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SPECIFICATION FOR PRECAST REINFORCED CONCRETE STREET LIGHTING POLES

(First Revision)

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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SPECIFICATION FOR PRECAST REINFORCED CONCRETE STREET LIGHTING POLES

(First Revision)

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Indian Standard

SPECIFICATION FOR PRECAST REINFORCED CONCRETE STREET LIGHTING POLES

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 29 August 1986, after the draft finalized by the Cement and Concrete Sectional Committee had been appproved by the Civil Engineering Division Council.

0.2 This standard has been prepared with the object of providing guidance to the manufacturers and the users in obtaining precast reinforced concrete street lighting poles capable of giving satisfactory service. The standard covers only poles in the manufacture of which mechanical compacting methods such as vibration, shocking, spinning, etc, have been adopted and does not include hand compacted poles in its scope. Recommendations regarding selection, handling and erection of poles are covered in IS : 7321-1974*.

0.3 This standard was first published in 1959 under the title 'Specification for reinforced concrete street lighting columns'. The present modification in title is intended to make it more clear.

0.4 The present revision has been taken up with a view to incorporating the modifications found necessary in the light of experience gained during the use of this standard. This revision incorporates significant modifications in respect of materials, design, earthing of poles, tests for poles and brackets, and sampling and inspection. In addition, modifications have been made in respect of some other provisions such as length, tolerance on dimensions, depth of planting, marking of poles, etc.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in

*Code of practice for selection, handling and erection of concrete poles for overhead power and telecommunication lines.

accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements for precast reinforced concrete poles suitable for use for street lighting, manufactured by mechanical compacting methods such as vibration, shocking, spinning, etc. This standard does not cover prestressed or hand compacted concrete poles.

1.2 The poles covered by this standard are not intended for overhead wiring purposes.

1.3 Concrete fittings attached to or forming part of a pole are also covered by this standard as far as practicable.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Load Factor — The ratio of ultimate transverse load to the 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.

2.2 Maximum Working Load — The maximum working load in the transverse direction that is ever likely to occur including the wind pressure on the pole. This load is assumed to act at a point 600 mm below the connection of the bracket to the pole and will create a bending moment equal to the sum of the bending moments caused by the following loads :

a) Wind pressure on the pole, bracket, luminaire and any raising or lowering contact gear;

b) Overhanging weight of bracket and luminaire; and

c) If raising and lowering gear is provided, the weight of such gear attached to the bracket plus 50 percent of the weight of the luminaire and the moving part of the gear.

2.3 Mounting Height — The mounting height is the vertical distance from the centre of the light source to the road surface or to the horizontal plane through the nearest point of the road where the light source is not vertically above it.

*Rules for rounding off numerical values (*revised*).

2.4 Outreach — The outreach is the shortest distance between the vertical through the centre of the base of the pole and the vertical through the centre of the light source.

2.5 Ultimate Transverse Load — The load at which failure occurs when it is applied to a point 600 mm below the centre of light source and perpendicular to the axis of the pole along the transverse direction with the butt end of the pole planted to the required depth as intended in the design.

3. OVERALL LENGTH OF POLES

3.1 The minimum length of pole shall be arrived at after fixing the mounting height on the basis of traffic situation of the concerned street and adding thereto the minimum planting depth as mentioned in 5.3. However, in no case the pole length should be less than 5·2 m, considering the minimum mounting height of 4·0 m and the corresponding planting depth of 1·2 m. For longer poles, the lengths shall be in steps of 0·5 m.

3.2 Tolerances — The tolerance on overall length and cross-sectional dimensions of the poles shall be $\pm$ 15 mm and $^{+5}_{-3}$ mm respectively. Tolerances on uprightness of the pole shall be 0·5 percent.

4. MATERIALS

4.1 Cement — Cement used in the manufacture of poles and fittings shall conform to IS : 269-1976*, or IS : 455-1976†, or IS : 1489-1976‡, or IS : 8041-1978§, or IS : 8043-1978‖, or IS : 8112-1976¶.

4.2 Aggregates — Aggregates shall comply with the requirements of IS : 383-1970**. Where specified, sample of aggregate shall be submitted to the purchaser for approval. The maximum size of aggregates shall in no case exceed 20 mm.

