



Designation: C 563 – 02

Standard Test Method for Optimum SO₃ in Hydraulic Cement Using 24-h Compressive Strength¹

This standard is issued under the fixed designation C 563; 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 test method describes the determination of optimum SO₃ for maximum 24-h compressive strength by measuring the change in strength produced in hydraulic cement mortar as a result of substituting calcium sulfate for a portion of the cement. Usually, but not always, the SO₃ content that produces the highest 24-h strength at 23°C also produces approximately the lowest expansion in water and the lowest contraction in air at that temperature.

1.2 This test method 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 C 114 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:

C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)²

C 114 Test Methods for Chemical Analysis of Hydraulic Cement²

C 150 Specification for Portland Cement²

C 204 Test Method for Fineness of Hydraulic Cement by Air Permeability Apparatus²

C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency²

C 471 Test Methods for Chemical Analysis of Gypsum and Gypsum Products²

¹ This test method 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 *Annual Book of ASTM Standards*, Vol 04.01.

C 511 Specification for Moist Cabinets, Moist Rooms and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes²

C 595 Specification for Blended Hydraulic Cements²

C 778 Specification for Standard Sand²

C 1157 Performance Specification for Blended Hydraulic Cement²

3. Significance and Use

3.1 The purpose of this test method is to estimate the SO₃ content for a hydraulic cement that gives maximum 24-h compressive strength.

3.2 The optimum SO₃ content for 24-h compressive strength is not necessarily the optimum SO₃ content for later ages or for volume change. Confirming tests can be made if the relationships between SO₃ and these properties are not known for the cement being tested.

3.3 This test method 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 test method is the same SO₃ content for optimum performance of a concrete prepared from the cement.

3.5 The test method is applicable to cements specified in Specifications C 150, C 595, and C 1157.

4. Apparatus

4.1 Use the apparatus as specified in Test Method C 109/ C 109M.

5. Materials

5.1 *Calcium Sulfate*—Use calcium sulfate for addition to the cement that is either a high-grade natural gypsum having an SO₃ content of at least 46 %, ³ or the calcium sulfate from the source used for the intended plant production. Grind the calcium sulfate to 100 % passing the 75- μ m (No. 200) sieve, and at least 800 m²/kg Blaine fineness (Test Method C 204). If the SO₃ content of the calcium sulfate is unknown, analyze it

³ Terra Alba, available from the U.S. Gypsum Co., Southard, OK plant, meets these requirements for fineness and SO₃ content.