



Designation: C 482 – 81 (Reapproved 1996)

Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement¹

This standard is issued under the fixed designation C 482; 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 approval. 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 to be bonded to portland cement. 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 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:

C 150 Specification for Portland Cement²

C 185 Test Method for Air Content of Hydraulic Cement Mortar²

C 207 Specification for Hydrated Lime for Masonry Purposes²

C 242 Terminology of Ceramic Whitewares and Related Products³

3. Terminology

3.1 Definitions:

3.1.1 For definitions of the types of tile listed in 1.1, refer to Terminology C 242.

4. Summary of Test Method

4.1 This test method consists of bonding tile under controlled conditions to a pure cement 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 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.

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. 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) 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.

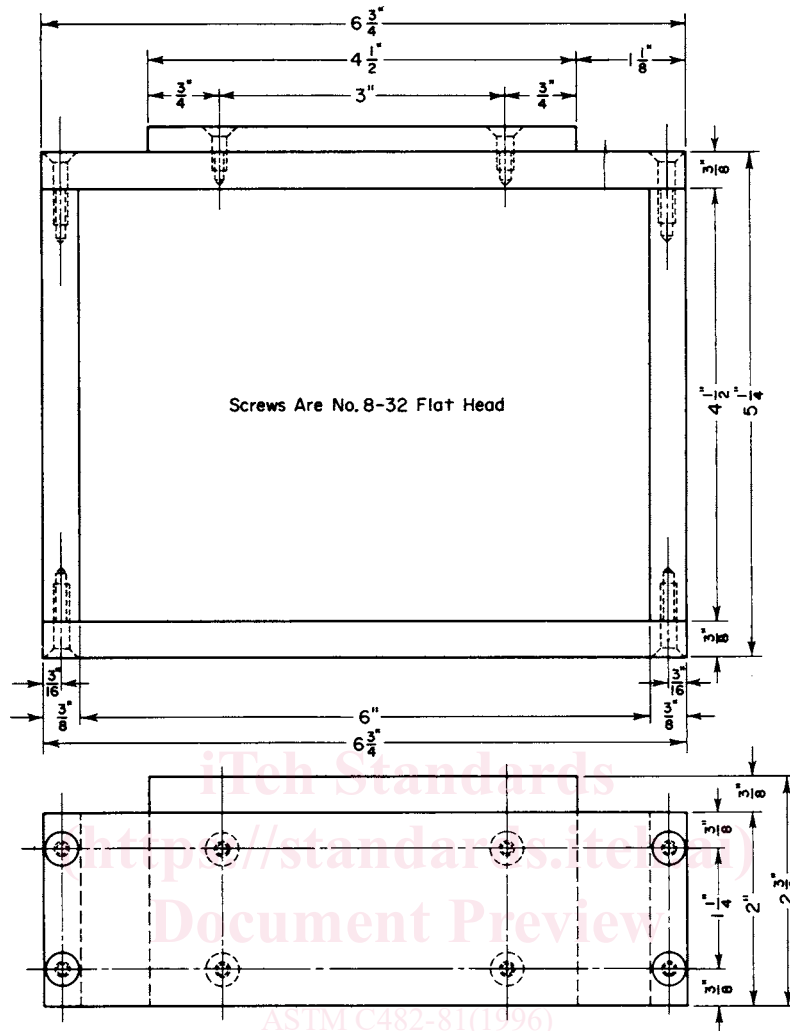
6.2 *Compression Testing Machine*—The testing machine may be either a hydraulic or screw type, with an accuracy of $\pm 1.0\%$. It shall be capable of applying a uniformly distributed shearing load at a rate of 200 ± 20 psi/min (1.4 ± 0.1

¹ This test method is under the jurisdiction of ASTM Committee C-21 on Ceramic Whitewares and Related Products and is the direct responsibility of Subcommittee C21.06 on Ceramic Tile.

Current edition approved Dec. 28, 1981. Published March 1982. Originally published as C 482 – 61 T. Last previous edition C 482 – 78.

² *Annual Book of ASTM Standards*, Vol 04.01.

³ *Annual Book of ASTM Standards*, Vol 15.02.



ASTM C482-81(1996)

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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)

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 C 150.

7.2 *Hydrated Lime*—Type S of Specification C 207.

