



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

TECHNICAL SPECIFICATION
OF
TOWER MATERIAL
FOR 220KV MULTI CIRCUIT-ZEBRA
TRANSMISSION LINE

TOWER SPECIFICATION

1.0 STANDARDS :

- 1.1 The design, fabrication, galvanizing and testing of material used for manufacture of 220 KV M/C tower suitable for ACSR “ Zebra “ conductor shall be according to the latest edition of the following standards (as mentioned Up-to-date) except where otherwise specified in the Specification.

1.	Specification for zinc	IS : 209-1992
2.	Code of practice for use of structural steel in general Building Construction.	IS : 800-1991
3.	Code of practice for use of structural steel in overhead transmission line towers.	IS 2062-1999
4.	Hexagon head bolts, screws and nuts of product grade 'C'.	IS : 1363-1992 (Part 3)
5.	Technical supply conditions for threaded fasteners (First Revision)	IS : 1367-1979
6.	Plain washers	IS : 2016-1992
7.	Steel for general structural purposes Specification.	IS : 2062-1999
8.	Recommended practice for hot-dip galvanizing of iron and steel.	IS : 2629-1990
9.	Methods of testing weight thickness and uniformity of coating on hot-dip galvanised articles.	IS : 2633-1992
10.	Single Coil Rectangular Section spring washers for bolts, nuts, screws.	IS : 2063-1972
11.	Specification for hot-dip zinc containing on structural steel and other allied products.	IS : 4759-1990
12.	Specification for hot-dip galvanised coating on fasteners.	IS :5358-1969
13.	Code of practice for design, installation and maintenance of overhead power lines.	IS : 5613-1976
14.	Heavy washers for steel structures.	IS : 6610-1991

15.	Hexagonal bolts for steel structures.	IS : 6639-1972
16.	Methods for determination of weight of zinc coating of zinc coated iron and steel articles.	IS : 6745-1972
17.	Transmission Tower bolts of property class 5.6.	IS : 12427-1992

2.0 PROCUREMENT OF EQUIPMENTS, TOOLS-TACKLES AND MATERIALS :

- 2.1 All the materials, tools, equipments in sufficient quantity, required for straightening, cutting, drilling, punching, bending, welding, galvanizing etc. activities shall be procured / arranged by the successful Bidder before the work is to be taken up on hand and shall not link the delivery period with procurement / arrangement of these items / tools / equipments. List of equipment and size of galvanized bath shall be submitted along with technical bid.
- 2.2 The Bidder shall make his own arrangement for procurement of steel conforming to IS: 2062 Grade-A before commencement of work-in sufficient quantity. The use of high tensile steel is not permitted.
- 2.3 In case of non-availability of any required steel section, Bidder at his own cost shall procure and utilize next higher section to complete the work. However, from design point of view, such alternate higher section shall be got approved from GETCO before the use. The total payable weight will be limited to A/T Guaranteed weight only.

The Bidder shall make his own arrangement for procurement of required Bolt-Nuts, accessories, attachments like 'D' shackles. 'U' bolts, anchor bolts, step bolts etc from the approved vendor of GETCO well in advance and supply as per scheduled completion period along with the inspection at sub vendor's premises.

The bolt nuts shall be procured from the following manufacturer's approved by GETCO.

1	M/s. GKW-Kolkata.	7	M/s. Agrawal ("A"Brand)
2	M/s. Nex Industries-Ludhiana.	8	M/s.Raj Enterprises Fasteners Pvt. Ltd.-Indore
3	M/s. Indian Steel & Wire	9	M/s. B.R.K. Industries-

	Products- Jamshedpur		Ludhiana
4	M/s. Bharat Industries-Kolkata	10	M/s. Tackman India-Chandigarh
5	M/s. Sterling Bolt Pvt. Ltd.- Howrah	11	M/S N.L. Engineers-Mohali, Ludhiyana.
6	M/S Simplex- Kolkata	12	A.V. FORGING , PUNJAB

For any other make of bolt nuts, the Bidder will have to take prior approval of the GETCO. For such approval the Bidder has to submit the following in respect of prospective bolt-nut supplier.

Plant Capacity per annum.

Type test reports for bolt nuts to be supplied (not older than 5 years).

List of orders executed / under execution.

