



Designation: **C482 – 02 (Reapproved 2014) C482 – 20**

Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste¹

This standard is issued under the fixed designation C482; 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 covers the determination of the ability of ~~glazed ceramic wall tile, ceramic mosaic tile, quarry tile, and pavers porcelain tile, and paver tile~~ to be bonded to portland cement paste. Tiles may be glazed or unglazed. This test method includes both face-mounted and back-mounted tile.

1.2 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.

1.3 *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~~ safety, health, and ~~health~~ 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:*²

[C150 Specification for Portland Cement](#)

[C185 Test Method for Air Content of Hydraulic Cement Mortar](#)

[C207 Specification for Hydrated Lime for Masonry Purposes](#)

[C242 Terminology of Ceramic Whitewares and Related Products](#)

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of the types of tile listed in 1.1, refer to Terminology [C242](#).

4. Summary of Test Method

4.1 This test method consists of bonding tile under controlled conditions to a pure portland cement paste bond coat, supported by a cement mortar bed.

4.2 After proper cure of the test assembly, a load is applied to one edge of the tile and the load increased at a definite rate until the bond between tile and bond coat is broken.

4.3 Because the laboratory method of applying shear stress rapidly loads both tile and setting bed in compression, a stronger than normal setting bed for the test specimens is specified. This avoids failure of the setting bed before the desired failure at the tile-bond coat interface occurs. In real tile installations with portland cement paste an entirely different loading mechanism, usually generated primarily by shrinking of the setting bed or structural backing, results in mild tension in setting bed and mild compression in the tile, but the same type of shear stress occurs between tile and bond coat as does in response to the laboratory loading method. The finding of an adequate bond strength under the conditions of this test method can be taken as proof that the tested tile could be permanently bonded in a properly installed conventional installation using the lean, low-shrinkage mortars customarily specified for this particular purpose.

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

Current edition approved Dec. 1, 2014 April 1, 2020. Published December 2014 April 2020. Originally approved in 1961. Last previous edition approved in 2009 2014 as C482 – 02 (2009) (2014). DOI: 10.1520/C0482-02R14; 10.1520/C0482-20.

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.

4.4 To maintain practical sample size and limit maximum breaking load, tile larger than nominal 4¼ in. (108 mm) on a side must be cut to 4 in. (102 mm).

5. Significance and Use

5.1 This test method provides a means of determining whether or not tile of the types indicated in 1.1 can be bonded with adequate strength to portland cement paste. Tile specifications can refer to this test method in order to establish minimum bond strength limits appropriate to the service conditions that are anticipated.

5.2 Separation between bond coat and setting bed, or breakage of the setting bed itself shall not be considered failures of tile bond.

6. Apparatus

6.1 *Molds*—Five frame-type molds having inside dimensions 6 by 4½ by 2 in. (152 by 114 by 51 mm) in depth. The molds shall be made of ⅜-in. (~~9.5-mm~~) (9.5 mm) thick rigid material such as brass, and the inside faces of the molds shall present a smooth surface. They shall be constructed in such a manner that they can be taken apart without damage to the molded cement block. Diagrams of suitable molds are shown in Fig. 1.

6.2 *Compression Testing Machine*—The testing machine may be either a hydraulic or screw type, with an accuracy of ±1.0 %. It shall be capable of applying a uniformly distributed shearing load at a rate of 200 ± 20 psi/min (1.4 ± ~~0.1 MPa~~ MPa/min) to the tile being tested. To obtain the actual loading rate in lbf/min (kgf/min) for a particular tile size, multiply the bonded area of the tile in square inches by 200 ± 20 (in pascals by 1.4 ± 0.1).

6.3 *Fixture*, for holding the specimen assembly in an upright position to prevent tilting while the specimen assembly is under load. The construction of such a fixture is shown in Fig. 2.

6.4 *Keys*—Differently sized keys, each for use with a different size range of tile, to be inserted between the edge of the bonded tile and the head of the compression testing machine. Their exact dimensions are shown in Fig. 3. Specially dimensioned keys may be required for unusual tile thicknesses.

7. Materials

7.1 *Portland Cement*—Type I of Specification C150.

7.2 *Hydrated Lime*—Type S of Specification C207.

7.3 *Standard Sand*—Dry, Standard Ottawa sand conforming to the requirements given in Section 9 of Test Method C185.

8. Test Sample

8.1 *Size of Sample*—The number of tile comprising a sample varies according to in accordance with the size of the tile (see Table 1).

8.2 *Selection and Preparation:*

8.2.1 Tile in the number specified in 8.1 shall be selected at random from the lot to be tested.

8.2.2 Mounted tile shall be separated from one another by mechanical means, but water or other solvent shall not be used to remove the mounting media, except as directed in 8.2.4. (It is not necessary to remove mounting media completely, provided it does not interfere with the methods prescribed in either 8.2.4 or Section 9.)

8.2.3 If any dimension between opposite edges of a tile exceeds nominally 4¼ in. (108 mm), the tile shall be cut on a diamond or abrasive saw, so that the dimension is reduced to ~~4 in.~~ 4 in. (102 mm). Any tile that has lugs or other protuberances on its edges, or that does not have a straight, square edge, shall be trimmed with a saw ¼ in. (6.4 mm) in from an edge, and preferably, perpendicular to any directional back-pattern, to provide one smooth, straight edge.

