



Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes¹

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

1. Scope

1.1 These test methods cover the determination of the compressive strength of chemical-resistant mortars, grouts, monolithic surfacings, and polymer concretes. These materials may be based on resin, silicate, silica, or sulfur binders.

1.2 Test Method A outlines the testing procedure generally used for systems containing aggregate less than 0.0625 in. (1.6 mm) in size. Test Method B covers the testing procedure generally used for systems containing aggregate from 0.0625 to 0.4 in. (1.6 to 10 mm) in size. Test Method C is used for systems containing aggregate larger than 0.4 in.

1.3 These test methods provide two different methods for controlling the testing rate.

1.4 The values stated in inch-pound units are to be regarded as standard. Within this text, the SI units shown in parentheses are provided for information only.

1.5 *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

C 470/C 470M Specification for Molds for Forming Concrete Test Cylinders Vertically

C 904 Terminology Relating to Chemical-Resistant Non-metallic Materials

E 4 Practices for Force Verification of Testing Machines

3. Terminology

3.1 *Definitions*—For definitions of terms used in these test methods, see Terminology **C 904**.

¹ These test methods are under the jurisdiction of ASTM Committee C03 on Chemical-Resistant Nonmetallic Materials and are the direct responsibility of Subcommittee C03.01 on Mortars and Carbon Brick.

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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.

4. Significance and Use

4.1 These test methods offer a means of determining the compressive strength of chemical-resistant mortars, grouts, monolithic surfacings, and polymer concretes.

5. Apparatus

5.1 *Equipment*, capable of weighing materials or specimens to $\pm 0.3\%$ accuracy.

5.2 Specimen Molds:

5.2.1 *Test Method A*—These molds shall be right cylinder $1 \pm \frac{1}{32}$ in. (25 ± 0.8 mm) in diameter by $1 \pm \frac{1}{32}$ in. high. The molds may be constructed in any manner that will allow formation of a test specimen of the desired size. Typical molds consist of a 1-in. thick, flat plastic sheet in which 1-in. diameter, smooth-sided holes have been cut, and to the bottom of which a $\frac{1}{4}$ -in. (6-mm) thick, flat plastic sheet (without matching holes) is attached by means of screws or bolts. Alternately, the molds may consist of sections of round plastic tubing or pipe, 1-in. inside diameter and 1 in. long, having sufficient wall thickness to be rigid and retain dimensional stability during the molding operation, and a $\frac{1}{4}$ -in. thick, flat plastic sheet on which one open end of each section can be rested. With the latter style of mold, the tubing segment may be sealed with a material, such as caulking compound or stopcock grease. For most types of specimens it is satisfactory to simply seal one end of the tubing segment with masking tape.

NOTE 1—For use with sulfur mortars an additional piece of flat plastic sheet at least $\frac{1}{8}$ in. (3 mm) thick containing a $\frac{1}{4}$ -in. (6-mm) hole and a section of plastic tubing or pipe 1 in. (25 mm) in diameter by 1 in. high are required. They are used to form a pouring gate and reservoir in the preparation of sulfur mortar specimens.

5.2.2 *Test Method B*—Molds for the 2 in. (50 mm) cube specimens shall be tight fitting and leakproof. The molds shall have not more than three cube compartments and shall be separable into not more than three parts. The parts of the molds, when assembled, shall be positively held together. The molds shall be made of materials not attacked by the product being tested. The sides of the molds shall be sufficiently rigid to prevent spreading or warping. The interior faces of the molds shall be manufactured to ensure plane surfaces with a permissible variation of 0.002 in. (0.05 mm). The distances

between opposite faces shall be $2 \pm \frac{1}{16}$ in. (50 ± 0.8 mm). The height of the molds, measured separately for each cube compartment, shall be $2 \pm \frac{1}{16}$ in. The angle between adjacent interior faces and between interior faces and top and bottom planes of the mold shall be $90 \pm 0.5^\circ$ measured at points slightly removed from the intersection of the faces.

5.2.3 *Test Method C*—Molds shall be right cylinders made of heavy gage metal or other rigid nonabsorbent material. The cylinder diameter shall be at least four times the nominal maximum aggregate size in the mix. The minimum cylinder diameter shall be 2 in. (50 mm). The cylinder height shall be two times the diameter. The plane of the rim of the mold shall be at right angles to the axis within 0.5° . The mold shall be at right angles to the axis within 0.5° . The mold shall not vary from the prescribed diameter by more than $\frac{1}{16}$ in. (1.5 mm) nor from the prescribed height by more than $\frac{1}{8}$ in. (3 mm). Molds shall be provided with a flat base plate with a means for securing it to the mold at a right angle to the axis of the cylinder in the instance of reusable metal molds. For molds other than metal, a mechanically attached smooth flat metal or integrally molded flat bottom of the same material, as the sides shall be used. Single-use molds shall conform to Specification C 470.

