Designation: C 260 – 06

Standard Specification for Air-Entraining Admixtures for Concrete[1]

This standard is issued under the fixed designation C 260; 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.

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

1. Scope*

1.1 This specification covers materials proposed for use as air-entraining admixtures to be added to concrete mixtures in the field.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 The text of this specification 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.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 183 Practice for Sampling and the Amount of Testing of Hydraulic Cement

C 185 Test Method for Air Content of Hydraulic Cement Mortar

C 233 Test Method for Air-Entraining Admixtures for Concrete

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *air-entraining admixture*, *n—for the purpose of this specification*, a material that is used as an ingredient of concrete, added to the batch immediately before or during its mixing, for the purpose of entraining air.

4. General Requirements

4.1 At the request of the purchaser, the manufacturer shall state in writing that the air-entraining admixture supplied for use in the work is essentially identical in concentration, composition, and performance to the air-entraining admixture tested under this specification.

NOTE 1—It is recommended that, whenever practicable, tests with the air-entraining admixture be made using all of the ingredients of the concrete proposed for the specific work, because the effect produced by the air-entraining admixture may vary with the properties of the other ingredients of the concrete.

4.2 Requirements for establishing compositional or chemical equivalence of a subsequent lot relative to a previous lot that was subjected to quality tests and found to comply with the requirements of 5.1 shall be determined if agreed upon by the purchaser and the manufacturer. At the request of the purchaser, the manufacturer shall recommend appropriate test procedures, such as infrared spectrophotometry (I.R.), pH value and solids content, for establishing the equivalence of materials from different lots or different portions of the same lot.

NOTE 2—Ultraviolet light absorption (UV) 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.

4.3 At the request of the purchaser, the manufacturer shall state in writing the chloride content of the air-entraining admixture and whether or not chloride was added during its manufacture.

NOTE 3—Admixtures that contain chlorides may accelerate corrosion of embedded metals.

5. Optional Uniformity Requirements

5.1 A series of two or more samples from a manufacturing lot will be considered sufficiently uniform to be properly composited into a single sample for quality testing provided they do not differ more than the amounts indicated in 5.4.

5.2 A subsequent sample or composite sample shall be considered in compliance with these requirements, so long as they differ from the original sample, tested to the requirements of 6.1, by no more than the amounts listed in 5.4, and provided that any additional optional, appropriate tests, such as infrared spectroscopy and ultraviolet light absorption, referred to in 4.2, also meet pre-agreed requirements.

[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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[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.

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

5.3 Determinations of uniformity shall be made in accordance with the procedures given in the sections "Check Tests for Uniformity" and "Procedure for Residue by Oven Drying" of Test Method C 233.

5.4 Allowable differences in results of uniformity determinations shall not exceed the following amounts:

5.4.1 The manufacturer shall provide an acceptable range of pH not to exceed a range of 3.0. The pH of samples tested shall fall within this range.

5.4.2 The air content in percent of Test Method C 185 mortars prepared from successive lots shall not differ by more than 2.0 from that for the acceptance sample.

5.4.3 The manufacturer shall provide acceptable limits of residue content not to exceed ±12 % of the midpoint of the limits. The residue content of samples tested shall fall within these limits (Note 4).

NOTE 4—As an example, an admixture may commonly be produced with residue content ranging from 5.0 to 6.5 %. The manufacturer would provide acceptable limits of 5.06 to 6.44 %, representing ±12 % of the midpoint of the limits which is 5.75 %.

6. Performance Requirements

6.1 The air-entraining admixture shall conform to the requirements in Table 1.

6.1.1 *Resistance to Freezing and Thawing*—The relative durability factor of concrete containing the admixture under test shall be not less than 80. The relative durability factor shall be calculated as follows:

TABLE 1 Physical Requirements[A]

Air-Entraining Admixtures	
Time of setting, allowable deviation from control, h:min:	
Initial: not more than	1:15 earlier nor 1:15 later
Final: not more than	1:15 earlier nor 1:15 later
Compressive strength, min, % of control:	
3 days	90
7 days	90
28 days	90
Flexural strength, min, % of control:[B]	
3 days	90
7 days	90
28 days	90
Length change, max shrinkage (alternative requirements):[B,C]	
Percent of control	120
Increase over control, percentage points[D]	0.006
Relative durability factor, min	80
Bleeding of the net amount of mixing water, max percent over control[E]	2

[A] The values in the table include allowance for normal variation in test results. The object of the 90 % compressive strength requirement for air entraining admixtures is to require a level of performance comparable to that of the reference concrete.

[B] Applicable only when required by the purchaser.

[C] Alternative requirements, see 6.1.2, "percent of control" limit applies when the length change of the control is 0.030 % or greater, "increase over control" limit applies when the length change of the control is less than 0.030 %.

[D] Applicable when shrinkage of control concrete is less than 0.030 %.

