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Standard Specification for Application of Portland Cement-Based Plaster¹

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1. Scope*

1.1 This specification covers the requirements for the application of full thickness portland cement-based plaster for exterior (stucco) and interior work.

1.2 This specification sets forth tables for proportioning of various plaster mixes and plaster thickness.

NOTE 1—General information will be found in Annex A1. Design considerations will be found in Annex A2.

1.3 The values stated in inch-pound units are to be regarded as the standard. The SI (metric) values given in parentheses are approximate and are provided for information purposes only.

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

1.5 Details of construction for a specific assembly to achieve the required fire resistance shall be obtained from reports of fire-resistance tests, engineering evaluations, or listings from recognized fire testing laboratories.

2. Referenced Documents

2.1 *ASTM Standards:*²

C11 Terminology Relating to Gypsum and Related Building Materials and Systems

C25 Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime

C35 Specification for Inorganic Aggregates for Use in Gypsum Plaster

C91 Specification for Masonry Cement

C150 Specification for Portland Cement

C206 Specification for Finishing Hydrated Lime

C207 Specification for Hydrated Lime for Masonry Purposes

C219 Terminology Relating to Hydraulic Cement

C260 Specification for Air-Entraining Admixtures for Concrete

C595 Specification for Blended Hydraulic Cements

C631 Specification for Bonding Compounds for Interior Gypsum Plastering

C897 Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters

C932 Specification for Surface-Applied Bonding Compounds for Exterior Plastering

C1063 Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster

C1116 Specification for Fiber-Reinforced Concrete and Shotcrete

C1328 Specification for Plastic (Stucco) Cement

E90 Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

E119 Test Methods for Fire Tests of Building Construction and Materials

E492 Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine

2.2 *ANSI Standard:*

A108.1 Specification for Installation of Ceramic Tile³

¹ 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 C11.03 on Specifications for the Application of Gypsum and Other Products in Assemblies.

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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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

*A Summary of Changes section appears at the end of this standard.

3. Terminology

3.1 Terms shall be defined as in Terminologies C11 and C219, except as modified herein.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *accelerator*—an admixture that will shorten the setting time of plaster.

3.2.2 *admixture*—a material other than water, aggregate, or basic cementitious material added to the batch before or during job mixing.

3.2.3 *acid etching*—the cleansing and controlled erosion of a solid surface, using an acid wash.

3.2.4 *air entrainment*—the use of an air-entraining admixture or air-entraining cementitious material in a plaster mix to yield a controlled quantity of minute (typically between 10 and 1000 µm in diameter) disconnected air bubbles in the plaster (see *entrapped air*).

3.2.5 *backplaster*—plaster applied to the face of metal lath opposite a previously applied plaster.

3.2.6 *barrier wall*—type of wall system that is intended to block or interrupt the movement of water to the interior.

3.2.7 *bond*—the state of adhesion between plaster coats or between plaster and plaster base.

~~3.2.7~~

3.2.8 *bonding compound or agent*—compounds surface applied or integrally mixed with plaster to improve the quality of bond between plaster and plaster base or between plaster coats.

~~3.2.8~~

3.2.9 *cementitious material*—a material that, when mixed with water and with or without aggregate, provides the plasticity and the cohesive and adhesive properties necessary for placement and the formation of a rigid mass.

~~3.2.9~~

3.2.10 *coat*—a thickness of plaster applied in a single operation.

~~3.2.9.1~~

3.2.10.1 *basecoat*—all plaster applied before the application of the finish coat.

~~3.2.9.2~~

3.2.10.2 *bedding coat*—a plaster coat that receives aggregate or other decorative material impinged into its surface before it sets.

~~3.2.9.3~~

3.2.10.3 *brown coat*—in three-coat work, the second coat, applied over the scratch coat. In two-coat work, brown coat refers to the double-up basecoat. In either use, the brown coat is the coat directly beneath the finish coat.

~~3.2.9.4~~

3.2.10.4 *dash-bond coat*—a thick wet mixture of portland cement and water, with or without aggregate, dashed onto the surface of a plaster base such as smooth monolithic concrete or concrete block surfaces to improve the mechanical key for subsequent plaster coats.

~~3.2.9.5~~

3.2.10.5 *double-up coat*—the brown-coat plaster applied to the scratch coat plaster before the scratch-coat plaster has set.

~~3.2.9.6~~

3.2.10.6 *finish coat*—the final layer of plaster applied over basecoat plaster.

~~3.2.9.7~~

3.2.10.7 *fog coat*—a light coat of cement and water, with or without aggregate or color pigment, applied by machine spray to improve color consistency.