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*Specification for ordinary and low heat Portland cement (*third revision*).

†Specification for Portland slag cement (*third revision*).

‡Specification for Portland-pozzolana cement (*second revision*).

§Specification for rapid hardening Portland cement (*first revision*).

‖Specification for hydrophobic Portland cement (*first revision*).

¶Specification for high strength ordinary Portland cement.

**Specification for coarse and fine aggregates from natural sources for concrete (*second revision*).

4.2.1 Other types of aggregates such as slag and crushed overburnt brick or tile which may be found suitable with regard to strength, durability of concrete and freedom from harmful effects may be used but such aggregates should not contain more than one percent of sulphates and should not absorb more than 10 percent of their own mass of water.

4.2.2 Heavy weight aggregates or light weight aggregates such as bloated clay aggregates and sintered fly ash aggregates may also be used provided the data on the properties of concrete made with them is satisfactory.

4.2.3 Fly ash conforming to IS : 3812-1981* may be used as part replacement of fine aggregates.

4.3 Reinforcement — The reinforcement shall be any of the following:

a) Mild steel and medium tensile steel bars conforming to IS : 432 (Part 1)-1982†,

b) Deformed steel bars conforming to IS : 1786-1985‡, or

c) Structural steel bars conforming to IS : 226-1975§.

4.3.1 The surface of all reinforcement shall be free from loose scales, oil, grease, clay or other materials that may have deteriorating effect on the bond between reinforcement and the concrete.

4.4 Concrete — Concrete used for the manufacture of reinforced concrete poles shall not be less than grade M 20 specified in IS : 456-1978||.

4.5 Admixtures — Admixtures may be used with the approval of the purchaser. The admixtures shall conform to IS : 9103-1979¶.

5. DESIGN

5.1 The poles shall be so designed that they do not fail owing to failure initiated by compression of concrete.

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*Specification for fly ash for use as pozzolana and admixture (*first revision*).

†Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement: Part 1 Mild steel and medium tensile steel bars (*third revision*).

‡Specification for high strength deformed steel bars and wires for concrete reinforcement (*third revision*).

§Specification for structural steel (standard quality) (*fifth revision*).

||Code of practice for plain and reinforced concrete (*third revision*).

¶Specification for admixtures for concrete.

5.2 The maximum wind pressure to be assumed for computing the design transverse load at first crack shall be as specified by the State Governments who are empowered in this behalf under the Indian Electricity Rules, 1956. In the absence of any data/information from the State Governments, wind pressure may be determined as specified in IS : 875-1964*. The wind pressure may also be calculated considering the shape factor of poles and brackets depending on their plan shape as per IS : 875-1964*.

5.3 Depth of Planting — The minimum depth of planting of a pole below ground level shall be in accordance with Table 1, the actual depth being determined on the basis of ground conditions.

TABLE 1 MINIMUM DEPTH OF PLANTING OF REINFORCED CONCRETE POLES

Mounting Height, m	Minimum Depth in Ground, m	Remarks
(1)	(2)	(3)
4·0 to 6·0	1·20	} In increments of preferably 0·5 m
6·5 to 7·5	1 50	
8·0 to 9·0	1·80	

5.4 Unless otherwise specified by the purchaser, the distance from the lantern support to the centre of light source shall be taken as given in Table 2.

TABLE 2 DISTANCE FROM LANTERN SUPPORT TO CENTRE OF LIGHT SOURCE

Sl No.	Mounting Height of Poles, m	Nominal Distance from Lantern Support to the Centre of Light Source, mm	
		For Top Entry Lantern	For Side Entry Lantern
(1)	(2)	(3)	(4)
i)	4·0 to 5·5	300	100
ii)	6·0 to 7·5	300 to 450*	100 to 150*
iii)	7·5 to 9·0	450	150

*As specified by the purchaser.

*Code of practice for structural safety of buildings: Loading standards (*revised*).

5.5 Outreach — This will be in standard length as specified in Table 3.

TABLE 3 STANDARD LENGTH OF OUTREACH

Mounting Height, m	Outreach, m
(1)	(2)
4·5	Not exceeding 0·5 m
6·0, 7·5, 9·0	Varying from 0·50 m to 2·75 m in steps of 0·25 m

5.5.1 Unless otherwise specified by the purchaser, the distance between the vertical through the centre of light source of a side entry lantern and the extremity of the concrete on the bracket arm shall be taken as 300 mm nominal.

