

**GUJARAT ENERGY TRANSMISSION
CORPORATION LTD.**

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**TECHNICAL SPECIFICATION
OF
VARIOUS EARTH WIRES
FOR
TRANSMISSION LINES
AND
SUB – STATIONS**

GETCO/E/TS – EWR019/ R5 July 2022

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TECHNICAL SPECIFICATION
FOR VARIOUS EARTH WIRES

CONTENTS

Clause No.	Title	Page No.
SECTION – I		
1.0	Scope	5
2.0	Standards	5
3.0	Climatic conditions	6
4.0	Principal Parameters	7
5.0	General Technical Requirements	8
6.0	Tests	11
7.0	Type tests	12
8.0	Inspection	16
9.0	Quality Assurance Plan	17
10.0	Documentation	18
11.0	Packing and Forwarding	18
12.0	Marking	21
13.0	Drawings	21
14.0	Deviations	21
ANNEXURES		
I	Electrical System Data	22
II	Test Procedures	23
III	Reference Drum Drawing	26
SCHEDULE		
	Guaranteed Technical Particulars	27
	SCHEDULE- A GTP For 7/3.66	28
	SCHEDULE – B GTP For 7/3.15	30

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TECHNICAL SPECIFICATION FOR EARTH WIRES

1.0 SCOPE

- 1.1 This specification provides for design, manufacture, testing, inspection, packing and dispatch, to destination of Steel Cored Earth wire, of sizes 7/3.66 & 7/3.15, specified herein for their satisfactory operation in various lines of various ratings and substations of the Gujarat State. The Earth wire shall be hot dip galvanized.
- 1.2 The Earth wire is to be used as Earth wire on single circuit and / or double circuit transmission lines of various ratings and / or substations of the purchaser for protection of steel structures, equipment, etc. or the sub-stations from lightning strokes, various types of faults, etc.

2.0 STANDARDS

- 2.1 The Earth wires shall conform to the following Indian / International Standards, which shall mean latest revisions, amendments / changes adopted and / or published as on the date of opening of the Tender. The list below gives only a few of the applicable Standards.

Sr. No.	Indian Standards	Title	International Standards
1	IS : 209 - 1966	Specification BS: 3436 for zinc	
2	IS : 2141 - 1968	Hot dipped galvanized stay strand.	
3	IS : 1521	Method of Ten-ISO / R 89 site testing of steel wire.	
4	IS : 2629	Recommended practice for Hot dip galvanizing of Iron and Steel.	
5	IS : 2633	Method of Testing uniformity of coating of Zinc coated articles.	
6	IS : 4826	Galvanized coating on round steel wire.	ASTM A – 472 729 BS : 443
7	IS : 6745	Methods of determination of weight of	BS : 443

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		zinc coating of zinc coated iron and steel articles.	
8	IS : 12776	For Earth wire, Testing Of Earth wire	
9	IS : 398 – Part-2 1996	Testing	
10	IS : 1778	Wooden Drums	

2.2 However, in an event where the supplier offers Earth wire conforming to standards other than the above, then the salient points of comparison between the standards adopted and the standards quoted herein shall be detailed in relevant schedule with an authenticated English version of such standards referred to.

3.0 CLIMATIC CONDITIONS

- i) Location : In the State of Gujarat As per Annexure-I.
 - ii) Maximum Ambient Air Temperature. ° C. : 50
 - iii) Minimum Ambient Air Temperature. ° C. : 0
 - iv) Average daily ambient Air Temperature ° C. : 35
 - v) Maximum relative humidity. - % : 95
 - vi) Average rainfall per annum.(mm) : 1150
 - vii) Maximum altitude above mean sea level – Mtrs : 1000
 - viii) Ceraunic level i.e. Average number of Thunder storm - Days/annum : 15
 - ix) Maximum wind pressure.(kg/Sq. meters) : 200
- 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) : 0.84

4.0 PRINCIPAL PARAMETERS

The details of wires are tabulated below: -

Sr. No	Description	Steel	
		Earthwire 7/3.66	Earthwire 7/3.15
1)	Number Of Strands – Nos.	7	7
2)	Diameter Of Strand – mm.		
	I) Strands		
	a) Nominal	3.66	3.15
	b) Maximum	3.74	3.23
	c) Minimum	3.58	3.07
	II) Overall Of Earth wire	10.98	9.45
3)	Cross Sectional Area Of – Sq. mm.		
	a) Earth wire	73.65	54.55
	b) Each Strand	10.516	7.793
4)	Laying Of Strands – Nos.		
	a) Center	1	1
	b) First Layer	6	6
5)	Weight (Excl. Wt. Of Grease) – Kg / Km.		
	a) Earth wire	575.00	428.00
	b) Strand (At Nominal Dia.)	83.286	61.143
6)	Maximum d.c. resistance in ohm, per km of the galvanized steel earth strand at 20°C	2.51	3.41
7)	Ultimate Tensile Strength Earth wire - KN	72.9	56
	a) Minimum tensile strength of strand (before stranding)N/ sq. mm.	1100	1100
	b) Minimum tensile strength of strand (after stranding)N/ sq. mm.	1050	1050
8)	Modulus of Elasticity – Kg / Sq. mm.	1.9×10^4	1.9×10^4
9)	Coefficient of linear expansion - per deg. C.	11.5×10^{-6}	11.5×10^{-6}