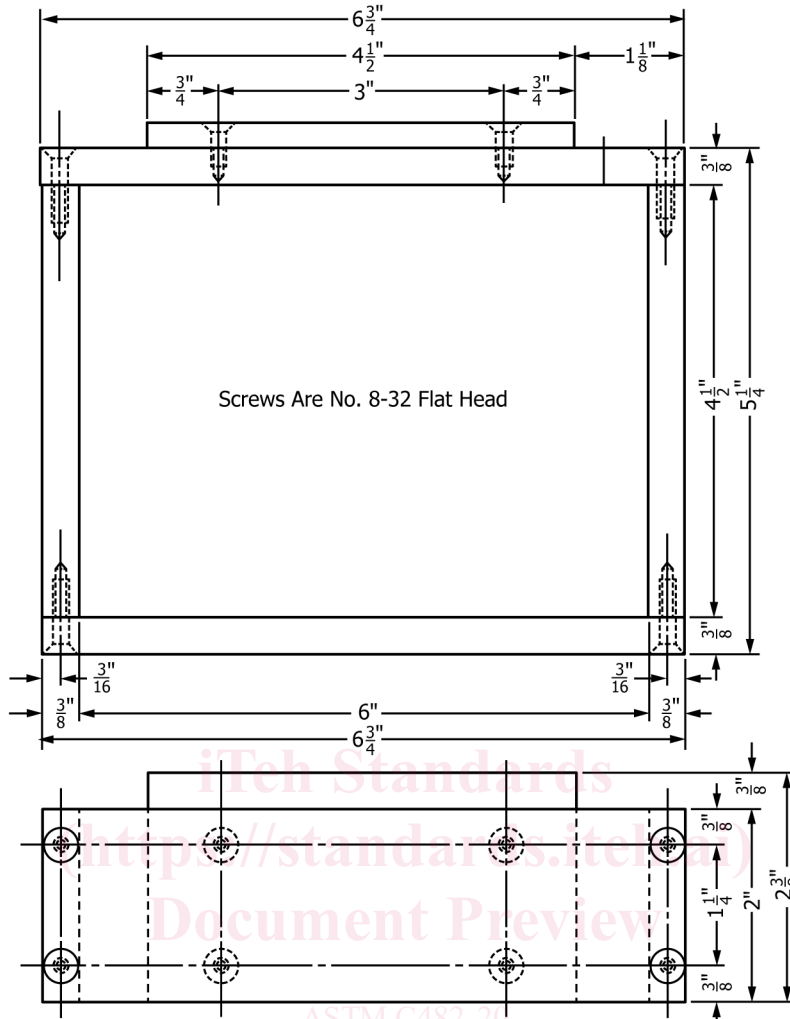
8.2.4 Tile that are cut on a saw requiring that they be wetted with water shall subsequently be thoroughly washed, rinsed at least once in clean water, and dried in an oven at a temperature of 225 ± 10°F (107 ± 5°C) 5 °C for 4 h. They shall be allowed to cool to room temperature before they are set on a mortar bed. Tile cut dry shall be brushed with a dry cloth to remove dust from the bonding surface.

8.2.5 Immerse nonvitreous and semivitreous tile (tile with a water absorption over 3 %) in water for at least ½ h prior to use, and fully drain them of surface moisture before installation. Nonvitreous and semivitreous tile, mounted with water-soluble adhesive, must have mounting media and adhesive carefully and completely removed under running water before immersion to prevent contamination of the bonding surface.

9. Procedure

9.1 Lightly oil the inside surfaces of the molds to permit easy removal of the specimen assemblies after fabrication. Fill the molds, without voids, to an excess with one of the following mortars:

9.1.1 *For Nonvitreous Tile (Water Absorption Over 7 %)*—~~For nonvitreous tile (water absorption over 7 %):~~ One part portland cement, 0.25 part hydrated lime, 3.30 parts dry standard sand, and 0.55 part potable water; all parts by mass.



<https://standards.iteh.ai/catalog/standards/sist/3-47a4-aa86-ca7e31deeda1/astm-c482-20> Metric Equivalents

Letter	in.	mm
A	3/16	4.8
B	3/8	9.5
C	6	152
D	6 3/4	171
E	4 1/2	114
F	5 1/4	133
G	1 1/4	32
H	2	51

FIG. 1 Mold for Mortar Block (Five Required)

9.1.2 *For Impervious, Vitreous, or Semivitreous Tile (Water Absorption Not Over 7%)*—For impervious, vitreous, or semivitreous tile (water absorption not over 7%): One part portland cement, 3.30 parts standard sand, and 0.50 part potable water; all parts by mass.

9.2 Screenshot the surface of the mortar to receive the tile by drawing a straight-edge, resting on opposite sides of the mold, across the mold to remove the excess mortar placed therein; do not float, puddle, or trowel the surface. The prepared mortar beds must receive the tile not less than 1 h nor more than 1 1/2 h after screeding. Use a freshly prepared, smooth paste of one part by weight of portland cement passing through a No. 200 (75-µm) (75 µm) sieve and 0.36 part by weight of potable water as a uniform bond coat on the surface of the prepared tile intended for bonding, in an amount sufficient to form a continuous layer not less than 1/32 in. (0.8 mm) or more than 1/16 in. (1.6 mm) over it, in addition to filling any depressions in it.

9.3 Place the tile on the mortar bed with one smooth, straight edge 1/4 in. (6.4 mm) in from a 6-in. (152-mm) (152 mm) long edge of the mortar bed and parallel to it. Center one-fifth of the tile in the sample along the edge of the mortar bed with a space between