



# Standard Test Method for Compressive Strength of Masonry Prisms<sup>1</sup>

This standard is issued under the fixed designation C1314; 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 test method covers procedures for masonry prism construction and testing, and procedures for determining the compressive strength of masonry,  $f_m$ , used to determine compliance with the specified compressive strength of masonry,  $f'_m$ . When this test method is used for research purposes, the construction and test procedures within serve as a guideline and provide control parameters.

1.2 This test method also covers procedures for determining the compressive strength of prisms obtained from field-removed masonry specimens.

1.3 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.

1.4 *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>

- C67 Test Methods for Sampling and Testing Brick and Structural Clay Tile
- C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C140 Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
- C143/C143M Test Method for Slump of Hydraulic-Cement Concrete
- C144 Specification for Aggregate for Masonry Mortar
- C270 Specification for Mortar for Unit Masonry

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.04 on Research.

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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.

- C476 Specification for Grout for Masonry
- C780 Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
- C1019 Test Method for Sampling and Testing Grout
- C1093 Practice for Accreditation of Testing Agencies for Masonry
- C1180 Terminology of Mortar and Grout for Unit Masonry
- C1232 Terminology of Masonry
- C1532 Practice for Selection, Removal, and Shipment of Manufactured Masonry Units and Masonry Specimens from Existing Construction
- C1552 Practice for Capping Concrete Masonry Units, Related Units and Masonry Prisms for Compression Testing
- C1587 Practice for Preparation of Field Removed Manufactured Masonry Units and Masonry Specimens for Testing
- E105 Practice for Probability Sampling of Materials
- E111 Test Method for Young's Modulus, Tangent Modulus, and Chord Modulus

## 3. Terminology

### 3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminologies C1180 and C1232.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *set*—a set consists of at least three prisms constructed of the same material and tested at the same age.

### 3.3 Notations:

3.3.1  $f'_m$ —specified compressive strength of masonry.

3.3.2  $f_m$ —compressive strength of masonry.

3.3.3  $h_p$ —prism height.

3.3.4  $t_p$ —least actual lateral dimension of prism.

## 4. Significance and Use

4.1 This test method provides a means of verifying that masonry materials used in construction result in masonry that meets the specified compressive strength.

4.2 This test method provides a means of evaluating compressive strength characteristics of in-place masonry construction through testing of prisms obtained from that construction when sampled in accordance with Practice C1532. Decisions made in preparing such field-removed prisms for testing,

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

determining the net area, and interpreting the results of compression tests require professional judgment.

4.3 If this test method is used as a guideline for performing research to determine the effects of various prism construction or test parameters on the compressive strength of masonry, deviations from this test method shall be reported. Such research prisms shall not be used to verify compliance with a specified compressive strength of masonry.

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

4.3.1 Appendix X2 includes guidance information for the researcher on aspects of materials, construction, and analysis.

## 5. Masonry Prism Construction

5.1 Construct prisms of units representative of those used in the construction. If units have projections (see Note 2) that project 1/2 in. (12.5 mm) or more, remove those projections by saw cutting flush with the surface of the unit at the base of the projection. The resulting units shall be a fully enclosed cell or cells that will ensure a full bearing surface over the net cross-section of the prism. If saw cutting will not result in a fully enclosed cell or cells, use full-size units, and, if grout is used, grout in accordance with 5.9.4. If prisms are used for field quality control or assurance, record the location in the structure that corresponds to the set of prisms constructed.

NOTE 2—Examples of projections include flutes, ribs, and face shells of open-ended units.

NOTE 3—Building codes or project specifications may require a set of prisms for a given square footage of construction. Recording the location of the structure that corresponds to a set of prisms allows the test results to be attributed to a particular portion of the structure.

5.2 Construct a set of prisms for each combination of materials and each test age at which the compressive strength of masonry is to be determined.

5.3 Build each prism in an opened, moisture-tight bag large enough to enclose and seal the completed prism. Construct prisms on a flat, level base. Construct prisms in a location where they will remain undisturbed until transported for testing.

5.4 Construct prisms as shown in Fig. 1 with units laid in stack bond in stretcher position. Orient units in the prism as in the corresponding construction. At the time of prism construction, the surfaces of the units shall be free of moisture. Where the corresponding construction is of multi-wythe ma-

sonry having wythes composed of different units or mortar, build prisms representative of each different wythe and test separately.

