



Standard Practice for Installation of Concrete Floor Tiles¹

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1. Scope

1.1 This practice covers the installation of concrete floor tile (CFT) units for application as exterior and interior flooring. Units described by this practice shall be manufactured to meet the requirements of Specification C1731. This practice is limited to the installation of CFT units.

1.2 This practice covers aspects of installation relating to performance in service.

1.3 *Units*—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.

1.4 *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

- C270 Specification for Mortar for Unit Masonry
- C920 Specification for Elastomeric Joint Sealants
- C979 Specification for Pigments for Integrally Colored Concrete
- C1232 Terminology of Masonry
- C1325 Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
- C1384 Specification for Admixtures for Masonry Mortars
- C1714/C1714M Specification for Preblended Dry Mortar Mix for Unit Masonry
- C1731 Specification for Concrete Floor Tile

¹ This test method is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.05 on Masonry Assemblies.

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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.

2.2 ANSI Standard:

ANSI A108/A118 American National Standards for the Installation of Ceramic Tile³

2.3 International Concrete Repair Institute Standard:

ICRI Guideline No 310.2-1997 Selecting and Specifying Concrete Surface Preparation for Sealers, Coating, and Polymer Overlays⁴

2.4 The Masonry Society Standard:

TMS 602-13/ACI 530.1-13/ASCE 6-13 Specification for Masonry Structures⁵

3. Terminology

3.1 Definitions:

3.1.1 *birdcage mixer attachment, n*—mixer attachment with open paddles designed to prevent air entrainment.

3.1.2 *cementitious backer board, n*—a fiber-reinforced cement-based substrate sheet for CFT installation.

3.1.3 *concrete floor tile (CFT), n*—a manufactured masonry unit that is a blend of cementitious material, aggregates, pigments, chemical admixtures, and water formed into the appropriate shape and cured in order to be applied by way of masonry mortar to an approved substrate.

3.1.4 *membrane, n*—a coating applied to the substrate as a liquid or sheet and used to protect the CFT installation from water intrusion, substrate cracks, thermal expansion/contraction, cement shrinkage, and subfloor deflection.

3.1.4.1 *Discussion*—Membranes include but are not limited to anti-fracture, cleavage, crack isolation, uncoupling, and waterproofing membranes.

3.1.5 *retemper, v*—to add water to mortar or grout to replace water lost to evaporation.

3.1.6 *sealer, n*—water- or petroleum-based material applied as a liquid to provide protection from water, stains, and contaminants.

3.1.7 *setting bed, n*—the mortar subsurface to which CFT units are adhered.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from International Concrete Repair Institute 10600 West Higgins Road, Suite 607 Rosemont, IL 60018, <http://www.icri.org>.

⁵ Available from The Masonry Society 105 South Sunset Street, Suite Q, Longmont, CO USA 80501-6172, <http://www.masonrysociety.org>.

4. Significance and Use

4.1 This practice is intended to provide technical information for designers, architects, and installers of CFT units in residential and light commercial construction. This practice does not address installation methods or techniques for floor tile units manufactured from other materials.

5. Materials

5.1 Materials shall comply with the contract documents. If the contract documents do not include materials or there are no contract documents, then the materials in 5.2 through 5.8 shall be used.

5.2 *Concrete Floor Tile (CFT)*—CFT units shall comply with the requirements of Specification **C1731**.

5.3 Mortar:

5.3.1 Mortar shall comply with one of the following requirements:

5.3.1.1 Thin set mortar and medium bed mortar shall comply with the requirements of ANSI A118.4 and A118.11.

5.3.1.2 Type N, S, or M mortar shall comply with the requirements of Specification **C270**.

5.3.1.3 Preblended dry mortar shall comply with the requirements of Specification **C1714/C1714M**.

5.3.2 Admixtures shall comply with Specification **C1384**. Chloride admixtures shall not be used with colored concrete or grout.

