



Standard Specification for Extended Life Mortar for Unit Masonry¹

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1. Scope

1.1 This specification covers extended life mortar as delivered for use in construction of non-reinforced or reinforced unit masonry.

1.2 This specification is a property standard.

1.3 Four types of mortar are covered: RM, RS, RN, and RO. These types of mortar can be manufactured by using one of the four mortar formulations with masonry aggregate: portland cement, portland cement-lime, masonry cement, or masonry cement with portland cements. The materials are listed in Section 5.

1.4 **Appendix X1** provides a rationale statement and commentary.

2. Referenced Documents

2.1 *ASTM Standards*:²

C91 Specification for Masonry Cement

C144 Specification for Aggregate for Masonry Mortar

C150 Specification for Portland Cement

C207 Specification for Hydrated Lime for Masonry Purposes

C270 Specification for Mortar for Unit Masonry

C780 Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

C1072 Test Methods for Measurement of Masonry Flexural Bond Strength

E447 Test Method for Compressive Strength of Laboratory Constructed Masonry Prisms (Withdrawn 1997)³

E518 Test Methods for Flexural Bond Strength of Masonry

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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.

³ The last approved version of this historical standard is referenced on www.astm.org.

2.2 *Other Document*:

National Institute of Standards and Technology, Handbook 44, *Specifications, Tolerances, and Other Technical Requirements for Commercial Weighing and Measuring Devices*⁴

3. Terminology

3.1 *Definitions of Terms Specific to This Standard*:

3.1.1 All terms in this specification have their conventional meaning, except as follows:

3.1.2 *extended life mortars*—mortar consisting of cementitious materials, aggregate, water and set-control admixtures which are measured and mixed at a central location, using weight-or-volume-control equipment. This mortar, as delivered to a construction site, shall be usable for a period in excess of 2½ h.

4. Ordering Information

4.1 The purchaser shall specify the following:

4.1.1 The mortar type in **Table 1**,

4.1.2 Length of workability time for the mortar, and

4.1.3 Desired consistency satisfactory for the mason's use when tested by the manufacturer in accordance with **10.2**.

4.2 At the request of the purchaser, the producer shall, prior to delivery, furnish laboratory and field performance data satisfactory to the purchaser that the materials to be used will produce mortar of the type specified.

NOTE 1—The purchase order or contract may list the mortar ingredients desired and may state a list of optional data, which are in addition to the performance requirements in Section 7. Examples of such tests are: Test Method **C1072**, Test Methods **E518**, Test Methods **E447**, and test data for mortar that has been re-tempered.

5. Materials

5.1 Materials used as ingredients in extended life mortar shall conform to the requirements specified in **5.1.1** through **5.1.4.2**.

5.1.1 *Cementitious Materials*—Cementitious materials shall conform to the following ASTM specifications.

5.1.1.1 *Portland Cement*—Types I, II or III of Specification **C150**.

⁴ Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

TABLE 1 Property Specification Requirements

| Mortar Type | Avg ^A Compressive Strength at 28 days, min psi, (MPa) | Water Retention min, % | Air Content, ^B max, % |
|-------------|--|------------------------|----------------------------------|
| | Cubes | | |
| RM | 2500 (17.2) | 75 | 18 |
| RS | 1800 (12.4) | 75 | 18 |
| RN | 750 (5.2) | 75 | 18 |
| RO | 350 (2.4) | 75 | 18 |

^A Twenty-eight days old from date of casting. Refer to 10.3.1. The strength values as shown are the standard values. Intermediate values may be specified in accordance with project requirements.

^B When structural reinforcement is incorporated in mortar, the maximum air content shall be 12 %, or bond strength test data shall be provided to justify higher air content.

5.1.1.2 *Masonry Cement*—Types M, S, or N of Specification C91.

5.1.1.3 *Hydrated Lime*—Specification C207, Type S.

NOTE 2—Type N limes may be permitted if shown by test or performance record to be not detrimental by the autoclave expansion.

5.1.2 *Aggregates*—The aggregate shall comply with Specification C144.

5.1.3 *Water*—Water shall be clean and free of oils, acids, alkalies, salts, organic materials or other substances that may be deleterious to mortar or corrosive to metals in the masonry.

5.1.4 *Admixtures*—Admixtures are permitted for use only at the production plant.

5.1.4.1 Evidence satisfactory to the purchaser shall be provided to show that the admixtures do not cause nor accelerate corrosion of metal which will be in contact with mortar.

5.1.4.2 Any admixture to be used shall be subject to written certification from the manufacturer, supported by evidence that the admixture will have no adverse effect on the long-term strength, durability, or appearance of the mortar nor on any material or component in contact with the mortar, nor any assemblage of which the mortar forms a part.

6. Manufacture and Delivery

6.1 *Storage of Materials*—Cementitious materials and aggregates shall be stored in such a manner as to prevent deterioration and contamination.

6.2 *Measurement of Materials*—Measure materials in accordance with 6.2.1 through 6.2.4.

