Specification No. 50 M (FM Tower)/19/May/2016-D(TD/FM)

PRASAR BHARATI
(India's Public Service Broadcaster)
DIRECTORATE GENERAL: ALL INDIA RADIO
(PLANNING & DEVELOPMENT UNIT)
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Specification for Design, Supply, Erection, Testing and Commissioning (DSETC) of 50 M Self Supporting Lattice Steel tower including provisions of mountings for installation of VHF FM Antenna etc. for FM Stations of All India Radio.

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A. Essential Requirements of Tender

1. The tenderer should submit schedule of Requirements/Materials without *price in the same format as given in AIR* Specification in the technical bid, failing which the tender shall be considered incomplete and is liable to be rejected.
2. Each statement of the technical specification has to be complied with & supported by printed technical literature, technical data sheets, schematic drawings and technical manuals from the manufacturer of the tower by the tenderer to assess the full merit of the offer, failing which the tender shall be considered incomplete and is liable to be rejected.
3. All the technical details, technical drawings must be submitted and enclosed with the tender by the tenderer, failing which the tender is liable to be rejected.
4. The complete technical specification compliance statement (section wise & clause wise) along with schedule of Requirements/Materials (un-priced) must be signed & stamped on each page by the tenderer/ manufacturer of the tower in the tender document including the clarifications, if any, asked by AIR. The manufacturer of the tower & tenderer should mention their name in CAPITAL LETTERS, full address with pin code, phone number, fax number, e-mail address and with their full signature.
5. The complete tender shall be page numbered.
6. The Authorization and Guarantee must be given by the tenderer/manufacturer of the tower on their letter head pad duly signed & stamped on each page. The Authorization and Guarantee other than the tenderer/ manufacturer of the tower and guarantee other than the tenderer in the tender will not be considered, failing which the tender shall be considered incomplete and is liable to be rejected.
7. Any change/modifications in AIR technical specifications format, language, technical parameters or of any other nature including the deletion of clause, words, lines in the technical compliance statement by the manufacturer of the tower/tenderer will not be acceptable to AIR and the tender is liable to be rejected.
8. The tenderer should submit the tender offer to All India Radio in the format given below, section wise

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& clause wise, in respect of all the sections of technical specifications to assess the full merit of the offer, failing which the tender shall be considered incomplete and is liable to be rejected.

S. No. of AIR Specification (Section wise & Clause wise) (1)	Details of AIR Specification (Part/ Section wise & Clause wise) (2)	Compliance (Yes/No) (3)	The page no. of the tender offer, where the information/ supporting document is available (4)	Remarks (5)
Section-I Clause wise				
Section-II Clause wise				
Section-III Clause wise				

SECTION-I

1.0 INTRODUCTION:

All India Radio requires 50 M Self Supporting Lattice Steel tower of mean probable design life of 100 years to support FM and Microwave dish antenna etc. The tower shall be self-supporting type having square section base out of galvanized steel sections/structures of four legs. Antenna arrangements on tower are indicated in the suggestive Drawing No. TM-16239. Provision for Band II antenna apertures for FM service shall be made on the tower. Necessary provisions in the design shall be made for mounting of the VHF FM antenna in future above the Band II aperture at the top of the tower. **Throughout the entire aperture of Band II, the outer to outer width of square cross section should be 400 mm (including splices, nuts & bolts at joints).**

a. In addition, the tower shall be designed to accommodate 2 Nos. of Microwave parabolic dish antenna (2.1 M dia.) at 25 M level platform and 2 Nos. of Yagi antenna at 25 M level platform as shown in the above mentioned suggestive drawing.
b. The tenderer shall quote for mounting of VHF FM antenna systems, feeder cables and related works/services as per details given in the subsequent paragraphs. The tower shall be designed to take self load and wind load for Band II, Microwave parabolic dish antenna, Yagi antenna, RF feeder cables, Power Supply cables etc. as per the details of load at Para No. 2.8.

1.1 SCOPE:

Design, fabrication, supply, erection, testing and commissioning of 50 M Self Supporting Lattice Steel tower and accessories complete with foundation work, internal ladder with free fall prevention system for climbing from ground to top of the tower, platforms with railings, Horizontal & Vertical Cable Racks/trays as per actual site conditions between transmitter building up to tower, pipe for side mounting of 6-Bay VHF FM (Pole type) Antenna.

a. Providing protection against lightning, earthing of tower, Aviation Obstruction Lights (AOL) including Beacon light and sun-switch. The power supply cable for multi point power sockets at various platforms, from bottom to the topmost platform of the tower, will also be supplied by the tenderer.
b. Painting of the tower structure.
c. Cleaning of the site by removing debris etc.
d. Joint inspection with representative(s) of the firm and AIR.
e. Joint inspection of pending works as pointed out during joint inspection with representative(s) of the firm and AIR.
f. The RF feeder cable and other cables i.e. cables for AOL, power supply etc. between the transmitter building and the tower base shall be routed on a horizontal cable tray supported on G.I. Poles/Angle Iron structure which will

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be supplied by the tenderer. The cables on the horizontal cable tray shall be provided with G.I. sheet cover of 16 SWG to avoid any damage to RF cable due to any falling objects. A suggestive drawing No. TM-14453/3 of Horizontal Cable tray is also enclosed.

g. The cables for AOL and utility outlets at various platforms shall be taken on tower on the vertical cable rack.
h. Visit to the site by the tenderer for collecting data and information.
i. Soil testing from a government approved laboratory.
j. Preparation of design documents & design drawings of Foundation & Tower and approval of the same by any one of the following institutions and submitting to AIR (in soft & hard copies).
   (a) Indian Institute of Technology
   (b) Structural Engineering Research Centre
m. Preparation of working structural drawings and submitting to AIR.
n. Handing over of tower with completion report (soft & hard copies) including photographs showing complete tower as well as each section of 20 M length from base to top, horizontal cable tray and foundation processes starting of excavation, steel layout and reinforcements etc. to leveled finished foundation.
o. Any other work necessary to complete the SETC work as a turnkey job.

1.2 GENERAL:

a. General terms and conditions of contract for SETC works including all the commercial aspects like, Packing and Packing List, Insurance and Marine Risk etc., Payment terms, Penalty/Compensation for Delay, Damages and Liabilities, Time Period and Extension for Delay, Foreclosure of Contract due to Abandonment or Reduction in Scope of Work, Cancellation of Contract in Full or Part, Recovery of Security Deposit, Performance Guarantee, Unsatisfactory Workmanship, Damages Incurred During Installation, Indian Electricity Rules, Defects, Recovery of Compensation, Ensuring Payment and Amenities, Compliance with State Labour Laws, Minimum Wages Act Compliance, Indemnifying Government against Patent Rights, Return of Surplus Material, Employment of Technical Staff and Employees, Release of Security Deposit, Safety Code etc. shall be followed by the successful tenderer as defined in the tender document in totality.
b. The tower shall be designed considering probability factor based on mean probable Design life of tower structure as 100 years.
c. *The tender shall be complete and include all minor items of work and accessories which may not have been specifically defined in this specification and schedule but which are useful and essential for the perfect assembly and completion of the tower. No extra charges will be paid for providing and installing of such items.*
d. The successful tenderer shall make his own arrangements for power supply, water and the storage of materials and their safe custody at installation site.
e. The successful tenderer shall make his own arrangement for employing labour-skilled and unskilled and shall make his own arrangement for providing accommodation for his labour. He should conform to all local, State laws and regulations concerning labour and their employment.
f. The successful tenderer shall make good all damage to the purchaser's buildings, property, equipment, article etc. howsoever arising from the construction of the foundation, erection of the tower, and in the course of such work and throughout the period during which the safety of the tower is guaranteed.
g. The successful tenderer shall indemnify and hold harmless the purchaser against all claims in respect of damages to buildings, property, articles situated nearby, not belonging to the purchaser, howsoever arising from the construction of the foundation, erection of the tower, and in the course of such work and throughout the period during which the safety of tower is guaranteed.
h. The successful tenderer shall indemnify and hold harmless the purchaser against claims in respect of injury/any mishap to any person, howsoever arising from the construction of the foundation, erection of the tower, and in the course of such work and throughout the period during which the safety of the tower is guaranteed.

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i. The successful tenderer shall fully discharge all obligations under the Indian Workmen's Compensation Act, any local, State laws and regulations in so far as it affects the workmen in his employment.

j. The tenderer shall be responsible for safe erection of the tower and other accessories etc. The tenderer shall take all necessary safety measures and precautions during the SETC of the tower. Tower work shall be got done at site under the supervision of qualified representative(s) of the firm.

k. The location of the tower at the site vis-à-vis the transmitter building will be marked by AIR on Site Lay Out Plan. Maximum area available, including excavation work, for tower will be 15 M x 15 M.

