

SPECIFICATION

CONDITION FOR TOWER WORKS

GENERAL :

The quoted rates for various items in the tender shall be inclusive of all the additional conditions and particular specifications and for adherence to all these conditions and specifications, no extra payment shall be made to the contractor. Any infringement and/or breach of these specification and condition(s) etc. shall render the contractor liable to action(s) under various clauses of the contract and such action stipulated in conditions therein.

ANNEXURE-A

ADDITIONAL CONDITIONS FOR TOWER WORKS

The following conditions shall be applicable for tower supply and erection in addition to other conditions given in tender form. Nothing extra shall be paid on these accounts unless otherwise mentioned.

- 1.0 The work of erection of tower also includes fabrication, supply and erection / assembly of box type cable feeder rack, platforms, wave guide rack, wave guide rack support (Optional) and painting of all steel members and fixtures. It also includes handing over of tower to the concerned DOT Administrator (User) after acceptance testing.
- 2.0 The contractor shall procure all structural steel members i.e. Angles, tees, Plates, nuts & bolts etc. conforming to relevant I.S. Codes from main producers as approved by the Ministry of Steel namely SAIL, TISCO, ISCO and RINL. All MS angles, Tees and Plates shall be of grade 'A' as per IS: 2062-1999 and IS: 8500-1991. Structural steel section not available from main producers can be procured from secondary producers approved by Power Grid Corporation subject to production of proof of manufacture of structural steel members from virgin billets produced from main steel producers before starting fabrication work. Samples shall also be taken and got tested by the Engineer-in-charge as per the provisions in this regard in the relevant I.S. Codes. In case the test results indicate that the steel arranged by the contractor does not conform to I.S. Codes, the same shall stand rejected and shall be removed from the site of work within three days from date of receipt of written order of the Engineer-in-charge to do so. The proof of manufacturer of structural steel members from virgin billets purchased from main steel producers is to be furnished by him before tower member / templates are cut.
- 2.1 Nuts and bolts of grade 5.6 as per IS:6639-1972, IS:12427-2001, IS:1363 (Part I)-1992 IS:1364-2002, IS: 1367-2002 (Part 8) and plain washers as per IS: 6610-1972 & spring washers of type 'B' as per IS: 3063-1994 shall be used.
- 2.2 Manufacturer's identity marking and item marking shall be provided on each section by punching and painting for enabling easy assembling and traceability. A plate indicating the name of the tower, specification's no., tower serial no., manufacturer's identity, year of manufacture and the maximum load capacity of the tower shall be supplied by the manufacturer for display at the bottom of the tower.
- 2.3 The steel structural members shall be stored by the contractor at site of work in such a way so as to prevent distortion and corrosion and nothing extra shall be paid on this account. Members of different sections and sizes shall be stored separately to facilitate easy checking.
- 2.4 For testing of steel members in accordance with IS 2062, specimen of sufficient length shall be cut from sectional member of steel as per requirement of relevant IS Codes and the contractor shall supply the steel members required for testing, free of charge.
- 2.5 The cost of tests shall be borne by the contractor/BSNL in the manner indicated below :-

- (i) By the contractor, if the results show that the steel does not conform to the relevant I.S. Codes.
 - (ii) By B.S.N.L., if the results show that the steel conforms to the relevant I.S. Codes.
- 3.0** All structural steel members including nuts, bolts, gusset plates etc. shall be hot dip galvanized (Minimum 90 microns thick) as per IS : 4759-1996 (Reaffirmed 2001) and IS:1367-2002. The standard zinc used for galvanizing shall conform to IS : 13229-1991 or IS:209-1992.
- 4.0** The communication towers should conform to the latest revisions of all the relevant standards of BIS including :-
- (a) IS 2062 - 1999 - Specifications for structural grade steel.
 - (b) IS 4759 – 1996 & IS 1367-2002 - Specifications for hot dip galvanization.
 - (c) IS 800 - 1984 - Code of practice for general construction in steel.
 - (d) IS 802 - Code of practice for use of structural steel in overhead transmission lines.
 - (e) IS 6639, IS : 1363, IS 12427, IS 1364 & IS : 1367 Part 8 - For nuts and bolts.
 - (f) IS 13229 - 1991 - Standard for Zinc for galvanizing.
 - (g) IS 6610 - 1972 - For plain washers and spring washers respectively.
 - IS 3063 - 1994
 - (h) IS 12843 - 1989 - For tolerance in Erection of steel structures.
 - (i) IS 7205 - 1974 - Safety code for Erection of structural steel work.
 - (j) IS 875 -1987 (Part-III) - Code of practice for design loads (Wind load)
- 5.0** The contractor shall arrange at his own expense all tools, plants and equipments for execution of the works. No tents, tools, pumps for dewatering or any type of machinery / equipment will be supplied by the department for carrying out any portion of work. The contract shall be in position to deploy all required machinery / tools / equipments within the time schedule specified in the individual work orders. No accommodation shall be provided by the department either for storage of materials or for his staff. He shall make his own arrangement.
- 6.0** The intending bidders should inspect the site of work fully before tendering and acquaint / satisfy themselves as to the conditions in regard to accessibility of site, nature and extent of ground, working conditions including stacking of materials, installation of T&P, conditions effecting accommodation and movement of labour etc. required for the satisfactory execution of work. The tentative list of sites in annexure –P. These sites are tentative and can be changed at any time. No claim of whatsoever will be entertained .
- 7.0** Erection of the tower and painting shall be done through specialized agencies only and all safety precautions shall be taken in accordance with safety code for erection of structural steel work (IS : 7205)
- 8.0** Agency executing the supply and erection of towers should take all precautions to see that no damage occurs to the adjoining structures while executing the work. Also, all the workers on the execution site should be adequately insured along with third party insurance for any unforeseen injury to passerby or occupants of adjoining buildings. Agency shall be solely responsible for any mishap on these accounts.
- 9.0** Foundation bolts shall be embedded and cast monolithic with concrete as per approved drawings and in consultation with the civil contractor, doing the foundation work. Which means that supplier will have to depute his representative to site at the time of concreting of stems to verify correctness of fixing of anchor bolts.
- 9.1** Templates & anchor bolts are to be supplied by manufacturer to individual site within 07 (seven) days from the date of receipt of intimation. Nothing extra shall be paid in this account.