6.2.1 Cementitious materials and the aggregate shall be measured by weight or by volume. Volumetric measurement shall be calibrated by weight.

6.2.2 Scales for batching mortar ingredients shall conform to the applicable sections of the current edition of the National Institute of Standards and Technology, Handbook 44.

6.2.3 Measure water by weight or by volume.

6.2.4 Measure admixtures by weight or by volume.

6.3 *Mixing*—Mix extended life mortar ingredients at a central location using either truck mixers or stationary mixers.

6.3.1 Agitation, not mixing, is allowed during transport.

6.4 *Delivery*—Unless otherwise specified, a delivery of the mortar shall conform to 6.4.1 and 6.4.2.

6.4.1 Thoroughly mix and deliver to the construction site mortar with a satisfactory degree of workability and without segregation of ingredients.

6.4.2 Temperature of the mortar at time of delivery shall be 40 to 120°F (4 to 49°C).

7. Property Requirements

7.1 When sampled and tested in accordance with Sections 9 and 10 respectively, the mortar shall comply with the appropriate sections of Table 1.

7.2 A test for compressive strength is the average of at least three specimens from one batch.

7.3 Mortar of known higher strength shall not be indiscriminately substituted when a mortar type of anticipated lower strength is specified.

7.4 Do not change the established proportions for extended life mortar designed for a particular job, nor utilize materials with different physical characteristics in the mix unless compliance with the requirements of this specification are reestablished.

7.4.1 Alter the dosage of the admixture which controls the setting time when needed to maintain a similar time of set during seasonal temperature changes.

NOTE 3—Consistency of the mortar should be correlated with the particular masonry unit to be used because certain mortars are more compatible with certain masonry units. The specifier should consult the admixture manufacturer to evaluate the interaction of the mortar type and masonry unit specified. Masonry units having a high initial rate of absorption will have greater compatibility with mortar of high-water retentivity. Refer to the Related Items That Have an Effect on Properties section in Appendix X1 of Specification C270.

8. Field Practice

8.1 *Tempering Mortars*—Mortars that have stiffened due to loss of water by evaporation shall be re-tempered not more than one time during the working life of the mortar by adding water to restore the required consistency.

8.1.1 Do not use mortar beyond the period of time established by the manufacturer. This time period shall be documented with test data.

NOTE 4—Extended life mortar is usually designed to have a workability period between 24 to 36 h.

8.2 *Storage at the Site*—The mortar shall be protected from freezing and evaporation.

9. Sampling

9.1 *Sampling Materials*—The mortar materials for laboratory tests shall be sampled at the plant where the mortar is manufactured. Water, aggregate and cementitious material shall be sampled in accordance with Test Method C780.

9.2 *Sampling Plastic Mortar at the Plant*—Discharge from the mixer a thoroughly mixed sample of mortar not less than 4 gal (15 L) into a nonabsorptive container, from which the quantity of mortar required for a specific quality control test can be taken.

9.3 *Sampling Plastic Mortar at the Site*—Obtain a composite sample by combining at least three equal portions from

separate mortar containers, producing a quantity not less than 4 gal (15 L) in a nonabsorptive container, from which the quantity of mortar required for a specific test can be taken.

9.4 Record sampling procedures to include the date, time, place, method of sampling, and weather conditions.

10. Testing

10.1 Test field and laboratory prepared trial mixtures of plastic mortar in accordance with 10.2 through 10.6.1.

10.2 *Consistency*—Determine the consistency of the mortar by the cone penetration method, according to Test Method C780.

10.2.1 Specimens for compressive strength testing shall have a cone penetration of 55 ± 5 mm (unless the purchaser specifies otherwise).

10.3 *Compressive Strength*—Fabricate specimens for compressive strength tests according to Test Method C780. Use 2-in. (50.8-mm) cubes, 2 by 4-in. (50.8 by 101.6-mm) cylinders or 3 by 6-in. (76.2 by 152.4 mm) cylinders conforming to Test Method C780.

10.3.1 When converting from cylinder strength to cube strength, the relationship shall be documented by the producer with test data.

10.3.2 *Storing, Curing and Testing*—Store, cure and test specimens according to Test Method C780, with the exception that the test specimens shall be at least 4 days old, and have attained final set when transported from the field to the laboratory. Store specimens in a laboratory moist room or moist closet for not less than 20 h prior to demolding.

NOTE 5—Final set may be determined by preparing at least one extra specimen for compressive strength. Demold the extra specimen in the field in order to establish that final set has occurred by visually inspecting the state of hardness after demolding.

NOTE 6—Plastic mortar may be transported from the field to the laboratory in order to establish conformance.

10.3.3 Test the specimens in a moist condition for compressive strength at 28 days from the date of casting.

10.3.4 The compressive strength of mortar will be considered satisfactory if the average of all specimens, at least three specimens from each batch, is equal to or exceeds the minimum specified strength in Table 1, when tested in accordance with requirements of Section 10.

10.3.5 Faulty specimens and those with individual strengths differing by more than 10 % from the average shall not be included in the reported average compressive strength made from the same sample and tested at the same period.