~~3.2.9.8~~

3.2.10.8 *scratch coat*—the first coat of plaster applied to a plaster base.

~~3.2.9.9~~

3.2.10.9 *skim coat*—a thin finish coat applied to an existing plaster surface or other substrate to improve appearance.

~~3.2.9.10~~

3.2.10.10 *three-coat work*—application of plaster in three successive coats with time between coats for setting or drying, or both.

~~3.2.10~~

3.2.11 *cold joint* (“*joining*” or “*jointing*”)—the juncture of fresh plaster application adjacent to set plaster, in the same plane.

~~3.2.11~~

3.2.12 *curing*—the act or processes of producing a moisture environment favorable to cement hydration, resulting in the setting or hardening of the plaster.

~~3.2.12~~

3.2.13 *drainage wall*—a wall system in which the cladding provides a substantial barrier to water intrusion, and which also incorporates a concealed water-resistive barrier over which drainage will occur.

3.2.14 *entrapped air*—unintentional air voids in the plaster generally larger than 1 mm.

~~3.2.13~~

3.2.15 *factory prepared* (“*mill-mixed*” or “*ready mixed*”)—pertaining to material combinations that have been formulated and dry-blended by the manufacturer, requiring only the addition of and mixing with water to produce plaster.

3.2.14 *3.2.16 fiber, natural or synthetic*—an elongated fiber or strand admixture added to plaster mix to improve cohesiveness or pumpability, or both.

3.2.15

3.2.17 floating—act of compacting and leveling brown-coat plaster to a reasonably true surface plane using a float tool or the act of bringing the aggregate to the surface of finish-coat plaster.

3.2.16

3.2.18 key (also mechanical key)—plaster that physically surrounds, penetrates, or deforms to lock onto the perforations or irregularities of the plaster base or previous coat of plaster.

3.2.17

3.2.19 metal plaster base—expanded metal lath, or welded or woven wire lath.

3.2.18

3.2.20 plaster—portland cement-based cementitious mixture (see *stucco*).

3.2.19

3.2.21 required—pertaining to a mandatory obligation imposed by a force outside of this specification, such as a building code, project specification, contract, or purchase order.

3.2.20

3.2.22 rustication (also “break”)—an interruption or change in plane of a plastered surface.

3.2.21

3.2.23 scoring (also known as “scratching”)—the grooving of the surface of an unset plaster coat to provide a key for a subsequent coat.

3.2.22

3.2.24 set—the chemical and physical change in plaster as it goes from a plastic, workable state to a rigid state. **3.2.23**

3.2.25 solid plaster bases, n—substrates that do not require a metal plaster base, including cast in place and precast concrete, concrete and stone masonry, clay brick, and tile.

3.2.24

3.2.26 stucco—portland cement-based plaster used on exterior locations.

3.2.25

3.2.27 stucco finish—a factory-prepared, dry blend of materials for finish coat applications.

3.2.26

3.2.28 temper, v—to mix or restore unset plaster with water to a workable consistency.

3.2.27

3.2.29 texture—any surface appearance as contrasted to a smooth surface.

4. Materials

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4.1 Materials shall conform to the requirements of the referenced specifications and standards and to the requirements specified herein.

4.2 *Cement:*

4.2.1 *Portland Cement*—Specification C150, Type I, II, and III, as specified. White where specified.

4.2.2 *Air-Entraining Portland Cement*—Specification C150, type as specified. White where specified.

4.2.3 *Masonry Cement*—Specification C91, Types N, S, and M. White where specified.

4.2.4 *Blended Hydraulic Cement*—Specification C595, Type IP, I(PM), IS, and I(SM) as specified.

4.2.5 *Air-Entraining Blended Hydraulic Cement*—Specification C595, Type IP-A, I(PM)-A, IS-A, and I(SM)-A as specified.

4.2.6 *Plastic Cement*—Plastic Cement shall meet the requirements of Specification C1328, Standard Specification for Plastic (Stucco) Cement.

NOTE 2—Plastic cements are not available nationally.

4.3 *Type “S” Hydrated Lime*—A hydrated lime that contains not more than 8 % unhydrated oxides when tested in accordance with Test Methods C25. See Specifications C206 and C207 for a complete description of a Type “S” hydrated lime.

4.4 *Aggregates:*

4.4.1 *Sand for Base Coats*—Specification C897. Aggregate failing to meet gradation limits in Specification C897 shall be permitted to be used, provided the plaster made with this sand has an acceptable demonstrated performance record in similar construction and climate conditions.

