Technical Specifications of 8 M and 9 M PCC Poles (F.O.S.-2.5) with working load 200 Kg.

Chief Engineer/P&D,
DHBVN, Hisar.

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TECHNICAL SPECIFICATIONS OF PCC POLES (F.O.S.-2.5) 8 M AND 9 M LENGTH

1. **SCOPE** - This specification covers manufacture, assembling and inspection before despatch at manufacturer's works of PCC poles with an overall length of 8 M and 9 M and working load of 200 Kg. At 0.6 from the top (As per drawing attached) suitable for use in one of lines.

2. **APPLICABLE STANDARDS** - Except when they conflict with the requirement in this specification, the poles shall comply with relevant provisions made in the following Indian Standards Specifications:
   
a) IS - 1678/1960/1978 specification for pre-stressed concrete poles for overhead power, traction and telecommunication.
   
b) IS-2905/1966 Methods of test for concrete poles for overhead power and telecommunication lines.
   
c) IS-7321/1974 code of practice for selection, handling and erection of concrete poles for overhead power and telecommunication lines.

3. **CLIMATIC CONDITIONS** – The PCC poles are required to be under the following site conditions -
   
1. Max. temp. 47.5 C.
2. Min Temp. - 2.5 C.
3. Max. relative humidity 100%
4. Average No. of rainy days per annum 120 days
5. Min. relative humidity 26%
6. Average annual rainfall 900 mm
7. Isocereunit level 45
8. Max. wind pressure 195 Kg/ Mtr.²
9. Average No. of dust storm lays per annum.
10. Altitude above mean 1000 Mtrs.
4. **TERMINOLOGY** - For the purpose of this standard the following definition shall apply.

4.1 **AVERAGE PERMANENT LOAD** - That fraction of the working load which may be considered of long duration over period of one year.

4.2 **LOAD FACTOR** - The ratio of ultimate transverse load to the transverse load at first crack.

4.3 **TRANSVERSE** - The direction of the line bisecting the angle contained by the conductor at the pole. In the case of straight run this will be normal to the run of the pole.

4.4 **TRANSVERSE LOAD AT FIRST CRACK** - For design, the transverse load at first crack shall be taken as not less than the value of the working load.

4.5 **WORKING LOAD** - The maximum load in the transverse direction, that is ever likely to occur, including the wind pressure on the pole. This load is assumed to be at a point 600 mm below the top with the butt end of the pole planted to the required depth as intended in the design.

4.6 **ULTIMATE FAILURE** - The conditions existing when the pole ceases to sustain a load increment owing to either crushing of concrete, or snapping of the pre-stressing tendon of permanent stretching of the steel in any part of the pole.

4.7 **ULTIMATE TRANSVERSE LOAD** - The load at which failure occurs, when it is applied at a point 600 mm below the top and perpendicular to the axis of the pole alongwith
the transverse direction with the butt end of the pole planted to the required depth.

5. **MATERIALS :-**

5.1 **CEMENT :-** The cement used in the manufacture of pre-stress concrete poles shall be ordinary or rapid hardening portland cement conforming to IS : 269/1978 (specifications for ordinary and low heat Portland cement) or IS : 8041/1976/1978 (specification for rapid hardening Portland cement).

5.2 **AGGREGATES :-**

Aggregates used for the manufacture of pre-stressed concrete shall confirm to IS : 383/1970 (specification for course and fine aggregate from natural sources for concrete). The nominal max. size of aggregate shall in no case exceed 10 mm.

5.3 **WATER :-**

Water should be free chlorides, sulphates, other salts and organic matter, potable water will be generally suitable.

5.4 **ADMIXTURES :-**

Admixture should not contain calcium chloride or other chlorides and salts which are likely to promote corrosion of pre-stressing steel.