5.6 The poles shall be designed to resist the maximum bending moment due to a load of 90 kg or the maximum working load, whichever is greater, applied at 600 mm below the centre of light source or, if so specified by the purchaser, at a point immediately below the connection of the bracket to the pole.

5.7 The minimum load factor shall be 2·5 as stipulated in Rule No. 76 of the Indian Electricity Rules, 1956. This factor may be reduced to a value not less than 2·0 in case of street lighting poles by the State Governments who are empowered in this behalf under the Indian Electricity Rules, 1956.

5.8 In order to provide adequate impact resistance for poles in excess of 7·5 m in height and in particular to reduce the danger of collapse when subjected to impact, a minimum of 284 mm^2 of steel reinforcement shall be provided in the lower portion of the pole extending from a minimum distance of 600 mm below the ground line to a minimum height of 600 mm above the door opening. Effective means shall be provided for maintaining it in position during the manufacture of the pole and all spacers or other devices used for this purpose shall be of rustproof material. Such steel shall be continuous and suitably distributed over the section of the concrete to resist impact from any direction and shall be spaced by means of transverse reinforcement to form a rigid cage. The diameter of the transverse reinforcement shall not be less than 5 mm at a spacing not greater than 16 times the diameter of the longitudinal reinforcement in the pole.

5.9 Vertical Load on Bracket — The vertical load on the bracket shall be taken as equivalent to the weight of the lantern, weight of raising and lowering gear attached to the bracket (if used) plus 50 percent of the weight of the lantern and of the moving part of that gear, the load

being applied at point of support of the lantern with the bracket rigidly fixed to the pole in the designed manner.

5.10 Transverse Load on Bracket — The load caused by wind pressure on the lantern and bracket is considered as acting at the point of support of the lantern with the bracket fixed to the pole. The design of the connections of bracket to pole shall provide for torsional stresses due to wind load on the bracket and the lantern.

6. FITTINGS

6.1 Spigot — When poles with top spigots are required, and unless otherwise specified by the purchaser, the following sizes shall be provided:

a) For 6, 7·5 and 9 m mouting heights: A spigot with 100 mm dia and 150 mm long.

b) For 4·5 m mounting height : A spigot with 80 mm dia and 80 mm long.

6.2 Nipples — Unless otherwise specified by the purchaser, nipples shall be provided at the end of the bracket as follows:

a) For mounting heights, 7·5 and 9 m:
   i) *To Take Pendant Lanterns* — Vertical 30 mm gas nipple having at least 40 mm of exposed thread;
   ii) *To Take Side Entry Lanterns* — 30 mm steel tubing with end horizontal and plain or threaded, as specified by the purchaser.

b) For mounting heights, 4·5 and 6 m:
   i) *To Take Pendant Lanterns* — Vertical 20 mm or 30 mm gas nipple having at least 25 mm of exposed thread;
   ii) *To Take Side Entry Lanterns* — 20 mm or 30 mm steel tubing with end horizontal and plain or threaded, as specified by the purchaser.

6.3 Ladder Arms — If required, and unless otherwise specified, ladder arms shall be as follows:

a) Double arms, each of 250 mm overall projections; and

b) Single arm, of 550 mm overall projection.

6.4 Door and Door Openings — Unless otherwise specified by the purchaser, a weatherproof door with a locking device, which will resist unauthorised entry, shall be included in the pole. The door opening shall be of size agreed upon between the manufacturer and the purchaser.

6.4.1 The bottom of the opening shall be at least 300 mm above ground level.

6.5 All metal works shall be of non-corroding metal or of metal suitably protected against corrosion.

6.6 Bore — All poles shall have a smooth walled central duct of diameter not less than 30 mm for the purpose of taking the supply from the base to the lighting unit at top.

6.7 Service Connections — Suitable apertures shall be provided on at least two sides of the pole below ground level for the entry of electric cables or gas service pipes. Unless otherwise specified, service slots shall be approximately 225 mm long and 75 mm wide with the top at least 300 mm below ground level. The edges of the slot shall be suitably rounded to prevent damage to the sheath or armouring of the cables.

