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Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete¹

This standard is issued under the fixed designation C 472; 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 (ϵ) indicates an editorial change since the last revision or reapproval.

These test methods have been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been approved by the Department of Defense.

1. Scope

1.1 These test methods cover the physical testing of gypsum, gypsum plasters, and gypsum concrete.

1.2 The test methods appear in the following sections:

Sections

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Normal Consistency of Gypsum Plaster.	15 to 19
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1.3 This standard does not purport to address all of the safety problems, 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. For a specific precautionary statement, see X1.2.1.

2. Referenced Documents

- 2.1 ASTM Standards:
- C 11 Terminology Relating to Gypsum and Related Building Materials and Systems²
- C 778 Specification for Standard Sand²
- E 11 Specification for Wire-Cloth Sieves for Testing Purposes³

3. Terminology

3.1 Definitions:

3.1.1 For useful definitions refer to Terminology C11.

4. Precautions for Physical Tests

4.1 Gypsum products are peculiar in that their properties are very greatly affected by the small amounts of impurities that may be introduced by careless laboratory manipulation. In order to obtain concordant results, it is, therefore, absolutely essential to observe the following precautions:

¹ These test methods are under the jurisdiction of ASTM Committee C-11 on Gypsum and Related Building Materials and Systems and are the direct responsibility of Subcommittee C11.01 on Specifications and Test Methods for Gypsum Products.

² Annual Book of ASTM Standards, Vol 04.01.

Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS 4.1.1 All apparatus shall be kept thoroughly clean. Especially, all traces of set plaster shall be removed. For mixing pastes and mortars, a 500-mL rubber dental bowl is a convenience.

4.1.2 Care must be used when drying gypsum, gypsum plasters, or gypsum concrete. Exceeding the specified drying temperatures may calcine the specimens, which will cause inaccurate test results.

5. Reagents and Materials

5.1 Distilled or deionized water, free of chlorides and sulfates, shall be used for mixing gypsum plasters and gypsum concrete.

5.2 Standard sand shall be used exclusively and shall meet the requirements of 20–30 sand in Specification C 778.

FREE WATER

6. Significance and Use

6.1 This test method determines the free water contained in gypsum, gypsum plasters, and gypsum concrete samples, and prepares the sample for subsequent testing.

7. Apparatus

7.1 Balance, capable of weighing at least 1 lb (454 g) at a precision of 0.002 lb (0.1 g).

7.2 Drying Oven, set at $110 \pm 5^{\circ}F$ (43.3 $\pm 2.8^{\circ}C$).

7.3 Desiccator, containing calcium chloride or equivalent desiccant.

8. Procedure

8.1 Weigh a sample of not less than 1 lb (0.45 kg) of the material as received and spread it out in a thin layer in a suitable-vessel. Place in an oven and dry at $110 \pm 5^{\circ}$ F (43.3 \pm 2.8°C) for 2 h; then cool in an atmosphere free from moisture and weigh again. The loss of weight corresponds to the free water and shall be calculated as a percentage of the sample as received.

8.2 Retain the dried sample in an airtight container until used for the fineness test (Sections 10 to 14).

9. Precision and Bias

9.1 The precision and bias of the free water test method have not been determined.

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³ Annual Book of ASTM Standards, Vols 04.01 and 14.02.

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FINENESS

10. Significance and Use

10.1 This test method covers a procedure for determining the fineness of gypsum and gypsum plasters and is used to determine compliance with gypsum and gypsum plaster specifications. The degree of correlation between the results of this test method and service performance has not been determined.

11. Apparatus

11.1 Sieves, as required by a particular gypsum or gypsum plaster specification, shall comply with Specification E 11.

11.2 *Balance*, capable of weighing at least 1000 g at a precision of 0.1 g.

11.3 Mechanical Sieving Machine may be used.

12. Procedure

12.1 Determine fineness by sieving a known weight of the dried sample through sieves of the specified sizes (Notes 1 and 2). The size of the sample to be used in determining fineness depends upon the particle size of the material. If the material will pass a $\frac{1}{4}$ -in. (6.4-mm) sieve, a 100-g sample will be sufficient; if the largest particles are more than 1 in. (25.4 mm) in diameter, use at least a 1000-g sample. With these limitations the size of sample to be used is left to the discretion of the operator. Shake the sample through each sieve with as little abrasion as possible (Note 3). Weigh the amount of material retained on each sieve and calculate the fineness, expressed as a percentage of the weight of the original sample.

