



Designation: C216 – 16

Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)¹

This standard is issued under the fixed designation C216; 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 specification covers brick intended for use in masonry and supplying structural or facing components, or both, to the structure.

1.2 The property requirements of this specification apply at the time of purchase. The use of results from testing of brick extracted from masonry structures for determining conformance or nonconformance to the property requirements (Section 7) of this specification is beyond the scope of this specification.

1.3 The brick are prismatic units available in a variety of sizes, textures, colors, and shapes. This specification is not intended to provide specifications for paving brick (see Specification C902).

1.4 Brick are ceramic products manufactured primarily from clay, shale, or similar naturally occurring earthy substances and subjected to a heat treatment at elevated temperatures (firing). Additives or recycled materials are permitted to be included at the option of the manufacturer. The heat treatment must develop a fired bond between the particulate constituents to provide the strength and durability requirements of this specification (see Terminology C1232).

1.5 Brick are shaped during manufacture by molding, pressing, or extrusion, and the shaping method is a way to describe the brick.

1.5.1 This standard and its individual requirements shall not be used to qualify or corroborate the performance of a masonry unit made from other materials, or made with other forming methods, or other means of binding the materials.

1.6 Three types of brick in each of two grades are covered.

1.7 The text of this specification references notes and footnotes that provide explanatory material. These notes and

footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.8 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.

2. Referenced Documents

2.1 *ASTM Standards*:²

C67 Test Methods for Sampling and Testing Brick and Structural Clay Tile

C902 Specification for Pedestrian and Light Traffic Paving Brick

C1232 Terminology of Masonry

C1272 Specification for Heavy Vehicular Paving Brick

3. Terminology

3.1 *Definitions*—For definitions relating to masonry and facing brick, refer to Terminology C1232.

4. Classification

4.1 *Grades*—Grades classify brick according to their resistance to damage by freezing when saturated at a moisture content not exceeding the 24-h cold water absorption. Two grades of facing brick are covered and the requirements are given in Section 7.

4.1.1 *Grade SW (Severe Weathering)*—Brick intended for use where high resistance to damage caused by cyclic freezing is desired.

4.1.2 *Grade MW (Moderate Weathering)*—Brick intended for use where moderate resistance to cyclic freezing damage is permissible.

NOTE 1—Although grade is associated with resistance to deterioration under freeze/thaw exposures, freeze/thaw resistance of a clay brick unit is also affected by the properties of the surrounding materials, the construction details, and the overall environment in which the clay unit is placed;

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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.

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

TABLE 1 Physical Requirements

Designation	Minimum Compressive Strength psi, (MPa) gross area		Maximum Water Absorption by 5-h Boiling, %		Maximum Saturation Coefficient ^A	
	Average of 5 brick	Individual	Average of 5 brick	Individual	Average of 5 brick	Individual
Grade SW	3000 (20.7)	2500 (17.2)	17.0	20.0	0.78	0.80
Grade MW	2500 (17.2)	2200 (15.2)	22.0	25.0	0.88	0.90

^A The saturation coefficient is the ratio of absorption by 24-h submersion in cold water to that after 5-h submersion in boiling water.

each of which may influence exposure to moisture and freezing conditions. Brick masonry should be detailed to minimize saturation or near-saturation of the units in freezing conditions. Measurement of moisture content of brick in buildings indicates that, when the building is designed and constructed to reduce water penetration, the 24-h cold water absorption is unlikely to be exceeded.

4.2 *Types*—Three types of facing brick are covered:

4.2.1 *Type FBS*—Brick for general use in masonry.

4.2.2 *Type FBX*—Brick for general use in masonry where a higher degree of precision and lower permissible variation in size than permitted for Type FBS is required.

4.2.3 *Type FBA*—Brick for general use in masonry selected to produce characteristic architectural effects resulting from nonuniformity in size and texture of the individual units.

4.3 When the type is not specified, the requirements for Type FBS shall govern.

5. Ordering Information

5.1 Orders for facing brick under this specification shall include the following information:

5.1.1 *Grade* (Section 4.1)—Grade SW governs when grade is not specified.

5.1.2 *Type* (Section 4.2)—Type FBS governs when type is not specified.

5.1.2.1 For Type FBA, specify chippage (10.1), tolerances (Section 9), or approve a designated sample.

5.1.3 *Color, color range, and texture* (10.4) by approving a sample.

5.1.3.1 *Finish on more than one face and one end* (10.5).

