



Designation: C87/C87M – 23

Standard Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar¹

This standard is issued under the fixed designation C87/C87M; 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 test method covers the determination of the effect on mortar strength of the organic impurities in fine aggregate, whose presence is indicated using Test Method C40/C40M. Comparison is made between compressive strengths of mortar made with washed and unwashed fine aggregate.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Some values have only SI units because the inch-pound equivalents are not used in the practice.

NOTE 1—Sieve size is identified by its standard designation in Specification E11. The alternative designation given in parentheses is for information only and does not represent a different standard sieve size

1.3 *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.* (Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to exposed skin and tissue upon prolonged exposure.)²

1.4 *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 This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.20 on Aggregates.

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² See section on Safety Precautions, *Manual of Aggregate and Concrete Testing, Annual Book of ASTM Standards*, Vol 04.02.

2. Referenced Documents

2.1 *ASTM Standards*:³

- C33/C33M Specification for Concrete Aggregates
- C40/C40M Test Method for Organic Impurities in Fine Aggregates for Concrete
- C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens)
- C125 Terminology Relating to Concrete and Concrete Aggregates
- C128 Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate
- C136/C136M Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C150/C150M Specification for Portland Cement
- C230/C230M Specification for Flow Table for Use in Tests of Hydraulic Cement
- 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
- C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- C702/C702M Practice for Reducing Samples of Aggregate to Testing Size
- D75/D75M Practice for Sampling Aggregates
- D3665 Practice for Random Sampling of Construction Materials
- E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 *Definitions*:

³ 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.

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

3.1.1 For definition of terms used in this test method, refer to Terminology C125.

4. Summary of Test Method

4.1 A portion of the fine aggregate that produced a color darker than the standard in Test Method C40/C40M is used to prepare mortar cube specimens. A separate portion of the same fine aggregate is washed in sodium hydroxide solution to remove the organic impurities that caused the failing result when tested in accordance with Test Method C40/C40M, and that washed fine aggregate is used to prepare another set of mortar cube specimens.

4.2 After curing for a stated period, the compressive strengths of the two sets of cube specimens are determined and compared.

5. Significance and Use

5.1 This test method is of significance in making a final determination of the acceptability of fine aggregates with respect to the requirements of Specification C33/C33M concerning organic impurities.

5.2 This test method is applicable to those samples which, when tested in accordance with Test Method C40/C40M, have produced a supernatant liquid with a color darker than the standard listed in Table 1 of C40/C40M (Organic plate No. 3, Gardner Color Standard No. 14, Circular Disk No. 14 or prepared color solution).

5.3 Many specifications provide for the acceptance of fine aggregate producing a darker color in the Test Method C40/C40M test, if testing by this test method indicates the strength of the mortar cubes prepared with the unwashed fine aggregate is comparable to the strength of mortar cubes made with the washed fine aggregate.

6. Apparatus

6.1 *Flow Table, Flow Mold, and Caliper*, as described in Specification C230/C230M.

6.2 *Tamper, Trowel, Cube Molds, and Testing Machine*, as described in Test Method C109/C109M.

6.3 *Mixer, Bowl, and Paddle*, as described in Practice C305.

6.4 *Curing Apparatus*, as described in Specification C511.

6.5 *pH Paper*, 0–14.

6.6 *pH Meter*, capable of reading to 0.1 pH units or better.

6.7 *Temperature Measuring Device*—Capable of measuring the temperature of water or air within the specified range and accurate to $\pm 1^\circ\text{C}$ [2°F] with readability or graduations of 0.5°C [1°F] or better.

7. Reagents and Materials

7.1 Portland cement shall be Type I or Type II, meeting the requirements of Specification C150/C150M.

7.2 *Sodium Hydroxide Solution (3 %)*—Dissolve 3 parts by mass of sodium hydroxide (NaOH) in 97 parts water.

7.3 *Phenolphthalein*—Dissolve 1 g of reagent grade phenolphthalein in 1 L of 95 % reagent grade ethyl alcohol.

8. Sampling and Sample Preparation

8.1 If sufficient material remains from the sample used for testing in accordance with Test Method C40/C40M, use this material for the tests described in this test method. If there is insufficient material remaining, obtain another field sample from the same source in accordance with Practice D75/D75M and Practice D3665.

NOTE 2—At least 20 kg of fine aggregate should be available for the testing described herein.

8.2 If the fine aggregate contains particles coarser than the 4.75-mm (No.4) sieve, remove the coarser particles by sieving on the 4.75-mm (No.4) sieve, so that when the particles are mixed in the designated mixer, there will be no damage to the mixer or crushing of the fine aggregate particles. Determine the percentage of the sample removed. (**Warning**—The clearances between the paddle and the bowl specified in Practice C305 are suitable when using the mortar made with graded standard sand. To permit the mixer to operate freely and to avoid serious damage to the paddle and bowl when coarser aggregates are used, it may be necessary to set the clearance adjustment bracket to provide greater clearances. A clearance of approximately 4.0 mm is required in Practice C305; a clearance of approximately 5 mm [$\frac{3}{16}$ in.] has been found to be satisfactory for this method when used with fine aggregate from which the material retained on the 4.75-mm (No. 4) sieve has been removed.)

8.3 Split the fine aggregate to be used for these tests into two approximately equal portions, using the procedure described in Practice C702/C702M. Set one portion aside to be used in the unwashed condition. The second portion is to be washed before use.

8.4 *Preparing Washed Fine Aggregate:*

8.4.1 Perform the washing and rinsing of the fine aggregate with care to minimize the loss of fines, so that the aggregate after washing and rinsing has a fineness modulus within 0.10 of that of the unwashed aggregate.

8.4.2 *Establishing a Standard for Thoroughness of Rinsing*—Place a small amount of the water to be used for washing and rinsing in a clean, clear container, and determine the pH of the water by use of pH paper, pH meter, or add a drop of phenolphthalein to the wash water and retain for later comparison.

8.4.3 *Washing the Aggregate*—Place sufficient quantity of fine aggregate for three batches in a suitable container, flood with the sodium hydroxide solution, and agitate thoroughly with a spoon, spatula, or trowel. At the end of the washing and after allowing to stand for fines to settle, siphon off as much of the sodium hydroxide solution as possible, without removing any of the aggregate fines.

8.4.4 *Rinsing the Aggregate*—Add a large quantity of water to the washed aggregate, agitate, allow to stand for fines to settle, and then siphon off the rinse water. Repeat this operation several times, until the water used for rinsing has a pH equal to or lower than the pH of the water prior to contact with the fine aggregate. If phenolphthalein was used as an indicator, the color of the wash water is to be equal or lighter in color than the solution prepared in 8.4.2.