



Designation: **C1019—16 C1019 – 18**

Standard Test Method for Sampling and Testing Grout¹

This standard is issued under the fixed designation C1019; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*~~Scope~~

1.1 This test method covers procedures for both field and laboratory sampling and compression testing of grout used in masonry construction. Grout for masonry is specified under Specification **C476**.

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

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~~ safety, health, and ~~health~~ environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens

C143/C143M Test Method for Slump of Hydraulic-Cement Concrete

C476 Specification for Grout for Masonry

C511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes

C617 Practice for Capping Cylindrical Concrete Specimens

C1064/C1064M Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

C1093 Practice for Accreditation of Testing Agencies for Masonry

C1611/C1611M Test Method for Slump Flow of Self-Consolidating Concrete

3. Significance and Use

3.1 Grout used in masonry is a fluid mixture of cementitious materials and aggregate with a high water content for ease of placement.

3.1.1 During construction, grout is placed within or between absorptive masonry units. Excess water must be removed from grout specimens in order to provide compressive strength test results more nearly indicative of the grout strength in the wall. In this test method, molds are made from masonry units having the same absorption and moisture content characteristics as those being used in the construction.

3.2 This test method is used to either help select grout proportions by comparing test values or as a quality control test for uniformity of grout preparation during construction.

¹ This test method is under the jurisdiction of ASTM Committee **C12** on Mortars and Grouts for Unit Masonry and is the direct responsibility of Subcommittee **C12.02** on Research and Methods of Test.

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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.

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

3.3 The physical exposure condition and curing of the grout are not exactly reproduced, but this test method does subject the grout specimens to absorption conditions similar to those experienced by grout in the wall.

NOTE 2—Test results of grout specimens taken from a wall should not be compared to test results obtained with this test method.

4. Apparatus

4.1 *Maximum-Minimum Thermometer.*

4.2 *Straightedge,* a steel straightedge not less than 6 in. (152.4 mm) long and not less than 1/16 in. (1.6 mm) in thickness.

4.3 *Tamping Rod,* a round, straight, steel rod with a diameter of 3/8 ± 1/16 in. (10 ± 2 mm) and a length of 12 ± 4 inches. (300 ± 100 millimetres). The rod shall have the tamping end or both ends rounded to a hemispherical tip of the same diameter as the rod.

4.4 *Nonabsorbent Blocks and Spacers,* nonabsorbent, rigid squares and rectangles with side dimensions so as to achieve the desired grout specimen side dimensions and of sufficient quantity or thickness to yield the desired grout specimen height, as shown in Fig. 1, Fig. 2, and Fig. 3.

NOTE 3—Nonabsorbent blocks may be of plastic, wood, or other nonabsorbent material. Certain species of wood contain sugars which cause retardation of cement. In order to prevent this from occurring, new wooden blocks shall be soaked in limewater for 24 h, sealed with varnish or wax, or covered with an impermeable material prior to use.

4.5 *Framing Square,* a framing square not less than 6 in. (150 mm) long and not less than 1/16 in. (2 mm) in thickness.

4.6 *Panels and plates,* pieces of 3/4 in. (19 mm) plywood with dimensions as needed to contain units and grout specimens. Soak in limewater for 24 h, seal with varnish or wax, or cover with an impermeable material prior to use. A nonabsorbant material of equivalent stiffness to the plywood is permitted.

PROCEDURES

5. Test Specimens

5.1 Each grout specimen shall have a square cross-section, 3 in. (76 mm) or larger on the sides and twice as high as its width. Dimensional tolerances shall be within 5 % of the width selected.

5.2 Test at least three specimens at each age specified.

NOTE 4—Frequency of sampling and age of test is to be determined by the specifier of this test method and is usually found in the construction documents.

5. Grout Specimen Molds

5.1 *Molds from Masonry Units:*

5.1.1 Select a level location where the molds remain undisturbed for up to 48 h.

NOTE 4—The location of specimen construction should be protected and as free from perceptible vibration as possible.

5.1.2 The construction of the mold shall simulate the in-situ construction. If the grout is placed between two different types of masonry units, both types shall be used to construct the mold.

5.1.3 Form a space with a square cross-section, 3 in. (76 mm) or larger on each side and twice as high as its width, by stacking specimen molds by arranging masonry units of the same type and moisture condition as those being used in the construction. The surface of the masonry units in contact with the grout specimen shall not have been previously used to mold the specimens. Place nonabsorbent blocks, a non-absorbent block as described in 4.4, cut to the proper size and of the proper thickness or quantity, at the bottom of the space to achieve the necessary height of specimen. Tolerance on space and specimen dimensions shall be within 5 % of the specimen width. See the specimen. Specimen molds Fig. 1, shall Fig. 2, and comply with Fig. 3 and accompanying notes: the following:

5.1.3.1 Molds shall have a cross-section that is nominally square.

5.1.3.2 Molds shall have a width of 3.0 in. (76 mm) to 3.75 in. (95 mm).

5.1.3.3 Molds shall have a height of at least twice the width (see Note 5).

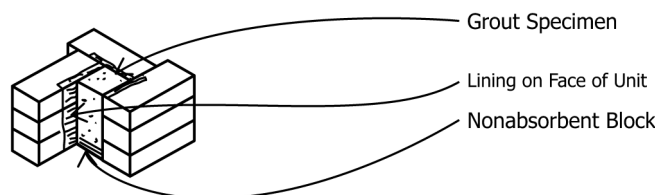


FIG. 1 Example of Grout Mold (Units 6 in. (152.4 mm) or Less in Height, 2 1/4 in. (57.2 mm) High Brick Shown)

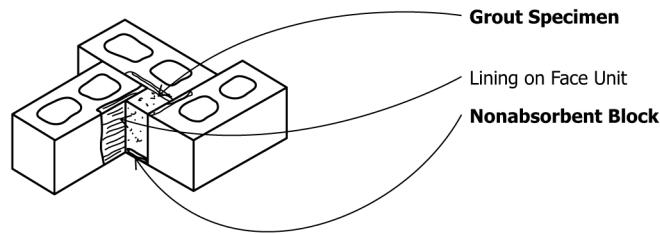


FIG. 2 Example of Grout Mold (Units Greater than 6 in. (152.4 mm) High, 8 in. (203.2 mm) High Concrete Masonry Unit Shown)

NOTE 5—The final specimen height requirement is defined in 5.1.3 as being 1.75 to 2.0 times the specimen width. The intent of the standard is to target a specimen height two times the specimen width while allowing some tolerance in those cases where the specimen would need to be cut down in height to meet the perpendicularity requirements. Having a mold that has a height at least twice the specimen width allows the final specimen to be meet the requirement or be cut to meet the requirement.

5.1.4 Line the masonry surfaces that will be in contact with the grout specimen with a thin, permeable material to prevent bond to the masonry units. New lining material shall be used for each specimen.

NOTE 6—The lining, such as paper towel, is used to aid in stripping the grout specimen from the mold. Proper installation of the lining prevents irregularly sized specimens and varying test results.

5.1.5 See Figs. 1-3 and accompanying notes for example of mold construction that conform with 5.1.2, 5.1.3, and 5.1.4.

5.1.6 Brace units to prevent displacement during grouting and curing.

5.2 Alternative Methods—Alternative methods of forming the specimens shall be used only with the approval of the specifier. Such approval shall be based on comparative testing of grout specimens constructed from molds as described in 6+5.1 and the alternative method. Approval shall be limited to a single specimen shape, method of forming, masonry units used, and grout mix. A conversion factor based on comparative testing of a minimum of ten pairs of specimens shall be used to modify results from alternative methods. The coefficient of variation of test results of specimens formed by the alternative method shall be less than or equal to that of the specimens formed in accordance with 6+5.1.

NOTE 7—Other methods of obtaining grout specimens and specimens of different geometry have been employed in grout testing, but are not described in this test method. Other methods used to obtain grout specimens include: drilling grout-filled cores of regular units; filling cores of masonry units specifically manufactured to provide grout specimens; filling compartments in slotted corrugated cardboard boxes specifically manufactured to provide grout specimens; and forming specimens from different sized masonry units of the same or similar material.

Since test results vary with methods of forming the specimen, specimen geometry, and grout mix, comparative test results between specimens made with molds described in 6+5.1 and specimens made with alternative methods are required and confined to a single specimen shape, method of forming, masonry units used, and grout mix.

6. Test Specimens

6.1 Specimens shall comply with the following:

6.1.1 Specimens shall have a nominally square cross section.

6.1.2 Specimens shall have an average specimen width between 3 in. (76 mm) and 3.75 in. (95 mm).

6.1.3 Specimens shall have a height before capping between 1.75 and 2.0 times the specimen width.

6.1.4 For each specimen, the difference between any width measurement and the average width for that specimen shall not exceed 1/8 in. (3.2 mm).

6.1.5 Neither end of the test specimen shall depart from perpendicularity to the vertical axis by more than 1 degree (approximately equivalent to 1/8 in. in 6 in.) (1 mm in 50 mm).

6.1.6 Specimens shall have side surfaces that are plane to within 1/8 in. in 6 in. (1 mm in 50 mm). See Fig. 4.

NOTE 8—Subsection 10.7 provides for cutting or grinding the top or bottom of hardened specimens to achieve dimensional requirements.

6.2 Test at least three specimens at each age specified.

NOTE 9—Frequency of sampling and age of test is to be determined by the specifier of this test method and is usually found in the construction documents.

7. Sampling Grout

7.1 Size of Sample—Grout samples to be used for slump and compressive strength tests shall be a minimum of 1/2 ft³ (0.014 m³).

7.2 Procedure—The procedures used in sampling shall include the use of precautions that will assist in obtaining samples that are representative of the nature and condition of the grout. After the final slump adjustment has been made, sample grout as the grout is being placed.

