Designation: C1141/C1141M – 15

Standard Specification for Admixtures for Shotcrete[1]

This standard is issued under the fixed designation C1141/C1141M; 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 specification covers materials proposed for use as admixtures to be added to a portland-cement shotcrete mixture for the purpose of altering the properties of the mixture.

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.

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C125 Terminology Relating to Concrete and Concrete Aggregates

C136/C136M Test Method for Sieve Analysis of Fine and Coarse Aggregates

C138/C138M Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

C173/C173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

C183/C183M Practice for Sampling and the Amount of Testing of Hydraulic Cement

C231/C231M Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

C260/C260M Specification for Air-Entraining Admixtures for Concrete

C311/C311M Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete

C494/C494M Specification for Chemical Admixtures for Concrete

C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C979/C979M Specification for Pigments for Integrally Colored Concrete

C989/C989M Specification for Slag Cement for Use in Concrete and Mortars

C1240 Specification for Silica Fume Used in Cementitious Mixtures

C1438 Specification for Latex and Powder Polymer Modifiers for use in Hydraulic Cement Concrete and Mortar

D98 Specification for Calcium Chloride

2.2 *ACI Documents:*

318 Building Code Requirements for Structural Concrete[3]

3. Terminology

3.1 For definitions of terms used in this standard, refer to Terminology C125.

4. Classification

4.1 This specification recognizes grades of admixtures, used in shotcrete made by either of two processes, as follows:

4.1.1 *Type I*—Dry mix shotcrete.

4.1.1.1 *Grade 1*—Accelerating admixture.

4.1.1.2 *Grade 2*—Retarding admixture.

4.1.1.3 *Grade 3*—Pozzolanic admixture.

4.1.1.4 *Grade 4*—Metallic iron admixture.

4.1.1.5 *Grade 5*—Coloring admixture.

4.1.1.6 *Grade 6*—Organic polymer admixture.

4.1.1.7 *Grade 7*—Not applicable.

4.1.1.8 *Grade 8*—Not applicable.

4.1.2 *Type II*—Wet-mix shotcrete.

4.1.2.1 *Grade 1*—Accelerating admixture.

4.1.2.2 *Grade 2*—Retarding admixture.

4.1.2.3 *Grade 3*—Pozzolanic admixture.

4.1.2.4 *Grade 4*—Metallic iron admixture.

4.1.2.5 *Grade 5*—Coloring admixture.

4.1.2.6 *Grade 6*—Organic polymer admixture.

[1] This specification is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.46 on Shotcrete.

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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] Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, http://www.concrete.org.

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

4.1.2.7 *Grade 7*—Water reducing admixture.
4.1.2.8 *Grade 8*—Air-entraining admixture.
4.1.3 Each of the above grades is further classified by identifying it according to the following classes:
4.1.3.1 *Class A*—Liquid.
4.1.3.2 *Class B*—Non-liquid.

5. Ordering Information

5.1 The purchaser shall include the following information in the contract or purchase order, if applicable:
5.1.1 The specification designation and date of issue,
5.1.2 Type of shotcrete, grade and class of admixture,
5.1.3 Quantity of admixture required,
5.1.4 Special packaging and package marking requirements,
5.1.5 Special sampling for inspection requirements, and
5.1.6 Any supplementary requirements.

6. Requirements

6.1 Shotcrete admixtures shall conform to the requirements for the applicable type and grade as given in Table 1.

6.2 At the request of the purchaser, the manufacturer shall state in writing that the admixture supplied is essentially identical in concentration, composition, and performance to the admixture previously tested under this specification and found to comply with the applicable requirements thereof.

6.3 Requirements for establishing compositional or chemical equivalence of a lot or of a subsequent lot relative to a previous lot that was subjected to quality tests and found to comply with the applicable requirements may be determined by agreement between the purchaser and the manufacturer. At the request of the purchaser, the manufacturer shall recommend appropriate test procedures, such as infrared spectrophotometry, pH value, and solids content, for establishing the equivalence of material from different lots or different portions of the same lot.

6.4 At the request of the purchaser, the manufacturer shall state in writing the chloride content of the admixture.

NOTE 1—Ultraviolet absorption of solutions and infrared spectroscopy of dried residues have been found to be valuable for these purposes. The specific procedures to be employed and the criteria to establish equivalence should be stipulated with due regard to the composition and properties of the sample.

NOTE 2—Admixtures containing relatively large amounts of chloride ions may make embedded metals susceptible to corrosion when moisture and oxygen are present in hardened shotcrete.

7. Sampling

7.1 Access shall be provided to the purchaser for sampling, either at the point of manufacture, or at the site of the work, as may be specified by the purchaser.

7.2 Samples shall be either grab or composite samples, as specified or required by this specification. A grab sample is one secured in a single operation. A composite sample is one obtained by combining three or more grab samples.

7.3 The sample size for each class of admixture shall be as follows:
7.3.1 *Class A Liquid Admixtures:*
7.3.1.1 Liquid admixtures shall be agitated thoroughly immediately prior to sampling. Individual grab samples shall represent not more than 9500 L [2500 gal] of admixture and