5.1.4 *Size* (9.1)—Specify width by height by length.

5.1.5 *Sampling* (12.2)—Person to select samples and place or places of selection of samples for testing.

5.2 Orders for facing brick under this specification may include the following information:

5.2.1 *Strength* (7.2)—Specify only if above minimum compressive strength in Table 1.

5.2.2 *Coring* (11.1)—At option of manufacturer if not specified.

5.2.3 *Frogging* (11.2)—Frog permitted in one bearing face if not specified.

5.2.4 *Costs of Tests* (Note 14)—Party who will pay and conditions for payment of compliance testing.

5.2.5 *Special Shapes* (10.5)—Specify size, dimensions and finished faces by approved shop drawing or other means.

NOTE 2—Color, color range, and texture are best specified by identifying a particular manufacturer and unit designation. Nominal dimensions should not be used to specify size.

NOTE 3—See sections 7.3 and 8 for optional information.

6. Materials and Manufacture

6.1 Colors and textures produced by application of inorganic coatings to the faces of the brick shall be permitted with the consent of the purchaser, provided that evidence is furnished of the durability of the coatings. Brick that are colored by flashing or textured by sanding, where the sand does not form a continuous coating, shall not be considered as surface-colored brick for the purpose of this specification.

NOTE 4—When surface-colored brick, other than sanded or flashed, are specified for *exterior* use, the purchaser should require that data be submitted showing that after 50 cycles of freezing thawing there is no observable difference in the applied finish when viewed from a distance of 10 ft (3.0 m) under an illumination of not less than 50 fc (538 lx) by an observer with normal vision.

Service records of the performance of the particular coated brick in exterior locations may be accepted in place of the freezing and thawing test, upon consent of the purchaser.

6.2 The brick shall be free of defects, deficiencies, and surface treatments, including coatings, that would interfere with the proper laying of the brick or significantly impair the strength or performance of the construction.

6.3 If any post-firing coatings or surface treatments are applied by the manufacturer, the manufacturer shall report the type and extent of these coatings or surface treatments in all certificates of compliance with this specification.

7. Physical Properties

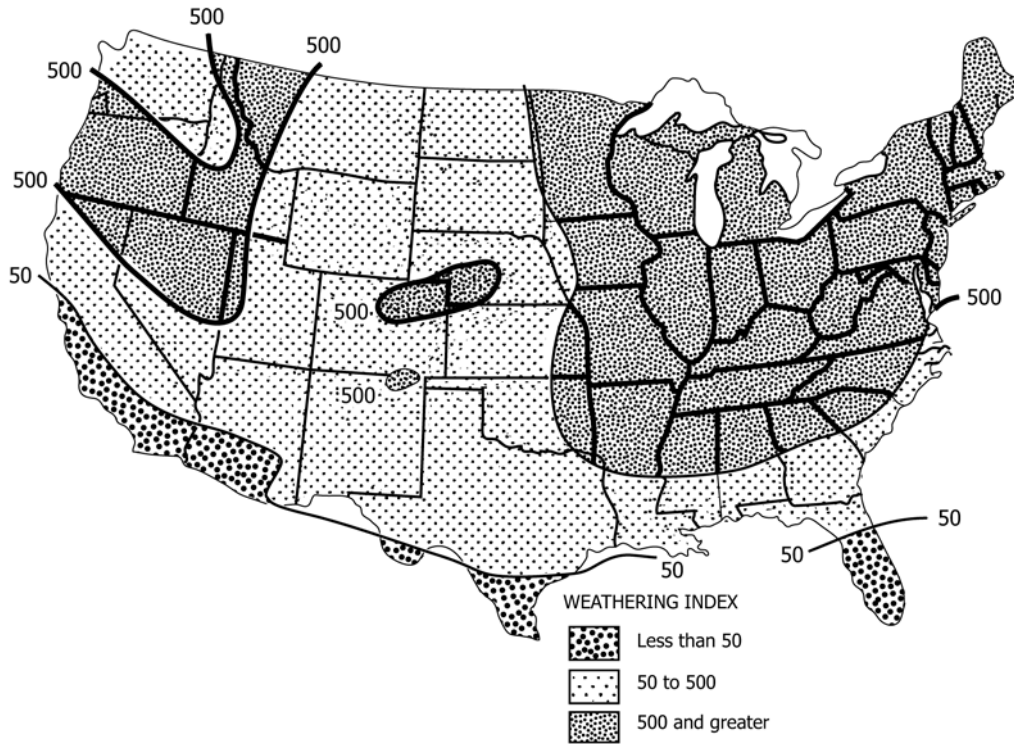
7.1 *Durability*—When grade is not specified, the requirements for Grade SW shall govern.

