Designation: C 243 – 95

Standard Test Method for Bleeding of Cement Pastes and Mortars[1]

This standard is issued under the fixed designation C 243; 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 test method covers the determination of the bleeding rate and bleeding capacity of cement paste and mortar.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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.* For specific hazard statements, see Section 5.

2. Referenced Documents

2.1 *ASTM Standards:*

C 109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)[2]

C 230 Specification for Flow Table for Use in Tests of Hydraulic Cement[2]

C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency[2]

C 778 Specification for Standard Sand[2]

C 1005 Specification for Weights and Weighing Devices for Use in the Physical Testing of Hydraulic Cements[2]

3. Significance and Use

3.1 This test method is intended primarily for use by those interested in research into the relative bleeding characteristics of cement pastes and mortars.

4. Apparatus

4.1 *Weights and Weighing Devices*—The weights and weighing devices shall conform to the requirements of Specification C 1005. The weighing device shall have a capacity of at least 5000 g and shall be evaluated for precision and accuracy at a total load of 5000 g.

4.2 *Tamper*—The tamper shall be made of a nonabsorptive, nonabrasive material such as medium-hard rubber or seasoned oak wood rendered nonabsorptive by immersion for 15 min in paraffin at approximately 200°C (392°F), and shall have a cross section of 13 by 25 mm (½ by 1 in.) and a convenient length (127 or 152 mm (5 or 6 in.)). The tamping face of the tamper shall be flat and at right angles to the length of the tamper.

4.3 *Liquid Displacement Bleeding Apparatus*[3]—The bleeding apparatus shall consist of a container for the paste or mortar to be tested, a collecting ring (Note 1), and a measuring buret with funnel, as illustrated in Fig. 1. The container shall be made of noncorroding metal, 127 mm (5 in.) in diameter and 102 mm (4 in.) in height. An outer ring 152 mm (6 in.) in diameter shall be soldered to the perimeter of the cup 12.7 mm (0.5 in.) below the top rim of the cup and extended 38 mm (1.5 in.) above the rim. The collecting ring shall be 76 mm (3.0 in.) in inside diameter, flanged as shown in Fig. 1, to direct the rising water into the funnel, and bevelled on the lower rim as shown in the lower left insert of Fig. 1 to trap only the rising water within the area of the 76-mm diameter ring. This ring shall be made of noncorroding metal and shall be centered and supported at the proper depth by brackets as shown in Fig. 1. The container and ring shall be of sufficient thickness and rigidity to maintain their shape under normal handling. The funnel and buret assembly shall be made of glass and so joined that there will be no rough edges to inhibit the rise of the water into the buret. The outside diameter of the funnel shall be 73.7 mm (2.9 in.). The rim of the funnel shall be ground on a plane parallel to the axis of the funnel and buret, but the resulting edge shall be rounded. The buret shall be of 25-mL capacity and not over 460 mm in over-all length. The constricted capillary, stopcock, and aspirator may be connected to the top of the buret through a suitable rubber stopper. The buret assembly shall be supported by a ring stand or similar equipment so that it can be conveniently raised or lowered over the collecting ring and held rigidly in place during the test period.

NOTE 1—At times, water bubbles rise up the outside wall of the collecting ring and enter the buret. It has been found that a band of inert epoxy put around the outside of the collecting ring blocks these bubbles and prevents them entering the buret.

4.4 *Mechanical Mixer*—A mechanical mixer shall be used that conforms to the requirements of Practice C 305.

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[1] This test method is under the jurisdiction of ASTM Committee C-1 on Cement and is the direct responsibility of Subcommittee C01.22 on Workability.

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[2] *Annual Book of ASTM Standards*, Vol 04.01.

[3] The application of the liquid-displacement principle to the collection and continuous measurement of bleeding water is due to R. C. Valore, Jr. of the National Institute of Standards and Technology, Washington, DC, who, with the collaboration of colleagues J. E. Bowling and R. L. Blaine, developed the idea into the present apparatus. See the paper by these authors on "The Direct and Continuous Measurement of Bleeding in Portland Cement-Water Mixtures," *Proceedings*, ASTM, Vol 49, 1949, p. 891.

