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SPECIFICATION FOR

REINFORCED CONCRETE POLES FOR TELECOMMUNICATION LINES

BUREAU OF CEYLON STANDARDS

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This standard does not purport to include all the necessary provisions of a contract.

SRI LANKA STANDARD

SPECIFICATION FOR REINFORCED CONCRETE POLES FOR TELECOMMUNICATION LINES

FOREWORD

This Sri Lanka Standard Specification was prepared by the Drafting Committee on Concrete Fence Posts and Telecommunication Poles. It was approved by the Civil Engineering Divisional Committee of the Bureau of Ceylon Standards and was authorised for adoption and publication by the Council of the Bureau on 1975-12-03.

This specification has been prepared with a view to clarifying and defining design requirements for different types of reinforced concrete poles used in telecommunication lines. This relates to concrete poles in the manufacture of which mechanical compacting methods, such as vibration, shocking, spinning, etc., have been adopted, and also to hand compacted poles.

For the purpose of deciding whether a particular requirement of this specification is complied with, the final value observed or calculated expressing the result of a test or calculation, shall be rounded off in accordance with CS 102:Presentation of Numerical Values. The number of figures to be retained in the rounded off values shall be the same as that of the specified value in this specification.

All quantities and dimensions in this specification have been given in the metric system, with the approximate inch-equivalents in brackets.

In the preparation of this standard, the assistance derived from the publications of the British Standards Institution is gratefully acknowledged.

1 SCOPE

This Sri Lanka standard specification covers requirements and methods of test for reinforced concrete poles, suitable for use in telecommunication lines.

2 TERMINOLOGY AND DEFINITIONS

For the purpose of this specification, the following definitions shall apply:

2.1 failure: The inability of a pole to support further load under test.

2.2 transverse: The direction along the line bisecting the angle made by the conductors at the pole.

2.3 ultimate load: The load which when applied at a point 500 mm (20 in) below the top and perpendicular to the axis normal to one of the edges of the cross-section at that point of the pole causes failure.

2.4 working load: The load which the pole is designed to carry continuously, in the transverse direction calculated as a single force applied at a point 500 mm (20 in) below the top of the pole.

3 REQUIREMENTS

3.1 Cement

The cement used in the manufacture of the pole and fittings shall comply with the requirements of CS 107:Specification for Ordinary Portland Cement or, of Rapid Hardening Portland Cement.

3.2 Aggregate

The aggregate used shall consist of clean, coarse and fine aggregates in accordance with *SLS ... Sri Lanka Standard Specification on Aggregates. The nominal maximum size of coarse aggregates shall not exceed 19.0 mm (0.75 in).

3.3 Water

Clean, fresh water which is free from inorganic or organic matter in solution or in suspension in such amounts that may impair the strength and durability of the concrete, shall be used during both mixing and maturing.

3.4 Concrete

The portion of cement to total aggregate shall be not less than 1:5 by mass, and the characteristic cube strength at 28 days, when made, cured and tested in accordance with SLS 262 Methods of sampling, analysis and testing of concrete, shall be not less than 30 MPa (4350 lbf/in^2).

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* *Under preparation.*

3.5 Reinforcement

Steel used for reinforcement shall conform to the requirements of CS 26:Specification for hot rolled mild steel round bars for concrete reinforcement or SLS 375 Cold worked deformed bars for the reinforcement of concrete.

4 MANUFACTURE

4.1 Reinforcement

4.1.1 *Preparation*

Reinforcement shall be cleaned and free from loose mill scale, loose rust, mud, oil, grease and any other coating which could reduce the bond between the concrete and the steel. A slight film of rust shall not be regarded as harmful, but the steel shall not be visibly pitted by rust.

4.1.2 *Positioning*

Longitudinal reinforcing bars shall where possible be continuous throughout the length of the pole, but may contain not more than one lap in each bar line, subject to the following conditions:

a) the laps shall be staggered

b) the length of lap shall be not less than 40 times the diameter of the smaller bar, unless welded in which case the strength of the welded joint shall be not less than the strength of the smaller of the 2 bars being jointed.

4.1.3 All reinforcement shall be accurately placed and effective means shall be provided for maintaining it in position during the manufacture of the pole.

4.1.4 The cover of concrete over all reinforcement shall be not less than 25 mm.

4.2 Placing and curing of concrete

The concrete shall be used as soon as possible after being mixed and no material which has developed an initial set shall be used in the work. Each mould shall be filled with concrete in one continuous operation. After the material has been placed in the moulds it shall be compacted and shall not be disturbed during the period of setting.