However, GETCO reserves right to test the samples of Bolts & nuts of the proposed Bolt-nut supplier before approving the make. The GETCO is at liberty to have samples of steel, zinc etc. to be used, test, check in any Laboratory recognized by the Government at the cost of Bidder and reject the material if found below standard.

The zinc used for galvanizing of fabricated materials shall be electrolytic high grade zinc (99.95% Purity.)

3.0 DRAWINGS AND BILLS OF MATERIALS :

3.1 The GETCO will provide one set of available drawings and bills of material pertaining to respective structure, to the successful Bidder on award of contract.

The successful Bidder has to submit copies of given drawings / bills of material for GETCO's approval before commencing the mass production along with manufacturing QAP (Quality Assurance plan)

Proto-Model (if required) shall be prepared and got inspected for the approval along with fabrication sketches, tower drawings and bills of material at no extra cost to the GETCO. Soft copy of approved bill of material must be submitted along with drawings of tower in AUTOCAD format to CE (Projects), Corporate Office, GETCO-Vadodara .

The approved copies of structural drawings and bills of materials shall be distributed as under :

- i) CE (Projects), GETCO , Corp Off, Vadodara - 2 sets
- ii) Supdt. Engineer (Trans), GETCO, Circle Office in-charge of work - 1 set
- iii) Ex- Engineer (Const), GETCO , Divisional Office in-charge of work - 3 sets

The approved copies of fabrication sketches shall be submitted in duplicate only to the CE (Projects), GETCO, Vadodara.

FOR EXTENSION ABOVE SIX METRE:-

- 1) Sag tension calculation based on approved check survey and actual river crossing parameter, design of special tower structure and special cross arm(Transposition Tower) shall be got approved from GETCO and shall prepare PROTO-MODEL assembly as per approved design. The proto- model assembly shall be inspected by the GETCO representative and subsequently the fabrication sketches, structural drawings and bill of material of respective structure will be approved by GETCO.
- 2) The quantity indicated in the schedule are provisional. These quantities may increase / decrease as per the site condition. The actual quantities of tower structures shall be according to approved design and bill of materials.
- 3) The bidder may offer readymade approved design of special tower structure suitable to parameter, terms and condition given by GETCO. However, such design should have been approved by any of the Electricity Boards(Power Utilities). In case of Acceptance of such design, the rate of the item will be reduced by 20%.
- 4) The GETCO will have right to use such designs, drawings, bill of materials, fabrication sketches etc for any other project under any other contractor through any other agency / contractor. The bidder has to pass on design right to GETCO along with fabrication sketches without any extra cost to GETCO.

4.0 PROTO-MODEL ASSEMBLY:

- 4.1 Before going for mass production, the Bidder shall prepare proto-model assembly at his own cost for each type of structure in accordance with respective approved drawings and bills of materials and rectify all the defects observed and arrange for its approval from the GETCO.
- 4.2 The steel bolts-nuts, washers etc. required for PROTO-MODEL assembly shall be arranged by the Bidder at his own cost.
- 4.3 Bidder having supplied particular type of transmission line tower as per GETCO drawing shall be exempted from preparation of Proto-Model assembly and its approval before mass production. However details of earlier supplied transmission line tower indicating Job No, Type of towers , order quantity and supplied qty should be furnished along with Technical Bid.

5.0 DESIGN, FABRICATION, STAMPING AND GALVANISING OF TOWER MATERIALS

- 5.1 Any extension or special cross arm or other type of tower, if required, to be supplied against this Tender the successful Bidder shall design and prepare Proto – Model and get approved from GETCO at no extra cost to the GETCO. Required design data will be provided by GETCO.

All the activities like straightening, cutting, drilling punching, bending, notching, stamping galvanizing etc. shall be carried out according to the Technical Specification given in this Tender document.

6.0 TYPE OF STRUCTURES :

- 6.1 All the structures shall be fully galvanised using only structural mild steel sections for members. The use of high tensile steel is not permitted. Hexagonal head bolts with nuts and spring washers shall be used for connections.

The type of structure shall be indicated as under:

- (a) 220 KV M/C tower suitable for ACSR “ Zebra“ conductor.

Tangent tower-MA- 2 Deg
Small Angle tower-MB-15 Deg
Medium Angle tower MC-30 Deg
Large Angle tower –MD- 60 Deg/DE.

The parameters for design of extension portion OR structure with height more than standard available extension will be provided to the successful Bidder, if required.