5.5 **PRE-STRESSING STEEL :-**

The pre-stressing steel wires, including those used as untensioned wires, should conform to IS : 1785/Part-I/1966 (specification for plan hard drawn steel wire for pre-stressed concrete Part-I cold drawn stress relieved wire (IS : 1785/Part-II) 1967 (specification for plan hard drawn steel wire for pre-stressed concrete Part-II As drawn wire) or IS : 6003/1970 (specification for indented wire for pre-stressed concrete).

5.6 **CONCRETE MIX :-**

The concrete mix shall be designed to the requirements laid down for controlled concrete (also called design mix concrete) in IS : 1343/1960
(code of Practice for pre-stressed concrete) and IS : 456/1964 (code of practice for plan and reinforced concrete) subject to the following special conditions:

a) Min. works cube strength at 28 days should be at least 420 Kg/cm.
b) The concrete strength at transfer should be at least 210 Kg./cm.
c) The mix should contain at least 380 Kg. of cement per cubic meter of concrete.
d) The mix should contain as low a water content as is consistent with adequate work ability, if it becomes necessary to add water to increase the work ability, the cement content also should be raised in such a way that the original value of water cement ratio is maintained.

6. **WELDING & LAPPING OF STEEL** :-

The high tensile steel wire shall be continuous over the entire length of the pole/tendon. Welding shall not be allowed in any case, however, jointing or coupling may be permitted provided the strength of the joints or coupling is not less than the strengths of each individual wire.

7. **MANUFACTURE** :-

7.1 All pre-stressing wires and reinforcements shall be accurately fixed as shown in the drawings and maintained in position during manufacture. The un-tensioned reinforcement is indicated in the drawing, should be held in position by the use of strips which should go around all the wires.

7.2 All wires shall be accurately stretched with uniform prestress in each wire. Each wire or group of wires shall be anchored positively during casting. Care shall be taken to see that the anchorages do not yield before the concrete attains the necessary strength.

7.3 **COVER** :-

The cover concrete measured from the outside of the pre-stressing tendon shall be normally 20 mm.
7.4 **COMPACTING :-**

The concrete shall be compacted by spinning, vibrating shocking or other suitable mechanical means. Hand compaction shall not be permitted.

7.5 **CURING :-**

The concrete shall be covered with a layer of sacking, canvas, hessian or similar absorbent material and kept constantly wet up to the time when the strength of concrete is at least equal to the minimum strength, of concrete is at least equal to the minimum strength, of concrete at transfer of prestress, thereafter, the pole may be removed from the mould and watered at intervals to prevent surface cracking of the unit, the interval should depend on the atmospheric humidity and temperature.

7.6 The pre-stressing wires shall be detensioned only after the concrete has attained the specified strength at transfer i.e. 210 Kg/cm². The cubes cast for the purpose of determining the strength at transfer should be cured as far as possible, under conditions similar to those under which the poles are cured. The transfer stage shall be determined based on the daily tests carried out on concrete cubes till the specified strength indicated above is reached. Thereafter the test on concrete shall be carried out as detailed in IS : 1343/1960 (code of practice for pre-stressed concrete). The manufacturer, shall supply when required by the purchaser or his representative, results of compressive test conducted in accordance with IS : 456/1964 (code of practice for plain and reinforced concrete) on concrete cubes made from the concrete used for the poles. If the purchaser so desires, the manufacturer shall supply cubes for test purposes and such cubes shall be tested in accordance with IS : 456/1964/1978. (code of practice for plain and reinforced concrete). The detensioning shall be done by slowly releasing the wires, without imparting shock or sudden load to the poles. The rate of detensioning may be
controlled by any suitable means either mechanical (screw type) or Hydraulic. The poles shall not be de-tensioned or released by cutting the pre-stressing wires during flames or bar choppers while the wires are still under tension.

8. **EARTHING** - Earthing shall be provided

a) By having length of 8 SWG GI wire embedded in concrete during manufacture and the ends of the wires, left projecting from the pole to a length of 175 mm, at 250 mm from top and 150 mm below ground level.

b) By providing two holes of suitable dimensions 250 mm from top and 150 mm below ground level to enable the GI wire to be taken from the top hole to the bottom hole through control hollow. The earth wire shall not be allowed to come in contact with the pre-stressing wires.

