



Designation: C 827 – 01

Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures¹

This standard is issued under the fixed designation C 827; 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 Department of Defense.

1. Scope

1.1 This test method covers the determination of change in height of cylindrical specimens from the time of molding until the mixture is hard.

1.2 This test method covers height change measurements at early ages for cementitious mixtures of paste, grout, mortar, and concrete.

1.3 This test method is intended for determination of changes in height that occur from the time of placement until the specimen is fully hard. These include shrinkage or expansion due to hydration, settlement, evaporation, and other physical and chemical effects.

1.4 The values stated in SI 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.*

1.6 The text of this test method references notes and footnotes that provide explanatory information. These notes and footnotes shall not be considered as requirements of the test method.

2. Referenced Documents

2.1 ASTM Standards:

- C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)²
- C 125 Terminology Relating to Concrete and Concrete Aggregates³
- C 143/C 143M Test Method for Slump of Hydraulic-Cement Concrete³
- C 191 Test Method for Time of Setting of Hydraulic Cement by Vicat Needle²
- C 192/C 192M Practice for Making and Curing Concrete

Test Specimens in the Laboratory³

- C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency²
- C 403/C 403M Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance³
- C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials³
- C 807 Test Method for Time of Setting of Hydraulic Cement Mortar by Modified Vicat Needle²
- C 939 Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)³
- C 953 Test Method for Time of Setting of Grouts for Preplaced-Aggregate Concrete in the Laboratory³
- C 1437 Test Method for Flow of Hydraulic Cement Mortar²

3. Terminology

3.1 *Definitions*—The terms used in this test method are defined in Terminology C 125.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *early-age change in height, n*—the measured increase or decrease in height of a laterally confined cylindrical test specimen from the time of molding to when the mixture becomes hard. The user may want to define this age as the time when a companion specimen of the same batch has reached the time of final setting by Test Method C 191 (paste), C 953 (mortar or grout), C 403/C 403M (concrete), or establish a predetermined age in minutes from the time the specimen is cast as the defined age to record the final measurement. Changes in height are measured and expressed as a positive or negative change in the height of a test specimen that is restrained from lateral movement.

4. Significance and Use

4.1 This test method provides a means for comparing the relative shrinkage or expansion of cementitious mixtures. It is particularly applicable to grouting, patching, and form-filling operations where the objective is to completely fill a cavity or other defined space with a freshly mixed cementitious mixture that will continue to fill the same space at time of hardening. It would be appropriate to use this test method as a basis for prescribing mixtures having restricted or specified volume change before the mixture becomes hard.

4.2 This test method can be used for research purposes to

¹ This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.68 on Volume Change.

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

³ *Annual Book of ASTM Standards*, Vol 04.02.

provide information on volume changes taking place in cementitious mixtures between the time just after mixing and the time of hardening. However, the specimen used in this test method is not completely unrestrained so that the measurements are primarily useful for comparative purposes rather than as absolute values. Further, the degree of restraint to which the specimen is subjected varies with the viscosity and degree of hardening of the mixture.

5. Apparatus (see Fig. 1)

5.1 *Projected Light Source*, a lamp and a condensing lens of sufficient intensity to adequately project a light beam on a wall about 5 m (15 ft) from the light source. Protect the test specimen from heat from the light source and limit air movement (Note 1).

NOTE 1—Placing a sheet of transparent glass or plastic between the light source and the test specimens may be beneficial.

5.2 *Indicator Ball*, a spherical ball of nonabsorptive material (Note 2), having a diameter not more than 16 mm (5/8 in.) nor less than 6 mm (1/4 in.), and composed of materials that have no reaction with the cementitious mixture during the test period.⁴

NOTE 2—A density of approximately 1.2 Mg/m³ has been found appropriate for most uses of this test method.

5.3 *Magnifying Lens System*, a magnifying lens system such that the image of the indicator ball produced by the projected light source is cast on the indicating chart about 5 m (15 ft) away at a magnification of 90–110×, mounted so as not to touch the test specimen when a test is in progress (see Note 3), and having a separate magnifying lens system for each specimen tested simultaneously.