1.3 DESIGN, CALCULATION AND DRAWINGS

a. The specifications indicated herein are only to guide the tenderer about the requirements of the purchaser. Detailed design of the tower from all aspects shall be got worked out by the tenderer, keeping in view the effects of local meteorological conditions like wind velocity, seismic data, temperature, codal provisions and as per good engineering practice to ensure the safety of the tower.

b. The tenderer shall obtain Wind & Seismic Zones data as per latest IS codes. The above data only shall be used in the Design Calculations. Copy of the same shall be submitted with the offer to evaluate the offer. However, it may be kept in view that the wind map and seismic map are approximate only and require a judicious decision on the part of the designer to provide a good design of the tower for a design life of 100 years.

c. It may also be ensured by the tenderer that if the site falls within a short distance from another wind zone having a higher basic wind speed, the tower shall be designed as per the higher basic wind speed.

d. The design of the tower shall be based on recognized principles of structural design Engineering, conforming to latest IS codes and Standard Engineering Practices. **Full responsibility regarding soundness of design including factor of safety and the execution of work rests with the tenderer.**

e. Safety Factor of various structural components of the tower as well as overall safety factor of the tower under worst atmospheric conditions and critical loading shall be better than 2 (two).

1.4 The tenderer must furnish with his tender the following documents/information to assess the full merit of the offer without which tender is liable for rejection. This is mandatory requirement.

a. (i) The tower profile drawing showing all the facilities and requirements as specified in the specification should be attached with the offer.

(ii) Outline drawings to scale showing the assembly of the structures. These drawings should show the main dimensions including the size of main structural members, mounting centres, methods of attachment to concrete foundations and any special features of design or form. Total Weight of tower shall be given (Excluding foundation materials).

b. Detailed information concerning design parameters with latest amendments such as loads due to wind effect as per IS:875 amended to date and seismic effect as per IS:1893 amended to date, dead loads, antenna loads, combination loads considered, design philosophy along with other information and shall contain the following:

i. Wind speed zone, terrain category, topographic factor, gust factor, risk factor etc.
ii. Seismic zones factor, importance factor, response reduction factor etc.
iii. Antenna loads due to band II FM antenna, Microwave dishes etc.
iv. Load combination considered.

c. The design calculations indicating the various formulas used for design, the bearing and shear stresses used for the design of bolted sections and the factors of safety adopted for the various structural components and materials. Safety Factor of various structural components of the tower as well as overall Safety Factor of the tower under worst atmospheric conditions shall be better than 2(two).

d. Typical design load calculation with methodology due to seismic effect.

e. The detailed design of foundations for **8.2 MT/Sq. M SBC.**

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f. Details of LED based Aviation Obstruction Light, Antenna Fixtures, Pipes, Power Supply cables, paint materials, earthing etc.
g. Detail of activity wise Bar / PERT chart with delivery schedule.
h. Details of weight of the tower structure, fasteners & steel used in foundation.
i. Details of past experience in similar type of work i.e. design, fabrication, supply, erection, testing and commissioning of self-supporting TV/Radio or any other towers not less than 50 M height, capacity of their plant and their organizational set up for undertaking such works.
j. Design forces compression/tension due to critical load combination, design of main members panel wise i.e. leg, bracing diagonal & horizontal with section adopted capacity members based on length, slenderness ratio, allowable stress with reference & formula.
k. Deflection at top of tower and reaction at base in most critical load combination.

1.5 The successful tenderer shall furnish the following within two months from the date of acceptance of the tender:

(i) General arrangement drawing(s) with all details and facilities provided on tower.

(ii) Detailed design documents and design drawings of tower and foundation.

(iii) Any other drawings for the completeness of the tower design as per AIR specification.

(iv) The tenderer shall submit a certificate testifying the soundness and safety of design of tower & foundation at his own cost from one of the following institutions.

(a) Indian Institute of Technology.
(b) Structural Engineering Research Centre.

After certification of the design, the successful tenderer should submit the detailed working structural drawings of tower & foundation to AIR.

While sending the working structural drawings, design documents & design drawings etc. to AIR, the following shall be indicated on <u>all the working structural drawings of tower & foundation itself.</u>

(1) AIR AT No. (2) AIR Specification No. & (3) Approval Certificate for soundness and safety of tower & foundation as per AIR specification along with signature, stamp of competent authority as outlined above.

After the acceptance of all working structural drawings by Zonal ADG (E), the successful tenderer shall send all working structural drawings to concerned Zonal ADG (E), concerned AIR Station(s) and DG: AIR indicating all the references. All these working structural drawings as per AIR specifications must be available with all concerned offices before the start of the tower work at the site.

1.6 <u>EXPERIENCE AND RESOURCES:</u>

a. The tenderer is required to submit details of his previous experience in similar type of work i.e. design, fabrication, supply, erection, testing and commissioning of self-supporting TV/Radio or any other towers not less than 50M height, capacity of their plant and their organizational set up for undertaking such works. **The criteria for this will be decided by the Zonal Office.**

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1.7 PATENTS AND COPYRIGHTS:

The tenderer shall hold the purchaser and his employees safe, harmless and immune from any liability that may arise out of infringements of patents and copyrights associated with the design, fabrication, erection and use of the tower and its accessories.

1.8 TIME OF COMPLETION:

Works shall be completed **within twelve months** from the date of placing the order.

1.9 INSPECTION & TESTS:

(a) Test for strength of foundation: The concrete used in the foundation should be designed as per IS:10262 amended to date. Along with the foundation, cubes should be cast, which can be tested on 7 days and 28 days to get the strength of the concrete used in the tower foundation. Reinforcement used in the foundation must also be tested in a NABL approved Laboratory.

(b) Pre-dispatch inspection of tower material by giving an advance notice of TWO weeks shall have to be got done by representative(s) of All India Radio at the premises of the manufacturer. Pre-dispatch inspection of tower material shall be done as per mutually accepted test procedure, which shall be submitted and got approved from All India Radio before the supply of tower material. However for guidance purpose, draft Acceptance Test Protocol is enclosed in **"Annexure-I".** *Travelling expenses for AIR's representative(s) will be borne by AIR.*

b. Structural Steel:

The tenderer shall procure all structural steel members from primary producers as approved by the Ministry of Steel namely SAIL, TISCO, ISCO, and RINL. Structural steel sections not available from main producers can be procured from secondary producers subject to production of proof of manufacture of structural steel members from virgin billets produced from primary steel producers before starting fabrication work. Original copies of the test certificates of steel should be made available at the time of inspection. Samples may be taken at the discretion of AIR and tested at approved laboratory as per provisions in this regard in the relevant IS codes, for which cost shall be borne by the tenderer. In case the test results indicate that the Steel arranged by the tenderer does not conform to relevant IS Codes, the same shall be rejected.

c. Fasteners:

Manufacturer's routine test certificates for bolts, nuts, washers etc. as laid down in relevant IS code shall be submitted by the tenderer at the time of inspection. Samples may be taken at the discretion of AIR and tested at approved laboratory as per provisions in this regard in the relevant IS codes, for which cost shall be borne by the tenderer. In case the test results indicate that the Fasteners arranged by the tenderer does not conform to relevant IS Codes, the same shall be rejected.

d. Galvanizing:

The tenderer shall prepare a detailed galvanizing procedure including Flow Chart with control parameters and all plant standards as required above and submit to AIR as part of Quality Assurance Plan.

e. All standard tests, including quality control tests, in accordance with appropriate BIS standard shall be carried out unless otherwise specified herein.

f. The tenderer shall submit all the test certificates during inspection.

g. In addition to the provisions of clause regarding inspection, following shall also be included:

1. The tenderer shall keep AIR informed in advance about the time of starting and progress of manufacture and fabrication of various parts, so that it can be inspected, if required.
2. The acceptance of any part or items shall in no way relieve the tenderer of any part of his responsibility for meeting the overall requirement of the specifications.
3. Any member of the structure found not to comply with the approved drawings, shall be rejected. No member once rejected should be resubmitted for inspection except in case, where Inspection Officer considers that the defect can be rectified.
4. All welded structures shall be subject to a non-destructive testing as per BIS code requirement and cost should be borne by the tenderer.

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5. All gauges, templates, jigs, fixtures, instruments necessary for inspection and testing shall be provided by the tenderer to AIR for the purpose of inspection.
6. To ensure effective in-process quality control, it is essential that the manufacturer arrange all the testing facilitates for tests like, weight of zinc coating, tensile & shear strength, non-destructive testing of welds etc. The manufacturer should have proper quality assurance system in line with requirement of this specification.
7. Each Piece of steel work shall be distinctly marked before delivery in accordance with marking diagram and shall bear such and other marks as well to facilitate erection.
8. Each individual tower member shall carry a stamped mark (number) assigned to in the approved drawings. These stamping shall be done by a metal die of 16 mm size before galvanizing and on optimum depth so as to be clearly legible after galvanizing.

