IS 13630-11 (2006): Ceramic Tiles - methods of test, Sampling and Basis of Acceptance, Part 11: Determination of resistance to surface abrasion - Glazed tiles [see IS 13630 (Parts 1 to 15)] [CED 5: Flooring, Wall Finishing and Roofing]

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भारतीय मानक

सिरैमिक टाईलें - परीक्षण पद्धतियाँ, नमूने लेने तथा स्वीकार्यता का आधार

(पहला पुनरीक्षण)

Indian Standard

CERAMIC TILES — METHODS OF TEST, SAMPLING AND BASIS FOR ACCEPTANCE

(First Revision)

ICS 91.100.23

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

August 2006 Price Group 2

FOREWORD

This Indian Standard (Parts 1 to 15) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Flooring, Wall Finishing and Roofing Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first published in various parts in 1992-93. This is the first revision; having all parts combined in one publication, of the standard in which the following major changes have been incorporated:

a) As per the decision taken in the last meeting, the requirements of all the parts have been included in one volume and the revised standard has been brought in line with ISO 10545 (various parts).
b) The requirements for determination of bulk density have been added in Part 2 and a few changes have been made in the requirements for determination of water absorption.
c) A few modifications have also been made in Part 3.
d) Requirements for determination of breaking strength have also been added in Part 6.
e) Requirements for determination of glazing resistance tests have also been modified in Part 9.
f) A new test for determination of impact resistance by measurement of co-efficient of restitution has been added as Part 14.
g) IS 13711 : 1993 'Sampling and basis for acceptance' has been amalgamated with Part 15 of this standard.

In formulation of this standard considerable assistance have been derived from the following standards:

ISO 10545-1 : 1995 Ceramic tiles — Part 1 : Sampling and basis for acceptance
ISO 10545-2 : 1995 Ceramic tiles — Part 2 : Determination of dimensions and surface quality
ISO 10545-3 : 1995 Ceramic tiles — Part 3 : Determination of water absorption, apparent porosity, apparent relative density and bulk density
ISO 10545-4 : 2004 Ceramic tiles — Part 4 : Determination of modulus of rupture and breaking strength
ISO 10545-5 : 1996 Ceramic tiles — Part 5 : Determination of impact resistance by measurement of coefficient of restitution
ISO 10545-6 : 1995 Ceramic tiles — Part 6 : Determination of resistance to deep abrasion for unglazed tiles
ISO 10545-7 : 1996 Ceramic tiles — Part 7 : Determination of resistance to surface abrasion for glazed tiles
ISO 10545-8 : 1994 Ceramic tiles — Part 8 : Determination of linear thermal expansion
ISO 10545-9 : 2004 Ceramic tiles — Part 9 : Determination of resistance to thermal shock
ISO 10545-10 : 1995 Ceramic tiles — Part 10 : Determination of moisture expansion
ISO 10545-11 : 1994 Ceramic tiles — Part 11 : Determination of crazing resistance for glazed tiles
ISO 10545-12 : 1995 Ceramic tiles — Part 12 : Determination of frost resistance
ISO 10545-13 : 1995 Ceramic tiles — Part 13 : Determination of chemical resistance
ISO 10545-14 : 1995 Ceramic tiles — Part 14 : Determination of resistance to stains
ISO 13006 : 1998 Ceramic tiles — Definitions, classification, characteristics and marking

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CERAMIC TILES — METHODS OF TEST, SAMPLING AND BASIS FOR ACCEPTANCE

PART 11 DETERMINATION OF RESISTANCE OF SURFACE ABRASION — GLAZED TILES

(First Revision)

1 SCOPE

This standard (Part 11) covers methods of test for determining the resistance to surface abrasion of all glazed ceramic tiles used for floor covering.

2 REFERENCE

The standard listed below is necessary adjunct to this standard:

IS No.	*Title*
11643 : 1985	Specification for silicon carbide for bonded abrasive products

3 PRINCIPLE

Determination of the abrasion resistance of the glaze of tiles by rotation of an abrasive load on the surface and assessment of the wear by means of visual comparison of abraded test specimens and non-abraded tiles.

4 ABRASIVE LOADS

The total load on each test specimen consists of:

a) 70.0 g of 5 mm diameter steel balls,
b) 52.5 g of 3 mm diameter steel balls,
c) 43.75 g of 2 mm diameter steel balls,
d) 8.75 g of mm diameter steel balls,
e) 3.0 g white fused aluminum oxide conforming to the grain size requirement of Grit No. 80 of Table I of IS 11643, and
f) 20 ml of de-ionized or distilled water.

