



Designation: C 212 – 9600

## Standard Specification for Structural Clay Facing Tile<sup>1</sup>

This standard is issued under the fixed designation C 212; 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.

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

### 1. Scope

1.1 This specification covers structural clay load-bearing facing tile. Structural facing tile are tile designed for use in interior and exterior unplastered walls and partitions of buildings.

1.2 The property requirements of this standard apply at the time of purchase. The use of results from testing of tile extracted from masonry structures for determining conformance or nonconformance to the property requirements (Section 6 and 7) of this standard is beyond the scope of this standard.

1.3 Tile covered by this standard are manufactured from clay, shale, or similar naturally occurring substances and subjected to a heat treatment at elevated temperatures (firing). The heat treatment must develop sufficient fired bond between the particulate constituents to provide the strength and durability requirements of this specification. (See *firing* and *fired bond* in Terminology C 43.)

1.4 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.

### 2. Referenced Documents

2.1 *ASTM Standards:*

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<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C-15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.02 on Clay Brick and Structural Clay Tile.

Current edition approved July 10, 1996; 2000. Published September 1996; January 2001. Originally published as C 212-46. Last previous edition C 212-93; C 212-96.

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>

### 3. Types

3.1 Two types of structural clay facing tile are covered, as follows:

3.1.1 *Type FTX*—Smooth-face tile suitable for general use in exposed exterior and interior masonry walls and partitions, and adapted for use where tile low in absorption, easily cleaned, and resistant to staining are required, and where a high degree of mechanical perfection, narrow color range, and minimum variation in face dimensions are desired.

3.1.2 *Type FTS*—Smooth- or rough-texture face tile suitable for general use in exposed exterior and interior masonry walls and partitions and adapted for use where tile of moderate absorption, moderate variation in face dimensions, and medium color range are permitted, and where minor defects in surface finish, including small handling chips, are not objectionable.

### 4. Classes

4.1 Two classes of structural clay facing tile are covered, as follows:

4.1.1 *Standard*—Tile suitable for general use in exterior or interior masonry walls and partitions.

4.1.2 *Special Duty*—Tile suitable for general use in exterior or interior masonry walls and partitions, and designed to have superior resistance to impact and moisture transmission and to support greater lateral and compressive loads than standard tile construction.

### 5. Ordering Information

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

5.1.1 *Type*—See Section 3.

5.1.2 *Class*—See Section 4. When class is not specified, the requirements for standard tile shall govern. If special duty tile are desired, the words “special duty” shall be included in the specifications. Special duty tile shall be accepted in lieu of standard tile except where the extra weight is an important factor in the loading of supporting members.

5.1.3 *Texture and Color*—See Section 9.

5.1.4 *Sizes*—See Section 10. Sizes shall be as specified.

5.1.5 *Number of Faces*—If two-face tile are desired, this shall be stated by the purchaser; otherwise, single-face tile may be furnished.

NOTE 1—See Section 15 for supplementary requirements applying to two-face tile.

### 6. Absorption

6.1 The tile shall conform to one of the requirements for water absorption of the type specified as prescribed in Table 1.

6.2 For Type FTS tile for use in masonry not exposed to frost action or in exposed masonry walls with an outside facing of 3 in. (76.2 mm) or more of stone, brick, or other masonry, limitations on absorption shall be waived.

### 7. Compressive Strength

7.1 The tile shall conform to the requirements for compressive strength of the class specified as prescribed in Table 2.

7.2 Special duty tile shall be accepted in lieu of standard tile except where the extra weight is an important factor in the loading of supporting members.

### 8. Material, Workmanship, and Finish

8.1 The body of all tile shall be of clay, shale, fire clay, or mixtures of these materials with or without admixtures, burned to meet the requirements of this specification. The body of all tile shall be free of cracks longer than one fourth of the dimension of the tile in the direction of the crack. The face or faces that will be exposed when in place shall be free of cracks that extend through the thickness of the face shell and free of chips that exceed the limits given in Table 3, except that percentages of the shipment

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

**TABLE 1 Maximum Water Absorption**

Type	By 24-h Sub- mersion in Cold Water, %		— By 1-h Boiling, %	
	Average	Individual	Average	Individual
FTX	7	9	9	11
FTX	7	9	9	11.0
FTS	13	16	16	19
FTS	13.0	16.0	16.0	19.0