9. **TESTS** -

9.1 **TRANSVERSE STRENGTH TEST** –

9.1.1 Poles made from ordinary Portland cement shall be tested only on the completion of 18 days and poles made from rapid hardening cement only on the completion of 14 days after the day of manufacture.

9.1.2 The pole may be tested in either horizontal or vertical position. If tested in horizontal position, provision, shall be made to compensate for the overhanging weight of the pole. For this purpose the overhanging portion of the pole may be, supported on movable trolley or similar device.

9.1.3 The pole shall be rigidly supported at the butt end at a distance equal to the agreed depth of planting i.e. 1. 5 M.

9.1.4 Load shall be applied at a point 600 mm from the top of the pole and shall be steadily and gradually increased to the design value of the transverse load at the first crack. The deflection at this load shall be measured.
A pre-stressed concrete pole shall be deemed not to have passed the test if visible cracks appear at a stage prior to the application of the designed transverse load for the first crack.

The load shall then be reduced to zero and increased gradually to a load equal to the first crack load plus 10% of the minimum ultimate transverse load and held up for 2 minutes. This procedure shall be repeated until the load reached the value of 80 percent of the minimum ultimate transverse load and thereafter load until failure occurs. Each time the load is applied, it shall be hold for 2 minutes. The load applied to pre-stressed concrete pole at the point of failure shall be measured to nearest five kgs.

The poles shall be deemed not to have passed the test if the observed ultimate transverse load is less than the designed ultimate transverse load.

9.2 **MEASUREMENT OF COVER**:

After completion of the transverse strength test, the sample pole shall be taken and checked for cover. The cover of the pole shall be measured at 3 points, one within 1.8 Mtr from the butt end of the pole, the second within 0.6 Mtr. from the top end the third at an intermediate point and the mean value compared with the specified value.

The mean value of the measured cover should not differ by more than 1 mm from the specified cover. The individual value should not differ by more than $\pm$ 3 mm from the specified value.

If these requirements are not met, the workmanship with reference to aligning of the end plates and pre-stressing wire and assembly of moulds should be improved and inspection production stage tightened suitably.

10. **INSPECTION**:

Inspection of material and supervision of tests in accordance with the relevant ISS as mentioned in column 2 above and supporting drg. and schedule and approved manufacturer specification shall be carried out by the
purchaser or duly authorized representative. The material shall be inspected and tested before dispatch by an authorized representative of the Board in respect of quality.

The Board reserves the right to inspect the material and the process at any time and the manufacture shall provide to the Inspecting Officer necessary access and facility without charge to satisfy him that the material is being manufactured in accordance with the specifications.

The purchaser or his authorized representative shall have access at all reasonable time to manufacturer's work too inspect and witness the tests of the material manufactured.

The purchaser has the right to have the tests carried out at the cost of supplier by an independent Govt. Agency whenever there is dispute regarding the quality of material supplied.

In order to ensure that the poles are manufactured strictly in accordance with the above specifications, the supplier shall also intimate to the Board from time to time its time table for the manufacture of the poles and actual date of commencement of manufacture of each lot so that the Inspecting Officer can be deputed to check the following during the course of manufacture of poles:

a) tensile strength of steel wire.
b) Release of stress from the steel wires after 5 to 8 days depending upon the quality of cement and curing.
c) Method of curing.
d) Quality of aggregate concrete and cement.
e) Water cement ratio and mixing lines.
f) Cube mould testing from concrete mixture to ensure that honey combing is not present in the mixture.
g) Cube mould testing from concrete being used.
h) Use of proper type of vibrators.
The Board’s authorized representative will supervise the manufacturing of the poles at various stages to ensure that the same are being manufactured in accordance with approved specification and drawings.