7.0 MATERIAL :

- 7.1 The steel required for fabrication of structure member shall conform to IS: 2062 -1999 Grade A. The zinc required for galvanizing shall be of Zn-99.95% and shall conform to IS: 209-1992. The bolts and nuts shall conform to IS: 12427-1992/IS: 1367(Part-3)-1991. The bolts and nuts shall be of minimum class 5.6. The plain washers shall conform to IS:2016-1992. Heavy washers shall conform to IS:6610-1991. Spring washers for bolts and nuts shall conform to IS:3063-1994. All bolts and nuts shall have hexagonal heads. The heads, being forged out of the solid, truly concentric and square with the shanks, must be perfectly straight. Fully threaded bolts shall not be used. The length of bolts shall be such that the threaded portion will not extend to the place of contact of the member. All bolts shall be threaded as per IS: 1363 (1992) to take full depth of the nut and shall be threaded enough to permit firm gripping of the member, but no further threaded portion of each bolt shall project through the nut at least 6mm. when fully tightened. All nuts shall fit hand tight to the point where the shank, of the bolt connects to the head. Flat and tapered washers shall be provided where necessary. The diameter of bolts shall be 12 mm, 16mm and 20mm. The thickness of spring washers shall be 2.5 mm, 3.5 mm and 4 mm respectively. Spring washers shall be provided under all nuts. These washers shall be positive lock type electro galvanized. Each structure shall be provided with step-bolt of not less than 16mm diameter having length 150mm. The step-bolt shall be fixed on one leg up to top of structure as indicated in approved drawing. Each step-bolt shall be provided with two nuts and one washer.
- 7.2 The attachments like 'U' bolt, 'D' shackle, strain plate etc. shall be as per approved drawings and shall be procured from the reputed registered firms with GETCO indicated at Clause. No.-2.3 of this specification.

8.0 FABRICATION WORKMANSHIP:

- 8.1 The details of fabrication shall conform to IS: 802 (Part-II) - 1978.
- 8.2 All the structure members shall be accurately fabricated to bolt together easily at site without any undue strain on the bolts. The diameter of the bolt-hole shall be equal to the diameter of bolt plus 1.5 mm. All similar parts of structure shall be made strictly interchangeable. All steel sections before any work is done on them, shall be carefully, levelled, straightened and made true to detailed drawings by methods which will not injure the materials so that when assembled the adjacent matching surfaces are in close contact throughout. No rough edges shall be permitted in the entire structure.

9.0 DRILLING AND PUNCHING :

- 9.1 Before any cutting work is started, all steel sections shall be carefully straightened and trued by pressure and not by hammering. They shall again be trued after being punched and drilled. Holes for bolts shall be drilled or punched with a jig but drilled holes shall be preferred. The following maximum tolerance of accuracy of punched holes is permissible. Holes must be perfectly circular and no tolerance in this respect is permissible. The maximum allowable difference in diameter of the holes on the two sides of plates or angle is 0.8 mm i.e. the allowable taper in a punched holes should not exceed 0.8mm of diameter. Holes must be square with the plates or angles and have their walls parallel. All burs left by drills or punch shall be removed completely. When the structure members are in positions, the holes shall be truly opposite to each other. Drilling or ramming to enlarge defective holes shall not be permitted.

10.0 ERECTION MARK :

- 10.1 Each individual structure member shall carry a code number conforming to the component number given to it in the bills of material and fabrication drawing. This code number shall be marked with marking dies, having 16 mm size-letter before galvanising and shall be legible after galvanising. The letters indicated for different types of structure shall only be used.

Erection mark shall be “AA - BBB - CC – DDD” , where

AA	=	Contractor's code	Alphabet
BBB	=	Contractor's project number	Numerical
CC	=	Structure type	Alphabet
DDD	=	Member number	Numerical.

This mark shall be got approved from the GETCO.

10.2 Each structure member shall also be marked with indelible ink through stencil of 16 mm size alphabet /numerical.

11.0 BENDING :

11.1 Mild steel angle sections upto 75 x 75 mm (upto 6 mm thick) shall be bent cold up to and including bend angle of 10 Deg. angles above 75x75 mm (thickness up to 6 mm) and up to and including 100 x 100 mm (thickness upto 8 mm) may also be bent cold up to the bend angle of 5 Deg. All other angle sections and bend angles not covered above shall be bent hot.