7.1.1 *Physical Property Requirements*—The brick shall conform to the physical requirements for the grade specified as prescribed in Table 1. For the compressive strength requirements in Table 1, test the unit with the compressive force perpendicular to the bed surface of the unit, with the unit in the stretcher position.

7.1.2 *Absorption Alternate*—The saturation coefficient requirement does not apply provided that the 24-h cold water absorption of each of the five units tested does not exceed 8.0 %.

7.1.3 *Freezing and Thawing Alternative*—The requirements for 5-h boiling water absorption and saturation coefficient do not apply, provided a representative sample of five brick, meeting the strength requirements of Table 1, passes the freezing and thawing test as described in the Rating Section of the Freezing and Thawing test procedures of Test Methods C67:

NOTE 5—The 50 cycle freezing and thawing test is used as an alternative only when the brick do not conform to either Table 1



Grade Recommendations for Face Exposures

Exposure	Weathering Index (Note 6)	
	Less than 50	50 and greater
In vertical surfaces:		
In contact with earth	SW or MW	SW
Not in contact with earth	SW or MW	SW
In other than vertical surfaces:		
In contact with earth	SW	SW
Not in contact with earth	SW or MW	SW

FIG. 1 Weathering Indices in the United States

requirements for maximum water absorption and saturation coefficient, or to the requirements of the Absorption Alternate in 7.1.2.

7.1.3.1 *Grade SW: Breakage and Weight Loss Requirement*—No individual unit separates or disintegrates resulting in a weight loss greater than 0.5 % of its original dry weight.

7.1.3.2 *Grade SW: Cracking Requirement*—No individual unit develops a crack that exceeds, in length, the unit's least dimension.

7.1.4 *Low Weathering Index Alternative*—If the brick are intended for use exposed to weather where the weathering index is less than 50 (see Fig. 1), and unless otherwise specified, the requirements given in Table 1 for 5-h boiling water absorption and for saturation coefficient shall not apply, but the minimum average compressive strength requirement of 2500 psi (17.2 MPa) shall apply.

NOTE 6—The effect of weathering on brick is related to the weathering index, which for any locality is the product of the average annual number of freezing cycle days and the average annual winter rainfall in inches

(millimetres), defined as follows.³

A *Freezing Cycle Day* is any day during which the air temperature passes either above or below 32°F (0°C). The average number of freezing cycle days in a year may be taken to equal the difference between the mean number of days during which the minimum temperature was 32°F or below, and the mean number of days during which the maximum temperature was 32°F or below.

Winter Rainfall is the sum, in inches (millimetres), of the mean monthly corrected precipitation (rainfall) occurring during the period between and including the normal date of the first killing frost in the fall and the normal date of the last killing frost in the spring. The winter rainfall for any period is equal to the total precipitation less one tenth of the total fall of snow, sleet, and hail. Rainfall for a portion of a month is prorated.

Fig. 1 indicates general areas of the United States that correspond to the weathering index categories listed. The index for geographic locations near the 50 line should be determined by analysis of weather bureau local climatological summaries, with due regard to the effect of microclimatic

³ Data needed to determine the weathering for any locality may be found or estimated from tables of Local Climatological Data—Annual Summary with Comparative Data available from the National Oceanic and Atmospheric Administration.

TABLE 2 Tolerances on Dimensions

Specified Dimension or Average Brick Size in Job Lot Sample, in. (mm)	Maximum Permissible Variation, in. (mm) plus or minus from:				
	Column A (for Specified Dimension)		Column B (for Average Brick Size in Job Lot Sample) ^A		
	Type FBX	Type FBS	Type FBX	Type FBS Smooth ^B	Type FBS Rough ^C
3 (76) and under	1/16 (1.6)	3/32 (2.4)	1/16 (1.6)	1/16 (1.6)	3/32 (2.4)
Over 3–4 (76 to 102), incl	3/32 (2.4)	1/8 (3.2)	1/16 (1.6)	3/32 (2.4)	1/8 (3.2)
Over 4–6 (102 to 152), incl	1/8 (3.2)	3/16 (4.8)	3/32 (2.4)	3/32 (2.4)	3/16 (4.8)
Over 6–8 (152 to 203), incl	5/32 (4.0)	1/4 (6.4)	3/32 (2.4)	1/8 (3.2)	1/4 (6.4)
Over 8–12 (203 to 305), incl	7/32 (5.6)	5/16 (7.9)	1/8 (3.2)	3/16 (4.8)	5/16 (7.9)
Over 12–16 (305 to 406), incl	3/32 (7.1)	3/8 (9.5)	3/16 (4.8)	1/4 (6.4)	3/8 (9.5)

^A Lot size shall be determined by agreement between purchaser and seller. If not specified, lot size shall be understood to include all brick of one size and color in the job order.

