Designation: C807 – 13

Standard Test Method for Time of Setting of Hydraulic Cement Mortar by Modified Vicat Needle[1]

This standard is issued under the fixed designation C807; 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 time of setting of hydraulic cement mortar by means of the modified Vicat needle.

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 *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.[2])

1.4 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)

C183 Practice for Sampling and the Amount of Testing of Hydraulic Cement

C187 Test Method for Amount of Water Required for Normal Consistency of Hydraulic Cement Paste

C219 Terminology Relating to 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

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

C778 Specification for Sand

C845 Specification for Expansive Hydraulic Cement

C1005 Specification for Reference Masses and Devices for Determining Mass and Volume for Use in the Physical Testing of Hydraulic Cements

D1193 Specification for Reagent Water

3. Terminology

3.1 Terms used in this standard are defined in Terminology C219.

4. Summary of Test Method

4.1 A mortar is prepared with the cement to be tested, using stipulated quantities of cement and water, and sufficient standard sand to produce a required consistency as determined by a stipulated penetration using the plunger of the modified Vicat apparatus. Mortar of the proper consistency is then tested for time of setting, using the needle of the modified Vicat apparatus for the determination of a stipulated penetration. The time required to obtain the stipulated penetration of the modified Vicat needle is the time of setting.

5. Significance and Use

5.1 The purpose of this test method is to establish whether or not a cement complies with a specification limit on time of setting. It has been found to be particularly applicable for the determination of the setting time of expansive cements (see Specification C845).

6. Apparatus

6.1 *Tamper and Trowel,* conforming to the requirements of Test Method C109/C109M. In addition, the edges of the trowel when placed on a plane surface shall not depart from straightness by more than 1 mm.

6.2 *Vicat Apparatus,* conforming to the requirements of Test Method C187, with the following modifications:

6.2.1 For consistency determination, the plunger end of the movable rod shall be 17.5 ± 0.5 mm in diameter instead of 10

[1] This test method is under the jurisdiction of ASTM Committee C01 on Cement and is the direct responsibility of Subcommittee C01.30 on Time of Set.

Current edition approved Dec. 1, 2013. Published January 2014. Originally approved in 1975. Last previous edition approved in 2008 as C807 – 08. DOI: 10.1520/C0807-13.

[2] See the section on Safety, 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**

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mm, and the total mass of the movable rod (including the 17.5-mm plunger) shall be 400 ± 0.5 g.

6.2.2 For time of setting determination, a 2 ± 0.05-mm stainless steel needle shall be substituted for the 1-mm needle. The total mass of the movable rod with the 2-mm needle shall be 300 ± 0.5 g.

6.3 *Mold for Consistency and Setting Time*—A smooth cylindrical brass ring 76 ± 0.5 mm inside diameter (3-in. brass tubing) by 40 ± 1 mm deep, cemented to a plane, non-absorptive plate, or smooth cylindrical brass cups having the above dimensions.

6.4 *Mixer, Bowl, Paddle, and Scraper,* conforming to the requirements of Practice C305.

6.5 *Glass Graduates,* conforming to the requirements of Specification C1005.

6.6 *Masses and Mass Determining Devices,* conforming to the requirements of Specification C1005. The devices for determining mass shall be evaluated for precision and accuracy at a total load of 1000 g.

7. Reagents and Materials

7.1 *Graded Standard Sand,* conforming to the requirements of Specification C778.

7.2 *Mixing Water*—Potable water is satisfactory for routine tests. For all referee and cooperative tests, reagent water conforming to the requirements of Specification D1193 for Type III or Type IV grade of reagent water shall be used.

8. Sampling

8.1 When the test is part of acceptance testing, sample the cement in accordance with Practice C183.

9. Conditioning

9.1 Maintain the temperature of the room, dry materials, paddle, bowl, and molds at 23.0 ± 3.0 °C.

9.2 Maintain the temperature of the mixing water at 23.0 ± 2.0 °C

9.3 The relative humidity of the mixing room shall not be less than 50 %.

9.4 The moist closet or moist room shall be in accordance with Specification C511.

10. Procedure

10.1 *Preparation of Mortar:*

10.1.1 Mix 750 g of cement, 375 mL of water, and the quantity of graded standard sand required to give the consistency specified below under "Test for Consistency" in accordance with the mortar mixing procedure described in Practice C305.