Manufacturer shall also initiate action for fabrication of tower after receipt of intimation to supply anchor bolts so that erection work commences after completion of tower foundation.

- 10.0** Wherever no mention has been made in the specifications, the work shall be carried out as per relevant BIS standards or as per the directions of the Engineer-in-charge given in writing based on sound engineering practice and local usage & that shall be final and binding on the contractor.
- 11.0** The agency has to confirm after erection of tower that the tilt, twist and rotation of the tower are within specified limits. The agency also has to check the verticality of the tower after erection. The verticality of tower shall be within the limit of (+ / -) 25mm as given in IS:12843 : 1989, Table iii(b) (i.e. the bottom of the line joining to the centre of the top of the tower and the centre of the base of the tower shall be within this limit. This may be checked in the field after the erection of tower at site.
- 12.0** The site of work may be changed by the Engineer-in-charge due to exigencies of the service within / adjoining revenue districts for which nothing extra shall be payable except the approved contract rates. Tower fabrication is to be done strictly as per written orders of Engineer-in-Charge. Supply and tower erection will be as per time schedule given by Engineer-in-Charge and strictly adhered by the intending tenderers.
- 12.1** Supply, erection and finishing shall be started as soon as the requisition is received from Engineer-in-Charge and should be completed within 60 days on receipt of the **work order / requisition or first day of handing over the site, whichever is later**. This time period for each site shall be reckoned from the 10th day of issuance of work order / requisition or handing over the site, whichever is later.
- 12.2** Connection between verticals legs and bracings shall be done to each other at site by Gusset / splices plates with nuts, bolts and washers as per design.
- 12.3** Rack for running feeder cables from the rear of Antenna to the base of the Tower shall be provided. Suitable support to be provided for all the feeder cable runner at 600 mm each, width of each rack shall be 300 mm.
- 12.4** A ladder shall be provided externally right through from the ground level up to 40M. Hoops and runners shall be provided to ensure the safety of the person climbing on the Tower. Antenna mounting pipe conforming to IS:1161-1998 of 2500 mm long, 1141.30 mm outer dia. And 3.65 mm wall thickness shall be used.
- 12.5** The ground based tower shall take 9 CDMA / GSM service delivery antenna, 3 sets of microwave back haul antenna of 1.2M dia. to cater for 3 USPs and additional antenna to be provided for proposed broad band service in future.
- 12.6** The mounting structure for antenna shall be of steel work and shall be such as to allow a nominal azimuth adjustment of (+ / -) 5 degree and an elevation adjustment of (+ / -) 5 degree .The design of antenna supporting cage and platform shall be in accordance with the specification given in Annexure –III.

13.0 STRAIGHTENING

All materials shall be straightened and or flattened by pressure unless required for a shape of curvilinear form before fabrication and shall be free from twists. Straightening shall not damage the material. The parts when assembled adjacent surfaces shall be in close contact. Hammering shall not be permitted for straightening. Sharp kinks or bends shall be rejected.

14.0 CUTTING

Cutting may be affected by shearing, flame cutting or sawing. The surface so cut shall be clean, smooth, square and free from any distortion.

15.0 BENDING AND WELDING

- (i) Mild steel angle sections up to 75x75mm (up to 6mm thick) may be bent cold up to and including bend angle of 10 degree, angles above 75x75mm (thickness up to 6mm) and up to and including 100x100mm (thickness up to 8mm) may also be bent cold up to the bend angle of 5 degree. All other angle sections not covered above shall be bent hot.
- (ii) Butt-welding, if used, in members shall be carried out either by submerged arc or shielded arc welding.
- (iii) Welding shall be free from cracks, discontinuity in welding, under-size, over-size or under cutting. It should be cleaned off slag and other deposit.
- (iv) Welds shall be adequately tested using radiography or other well-known methods of non-destructive testing. Welding shall be carried out as per IS: 9595-1996. Welding connection of base plate are as per IS 800 : 1984.

16.0 HOLES

- (i) Holes for bolts shall be drilled using jigs provided with hardened steel bushes and shall not be punched or formed by flame cuttings process. All drill burns shall be completely removed. Drilling of holes shall be done before galvanizing.
- (ii) Holes on both sides of the bend line in a bent member shall be drilled after bending. The relative position of these holes shall be checked using proper templates.
- (iii) Holes shall be circular and of a diameter 1.5 mm more than the dia. of the bolt.
- (iv) Holes shall be drilled at right angles to the surface of the plates or angles, unless otherwise specified.
- (v) The accuracy of location of hole shall be such that for any group when assembled they shall admit the bolt at right angles to the plane of the connection.
- (vi) Spacing of bolts and edge distances shall be in accordance with IS 800-1984.
- (vii) Butting ends of main leg members shall be cut with saw. Flame cutting or shearing shall not be permitted.

17.0 MARKING

Identification marks allotted to each member shall be distinctly stamped with marking dyes of 16mm size before galvanizing.

18.0 TOLERANCES

Fabrication tolerance shall not exceed those specified in IS 7215-1974 as applicable to group "B" structure.

19.0 GALVANIZING

- 19.1 Hot dip galvanizing protects steel from corrosion by providing a thick, tough metallic zinc coating, which completely covers the steel surface and seals it from the corrosive action of its environment. The galvanized coating provides outstanding abrasion resistance. Where there is damage or minor discontinuity in the coating of zinc, protection of the steel is maintained by the cathodic action of the surrounding galvanized coating. Metallic zinc is strongly resistant to the corrosive action of normal

environments and hot dip galvanized coatings therefore provide long-term protection for steel.

19.2 Zinc for galvanizing should conform to IS 13229-1991.

19.3 All members and fasteners of Tower structures are to be hot dip galvanized. Galvanizing of members of the tower shall conform to IS 4759 and 2629. Bolts and other fasteners shall be galvanized in accordance with IS 1367 (part 13). The total mass of galvanizing coating shall not be less than 610gm/sqm (i.e.85 micron) thickness.