10)	Chemical Composition - % a) Carbon b) Manganese c) Phosphorous d) Sulphur e) Silicon	0.55 Max. 0.40 – 1.10 0.05 Max. 0.05 Max. 0.15 – 0.35	
11)	Zinc Purity - %	99.95	
13)	Length Of Lays a) First Layer i) Maximum ii) Minimum	307 143	265 123
14)	Elongation (Minimum) - % Before stranding After Stranding	4 3.5	4 3.5
15)	Oil treatment	Boiled Linseed Oil	Boiled Linseed Oil

5.0 GENERAL TECHNICAL REQUIREMENT

5.1 The Earth wire shall be suitable for being installed directly in air supported on suspension clamps (hardware) or anchored through tension clamps (hardware) at the power cross arms of single circuit, double circuit or multi circuit transmission line towers.

5.2 The Earth wire shall therefore be suitable for satisfactory operation under the tropical climatic conditions listed in the relevant clause. The applicable design particulars of the Earth wire to be used on these lines is furnished in Annexure - II. "System Particulars".

5.3 Physical constants for Galvanised steel wires

5.3.1 Density

5.3.1.1 At a temperature of 20°C, the density of galvanized steel wire is to be taken as 7.80 g/cm³.

5.3.2 Co-efficient of Linear Expansion

In order to obtain uniformity in calculations a value of 11.5×10^{-6} Per °C may be taken as the value for the co-efficient of Linear Expansion of

galvanized steel wires used for the cores of steel-reinforced aluminium conductors.

5.4 Materials

5.4.1 Galvanised steel wire shall be drawn from high carbon steel rods produced by either acidic or basic open Earth process, electric furnace process or basic oxygen process. All the properties of the steel strands and wires shall confirm to the relevant standards.

5.4.2 The Zinc used for galvanising shall be electrolytic high grade Zinc not less than 99.95 percent purity. It shall conform to and satisfy all the requirements of relevant ISS, BSS or other Standards to be specified with the due justification. Galvanising has to be done by hot dip galvanising process. Neutral grease may be applied between the layers of wires, however the weight of the same shall be specified and added to the total weight of the conductor.

5.4.3 The bidder should specify the source of raw materials along with the proof of last purchases made. The GETCO may reject the tender of the Bidders whose raw material suppliers are found to be supplying any poor quality or Non standard materials, to the GETCO or any other purchaser.

5.4.4 The galvanized Earth wire after stranding operation shall be dipped in boiled linseed oil before winding it on the drum.

5.5 Freedom From Defects

5.5.1 The wires shall be smooth and free from all imperfections such as spills, splits, slag inclusion, die marks, scratches, fittings, blow-holes, projections, looseness, overlapping of strands, chipping of layers etc. and all such other defects which may hamper the mechanical & electrical properties of the Earth wire and also the installation of the Earth wire at the site etc. Special care should be taken to keep away dirt, grit etc. during stranding.

5.6 Wire Sizes

5.6.1 Nominal Size and Tolerances

The galvanized steel wires for the stranded Earth wire covered by this standard shall have diameters specified in the clause above and shall be

within the tolerances indicated therein. The diameter of the steel wires shall be measured over the zinc coating.

5.7 Joints In Wires

5.7.1 Galvanised steel wires

5.7.1.1 There shall be no joints except those in the base rod or wire before final drawing, in steel wires forming the Earth wire.

5.8 Stranding

5.8.1 The wires used in the construction of Earth wire before and after stranding shall satisfy all the relevant requirements as per the standards indicated or any other standards with due justification.

5.8.2 The zinc used for galvanising shall be electrolytic high grade Zinc. It shall conform to and satisfy all the requirements of relevant standards indicated or any other standards with due justification. Galvanising shall be done by hot dip galvanising process. Neutral grease should be applied between the layers of wires.

5.8.3 The lay ratio of the different layers shall be within the limits given in Table above.

5.8.4 In all constructions, the successive layers shall have opposite directions of lay, the outermost layer being right-handed. The wires in each layer shall be evenly and closely stranded.

5.9 Standard Length

5.9.1 The standard length of the earth wire shall be 2000-meter. A tolerance of +/-5% on the standard length shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths.

5.9.2 Random lengths will be accepted provided no length is less than 95% of the standard length specified and the total quantity of such random lengths shall not be more than 5% of the total quantity ordered.

5.9.3 Bidder shall also indicate the maximum single length, above the standard length, he can manufacture in the guaranteed technical particulars. This is required for special stretches like river crossing etc. The purchaser reserves

the right to place orders for the above length to the extent of 50% of the total ordered quantity on the same terms and conditions applicable for the standard and special lengths during the tendency of the contract.

- 5.9.4 For specification of standard length mentioned in the above clause may be specified as under for Earth wire of sizes 7/3.66 and 7/3.15:

Sr. No.	Type of wire	Standard length in Meter	Tolerance.
1	Earth wires of various sizes	2000 2500*	$\pm 5\%$ $\pm 5\%$

(*) For river crossings, special locations, if any.

