Designation: C1026 – 13 (Reapproved 2018)

Standard Test Method for Measuring the Resistance of Ceramic and Glass Tile to Freeze-Thaw Cycling[1]

This standard is issued under the fixed designation C1026; 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.

1. Scope

1.1 This test method describes the procedures and equipment required to test either glazed or unglazed ceramic or glass tiles for resistance to repeated cycles of freezing and thawing. Tiles of any size or shape may be tested by this test method.

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

1.3 *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.*

1.4 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*

C242 Terminology of Ceramic Whitewares and Related Products[2]

3. Summary of Test Method

3.1 A designated test load of tile specimens is saturated with water prior to being placed face-up in a metal water-filled container inside a freezer. The water level is adjusted such that the tile specimens are partially submerged. A thermocouple is inserted into the bottom of the metal container such that the water surrounding the thermocouple is the last location to freeze and thaw. Freezing is followed by a thawing cycle using water that flows over the test load. The number of freeze-thaw cycles is recorded and after 300 cycles, the test load is visually examined for damage and checked for total weight loss.

4. Significance and Use

4.1 The test for resistance to freezing and thawing functions as a guide to the selection of ceramic and glass tiles suitable for outdoor service in geographic areas subjected to freezing. It can serve as a test method to verify compliance with specifications for ceramic and glass tiles, and provides a control test for determining the freeze/thaw resistance of tiles being manufactured for exterior installations.

5. Apparatus

5.1 *Freezing Chamber.* The freezing chamber for this test method may be of any type provided it has the capacity to cool the test load to 27 ± ½ °F (-3 ± ¼ °C) within a period of 3 to 6 h. By adjusting the mass of the test load, any freezer can be used in this test as long as a 3- to 6-h period to reach 27 ± ½ °F (-3 ± ¼ °C) is achieved. See Figs. 1 and 2.

5.2 *Freezing Container.* A freezing container of such design and shape that it fits inside the freezing chamber and will allow the test specimens to be laid flat on a tile support rack at the bottom of the container. The freezing container may be of any convenient size or shape (a stainless steel sink works well). It must have a low point in which the thermocouple can be securely located such that the water around the thermocouple freezes last (typically near the bottom center of the container). The water level inside the container is maintained throughout the test by adjusting the height of an overflow drain. See Fig. 3.

5.3 *Tile Support Rack.* A rack capable of supporting the test specimens a minimum of ¼ in. (6 mm) above the bottom of the freezing container in a consistent, level manner. It should be rustproof, unaffected by freeze/thaw cycling and with sufficient openings that the thawing water passes easily over and around the frozen tile specimens during the thawing cycle. See Fig. 4.

5.4 *Water Reservoir.* A reservoir of sufficient volume, in which water is maintained at a temperature of 60 ± 20°F (16 ± 11°C) and used to raise the temperature of the test load to 40 ± ½ °F (5 ± ¼ °C) during the thawing cycle. See Fig. 5.

5.5 *Water Pump.* A low-pressure water pump of sufficient capacity to pump water from the water reservoir into the

[1] This test method is under the jurisdiction of ASTM Committee C21 on Ceramic Whitewares and Related Productsand is the direct responsibility of Subcommittee C21.06 on Ceramic Tile.

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[2] *Annual Book of ASTM Standards*, Vol 15.02.

FIG. 1 Freezing Chamber, Front View

freezing chamber in such manner that it can flood water over the test load. A flow or pressure reduction valve may need to be installed between the water pump and the flooding assembly to prevent spraying. See Fig. 6.

5.6 *Flooding Assembly.* PVC pipe or similar which assembled to spread thawing water throughout the freezing container. Holes ⅛ in. (3 mm) in diameter are drilled in the bottom of the flooding assembly. Holes ¼ in. (6 mm) in diameter are drilled in the top to maintain the flow of water in the event the bottom holes become frozen. No holes shall be drilled in the flooding assembly which would allow water to fall directly on the thermocouple. See Figs. 7-9.

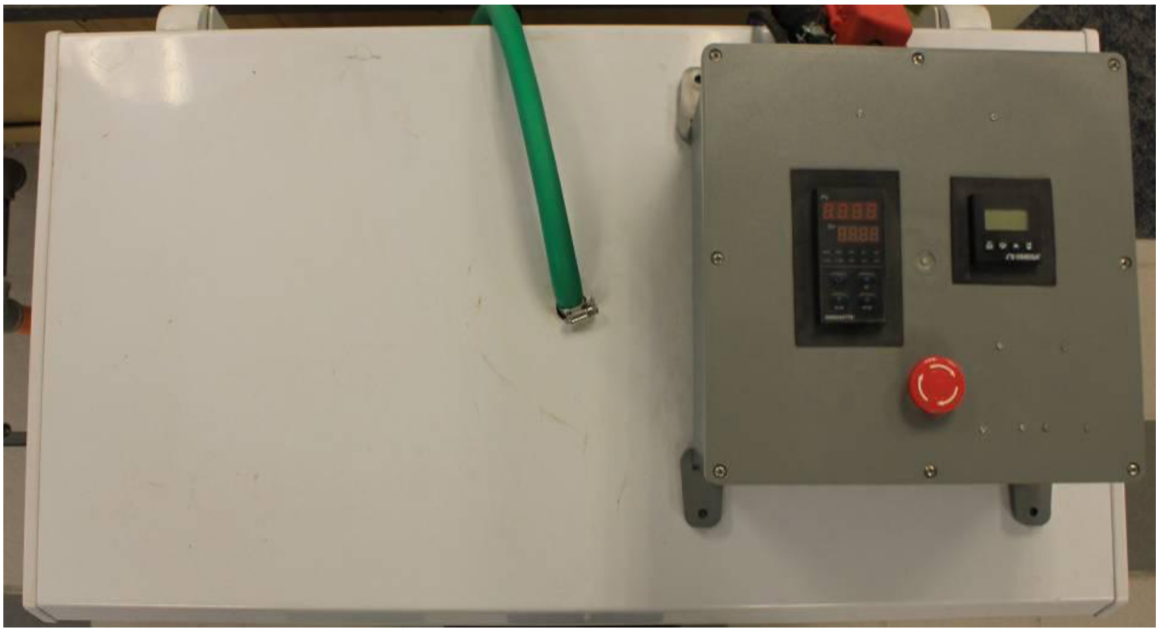

FIG. 2 Freezing Chamber, Top View
Includes Inlet Hose from Water Pump and Control Box Housing the Temperature Controller and Cycle Counter

FIG. 3 Freezing Container
Includes Low Point for the Thermocouple and Adjustable Overflow Drain in the Corner

5.7 *Controller.* A device capable of receiving input from a thermocouple and accurately measuring and displaying the temperature of the water around the thermocouple within ½ °F (¼ °C). The controller must have an electric relay triggered by