5 APPARATUS

5.1 Abrasion Apparatus — The abrasion apparatus consists of a steel case with an inbuilt electrical drive connected to a horizontal supporting plate of diameter 580 mm with positions for test specimens of dimensions at least 100 mm × 100 mm (*see* Fig. 1). The distance between the centre of the supporting plate and the centre of each position shall be 195 mm. There shall be equal distances between each adjacent position. The supporting plate rotates at 300 revolutions per minute with an eccentricity (e) of 22.5 mm so that every part of each test specimen describes a circular motion of diameter 45 mm. The test specimens are held down with the aid of metal holders which are provided with rubber seals (*see* Fig. 2). The internal diameter of the holders is 83 mm, thus providing a test area of about 54 cm^2. The thickness of the rubber is 9 mm and the height of the space under the holder is 25.5 mm.

5.1.1 The apparatus switches off automatically after completion of a preset number of revolutions.

5.1.2 The supporting plate with holders and test specimens shall be covered during operation.

5.1.3 A suitable apparatus of another description may be used, provided that the results comply with the results from the apparatus described above.

5.2 Apparatus for Visual Assessment — The apparatus consists of a viewing box equipped with fluorescent lighting of colour temperature 6 000 K to 6 500 K placed vertically above the surface to be observed providing 300 lux illuminance. The dimensions of the box shall be 61 cm × 61 cm × 61 cm and the inner faces shall be painted a neutral grey. Tight source is screened to avoid direct viewing.

5.3 Drying Oven, capable of operation at 110 ± 5°C.

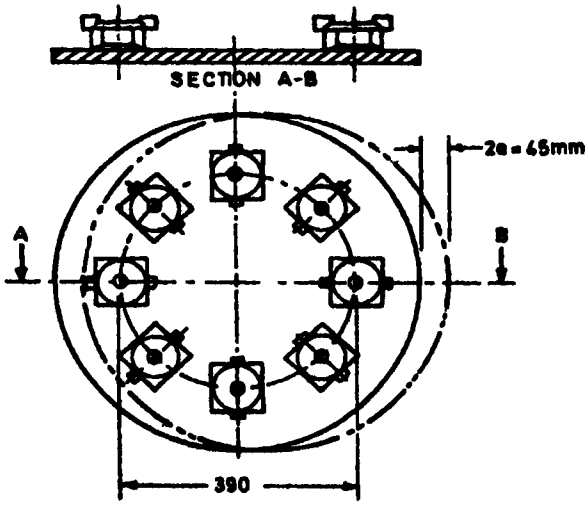
5.4 Balance, if mass loss is required.

6 TEST SPECIMENS

6.1 Types of Test Specimens

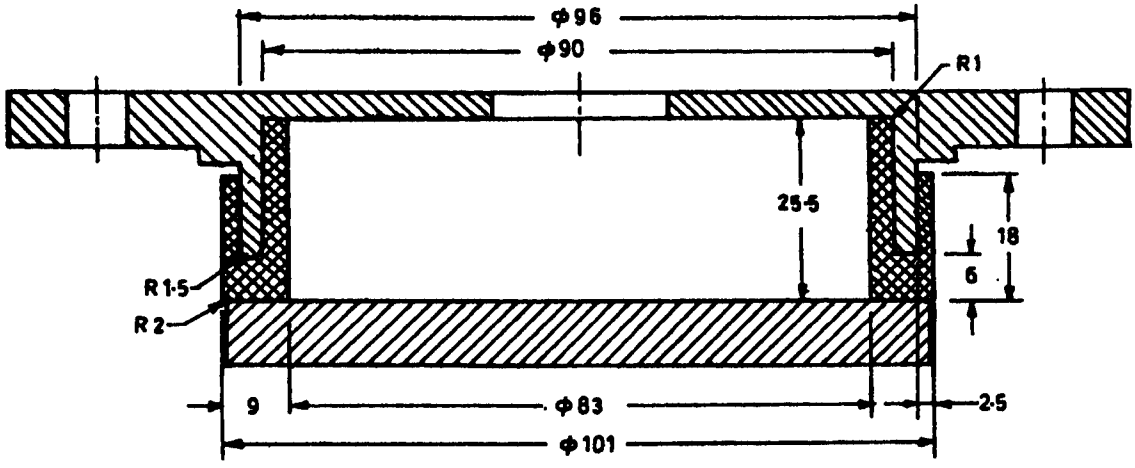
6.1.1 Test specimens shall be representative of the sample; where tiles have different colour or decorative effects in parts of the surface, care should be taken to include all distinctive parts.

