasions etc.

1.5.4 **4R Vibration Dampers:**

1.5.4.1 4R type vibration dampers are proposed to be provided in each span, one at each end of conductor with normal span 350 Mtr. for 220 KV lines. The dampers shall be capable of effectively damping out the vibration of the conductors. In longer spans two dampers are proposed to be fitted on each end of conductor.

1.5.4.2 Calculations and complete design, weight etc. of the damper shall be furnished with the tender together with the damping characteristics and energy dissipation curves of the dampers and guarantee of their effectiveness for the conductor specified. For purpose of these calculations, the designed data shall be as given in Section-II of this specification. The offer is liable for rejection in the absence of this data.

1.5.4.3 The vibration dampers shall be of approved design. The clamp of the vibration damper shall be made of aluminum alloy so designed as to prevent any damage to or chafing of the conductor, during erection or continued operation.

1.5.4.4 Clamping bolts shall be provided with self-locking nuts designed to prevent corrosion of the threads. All ferrous parts, including the messenger cable shall be hot dip galvanized. The ends of the messenger cable shall be effectively sealed to prevent corrosion.

1.6 **Galvanization:**

1.6.1 All ferrous parts of accessories for power conductors shall be galvanized in accordance with IS: 2629-1966 (with latest amendment) 'Recommended practice for hot dip galvanizing of iron and steel'. The method for testing weight, thickness and uniformity of coating of hot dip galvanized articles shall be in accordance with IS: 2633-1972 (with latest amendment). The hardware and accessories shall have Zinc coating of 610 gm/$m^2$.

1.6.2 The Zinc used for galvanizing shall conform to IS: 209(with latest amendment).

1.6.3 The threads in nuts and tapped holes shall be cut after galvanizing and shall be of well lubricated or greased. All other threads shall be cut before galvanizing. The bolt threads shall be under cut to take care of increase in diameter due to galvanizing.

1.6.4 Spring washers shall be electro-galvanized.

1.7 **Tests:**

1.7.1 The Bidder shall submit with Technical Bid the type tests certificates (along with certified copy of dimensional drawing of accessory tested) for all the type tests as listed below issued by independent government approved laboratory.

**Preformed Armour Rod**

a) Visual examination.
b) Verification of dimension
c) Tensile strength test
d) Electrical resistance test.
e) Slip strength test.
f) Bend test
g) Resilient test

**Mid Span Joint & Repair Sleeve**

a) Visual examination.
b) Verification of dimension
c) Failing load test
d) Electrical resistance test.
e) Heating cycle test with AL 59 conductor.(Mid Span Joint only)
f) Chemical Composition test
g) Temperature rise test with AL59 conductor(MSJ only) (@1250 Ampere)

**Vibration Damper**

a) Visual examination.
b) Verification of dimension
c) Resonance frequency test
d) Fatigue test.
e) Mass pull off test.
f) Dynamic characteristics test
g) Damping efficiency test
h) Clamp slip test
i) Torque test
j) Galvanizing / Electroplating test
k) Magnetic power loss test

1.7.1.2 In case of non-submission of type test reports, the evaluation shall be carried out accordingly.

1.7.1.3 The purchaser reserves the right to ask the supplier to arrange type tests on samples selected from any of offered lot for inspection in presence of GETCO representative. The testing charges for the same shall be borne by the GETCO if the sample withstands the tests successfully otherwise Bidder have to bear the same.

1.7.2 **Acceptance of Lot:**

1.7.2.1 The firm may offer a lot of 100 nos. of the items or ordered quantity, whichever is less for inspection. The firm may give minimum 15 days advance notice to the purchaser so as to facilitate the purchaser to depute his representative for witnessing the acceptance tests at the firm's works.

1.7.2.2 All the acceptance tests mentioned in subsequent clause No. 1.7.2.4 shall be carried out by the firm at his works in the presence of GETCO's representative on the samples

selected as per the sampling criteria of relevant IS. Incase the testing facilities are not available at the firm's works, and then the firm has to arrange for the same at govt. approved laboratory. However, such testing charges shall be borne by the firm only.

