



Designation: C1567 – 23

Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)¹

This standard is issued under the fixed designation C1567; 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 permits detection within 16 days of the potential for deleterious alkali-silica reaction of combinations of cementitious materials and aggregate in mortar bars. The cementitious materials are composed of various proportions of hydraulic cement, pozzolans and slag cement.

1.2 The test results are only valid for the specific combinations of pozzolan, slag, and reactive aggregates tested.

1.3 This test is not suitable for evaluating the potential for deleterious reaction of combinations of hydraulic cement and aggregate (that is, in the absence of pozzolans or slag cement).

1.4 The text of this test method refers to notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this test method.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.50 on Aggregate Reactions in Concrete.

Current edition approved June 1, 2023. Published July 2023. Originally approved in 2004. Last previous edition approved in 2022 as C1567–22a. DOI: 10.1520/C1567-23.

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)
- C125 Terminology Relating to Concrete and Concrete Aggregates
- C127 Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
- C128 Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate
- C150/C150M Specification for Portland Cement
- C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
- C490/C490M Practice for Use of Apparatus for the Determination of Length Change of Hardened Cement Paste, Mortar, and Concrete
- C494/C494M Specification for Chemical Admixtures for Concrete
- C511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
- C618 Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- C989/C989M Specification for Slag Cement for Use in Concrete and Mortars
- C1240 Specification for Silica Fume Used in Cementitious Mixtures
- C1260 Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
- C1437 Test Method for Flow of Hydraulic Cement Mortar

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

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C1778 Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete

D1193 Specification for Reagent Water

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms relating to concrete or aggregates, see Terminology **C125**.

3.2 *relative density (OD), n*—as defined in Test Methods **C127** or **C128**, for coarse and fine aggregates, respectively.

4. Significance and Use

4.1 This test method provides a means for evaluating the ability of pozzolans and slag cement to control deleterious internal expansion due to alkali-silica reaction when used with an aggregate intended for use in concrete. It is based on the Accelerated Test Method developed at the National Building Research Institute (NBRI) in the Republic of South Africa (1-4).³

4.2 This test method has been developed for evaluating combinations of certain cementitious materials with a single aggregate source in a mortar of standard proportions. It yields an empirical result, which is utilized to compare to criteria within some specifications to accept or reject the combination of materials being evaluated for a particular application. Currently this method has no standard procedure for testing fine and coarse aggregates proposed for use in concrete together in a single batch of mortar, nor for varying the proportions of the constituent materials of the mortar beyond the relative proportions of the individual cementitious material constituents to each other, as the significance of these practices have not been determined nor have appropriate limits been established for evaluating the results of tests conducted using these modifications.

4.3 Different levels of pozzolan and slag cement may require testing to determine the amount required to reduce expansion to an acceptable level. Pozzolans and ground granulated blast-furnace slag may be tested separately or in combination.

4.4 It is recommended to test the same aggregate and hydraulic cement (without pozzolans and slag cement) using Test Method **C1260**.

4.5 Results of tests conducted as described herein shall form a part of the basis for determining the precautions that shall be taken against excessive expansion due to alkali-silica reaction. Refer to Guide **C1778** for the interpretation of the test results from Test Method **C1567**.

5. Apparatus

5.1 The apparatus shall conform to Practice **C490/C490M**, except as follows:

5.2 *Sieves*—Square hole, woven-wire cloth sieves, shall conform to Specification **E11**.

5.3 *Mixer, Paddle, and Mixing Bowl*—Mixer, paddle, and mixing bowl shall conform to the requirements of Practice **C305**, except that the clearance between the lower end of the paddle and the bottom of the bowl shall be 5.1 mm ± 0.3 mm.

5.4 *Tamper and Trowel*—The tamper and trowel shall conform to Test Method **C109/C109M**.

5.5 *Containers*—The containers shall be of such a nature that the bars can be totally immersed in either the water or 1N sodium hydroxide (NaOH) solution. The containers shall be made of material that can withstand prolonged exposure to 80 °C and must be resistant to a 1N NaOH solution (see **Note 1**). The containers must be so constructed that when used for storing specimens, the loss or gain of moisture is prevented by tight-fitting covers, by sealing, or both (see **Note 2**). The bars in the solution must be placed and supported so that the solution has access to the entire surface of each bar; therefore, ensure that the specimens do not touch the sides of the container or each other. The specimens, if stood upright in the solution, shall not be supported by the metal gage stud.

NOTE 1—The NaOH solution corrodes glass or metal containers.

NOTE 2—Some microwave-proof food storage containers made of polypropylene or high-density polyethylene have been found to be acceptable.

5.6 *Oven, or Water Bath*—A convection oven or water bath with temperature control maintaining 80.0 °C ± 2.0 °C.

6. Reagents

6.1 *Sodium Hydroxide (NaOH)*—USP or technical grade may be used, provided the Na⁺ and OH⁻ concentrations are shown by chemical analysis to lie between 0.99 N and 1.01 N.

6.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Type IV of Specification **D1193**.

6.3 *Sodium Hydroxide Solution*—Each litre of solution shall contain 40.0 g of NaOH dissolved in 900 mL of water, and shall be diluted with additional distilled or deionized water to obtain 1.0 L of solution. The volume proportion of sodium hydroxide solution to mortar bars in a storage container shall be 4 ± 0.5 volumes of solution to 1 volume of mortar bars. The volume of a mortar bar may be taken as 184 mL. Include sufficient test solution to ensure complete immersion of the mortar bars.

6.3.1 **Warning**—Before using NaOH, review: (1) the safety precautions for using NaOH; (2) first aid for burns; and (3) the emergency response to spills, as described in the manufacturer's Material Safety Data Sheet or other reliable safety literature. NaOH can cause very severe burns and injury to unprotected skin and eyes. Suitable personal protective equipment must always be used. These include full-face shields, rubber aprons, and gloves impervious to NaOH. Gloves must be checked periodically for pinholes.

³ The boldface numbers in parentheses refer to a list of references at the end of the text.