11. **STACKING:** The supplier shall stack, the poles in such a way that it is possible for the Inspecting Officer to select and inspect the poles, as he may choose to inspect. All such facilities for taking out the selected poles will be extended by the supplier free of charge.

12. **MARKING:**

The poles shall be clearly and indelibly marked with the following particulars during manufacture before testing at a position so as to be easily read after erection position.

a) Date month and year of manufacture.

b) Working load of pole in kg.

c) Maker’s Serial No. or mark.

HSEB and planting depth will henceforth be embossed on each pole. Firms will give month wise schedule of manufacture against P.O. to facilitate inspection during manufacturing process.

Whenever poles are tested out of any lot lying in HSEB stores, cost of the poles and testing charges will be charged to stock storage.

Checking of cover over the steel. Out of every 500 poles, one may be taken for ultimate strength testing, cover checking after crushing and checking of un-tensioned tensioned wire.
To

Chief General Manager/MM,
DHBVN, Hisar.

Memo No.: Cl- 39/3D-17,5
Date: 06.06.2007


In this regards it is to inform you that the following amendments in the Specification No. S-95/DD-177, HSD/S-573/ST-50 for 8, 9 & 11 Meter PCC Poles respectively, have been approved by the tech. committee of DHBVN.

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Detail of Existing Clause</th>
<th>Proposed amendments</th>
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<tr>
<td>1.</td>
<td><strong>Clause No. 5.5 Pre stressing Steel</strong>: The pre stressing steel wires including these used as untensioned wires, should conform to IS-1985 (Part-I) -1966 (Specification for plain hard drawn steel wire), IS, 1785 (Part-II) -1967 (Specification for plain hard-drawn steel wire for prestressed concrete Part-II as drawn wire) or IS 6003.1970 (Specification for indented wire for prestressed concrete) or the latest version thereof.</td>
<td>The pre stressing steel wires including these used as unmentioned wires, should conform to IS-1985 (Part-I) -1966 (Specification for plain hard drawn steel wire), IS, 1785 (Part-II) -1967 (Specification for plain hard-drawn steel wire for prestressed concrete Part-II as drawn wire) or IS 6003.1970 (Specification for indented wire for prestressed concrete) or the latest version thereof. The placement/positioning of tension wires should be as per the drawing enclosed.</td>
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<td>2.</td>
<td><strong>Clause No 5.4 Aggregates</strong>: Aggregates used for the manufacture of prestressed concrete poles shall conform to IS: 383-1970 (Specification for coarse and fine aggregates from natural sources for concrete). The nominal max. size of aggregates shall in no case exceed 10 mm. However the Pole manufactures should get the mix design done in accordance with the availability of aggregates at the quarry site (where from the aggregates are being received). The arrangements for testing of tensile strength of reinforcement being used in by the pole manufactures may also be available at the factory site. Set of sieves should be available for testing of aggregates being used by the pole manufacture. The material should be subject to test at regular interval.</td>
<td>Aggregates used for the manufacture of prestressed concrete poles shall conform to IS: 383-1970 (Specification for coarse and fine aggregates from natural sources for concrete). The nominal max. size of aggregates shall in no case exceed 10 mm. However the Pole manufactures should get the mix design done in accordance with the availability of aggregates at the quarry site (where from the aggregates are being received). The arrangements for testing of tensile strength of reinforcement being used in by the pole manufactures may also be available at the factory site. Set of sieves should be available for testing of aggregates being used by the pole manufacture. The material should be subject to test at regular interval.</td>
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3. **Clause No 5.3 Water:** Water should be free from Chlorides, Sulphate, other salts and organic matter. Portable water shall be generally suitable.

4. **Clause No 5.10 Cement:** The cement used in the manufacture of pre-stressed concrete poles shall be ordinary or rapid hardening Portland cement conforming to IS: 269-1976 (Specifications for ordinary and low heat Portland cement) or IS:8041E-1978 (specification for rapid hardening Portland cement).