12.2 If a mechanical sieving machine is used, make a series of tests at one minute intervals, with each type of material and sieve size combination to be used. When not more than 0.5 g passes each sieve in a one minute interval, use that time as the standard sieving time for that test procedure on that machine.

NOTE 1—For suggested method of sieving gypsum through a No. 325. $(45-\mu m)$ sieve, see Appendix XI.

NOTE 2—The sizes of the sieves to be used are given in the specifications of ASTM covering the particular product in question.

NOTE 3—When sieving through a No. 100 sieve, use a lateral motion, and tap the side of the sieve with the palm of the hand. Continue without brushing until not more than 0.5 g passes through during 1 min of sieving. If the sieve openings become clogged, transfer the retained material temporarily to another vessel, invert the sieve over a sheet of paper on the table and tap it sharply against the table. Then transfer all the retained material back into the sieve and continue sieving.

13. Report

13.1 Report the percent by weight retained on each sieve (see Section 12).

14. Precision and Bias

14.1 The precision and bias of the fineness test method have not been determined.

NORMAL CONSISTENCY OF GYPSUM PLASTER

15. Significance and Use

15.1 This test method is used to determine the volume of water required for mixing gypsum plaster when performing the setting time and compressive strength tests.



FIG. 1 Modified Vicat Apparatus (Conical Plunger Method)

16. Apparatus

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16.1 Modified Vicat Apparatus—The modified Vicat apparatus (Fig. 1)⁴ shall consist of a bracket, A, bearing a movable brass rod, B, 6.3 mm in diameter and of suitable length to fit the Vicat Bracket. On the lower end of the rod shall be attached a conical plunger, C, made of aluminum with an apex angle of 53° 08 min and a height of 45 mm. The total weight of the rod and plunger shall be 35 g. This total weight may be increased by means of a weight, G, screwed into the rod. The rod can be held in any desired position by a screw, E. The rod shall have a mark, D, midway between the ends which moves under a scale, F, graduated in millimetres, attached to the bracket, A.

16.2 Mold—The conical ring mold shall be made of a noncorroding, nonabsorbent material, and shall have an inside diameter of 60 mm at the base and 70 mm at the top and a height of 40 mm.

16.3 Base Plate—The base plate for supporting the ring mold shall be of plate glass and about 100 mm square.

16.4 *Balance*, capable of weighing at least 500 g at a precision of 0.1 g.

16.5 Graduated Cylinder, shall be made to deliver the indicated volume at 68°F (20°C) and shall be subdivided to at least 1 mL.

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⁴ This method is described by Kuntze, R. A., "An Improved Method for the Normal Consistency of Gypsum Plasters," *ASTM Bulletin No. 246*, ASTM, May 1960, p. 35.

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17. Procedure

17.1 Clean the plunger, mold, and base plate of the modified Vicat apparatus. Apply a thin coat of petroleum jelly or other suitable lubricant to the upper surface of the base plate in order to prevent leaks during the test.

17.2 Sift a weighed quantity of the sample (200 to 300 g as required to fill the mold) into a known volume of water. The temperature of the water shall be $70 \pm 2^{\circ}F$ (21 \pm 1.1°C). If the plaster is unretarded, add to the mixing water 0.2 g of sodium citrate per 100 g of sample. After allowing the sample to soak for 2 min, stir the mixture for 1 min to an even fluidity. Pour this sample into the ring mold, work slightly to remove air bubbles, and then strike off flush with the top of the mold. Wet the plunger of the modified Vicat apparatus and lower it to the surface of the sample at approximately the center of the mold. Read the scale and release the plunger immediately. After the rod has settled, read the scale again. Readings are reproducible on a retarded mix, and therefore, in order to eliminate error, two or three determinations should be made on each mix, care being taken to have the mold completely filled and the plunger clean and wet.

