



Standard Test Method for Relative Resistance to Deep Abrasive Wear of Unglazed Ceramic Tile by Rotating Disc¹

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1. Scope

1.1 This test method covers the deep abrasive wear by measuring the loss of volume resulting from abrasion of unglazed ceramic tile under given conditions by means of a rotating disc and the use of abrasive material.

1.2 *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 Products²

C 448 Test Methods for Abrasion Resistance of Porcelain Enamels²

C 501 Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser²

C 1027 Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile²

3. Terminology

3.1 Definitions:

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

4. Significance and Use

4.1 This test method provides the means to measure the potential resistance to wear of unglazed ceramic tile intended for floor coverings. This test method does not consider physical appearance but is intended to measure durability. See Test Method C 1027 for the determination of visible abrasion resistance of glazed ceramic tile.

4.1.1 See Test Method C 501 for an alternative method to determine deep abrasion.

5. Apparatus³

5.1 Abrasion apparatus (see Fig. 1) consisting essentially of a rotating disc, a storage hopper with a dispensing device for the abrasive material, a test specimen support, and a counterweight. The disc is made of Fe 360A steel (ISO 630-1980) with a diameter of 200 ± 0.2 mm and thickness at the edge of 10 ± 0.1 mm, and with a rate of revolution of 75 r/min. The pressure with which test specimens are held against the steel disc is determined by calibrating the apparatus against float glass (bathside). The pressure is adjusted such that, after 150 revolutions, a chord of 24 ± 0.5 mm is produced.

NOTE 1—For the specification of float glass, see Test Method C 448, Table A1.4.

5.1.1 When the disc diameter has worn to 199 mm, the steel disc shall be replaced.

5.2 A linear measuring gage capable of measuring to 0.1 mm.

5.3 *Abrasive Material*—White fused aluminum oxide of grain size 80 (32 GB 1971) FEPA Bonded Abrasive Grain Size Standard Grits 8-220.

6. Test Specimen

6.1 *Types of Test Specimens*—Tests shall be carried out using whole tiles or test specimens of suitable dimensions. Before testing, small specimens shall be fixed with an adhesive onto a larger background, avoiding joints where possible.

6.2 *Sampling*—A minimum of five tiles shall be tested. Only tile that show no visible warpage when checked with a straightedge shall be used.

7. Procedure

7.1 Place a test specimen in the apparatus so that it is tangential against the disc. Ensure that the feed of abrasive material into the grinding zone is uniform at a rate of $100 \text{ g} \pm 10 \text{ g}$ per 100 revolutions.

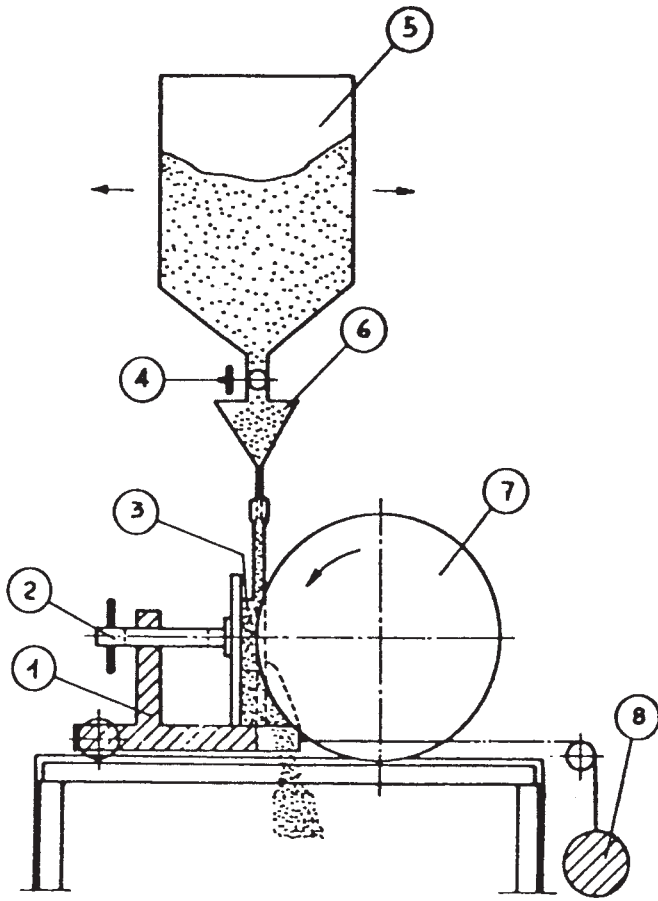
7.2 Rotate the steel disc for 150 revolutions. Remove the test specimen from the apparatus and measure the cord length

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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.

³ Equipment source: Gabrielli S.R.L., Box 218, 50019 Sesto Fiorentino, Florence, Italy, Fax: 55-42-15-654.



