



Standard Specification for Concrete Floor Tile¹

This standard is issued under the fixed designation C1731; 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.

INTRODUCTION

The purpose of this specification is to establish the product specifications and minimum performance requirements of concrete floor tile.

1. Scope*

1.1 This specification covers concrete floor tile (CFT) for application as interior and exterior flooring. The units described by this specification are manufactured from cementitious materials, mineral aggregates (normal weight, lightweight, or both), water, and additives that are cast into various textures and shapes, often simulating natural stone, brick, terracotta, saltillo, and others.

1.2 This specification is limited to requirements for the physical attributes for the CFT units.

1.3 The use of results from testing installed CFT units that have been removed from use for determining conformance or nonconformance to the requirements of this specification is beyond the scope of this specification.

1.4 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.

1.5 *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:²

C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field

¹ This specification 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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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.

C33/C33M Specification for Concrete Aggregates
C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
C140/C140M Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
C150/C150M Specification for Portland Cement
C157/C157M Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
C172/C172M Practice for Sampling Freshly Mixed Concrete
C260/C260M Specification for Air-Entraining Admixtures for Concrete
C331/C331M Specification for Lightweight Aggregates for Concrete Masonry Units
C482 Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste
C494/C494M Specification for Chemical Admixtures for Concrete
C595/C595M Specification for Blended Hydraulic Cements
C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
C979/C979M Specification for Pigments for Integrally Colored Concrete
C989/C989M Specification for Slag Cement for Use in Concrete and Mortars
C1093 Practice for Accreditation of Testing Agencies for Masonry
C1116/C1116M Specification for Fiber-Reinforced Concrete
C1157/C1157M Performance Specification for Hydraulic Cement
C1232 Terminology of Masonry
C1353/C1353M Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abraser
C1600/C1600M Specification for Rapid Hardening Hydraulic Cement
C1602/C1602M Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

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

C1645/C1645M Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units

NOTE 1—An installation guide for concrete floor tile (CFT) is being developed concurrently in Subcommittee C15.05 Masonry Assemblies.

2.2 ANSI Standards:

A137.1-2012 American National Standard Specification for Ceramic Tile³

3. Terminology

3.1 Terminology defined in Terminology C1232 shall apply for this section.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *concrete floor tile (CFT)*, *n*—manufactured masonry unit that is a blend of cementitious material, aggregates, pigments, chemical admixtures, and water that is designed to be applied via masonry mortar to a horizontal substrate.

3.2.2 *back pattern*, *n*—grooves or other textures included on the back of the CFT unit.

4. Materials and Manufacture

4.1 *Cementitious Materials* shall conform to the following applicable specifications:

4.1.1 *Portland Cement*—Specification C150/C150M.

4.1.2 *Blended Cement*—Specification C595/C595M.

4.1.3 *Hydraulic Cement*—Specification C1157/C1157M.

4.1.4 *Rapid Hardening Hydraulic Cements*—Specification C1600/C1600M.

4.1.5 *Pozzolans and Fly Ash*—Specification C618.

4.1.6 *Ground Granulated Blast-Furnace Slag*—Specification C989/C989M.

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

4.2.1 *Normal Weight*—Specification C33/C33M.

4.2.2 *Lightweight*—Specification C331/C331M.

4.3 *Chemical Admixtures* shall conform to the following applicable specifications:

4.3.1 *Air-Entraining Admixtures*—Specification C260/C260M.

4.3.2 *Water-Reducing, Retarding, and Accelerating Admixtures*—Specification C494/C494M.

4.3.3 *Pigments for Integrally Colored Concrete*—Specification C979/C979M.

4.4 *Reinforcing Fibers*—Specification C1116/C1116M.

4.5 *Water*—Specification C1602/C1602M.

4.6 *Other Constituents*—Integral water repellents and other materials shall be previously established as suitable for use in concrete floor tile or shall be shown by test or experience not to be detrimental to concrete floor tile or any material customarily used in concrete floor tile construction.

