



## Standard Specification for Fly Ash Facing Brick<sup>1</sup>

This standard is issued under the fixed designation C1790; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This specification covers fly ash brick intended for use in masonry, which are made from fly ash, water, and suitable mineral aggregates with or without the inclusion of other materials, and without the use of portland cement. This specification covers units intended for use in masonry, in both structural and facing applications.

1.2 Units covered under this specification include a fly ash binder that undergoes hydraulic, pozzolanic, alkali-activated, or geopolymer reactions, or any combination thereof. These chemical reactions, in conjunction with the other materials in the units, provide the strength and durability necessary to meet the requirements of this specification.

NOTE 1—This specification addresses properties of units formed using fly ash, aggregates, and other allowed binders. Although not required by this standard, users may request tests that establish assembly performance such as unit-mortar bond and fire resistance.

1.3 This specification references notes and footnotes, which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

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

1.5 *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:

- C33 Specification for Concrete Aggregates
- C140 Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
- C331 Specification for Lightweight Aggregates for Concrete Masonry Units

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.03 on Concrete Masonry Units and Related Units.

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- C426 Test Method for Linear Drying Shrinkage of Concrete Masonry Units
- C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- C979 Specification for Pigments for Integrally Colored Concrete
- C989 Specification for Slag Cement for Use in Concrete and Mortars
- C1232 Terminology of Masonry
- C1240 Specification for Silica Fume Used in Cementitious Mixtures
- C1645 Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units

### 3. Terminology

3.1 Terms defined in Terminology C1232 shall apply for this specification.

#### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *fly ash brick, n*—a masonry unit made from fly ash, water, and suitable aggregates with or without the inclusion of other materials and specifically without the inclusion of portland cement.

### 4. Materials

4.1 *Cementitious Materials*—No portland cement shall be used. Materials shall conform to the following applicable specifications:

- 4.1.1 *Pozzolans*—Specification C618.
- 4.1.2 *Slag Cement*—Specification C989.
- 4.1.3 *Silica Fume*—Specification C1240.

4.2 *Aggregates*—Aggregates shall conform to the following specifications, except that grading requirements shall not necessarily apply:

- 4.2.1 *Normal Weight Aggregates*—Specification C33.
- 4.2.2 *Lightweight Aggregates*—Specification C331.

4.3 *Pigments for Integrally Colored Concrete*—Specification C979.

4.4 *Other Constituents*—Other constituent materials shall be previously established as suitable for use in fly ash units and shall conform to applicable ASTM standards or shall be shown by test or experience not to be detrimental to the durability of the fly ash units or any material customarily used in masonry construction.

\*A Summary of Changes section appears at the end of this standard

## 5. Physical Properties

**5.1 Physical Requirements**—At the time of delivery to the purchaser, units shall conform to the physical requirements prescribed in **Table 1**. All units shall be sound and free of cracks or other defects that interfere with the proper placement of the units or significantly impair the strength or permanence of the construction. Minor cracks incidental to the usual method of manufacture or minor chipping resulting from customary methods of handling in shipment and delivery are not grounds for rejection.

**5.2 Strength**—When bricks are required having strengths greater than prescribed by this specification, the purchaser shall specify the desired minimum compressive strength.

**5.3 Durability**—Freeze-thaw durability shall be demonstrated by test. The units shall be tested in accordance with **8.5**. The average mass loss of all the specimens tested shall not be greater than: (a) 0.046 lb/ft<sup>2</sup> (225 g/m<sup>2</sup>) when subject to 28 freeze-thaw cycles, or (b) 0.102 lb/ft<sup>2</sup> (500 g/m<sup>2</sup>) when subject to 49 freeze-thaw cycles.

**5.4 Shrinkage**—At the time of delivery to the purchaser, the total linear drying shrinkage of units shall not exceed 0.065 % when tested in accordance with Test Method **C426**.

**NOTE 2**—The purchaser is the public body or authority, association, corporation, partnership, or individual entering into a contract or agreement to purchase or install, or both, fly ash facing brick. The time of delivery to the purchaser is FOB plant when the purchaser or the purchaser's agent transports the fly ash facing brick, or at the time unloaded at the worksite if the manufacturer or the manufacturer's agent transports the fly ash facing brick.

## 6. Permissible Variation in Dimensions

**6.1 Measured width, height, and length of test specimens** shall not differ by more than the amount shown in **Table 2**.

**NOTE 3**—Specified dimensions of fly ash facing brick are the manufacturer's designated dimensions.

**6.2** For those units with faces altered for aesthetic purposes, overall dimensional tolerances apply only to those dimensions not affected by the altering.

**NOTE 4**—For such units, dimensions will vary. Consult with suppliers to determine achievable dimensional tolerances.

**6.3** For cored fly ash facing brick, the net cross-sectional area in any plane parallel to the surface containing the cores shall be at least 75 % of the gross cross-sectional area measured in the same plane. No part of any hole shall be less than 3/4 in. (19.1 mm) from any edge of the unit.