**TABLE 2 Compressive Strength Based on Gross Area**

Class	End-Construction Tile		Side-Construction Tile	
	Minimum Average of Five Tests, psi (MPa)	Individual Minimum, psi (MPa)	Minimum Average of Five Tests, psi (MPa)	Individual Minimum, psi (MPa)
Standard	1400 (9.7)	1000 (6.9)	700 (4.8)	500 (3.4)
Special duty	2500 (17.2)	2000 (13.8)	1200 (8.3)	1000 (6.9)

**TABLE 3 Maximum Permissible Extent of Chippage From the Edges and Corners of Finished Face or Faces Into the Surfaces**

Type	Chippage in inches (millimetres) in from	
	Edge	Corner
FTX	¼ (3.2)	¼ (6.4)
FTS (smooth) <sup>A</sup>	¼ (6.4)	⅜ (9.5)
FTS (rough) <sup>B</sup>	⅝ (7.9)	½ (12.7)

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

<sup>B</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.

are allowed additional chippage which shall not exceed the limits given in Table 4. The tile shall be free of other imperfections detracting from the appearance of the finished wall when viewed at a distance of 10 ft (3.04 m) for Type FTX and at a distance of 15 ft (4.57 m) for Type FTS.

8.2 *Plaster Base Finish*—Surfaces of tile for plaster-base finish shall be smooth, scored, combed, or roughened. When smooth, the tile shall be free of glaze and the absorption shall be not less than 5%. When scored, each groove shall be not less than ¼ in. (1.6 mm) nor more than ¼ in. (6.4 mm) in depth and not more than 1 in. (25.4 mm) in width. The area covered by grooves shall not exceed 50% of the area of the scored faces. When combed, the tile shall be scratched or scarified, prior to burning, by mechanical means which shall make scratches or scarifications on the surface of the tile not less than ¼ in. (1.6 mm) nor more than ⅛ in. (3.2 mm) in depth, and not more than ¼ in. apart. When roughened, the die skin on the face of the tile shall be entirely broken by mechanical means, such as wire cutting or wire brushing. (The die skin is visible within the cells of the tile.)

## 9. Texture and Color

9.1 *Type FTX*—The face or faces of all tile that will be exposed when in place shall have a smooth and unbroken natural die finish. (The die finish is visible within the cells of the tile.) The color range of the finished faces shall conform to an approved sample consisting of not less than five stretcher tile fully representing the range of shade.

9.2 *Type FTS*—The texture of the finished surface that will be exposed when in place shall conform to an approved sample consisting of not less than five stretcher tile, each representing the texture desired. The approximate color range shall be indicated by an approved sample consisting of not less than five stretcher tile.

NOTE 2—Facing tile are not ordinarily available in uniform (straight range) colors. Samples submitted for approval should include the extremes of the color ranges that will be furnished, unless full burning range (kiln run) is acceptable.

## 10. Sizes and Shapes

10.1 The tile shall be of the sizes and shapes specified.

## 11. Tolerances

11.1 *Tolerances on Dimensions*—The average size of the tile furnished shall approximate closely the size specified in the invitation for bids. The dimensions of individual tile shall not differ from the specified standard dimensions for the type specified by more than the amounts given in Table 5.

11.2 *Tolerances on Distortion*, Distortion of face or edges of individual tile from a plane surface or from a straight line, respectively, shall not exceed the amounts shown in Table 6 for the type specified.

**TABLE 4 Percentages of Shipment Allowed Chippage Over Maximum Permissible in Table 3**

Type	Percentage Allowable	Chippage in inches in from	
		Edge	Corner
FTX	5	¼ (6.4)	⅜ (9.5)
FTS (smooth)	10	⅝ (7.9)	½ (12.7)
FTS (rough)	15	⅞ (11.1)	¾ (19.1)

**TABLE 5 Tolerances on Dimensions**

Specified Unit Dimension, in. (mm)	Maximum Permissible Variation from Specified Unit Dimension, plus or minus, in. (mm)	
	FTX	FTS
3 (76.2) and under	$\frac{1}{16}$ (1.6)	$\frac{3}{32}$ (2.4)
Over 3 to 4 (76.2 to 101.6); Over 3 to 4 (76.2 to 101.6), incl —incl	$\frac{3}{32}$ (2.4)	$\frac{2}{16}$ (3.2)
Over 4 to 6 (101.6 to 152.4), incl Over 4 to 6 (101.6 to 152.4); —incl	$\frac{2}{16}$ (3.2)	$\frac{3}{16}$ (4.8)
Over 6 to 8 (152.4 to 203.2), incl Over 6 to 8 (152.4 to 203.2); —incl	$\frac{5}{32}$ (4.0)	$\frac{4}{16}$ (6.4)
Over 8 to 12 (203.2 to 304.8), incl Over 8 to 12 (203.2 to 304.8); —incl	$\frac{7}{32}$ (5.6)	$\frac{5}{16}$ (7.9)
Over 12 to 16 (304.8 to 406.4), incl Over 12 to 16 (304.8 to 406.4); —incl	$\frac{9}{32}$ (7.1)	$\frac{6}{16}$ (9.5)