5.4 Grout:

5.4.1 Premixed sanded or unsanded cementitious grout shall comply with the requirements of ANSI A118.6.

5.4.2 Premixed sanded or unsanded high performance cementitious grout shall comply with the requirements of ANSI A118.7.

NOTE 1—High performance grouts include latex/polymer powder or a liquid latex admixture for improved tensile strength, flexural strength, and lower water absorption.

5.4.3 Modified epoxy emulsion grout shall comply with the requirements of ANSI A118.8.

5.4.4 Pigments used in grout shall comply with the requirements of Specification **C979**.

5.5 Membranes:

5.5.1 All membranes shall meet applicable ASTM International and ANSI standards and be installed per the membrane manufacturer's installation instructions.

5.6 Sealer:

5.6.1 Sealer material and installation shall meet applicable ASTM International and ANSI standards and local environmental requirements.

5.7 Cementitious Backer Boards:

5.7.1 Cementitious backer boards shall comply with Specification **C1325** and shall meet requirements of ANSI A118.9.

5.8 Joint Sealants:

5.8.1 Joint sealants shall comply with the requirements of Specification **C920**.

6. Environmental Conditions

6.1 *Hot and Dry Conditions*—When the environmental conditions exceed 90°F (32.2°C), installation of mortar and grout shall comply with the hot weather construction requirements of local building code, the recommendations of CFT manufacturer, or hot weather construction provisions of TMS 602/ACI 530.1/ASCE 6, Article 1.8 D.

6.2 *Freezing or Low Temperatures*—Installations shall be protected from temperatures below 40°F (4.4°C). When the environmental conditions are below 40°F (4.4°C), installation of mortar and grout shall comply with the cold weather construction provisions of TMS 602/ACI 530.1/ASCE 6, Article 1.8 C.

6.2.1 Protect CFT units from moisture. Units containing frozen moisture, visible ice, or snow on any surface shall not be installed.

7. Substrate/Surface Preparation

7.1 New or Existing Concrete Slab:

7.1.1 Concrete surface profiles shall range from CSP 2 to CSP 5 as described in ICRI Guideline No 310.2

7.1.2 Light-broom-finished concrete slab surface is recommended. Troweled smooth finished surfaces shall be mechanically abraded by grinding or shot blasting or by other means designed to provide an adequate bond.

7.1.3 Allow the concrete slab to cure for a minimum of 28 days or as otherwise specified to provide a dimensionally stable substrate for installation.

7.1.4 Inspect the surface for paint, dirt, sealer, or any other foreign substances that may inhibit bonding and ensure the surface is clean and free of loose or spalling material.

7.1.5 If a membrane is specified, consult the membrane manufacturer for substrate requirements.

7.2 Plywood Floor:

7.2.1 Do not bond CFT directly to wood substrate; prepare substrate using one of three materials:

7.2.1.1 Cementitious backer board.

7.2.1.2 Cleavage or uncoupling membrane.

7.2.1.3 Prefloated 1¼- to 2-in. (31.8- to 50-mm) mortar bed on a cleavage membrane shall meet requirements of ANSI A108.2. Mortar beds over 2 in. (50-mm) shall be installed per the contract documents.

7.3 Waterproofing and Crack Isolation Membranes:

7.3.1 Waterproofing membranes are recommended for interior installations and shall comply with ANSI A118.10.

7.3.2 Crack isolation membranes are recommended for interior and exterior installations and shall comply with ANSI A118.12.

7.4 Substrate shall be plumb or level, and true with maximum variation from required plane to be ⅛-in. (3.5 mm) in 10-ft. (3.05 m).

7.5 Movement joints shall meet the requirements of ANSI A108.01.

8. Installation of CFT Units

8.1 *General Installation*—Three installation options are provided; CFT manufacturer's recommendations shall be consulted for preferred method.

8.1.1 *Thin-set Mortar:*

8.1.1.1 The thin-set mortar bed thickness shall be no greater than $\frac{3}{16}$ in. (4.8 mm) thick or as specified.

8.1.2 *Standard Bed Mortar:*

8.1.2.1 Use premixed dry mortar that meets the requirements of Specification **C1714/C1714M** or mix in accordance with **C270**.