- 5.9.5 Drum Drawing with minimum required details is attached as Annexure – III. Any deviation from the details given shall be clearly indicated in “Technical Deviation”.

6.0 **TESTS :**

- 6.1 The type, acceptance, routine tests, tests any specifically demanded by the GETCO and tests during manufacture shall be carried out on the Earth wire free of cost.
- 6.1.1 Type tests shall mean those tests, which are to be carried out to prove the Process of manufacture and general conformity of the material to this Specification. These tests shall be carried out on samples prior to commencement of commercial production against the order. The supplier shall indicate his schedule for carrying out these tests in the activity schedule. These tests shall have to be carried out at the Government approved testing laboratory only in presence of GETCO’s representative. GETCO reserves rights to specify the name of laboratory also, if so felt.
- 6.1.2 Acceptance Tests shall mean those tests, which are to be carried out on samples taken from each lot offered for pre-dispatch inspection, for the purposes of acceptance of that lot (all the coils of the galvanized steel stranded Earth wire which are of the same grade, diameter and construction and are manufactured under similar condition in a single group and / or at a time from the same lot of raw materials, shall mean the lot). These tests shall be carried out at the manufacturers works in presence of GETCO’s representative before the dispatch of the materials to the site.

- 6.1.3 Routine tests shall mean those tests, which are to be carried out on each strand/spool/length of the Earth wire, continuously, to check requirements which are likely to vary during production. These tests shall be carried out by the manufacturer on each drum and shall have to furnish the reports to the GETCO's representative during his visit for acceptance tests.
- 6.1.4 Tests during manufacture shall mean those tests, which are to be carried out during the process of manufacture and end inspection by the supplier to ensure the desired quality of the end product to be supplied by him.
- 6.1.5 One sample from each of the lot offered for the acceptance test shall be taken and chemical analysis shall be carried out. The contents and values of the various contents shall be as specified in this specification.
- 6.1.6 Samples for individual wires for tests shall be taken before stranding from not less than ten percent of the coils of steel wires. If samples are taken after stranding, they shall be obtained by cutting 1.2 meters from the outer end or inner end of the finished conductor from not more than ten percent of the finished reels.
- 6.1.7 The standards to which these tests will be carried out are listed against them. Where a particular test is a specific requirement of this specification, the norms and procedures of the test shall be as specified in Annexure-II or as mutually agreed to between the supplier and the purchaser in the Quality Assurance Programme.
- 6.1.8 For all type and acceptance tests, the acceptance values shall be the values guaranteed by the Bidder in the "Guaranteed Technical Particulars ", of his proposal or the acceptance value specified in this specification, whichever is more stringent for that particular test.

7.0 Type Tests

The following tests from NABL accredited laboratory shall be carried out in accordance with latest / amended / up to date IS/IEC. 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 approved laboratory shall not be older than Ten years. Type test reports shall be valid as on the last date of submission of bid.

- 7.1.1 Bidder shall submit the following Type test reports as per IS 12776-2002(Gr.-1100) along with Technical Bid. ON EARTH WIRE:
- i) Ultimate Tensile Strength on Individual Wire after stranding
 - ii) Measurement of Diameter of Wire (Cl.6.1)
 - iii) Breaking Load of Strand Wire (Cl. 8.1)

- iv) Percentage Elongation Test on Individual Wire after stranding (Cl. 8.2)
- v) Galvanizing test (Cl. 8.5)
 - a) Weight of Zinc coating
 - b) Uniformity of Zinc coating
- vi) Wrapping Test after stranding (Cl. 8.4)
- vii) Chemical composition test (Cl. 4.1)
 - a) Carbon©
 - b) Maganese(Mn)
 - c) Silicon(Si)
 - d) Phosphurous(P)
 - e) Sulphur(S)
- viii) DC Electrical Resistance test (Cl. 8.3)
- ix) Torsion test after stranding (Cl. 8.6)
- x) Lay length & lay direction

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 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.

7.1.2 For the following type tests, the supplier shall offer at least three drums for selection of samples.

- a) UTS test on Stranded Wire : As per Annexure-II
- b) DC resistance test on stranded wire : --- do ---
- c) Ductility Test (After Stranding) : --- do ---
- d) Coating Test : --- do ---

7.2 Acceptance Tests

a)	Visual and dimensional check on drum	As per Relevant IS with latest Amendment and Annexure
b)	Visual check for joints, scratches etc. and lengths of Earth wire	- D O -
c)	Dimensional check	- D O -
d)	Check for lay ratio of various layers.	- D O -

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e)	Galvanising test on steel strands	- D O -
f)	Torsion and elongation test on steel strands	- D O -
g)	Breaking load test on steel strands.	- D O -
h)	Wrap test on steel strands.	- D O -
i)	DC resistance test on strands	- D O -
j)	UTS test on welded joint of steel rod.	- D O -
k)	Chemical Analysis	- D O -

Note : All the above test shall be carried out on steel strands after stranding only.