5. Physical Properties

5.1 Dimensions:

5.1.1 CFT units shall have a minimum thickness of ¼ in. (6.4 mm) and a maximum thickness of 1.2 in. (30 mm).

5.1.2 CFT units shall not exceed 36 in. (914 mm) in any face dimension.

5.1.3 Dimensional Tolerances:

5.1.3.1 *Standard Units*—For standard units, no overall dimension (width, height, and length) shall differ by more than ±⅛ in. (3.2 mm) from the specified dimensions.

5.1.3.2 *Irregular Units*—For irregular units that feature deliberate dimensional variations more than ±⅛ in. (3.2 mm), the CFT manufacturer shall be consulted as to specific dimensional tolerances.

NOTE 2—Dimensional tolerances for irregular units may vary due to the wide variety of CFT shapes and styles including tumbled, flagstone, and other rustic appearances.

5.2 Compressive Strength:

5.2.1 The average compressive strength shall equal or exceed 4000 psi (27.6 MPa) with no individual specimen less than 3600 psi (24.8 MPa).

5.2.2 For wet-cast products sample concrete from regular production in accordance with Practice C172/C172M and prepare three cylinders in accordance with Practice C31/C31M. Test compressive strength of the concrete mix in accordance with Test Method C39/C39M.

5.2.3 For dry-cast products sample a minimum of three specimens from regular production in accordance with Test Method C140/C140M. Test compressive strength in accordance with Annex A4 of Test Method C140/C140M.

5.3 Shear Bond Strength:

5.3.1 Units shall develop a shear bond strength with the mortar substrate of at least 50 psi (0.34 MPa) when tested in accordance with Test Method C482 with the following modifications (listed in 5.3.1.1 through 5.3.1.4):

5.3.1.1 Five units shall be tested.

5.3.1.2 The mortar substrate shall be that specified for testing of non-vitreous tile in Test Method C482.

5.3.1.3 CFT units shall be cut to 4 by 4 in. (101.6 by 101.6 mm). If the CFT nominal unit length or width is smaller than 4 in. (101.6 mm), the CFT unit mix shall be cast into a larger mold that allows the 4- by 4-in. (101.6- by 101.6-mm) sample unit to be cut.

5.3.1.4 Shear bond testing shall be conducted using the actual bonding surface of the CFT unit as manufactured. If the CFT unit used for testing has a directional back pattern, this back pattern shall be oriented parallel to the direction of loading.

5.4 Resistance to Freezing and Thawing:

5.4.1 If units are exposed to freezing and deicing materials during service, the manufacturer shall satisfy the purchaser either by proven field performance or a laboratory freezing-and-thawing test that the units have adequate resistance to freezing and thawing.

5.4.2 If a laboratory test is used sample and test five CFT units in accordance with Test Method C1645/C1645M. Specimens sampled from units that will not be exposed to deicing

³ Available from Available from Tile Council of North America, <https://www.tcnatile.com>.

salts in service shall be tested in tap water. Specimens sampled from units that will be exposed to deicing materials in service shall be tested in a 3 % saline solution. If the CFT is too large to test full-size due to specimen configuration or lack of suitable specimen containers, obtain a specimen by saw-cutting a full-height coupon with a surface area of at least 29.5 in.² (190 cm²).

5.4.3 The average mass loss of all the specimens tested shall not be greater than: (a) 225 g/m² when subject to 28 freeze-thaw cycles, or: (b) 500 g/m² when subject to 49 freeze-thaw cycles.

5.5 *Water Absorption:*

5.5.1 Sample and test three CFT units in accordance with Test Method **C140/C140M**.

5.5.2 Perform tests on full-size CFT units. If the CFT is too large for the testing apparatus, the unit shall be cut to 8 by 8 in. (203.2 by 203.2 mm) or as necessary to fit the testing apparatus.

5.5.3 The average CFT water absorption shall not exceed 12 % with no individual specimen exceeding 14 %.

5.6 *Flexural Load:*

5.6.1 Sample and test three CFT units in accordance with Annex A6 of Test Method **C140/C140M**.

5.6.2 The average CFT flexural load shall be greater than or equal to 300 lbs (1334 N) with no individual specimen less than 250 lbs (1112 N).