TABLE 1 Shotcrete Admixture Requirements

Type I—Dry-Mix Shotcrete			
Grade	Admixture	ASTM Standard	Other Limits
1	Accelerating	D98, C494/C494M Type C or E	
2	Retarding	C494/C494M Type B or D	
3	Pozzolanic	C618, C989/C989M, C1240	
4	Metallic iron	Not established	The metallic particles shall be ground iron free from rust, oil, foreign materials, and nonferrous metal particles. The grading of the metallic aggregates shall be as follows when tested according to C136/C136M: U.S. Sieve No.[A] — %Passing 4.75 mm (No. 4) — 100 2.36 mm (No. 8) — 90–100 1.18 mm (No. 16) — 70–85 600 µm (No. 30) — 20–35 300 µm (No. 50) — 0–10 150 µm (No. 100) — 0–5
5	Coloring	C979/C979M	Even when using materials conforming to C979/C979M, it may be difficult to obtain uniformity of coloring because of the placement procedures in dry-mix shotcreting.
6	Organic Polymer	C1438	
Type II—Wet-Mix Shotcrete			
Grade	Admixture	ASTM Standard	Other Limits
1	Accelerating	D98, C494/C494M Types C or E	
2	Retarding	C494/C494M, Type B, D or G	
3	Pozzolanic	C618, C989/C989M, C1240	
4	Metallic iron	Not established	See Type I, Grade 4
5	Coloring	C979/C979M	
6	Organic Polymer	C1438	
7	Water reducing	C494/C494M, Types A, D, E, F, or G	
8	Air-entraining	C260/C260M	

[A] The sieve designations in parentheses are provided for information only; the only standard sieve sizes are those stated in SI units.

shall have a volume of at least 1 L [1 qt]. A minimum of four grab samples shall be taken from different locations well distributed throughout the quantity to be represented. Composite samples shall be prepared by thoroughly mixing the selected grab samples, and the resultant mixture sampled to provide at least 4 L [1 gal] for testing.

7.3.1.2 Admixtures in bulk storage tanks shall be sampled equally from the upper, intermediate, and lower levels by means of drain cocks in the sides of the tanks, or a weighted sampling bottle fitted with a stopper that can be removed after the bottle is lowered to the desired depth.

7.3.1.3 Samples shall be packaged in impermeable, airtight containers which are resistant to attack by the admixture.

7.3.2 *Class B Non-liquid Admixtures:*

7.3.2.1 Individual grab samples (except pozzolanic) shall not represent more than 2 Mg [2 tons] of admixture and shall weigh at least 1 kg [2 lb]. A minimum of four grab samples shall be taken from different locations well distributed throughout the quantity to be represented. Composite samples shall be prepared by thoroughly mixing the selected grab samples, and the resultant mixture sampled to provide at least 2.2 kg [5 lb] for testing. Grading of composite samples shall be determined for each 2 Mg [2 tons] of Grade 4 metallic iron admixtures shipped.

7.3.2.2 Pozzolanic admixtures shall be sampled and tested in accordance with the requirements established in Test Methods C311/C311M.

7.3.2.3 Samples of packaged admixtures shall be obtained by means of a tube sampler as described in Practice C183/C183M.

7.3.2.4 When recommended by the manufacturer, the entire sample of an admixture shall be dissolved in water prior to testing.

7.3.2.5 Samples shall be packaged in moisture-proof, airtight containers.

8. Number of Tests and Retests

8.1 The number of tests and retests to be performed on specified materials shall be the number stipulated in the referenced ASTM standard.

9. Specimen Preparation

9.1 The specimens for tests shall be prepared as required by the particular test method referenced by the ASTM specification relating to the particular admixture.

NOTE 3—It is recommended that, whenever practicable, tests with the admixture be made using all of the ingredients of the shotcrete proposed for the specified work, because the effect produced by the admixture may vary with the properties of the other ingredients of the concrete.

10. Inspection

10.1 Inspection of the material shall be agreed upon between the purchaser and supplier as part of the purchase contract.

11. Rejection

11.1 The shotcrete admixture may be rejected if it fails to meet any of the applicable requirements of this specification. See Table 1.

11.2 An admixture stored at the point of manufacturer for more than six months prior to shipment or an admixture in local storage by a vendor for more than six months after completion of tests, may be retested before use and may be rejected if it fails to conform to any of the applicable requirements of this specification.

11.3 Packages or containers varying more than 2 % from the specified weight or volume shall be rejected. If the average weight or volume of 50 packages taken at random is less than that specified, the entire shipment shall be rejected.

11.4 When the admixture is to be used in non-air-entrained wet-mix shotcrete, it shall be rejected if the tested shotcrete containing the admixture has an air content greater than 5 %. When the admixture is to be used in air-entrained wet-mix shotcrete, it shall be rejected if the tested shotcrete containing the admixture has an air content greater than 12 % or less than 5 %. The air content shall be determined on a sample taken prior to shooting in accordance with either of Test Methods C138/C138M, C173/C173M or C231/C231M.

11.5 Rejection and reason(s) for rejection shall be reported to the producer or supplier promptly in writing.

12. Certification

12.1 When specified in the purchase order or contract, a certificate shall be furnished to the purchaser that the material has been tested in accordance with this specification and found to meet the requirements. When specified in the purchase order or contract, a report of test results on samples taken from material shipped shall be furnished. The test report requested in accordance with the purchase order shall be furnished within 60 days after shipment of the order.

13. Product Marking

13.1 When the admixture is delivered in packages or containers, the proprietary name of the admixture, the type, grade, and class under this specification, and the net weight or volume shall be plainly marked thereon. Similar information shall be provided in the shipping paper accompanying packaged or bulk materials.

14. Supplementary Requirements

14.1 Supplementary requirements may be specified by the purchaser and apply only when they appear separately on the purchase contract or order.

14.2 Quality assurance requirements shall be specified in the purchase contract or order with a reference to a pertinent document agreed upon by the supplier and purchaser.

SUMMARY OF CHANGES

Committee C09 has identified the location of selected changes to this specification since the last issue, C1141 – 08, that may impact the use of this specification. (Approved Dec. 1, 2015.)

(1) Deleted withdrawn standard, Test Method C1398, from Section 2 and removed citations to C1398 from the text.

(2) Updated designations of referenced documents that have changed from single to dual-designation.