4.4.2 *Perlite*—Specification C35.

4.4.3 *Sand for Job-Mixed Finish Coats*—Specification C897.

4.5 *Water*—Water used in mixing, application, and finishing of plaster shall be clean, fresh, suitable for domestic water consumption, and free of such amounts of mineral or organic substances as would affect the set, the plaster, or any metal in the system.

4.6 *Admixtures*—See 3.2.2 and A2.5.

4.7 *Fibers*—Specification C1116 on alkali-resistant fibers, glass fibers, nylon, polypropylene or carbon fibers.

5. Requirements for Bases to Receive Portland Cement-Based Plaster

5.1 Metal bases and accessories used to receive plaster shall be installed in conformance with Specification C1063, except as otherwise specified.

NOTE 3—All metal, or PVC, or CPVC plastic members should be free of deleterious amounts of rust, oil, or other foreign matter, which could cause bond failure or unsightly discoloration.

5.2 Surfaces of solid bases to receive plaster, such as masonry, stone, cast-in-place or precast concrete shall be straight and true within ¼ in. in 10 ft (2.1 mm/m) and shall be free of form oil or other elements, which would interfere with bonding. Conditions where the surfaces are out of tolerance shall be corrected prior to the application of the plaster. Form ties or other obstructions shall be removed or trimmed back even with the surface of the solid base.

5.2.1 Solid surfaces shall have the suction (ability to absorb water) or surface roughness, or both, to provide the bond required for the plaster.

5.2.2 Smooth or nonabsorbent solid surfaces, such as cast-in-place or precast concrete, shall be prepared to receive portland cement plaster by one of the following methods:

5.2.2.1 Sandblasting, wire brushing, acid etching, or chipping or a combination thereof,

5.2.2.2 Application of a dash-bond coat applied forcefully against the surface, left untroweled, undisturbed, and moist cured for at least 24 h, or

5.2.2.3 Application of a bonding compound suitable for exterior or interior exposure solid surfaces in accordance with the manufacturer's written directions.

5.2.3 Where bond cannot be obtained by one or more of the methods in 5.2.2, a furred or self-furring metal plaster base shall be installed in accordance with Specification C1063.

6. Plaster Proportions and Mixing

6.1 Proportions:

6.1.1 All portland cement plasters shall be mixed and proportioned in accordance with the following tables and accompanying requirements, using measuring devices of known volume with successive batches proportioned alike.

6.1.2 Plaster mix used shall be as designated and referenced to Table 1.

6.1.3 Base-coat proportions shall be as shown in Table 2 for the mix specified from Table 1.

6.1.3.1 *Measurement of Materials*—The method of measuring materials for the plaster shall be such that the specified proportions are controlled and accurately maintained. The weights per cubic foot of the materials are considered to be as follows:

Material	Weight, lb/ft ³ (kg/m ³)
Portland cement	94 (1505)
Blended cement	Weight printed on bag
Masonry or plastic cement	Weight printed on bag
Hydrated Lime	40 (640)
Lime Putty	80 (1280)
Sand, Damp and Loose (6.1.3.2)	80 (1280) of dry sand

6.1.3.2 For purposes of this specification, a weight of 80 lb (1280 kg) of oven-dried sand shall be used. This is, in most cases, equivalent to one cubic foot of loose, damp sand.

6.1.4 Finish-coat proportions for job-mixed finish coats shall be as specified in Table 3.

6.1.5 *Factory-Prepared Finish Coats*—See 3.2.14.3.2.16.

TABLE 1 Plaster Bases—Permissible Mixes

NOTE—See Table 2 for plaster mix symbols.

Property of Base	Mixes for Plaster Coats	
	First (Scratch)	Second (Brown)
Low absorption, such as dense, smooth clay tile, brick, or concrete	C	C, CL, M, or CM
	CM or MS	CM, MS, or M
	P	P
High Absorption, such as concrete masonry, absorptive brick, or tile	CL	CL
	M	M
	CM or MS	CM, MS, or M
	P	P
Metal plaster base	C	C, CL, M, CM, or MS
	CL	CL
	CM or MS	CM, MS, or M
	M	M
	CP	CP or P
	P	P

TABLE 2 Base-Coat Proportions,^A Parts by Volume^B

Plaster Mix Symbols	Cementitious Materials					Volume of Aggregate per Sum of Separate Volumes of Cementitious Materials	
	Portland Cement or Blended Cement	Plastic Cement	Masonry Cement		Lime	1st Coat	2nd ^C Coat
			N	M or S			
C	1	...	...	...	0– ³ / ₄	2½–4	3–5
CL	1	...	...	...	³ / ₄ –1½	2½–4	3–5
M	...	...	1	...	...	2½–4	3–5
CM	1	...	1	...	...	2½–4	3–5
MS	...	...	...	1	...	2½–4	3–5
P	...	1	...	...	...	2½–4	3–5
CP	1	1	...	...	...	2½–4	3–5

^A The mix proportions for plaster scratch and brown coats to receive ceramic tile shall be in accordance with the applicable requirements of ANSI A108.1 series applicable to specified method of setting time.

