



Standard Specification for Spun Cast Prestressed Concrete Poles¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers spun cast prestressed concrete poles for use as structural supports for streetlights; traffic signals; and transmission, distribution, and communication lines.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:

- A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement²
- A 416/A 416M Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete²
- A 421 Specification for Uncoated Stress-Relieved Wire for Prestressed Concrete²
- A 496 Specification for Steel Wire, Deformed, for Concrete Reinforcement²
- A 615/A 615M Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement²
- A 617/A 617M Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement²
- A 641 Specification for Zinc-Coated (Galvanized) Carbon Steel Wire³
- A 706/A 706M Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement²
- A 722/A 722M Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete²
- C 31/C 31M Practice of Making and Curing Concrete Test Specimens in the Field⁴
- C 33 Specification for Concrete Aggregates⁵
- C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens⁶
- C 42 Test Method for Obtaining and Testing Drilled Cores

and Sawed Beams of Concrete⁵

C 150 Specification for Portland Cement⁷

C 172 Practice for Sampling Freshly Mixed Concrete⁵

C 260 Specification for Air-Entraining Admixtures for Concrete⁵

C 330 Specification for Lightweight Aggregates for Structural Concrete⁵

C 494 Specification for Chemical Admixtures for Concrete⁵

C 595M Specification for Blended Hydraulic Cements⁷

C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolans for Use as a Mineral Admixture in Concrete⁵

2.2 AASHTO Standard:

Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (LTS-2)⁸

2.3 ANSI Standard:

National Electrical Safety Code⁹

2.4 PCI Guides:

Guide for Design of Prestressed Concrete Poles¹⁰

Guide Specification for Prestressed Concrete Poles¹⁰

3. Terminology

3.1 Definitions:

3.1.1 *cracking load*—a load which creates a bending moment of enough magnitude to produce a tensile stress greater than the sum of induced compression plus the tensile strength of the concrete resulting in tensile cracks on the tension face of the pole.

3.1.2 *spun pole*—a pole in which the concrete is distributed and compacted through centrifugal force.

3.1.3 *ultimate load*—maximum load the pole will carry in the specified direction, before the concrete or steel will reach its limiting state.

4. Basis of Acceptance

4.1 The acceptability of the poles shall be determined by the results of full-scale bending and torsional tests. Poles shall be

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² *Annual Book of ASTM Standards*, Vol 01.04.

³ *Annual Book of ASTM Standards*, Vol 01.06.

⁴ *Annual Book of ASTM Standards*, Vol 04.10.

⁵ *Annual Book of ASTM Standards*, Vol 04.02.

⁶ *Annual Book of ASTM Standards*, Vol 04.07.

⁷ *Annual Book of ASTM Standards*, Vol 04.01.

⁸ Available from American Association of State Highway and Transportation Officials, 444 N. Capitol Street, NW, Washington, DC 20001.

⁹ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

¹⁰ Available from Prestressed Concrete Institute, 201 North Wells Street, Chicago, IL 60606.

accepted on the basis of producer certification and historical test data of full-scale bending and torsional tests on equal or larger poles. The purchaser shall specify the number and frequency of full-scale tests. Poles failing to meet the strength requirements specified by the purchaser or the tolerances specified herein shall be rejected.

5. Materials

5.1 *Cement*—Portland cement shall conform to the requirements of Specification C 150 or shall be portland blast-furnace slag cement or portland-pozzolan cement conforming to the requirements of Specification C 595M.

5.2 *Aggregate*—Aggregates shall conform to Specification C 33 except that the requirements for grading shall not apply. If a producer can demonstrate that aggregates conforming to Specification C 330 could be used to manufacture an acceptable product, those aggregates may be used.

5.3 *Water*—Water used for mixing concrete shall be free of oils, organic matter, and other substances in amounts that may be deleterious to concrete, and it shall not contain concentration of chloride ions in excess of 500 ppm or sulfate ions in excess of 1000 ppm.

5.4 *Admixture*—Chemical admixtures shall conform to Specification C 494. Air-entraining admixtures shall conform to Specification C 260. Fly ash or other pozzolanic admixtures shall conform to the requirements of Specification C 618. Admixtures shall not cause the chloride ion content of the concrete to exceed 0.06 % by mass of cement.

5.5 *Steel*—Prestressing steel shall conform to Specifications A 416/A 416M, A421, or A722/A 722M. Non-tensioned longitudinal reinforcement shall conform to Specifications A 615/A 615M, A617/A 617M, or A496. Circumferential wire reinforcement shall conform to Specification A 82, A 496, or A 641. Base plates, anchor bolts and top mount couplings shall conform to the ASTM specifications designated on contract drawings.

5.6 All inserts shall be corrosion resistant and used according to the manufacturer's specifications. No aluminum inserts shall be allowed.

6. Requirements

6.1 General Requirements:

6.1.1 *Concrete Cover*—The minimum concrete cover over all reinforcing steel shall be $\frac{3}{4}$ in. (19 mm) unless specified otherwise by purchaser. For street lighting poles, cover can be reduced to $\frac{1}{2}$ in. (13 mm).

6.1.2 *Circumferential Wire*—Circumferential wire spacing shall be a maximum of 4 in. (102 mm), except at the ends (measured from either the top or bottom to a distance of 1 ft (305 mm)) where the maximum spacing will be 1 in. (25 mm).