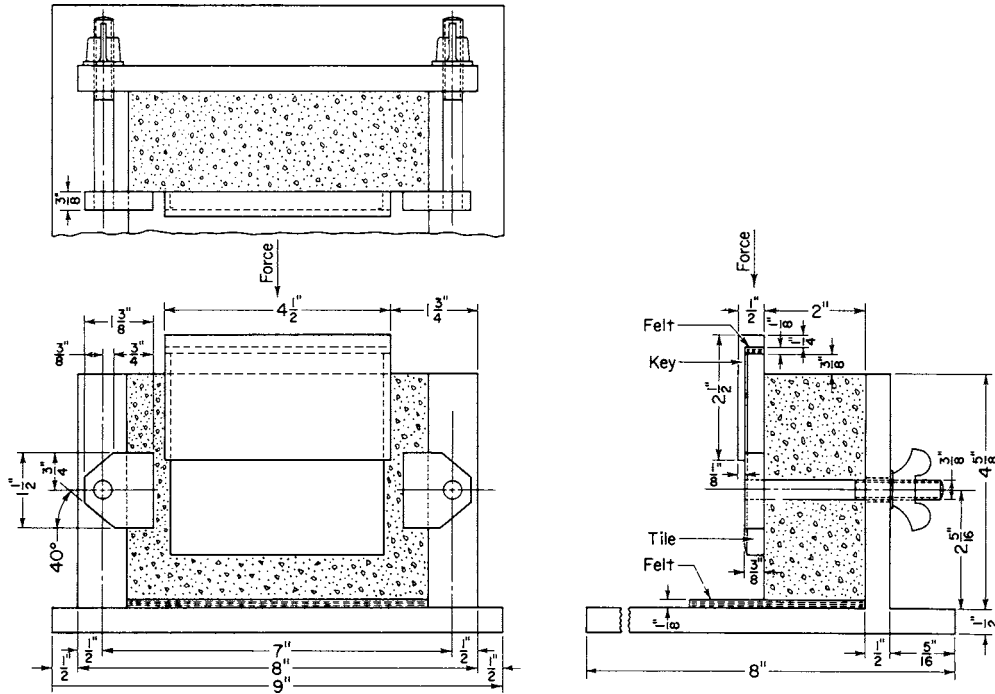
7.3 *Standard Sand*—Dry, Standard Ottawa sand conforming to the requirements given in Section 9 of Test Method C 185.

8. Test Sample

8.1 *Size of Sample*—The number of tile comprising a sample varies according to 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.



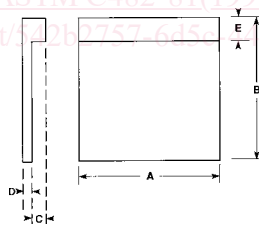
Metric Equivalents

Letter	in.	mm	Letter	in.	mm
A	3/8	9.5	H	9	229
B	1 3/8	35	I	1/4	6.4
C	3/4	19	J	1/8	3.2
D	1 1/2	38	K	2	51
E	1/2	13	L	1 5/16	33
F	7	178	M	2 5/16	59
G	8	203	N	4 1/2	114

FIG. 2 Fixture for Bond Strength Test

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Metric Equivalents

Tile Size, in. (mm)	A	B	C	D	E
1 1/16 (27) and smaller	3/4 (19)	1 1/8 (29)	3/16 (4.8)	1/8 (3.2)	3/8 (9.5)
1 1/8 (29) to 1 1/16 (40)	1 1/8 (29)	1 1/8 (29)	3/16 (4.8)	1/8 (3.2)	3/8 (9.5)
2 5/8 (41) to 2 1/4 (57)	1 5/8 (41)	1 3/4 (44)	3/16 (4.8)	1/8 (3.2)	3/8 (9.5)
2 5/16 (59) to 3 1/2 (88)	2 1/2 (64)	1 3/4 (44)	3/16 (4.8)	1/8 (3.2)	3/8 (9.5)
3 3/16 (90) to 4 1/4 (108) (1/4 (6.4) to 3/8 (9.5) thick)	4 1/4 (108)	2 1/2 (76)	1/4 (6.4)	1/8 (3.2)	3/8 (9.5)
3 3/4 (94) to 4 1/4 (108) (over 3/8 (9.5) thick)	4 1/4 (108)	2 1/2 (76)	3/8 (9.5)	1/8 (3.2)	3/8 (9.5)

FIG. 3 Key Detail for Fixture in Fig. 2

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 4 1/4 in. (108 mm), the tile shall be cut on a diamond or abrasive saw, so that the dimension is reduced to 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 1/4 in. (6.4 mm) in from an edge, and