Designation: ~~C199 – 84 (Reapproved 2016)~~ C199 – 22

Standard Test Method for Pier Test for Refractory Mortars[1]

This standard is issued under the fixed designation C199; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method covers the determination of refractoriness of all types of refractory mortar by heating a pier of brick laid up with the test mortar to learn whether the prescribed heat treatment causes the mortar to flow out of the joints.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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

1.4 *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:*[2]

C24 Test Method for Pyrometric Cone Equivalent (PCE) of Fireclay and High-Alumina Refractory Materials

C113 Test Method for Reheat Change of Refractory Brick

3. Significance and Use

3.1 This test method is used to estimate the application temperature limits of a refractory mortar and will establish its classification.

3.2 This test method will be regarded as a pass or fail test because the results are based on observations of whether the mortar flowed from the joints as a result of the heat treatment used.

3.3 Results obtained by this test method will not agree with those obtained in service when heating is done from only one side.

3.4 This test method is not applicable for testing nonaqueous mortars.

[1] This test method is under the jurisdiction of ASTM Committee C08 on Refractories and is the direct responsibility of Subcommittee C08.01 on Strength.

Current edition approved ~~June 1, 2016~~Feb. 1, 2022. Published ~~June 2016~~February 2022. Originally approved in 1945. Last previous edition approved in ~~2011~~2016 as C199 – 84 (2016). ~~(2011).~~ DOI: ~~10.1520/C0199-84R16.~~10.1520/C0199-22.

[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.

4. Apparatus

4.1 *Brick*—Three 9-in. (228-mm) straight fireclay or high-alumina brick, conforming to the following respective requirements for refractories:

~~Class of Mortar to be Tested~~	~~PCE,[A] Not Lower than Cone No.~~
~~High-alumina~~	~~36~~
~~Super-duty~~	~~33~~
~~High-duty~~	~~31½~~
~~Medium-duty~~	~~29~~

~~[A] See Test Method C24.~~

Class of Mortar to be Tested	PCE,[A] Not Lower Than Cone No.
High-alumina	36
Super-duty	33
High-duty	31½
Medium-duty	29

[A] See Test Method C24.

4.2 *Spacing Rods*—~~Spacing Rods—~~Nine joint-thickness spacing rods made of 3⁄32-in. (2-mm) diameter drill rod, cut into 6-in. (152-mm) lengths.

4.3 *Drying Oven,* to accommodate five 9-in. (228-mm) straight brick standing on end, for use at 220 to ~~230°F~~230 °F (105 to ~~110°C).~~110 °C).

4.4 *Furnace,* capable of heating the test pier uniformly at one of four temperatures, the highest being ~~3100°F (1705°C).~~3100 °F (1705 °C).

5. Sampling

5.1 The sample of mortar evaluated will be a prepared test sample of about 10 lb (4.5 kg). If a larger quantity is presented, ranging in size up to a commercial container, it must be reduced in size to about 10 lb (4.5 kg) for evaluation. To do this, the contents of the container shall be thoroughly mixed in the container, or transferred without loss to a clean impervious receptacle of larger size and mixed thoroughly to a uniform consistency. ~~A10 lb (4.5 kg)~~ A 10-lb (4.5-kg) test sample shall then be taken and sealed in a metal or glass container.

6. Test Specimens

6.1 The test mortar shall be of troweling consistency. When working with wet mortars not at this consistency small amounts of water will be added, followed by thorough mixing until a troweling consistency is achieved. For dry mortars, the mortar shall be thoroughly mixed with water to a troweling consistency, and allowed to stand in a suitable sealed container for a period of not less than 16 h before preparing the test specimen.

7. Procedure

7.1 *Construction of Pier:*

7.1.1 The pier shall consist of two whole brick and two half-brick laid flat. The top and bottom brick shall be whole brick, and between these the two half-brick shall be placed so that the original ends will form a vertical joint in the center of the pier. The class of mortar being tested shall determine the refractoriness of the brick to be used, as prescribed in 4.1. Uniformity in thickness of the joints in the pier shall be attained with the aid of the spacing rods.

7.1.2 Apply the mortar to the large face of one of the whole brick, after which place four spacing rods across it, ½ in. ~~(13 mm)~~ (13 mm) from the ends and ½ in. on either side of the center.

7.1.3 Coat a large face and the original end of a half-brick with mortar and place the coated face in contact with the rods on the lower brick. Prepare the other half-brick in the same manner, and when putting it in position to complete the vertical joint, place a spacing rod across and in the center of that joint. Also use four rods to form the top horizontal joint. Use mortar in excess of that actually required to form the joints.

7.1.4 Adjust the rods so that their ends are flush with one side of the pier. Firmly press or rub the brick units together so that the joints formed will not exceed ⅛ ~~in.~~ in. (3 mm) in thickness. Carefully remove the excess mortar from the joints, particularly on the side where the rods are flush.

7.1.5 Remove the spacing rods as soon as the mortar has developed an initial set, to prevent bulging of the mortar from the joint.

7.2 *Drying and Heat Treatment of Pier:*

7.2.1 After constructing the pier and removing the spacing rods, allow it to air-dry undisturbed at room temperature for ~~24 h,~~ 24 h, and then oven-dry at 220 to ~~230°F~~230 °F (105 to ~~110°C~~)110 °C) for ~~18 h~~ 18 h (overnight).

7.2.2 Carry out the heat treatment for each of the classes of mortar in accordance with all applicable portions of Test Method C113, as shown in the following table:

~~Class of Mortar~~	~~Heating Schedule (from heating schedule table in Test Method C113)~~
~~Super-duty~~	~~Schedule C (2910°F (1600°C))~~
~~High-duty~~	~~Schedule C, except that upon reaching 72730°F (1500°C) in approximately 3 h, that temperature shall be maintained for 5 h~~
~~Medium-duty~~	~~Schedule B (2550°F (1400°C))~~

~~For high-alumina mortars the schedule shall be as follows:~~

~~Elapsed Time From Start of Heating, h~~	~~Temperature, °F (°C)~~
~~1~~	~~1500 (815)~~
~~2~~	~~2300 (1260)~~
~~3~~	~~2750 (1510)~~
~~4~~	~~3010 (1655)~~
~~5~~	~~3100 (1705)~~
	~~Maintain for 5 h~~

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2	2300 (1260)
3	2750 (1510)
4	3010 (1655)
5	3100 (1705)
	Maintain for 5 h

8. Report

8.1 The report shall include the following:

8.1.1 Class of mortar for which the sample was tested, and