



Designation: **C 307 – 9903**

## Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing<sup>1</sup>

This standard is issued under the fixed designation C 307; 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.

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

### 1. Scope

1.1 This test method covers the determination of tensile strength of cured chemical-resistant materials in the form of molded briquets. These materials include mortars, brick and tile grouts, machinery grouts, and monolithic surfacings. These materials shall be based on resin, silicate, silica, or sulfur binders.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

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.*

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<sup>1</sup> This test method is under the jurisdiction of ASTM Committee ~~C-3~~ C03 on Chemical-Resistant Nonmetallic Materials and is the direct responsibility of Subcommittee C03.01 on Test Methods.

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## 2. Referenced Documents

- 2.1 *ASTM Standards*:<sup>2</sup>  
 C 904 Terminology Relating to Chemical-Resistant Nonmetallic Materials  
 E 4 Practices for Force Verification of Testing Machines

## 3. Terminology

- 3.1 *Definitions*:  
 3.1.1 For definitions of terms used in this test method, see Terminology C 904.

## 4. Significance and Use

4.1 It is recognized that chemical-resistant mortars, grouts, and monolithic surfacings are not usually under tension when in service; however, such data are useful for purposes of determining the rate of cure and other properties.

4.2 This test method is not recommended for mortars, grouts, and monolithic surfacings containing aggregate greater than 1/4 in.

## 5. Apparatus

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

5.2 *Specimen Molds*— The molds for making briquet test specimens shall be sufficiently rigid to prevent deformation during molding and shall be made of corrosion-resistant material. Gang molds, when used, shall be of the type shown in Fig. 1. The dimensions of the briquet molds shall be the width of the mold, between inside faces, at waist line of briquet, 1 in. (25 mm) with permissible variations of  $\pm 0.01$  in. ( $\pm 0.25$  mm); ~~The width and the thickness depth of the molds measured at the point of greatest thickness of either side of the briquet mold at the waist line, shall be 1 in. with permissible variations of  $+0.004$  in. ( $+0.10$  mm) and  $-0.002$  in. ( $-0.05$  mm).~~  $\pm 0.02$  in. (25 mm  $\pm$  0.5 mm). The briquet test specimens molds shall conform to the dimensional requirements shown in Fig. 2.

5.3 *Equipment for Mixing Materials*, shall consist of a container of suitable size, preferably corrosion resistant, and a strong, sturdy spatula, trowel, or mechanical mixer.

5.4 The following additional equipment is required for sulfur mortars.

5.4.1 *Melting Chamber*, of sufficient volume and heat capacity to melt the mortar sample and maintain the temperature of the melt between 260 and 290°F (127 and 143°C).<sup>3</sup>

5.4.2 *Laboratory Mixer*, of such a type and speed to be capable of lifting the aggregate without beating air into the melt.

5.4.3 *Ladle*, of sufficient capacity to completely pour one briquet.

5.5 *Testing Machine*, the testing machine shall be of any type sufficient to provide the required load and the rate of crosshead movement prescribed. It shall have been verified to have an accuracy of 1.0 % or better within 12 months of the time of use in accordance with Practices E 4.

5.6 *Tension Clips*, for holding the tension test specimens, shall be in accordance with Fig. 3.

## 6. Test Specimens

6.1 All specimens for a single determination shall be made from a single mix containing sufficient amounts of the components in the proportions and in the manner specified by the manufacturer of the materials. If the proportions so specified are by volume, the constituents shall be weighed and the corresponding proportions by weight shall be reported.

6.1.1 *Number of Specimens*—Prepare a minimum of six briquet specimens for each material tested.

6.2 *Temperature*:

6.2.1 *Resin, Silicate, and Silica Materials*—The standard temperature of the materials, molds apparatus, and the ambient temperature of the mixing area shall be  $73 \pm 4^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ). Record the actual temperature.

6.2.2 *Sulfur Mortars*— The material shall be maintained at  $275 \pm 15^\circ\text{F}$  ( $135 \pm 8^\circ\text{C}$ ). The temperature of the molds and the ambient temperature of the mixing area shall be  $73 \pm 4^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ). Record the actual temperature.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards*, Vol 04.05, volume information, refer to the standard's Document Summary page on the ASTM website.

