



Standard Specification for Mortar Cement¹

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1. Scope

1.1 This specification covers three types of mortar cement for use where mortar for masonry is required.

1.2 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Values in SI units shall be obtained by measurement in SI units or by appropriate conversion, using the Rules for Conversion and Rounding given in Standard [IEEE/ASTM SI 10](#), of measurements made in other units. Values are stated in only SI units when inch-pound units are not used in practice.

1.3 The text of this standard refers to 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 Section 16. *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. (Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.)*²

2. Referenced Documents

2.1 ASTM Standards:³

[C91 Specification for Masonry Cement](#)

[C109/C109M Test Method for Compressive Strength of](#)

[Hydraulic Cement Mortars \(Using 2-in. or \[50-mm\] Cube Specimens\)](#)

[C151 Test Method for Autoclave Expansion of Hydraulic Cement](#)

[C183 Practice for Sampling and the Amount of Testing of Hydraulic Cement](#)

[C185 Test Method for Air Content of Hydraulic Cement Mortar](#)

[C187 Test Method for Amount of Water Required for Normal Consistency of Hydraulic Cement Paste](#)

[C188 Test Method for Density of Hydraulic Cement](#)

[C219 Terminology Relating to Hydraulic Cement](#)

[C266 Test Method for Time of Setting of Hydraulic-Cement Paste by Gillmore Needles](#)

[C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency](#)

[C430 Test Method for Fineness of Hydraulic Cement by the 45- \$\mu\$ m \(No. 325\) Sieve](#)

[C511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes](#)

[C778 Specification for Sand](#)

[C1357 Test Methods for Evaluating Masonry Bond Strength](#)

[C1506 Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters](#)

[IEEE/ASTM SI 10 Standard for Use of the International System of Units \(SI\): The Modern Metric System](#)

3. Terminology

3.1 *Definitions*—Terms used in this specification are defined in Terminology [C219](#).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *mortar cement*—a hydraulic cement, primarily used in masonry construction, consisting of a mixture of portland or blended hydraulic cement and plasticizing materials (such as limestone or hydrated or hydraulic lime), together with other materials introduced to enhance one or more properties such as setting time, workability, water retention, and durability.

3.2.1.1 *Discussion*—Mortar cement is similar to masonry cement in use and function (see Specification [C91](#)). However, this specification requires lower air contents and includes a flexural bond strength requirement.

¹ This specification is under the jurisdiction of ASTM Committee [C01](#) on Cement and is the direct responsibility of Subcommittee [C01.11](#) on Masonry Cement.

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² *Annual Book of ASTM Standards*, Vol 04.01. See the section on Safety Precautions in the Manual of Cement Testing.

³ 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.



4. Classification

4.1 Mortar cements are classified as Type N, S, or M, according to the physical requirements prescribed in Table 1.

5. Physical Properties

5.1 Mortar cement shall conform to the applicable requirements prescribed in Table 1 for its classification.

6. Sampling

6.1 At the option of the purchaser, the cement shall be sampled and tested to verify compliance with this specification, sampling and testing shall be performed in accordance with Practice C183.

6.2 Practice C183 is not designed for manufacturing quality control and is not required for manufacturer's certification.

7. Temperature and Humidity

7.1 The temperature and relative humidity of the air in the vicinity of the mixing slab and dry materials, molds, base plates, and mixing bowl shall conform to the requirements of Test Method C109/C109M.

7.2 The moist cabinet or moist room shall conform to the requirements of Specification C511.

8. Fineness

8.1 Determine the residue on the 45 μm (No. 325) sieve in accordance with Test Method C430.

9. Normal Consistency

9.1 Determine the normal consistency by the Vicat apparatus in accordance with Test Method C187.

10. Autoclave Expansion

10.1 Determine the autoclave expansion in accordance with Test Method C151. After molding, store the bars in the moist cabinet or room for 48 h $\pm$ 30 min before removal from the molds for measurement and testing in the autoclave. Calculate the difference in length of the test specimen before and after autoclaving to the nearest 0.01 % of the effective gauge length, and report as the autoclave expansion of the mortar cement.

11. Time of Setting

11.1 Determine the time of setting by the Gillmore needle method in accordance with Test Method C266.

12. Density

12.1 Determine the density of the mortar cement in accordance with Test Method C188, using kerosine as the liquid. Use the density so determined in the calculation of the air content of the mortars.

13. Blended Sand

13.1 The sand shall be a blend of equal parts by weight of graded standard sand and 20-30 standard sand conforming to Specification C778.

14. Preparation of Mortar

14.1 *Proportions for Mortar*—Mortar for air entrainment, compressive strength, and water retention tests shall be proportioned to contain 1620 g of sand and a mass of cement, in grams, as indicated in Table 2. The sand shall consist of 810 g of graded standard sand and 810 g of 20-30 standard sand. The quantity of water, measured in millilitres, shall be such as to produce a flow of 110 $\pm$ 5 as determined by Test Method C109/C109M.

14.2 *Mixing of Mortars*—Mix the mortar in accordance with Practice C305.

14.3 *Determination of Flow*—Determine the flow in accordance with Test Method C109/C109M.

15. Air Entrainment

15.1 *Procedure*—If the mortar has the correct flow, use a separate portion of the mortar for the determination of entrained air. Determine the mass of 400 mL of mortar in accordance with Test Method C185.