20.0 PAINTING

Painting of galvanized steel towers is required to give additional protection and to give 'Day warning' as per additional protection and civil aviation specifications. Painting shall be done by specialized agencies only and all safety precautions shall be taken in accordance with the safety code for erection of steel tower.

20.1 COASTAL AREA

All steel galvanized sections like L angles, flats, tubular sections, bolts and nuts etc. shall be given a coat of ETCH primer. Zinc Chromate primer shall be applied over ETCH primer. Synthetic enamel paint of two or more coat thickness shall be applied over the above.

20.2 NON COASTAL AREA:

In the non-coastal area Zinc Chromate may be applied instead of zinc phosphate painting shall be done in accordance with IS 1477 Part I & II. Priming coat of zinc Chromate/phosphate shall conform to IS 104.

20.3 CLEANING

Dust, grease and rust on galvanized tower members namely angles, tees, plates railing, ladders, racks etc. shall be removed by wire brushing and cleaned with a piece of cloth.

20.4 APPLICATION OF ETCH PRIMER

After cleaning the tower members a first coat of an etch primer has to be applied to the tower structure members. The etch primer consists of polyvinyl butyl phosphoric acid catalyst and zinc chromate base and are supplied separately. They should be mixed before use in specified ratio of four parts base to one part catalyst or as specified by the manufacturer. The primer is to be applied uniformly to get a very thin and almost invisible coat and every part of the tower structure should be treated with this primer. Subsequent painting of the zinc chromate primer should be commenced within two hours of application of the primer. The etch primer once mixed should be used up immediately.

20.5 APPLICATION OF PAINT

After 48 hours of application of primer, the first coat of the paint should be applied carefully, well brushed into the surface, corners, crevices etc. should be uniform and even. The second coat of paint should be applied 48 hours after the application of the first coat. Care should be taken to see that the painting is not carried out at the hottest time of the day and air pockets should be avoided.

20.6 SPECIAL REMARKS

- (i) The painting shall be done carefully so that all corners and crevices of the mast receive the paint and no base surface is left exposed anywhere. Special care is to be taken in applying paint at the place where galvanized coating has got removed.
- (ii) No driers such as Litharge or Turpentine are to be used. The practice of mixing kerosene oil with paint is strictly forbidden.
- (iii) The primer and the paints used should be got approved prior to their use.
- (iv) The painting shall conform to civil aviation guideline.

20.7 PAINTS

Paints shall be synthetic enamel of the best quality and anticorrosive and withstand exposures to outside conditions. They should be of standard quality equivalent to synthetic enamel paint of Shalimar or Berger paints or Asian paints.

20.8 ORANGE AND WHITE BANDS (DAY MARKINGS)

To conform to Civil Aviation regulations the towers shall be painted in alternate bands of international orange and international white, terminating with orange at top and the bottom, Height of each band should be not exceed 6 metres and should not be less than 0.5 mt. The correct shade for the international orange corresponds to ISI shade 592 as given in the Indian Standard Institution Publication-colours for ready mixed paint, IS: 1755, IS: 2732-1964.

21.0 RECTIFICATION / REPAIRS TO DAMAGED PARTS

- 21.1 Damaged components of the steel work should be rectified as per directions of the Engineer-in-charge minor damages to the galvanizing shall be made good by cleaning the damaged portion free of all rust and applying a zinc rich paste to the same thickness as the original coat of galvanizing.
- 21.2 Members of components, which are dented, bent or twisted in transit or by handling during erection shall not be used on work but shall be replaced as directed by the Engineer-in-Charge.

22.0 ERECTION

- (i) It shall be ensured that structural components with correct markings as indicated in drawings are used in correct position.
- (ii) At the base connections the foundation bolts shall be located correctly using templates and grouted ensuring that all templates are in one horizontal plane. After erection of the first panel, its verticality shall be checked and corrected if necessary.
- (iii) Further erection work shall proceed panel by panel, bolts and nuts shall be finally tightened up to the torque specified using torque wrenches. Verticality of the tower shall be checked after complete erection of each panel. Each panel shall be completed in all

respects and shall have the approval of the Engineer-in-charge before proceeding to the next panel.

(iv) If a panel is to be left incomplete, it shall be ensured if necessary by erection of temporary bracings that all the members erected form a stable configuration, sufficient to withstand dead and wind loads.

(v) The joint shall be made by drawing the light members into position with barrel drifts. Drifts may be used on the heavier members only to secure them in correct position. No member shall be force fitted. Any error in steel work, which prevents the assembly and fitting up to the parts by the proper use of drifts, shall be investigated immediately. If any defect or deficiency in the member comes to notice, the same shall be rectified as per directions of the Engineer-in-Charge.

(vi) Packing plates shall be provided at the joints as shown on approved drawings in order to make up the change in the thickness of the parts jointed. No other packing plates shall be used.

(vii) Hot dip galvanized bolts and nuts and washers of grade 5.6 shall be provided in all connections involving leg members main diagonals as well as horizontal through inter section of the main diagonals in k brace, panels and plain bracings

(viii) Hot dip galvanized contact surfaces of joints providing with hot dip galvanized bolts nuts and washers shall be free of oil, paint and lacquer or other coatings and shall be scored by wire brushing or light blasting after galvanization and prior to assembly.

(ix) Bolts used for connections shall not be less than 12mm dia. and the length shall be such that not more than half of the pitch of the thread lies inside the grip length. The threaded portion of the bolt shall protrude by not less than 3mm beyond the lock nut after it has been fully tightened.

(x) Bolts and nuts shall be tightened by using the part turn method. The nut shall be brought to the snug, tight position after which it will be given a further half to one turn depending upon the length of the bolt. In joints with several fasteners all the nuts bolts shall be brought to the snug tight position, before tightening further systematically. The nut rotation from snug tight condition is given in the table below:

NUT ROTATION FROM SNUG TIGHT CONDITION

Bolt length (as measured from underside of head to extreme end of point)	Bolts faces Normal to bolt axis.	One face normal To bolt axis & other face sloped not more than 1:20 (bevel washer not used)	Bolt faces slope not more than 1:20 from normal to bolt axis (bevel washers not used).
Upto including 4 dia.	1/3turn	1/2 turn	2/3 turn
Over 4 dia. But not exceeding 8 dia.	1/2 turn	2/3 turn	5/6 turn
Over 8 dia. But not exceeding 12 dia.	2/3 turn	5/6 turn	1 turn.