**TABLE 6 Tolerances on Distortion**

Maximum Face Dimensions (Height or Length), in. (mm)	Maximum Permissible Distortion, in. (mm)	
	Type FTX	Type FTS
8 (203.2) and under	$\frac{3}{32}$ (2.4)	$\frac{4}{32}$ (3.2)
Over 8 to 12 (203.2 to 304.8), incl	$\frac{4}{32}$ (3.2)	$\frac{6}{32}$ (4.8)
Over 12 to 16 (304.8 to 406.4), incl	$\frac{6}{32}$ (4.8)	$\frac{9}{32}$ (6.4)

## 12. Coring

12.1 Requirements as to coring shall apply to multicored tile only. Multicored tile (Fig. 1) shall contain hollow spaces (cores) which are enclosed within the perimeter of the exterior shells and have a cross-sectional area of not more than  $1\frac{1}{2}$  in.<sup>2</sup> (9.7 cm<sup>2</sup>).

12.2 The type of coring is optional with each manufacturer. The distance from the perimeter of the core to the face of the tile shall be not less than  $\frac{3}{4}$  in. (19.1 mm) except in tile that are designed to be split for fractional lengths where the maximum distance from the face of the tile to the perimeter of the kerfing cores shall be not less than  $\frac{1}{2}$  in. (12.7 mm).

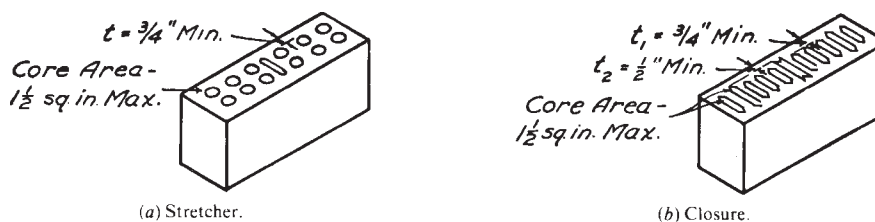
## 13. Size and Number of Cells

13.1 Requirements as to number of cells in direction of wall thickness and as to shell and web thickness shall apply to hollow tile only. Hollow tile (Fig. 2) shall contain hollow spaces (cells) which are enclosed within the perimeter of the exterior shells and have a minimum dimension greater than  $\frac{1}{2}$  in. (12.7 mm) and a cross-sectional area greater than  $1\frac{1}{2}$  in.<sup>2</sup> (9.7 cm<sup>2</sup>). End-construction tile are designed to be placed in the wall with axes of the cells vertical. Side-construction tile are designed to be placed in the wall with the axes of the cells horizontal. Where end-construction tile are used on the side they shall conform to the requirements of side-construction tile and *vice versa*.

13.2 Hollow tile shall conform to the following requirements as to number of cells in the direction of wall thickness:

Nominal Horizontal Thickness of Tile as Laid in Wall, in. (mm)	Minimum Number of Cells in Direction of Wall Thickness
4 (101.6)	1
6 (152.4)	2
8 (203.2)	2
10 (254.0)	3
12 (304.8)	3

The following tile shall be considered as having one additional cell in the direction of wall thickness:



**FIG. 1 Multicored Tile (4-in. Thickness)**

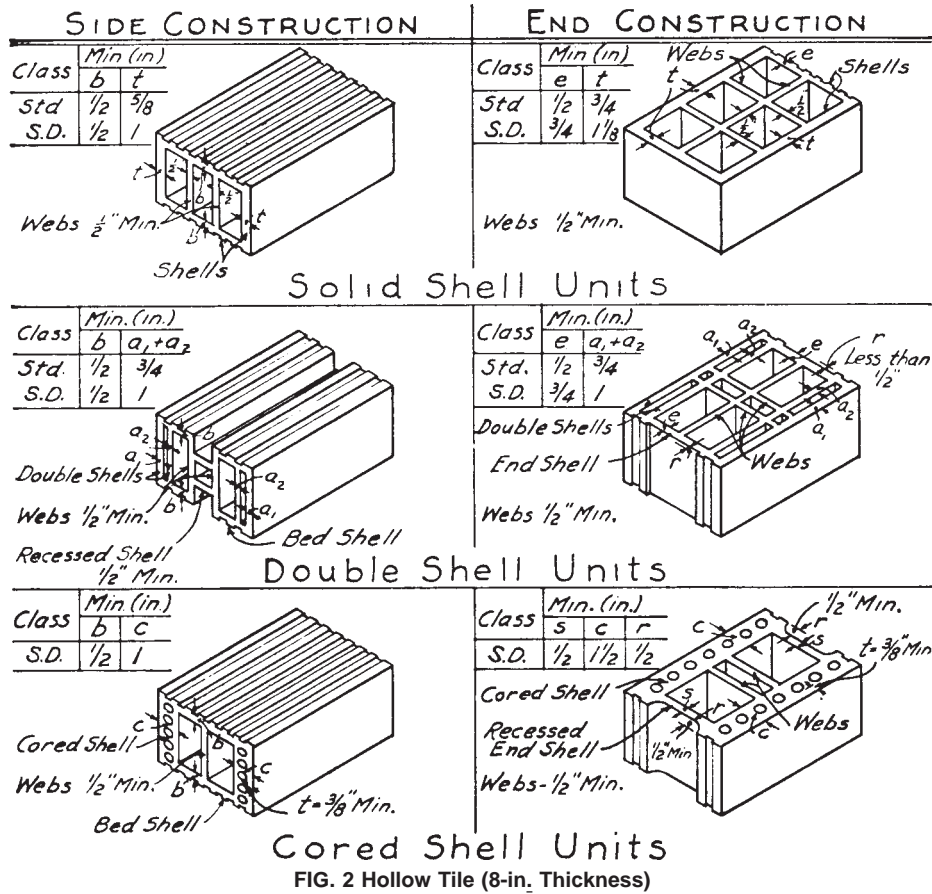


FIG. 2 Hollow Tile (8-in. Thickness)

13.2.1 Standard double-shell tile, provided the combined width of the voids between exterior and interior side shells on both sides of the tile is not less than 1/2 in. (12.7 mm) and the combined thickness of the short webs between inner and outer shells is not greater than that of the long transverse webs holding the inner shells.

13.2.2 All special duty double-shell tile, also special duty solid and cored-shell tile having face shells at least 1 1/2 in. (38.1 mm) thick on both sides of the tile.

13.3 Width of Cell—The width of any cell in side-construction tile, measured in the direction of wall thickness, shall not exceed 4 1/2 times the average overall thickness of either the upper or lower bearing shells.

14. Shell and Web Thickness

14.1 Side Shells of Standard Tile—The thickness of the side shells of standard tile shall be not less than the values shown in Table 7 applying to the direction of cells in the wall (see Fig. 2). The thickness of exposed end shells of standard end-construction tile shall be not less than the thickness of the side shells shown in Table 7. The net thickness of interior end shells for end-construction tile, exclusive of scoring, shall be not less than 1/2 in. (12.7 mm).

TABLE 7 Thickness of Side Shells

Direction of Cells — in Wall	Average Overall-Thickness, <sup>A</sup> in. (mm)		Combined Overall Thickness of Inner and Outer Shells of Double-Shell Tile, <sup>B</sup> in. (mm)
	Solid-Shell Tile	Cored-Shell Tile	
Standard Tile			
Side construction	5/8 (15.9)	...	3/4 (19.1)
End construction	3/4 (19.1)	...	3/4 (19.1)
Special Duty Tile			
Side construction	1 (25.4)	1 (25.4)	1 (25.4)
End construction	1 1/8 (28.6)	1 1/2 (38.1)	1 (25.4)

<sup>A</sup> Average overall thickness is the average thickness of the shell of an individual tile measured between the inside of the shell and the outside of the scoring.

<sup>B</sup> Combined overall thickness of double shells is the sum of the over-all thickness of the outer shell and inner shell but does not include the thickness of the space between the shells.

14.2 *Side Shells of Special-Duty Tile*—The thickness of the side shells of special duty tile shall be not less than the values shown in Table 7 for the proper direction of the cells in the wall (see Fig. 2). The thickness of end shells of special-duty end-construction tile shall be not less than  $\frac{3}{4}$  in. (19.1 mm).

14.3 *Webs, Bearing Shells, and Recessed Ends*—For standard and special-duty tile, the thickness of webs shall be not less than  $\frac{1}{2}$  in. (12.7 mm), except that the short webs between the inner and outer shells of double shells shall be not less than  $\frac{1}{4}$  in. (6.4 mm); also, the net thickness of the top and bottom shells in side-construction tile and of end shells in end-construction tile, which are recessed not less than  $\frac{1}{2}$  in., shall be not less than  $\frac{1}{2}$  in. (see Fig. 2).

