



Designation: C 1439 – 99^{ε1}

Standard Test Methods for Polymer-Modified Mortar and Concrete¹

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^{ε1} NOTE—Editorial corrections were made throughout in October 1999.

1. Scope

1.1 Most sections of ASTM test methods and practices for hydraulic cement mortar and concrete apply to the preparation and testing of specimens made with polymer-modifiers. However, there are some exceptions, most notably curing, that need special procedures in order to develop the properties inherent with polymer-modification. These test methods cover these exceptions.

1.2 For testing polymer-modified mortar and concrete specimens, the procedures in this standard supersede those in the referenced ASTM test methods and practices. These test methods are not applicable to dry, packaged mortar and concrete.

1.3 The values stated in SI units are to be regarded as standard.

1.4 *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:

- C 33 Specification for Concrete Aggregates²
- C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens²
- C 109 Test Method for Compressive Strength of Hydraulic Cement Mortar (using 2-inch or 50 mm Cube)²
- C 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate²
- C 128 Test Method for Specific Gravity and Absorption of Fine Aggregate²
- C 138 Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete²
- C 143 Test Method for Slump of Portland Cement Concrete
- C 150 Specification for Portland Cement²
- C 173 Test Method for Air Content of Freshly Mixed

Concrete by the Volumetric Method²

C 185 Test Method for Air Content of Hydraulic Cement Mortar³

C 192 Practice for Making and Curing Concrete Test Specimens in the Laboratory²

C 231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method²

C 260 Specification for Air-Entraining Admixtures for Concrete²

C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency³

C 403 Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance²

C 494 Specification for Chemical Admixtures for Concrete²

C 778 Specification for Standard Sand³

C 1202 Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration²

C 1404 Test Method for Bond Strength of Adhesive Systems Used with Concretes Measured by Direction Tension²

C 1438 Specification for Latex and Powder Polymer Modifiers for Hydraulic Cement Concrete and Mortar²

3. Significance and Use

3.1 These test methods are used to develop data for comparison with the requirements of Specification C 1438. Standardized procedures are used to compare the properties of specimens made from test mixtures of polymer-modified concrete or mortar with the properties of specimens made from reference mixtures. These test methods are not intended to simulate job conditions.

4. Materials

4.1 *polymer modifier*—the polymer modifier of the required type as furnished by the supplier.

4.2 *antifoam agent*—antifoam agent of the type recommended by the manufacturer, if one is not incorporated in the polymer modifier.

4.3 *cement*—portland cement conforming to Specification C 150; if necessary, blend into a single lot prior to test. Use same lot for both test and reference mixtures.

¹ This test method is under the jurisdiction of ASTM Committee C-9 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.44 on Polymer Modified Concrete and Mortars.

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² *Annual Book of ASTM Standards*, Vol 04.02.

³ *Annual Book of ASTM Standards*, Vol 04.01.

4.4 *aggregates*—fine and coarse aggregates for concrete conforming to Specification C 33; if necessary, blend each into a single lot prior to test. Use same lot for both test and reference mixtures.

4.5 *graded sand*—sand for mortar mixtures conforming to Specification C 778; if necessary, blend into a single lot prior to test. Use same lot for both test and reference mixtures.

5. Proportioning of Concrete and Mortar Mixtures

5.1 *Concrete Mixture Proportioning*—Make the test and reference concrete with proportions similar to those shown for a nominal cubic-meter batch.

5.1.1 *Test Concrete*—Make the test concrete conforming to the following requirements:

	Parts by Mass, kg
Portland cement	390 ± 3
Fine aggregate ^A	975 ± 6
Coarse aggregate #8 ^A	780 ± 6
Polymer Modifier	^B
Antifoam agent	^C
Potable water	^D

^A Saturated-surface-dry basis as described in Test Methods C 127 and C 128.

^B The level recommended by the manufacturer.

^C If the polymer modifier does not contain an antifoam agent, add the type and dosage recommended by the manufacturer, to the polymer modifier prior to mixing the concrete.

^D The amount of water to give a slump of 90 ± 15 mm.

5.1.2 *Reference Concrete*—Make the reference concrete conforming to the following requirements:

	Parts by Mass, kg
Portland cement	390 ± 3
Fine aggregate ^A	975 ± 6
Coarse aggregate #8 ^A	780 ± 6
Air-entraining admixture	^B
Potable water	^C

^A Saturated-surface-dry basis as described in Test Methods C 127 and C 128.