7.2.1 Field Sampling—Collect two or more portions taken at regularly spaced intervals during the discharge of the middle portion of the batch. The elapsed time between obtaining the first and final portions of the sample shall be not more than 15 min.

7.2.2 Laboratory Sampling—The entire mixed batch of grout is the sample.

NOTE 10—The field technician sampling, making, and curing specimens for acceptance testing should be certified (American Concrete Institute Field

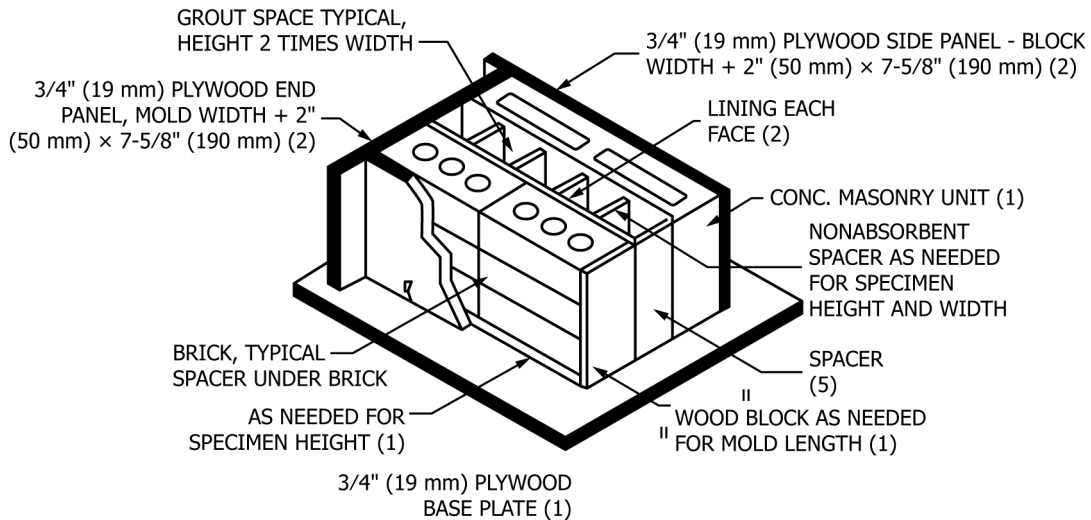


FIG. 3 Example of Grout Mold with Brick and Concrete Masonry Units

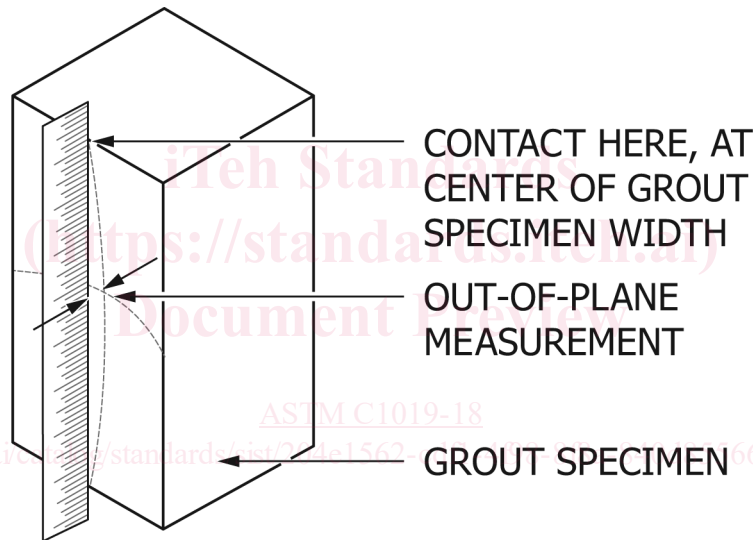


FIG. 4 Out-of-plane Measurement

Testing Technician—Grade I, National Concrete Masonry Association Masonry Testing Technician, or equivalent). Equivalent certification programs should include both written and performance examinations.

7.3 Place the grout sample in a non-absorbent container and cover the top to protect the sample from the sun, wind, and any other sources of rapid evaporation and from contamination. Transport the grout sample to the mold location. Remix the sample with a shovel or trowel to ensure uniformity prior to filling molds. Keep remaining grout sample protected in a covered, non-absorbent container until used to fill any depression in the sample due to initial water loss.

8. Temperature and Slump Test

8.1 Measure and record the temperature of the grout sample in accordance with Test Method C1064/C1064M.

8.2 Begin filling the slump cone within 5 min of obtaining the final portion of the sample.

8.3 For all grout except self-consolidating grout, measure and record the slump in accordance with the requirements of Test Method C143/C143M.

8.4 For self-consolidating grout, measure and record the slump flow in accordance with the requirements of Test Method C1611/C1611M and visual stability index (VSI) in accordance with the requirements of Test Method C1611/C1611M, Appendix X1.