

TECHNICAL SPECIFICATION FOR 8.5 M. LONG 180 KG. WORKING LOAD PCC POLES.**1.0 SCOPE:**

This specification covers pre-stressed concrete poles suitable for use in 11KV/L.T. Overhead Power lines and conforming to IS: 1678:1998 (and its amendments thereof).

2.0 GENERAL:

- 2.1 Solid sections pre-stressed cement concrete poles shall be suitable for use in overhead 11KV/L.T. Distribution lines and suitable for a working load of 180 KG. applied in transverse direction at a distance of 300 mm. below top. The Overall length of the pole shall be 8.5 M. having depth of plantation as 1.52 mtr. suitable for plantation direction into ground, when used in straight-line position. The structural strength of pole in longitudinal direction shall be at least one fourth of the strength in transverse direction. The average permanent load is 40% of working load.

Poles of working load 200 Kg. applied in transverse direction at a distance of 600 mm below top shall also be acceptable. However no extra cost shall be payable for this design.

For earthing G.I wire No. 8 SWG shall be embedded with projecting length of 150 mm. at 300 mm. from top and 150 mm. at 1350 mm. from bottom as per enclosed drawing. The pole shall conform to IS: 1678-1998, IS: 1343-1980 and IS: 456-2000. (Or their latest editions/revisions thereof)

Two numbers through holes of 18-mm. dia. on the broader longitudinal side of the poles in the direction of conductor to be laid normal to and shall be provided such that the centers of these holes are at a distance of 100 mm. and 200 mm. from the top of poles.

Apart from above, necessary lifting hooks may also be provided.

- 2.1 The bidders shall quote only for following cross sections of 8.5 M long PCC Poles.

Category-I:	90 mm × 145 to 300 mm.	$\left. \begin{array}{c} \text{Tolerance} \\ \pm 5 \text{ mm} \end{array} \right\}$
Category-II:	100 mm × 125 to 280 mm.	

3.0 MATERIAL:**3.1 CEMENT:**

The cement used in the manufacture of prestressed concrete poles shall be any of the following: -

- Portland slag cement conforming to IS: 455 but with not more than 50 percent slag content.
- Rapid hardening Portland cement conforming to IS: 8041.

- c) 43 Grade ordinary Portland conforming to IS: 8112 and
- d) 53 Grade ordinary Portland cement conforming to IS: 12269.

3.2 **AGGREGATES:**

Aggregates used for manufacture of prestressed concrete pole shall conform to IS: 383:1970 (latest amendments thereof). If required a sample of the aggregates shall be submitted by the manufacturer to the purchaser for approval. The maximum size of the aggregate shall in no case exceed 20 mm.

3.3 **WATER:**

The water used for concrete mixing and curing shall be clean and free from organic and inorganic matter harmful to concrete.

3.4 **ADMIXTURE:**

The use of admixture is not generally recommended. These may be used only with the approval of the purchaser based on evidence that with the passage of time neither the compressive strength of concrete is reduced by more than 10% nor are other requisite qualities of concrete and/or steel impaired by the use of such admixtures. The admixture shall conform to IS: 9103.

3.5 **PRESTRESSING STEEL (High Tensile Steel):**

High tensile steel used for manufacture of prestressed concrete poles shall conform to IS: 1785 or IS: 2090 or IS 6003-1983 (latest amendments thereof). The Pre-stressing steel shall be free from splits, harmful scratches surface flaws, rough rust, scale and other similar deleterious matter liable to affect adversely proper tensioning or its bond with concrete. The diameter of smooth wire used for prestressing of poles shall be 4 mm. or 5-mm. dia. or a combination of two sizes and its ultimate tensile strength shall not be less than 175 Kg/mm² for 4 mm wire & 160 Kg/mm² for 5 mm dia wire.

3.6 **OTHER REINFORCEMENT:**

Apart from the high tensile steel provided for prestressing the poles, 6mm. dia plain round M.S Bar or 4mm.dia.H.T. Wire stirrups (as per IS: 432 or IS: 1786) shall be provided 4 Nos. at each end and 4 Nos. in the mid portion uniformly distributed.

The surface of reinforcement shall be free from loose scale, oil, grease, clay or other material that may have degenerating affect on the bond between the reinforcement and concrete.

4.0 **CONCRETE:**

Design Mix. Concrete as defined in para 9.0 of IS: 456: 2000 and para 8 of IS: 1343: 1980 will be used in the manufacture of the poles. The design of concrete mix shall conform to the requirements laid down for controlled concrete under Para 9.2 of IS: 456:2000 subject to following further conditions.