^B The amount of air-entraining admixture, meeting Specification C 260, to give an air content within 2 % of the test concrete and not exceeding 7.0 %.

^C The amount of water to give a slump of 90 ± 15 mm.

5.2 *Mortar Mixture Proportioning*:

5.2.1 *Test Mortar*—Make the test mortar conforming to the following proportions:

	Parts by Mass, kg
Portland cement	100 ± 2
Graded sand ^A	275 ± 10
Polymer modifier	^B
Antifoam agent	^C
Potable water	^D

^A Saturated-surface-dry basis as described in Test Methods C 128.

^B The level recommended by the manufacturer.

^C If the polymer modifier does not contain an antifoam agent, add the type and dosage recommended by the manufacturer, to the polymer modifier prior to mixing the mortar.

^D The amount of water that produces a flow of 105 to 115 % when tested according to Test Method C 109.

5.2.2 *Reference Mortar*—Make the reference mortar conforming to the following proportions:

	Parts by Mass, kg
Portland cement	100 ± 2
Graded sand ^A	275 ± 10
Air-entraining admixture	^B
Potable water	^C

^A Saturated-surface-dry basis as described in Test Methods C 128.

^B The amount of air-entraining admixture, meeting Specification C 260, to give an air content that is within 2 % of the test mortar and not exceeding 12.0 %.

^C Amount of water that produces a flow of 105 to 115 % when tested according to Test Method C 109.

6. Procedure

6.1 *General*—Mix concretes and mortars in mechanical mixers in batches of such size as to leave about 10 % excess after molding test specimens and testing the unhardened mixtures.

6.2 *Temperature*—Before mixing the concrete or mortar, bring the materials to a uniform temperature, as described in Practice C 192 for concrete and Test Method C 109 for mortar.

6.3 *Polymer Modifier*—Store the polymer modifier in a dry place, in moisture-proof containers. Mix the polymer modifier thoroughly before use to ensure uniformity.

6.4 *Reference Concrete and Mortar*—Prepare reference concrete or mortar in compliance with Practice C 192 or Test Method C 109, respectively.

NOTE 1—For trial batches to establish the amounts of water and air-entraining admixture to achieve the specified fresh properties, it is permissible to add these ingredients in increments and remix the batches. With the first increment of water and air-entraining admixture, if applicable, follow the mixing procedures specified in the previous section. If the slump, or flow, or air content is less than required, add additional water or air-entraining admixture and remix the batch. For mortar mixtures, remix at slow speed for 30 s. For concrete, remix the batch for 1 min. Remixing is permitted as often as necessary, provided the elapsed time from the start of initial mixing to the completion of mixing does not exceed 30 min. Cover the mixer to minimize evaporation when tests of fresh properties are being performed. These are trial batches only and are not to be used for testing.

6.5 *Test Mortar*—For mixing test mortar, follow Practice C 305, with the following changes:

6.5.1 *For Latex Polymer Modifiers*:

6.5.1.1 Place all the polymer modifier (with antifoam agent, as required) and mixing water in the bowl.

6.5.1.2 Add the cement to the bowl; start the mixer and mix at the slow speed (140 ± 5 r/min) for 30 s.

6.5.2 *For Powder Polymer Modifiers*:

6.5.2.1 Blend all the polymer modifier (with antifoam agent, as required) and cement, within 1 h of mixing the mortar.

6.5.2.2 Place the water in the bowl.

6.5.2.3 Add the cement/polymer modifier blend to the water; start the mixer and mix at the slow speed (140 ± 5 r/min) for 30 s

6.6 *Test Concrete*—For mixing test concrete, follow Practice C 192, with the following changes:

6.6.1 *For Latex Polymer Modifiers*—Prior to starting rotation of the mixer, add the coarse aggregate, polymer modifier, and approximately half of the water. Rotate the mixer a few revolutions, then add the fine aggregate, cement and remaining water. Mix the concrete for 3 min, followed by a 1 minute rest, followed by 1 min final mixing. Cover the open end of the mixer during the rest period to prevent evaporation. Take precautions to compensate for mortar retained by the mixer so that the discharged batch, as used, will be correctly proportioned (see Note 2).

6.6.2 *For Powder Polymer Modifiers*—Blend all the polymer modifier (with antifoam agent, as required) and cement, within 1 h of mixing the concrete. Prior to starting rotation of the mixer, add the coarse aggregate and approximately half of the water. Rotate the mixer a few revolutions, then add the fine aggregate, cement/polymer modifier blend, and remaining