10.1.2 Upon completion of mixing, place a layer of mortar about 20 mm in thickness in the mold and puddle with the tamper. Hold the tamper with the 25-mm side parallel to the radius of the mold for 14 strokes spaced equally around the outside of the mold. Apply an additional four strokes to the center of the specimen with the longitudinal axis of the tamper at the center of the mold and rotate the tamper 45° between each stroke. Then fill the mold to overflowing with mortar and puddle as specified for the first layer. Cut off the mortar to a plane surface flush with the top of the mold in two operations. First, with the trowel held at about a 20° angle, start at one side of the mold, 10 mm above the mold, and finish the stroke by cutting the mortar off the top of the mold at the opposite side. Second, starting from the opposite direction, cut the mortar flush with the top of the mold by drawing the straight edge of the trowel (held nearly perpendicular to the mold) with a sawing motion across the top of the mold.

10.2 *Test for Consistency*—Center the mortar confined in the mold under the movable rod of the modified Vicat apparatus described above. Bring the plunger in contact with the surface of the mortar and tighten the setscrew. Then set the movable indicator to the upper zero mark on the scale, or take an initial reading, and release the rod 35 to 50 s after starting to fill the mold. The mortar shall have the desired consistency when the rod settles to a point 20 ± 4 mm below the original surface 30 s after being released. Cover the bowl containing the remainder of the mortar with the lid while the consistency test is being made. Make trial mortars with varying percentages of standard sand until the desired consistency is obtained.

10.3 *Test for Time of Setting*—Mix the mortar remaining in the bowl at medium speed (285 ± 10 rpm) for 30 s after it has been found that the mortar has the proper consistency. Following the completion of the mixing, mold the test specimen as specified above. Immediately after molding, place the test specimen in the moist closet or moist room where it shall remain except when penetration tests are being made. Allow the time of setting specimen to remain in the moist closet or moist room for 30 min without being disturbed. Then, using the modified Vicat apparatus described above, bring the needle in contact with the surface of the mortar and tighten the setscrew. Set the movable indicator to the upper zero mark on the scale, or take an initial reading. Release the rod quickly by releasing the setscrew, and allow the needle to settle for 30 s. Determine the penetration of the needle at this time and every 30 min thereafter until the needle fails to penetrate to the bottom of the mold. Then, take penetration tests every 10 min until a penetration of 10 mm or less is obtained. Perform no penetration test closer than 10 mm from any previous penetration test or from the inside edge of the mold. Record the results of all penetration tests, and, by interpolation, determine the time when a penetration of 10 mm is obtained. The difference, in minutes, between the time of contact of cement and water in the mortar mixing procedure and the time a penetration of 10 mm is obtained is the time of setting.

10.4 *Precautions*—Maintain testing apparatus on a rigid surface, free of vibration during the penetration test. Do not oil the plunger of the Vicat apparatus at any time, but keep the plunger and guide bearing clean at all times.

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11. Calculation

11.1 Calculate the time of setting to the nearest one minute as follows:

$$\left(\left(\frac{(H-E)}{(C-D)}\right)\times(C-10)\right)+E \quad (1)$$

where:

E = time in minutes of last penetration greater than 10 mm,
H = time in minutes of first penetration less than 10 mm,
C = penetration reading at Time E, and
D = penetration reading at Time H.

12. Report

12.1 Report the time of setting in minutes, to the nearest one minute.

13. Precision and Bias

13.1 The multilaboratory standard deviation has been found to be 15.2 min. Therefore, the results of two properly conducted tests from two different laboratories on samples of the same cement should not differ by more than 43 min. (See Note 1)

13.2 No information can be presented on the bias of the procedure in this test method for measuring time of setting because no material having an accepted reference value is available.

NOTE 1—These numbers represent, respectively, the 1s and d2s limits as defined in Practice C670.

14. Keywords

14.1 hydraulic-cement mortar; time of setting; Vicat needle, expansive

SUMMARY OF CHANGES

Committee C01 has identified the location of selected changes to this test method since the last issue, C807 – 08, that may impact the use of this test method. (Approved Dec. 1, 2013)

(1) Revised warning statement in 1.3 and added Footnote 2.

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