[E] Bleeding is computed as a percentage of the net amount of mixing water in each concrete. The net mixing water is the water in excess of that present as absorbed water in the aggregates. For example, a test concrete mixture that contains 4.65 kg of net mix water and produces 0.29 kg of bleed water would have 6.24 % bleed water by mass of net mixing water. If a control mixture produces 7.05 % bleed water, the change in bleeding between the test and control concrete mixtures would be – 0.81 percentage points.

$$DF \text{ (or } DF_1) = PN/300 \quad (1)$$

$$RDF = (DF/DF_1) \times 100$$

where:

DF = durability factor of the concrete containing the admixture under test,

DF_1 = durability factor of the concrete containing the reference admixture,

P = relative dynamic modulus of elasticity in percentage of the dynamic modulus of elasticity at zero cycles (values of P will be 60 or greater),

N = number of cycles at which P reaches 60 %, or 300 if P does not reach 60 % prior to the end of the test (300 cycles), and

RDF = relative durability factor.

6.1.2 *Length Change*—After 14 days of drying, the length change of the concrete containing the test admixture shall not be more than 120 % of that of the concrete containing the reference admixture. When, after 14 days of drying, the length change of the reference concrete is less than 0.030 %, the length change of the concrete containing the test admixture shall not be more than 0.006 percentage points greater than that of the reference concrete.

7. Sampling

7.1 Opportunity shall be provided the purchaser for careful sampling and inspection, either at the point of manufacture or at the site of the work, as 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 obtained in a single operation. A composite sample is one obtained by combining three or more grab samples.

7.3 For the purpose of this specification, it is recognized that samples will be taken for the two following reasons:

7.3.1 *Quality Tests*—A sample taken for the purpose of evaluating the quality of a source or lot of admixture will be required to meet all the applicable requirements of this specification. Samples used to determine conformance with the requirements of this specification shall be composites of grab samples taken from sufficient locations to ensure that the composite sample will be representative of the lot.

7.3.2 *Uniformity Tests*—A sample taken for the purpose of evaluating the uniformity of a single lot or of different lots from the same source will generally be subjected to a limited number of tests as the result of agreement between the purchaser and manufacturer (see Section 4). Such samples shall be composite samples from individual lots when different lots from the same source are being compared. When the uniformity of a single lot is being determined, grab samples shall be used.

7.4 *Liquid Air-Entraining Admixtures*—Liquid admixtures shall be agitated thoroughly immediately prior to sampling. Grab samples taken for quality or uniformity tests shall represent not more than 9500 L (2500 gal) of admixture and shall have a volume of at least 1 L (1 qt). A minimum of three grab samples shall be taken. Composite samples shall be prepared by thoroughly mixing the grab samples selected and the resultant mixture sampled to provide at least 4 L (1 gal) for

quality tests. Grab samples shall be taken from different locations well distributed throughout the quantity to be represented.

7.4.1 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.

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

7.5 *Nonliquid Air-Entraining Admixtures*—Grab samples taken for quality or uniformity tests shall represent not more than 2 metric tons (2 tons) of admixture and shall have a mass of at least 1 kg (2 lb). A minimum of four grab samples shall be taken. Composite samples shall be prepared by thoroughly mixing the grab samples selected and the resultant mixture sampled to provide at least 2.5 kg (5 lb) for the composite sample. Grab samples shall be taken from different locations well distributed throughout the quantity to be represented.

7.5.1 Samples of packaged admixtures shall be obtained by means of a tube sampler as described in Practice C 183.

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

7.6 Samples shall be thoroughly mixed before testing to assure uniformity. When recommended by the manufacturer, the entire sample of a nonliquid admixture shall be dissolved in water prior to testing.

8. Test Methods

8.1 Determine the properties enumerated in Section 6 in accordance with Test Method C 233. It is recommended that, whenever practicable, tests be made in accordance with the section on Materials for Tests for Specific Uses in Test Method C 233, using the cement proposed for the specific work.

9. Rejection

9.1 The air-entraining admixture shall be rejected if the purchaser desires when it fails to meet any of the applicable requirements of this specification.

9.2 After completion of tests, an admixture stored at the point of manufacture for more than 6 months prior to shipment, or an admixture in local storage in the hands of a seller for more than 6 months, shall be retested before use when requested by the purchaser. It shall be rejected, if the purchaser desires, when it fails to conform to any of the applicable requirements of this specification.

9.3 Packages or containers varying more than 5 % from the specified weight or volume shall be rejected if the purchaser desires. If the average weight or volume of 50 packages or containers taken at random is less than that specified, the entire shipment shall be rejected if the purchaser desires.

10. Packaging and Marking

10.1 The proprietary name of the air-entraining admixture and the net quantity in pounds or gallons (kilograms or litres) shall be plainly indicated on the packages or containers in which the admixture is delivered. Similar information shall be provided in the shipping advices accompanying packaged or bulk shipments of admixtures.

11. Keywords

11.1 air content; air entraining admixtures; cement; concrete; pH, residue; specific gravity

SUMMARY OF CHANGES

Committee C09 has identified the location of selected changes to this specification since the last issue, C 260 – 01, that may impact the use of this specification. (Approved August 1, 2006)

(*1*) Revised 5.4.1.