
Standard Method of Test for

**Characterization of the Air-Void
System of Freshly Mixed Concrete
by the Sequential Pressure Method**

AASHTO Designation: T 395-22¹

Adopted: 2022

Technical Subcommittee: 3b, Fresh Concrete



**American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1. This method covers determination of the air content and sequential air method (SAM) number of freshly mixed concrete from observation of the change in volume of concrete with a sequential change in test pressure.
- 1.2. This method is intended for use with concretes and mortars made with aggregates for which the aggregate correction factor can be satisfactorily determined by the technique described in Section 7. It is not applicable to concretes made with light-weight aggregates, air-cooled blast-furnace slag, or other aggregates with high porosity. This test method is also not applicable to nonplastic fresh concrete such as is commonly used in the manufacture of pipe and concrete masonry units.
- 1.3. The text of this standard references notes and footnotes that provide explanatory information. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements for this standard.
- 1.4. The values stated in inch-pound units are to be regarded as the standard.
- 1.5. *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.
- 1.6. *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.*

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*

- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- R 39, Making and Curing Concrete Test Specimens in the Laboratory
- R 60, Sampling Freshly Mixed Concrete
- R 61, Establishing Requirements for Equipment Calibrations, Standardizations, and Checks
- R 100, Making and Curing Concrete Test Specimens in the Field
- 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

2.2. *ASTM Standards:*

- C192/C192M, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
- C457/C457M, Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete
- C666/C666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
- C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- D5720, Standard Practice for Static Calibration of Electronic Transducer-Based Pressure Measurement Systems for Geotechnical Purposes (withdrawn 2018; no replacement)
- E177, Standard Practice for Use of the Terms Precision and Bias in ASTM Test Methods²

2.3. :

- ACI 201.2R, Guide to Durable Concrete

2.4. *Other Reference:*

- Powers, T. C., Void Spacing as a Basis for Producing Air-Entrained Concrete. *ACI Journal*, Part 2, *Proc.*, Vol. 50, 1954.

3. SIGNIFICANCE AND USE

- 3.1. This test method covers the determination of the air content and the sequential air method (SAM) number of freshly mixed concrete. The test determines the air content of freshly mixed concrete exclusive of any air that exists inside voids within aggregate particles. For this reason, it is applicable only to concrete made for which the aggregate correction factor can be determined. (See Sections 7.1 and 10.1.)
- 3.2. This test method and T 152, T 121M/T 121, and T 196M/T 196 provide sequential pressure, static pressure, gravimetric, and volumetric procedures, respectively, for determining the air content of freshly mixed concrete. The sequential pressure procedure of this test method gives substantially the same air content as the other test methods for concrete made with dense aggregates. The sequential pressure procedure of this test method also gives the SAM number, which can be used to estimate the freeze-thaw durability of the paste in a hardened concrete mixture.
- 3.3. The air content of the same hardened concrete mixture may be either higher or lower than determined by this test method. This depends on the methods and amount of consolidation effort applied to the concrete from which the hardened concrete specimen is taken; uniformity and stability of the air voids in the fresh and hardened concrete; accuracy of the microscopic

examination to measure the hardened air content, if used; time of comparison; environmental exposure; stage in the delivery, placement, and consolidation processes at which the air content is determined, that is, before or after the concrete goes through a pump; and other factors.

- 3.4. In cases where the air content did not vary between the fresh and hardened concrete, this test method has shown to predict freeze-thaw durability as well as the spacing factor as measured by ASTM C457/C457M.

4. APPARATUS

- 4.1. *Air Meter*—A device consisting of a measuring bowl and cover assembly as shown in Figure 1 conforming to the requirements of Sections 4.2 and 4.3. The operational principle of this meter consists of sequentially equalizing known volumes of air in a sealed air chamber, at a series of known pressures, with the unknown volume of air in the concrete sample placed in the measuring bowl. A digital pressure gauge with 0.01 psi (0.07 kPa) accuracy shall be used. The digital gauge shall be able to compute and report the air content within 0.1 percent and the SAM number to 0.01 psi (0.07 kPa). The cover assembly shall be fixed to the measuring bowl with the same uniform pressure that was used during the calibration of the meter.

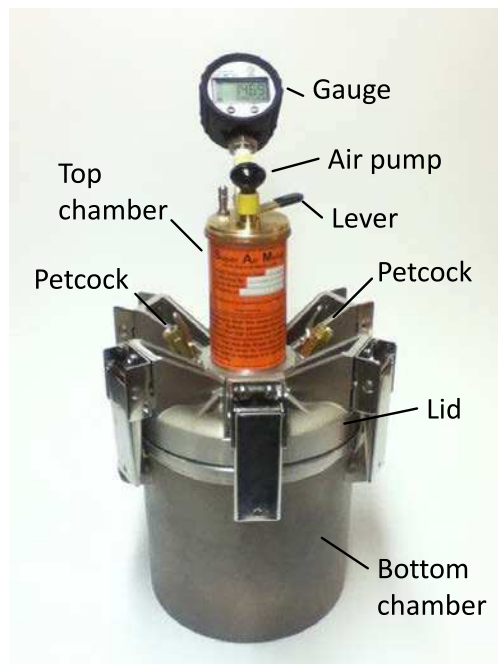


Figure 1—Schematic of the Assembled Meter

- 4.2. *Measuring Bowl*—The measuring bowl shall be essentially cylindrical in shape, made of steel, hard metal, or other hard material not readily attacked by the cement paste, having a minimum diameter equal to 0.75 to 1.25 times the height, and a capacity of at least 0.20 ft³ (5.7 L). It shall be flanged or otherwise constructed to provide for a pressure-tight fit between the bowl and cover assembly. The interior surfaces of the bowl and surfaces of rims, flanges, and other component fitted parts shall be machined smooth. The measuring bowl and cover assembly shall be sufficiently rigid to limit the expansion of the apparatus assembly to not more than 0.1 percent of air content on the indicator scale as described in Section A1.1.1 through A1.1.5.