



Designation: C 465 – 99

Standard Specification for Processing Additions for Use in the Manufacture of Hydraulic Cements¹

This standard is issued under the fixed designation C 465; 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 pertains to the criteria and tests to be used for determining whether a processing addition, when used in the recommended amount at the option of the cement producer in the manufacture of hydraulic cements, meets the requirements as prescribed by definition in Specifications C 150, C 1157, C 845, and C 595. The materials listed in the following former ASTM Specifications shall be considered as meeting the requirements of this specification:

- C 150 – 62, for Portland Cement²
- C 205 – 58 T, for Portland Blast-Furnace Slag Cement³
- C 340 – 58 T, for Portland Pozzolan Cement³
- C 358 – 58, for Slag Cement³

1.2 The following safety hazards caveat pertains only to the test methods described in 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.*

2. Referenced Documents

2.1 ASTM Standards:

- C 33 Specification for Concrete Aggregates⁴
- C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens⁴
- C 78 Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)⁴
- C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)⁵
- C 114 Test Methods for Chemical Analysis of Hydraulic Cement⁵
- C 115 Test Method for Fineness of Portland Cement by the Turbidimeter⁵

- C 138 Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete⁴
- C 143 Test Method for Slump of Hydraulic Cement Concrete⁴
- C 150 Specification for Portland Cement⁵
- C 151 Test Method for Autoclave Expansion of Portland Cement⁵
- C 173 Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method⁴
- C 185 Test Method for Air Content of Hydraulic Cement Mortar⁵
- C 187 Test Method for Normal Consistency of Hydraulic Cement⁵
- C 191 Test Method for Time of Setting of Hydraulic Cement by Vicat Needle⁵
- C 192 Practice for Making and Curing Concrete Test Specimens in the Laboratory⁴
- C 204 Test Method for Fineness of Hydraulic Cement by Air Permeability Apparatus⁵
- C 205 – 58T Specification for Portland Blast-Furnace Slag Cement³
- C 226 Specification for Air-Entraining Additions for Use in the Manufacture of Air-Entraining Portland Cement⁵
- C 231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method⁴
- C 293 Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)⁴
- C 340 – 58T Specification for Portland Pozzolan Cement³
- C 358 – 58 Specification for Slag Cement³
- C 595 Specification for Blended Hydraulic Cements⁵
- C 596 Test Method for Drying Shrinkage of Mortar Containing Portland Cement⁵
- C 617 Practice for Capping Cylindrical Concrete Specimens⁴
- C 845 Specification for Expansive Hydraulic Cement⁵
- C 1157 Performance Specification for Blended Hydraulic Cement⁵
- D 891 Test Methods for Specific Gravity, Apparent, of Liquid Industrial Chemicals⁶
- E 203 Test Method for Water Using Karl Fischer Reagent⁶

¹ This specification is under the jurisdiction of ASTM Committee C-1 on Cement and is the direct responsibility of Subcommittee C01.20 on Additions. Current edition approved Feb. 10, 1999. Published May 1999. Originally published as C 465 – 61 T. Last previous edition C 465 – 96.

² See 1961 Book of ASTM Standards, Part 4.

³ Discontinued, see 1958 Book of ASTM Standards, Part 4.

⁴ Annual Book of ASTM Standards, Vol 04.02.

⁵ Annual Book of ASTM Standards, Vol 04.01.

⁶ Annual Book of ASTM Standards, Vol 15.05.

3. Materials

3.1 Cements:

3.1.1 In cases where it is desired that the proposed addition be accepted for general use in portland cement, tests shall be made on cements prepared from at least five different clinkers. As a minimum, these clinkers shall represent two Type I cements containing not less than 9.0 % C_3A , one Type II cement, and two Type III cements, all conforming to Specification C 150.

3.1.2 In cases where it is also desired that the proposed addition be used in blended cements, the test and test procedures shall be as specified with a control and an addition for cement conforming to the appropriate Specification C 595 or C 1157.

3.1.3 Processing additions which have been shown to meet the requirements of this specification may also be used in cements conforming to Specification C 845. Testing of the addition with these special cements, where desired, shall be done using the tests and test procedures as specified with a control cement and a cement containing the addition, both conforming to Specification C 845.