7.3 **Routine tests**

- a) Checks ensure that the joints are as per specifications.
- b) Check that there are no cuts, fins etc. on the strands.
- c) Check that drums are as per specification.
- d) All acceptance tests as mentioned in Clause 7.3 above shall be carried out on each coil.

7.4 **Test During Manufacture**

a)	Chemical analysis of Zinc used for galvanising	As per Relevant IS with latest Amendment and Annexure
b)	Chemical analysis of steel used for making steel strands.	- D O -

7.5 **Testing Charges**

7.5.1 The testing charges for the type tests specified and as per relevant IS shall be borne by the bidder. All the suppliers irrespective of quantity allotted to them, and time when they have earlier carried out the Type Test, will have to carry out the Type Tests at their own cost at the Govt. approved NABL laboratory and GETCO will not have any bearing on this account.

7.5.2 In case of failure in any of the type test/s, the supplier is either required to modify the design of the material or repeat the particular type test three times successfully at his own expenses. The decision of the owner in this regard shall be final and binding. The GETCO at its own desecration may also cancel the order at the risk and cost of the contractor.

7.5.3 Bidder shall indicate the laboratories in which they proposed to conduct the

Type tests. They shall ensure that the tests can be completed in these laboratories within the time schedule guaranteed by them in the appropriate schedule. GETCO reserves the right to specify the name of the laboratory also, if so felt.

- 7.5.4 The entire cost of testing for the acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted unit price of conductor.

7.6 Additional Tests

The GETCO reserves the right of getting done any other test(s) of reasonable nature carried out at Supplier'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.

7.7 Sample Batch For Type Testing

- 7.7.1 The Supplier shall offer at least three (3) drums for selection of samples required for conducting all the type tests as mentioned in Clause
- 7.7.2 The Supplier is required to carry out all the acceptance tests successfully in the presence of Purchaser's representative before dispatch of the selected sample to the testing laboratory for type test.

7.8 Test Reports

- 7.8.1 Type test reports shall be furnished in at least two (2) copies along with one original. One copy shall be returned duly certified by the Purchaser only, after which the material already inspected i.e. the materials manufactured for selection of sample for type test, shall be dispatched on receipt of Dispatch Instructions from the Chief Engineer (Project).
- 7.8.2 Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the purchasers representative.
- 7.8.3 Test Certificates of test during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Purchaser.

7.9 Test Facilities

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

- a) Calibration Reports from Government approved testing laboratory of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burette, thermometer, barometer etc.
- b) Standard resistance for calibration of resistance bridges.
- c) Finished Earth wire shall be checked for length verification and surface finish on separate rewinding machine at reduced speed (variable from 8 to 16 meters per minute). The rewinding facilities shall have appropriate clutch system and free of vibrations, jerks etc. with transverse layering facilities.
- d) The bidder should have all the routine and acceptance testing facilities, in house.

8.0 INSPECTION

- 8.1 The Purchaser's representative shall at all times be entitled to have access to the works and all places of manufacture where Earth wire shall be manufactured and the representative shall have full facilities for unrestricted inspection of the Suppliers works raw materials and process of manufacture and conducting necessary tests as may be deemed fit, for certifying the quality of product.
- 8.2 The Supplier shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of Earth wire in its various stages so that arrangements can be made for inspection.
- 8.3 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected, tested, and necessary dispatch instructions are issued in writing, except for the cases where waiver of inspection is granted by competent authority of the GETCO, and even in this case also written dispatch instructions will be issued. Any dispatches before the issue of Dispatch Instructions in writing will be liable for rejection and non-acceptance by the consignee.

8.4 The acceptance of any quantity of material shall in no way relieve the Supplier of any of his responsibilities for meeting all requirements of the specification, and shall not prevent subsequent rejection if such material is later found to be defective.

8.5 At least 5% of the total number of drums subject to minimum of two in any lot put up for inspection, shall be selected at random to ascertain the length of wire by following method:

"At the works of the manufacturer of the Earth wire, the Earth wire shall be transferred from one drum to another at the same time measuring its length with the help of a graduated pulley & Cyclometer. The difference in the average length thus obtained and as declared by the Supplier in the packing list shall be applied to all the drums if the Earth wire is found short during checking."

8.6 The sample cut of from any numbers of drums for carrying out any type of tests will be to the suppliers account.

9.0 QUALITY ASSURANCE PLAN

9.1 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 names of sub suppliers for the raw materials, list of standards according to which the raw aterials 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 list 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 of wire specified. In the case if the suppliers does not possess all the Routine and Acceptance testing facilities the tender will be rejected.
 - vii) The GETCO 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 out rightly rejected and he may be black listed.
 - viii) Special features provided to make it maintenance free.
- 9.2 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.
- 9.3 The Supplier shall submit the routine test certificates of all the bought out items, accessories etc.