^B Type FBS Smooth units have relatively fine texture and smooth edges, including wire cut surfaces and dry-pressed brick. These definitions relate to dimensional tolerances only.

^C Type FBS Rough units are extruded brick with textured, rounded, or tumbled edges or faces, and molded brick. These definitions apply to dimensional tolerances only.

conditions, especially altitude.

The recommended correlation between grade of facing brick, weathering index, and exposure is found in Fig. 1. The specifier may use these recommendations or use the grade descriptions and physical requirements along with use exposure and local climatological conditions to select grade.

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

7.3 Initial Rate of Absorption (IRA)—Test results for IRA shall be determined in accordance with the IRA (Suction) (Laboratory Test) of Test Methods C67 and shall be furnished at the request of the specifier or purchaser. IRA is not a qualifying condition or property of units in this specification. This property is measured in order to assist in mortar selection and material handling in the construction process. See Note 7.

NOTE 7—Initial Rate of Absorption (Suction)—Both laboratory and field investigation have shown that strong and watertight joints between mortar and masonry units are not achieved by ordinary construction methods when the units as laid have excessive initial rates of absorption. Mortar that has stiffened somewhat because of excessive loss of mixing water to a unit may not make complete and intimate contact with the second unit, resulting in poor adhesion, incomplete bond, and water-permeable joints of low strength. IRA of the units is determined by the oven-dried procedure described in the IRA (Suction) (Laboratory Test) of Test Methods C67. IRA in the field depends on the moisture content of the masonry unit and is determined in accordance with the IRA (Suction)—Field Test of Test Methods C67. Units having average field IRA exceeding 30 g/min·30 in.² (30 g/min·194 cm²) should have their IRA reduced below 30 g/min·30 in.² prior to laying. They may be wetted immediately before they are laid, but it is preferable to wet them thoroughly 3 to 24 h prior to their use so as to allow time for moisture to become distributed throughout the unit.

NOTE 8—Loose sand, such as mold-release sand in molded brick and parting agents, used in the manufacturing process is not intended as a surface coating. Such loose sand is typically removed during the process of construction and cleaning and is not addressed in this specification.

NOTE 9—The cleaning procedures used on surface-coated brick can have an effect on the appearance of the surface coating. Manufacturers should be consulted for specific cleaning recommendations on these units.

8. Efflorescence

8.1 Brick are not required to be tested for efflorescence to comply with this specification unless requested by the specifier or purchaser. When the efflorescence test is requested by the

specifier or purchaser, the brick shall be sampled at the place of manufacture, and tested in accordance with Test Methods C67, and a rating for efflorescence shall be “not effloresced.” If the rating for efflorescence is “effloresced,” the brick represented by the testing do not meet the efflorescence requirements of this specification.

9. Dimensions and Permissible Variations

9.1 Size—The size of brick shall be as specified by the purchaser (see Note 10). In a sample of ten brick selected to represent the extreme range of sizes of brick to be supplied, no brick shall depart from the specified size by more than the individual tolerance for the type specified as prescribed in Table 2, Column A. The average size of the ten brick sample shall be determined, and no brick in the job lot (delivered brick) shall vary from this average size by more than the individual tolerance for the type specified as prescribed in Table 2, Column B. No individual brick in the job lot shall fall outside of the dimensional tolerances of Table 2, Column A. Tolerances on dimensions for Type FBA shall be as specified by the purchaser, but not more restrictive than FBS.

NOTE 10—Brick names denoting sizes may be regional and, therefore, may not be included in all reference books. Purchasers should ascertain the sizes of brick available in their locality and should specify accordingly, stating the desired dimensions (width by height by length).

9.2 Warpage—Tolerances for warpage of surfaces or edges intended to be exposed in use of individual brick from a plane surface and from a straight line, respectively, shall not exceed the maximum for the type specified as prescribed in Table 3. Tolerances for warpage for Type FBA shall be as specified by the purchaser.