*Annual Book*

<sup>3</sup> The sole source of supply of the Forney capping compound melting chamber, Model LA-0130, known to the committee at this time is Forney Industries, Inc., 1565 Broadway Ave., Hermitage, PA 16148. If you are aware of alternative suppliers, please provide this information to ASTM Standards, Vol 03.01, Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

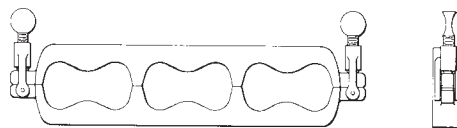


FIG. 1 Briquet Gang Mold

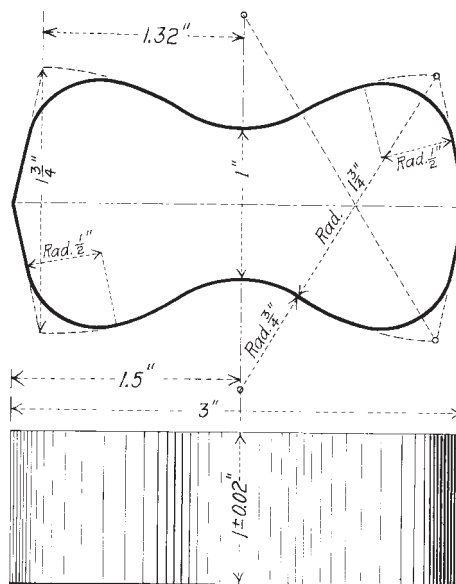


FIG. 2 Briquet Specimens for Tensile Strength Test

### 6.3 Molding Test Specimens:

6.3.1 ~~Assemble and lubricate~~ the mold by applying a thin film of an appropriate mold release or lubricant like silicone stop-cock grease or petroleum jelly.

6.3.2 *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 operations, 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 so that it is 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.

6.3.3 *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 the report section under Conditioning Procedure.

#### 6.3.4 Sulfur Mortars:

6.3.4.1 Assemble the mold as you would for the specimens to be cast in 6.3.2~~1~~. However, cover the waist of the mold with a small lubricated plate.

6.3.4.2 Melt at least 2.2 lb (1.0 kg) of sulfur mortar in the melt chamber in not more than 1 h. Hold the temperature of the melt at  $275 \pm 15^\circ\text{F}$  for at least 15 min while stirring gently with the laboratory mixer. (The mixer speed should be controlled so that it is sufficient to lift the aggregate without beating air into the melt.)

6.3.4.3 Using the ladle, pour the molten sulfur mortar into both sides of the mold and puddle it to completely fill the space under the plate. Allow the plate, placed across the center of the mold, to remain in place for at least 15 min after the briquet has been poured.

## 7. Conditioning

7.1 *Resin, Silicate, and Silica Materials*—Age the test specimens for a period of seven days, including the cure period in the mold, at  $73 \pm 4^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ). If a longer or shorter conditioning period is used, the time shall be reported.

7.2 *Sulfur Materials*— Before testing, condition the specimens at  $73 \pm 4^\circ\text{F}$ . The time between casting the specimen and testing the specimen shall be at least 24 h.

## 8. Procedure

8.1 *Measurement of Specimens*—Measure the depth and the width at the waist of each test specimen to the nearest  $0.001 \pm 0.02$  in. ( $0.0254$  mm) and the width at the waist to  $\pm 0.001$  in. ( $0.5$  mm).

8.2 Test the specimens on the seventh day after preparation. If desired, the conditioning time may be lengthened or shortened to establish the age-strength relationship. Report the age of the specimens.

8.2.1 Sulfur materials may be tested 24 h after preparation.

8.3 Center the specimens carefully in the clips of the testing machine. Pull the specimens at a speed of 0.20 to 0.25 in./min (5 to 6.4 mm/min) of crosshead movement (speed of movement when the machine is running without a load).