10.0 DOCUMENTATION

- 10.1 Two sets of type test reports, duly approved by the Purchaser shall be submitted by the Supplier, before commencement of supply. A copy of acceptance and routine test certificates, duly approved by the purchaser shall accompany the dispatch consignment.
- 10.2 The manufacturing of the earth wire only shall be strictly in accordance with the GTP/approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication works in connection with the conductor prior to the approval of the drawing shall be at supplier's risk.
- 10.3 Approval of drawing etc. by the purchaser shall not relieve the Supplier of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes

of practices. The earth wire shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and purchaser shall have the power to reject any work or material which in his judgment is not in full accordance therewith.

- 10.4 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.
- 10.5 The bidder shall submit Quality Assurance Plan for manufacturing process and Field Quality Plan with the technical bid.
- 10.6 All the points other than GTP, which are asked to confirm in technical specifications must be submitted separately with the bid.

11.0 PACKING & FORWARDING

- 11.1 The Earth wire shall be supplied in non-returnable strong wooden drums provided with lagging of adequate strength, and displacement during transit, storage and subsequent handling and stringing operations in the field. The drums shall generally conform to IS: 1778-1980 except otherwise specified hereinafter.
- 11.2 The drums shall be suitable for wheel mounting and for jetting off the Earth wire under a minimum controlled tension of the order of 5 kN.
- 11.3 The bidder should submit the proposed drum drawings along with the bid. However, the same shall be in line with the requirements as stated herein. After placement of the Letter of Award, the Supplier shall submit four copies of fully dimensioned drawing of the drum, for Purchaser's approval before taking up manufacturing of earth wire and or drums. After getting approval from the Purchaser, Supplier shall submit 6 more copies of the approved drawing to Purchaser for further distribution and field use at Purchaser's end.
- 11.4 All wooden components shall be manufactured out of seasoned soft wood free from defects that may materially weaken the component parts of the drums. Preservative treatment for anti-termite/anti-fungus (Aldrime / Aldruse) etc. shall be applied to the entire drum with preservatives of a quality which is not harmful to the Earth wire or to the persons using or storing the same.

- 11.5 The flanges shall be of three-ply construction with each ply at right angles to the other and nailed together. The nails shall be driven from the inside face flange, punched and then clenched on the outer face. The tolerance in thickness of each ply shall be +3 mm only. There shall be at least 3 nails per plank of ply with maximum nail spacing of 75 mm. Where a slot is cut in the flange to receive the inner end of the earth wire, the entrance shall be in the line with the periphery of the barrel.
- 11.6 The wooden battens used for making the barrel of the Earth wire shall be of Segmental type. These shall be nailed to the barrel supports with at least Two Nails. The battens shall be closely butted and shall provide a round Barrel with smooth external surface. The edges of the battens shall be rounded Or chamfered to avoid damage to the Earth wire.
- 11.7 Barrel studs shall be used for construction of drums. The flanges shall be holed and the barrel supports slotted to receive them. The barrel studs shall be threaded over a length on either end, sufficient to accommodate washers, spindle plates and nuts for fixing flanges at the required spacing. Barrel studs should be tack welded with the nuts after tightening.
- 11.8 Normally, the nuts on the studs shall stand proud of the flanges. All the nails used on the inner surface of the flanges and the drum barrel shall be countersunk. The ends of barrel shall generally be flushed with the top of the nuts.
- 11.9 The complete drum including inner cheek of the flanges and drum barrel surface shall be painted with bitumen based paint.
- 11.10 Before reeling, card board or double corrugated or thick bituminized waterproof bamboo paper shall be secured to the drum barrel and inside of flanges of the drum by means of a suitable commercial adhesive material. The paper should be dried before use. After reeling the Earth wire, the exposed surface of the outer layer of Earth wire shall be wrapped with thin polythene sheet across the flanges to preserve the Earth wire from dirt, grit and damage during transportation and handling and also to prevent ingress of rain water during storage / transport.
- 11.11 A minimum space of 125 mm shall be provided between the inner surface of the external protective layer and outer layer of the 7/3.66 Earth wire, however 75 mm shall be acceptable for all other Earth wires.

- 11.12 Each batten shall be securely nailed across grains as far as possible to the Flange edges with at least 2 nails per end. The length of the nails shall not be less than twice the thickness of the battens. The nail shall not protrude above the general surface and shall not have exposed sharp edges or allow the battens to be released due to corrosion.
- 11.13 Outside the protective layer, there shall be minimum of two binder consisting of hoop iron/galvanized steel wire. Each protective layer shall have two recess to accommodate the binders.
- 11.14 The Earth wire ends shall be properly sealed and secured with the help of U-nails on one side of the flanges. The end securing shall be done by taking out at least 500 mm. of steel core on either ends and sealing it with U-nails.
- 11.15 Wire at three locations at the most 75 mm apart or less covered with PVC adhesive tape so as to avoid loosening of layers in transit and handling.
- 11.16 Only one length of Earth wire shall be wound on each drum.

	Earth/Stay wire	Length	Drum Size	Flange Dia (A)	Barrel Dia (B)	Travers (W)	Noof Rod	Thickness (T)
1	7/3.66	2000 \pm 5% 2500 \pm 5%	Drawing to be submitted as per requirement					37+37+37=111 50+50+50=150
2	7/3.15	2000 \pm 5% 2500 \pm 5%	Drawing to be submitted as per requirement					37+37 + 37 = 111 37+37 + 37 = 111

- 11.17 If any bidder wishes to supply the Earth wire in the steel drums the same will be acceptable, however free of cost.

