Designation: C185 – 08

AmericanAssociation State
Highway and Transportation Officials Standard
AASHTO No.: T137

Standard Test Method for Air Content of Hydraulic Cement Mortar[1]

This standard is issued under the fixed designation C185; 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.

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

1. Scope*

1.1 This test method covers the determination of the air content of hydraulic cement mortar under the conditions hereinafter specified.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 Values in SI shall be obtained by measurement in SI units or by appropriate conversion, using the Rules for Conversion and Rounding in IEEE/ASTM SI 10, of measurements made in other units.

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.*

1.5 **Warning—** Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.[2]

2. Referenced Documents

2.1 *ASTM Standards:*[3]

C91 Specification for Masonry Cement
C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
C150 Specification for Portland Cement
C183 Practice for Sampling and the Amount of Testing of Hydraulic Cement
C230/C230M Specification for Flow Table for Use in Tests of Hydraulic Cement
C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
C511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
C595 Specification for Blended Hydraulic Cements
C778 Specification for Sand
C1005 Specification for Reference Masses and Devices for Determining Mass and Volume for Use in the Physical Testing of Hydraulic Cements
C1157 Performance Specification for Hydraulic Cement
C1328 Specification for Plastic (Stucco) Cement
C1329 Specification for Mortar Cement
E438 Specification for Glasses in Laboratory Apparatus
E694 Specification for Laboratory Glass Volumetric Apparatus
IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System

3. Summary of Test Method

3.1 Prepare a mortar with standard sand and the cement to be tested, using a water content sufficient to give a required flow. Compact the mortar into a measure of known volume and determine mass. Calculate the air content from the measured density of the mortar, the known densities of the constituents, and the mixture proportions.

4. Significance and Use

4.1 The purpose of this test method is to determine whether or not the hydraulic cement under test meets the air-entraining or non-air-entraining requirements of the applicable hydraulic cement specification for which the test is being made. The air content of concrete is influenced by many factors other than the potential of the cement for air entrainment.

5. Apparatus

5.1 *Flow Table, Flow Mold, and Caliper,* shall conform to Specification C230/C230M.

5.2 *Measure*—A cylindrical measure having an inside diameter of 76 ± 2 mm and a depth (approximately 88 mm)

[1] This test method is under the jurisdiction of ASTM Committee C01 on Cement and is the direct responsibility of Subcommittee C01.21 on Air Entrainment.

Current edition approved July 1, 2008. Published August 2008. Originally approved in 1944. Last previous edition approved in 2002 as C185 – 02. DOI: 10.1520/C0185-08.

[2] Refer to the section on Safety Precautions, "Manual of Cement Testing," *Annual Book of ASTM Standards*, Vol 04.01.

[3] 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.

***A Summary of Changes section appears at the end of this standard**

adjusted by standardization with water to contain 400 ± 1 mL at 23.0 ± 2.0 °C (Note 1). For the purposes of this test, the capacity of the measure in millilitres is the mass of the water content of the measure, in grams, divided by 0.9976, no correction in mass being made for the buoyant effect of air. The measure shall have a uniform wall thickness. The thickness of the wall and bottom shall not be less than 2.9 mm. The total mass of the empty measure shall not be more than 900 g. The measure shall be made of a metal not attacked by the cement mortar.

NOTE 1—Calibrate the 400-mL measure by filling with distilled water at 23.0± 2.0 °C to a point where the meniscus extends appreciably above the top of the measure, placing a clean piece of plate glass on the top of the measure, and allowing the excess water to be squeezed out. The absence of air bubbles as seen through the glass ensures that the measure is completely full. Care shall be taken that the excess water is wiped from the sides of the container before weighing.

5.3 *Mixer, Bowl, and Paddle,* shall conform to the apparatus section of Practice C305.

5.4 *Straightedge*—A steel straightedge not less than 200 mm long and not less than 1.5 mm nor more than 3.5 mm in thickness.

5.5 *Weights and Weighing Devices,* shall conform to Specification C1005. Evaluate the weighing device for precision and accuracy at a total load of 2 kg.

