



Standard Test Method for Obtaining and Testing Specimens of Hardened Lightweight Insulating Concrete for Compressive Strength¹

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

^{ε1} NOTE—Designation editorially updated in September 2014.

1. Scope

1.1 This test method covers obtaining, preparing, and testing specimens of hardened, lightweight, insulating concrete made with either lightweight aggregate conforming to Specification C332 or using preformed foam made from a foaming agent conforming to Specification C869 and having an oven-dry density not exceeding 800 kg/m³ [50 lb/ft³].

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the 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

- C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
- C88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- C125 Terminology Relating to Concrete and Concrete Aggregates
- C332 Specification for Lightweight Aggregates for Insulating Concrete

¹ This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.21 on Lightweight Aggregates and Concrete.

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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.

- C617 Practice for Capping Cylindrical Concrete Specimens
- C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- C869 Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete
- C1005 Specification for Reference Masses and Devices for Determining Mass and Volume for Use in the Physical Testing of Hydraulic Cements

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology C125.

4. Significance and Use

4.1 This test method is used to determine the compressive strength of hardened lightweight insulating concrete using samples taken from the field. The test results can be used to determine specification compliance when results of tests on specimens molded at the time of construction are not available or are defective, and to establish the strength properties of existing construction.

5. Apparatus

5.1 *Masonry or Carpenter's Saw*, for removing a sample from hardened concrete and cutting cubes from the sample. A core drill is permitted for concrete thicker than 150 mm [6 in.].

5.2 *Testing Machine*, conforming to the requirements in Test Method C39/C39M.

5.3 *Scales and Weights*, used in weighing specimens shall conform to Specification C1005.

5.4 *Drying Oven*, conforming to the requirements in Test Method C88.

6. Sampling

6.1 Remove a sufficiently large sample, from each sample location, so that at least four test specimens for compressive strength, and one for density (unit weight), can be prepared

without the inclusion of any concrete that has been cracked, spalled, undercut, or otherwise damaged. The sample shall be of such length and width as to permit the cubes and prisms to be cut therefrom without approaching any edge of the sample closer than 25 mm [1 in.]. Unless otherwise specified, the sample shall not be obtained until the concrete is at least 14 days old. Indicate the casting direction on the sample.

7. Test Specimens

7.1 Compressive strength specimens shall be cubes not less than 50 mm [2 in.], nor more than 100 mm [4 in.] on a side. The dimensions of the cubes shall be equal to the thickness of the concrete slab unless that thickness exceeds 100 mm [4 in.], in which case the depth of the specimen shall be reduced to 100 mm [4 in.] by sawing off the lower portion as placed. The casting direction shall be marked on each prepared cube so that load can be applied in the direction of casting.

7.2 Specimens for density (unit weight) determination shall be oven-dry prism-shaped specimens with a volume of at least 650 mL [40 in.³].

8. Preparation of Test Specimens

8.1 The surfaces of compressive strength specimens that will be in contact with the bearing surfaces of the testing machine shall be plane within 0.5 mm [0.02 in.]. The planeness of the bearing surfaces of the specimens shall be checked by means of a straightedge and feeler gauge, making measurements across both diagonals of the bearing faces of the cube. If the bearing surfaces depart from a plane more than 0.5 mm [0.02 in.], they shall be ground to within this tolerance or capped with materials conforming to Specification C617. The capped surface shall be plane within 0.05 mm [0.002 in.] (Note 1). The surface of the specimen in contact with the lower bearing block of the testing machine shall not depart from perpendicularity to the axis by more than 1° (approximately equivalent to 0.8 mm [0.03 in.] in 50 mm [2 in.] or 1.7 mm [0.07 in.] in 100 mm [4 in.]), and the combined departure of the two bearing surfaces from perpendicularity to the axis shall not exceed 3°. The difference between the longest and shortest cube edge shall not exceed 3 mm [$\frac{1}{8}$ in.].

NOTE 1—These relatively low-strength materials can tolerate greater deviation from planeness of bearing surfaces without affecting strength than can more rigid materials. However, if the specimen is capped, the capped surface shall conform to the more restrictive specification.

8.2 Store specimens in laboratory air until drying is initiated.

8.3 The specimens to be tested for compressive strength shall be dried in an oven at $60 \pm 3^\circ\text{C}$ [$140 \pm 5^\circ\text{F}$] for 3 days prior to testing if the insulating concrete is made using lightweight aggregate. If the insulating concrete is made using preformed foam, air dry the specimens for 3 days at $23 \pm 2^\circ\text{C}$ [$73.5 \pm 3.5^\circ\text{F}$].

