



Designation: C1713 – 10

Standard Specification for Mortars for the Repair of Historic Masonry¹

This standard is issued under the fixed designation C1713; 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.

1. Scope

1.1 This specification covers mortar for the repair of masonry that was constructed with methods and materials that pre-date the origination of current standards of construction that are compatible with it. The mortar may be used for non-structural purposes such as repointing of the masonry, or for structural purposes such as, but not restricted to, reconstruction or repair of mortar joints that contribute to the structural integrity of the masonry.

1.2 Masonry includes the following units laid in mortar: (1) cast stone, (2) clay masonry units/brick and clay tile, (3) concrete masonry units, (4) natural stone, and (5) terra cotta.

1.3 This specification may be used to pre-qualify mortar for a project.

1.4 Mortars tested using this specification are laboratory-prepared mortars and do not represent in-place, site mortars.

1.5 Use of this specification should be based on a thorough understanding of the function, maintenance, and repair requirements for the preservation and continued performance of the masonry in the context of the building structure and long-term performance. The user of this specification is responsible for examining all criteria and selecting the appropriate mortar formulation and properties required.

1.6 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.7 *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:*²

C5 Specification for Quicklime for Structural Purposes

¹ This specification is under the jurisdiction of ASTM Committee C12 on Mortars and Grouts for Unit Masonry and is the direct responsibility of Subcommittee C12.03 on Specifications for Mortars.

Current edition approved Feb. 1, 2010. Published February 2010. DOI: 10.1520/C1713-10.

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.

- C10 Specification for Natural Cement
- C61 Specification for Gypsum Keene's Cement
- C91 Specification for Masonry Cement
- C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
- C110 Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone
- C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C141 Specification for Hydraulic Hydrated Lime for Structural Purposes
- C144 Specification for Aggregate for Masonry Mortar
- C150 Specification for Portland Cement
- C207 Specification for Hydrated Lime for Masonry Purposes
- C216 Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
- C270 Specification for Mortar for Unit Masonry
- C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
- C511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
- C595 Specification for Blended Hydraulic Cements
- C780 Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
- C948 Test Method for Dry and Wet Bulk Density, Water Absorption, and Apparent Porosity of Thin Sections of Glass-Fiber Reinforced Concrete
- C979 Specification for Pigments for Integrally Colored Concrete
- C1093 Practice for Accreditation of Testing Agencies for Masonry
- C1157 Performance Specification for Hydraulic Cement
- C1180 Terminology of Mortar and Grout for Unit Masonry
- C1329 Specification for Mortar Cement
- C1357 Test Methods for Evaluating Masonry Bond Strength
- C1384 Specification for Admixtures for Masonry Mortars
- C1403 Test Method for Rate of Water Absorption of Masonry Mortars
- C1489 Specification for Lime Putty for Structural Purposes

C1506 Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters
E96/E96M Test Methods for Water Vapor Transmission of Materials

3. Terminology

3.1 The terms used in this specification are identified in Terminology **C1180**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aggregate, n*—material as defined in Terminology **C1180**, but limited to the material groups listed under Section 4 of this specification.

3.2.2 *binder, n*—material as defined in Terminology **C1180**, but limited to the cementitious material groups listed under Section 4 of this specification to be mixed with potable water.

3.2.3 *curing, n*—process by which a mortar gains its long-term, final-state properties.

3.2.4 *curing time (CT), n*—number of days in which a hardened state sample is cured before testing.

3.2.5 *historic masonry, n*—masonry that may have been constructed with methods and materials that pre-date the origination of current standards.

3.3 *Properties*, as determined by Section 8 of this specification:

3.3.1 *absorption rate (AR), n*—a measure of the hardened mortar's ability to absorb water from a dry condition, measured as the initial flow of water into the mortar, as defined under Test Method **C1403** and evaluated at the specified curing time (CT).

3.3.2 *air content, n*—cumulative volume of air in a mortar, as a percentage of the total volume of mortar in its plastic state.

