



Designation: C 216 – 01

## Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)<sup>1</sup>

This standard is issued under the fixed designation C 216; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

*This standard has been approved for use by agencies of the 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 standard 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 6) of this standard is beyond the scope of this standard.

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 C 902).

1.4 Brick are manufactured from clay, shale, or similar naturally occurring earthy substances and subjected to a heat treatment at elevated temperatures (firing). The heat treatment must develop a fired bond between the particulate constituents to provide the strength and durability requirements of this specification (see firing, fired bond, and incipient fusion in Terminology C 43).

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

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

1.7 The text of this standard 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.

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

### 2. Referenced Documents

#### 2.1 ASTM Standards:

C 43 Terminology of Structural Clay Products<sup>2</sup>

C 67 Test Methods of Sampling and Testing Brick and Structural Clay Tile<sup>2</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.02 on Brick and Structural Clay Tile.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 04.05.

C 902 Specification for Pedestrian and Light Traffic Paving Brick<sup>2</sup>

E 835/E 835M Guide for Modular Coordination of Clay and Concrete Masonry Units<sup>3</sup>

### 3. Grades

3.1 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 Table 1.

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

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

NOTE 1—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 should not be exceeded.

### 4. Types

4.1 Three types of facing brick are covered:

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

4.1.2 *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.

4.1.3 *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.

4.2 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 3)—Grade SW governs when Grade is not specified.

5.1.2 *Type* (Section 4)—Type FBS governs when Type is not specified.

5.1.2.1 For Type FBA, specify chippage (Table 3), tolerances (Section 10), or approve a designated sample.

<sup>3</sup> Annual Book of ASTM Standards, Vol 04.07.

\*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 <sup>A</sup>	
	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

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

TABLE 2 Grade Recommendations for Face Exposures

Exposure	Weathering Index (Note 4 and Fig. 1)	
	Less than 50	50 and greater
In vertical surfaces:		
In contact with earth	MW	SW
Not in contact with earth	MW	SW
In other than vertical surfaces:		
In contact with earth	SW	SW
Not in contact with earth	MW	SW

5.1.3 Color, color range, and texture (9.1) by approving a sample.

5.1.3.1 Finish on more than one face and one end (9.2).

5.1.3.2 *Grade SW: Breakage Requirement*—No individual unit separates into two or more significant pieces.

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

5.1.4 *Size* (10.1)—Specify width by height by length.

5.1.5 *Sampling* (12.1)—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* (6.2)—Specify if above minimum compressive strength in Table 1.

5.2.2 *Chippage and Tolerance Variance* (8.5)—Change from 5% not meeting the requirements.

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

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

5.2.5 *Costs of Tests* (Note 11)—Party to pay and conditions for payment of compliance testing.

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.

**6. Physical Properties**

6.1 *Durability*—When Grade is not specified, the requirements for Grade SW shall govern. Unless otherwise specified by the purchaser, brick of Grade SW shall be accepted instead of Grade MW.

6.1.1 *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.

6.1.2 *Absorption Alternate*—The saturation coefficient requirement does not apply, provided the 24-h cold water

absorption of each unit of a random sample of five brick does not exceed 8.0 %.

6.1.3 *Freezing and Thawing Alternative*—The requirements for 5 h boiling water absorption and saturation coefficient do not apply, provided a 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 C 67:

6.1.3.1 *Grade SW—Weight Loss Requirement*—Not greater than 0.5 % loss in dry weight of any individual unit.

NOTE 3—The 50 cycle freezing and thawing test is used as an alternative only when the brick do not conform to either Table 1 requirements for maximum water absorption and saturation coefficient, or to the requirements of the Absorption Alternate in 6.1.2.

6.1.4 *Waiver of Absorption and Saturation Coefficient Requirements*—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 4—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.<sup>4</sup>

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 which correspond to the weathering index categories found in Table 2. 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 conditions, especially altitude.

The recommended correlation between grade of facing brick, weathering index, and exposure is found in Table 2. 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.

6.2 *Strength*—When brick are required having strengths greater than prescribed by this specification, the purchaser shall

<sup>4</sup> 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 3 Maximum Permissible Extent of Chippage From the Edges and Corners of Finished Face or Faces onto the Surface

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

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

<sup>B</sup> Smooth texture is the unbroken natural die finish.

<sup>C</sup> Rough texture is the finish produced when the face is sanded, combed, scratched, or scarified or the die skin on the face is entirely broken by mechanical means such as wire-cutting or wire-brushing.