(xi) Alternatively nuts may be tightened using a calibrated wrench so that the proof load of the bolt specified in IS 1367 is achieved "snug tight is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Following this initial operation, bolts shall be placed in remaining holes in the connection and brought to snug tight position".

22.1 VERTICALITY TOLERANCES

The verticality of towers of different heights shall be within the provisions of Table-1(III)(b) of IS:12843 : 1989, viz. $\pm H / 1000$ or ± 20 mm (whichever is less) and $H/1500$ or ± 25 mm (whichever is less) for towers up to and including 30M height and over 30M height respectively. (H refers to the height of tower).

22.2 WORKING PLATFORM AND LADDER

A set of 3 (three) platform with railing as per the attached drawing at Annexure – I shall be provided at height of 34M, 36.4M and 38.8M respectively. A resting platform shall also be provided at a height of 20M from the ground level as per the details provided in the specifications. A ladder up to the top most platform inside the tower and cable tray assembly shall also be provided as per the specifications attached at Annexure II.

A working platform with railings is provided at a height from where erection and maintenance of Antenna, Aviation lamps, Lightning arrester etc. can be done easily. A ladder from rooftop up to top of platform at tower is provided with safety rings. Width of ladder shall be minimum 300 mm and safety ring of 750 mm shall be provided. Entry from ladder up to top of platform shall be such that no extra efforts will require to reach at the platform. Width of platform should be minimum 600mm.

23.0 WAVE GUIDE

A tray of galvanized m.s. angle and flats of 600 mm width shall be provided as wave guide to carry the feeder cables from Antenna fixed at top of tower up to the BTS. This shall not bend sharply at right angles at turning point to avoid damage to running feeder cables.

Waveguide is provided in towers to carry the feeder cables from Antenna fixed at top of tower up to Transmission room. It is a tray of galvanized M.S. angles and Flats of 600mm width.

(a) Wave guide should enter straight into the termination at last length.

(b) Precaution should be taken to avoid twisting of the wave-guide while tightening the nut of the termination flange.

(c) Twisting can be permissible by an amount of 1 over 5 meters of wave guide length.

(d) Bend in the wave-guide should be less than 2M diameter.

(e) Wave-guide should be clamped suitably at all the stages on wave-guide rack and at proper places at approx. every 2 meters length in bend portion.

24.0 MEASUREMENTS

24.1 Unless otherwise specified, for item of erection, the payment shall be made on weight basis. The weight shall be calculated as under.

24.2 The weight of all the structural members including tees, angles, channels, flats, rods, bars, tubes, gusset plates, splice plates, chequered plates, cleats, brackets, antenna, holding pipes, lightning arrester pipe etc. shall be measured as given below.

24.3 The actual dimensions (length & width) of the members shall be measured in running meters correct to a centimeter and the thickness shall be measured correct to a millimeter.

- 24.4 For calculation of weight, the coefficients as given in the standard tables of BIS codes shall be followed.
- 24.5 In case the coefficients are not available in BIS Codes, than the coefficient available in other standard tables shall be followed.
- 24.6 In case the coefficients are ne2ther available in BIS Codes nor in other standards, than the coefficients shall be derived based on actual weight taken at site.
- 24.7 In case none of the above is possible, the actual weight shall be measured at site before erection.
- 24.8 No deductions shall be made for rivet or bolt holes made as per drawings and no additions shall be made in weight due to galvanizing of the members.
- 24.9 If actual weight measured at site, is less than the weight as per BIS codes / other standards, then the actual weight shall be measured.

25.0 **RATES**

- 25.1 Unless otherwise specified, the rates quoted for the items shall include all labour, material, taxes, insurance, watch & ward, necessary T&P required for the work, tests, all weighing / measuring equipments etc. all complete. Nothing extra shall be paid over and above the quoted rates for the items.
- 25.2 The contractor shall pay Octroi wherever applicable. The Form "C" & "D", Octroi exemption certifies etc will not be issued by BSNL for any materials required in the work. The contractor shall quote all inclusive rates only. Nothing extra shall be paid over the quoted rates.

26.0 **PROTECTION OF LIFE, PROPERTY AND EXISTING FACILITIES :**

- 26.1 The contractor is fully responsible for taking all possible safety precaution during preparation for and actual performance of the works, and for keeping the construction site in a reasonable safe condition. The Contractor shall protect all life and property from damage or losses resulting from his construction operations and shall minimize the disturbance and inconvenience to the public.
- 26.2 In this connection, the attention of the contractors are drawn to the safety measures and precautions including code of conduct while safely carrying out the work and also detailed Engineering Instructions enumerated in this tender document.
- 26.3 The contractor shall be solely liable for all expenses for and in respect of repairs and / or damage occasioned by injury of or damage to such underground and over-ground structures or other properties and undertake to indemnify and keep indemnified the BSNL from and against all actions, cause of actions, damages, claims and demands what-so-ever either in law or in quality and all losses and damages and costs (inclusive between attorney and client), charges and expenses in condition therewith and / or incidental thereto.
- 26.4 The current market value of any commodities lost as a result of any damage to the aforesaid existing facilities shall be paid by the contractor together with such additional sums necessary to liquidate the personal or property damages resulting there from.

27.0 **INSURANCE**

Without limiting any of his other obligations or liabilities, the contractor shall, at his own expense, take and keep comprehensive insurance including third party risk for the plant, machinery, materials, etc. brought to the site and for all the work during the execution. The contractor shall also take out workmen's compensation insurance as required by law and undertake to indemnify and keep indemnified the BSNL from and against all manner of claims and demands and losses and damages and cost (including between attorney and client) charges and expenses that may arise in regard the same or that the BSNL may suffer or incur with respect to and/or incidental to the same.