10.3.6 After discarding faulty specimens or strength values, a minimum of two specimens or strength values must remain for determining the compressive strength at any given period.

10.4 *Air Content*—Determine air content of the mortar by either the pressure method or the volumetric method according to Test Method C780.

10.5 *Water Retention*—Conduct the water retention test in accordance with Specification C91 with the following exceptions:

10.5.1 Manufacture mortar according to Section 6, and sample mortar according to Section 9.

10.5.2 Drop the flow table 15 times in 9 s both before and after suction.

10.6 *Records*—Upon completion of the testing, furnish to the purchaser complete records of sampling and test results.

10.6.1 Report specific evidence of the appearance of faulty specimens.

11. Inspection

11.1 The purchaser shall afford the manufacturer all reasonable access for the procurement of samples of fresh mortar at the job site to determine conformance to this specification.

12. Rejection and Rehearing

12.1 The purchaser may reject mortar that fails to conform to the requirements of this specification. Rejection should be reported to the manufacturer promptly and in writing. In case of dissatisfaction with the results of the test, the manufacturer may make claim for a rehearing.

13. Batch Ticket Information

13.1 The manufacturer of the mortar shall furnish to the purchaser a delivery ticket which shows the following information for each batch:

13.1.1 Name of extended life mortar manufacturer and batch plant and trade names of admixtures used,

13.1.2 Serial number of ticket,

13.1.3 Date and time the mortar was produced,

13.1.4 Truck or vehicle delivery number,

13.1.5 Name of purchaser,

13.1.6 Specific designation of job (name and location),

13.1.7 Specific type of mortar ordered and delivered,

13.1.8 Amount of mortar delivered in cubic yards (or cubic meters), and

13.1.9 A location for the signature or initials of purchaser's representative.

14. Certification

14.1 When specified in the purchase order or contract, the producer's certification shall be furnished to the purchaser stating that the materials used and the mortar delivered have been manufactured and tested in accordance with this specification and the requirements have been met. This statement shall be included with the test reports upon completion of the work.

14.2 Additional information available, when specified, may include test results related to preconstruction, and construction test specimens of masonry assemblages using the mortar with job units. Refer to Note 1 for examples of such tests.

15. Specification Limitations

15.1 There is no ASTM standard method for measuring the composition or physical properties of hardened mortars from a structure.

16. Keywords

16.1 air content; compressive strength; masonry; masonry cement; mortar; portland cement-lime; set-retarding admixture; water retention

APPENDIX

(Nonmandatory Information)

X1. RATIONALE STATEMENT AND COMMENTARY

X1.1 History of Development

X1.1.1 Extended life mortar with an extended board life was successfully developed in Germany in 1970 to 1973. Since that time it has been successfully used in Switzerland, Ireland, England, Austria, Spain, France, Italy, and Canada. In 1982 it started to be used in the United States. At that time a task group was formed in ASTM under the Research Subcommittee C12.02, with the purpose of acquiring sufficient test data to determine if an ASTM standard should be prepared for this material. In 1983, Subcommittee C12.02 recommended that a standard specification be considered by ASTM. At that time the specification Subcommittee C12.03 accepted this task and assigned it to a task group. This Subcommittee instructed the task group to draft a separate standard specification for extended life mortar for unit masonry. It was the opinion of the task group that this document be a property specification. Select references used by the task group to develop this specification include Refs (1–5). Their review by users of the specification is recommended by the task group.

X1.2 Description

X1.2.1 Unlike conventional mortar, which is prepared at the job site and batched by volume, extended life mortar is prepared at a manufacturing plant and is batched by mass weight, or by volume.

X1.2.2 Extended life mortar is delivered to the job at a consistency ready to use. Usually it is delivered in ready-mix trucks or in containers. It is stored in containers at the job in a

protective manner that minimizes moisture loss due to evaporation and protects the mortar from freezing in cold weather. No other materials or admixtures are added at the job. The mortar contains a set regulator, which is a retarding-type admixture, that controls the initial hydration period of the cement. This allows the mortar to remain plastic and workable for a period which is generally 24 to 36 h. At any time during this period, when the mortar is used, suction by the masonry units will occur and initial set takes place in a normal manner. The early strength that develops is satisfactory for the walls to be constructed at a normal rate and the mortar will retain enough water to ensure long-term strength development. Often the walls are loaded at approximately the same time as with conventional mortar and current masonry practices. However, when in doubt, it is recommended that prism tests be conducted according to Test Methods E447 in order to ensure safety. Data show that bond strength, compressive strength, and water permeance can be equal to or better than conventional mortar. Contact the admixture supplier for test data.

X1.3 Testing

X1.3.1 This specification is a property specification requiring the properties of field use mortar. The laboratory procedure for measuring the flow of the mortar in the water retention test has been modified to ensure that the mortar will remain on the flow table. In place of dropping the flow table 25 times in 15 s, it is dropped 15 times in 9 s. This specification essentially adopts Test Method C780 as the test method for evaluation of the mortar properties.

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