



Designation: C 341/C 341M – 03a

## Standard Practice for Length Change of Cast, Drilled, or Sawed Specimens of Hydraulic-Cement Mortar and Concrete<sup>1</sup>

This standard is issued under the fixed designation C 341/C 341M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This practice covers the determination of the length changes of cast, drilled, or sawed specimens of hydraulic-cement mortar and concrete due to causes other than externally applied forces and temperature changes. It can be readily adapted, if desired, to studies of length change involving different schedules or environmental treatment than the standard procedures prescribed by this practice.

1.2 The values stated in either inch-pound units or SI units shall be regarded separately as standard. The units stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining in any way. The inch-pound units are shown in brackets.

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.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

- A 276 Specification for Stainless Steel Bars and Shapes
- C 31/C 31M Practice for Making and Curing Concrete Test Specimens in the Field
- C 42/C 42M Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- C 157/C 157M Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete
- C 192/C 192M Practice for Making and Curing Concrete Test Specimens in the Laboratory
- C 490 Practice for Use of Apparatus for the Determination

of Length Change of Hardened Cement Paste, Mortar, and Concrete

C 666 Test Method for Resistance of Concrete to Rapid Freezing and Thawing

### 3. Terminology

#### 3.1 Definition

3.1.1 *length change,  $n$* —an increase or decrease in a linear dimension of a test specimen, which has been caused to change by any factor other than externally applied forces and temperature changes.

### 4. Significance and Use

4.1 Measurements of length change permit assessment of the potential for volumetric expansion or contraction of cast, drilled, or sawed specimens of hydraulic-cement mortar, and concrete due to various causes other than externally applied forces and temperature changes. This practice is particularly useful for comparative evaluation of this potential in different mortar or concrete specimens.

### 5. Apparatus

5.1 *Length Comparator*—The length comparator shall generally conform to the requirements of Specification C 490, except that it shall be constructed to accommodate the specimens to be tested under this practice, which shall have gage lengths of 75 mm [3 in.] or more.

5.1.1 *Gage Studs in Ends of Specimens*—When the comparator is to be used to measure between gage studs in the ends of specimens, the gage length for computing percentage length change shall be considered to be the distance between the innermost ends of the gage studs, and the contact terminals of the comparator shall be plane, polished, heat-treated surfaces as described in Specification C 490. Fig. 3 of Specification C 490 shows one type of comparator that has been found suitable for such specimens. A horizontal comparator is desirable for specimens that are considered too large to be handled by the type of comparator illustrated in Fig. 3 of Specification C 490.

5.1.2 *Gage Studs on Sides of Specimen*—When the comparator is to be used to measure between gage studs on the sides of specimens, the contact terminals shall be conical,

<sup>1</sup> This practice 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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<sup>2</sup> 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.

heat-treated surfaces as shown in Fig. 1, which illustrates a type of comparator that has been found satisfactory for this type of specimen. In this case, the gage length shall be the distance between the reference points located in the exposed ends of the gage studs (see 5.2).

5.2 *Gage Studs*—Gage studs shall be Type 316 stainless steel, meeting Specification A 276.

5.2.1 *For Ends of Specimens*—Gage studs that are to be located in the ends of specimens shall have a rounded surface to provide point contact with the terminals of the comparator. The types of studs described in Specification C 490 are suitable for insertion in drilled holes. Spherical studs having a diameter of 6 to 10 mm [ $\frac{1}{4}$  to  $\frac{3}{8}$  in.], or studs that are sections of spheres of similar diameter, are suitable for cementing to the ends of specimens.

5.2.2 *For Sides of Specimens*—The exposed end of gage studs that are to be located on the sides of specimens shall have a plane surface with a diameter or diagonal of 10 to 13 mm [ $\frac{3}{8}$  to  $\frac{1}{2}$  in.]. For dry setting, the length of the stud shall be 13 to 16 mm [ $\frac{1}{2}$  to  $\frac{5}{8}$  in.]. Shorter lengths of stud, including plane disks, shall be satisfactory for studs that are to be cemented.

