



Designation: C1713 – 23

Standard Specification for Mortars for the Repair of Historic Masonry¹

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1. Scope

1.1 This specification covers mortar for the repair of masonry constructed with methods and materials that pre-date the origination of current standards of construction. 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, re-construction 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 brick and tile, (3) concrete masonry, (4) natural stone, (5) terra cotta, and (6) calcium silicate.

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 This specification provides a basis for the design of an appropriate mortar formulation based upon performance, material and aesthetic requirements. Use of this specification requires a thorough understanding of the function, maintenance, and repair requirements for the preservation and continued performance of the masonry assembly in the context of the assembly's structure, water management, and long-term performance.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the*

Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:²

C5 Specification for Quicklime for Structural Purposes

C10/C10M Specification for Natural Cement

C61/C61M Specification for Gypsum Keene's Cement

C91/C91M 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/C136M Test Method for Sieve Analysis of Fine and Coarse Aggregates

C141/C141M Specification for Hydrated Hydraulic Lime for Structural Purposes

C144 Specification for Aggregate for Masonry Mortar

C150/C150M 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/C595M 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/C979M Specification for Pigments for Integrally Colored Concrete

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.

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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.

C1072 Test Methods for Measurement of Masonry Flexural Bond Strength
C1093 Practice for Accreditation of Testing Agencies for Masonry
C1157/C1157M Performance Specification for Hydraulic Cement
C1180 Terminology of Mortar and Grout for Unit Masonry
C1329/C1329M Specification for Mortar Cement
C1384 Specification for Admixtures for Masonry Mortars
C1400 Guide for Reduction of Efflorescence Potential in New Masonry Walls
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
C1707 Specification for Pozzolan Hydraulic Lime for Structural Purposes
E96/E96M Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
E2260 Guide for Repointing (Tuckpointing) Historic Masonry

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 Lime shall conform to the following specifications:

4.1.2.1 *Hydraulic Hydrated Lime*—shall conform to Specification **C141/C141M**.

4.1.2.2 *Pozzolan Hydraulic Lime*—shall conform to Specification **C1707**.

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/C595M**.

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/C1157M**.

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/C91M**.

4.1.3.4 *Mortar Cement*—shall conform to Specification **C1329/C1329M**.

4.1.3.5 *Natural Cement*—shall conform to Specification **C10/C10M**.

4.1.3.6 *Portland Cement*—shall conform to Specification **C150/C150M**.

NOTE 4—For interior gypsum mortar based systems requiring gypsum cement refer to Specification **C61/C61M** 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