5. **Clause No 7.5 Curing:** The concrete shall be covered a layer of sacking canvas, Hessian or similar absorbent material and kept constantly wet up to the time when the strength or concrete is at least equal to the minimum strength of the concrete at transfer of prestress. Thereafter, the pole may be removed from the mould and watered at intervals to prevent surface cracking of the unit, the interval should depend on the atmospheric humidity and temperature.

6. **Clause No 5.6:** The concrete mix shall be designed to the requirement laid down for controlled concrete (also called design mix. Concrete in IS 1343-1980 (code of practice for plain & reinforced concrete) subject to the following special conditions:
   a) Minimum work cube strength at 28 days should be at least 400 Kg/Cm² for 11 mtr. and 420 Kg/Cm² for 8 Meter & 9 Meter.
   b) The concrete strength at transfer should be at least 200 Kg/Cm² for 11 Meter & 210 Kg/Cm² for 8 Meter & 9 Meter.
   c) The mix should contain at least 380 Kg of cement per cubic meter of concrete.

   Water should be free from Chlorides, Sulphate, other salts and organic matter. Portable water shall be generally suitable. However quantity of water used in manufacturing & curing of the poles should be got tested from the recognized Govt Laboratory.

   The cement used in the manufacture of pre-stressed concrete poles shall be ordinary or rapid hardening Portland cement conforming to IS: 269-1976 (Specifications for ordinary and low heat Portland cement) or IS:8041E-1978 (specification for rapid hardening Portland cement.) however evolving of mix design is necessary.

   The concrete shall be covered a layer of sacking canvas, Hessian or similar absorbent material and kept constantly wet up to the time when the strength of concrete is at least equal to the minimum strength of the concrete at transfer of prestress. Thereafter, the pole may be removed from the mould and watered at intervals to prevent surface cracking of the unit, the interval should depend on the atmospheric humidity and temperature. Curing of poles plays a very important role in the strength of the poles, therefore, arrangements for extensive curing at casting yard after initial setting with good quality water are to be ensured.

   The concrete mix. Shall be designed to the requirement laid down for controlled concrete (also called design mix. Concrete in IS 1343-1980 (code of practice for plain & reinforced concrete) subject to the following special conditions:
   a) Minimum work cube strength at 28 days should be at least 400 Kg/Cm² for 11 mtr. and 420 Kg/Cm² for 8 Meter & 9 Meter.
   b) The concrete strength at transfer should be at least 200 Kg/Cm² for 11 Meter & 210 Kg/Cm² for 8 Meter & 9 Meter.
   c) The mix. Should contain at least 380 Kg of cement per cubic meter of concrete.
| d) The Mix should contain as low a water content as is consistent with adequate workability. If it becomes necessary to add water to increase the workability, the cement content also should be raised, such a way that the original value of the water/cement ratio is maintained. |
| c) Random casting of CC cubes testing from the mix being used by the Pole manufacturers should be done and it should be got tested from the recognized Govt. Lab. to ascertain a compressive strength of the concrete. Concrete cubes should be cured under similar condition as that of poles by placing it on Poles. |

As such the above mentioned amendments be incorporated in the Specification being used for the process of the procurement of the material by your office please.

Chief General Manager/P&D,
DHBVN, Hisar
Existing Reinforcement detailing

Proposed Reinforcement detailing

Fig. 1: Reinforcement detailing at PRC Palco
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<td>Working load at 0.6 M from top</td>
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<td>Factor of safety</td>
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<td>Breadth</td>
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<td>No. of tensioned wire per pole</td>
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<td>8.</td>
<td>No. of untensioned wire per pole</td>
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<td>9.</td>
<td>Length of each untensioned wire</td>
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<td>10.</td>
<td>Concrete quantity</td>
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<td>11.</td>
<td>Steel quantity</td>
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<td>12.</td>
<td>Cement quantity</td>
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