5.3 *Drying Room and Controls*—A drying room and controls as described in Test Method C 157/C 157M shall be used for storing specimens in air.

## 6. Sampling

6.1 Samples of drilled or sawed hydraulic cement mortar or concrete shall be obtained in accordance with the section on Sampling of Test Method C 42/C 42M.

6.2 Samples of field cast hydraulic cement mortar or concrete shall be cast in accordance with Practice C 31/C 31M.

6.3 Constituent materials for concrete or mortar specimens made in the laboratory for use in this practice shall be sampled using applicable standard methods.

6.3.1 The specimens for use in this practice prepared from the constituent materials in the laboratory shall be cast prisms or cylinders made and cured in accordance with the applicable requirements of Practice C 192/C 192M and Practice C 490.

## 7. Test Specimens

7.1 Test specimen geometry shall be either cylindrical or rectangular prisms. Specimens shall be either cast from freshly mixed materials or drilled or sawn from existing concrete or mortar structures. Specimens shall be free from reinforcing steel, visible cracks, or other structural defects. They shall be of any size but specimens that are to be compared shall not differ in their cross-sectional dimensions by more than 10 % or in length by more than 20 % (Note 1). The gage length shall be at least six times the maximum nominal size of the coarse aggregate but not less than 75 mm [3 in.], and that the minimum cross-sectional dimension be at least three times the maximum nominal size of the coarse aggregate but not less than 50 mm [2 in.]. When the gage studs are to be located on the sides of the specimen, the over-all length of the specimen shall exceed the gage length by at least 50 mm [2 in.].

NOTE 1—Specimens used for length change measurements during freeze thaw resistance testing as described in Test Method C 666 should follow the dimensional requirements of that method.

## 8. Setting Gage Studs

8.1 Gage studs shall either be cast in place, dry-set or cemented in drilled holes, or cemented directly to the surface of the specimen.

8.2 *Drilling Holes*—For gage studs that are to be cemented, holes shall be drilled (Note 2) only slightly larger than the studs. For gage studs that are to be dry-set, holes shall be drilled about 0.1 mm [0.005 in.] smaller in diameter than the studs. In the case of small specimens, take care that the

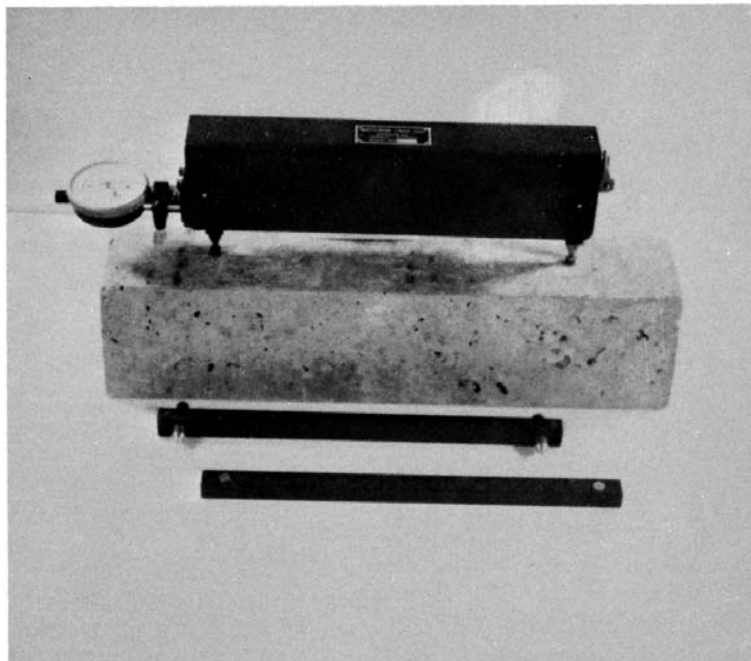


FIG. 1 Type of Suitable Extensometer for Measurement of Length Change of Specimens Having Gage Studs on Sides