9.3 Out-of-Square—The maximum permitted dimension for out-of-square of the finished face of the brick is 1/8 in. (3.2 mm) for Type FBS brick and 3/32 in. (2.4 mm) for Type FBX brick. Tolerances on out-of-square for Type FBA brick shall be specified by the purchaser.

NOTE 11—Linear dimensions and flat surfaces of specially shaped brick shall meet the requirements for size and warpage, respectively, of the specified type. Tolerances for size and warpage of nonlinear dimensions and surfaces, and out-of-square shall be determined by agreement with the manufacturer.

TABLE 3 Tolerances on Warpage

Maximum Dimension, in. (mm)	Maximum Permissible Warpage, in. (mm)	
	Type	Type
	FBX	FBS
8 (203) and under	1/16 (1.6)	3/32 (2.4)
Over 8–12 (203 to 305), incl	3/32 (2.4)	1/8 (3.2)
Over 12–16 (305 to 406), incl	1/8 (3.2)	5/32 (4.0)

10. Finish and Appearance

10.1 The face or faces that will be exposed in place shall be free of chips that exceed the limits given in **Table 4**. The aggregate length of chips shall not exceed 10 % of the perimeter of the face of the brick.

NOTE 12—Of all the units that will be exposed in place, a small percentage of the units may have chips that are larger in size than those chips allowed for the majority of the units. This special allowed percentage, listed in the second column from the left of **Table 4** ranges up to 5 % for FBX, up to 10 % for FBS (Plain), and up to 15 % for FBS (Textured). The remainder of the units that will be exposed in place, listed in the fifth column from the left, must conform to the chip sizes listed in the sixth and seventh columns from the left.

Example: Type FBS (Plain) units will conform to the requirements of **Table 4** if not more than 10 % of the units have edge chips greater than 1/4 in. (6.4 mm) but less than 5/16 in. (7.9 mm) or corner chips greater than 3/8 in. (9.5 mm) but less than 1/2 in. (12.7 mm) and the remainder of the units, in this maximum case 90 % (100 % – 10 %) do not have edge chips greater than 1/4 in. (6.4 mm) in from the edge nor corner chips greater than 3/8 in. (9.5 mm) in from the corner.

10.1.1 Other than chips, the face or faces shall be free of cracks or other imperfections detracting from the appearance of the designated sample when viewed under diffused lighting from a distance of 15 ft (4.6 m) for Type FBX and a distance of 20 ft (6.1 m) for Types FBS and FBA.

10.2 The number of brick in a delivery that are broken or otherwise fail to meet the requirements for chippage and tolerances shall not exceed 5 %.

10.3 After brick are placed in usage, the manufacturer or the manufacturer’s agent shall not be held responsible for compliance of brick with the requirements of this specification for chippage and tolerances.

10.4 If brick having a particular color, color range, or texture are desired, these features shall be specified separately by the purchaser. At least one end of the majority of the individual brick shall have the same general texture and general color tone as the approved sample. The texture of the finished surfaces that will be exposed when in place shall conform to an approved sample consisting of not less than four

stretcher brick, each representing the texture desired. The color range shall be indicated by the approved sample.

10.5 Where brick with other than one finished face and one finished end are required (brick with two finished faces or ends, or other types), all such special brick shall be explicitly specified by the purchaser.

NOTE 13—The manufacturer should be consulted for the availability of specialty units suitable for the intended purpose.

11. Coring and Frogging

11.1 *Coring*—Brick are cored at the option of the manufacturer. Special coring configurations or 100 % solid units shall be specified and shall meet all other requirements of this section. The net cross-sectional area of cored brick 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 brick.

11.2 *Frogging*—Brick are frogged at the option of the manufacturer; brick required to be without frogs shall be specified by the purchaser and shall meet all other requirements of this section. One bearing surface of each brick shall be permitted to have a recess (panel frog) or deep frogs, or both. The recess or panel frog shall not exceed 3/8 in. (9.5 mm) in depth and no part of the recess or panel frog shall be less than 3/4 in. (19.1 mm) from any edge of the brick. In brick containing deep frogs, frogs deeper than 3/8 in. (9.5 mm), any cross-section through the deep frogs parallel to the surface containing the deep frogs shall conform to the requirements of **11.1**.

12. Sampling and Testing

12.1 The brick shall be sampled and tested in accordance with applicable sections in Test Methods **C67**.

NOTE 14—Unless otherwise specified in the purchase order, the cost of tests is typically borne as follows: If the results of the tests show that the brick do not conform to the requirements of this specification, the cost is typically borne by the seller. If the results of the tests show that the brick do conform to the requirements of this specification, the cost is typically borne by the purchaser.