1.7.2.3 Unless the materials are inspected and all acceptance tests are completed satisfactorily and approval thereof is given in writing, the materials shall not be dispatched by the supplier.

1.7.2.4 **Acceptance Tests:**

1.7.2.4.1 **Acceptance Tests of MS Joints, Repair Sleeves:**

The following acceptance tests shall be carried out on MS joints and Repair sleeves as per IS: 2121 (part-II)/ 1981 (with latest amendment).

(i) Visual examination
(ii) Dimensional verification
(iii) Failing load test
(iv) Galvanizing test
(v) Electrical resistance test
(vi) Chemical Composition test

1.7.2.4.2 **Acceptance Tests for P. A. Rods:**

The following acceptance tests shall be carried out on P.A. rods as per IS: 2121 (part-I)/1981 (with latest amendment).

(i) Visual examination
(ii) Verification of dimension
(iii) Tensile strength test
(iv) Electrical resistance test
(v) Slip strength test

1.7.2.4.3 **Acceptance Tests for Vibration Dampers:**

The following acceptance tests shall be carried out on vibration dampers as per IS: 9708/ 1980 (with latest amendment).

(i) Visual examination
(ii) Verification of dimensions
(iii) Resonance frequency test
(iv) Fatigue test
(v) Mass pull off test
(vi) Galvanizing test

1.7.3 **Submission of Routine Test Certificates:**

The firm has to carry out specified routine tests on all the items offered by him in the lot and submits the certificates thereof to the Inspector deputed by GETCO at the time of inspection of lot.

1.8 Hot Line Maintenance:

1.8.1 The accessories for power conductor offered shall be suitable for employing line maintenance techniques, with requisite speed, ease and safety.

1.9 **Drawings:**

1.9.1 The Bidder shall submit full detailed dimensional drawings to scale indicating the materials used for the construction of each part along with the test certificates for the materials. The offer will be liable to be rejected if the drawing dimensions along with materials composition certificates are not submitted along with the offer. The drawing should indicate the parts on which identifying markings will be embossed. The approved drawings set must be submitted in soft copy in Auto CAD format.

## 1.10 Interchangeability:

1.10.1 Corresponding parts of power conductor accessories should be made to gauge or jig and shall be interchangeable in every respect.

## 1.11 Marking:

1.11.1 Each item to be supplied shall be legibly and indelibly marked with trademark of the manufacturer and suitable identification mark along with the word ‘GETCO’.

## 1.12 Packing:

1.12.1 All hardware and accessories shall be supplied in strong wooden boxes/ crates with steel hoop and hands to withstand rough handling during the transits and transportation.

However, the Stores may be packed in gunny bags with proper packing filters if delivered by road transport on door delivery basis.

The gross weight of wooden packing shall not normally exceed 500 Kg. Different fittings with the accessories shall be packed in different packings. All nuts should be hand tightened to the maximum possible point.

1.12.2 All parts shall be adequately and clearly marked for safe delivery and proper identification at destination.

## 1.13 Guaranteed Technical Particulars (GTP):

1.13.1 The Bidder shall fill in the guaranteed technical particulars of accessories given in Schedule–A, Section–III of this specification. All the columns must be filled in clearly. Tenders incomplete in this respect shall be out rightly ignored.

## 1.14 ISI Mark:

1.14.1 Materials having ISI mark shall be preferable.

## 1.15 Note to the Bidders:

1.15.1 The purchaser reserves the right to award contract item-wise basis or to reject the offer without assigning any reasons.

1.15.2 The offers without samples will be out rightly rejected. The samples submitted shall not be returned back. If desired, the GETCO will carry the testing of sample at GETCO’s cost as per relevant IS before accepting the offer.

# SECTION: ACCESSORIES-II

## SPECIFIC TECHNICAL REQUIREMENTS

1 **Scope:**

1.1 This section covers the specific technical particulars, requirement and desired delivery etc. for the accessories for power conductor for 220 KV transmission line with AL 59 conductor. The equipment shall also conform to the general technical requirements covered under section-I of this specification.

