



Designation: C 435 – 93 (Reapproved 1999)

## Standard Classification of Steel Pouring Pit Fireclay Refractories<sup>1</sup>

This standard is issued under the fixed designation C 435; 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 classification covers certain fire-clay refractories for steel pouring pit service. It covers only burned products made by the usual processes of manufacture. The purpose of this classification is to describe the various classes and types of materials in accordance with the normal and characteristic properties that are important in their use.

1.2 *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 20 Test Methods for Apparent Porosity, Water Absorption, Apparent Specific Gravity, and Bulk Density of Burned Refractory Brick and Shapes by Boiling Water<sup>2</sup>
- C 24 Test Method for Pyrometric Cone Equivalent (PCE) of Fireclay and High-Alumina Refractory Materials<sup>2</sup>
- C 113 Test Method for Reheat Change of Refractory Brick<sup>2</sup>
- C 133 Test Methods for Cold Crushing Strength and Modulus of Rupture of Refractories<sup>2</sup>
- C 605 Test Method for Reheat Change of Fireclay Nozzles and Sleeves<sup>2</sup>

### 3. Significance and Use

3.1 This classification is important for the purpose of controlling the properties of steel pouring pit fireclay refractories during their manufacture, for use in specifying properties for purchasing these types of refractories and as a guide for the control of the quality of these refractories by the consumer.

### 4. Basis of Classification

4.1 For the purpose of this classification, pouring pit refractories are divided into the following three different classes:

4.1.1 Nozzles,

4.1.2 Sleeves, and

4.1.3 Ladle brick.

4.2 Each class is further divided into Types A, B, and C.

### 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 specimens selected at random. The number of specimens required for the test sample is given in Table 1.

### 7. Test Methods

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

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

7.1.2 *Apparent Porosity*—Test Methods C 20.

7.1.3 *Reheat Test for Ladle Brick*—Test Method C 113, using Schedule E for Type A, Schedule D for Type B, Schedule C and Schedule F for Type C.

7.1.4 *Reheat Linear Change for Sleeves and Nozzles*—Test Method C 605.

7.1.5 *Modulus of Rupture for Ladle Brick*—Test Methods C 133.

### 8. Retests

8.1 Because of variables resulting from sampling and the lack of satisfactory reproducibility in tests conducted by different laboratories, the material may be resampled and retested when requested by either the manufacturer or the purchaser. This may apply 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.

### 9. Keywords

9.1 fireclay ladle brick; fireclay nozzles; fireclay sleeves; pouring pit refractories

<sup>1</sup> This classification is under the jurisdiction of ASTM Committee C08 on Refractories and is the direct responsibility of Subcommittee C08.07 on Alumina, Silica, and Special Refractories.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 15.01.

**TABLE 1 Classification of Steel Pouring Pit Refractories According to Classes and Types**

Class	Type	PCE, Cone Number	Porosity, %	Reheat Linear Change	Modulus of Rupture, min, psi (MPa)	Number of Brick or Shapes Required for Testing <sup>A</sup>
Nozzles	A	15 to 20	8 min	1 % expansion (2460°F (1350°C)), min	...	10
	B	20 to 29	8 min	1 % expansion (2460°F (1350°C)), min	...	10
	C	29 min	10 min	1 % shrinkage (2460°F (1350°C)), max	...	10
Sleeves	A	15 to 20	10 min	1 % expansion (2460°F (1350°C)), min	...	10
	B	20 to 29	10 min	1 % expansion (2460°F (1350°C)), min.	...	10
	C	29 min	10 min	1 % shrinkage (2460°F (1350°C)), max	...	10
Ladle brick	A	15 min	18 max	5 % expansion (2350°F (1290°C)), min	700 (4.83)	10
	B	15 min	18 max	2.5 % expansion (2460°F (1350°C)), min	700 (4.83)	10
	C	26 min	18 max	0.5 % shrinkage (2730°F (1500°C)), max <sup>B</sup>	700 (4.83)	13

<sup>A</sup> Two extra brick or shapes are included to provide for those that may become damaged in shipment.

<sup>B</sup> If the product shows shrinkage in excess of 0.5 % in the test at 2730°F (1500°C) additional specimens shall be tested at 2910°F (1600°C), in which case no shrinkage shall develop.

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