

SECTION – X (A)

(VOLUME – IIB)

TECHNICAL SPECIFICATIONS

FOR

STUB SETTING AND CASTING OF FOUNDATIONS

(VOLUME – IIB)

SECTION-X(A)

**TECHNICAL SPECIFICATIO FOR STUB SETTING AND CASTING OF
FOUNDATIONS**

1.0	TESTING OF SOIL
2.0	EXCAVATION
3.0	SETTING OF STUBS
4.0	MIXING, PLACING, COMPACTING OF CONCRETE AND REINFORCEMENT
5.0	BACK-FILLING AND REMOVAL OF STUB TEMPLATE
6.0	CURING
7.0	BENCHING
8.0	PROTECTION OF TOWER FOOTING
9.0	MEASURING OF BACK FILLING
10.0	EARTHING

(VOLUME – IIB)

SECTION-X (A)

TECHNICAL SPECIFICATION FOR STUB SETTING AND CASTING OF FOUNDATIONS

1.0 Setting of stubs:

- 1.1 The stubs shall be set correctly in accordance with the approved method at the exact location aligned precisely to correct levels with the help of stub setting template and leveling instruments. Stubs shall be set in the presence of owner's representative only and contractor shall sufficiently intimate in advance to the Owner's representative for such presence.
- 1.2 Setting of stubs shall be approved by the Owner's representative.
- 1.3 The following tolerances shall be applicable in case of position of foundation as a whole with reference to the tower position as spotted on the survey chart:

<u>Type of Tower</u>	Out of alignment	From centre line of route	From transn. Centre line
Suspension or Intermediate	0.5°	± 25 mm	± 25 mm
Section or Tension (Set at bi-section of deviation angle)	0.5°	± 25 mm	± 25 mm

- 1.4 The Owner may get certain foundations such as well type or pile type constructed through other agencies. However, the contractor shall be required to set the stubs for the same and coordinate his work with the other agencies accordingly.

2 Mixing, Placing, Compacting of Concrete and Reinforcement:

- i) The concrete shall be mixed in a mechanical mixer. However, in case of difficult terrain hand mixing may be permitted at the discretion of the Engineer. The water for mixing concrete shall be fresh, clean and free from oil, acids and alkalis. Saltish or brackish water shall not be used.
- ii) Mixing shall be continued until there is uniform distribution of material and the mix is uniform in colour and consistency, but in no case the mixing shall be done for less than two minutes. Normally, mixing shall be done close to the foundation, but where this is not possible mixing may be resorted to at the nearest convenient place. The concrete shall be transported from the place of mixing to the place of final laying/placing as rapidly as practicable by methods, which shall prevent the segregation or loss of any ingredient. The concrete shall be placed and compacted before setting commences.
- iii) The concrete shall be laid in 150 mm layers and consolidated well so that the cement cream works up to the top and no honey-combing is left in the concrete. However, in case of difficulty terrain, manual compaction may be permitted at the discretion of site Engineer. After concreting the chimney portion to the required height, the top surface should be finished smooth with a slight slope towards the outer edge, to drain off any rain water falling on the coping, and making ingress in to the stub angle.
- iv) In wet locations, the site must be kept completely de-watered, both during the placement of concrete and for 24 hours thereafter. There should be no disturbance on concrete by water during this period.

- v) The formwork shall be removed 24 hours later after concreting or after the concrete has fully set. If the concrete surface is found to be defective on removal of the formwork, the damage shall be required with rich cement and sand mortar to the satisfaction of the Engineer's representative before the foundation pits are back filled.
- vi) The concrete volume and dimensions of the foundation shall be as per approved drawings. Measurement of concrete volume shall be in cubic metres and shall be worked out to the second decimal place.
- vii) Steel required for reinforcement of foundations shall be provided for by the contractor. No payment will be made for wire required for binding the reinforcement, chairs, bolsters and spacers, as the cost of these is deemed to be included in the unit rate quoted for reinforcement.
- viii) The payment for foundations shall be restricted to the ceiling volumes or design volumes whichever is lower.

3 Back-filling and removal of stub template:

- i) Following the opening of the form work and removal of shoring and timbering, if any, back-filling shall be started, after repairs, if any, to the foundation concrete, Back-filling shall normally be done with the excavated soil, unless it consists of large boulders/stones, in which case the boulders shall be broken to a maximum size of 80 mm. At such locations where borrowed earth is required for back filling, this shall be done by the Contractor at his own cost, irrespective of lead.
- ii) The back-filling materials should be clean and free from organic or other foreign materials. The earth shall be deposited in maximum

200 mm layer, leveled, wetted and tamped properly before another layer is deposited. Care shall be taken that the back filling is started from the foundation ends of the pits, towards the outer ends. After the pits have been back-filled to full depth, the stub template may be removed.