All plates upto 12 mm thickness shall be bent cold upto a maximum bend angle of 15 Deg. Greater bends and other thicknesses shall be bent hot.

All hot bent material shall be air cooled. The bends shall be of even profile and free from any surface damages.

12.0 GALVANISING :

12.1 The galvanizing shall be done to all the structure members after the fabrication work is completed. The nuts may be tapped or re-run after galvanizing. Threads of bolts and nuts shall have neat fit and can be turned with finger throughout the length of the threads of bolts and they shall be capable of developing full strength of bolts.

12.2 The zinc deposition should not be less than specified, per galvanized surface area of the fabricated structure member.

12.3 The galvanizing of the structure members shall conform to IS: 2629-1985 & IS: 4759-1984. All galvanized members shall withstand tests as per IS: 2633-1986.

The weight of zinc coating shall be determined as per the method stipulated in IS:2633-1986. Spring washers shall be electro galvanized as per IS:1573-1970.

12.4 All the stubs, cleats and stub-setting templates shall be fully galvanized.

12.5 Unless otherwise specified the fabricated tower parts & stub shall have a minimum overall zinc coating of 610 Gram per Sq. meter of surface except for plates below 5 mm which shall have zinc coating of 460 Gram per sq. meter of surface. The average zinc coating for section 5 mm & above shall be maintained as 87 Micron & that for section below 5 mm shall be maintained as 65 Micron.

13.0 CONFORMITY:

13.1 The Bidder shall ensure that the specified materials and workmanship of all structures actually supplied strictly conform to drawings/data supplied/approved by the GETCO. -In case any deviation is detected during the process of supply or even after erection, the Bidder shall replace such defective structure free of cost to the GETCO. All expenditure or losses incurred in erection, to and fro transportation and any other expenditure or losses incurred by the GETCO on this account shall be borne by the Bidder. No extensions in delivery period shall be allowed on this account.

14.0 QUALITY ASSURANCE PLAN

14.1 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, proposed to be used in the fabrication against this Specification, 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 Bidder's representative 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 list of areas where manual processing exists.

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

List of testing equipment available with the Bidder for final testing as per relevant IS specified. In the case if the Bidder does not possess all the Acceptance testing facilities the same tests shall be carried out at Govt. approved third party lab.

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

Special features provided to make it maintenance free.

The Field Quality Plan (FQP) is to be submitted along with Technical Bid.

14.2 The bidder shall also submit following information to the purchaser along with the technical Bid. .

i) List of raw materials as well as bought out accessories, and the name of suppliers of raw materials as well as bought out accessories.

ii) Type test certificates of the raw material and bought out accessories.

iii) Quality assurance plan (QAP) with hold points for purchaser's inspection.

14.3 The Bidders shall submit the routine test certificates of all the bought out items, accessories etc.

15.0. INSPECTION :

The successful Bidder has to offer inspection of fabricated tower material every month as per scheduled bar chart giving minimum time of not less than 10 days. The inspection of fabricated tower material shall be carried out at manufacturer's works for Acceptance tests as per relevant Indian standard. The inspection of bolts-nuts, hanger, washers, step-bolts and other bought out items shall be carried out at Manufacturer's works as per relevant IS. The testing charges shall be borne by the bidder. If the testing facilities are not available for the tests to be carried out, the same shall be carried out at third party laboratory at no extra cost to the GETCO.

The GETCO reserves right to pick-up sample of any material from the lot received at site and get the same tested as per ISS at third party Laboratory (preferably Government Laboratory or Educational Institution). The material should pass these and if the material fails,

they will be summarily rejected and Bidder should make immediate arrangement to replace them with standard materials and after getting them duly inspected. Rejected/ defective material if found during inspection shall be destroyed in presence of GETCO's representative. The bidder shall replace the material if not found as per specific requirements, at no extra cost to the GETCO, including testing charges.

All the gauges and templates required for measurement of bend angles shall be provided by the Bidder.