3.3.3 *flexural bond strength (FBS), n*—maximum flexural tensile stress that causes failure of the bond between the mortar and masonry unit in a tested assembly at the specified curing time (CT).

3.3.4 *maximum compressive strength (F_{cmx}), n*—upper allowable limit on the ultimate strength of a hardened mortar sample subjected to compression measured as force per unit area at the specified curing time (CT).

3.3.5 *minimum compressive strength (F_c), n*—lower allowable limit on the ultimate strength of a hardened mortar sample subjected to compression measured as force per unit area at the specified curing time (CT).

3.3.6 *total porosity, n*—volume percentage of all pores or void space in the mortar at the specified curing time (CT).

3.3.7 *water retention, n*—as defined in Terminology **C1180**. Test shall be conducted on a sample in its plastic state.

3.3.8 *water vapor permeability (WVP), n*—ability of a mortar to pass water through it in vapor form at the specified curing time (CT).

4. Constituent Materials

4.1 *Binder Materials* shall be classified into the following groups:

4.1.1 *Group L*—Lime (non-hydraulic) shall conform to the following specifications:

4.1.1.1 Hydrated Lime shall conform to Specification **C207**, Types S or SA. Types N and NA hydrated limes are permitted if soaked or shown by test or performance record to be not detrimental to the mortar.

4.1.1.2 Lime putty shall conform to Specification **C1489**.

NOTE 1—Specification **C5**, Appendix 1, may be used, and the resulting putty should meet the requirements of Specification **C1489**.

4.1.2 *Group HL*—Hydraulic Hydrated Lime shall conform to Specification **C141**.

4.1.3 *Group HC*—Hydraulic Cements shall conform to the following specifications:

4.1.3.1 *Blended Hydraulic Cement*—shall conform to Specification **C595**.

NOTE 2—Blended hydraulic cement may not be appropriate for structures built before the second half of the 20th century.

4.1.3.2 *Performance Hydraulic Cement*—shall conform to Specification **C1157**.

NOTE 3—Performance hydraulic cement may not be appropriate for structures built before the second half of the 20th century.

4.1.3.3 *Masonry Cement*—shall conform to Specification **C91**.

4.1.3.4 *Mortar Cement*—shall conform to Specification **C1329**.

4.1.3.5 *Natural Cement*—shall conform to Specification **C10**.

4.1.3.6 *Portland Cement*—shall conform to Specification **C150**.

NOTE 4—For interior gypsum mortar based systems requiring gypsum cement refer to Specification **C61** and consult with the product manufacturer regarding exposure suitability.

4.2 *Aggregates*—Aggregate shall conform to Specification **C144**. Aggregates that conform to all aspects of Specification **C144** except for the gradation limits are permitted if demonstrated by their history of performance under equivalent conditions and mortar formulation to be non-detrimental to the mortar. To determine aggregate gradation, use Test Method **C136**.

NOTE 5—The need to aesthetically match the color and texture of an existing mortar may be justification for deviating from the gradation limits of Specification **C144**.

4.3 *Water*—Water shall be clean and free of oils, acids, alkalis, salts, organic materials, or other substances that are deleterious to mortar or any metal used in the masonry.

4.4 *Admixtures:*

4.4.1 *Admixtures*—shall meet the requirements of Specification **C1384**. Calcium chloride is not permitted. Other admixtures that are outside the scope of Specification **C1384** are permitted if they contain no more than 0.3 % water-soluble alkali and if demonstrated by their history of performance under equivalent conditions and mortar formulation to be non-detrimental to the mortar and items in contact.

4.4.2 *Pigments*—Pigments shall meet the requirements of Specification **C979**. Pigments which are not described by Specification **C979** are permitted if demonstrated by their history of performance under equivalent conditions and mortar formulation to be non-detrimental to the mortar. Pigment addition shall not exceed 10 % by weight of the binder materials except for carbon black which is limited to 2 % unless otherwise demonstrated by history of performance