Designation: C 501 – 84 (Reapproved 2002)

Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser[1]

This standard is issued under the fixed designation C 501; 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[2] covers the establishment of an abrasive wear index by determination of the loss of weight resulting from abrasion of unglazed ceramic tile. It is applicable to tile described in Definitions C 242.

1.2 The values stated in inch-pound units are to be regarded as the 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 242 Terminology of Ceramic Whitewares and Related Products[3]

2.2 *Federal Specification:*

SS-T–308b Tile, Floor, Wall, and Trim Units, Ceramic[4]

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, see Terminology C 242.

4. Summary of Test Method

4.1 This test method consists of mounting the tile specimens in suitable holders, attaching the mounted holders to the spindle of the Taber Abraser, and subjecting the specimens to a prescribed number of revolutions under abrasive wheels of specified coarseness and under a definite applied load. From the loss of weight due to abrasion, the abrasive wear index is calculated by a given formula.

5. Apparatus

5.1 *Taber Abrading Machine*,[5] equipped with replaceable hard abrasive H-22 Calibrade wheels, which can be loaded by weights.

5.2 *Vacuum Pick-Up*, to remove the abraded material while the machine is in operation.

5.3 *Revolution Counter*.

5.4 *Wheel Refacer*.[5]

5.5 *Balance*, having a sensitivity of 0.05 g.

6. Sampling

6.1 Four tile specimens 4 in. (102 mm) square or larger, or if ceramic mosaic tile, sufficient tile for four specimen assemblies 4 in. square shall constitute a sample and shall be chosen from the lot to be tested. Only tile that show no visible warpage when checked with a straightedge shall be used.

7. Test Specimen

7.1 The test specimen shall be 4 in. (102 mm) square and in one piece, if possible. If larger, it should be trimmed down to the desired size by removing equal amounts on opposite sides. In case of ceramic mosaic tile where several small units must be used to obtain a 4-in. square specimen assembly, the small units shall be mounted securely on a 4-in. square rigid material, such as a metal plate, by means of a suitable adhesive, and in such a manner that open joints are eliminated and the tile

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[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.

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[2] This test method is basically the same as the abrasion test given in Federal Specification SS-T-308b, except two minor changes have been made:

(*1*) The number of specimens required by the test is changed from three to four, so that the condition of the abrasive wheels used can be specified as new and once dressed. The diameters of wheels redressed more than once vary greatly and nonuniformly, introducing an unnecessary variation in test results.

(*2*) The bulk specific gravity of the tile tested has been eliminated from calculation of the wear index. The probable resulting maximum error of 2½ % in the wear-index value, when an average is assumed, does not justify the cumbersome determinations of bulk specific gravity of the specimen. Measurements of bulk specific gravities of twenty different unglazed tile from eight different manufacturers, including quarry tile, porcelain tile, natural clay tile and conductive tile showed a range of bulk specific gravity from 2.34 to 2.47, except for that of conductive tile which was as high as 2.98. The average of 2.40 was selected as a constant to be substituted for *G* in the SS-T-308b formula to obtain the formula in this test method. Therefore, to obtain the value 88, the constant of 36.75 in the SS-T-308b test has been multipled by 2.40 to keep the wear indexes of both tests on the same numerical scale.

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

[4] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

[5] The Tabor Abraser and the Model 200 wheel refacer are available from Teledyne Taber Instrument Corp., 17 Goundry St., North Tonawanda, NY 14150.

surfaces lie in a plane and are parallel to the metal plate. This can best be accomplished by placing the small tile units face down and in direct contact with each other on a true plane surface, such as a piece of plate glass, applying a sufficiently thick layer of adhesive to the 4-in. square metal plate that is to form the support of the assembly, and laying the metal plate on the tile units with the adhesive down. Apply a weight of at least 2 kg and of the same facial dimensions as the metal plate. If the assembly is kept in this position until the adhesive has set, any difference in thickness of the individual tile units is taken up between the tile and the backing plate and the plane of the face of the tiles will be parallel with the plane of the metal plate.

8. Procedure

8.1 Mount the specimen or specimen assembly on the drive-pin holder by means of a double-sided pressure-sensitive sheet. Cut the pressure-sensitive sheet to approximately 3 in. (76 mm) square and center it on the specimen. Determine the weight of the specimen and holder assembly to ±0.05 g and record this weight.

8.2 Alternatively, mount the specimen on the holder by means of the center bolt and nut; the specimen must have a drilled hole at its center for this mounting. If a center bolt mounting is used, the specimen may be weighed alone (without the holder) before and after the test. This mounting is recommended when heavy specimens plus the weight of the holder might exceed the capacity of the available balance.

8.3 Mount the holder on the spindle of the abrading machine equipped with H-22 coarse Calibrade wheels, new or freshly dressed once on the wheel refacer (Note 1). Apply a 9.8-N load (Note 2) to each abrasive wheel and carefully swing the wheels into position on the specimen. Apply the vacuum pickup to the specimen by arranging the exhaust nozzle 1⁄16 to 1⁄8 in. (1.5 to 3.0 mm) above the specimen.

NOTE 1—Two sets of new wheels are required for this method. They shall each be used new and refaced once. There shall be a total of four 1000-cycle runs.

NOTE 2—9.8 N = 1 kgf.

8.4 Run the abraser for a total of 1000 cycles, determined by reading the revolution counter. Remove the holder with the specimen and reweigh to ±0.05 g.

8.5 Repeat this operation for the other three specimens or specimen assemblies.

9. Calculation

9.1 Calculate the abrasive wear index, I_w, expressed in whole numbers, as follows:

$$I_w = \frac{88}{W_o - W_f} \quad (1)$$

where:

W_o = original weight of specimen and holder, g, and
W_f = final weight of specimen and holder, g

NOTE 3—If a center bolt mounting has been used, the weight of the holder is eliminated.

10. Report

10.1 Report the following:

10.1.1 Type and size of tile tested,

10.1.2 Average abrasive wear index of the four specimens tested, and

10.1.3 Abrasive wear index of each of the four specimens tested.

11. Precision and Bias [6]

11.1 The following values were determined for the percent coefficients of variation of this test method on the basis of an interlaboratory test program.

11.1.1 *Precision*—The intralaboratory results were 9% and the interlaboratory results 10 %.

11.1.2 *Bias*

11.1.2.1 No statement of bias can legitimately be derived for this test method, since no generally accepted reference standard is available for comparison.

11.1.2.2 The rate of abrasion is sensitive to relative humidity and where possible, test should be run under constant humidity conditions. The relationship to humidity is presently under study by Subcommittee C21.06.

[6] Supporting data are available on loan from ASTM Headquarters. Request RR: C21-1001.