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Standard Specification for Clay Roof Tiles¹

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1. Scope

1.1 This specification covers clay tiles intended for use as roof covering where durability and appearance are required to provide a weather-resistant surface of specified design.

1.2 Tiles are manufactured from clay, shale, or similar naturally occurring earthy substances and subjected to 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* and *fired bond* in Terminology C1232).

1.3 Tiles are shaped during manufacture by molding, pressing, or extrusion and it is permitted to use the shaping method to describe the tiles.

1.4 Tiles are generally planar or undulating rectangular shapes available in a variety of cross-sectional profiles, shapes, sizes, surface textures, and colors.

1.5 Three grades of tile having various degrees of resistance to weathering are covered in this specification. Three types of tile are defined to cover the features that influence appearance.

1.6 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.

1.7 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This specification is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.06 on Roofing Tile.

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2. Referenced Documents

2.1 *ASTM Standards:*²

C1232 Terminology for Masonry

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

C297/C297M Test Method for Flatwise Tensile Strength of Sandwich Constructions

C554 Test Method for Craze Resistance of Fired Glazed Ceramic Whiterwares by a Thermal Shock Method

3. Terminology

3.1 *Definitions*—For definitions of terms relating to structural clay products, and clay roof tiles, see Terminology C1232.

4. Classification

4.1 Clay roof tiles covered by this specification are classified by grade for durability and type for appearance as follows:

4.1.1 *Grades:*

4.1.1.1 *Grade 1*—Providing resistance to severe frost action.

4.1.1.2 *Grade 2*—Providing resistance to moderate frost action.

4.1.1.3 *Grade 3*—Providing negligible resistance to any frost action.

4.1.1.4 Grades relate to exposure to weather as defined in Table 1.

4.2 *Types:*

4.2.1 *Type I*—High-profile tiles—tiles having a rise-to-width ratio greater than 1:5.

4.2.2 *Type II*—Low-profile tiles—tiles having a rise-to-width ratio equal to, or less than 1:5.

4.2.3 *Type III*—All other tiles, including flat.

5. Material and Finish

5.1 Colors and textures produced by application of inorganic coatings to the faces of the tiles are not prohibited provided that evidence satisfactory to the purchaser is furnished regarding the durability of the coatings. Tiles that are

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.

TABLE 1 Grade Classification for Clay Roof Tiles

Grade (All Types)	Weathering Index (see Annex A1)
1	500 and greater
2	50 to 500
3	less than 50

colored by flashing or textured by sanding, where the sand does not form a continuous coating, are not considered as surface-colored tiles for the purpose of this specification.

NOTE 1—When surface colored tiles (other than sanded or flashed) are specified, data satisfactory to the purchaser shall be submitted showing that after 50 cycles of freezing-thawing (5.2) there is no observable difference in the applied finish when viewed from a distance of 40 ft (12 m) under an illumination of not less than 50 fc (538 lm/m²) by an observer with normal vision. It is not prohibited to present service records of the performance of the particular coated tiles in appropriate locations in place of the freezing and thawing test, with the consent of the purchaser.

5.2 The tiles shall be free of defects, deficiencies, or bloating, that would interfere with the proper laying of the tiles, the performance of the roof, or the requirements of this specification.

5.2.1 Tiles that, when broken, have a dark area that has a steely appearance and is sharply delineated from the surrounding normal color of tile are not prohibited. This dark area is known as black heart or black core. Black heart is generally the result of the reduction of iron minerals during the firing process. Its presence, regardless of the size in the tile that otherwise meets the physical performance of this specification, shall not be cause for rejection.

5.3 The exposed tile surface shall be free of chippage or other imperfections detracting from the appearance of the designated sample when viewed from a distance 40 ft (12 m) under an illumination of not less than 50 fc (538 lm/m²) by an observer with normal vision.

