



Standard Specification for Admixtures for Shotcrete¹

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

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.

Current edition approved Dec. 1, 2015. Published February 2016. Originally approved in 1989. Last previous edition approved in 2008 as C1141/C1141M – 08. DOI: 10.1520/C1141_C1141M-15.

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.

- 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 Concrete³

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.

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	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: <table><tr><td>U.S. Sieve No.^A</td><td>%Passing</td></tr><tr><td>4.75 mm (No. 4)</td><td>100</td></tr><tr><td>2.36 mm (No. 8)</td><td>90–100</td></tr><tr><td>1.18 mm (No. 16)</td><td>70–85</td></tr><tr><td>600 μm (No. 30)</td><td>20–35</td></tr><tr><td>300 μm (No. 50)</td><td>0–10</td></tr><tr><td>150 μm (No. 100)</td><td>0–5</td></tr></table> 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.	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
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150 μm (No. 100)	0–5																
2	Retarding	C494/C494M Type B or D															
3	Pozzolanic	C618, C989/C989M, C1240															
4	Metallic iron	Not established															
5	Coloring	C979/C979M															
6	Organic Polymer	C1438															
Type II—Wet-Mix Shotcrete																	
Grade	Admixture	ASTM Standard	Other Limits														
1	Accelerating	D98, C494/C494M Types C or E	See Type I, Grade 4														
2	Retarding	C494/C494M, Type B, D or G															
3	Pozzolanic	C618, C989/C989M, C1240															
4	Metallic iron	Not established															
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															

^AThe sieve designations in parentheses are provided for information only; the only standard sieve sizes are those stated in SI units.