1.10 CERTIFICATION & COMPLETION REPORT:

(a) After erection of tower, the tower structure shall be inspected and certified for its structural safety & firmness, verticality and all other design specifications by IITs, NITs or any of the recognized Govt. Institution(s). Certified inspection report with all the observations, recommendations etc. shall be submitted to All India Radio. The recommendations/suggestions will have to be incorporated by the tenderer before submitting the final completion report. All costs on this inspection and post inspection corrections, if required, for completeness of the tower shall be borne by the tenderer.

(b) The tenderer is also required to submit duly bound completion report for the reference and record of All India Radio. A soft copy of the above must also be submitted.

1.11 GUARANTEE:

1) The tenderer shall guarantee the stability, safety, durability and satisfactory mechanical behavior of the structure under specified conditions of operation, wind pressure and loading, for a period of **FIVE** years from the date of the taking over of the tower.
2) In the event of structural failure or any component/part of the structure within the guarantee period specified above, the tenderer shall undertake to replace the components/parts which have failed and those which were damaged as a result thereof, free of cost and bear the expenditure to be incurred for re-erection of the tower.
3) All the Electrical/Electronic parts/materials such as AOL, Control Panels, cabling/wiring etc. shall be guaranteed for **THREE** years from the date of handing over.

SECTION-II

2.0 TECHNICAL SPECIFICATIONS:

All the IS Specification referred herein after shall be read with the latest amendments.

2.1 FABRICATION AND DESIGN:

2.1.1 Tower steel section:

(i) All tower members shall be made out of structural steel confirming to IS:2062 amended to date, **High Tensile Structural Steel.**
(ii) The main members in legs, bracings etc, **shall not be less than 6 mm thick.**
(iii) The secondary members, like hand-rails, ladders etc. **shall not be less than 5 mm thick.**

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(iv) In case certain steel sections are not available in the market in the designed thickness, the next higher thickness available should be used.

(v) The bidder shall arrange for procurement of Zinc required for galvanizing the structure by him. The rate of fabrication shall be inclusive of the cost of Zinc and galvanization. The Zinc required for galvanizing shall conform to IS: 209 amended to date or IS:13229 amended to date.

2.1.2 Fasteners (Bolts, nuts and washers):

(i) Assembly of tower members and other structures on tower shall be by means of nuts and bolts alongwith locking nuts/spring washers of approved design as per AIR specification/approved drawings and *Riveting and welding, if the design demands, shall conform to relevant IS specifications.*

(ii) The quality of steel used for nuts, bolts, washers etc. should confirm to mechanical properties as per IS:1367 amended to date and dimension to IS:6639 amended to date.

(iii) The bolts shall be as per design requirement and minimum property class 5.6 as specified in IS:1367 amended to date and matching nut property class as specified in IS:1367 amended to date.

(iv) Nuts should be double chamfered as per the requirement of IS:1363 amended to date.

(v) The shear, bearing & tensile strength shall be in accordance with IS:800 amended to date. The fasteners shall be procured from reputed manufacturers such as UNBRAKO, TVS SUNDRAM etc.

(vi) All the bolts and nuts shall be galvanized by high temperature hot-dip galvanizing in accordance with IS:1367 amended to date. Thickness of galvanizing coating shall also be in accordance with the environmental condition at tower site considering life of tower as 100 years and as per relevant BIS codes. The washers, spring washers shall be hot-dip galvanized as per Grade 4 of IS:1573 amended to date.

(vii) Nut Rotation From Snug Tight Condition:

Bolt length (as measured from underside of head to extreme end of point)	A bolt 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.	1/3 turn	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.	2/3turn	5/6 turn	1 turn

Alternatively nuts may be tightened using a calibrated wrench so that the proof load of the bolt specified in IS: 1367 amended to date 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".

2.1.3 Fabrication:

(i) The fabrication of tower components shall confirm to IS:800 amended to date.

(ii) All steel sections shall be fabricated as per the approved drawings.

(iii) Gas cutting, shearing, sawing, modification of holes, welding etc. is not permitted for finished members at the site.

2.1.4 Drilling and punching:

(i) Holes for bolts shall be drilled or punched with jig, but drilled holes shall be preferred. Punching may be adopted for thickness up to 5 mm. Tolerances regarding punched holes are as follows.

a. Holes must be perfectly circular and no tolerance in this respect will be permissible.

b. The maximum allowable difference in diameter of the holes on the two sides of plates or angles shall

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be 0.8 mm i.e., the allowable tolerance in punched holes should not exceed 0.8 mm on diameter.

(ii) Drilled & punched holes must be square with the plates or angles and have their wall parallel.

(iii) Holes on both side of the bend line in a bent member shall be drilled after bending.

(iv) The mild steel section up to 75×75×6 may be bent by cold process upto bend angle 10° and all other angle sections and bend angles shall be bent by hot process.

(v) The formation of bends by the "Cut & Weld" method unless specified in drawings is not permitted without prior approval of AIR.

(vi) No angle member shall have two leg flanges brought together by closing the angle.

2.1.5 Welding:

(i) Welding, if any, shall be carried out in accordance with IS:816, IS:1024 and IS:9595 amended to date as appropriate.

(ii) Butt welding shall be carried out either by submerged arc or shielded arc welding.

(iii) Pre-heating and post heating shall be employed as may be necessary for welding members.

(iv) For welding of any particular type of joint, welder shall give evidence, acceptable to AIR of having satisfactorily completed appropriate tests as described in relevant BIS codes.

2.1.6 Tolerance:

Fabrication tolerances shall not exceed those specified in IS:7215 amended to date as applicable to group B structures.

2.1.7 Galvanizing:

(i) All steel tower members shall be hot dip galvanized after fabrication is completed. The galvanization of the tower members shall conform to IS:2629 and IS:4759 amended to date.

(ii) The thickness of hot dip galvanizing shall be generally 85 microns (equivalent to 610g/m^2 of Zinc Coating) in accordance with IS:4759 amended to date. However higher coating shall be employed if tower site's environmental & pollution condition warrants so, in accordance with Table 1 of IS:4759 amended to date for hot dip galvanizing.

(iii) All galvanized members shall withstand test as per IS:2633 & IS:3203 amended to date.

(iv) All fasteners shall be galvanized in accordance with IS:1367 amended to date.

(v) Spring washers shall be electro galvanized as per Grade 4 of IS:1573 amended to date.

2.1.8. All steel used shall be galvanized, conforming to relevant IS specification i.e. IS:2629 amended to date for tower members, IS: 1367 amended to date for fasteners and IS:1573 amended to date for washers.

2.1.9. The overall force co-efficient for wind load on tower shall be taken from IS: 875-1987 amended to date for Self-Supporting Lattice Steel Towers. For calculating the solidity ratio, actual obstruction area of tower shall be considered. Separate Wind obstructing areas shall be taken for ladder, cable rack and platforms etc.

2.1.10. The basic dynamic wind pressure at different heights for different zones shall be taken from the Indian Standard Code.

2.1.11. The basic wind velocity for the site is to be taken from BIS Code No. IS:875-1987 amended to date.

2.1.12. The permissible stresses in the various structural members of tower shall be adopted from the relevant clauses of IS: 800 amended to date.

2.1.13. Loading effect due to antenna and various accessories as indicated at Para No. 2.8 will be taken into consideration.

2.1.14. Loading effect of seismic forces as per IS: 1893 amended to date and cyclonic winds and conditions of frost etc., if any, is also be taken into consideration.

2.1.15. Weight of the tower should not be less than **30 MT** (Excluding foundation steel).

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2.2. **FOUNDATION:**

2.2.1. The tenderer is advised to inspect the tower site and acquaint himself with the local terrain & site conditions, soil conditions, nature of sub soil, water table and its seasonal variations etc. and make such local enquiries, as may be necessary for any data required by him, before quoting his rates. Ground has to be properly leveled after erection of the tower & cleared of all debris etc. Foundation is to be protected by provision of pitching work on sloping terrain to protect the foundation from erosion.

2.2.2. For the purpose of this bid, the tenderer shall quote the rates (in the commercial bid) on the basis of **8.2 MT/ Sq. M Soil Bearing Capacity (SBC) at 2 m depth**. The tenderer shall also quote for "Extra for reduced Soil Bearing Capacity (SBC) below **8.2 MT /Sq. M for every 0.55 MT/Sq. M decrease**."

2.2.3. The successful tenderer shall carry out soil tests through NABL approved Laboratory. When a test boring is conducted, all safety requirements are to be taken/ adhered from human safety aspect. Complete test observations will have to be recorded and furnished to All India Radio. After taking samples, the bored hole should be closed properly.

2.2.4. The cement, sand and concrete used shall be of best grade and the concrete shall preferably be mixed in a mechanical mixer in the standard ratio 1:2:4. The foundation shall be watered and cured for at least 14 days and the erection of the tower shall be commenced only after the foundations are thoroughly cured. Measurements of levels of all tower footings will be taken in the presence of AIR representative.