5.7 *Length Change:*

5.7.1 The concrete mix shall be tested for length change in accordance with Test Method **C157/C157M** except as modified below:

5.7.1.1 Sample concrete from regular production in accordance with Practice **C172/C172M** and mold three prism specimens for testing following the requirements in Procedures for Molding Specimens, Concrete Specimens of Test Method **C157/C157M**.

5.7.2 The length change of each specimen shall not exceed ± 0.10 % when tested at seven days after manufacture.

5.8 *Abrasion Resistance:*

5.8.1 Sample and test three full-size CFT units in accordance with Test Method **C1353/C1353M**.

5.8.2 For each unit, CFT wear index shall be 20 or greater.

5.9 *Dynamic Coefficient of Friction:*

5.9.1 Sample and test three CFT units in accordance with Section 9.6 of ANSI A137.1.

5.9.2 For each unit, dynamic coefficient of friction values for wet surfaces shall be 0.42 or greater.

NOTE 3—Sealing CFT units may affect coefficient of friction values.

6. Sampling

6.1 *Sampling Concrete Mixes*—From each manufacturing location, obtain representative samples from standard production of each concrete mix used for CFT, as appropriate for the physical property in Section 5.

6.2 *Sampling Concrete Floor Tile*—From each manufacturing location, obtain samples of CFT units that are representative of the production from which they are selected.

6.3 Test samples biannually or when materials, proportions, or production methods have changed, whichever is more frequent.

6.3.1 Testing laboratories shall be accredited in accordance with Practice **C1093** or an equivalent standard if testing performed by laboratories not specializing in masonry materials.

6.3.2 All samples shall be tested at least 28 days after manufacture unless otherwise indicated.

6.4 *Color and Texture*—If concrete floor tile having a particular color, color range, or texture are desired, these features shall be specified separately by the purchaser. 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 concrete floor tiles, each representing the texture desired. The color range shall be indicated by the approved samples.

7. Packaging and Package Marking

7.1 Each package shall identify the manufacturer's name, product name and identification, date and location of manufacture, and statement of product conformity to this specification.

8. Certification

8.1 Upon request of the purchaser in the contract or order a manufacturer's report shall be furnished at the time of shipment stating results of tests made on samples from regular production and certifying that the CFT units conform to applicable requirements of this specification.

NOTE 4—Guidance on preparing the manufacturer's report is provided in **Appendix X1**.

9. Keywords

9.1 adhered; cementitious; CFT; concrete; concrete floor tile; flooring; manufactured; masonry; tile

APPENDIX

(Nonmandatory Information)

X1. MANUFACTURER'S REPORT

X1.1 A complete report shall include the following:

X1.1.1 Dimensions of each CFT unit specified;

X1.1.2 The weight per area of CFT units;

X1.1.3 The maximum compressive load imposed on each sample along with the compressive strength in pounds per square inch as determined in 5.2;

X1.1.4 The maximum load and shear bond strength as determined in 5.3;

X1.1.4.1 The location of failure of each specimen shall be noted, that is, in the CFT unit itself between the concrete tile unit and the bond coat, between the bond coat and the mortar setting bed, and in the setting bed itself;

X1.1.5 Weight loss as a percentage of the original weight of the dry CFT units as determined in 5.4;

X1.1.5.1 The number of cycles at the time of CFT disintegration;

X1.1.5.2 The type of breakage or disintegration in detail;

X1.1.6 Water absorption as determined in 5.5;

X1.1.7 Maximum flexural load as determined in 5.6;

X1.1.8 Length change as determined in 5.7;

X1.1.9 Abrasion resistance as determined in 5.8; and

X1.1.10 Static coefficient of friction as determined in 5.9.

SUMMARY OF CHANGES

Committee C15 has identified the location of selected changes to this standard since the last issue (C1731 – 15) that may impact the use of this standard. (June 1, 2016)

(1) Revised 5.9, 5.9.1, and 5.9.2.

(2) Deleted Test Method C1028 from 2.1 and added ANSI A137.1-2012 to 2.2.

Committee C15 has identified the location of selected changes to this standard since the last issue (C1731 – 13) that may impact the use of this standard. (July 1, 2015)

(1) Revised 5.3 to clarify the type of mortar substrate to use for the shear bond test.

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