



## Standard Specification for Gypsum Plasters<sup>1</sup>

This standard is issued under the fixed designation C 28/C 28M; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

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

### 1. Scope

1.1 This specification covers four gypsum plasters; gypsum mill-mixed plaster, gypsum neat plaster, gypsum wood fibered plaster and gypsum gauging plaster.

1.2 The values stated in either inch-pound or SI (metric) units are to be regarded separately as the standard. Within the text, the SI units are shown in brackets. The values stated in each system shall be used independently of the other. Values from the two systems shall not be combined. This paragraph does not apply to the appendix.

1.3 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.4 The following safety hazards caveat pertains only to the test methods described in the appendix to this specification. *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:

- C 11 Terminology Relating to Gypsum and Related Building Materials and Systems<sup>2</sup>
- C 22 Specification for Gypsum<sup>2</sup>
- C 35 Specification for Inorganic Aggregates for Use in Gypsum Plaster<sup>2</sup>
- C 471M Test Methods for Chemical Analysis of Gypsum and Gypsum Products<sup>2</sup>
- C 472 Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete<sup>2</sup>
- C 778 Specification for Standard Sand<sup>2</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C11 on Gypsum and Related Building Materials and Systems and is the direct responsibility of Subcommittee C11.01 on Specifications and Test Methods for Gypsum Products.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 04.01.

E 11 Specification for Wire-Cloth and Sieves for Testing Purposes<sup>3</sup>

### 3. Terminology

3.1 *Definitions*—Definitions shall be in accordance with Terminology C 11.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *gypsum gauging plaster for finish coat, n*—a calcined gypsum plaster designed to be mixed with lime putty for the finish coat.

3.2.2 *gypsum neat plaster, n*—calcined gypsum mixed at the mill with other ingredients to control working quality and setting time.

3.2.2.1 *Discussion*—Neat plaster is either fibered or unfibered. The addition of aggregate is required on the job.

3.2.3 *gypsum mill-mixed plaster, n*—calcined gypsum plaster, mixed at the mill with a mineral aggregate, designed to function as a base coat to receive various finish coats.

3.2.3.1 *Discussion*—Other materials are not prohibited from being added to control setting time and other desirable working properties.

3.2.4 *gypsum wood-fibered plaster, n*—A calcined gypsum plaster in which wood fiber is used as an aggregate.

### 4. Materials

4.1 *Calcined Gypsum*—Calcined gypsum shall be manufactured from gypsum meeting the requirements of Specification C 22.

4.2 *Vermiculite Aggregate*, Specification C 35.

4.3 *Perlite Aggregate*, Specification C 35.

4.4 *Sand Aggregate*, Specification C 35.

4.5 *Ottawa Sand*, Specification C 778 for 20–30 sand.

4.6 *Wood Fiber*, non staining wood fiber.

### 5. Composition

5.1 When tested in accordance with Test Methods C 471M, calcined gypsum shall contain no less than 66.0 weight %  $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$ .

5.2 *Aggregate*—plasters shall contain a volume of aggregate not more than that shown in Table 1.

<sup>3</sup> Annual Book of ASTM Standards, Vol 14.02.

**TABLE 1 Composition and Physical Properties**

Product	Aggregate Type	Composition, Aggregate per 100 lb of Plaster, not more than		Setting Time <sup>A</sup> hours	Compressive Strength <sup>B</sup> not less than	
		ft <sup>3</sup>	m <sup>3</sup>		psi	MPa
Mill-Mixed Plaster over Lath Base	Vermiculite	2	0.057	1½ to 8	450	3.1
	Perlite	2	0.057	1½ to 8	600	4.1
	Sand	2.5	0.071	1½ to 8	700	4.8
Mill-Mixed Plaster over Masonry	Vermiculite	3	0.085	1½ to 8	325	2.2
	Perlite	3	0.085	1½ to 8	400	2.8
	Sand	3	0.085	1½ to 8	400	2.8
Neat Plaster	none	...	...	2 to 16 <sup>C</sup>	750 <sup>D</sup>	5.2
Wood Fibered Plaster	none	...	...	1½ to 8	1200	8.3
Gauging Plaster	none	...	...	<sup>E</sup>	1200	8.3

<sup>A</sup> Setting time shall be not less than the shorter time shown nor more than the longer time shown.

<sup>B</sup> Compressive strengths are as tested at the setting times specified in Test Methods C 472.

<sup>C</sup> When mixed with 3 parts by weight of Ottawa sand.

<sup>D</sup> When mixed with 2 parts by weight of Ottawa sand.

<sup>E</sup> When not retarded, the setting time shall be not less than 20 nor more than 40 minutes and, when retarded, not less than 40 minutes.

NOTE 1—An approximation of the aggregate content may be made by using the test methods in the appendix. A more accurate method for determining sand in plaster is described in Test Methods C 471M. Test Methods C 471M requires that the original sand and plaster components be available separately.

## 6. Mechanical Properties

6.1 *Compressive Strength*—When tested in accordance with Test Methods C 472 the compressive strength shall be as specified in Table 1.