2.3. VERTICALITY TOLERANCES, DEFLECTION, TWIST & SWAY:

2.3.1. **UNDER STILL AIR CONDITIONS:**

2.3.1.1. The tower shall be vertical after erection and no straining shall be permitted to achieve this. The verticality of tower shall be within the provisions of Table-1(III) (b) of IS: 12843:1989 amended to date, viz. ± H/1500 or ± 25 mm (whichever is less) for towers over 30 M height 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. (H refers to the height of the tower).

2.3.2. **UNDER MAXIMUM WIND LOAD CONDITIONS:**

2.3.2.1 The maximum deflection of the axis of tower shall not be more than 1/100 of tower height from vertical at various levels including top, under maximum wind and other critical loading condition.

2.3.2.2 The angular twist shall not exceed 0.5 degree.

2.3.2.3 The sway shall not exceed 0.5 degree.

2.4. **PROTECTION AGAINST LIGHTNING:**

The tower shall be provided with a suitably designed complete system of lightning protection in accordance with the relevant latest IS code including necessary earthing based on the specific resistivity of the soil and sub-soil water level. The lightning protection system shall be got approved from All India Radio, before execution. Copper strip of size **50 mm×3 mm** is to be provided for Lightning Arrester from top of the tower to the ground to be connected to tower earthing system.

2.5. **PAINTING:**

(a). For Non-coastal Area

2.5.1. The tower shall be given one coat of ETCH primer (2 Pack) followed by two coats of Zinc Chromate primer and two or more coats of synthetic enamel paint after erection. The tower shall be painted to have equal alternate bands of international orange and white colours with top and bottom bands painted in orange as per latest International Civil Aviation Organisation Recommendations.

2.5.2. The paints used in painting shall be in accordance with IS: 2074, IS: 2932 & IS: 2933 amended to date.

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2.5.3. Etch primer shall confirm to IS: 5666 amended to date and Priming of Zinc Chromate shall conform to IS: 104 amended to date.

2.5.4. Painting shall be done in accordance with IS: 1477 Part I & II amended to date.

2.5.5. The minimum dry film thickness shall be 8 microns of ETCH primer, 40 microns of each coat of Zinc Chromate primer and 40 microns of each coat of synthetic enamel paint. The overall Dry Film Thickness (DFT) should not be less than 168 microns.

(b). For Coastal Area

2.5.6. The tower shall be given one coat of ETCH primer (2 Pack) followed by two coats of Epoxy Red Oxide Zinc Phosphate Weldable primer(Two component) and two or more coats of Polyurethane Full Gloss Enamel(Two Pack) paint after erection. The tower shall be painted to have equal alternate bands of international orange and white colours with top and bottom bands painted in orange as per latest International Civil Aviation Organisation Recommendations.

2.5.7 The paints used in painting shall be in accordance with IS: 13213 amended to date.

2.5.8. Etch primer shall confirm to IS: 5666 amended to date and Epoxy Red Oxide Zinc Phosphate Weldable primer(Two component) shall conform to IS: 14506 amended to date.

2.5.9. Painting shall be done in accordance with IS: 1477 Part I & II amended to date.

2.5.10. The minimum dry film thickness shall be 8 microns of ETCH primer, 25 microns of each coat of Epoxy Red Oxide Zinc Phosphate Weldable primer(Two component) and 35 microns of each coat of Polyurethane Full Gloss Enamel(Two Pack) paint. The overall Dry Film Thickness (DFT) should not be less than 128 microns.

2.6. **EARTHING FOR TOWER:**

All the four tower legs shall be earthed individually, following the standard practice of earthing of such structures in level ground and mountainous regions (Details shall be attached with the tender). *The earth resistance of the tower earthing shall be less than 1 ohm.* A suggestive **drawing No. TM-16597** for earthing is enclosed.

2.7. **FACILITIES ON TOWER:**

The following facilities are required to be provided on tower:

2.7.1. **PLATFORM:**

Provision of platform for access to the antenna and cables at different levels to be made. 1.5 meter high handrails would be provided at each level with expanded metal net for additional safety. Platform flooring will consist of chequered plate conforming to IS:3502 amended to date and shall be designed as to take stationary and moving load of 4 persons plus equipment (weighing about 100 Kg.). At each platform "Toe-plates"(6") as a form of protection against accidental dislodging of small tools, are to be provided.

2.7.2. **LADDERS:**

2.7.2.1. An internal ladder of width not less than 300 mm starting from ground level of the tower and going up to the top with openings at all the platforms shall be provided. The ladder shall be foldable/ retractable at the ground level and length of foldable/retractable portion of ladder should not be more than 1.5M. The ladder shall be hooped type with **FREE FALL PREVENTION SYSTEM** for safety of the climbing personnel. The face on which the ladder is to be provided shall be intimated by All India Radio before the commencement of erection of tower.

2.7.2.2. Rungs of the ladder shall be clear of any obstructions to the climber and equally spaced by not more than 250 mm.

2.7.3 **AVIATION OBSTRUCTION LIGHTS & POWER CABLES:**

(Manzoor Ali, AE) (P.K.Sharma, AE) (Aditya Chaturvedi, DE) (S.Hyder, DE)

a) LED based Aviation Obstruction Lights including beacon light (with twin aviation obstruction light arrangement in 'ON' duty and 'STANDBY' mode with alarm monitoring) should be provided. The globes and their housings shall be strong, weather proof and of approved manufacturer. There shall be 2 lights located diagonally at each level, except the top level. The aviation obstruction lighting arrangement shall be as per latest International Civil Aviation Organization Recommendations.

b) Power supply load of the aviation lights shall be evenly distributed on all the three phases, in order to ensure that with failure of the single phase all the lamps at each level do not go off. The power supply cable for the lights shall conform to IS: 1554 amended to date or the power supply cables for the aviation lights shall be liberally rated and shall conform to the latest Indian Standard specifications.

c) One No., 3 Core, 6 Sq. mm copper conductor (Stranded), XLPE insulated, sheathed, weatherproof, armoured Power Supply cable for Multipoint power sockets on each platform shall be supplied and laid & clamped to the cable rack. This cable shall be terminated in SP&N MCB of suitable rating in a suitable weather proof metal box at the tower base including the earthing etc. Power sockets with switches of suitable rating shall be provided and suitably mounted at each platform in weatherproof boxes.

d) Two Nos. 4 core, suitably rated, copper conductor, XLPE insulated, sheathed, weather proof, armoured power supply cable for AOL shall be provided and laid on vertical Cable Tray and fixed with cable clamps. This cable shall be terminated in TP&N MCB of suitable rating in a suitable weatherproof metal box at the tower base including the earthing etc.

e) Distribution of supply to Aviation Obstruction Lights shall be through suitable weatherproof junction boxes with suitable mounting.

f) The successful tenderer shall provide temporary Aviation Obstruction Lights during erection of tower as soon as the tower reaches the height of 25 meters or such heights as prescribed in latest International Civil Aviation Organization Recommendations.

g) A "Sun Switch" is required to be provided for AOL so that these are "ON" automatically, if sufficient sunlight is not available around tower. In no case, Sun Switch is to be installed inside a room or covered space.

h) The details of Power Supply arrangements for aviation obstruction lights shall be provided with the tender.

i) The LED based AOL offered shall be approved by National Physical laboratory (NPL) / ERTL / and test report for the same must be submitted with the offer as well as with the material.

j) The detailed internal circuit diagram of the AOL, No. of LEDs used, details of configuration of LEDs (series parallel arrangement etc.) should be submitted with the offer.

2.7.4. CABLE RUN-WAY AND ANTENNA SUPPORTING FIXTURES:

2.7.4.1. Vertical Cable Rack:

The vertical cable rack for laying cables as indicated in Para 2.8.2 starting from the base to the top of the tower shall be provided. This cable rack shall be routed along the tower face or leg and should be just behind the climbing ladder or be a part of this for easy accessibility. The cable rack shall carry all the RF feeder cables, AOL & Service cables etc. It should have provisions for fixing the cable clamps. Reference drawing No. TM-16640 is enclosed.

2.7.4.2. Side Mounted FM Antenna Fixtures:

Provision for fixing 100 mm inner dia. supporting seamless GI pipe Class "C" of 18 M length for side mounting VHF FM Pole type Antenna as per drawing No. TM-15404 shall be made on three faces of the tower. This supporting pole will be fixed in VHF FM Band -II Aperture on *one of the three faces, to be intimated at the time of erection of tower*. The fixtures of the antenna shall not foul with the cable routing from the power divider to the antenna. The above pipe shall be supplied by the tenderer as part of tower.

2.7.4.3. Top Mounted Antenna Fixtures:

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Provision is to be made for fixing 100 mm inner dia. supporting seamless GI pipe Class "C" of 12 M length as per drawing No. TM-16239 for top mounting VHF FM Pole Type Antenna for second channel in future.