^B Variations in lime, sand, and perlite contents are allowed due to variation in local sands and insulation and weight requirements. A higher lime content will generally support a higher aggregate content without loss of workability. The workability of the plaster mix will govern the amounts of lime, sand, or perlite.

^C The same or greater sand proportion shall be used in the second coat than is used in the first coat.

TABLE 3 Job-Mixed Finish Coat Proportion Parts by Volume

Plaster Mix Symbols ^A	Cementitious Materials					Volume of Aggregate per Sum of Separate Volumes of Cementitious Materials ^B
	Portland Cement or Blended Cement	Plastic Cement	Masonry Cement ^A		Lime	
			N	M or S		
F	1	...	...	...	³ / ₄ –1½	1½–3
FL	1	...	...	...	1½–2	1½–3
FM	...	...	1	...	...	1½–3
FCM	1	...	1	...	...	1½–3
FMS	...	...	...	1	...	1½–3
FP	...	1	...	...	...	1½–3

^A Additional portland cement is not required when Type S or M masonry cement is used.

^B In areas not subject to impact, perlite aggregate shall be permitted to be used over base-coat plaster containing perlite aggregate.

6.1.6 Dash-bond coat proportions shall be 1 volume part portland cement and not more than 2 volume parts of aggregate mixed to a consistency that will permit application as specified in 7.1.5.

6.1.7 Admixtures shall be proportioned, mixed, and applied in accordance with the printed directions of the manufacturer. (See A2.5.)

6.2 Mixing:

6.2.1 All plaster shall be prepared in a mechanical mixer, using sufficient water to produce a workable consistency and uniform color. (See X1.1.)

6.2.2 Base-coat plasters that have stiffened because of evaporation of water shall be permitted to be tempered one time only to restore the required consistency. Plaster not used within 1½ h from start of initial mixing shall be discarded.

NOTE 4—Severe hot, dry climate conditions accelerate the stiffening of plaster and require reduction of this limit. The use of cold waters will slow the stiffening process.

6.2.3 Finish-coat plaster shall not be tempered.

7. Application

7.1 General:

7.1.1 Portland cement plaster shall be applied by hand or machine to the nominal thickness specified in Table 4.

7.1.2 Plaster nominal thickness shall be measured from the back plane of the metal plaster base, exclusive of ribs or dimples, or from the face of the solid backing with or without metal plaster base, to the outer surface exclusive of texture variations.

7.1.3 Portland cement-based plaster shall be applied on furred metal plaster base when the surface of solid backing consists of gypsum board, gypsum plaster, wood, or rigid foam board-type products.

NOTE 5—On horizontal ceiling supports or roof soffits protected by a drip edge, gypsum board products shall be permitted to be used as backing for metal base to receive portland cement plaster.

7.1.4 Separation shall be provided where plaster abuts dissimilar construction materials or openings. (See A2.1.4.)

7.1.5 Each plaster coat shall be applied to an entire wall or ceiling panel without interruption to avoid cold joints and abrupt changes in the uniform appearance of succeeding coats. Wet plaster shall abut set plaster at naturally occurring interruptions in the plane of the plaster, such as corner angles, rustications, openings, and control joints where this is possible. Joinings, where necessary, shall be cut square and straight and not less than 6 in. (152 mm) away from a joining in the preceding coat.

7.1.6 Metal plaster base shall be covered with three-coat work with or without solid backing. The combined total nominal thickness shall be as shown in Table 4. A dash-bond coat shall not replace one of the specified number of coats.