28.0 INDEMNITIES :

- 28.1** The contractor shall all the times hold the BSNL harmless and indemnify from against all actions, suits, proceedings, works, cost, damages, charges, claims and demands of every nature and descriptions brought or procured against BSNL, its officers, and employees and forthwith upon demand and without protest or demur to pay the BSNL any or all losses and damages and cost (inclusive between attorney and client) and all costs incurred in endorsing this or any other indemnity or security which the BSNL may now or at any time have relative to the work or the contractor's obligation or in protecting or endorsing its right in any suit or other legal proceedings, charges and expenses and liabilities resulting from or incidental or in connection with injury, disease or disablement to or death of any person(s) including employee(s) of the contractor or damage to property resulting from or arising out of or in any way connected with or incidental to the operations caused by the contract documents. In addition the contractor shall reimburse the BSNL or pay to the BSNL forthwith on demand without protest or demur all costs, charges and expenses and losses and damages otherwise incurred by it in consequences of any claims, demand and actions which may be brought against the BSNL arising out of or incidental to or in connection with the operation covered by the contract.
- 28.2** The contractor shall at his own cost at the BSNL request defend any suit or other proceeding asserting a claim covered by this indemnity, but shall not settle, compound or compromise any suit or other finding without first consulting the BSNL.

29.0 QUALITY ASSURANCE AND TESTING.

The testing of prototype tower shall be certified by the representative of Engineer-in-Charge within two weeks of award of work. At factory itself other quality parameters will be checked at regular intervals.

30.0 ACCEPTANCE TESTING.

The completed work shall be inspected for approval by the "Acceptance Testing Unit of the DOT". It shall be the responsibility of the contractor to offer the completed work for inspection and approval of the A/T in co-ordination with and as per the directions of the Engineer-in-Charge and nothing extra shall be payable on this account. If the completed work is not found satisfactory as per the prescribed specifications, corrective measures ordered by the Engineer-in-Charge shall be carried out immediately by the contractor without any additional expenditure liability to the BSNL.

31. PROGRAMME FOR EXECUTION OF WORK :-

- 31.1** The contractor shall submit a programme for execution of this work in the form of Bar chart/ PERT chart to the Engineer-in-charge indicating the duration of various construction activities separately taking into consideration total time of completion given in tender document, within a month from the date of award of work. The total time taken for various activities should not exceed the stipulated time of completion specified in the NIT.
- 31.2** In case the NIT stipulates earlier completion for any part of the work then contractor shall separately submit a programme for execution of the work requiring early completion in the form of bar chart/ PERT chart to the Engineer-in-charge indicating the duration of various construction activities separately taking in to consideration time of completion given in the tender document for the said part portion, within a month from the date of award of work. The time taken for various activities should not exceed the stipulated time of completion for the part portion specified in the NIT.
- 31.3** In case the NIT stipulates earlier completion period for part portion of the work, then provisions of the contract clauses pertaining to compensation for delay (clause-2), determination of the contract (clause-3), liability to pay compensation even if action is not taken under clause-3 (clause-4), time and extension for delay (clause-5) and other relevant

clauses shall apply separately to the part of the work stipulated to be completed at early date considering stipulated time of completion for part portion as relevant time.

- 31.4 The work shall be executed as per programme approved by the Engineer-in-charge of the work. No claim whatsoever will be entertained on this account.
32. No payment shall be made to the contractor for any damage caused during the execution of work because of cause(s) not covered under Clause 43 of the Contract. The damage to work will be made good by the contractor at his own cost, and no claim on this account shall be entertained.
33. Some restrictions may be imposed by the security staff etc. on the working and/ or movement of labour, materials etc. and the contractor shall be bound to follow all such restrictions/ instructions and nothing extra shall be payable on this account.
34. The contractor shall comply with proper and legal orders and directions of the local or public authority or municipality and abide by their rules and regulations and pay all fees and charges which he may be liable and nothing extra shall be payable on this account. The work shall be carried out without infringing on any of the local Municipal Bye-Laws.
35. The contractors shall given a performance test of the entire installations as per standard specifications before the work is finally accepted and nothing extra what so ever shall be payable to the contractor for the tests.
36. The rate for every item of work to be done under this contract shall be for all heights, depths, lengths and widths of the structure (except where specially mentioned in the item) and nothing extra will be paid on this account. **The rate for all items of work, wherein cement is used, is inclusive of charges of curing.**
- 37.1 **The contractor shall maintain in good condition all work during execution till completion of entire work allotted to him.**
- 37.2 **The contractor shall cause the site to be cleared thoroughly of rubbish, scaffolding materials etc. before the actual date of completion of the work as well as time to time as per directions of the Engineer-in-charge of the work.**
- 37.3 **The contractor shall make his own arrangement for obtaining electrical connection, if required and make necessary payments directly to the department concerned.**
- 37.4 **Other agencies doing work of electrification, external services, other building work, horticulture work etc. for this project will also simultaneously execute their part of the works and the contractor shall afford necessary facilities for the same. The contractor shall leave such necessary holes, openings etc. for laying /burying pipes, cables, conduits, clamps, boxes and hooks etc. as may be required for the electrical and sanitary works etc. and nothing extra over the agreement rate shall be paid for the same.**
- 37.5 **The contractor shall be responsible to arrange at his own cost all necessary tools and plants required for execution of the work.**
- 37.6 **The rate of all items of work, shall, unless clearly specified otherwise, include cost of all labour, material and other incidental inputs involved which are essential to complete the work as per entire satisfaction of the Engineer-in-Charge.**
- 37.7 **For the purpose of recording measurement for preparing running account bills, the abbreviated nomenclature indicated in the standard schedule of rates relevant to the contract may be adopted. The abbreviated nomenclature shall be taken to cover all the**

materials and preparations as per the complete nomenclature of the relevant items in the agreement and other relevant specifications.

