Designation: C 827 – 95a (Reapproved 1997)ε1

Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures[1]

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.

ε[1] NOTE—Section 13, Keywords was added editorially in July 1997.

1. Scope

1.1 This test method covers the determination of change in height of cylindrical specimens from the time of casting until the mixture is hard. If desired, this test method can be adapted to studies of changes in height involving different time schedules or other environmental treatment from the standard procedures prescribed by this test method.

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

1.3 Use of this test method is suggested 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 phrase "early age change in height" as used herein, is defined as the measured increase or decrease in height of a laterally confined cylindrical test specimen from the time of casting 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 (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.

1.5 The values stated in SI units are to be regarded as the standard.

1.6 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)[2]

C 143 Test Method for Slump of Hydraulic Cement Concrete[3]

C 191 Test Method for Time of Setting of Hydraulic Cement by Vicat Needle[2]

C 192 Practice for Making and Curing Concrete Test Specimens in the Laboratory[3]

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

C 403 Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance[3]

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials[3]

C 807 Test Method for Time of Setting of Hydraulic Cement Mortar by Modified Vicat Needle[2]

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 Laboratory[3]

3. Significance and Use

3.1 This test method affords 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.

3.2 This test method can be used for research purposes to provide information on volume changes taking place in cementitious mixtures between the time just after mixing and the time

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

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

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.

4. Apparatus (see Fig. 1)

4.1 *Projected Light Source*—The projected light source shall consist of a lamp and a condensing lens and be of sufficient intensity to adequately project a light beam on a wall about 5 m (or 15 ft) from the light source. Heat from the light source should not be directed toward the test specimen.

4.2 *Indicator Ball*—The indicator ball shall be a spherical ball of nonabsorptive material with a density that is 55 ± 5 % of the density of the cementitious mixture being tested (Note 1). The diameter shall not be more than 16 mm (or ⅝ in.) nor less than 6 mm (or ¼ in.). The indicator ball shall be composed of materials that have no reaction with the cementitious mixture during the test period.[4]

NOTE 1—A density of approximately 1.2 mg/m^3 has been found appropriate for most uses of this test method.

4.3 *Magnifying Lens System*—The magnifying lens system shall cause the image of the indicator ball produced by the projected light source to be cast on the indicating chart about 5 m (or 15 ft) away at a magnification of 90–110×. The system shall be able to be mounted so as not to touch the test specimen when a test is in progress (see Note 2). A separate magnifying lens system will be required for each specimen tested simultaneously.

NOTE 2—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 nearest the test specimen and has a focal length of 50.8 mm (or 2 in.) and is located approximately 114.3 mm (or 4½ in.) from the indicator ball. The projection lens has a focal length of 41.4 mm (or 1⅝ in.), and relative aperture of *f*1.6 and is 133.1 mm (or 5¼ in.) from the relay lens.

4.4 *Indicating Charts*—These charts shall be composed of stiff material approximately 600 mm (or 24 in.) high by 250 mm (or 10 in.) wide. The chart shall have a white surface with a vertical black line 2 mm (or 1⁄16 in.) wide, centered and running the complete length of the chart, and a horizontal black line 1 mm (or 1⁄32 in.) in width midway on the chart, identified as the zero (0) or starting line. The vertical line shall have 2 mm (or 1⁄16 in.) horizontal graduations above and below the zero line on its entire length. A means for attaching this chart vertically and firmly to a distant wall shall be provided.

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

4.6 *Rods*—Two straight, steel tamping rods: one 10 mm (or ⅜ in.) in diameter and approximately 300 mm (or ½ in.) in length and the other 16 mm (or ⅝ in.) in diameter and approximately 600 mm (or 24 in.) in length shall be used, for grout and mortar, or concrete respectively.

5. Test Specimens

5.1 Unless otherwise specified, two test specimens shall be prepared from each batch and 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, the cylinder mold height shall be 100 mm (or 4 in.). For cementitious mixtures containing aggregate that will not all pass through a 4.75-mm (No. 4) sieve, but which will all pass the 12.5-mm (½-in.) sieve, the cylinder mold height shall be 150 mm (or 6 in.). For concrete mixtures having particles retained on the 12.5 mm (½-in.) sieve or larger, the cylinder mold height shall be 300 mm (or 12 in.).

6. Calibration

6.1 *General*—Provision should be made for minimizing 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.

6.2 *Apparatus Calibration*—Calibrate the entire apparatus prior to the start of each test. Darken the laboratory, illuminate the projected light source, and locate the dummy test specimens (preferably hardened test specimens) in the light beam before each of the magnifying lens systems. Adjust the location

[4] A 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.

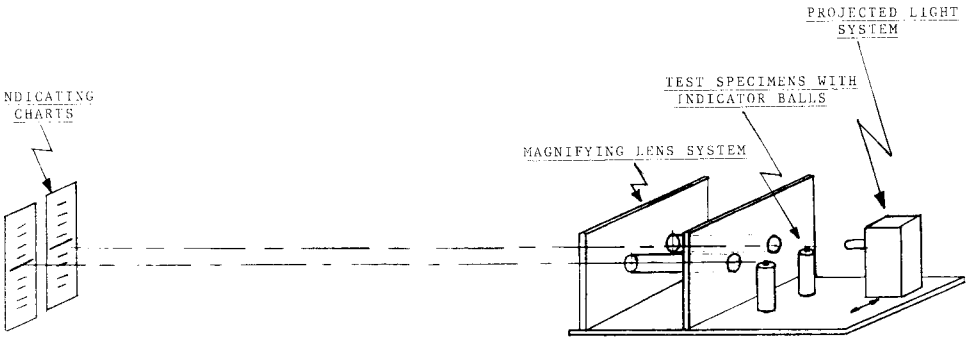

FIG. 1 Apparatus for Early Change in Height