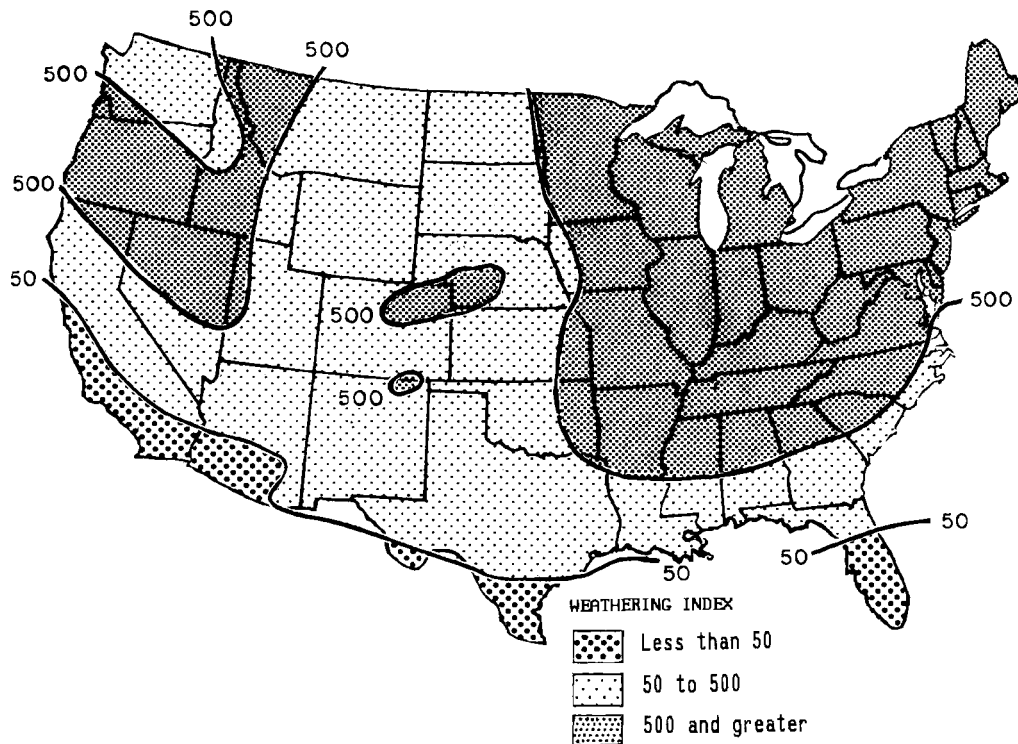


FIG. 1 Weathering Indices in the United States (see Table 2)

specify the desired minimum compressive strength.

6.3 Initial Rate of Absorption (IRA)—Test results for IRA shall be determined in accordance with the IRA (Suction) (Laboratory Test) of Test Methods C 67 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 5.

NOTE 5—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 C 67. 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 C 67. Units having average field IRA

exceeding 30 g/min·30 in.<sup>2</sup> (30 g/min·194 cm<sup>2</sup>) should have their IRA reduced below 30 g/min·30 in.<sup>2</sup> 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.

7. Efflorescence

7.1 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 C 67, 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.

8. Material and Finish

8.1 Colors and textures produced by application of inorganic coatings to the faces of the brick are 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, are not considered as surface-colored brick for the purpose of this specification.

NOTE 6—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 ft-candles (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.

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

8.3 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.

8.4 The face or faces that will be exposed in place shall be free of chips that exceed the limits given in Table 3. The aggregate length of chips shall not exceed 10 % of the perimeter of the face of the brick.

NOTE 7—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 3 ranges up to 5 % for FBX, up to 10 % for FBS Smooth, and up to 15 % for FBS Rough. 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 Smooth units will conform to the requirements of Table 3 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.

8.4.1 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 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.

8.5 Unless otherwise agreed upon between the purchaser and the seller, a delivery of brick is permitted to contain not more than 5 % brick, including broken brick, that do not meet the requirements for chippage and tolerances.

8.6 After brick are placed in usage the manufacturer or his agent shall not be held responsible for compliance of brick with the requirements of this specification for chippage and dimensional tolerances.

9. Texture and Color

9.1 If brick having a particular color, color range, or texture are desired, these features shall be specified separately by the purchaser. Unless otherwise specified 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.

9.2 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 8—The manufacturer should be consulted for the availability of specialty units suitable for the intended purpose.

10. Size and Tolerances

10.1 Size—The size of brick shall be as specified by the purchaser (see Note 9). 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 4, 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 4, Column B. No individual brick in the job lot shall fall outside of the dimensional tolerances of Table 4, Column A. Tolerances on dimensions for Type FBA shall be as specified by the purchaser, but not more restrictive than FBS.

TABLE 4 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) <sup>A</sup>		
	Type FBX	Type FBS	Type FBX	Type FBS Smooth <sup>B</sup>	Type FBS Rough <sup>C</sup>
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	9/32 (7.1)	3/8 (9.5)	3/16 (4.8)	1/4 (6.4)	3/8 (9.5)

<sup>A</sup> 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.

<sup>B</sup> Type FBS Smooth units have relatively fine texture and smooth edges, including wire cut surfaces. These definitions relate to dimensional tolerances only.

<sup>C</sup> Type FBS Rough units have textured, rounded, or tumbled edges or faces. These definitions apply to dimensional tolerances only.



NOTE 9—For a list of modular sizes, see Guide E 835/E 835M. Sizes listed in this standard are not produced in all parts of the United States. 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).

10.2 *Warpage*—Tolerances for distortion or 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 5. Tolerances on distortion for Type FBA shall be as specified by the purchaser.

10.3 *Out-of-Square*—The maximum permitted dimension for out-of-square of the exposed 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 10—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.

11. **Coring and Frogging**

11.1 *Coring*—Unless otherwise specified in the invitation for bids, brick are cored at the option of the seller. 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*—Unless otherwise specified in the invitation for bids, one bearing face of each brick is permitted to have a recess or panel frog and deep frogs. 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 For purposes of tests, brick that are representative of the commercial product shall be selected by a competent person appointed by the purchaser, the place or places of selection to be designated when the purchase order is placed. The sample or samples shall include specimens representative of the complete range of colors and sizes of the brick supplied or to be supplied. The manufacturer or the seller shall furnish specimens for tests without charge.

12.2 The brick shall be sampled and tested in accordance with Test Methods C 67.

NOTE 11—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.

13. **Keywords**

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

TABLE 5 Tolerances on Distortion

Maximum Dimension, in. (mm)	Maximum Permissible Distortion, in. (mm)	
	Type FBX	Type 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)	3/16 (4.0)

SUMMARY OF CHANGES

Committee C15 has identified the location of selected changes to this standard since C 216–00 that may impact the use of this standard.

- (1) End points for breakage and cracking were added to Paragraph 5.1.3.
- (2) Paragraph 7.1 was modified to clarify the place of sam-

pling for efflorescence testing and whether the brick must pass the requirement for efflorescence in order to comply with the standard.

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