



Designation: C 414 – 9903

## Standard Test Method for Working, Setting, and Service Strength Setting Times of Chemically Setting Chemical-Resistant Silicate and Silica Mortars<sup>1</sup>

This standard is issued under the fixed designation C 414; 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~~ offers a means of determining the working time, setting time, and service strength setting time of chemically setting, chemical-resistant silicate and silica mortars.

NOTE 1—For chemical-resistant resin mortars refer to Test Methods C 308.

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.*

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee ~~C-3~~ C03 on Chemical-Resistant Nonmetallic Materials and are 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 308 Test Methods for Working, Setting, and Service Strength Setting Times of Chemical-Resistant Resin Mortars

C 579 Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes

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

## 3. Terminology

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

## 4. Significance and Use

4.1 This test method offers a means of determining the working time, initial setting time and service strength setting time of chemically setting chemical-resistant silicate and silica mortars.

## 5. Apparatus

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

5.2 *Mixing Pan*—A metal or porcelain enameled pan measuring approximately 8 by 8 by 2 in. (200 by 200 by 50 mm) deep.

5.3 *Trowel*—A bricklayer's triangular trowel approximately 4 in. (100 mm) in length.

5.4 *Aluminum Foil Dish*—A flat-bottomed container  $2\frac{1}{4}$  in. (60 mm) in diameter by  $\frac{5}{8}$  in. (16 mm) high. An aluminum foil dish for milk analysis is suitable.

5.5 *Gillmore Needle*—The Gillmore needle shall conform to the following requirements:

Initial Needle	
Weight	113.4 $\pm$ 0.5 g
Diameter	0.083 $\pm$ 0.002 in.
Final Needle	
Weight	453.6 $\pm$ 0.5 g
Diameter	0.042 $\pm$ 0.002 in.

5.5.1 The needle tips shall be cylindrical for a distance of about  $\frac{3}{16}$  in. (4.8 mm). The needle ends shall be plane and at right angles to the axis of the rod and shall be maintained in a clean condition. The Gillmore needles should preferably be mounted as shown in Fig. 1.

## 6. Temperature Conditions

6.1 All material used in this test method shall be stored for at least 16 h prior to use at the standard test temperature of  $73 \pm 4^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ). The standard temperature for the working, initial setting, and service strength setting times shall be  $73 \pm 4^\circ\text{F}$ .

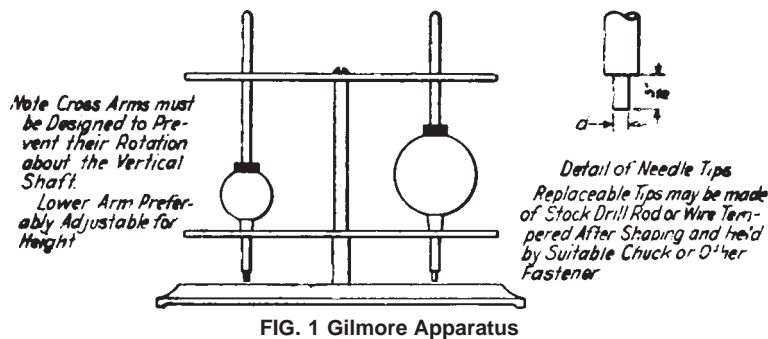
6.2 The relative humidity of the surrounding air shall be kept below 80 % during mixing of the mortar and conditioning of the specimens.

6.3 Other test temperatures are acceptable upon agreement between the manufacturer and user, provided that they are reported with the test data.

## 7. Preparation of Mortar

7.1 Prepare a 4.4 lb (2000 g) sample of mortar using the proportionate amounts of powder filler and liquid recommended by the manufacturer. If the proportions are specified by volumes, weigh the volumes and report the corresponding weights. Pour the

<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* volume information, refer to the standard's Document Summary page on the ASTM website.



liquid into the mixing pan and gradually add the powder filler to the liquid while mixing with the ~~trowel or mechanical mixer.~~<sup>3</sup> ~~trowel.~~ Note and record the time mixing begins. Thoroughly mix the mass until a uniform mixture is secured. The total mixing time shall be in accordance with the manufacturer's recommendation.

7.2 Fill an aluminum dish and strike off the surface evenly with a straight-edge spatula. Spread out the remainder of the mortar in the mixing pan to a uniform ~~thickness, covering the entire surface of the mixing pan.~~ thickness.

7.3 Prepare test specimens in accordance with C 579 if service strength setting time is to be determined.

## 8. Procedure

8.1 *Working Time*— Remove approximately 0.5 oz (15 g) portions of the silicate or silica mortar at 5-min (maximum) intervals and ~~trowel on the horizontal surface of onto a smooth, clean, and dry freezer paper.~~<sup>3</sup> horizontal surface. Before taking the 0.5 oz portions, work the trowel through the mix to work in any skin that may have formed on the surface. Consider the mortar workable if it stays in the applied position without following the trowel or without curling behind the trowel while spreading. Record the working time as the time in minutes from the start of mixing the filler and binder until the mortar ceases to be workable and fails to stay in the applied position while spreading. Do not return the material used for tests to the mixing pan.

8.2 *Initial Setting Time*—Test the ~~sample specimen~~ in the aluminum dish (see 7.2) for penetration by the Gillmore needle. Record the initial setting time as the time in hours from the start of mixing the filler and binder until the 1 lb (454 g) Gillmore Needle, having a tip diameter of  $\frac{1}{24}$  in. (1.06 mm) penetrates the sample  $\frac{3}{16}$  in. (5 mm), the length of the needle tip, in 1 min.

NOTE 2—In order that sufficient data will be obtained with the sample, it is suggested that tests be made at maximum time intervals of 30 min until the needle takes 15 to 30 s for penetration; then the tests can be repeated at more frequent intervals, as the time for penetration nears 60 s.

8.3 *Service Strength Setting Time, Compressive*—In accordance with Test Method C 579, make a minimum of three test specimens for testing at each time interval; this normally requires a minimum of twelve specimens. Test three specimens on the seventh day after preparation in accordance with Test Method C 579 and continue testing every 48 h until the average compressive strength of the three test specimens at the respective time interval reaches 90 % of manufacturer's published compressive strengths when tested at  $73 \pm 4^{\circ}\text{F}$ . Other test temperatures are acceptable as agreed upon by the user and manufacturer. They shall agree on an acceptable time, temperature, and compressive strength percentage criterion for service strength setting time as applies to their specific application.

## 9. Report

9.1 Report the following information:

9.1.1 Manufacturer's name of mortar and generic type,

9.1.2 Mixing ratio and component weights,

9.1.3 Test conditions (temperature and humidity),

9.1.4 Working time (minutes),

9.1.5 Initial setting time (hours),

9.1.6 Manufacturer's published compressive strength,

9.1.7 Service compressive strength setting time (days).

9.1.8 Report the compressive strengths determined at the respective time intervals.

9.2 If test temperatures or other test criteria are different than so stated by the test method, then same shall be reported.

## 10. Precision and Bias

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

10.2 To obtain sufficient results to make a statement of precision and bias, repeat Sections 6, 7, and 8 at least three more times.

10.3 Test results that are manifestly faulty or that give values differing by more than 15 % from the average value of all respective results obtained when using the same mortar components and tested at the same temperatures shall not be considered in determining the average working time, initial setting time, or the service compressive strength setting time. If, after discarding values, there are less than three remaining for determination of the working time, initial setting time, and the service compressive strength time, a retest shall be made.

## 11. Keywords

11.1 chemical-resistant; mortars; service strength setting time; setting time; silica mortars; silicate mortars; working time

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 **C 414 – 9903**

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