2.7.4.4 **Horizontal Cable Rack:**

The cable run between the tower base & transmitter building shall be through a horizontal cable tray to be provided by the tenderer. The rack will be supported on 75 mm inner dia. Class "C" G.I. pipes or 60×60×5mm G.I. angle iron structures & the rack will be covered by Semi Circular or suitable design 16 SWG G.I. sheet cover. The tenderer must quote for the horizontal cable rack on the basis of **per meter rates.** The pricing for horizontal cable rack should include the laying charges of all cables on this tray. Reference drawing No. TM-14453/3 is enclosed. Pipes or angle frames should be grouted with RCC in ground as per practice and have a height of 4 Mtrs. from the ground.

2.8. LOADING DUE TO FM ANTENNA, YAGI ANTENNA, MICROWAVE DISH & RF CABLES ETC.

2.8.1. The following Net weight and Wind loading figures may be taken into consideration in respect of Antenna, cables etc. Ice loading shall also be taken into design as per site requirement, if required. These are in addition to self loading of tower.

S. No.	Description	Net weight (Kg)	Wind load (Kg)	Remarks
1.	6/8-Bay Side Mount (Pole Type) FM Antenna	600	900 at 198 Km/hr.	Weight & wind loading due to support column/ mounting accessories not included.
2.	Top Mounted (FM Antenna)	250	400 at 198 km/.hr.	-do
3.	Microwave Dish Antenna-2 nos. (Dia 2.1 M solidity factor 0.25)	50 each	To be calculated by the tenderer	Provision of 2 Microwave dishes at lower platform.
4.	Yagi Antenna-2 nos.	30 each	-do-	Provision of 2 Yagi Antenna at lower platform.

The above weights do not include weight of the Antenna Supporting Interface on which the antenna will be mounted.

2.8.2. The following cables are to be installed on tower. Wind loading due to these may also be taken into consideration.

S. No.	Description of item with weight in Kg.	Qty.
1.	4" RF Coaxial cable (Approx 5.50 Kg per metre)	2 Nos.
2.	1-5/8" RF Coaxial cable (Approx 1.50 Kg per metre)	2 Nos.
3.	7/8" RF Coaxial cable for M/W Dish Antenna (Approx. 0.50 Kg per metre)	2 Nos.
4.	RF Coaxial cable for Yagi Antenna (Approx. 0.20 Kg per metre)	2 Nos.
5.	3 Core, 6 Sq. mm Power Supply cable*	1 No.
6.	LED based Aviation Obstruction Light cable*	2 Nos.

(* items are to be supplied by tenderer including lugs, connectors etc.)

2.8.3. The weight and wind load of VHF FM antenna fixtures and 100 mm inner dia. seamless G.I. pipe Class "C" of 18M length is required to be taken into consideration for loading by the tenderer as per design.

2.9. WORKMANSHIP:

(Manzoor Ali, AE) (P.K.Sharma, AE) (Aditya Chaturvedi, DE) (S.Hyder, DE)

a. All workmanship for foundation work shall be in accordance with specifications, approved drawings and IS: 456 amended to date.
b. The tenderer shall carryout excavation in all kind of soils. While excavating, excavation shall be adequately supported or formed to ensure stability of the sides and prevents any damage to the surrounding ground or structures.
c. Excavation material suitable for re-use as backfill shall be stored within the site working area.
d. For excavation in cohesive soil the final 150 mm above foundation bottom level shall only be removed immediately prior to placing to M10 concrete pad.
e. The tenderer shall not permit water accumulation in excavated pit.
f. The tenderer shall carry out concrete trial mix using representative materials. Mix proportioning shall be carried out under full scale condition as per IS: 10262 amended to date. The testing shall be carried out in accordance with IS: 456 amended to date. Minimum three test cubes shall be tested.
g. The aggregate and cement shall be proportioned by means of efficient weigh batching machines. The machine shall be maintained & cleaned periodically.
h. The concrete shall be mixed in batches, in concrete mixing machines, which shall comply to IS Codes. Manual or hand mixing is not permitted.
i. The tenderer shall carry out slump or other workability tests as required during concreting of work, in order to relate the degree of workability of the mix to the values obtained during the trial mix.
j. All frameworks shall be accurately constructed to produce the correct foundation shape and shall be sufficiently strong to withstand pressure arising from concrete during placement and compaction.
k. Reinforcement bar shall be bent and fixed in accordance with procedure specified in IS: 2502 amended to date. The high strength deformed steel bars should not be re-bent, straightened. All the reinforcement should be placed and maintained in the position as shown in the drawing by providing proper block, spacers and supporting bar.
l. The concrete shall be placed in layer maintaining proper cover of reinforcement, which shall be compacted by vibrators.
m. The curing & protection shall start immediately after compaction of the concrete and shall ensure adequate protection.
n. Backfilling shall be compacted in 300 mm layers to achieve a bulk density of not less than 1.7 MT/m^3.
o. The tenderer shall clear the site from all surplus soil and other materials before handing over the tower to AIR.
p. Inspection and testing of concrete work shall be in accordance to provisions of IS: 456 amended to date.
q. In case of rock anchorage type foundation, workmanship & other requirements shall be in accordance with IS: 10270 amended to date.

2.10. Marking of Members

Each individual tower member shall carry a stamped mark (number) assigned to in the approved drawings. These stamping shall be done by a metal die of 16 mm size before galvanizing and on optimum depth so as to clearly legible after galvanizing. A plate indicating the name of the tower, Specification No., AT No., Manufacturer's identity and year of manufacture shall be supplied by the tenderer for display at the bottom of the tower.

2.11. Packing

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

a. Angle shall be packed in bundles securely wrapped four times around at each end and over 900 mm with No. 9 SWG gauge wire with ends twisted tightly. Gross weight of any bundle shall not exceed 450 Kg.
b. Angles, brackets, plates and similar small loose pieces shall be tested and bolted together in multiples, and securely wired together through holes wrapped round at least four times with No. 9 SWG steel wire and ends twisted tightly. Gross weight of each bundle shall not exceed 70 Kg.
c. The correct numbers of bolts, nuts and washers plus extra bolts, nuts and washers for the tower shall constitute a packing unit and shall be dispatched packed in crates or wooden boxes strong enough to withstand the normal vigorous transit and handling. The various sizes of bolts, nuts and washers shall be kept in separate bags inside

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the main container. Each container shall carry a list of the bolts contained therein printed in water-proof ink, resistant to moisture. Weight of the container shall not exceed 70 Kg.

2.12. Marking of Packages

Each bundle or package shall have the following details marked on it.

a. The name and address of the Consignee.
b. The relevant marks and number of tower members or reference of bolts, nuts and small components like gusset plates, various attachments etc. for easy identification.
c. The marking shall be stenciled in indelible ink on the top member of the bundle of tower steel and on wooden boxes or gunny bags containing smaller components.
d. DD shall, in no case, be responsible for loss of any package or bundle during transit. It shall be the responsibility of the bidder to replace the lost items free of cost.

2.13. Additional items of works

Mounting of Antenna system:

After the erection of the tower, the tenderer shall also mount VHF FM Antenna, RF cable, junction boxes etc, on the tower as per details. The antenna system and RF feeder cables will be provided by AIR.

For the sake of completeness of works, the tenderer may have to undertake minor/major items of works that may become necessary for the mounting of antenna system mentioned hereto.

2.14. List of Annexure/Drawings:

2.14.1. Draft Acceptance Test Protocol (ATP)	- Annexure-I
2.14.2. Tower profile (General Arrangement)	- Drg. No. TM-16239
2.14.3. Mounting Arrangement of 6-Bay FM Antenna	- Drg. No. TM-15404
2.14.4. Details of Horizontal Cable Rack	- Drg. No. TM-14453/3
2.14.5. Details of Vertical Cable Rack	- Drg. No. TM-16640
2.14.6. A suggestive Earthing drawing	- Drg. No. TM-16597

SECTION-III

SCHEDULE OF REQUIREMENTS/MATERIALS (UN-PRICED) FOR 50M SELF SUPPORTING LATTICE STEEL TOWER (FOR EACH TOWER)

I). SUPPLY OF MATERIAL AT SITE: (*All the following items shall conform to detailed AIR Specification*)

S. No.	DESCRIPTION	Make & Model	QTY.	UNIT
1.	Supply of 50M tower superstructure material including Fabrication, Galvanizing *as per AIR Specification* complete as required. # *Quantity in Metric Ton (MT) offered to be mentioned by tenderer.*		#MT	MT
2.	**Accessories:**			
(i)	Supply of LED based Aviation Obstruction Light including beacon light (with twin aviation obstruction light arrangement in 'ON' duty and 'STANDBY' mode with alarm) along with Sun-Switch, Control Panel (with MCBs, alarm indicators etc.), Power Supply Cable and accessories etc. complete as required.		1 Set Complete	Set Complete