12.0 Marking

Each drum shall have the following information stenciled on it in indelible ink along with other essential data:

- Contract/Award letter / order number
- Name and address of consignee
- Manufacturer's name and address
- Drum Number
- Size of Earth wire

- f) Length of Earth wire in meters
- g) Gross weight of drum with Earth wire
- h) Weight of empty drum with lagging
- i) Arrow marking for unwinding.

13.0 DRAWINGS

- 13.1 All the bidders have to submit the drawings for the drums to be utilized for packing of the Earth wire, for the lengths specified in this Tender Specification.
- 13.2 All the bidders have to submit the Sectional view drawings for the Earth wire.

14.0 DEVIATIONS

- 14.1 Any deviation to this tender Specification will be out rightly rejected. All the Bidders have to submit this specification duly authenticated without any alterations, additions etc. on each page along with the Technical Bid. Any offer without this will be out rightly rejected.

15.0 GENERAL PARTICULARS:

- a) The bidder is required to impart training in view of manufacture, assembly, erection, operation and maintenance for offered item, at his works, to the person/s identified by GETCO, in the event of an order, free of cost. The cost of logistics will be bear by GETCO.
- b) Please note that the evaluation will be carried out on the strength of content of bid only. No further correspondence will be made.
- c) The bidder shall bring out all the technical deviation/s only at the specified annexure.
- d) The bidder should indicate manufacturing capacity by submitting latest updated certificate of a Chartered Engineer (CE).

ANNEXURE-I

SYSTEM PARTICULARS

A) Electrical System Data :

		7/3.66	7/3.15
a)	System Voltage (KV rms)	400	220/132/66
b)	Max. Voltage KV rms)	420	245/145/72.5
c)	Lightning impulse withstand voltage (dry & wet) (KVP)	1425	1050/650/ 350
d)	Power Frequency withstand voltage (wet) (KV rms)	650	460/275/140
e)	Short circuit level (KA)	40	40/40/25
f)	Switching Surge withstand voltage (wet) KVP	1050	-
g)	Frequency – Hz		
	I) Normal	50	50
	II) Maximum	51	51
	III) Minimum	47	47
h)	Number Of Circuits	Single / Double	
i)	Normal Span – m	400	350/300/260
j)	Wind Span – m	440	385/330/285
k)	Weight Span – m		
	I) Maximum	600	525/450/390
	II) Minimum	-200	-100/-100/-50
l)	Factor Of Safety (At Every Day Temp. & No Wind)	4	4

ANNEXURE - II

TEST PROCEDURES (EARTH WIRE)

1.0 UTS TEST ON STRANDED EARTHWIRE

Circles perpendicular to the axis of the Earth wire shall be marked at two places on a sample of Earth wire of minimum 5 m length suitably compressed with dead end clamps at either end. The load shall be increased at a steady rate up to 50% of the UTS and held for one minute, the circles drawn shall not be distorted due to Relative movement of strands. Thereafter the load shall be increased at a steady rate to 100% of the UTS and held for one minute. The applied load shall then be increased until the failing load is reached and the value recorded.

2.0 RESISTANCE TEST ON STRANDED EARTHWIRE

On Earth wire sample of minimum 5m length two contact clamps shall be fixed with a pre-determined bolt torque. The resistance shall be measured by a kelvin double bridge by placing the clamps initially at zero meter and subsequently one meter apart. The test shall be repeated at least five times and the average value shall be recorded. The value obtained shall be corrected to the value at 20 deg. C as per Clause No. 8.3.2 of IS : 12776 / 1989, read with the latest amendment. The resistance corrected at 20 deg. C shall conform to the requirements of this specification.

3.0 CHEMICAL ANALYSIS OF ZINC

Samples taken from the zinc ingots shall be chemically / spectrographically analysed. The same shall be in conformity to the requirements stated in this specification.

4.0 CHEMICAL ANALYSIS OF STEEL

Samples taken from the steel ingots/coils/strands shall be chemically / spectrographically analysed. The same shall be in conformity to the requirements stated in this specification.

5.0 VISUAL AND DIMENSIONAL CHECK ON DRUMS

The drums shall visually and dimensionally checked to ensure that they conform to the requirements of this specification.

6.0 VISUAL CHECK FOR JOINTS, SCRATCHES ETC.

Earth wire drums shall be rewound in the presence of the inspecting officer. The inspector shall visually check the scratches, joints, etc. and that the Earth/Stay wire generally conform to the requirements of the specification.

7.0 DIMENSIONAL CHECK OF STEEL STRANDS

The individual strands shall be dimensionally checked to ensure that they conform to the requirements to this specification.

8.0 CHECK FOR LAY-RATIOS OF OUTER LAYER

The lay-ratios of outer layer shall be checked to ensure that they conform to the requirements of this specification.