6.8 Breathing Holes — Breathing holes shall be provided in the door and also as close to the top of the pole as is practicable to allow circulation of air and to limit condensation. The holes shall be suitably protected against the entry of rain water.

7. MANUFACTURE

7.1 All reinforcement shall be accurately placed and maintained in position during manufacture. All spacers and other devices used to obtain the necessary cover shall be of corrosion-resistant material.

7.2 Cover — Unless otherwise specified, the cover of concrete over all reinforcement in the case of centrifugally spun poles, shall be not less than 15 mm. In the case of poles made by any other mechanical compaction process, the cover shall be at least equal to the maximum size of aggregate plus 2 mm but in no case less than 20 mm. In case of corrosive atmosphere, cover may be suitably increased.

7.3 Welding and Lapping of Reinforcement — The strength of welded joints shall be equal to the strength of the bars or at least to that of the smaller bar where the bars joined differ in sectional area. Where the bars are lapped, these shall be staggered and the lap shall conform to IS : 456-1978*.

7.4 Compacting — 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

*Code of practice for plain and reinforced concrete (*third revision*).

until the concrete attains sufficient strength. Then the poles and brackets may be removed from the mould and watered at intervals to prevent surface cracking of the unit; the interval shall depend on the atmospheric humidity and temperature. Steam curing may also be permitted.

7.6 During manufacture, daily tests on concrete cubes shall be carried out till the concrete achieves the required strength. Thereafter the tests on concrete shall be carried out as detailed in IS : 456-1978*. The manufacturer shall supply, when required by the purchaser or his representative, results of compressive tests conducted in accordance with IS : 456-1978* 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 : 456-1978*.

7.7 **Earthing** — Earthing shall be provided by either of the following means:

a) By having a length of galvanized iron wire of 4 mm diameter or equivalent strip or equivalent bare copper cable embedded in concrete during manufacture and the ends of the wire or strip or cable left projecting from the pole to a length of 100 mm at 215 mm from top and 150 mm below ground level.

b) By providing two holes of suitable dimensions 215 mm from top and 150 mm below ground level to enable a galvanized iron wire of 4 mm diameter or equivalent strip or equivalent bare copper cable to be taken from the top hole to the bottom hole through the central hollow.

NOTE — The details of embedment of the wire or strip or cable shall be as agreed upon between the manufacturer and the purchaser.

7.8 **Finish** — The poles shall be of good finish and free from honeycombing. The surfaces of the poles in contact with the moulds shall be smooth and regular in shape. All arrises shall be clear and well-defined so as to present a neat appearance.

8. TESTS

8.1 **Transverse Strength Test for Poles** — The transverse strength test of poles shall be conducted in accordance with IS : 2905-1966†. The poles tested as above shall comply with the following requirements:

a) The permanent set after removal of test load, 60 percent greater than the working load, shall not exceed 15 percent of the deflection at that load.

*Code of practice for plain and reinforced concrete (*third revision*).

†Methods of test for concrete poles for overhead power and telecommunication lines.

b) The pole shall be deemed not to have passed the test if cracks wider than 0·1 mm appear at a stage prior to the application of the design transverse load at first crack and/or the observed ultimate transverse load is less than the design ultimate transverse load.

8.2 Strength Test for Brackets

8.2.1 The brackets shall be tested either in its normal position at the top of the pole or fixed into a special pole head of identical dimensions, which may be a portion cut from a pole. The pole or pole head shall be rigidly fixed in a vertical position.

8.2.2 Vertical and transverse test loads calculated in accordance with **5.9** and **5.10** shall be gradually applied at the end of the bracket, the ratio between the vertical and transverse loads being kept constant. When the maximum working loads are reached, it shall be maintained for at least 2 minutes and the maximum deflection shall be measured.

8.2.3 The load shall then be reduced to zero and the residual deflection shall be measured after 10 minutes.

8.2.4 The brackets shall be considered satisfactory if the recovery is at least 75 percent of the maximum deflection while under load.

8.2.5 The load causing failure shall be not less than ' the maximum working load multiplied by the load factor considered in the design '.