- iii) The back filling and grading shall be carried to an elevation of about 75 mm above the finished ground level to drain out water. After back-filling a 50 mm high earthen embankment (Bund) shall be made along the sides of the excavated pits and sufficient water will be poured in the back-filled earth for at least 24 Hours.

4 Curing:

The concrete after setting for 24 hours shall be cured by keeping the concrete wet continuously for a period of 10 days after lying. The pit may be back filled with selected earth sprinkles with necessary amount of water for a period of 24 hours and thereafter both the back filled earth and exposed chimney top shall be kept wet for the remainder of the prescribed time of 10 days. The uncovered concrete chimney above the back-filled earth shall be kept wet by providing empty cement bags dipped in water fully wrapped around the concrete chimney for curing and ensuring that the bags are kept wet by the frequent pouring of water on them.

5 Protection of tower footing:

- i) Special measures are required for protection of tower footings located close to or in nallahs, river streambeds, etc. and subject to approval by the Engineer. The work includes all necessary stone revetment, concreting, earth filling above ground level, providing suitable revetment or galvanized wire netting and meshing packed with boulders. The contractor shall furnish recommendations for

providing protection at such locations. The Bidders are required to furnish unit rates for such protective works in the price schedules. The unit rates shall be applicable with actual quantities of revetment and extra excavation work done if any.

- ii) On ordinary flat ground, the stubs shall be set with their tops above ground level as per design and given a coping but not marking up of plinths shall be required. Where the ground surface is irregular, the foundation shall be finished off in a substantial and permanent way forming a plinth by side cutting, building a suitable stone revetment or in case of rock foundations by building up with cement, as desired by the Engineer.

The quantity of excavated earth obtained from a particular location shall generally be utilized in back-filling work in protection of tower footing of same location, unless it is unsuitable for such purpose. In the later case, the back filling shall be done with borrowed earth of suitable quality irrespective of lead and lift and consolidated at no extra cost to the owner.

The provisional quantities for protections work to foundations are furnished in respective schedule of Bid Proposal Sheets. The unit rates shall also be applicable for adjusting with the actual quantities for protection works done.

No separate rates shall be allowed for borrowed earth and the Contractor shall make his own arrangements for procurement of borrowed without any extra cost.

6 Measurement of back filling:

The volume of back filling shall be considered equal to that of the excavation. This also applies to any earthwork embankments to be provided over the foundation to the design drawings.

SECTION – X (B)

(VOLUME – IIB)

TECHNICAL SPECIFICATIONS

FOR

**ERECTION OF TOWERS, STRINGING OF CONDUCTORS, INSTALLATIONS
OF LINE MATERIALS AND COMMISSIONING**

PART-IIB

SECTION-X(B)

TECHNICAL SPECIFICATION FOR ERECTION OF TOWER SUPER STRUCTURE, STRINGING AND INSTALLATION OF LINE MATERIALS AND COMMISSIONING

- 1.0 GENERAL
- 2.0 ERECTION OF SUPER STRUCTURE
- 3.0 TREATMENT OF JOINTS
- 4.0 ASSEMBLY
- 5.0 INSULATOR HOISTING
- 6.0 INSTALLATION OF POWER CONDUCTOR AND EARTHWIRE
- 7.0 FIXING OF CONDUCTOR AND EARTHWIRE ACCESSORIES
- 8.0 SAFETY PRECAUTIONS
- 9.0 FINAL CHECKING, TESTING AND COMMISSIONING

PART-IIB

SECTION – X (B)

TECHNICAL SPECIFICATION FOR ERECTION OF TOWER SUPER STRUCTURE, STRINGING AND INSTALLATION OF LINE MATERIALS AND COMMISSIONING:

1.0 General:

The details of the scope of erection work shall include the cost of labour, and tools and plants like tension stringing equipment and all other incidental expenses in connection with erection and stringing work.

The contractor shall be responsible for transportation of all materials to the site, proper storage and preservation at their own cost till such time the erected line is taken over the Owner. Similarly the Contractor shall be responsible for transportation, proper storage, safe custody, loss or damage of all materials for incorporation in the lines and shall maintain and render proper account for all such materials lost or damaged during storage and erection.