The inspection shall be carried out as per guideline given here under:-

16.0 GENERAL GUIDE-LINE FOR INSPECTION :

16.1 Fabricated Structure Members:

- i) Visual examination and quantity verification of offered lot.
- ii) Sample selection from the offered lot at a ratio of 50 MT (or part thereof) 1 no. for all tests.
- iii) Dimension, fabrication and trueness verification of structure member from fabrication sketch.
- iv) Galvanizing test of each sample i.e. dip test, hammer test and mass of zinc test.
- v) Random verification Zinc coating over galvanized surface by Elcometer.
- vi) Tensile test and bend test on each sample.
- vii) Chemical composition test on at least one sample per lot offered for inspection.
- viii) Verification of manufacturer's test certificate for mild steel used in structure members and submission of copy of the same along with inspection report. Failing in which dispatch instruction will not be issued.

16.2 Bolts-Nuts, Washers, Accessories, Attachments etc.: (To be carried out at manufacture's works.)

- i) Visual examination and quantity verification of offered lot.
- ii) Sample selection from the offered lot as per relevant IS for each item.

- iii) Dimension, fabrication and trueness verification from fabrication sketch.
- iv) Galvanizing test on each sample.
- v) Other acceptance tests for respective item as per relevant Indian Standard and as per latest IS revision.
- vi) The inspection report shall be along with size and quantity shall be mentioned in each type of bolt-nuts and attachment.

16.3 No member once rejected shall be resubmitted for inspection. Such member shall be destroyed in presence of the Inspector.

16.4 The acceptance of any lot shall in no way relieve the Bidder for any of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection of any item of that lot later found defective.

17.0 DESPATCH INSTRUCTIONS :

17.1 On receipt and verification of test certificates, the CE (Projects), GETCO, Corp Off, Vadodara will issue a clearance for dispatch of inspected material. No material shall be dispatched before receipt of such dispatch instruction in writing.

The bolt-Nuts and all other items procured from other manufacturer should be dispatched directly to the consignee to avoid double payment of Sales Tax / VAT.

18.0 PACKING AND MARKING ON PACKING :

18.1 The material shall be boxed or bundled for transport in the following manner:

Angle shall be packed in bundles securely wrapped four times around at each end and over 900mm. with No. 9 SWG steel wire with ends twisted tightly. Gross weight of any bundle shall not exceed approximately 450 Kg.

Cleat angles, brackets, filler plates and similar small loose pieces shall be nested and bolted together through holes wrapped round at least four times with No. 9 SWG steel wire and ends twisted tightly. Gross weight of each bundle shall not exceed 70 Kg.

The correct number of bolts, nuts and washers required for structures shall be packed in heavy gunny bags accurately tagged in accordance with the contents and a number of bags packed in a solid box of 22 mm. thick lumbers with panel end to be accurately nailed and further reinforced with 22mmx75mm. Batons round the sides at the ends with 25mm x No. 18 SWG iron band stretched entirely around the batons with ends overlapping at least 150mm. Gross weight of each box shall not exceed approximately 70 Kg.

18.2 All above packings are subject to the approval of the GETCO

18.3 Each bundle or packing shall have the following marks :

The name of the consignee (as per dispatch instructions given by the GETCO.)

Ultimate destination as required by the GETCO. The relevant marks and number of structure members or reference or bolts, nuts and small components like gusset plates, various attachments, etc. for easy identification.

19.0 MATERIAL ACCOUNTS :

19.1 The successful Bidder has to approach the consignee for reconciliation of the materials supplied as per approved Bill of Material (Member wise without any shortages) from time to time and get the completion certificate for receipt of complete structure quantities.

All the final accounts shall be according to sectional weight basis, as per approved bills of material only based on completion certificate issued by field office.

20 WEIGHTS :

20.1 The unit weights of each type of structure, including bolt-nuts, accessories, attachments shall be furnished and / or to be approved by the GETCO. The weight of structure shall mean the weight calculated by using the black sectional (i.e. un galvanised) weights of all steel members of the sizes indicated in the fabrication drawings and bills of materials without taking into consideration the reduction in weight due to drilling of bolts, holes, skew cuts, chamfering etc. or increase in weight due to galvanizing but taking

into consideration the weight of the special fittings, bolts, nuts, washers and other accessories.

21 GENERAL :

21.1 The successful bidder shall submit Drawing/Design and Bills of Material in soft copy as well as in hard copy with out any extra cost to the GETCO, failing in which 10 % equivalent amount of order will be with held till submission.

22.0 EMBOSSING OR ENGRAVING:

The successful Bidder wherever possible will have to provide embossing / engraving on the tower member, Manufacturer's name and trademark.