- 37.8 In case of items for which abbreviated nomenclature is not available in the standard relevant schedule of rates and also in the case of extra and substituted items of work for which abbreviated nomenclature is not provided in the agreement the full nomenclature of items shall be reproduced in the measurement books and bill forms for running account bills.
- 37.9 Whenever any reference to any Indian standard specifications occurs in the documents relating to this contract the same shall be inclusive of all amendments issued thereto if any, up to the date of receipt of the tender.
- 37.10 The contractor shall take instruction from the Engineer-in-Charge regarding collection and stacking of materials at any place. No excavated earth or building materials shall be stacked on the areas where other buildings, roads, services or compound walls are to be constructed and they shall not be stored near any existing structures so as to endanger their safety.
- 37.11 The site of work should be seen by the tenderer before quoting his rates with respect to approaches to the site and conditions of the same. If any approach road from main road is required at the site or existing approach is to be improved and maintained, for cartage of materials by the contractor, the same shall be provided, improved and maintained by the contractor at his own cost.
- 37.12 If as per municipal rules the huts for labourers are not to be erected at the site of work by the contractor, the contractors are required to provide such accommodation as is acceptable to local bodies and nothing extra shall be paid on this account.
38. The contractor shall take all precautions to avoid all accidents by exhibiting necessary caution boards such as day and night boards, speed limit boards and flags, red lights and providing barriers etc. He shall be responsible for all damages and accidents caused due to negligence on his part. No hindrance shall be caused to traffic during the execution of work. Nothing extra shall be paid on this account. **Any damage done by the contractor to any existing work during the course of execution of the work awarded to him shall be made good by him at his own cost.**
39. The contractor will work in close liaison, during the works, with other contractors of water supply, sanitary, drainage arrangements, electrical installation and any other works and adjust his work plan accordingly **at no extra cost to the department.**

40. Other Taxes :

- 40.1 **Income Tax and surcharges over Income Tax etc.** at the rates fixed by the Ministry of finance, Government of India, shall be deducted from all the running and final bills of the contractor. Should there be any increase in rate of Income Tax and surcharge during execution of the contract, the same shall be payable by the contractor.
- 40.2 **Works Contract Sales Tax** as prevalent as per statutory orders of State/Central Government and shall be charged on gross value of all the bills and shall be recovered from each bill of the contractor as 'works contract sales tax'. Should there be any increase in rate of Works Contract Sales Tax during execution of the contract, the same shall also be payable by the contractor.

41. Secured Advance:

- 41.1 Secured advance on structural steel members i.e. angles, tees, plates, etc. conforming to the relevant IS: Codes from main producers as approved by the Ministry of Steel viz. SAIL, TISCO, IISCO and RINL shall be paid only after the Engineer-in-Charge has personally verified that the materials brought at site of work, for use in work.
- 42. Documentation** : Two hard copies as well as one soft copy of complete document along with the installation details shall be supplied by the supplier.

ANNEXURE-B**ADDITIONAL SPECIFICATIONS****1. GENERAL**

- 1.1. The Work shall, in general, conform to the CPWD Specifications. The CPWD specifications shall mean CPWD Specifications – 1996 Vol. 1 to VI with up-to-date correction slips and Revised CPWD Specifications 2002 for Cement Mortar, Cement Concrete and RCC works which supersede Chapter 3,4 & 5 of CPWD specifications 1996 Vol. II.
 - 1.1.1. Should there be any difference between the specifications mentioned above and the specifications given in the schedule of quantities, the later shall prevail.
 - 1.1.2. If the specifications for any item are not available in the CPWD Specifications cited above, relevant BIS Specifications should be followed.
 - 1.1.3. In case BIS Specifications are also not available, the decision of Engineer-in-Charge given in writing based on acceptable sound engineering practice and local usage shall be final and binding on the contractor.
- 1.2. The work will be carried out in accordance with the architectural drawings and structural drawings to be issued by the Engineer-in-Charge. The structural and architectural drawings shall have to be properly correlated before executing the work.
 - 1.2.1. In case of any difference noticed between Architectural and Structural drawings, the contractor shall obtain final decision in writing of the Engineer-in-Charge.
 - 1.2.2. In case of any discrepancy in the item given in the schedule of quantities appended with the tender and architectural drawings relating to the relevant item, former shall prevail unless otherwise given in writing by the Engineer-in-Charge
- 1.3. For items where so desired, samples shall be prepared before starting the particular items of work for prior approval of the Engineer-in-Charge and nothing extra shall be payable on this account.
- 1.4. Materials brought at site of work shall not be used in the work before getting satisfactory Mandatory test results. For details, relevant provisions in the CPWD specification shall be referred to.
 - 1.4.1. Wherever it is desired to procure factory-made materials, such factory-made materials shall be procured from reputed and approved manufacturers or through their authorized dealers. The contractor shall obtain the approval from the Engineer-in-Charge of such firms prior to procurement of such factory-made materials. The Engineer-in-charge may, at any stage, inspect such factories/ manufacturing units. The contractor shall have no claim if the factory made materials brought to the site are rejected by the Engineer-in-charge in part or in full due to bad workmanship/ quality etc. even after the inspection of the manufacturing units.
 - 1.4.2. The manufactured materials brought at site of work shall, in general, conform to the relevant specifications. The source for supply of the manufactured materials shall be approved by the Engineer-in-charge. The contractor shall have no claim if the manufactured materials brought to the site are rejected by the Engineer-in-charge in part or in full due to bad workmanship/ quality etc.
 - 1.4.3. The preference amongst the various alternative materials available shall be as follows: -
 - (a) The materials shall be as per the Brand specified to be used in the work.

- (b) If the Brand specified material is not available then the material shall be ISI marked.
 - (c) If ISI marked item is not available then it should be from ISO certified Company.
 - (d) If the ISI marked or ISO certified items are not available then the best available items in the market to be procured.
- 1.4.4. Equivalents for the various materials and the materials of approved make shall be got approved from the Engineer-in-Charge of work in writing before using them on the work.
- 1.4.5. The contractor shall provide at his own cost suitable weighing and measuring arrangements at site for checking the weight / dimensions as may be necessary for execution of the work.**
- 1.4.6. **All materials brought to the site by the contractor for use in the work shall be got checked from the Engineer-in-Charge or his authorised representative on receipt of the same at the site and before they are actually used in the work.**
- 1.4.7. Any infringement and/or breach of the above specifications and condition(s) etc. shall render the contractor liable to action(s) under various clauses of the contract and such actions stipulated in the conditions therein.**

ANNEXURE-C

SPECIFICATION FOR TOWER MATERIAL AND TOOLS ETC.