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(ii)	a) Supply of 3 Core, 6 Sq.mm, Copper Conductor (Stranded), XLPE insulated, Sheathed, armoured, weather proof cable with lugs etc. complete as required.		130 M	M
	b) Supply of 32 A, SP&N MCB along with weather proof metal boxes with multipoint power sockets and switches at base and each platforms, earthwire etc. complete as required.		1 Set Complete	Set Complete
(iii)	Supply of Vertical ladder material with Free Fall Prevention system complete as required.		1 Lot	Lot
(iv)	Supply of Horizontal Cable Tray material as per specification complete as required.(Rate per meter shall be quoted)		25M	M
(v)	Supply of Vertical Cable Tray material as per specification complete as required.(Rate per meter shall be quoted)		50M	M
(vi)	Supply of Lightning Arrester material complete as required.		1 Set Complete	Set Complete
(vii)	Supply of tower earthing system material for 50M tower (4 Nos. earthing) along with copper strips as per AIR specification.		1 Lot	Lot
(viii)	Supply of 100 mm inner dia. Class 'C', seamless GI pipe of *18 M length*		1 Job	Job
5.	Submission of working structural drawings of 50M tower (for foundation and tower structure) as per AIR specification to: a) AIR Station -1 set c) Zonal Office -1 set d) DG: AIR -1 set		3 Sets Complete	Set Complete
6.	Submission of certified inspection report for structural safety & firmness, verticality and all other design specifications by IITs, NITs or any of the recognized Govt. Institution(s) after erection of tower to Zonal ADG (E).		2 Sets Complete	Set Complete
7.	Submission of Completion Report (soft & hard copies) including photographs showing complete tower as well as each section of 20 M length from base to top, horizontal cable tray and foundation processes - starting of excavation, steel layout and reinforcements etc. to leveled finished foundation to: a) AIR Station -1 set c) Zonal Office -1 set d) DG: AIR -1 set		3 Sets	Set
8.	Any other items required for the completeness of the system. Items wise details (including part No., if any) are to be given by the tenderer.		1 Set	Set
	TOTAL OF SUPPLY (A)			

II). WORKS:

(All the following works shall conform to detailed AIR Specification)

S. No.	Description	Qty.	Unit
1.	Design of 50M tower & foundation as per AIR specifications *and* Submission of SERC/IIT approved design documents and design drawings (soft & hard copies) duly signed & stamped by competent authority and working structural drawings of 50M tower (for foundation and tower structure) as per AIR specification to Zonal ADG (E).	1 Job	Job

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2.	Erection, Testing and Commissioning of 50M Self Supporting Lattice Steel tower at site as per AIR specification complete as required.	1 Job	Job
3.	Casting of tower foundation including Supply of complete raw materials, hardware, labour, site clearance etc. as per AIR specification complete as required.	1 Job	Job
4.	Soil testing with detailed report & document	1 Job	Job
5.	Fixing of LED based Aviation Obstruction Lights along with cable & MCB complete as required.	1 Job	Job
6.	Painting of tower including paint materials complete as required.	1 Job	Job
7.	Earthing work for tower (4 Nos. earthing) complete as per AIR specification.	1 Job	Job
8.	Tower Lightning Arrester installation work complete as required.	1 Job	Job
9.	Fixing of 100 mm inner dia. Class 'C', seamless GI pipe of 18 M length for mounting provisions for VHF FM Antenna complete as required.	1 Job	Job
10.	Fixing of Vertical ladder with Free Fall Prevention System complete as required.	1 Job	Job
11.	Fixing of Vertical Cable Tray with clamps complete as required. (Rate per meter shall be quoted)	50 M	M
12.	Fixing of Horizontal Cable Tray with clamps complete as required. (Rate per meter shall be quoted)	25 M	M
13.	Laying of power supply cable and fixing of weather proof metal boxes with Multipoint Power sockets and switches at base and each platforms, fixing of 32 A, SP&N, MCB including connections, testing etc. complete as required.	1 Job	Job
14.	Pre-dispatch inspection of tower materials at the works of OEM/tower manufacturer	1 Job	Job
15.	Any other works required for the completion of DSETC. Break up details of work are to be given by the tenderer.	1 Job	Job
	TOTAL OF WORKS (B)		
16.	Additional charges for reduced soil bearing capacity below 8.2 MT/Sq. M **for every 0.55 MT/Sq. M decrease.**	1 Job	Job

III. (OPTIONAL) {The tenderer must quote all items}

S. No.	DESCRIPTION	Qty.	Unit
1.	Hoisting of VHF FM Antenna & laying of RF Coaxial Cable as required.	1 Job	Job

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ANNEXURE-I

PRASAR BHARATI
(India's Public Service Broadcaster)
DIRECTORATE GENERAL: ALL INDIA RADIO
(PLANNING & DEVELOPMENT UNIT)

ACCEPTANCE TEST PROTOCOL FOR 50M SELF SUPPORTING LATTICE STEEL TOWER

AIR Specification No. 50M(FM Tower)/19/May/2016-D(TD/FM) *for Design, Supply, Erection, Testing and Commissioning of 50M Self Supporting Lattice Steel tower including provisions for mounting of VHF FM Antenna, Microwave Dish Antenna, Yagi Antenna and their feeder cables etc. may be referred.*

I. PRE-DISPATCH TEST/ INSPECTION PROCEDURE:

A. Raw Material:

S. No.	Description	Specification	Procedure of Verification
1.	Steel pipes, M.S. Angles, M.S. Plates, M.S. Flats, M.S. Rods, Chequered plates	As per IS amended up to date	Verification of Quality Control (Q.C.) reports of supplier/Manufactures test certificates

B. Manufactured component / sub-assemblies:

S. No.	Description	Specification	Procedure of Verification
1.	Base shoe, Typical Bay proof assembly, Welded Components, Galvanizing, Fasteners bolts & nuts	As per IIT/SERC approval & acceptance of Directorate	Verification of Quality Control (Q.C.) reports and random checks shall be made on any chosen items for conformity with Quality Control reports

C. Accessories:

S. No.	Description	Specification	Procedure of Verification
1.	**Cables** a. Power Supply cable b. AOL power supply cable	As per AIR Specification	Verification of Quality Control (Q.C.) reports/Manufactures test certificates
2.	Lightning Arresters		
3.	AOL, Sun Switch & accessories		
4.	Copper earthing material		

Test results and inspection report in respect of part-I (A, B, C) shall be submitted by the tenderer after inspection by the authorized inspecting officer of AIR.

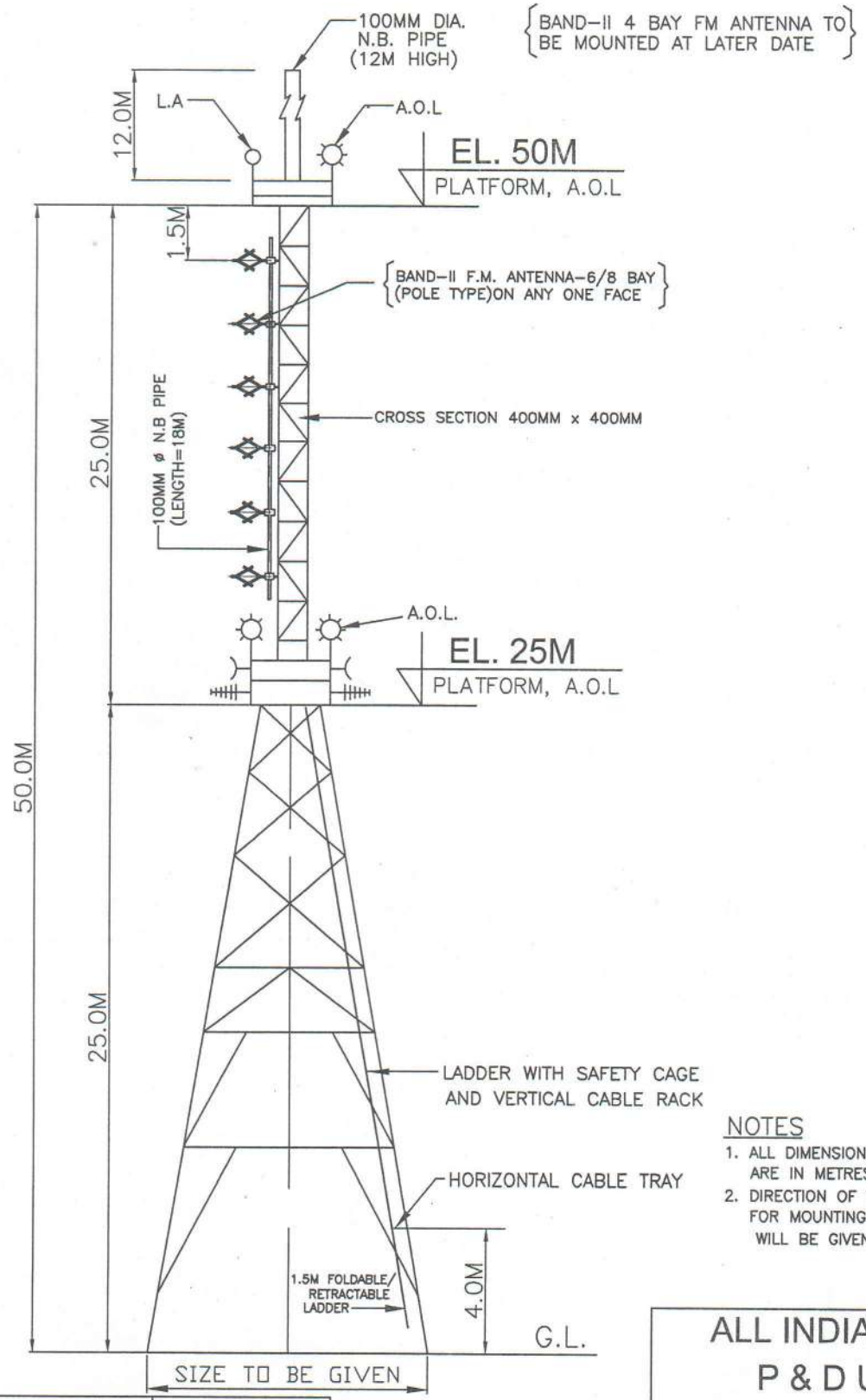
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50M HIGH F.M. TOWER