- a) Minimum cube strength at 28 days shall not be less than 450 Kg/cm² in accordance with acceptability criteria given in clause 16 of IS: 456:2000.
- b) The mix shall contain as low as possible water cement ratio as is consistent with adequate workability.
- c) The concrete shall be compacted thoroughly by vibration, pressure, shock, or other means and shall have a density of not less than 2.4 MT/cm³.

- d) The cube strength of concrete at transfer of prestress shall not be less than 245 Kg/cm².
- e) The supplier shall be required to maintain a register showing the test results of cubes at the age of 3 and 28 days and at the transfer of prestress. For strength test the cubes shall be taken for each days casting. The register will show the serial number and the pole cast that day for which the test will apply. The acceptability criteria will be as per Para 16.3 to 17.5 of IS: 456. The register shall be opened for inspection with the authorized representative of the Corporation.
- f) The tenderer shall give a proper mix design of the grade M 45 of design mix concrete proposed to be used for casting of pole and such mix design may be supported by the test certificate of some Govt. Lab, or other Recognized Lab. Mix design done earlier not prior to one year may be considered adequate for later work, provided there is no change in source and quality of material.

5.0 **DESIGN:**

- 5.1 The poles shall be so designed that they do not fail owing to failure initiated by compression in concrete. Maximum wind pressure to be assumed may be determined as specified in IS: 875. (Part-3).
- 5.2 The pole shall be 8.5 M. long and should be designed for an ultimate load of 450 Kg. /500 Kg. acting at 300 mm/600 mm. below top. The dimensions, reinforcement etc. required to be provided may be shown in the drawing supplied by the tenderer.
- 5.3 The ultimate moment capacity in longitudinal direction should be atleast one fourth of that in transverse direction. The PCC Pole be designed so that it should be safe against bending, shear, torsion and axial load at various stages of loading under most unfavorable condition of loading.
- 5.4 The G.I Wire, no.8 SWG, which be in one continuous length, shall be embedded in the pole for earthing purpose. No joint of any kind in this wire shall be permitted. The position and details of connection to be provided at the end of earth wire have been shown in the enclosed drawing. Two nos. Galvanized bolts with two nuts and 3 washers with each bolt are to be supplied by the manufacturer.
- 5.5 The position and diameter of the holes to be provided in the poles are also shown in the enclosed drawing and shall be centrally located and will be perpendicular to the face of the pole.
- 5.6 Factor of safety against ultimate failure is 2.5. While it is 1.0 for first crack moment. Designer should mention basis for adopting various design constants e.g. permissible tensile, compressive stress, modulus of rupture etc.
- 5.7 The poles shall be designed to be suitable for fitting stays and clamps.
- 5.8 Eye hooks shall be provided for lifting of poles. The poles should be strong enough for lifting and erection in any direction during handling and transport. During erection poles are laid on the ground and lifted at some point near the end, similarly while loading and unloading the poles from carriers they are lifted at one end resting on the ground and pushed on to the trucks. The poles should be able to withstand all such manual handling.

5.9 **TRANSVERSE STRENGTH AT FAILURE:**

The poles shall be designed that its strength in transverse direction shall be sufficient to take the load due to wind on wires and poles, multiplied by load factor.

6.0 **MANUFACTURE:**

The tensioning of prestressing tendons shall be carried out in a manner that will induce a smooth and even rate of increase of stress in the tendons.

6.1 The force induced in the prestressing tendon shall be determined by suitable means attached to the tensioning apparatus. It is essential that the method used to determine the initial prestress in the wire give accurate result. Each wire shall be anchored positively during casting. Prestress in each wire shall be uniform. Care must be taken to ensure that anchorage do not yield before concrete attains the desired strength.

6.2 The cover of concrete measured from the outside of the prestressing tendon shall be atleast 30 mm. or the size of the cable or bar whichever is bigger.

6.3 When measuring the prestressing force, any slip which may occur in the gripping device shall be taken into consideration.

6.4 The transfer of pre-stressed shall be carried out gradually by a proper device, so that the entire set of wires are released simultaneously.

6.5 In long line method, where the transfer is made on several moulds at a time, care shall be taken to ensure that prestressing force is evenly applied on all moulds and that the transfer of prestress to concrete is uniform along with entire length of tension line by ensuring correct alignment of moulds on guide plates.