8.1.2.2 The mortar bed thickness shall range from minimum $\frac{1}{2}$ in. (13 mm) thick to maximum 1-in. (25 mm) thickness or as specified.

8.1.3 *Medium Bed Mortar:*

8.1.3.1 The medium bed mortar bed thickness shall be no greater than $\frac{3}{4}$ in. (19 mm) thick or as specified.

NOTE 2—Medium-bed mortars use larger aggregate to allow for a thicker setting bed than thin-set mortar and are designed for use with large format, heavy, or thick tiles.

NOTE 3—The TCNA Handbook currently defines large format tiles as 8 in. by 8 in. and larger.

8.2 The bonding surface of the CFT unit shall be moistened before installation. The surface shall appear damp but without freestanding water. Units shall not be immersed or submerged in water before installation.

8.3 Review and follow the instructions printed on each bag of packaged thin-set mortar, medium bed mortar, or premixed dry mortar.

8.3.1 Mix mortar and clean cool water together by hand or with a variable-speed electric drill at a slow speed (150 to 200 rpm [16 to 21 rad/s]) to a smooth, paste consistency.

8.3.2 Use a birdcage mixer attachment rather than a paddle mixer attachment to avoid entraining air in the mix.

8.3.3 Stir mortar with the trowel to keep fluffy and do not retemper.

8.4 Spread mortar onto the substrate using the flat edge of a $\frac{1}{2}$ in. (12.7-mm) square notched trowel or $\frac{3}{4}$ -in. (19.1-mm) rounded notched trowel. Use the notched edge to form grooves in one direction under each CFT unit. When mortar is properly mixed, the troweled ridges on the substrate should stand with little or no slump.

8.5 Do not allow the mortar to “skin over” and lose plasticity before the CFT units are placed. Extreme air and slab temperatures may affect the mortar's setting time. Do not spread too much mortar at one time.

8.6 Spread mortar uniformly on the back of each CFT unit using the flat side of a trowel so that a minimum of 95 % of the back surface is covered.

8.7 Place CFT units by moving them $\frac{1}{8}$ to $\frac{1}{4}$ in. (3.175 to 6.35 mm) back and forth perpendicular to the ridges until the ridges collapse and all the voids are filled.

8.8 CFT units shall be cut with a wet saw for best results. Wash pieces with clean water after cutting to avoid staining from grit and debris.

9. Grouting and Finishing Joints

9.1 When grout joints are up to $\frac{1}{8}$ in. (3.2 mm) wide, nonsanded grout shall be used. When grout joints are $\frac{1}{8}$ to $1\frac{1}{2}$ in. (3.2 to 38.1 mm) wide, sanded grout or mortar mixed in accordance with Specification **C270** should be used.

9.2 A grout bag is recommended to fill all joints. If grout is floated with a trowel, tiles shall be presealed to prevent staining.

9.3 Completely fill each grout joint slightly higher than the CFT surface.

9.4 Tool and finish joints as recommended by the CFT manufacturer.

10. Cleaning

10.1 Do not allow mortar and grout to set up on the surface of the CFT unit. Remove excess mortar and grout when it has sufficiently hardened but before final set.

NOTE 4—CFT units can be presealed to ease the removal of grout scum and haze.

10.1.1 Do not use a wet brush to treat mortar joints or clean excess mortar.

10.1.2 Do not use a wire brush to clean excess mortar.

10.1.3 Do not use muriatic acid to clean excess mortar or grout; use acid-based products with caution.

10.2 Consult the CFT manufacturer regarding cleaning with a pressure washer.

11. Sealing

11.1 Consult the CFT manufacturer for recommendations. Select the sealer appropriate for the location of installation, expected traffic, and appearance desired.

11.2 Apply the sealer in accordance with the sealer manufacturer's installation recommendations.

11.3 At a minimum, ensure the surface is clean and dry before sealing to avoid discoloration. Remove any residue and grout haze before sealing.

12. Keywords

12.1 cementitious; concrete floor tile; flooring; grout; installation; masonry; membrane; mortar; tile

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