(FOR REFERENCE ONLY)

SCALE:– N.T.S.



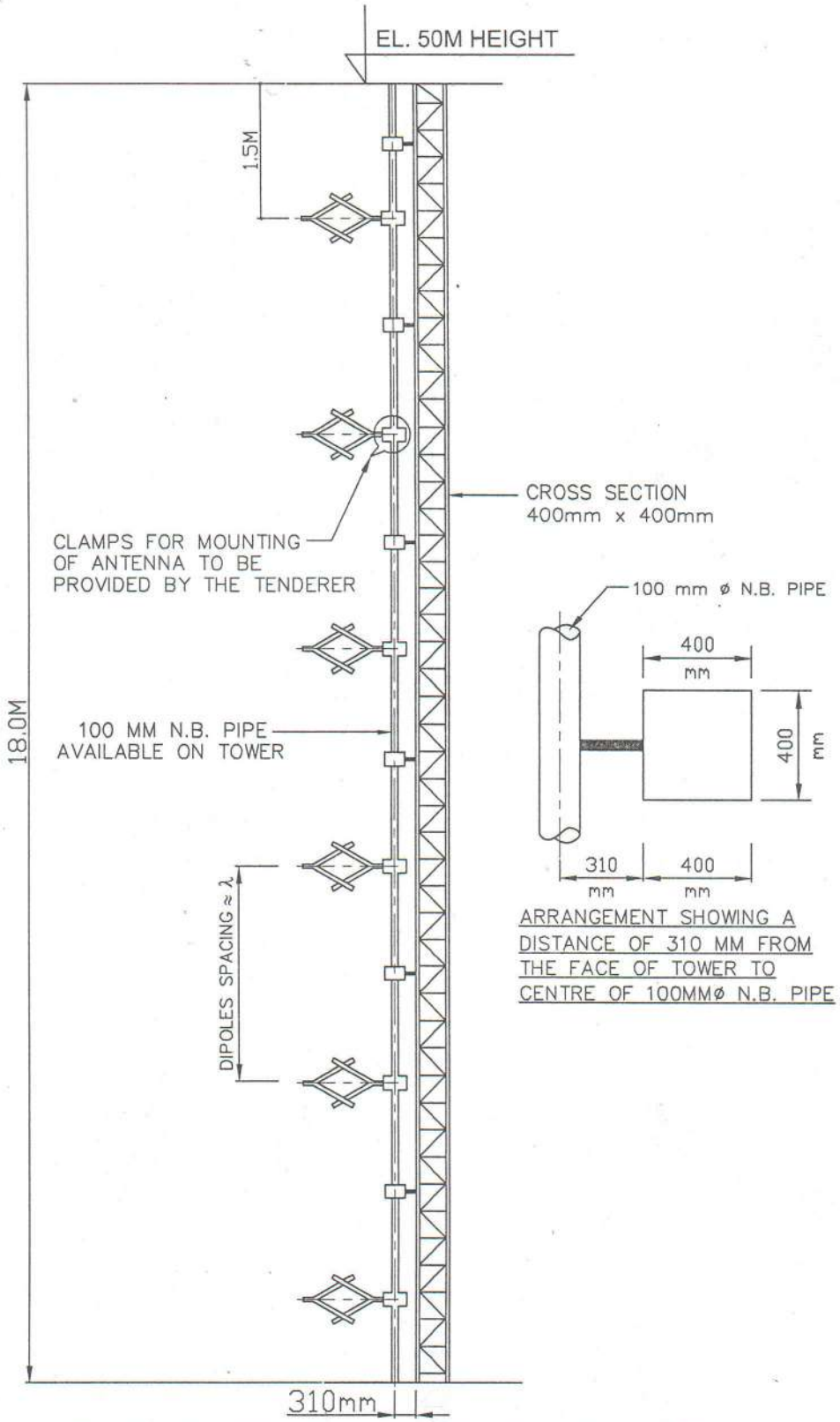
NOTES

1. ALL DIMENSIONS AND LEVELS ARE IN METRES.
2. DIRECTION OF TOWER FACE FOR MOUNTING F.M. ANTENNA WILL BE GIVEN LATER ON.

DRN: –	A.E.	D.E.

ALL INDIA RADIO
P & D UNIT
DRG.No. TM - 16239

1168115/2024/Tx Design Division - P&D Unit



ARRANGEMENT SHOWING A DISTANCE OF 310 MM FROM THE FACE OF TOWER TO CENTRE OF 100MMø N.B. PIPE

MOUNTING ARRANGEMENT OF 6 BAY FM ANTENNA ON TOWER (DRG. FOR REFERENCE ONLY)

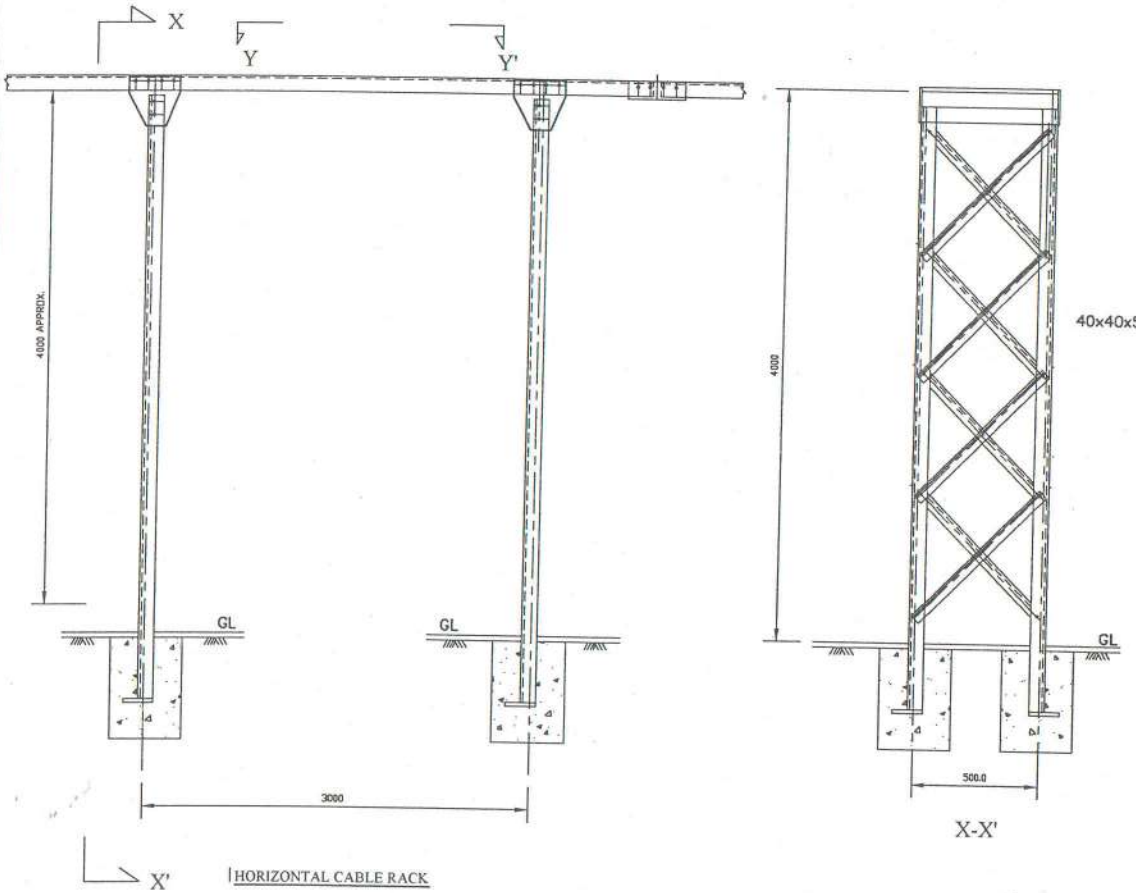
SCALE:– N.T.S.