8.4 Measure the lengths of the sides of each specimen at about midheight to the nearest 0.25 mm [0.01 in.]. Determine the average length of opposite sides and used those values to calculate the cross-sectional area to the nearest 10 mm² [0.01

in.²]. Measure the height of the specimen along each vertical edge to the nearest 0.25 mm [0.01 in.] and calculate the average height.

8.5 The specimens for determination of density (unit weight) shall be dried in an oven at $110 \pm 5^\circ\text{C}$ [$230 \pm 10^\circ\text{F}$] and weighed at 24-h intervals until the loss in mass does not exceed 1 % in a 24 h period. Measure the mass and dimensions of the oven-dry specimens. Calculate the density of each specimen in units of kg/m³ [lb/ft³].

9. Procedure

9.1 Test four specimens from a single sample location for compressive strength in accordance with the following:

9.1.1 *Placing of Specimen*—Wipe clean the bearing faces of the upper and lower bearing blocks of the compression testing machine and of the test specimen and place the test specimen on the lower bearing block. Test specimens in the direction in which they were cast. Align the axis of the specimen with the center of thrust of the spherically seated block. Tilt the moveable portion of the spherically seated block by hand so that the bearing face appears to be parallel to the end of the test specimen.

9.1.2 *Rate of Loading*—Apply the load continuously and without shock at a constant rate such that the maximum load will be reached in 50 ± 30 s. Record the maximum load sustained by the specimen.

9.2 Calculate the compressive strength of each specimen by dividing the maximum load by the cross-sectional area. Calculate the average compressive strength of the four specimens representing the sample location, and record this average strength to the nearest 0.1 MPa [10 psi].

10. Report

10.1 Report the following for each specimen tested, where applicable:

- 10.1.1 Source of sample,
- 10.1.2 Identification number,
- 10.1.3 Dimensions to nearest 0.25 mm [0.01 in.],
- 10.1.4 Cross-sectional area to nearest 10 mm² [0.01 in.²],
- 10.1.5 Type of cap, if used,
- 10.1.6 Maximum load, kilonewtons [pounds-force],
- 10.1.7 Average compressive strength of the four specimens from a single sample location, to the nearest 0.1 MPa [10 psi],
- 10.1.8 Defects in either specimen or caps,
- 10.1.9 Age, in days, and
- 10.1.10 Calculated oven-dry density.

11. Precision and Bias

11.1 Precision:

11.1.1 *Single Operator Precision*—The single-operator standard deviation of a compressive strength test result (the average of four individual determinations) is given in the first column of Table 1. The results of two properly conducted tests by the same operator on the same concrete are not expected to differ by more than the values in the second column of Table 1. The range (difference between highest and lowest) of the four

TABLE 1 Single-Operator Precision

Standard Deviation, MPa [psi] ^A	Acceptable Difference Between Two Test Results, MPa [psi] ^A	Acceptable Range for Four Individual Determinations, MPa [psi] ^B
Insulating concrete made with preformed foam		
0.28 [40]	0.76 [110]	2.00 [290]
Insulating concrete made with lightweight aggregate		
0.14 [20]	0.41 [60]	1.03 [150]

^A These numbers represent the (1s) and (d2s) limits described in Practice C670.

^B Acceptable range is based on Table 2 in Practice C670.

TABLE 2 Multi-Laboratory Precision

Standard Deviation, MPa [psi] ^A	Acceptable Difference Between Two Test Results, MPa [psi] ^A
Insulating concrete made with preformed foam	
0.28 [40]	0.76 [110]
Insulating concrete made with lightweight aggregate	
0.14 [20]	0.41 [60]

^A These numbers represent the (1s) and (d2s) limits described in Practice C670.

individual determinations obtained by the same operator are not expected to exceed the values in the third column of Table 1.

11.1.2 Multi-Laboratory Precision—The multi-laboratory standard deviation of a test result for compressive strength is given in the first column of Table 2. Therefore, results of two properly conducted tests in different laboratories on the same

concrete are not expected to differ by more than the values shown in the second column of Table 2.

NOTE 2—The data used to develop the precision statements were obtained in a study involving three laboratories, three materials, two operators per laboratory, and six replicates. The precision indices shown in SI units are exact conversions of the inch-pound values in brackets.

11.2 Bias—No standard reference material is available for determination of the bias of this test method.

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