2.2 **System and Climatic Particulars:**

| | |
|---|---|
| (i) Line Voltage: | 220 KV |
| (ii) Frequency: | 50 c/s |
| (iii) No. Of Circuits: | Single circuit and double circuit |
| (iv) Power Configuration: | Barrel type |
| (v) Normal Span: | 350 Mts |
| (vi) Wind Pressure on: Conductor and Earth Wire | 150 Kg/$m^2$ on 2/3$^{rd}$ projected area |
| (vii) Temperature Range: | |
| (a) Minimum: | $0^0$ C |
| (b) Maximum: | $95^0$ C |
| (c) Everyday: | $32^0$ C |

2.3 **Technical Particulars:**

2.3.1 **Conductor:**

| | | | |
|---|---|---|---|
| (iii) | Type | : | AL 59 having equivalent weight to ACSR 'Zebra' |
| (iv) | Stranding & Wire Dia. | : | |
| | (b) Aluminum Alloy | : | 61/3.50 mm. |
| (vii) | Overall Diameter | : | 31.50 mm. |
| (viii) | Sectional Area | : | 587 sq. mm. |
| (ix) | Approximate Total Weight | : | 1621 Kg/km. |
| (x) | Ultimate Strength | : | 14395 Kg. |

3.2 **Accessories for Power Conductor:**

3.2.1 **Compression Type Mid-span Straight Joints:**
(Reference drawing No. GETCO/E/2L-STD/AL59-MSJ/005)

| | | |
|---|---|---|
| (i) | Minimum failing load: | 90% of ultimate strength of conductor i.e. 12956 kg. |
| (ii) | Material: | |
| | (a) Sleeve: | Extruded Aluminium Alloy tube of matching Chemical Composition to AL 59 conductor |
| (iii) | Elec. Resist. At $20^0$ C: | 75% of measured resistance of equivalent length of conductor |
| (iv) | Ferrous Parts: | Hot dip galvanized |

3.2.2 **Repair Sleeves:**
(Reference drawing No. GETCO/E/2L-STD/AL59-RS/006)

| | | |
|---|---|---|
| (i) | Minimum failing load: | 90% of ultimate strength of conductor i.e. 12956 kg. |
| (ii) | Material: | Aluminium alloy |
| (iii) | Elect. Resist. At $20^0$ C: | 75% of measured resistance of equivalent length of conductor |

3.2.3 **Preformed Armour Rods:**
(Reference drawing No. GETCO/E2/1/06L-STD/CAC-031/003)

| | | |
|---|---|---|
| (i) | Type: | Preformed |
| (ii) | Material: | Aluminium alloy |
| (iii) | Purity of Aluminium | : EC Grade 99.5% |
| (iv) | Corona Formation Voltage: | 110% of maximum line-to-ground voltage |
| (v) | End Condition: | Ball ended |
| (vi) | Direction of Lay of Rods: | Right hand lay |
| (vii) | Tensile Strength: | 35 kg. /$mm^2$ |
| (viii) | Slip Strength: | 15% U.T.S. |

3.2.4 **Vibration Dampers:**
(Reference drawing No. GETCO/E2/1/06L-STD/CAC-031/002)

| | | |
|---|---|---|
| (i) | Type: | 4R Type |
| (ii) | Material: | Aluminium alloy |
| (iii) | Ferrous parts: | Hot dip galvanized |
| (iv) | Testing as per: IS specification | IS: 9708-1980 (with latest amendment) |

**GUJARAT ENERGY TRANSMISSION CORPORATION LTD.**
Sardar Patel Vidyut Bhavan, Race Course,
Vadodara: 390 007

# GUARANTEED TECHNICAL PARTICULARS

# FOR

# ACCESSORIES AL 59 CONDUCTOR

## SECTION - III

## BIDDER SCHEDULE

(To be filled in and signed by the Bidder)

The bidder must fill up all the point of GTP for offered item/s. Instead of indicating "refer drawing, or as per IS/IEC", the exact value/s must be filled in.

