



Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile¹

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1. Scope

1.1 This test method covers the determination of the resistance to thermal shock of glazed ceramic tiles under normal conditions of use.

1.2 The values stated in SI 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

C242 Terminology of Ceramic Whitewares and Related Products

C373 Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles

3. Terminology

3.1 *Definitions*—For the definitions of terms used on this test method, refer to Terminology C242.

4. Summary of Test Method

4.1 This test method consists of determining the thermal shock resistance of ceramic tiles by cycling a sample ten times between the temperatures of $15 \pm 5^\circ\text{C}$ ($59 \pm 9^\circ\text{F}$) and $145 \pm 5^\circ\text{C}$ ($293 \pm 9^\circ\text{F}$). This test method includes two procedures, with and without immersion, for tiles with a water absorption less than or equal to 10 % and tiles with a water absorption

greater than 10 %, respectively. After completing ten cycles, the tiles are inspected for any damage as a result of the cycling.

5. Significance and Use

5.1 This test method is intended for testing glazed ceramic tile that are to be used in areas in which they may be subjected to rapid or severe temperature changes.

6. Apparatus

6.1 *Water Bath*, for testing with immersion, through which $15 \pm 5^\circ\text{C}$ ($59 \pm 9^\circ\text{F}$) water flows at a rate of 1 gal/min. The bath shall hold at least 5 gal (19 L) of water and shall be of dimensions such that five whole tiles are immersed completely when placed in the bath vertically.

6.2 *Covered Water Bath*, for testing without immersion, consisting of the Water Bath in 6.1 covered with an aluminum sheet and layer of aluminum grains. The aluminum sheet shall be 5.18-mm (0.204-in.) thick—No. 4 B&S—gage and of dimensions such that five whole tiles can be placed glazed face down on it. The aluminum sheet shall cover the mouth of the bath with the flow of water directed such that it is in contact with bottom surface of the aluminum sheet. The entire top surface of the aluminum sheet shall be covered with a 3-mm (0.197-in.) thick layer of aluminum grains. The diameters of the aluminum grains shall be in the range of 0.3 mm (0.012 in.) to 0.6 mm (0.024 in.).

6.3 *Oven*, capable of maintaining a constant temperature of $145 \pm 5^\circ\text{C}$ ($293 \pm 9^\circ\text{F}$).

7. Sampling

7.1 The test sample shall consist of five whole tiles or trim units, selected at random from the lot to be tested.

8. Procedure

8.1 Before testing for resistance to thermal shock, inspect the tiles for visible defects. To assist in detecting defects, a suitable stain, such as waterproof black India ink or a 1 % aqueous solution of methylene blue, may be used. Apply the ink or dye solution to the face of the tiles and wipe off with a damp cloth after 1 min. All tiles should be free from defects before testing.

8.2 *Testing With Immersion*—For tiles with a water absorption less than or equal to 10 %, the low temperature condition

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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.

shall consist of immersing the tiles vertically in the water bath, such that they are not in contact with each other, for 5 min.

8.3 Testing Without Immersion—For tiles with a water absorption greater than 10 %, the low temperature condition shall consist of placing the tiles glazed face down on the covered water bath, such that they are not in contact with each other, for 5 min.

8.4 Testing With and Without Immersion—After 5 min at the low temperature condition, immediately transfer the tiles to the oven maintained at a temperature of $145 \pm 5^{\circ}\text{C}$ ($293 \pm 9^{\circ}\text{F}$). Continue to heat the tiles in the oven until a uniform temperature is achieved (usually 20 min) and then immediately transfer the tiles back to the low temperature condition.

8.5 Repeat this cycle ten times.

8.6 After completing ten cycles, inspect the tiles for visible defects. To assist in detecting defects, a suitable stain such as waterproof black India ink or a 1 % aqueous solution of methylene blue, may be used. Apply the ink or dye solution to the face of the tiles and wipe off with a damp cloth after 1 min.

9. Report

9.1 The test report shall include the following information:

9.1.1 A description of the tiles,

9.1.2 The water absorption (%) of the tiles,

9.1.3 The type of test performed (with or without immersion), and

9.1.4 The number of test specimens with visible defects.

10. Precision and Bias

10.1 No justifiable statements can be made either on the precision or on the bias of this test method for testing thermal shock resistance of glazed ceramic tile by this test method since the test result merely states whether there is conformance to the criteria for success specified in the procedure.

11. Keywords

11.1 ceramic tile; glazed ceramic tile; thermal shock resistance

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