The Contractor shall set up required number of stores along the line and the exact location of such stores shall be discussed and agreed to between the contractor and the owner.

If any defects are found in case of hot-dip galvanized members, the members if acceptable to Owner shall be repaired by applying zinc rich protection paint.

2.0 **Erection of Super Structure:**

The towers shall be erected on the foundations not less than 14 days after concreting or till such time that the concrete has acquired full strength. The towers are erected as per the erection drawings furnished by the manufacturers. To facilitate, erection, each tower member shall be marked to correspond with a number shown in the erection drawing. The steel is first delivered to the tower location and is placed in such a manner as to be accessible for erection. Any damage to the steel and injuring of galvanizing shall be avoided. No member shall be subjected to any undue over stress during erection.

The erection of tower may be carried out by any of the following methods generally followed:

- i) Built up method or piece meal method.
- ii) Section method.
- iii) Any other approved advanced method.

3.0 **Treatment of Joints:**

Before starting assembly, the surfaces shall be cleaned and applied with a coat of zinc rich paint, if required.

4.0 **Assembly:**

4.1 Irrespective of the method followed for the erection of towers, the points mentioned below shall be observed:

- a) Straining of the members shall not be permitted for bringing them in to position. It may, however, be necessary to match hole positions at joints and to facilitate this, tommy bars not more than 450 mm long may be used.
- b) Before starting erection of an upper section the lower section shall be completely braced and all bolts fitted in accordance with approved drawings.

- c) All plan diagonals relevant to a section of tower shall be placed in position before assembly of upper section is taken up.
- d) All bolts shall have their nuts facing outside of the tower for horizontal or nearly horizontal bolt connections and downwards for vertical bolt connection. The bolt positioning in assembled towers shall be as per IS-5613, Part-II, Section-2, 1976.
- e) The cross arms be assembled on ground and the top cross arm shall be lifted first, followed by the middle and bottom cross-arms. The tips shall be fully tightened before lifting them in to position, such bolts which are not accessible for tightening by ordinary tommy spanners, may be tightened with the help of box or ratchet ring spanner.
- f) The towers shall be fitted with Number plates, danger plates, phase plates, circuit plates and anti-climbing devices as described elsewhere in the specifications.
- g) All the blank holes, if any left after complete erection of the tower are to be filled up by bolts and nuts of correct size.

4.2

Tightening & punching of Bolts & Nuts:

All nuts shall be tightened properly using correct size spanners. Before tightening it shall be seen that filler washers and placed in relevant gaps between members, bolts of proper size and length are inserted and one spring washer has been inserted under each nut. In case of step bolts the spring washer shall be placed under the outer nut. The tightening shall progressively be carried on from the top downwards, care being taken that all bolts at every level are tightened simultaneously. It may be better to employ four persons, each covering one leg and the face to his left.

The threads of bolts projecting outside nuts shall be punched at three positions on the diameter to ensure that the nuts are not loosened in course of time. If during tightening a nut is found to be slipping or running over the bolt threads, the bolt together with the nuts shall be changed out right. All the bolts and nuts in all

joints up to the level of bottom cross arm from the tower base shall be tack welded after final tightening. After welding cold galvanized paint having at least 90% Zinc content shall be applied to the welded portion. AT least two coats of the paint shall be applied. The cost of welding and paint including application of paint shall be deemed to be included in the erection price.

In addition to tack welding of nuts with bolts, as described above, the Contractor can also propose some alternative arrangements like use of epoxy adhesive which can serve the purpose of locking the nut permanently with the bolt and thus preventing pilferage of the tower members.

In case the Bidder offers some alternative to tack welding as stated above, the Bidder shall have to furnish all the technical parameters of the same, to facilitate the owner to technically evaluate its acceptability. However, the evaluation of the tender shall be done based on the tack welding only.

5.0 **Insulator Hoisting:**

5.1 The string shall be fixed on the tower just prior to the stringing of conductors, but only after the towers have been fully assembled, bolt/nuts tightened as per the requirements of the technical specification. Damaged insulators and fittings, if any, shall not be employed in the assemblies. Before hoisting all insulators shall be cleaned in a manner that may not spoil or injure or scratch the glaze of the porcelain and in no case any oils shall be used for the purpose. Security clips shall be in position for the insulators before hoisting.

5.2 Arcing horns or grading rings, shall be placed along the line on suspension, and facing upwards on tension insulator string assemblies. The yoke arrangements shall be horizontal for tension, and longitudinal for suspension strings. Torque wrench shall be used for fixing various line materials and their

components like suspension clamps for conductor and earthwire, etc. wherever recommended by the manufacturer of the same.