TABLE 4 Nominal Plaster Thickness^A for Three- and Two-Coat Work, in. (mm)

BASE	Vertical				Horizontal			
	1st Coat	2nd Coat	3rd Coat ^B	Total	1st Coat	2nd Coat	3rd Coat ^B	Total
Interior/Exterior								
Three-coat work: ^C								
Metal plaster base	3/8 (9.5)	3/8 (9.5)	1/8 (3)	7/8 (22)	1/4 (6)	1/4 (6)	1/8 (3)	5/8 (16)
Solid plaster base:								
Unit masonry	1/4 (6)	1/4 (6)	1/8 (3)	5/8 (16)	Use two-coat work			
Cast-in-place or precast concrete	1/4 (6)	1/4 (6)	1/8 (3)	5/8 (16)				3/8 (9.5), max
Metal plaster base over solid base	1/2 (12.5)	1/4 (6)	1/8 (3)	7/8 (22)	1/2 (12.5)	1/4 (6)	1/8 (3)	7/8 (22)
Two-coat work:								
Solid plaster base:								
Unit masonry	3/8 (9.5)	1/8 (3)		1/2 (12.5)				3/8 (9.5)
Cast-in-place or pre-cast concrete	1/4 (6)	1/8 (3)		3/8 (9.5)				3/8 (9.5)

^A Exclusive of texture.

^B For solid plaster partitions, additional coats shall be applied to meet the finished thickness specified.

^C For exposed aggregate finishes, the second (brown) coat shall become the "bedding" coat and shall be of sufficient thickness to receive and hold the aggregate.

7.1.7 Two-coat work shall be used only over solid bases meeting the requirements of 5.2. The combined total nominal thickness shall be as shown in Table 4. A dash-bond coat shall not replace one of the specified number of coats.

7.1.8 Backplaster where required, shall be applied only after the coat on the opposite side has set sufficiently to resist breaking or cracking the plaster keys.

7.1.9 Each coat shall be permitted to set before the next coat is applied. (See X1.4.2.)

7.1.10 Plaster coats that have become dry shall be evenly dampened with water prior to applying subsequent coats to obtain uniform suction. There shall be no visible water on the surface when plaster is applied.

7.2 Plaster Application on Metal Plaster Bases:

7.2.1 The first (scratch) coat shall be applied with sufficient material and pressure to form full keys through, and to embed the metal base, and with sufficient thickness of material over the metal to allow for scoring the surface.

7.2.1.1 As soon as the first (scratch) coat becomes firm, the entire surface shall be scored in one direction only. The vertical surfaces shall be scored horizontally.

7.2.1.2 The first (scratch) coat shall become sufficiently rigid to support the application of the second (brown) coat without damage to the monolithic continuity of the first (scratch) coat or its key.

7.2.2 The second (brown) coat shall be applied with sufficient material and pressure to ensure tight contact with the first (scratch) coat and to bring the combined thickness of the base coat to the nominal thickness shown in Table 4.

7.2.2.1 The surface of the second (brown) coat shall be brought to a true, even plane with a rod or straightedge, filling surface defects in plane with plaster. Dry rodding the surface of the brown coat shall be permitted.

7.2.2.2 The surface shall be floated uniformly to promote densification of the coat and to provide a surface receptive to bonding of the finish coat.

7.2.3 The third (finish) coat shall be applied with sufficient material and pressure to ensure tight contact with, and complete coverage of the base coat and to the nominal thickness shown in Table 4 and 7.3.1.1.

7.3 Plaster Application on Solid Plaster Bases:

7.3.1 High-suction bases shall be evenly dampened with clean water prior to the application of plaster. Do not dampen low-suction solid bases, such as dense concrete or smooth brick.

7.3.1.1 Where masonry or concrete surfaces vary in plane, plaster thickness required to produce level surfaces shall not be required to be uniform.

7.3.2 Three-Coat Application on Solid Bases:

7.3.2.1 The first (scratch) coat shall be applied with sufficient material and pressure to ensure tight contact and complete coverage of the solid base, to the nominal thickness shown in Table 4. As soon as the first (scratch) coat becomes firm, the entire surface shall be scored in one direction only. The vertical surfaces shall be scored horizontally.

7.3.2.2 The second (brown) coat shall be applied using the same procedures specified in 7.2.2 and 7.2.2.1, bringing the surface to a true, even plane with a rod or straightedge, filling any defects in plane with plaster and darbying. The surface shall be floated uniformly to provide a surface receptive to the application of the third (finish) coat.

7.3.2.3 The third (finish) coat shall be applied as specified in 7.2.3.

7.3.3 Two-Coat Application on Solid Plaster Bases:

7.3.3.1 The first (scratch) coat shall be applied as specified in 7.3.2.1.

7.3.3.2 The second (finish) coat shall be applied as specified in 7.2.3.

7.4 Finish-Coat Application:

7.4.1 Job-mixed or factory-prepared finish coats shall be applied, by machine or by hand, as specified in 7.2.3.

7.4.2 The use of excessive water during the application and finishing of finish-coat plaster shall be avoided.