6.2 *Setting Time*—When tested in accordance with Test Methods C 472 using the Vicat method, the setting time shall be as specified in Table 1.

NOTE 2—*Setting Time*—Attention is directed to conditions affecting job set of gypsum plasters that are usually beyond the control of the producer. Materials added at the site of application such as water and aggregates affect job sets. In addition, the various bases with different absorptive values may affect job performance. The plaster may be retarded to provide a setting time of not more than 4 h. Setting times more than 2 h may result in lower compressive strengths.

6.3 *Fineness of Gauging Plaster for Finish Coat*—When tested in accordance with Test Method C 472 all shall pass a No. 14 [1.4 mm] sieve and not less than 60 % shall pass a No. 100 [150 μm] sieve.<sup>4</sup>

## 7. Sampling

7.1 At least 1 % of the packages, but not less than 5 packages, shall be sampled. Packages to be sampled shall be selected at random. Samples shall be taken both from the outer portion and the center of each package. The materials so obtained shall be thoroughly mixed to provide a composite sample of not less than 7 lb [3.2 kg]. This composite sample

shall be placed immediately in a clean, dry, airtight container for delivery to the laboratory.

## 8. Packaging and Package Marking

8.1 Gypsum plasters shall be dry and free of lumps, and shall be shipped in packages.

8.2 When shipped for resale, the following information shall be legibly marked on each package or on a tag of suitable size attached to the package:

- 8.2.1 Name of manufacturer or seller,
- 8.2.2 Brand, and
- 8.2.3 Net weight of the package.

## 9. Inspection

9.1 Inspection of the gypsum plaster shall be agreed upon between the purchaser and the supplier as part of the purchase agreement.

## 10. Rejection

10.1 Rejection of gypsum plaster that fails to conform to the requirements of this specification shall be reported to the producer or supplier promptly and in writing. The notice of rejection shall contain a statement documenting requirements of this specification.

## 11. Certification

11.1 When specified in the purchase agreement, a manufacturer's or supplier's report shall be furnished at the time of shipment certifying that the product is in compliance with this specification.

## 12. Keywords

12.1 aggregate; gauging plaster; gypsum plaster; mill-mixed plaster; neat plaster; plaster; wood fibered plaster

<sup>4</sup> Detailed requirements for these sieves are given in Specification E 11.

**APPENDIX**

(Nonmandatory Information)

**X1. DETERMINATION OF AGGREGATE CONTENT OF MILL-MIXED PLASTER**
**INTRODUCTION**

The determination of the aggregate content of mill-mixed plaster is normally not precise. Most gypsum plasters contain natural impurities that cannot be separated from the aggregate by either mechanical or chemical means. A better estimate can be made by obtaining the approximate purity of the gypsum plaster used in the product from the manufacturer.

An accurate method for determining sand in set plaster is contained in Test Methods C 471M. Separate specimens of the sand and gypsum plaster used in the mill-mixed plaster are required for Test Methods C 471M.

**X1.1 Scope**

X1.1.1 This appendix covers mechanical and chemical test methods for separating the aggregate from gypsum plaster.

$$W_R = \frac{w_a}{w_p} \times 100 \quad (\text{X1.1})$$

where:

$W_R$  = weight ratio, lbs of aggregate/100 lbs (45 kg) of plaster,

$w_a$  = weight of aggregate, g, and,

$w_p$  = weight of plaster, g.

**X1.2 Mechanical Separation**
**X1.2.1 Significance and Use:**

X1.2.1.1 This test method is used to estimate the weight or volume of aggregate contained in mill-mixed gypsum plasters by mechanical separation.

**X1.2.2 Interferences:**

X1.2.2.1 It is assumed by this test method that the aggregate meets Specification C 35 and that only a minor portion of the aggregate passes through a 100-mesh (150  $\mu\text{m}$ ) sieve. To the extent that a greater portion passes the 100 mesh sieve, the results will show lower values for volume of the aggregate, and higher values for the weight of the gypsum plaster, than actually in the sample.

**X1.2.3 Apparatus:**

X1.2.3.1 *Sieve*—Specification E 11, 100 mesh (150  $\mu\text{m}$ ).

X1.2.3.2 *Balance*—with a capacity of not less than 100 g and a precision of at least 0.1 g.

**X1.2.4 Procedure:**

X1.2.4.1 Weigh 100 g of the sample to  $\pm 0.1$  g.

X1.2.4.2 Sieve the 100 g specimen through the 100 mesh (150  $\mu\text{m}$ ) sieve. Examine the material on the sieve to be sure small lumps or agglomerates of plaster are not retained. The retained portion is assumed to be aggregate. If the weight ratio of the aggregate and plaster is to be determined, weigh each portion to the nearest 0.1 g. If the volume ratio of aggregate to the weight of plaster is to be determined, measure the volume of aggregate retained on the sieve to the nearest mL and weigh the material passing through the sieve to the nearest 0.1 g.