6.6 The high tensile wire shall be continuous over the entire length of the tendon. Welding shall not be allowed in any case.

6.7 **COMPACTING:**

Concrete shall be compacted by vibrating, Shocking or other suitable mechanical means. Hand compaction shall not be permitted

6.8 **CURING:**

To be done as specified in IS: 1678 (1998). Curing of PCC Pole preferably be done in tanks filled with water. The firms who confirm in writing compulsorily, at the time of bidding, of having curing tank facility or give consent for construction of curing tank within a period of two months, shall be given positive preference in final quantity allotment.

7.0 **INSPECTION / TESTING:**

7.1 The minimum offered number of poles for inspection/ testing should not be less than 500.

7.2 The PVVNL authorized representative shall be entitled for periodical checking and inspecting of the raw material to be used in entire production scheme and finished poles. The supplier's shall be bound to follow all written instructions found necessary to ensure quality control and conformity the product to the relevant standards.

7.3 The transverse strength test on the poles shall be performed in accordance with IS: 2905-1989 (or latest amendments thereof).

7.4 A pole shall be deemed not to have passed the test if hair cracks appear at a stage prior to application of 50% of the ultimate Transverse load or the hair cracks if any, produced on application of 60% of the minimum ultimate Transverse load of 450 Kg. at 300 mm. from top do not close upon the removal or reduction of test load.

7.5 For the purpose of test, a lot shall consist of maximum of 200 Nos. of poles. 15 Nos. Of poles out of a lot shall be tested for over all length, cross section and

uprightness, and 1% of the poles of the lot shall be tested till breakage amongst those 15 Nos. for transverse strength. Lot with lesser number of poles will also be tested as per above criteria.

7.6 The poles for test shall be selected at random out of a lot.

7.7 A lot shall be considered as conforming to these specifications if it satisfied the following conditions:

- (A) The number of poles which do not satisfy the requirement of overall length, cross section and uprightness shall not exceed one no. out of the 15 Nos. poles tested. If the number of such poles exceeds one then all the poles in a lot shall be tested for these requirements and those not satisfying the requirement shall be rejected.
- (B) All the poles tested for transverse strength test shall satisfy the requirement of the test. If one or more poles fail, twice the number of poles originally tested shall be taken from those already selected, and subjected to the test. If there is no failure among these poles, the lot shall be considered to have satisfied the requirements of this test.
- (C) A pole should be deemed to have passed the transverse load test if there is no permanent set observed 10 minutes after the release of applied load 180 Kg.

7.8 No payment shall be made for broken pole to the extent of 1% or more during inspection/testing out of the lot offered for the inspection.

8.0 TOLERANCE:

- (i) The tolerance on overall length of the pole shall be ± 15 mm.
- (ii) The tolerance on cross sectional dimensions shall be ± 5 mm.
- (iii) The tolerance on the uprightness or straightness of the pole shall be 0.5% (Measurement of uprightness or straightness of pole shall be done as per clause No. 4.2.1.1 of IS: 1678:1998).
- (iv) A tolerance of ± 15 mm is also allowed in the position of G.I Wire.

9.0 MARKING:

The pole shall be clearly and indelibly engraved with the following particulars during manufacture so as to easily read after erection in position.

9.1(a) Name of firm, Serial No. of pole & PO No. at (i) 400 mm, below top (ii) 3.0 meters from the bottom.

9.1(b) P.V.V.N.L., Date, month and year of casting at a place in between name of firm as given in (a).

9.2 Colored indelible depth marker at 1.52 mtr. from bottom to verify planting depth is also to be ensured.

4. 'Proven design' as mentioned in clause No.1.2.6 of Instruction to Tenderers implies that the drawing & design calculation of 8.5 M Long PCC Pole should be got approved by a approved Institution.

5. Data of R/R shall be deemed to be date of delivery for dispatch by rail, the data of receipt of material in purchaser's store shall be deemed to be the date of delivery for dispatch by Road.

6. No payment shall be made for broken pole during inspection/testing out of the lot offered for inspection.

7. THE BIDDER SHOULD SIGN AND STAMP EACH PAGE OF THE BIDS ITS ANNEXURE/DOCUMENTS NECESSARILY.
8. Incase of any Inconsistency the provisions contained above shall prevail.
9. The tender part II (price part) of bidders who quote poles of cross-sections different from that mentioned in the tender specification shall not be opened.