
Standard Method of Test for Time of Setting of Hydraulic Cement by Vicat Needle

AASHTO Designation: T 131-22

Technically Revised: 2022

Technical Subcommittee: 3a, Cement, Lime, and Concrete Materials

ASTM Designation: [C191-19](#)



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1. SCOPE

- 1.1. These test methods determine the time of setting of hydraulic cement by means of the Vicat needle. Two test methods are given: Method A is the Reference Test Method using the manually operated standard Vicat apparatus, while Method B permits the use of an automatic Vicat machine that has, in accordance with the qualification requirements of this method, demonstrated acceptable performance.
- 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.*
Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue on prolonged exposure.
- 1.4. The text of this standard references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.
Note 1—For the method for determining the time of setting by Gillmore needles, see [T 154](#).
- 1.5. *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:
- [M 85](#), Portland Cement
 - [M 201](#), Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes

- [M 240M/M 240](#), Blended Hydraulic Cement
- [R 18](#), Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- [T 129](#), Amount of Water Required for Normal Consistency of Hydraulic Cement Paste
- [T 154](#), Time of Setting of Hydraulic Cement Paste by Gillmore Needles
- [T 162](#), Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency

2.2. *ASTM Standards:*

- [C151/C151M](#), Standard Test Method for Autoclave Expansion of Hydraulic Cement
- [C183](#), Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement
- [C219](#), Standard Terminology Relating to Hydraulic and Other Inorganic Cements
- [C1005](#), Standard Specification for Reference Masses and Devices for Determining Mass and Volume for Use in the Physical Testing of Hydraulic Cements
- [C1157/C1157M](#), Standard Performance Specification for Hydraulic Cement
- [D1193](#), Standard Specification for Reagent Water

3. TERMINOLOGY

- 3.1. *Definitions*—The terms used in this test method are defined in accordance with [ASTM C219](#).

4. SUMMARY OF TEST METHOD

- 4.1. A paste that is proportioned and mixed to normal consistency, as described in the test method [T 129](#), is molded and placed in a moist cabinet and allowed to start setting. Periodic penetration tests are performed on this paste by allowing a 1-mm Vicat needle to settle into this paste. The Vicat initial time of setting is calculated as the time elapsed between the initial contact of cement and water and the time when the penetration is at 25 mm. The Vicat final time of setting is calculated as the time when the needle does not sink visibly into the paste.

5. SIGNIFICANCE AND USE

- 5.1. This test method provides a means of determining compliance with a specification limit for Vicat time of setting. Refer to the appropriate specification for the cement to determine if this test method is used for specification compliance.
- 5.2. The measured time of setting is affected by the percentage and temperature of the water used, amount of kneading the paste received, and temperature and humidity of the mixing room air and the moist cabinet or moist room air.
- 5.3. The measured time of setting of hydraulic cement is test method specific. Time of setting as measured by this method will not necessarily be similar to other methods used for determining the time of setting of hydraulic cements.

6. APPARATUS

- 6.1. *Vicat Apparatus*—See Annex A, Figure A1.1. The Vicat apparatus for this test method shall have a movable rod, B, of mass 300 ± 0.5 g.

- 6.1.1. The end of the rod used for measuring penetration shall have a removable needle, D, with a diameter of 1.00 ± 0.05 mm and length no less than 50 mm.
- 6.1.2. The needle end that contacts the specimen shall be flat, plane, and at right angles to the axis of the rod.
- 6.2. *Reference Masses and Devices for Determining Mass*—Conforming to the requirements of [ASTM C1005](#). The devices for determining mass shall be evaluated for continuing precise performance utilizing the procedure in [ASTM C1005](#), Appendix X1 using a verification check mass of approximately 1000 g.
- 6.3. *Glass Graduates*—200- or 250-mL capacity, and conforming to the requirements of [ASTM C1005](#).
- 6.4. *Plane Nonabsorptive Plate*— 100 ± 5 mm square of similar planeness, corrosivity, and absorptivity to that of glass (see Annex A, Figure A1.1, H).
- 6.5. *Flat Trowel*—Having a sharpened straight-edged steel blade 100 to 150 mm in length. The edges, when placed on a plane surface, shall not depart from straightness by more than 1 mm.
- 6.6. *Conical Ring*—Made of a rigid noncorroding, nonabsorbent material that shall have a height of 40 ± 1 mm, an inside diameter at the bottom of 70 ± 3 mm, and an inside diameter at the top of 60 ± 3 mm (see Annex A, Figure A1.1, G).
- 6.7. *Mixer, Bowl, and Paddle*—Conforming to [T 162](#).
- 6.8. *Automatic Vicat Needle Apparatus for Method B*—The apparatus shall be equipped with a Vicat needle as described in Sections 6.1.1 and 6.1.2. The total mass supported by the needle tip at the time of measurement shall be 300 ± 0.5 g. The instrument shall be capable of automatically completing and recording penetration measurements of a test specimen at predetermined time intervals not exceeding 10 min and make each penetration test at least 5 mm away from any previous penetration and at least 10 mm away from the inner side of the mold.
- 6.9. *Specimen Mold for Method B*—The cement paste is held in a conical ring with a height of 40 ± 1 mm and a removable base plate. The test surface shall have a minimum diameter of 60 ± 3 mm.
- 6.10. Inspect and document Section 6 apparatus for conformance to the requirements of this test method at least every $2\frac{1}{2}$ yr (see Note 2).
- Note 2**—[ASTM C1005](#) requires annual compliance checks for the reference masses and for the devices for determining mass.

7. REAGENTS AND MATERIALS

- 7.1. *Mixing Water*—Potable water is satisfactory for routine tests. Use water conforming to the requirements of [ASTM D1193](#) for Type III or Type IV grade reagent water for all referee and cooperative tests.

8. SAMPLING

- 8.1. When the test is required for acceptance testing, sample cement in accordance with [ASTM C183](#).