17.3 Gypsum molding plaster and gypsum gauging plaster shall be considered of normal consistency when a penetration of 30 ± 2 mm is obtained when tested in accordance with 17.1 and 17.2. The weight of the rod and plunger for this determination shall be 35 g. Normal consistency shall be expressed as the number of millilitres of water required to be

added to 100 g of the gypsum.

17.4 All gypsum mixtures containing aggregates shall be considered of normal testing consistency when a penetration of 20 ± 3 mm is obtained when tested in accordance with 17.1 and 17.2. The weight of the rod and plunger for these determinations shall be 50 g.

17.5 Gypsum neat plaster shall be tested for normal consistency after the plaster is first mixed with standard sand (see 5.1) in the ratio of 200 g of sand to 100 g of plaster.

18. Report

18.1 Report the normal consistency as the number of milliliters of water required to be added to 100 g of the dry mixture.

19. Precision and Bias

19.1 The precision and bias of the test method for normal consistency of gypsum plaster have not been determined.

NORMAL CONSISTENCY OF GYPSUM CONCRETE

20. Significance and Use

20.1 This test method is used to determine the volume of water required for mixing gypsum concrete when performing the setting time and compressive strength tests.

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21. Apparatus

21.1 Consistometer (Fig. 2)—The consistometer consists of a conical vessel made of noncorroding, nonabsorbent material, and having an inside diameter of 9 in. (229 mm) at the top and $1\frac{3}{4}$ in. (44.5 mm) at the bottom, and a height of $5\frac{1}{2}$ in. (139.7 mm). It shall be provided with a sliding gate at the bottom and supported so that the bottom is 4 in. (102 mm) above the base plate. The base plate shall be of plate glass, free of scratches and about 18 in. (457 mm) square.

21.2 *Balance*, capable of weighing at least 2000 g at a precision of 1 g.

22. Procedure

22.1 Clean and dry the consistometer and the base plate and close the sliding gate.

22.2 Sift 2000 g of the sample into a known volume of water (see 5.1) to which 1.0 g of sodium citrate has previously been added. The temperature of the water shall be $70 \pm 2^{\circ}F(21 \pm 1.1^{\circ}C)$. After allowing the sample to soak for 1 min, stir the mixture for 3 min to an even fluidity. Pour the mixture into the consistometer until level with the top. Then rapidly and completely open the sliding gate, allowing the mixture to run out onto the base plate. When the sliding gate is opened, take care to avoid jarring the consistometer.

22.3 Measure the resulting patty along its major and minor axes and determine the average diameter.

22.4 Gypsum concrete shall be considered of normal consistency when a patty diameter of $15 \pm \frac{1}{2}$ in. (381 ± 12.7 mm) is obtained when tested according to 22.1 through 22.3.

23. Report

23.1 Report the normal consistency as the number of

millilitres of water required to be added to 100 g of the gypsum concrete.

24. Precision and Bias

24.1 The precision and bias of the test method for normal consistency of gypsum concrete have not been determined.

SETTING TIME

25. Significance and Use

25.1 This test method is used to determine the setting time of gypsum plaster and gypsum concrete, and is used to determine compliance with gypsum plaster and gypsum concrete specifications. Since variable job conditions can influence the setting time, the degree of correlation between this test method and service performance has not been determined.

25.2 This test method does not determine the time of complete hydration of gypsum plaster or gypsum concrete. To determine the time of complete hydration see Setting Time, Alternate Temperature Rise Method, Sections 30 to 35.

26. Apparatus

26.1 Vicat Apparatus—The Vicat apparatus (Fig. 3) shall consist of a frame, A, bearing a movable rod, B, weighing 300 g, one end, C, the plunger end, being 10 mm in diameter for a distance of at least 50 mm, the other end having a removable needle, D, 1 mm in diameter and 50 mm in length. The rod, B, shall be reversible, shall be able to be held in any desired position by a screw, E, and shall have an adjustable indicator, F, that moves over a scale (graduated in



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millimetres) attached to the frame, A. The paste shall be held in a rigid conical ring, G, resting on a glass plate, H, about 100 mm square. The ring shall be made of a noncorroding, nonabsorbent material and shall have an inside diameter of 70 mm at the base and 60 mm at the top, and a height of 40 mm.

