



Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete¹

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This standard has been approved for use by agencies of the U.S. Department of Defense.

ε¹ NOTE—Corrected editorially in May 2015.

1. Scope*

1.1 This specification covers two types of chemical admixtures to be added to hydraulic cement concrete mixtures for the purpose of producing flowing concrete. The types are as follows:

1.1.1 *Type I*—Plasticizing, and

1.1.2 *Type II*—Plasticizing and retarding.

1.2 This specification stipulates tests of a chemical admixture with reference concreting materials or with concrete-making materials proposed for specific work. Unless otherwise specified by the purchaser, the tests shall be made using reference concreting materials.

1.3 If a chemical admixture has been tested and found to comply with the provisions of this specification using reference materials, and is being considered for use with other materials for specific work, additional tests for such use are allowed if agreed upon between the purchaser and the supplier and are allowed to consist of a portion of the tests described herein.

1.4 This specification provides for three levels of testing.

1.4.1 *Level 1*—During the initial approval stage, proof of compliance with the performance requirements defined in **Table 1** demonstrates that the admixture meets the requirements of this specification. Uniformity and equivalence tests of the section on Lot Uniformity and Equivalence shall be carried out to provide results against which later comparisons can be made.

1.4.2 *Level 2*—Limited retesting described in the section relating to general requirements may be requested at intervals by the purchaser. Proof of compliance with the requirements of **Table 1** demonstrates continued conformity of the admixture with the requirements of the specification.

1.4.3 *Level 3*—For acceptance of a lot or for measuring uniformity within or between lots, when specified by the purchaser, the uniformity and equivalence tests of the section on Lot Uniformity and Equivalence shall be used.

1.5 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 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.

NOTE 2—It is recommended that, whenever practicable, tests be made using the concrete-making materials (cement, pozzolan, slag, aggregates, air-entraining admixture), the mixture proportions, and the batching sequence and other physical conditions proposed for the specific work. The specific effects produced by chemical admixtures may vary with the properties and proportions of the other ingredients of the concrete.

NOTE 3—Temperature has a pronounced effect on time of setting of concrete. This may be exaggerated by the use of admixture Types I and II. If concrete temperatures to be expected on a particular job differ significantly from the conditions set forth in this specification, further testing may be desirable.

NOTE 4—An unusually rapid loss of workability with time, sometimes termed “slump loss”, can be experienced with these admixtures. The rate of slump loss will vary with the particular concreting materials and proportions, mixing equipment and procedures, and temperatures experienced on any particular job. At elevated temperatures, the slump may be retained for a longer period if a Type II admixture is used.

NOTE 5—Admixtures that contain relatively large amounts of chloride may accelerate corrosion of prestressing steel. Compliance with the requirements of this specification does not constitute assurance of acceptability of the admixture for use in prestressed concrete (see ACI 318).

NOTE 6—Admixtures that contain relatively large amounts of alkali ($\text{Na}_2\text{O} + 0.658 \text{ K}_2\text{O}$) may contribute to reaction with some aggregates. Compliance with the requirements of this specification does not assure acceptability when used with alkali-reactive aggregates and some cements.

1.6 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

¹ This specification is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.23 on Chemical Admixtures.

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1.7 The following precautionary caveat pertains only to the test method sections of this specification: *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.* **Warning**—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.²

2. Referenced Documents

2.1 ASTM Standards:³

C33/C33M Specification for Concrete Aggregates
C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
C78/C78M Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
C125 Terminology Relating to Concrete and Concrete Aggregates
C136 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
C143/C143M Test Method for Slump of Hydraulic-Cement Concrete
C150/C150M Specification for Portland Cement
C157/C157M Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
C173/C173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C183 Practice for Sampling and the Amount of Testing of Hydraulic Cement
C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory
C231/C231M Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C260/C260M Specification for Air-Entraining Admixtures for Concrete
C403/C403M Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
C666/C666M Test Method for Resistance of Concrete to Rapid Freezing and Thawing
C778 Specification for Sand
D75 Practice for Sampling Aggregates
D1193 Specification for Reagent Water
E100 Specification for ASTM Hydrometers
Manual of Aggregate and Concrete Testing

2.2 American Concrete Institute Standard:⁴

ACI 211.1 Standard Practice for Selecting Proportions for Normal and Heavyweight Concrete

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

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.

⁴ Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, <http://www.aci-int.org>.

ACI 318 Building Code Requirements for Structural Concrete

TABLE 1 Physical Requirements^A

	Type I Plasticizing	Type II Plasticizing and Retarding
Time of setting, allowable deviation from Reference, h		
Initial: at least	...	1 later
	1 earlier nor 1½ later	3½ later
Final: at least	...	...
	1 earlier nor 1½ later	3½ later
Increase in slump, min.	90 mm [3.5 in.]	90 mm [3.5 in.]
Compressive strength, min., % of reference		
3 days	90	90
7 days	90	90
28 days	90	90
6 months	90	90
1 year	90	90
Flexural strength, min., % of reference		
3 days	90	90
7 days	90	90
28 days	90	90
Length change after 14 days drying, max. shrinkage (alternative requirements): ^B		
% of reference	135	135
Increase over reference, in.	0.010	0.010
Relative durability factor, min. ^C	80	80

^A The values in the table include allowance for normal variation in the test results. The object of the 90 % strength requirements is to require a level of performance comparable to that of the reference concrete.

^B *Alternative Requirements*—Percent of reference limit applies when length change of reference is 0.030 % or greater; increase over reference limit applies when length change of reference is less than 0.030 %.

^C The requirement is applicable only when the admixture is to be used in air-entrained concrete which may be exposed to freezing and thawing while wet.

3. Terminology

3.1 Definitions:

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

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *flowing concrete, n*—concrete that is characterized by a slump greater than 7½ in. [190 mm] while maintaining a cohesive nature, and which otherwise meets the requirements of **Table 1**.

3.2.2 *plasticizing admixture, n*—a chemical admixture which, when added to concrete, produces flowing concrete without further addition of water and does not retard the setting of the concrete.

3.2.3 *plasticizing and retarding admixture, n*—a chemical admixture which, when added to concrete, produces flowing concrete without further addition of water and retards the setting of concrete.

3.2.4 *reference concrete, n*—concrete which contains the same amounts of cement, aggregates, water, and other concreting materials, but no plasticizing admixture.

3.2.5 *test concrete, n*—concrete which has a plasticizing admixture added.