NOTE 2—The material from which the mold is constructed must be chemically inert and have antistick properties. Polyethylene, polypropylene, polytetrafluoroethylene, and metal forms having either a sintered coating of tetrafluoroethylene or a suitable release agent compatible with the material being tested are satisfactory. Because of their superior heat resistance, only trifluorochloroethylene and tetrafluoroethylene mold release agents should be used with sulfur materials.

5.3 The testing machine may be of any type of sufficient capacity which will provide the rates of loading prescribed. It shall have been verified to have an accuracy of 1.0 %, or better, within twelve months of the time of use in accordance with Practices E 4. The testing machine shall be equipped with two steel bearing blocks with hardened faces, one of which is a spherically seated block that will bear on the top bearing plate, and the other a plain rigid block that will support the bottom bearing plate. The diameter of the spherical bearing block shall be at least 75 % of the width of the specimen. The bearing faces shall not depart from a plane by more than 0.001 in. (0.025 mm) in any 6-in. (150-mm) diameter circle.

6. Test Specimens

6.1 Make all specimens for a single determination from a single mix.

6.2 *Test Method A*—Prepare test specimens to be used in accordance with Test Method A as described in 6.5. Test specimens shall be right cylinders $1 + \frac{1}{32}$, $-\frac{1}{16}$ in. ($25 + 0.8$, -1.6 mm) in diameter by $1 \pm \frac{1}{16}$ in. (25 ± 1.6 mm) high. If the faces of the specimen are not flat, smooth, and normal to the cylinder axis, they may be sanded, ground, or machined to specification. Exercise care that the frictional heat developed during such operations does not damage the specimens.

6.3 *Test Method B*—Prepare test specimens to be used in accordance with Test Method B as described in 6.5. Test specimens shall be cubes with dimensions of $2 + \frac{1}{16}$, $-\frac{1}{8}$ in. ($50 + 1.5$, -3.0 mm). If the faces of the cube are not flat,

smooth, and normal to each other, they may be sanded, ground, or machined to specification. Exercise care that the frictional heat developed during such operations does not damage the specimens.

6.4 *Test Method C*—Prepare test specimens to be used in accordance with Test Method C as described in 6.6.

6.4.1 Do not test specimens if any individual diameter of a cylinder differs from any other diameter of the same cylinder by more than 2 %.

6.4.2 Neither end of compressive test specimens, when tested, shall depart from perpendicular to the axis by more than 0.5° (approximately equivalent to $\frac{1}{8}$ in. in 12 in. (3 mm in 300 mm)). Cap the ends of compression test specimens that are not flat within 0.002 in. (0.05 mm) in accordance with 6.6, sawed or ground. Determine the diameter used for calculating the cross-sectional area of the test specimen to the nearest 0.01 in. (0.25 mm) by averaging two diameters measured at right angles to each other at about mid-height of the specimen.

6.5 Specimen Preparation for Test Methods A and B:

6.5.1 *Resin, Silicate, and Silica Materials*—Mix a sufficient amount of the components in the proportions and in the manner specified by the manufacturer of the materials. Fill the molds one-half full. Remove any entrapped air by using a cutting and stabbing motion with a spatula or rounded-end rod. Fill the remainder of the mold, working down into the previously placed portion. Upon completion of the filling operation, the tops of the specimens should extend slightly above the tops of the molds. When the molds have been filled, strike off the excess material, even with the top of the mold. Permit the material to remain in the mold until it has set sufficiently to allow removal without danger of deformation or breakage.

6.5.1.1 *Silicate Materials*—Some silicates may require covering during the curing period. After removal from the molds, acid-treat the specimens, if required, in accordance with the recommendations given by the manufacturer. No other treatment shall be permitted. Record the method of treatment in 9.1.8.

6.5.2 Sulfur Materials:

6.5.2.1 *Sulfur Mortars*—Slowly melt a minimum of 2 lb (900 g) of the material in a suitable container at a temperature of 265 to 290°F (130 to 145°C) with constant agitation. Stir to lift and blend the aggregate without beating air into the melt. Place the piece of plastic sheet containing the $\frac{1}{4}$ -in. (6-mm) round hole over the open face of the mold with the hole centered on the face. On top of the piece of plastic sheet and surrounding the hole, place a section of plastic tubing or pipe 1 in. (25 mm) in diameter by 1 in. high. Pour the melted material through the hole into the mold and continue to pour until the section of tubing or pipe is completely filled. The excess material contained in the hole in the plastic sheet acts as a reservoir to compensate for shrinkage of the material during cooling.

6.5.2.2 Allow the specimen to remain in the mold until it has completely solidified. Upon removal, file, grind, or sand the surface flush, removing the excess material remaining at the pouring gate.

6.5.2.3 *Sulfur Concrete*—Heat and mix a sufficient amount of aggregate components and sulfur cement in the proportions