**TABLE 2 Maximum Permissible Variation in Dimensions, in. (mm)**

Specified Dimensions, in. (mm)	Permissible Variation in Dimensions, in. (mm)
3 (76) and under	±1/16 (1.6)
Over 3-4 (76 to 102), incl	±3/32 (2.4)
Over 4 (102)	±1/8 (3.2)

## 7. Finish and Appearance

**7.1** At the time of delivery to the purchaser, no more than 5 % of the units in the shipment shall have finished face(s) that exhibit one or more of the characteristics described in **7.1.1** through **7.1.3**.

**7.1.1** Units containing chips larger than 1/2 in. (12.5 mm) in any dimension.

**7.1.2** Units containing cracks wider than 0.02 in. (0.5 mm) and longer than 25 % of the nominal height of the unit.

**7.1.3** Broken units.

**NOTE 5**—Units specified to have particular features or finishes, such as split face and tumbled units, should not be rejected based on the conformance of such features to the requirements of **7.1.1**.

**7.2** The finished face(s) of units shall not show imperfections except as permitted in **7.1.1** through **7.1.2** when viewed from a distance of 20 ft under diffused lighting.

**7.3** The color and texture shall be specified by the purchaser. The exposed faces shall conform to an approved sample consisting of not fewer than four units, representing the range of color and range of texture permitted.

**NOTE 6**—Fly ash brick are produced using a wide variety of natural aggregates and other materials. As such, slight variations inherent in natural materials should be expected. Since specifying units and approving samples can take place several months prior to production of actual units for a project, slight variations in appearance from the approved sample are to be expected.

## 8. Sampling and Testing

**8.1** For purposes of testing, the term lot refers to any number of fly ash units of any configuration or dimension manufactured by the producer using the same materials, mix design, manufacturing process, and curing method.

**8.2** Compressive strength and absorption shall be based on tests of fly ash facing brick from the same lot. Sample and test compressive strength and absorption in accordance with Test Methods **C140**, Annex A2, within 12 months of production of the units.

**TABLE 1 Strength, Absorption, and Density Classification Requirements<sup>A</sup>**

Density Classification	Oven-Dry Density, lb/ft <sup>3</sup> (kg/m <sup>3</sup> )	Maximum Water Absorption, lb/ft <sup>3</sup> (kg/m <sup>3</sup> )			Minimum Net Area Compressive Strength, lb/in. <sup>2</sup> (MPa)	
	Average of Three Units	Average of Three Units	Individual Units	Average of Three Units	Individual Units	
Lightweight	Less than 105 (1680)	15 (240)	17 (272)	3500 (24.1)	3000 (20.7)	
Medium Weight	105 to less than 125 (1680–2000)	13 (208)	15 (240)	3500 (24.1)	3000 (20.7)	
Normal Weight	125 (2000) or more	10 (160)	12 (192)	3500 (24.1)	3000 (20.7)	

<sup>A</sup>Average oven-dry density, based on a set of three units, shall fall within ranges defined in the table to be classified as lightweight, medium weight, or normal weight.

8.3 Dimensional tolerance shall be based on tests of fly ash facing brick of each configuration. Sample and test dimensional tolerance in accordance with Test Methods **C140**, within 12 months of production of the units.

8.4 Total linear drying shrinkage shall be based on tests of fly ash facing brick from the same lot, conducted in accordance with Test Method **C426**, within 24 months of production of the units.

8.5 Freeze-thaw durability shall be based on tests of fly ash facing brick made from the same lot, conducted in accordance with Test Method **C1645**, within 24 months of production of the units. Specimens sampled shall be tested in tap water.

## 9. Compliance

9.1 If a sample fails to conform to the specified physical requirements, the manufacturer shall be permitted to remove

units from the shipment. A new sample, with a similar configuration and dimension, shall be selected by the purchaser from remaining units in the shipment and tested. If the second sample meets the specified physical requirements, the remaining portion of the shipment represented by the sample meets the specified physical requirements. If the second sample fails to meet the specified physical requirements, the remaining portion of the shipment represented by the sample fails to meet the specified physical requirements.

## 10. Keywords

10.1 absorption; brick; compressive strength; durability; fly ash; fly ash brick; fly ash facing brick; fly ash masonry units; freeze thaw; linear drying shrinkage

## SUMMARY OF CHANGES

Committee C15 has identified the location of selected changes to this standard since the last issue (C1790 – 14a) that may impact the use of this standard. (June 1, 2015)

(1) Changed **Note 1**.

(2) Changed permissible variation in dimensions **(6.1)**.

Committee C15 has identified the location of selected changes to this standard since the last issue (C1790 – 14) that may impact the use of this standard. (December 15, 2014)

(1) Increased permissible variation in dimensions **(6.1)**.

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