After placing, concrete shall be protected, during setting and in the first stage of hardening from shocks , running or surface water and the harmful effects of sunshine and drying winds. The concrete shall be prevented from drying out for at least 7 days.

Concrete made from Portland cement may be steam cured if the manufacturer so desires, in which case it shall be prevented from drying out for at least 4 days.

4.3 Construction and finish

4.3.1 Each pole shall be made of concrete proportioned, mixed, placed and compacted to give a dense concrete free from voids.

4.3.2 Each pole shall have a dense surface finish showing no coarse aggregate, and shall have no crevices likely to assist in the disintegration of concrete or rusting of the steel by the action of natural agencies.

4.4 Earthing

Unless otherwise specified by the purchaser, provision shall be made for connecting the metal work at the top of the pole to the earth electrode by one of the methods specified below.

4.4.1 An annealed bare copper conductor in the concrete

or

An annealed bare copper conductor attached to the exterior of the pole, or

The provision of means by which the purchaser may attach to the pole an external annealed bare copper conductor.

4.4.2 Where the main reinforcement bars are continuous or welded but not prestressed and the total cross sectional area of the bar or the group of bars where the reinforcing cage is welded together is not less than 250 mm^2 (0.4 in^2) either two copper tails or suitable non-ferrous terminals brazed one to each end of the reinforcement or a galvanized mild steel tail welded to the main reinforcement at the butt end together with a galvanized nut and socket arrangement also welded to the main reinforcement at the top as shown in Figure 2.

The protruding length and the cross-sectional area of any tail or bare conductor shall be not less than 300 mm (12 in) and 30 mm^2 (0.05 in^2) respectively.

Clause 4.4.1 specifies the method of connection between the points shown in Figure 1, whereas 4.4.2 specifies the method of connection when tails are used.

Where copper conductor or galvanized mild steel tails or arrangement in Figure 2 are not used, provision shall be made for suitable external connections at the respective points shown in Figure 1.

4.5 Maturing

Poles shall be matured for the following periods from the date of their manufacture before testing or despatch:

Ordinary Portland Cement	- 28 days
Rapid-hardening Portland Cement	- 21 days
Ordinary Portland Cement (Steam Cured)	- 14 days

4.6 Dimensions

4.6.1 *Shape*

The poles shall generally be square in section and they may be of uniform section throughout their length or tapering along their lengths on all four faces. The cross sectional dimensions shall be adequate to conform to the strength requirements given in **4.7**. Unless otherwise specified by the purchaser and provided the strength requirements are fulfilled, the dimensions given in **4.6** shall be used.

4.6.2 *Standard lengths*

The poles shall be of the following lengths - 5.6 m (18 ft 4 in), 6.7 m (22 ft), 7.5 m (24 ft 8 in), 8.0 m (26 ft 4 in), and 9.0 m (29 ft 8 in).

4.6.3 *Standard sections*

The poles shall have the following corresponding cross sectional dimensions at the base:

140 mm x 140 mm (5.5 in x 5.5 in), 180 mm x 180 mm (7.0 in x 7.0 in), 185 mm x 185 mm (7.3 in x 7.3 in), 190 mm x 190 mm (7.5 in x 7.5 in), 205 mm x 205 mm (8.0 in x 8.0 in).

4.6.4 *Tolerances*

4.6.4.1 Tolerance on length = $\pm$ 15 mm

4.6.4.2 Tolerance on cross-sectional dimension = $\pm$ 3 mm

4.6.4.3 Tolerance on straightness = 0.5 per cent

4.7 Ultimate transverse load

The minimum ultimate transverse loads for each length of pole shall be as stated in Table 1.

TABLE 1 - Minimum ultimate transverse load

Length of pole m	Minimum ultimate transverse load at 0.5 m (20 in) from top kN (lbf)
5.6	2.6 (577)
6.7	3.6 (800)
7.5	3.6 (800)
8.0	3.6 (800)
9.0	3.6 (800)

The working load shall be taken as 40 per cent of the ultimate load.

4.8 Fitting and holes

Concrete fittings attached to or forming part of a pole shall comply with the specification as far as practicable.

NOTE - The provision of holes for the attachement of fittings and the recess for the seating of cross arms are given in Appendix B and a typical arrangement of holes is shown in Figure 1 and 3.