## SCHEDULE – 'A'

**Accessories for Power Conductor:**

**(i) Compression type Mid-span straight joints**

1. Suitable for (conductor size):
2. Outside diameter of sleeves:
   (a) Before compression:
   (b) After compression:
3. Length of Sleeve:
   (a) Before compression:
   (b) After compression:
4. Weight of Sleeve:
5. Slipping strength of Mid-span joint:
6. Breaking strength of Mid-span joint:
7. Conductivity of the compression joint:
8. Resistance as Percentage of Measured Resistance of Equivalent Length of Conductor:

**(ii) Repair Sleeves:**

1. Material:
2. Suitable for (conductor size):
3. Out side diameter of sleeves:
   (a) Before compression:
   (b) After compression:
4. Length of sleeves:
   (a) Before compression:
   (b) After compression:
5. Weight of sleeve:
6. Breaking strength as percentage of:
   Ultimate tensile strength of conductor
7. Conductivity:
8. Resistance as percentage of:
   Measured resistance of equivalent
   Length of conductor

**(iii) Preformed Armour Rods:**

1. Type:
2. Suitable for (conductor size):

3. Total weight of set of rods (kg):
4. No. Of wire per set:
5. Nominal diameter of wire:
6. Length of wire:
7. Percentage tolerance on:
   Length and diameter of wire
8. Overall diameter of the conductor:
   After use of the Armour rod – mm
9. End condition:
10. Center marking provided: Yes/No
11. Total weight:
12. Pitch of helix:
13. Direction of lay:
14. Efficiency of damping:
15. Tensile strength:
16. Conductivity:

**(iv) <u>Vibration Dampers</u>:**

1. Type:
2. Suitable for (conductor size):
3. Total weight of each damper:
4. Diameter of balancing weight:
5. Length of balancing weight:
6. Weight of each balancing weight:
7. Tolerance of balancing weight:
8. Material, quality, length and size:
   Of messenger cable
9. Slipping strength of messenger:
   Cable clamp
10. Diagram showing power/dissipated:
    By the damper for various vibration
    Frequencies and amplitudes
11. Damping efficiency of damper:
12. Natural frequency of damper:
    (a) Upper C.P.S.:
    (b) Lower C.P.S.:
13. The number of dampers required:
    For span for various span length
    And their spacing
14. Position of fixing damper on the:
    Conductor from the clamp mount
    (a) At tension point:
        (i) First damper:
        (ii) Second damper:
        (iii) Third damper:
    (b) At suspension points:
        (After fixing Armour rods)
        (i) First damper:
        (ii) Second damper:
        (iii) Third damper:
15. I.S. No. To which:
    4R damper conforming

**Signature of the Bidder: _____**
**Name: _____**
**Designation: _____**
**Date: _____**
**Authorized common rubber**
**Stamp / seal of the bidder: _____**

## Annexure – A

**Vibration Test :**

The suspension string shall be tested in suspension mode, and tension string in tension mode itself in laboratory span of minimum 30 metres. In the case of suspension string a load equal to 600 kg shall be applied along the axis of the suspension string by means of turn buckle. The insulator string along with hardware fittings and the sub-conductors if any, each tensioned at 25 % of its UTS shall be secured with clamps. The system shall be suitable to maintain constant tension on each sub-conductors throughout the duration of the test. Vibration dampers shall not be used on the test span. All the sub-conductors shall be vertically vibrated simultaneously at one of the resonance frequencies of the insulators string (more than 10 Hz) by means of vibration inducing equipment. The peak to peak displacement in mm of vibration at the antinode point, nearest to the string, shall be measured and the same shall not be less than $1000/f^{1.8}$ where f is the frequency of vibration in cycles/sec. The insulator string shall be vibrated for not less than 10 million cycles without any failure. After the test the hardware (including clamp) shall be examined for looseness, fatigue failure and mechanical strength test. There shall be no deterioration of properties of hardware components after the vibration test.