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.

Designation: C1293/C1293M – 23a

Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction[1]

This standard is issued under the fixed designation C1293/C1293M; 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 covers the determination of the susceptibility of an aggregate or combination of an aggregate with pozzolan or slag for participation in expansive alkali-silica reaction by measurement of length change of concrete prisms.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as the standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

NOTE 1—Sieve size is identified by its standard designation in Specification E11. The alternative designation given in parentheses is for information only and does not represent a different standard sieve size.

1.3 The text of this standard 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 the 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* (**Warning—**Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.[2])

1.5 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

C29/C29M Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
C33/C33M Specification for Concrete Aggregates
C114 Test Methods for Chemical Analysis of Hydraulic Cement
C125 Terminology Relating to Concrete and Concrete Aggregates
C138/C138M Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
C143/C143M Test Method for Slump of Hydraulic-Cement Concrete
C150/C150M Specification for Portland Cement
C157/C157M Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory
C294 Descriptive Nomenclature for Constituents of Concrete Aggregates
C295/C295M Guide for Petrographic Examination of Aggregates for Concrete
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
C595/C595M Specification for Blended Hydraulic Cements
C618 Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
C702/C702M Practice for Reducing Samples of Aggregate to Testing Size
C856/C856M Practice for Petrographic Examination of Hardened Concrete
C989/C989M Specification for Slag Cement for Use in Concrete and Mortars
C1240 Specification for Silica Fume Used in Cementitious Mixtures

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

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[2] Section on Safety Precautions, "Manual of Aggregate and Concrete Testing," *Annual Book of ASTM Standards*, Vol 04.02.

[3] 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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C1260 Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
C1778 Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete
D75/D75M Practice for Sampling Aggregates
E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

2.2 *CSA Standards*:[4]

CSA A23.2-14A Potential Expansivity of Aggregates (Procedure for Length Change due to Alkali-Aggregate Reaction in Concrete Prisms at 38 °C)
CSA A23.2-27A Standard Practice to Identify Degree of Alkali-Reactivity of Aggregates and to Identify Measures to Avoid Deleterious Expansion in Concrete
CSA A23.2-28A Standard Practice for Laboratory Testing to Demonstrate the Effectiveness of Supplementary Cementing Materials and Lithium-Based Admixtures to Prevent Alkali-Silica Reaction in Concrete

3. Terminology

3.1 Terminology used in this standard is as given in Terminology C125 or Descriptive Nomenclature C294.

4. Significance and Use

4.1 Alkali-silica reaction is a chemical interaction between some siliceous constituents of concrete aggregates and hydroxyl ions (**1**).[5] The concentration of hydroxyl ion within the concrete is predominantly controlled by the concentration of sodium and potassium (**2**).

4.2 This test method is intended to evaluate the potential of an aggregate or combination of an aggregate with pozzolan or slag to expand deleteriously due to any form of alkali-silica reactivity (**3**, **4**).

4.3 If testing an aggregate with pozzolan or slag, the results are used to establish minimum amounts of the specific pozzolan or slag needed to prevent deleterious expansion. Pozzolan or slag from a specific source can be tested individually or in combination with pozzolan or slag from other sources.

4.4 When selecting a sample or deciding on the number of samples for test, it is important to recognize the variability in lithology of material from a given source, whether a deposit of sand, gravel, or a rock formation of any origin. For specific advice, see Guide C295/C295M.

4.5 This test method is intended for evaluating the behavior of aggregates in concrete with an alkali (alkali metal oxide) content of 5.25 kg/m^3 [8.85 lb/yd^3] or in concrete containing pozzolan or slag with an alkali content proportionally reduced from 5.25 kg/m^3 [8.85 lb/yd^3] Na_2O equivalent by the amount of pozzolan or slag replacing portland cement or portland-limestone cement. This test method assesses the potential for deleterious expansion of concrete caused by alkali-silica reaction, of either coarse or fine aggregates, from tests performed under prescribed laboratory curing conditions that will probably differ from field conditions. Thus, actual field performance will not be duplicated due to differences in concrete alkali content, wetting and drying, temperature, other factors, or combinations of these (**5**).

4.6 Results of tests conducted on an aggregate as described herein should form a part of the basis for a decision as to whether precautions should be taken against excessive expansion due to alkali-silica reaction. For interpretation of test results, refer to Guide C1778.

4.7 If the expansions in this test method are greater than the limit shown in Guide C1778, the aggregate or combination of aggregate with the tested amount of pozzolan or slag is potentially alkali-reactive. Supplemental information should be developed to confirm that the expansion is actually due to alkali-silica reaction. Petrographic examination of the concrete prisms should be conducted after the test using Practice C856/C856M to confirm that known reactive constituents are present and to identify the products of alkali-silica reactivity. Confirmation of alkali-silica reaction is also derived from the results of the test methods this procedure supplements (see Guide C1778).

4.8 This test method does not address the general suitability of pozzolans or slag for use in concrete. These materials should comply with Specification C618, Specification C989/C989M, or Specification C1240.

5. Apparatus

5.1 The molds, the associated items for molding test specimens, and the length comparator for measuring length change shall conform to the applicable requirements of Test Method C157/C157M and Practice C490/C490M, and the molds shall have nominal 75 mm [3 in.] square cross sections.

5.2 The storage container options required to maintain the prisms at a high relative humidity are described in 5.2.1.

5.2.1 *Recommended Container*—The recommended containers are 19 L to 22 L [5 gal to 6 gal] polyethylene pails with airtight lids and approximate dimensions of 250 mm to 270 mm [9¾ in. to 10¾ in.] diameter at bottom, 290 mm to 310 mm [11¼ in. to 12¼ in.] at top, by 355 mm to 480 mm [14 in. to 19 in.] high. Prevent significant loss of enclosed moisture due to evaporation with airtight lid seal. Place a perforated rack in the bottom of the storage container so that the prisms are 30 mm to 40 mm [1⅛ in. to 1⅝ in.] above the bottom. Fill the container with water to a depth of 20 mm ± 5 mm [¾ in. ± ¼ in.] above the bottom. A significant moisture loss is defined as a loss greater than 3 % of the original amount of water placed at the bottom of the pail. Place a wick of absorbent material around the inside wall of the container from the top so that the bottom of the wick extends into the water (see Note 2).

5.2.2 *Alternative Containers*—Alternative storage containers may be used. Confirm the efficiency of the alternative storage container with an alkali-reactive aggregate of known

[4] Available from Canadian Standards Association (CSA), 5060 Spectrum Way, Mississauga, ON L4W 5N6, Canada, http://www.csa.ca.

[5] The boldface numbers in parentheses refer to a list of references at the end of this standard.