5 TESTS

5.1 Type test

Unless otherwise specified with the enquiry or order, a written statement that the number of poles specified in Table 2, identical in all essential features of design with those purchased, have passed the type test shall be deemed to be sufficient evidence that the poles comply with the requirements of this standard. The statement shall give the results of all tests and state the age of the poles when tested.

The poles selected for the test shall be tested in accordance with Appendix A. The permanent set after removal of a test load of 60 per cent of the minimum ultimate load specified in Table 1 shall not exceed 10 per cent of the deflection at the test load. The hair cracks produced in testing shall clearly close up on removal of the test load specified above. The test load at failure shall exceed the minimum ultimate load specified in Table 1.

5.2 Proof test

The poles shall be tested in accordance with Appendix A except that the minimum load applied shall be equal to 40 per cent of the ultimate load specified in Table 1. The deflection at each measurement, and the permanent set after removal of the test load, shall not exceed by more than 15 per cent the average of the corresponding values, for the poles subjected to the type test.

6 SAMPLING AND INSPECTION

6.1 Sampling

6.1.1 *lot:* In any batch, all telecommunication poles of the same dimensions shall be grouped together to constitute a lot.

6.1.2 *sub-lot:* If the number of telecommunication poles in a lot exceed 500, the lot shall be divided into a suitable number of sub-lots, such that the number of poles in any sub-lot shall not exceed 500.

6.1.3 *sample size:* Sample size shall be made up of poles selected at random from lot or sub-lot.

6.2 Number of tests

The number of poles to be tested for dimensional requirements (overall length cross-section and uprightness) and strength shall be in accordance with Table 2.

6.3 Criterion for conformity

6.3.1 The number of telecommunication poles which do not satisfy the requirements of overall length, cross-section and uprightness shall not exceed the corresponding number given in Column 3 of Table 2.

6.3.2 All the telecommunication poles for strength test shall satisfy the requirements of the test. If one or more telecommunication poles fail in test twice the number of telecommunication poles originally tested shall be selected from the lot or sub-lot and subjected to the test. If there is no failure of the test among these telecommunication poles, the lot or the sub-lot shall be considered to have satisfied the requirements of this test.

TABLE 2 - Sample size and criterion for conformity

Size of lot or sub-lot	Dimensional requirements		No. of poles for strength test	
	Sample size	Permissible no. of defectives	Type test	Proof test
(1)	(2)	(3)	(4)	(5)
Up to 100	10	1	5	5
101 to 200	15	1	7	8
201 to 300	20	2	10	10
301 to 500	30	3	15	15

7 MARKING

The poles shall be clearly and indelibly marked during manufacture, at a position approximately 3.0 m (10 ft.) from the butt end with the following (See Fig. 1).

a) A horizontal mark at a point 3.0 m (10 ft.) from the butt end,

b) Year of manufacture (last 2 figures),

c) Manufacturer's mark, and

d) Length of pole in metres.

APPENDIX A

A.1 STRUCTURAL TEST FOR POLES

A pole may be tested in either the horizontal or vertical position. Hold the pole rigidly at the butt end in accordance with the supported length specified in Table 3.

TABLE 3 - Supported length

Length of pole m	Supported length m (in)
5.6	0.9 (36)
6.7	1.1 (44)
7.5	1.2 (48)
8.0	1.4 (56)
9.0	1.5 (60)

If tested in the horizontal position, provision may be made by suitable supports to minimize the bending moment induced by the weight of the pole. Apply the test load at a point 0.5 m (20 in) from the top of the pole and raise it in increments of 10 per cent of the ultimate load. Take measurements of deflection after each increment and other measurements detailed below as appropriate.

A.1.1 Type test

At 40 per cent and at 60 per cent of the ultimate load reduce the load to zero and measure the permanent set. Then increase the load in steps of 10 per cent of the ultimate load until failure occurs. Maintain each load above 60 per cent of the ultimate load for at least two minutes.

A.1.2 Proof test

At 40 per cent of the ultimate load reduce the load to zero and measure the permanent set.

APPENDIX B

B.1 RECOMMENDATIONS FOR THE PROVISION OF HOLES

A typical arrangement of holes is shown in Figure 1, but other arrangements may be specified by the user.