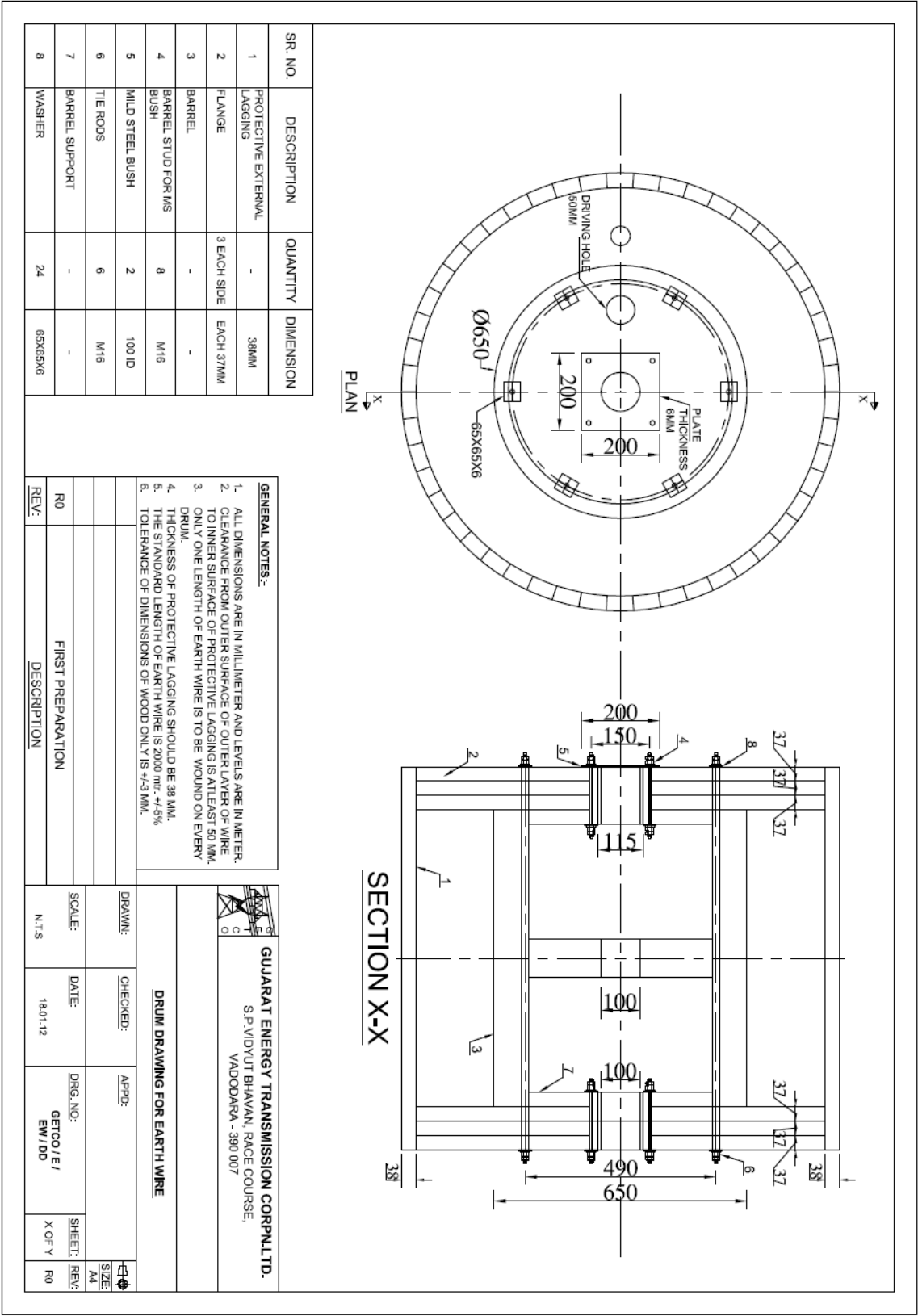
9.0 GALVANISING TEST

The test Procedure shall be as specified in relevant IS. The material shall conform to the requirements of this specification.

10.0 TORSION AND ELONGATION TESTS ON STEEL STRANDS

The test procedures shall be as per the relevant IS. In torsion test, the number of complete twists before fracture shall not be less than 18 on a length equal to 100 times the standard diameter of the strand. In case test sample length is less or more than 100 times the standard diameter of the strand, the minimum number of twist will be proportionate to the length and if number comes in the fraction then it will be rounded off to next higher whole number. In elongation test, the elongation of the strand shall not be less than 4% for a gauge length of 200 mm.

ANNEXURE - III
REFERENCE DRUM DRAWING



SIGNATURE AND
SEAL OF THE BIDDER



GUJARAT ENERGY TRANSMISSION
CORPORATION LTD.

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

GUARANTEED TECHNICAL PARTICULARS

FOR

EARTHWIRE

SCHEDULE - A
GURANTEED TECHNICAL PARTICULARS OF 7/3.66
EarthWire

The Guaranteed Technical particulars furnished below shall be duly attested by the Bidder. Any correction / alterations in this GTP will lead to out right rejection of the Bid.