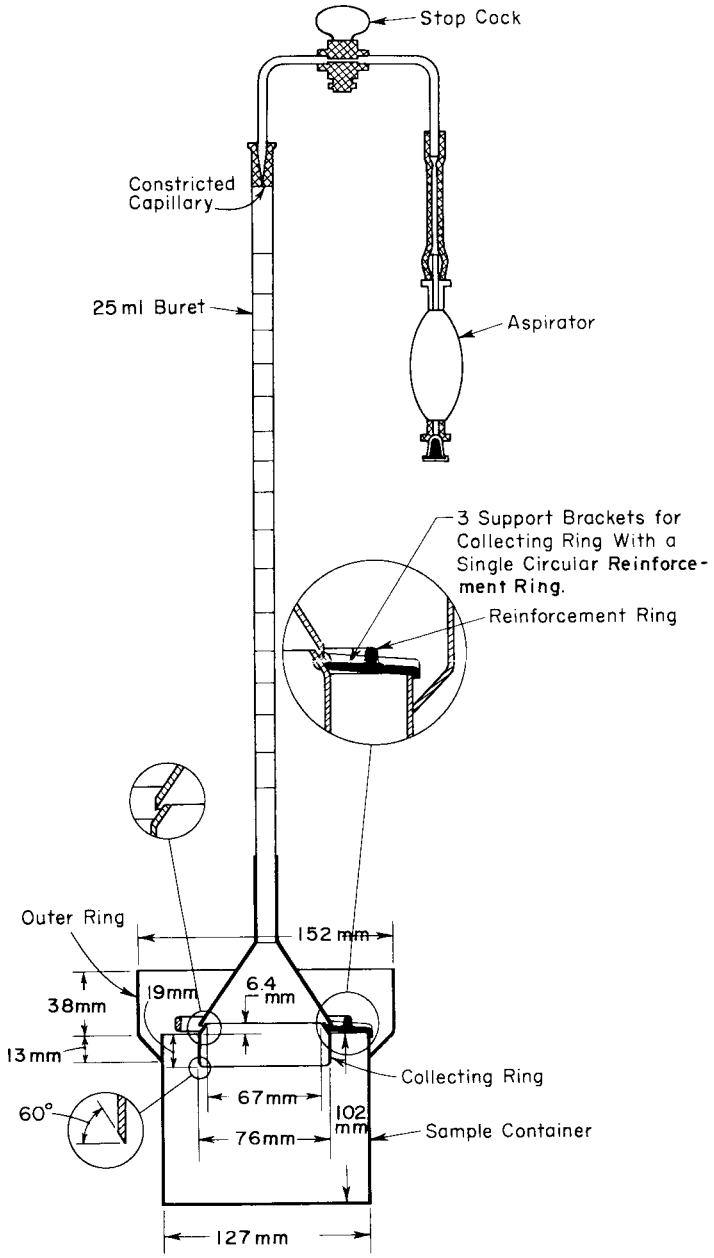

FIG. 1 Liquid Displacement Bleeding Apparatus

4.5 *Flow Table*—The flow table shall conform to the requirements of Specification C 230.

4.6 *Flow Mold*—The flow mold shall conform to the requirements of Specification C 230.

5. Hazards

5.1 Many chlorinated hydrocarbons are considered to be toxic substances which can be absorbed through the skin, but the major exposure is from inhalation of vapors. Chronic poisoning can occur from long continued exposure to small amounts. Acute poisoning can follow a single heavy exposure. Avoid skin contact and work with chlorinated hydrocarbons only in a properly vented fume hood.

5.2 Place the bleeding apparatus in a location subject to a minimum vibration and set on a sponge rubber mat or equivalent.

6. Temperature and Humidity

6.1 The temperature of the room and the temperature of the cement, sand, and water shall be 23 ± 1.7°C (73.4 ± 3°F).

6.2 The relative humidity of the laboratory shall be not less than 50 %.

7. Tests on Pastes

7.1 *Batch*—The paste mix shall consist of 2300 g of cement and 1035 g of water.

7.2 *Mixing*—When mechanically mixing pastes, the materials for the batch shall be introduced in the following manner:

7.2.1 Place all the mixing water in the bowl.

7.2.2 Add the cement to the water and mix for 3 min at slow speed (140 ± 5 rpm).

7.2.3 Let the paste stand for 3 min. During the first 15 s of

this interval, quickly scrape down into the batch any paste that may have collected on the side of the bowl; then for the remainder of this period, cover with a lid or damp cloth.

7.2.4 Mix for 3 min at slow speed.

7.3 *Procedure*—Immediately following completion of mixing, carefully pour the paste into the sample container and screed with a steel straightedge to make certain that the paste height is level with the rim of the 127-mm (5-in.) diameter container. Screeding should be completed within 15 s. Take the completion of screeding as the starting time for the test. Place the collecting ring in the center of the paste surface and embed it to a depth of approximately 19.1 mm (¾ in.) using the three support brackets as a guide. Cover the surface of the paste with 1,1,1-trichloroethane to a depth of 31.8 mm (1¼ in.) (Note 2). Lower the funnel-buret assembly to within 6.4 mm (¼ in.) of and directly over the collecting ring. Draw 1,1,1-trichloroethane up into the buret by means of an aspirator to the "zero" mark of the buret and close the stopcock. Four minutes after the starting time, take the first reading; take readings thereafter at 2-min intervals until 30 min after the starting time, and then at 10-min intervals until cessation of bleeding (Note 3).