5.4 Unless otherwise agreed upon between the purchaser and the seller, a delivery of tiles shall contain not less than 95 % whole tiles. In this specification, the term *whole tiles* shall be understood to mean tiles meeting the appearance requirements of this specification.

5.5 After tiles are placed in usage, the manufacturer or his agent shall not be held responsible for compliance of tiles with the requirements of this specification for dimensional tolerances, finish, texture, or color.

6. Performance Requirements

6.1 *Durability*—The tiles shall conform to the physical requirements for the Grade specified as prescribed in Table 2. Unless otherwise specified by the purchaser, tiles of a higher Grade (greater weathering index) shall be accepted instead of a lower Grade. The saturation coefficient requirement does not apply when the average cold water absorption of a random sample of five tiles does not exceed 6 %, no more than one tile of the sample exceeds 6 % and its cold water absorption is less than 8 %. When Grade 3 tiles are used in regions where the weathering index is less than 50 (see Annex A1), unless otherwise specified, the requirements for water absorption and for saturation coefficient shall not apply.

TABLE 2 Physical Requirements

Grade	Absorption Requirements			
	Cold Water Absorption Maximum Percent		Maximum Saturation Coefficient ^a	
	Average of Five Tiles	Individual Tile	Average of Five Tiles	Individual Tile
1	6	8	0.74	0.76
2	11	13	0.80	0.82
3	13	15	0.84	0.86

^aThe saturation coefficient is the ratio of absorption by 24-h submersion in water at a temperature of 75 ± 10°F (24 ± 6°C) to that after 5 h submersion in boiling water.

NOTE 2—Frost is of profound importance in mechanical weathering where its effectiveness is dependent on the frequency of temperature fluctuation across the freezing point in the presence of water. The ability of a tile to resist failure in a wet and freezing environment is, therefore, of paramount importance. If a tile fails in such an environment, its use will result in an unacceptable deterioration of appearance or more likely, a total failure to function (that is, protect the underlying structure from rain), or both. Such a tile is completely unacceptable for use regardless of its other properties such as strength.

NOTE 3—The resistance of clay roof tiles to weathering cannot be predicted with complete assurance using any of the physical tests prescribed. However, practical experience has demonstrated satisfactory performance of clay roof tiles, some for hundreds of years, and this experience forms the basis of the prescriptive requirements of Table 2. There is generally excellent correlation between field performance and the requirements. However, it is possible that some tiles that meet this specification are not suitable for severe climates. Furthermore, it is also possible for other tiles that do not meet this specification to show acceptable serviceability in the most severe climates. The best indication of clay roof tile durability is the service record of experience with the specified product in the environment of its intended use.

6.1.1 Measure the water absorption, and calculate the saturation coefficient, in accordance with Test Methods C67. The test sample shall consist of five whole tiles.

6.1.2 The physical requirements in Table 2 shall be achieved as a result of the firing process and associated thermal reactions within the tile body (and glaze, if present) which include development of the fired bond, increase in density, increase in strength, and reduction in water absorption. Tiles shall not comply with this specification if other processes, for example, immersion in solutions of organic materials to effect impregnation or surface sealing, are used to change the physical properties which result from the firing process. It is not prohibited to test tiles in accordance with this Specification after the impregnation and sealing materials are removed as prescribed in Test Methods C67.

6.2 *Freezing and Thawing*—The requirements specified in 6.1 for water absorption (5-h boiling) and saturation coefficient shall not apply for all Grades provided that a sample of five tiles, meeting all of the other requirements, experiences no breakage, no crack development that exceeds the minimum dimension of the specimen, and not greater than 0.5 % loss in dry weight when subjected to 50 cycles of the freezing-and-thawing test of Test Methods C67, modified in accordance with 6.2.1.

6.2.1 Modify Test Methods C67, Section 8, as follows: The test sample shall consist of five whole tiles. The freezing trays and containers shall be of sufficient size and depth to allow the tiles to be completely submerged in water when placed