6.1.3 *Grounding*—The purchaser shall specify any grounding requirements needed.

6.1.4 *Exterior Surface Treatment*—Exterior concrete surface finish shall be as specified by the purchaser.

6.1.5 *Prestressing*—Initial prestress shall not be applied until the concrete strength has reached the greater of 3500 psi (24 MPa) or 1.67 times the maximum expected stress in the concrete due to the prestressing forces immediately after transfer and before losses occur.

6.1.6 The minimum 28-day compressive strength for concrete used in poles shall be 7000 psi (48 MPa) as determined using Test Methods C 39 or C 42. For street lighting poles, the compressive strength may be reduced to a minimum of 5000 psi (35 MPa). The cylinders for compression tests shall be made in accordance with Practices C 31 and C 172.

6.2 Load Requirements:

6.2.1 Poles shall be designed to withstand ultimate load. Ultimate capacity of the pole shall be determined in accordance with the PCI Guide for design (2.4). Where local codes so require, seismic loads shall be considered in the design of poles. Poles shall be proportioned so that stresses produced by the manufacturing process, transportation, and installation, as well as dead and live loads, will not be detrimental to the strength, serviceability requirements, and aesthetics of the structure. Under corrosive environments or strain pole applications or both, poles shall be designed so that the cracking capacity exceeds the unfactored loads based on a 10-year minimum return period.

6.2.2 Unless local codes or agency standards require otherwise, the following loading criteria shall apply:

6.2.2.1 AASHTO loading criteria shall apply for street lights and traffic signals.

6.2.2.2 ANSI National Electric Safety Code loading criteria (2.3) shall apply for transmission, distribution, and communication lines. The purchaser will specify the load trees required for design. If deflection is critical, the purchaser shall specify maximum allowable deflection.

7. Load Test Procedures

7.1 The poles shall be tested in either a horizontal or vertical position.

7.2 The number, location, direction, holding time, sequence, and increments of the test loads, and the number, location, and direction of deflection reading shall be approved by the purchaser.

7.3 The method of attaching the test loads to produce bending and torsional stresses, applying the test loads, and measuring and recording the test loads and deflections shall be approved by the purchaser before testing begins.

7.4 The producer shall furnish the purchaser copies of the test report. This report shall include all recorded test data as well as drawings describing the test.

8. Tolerances

8.1 The following tolerances are based on experience with the spun pole manufacturing process:

8.1.1 *Length*—shall vary by no more than 2 in. (50 mm) or 1 in. (25 mm) plus $\frac{1}{4}$ in. (6 mm) per 10 ft (3 m), whichever is greater.

8.1.2 Cross Section:

8.1.2.1 *Outside Diameter*—shall vary by no more than $\frac{1}{4}$ in. (6 mm).

8.1.2.2 *Wall Thickness*—shall be no less than 88 % of the design thickness or no more than $\frac{1}{4}$ in. (6 mm) less than the design thickness, whichever is greater.

8.1.3 *Deviation from Longitudinal Axis (Sweep)*—shall vary no more than $\frac{1}{4}$ in. (6 mm) per 10 ft (3 m) of length, applicable for the entire length or any segment thereof.

8.1.4 *End Squareness*—shall vary no more than ½ in. (13 mm) per 1 ft (305 mm) of diameter.

8.1.5 *Mass*—shall vary no more than 10 % of the design mass.

8.1.6 *Reinforcement Placement:*

8.1.6.1 *Longitudinal Reinforcement*—shall vary no more than ¼ in. (6 mm) for individual elements and no more than ⅛ in. (3 mm) for the centroid of a group.

8.1.6.2 *Spiral Reinforcement*—shall be within $\pm 1\frac{1}{2}$ in. (38 mm) of its specified location, except at the ends (measured from either top or bottom to a distance of 1 ft (305 mm)) where the spacing location shall be within $\pm \frac{1}{4}$ in. (6 mm). The number of spirals of cold-drawn circumferential wire along any 5 ft (1.5 m) of length shall not be less than required by design.

8.1.7 *Bolt Holes:*

8.1.7.1 *Bolt Hole Diameter*—shall vary no more than ⅛ in. (1.5 mm).

8.1.7.2 *Bolt Hole/Insert Spacing*—shall vary no more than ⅛ in. (3 mm) for holes within a group and no more than 1 in. (25 mm) for the centerline of the group.

8.1.8 *Aperture and Blockout Placement*—shall vary no more than 2 in. (50 mm) from the designated location.

9. Detail Drawings

9.1 The producer shall furnish the purchaser sets of fabri-

cation and detail drawings that shall include the following information:

9.1.1 Dimension and length,

9.1.2 Description and location of the steel reinforcement,

9.1.3 Twenty-eight-day strength of the concrete and detensioning strength,

9.1.4 All the necessary stressing information,

9.1.5 Size, description, quantity, and location of all hardware that is a part of the pole.

9.1.6 Cracking and ultimate moment at the ground line or the most critical section along the pole length,

9.1.7 Marking of the poles as specified, and

9.1.8 Any other special information required by the purchaser.

10. Inspection

10.1 The quality of materials, the process of manufacture, and the finished poles shall be subject to inspection and approval by the purchaser. The producer shall afford the purchaser reasonable access for making the necessary checks of the production facilities and any required tests. All tests and inspection are to be conducted so as not to interfere unnecessarily with the manufacture and delivery of the pole.

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