9. SAMPLING AND INSPECTION

9.1 Scale of Sampling

9.1.1 *Lot* — In a consignment, 500 poles (or brackets) or a part thereof of the same mounting height, same dimensions and belonging to the same batch of manufacture, shall be grouped together to constitutes a lot.

9.1.2 For ascertaining the conformity of the materials in the lot to the requirements of this specification, samples shall be tested from each lot separately.

9.1.3 The number of poles or brackets to be selected from the lot shall depend on the size of the lot and shall be according to Table 4.

9.2 Number of Tests and Criteria for Conformity

9.2.1 All the poles/brackets selected according to **9.1.3** shall be tested for overall length, cross-section and uprightness (*see* **3.2**). A pole/bracket failing to satisfy one or more of these requirements shall be considered as defective. All the poles/brackets in the lot shall be considered as conforming to these requirements if the number of defective poles/brackets found in the sample is less than or equal to the corresponding acceptance number given in col 3 of Table 4.

TABLE 4 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES

(*Clauses* 9.1.3 *and* 9.2.1)

No. of Poles or Brackets in the Lot	Dimensional Requirements		Transverse Strength at First Crack	Transverse Strength, Ultimate
	Sample Size	Acceptance Number		
(1)	(2)	(3)	(4)	(5)
Up to 100	10	1	2	Nil
101 to 200	15	1	3	Nil
201 to 300	20	2	4	Nil
301 to 500	30	3	5	1

NOTE — The poles or brackets tested up to first crack may be used, provided the crack is closed after removal of the load.

9.2.2 The lot having been found satisfactory according to **9.2.1** shall be further tested for transverse strength (*see* **8.1**) of the poles. For this purpose, the number of poles given in col 4 of Table 4 shall be tested. These poles may be selected from those already tested according to **9.2.1** and found satisfactory. All these poles tested for transverse strength shall satisfy the corresponding specification requirements. If one or more poles fail, twice the number of poles originally tested shall be selected from those already selected and subjected to this test. If there is no failure among these poles, the lot shall be considered to have satisfied the requirements of this test.

9.2.3 All the brackets selected from the lot according to **9.1.3** shall be subjected to strength test for brackets (*see* **8.2**). All the brackets tested for strength test shall satisfy the requirements of this specification. If one or two brackets fail, twice the number of brackets originally tested shall be selected from the lot and subjected to this test. If there is no failure among these brackets, the lot shall be considered to have satisfied the requirements of the specification. If more than two brackets fail, the lot shall be considered not to have satisfied the requirements of the specification.

10. MARKING

10.1 The poles shall be clearly and indelibly marked with the following particulars either during or after the manufacture, but before testing, at a position so as to be clearly read after erection in position:

a) Month and year of manufacture;

b) Name of the manufacturer, or his registered trade-mark, or both;

c) Serial number of the poles; and

d) Position of centre of gravity of the poles with the words ' C.G. '

10.1.1 Each pole may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provision of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard, under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

11. INFORMATION TO BE SUPPLIED WITH THE ENQUIRY OR ORDER

11.1 The following information shall be supplied with enquiry or order:

a) Mounting height;

b) Type of lantern and outreach;

c) Weight of lantern and, if provided, weight of raising and lowering gear;

d) Spigot and nipples (*see* **6.1** *and* **6.2**);

e) Angle which the axis of the nipple at the end of the bracket makes with the vertical (*see* **6.2**);

f) Ladder arms, if required (*see* **6.3**);

g) Size of door opening (*see* **6.4**);

h) Any special requirements in respect of depth of planting; and

j) Position and size of service slots (*see* **6.7**).

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N $= 1\ kg.m/s^2$
Energy	joule	J	1 J $= 1$ N.m
Power	watt	W	1 W $= 1$ J/s
Flux	weber	Wb	1 Wb $= 1$ V.S
Flux density	tesla	T	1 T $= 1\ Wb/m^2$
Frequency	hertz	Hz	1 Hz $= 1\ c/s(s^{-1})$
Electric conductance	siemens	S	1 S $= 1$ A/V
Electromotive force	volt	V	1 V $= 1$ W/A
Pressure, stress	pascal	Pa	1 Pa $= 1\ N/m^2$

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