APPENDIX B

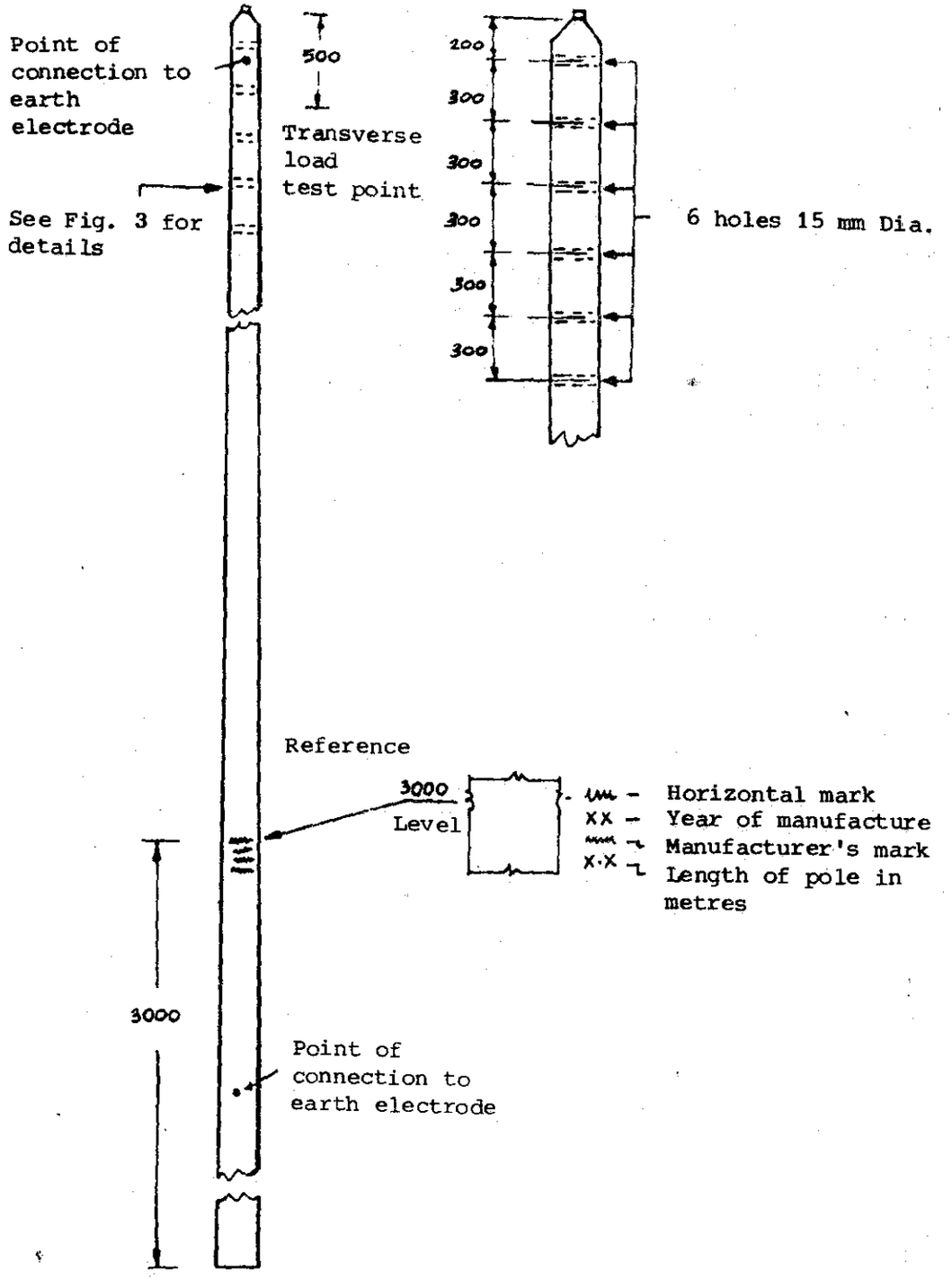

FIGURE 1 - Elevation of typical pole in direction of line indicating holes and markings

NOTES

1 5.5 m pole shall have only 4 holes from the top.

2 This drawing gives information on holes and markings only and shall not be used as a basis for design. All dimensions in millimetres unless otherwise stated.

