



Designation: C 356 – 87 (Reapproved 1997)

Standard Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat¹

This standard is issued under the fixed designation C 356; 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 amount of linear shrinkage and other changes that occur when a preformed thermal insulating material is exposed to soaking heat. This test method is limited to preformed high-temperature insulation that is applicable to hot-side temperatures in excess of 200°F (93°C), with the exception of insulating fire brick which is covered by Test Method C 210. At temperatures below 200°F, where humidity may also contribute to dimensional changes in a material, it should be tested in accordance with Test Method C 548.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.3 *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 154 Test Method for Warpage of Refractory Brick and Tile, or Deviation from a Plane Surface²
- C 168 Terminology Relating to Thermal Insulating Materials³
- C 210 Test Methods for Reheat Change of Insulating Firebrick⁴
- C 548 Test Method for Dimensional Stability of Low-Temperature Thermal Block and Pipe Insulation⁵

3. Terminology

3.1 *Definitions*—Terminology C 168 shall apply to the terms used in this test method.

¹ This test method is under the jurisdiction of ASTM Committee C-16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.31 on Chemical and Physical Properties.

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² Discontinued; see 1986 *Annual Book of ASTM Standards*, Vol 15.01.

³ *Annual Book of ASTM Standards*, Vol 04.06.

⁴ *Annual Book of ASTM Standards*, Vol 15.01.

⁵ Discontinued; see 1982 *Annual Book of ASTM Standards*, Vol 04.06.

4. Significance and Use

4.1 Linear shrinkage, as used in this test method, refers to the change in linear dimensions that has occurred in test specimens after they have been subjected to soaking heat for a period of 24 h and then cooled to room temperature.

4.2 Most insulating materials will begin to shrink at some definite temperature. Usually the amount of shrinkage increases as the temperature of exposure becomes higher. Eventually a temperature will be reached at which the shrinkage becomes excessive. With excessive shrinkage, the insulating material has definitely exceeded its useful temperature limit. When an insulating material is applied to a hot surface, the shrinkage will be greatest on the hot face. The differential shrinkage which results between the hotter and the cooler surfaces often introduces strains and may cause the insulation to warp. High shrinkage may cause excessive warpage and thereby may induce cracking, both of which are undesirable. High shrinkage may also open gaps at the insulation joints to an excessive extent rendering the application less efficient and more hazardous. In order to predict the limit of permissible shrinkage in service, the degree of linear shrinkage to be tolerated by specimens of an insulating material when subjected to soaking heat must be determined from experience.

4.3 It is recognized that a fixed relation between linear shrinkage under soaking heat and actual shrinkage in service cannot be established for different types of insulating materials. Generally the amount of shrinkage increases with time of exposure. The amount and rate of increase varies from one material to another. In addition, the various types of materials may have different amounts of maximum permissible shrinkage. Therefore, each product must define its own specific limits of linear shrinkage under soaking heat.

5. Apparatus

5.1 *Furnace*—A gas-fired or electrically heated muffle furnace, having a size sufficient to accommodate at least four test specimens and two dummy specimens, 6 by 2½ by 1½ in. (152.4 by 63.5 by 38.1 mm) (Note 1), spaced so as to allow a clearance of at least ½ in. (12.7 mm) on all surfaces of every test specimen. The temperature of the furnace shall be controlled throughout the volume occupied by the specimens to