6.0 **Installation of power conductor and earthwire:**

6.1 General:

The erection of conductors shall be done in 4 stages as follows:

- a) Delivery of conductors at site
- b) Running out (also called paying out) and stringing
- c) Tensioning and sagging, and
- d) Clipping-in.

6.2 **Delivery of conductors at site:**

6.2.1 The standard length contained in all the drums supplied against the line requirement shall be noted down and the drums shall be batched 3 drums in a batch.

6.2.2 At every dumping site, two such batches shall be dumped.

6.2.3 While deciding the place of dumping, due consideration shall be made of the particular standard length of the batch, extra length consumed on account of sag, damaged ends of the conductor in the drum, inclined spans, etc. The points noted under the Clause 'Tensioning and Sagging of conductors' in this section shall as well be borne in mind so that the planning for dumping of the drums would not be disturbed, once it is finalized.

6.2.4 All drums in dilapidated condition shall be discarded and the conductor shall be rewound on new drums before use. In case of the drums with only the lagging damaged, use may be made of turntables holding the drums on vertical rotational axis, for running out.

6.3 **Running out:**

6.3.1 Whatever the method employed for running out the conductors, care shall be taken that the conductors do not touch or rub against ground or objects which would cause scratches or damages to the strands. The conductors shall be run out

of the drums from the top (and not from the bottom) in order to avoid damage due to checking. The conductors shall be pulled out evenly in preference to pulling out a complete section of one wire. The conductor immediately after running out, shall be raised at the supports to a level as that of the clamp and placed into the running blocks or the aerial rollers.

6.3.2 The running blocks shall be of diameter not less than the internal barrel diameter of the drum as given in the IS: 1778-1961. In case such blocks are not available, the blocks shall be provided with two small pulleys, which shall enable the conductor to form a curve of minimum equivalent diameter. The groove of the pulley shall be of the design that the seat is semi-circular and larger than the diameter of the conductor and it does not slip or rub against the sides. The groove shall be lined with hard rubber or neoprene to avoid damage to conductor and shall be mounted on well-oiled bearings.

6.3.3 The running blocks shall be suspended in manner to suit the design of cross arms. All running blocks, especially those at the tensioning end, shall be fitted with cross arms with sacking wrapped over the steel work and under the slings to avoid damage to the slings as well as to the protective surface finish of the steel work. In case suspension, light angle or section towers are used for termination of stringing operations for longer periods they shall be suitably guyed. Normally, suspension towers shall not be used even for temporary terminations, if this becomes necessary, these shall well guyed and steps taken to avoid damage. The drums shall be provided with suitable breaking device to avoid loose running out and to prevent kinking of the conductors. The conductor shall continuously be observed for loose, or broken strands or any other damage. When approaching the end of a drum length, at least three coils shall be left when the stringing operations are stopped. These coils shall be removed carefully and if another length is required to be run out, a joint shall be made according to the recommendation of the manufacturers. Normally, the joint shall be compression joint done with hydraulic compressor.

- 6.3.4 Repairs to conductors, if necessary, shall be carried out during the running out operations, with repair sleeves. Repairing of conductor surface shall be done only in case of minor damage, scuff marks etc keeping in view both electrical and mechanical safe requirements. The final conductor surface shall be clean, smooth and without any projections, sharp points, cuts, abrasions etc.
- 6.3.5 Conductor splices shall be so made that they do not crack or get damaged in the stringing operation. The contractor shall use only such equipments/methods during conductor stringing which ensures complete compliance in this regard.
- 6.3.6 Derricks shall be used where roads, rivers, canals, telephones or over head power lines, railway premises, fences or walls have to be crossed during stringing operations. It shall be ensured that normal services are not interrupted or damage caused to property. Shutdown shall be obtained when working at crossing of overhead power lines, and railways (electrified or otherwise).
- 6.3.7 The sequence of running out shall be from top downwards, that is the earth conductor shall be run out first, followed by top, middle and bottom power conductors in succession. Unbalances of loads on towers shall be avoided as far as possible. The sequence of running out shall be from top to downwards i.e., the earthwire shall be run out first, followed by the conductors in succession. Unbalance of loads on towers shall be avoided as far as possible. Outer phases of line conductor shall be strung before the stringing of the middle phase is taken up. B & C type towers are not designed for one side stringing. Therefore, proper guying arrangement shall be made for B & C type of towers during stringing on one section while the other section is strung. The contractor shall forward detailed proposals along with calculation for guying for approval by the engineer. Proper tools and instruments shall be made available to the Engineer by the contractor for checking the tension in the guy wires. All the expenditure on account of the above work is deemed to be included in the bid price.
- 6.3.8 The proposed 220 KV/110KV /66 KV Transmission line may run in parallel for certain distances with existing 220 kV, 110 kV & 66 kV lines which may remain

energized during the of dangerous voltage build up due to electromagnetic and electrostatic coupling in the pulling wire conductors and earth wires, which although comparatively small during normal operations could be the contractors responsibility to take adequate safety precautions to protect his personnel and others from this potential danger.