26.2 In addition, the Vicat apparatus shall conform to the following requirements:

۲. I		
	Weight of plunger	$300 \pm 0.5 g$
	Diameter of larger end of plunger	$10 \pm 0.05 \text{ mm}$
н.	Diameter of needle	$1 \pm 0.05 \text{ mm}$
÷	Inside diameter of ring at bottom	70 ± 3 mm
	Inside diameter of ring at top	60 ± 3 mm
	Height of ring	$40 \pm 1 \text{ mm}$
	Graduated scale	The graduated scale, when
		compared with a standard
		scale accurate to within 0.1
		mm at all points, shall not
		show a deviation at any point
		greater than 0.25 mm.
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26.3 *Balance*, capable of weighing at least 500 g at a precision of 0.1 g.

26.4 Stopwatch or Clock, for determining setting time.

26.5 Temperature and Humidity Controlled Cabinet, capable of maintaining a temperature of $70 \pm 2^{\circ}F$ (21.1 \pm 1.1°C) and a relative humidity of not less than 85 %.

27. Procedure

27.1 Gypsum Concrete and All Gypsum Plasters, Except Gypsum Neat Plaster-Start the timing of the test approximately at the moment of contact of the dry material with the water. Mix approximately 200 g of the sample to make a paste of normal consistency. Mix enough paste to fill the conical ring. For the quantity of water and directions for mixing, see Sections 15 to 24, except that no retarder shall be added. The temperature of the water shall be $70 \pm 2^{\circ}F$ (21.1 \pm 1.1°C). Place the conical ring on the base plate and fill the ring with the paste level with the top of the ring. Position the end of the needle so that it just touches the top surface of the paste and tighten the screw. Release the screw so that the needle falls freely into the paste. After each penetration, wipe the needle clean, and move the base plate and ring slightly so that the needle will not strike the same place twice. Test the sample at intervals according to the table in 27.3. Setting time shall be considered complete when the needle no longer penetrates to the bottom of the paste. When setting times are expected to be longer than 1/2 h, the test specimens shall be stored in the cabinet described in 26.5.

27.2 Gypsum Neat Plaster—Test gypsum neat plaster for setting time as mixed with three parts by weight of standard sand (see 5.2). Mix dry a 100-g sample of the gypsum neat plaster and 300 g of the sand, and then add sufficient water to produce a normal consistency. For the quantity of water and mixing instructions, see Sections 15 to 24 except no retarder shall be used. The temperature of the water shall be $70 \pm 2^{\circ}F(21.1 \pm 1.1^{\circ}C)$. Stir for 1 min, to an even, lump-free consistency. Place the mortar in the conical ring and test for setting time as described in 27.1

27.3 *Frequency of Testing*—The frequency of testing of the materials shall be as follows:

First Test	Frequency of Subsequent Tests
15 min	5 min
15 min	I h
15 min	5 min
15 min	5 min
l 1∕₂ h	1 h
2 h	1 h
1 1/2 h	1 h
11/2 h	1 h
40 min	2 h
15 min	5 min
	15 min 15 min 15 min 15 min 1½ h 2 h 1½ h 1½ h 1½ h

28. Report

28.1 Report the setting time as the elapsed time in minutes from the time when the sample was first added to the water to the time when set is complete.

29. Precision and Bias

29.1 The precision and bias for the setting time test method have not been determined.

SETTING TIME (Alternate Temperature Rise Method)

30. Significance and Use

30.1 This test method determines the hydration time by measuring the maximum temperature rise of gypsum plaster or gypsum concrete. The temperature rise is caused by the reaction of calcium sulfate hemihydrate with water to form calcium sulfate dihydrate. It is assumed that the maximum temperature rise coincides with the completion of the reaction. This test method is not used to determine compliance with specifications for gypsum plaster or gypsum concrete unless it is specified in the purchase contract.

30.2 The setting time determined by this test method is usually longer than the setting time determined in Sections 25 to 29.

30.3 The degree of correlation between this test method and service performance has not been determined.

31. Apparatus

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31.1 Potentiometer—A single- or multiple-channel recording potentiometer or thermistor bridge shall be used to record the temperature change of the sample under test. The chart speed shall be at least 1 in. (25 mm)/h. Imprints recording the temperature shall not be longer than 1 min apart for each sample.