NOTE 2—Approximately 500 mL of 1,1,1-trichloroethane are required per test. This may be reclaimed by siphoning off the liquid at the end of the test and placing it in a separatory funnel. The 1,1,1-trichloroethane may be tinted with an oil-soluble dye for ease in reading the level in the buret. Attention is drawn to the need for using 1,1,1-trichloroethane in a well ventilated room or under a ventilation hood to avoid any cumulative toxic effects.

NOTE 3—To compensate for density changes as increasing quantities of water gather in the buret, zero the meniscus immediately before taking each reading.

8. Tests on Mortars

8.1 *Batch*—The mortar mix shall consist of 930 g of cement and 2325 g of graded sand as specified in Specification C 778. The amount of mixing water, measured in grams, shall be such as to produce a flow of between 105 and 110 as determined in accordance with 8.3 and shall be expressed as weight percent of the cement (Note 4).

8.2 *Mixing*—When mixing mortars, the materials for the batch shall be introduced in the following manner:

8.2.1 Place all the mixing water in the bowl.

8.2.2 Add the cement to the water, then start the mixer and mix for 30 s at slow speed (140 ± 5 rpm).

8.2.3 Add the entire quantity of sand slowly over a 30-s period, while mixing at slow speed.

8.2.4 Mix at slow speed for an additional 2 min.

8.2.5 Stop the mixer and let the mortar stand for 3 min. During the first 15 s of this interval, quickly scrape down into the batch any mortar that may have collected on the side of the bowl; then for the remainder of the interval, cover the bowl with a lid or damp cloth.

8.2.6 Finish by mixing for 3 min at slow speed.

NOTE 4—As a guide for the initial trial mortar, the weight percent of water of the cement to produce the specified flow will be about 50 to 52 % for portland cement containing air-entraining material, and about 52 to 54 % for portland cement not containing air-entraining material.

8.3 *Determination of Flow*—Determine flow of the mortar mix in accordance with the procedure described in the Determination of Flow Section of Test Method C 109, with the following exceptions:

8.3.1 The table shall be dropped through a height of 13 mm (½ in.) ten times in 6 s.

8.3.2 When a batch having the proper flow has been obtained, discard the portion used in making the flow determination and do not use it in the bleeding determination.

8.4 *Procedure*—Immediately following the flow test, remix for 30 s the mortar remaining in the mixing bowl. Within a total elapsed time of not more than 2 min and 30 s after completion of the original mixing of the mortar batch, begin placing the mortar in the sample container. Place the mortar in three layers, tamp each layer 40 times with the tamper, and strike off the surface level with the edge of the 127-mm (5-in.) diameter container by screeding with a steel straightedge. Conduct the remainder of the test in the same manner as that for the paste (7.3), using as a starting time the completion of striking off the surface of the mortar in the container.

9. Calculation

9.1 *Bleeding Rate*—Calculate the initial rate of bleeding as follows, using values taken during the first 30 min of the test when the bleeding should be proceeding at a uniform rate (Note 5):

$$R_B = V_1/At \quad (1)$$

where:

R_B = bleeding rate, mL/cm^2,
V_1 = volume of bleeding water, mL, measured during time interval, t,
A = area covered by the 76.2-mm (3.0-in) diameter collecting ring, cm^2, and
t = time during which bleeding occurs at a uniform rate, s.

9.2 *Bleeding Capacity*—Calculate the bleeding capacity as follows:

$$C_B = V_2/V_3 \quad (2)$$

where:

C_B = bleeding capacity, mL/mL,
V_2 = total volume of bleeding water, mL, and
V_3 = volume of the cylinder of paste or mortar directly under the 76.2-mm (3.0-in) diameter collecting ring, mL.

10. Report

10.1 Calculate and report bleeding rate and bleeding capacity values to the nearest three significant digits.

NOTE 5—Since many cements will not bleed at a constant rate for the entire 30-min period, it may be necessary to plot the bleeding values against time to determine the correct initial slope of the curve, that is, initial bleeding rate.

11. Precision and Bias

11.1 It is not practicable to specify the precision of the procedure in this test method.

12. Keywords

12.1 bleeding capacity; bleeding rate; cement mortar; cement paste

For additional useful information on details of cement test methods, reference may be made to the "Manual of Cement Testing," *Annual Book of ASTM Standards*, **Vol 04.01.**