6.4 **Stringing of the conductor and earthing:**

The bidder shall give complete details of the stringing methods, which he proposes to adopt. Before the commencement of stringing, the contractor shall submit stringing charts for the conductors and earthwire showing the initial and final sags and tensions for various temperatures and spans, along with equivalent spans in the lines for approval by the Engineer.

6.5 **Jointing:**

- i) All joints on the earthwire and conductor shall be of compression type, in accordance with the recommendations of the manufacturer for which all necessary tools and equipment like compressors, dies, etc. shall have to be arranged for by the contractor. Each part of the joint shall be cleaned by wire brush to make it free of rust or dirt etc. and properly greased before the final compression is done with the compressors.
- ii) All joints or splices shall be made at least 30 meters away from the structures. No joints or splices shall be made in spans crossing over main roads, railways, small rivers etc. Not more than one joint per sub-conductor shall be allowed in one span. The compression type fittings used shall be of self-centering type. Care shall be taken to mark the

conductors to indicate when the fitting is centered properly. During compression or splicing operation the conductor shall be handled in such a manner so as to prevent lateral or vertical bearing against the dies. After pressing the joints, the aluminium sleeve shall have all corners rounded, burrs and sharp edges removed and smoothened.

- iii) To avoid damage to the joint during sagging operation, the contractor shall use a suitable protector with mid-span compression joints in case the joints have to be passed over pulley blocks/aerial rollers. The size of the sleeve of the pulley shall be such that the joint with protector can be passed over it smoothly.

6.6

Sagging-in-operation:

- i) The conductors shall be pulled up to the desired sags and left in running blocks for at least one hour after which the sag shall be rechecked and adjusted, if necessary, before transferring the conductors from the running blocks to the suspension clamps. The conductors shall be clamped within 36 hours of sagging in.
- ii) The sag shall be checked in the first and the last span of the section in case of sections up to eight spans and in one intermediate span also for sections with more than eight spans. The sag shall also be checked when the conductors have been drawn up and transferred from running blocks to the insulator clamps.
- iii) The running blocks, when suspended from the transmission structure for sagging shall be so adjusted that the

conductors on running blocks will be at the same height as the suspension clamp to which it is to be secured.

- iv) At sharp vertical angles, the sags and tensions shall be checked on both sides of the angle, for equality of tension. All suspension insulator assemblies shall normally assume a vertical position when the conductor is clamped.

6.7

Tensioning and sagging of conductors:

The tension insulator sets, complete with clamped conductors, shall be hoisted at the ends remote from the tensioning points. The running blocks at the tensioning end shall be fitted on the cross-arms with tension end with sacking wrapped under the slings.

The mid-span tension joints shall be placed to ensure the following:

- a) No joints shall be placed within 15 mtr of the conductor support.
- b) There shall be no joints in important crossing spans, except where the spans are longer than the standard conductor length on the drums: and
- c) There shall be not more than one joint per conductor in a span.

The tensioning and sagging shall be done in accordance with the approved stringing charts prepared from the data and relevant specifications of the line. Initial stringing chart for conductor and 'final' – string charts for earth wire shall be employed for the purpose. Both sags and tension may checked if considered necessary, but checking on sag only shall also be considered sufficient. The sag shall preferably be checked in a span lying approximately in the middle of the relevant section, such span

being as near the length of the ruling span for the section as practicable. Dynamometers shall be employed for measuring tension in the conductor and earth wire. The Dynamometers employed shall be periodically calibrated with standard dynamometer.

Tensioning and sagging operations shall be carried out in calm weather when rapid changes in temperature are not likely to occur.

6.8 **Clipping-in:**

Clamping the conductors in positioning, armouring at supports placing of the dampers and spacers, etc. shall be done in accordance with the recommendations of the manufacturer or field personnel or both.

