



Standard Classification of Fireclay and High-Alumina Refractory Brick¹

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

1. Scope

1.1 This classification covers machine-made fireclay and high-alumina refractory brick, and its purpose is to set forth the various classes and types of these materials in accordance with their normal and characteristic properties, which are important in their use.

2. Referenced Documents

2.1 ASTM Standards:

C 16 Test Method for Load Testing Refractory Brick at High Temperatures²

C 24 Test Method for Pyrometric Cone Equivalent (PCE) of Fireclay and High-Alumina Refractory Materials²

C 113 Test Method for Reheat Change of Refractory Brick²

C 133 Test Methods for Cold Crushing Strength and Modulus of Rupture of Refractories²

C 134 Test Methods for Size, Dimensional Measurements, and Bulk Density of Refractory Brick and Insulating Firebrick²

NOTE 1—Chemical analysis of refractory products is determined by a combination of x-ray fluorescence (XRF) and inductively coupled plasma (ICP) using standard reference materials (SRM), including various types of minerals and refractory materials that are available from the National Institute of Standards and Technology³ and other appropriate sources.

3. Significance and Use

3.1 Alumina-silica refractory brick is produced from various combinations of alumina and silica-containing materials. These bricks can vary in chemical composition from almost 100 % alumina and little silica to almost 100 % silica and little alumina. It is therefore useful to establish a classification scheme based on physical properties and chemical analysis. One group, fireclay brick, is classified based on physical properties since some overlap of alumina and silica content can

occur. A second group, high-alumina brick, is classified primarily based on alumina content. The classification allows those familiar with refractory materials to group similar products from various suppliers in a standard and consistent manner.

4. Basis of Classification

4.1 *Fireclay Brick* are divided into five different classes:

4.1.1 Super-duty,

4.1.2 High-duty,

4.1.3 Semi-silica,

4.1.4 Medium-duty, and

4.1.5 Low-duty.

4.2 The super- and high-duty classes are divided further into three types under each class.

4.3 *High-Alumina Brick* are divided into seven different classes by percent alumina:

4.3.1 50,

4.3.2 60,

4.3.3 70,

4.3.4 80,

4.3.5 85,

4.3.6 90, and

4.3.7 99.

5. Properties

5.1 The properties required for compliance with a class or type are shown in Table 1.

6. Test Specimens

6.1 Testing for compliance with this classification shall be performed on 9 by 4½ by 2½ or 3-in. (228 by 114 by 64 or 76-mm) rectangular brick as made, or on specimens of either size cut from larger units having dimensions not more than 3 in. (76 mm) in thickness, 6¾ in. (171 mm) in width, and 13½ in. (342 mm) in length.

7. Test Methods

7.1 The properties enumerated in this classification shall be determined in accordance with the following ASTM test methods:

7.1.1 *Pyrometric Cone Equivalent (PCE)*— Test Method C 24.

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² *Annual Book of ASTM Standards*, Vol 15.01.

³ Available from the National Institute of Standards and Technology (NIST), Gaithersburg, MD 20899.

TABLE 1 Fireclay and High Alumina Refractory Brick Classified According to Classes and Subdivided into Types

Class	Type	PCE, min	Hot Load Subsidence, max, %	Reheat Shrinkage, max, %	Modulus of Rupture, min, psi (MPa)	Other Test Requirements
<i>Fireclay Brick:</i> Super-duty	Regular	33	...	1.0 at 2910°F (1600°C)	600 (4.14)	...
	Spall-resistant	33	...	1.0 at 2910°F (1600°C)	600 (4.14)	...
	Slag-resistant	33	...	...	1000 (6.89)	Bulk density, min, 140 lb/ft ³ (2.24 g/cm ³)
High-duty	Regular	31½	...	...	...	...
	Spall-resistant	31½	...	...	500 (3.45)	...
	Slag-resistant	31½	...	...	1200 (8.27)	Bulk density, min, 137 lb/ft ³ (2.19 g/cm ³) or porosity, max, 15 %
Semi-silica		...	1.5 at 2460°F (1350°C)	...	300 (2.07)	Silica (SiO ₂) content, min, 72 %
Medium-duty		29	...	...	500 (3.45)	...
Low-duty		15	...	...	600 (4.14)	...
<i>High-Alumina Brick:</i>						<i>Alumina (Al₂O₃) content, %:</i>
Alumina, %:						
50		34	...	...	...	50 ± 2.5
60		35	...	...	...	60 ± 2.5
70		36	...	...	...	70 ± 2.5
80		37	...	...	...	80 ± 2.5
85		...	...	...	...	85 ± 2.0
90		...	...	...	...	90 ± 2.0
99		...	...	...	...	min, 97

7.1.2 *Reheat Test for Super-Duty Brick* (2910°F, 1600°C)—Schedule C of Test Method C 113.

7.1.3 *Load Test* (2460°F, 1350°C)—Schedule No. 2 of Method C 16.

7.1.4 *Modulus of Rupture*—Test Methods C 133.

7.1.5 *Bulk Density*—Test Methods C 134.

7.1.6 *Silica and Alumina Contents*—XRF and ICP.

material shall be resampled and retested when requested by either the manufacturer or the purchaser. This is applicable in instances when the first test results do not conform to the requirements prescribed in this classification. The final results to be used shall be the average of at least two sets of results, each of which has been obtained by following in detail the specified testing procedures.

8. Retests

8.1 If variables result from sampling or a lack of satisfactory reproducibility in tests conducted by different laboratories, the

9. Keywords

9.1 fireclay brick; high-alumina brick; properties

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