NOTE 3—One magnifying lens system that has been found acceptable consists of two lenses: a projection and a relay lens enclosed in a sealed tube. In this system, the relay lens is located nearer the test specimen and has a focal length of 50.8 mm (2 in.) and is located approximately 115 mm (4 1/2 in.) from the indicator ball. The projection lens has a focal length of 41.4 mm (1 5/8 in.), and relative aperture of f1.6 and is 133.1 mm (5 1/4 in.) from the relay lens.

5.4 *Indicating Charts*, composed of stiff material approximately 600 mm (24 in.) high by 250 mm (10 in.) wide, with a

white surface and a vertical black line 2 mm (1/16 in.) wide, centered and running the complete length of the chart, and a horizontal black line 1 mm (1/32 in.) in width midway on the chart, identified as the zero (0) or starting line, and 2-mm (1/16-in.) horizontal graduations above and below the zero line on the entire length of the vertical line, and a means for attaching this chart vertically and firmly to a distant wall.

5.5 *Molds*, rigid, watertight molds with a smooth interior surface made of steel, cast iron, or other nonabsorbent material nonreactive with the cementitious mixture being tested, cylindrical in shape, with internal height twice the internal diameter. Three sizes of molds are used in this test method with heights of 100, 150, 300 mm (4, 6, 12 in.).

5.6 *Rods*, two straight, steel tamping rods: one 10 mm (3/8 in.) in diameter and approximately 300 mm (12 in.) in length and the other 16 mm (5/8 in.) in diameter and approximately 600 mm (24 in.) in length. The 10-mm rod shall be used with paste, grout, and mortar. The 16-mm rod shall be used with concrete.

6. Test Specimen

6.1 Unless otherwise specified, prepare two test specimens from each batch to be tested simultaneously using duplicate test apparatus. For cement pastes, grouts, and mortars where all the aggregate will pass through a 4.75-mm (No. 4) sieve, use the 100-mm (4-in.) mold. For cementitious mixtures containing aggregate that will not all pass through a 4.75-mm sieve, but which will all pass the 12.5-mm (1/2-in.) sieve, use the 150-mm (6-in.) mold. For concrete mixtures having particles retained on the 12.5-mm (1/2-in.) sieve or larger, use the 300-mm (12-in.) mold.

7. Calibration

7.1 *General*—Minimize any sources of light not required for the tests. Locate the test equipment and specimens on a surface substantially free of vibration during the test. If desired, use a single projected light source for both test specimens with duplicate magnifying lens systems and indicating charts.

7.2 *Apparatus Calibration*—Calibrate the entire apparatus prior to the start of each test. Darken the room, illuminate the projected light source, and place the dummy test specimens (preferably hardened test specimens) in the light beam before each of the magnifying lens systems. Adjust the location of each test specimen until a sharp, clear image of the indicator ball is produced on the indicating chart. Then reposition the indicating chart so that the indicating ball image falls on the

⁴ An 11-mm (7/16-in.) nylon plastic indicator ball has been found acceptable for most tests and is available from U.S. Plastics Corp., 1390 Neubrecht Rd., Lima, OH 45801.

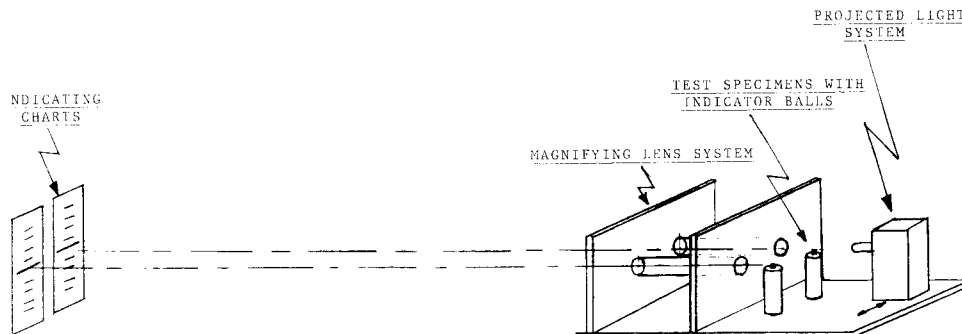


FIG. 1 Apparatus for Early Change in Height