12.2 The manufacturer or the seller shall furnish specimens for tests. The place or places of selection shall be designated when the purchase order is placed.

13. Keywords

13.1 appearance requirements; clay; facing brick; fired masonry units; masonry; physical properties; shale; solid brick

TABLE 4 Maximum Permissible Extent of Chippage From the Edges and Corners of Finished Face or Faces onto the Surface

Type	Percentage Allowed ^A	Chippage in in. (mm) in from		Percentage Allowed ^A	Chippage in in. (mm) in from	
		Edge	Corner		Edge	Corner
FBX	5 % or less	$\frac{1}{8}$ – $\frac{1}{4}$ (3.2–6.4)	$\frac{1}{4}$ – $\frac{3}{8}$ (6.4–9.5)	95 to 100 %	0 – $\frac{1}{8}$ (0–3.2)	0 – $\frac{1}{4}$ (0–6.4)
FBS ^B (Plain)	10 % or less	$\frac{1}{4}$ – $\frac{5}{16}$ (6.4–7.9)	$\frac{3}{8}$ – $\frac{1}{2}$ (9.5–12.7)	90 to 100 %	0 – $\frac{1}{4}$ (0–6.4)	0 – $\frac{3}{8}$ (0–9.5)
FBS ^C (Textured)	15 % or less	$\frac{5}{16}$ – $\frac{7}{16}$ (7.9–11.1)	$\frac{1}{2}$ – $\frac{3}{4}$ (12.7–19.1)	85 to 100 %	0 – $\frac{5}{16}$ (0–7.9)	0 – $\frac{1}{2}$ (0–12.7)
FBA	to meet the designated sample or as specified by the purchaser, but not more restrictive than Type FBS (rough)					

^A Percentage of exposed brick allowed in the wall with chips measured the listed dimensions in from an edge or corner.

^B Plain units are extruded brick with an unbroken natural die finish face and dry-pressed brick.

^C Textured units are extruded brick with the face sanded, combed, scratched, scarified, or broken by mechanical means such as wire-cutting or wire-brushing, and molded brick.

APPENDIXES

(Nonmandatory Information)

X1. INTRODUCTION

X1.1 A thorough understanding of facing brick use begins with comprehension of this specification, ASTM C216. This appendix is designed to explain the specification, noting subtleties and relationships that might not otherwise be clear. This specification provides requirements for brick as a product.

It cannot cover all of the considerations for the uses of brick.

X1.2 Since this specification was first published in 1947, it has undergone many changes, and continues to do so under the jurisdiction of ASTM Committee C15.

X2. SCOPE (Section 1)

X2.1 This specification covers units made primarily from clay or shale that are formed to a specific shape, dried, and fired. Brick are made from a wide variety of materials, with variations in local geology determining the use of appropriate raw materials and mineral content. Manufacturers often add other materials to improve the forming, color and performance properties of the resulting brick. More recently, recycled materials have been incorporated in brick production. The brick may be extruded, molded, or dry-pressed. Brick covered by this specification must be fired at a temperature high enough to produce “incipient fusion,” the start of a permanent, glassy bond between the inorganic particles. Adobe units, which are either sun-dried or stabilized with asphalt, are not covered by this specification. There is no ASTM specification for adobe units.

physical properties necessary to ensure the performance or serviceability of the other product in real-world applications under typical exposure environments.

X2.3 Fired clay masonry units, commonly known as “brick,” have been used extensively throughout the world for centuries as basic masonry building units. Brick are available in many colors, sizes, and textures, are made of fired clay or shale, and are usually in the form of rectangular prisms, of a size convenient to be installed by hand. Facing brick are used primarily for masonry elements requiring a finished appearance.

X2.4 Brick properties can change over time after bricks are placed in use. Properties of brick addressed by this specification that may change include cold and boiling water absorption, initial rate of absorption, saturation coefficient, efflorescence, size, and compressive strength. Properties can be affected by contact with mortar, paint, plaster, or other coatings. Brick increase in size due to irreversible moisture expansion or by freeze-thaw cycling when wet. Brick can decrease in compressive strength due to freeze-thaw cycling or salt crystallization. As a consequence, the property requirements of this specification apply only at the time of purchase. Although brick can be tested after removal from a structure, results of those tests should not be used to check compliance with this specification