DRN:–	A.D.E.	D.D.E.

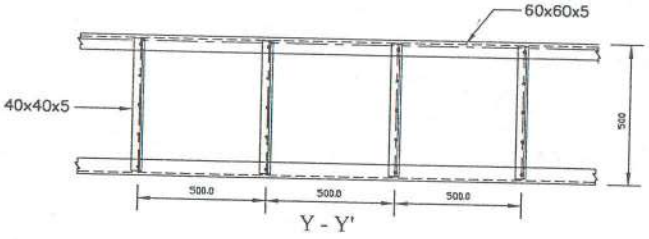
ALL INDIA RADIO
P & D UNIT
DRG.No. TM - 15404

1168115/2024/Tx Design Division - P&D Unit

S NO	DATE	BRIEF RECORD	INITIAL
1	4.10.99	DISTANCE BETWEEN TWO LEGS OF HORZ. CABLE RACK CHANGED & WIDTH OF RACK IN SECTION X–X' & Y–Y' CHANGED & MEMBER SIZE GIVEN IN mm.	Sd/
2	29.10.07	SIZE OF ANGLE IRON OF HORIZONTAL TRAY CHANGED TO 60x60x3 mm. & SHAPE OF G.I. SHEET COVER CHANGED TO SEMI–CIRCULAR	
3	12.02.09	SIZE OF ANGLE IRON OF HORIZONTAL TRAY CHANGED TO 60x60x5 mm.	Sd/–

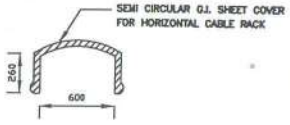


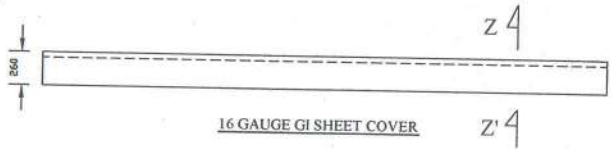
HORIZONTAL CABLE RACK



NOTES:--

1. THIS DRG. IS FOR REFERENCE ONLY.
2. THE HEIGHT OF HORIZONTAL RACK WILL BE ABOUT 4.0 M.
3. MAXIMUM SPACING BETWEEN VERTICAL SUPPORTS BE 4.0 M.
4. 16 GUAGE G.I. SHEET COVER SHOULD BE PROVIDED ON HORIZONTAL CABLE RACK TO PROTECT CABLES.
5. ALL DIMENSION ARE IN MILLIMETRES.





16 GAUGE GI SHEET COVER

	DATE	NAME
DRN	4 8 99	A.S.BHOOJAN
TRD	24 10 07	KALOMBA
CHD		
COMP		
C.D.		

SCALE:– N.T.S.

Sd/ A.D.E | Sd/ D.D.E

GENERAL

DETAILS OF HORIZONTAL CABLE RACK

ALL INDIA RADIO
P&D UNIT
NEW DELHI,INDIA

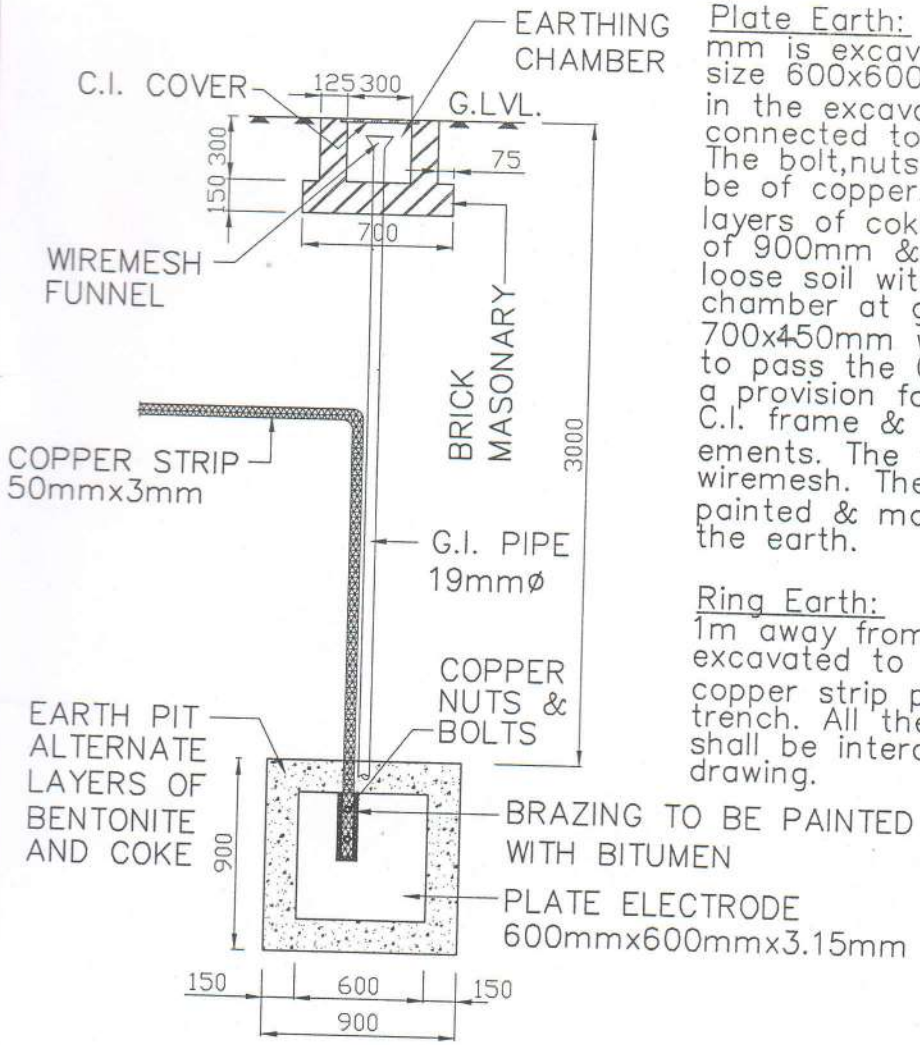
APPROVED:–

NO. TM- 14453/3

NO. TM- 14453/3

(SUGGESTIVE DRAWING)

PLATE EARTHING

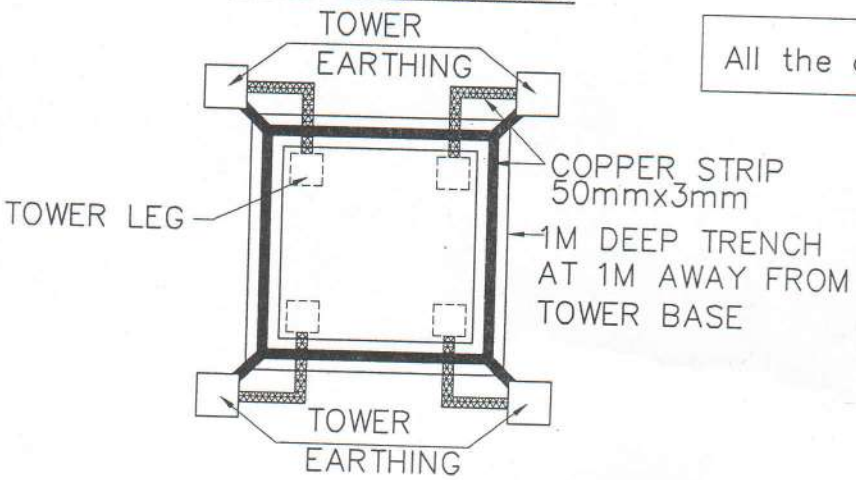


NOTES:-

Plate Earth: Pit size of 900x900x3900 mm is excavated & copper plate of size 600x600x3.15mm is placed vertically in the excavated pit. The plate shall be connected to copper strip of 50x3mm. The bolt,nuts,check nuts & washers shall be of copper. The pit is filled with alternate layers of coke & bentonite up to a depth of 900mm & remaining portion filled with loose soil without stones. The masonary chamber at ground level of size 700x 700x~~1~~50mm with a hole in the middle to pass the G.I. pipe of 19mm dia with a provision for funnel & provided with C.I. frame & cover with locking arrang-ements. The funnel shall be fixed with wiremesh. The main hole cover shall be painted & marked with resistance of the earth.

Ring Earth: The trench all-around at 1m away from the tower base shall be excavated to a depth of 1m. 50x3mm copper strip placed at the bottom of the trench. All the copper earth electrodes shall be interconnected as shown in the drawing.

RING EARTHING



All the dimensions are in millimeters.

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