## 9. Calculations

9.1 *Tensile Strength*— The tensile strength is equal to the stress calculated at maximum load. It is calculated as follows:

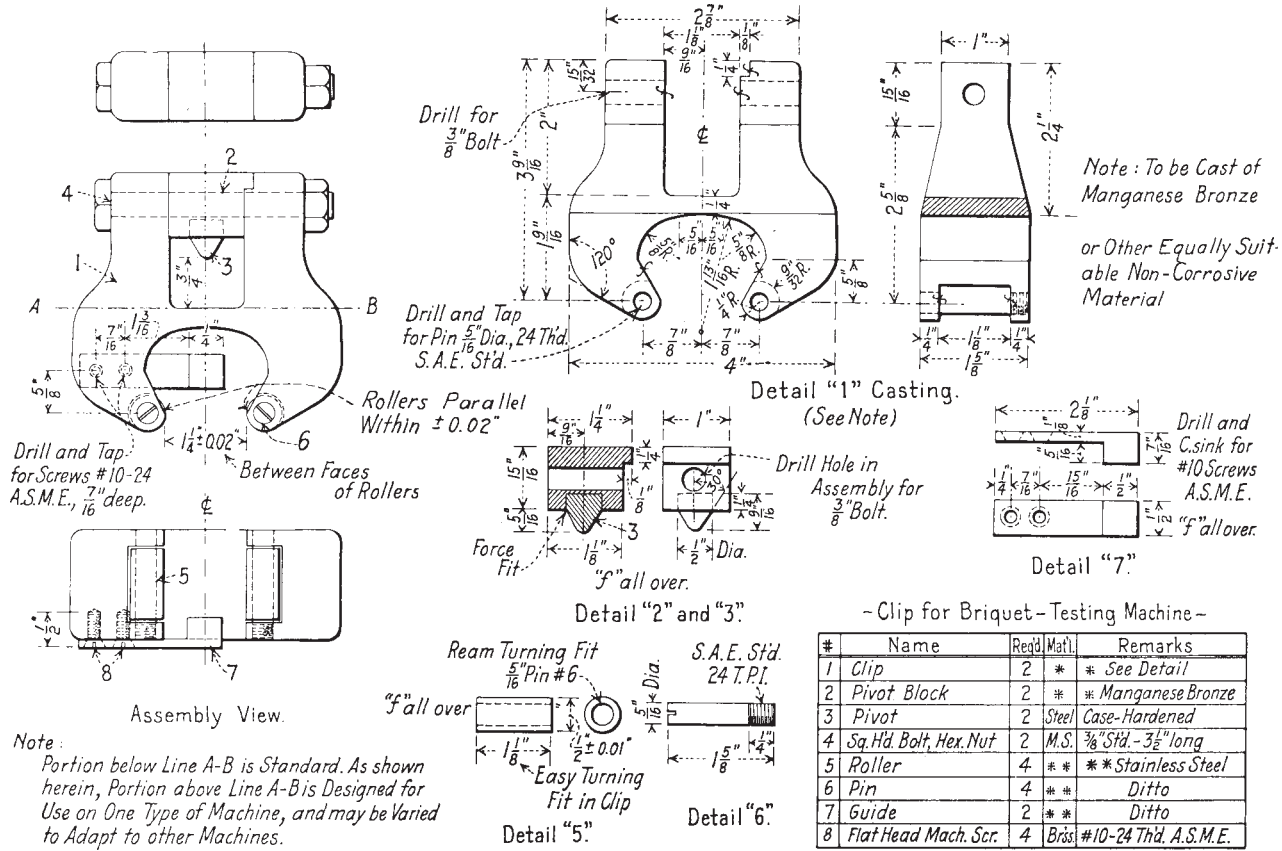


FIG. 3 Clips for Briquet Towing Machines

$$S = P/bd$$

(1)

where:

$S$  = stress in the specimen at the waist, psi (MPa),

$P$  = load at or prior to the moment of crack or break, lbf (N),

$b$  = width at the waist of the briquet tested, in. (mm), and

$d$  = depth of briquet tested, in. (mm).

## 10. Report

10.1 The report shall include the following:

10.1.1 Manufacturer, product trade name, and generic type,

10.1.2 Mixing ratio, if applicable,

10.1.3 Conditioning procedure,

10.1.4 Test conditions (temperature and humidity),

10.1.5 Total duration of conditioning in days, and

10.1.6 Individual and averaged results of tensile strength.

## 11. Precision and Bias

11.1 Precision and bias for this test method have not been established.

11.2 Test specimens that are manifestly faulty should be rejected and not considered in determining the tensile strength. Jawbreaks should be rejected.

11.3 If any strength value differs from the mean by more than 15 %, the farthest value from the mean shall be rejected and the mean recalculated. Repeat the process until all the tested values are within 15 % of the mean. If less than two-thirds of the values remain, the test shall be rerun.

## 12. Keywords

12.1 brick;

12.1 chemical resistant; grout; monolithic surfacing; mortar; tensile strength

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