



Designation: C1243 – 93 (Reapproved 2015)<sup>ε1</sup>

## Standard Test Method for Relative Resistance to Deep Abrasive Wear of Unglazed Ceramic Tile by Rotating Disc<sup>1</sup>

This standard is issued under the fixed designation C1243; 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.

<sup>ε1</sup> NOTE—Corrected Eq 1 editorially in Feb. 2017.

### 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 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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:*<sup>2</sup>

C242 Terminology of Ceramic Whitewares and Related Products

C448 Test Methods for Abrasion Resistance of Porcelain Enamels

C501 Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser

C1027 Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile

### 3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, see Terminology C242.

<sup>1</sup> 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.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

### 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 C1027 for the determination of visible abrasion resistance of glazed ceramic tile.

4.1.1 See Test Method C501 for an alternative method to determine deep abrasion.

### 5. Apparatus<sup>3</sup>

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  $200 \pm 0.2$  mm and thickness at the edge of  $10 \pm 0.1$  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  $24 \pm 0.5$  mm is produced.

NOTE 1—For the specification of float glass, see Test Method C448, 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.

<sup>3</sup> The sole source of supply of the apparatus known to the committee at this time is Gabrielli S.R.L., Box 218, 50019 Sesto Fiorentino, Florence, Italy, Fax: 55-42-15-654.. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,<sup>1</sup> which you may attend.

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 chord length ( $l$ ) 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  $\text{mm}^3$ . This is calculated from the chord length ( $l$ ) of the groove by means of the formula:

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

where:

$$\pi = 3.14$$

$$\sin \frac{\alpha}{2} = \frac{1}{d}$$

( $d$ ) = the diameter of the rotating disc (200 mm),

( $h$ ) = the thickness of the rotating disc (10 mm),

( $\alpha$ ) = the angle (in degrees) subtended at the center of the rotating disc by the chord (see Fig. 2), and

( $l$ ) = 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,  $\text{mm}^3$  for each individual groove;

9.1.4 The average volume,  $\text{mm}^3$ ; 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

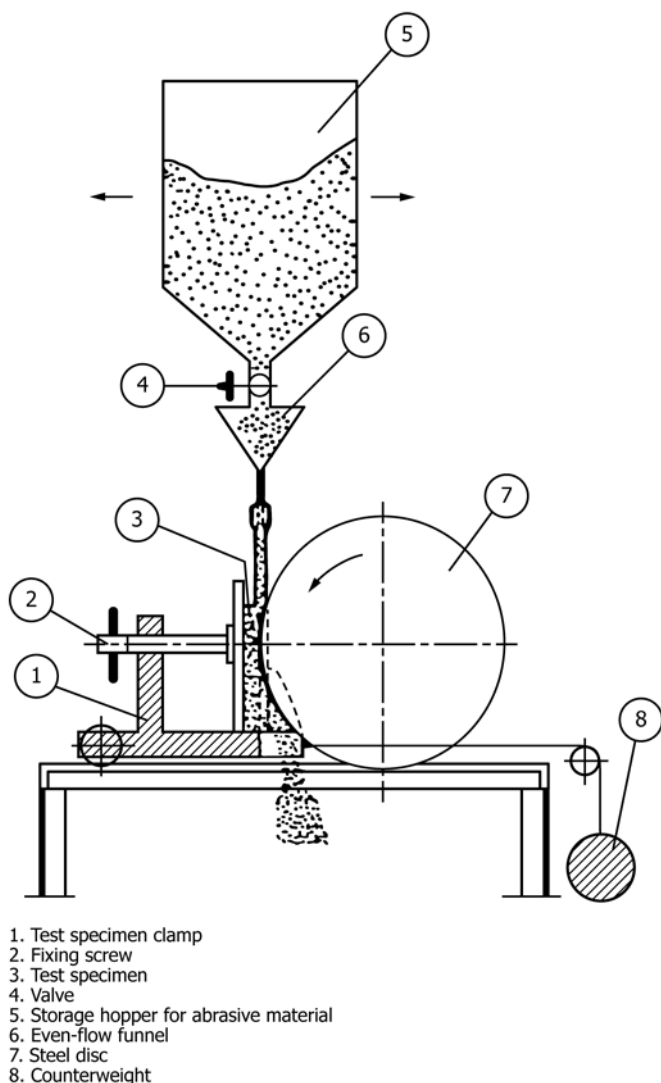


FIG. 1 Abrasion Apparatus

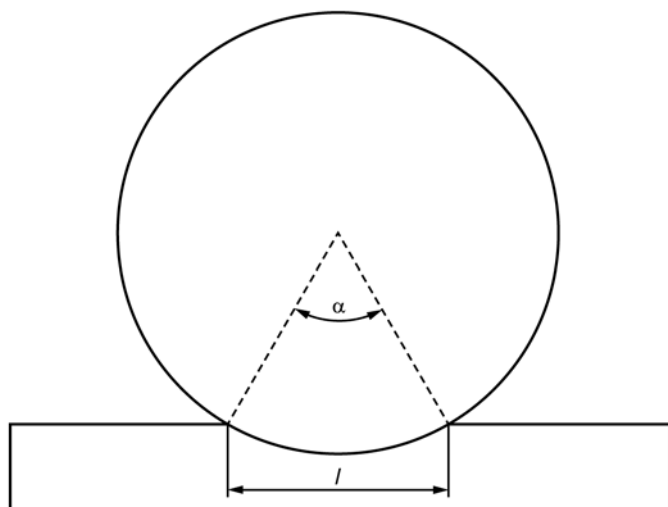


FIG. 2 Definition of Chord

**TABLE 1 Predetermined Values**

(l) mm	(v) mm <sup>3</sup>	(l) mm	(v) mm <sup>3</sup>	(l) mm	(v) mm <sup>3</sup>	(l) mm	(v) mm <sup>3</sup>	(l) mm	(v) mm <sup>3</sup>
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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