3.1.4 In cases where it is desired that the proposed addition be limited in use to specific types of cement less in number than required in 3.1.1, the tests and test procedures shall be as specified, and at least two pairs of cements shall be prepared from two clinkers from different plants for each type under specific consideration.

3.1.5 In cases where it is desired that the proposed addition be limited in use to a single plant, the tests and test procedures shall be as specified and at least two pairs of cements shall be prepared from clinker representing each type under specific consideration.

3.1.6 The two companion cements to be made from any one clinker shall be ground to the same fineness within $7 \text{ m}^2/\text{kg}$ when tested in accordance with Test Method C 115 or within $13 \text{ m}^2/\text{kg}$ when tested in accordance with Test Method C 204, and the SO_3 content, expressed as a percentage of the cement mass and reported to the nearest 0.01 %, shall differ by not more than 0.3, so as to afford comparable samples for indicating the effect of the addition on the cement. Each control cement shall comply with all requirements in the specification applicable to that type of cement, and shall not contain the proposed addition when tested by the method furnished by the producer or seller of the addition.

3.1.7 The percentage of each of the following shall be determined for each lot of cement tested: silicon dioxide (SiO_2), aluminum oxide (Al_2O_3), ferric oxide (Fe_2O_3), calcium oxide (CaO), magnesium oxide (MgO), sulfur trioxide (SO_3), ignition loss, insoluble residue, sodium oxide (Na_2O), and potassium oxide (K_2O). There shall also be calculated the potential percentages of the following compounds: tricalcium silicate, dicalcium silicate, tricalcium aluminate, and tetracalcium aluminoferrite. Determinations for the percentage of the addition shall be made, both on the control cements and on those with which the addition was interground, using the method proposed therefore by the sponsor.

3.2 *Aggregates*—The fine and coarse aggregates shall comply with Specification C 33; the coarse aggregate shall comply

with the grading requirements for Size No. 57 or Size No. 67. A sufficient quantity from a single lot of coarse aggregate and from a single lot of fine aggregate shall be provided to complete all tests. To prevent the segregation of particle sizes in the fine aggregate, a single lot of sand sufficient for all tests shall either (1) be separated on the 4.75-mm (No. 4), 1.18-mm (No. 16), $300 \mu\text{m}$ (No. 50), and $150 \mu\text{m}$ (No. 100) sieves and then be recombined in the required quantity for each batch; or (2) be blended while in a damp condition, and maintained in that condition for the duration of the tests. Under option (2), lots of appropriate size for single mortar and concrete batches shall be carefully split or quartered from the entire batch.

4. General Requirements

4.1 Processing additions shall conform to the respective requirements in this specification.

4.2 The trade name, source, character of the material, and means for the quantitative determination of the addition in the finished cement shall be furnished by the sponsor, manufacturer, or supplier of the addition, and the information shall form a part of the record of tests of the addition. If the processing addition is a liquid, the specific gravity and percent water content shall also be part of the record.

4.2.1 The specific gravity, run in accordance with 7.1.1 shall be within ± 0.05 units of the value reported in 4.2.

4.3 Processing additions shall be evaluated by comparing cements containing the addition to otherwise identical cements from the same source without the addition, or containing a processing addition which has been shown to comply with this specification using control cements without any additions, hereinafter designated the “control” cement.

4.4 The amount of the processing addition to be interground with the cement for evaluation purposes shall be determined by the sponsor of the addition.

4.4.1 The amount of the addition in the cement containing the addition and showing compliance with the requirements of this specification shall be determined quantitatively by means of the quantitative determination required by 4.2.

4.4.2 The amount of addition, so determined, shall be used to state the amount of addition that shows compliance with this specification.

4.4.3 When tests on cements containing the addition show compliance with the requirements of this specification, the addition in cement may be used in any amount up to the maximum amount showing compliance.

4.5 The cement produced for evaluation purposes with the processing addition shall comply with the appropriate Specifications C 150, C 845, C 1157M, or C 595, except that it contains the addition under test. The effect of the addition on the properties of the cement shall also be within the following limits:

4.5.1 The percentage of water by mass of cement required for normal consistency of cement containing the addition shall not exceed that required by the corresponding control cement by more than 1.0. For those cements not limited to a fixed water requirement, the percentage of water by mass of cement required for standard consistency of the mortar used for strength determinations as described in 4.5.4 shall not be