5.6 *Glass Graduates*—Glass graduates of 250-mL capacity, conforming to the requirements of Specifications E438 and E694.

5.7 *Tamper,* conforming to the requirements of Test Method C109/C109M. The tamping face of the tamper shall be flat and at right angles to the length of the tamper.

5.8 *Tapping Stick,* a piece of hard wood having a diameter of approximately 16 mm and a length of approximately 152 mm.

5.9 *Spoon*—A metal restaurant-type serving spoon not less than 230 mm in length and with a bowl approximately 100 mm in length.

6. Temperature and Humidity

6.1 Maintain the temperature of the room and dry materials at 23.0 ± 4.0 °C.

6.2 Condition the mixing water and the measure, if it is being calibrated at 23 ± 2 °C.

6.3 Maintain the relative humidity of the laboratory at not less than 50 %.

7. Standard Sand

7.1 Use sand conforming to the requirements of Specification C778 for 20–30 sand.

8. Sampling

8.1 Sample the cement in accordance with Practice C183.

NOTE 2—Polyvinyl chloride (PVC) sample containers, upon occasion, have been found to affect the air-entraining potential of a cement sample. The same problem might be experienced with containers made from other plastics.

9. Procedure

9.1 *Batch*—Proportion the standard mortar using 350 g cement to 1400 g 20–30 standard sand and sufficient water to give a flow of 87½ ± 7½ % when determined in accordance with 9.3.

NOTE 3—Test Method C185 refers to hydraulic cements that comply under Specification C150, Specification C595, and Performance Specification C1157. Masonry cements (see Specification C91), mortar cements (see Specification C1329), and plastic cements (see Specification C1328) require different sand, mass, and flow. Refer to the applicable specification.

9.2 *Mixing of Mortar*—Mix the mortar in accordance with Practice C305.

9.3 *Flow Determination*—Carefully wipe dry the flow-table top and place the flow mold at the center of it. Using the spoon, place a layer of mortar about 25 mm in thickness in the mold and tamp 20 times with the tamper. The tamping pressure shall be just sufficient to ensure uniform filling of the mold. Overfill the top of the mold approximately 20 mm with mortar and tamp as specified for the first layer. Then cut off the mortar to a plane surface, flush with the top of the mold, by drawing the straightedge with a sawing motion across the top of the mold. Wipe the flow table top clean and dry, being especially careful to remove any water from around the edge of the mold. Lift the mold away from the mortar 1 min after completing the mixing operation. Immediately drop the table 10 times in accordance with Specification C230/C230M. The flow is the resulting increase in average diameter of the mortar mass, as determined with the calipers, measured on at least four diameters at approximately equispaced intervals, expressed as a percentage of the original diameter. Make trial mortars with varying percentages of water until the specified flow is obtained. Make each trial with fresh mortar.

9.4 *Mass per 400 mL of Mortar*—When the quantity of mixing water has been found that produces a flow of 87½ ± 7½ %, immediately determine the mass per 400 mL of mortar, using the mortar remaining in the mixing bowl after the flow has been determined. In the determination of the mass per 400 mL, do not use the portion of the mortar used in the flow determination. Using the spoon, place the mortar gently into the 400–ml measure in three equal layers. Tamp each layer 20 times around the inner surface of the measure. For the final layer of mortar, overfill the 400–ml measure approximately 20 mm. The position of the tamper shall be that: the broad side of the tamper is parallel to the radius and is perpendicular to the inner surface of the measure. Each layer is tamped in one complete revolution (rotation) with only sufficient pressure to adequately fill the measure and eliminate voids within the mortar. After the measure has been filled and tamped in the above prescribed manner, tap the sides of the measure lightly with the side of the tapping stick, one each at five different points at approximately equal spacing around the outside of the measure, in order to preclude entrapment of extraneous air (Note 4). No obvious space shall be left between the mortar and the inner surface of the measure as a result of the tamping operation. Then cut the mortar off to a plane surface, flush with the top of the measure, by drawing the straightedge with a sawing motion across the top of the measure, making two