31.2 Temperature Sensors—Temperature changes may be indicated by either thermocouples or thermistors which may be movable or in a fixed position. Temperature sensing elements shall be of such capacity and sensitivity that, when connected to the recording potentiometer, a temperature change of 1°F (0.5°C) in the sample shall be recorded on the chart.

31.3 Sample Cups—Paper or non-insulating plastic cups with a capacity of 6 to 9 oz (178 to 268 mL) shall be used. The cup containing the mixture under test shall be placed inside a matching cup held in an insulated block or beaker, as specified in 31.4. The movable temperature sensor, in this case, shall be positioned 25 to 33 % of the distance up from the bottom and between the inner and outer cup. Alter-

Copyright ASTM International Provided by IHS under license with ASTM No reproduction or networking permitted without license from IHS Order Number: W1953855 Sold to:ALSTON & BIRD, LLP [189014100001] - ELIZABETH.POWELL@ALSTON.COM, Not for Resele.2017-02-08 20;40:49 UTC nately, the cup containing the test mixture may be positioned over a spring-loaded sensor to ensure close contact with the bottom of the cup.

31.4 Insulated Block or Beaker, with walls and bottom having a thermal resistance of at least R6 (6 $(h \cdot ft^2 \cdot ^\circ F)/Btu)$ (1.1 $(m^2 \cdot K)/W$), and a centered cavity into which the sample cup fits snugly.

Nore 4—An insulating block may be constructed from a block of expanded polystyrene which, after carving a cavity into which the sample cup fits snugly, has walls and bottom at least 1.5 in. (38 mm) thick. An insulating beaker may be made by stuffing glass fiber or mineral wool insulation at least 2 in. (50.8 mm) thick around the sample container and within the walls of a beaker. The insulated block or beaker should have an insulated cover of the same insulating material through which the temperature probe can extend into the test material.

32. Test Conditions

32.1 Tests shall be made in a room or cabinet maintained at a temperature of $70 \pm 2^{\circ}F(21.1 \pm 1.1^{\circ}C)$. Materials and mixing water used for the test shall be at $70 \pm 2^{\circ}F(21.1 \pm 1.1^{\circ}C)$.

NOTE 5—If a constant-temperature cabinet is not available, a constant-temperature water bath may be fitted with a cover which will admit the body of the cup holder but not its rim, so that the cup holder is in contact with the water in the bath.

33. Procedure

33.1 Gypsum Concrete and All Gypsum Plasters, Except Gypsum Neat Plaster—Start the timing of the test at the moment of contact of the dry material with the water. Mix approximately 200 g of the sample to make a paste of normal consistency. Place the paste in a clean dry sample to about ³/₄ in. (19 mm) from the top. Place the filled cup in an empty cup in the insulated block or beaker and adjust the sensing element as required in 31.3. Cover the cup with a watch glass or plastic film or cover the surface of the paste with mineral oil to a depth of approximately ¹/₄ in. (6 mm).

33.2 Gypsum Neat Plaster—Prepare the plaster as required in 27.2 and test as required in 33.1.

34. Report

34.1 Report the setting time as the elapsed time in minutes from the time when the sample was first added to the water to the time when set is complete.

35. Precision and Bias

35.1 The precision and bias for the setting time, alternate temperature rise test method, have not been determined.

COMPRESSIVE STRENGTH

36. Significance and Use

36.1 This test method is used to determine the compressive strength of gypsum plaster and gypsum concrete and is used to determine compliance with applicable specifications. The correlation between this test method and service performance has not been determined.

37. Apparatus

37.1 Specimen Molds-Molds for making test specimens shall be 2-in. (50.8 mm) split cube molds made of

noncorrodible material and shall be sufficiently rigid to prevent spreading during molding. The molds shall have not more than three cube compartments and shall be separable into not more than two parts. When assembled, the parts of the molds shall be held firmly together, and dimensions shall conform to the following requirements: Interior faces shall be plane surfaces with a maximum variation of 0.001 in. (0.03 mm) for new molds and 0.002 in. (0.05 mm) for old molds; distance between opposite faces, and height of the molds, measured separately for each cube compartment, shall be 2 ± 0.005 in. (50.8 ± 0.13 mm) for new molds or 2 ± 0.020 in. (50.8 ± 0.51 mm) for old molds, 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.