3 Alternative arrangement in Fig. 2 can be used as decided by the purchaser.

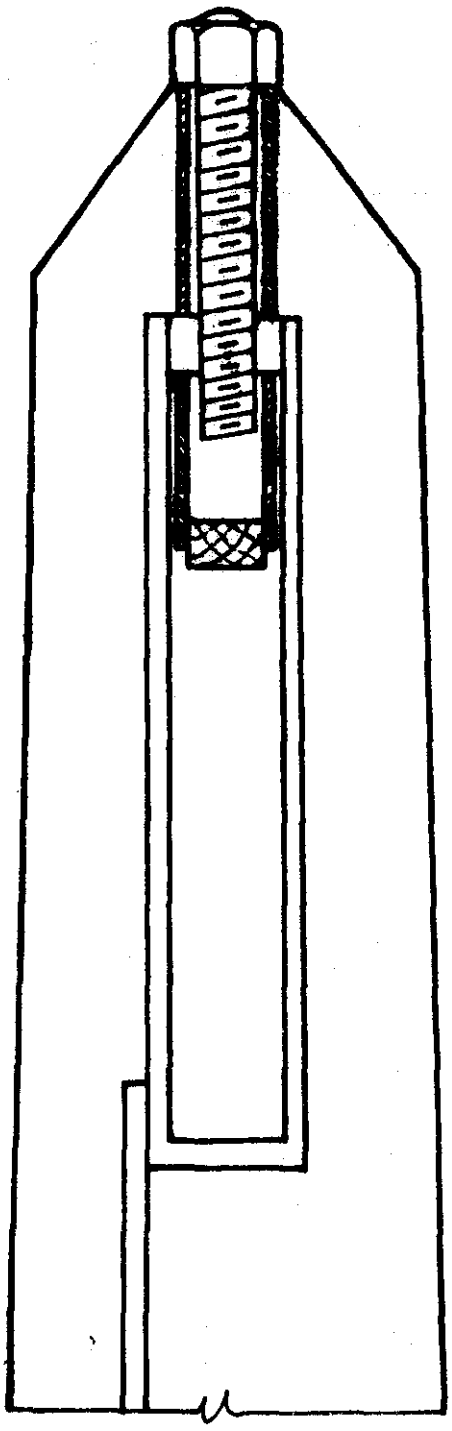

FIGURE 2

(See Note 3 in Fig. 1)

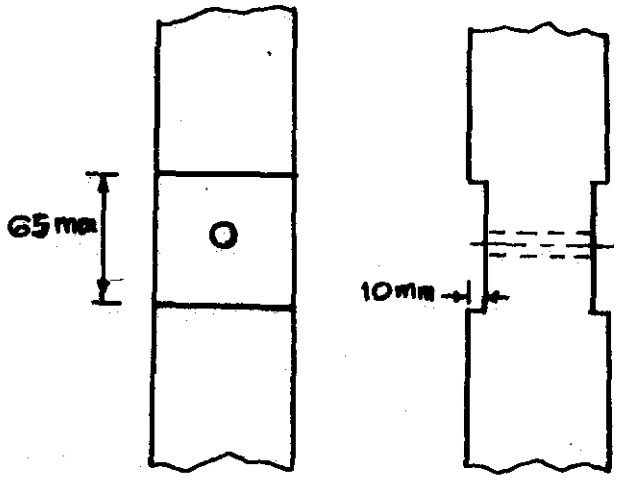

FIGURE 3 - Cross arm recess

BUREAU OF CEYLON STANDARDS

The Bureau of Ceylon Standards (BCS) is the national standards organization of Sri Lanka and was established by the Hon. Minister of Industries & Fisheries, as provided for by the Bureau of Ceylon Standards Act. No. 38 of 1964.

The principal objects of the Bureau as set out in the Act are to promote standards in industry and commerce, prepare national Standards Specifications and Codes of Practice and operate a Standardization Marks Scheme and provide testing facilities, as the need arises.

The Bureau is financed by Government grants and the sale of its publications. Financial and administrative control is vested in a Council appointed in accordance with the provisions of the Act.

The detailed preparation of Standard Specifications is done by Drafting Committees composed of experts in each particular field assisted by permanent officers of the Bureau. These Committees are appointed by the Divisional Committees, which are appointed by the Council. All members of the Drafting and Divisional Committees render their services in an honorary capacity. In preparing the Standard Specifications, the Bureau endeavours to ensure adequate representation of all view points.

In the international field the Bureau represents Sri Lanka in the International Organization for Standardization (ISO) and will participate in such fields of Standardization as are of special interest to Sri Lanka.

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