The jumper at the section and angle towers shall be formed to parabolic shape to ensure minimum clearance requirements. Pilot suspension insulator strings shall be used where necessary to restrict jumper swing. Fasteners on all fittings and accessories shall be secured in position, the security clip also properly opened and sprung in to position.

7.0 **Fixing of conductor and earthwire accessories:**

All conductor and earth wire accessories shall be installed by the contractor as per the design requirements and respective manufacturer instructions within 24 Hours of the conductor/earthwire clamping. While installing the conductor and earthwire accessories proper care shall be taken to ensure that the surfaces are clean and smooth and no damage shall occur at any part of the accessories.

8.0 **Safety Precautions:**

8.1 All conductors shall be temporarily earthed in an effective manner at every section point. Such temporary earth shall be removed after stringing of the entire line is over and before testing and commissioning of the line.

8.2 The jumps provided for the conductors at the anchor towers shall be of adequate length to satisfy the live metal clearances as indicated in the drawings enclosed.

8.3 Final checking, testing and commissioning: After completion of works, final checking of the line shall be done by the contractor to ensure that all the foundation works, tower erection, and stringing are done strictly in accordance with the intent of the specifications. All the works shall be thoroughly inspected keeping in view, the following main points:

- a) Sufficient back-filled earth laying over each foundation pit is adequately compacted.
- b) Concrete chimneys and their coping are in good pointed conditions.
- c) All tower members are correctly used, strictly in accordance with the approved drawing and are free of any defects or damage whatsoever.
- d) All bolts are properly tightened and punched.
- e) The stringing of the conductors and earthwire has been done as per the approved sag and tension charts and desired clearances are clearly available.
- f) All conductor and earth wire accessories are properly installed.
- g) All other requirements to complete the work like fixing of danger plates; phase plates, number plates, ant climbing

devices, aviation signals (wherever required) etc are properly installed.

- h) The line insulation is tested by the contractor by providing his own equipment, personnel, etc to the satisfaction of the Engineer.
- i) The line is tested satisfactorily for commissioning purpose following clearance given by the electrical inspectorate and KPTCL in this behalf.

9.0

Final Checking, Testing and Commissioning:

After completion of works, final checking of the line shall be done by the contractor to ensure that all the foundation works, tower erection and stringing are done strictly in accordance with the intent of the specifications. All the works shall be thoroughly inspected keeping in view, the following main points:

- a) Sufficient back-filled earth laying over each foundation pit is adequately compacted.
- b) Concrete chimneys and their coping are in good pointed conditions.
- c) All tower members are correctly used, strictly in accordance with the approved drawing and are free of any defects or damage whatsoever.
- d) All bolts are properly tightened and punched.
- e) The stringing of the conductors and earthwire has been done as per the approved sag and tension charts and desired clearances are clearly available.
- f) All conductor and earthwire accessories are properly installed.
- g) All other requirements to complete the work like fixing of danger plates, phase plates, number plates, anti-climbing

devices, aviation signals (wherever required) etc., are properly installed.

- h) The line insulation is tested by the Contractor by providing his own equipment, personnel, etc., to the satisfaction of the Engineer.
- i) The line is tested satisfactorily for the commissioning purpose following clearance given by the electrical inspectorate and KPTCL in this behalf.

10.0 **Earthings:**

Each tower shall be earthed after the foundation has been cast. For this purpose, earth strips shall be fixed to the stub during concreting of the chimney and taken out horizontally below the ground level. The earth strip shall be provided on the leg with step bolts.

The footing resistance of all towers to earth shall not exceed the values specified in IS-3043-1966 after earthing and tower erection but before stringing of the overhead ground wire. In case the resistance exceeds the specified value, multiple pipe earthing or counterpoise earthing shall be adopted in accordance with the following procedure, but without interfering with the foundation concrete even though the earth strip/counterpoise lead remains exposed at the tower end. The connection in such case shall be made with the existing lattice member holes on the leg just above the chimney top.

Pipe earth: The installation of the pipe earthing shall be in accordance with IS 5613.

Counterpoise earth: Counterpoise earth consists of four lengths of galvanized steel stranded wires, each fitted with a lug for connection to the tower leg at one end. The wires are connected to arch of the legs and taken radially away from the tower and embedded horizontally 450

Mtr. below ground level. The length of earth wire is normally limited to 15 mtr. But may be increased if the resistance requirements are not met. The size of the galvanized steel stranded wire may be taken equal to sizes of the earth conductor. The counterpoise type earthing of tower shall be in accordance with IS 5613.