This work of erection of self supporting tower (Steel), assembly of tower members including Platforms, Guardrails, ladders guard wires, Lightning arrestors etc. as per drawing for each stations shall be such that the tilt, twist and rotation of the tower are within the specified limits. The arrangement necessary for carrying out the above test will be made by the contractor.

1. These shall be as per C-DOT design Tower / approved shop drawings.
2. The contractor should arrange the tower members by numbers and the quantity should be checked according to the details of tower. In case the members are found twisted and bend this shall be replaced by the contractor at his own cost. The tower members shall be stamped and engraved for facility during erection. Necessary bolts should be supplied as per the drawing. No material for work shall be supplied by the department.
3. All the component of the tower Super structures will be supplied by the contractor as per the drawings. The contractor will be responsible for the safe storage and custody of the same until the installation is completed and handed over to the BSNL. No enclosed accommodation shall be provided at site for storage of the materials or for contractor staff. The contractor shall therefore make his temporary arrangement for such accommodation.
4. The tools and equipments required for the tower shall be supplied by the contractor. The contractor shall provide all the necessary erection tools and erection gear within the tendered cost and shall use such method and applicants for performance of all the operations connected with the work under the contract, as will ensure satisfactory quality of work and rate of progress. The list of tools and other erection gear is as given below :-

1. Winch coupled with engine double drum	--	2 nos.
2. Hand winch	--	2 nos.
3. Block single wheel 200 mm diameter	--	15 nos.
4. Block double wheel 200 mm diameter	--	08 nos.
5. Temporary steel tower required for erection of tower over 50m height 30 m ht. 0.8 x 0.9	--	01 no.
6. Steel pole 0.4 x 4m x 15 m in length	--	02 nos.
7. Wire rope 12 mm dia. 300 metre in length	--	02 nos.
8. Wire rope 16mm		
9. Wire rope 18 mm		
10. Wooden log 150 mm dia 7metre in length		
11. Bender		
12. Wire cutter		
13. Shackles		
14. Plier		
15. Wrench		
16. Box wrench		
17. Machinist Hammer		
18. Knock pin		
19. Steel measuring tape	--	04 nos.
20. Gasoline torch	--	01 no.
21. Transit Theodolite	--	02 nos.
22. Telephone set of two	--	01 set.
5. The lightning rod shall be accurately fixed as shown in the details of the towers. The lightning rod shall be made of Copper as per IS:613.

CHECK LIST**ANNEXTURE- D**

SL NO	DESCRIPTION	YES/NO	REMARKS
MATERIAL			
1	On receipt of tower material at site check availability of all sections as per drawing.		
2	All steel members shall generally conform to IS:226-1975/IS : 2062-1999.		
3	Test certificate from the manufacturer SAIL/TISCO/VSPL available.		
4	Independent test report from approved lab available on the quality of steel.		
5	Steel members shall be free from cracks, lamination, excessive rust and scaling.		
6	Edges of members shall not be sharp.		
7	Position of holes must conform to drawing. Holes shall have there axis perpendicular to the bored.		
8	Test certificate for mass of zinc coating available.		
9	Galvanisation thickness is checked in the field by instrument (ELCOMETER etc.).		
10	The adhesion of zinc coating should be checked by giving pivoted hammer blows. The zinc coating shall not flat off when applied pivot hammer blows.		
ERECTION			
11	Whether base width of the tower is as per the drawing		
12	Whether top width of the tower is as per the drawing.		
13	Whether height width of the tower is as per the drawing.		
14	Whether condition of the welding at various locations is satisfactory.		
15	Bulky white deposits and blisters and is satisfactory.		
16	Whether quality of primer (if applied) is satisfactory.		
17	Whether any mispunch/excess holes are made in any member.		
18	Whether the tightening of bolts is checked with torque wrench and found satisfactory.		
19	Whether length of any bolts are short.		
20	Whether any gap is observed between the chequered plate at working plate		
21	Whether any lack of fit in any member due to defective fabrication.		
22	Whether the member dimension, member lengths, slop, section sizes etc are as per drawing.		
23	Whether bolt holes, bolt size, bolt no. and its position on member is as pr drawing.		
24	Whether gussets plate spacers, washers, nuts etc. are placed as per drawing.		
25	Whether all the members are reasonably straight.		
26	Necessary safety belt and safety shoes are provided to the workers.		
27	Insurance as per contract is available.		

28	Verticality of the erected tower checked with the help of plumb bob and / or theidolite.(The theodolite if used should check for vertical error before use.)		
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SIGN. OF JTO (Civil)

SIGN. OF SDE (Civil)

SIGN. OF EE (Civil)

SCHEDULE-“B”

SPECIFICATION FOR TOWER ERECTION WORKS

This work of erection of self supporting tower (Steel), assembly of tower members including Platforms, Guardrails, ladders guard wires, Lightning arrestors etc. as per drawing for each stations shall be such that the tilt, twist and rotation of the tower are within the specified limits. The arrangement necessary for carrying out the above test will be made by the contractor.

