



Designation: C780 – 23

Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry¹

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

INTRODUCTION

These test methods provide standard procedures for sampling and testing mortars for composition and plastic and hardened properties, either before or during actual construction. The procedures outlined in the Annexes are considered applicable for evaluating various combinations of portland cement, lime, and masonry cement for mortars common to plain and reinforced unit masonry construction.

The test procedures describe methods for the measurement of mortar composition and mortar properties. No attempt is made to claim or substantiate specific correlations between the measured properties and mortar performance in the masonry. However, data from these test methods can be combined with other information to formulate judgments about the quality of the masonry.

Testing using these procedures is limited to the preconstruction evaluation of masonry mortars within the laboratory, to the evaluation of masonry mortars at the construction site, and in establishing the degree of quality control exercised during mortar production at the construction site.

1. Scope*

1.1 These test methods cover procedures for the sampling and testing of mortars for composition and for their plastic and hardened properties, either before or during their actual use in construction.

NOTE 1—Guide C1586 provides guidance on evaluating mortar and clarifies the purpose of both these test methods and Specification C270.

NOTE 2—The testing agency performing these test methods should be evaluated in accordance with Practice C1093.

1.2 *Preconstruction Evaluation*—These test methods permit comparisons of mortars made from different materials under simulated field conditions. They are also used to establish baseline values for comparative evaluation of field mortars.

1.3 *Construction Evaluation*—Use of these methods in the field provide a means for quality assurance of field-mixed mortar. They include methods for verifying the mortar mix proportions, comparing test results for field mortars to preconstruction testing, and determining batch-to-batch uniformity of the mortar.

1.4 The test results obtained under these test methods are not required to meet the minimum compressive values in accordance with the property specifications in Specification C270.

1.5 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.

1.6 The text of this standard 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 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. For specific hazards statements, see Section 8.*

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.*

¹ These test methods are under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and are the direct responsibility of Subcommittee C15.20 on Research for Mortars and Grouts.

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

2. Referenced Documents

2.1 ASTM Standards:²

- C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
- C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens)
- C128 Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate
- C173/C173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
- 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
- C231/C231M Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- C270 Specification for Mortar for Unit Masonry
- C470/C470M Specification for Molds for Forming Concrete Test Cylinders Vertically
- C511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
- C617/C617M Practice for Capping Cylindrical Concrete Specimens
- C1093 Practice for Accreditation of Testing Agencies for Masonry
- C1180 Terminology of Mortar and Grout for Unit Masonry
- C1231/C1231M Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Cylindrical Concrete Specimens
- C1324 Test Method for Examination and Analysis of Hardened Masonry Mortar
- C1586 Guide for Quality Assurance of Mortars
- E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 Terminology defined in Terminology C1180 shall apply for these test methods.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *disturbed sample, n*—any plastic mortar test sample which is taken at some time after mixing and bulk sampling, that is further remixed or molded immediately prior to test, or both.

3.2.2 *undisturbed sample, n*—any plastic mortar test sample molded immediately after mixing and sampling that sits on a vibration-free surface until tested.

3.2.3 *as-mixed samples, n*—mortar samples that are obtained after mixing and prior to use of the mortar in construction.

3.2.4 *mortar board samples, n*—mortar samples that are obtained from the mortar board after some established time period from the end of mixing, and before retempering.

3.2.4.1 *Discussion*—Retempered mortar board samples are those obtained from the mortar board after retempering. Since mortar on a mason's mortar board is disturbed by the activity of the mason, samples from a mason's mortar board shall be so identified to differentiate them from samples taken from a mortar board used exclusively for test purposes.

4. Summary of Test Methods

4.1 Preconstruction evaluation of mortar systems involves the preparation of one or more trial batches, which are mixed in the laboratory using mechanical batch mixers. These trial batches are sampled and used in establishing the plastic and hardened properties of the mixtures. Because all the trial mixtures are prebatched by weight, additional characteristics of the mortars may be calculated and used in an analysis of mortar performance.

4.2 During actual construction, evaluation of masonry mortars is possible by sampling the mortar at various stages of construction, and performing tests on both its plastic and hardened properties. The test results permit further verification of preconstruction testing, and reflect batch-to-batch variations introduced during mortar production and use at the construction site. More immediate corrective action for the mixing procedure is thereby attainable.

4.3 The following test methods may be singly or collectively incorporated into the testing to establish mortar composition, and mortar plastic and hardened properties:

4.3.1 **Annex A1**—Test Method for Consistency by Cone Penetration,

4.3.2 **Annex A2**—Test Method for Consistency Retention (Board Life) of Mortars for Unit Masonry Using a Cone Penetrometer,

4.3.3 **Annex A3**—Test Method for Initial Consistency and Consistency Retention (Board Life) of Masonry Mortars Using a Modified Concrete Penetrometer,

4.3.4 **Annex A4**—Test Method for Mortar Aggregate Ratio,

4.3.5 **Annex A5**—Test Method for Mortar Air Content, and

4.3.6 **Annex A6**—Test Method for Compressive Strength of Molded Masonry Mortar Cylinders and Cubes.

5. Significance and Use

5.1 During preconstruction and construction evaluations, use of these test methods establishes specific and overall performance characteristics for the mortar system.

5.2 Preconstruction testing of mortars prebatched by weight provides information for the selection of the individual mortar system best suited for the masonry to be constructed. The recommended tests and their significance are as follows:

5.2.1 Consistency determinations by cone penetration (**Annex A1**) allow gaging the water additions for all mortars included in the preconstruction test series. Even if the mortar consistency as measured at the construction site is at a different penetration value than those measured during the preconstruction tests, the cone preparation test serves to standardize water additions for mortars being considered as alternatives before

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.