5.5 Build prisms with full-size or reduced length units. Any required saw cutting shall be performed on units prior to prism construction. The moisture content(s) of units used to construct prisms shall be representative of those used in construction. Prisms composed of units that contain closed cells shall have at least one complete cell with one full-width cross web on either end (see Fig. 2). Prisms composed of units without closed cells shall have as symmetrical a cross section as possible. The minimum length of prisms shall be 4 in. (100 mm).

NOTE 4—When using larger masonry units, experience has shown that reducing the length of these units prior to prism construction makes their handling and transportation easier. Thus, these reduced length unit prisms are less likely to be damaged and are more likely to be properly capped and tested. Also, the smaller prism will be less likely to be affected by plate bending effects during testing, as described in Note 11, and will therefore provide a more accurate assessment of the strength of the materials in the masonry prism. For these reasons, the use of reduced length prisms is encouraged.

5.6 Build masonry prisms with full mortar beds (mortar all webs and face shells of hollow units). Use mortar representative of that used in the corresponding construction. Use mortar joint thickness and a method of positioning and aligning units, that are representative of the corresponding construction. Use mortar joints that are cut flush. For prisms to be grouted, remove mortar “fins” that protrude into the grout space.

5.7 Build prisms a minimum of two units high with a height-to-thickness ratio,  $h_p/t_p$ , between 1.3 and 5.0.

5.8 Immediately following the construction of the prism, seal the moisture-tight bag around the prism.

### 5.9 Grouted Prisms.

5.9.1 When prisms are fabricated for field quality control or assurance, build prisms at the same time as the corresponding construction, and grout prisms when the corresponding construction is being grouted. When prisms are used for other purposes, grout prisms not less than 4 h nor more than 48 h following the construction of the prisms.

NOTE 5—Testing of prisms may be part of a project’s field quality control or assurance program. These prisms are intended to be representative of a constructed masonry element such as a wall, column, pilaster, or beam. They are built as companions to the masonry element at a jobsite where the masonry element is site-constructed, or within a factory or shop where the element is shop-built. Prisms may also be fabricated in a

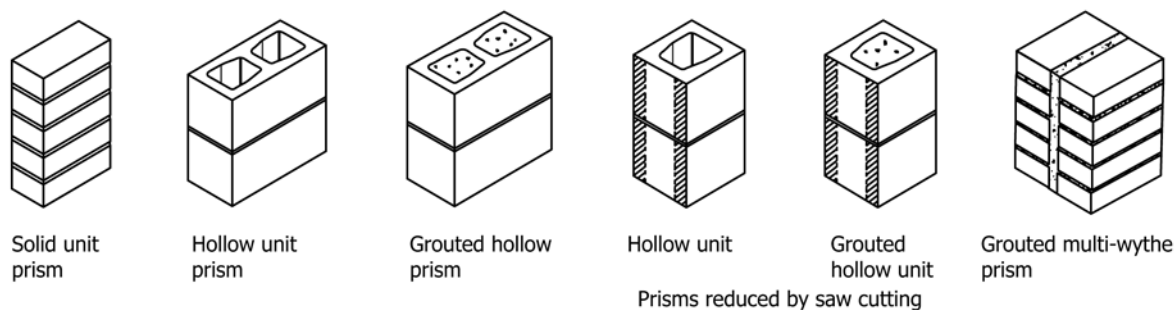


FIG. 1 Masonry Prism Construction

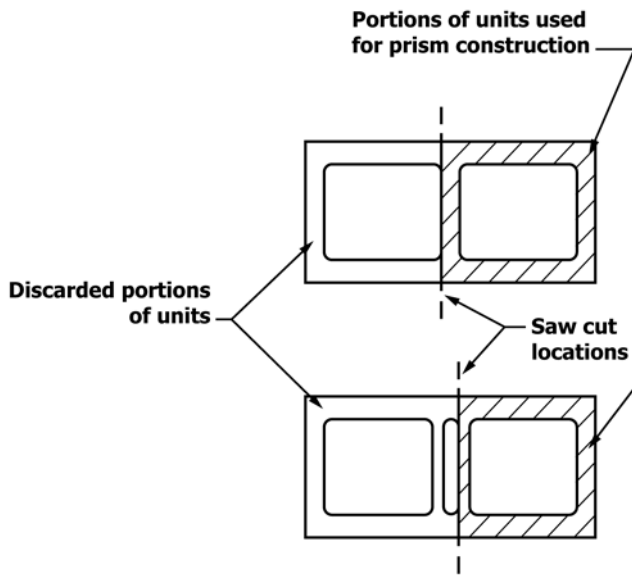


FIG. 2 Reduction of Hollow Units Prior to Prism Construction

laboratory for research purposes.

