



Designation: C 91 – 03a

Standard Specification for Masonry Cement¹

This standard is issued under the fixed designation C 91; 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.

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

1. Scope

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

1.2 The values stated in SI units are to be regarded as the standard. Values in SI units shall be obtained by measurement in SI units or by appropriate conversion of measurements made in other units, using the Rules for Conversion and Rounding given in IEEE/ASTM SI 10.

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 Sections 16 and 17 of 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. (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:

- C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)³
- C 151 Test Method for Autoclave Expansion of Portland Cement³
- C 183 Practice for Sampling and the Amount of Testing of Hydraulic Cement³
- C 185 Test Method for Air Content of Hydraulic Cement Mortar³

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 *Annual Book of ASTM Standards*, Vol 04.01.

C 187 Test Method for Normal Consistency of Hydraulic Cement³

C 188 Test Method for Density of Hydraulic Cement³

C 219 Terminology Relating to Hydraulic Cement³

C 230/C 230M Specification for Flow Table for Use in Tests of Hydraulic Cement³

C 266 Test Method for Time of Setting of Hydraulic Cement Paste by Gillmore Needles³

C 270 Specification for Mortar for Unit Masonry⁴

C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency³

C 430 Test Method for Fineness of Hydraulic Cement by the 45- μ m (No. 325) Sieve³

C 511 Specification for Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes³

C 778 Specification for Standard Sand³

C 1506 Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters³

IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System⁵

3. Terminology

3.1 Definitions:

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

3.1.2 Other terms used in this specification are defined in Terminology C 219.

4. Classification

4.1 *Type N*—For use in preparation of Specification C 270 Type N mortar without further addition of cements or hydrated lime, and for use in preparation of Specification C 270 Type S

⁴ *Annual Book of ASTM Standards*, Vol 04.05.

⁵ *Annual Book of ASTM Standards*, Vol 14.04.

or Type M mortar when cement is added in accordance with the requirements of C 270.

4.2 *Type S*—For use in preparation of Specification C 270 Type S mortar without further addition of cements or hydrated lime.

4.3 *Type M*—For use in preparation of Specification C 270 Type M mortar without further addition of cements or hydrated lime.

5. Physical Properties

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

6. Sampling

6.1 The masonry cement shall be sampled in accordance with Practice C 183.

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 C 109/C 109M.

7.2 The moist cabinet or moist room shall conform to the requirements of Specification C 511.

8. Fineness

8.1 Determine the residue on the 45- μm (No. 325) sieve in accordance with Test Method C 430.

9. Normal Consistency

9.1 Determine normal consistency by the Vicat apparatus in accordance with Test Method C 187.

10. Autoclave Expansion

10.1 Determine autoclave expansion in accordance with Test Method C 151. 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 masonry cement.

11. Time of Setting

11.1 Determine the time of setting by the Gillmore needle method in accordance with Test Method C 266.

12. Density

12.1 Determine the density of the masonry cement in accordance with Test Method C 188, 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 standard 20–30 sand conforming to Specification C 778.

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, in accordance with Table 2. The sand shall consist of 810 g of graded standard sand and 810 g of 20–30 standard sand (Note 1). The quantity of water, measured in millilitres shall be such as to produce a flow of 110 ± 5 as determined by Test Method C 109/C 109M.

NOTE 1—Historically, field-mixed mortar has been proportioned by volume measured in increments or fractions of ft^3 . The comparable whole SI-unit volume to 1 ft^3 is 28 L. The specified mortar proportions approximate the 1:3 nominal proportions by volume, commonly specified for construction, on the basis of the following assumed mass and volume relationships:

The mass of dry sand in 28 L of loose damp sand is 36 kg.

28 L Type N masonry cement has a mass of 32 kg.

28 L Type S masonry cement has a mass of 34 kg.

28 L Type M masonry cement has a mass of 36 kg.

For example, the amount of cement needed to provide a 1:3 volume proportion of cement to sand using a Type N masonry cement is as follows:

$$A = 1620 \times (C/B) = 1620 \times (32/108) = 480 \quad (1)$$

TABLE 1 Physical Requirements

Masonry 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
Final set, minutes, not more than	1440	1440	1440
Compressive strength (average of 3 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)	3.4 (500)	9.0 (1300)	12.4 (1800)
28 days, MPa (psi)	6.2 (900)	14.5 (2100)	20.0 (2900)
Air content of mortar, prepared and tested in accordance with requirements of this specification:			
Min, volume %	8	8	8
Max, volume %	21	19	19
Water retention value, min, % of original flow	70	70	70