**X1.2.5 Calculation and Report:**

X1.2.5.1 *Weight Ratio*— Calculate and report the weight ratio as pounds of aggregate/100 lb (45 kg) of plaster per Eq X1.1.

X1.2.5.2 *Volume Ratio*— Calculate and report the volume ratio as cubic feet of aggregate/100 lbs (45 kg) of plaster per Eq X1.2.

$$V_R = \frac{v_a}{w_p} \times 1.60 \quad (\text{X1.2})$$

where:

$V_R$  = Volume ratio, cubic feet of aggregate per 100 lbs of plaster,

$v_a$  = volume of aggregate, mL, and

$w_p$  = weight of plaster, g.

**X1.2.6 Precision and Bias:**

X1.2.6.1 It is not practical to specify the precision or the bias of this test method because of the unknown variabilities in the particle sizes of the aggregates.

**X1.3 Chemical Separation**
**X1.3.1 Significance and Use:**

X1.3.1.1 This test method is used to estimate the weight or volume of aggregate contained in mill-mixed gypsum plasters by chemical separation.

**X1.3.2 Interferences:**

X1.3.2.1 It is assumed in this test method that all of the material insoluble in ammonium acetate is aggregate and the soluble material is plaster. In many cases there is a significant amount of insoluble material in the plaster. To the extent that this is true it will produce erroneous calculated amounts of aggregate and plaster. If possible, obtain the approximate purity of the plaster from the manufacturer. This information will greatly increase the accuracy of the results.

X1.3.2.2 In the volume calculation it is assumed that the volume of the insoluble material in the plaster is insignificant compared to the volume of the aggregate. This is usually the case.

**X1.3.3 Apparatus:**

X1.3.3.1 *Analytical Balance*—with a precision of 0.001 g.

X1.3.3.2 *Drying Oven*—capable of maintaining a temperature of 100 to 110°C.

**X1.3.4 Reagents:**

X1.3.4.1 *Ammonium Acetate Solution (250 g/L)*—dissolve 250 g of ammonium acetate ( $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ ) in water and dilute to 1 L.

X1.3.4.2 *Ammonium Hydroxide (1+59)*—Mix one volume of concentrated ( $\text{NH}_4\text{OH}$ ) (sp gr 0.90) with 59 volumes of water.

**X1.3.5 Procedure:**

X1.3.5.1 Accurately weigh  $40 \pm 0.05$  g of the sample into a 1-L beaker. Add 600 to 700 mL of ( $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ ) solution that is slightly alkaline to litmus paper. If acidic, add a few mL of ( $\text{NH}_4\text{OH}$ ) (1+59) to the stock ( $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ ) solution to render it slightly alkaline prior to the addition of the test sample.

X1.3.5.2 Warm the suspension to a temperature of  $70 \pm 5^\circ\text{C}$  and stir continuously for 20 to 30 min. Filter the warm suspension through a small Buchner funnel or Gooch crucible in which filter paper has previously been formed, the funnel and mat having been dried at 110°C to a constant weight within 0.01 g. Refilter the first 100 mL of the filtrate. Wash the aggregate remaining in the beaker onto the filter with an additional 100 mL of warm ( $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ ) solution. Wash the beaker and residue with 200 to 300 mL of water, dry the funnel and aggregate at 100°C to constant weight.

**X1.3.6 Calculation and Report:**

X1.3.6.1 *Weight Ratio*—Calculate and report the weight ratio as pounds of aggregate/100 lbs (45 kg) of plaster per Eq X1.3.

$$W_R = \frac{w_1 - \frac{w_1 - w_2}{p}}{\frac{w_1 - w_2}{p}} \times 100 \quad (\text{X1.3})$$

where:

$W_R$  = weight ratio, lbs of aggregate/100 lbs (45 kg) of plaster,

$w_1$  = Weight of original specimen, g,

$w_2$  = weight of insoluble residue retained on filter, g, and

$p$  = Purity of gypsum plaster expressed as a decimal (that is, 85 % purity = 0.85). If purity is unknown use 0.9 (90 %) as an estimate.

X1.3.6.2 *Volume Ratio*—Calculate the volume ratio as cubic feet of aggregate/100 lbs (45 kg) of plaster per Eq X1.4.

$$V_R = \frac{v_1}{\frac{w_1 - w_2}{p}} \times 1.6 \quad (\text{X1.4})$$

where:

$V_R$  = volume ratio, cubic feet of aggregate/100 lbs (45 kg) of plaster,

$v_1$  = volume of insoluble residue retained on filter, mL,

$w_1$  = weight of original specimen, g,

$w_2$  = weight of insoluble residue retained on filter, g, and

$p$  = purity of gypsum plaster expressed as a decimal (that is, 85 % purity = 0.85). If purity is unknown use 0.9 (90 %) as an estimate.

**X1.3.7 Precision and Bias:**

X1.3.7.1 It is not practical to specify the precision or the bias of this test method because of the unknown variabilities in the purity of the plaster.

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