15.2 *Calculation*—Calculate the air content of the mortar, and report it to the nearest 1 % as follows:

$$D = (W_1 + W_2 + V_w) / [(W_1/S_1) + (W_2/S_2) + V_w] \quad (1)$$

$$A = 100 - (W_m/4D)$$

TABLE 1 Physical Requirements

Mortar Cement Type	N	S	M
Fineness, residue on a 45 μm (No. 325) sieve, max, %	24	24	24
Autoclave expansion, max, %	1.0	1.0	1.0
Time of setting, Gillmore method:			
Initial set, minutes, not less than	120	90	90
Initial set, minutes, not more than	1000	1000	1000
Compressive strength (average of three cubes):			
The compressive strength of mortar cubes, composed of 1 part cement and 3 parts blended sand (half graded standard sand and half standard 20-30 sand) by volume, prepared and tested in accordance with this specification, shall be equal to or higher than the values specified for the ages indicated below:			
7 days, MPa [psi]	3.5 [500]	9.0 [1300]	12.4 [1800]
28 days, MPa [psi]	6.2 [900]	14.5 [2100]	20.0 [2900]
Flexural bond strength			
28 days, min, MPa [psi]	0.5 [70]	0.7 [100]	0.8 [115]
Air content of mortar:			
Min, volume %	8	8	8
Max, volume %	21	19	19
Water retention value, min, %, of original flow	70	70	70

**TABLE 2 Cement in Laboratory Batch of Mortar**

Mortar Cement Type	Mass of Cement, g
N	480
S	510
M	540

where:

- D = density of air-free mortar, g/cm^3 ,
 W_1 = mass of cement, g,
 W_2 = mass of sand, g,
 V_w = mL-g of water used,
 S_1 = density of cement, g/cm^3 ,
 S_2 = density of standard sand, 2.65 g/cm^3 ,
 A = volume percent of entrained air, and
 W_m = mass of 400 mL of mortar, g.

16. Compressive Strength

16.1 Test Specimens:

16.1.1 *Molding*—Immediately after determining the flow and mass of 400 mL of mortar, return all of the mortar to the mixing bowl and remix for 15 s at the medium speed. Then mold the test specimens in accordance with Test Method C109/C109M, except that the elapsed time for mixing mortar, determining flow, determining air entrainment, and starting the molding of cubes shall be within 8 min.

16.1.2 *Storage*—Immediately after molding, store all test specimens in the molds on plane plates in a moist cabinet or moist room for 48 to 52 h in such a manner that the upper surfaces shall be exposed to the moist air. Then remove the cubes from the molds, and place them in the moist cabinet or moist room for five days in such a manner as to allow free circulation of air around at least five faces of the specimens. At the age of seven days, immerse the cubes for the 28-day tests in saturated lime water in storage tanks of noncorrodible materials.

16.2 Procedure:

16.2.1 Test the cube specimens immediately after their removal from the moist cabinet or moist room for seven-day specimens, and immediately after their removal from storage water for all other specimens. If more than one specimen at a time is removed from the moist cabinet or moist room for seven-day tests, cover these cubes with a damp cloth until the time of testing.

16.2.2 The remainder of the testing procedure shall conform to Test Method C109/C109M.

17. Water Retention

17.1 Water retention shall be determined in accordance with the procedures in Test Method C1506.

18. Flexural Bond Strength

18.1 Flexural bond strength shall be determined in accordance with the test method for laboratory prepared specimens of Test Methods C1357, except sand shall be a blend of equal mass of graded and standard 20-30 sand conforming to

Specification C778 and mortar shall be proportioned to contain mass of cement in kg equal to 0.20 times the net mass in kg printed on the bag and 22.0 kg of sand. The flexural bond strength of mortar cement shall be determined as the average gross area flexural bond strength of 30 joints minus 1.28 times the standard deviation of the sample.

19. Storage

19.1 The cement shall be stored in such a manner as to permit easy access for proper inspection and identification of each shipment, and in a suitable weathertight building that will protect the cement from dampness and minimize warehouse set.

20. Inspection

20.1 Adequate facilities shall be provided to the purchaser for the necessary inspection and sampling.

20.2 All packages shall be in good condition at the time of inspection.

21. Rejection

21.1 At the option of the purchaser, the cement shall be rejected if it fails to meet any of the requirements of this specification.

21.2 At the option of the purchaser, packages more than 2 % below the mass marked thereon shall be rejected. At the option of the purchaser, the entire shipment shall be rejected if the average mass of packages in any shipment, as shown by weighing 50 packages taken at random, is less than that marked on the packages.

21.3 At the option of the purchaser, cement remaining in storage prior to shipment for a period greater than six months after testing shall be retested and, at the option of the purchaser, shall be rejected if it fails to meet any of the requirements of this specification.

22. Manufacturer's Certification

22.1 Upon request of the purchaser in the contract or order, a manufacturer's report shall be furnished at the time of shipment stating the results of the tests made on samples of the material taken during production or transfer and certifying that the applicable requirements of this specification have been met.

23. Packaging and Package Marking

23.1 When mortar cement is delivered in packages, the brand, name of the manufacturer, type of mortar cement, and net mass of the package in kilograms shall be indicated plainly thereon. Similar information shall be provided in the shipping documents accompanying the shipment of mortar cement in bulk.

24. Keywords

24.1 flexural bond strength; masonry; mortar; mortar cement



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