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Standard Guide for Approximation of Optimum SO₃ in Hydraulic Cement Using Compressive Strength¹

This standard is issued under the fixed designation C563; 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 guide describes the determination of approximate optimum SO₃ for maximum compressive strength at 24 h, 3 days, or 7 days by measuring the change in strength produced in hydraulic cement mortar 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

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

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
C471M Test Methods for Chemical Analysis of Gypsum and Gypsum Products (Metric)
C511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
C595 Specification for Blended Hydraulic Cements
C1157 Performance Specification for Hydraulic Cement
C1437 Test Method for Flow of Hydraulic Cement Mortar

3. Significance and Use

3.1 The purpose of this guide is to estimate the SO₃ content for a hydraulic cement that gives maximum compressive strength in mortar made and cured at 23°C. 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 compressive strength is different at different ages of mortar; typically this SO₃ content is higher at 3 days than the 24-h, and often higher for 7 days than that for 3 days. A manufacturer can choose the age of 24-h, 3 days or 7 days for specimens at which to determine optimum SO₃ content.

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.

4. Apparatus

4.1 Use the apparatus as specified in Test Method C109/C109M.

5. Materials

5.1 *Calcium Sulfate*—Use calcium sulfate for addition to the cement that is either a high-grade natural gypsum having an

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.