Sr. No	Description	Steel
1)	Number Of Strands – Nos.	7
2)	Diameter Of Strand – mm. I) Strands a) Nominal b) Maximum c) Minimum II) Overall Of Earthwire	 3.66 3.74 3.58 10.98
3)	Cross Sectional Area Of – Sq. mm. a) Total b) Each Strand	 73.65 10.516
4)	Laying Of Strands – Nos. c) Center b) First Layer	 1 6
5)	Weight (Excl. Wt. Of Grease) – Kg / Km. a) Whole Earthwire b) Stand (At Nominal Dia.)	 575 83.286
6)	Ultimate Tensile Strength Earth wire - KN a) Minimum tensile strength of strand (before stranding)N/ sq. mm. b) Minimum tensile strength of strand (after stranding)N/ sq. mm.	 72.9 1100 1050
7)	Modulus of Elasticity – Kg / Sq. Cm.	1.933 X 10 ⁴
8)	Coefficient of linear expansion - per deg. C.	11.5x10 ⁻⁶
9)	Chemical Composition - % f) Carbon g) Manganese h) Phosphorous i) Sulphur	 0.55 Max. 0.40 – 1.10 Max. 0.05 Max. 0.05

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	j) Silicon	0.15 – 0.35
10)	Zinc a) Purity - % i) Zinc Min. ii) Lead Max. iii) Cadmium Max. iv) Iron Max. v) Total Impurities b) Quality	99.95 0.025 0.02 0.01 0.05Max 99.95% pure
11)	Length Of Lays a) First Layer i) Maximum ii) Minimum	307 143
12)	Joint	Not Allowed
13)	Standard Length – Mtrs.	2000
14)	Oil Treatment	Boiled Linseed Oil
15)	Weight Of Zinc Coating – Gm / Sq. Mtr. a) Before Stranding b) After Stranding	275 262
16)	Galvanizing Process	Hot Dip
17)	Elongation (Minimum After Stranding) - %	4
18)	Maximum d.c. resistance in ohm, per km of the galvanized steel earth strand at 20°C	2.50
19)	Drawings Of Drum (With All Details)	3 Ply as per GETCO spec.
20)	Details of Manufacturers of Steel Wire Rods	To be submitted by Bidder
21)	Standard Drum Length – Mtr. a) Normal b) Special River Crossing Etc	2000 2500

Signature of the Bidder : _____

Name : _____

Designation : _____

Date : _____

Authorized common rubber
Stamp / seal of the bidder : _____**SIGNATURE AND
SEAL OF THE BIDDER**

SCHEDULE - B
GURANTEED TECHNICAL PARTICULARS OF 7/3.15
Earthwire

The Guaranteed Technical particulars furnished below shall be duly attested by the Bidder. Any correction / alterations in this GTP will lead to out right rejection of the Bid.

Sr.No	Description	Steel
1)	Number Of Strands – Nos.	7
2)	Diameter Of Strand – mm. I) Strands a) Nominal b) Maximum c) Minimum II) Overall Of Earth wire	 3.15 3.23 3.07 9.45
3)	Cross Sectional Area Of – Sq. mm. a) Total b) Each Strand	 54.551 7.793
4)	Laying Of Strands – Nos. a) Center b) First Layer	 1 6
5)	Weight (Excl. Wt. Of Grease) – Kg / Km. a) Whole Earth wire b) Stand (At Nominal Dia.)	 428 61.143
6)	Ultimate Tensile Strength Earth wire - KN a) Minimum tensile strength of strand (before stranding)N/mm.sq. b) Minimum tensile strength of strand (after stranding)N/mm.sq.	 56 1100 1050
7)	Modulus of Elasticity – Kg / Sq. mm.	1.933 X 10 ⁴
8)	Coefficient of linear expansion - per deg. C.	11.5×10 ⁻⁶
9)	Chemical Composition - % a) Carbon b) Manganese c) Phosphorous d) Sulphur e) Silicon	 0.55 Max. 0.40 – 1.10 Max. 0.05 Max. 0.05 0.15 – 0.35

**SIGNATURE AND
SEAL OF THE BIDDER**

10)	Zinc a) Purity - % i) Zinc Min. ii) Lead Max. iii) Cadmium Max. iv) Iron Max. v) Total Impurities b) Quality	99.95 0.025 0.02 0.01 0.05Max 99.95% pure
11)	Length Of Lays a) First Layer i) Maximum ii) Minimum	265 123
12)	Joint	Not Allowed
13)	Standard Length – Mtrs.	2000
14)	Oil Treatment	Boiled Linseed Oil
15)	Weight Of Zinc Coating – Gm / Sq. Mtr. a) Before Stranding b) After Stranding	240 228
16)	Galvanising Process	Hot Dip
17)	Elongation (Minimum After Stranding) - %	4
18)	Maximum d.c. resistance in ohm, per km of the galvanized steel earth strand at 20°C	3.41
19)	Drawings Of Drum (With All Details)	3 ply as per GETCO spec.
20)	Details of Manufacturers of Steel Wire Rods	To be submitted by Bidder
21))	Standard Drum Length – Mtr. a) Normal b) Special River Crossing Etc	2000 2500

Signature of the Bidder : _____

Name : _____

Designation : _____

Date : _____

Authorised common rubber

Stamp / seal of the bidder : _____