
Standard Practice for Making and Curing Concrete Test Specimens in the Field

AASHTO Designation: R 100M/R 100-23^{1,2,3}

Technically Revised: 2023

Editorially Revised: 2023

Technical Subcommittee: 3b, Fresh Concrete

ASTM Designation: C31/C31M-21a



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1. SCOPE

- 1.1. This practice covers procedures for making and curing cylinder and beam specimens from representative samples of fresh concrete for a construction project.
- 1.2. The concrete used to make the molded specimens shall be sampled after all on-site adjustments have been made to the mixture proportions, including the addition of mix water and admixtures. This practice is not intended for making specimens from concrete not having measurable slump or requiring other sizes or shapes of specimens.
- 1.3. The values stated in SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.
- 1.4. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*
Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to exposed skin and tissue upon prolonged exposure.
- 1.5. The text of this standard references notes that provide explanatory material. These notes shall not be considered as requirements of the standard.

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- < M 195, Lightweight Aggregates for Structural Concrete
 - < M 201, Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
 - < M 205M/M 205, Molds for Forming Concrete Test Cylinders Vertically
 - < M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - < R 60M/R 60, Sampling Freshly Mixed Concrete
 - < T 119M/T 119, Slump of Hydraulic Cement Concrete
 - < T 121M/T 121, Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

- < T 152, Air Content of Freshly Mixed Concrete by the Pressure Method
- < T 196M/T 196, Air Content of Freshly Mixed Concrete by the Volumetric Method
- < T 197M/T 197, Time of Setting of Concrete Mixtures by Penetration Resistance
- < T 231, Capping Cylindrical Concrete Specimens
- < T 309, Temperature of Freshly Mixed Portland Cement Concrete

2.2. *ASTM Standards:*

- < C125, Standard Terminology Relating to Concrete and Concrete Aggregates
- < E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- < E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- < E2251, Standard Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids
- < E2877, Standard Guide for Digital Contact Thermometers

2.3. *International Electrotechnical Commission Standard:*

- < IEC 60584-1: 2013 Thermocouples - Part 1: EMF Specifications and Tolerances

2.4. *ACI Standard:*

- < ACI 309R, *Guide for Consolidation of Concrete*

3. TERMINOLOGY

- 3.1. For definitions of terms used in this practice, refer to ASTM C125.

4. SIGNIFICANCE AND USE

- 4.1. This practice provides standardized requirements for making, curing, protecting, and transporting concrete test specimens under field conditions.
- 4.2. *If the specimens are made and standard cured, as stipulated herein, the resulting strength test data where the specimens are tested are able to be used for the following purposes:*
- 4.2.1. Acceptance testing for specified strength;
 - 4.2.2. Checking the adequacy of mixture proportions for strength;
 - 4.2.3. Quality control.
- 4.3. *If the specimens are made and field cured, as stipulated herein, the resulting strength test data when the specimens are tested are able to be used for the following purposes:*
- 4.3.1. Determination of whether a structure is capable of being put in service;
 - 4.3.2. Comparison with test results of standard cured specimens or with test results from various in-place test methods;
 - 4.3.3. Adequacy of curing and protection of concrete in the structure; or
 - 4.3.4. Form or shoring removal time requirements.

5. APPARATUS

- 5.1. *Molds, General*—Molds for specimens or fastenings thereto in contact with the concrete shall be made of steel, cast iron, or other nonabsorbent material, nonreactive with concrete containing portland or other hydraulic cements. Molds shall hold their dimensions and shape under conditions of use. Molds shall be watertight during use as judged by their ability to hold water poured into them. Provisions for tests of watertightness are given in M 205M/M 205. A suitable sealant, such as heavy grease, modeling clay, or microcrystalline wax shall be used where necessary to prevent leakage through the joints. Positive means shall be provided to hold base plates firmly to the molds. Reusable molds shall be lightly coated with mineral oil or a suitable nonreactive form release material before use.
- 5.2. *Cylinder*—Molds for casting concrete test specimens shall conform to the requirements of M 205M/M 205.
- 5.3. *Beam Molds*—Beam molds shall be of the shape and dimensions required to produce the specimens stipulated in Section 6.2. The inside surfaces of the molds shall be smooth. The sides, bottom, and ends shall be at right angles to each other and shall be straight and true and free of warpage. Maximum variation from the nominal cross section shall not exceed 3.2 mm ($1/8$ in.) for molds with depth or breadth of 152 mm (6 in.) or more, or 1.6 mm ($1/16$ in.) for molds of smaller depth or breadth. Except for flexure specimens, molds shall not vary from the nominal length by more than 1.6 mm ($1/16$ in.). Flexure molds shall not be shorter than 1.6 mm ($1/16$ in.) of the required length (greater lengths are allowed).
- 5.4. *Tamping Rods*—A round, smooth, straight, steel rod with a diameter conforming to the requirements in Table 1. The length of the tamping rod shall be at least 100 mm (4 in.) greater than the depth of the mold in which rodding is being performed, but not greater than 600 mm (24 in.) in overall length (see Note 1). The rod shall have the tamping end or both ends rounded to a hemispherical tip of the same diameter as the rod.
- Note 1**—A rod length of 400 mm (16 in.) to 600 mm (24 in.) meets the requirements of the following: T 119M/T 119, T 121M/T 121, T 152, and T 196M/T 196.

Table 1—Tamping Rod Requirements

Diameter of Cylinder or Width of Beam, mm (in.)	Rod Dimensions ^a	
	Diameter, mm (in.)	Length of Rod, mm (in.)
<150 (6)	10 ($3/8$)	300 (12)
150 (6)	16 ($5/8$)	500 (20)
225 (9)	16 ($5/8$)	600 (24)

^a Rod tolerances length ± 100 mm (4 in.) and diameter ± 2 mm ($1/16$ in.).

- 5.5. *Vibrators*—Internal vibrators shall be used. The vibrator frequency shall be at least 9000 vibrations per minute (150 Hz) while the vibrator is operating in the concrete. The diameter of a round vibrator shall be no more than one fourth of the diameter of the cylinder mold or one fourth the width of the beam mold. Other shaped vibrators shall have a perimeter equivalent to the circumference of an appropriate round vibrator. The combined length of the vibrator shaft and vibrating element shall exceed the depth of the section being vibrated by at least 75 mm (3 in.). The vibrator frequency shall be checked periodically.
- Note 2**—For information on size and frequency of various vibrators and a method to periodically check vibrator frequency, see ACI 309R.
- 5.6. *Mallet*—A mallet with a rubber or rawhide head weighing 0.57 ± 0.23 kg (1.25 ± 0.50 lb) shall be used.