A. TOWER MATERIAL & TOOLS ETC:

1. These shall be as per C-DOT design Tower / approved shop drawings.
2. The contractor should arrange the tower members by numbers and the quantity should be checked according to the details of tower. In case the members are found twisted and bend this shall be replaced by the contractor at his own cost. The tower members shall be stamped and engraved for facility during erection. Necessary bolts should supplied be as per the drawing. No material for work shall be supplied by the department.
3. All the component of the tower Super structures will be supplied by the contractor as per the drawings. The contractor will be responsible for the safe storage and custody of the same until the installation is completed and handed over to the BSNL. No enclosed accommodation shall be provided at site for storage of the materials or for contractor staff. The contractor shall therefore make his temporary arrangement for such accommodation.
4. The tools and equipments required for the tower shall be supplied by the contractor. The contractor shall provide all the necessary erection tools and erection gear within the tendered cost and shall use such method and applicants for performance of all the operations connected with the work under the contract, as will ensure satisfactory quality of work and rate of progress. The list of tools and other erection gear is as given below :-

1. Winch coupled with engine double drum	--	2 nos.
2. Hand winch	--	2 nos.
3. Block single wheel 200 mm diameters	--	15 nos.
4. Block doubles wheel 200 mm diameter	--	08 nos.
5. Temporary steel tower required for erection of tower over 50m height 30 m ht. 0.8 x 0.9	--	01 no.
6. Steel pole 0.4 x 4m x 15 m in length	--	02 nos.
7. Wire rope 12 mm dia 300 metre in length	--	02 nos.
8. Wire rope 16mm		
9. Wire rope 18 mm		
10. Wooden log 150 mm dia 7metre in length		
11. Bender		
12. Wire cutter		
13. Shackles		
14. Plier		
15. Wrench		
16. Box wrench		
17. Machinist Hammer		
18. Knock pin		
19. Steel measuring tape	--	04 nos.
20. Gasoline torch	--	01 no.
21. Transit theodolite	--	02 nos.
22. Telephone set of two	--	01 set.

5. The lightning rod shall be accurately fixed as shown in the details of the towers. The lightning rod shall be made of Copper as per IS:613.

B. TOWER ERECTION WORK

1. Towers members shall be arranged member by member and quantity checked according to drawing supplied.
2. In case any member is bent or twisted, it shall be replaced.
3. In tower erection work erecting order shall be observed and orientation of tower shall be accurately carried out. In assembling, members shall be successively lifted on the position shown in the details of tower. Precautions shall be taken so that the lifted weight does not exceed the weight limit.
4. The erection work of tower etc. should be carried out strictly in accordance to the schedule specified in the manufacture's instructions.

The contractor may however, adopt any other standard procedure for erection of the tower but he shall have to submit the details of his proposed method of erection for approval of the Engineer-in-charge, before commencing the work. If, at any time before the commencement and during the progress of the work, the methods adopted or appliances used, appear to the Engineer-in-charge to be inefficient or in-appropriate for securing the quality of the work or the asked rate of progress, he may be asked to comply with departmental instructions. But failure of the Engineer-in-charge to bring such defects to the notice of the contractor does not relieve the later of his obligations as regards the quality of work and rate of progress required by the contract.

Any loss to the contractor on account of stoppage of work for reasons given above have to be borne by him and any damage to the materials shall be made good by the contractor to the BSNL.

5. The erection of tower should be carried out during normal working hours during day time i.e. 7.00 am to 6.00 pm.
6. A telephone may be used for communication between workers on the ground and those on the top as the erection progresses to the upper part of the tower.
7. Bolts and nuts should be fitted in positions as shown in drawings. Bolts in horizontal level shall be inserted from inside of tower with nuts applied on the outside of the tower. Bolts in a vertical line shall be inserted from beneath with nuts applied on upside.
8. During erection bolts & nuts shall be tightened in the following order:

In the first place the first and second sections of tower shall be assembled with bolts and nuts tightened tentatively.

In the second place the second section shall be placed above the first and tentatively tightened. The second section is tightened completely after it has been confirmed that the section is accurately assembled. The remaining part of the tower shall be assembled in the same manner. After completion of erection the verticality of the tower shall be checked.

9. Verticality of the Tower i.e. the bottom of the line joining the centre of the tower and the centre of the base of the tower shall be within the prescribed limit from the centre of the base of the tower. The top horizontal member of the tower on all four faces shall have centre clearly and visibly marked for easy check of verticality.
10. The hoisting of W/G should be carried out under close supervision and instructions of the Engineer-in-charge or his representative. The work will have to be planned well in advance. Angle adopters should be got assembled and fixed over the W/G rack first. Then the correct W/G drum for the stations and length should be identified and placed over the raised axle to be arranged by the contractor for free rotation of the drum below the tower. Thereafter, W/G

will be fastened at a point based about 1.0 m length from one end. End of the sufficient length should be tied to wire grip for hoisting. Hoisting should be done slowly and cautiously so as to avoid collision of the W/G with any member of the tower after it has reached a height of 40m. Another wire grip should be fastened with the W/G and hoisting rope should be tied to this wire grip also. The hoisting rope should be kept along with W/G always and if needed W/G may be tied with ropes at several places. Similar action should be taken when W/G reaches above 80m height.

11. After it has reached to the specified height W/G should be taken to the W/G rack and should be fixed to angle also, which should be got fitted on the rack earlier. The hoisting rope should be released only after the W/G has been properly clamped over the vertical W/G rack. Thereafter, it should be taken into the equipment room over the horizontal W/G rack and through the W/G rack holes. After securing it with horizontal W/G, it should be properly clamped with the entry glands in wall and the other edge of the port. All precautions in handling W/G etc. should be followed and bends to W/G may be given with the help of tools.

Before the antenna or W/G are hoisted, these are to be insured by the contractor for the full cost of the antenna and the W/G.

SCHEDULE – “C”

SPECIFICATION FOR PAINTING OF THE TOWER

Painting shall be done by specialized agencies only and all safety precautions shall be taken in accordance with safety code for erection of steel work.

Procedure consists of:

1. Cleaning the tower member.
2. Application of the primer before erection.
3. Touching up and application of two coats of paint after erection.

The painting shall be done carefully so that all the corners of the tower receive the paints and no bare surface is left exposed any where. The practice of mixing turpentine oil with paints is forbidden. The primer and the paints used should be got approved prior to their use. The painting shall conform to Civil aviation guidelines as given below:

ORANGE AND WHITE BANDS:

To conform to the civil aviation regulations the tower shall be painted in alternate bands of international orange and white terminating with orange at top and bottom. The correct shade for international orange correspond to IS shade 592 as given in Indian standards Institution publication of Indian standard colours for ready mix paints IS – 1755, 2732/64.

After application of coat of zinc primer and each coat of paints, the work of painting should be got inspected.

No tools and appliances for carrying out this work will be supplied by the BSNL.