



Designation: **C426 – 10 C426 – 15**

Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units¹

This standard is issued under the fixed designation C426; 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 U.S. Department of Defense.

1. Scope*

1.1 This test method covers a routine standardized procedure for determining the linear drying shrinkage of concrete masonry units or related concrete units under specified accelerated drying conditions.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered 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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

C490 Practice for Use of Apparatus for the Determination of Length Change of Hardened Cement Paste, Mortar, and Concrete

C1093 Practice for Accreditation of Testing Agencies for Masonry

C1232 Terminology of Masonry

2.2 *ANSI Standard:*

B94.11M—1993 Twist Drills³

3. Terminology

3.1 Terminology defined in Terminology C1232 shall apply for this test method.

3.2 ~~Definitions:~~ *Definitions of Terms Specific to This Standard:*

3.2.1 *linear drying shrinkage*—in this test method, the change in linear dimension of the test specimen due to drying from a saturated condition to an equilibrium weight and length under specified accelerated drying conditions.

4. Significance and Use

4.1 This test method is intended to evaluate the drying shrinkage characteristics of a given unit. The results of this laboratory method are considered in determining concrete masonry crack control provisions.

NOTE 1—The testing laboratory performing this test method should be evaluated in accordance with Practice C1093.

5. Apparatus

5.1 *Strain Gauge*—The instruments for measuring linear drying shrinkage shall be so designed as to permit or provide the conditions described in 5.1.1 through 5.1.5.

NOTE 2—Strain gauges may be obtained with various gauge lengths. The 10-in. (254-mm) gauge length is recommended for use with regular concrete masonry units, however, particular sizes of products may require other lengths. The length of the shrinkage specimen shall not be less than required for a minimum gauge length (distance between gauge plugs) of 6 in. (152.4 mm).

¹ This test method is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.03 on Concrete Masonry Units and Related Units.

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² 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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

*A Summary of Changes section appears at the end of this standard

5.1.1 A means of positive contact with the specimen that will ensure reproducible measurements of length.

5.1.2 Means for precise measurement, consisting of a dial micrometer or other measuring device graduated to read in 0.0001-in. (0.0025-mm) units, and accurate within 0.0001 in. (0.0025 mm) in any 0.0010-in. (0.025-mm) range, and within 0.0002 in. (0.0050-mm) in any 0.0100-in. (0.254-mm) range.

5.1.3 Sufficient range to allow for small variations in the gauge lengths.

NOTE 3—If the shrinkage reference points are set carefully to position, a dial micrometer with a travel of 0.2 or 0.3 in. (5.1 or 7.6 mm) provides ample range in the instrument.

5.1.4 Means for checking the strain gauge at regular intervals against a standard reference bar. The standard reference bar shall be protected from air currents by placing it inside a wooden box which should be closed except when the strain gauge is being checked against it.

NOTE 4—A standard reference bar shall be furnished by the manufacturer of the instrument. A standard bar of ordinary steel is satisfactory, but corrections must be made for variations in its length due to temperature changes. When a more nearly constant datum is desired, Invar is preferable because of its low coefficient of thermal expansion.

5.1.5 Convenient and rapid measurement of specimens.

5.2 *Comparator*—When desirable to measure specimens end to end, a comparator conforming to the requirements of Practice C490 may be used as an alternative to the strain gauge for measuring linear drying shrinkage.

5.3 *Gauge Plugs*—The gauge plugs shall be made from metal that is resistant to corrosion. Plugs for use with strain gauges shall be $\frac{3}{8}$ to $\frac{1}{2}$ in. (9.5 to 12.7 mm) in diameter and $\frac{1}{2} \pm \frac{1}{8}$ (12.7 $\pm$ 3.2 mm) in thickness. Plugs for use with the comparator shall consist of $\frac{1}{4}$ -in. (6.4-mm) diameter stainless steel gauge studs shown in Practice C490.

5.4 *Drying Oven*—The oven shall be reasonably airtight and provide the features described in 5.4.1 through 5.4.4.

NOTE 5—One suggested oven construction is shown in Fig. 1.

5.4.1 A minimum storage capacity of three whole test specimens and a clearance of 1 in. (25.4 mm) on all sides of each test specimen.

5.4.2 A constant, uniform temperature of $122 \pm 2^\circ\text{F}$ ($50 \pm 0.9^\circ\text{C}$) throughout the insulated cabinet attained by means of an electrical heat source (Note 6).

NOTE 6—Direct heating of test specimens with the combustion products of gas or other carbonaceous fuels is not satisfactory due to the presence of carbon dioxide and water and their possible effect on the drying characteristics of portland cement products.

5.4.3 A means of drying specimens to a condition of equilibrium with a relative humidity of $17 \pm 2\%$ (Note 7).

5.4.3.1 Calcium chloride (CaCl_2), if used for this purpose, shall be in flake form. Suitable dishes or trays shall be provided to give an exposed solution area of not less than 25 in.² for each cubic foot (5800 cm² for each m³) of oven volume. Dishes or trays shall contain sufficient solid calcium chloride so that the crystals will be exposed above the surface of the solution throughout the test. The calcium chloride solution shall be thoroughly stirred every 24 h, and more often if necessary, to prevent the formation of lumps and crusting over.

NOTE 7—The air immediately above a saturated solution of calcium chloride (CaCl_2) at 122°F (50°C) is approximately 17 %.

5.4.4 Moderate circulation of air within the oven, over and around all test specimens and the drying agent.

5.5 *Cooling Chamber*—An airtight enclosure of sufficient capacity for cooling a minimum of three whole specimens to a temperature of $73.4 \pm 2^\circ\text{F}$ ($23 \pm 1.1^\circ\text{C}$).

5.6 *Immersion Tank*—A suitable container for completely immersing three whole test specimens in water maintained at $73.4 \pm 2^\circ\text{F}$ ($23 \pm 1.1^\circ\text{C}$).

5.7 *Balance or Scale*—The balance shall be sensitive to within 0.1 % of the weight of the smallest specimen tested.

6. Test Specimens

6.1 The test specimens selected shall be whole units, free of visible cracks or other structural defects, which shall be representative of the lot from which they are selected (Note 8). Portions of face shells (see 6.1.1) may be used for test in lieu of whole units providing they are cut lengthwise from hollow units at least 12 in. (304.8 mm) in length. Specimens to be used for testing shall not be exposed to external heat sources.

NOTE 8—In tests of short units such as concrete brick by this method, use of a 10-in. (254-mm) Whittemore strain gauge is reported to be feasible when two units are butted together and joined using an epoxy resin cement to form an extremely thin joint between the units. The abutting ends of the units should be ground to ensure intimate contact and a thin joint; these precautions are necessary to ensure the thinnest joints practicable and thereby avoid abnormal shrinkage indications. Some laboratories have obtained satisfactory results using a 10-in. Whittemore strain gauge on specimens joined with unfilled epoxy cements.

6.1.1 The number of specimens selected should consist of three whole units or three half face-shells. (See Fig. 2.)

6.1.2 The portions known as half face-shells should be at least 4 in. (101.6 mm) wide and should be of the same length as the face shell. Half face-shell specimens must be saw-cut from hollow units not less than 12 in. (304.8 mm) in length.