Designation: C1089 – 13

# Standard Specification for Spun Cast Prestressed Concrete Poles[1]

This standard is issued under the fixed designation C1089; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope

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

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

A82/A82M Specification for Steel Wire, Plain, for Concrete Reinforcement (Withdrawn 2013)[3]

A416/A416M Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

A421/A421M Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete

A496/A496M Specification for Steel Wire, Deformed, for Concrete Reinforcement (Withdrawn 2013)[3]

A615/A615M Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

A617/A617M Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement (Withdrawn 1999)[3]

A641/A641M Specification for Zinc–Coated (Galvanized) Carbon Steel Wire

A706/A706M Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

A722/A722M Specification for Uncoated High-Strength Steel Bars for Prestressing Concrete

C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field

C33 Specification for Concrete Aggregates

C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens

C42/C42M Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C150 Specification for Portland Cement

C172 Practice for Sampling Freshly Mixed Concrete

C260 Specification for Air-Entraining Admixtures for Concrete

C330 Specification for Lightweight Aggregates for Structural Concrete

C494/C494M Specification for Chemical Admixtures for Concrete

C595 Specification for Blended Hydraulic Cements

C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

2.2 *AASHTO Standard:*

Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (LTS-5)[4]

2.3 *IEEE Standard:*

National Electrical Safety Code[5]

2.4 *PCI Guides:*

Guide for Design of Prestressed Concrete Poles[6]

Guide Specification for Prestressed Concrete Poles[6]

## 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.

[1] This specification is under the jurisdiction of ASTM Committee C27 on Precast Concrete Products and is the direct responsibility of Subcommittee C27.20 on Architectural and Structural Products.

Current edition approved Jan. 1, 2013. Published February 2013. Originally approved in 1988. Last previous edition approved in 2006 as C1089 – 06. DOI: 10.1520/C1089-13.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

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

[5] Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., Piscataway, NJ 08854, http://www.ieee.org.

[6] Available from Prestressed Concrete Institute, 209 West Jackson Blvd., Chicago, IL 60606.

## 4. Basis of Acceptance

4.1 Acceptability of spun prestressed concrete poles produced in accordance with this specification shall be determined by the results of compressive strength tests of concrete cylinders and mill certificates for the reinforcing steel. A written statement, signed by the manufacturer, shall verify that the cement, aggregates, admixtures, and steel conform to the applicable specifications for the material. Concrete strength shall be determined by the compressive strength tests of cylinders. The manufacturer's statement shall also certify adherence to tolerance on dimensions and mass. Acceptability of the poles produced in accordance with this specification may also be determined by the results of full-scale bending tests.

## 5. Materials

5.1 *Cement*—Portland cement shall conform to the requirements of Specification C150 or shall be portland blast-furnace slag cement or portland-pozzolan cement conforming to the requirements of Specification C595.

5.2 *Aggregate*—Aggregates shall conform to Specification C33 except that the requirements for grading shall not apply. If a producer can demonstrate that aggregates conforming to Specification C330 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 C494/C494M. Air-entraining admixtures shall conform to Specification C260. Fly ash or other pozzolanic admixtures shall conform to the requirements of Specification C618. 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 A416/A416M, A421/A421M, or A722/A722M. Non-tensioned longitudinal reinforcement shall conform to Specifications A615/A615M, A617/A617M, A706/A706M, or A496/A496M. Circumferential wire reinforcement shall conform to Specification A82/A82M, A496/A496M, or A641/A641M. 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 ¾ in. (19 mm) unless specified otherwise by purchaser. For street lighting poles, cover can be reduced to ½ in. (13 mm).

6.1.2 *Circumferential Wire*—Circumferential wire center-to-center 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 1.25 in. (32 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 8000 psi (55 MPa) as determined using Test Methods C39/C39M or C42/C42M. 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 C31/C31M and C172.

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 loads 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 sustained load applications, such as strain poles and electric transmission line dead end structures, poles shall be designed so that the cracking capacity exceeds the service loads as specified by the purchaser.

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 IEEE National Electrical Safety Code loading criteria (2.3) shall apply for electric 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

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

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

7.3 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 ¼ 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 ¼ in. (6 mm).

8.1.2.2 *Wall Thickness*—shall vary by no more than minus 12 % of the design thickness or minus ¼ in. (6 mm), whichever is greater.

8.1.3 *Deviation from Longitudinal Axis (Sweep)*—shall vary no more than ¼ 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 by no more than minus 10 % and plus 20 % 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 ±1½ 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 ±¼ 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 1⁄16 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 drawings that shall include the following information:

9.1.1 Dimension and length,

9.1.2 Description of the steel reinforcement,

9.1.3 Twenty-eight-day strength of the concrete,

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 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.