- 1. Test specimen clamp
- 2. Fixing screw
- 3. Test specimen
- 4. Valve
- 5. Storage hopper for abrasive material
- 6. Even-flow funnel
- 7. Steel disc
- 8. Counterweight

FIG. 1 Abrasion Apparatus

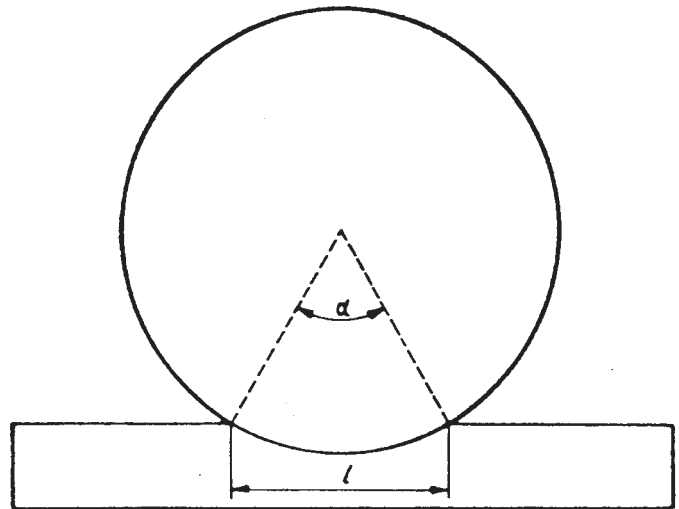


FIG. 2 Definition of Chord

$$V = \left(\frac{\pi\alpha}{180} - \sin \alpha \right) \left(\frac{h \cdot d^2}{8} \right) \quad (1)$$

where:

- $\pi = 3.14 \sin \frac{\alpha}{2} = \frac{l}{d}$
- (*d*) = the diameter of the rotating disc (200 mm),
- (*h*) = the thickness of the rotating disc (10 mm),
- (α) = the angle (in degrees) subtended at the center of the rotating disc by the chord (see Fig. 2),
- (*l*) = the length of chord (mm).

Some values are given in Table 1.

9. Report

9.1 Report the following:

- 9.1.1 Type and size of tile tested,
- 9.1.2 The chord length (*l*) of each groove to the nearest 0.5 mm;
- 9.1.3 The volume (*V*) of material removed, mm³ for each individual groove;
- 9.1.4 The average volume, mm³; and
- 9.1.5 State if the volume values were taken from Table 1 or calculated.

10. Precision and Bias

10.1 Precision is being determined.

11. Keywords

11.1 deep abrasive wear; relative resistance; rotating disc; unglazed ceramic tile

(*l*) of the groove by means of the linear measuring gage to the nearest 0.5 mm. Test each test specimen in at least two places at right angles on its proper surface.

7.3 If relief surfaces would interfere with the determination of the abrasion resistance, the projections may be ground off, but the results of the test will not be the same as for similar tiles having plane surfaces. Do not reuse the abrasive grain.

8. Calculation of Results

8.1 The resistance to deep abrasion is expressed as the volume (*V*) of material removed, in mm³. This is calculated from the chord length (*l*) of the groove by means of the formula:

TABLE 1 Predetermined Values

| (l) mm | (v) mm ³ | (l) mm | (v) mm ³ | (l) mm | (v) mm ³ | (l) mm | (v) mm ³ | (l) mm | (v) mm ³ |
|-----------|------------------------|-----------|------------------------|-----------|------------------------|-----------|------------------------|-----------|------------------------|
| 20 | 67 | 30 | 227 | 40 | 540 | 50 | 1062 | 60 | 1851 |
| 20.5 | 72 | 30.5 | 238 | 40.5 | 561 | 50.5 | 1094 | 60.5 | 1898 |
| 21 | 77 | 31 | 250 | 41 | 582 | 51 | 1128 | 61 | 1947 |
| 21.5 | 83 | 31.5 | 262 | 41.5 | 603 | 51.5 | 1162 | 61.5 | 1996 |
| 22 | 89 | 32 | 275 | 42 | 626 | 52 | 1196 | 62 | 2046 |
| 22.5 | 96 | 32.5 | 288 | 42.5 | 649 | 52.5 | 1232 | 62.5 | 2097 |
| 23 | 102 | 33 | 302 | 43 | 672 | 53 | 1268 | 63 | 2149 |
| 23.5 | 109 | 33.5 | 316 | 43.5 | 696 | 53.5 | 1306 | 63.5 | 2202 |
| 24 | 116 | 34 | 330 | 44 | 720 | 54 | 1342 | 64 | 2256 |
| 24.5 | 123 | 34.5 | 345 | 44.5 | 746 | 54.5 | 1380 | 64.5 | 2310 |
| 25 | 131 | 35 | 361 | 45 | 771 | 55 | 1419 | 65 | 2363 |
| 25.5 | 139 | 35.5 | 378 | 45.5 | 798 | 55.5 | 1459 | 65.5 | 2422 |
| 26 | 147 | 36 | 393 | 46 | 824 | 56 | 1499 | 66 | 2479 |
| 26.5 | 156 | 36.5 | 409 | 46.5 | 852 | 56.5 | 1541 | 66.5 | 2537 |
| 27 | 165 | 37 | 427 | 47 | 880 | 57 | 1583 | 67 | 2596 |
| 27.5 | 174 | 37.5 | 444 | 47.5 | 909 | 57.5 | 1625 | 67.5 | 2656 |
| 28 | 184 | 38 | 462 | 48 | 938 | 58 | 1669 | 68 | 2717 |
| 28.5 | 194 | 38.5 | 481 | 48.5 | 968 | 58.5 | 1713 | 68.5 | 2779 |
| 29 | 205 | 39 | 500 | 49 | 999 | 59 | 1758 | 69 | 2842 |
| 29.5 | 215 | 39.5 | 520 | 49.5 | 1030 | 59.5 | 1804 | 69.5 | 2906 |

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