14.4 *Cored Shells*—In cored shells, the distance from the perimeter of the core to the exposed face surface of the shell shall be not less than  $\frac{3}{8}$  in. (9.5 mm) (see Fig. 2). The volume of the shell cores shall not exceed 35 % of the gross volume of the face shell. The cross-sectional area of any shell core shall be not greater than 1 in.<sup>2</sup> (6.5 cm<sup>2</sup>).

14.5 *Double Shells*—In double shells of side-construction or end-construction tile, the thickness of the outer shells shall be not less than  $\frac{3}{8}$  in. (9.5 mm) for standard tile nor less than  $\frac{1}{2}$  in. (12.7 mm) for special duty tile. The length of void between the inner and outer shell shall not exceed 5 in. (127 mm) when measurements are made horizontally for end-construction tile and vertically for side-construction tile, with the unit resting in its proper wall position, nor shall the distance between inner and outer shells exceed  $\frac{5}{8}$  in. (15.9 mm).

14.6 *Scoring*—When face shells are scored, each groove shall be not less than  $\frac{1}{8}$  in. (3.2 mm) nor more than  $\frac{1}{4}$  in. (6.4 mm) in depth, and not more than 1 in. (25.4 mm) in width. The area covered by the grooves shall not exceed 50 % of the area of the scored faces.

## 15. Supplementary Requirements for Two-Face Tile

15.1 Two-face tile, intended for use where two exposed smooth faces are required, shall meet the requirements for tolerances on dimensions and on distortion prescribed in 15.2 and shall meet all other requirements for single-face tile. Two-face tile having one smooth face and one rough-texture face shall be specified, in which case they shall conform to the requirements for Type FTS.

15.2 The tolerances on all dimensions shall conform to Table 5. The tolerances on distortion of each finished face shall conform to Table 6.

NOTE 3—The thickness of individual two-face tile is affected by the distortion (11.2). The thickness of a two-face tile shall be considered either the maximum or minimum thickness of the tile, whichever is farthest from the standard dimension.

## 16. Test Methods

16.1 Sample the tile and determine the properties enumerated in this specification in accordance with the following methods:

16.1.1 *Compressive Strength*—Test Methods C 67.

16.1.2 *Absorption by 1-h Boiling*—Test Methods C 67.

16.1.3 *Absorption by 24-h Submersion*—Test not less than five pieces of tile, each weighing not less than 0.5 lb (0.2 kg) and representative of the whole lot of tile from which they were selected as follows:

16.1.3.1 *Drying*—Dry the test specimens to constant weight in a ventilated oven at 110 to 115°C (230 to 239°F). When cool, weigh each specimen.

16.1.3.2 *Saturation*—Submerge the dry specimen, without preliminary partial immersion, in clean water (distilled or soft rain water) at 15.5 to 30°C (60 to 86°F) for 24 h. Remove the specimen, wipe the surface water with a damp cloth, and weigh the specimen. Complete weighing of any one specimen within 5 min after removing the specimen from the bath.

16.1.3.3 *Calculation*—Calculate the absorption of each specimen as follows:

$$\text{Absorption, \%} = [(W_2 - W_1)/W_1] \times 100 \quad (1)$$

where:

$W_1$  = dry weight of the specimen, and

$W_2$  = saturated weight of the specimen after 24-h submersion in cold water.

16.1.3.4 *Report*—Report the average cold water absorption of all of each specimen, rounded to the specimens tested as nearest 0.1 %.

16.1.3.5 Calculate the average cold water absorption of all the lot of tile specimens tested, and report to the nearest 0.1 %.

## 17. Inspection

17.1 The purchaser or his authorized representative shall be provided proper facilities for sampling and inspection of tile, both at the place of manufacture and at the site of the work. At least 10 days from the time of sampling shall be allowed for completion of the tests. The expense of inspection and testing shall be borne by the purchaser.

## 18. Rejection

18.1 In case the shipment fails to conform to the requirements for the class specified, the manufacturer is permitted to sort it, and new specimens shall be selected by the purchaser from the retained lot and tested at the expense of the manufacturer. In case the second set of specimens fails to meet the requirements, the entire lot shall be rejected.

## 19. Keywords

19.1 appearance requirements; clay; facing tile; load-bearing tile; masonry construction; physical properties; shale; tile

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