
Standard Method of Test for

Air Content of Freshly Mixed Concrete by the Volumetric Method

AASHTO Designation: T 196M/T 196-23

Technically Revised: 2023

Technical Subcommittee: 3b, Fresh Concrete

ASTM Designation: C173/C173M-16



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1. SCOPE

- 1.1. This test method covers determination of the air content of freshly mixed concrete containing any type of aggregate, whether it be dense, cellular, or lightweight.
- 1.2. The values stated in either inch-pound or SI units shall be regarded separately as standard. The inch-pound units are shown in brackets. The values stated are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two units may result in nonconformance.
- 1.3. *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 skin and tissue upon prolonged exposure.
- 1.4. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*
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2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- < M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - < R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - < R 60M/R 60, Sampling Freshly Mixed Concrete
 - < R 100M/R 100, Making and Curing Concrete Test Specimens in the Field
 - < T 19M/T 19, Bulk Density (“Unit Weight”) and Voids in Aggregate
 - < 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 309, Temperature of Freshly Mixed Portland Cement Concrete

2.2. *ASTM Standards:*

- C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- C1064/C1064M., Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- E2877, Standard Guide for Digital Contact Thermometers

3. SIGNIFICANCE AND USE

- 3.1. This test covers the determination of the air content of freshly mixed concrete. It measures the air contained in the mortar fraction of the concrete but is not affected by air that may be present inside porous aggregate particles. Therefore, this is the appropriate test to determine the air content of concretes containing lightweight aggregates, air-cooled slag, and highly porous or vesicular natural aggregates.
- 3.2. This test method requires the addition of sufficient isopropyl alcohol, when the meter is initially being filled with water, so that after the first or subsequent rolling, little or no foam collects in the neck of the top section of the meter. If more foam is present than that equivalent to 2 percent air above the water level, the test is declared invalid and must be repeated using a larger quantity of alcohol. Addition of alcohol to dispel foam any time after the initial filling of the meter to the zero mark is not permitted.
- 3.3. The air content of hardened concrete may be either higher or lower than that determined by this test method. This depends on the methods and amounts of consolidation effort applied to the concrete from which the hardened concrete specimen is taken; uniformity and stability of the air bubbles in the fresh and hardened concrete; accuracy of the microscopic examination, if used; time of comparison; environmental exposure; stage in the delivery, placement, and consolidation processes at which the air content of the unhardened concrete is determined, that is, before or after the concrete goes through a pump; and other factors.

4. APPARATUS

- 4.1. *Air Meter*—An air meter consisting of a bowl and a top section (Figure 1) conforming to the following requirements:
- 4.1.1. The measuring bowl and top sections shall be of sufficient thickness and rigidity to withstand rough field use. The material shall not be attacked by high pH cement paste, deform when stored at high temperatures in closed spaces, or become brittle or crack at low temperatures. A watertight seal must be obtained when the top section is attached to the bowl.

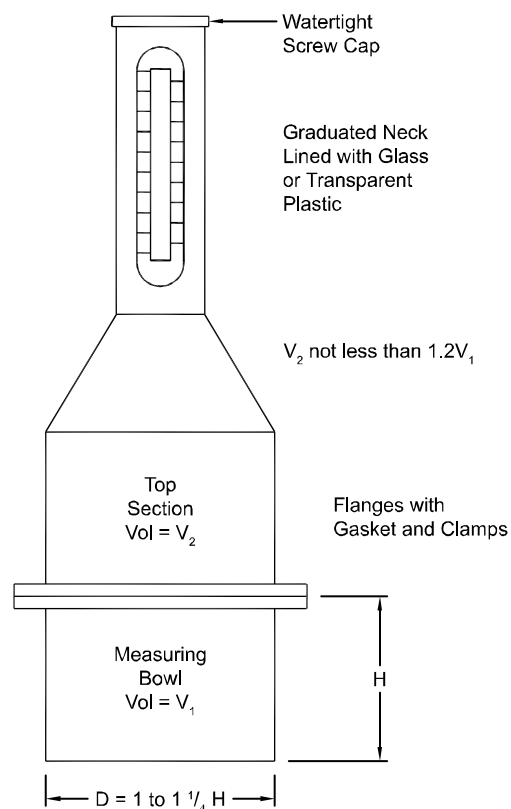


Figure 1—Apparatus for Measuring Air Content of Fresh Concrete by Volumetric Method

- 4.1.2. *Measuring Bowl*—The measuring bowl shall have a diameter equal to 1 to 1.25 times the height and be constructed with a flange at or near the top surface. Measuring bowls shall not have a capacity of less than 2.0 L [0.075 ft³].
- 4.1.3. *Top Section*—The top section shall have a capacity at least 20 percent larger than the measuring bowl and shall be equipped with a flexible gasket and a device to attach the top section to the measuring bowl and make a watertight connection. The top section shall be equipped with a transparent scale, graduated in increments not greater than 0.5 percent from zero at the top, to 9 percent or more of the volume of the bowl. Graduations shall be accurate to ± 0.1 percent by volume of the measuring bowl. The upper end of the neck shall have a watertight cap that will maintain a seal when the meter is inverted and rolled.
- 4.2. *Funnel*—A funnel with a spout of a size permitting it to be inserted through the neck of the top section and long enough to extend to a point just above the bottom of the top section. The discharge end of the spout shall be so constructed that when water is added to the container there will be a minimum disturbance of the concrete.
- 4.3. *Tamping Rod*—A round, smooth, straight steel; high-density polyethylene; or other plastic rod of equal or greater abrasion resistance with a $16 \pm 2\text{-mm}$ [$\frac{5}{8}\text{ in.} \pm \frac{1}{16}\text{-in.}$] diameter. The length of the tamping rod shall be at least 100 mm [4 in.] greater than the depth of the measuring bowl 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.