37.2 Testing Machine, either the hydraulic or the screw type, with sufficient opening between the upper bearing surface and the lower bearing surface of the machine to permit the use of verifying apparatus. The load applied to the test specimen shall be indicated with an accuracy of ± 1.0 %. The load indicating device shall have a means of indicating maximum load. The upper bearing shall be a spherically seated, hardened metal block firmly attached at the center of the upper head of the machine. The center of the sphere shall lie at the center of the surface of the block in contact with the specimen. The block shall be free to tilt in any direction. A hardened metal bearing block shall be used beneath the specimen to minimize wear of the lower platen of the machine. The lower bearing block shall have concentric circles at 1/4 in.-intervals centered on the block to facilitate accurate centering of the test specimen. The bearing block surfaces intended for contact with the specimen shall have a Rockwell hardness number not less than 60 HRC. These surfaces shall not depart from plane surfaces by more than 0.0005 in. (0.013 mm) when the blocks are new and shall be maintained within a permissible variation of 0.001 in. (0.025 mm).

37.3 Drying Oven, a mechanical convection oven maintained at a temperature of $100 \pm 10^{\circ}$ F (37.8 \pm 5.5°C) and a relative humidity not to exceed 50 %.

37.4 *Desiccator*, that can be tightly sealed and of such a size as to hold at least one set of 6 cubes, containing magnesium perchlorate or calcium chloride.

38. Test Specimens

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38.1 Mix sufficient sample at normal consistency to produce not less than 34 fluid oz (1000 mL) of mixed mortar and cast into six specimen molds (see 37.1). Neat gypsum plaster shall be premixed dry with two parts by weight of standard sand (see 5.2). For the quantity of water, see Sections 15 to 24, except that no retarder shall be added. The temperature of the water shall be 70 \pm 2°F. Place the required amount of water in a clean 2-qt (2-L) mixing bowl. For all gypsum plasters except gypsum concrete, add the required amount of dried plaster and allow to soak for 2 min. Mix vigorously for 1 min with a metal spoon, stiff-bladed spatula or mechanical mixer to produce a mortar of uniform consistency. For gypsum concrete, soak for 1 min, and stir vigorously (about 150 complete circular strokes per minute) with a large spoon or mechanical mixer for 3 min. Setting time of the mortar, as determined by Sections 25 to 29, shall

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be within the time limits shown in Table 1. If setting time is in excess of the maximum limit, the cubes shall be discarded, and the next mix shall be adjusted by adding freshly ground gypsum accelerator to the plaster, except for Keene's cement, to which molding plaster shall be added to reduce setting time within the limits shown. The amount of gypsum accelerator or molding plaster used to accelerate the setting time shall not exceed 1 % of the dry weight of the plaster or Keene's cement.

NOTE 6-The Hobart N-50 mixer has been found satisfactory for this purpose.

38.2 Coat the molds with a thin film of mineral oil or other mold release agent and place on an oiled glass or metal plate. Place a layer of mortar about 1 in. (25 mm) in depth in each mold and puddle ten times across the mold between each pair of opposite faces with a 1 in. (25 mm) wide spatula to remove air bubbles. Fill the molds to a point slightly above the tops of the molds, by the same filling and puddling procedure used for the first layer. Also fill the conical mold for the Vicat apparatus described in 26.1 and 26.2 and determine the time of setting (see Section 27). As soon as the mortar or paste has set, cut off the excess to a plane surface flush with the top of the mold, using a stiff broad knife or similar implement. Place the filled molds in moist air (90 to 100 % relative humidity). The cubes may be removed from the molds as soon as thoroughly hardened, but must be retained in the moist air not less than a total of 16 h. Place the cubes in an oven as specified in 37.3. Dry the cubes to constant weight as determined by weighing once each day, but do not dry longer than 7 days. Then place the cubes in a desiccator as described in 37.4 for a minimum of 16 h before testing. Test the cubes immediately on removal from the desiccator.