5.9.2 Where the corresponding construction is to be solidly grouted, solidly grout the prisms. Use grout representative of that used in the corresponding construction. Before placing grout, remove mortar droppings from the grout space. Use grout consolidation and reconsolidation procedures representative of those used in the construction. Place additional grout into the prisms as necessary after each consolidation. Screed off excess and finish the grout so that it is level with the top of the prism and in contact with the units at the perimeter of the grout space. Grouted prisms shall contain no reinforcement.

5.9.3 Where the corresponding construction is to be partially grouted, construct two sets of prisms; grout one set solid as described in 5.9.2 and leave the other set ungrouted.

5.9.4 If open-end units or prisms containing grout between similar wythes are to be grouted, use a rigid impermeable material as a form to confine the grout during placement on all ends that are open (see Note 6). Brace forms to prevent displacement during grouting. Grout as described in 5.9.2.

NOTE 6—Satisfactory performance of forming material has been achieved using wood covered with plastic, steel plates, or pieces of rigid acrylic and strapped or clamped in place. Use of impermeable material is more representative of actual construction, if grouted open ends are not in contact with webs of adjacent units.

5.9.5 Immediately following the grouting operation, reseal the moisture-tight bag around the prism.

5.10 Keep all prisms from freezing. Do not disturb or move prisms for the first 48 h after construction and grouting. Keep prisms in the moisture-tight bags until 48 h prior to testing.

5.11 Store an indicating maximum-minimum thermometer with the sample and record the maximum and minimum temperatures experienced during the initial 48-h period.

## 6. Obtaining and Transporting Masonry Prisms

6.1 For field-removed masonry specimens, select and remove specimens in accordance with Practice C1532.

6.2 Prior to transporting constructed prisms and field-removed masonry specimens, strap or clamp each prism or specimen to prevent damage during handling and transportation. Secure prisms and specimens to prevent jarring, bouncing, or tipping over during transporting.

6.3 Transport prisms and masonry specimens in accordance with Practice C1532.

6.4 For field-removed masonry specimens, after the specimens have been transported to the laboratory, obtain prisms from the masonry specimens using procedures outlined in Practice C1587.

## 7. Curing

7.1 After the initial 48 h of curing for constructed prisms, maintain the bagged prisms in an area with a temperature of  $75 \pm 15^\circ\text{F}$  ( $24 \pm 8^\circ\text{C}$ ). Two days prior to testing, remove the moisture-tight bags and continue storing at a temperature of  $75 \pm 15^\circ\text{F}$  ( $24 \pm 8^\circ\text{C}$ ) and a relative humidity less than 80 %.

7.2 For prisms obtained from field-removed masonry, store within the laboratory at a temperature of  $75 \pm 15^\circ\text{F}$  ( $24 \pm 8^\circ\text{C}$ ) and a relative humidity less than 80 % for at least two days prior to testing.

7.3 Prisms shall not be oven-dried or otherwise exposed to temperatures exceeding storage temperature requirements at any time prior to testing.

7.4 Visible moisture shall not be present on the surface of the prisms at the time of testing. Extend storage time as needed to ensure dry surface conditions of the prisms at the time of testing.

7.5 Test prisms at an age of 28 days or at the designated test ages. Test a set of prisms at each age. Prism age shall be determined from the time of laying units for ungrouted prisms, and from the time of grouting for grouted prisms.

## 8. Measurements and Determination of Net Area

8.1 *Measuring Prisms*—As shown in Fig. 3, measure the

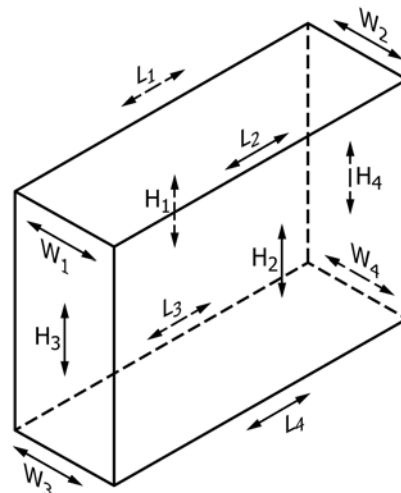


FIG. 3 Prism Measurement Location