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Standard Guide for Approximation of Optimum SO₃ in Hydraulic Cement¹

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1. Scope*

1.1 This guide describes the determination of approximate optimum SO₃ for maximum performance as a result of substituting calcium sulfate for a portion of the cement.

1.2 This guide refers to the sulfur trioxide (SO₃) content of the cement only. Slag cements and occasionally other hydraulic cements can contain sulfide or other forms of sulfur. The determination of SO₃ content by rapid methods may include these other forms, and may therefore produce a significant error. If a significant error occurs, analyze the cement for SO₃ content using the reference test method of Test Methods C114 for sulfur trioxide.

1.3 Values stated as SI units are to be regarded as standard.

1.4 *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

- C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
- C78 Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
- C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
- C114 Test Methods for Chemical Analysis of Hydraulic Cement
- C150 Specification for Portland Cement
- C192 Practice for Making and Curing Concrete Test Specimens in the Laboratory

¹ This guide is under the jurisdiction of ASTM Committee C01 on Cement and is the direct responsibility of Subcommittee C01.28 on Sulfate Content

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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.

- C204 Test Methods for Fineness of Hydraulic Cement by Air-Permeability Apparatus
- C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
- C430 Test Method for Fineness of Hydraulic Cement by the 45-μm (No. 325) Sieve
- C465 Specification for Processing Additions for Use in the Manufacture of Hydraulic Cements
- C471M Test Methods for Chemical Analysis of Gypsum and Gypsum Products (Metric)
- C595 Specification for Blended Hydraulic Cements
- C596 Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement
- C1157 Performance Specification for Hydraulic Cement
- C1437 Test Method for Flow of Hydraulic Cement Mortar
- C1702 Test Method for Measurement of Heat of Hydration of Hydraulic Cementitious Materials Using Isothermal Conduction Calorimetry

3. Significance and Use

3.1 The purpose of this guide is to estimate the SO₃ content for a hydraulic cement that gives maximum performance. The value obtained is one way to establish an appropriate level of sulfate in the manufacture of cements specified in Specifications C150, C595, and C1157.

3.2 The SO₃ content of a cement giving maximum performance is different at different ages, with different performance criteria and with different materials such as supplementary cementitious materials and chemical admixtures. A manufacturer can choose the performance criteria to determine optimum SO₃ content. This optimum SO₃ content may be a compromise between different ages and different performance criteria.

NOTE 1—Typically, the optimum SO₃ content is higher the later the age.

3.3 This guide indicates optimum SO₃ content for cement in mortar made and cured at a standard temperature of 23.0 ± 2.0°C (73.5 ± 3.5°F). The optimum SO₃ increases with increasing temperature and may increase when water-reducing admixtures are used.

3.4 It should not be assumed that the optimum SO₃ estimated in this guide is the same SO₃ content for optimum performance of a concrete prepared from the cement.

3.5 The guide is applicable to cements specified in Specifications C150, C595, and C1157.

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