39. Procedure

39.1 As soon as the cube specimens have been dried

TABLE 1 Setting-Time Limits for Mortar

	Setting Time, min	
Kind of Material	min	max
Molding plaster	20	140
Keene's cement:		
Standard	40	120
Quick set	20	40
Gypsum concrete	20	40
Ready-mixed plaster	90	120
Neat plaster (with 2 parts sand)	120	150
Wood-fibered plaster	90	120
Bond plaster	120	150
Gauging plaster:		
Slow set	40	120
Quick set	20	40
Veneer plaster	30	90

(Section 38), determine their compressive strengths. Position the cubes in the testing machine so that the load is applied on surfaces formed by faces of the molds, not on top and bottom. Apply the load continuously and without shock, at a constant rate within the range 15 to 40 psi (103 to 276 kPa)/s. During application of the first half of the maximum load a higher rate of loading shall be permitted.

40. Report

40.1 Report the average compressive strength as the compressive strength of the material, except that if the strengths of one or two of the cubes vary more than 15 % from the average of the six, discard them and report the compressive strength as the average of the remaining specimens. In case the compressive strengths of three or more cubes vary more than 15 % from the average, discard the results and repeat the test.

41. Precision and Bias

41.1 The precision and bias for the compressive strength test method have not been determined.

DENSITY

42. Significance and Use

42.1 This test method is used to determine the density of cast gypsum concrete and is used to determine compliance with the specification for gypsum concrete. The correlation between this test method and service performance has not been determined.

43. Apparatus

43.1 *Balance*, capable of weighing at least 1500 g (3.3 lb) to the nearest gram (0.002 lb).

44. Procedure

44.1 Determine the density of gypsum concrete by weighing the six cubes in grams to the nearest gram or in pounds to the nearest 0.002 lb after drying and cooling, as described in 38.2, and before determining the compressive strength.

45. Report

45.1 Report the density in pounds per cubic foot calculated by multiplying the total weight of the six cubes in grams by 0.0794 or the total weight in pounds by 36.0.

46. Precision and Bias

46.1 The precision and bias for the density test method have not been determined.

47. Keywords

47.1 gypsum; gypsum concrete; gypsum plasters

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APPENDIX

(Nonmandatory Information)

X1. ALCOHOL WASH METHOD OF SIEVING GYPSUM AND GYPSUM PRODUCTS

X1.1 It is impracticable to sieve dry gypsum through a No. 325 (45- μ m) sieve, and water cannot be used as a washing agent without introducing errors due to hydration or solution.

X1.2 Use isopropyl alcohol (99 %) as the washing agent (see X1.2.1). Place the alcohol in a vessel 1 to 2 in. (25.4 to 50.8 mm) larger in diameter than the sieve, to a depth above 2 in. Place 50 ± 0.01 g of the sample on a No. 325 (45-µm) sieve or, if desired, a coarser sieve up to and including the No. 100 (150-µm) sieve. Lower the sieve into the alcohol until the sample is wetted throughout. Lift the sieve out of the alcohol, with a swirling motion, permitting the alcohol to drain through the sample back into the vessel. Repeat this operation at least eight times, until the alcohol passes freely through the sieve and the sample is essentially free from fines. Wash the residue retained on the sieve with about 100 mL of clear alcohol, and then blot the bottom of the sieve with a soft, dry, lint-free cloth. Dry the sieve with the residue at 100 to 125°F (38 to 53°C). Shake the sieve on a mechanical shaker (Ro-Tap or equivalent) for $2 \min \pm 2$ s. Weigh the material retained on the sieve. Multiply by 2 the weight of material retained after shaking in order to obtain percentage of the original sample. If desired, to permit simultaneous determinations of coarser fractions, the residue after drying and before shaking may be transferred to a series of coarser sieves up to and including the No. 100, nested in sequential order above the No. 325 sieve. The alcohol may be reused after decanting or filtering, provided its strength does not fall below 95 %.

X1.2.1 Caution—When using isopropyl alcohol, keep fire away, provide good ventilation, and avoid excessive inhalation of vapor.

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