6.1.2 The usual facial dimensions of test specimens are 100 mm × 100 mm. Test specimens with smaller facial dimensions shall be fastened close together on a suitable supporting material. Edge effects at the narrow joints shall be ignored.



All dimensions in millimetres.

FIG. 1 APPARATUS WITH POSITIONS FOR EIGHT SPECIMEN HOLDERS



All dimensions in millimetres.

FIG. 2 SPECIMEN HOLDER

6.2 Number of Test Specimens

6.2.1 Eleven test specimens are required. In addition, eight test specimens are required for the visual assessment.

6.2.2 The procedure requires one test specimen for each stage of abrasion and subsequently, an additional three test specimens to check the result at the visual failure point.

6.3 Preparation

The glazed surface of the test specimen shall be clean and dry.

7 PROCEDURE

7.1 Calibration of the abrasion apparatus is only necessary occasionally or when there is doubt regarding the validity of the results. One possible calibration method is given in the Annex A.

7.2 Clamp a metal holder on to the glazed surface of each test specimen on the abrasion apparatus. Introduce the abrasive load into the holder through a hole in its upper surface. The hole may then be sealed to prevent loss from the abrasive load. The number of revolutions of the preset counter required for each abrasion stage of the test is 100, 150, 600, 750, 1 500, 2 100, 6 000 and 12 000. Remove one test specimen after each abrasion stage and continue the test until failure is observed.

7.3 After abrasion, rinse the test specimens under running water and dry in the oven at 110 ± 5°C. If the

test specimens are stained with iron oxide, completely remove the stain with 10 percent (*v/v*) hydrochloric acid. Immediately rinse under the running water and dry.

7.4 For the visual comparison, surround an abraded test specimen by unabraded tiles of exactly the same type in an apparatus for visual assessment under an illumination of 300 lux. View with the naked eye (or with the aid of spectacles, if usually worn) from a distance of 2 m and a height of 1.65 m. Note the number of revolutions at which any change in the area that has been subjected to abrasion can be readily distinguished. The consensus of at least three observers is required.

7.5 The result is checked by retesting at the abrasion stage when failure is observed and at the next higher and lower abrasion stages. If the result is not the same, the lower of the two abrasion stages shall be used to decide the classification.

7.6 Then test the abraded area of the tile which has passed 12 000 revolutions stage for stain resistance in accordance with IS 13630 (Part 8).

7.7 After use, the steel balls should be cleaned with water followed by methylated spirits and then thoroughly dried to prevent rusting. Before each test, screen the steel balls in the abrasive load into specified size categories and replace any mass in each size categories.

7.8 If there is an agreement to determine the mass lost from a surface during abrasion testing, this shall be obtained by measuring the dry mass of three test specimens before the test and after 6 000 revolutions. Upon agreement subsequently test abraded tiles which have passed 1 500, 2 100 and 6 000 revolutions stages for stain resistance in accordance with IS 13630 (Part 8) at the abrasion stage at which visual failure occurred. Other relevant properties may be determined by agreement during the execution of the test procedures for instance change of colour or gloss. The additional information, which is obtained by agreement, shall not be used to classify tiles.

8 CLASSIFICATION OF RESULTS

The test specimens are classified according to Table 1. In order to be classified as Class 5, the tile must also pass the test specified in IS 13630 (Part 8) test for resistance to stains on the abraded area. If there is no visual failure after 12 000 revolutions but if stains cannot be removed by any standard procedure the tile shall be Class 4.

Table 1 Classification of Glazed Ceramic Tiles

Sl No.	Abrasion Stage; Failure Visible at Revolutions	Class
(1)	(2)	(3)
i)	100	0
ii)	150	1
iii)	600	2
iv)	750, 1 500	3
v)	2 100, 6 000, 12 000	4
vi)	> 12 000 [1]	5

[1] Must pass the test specified in IS 13630 (Part 8).

9 TEST REPORT

The test report shall contain the following:

a) Description of the tiles;
b) Preparation of test specimens;
c) Test method;
d) Classification according to 8;
e) Abrasion stage at which visual failure occurred; and
f) Mass loss, colour change, gloss change of other properties measured by agreement.

ANNEX A

(*Clause* 7.1)

CALIBRATION OF THE ABRASION APPARATUS USING FLOAT GLASS

A-1 REFRENCE MATERIAL

The reference material shall be float glass with a minimum thickness of 6 mm.

A-2 IDENTIFICATION OF THE FLOAT BATH SURFACE OF THE GLASS

As the calibration test is carried out on the float bath side, this has first to be identified. One of the following methods can be used.

A-2.1 Chemical Method

A-2.1.1 *Reagents*

A-2.1.1.1 *Etching solutions* — Thoroughly mix 10 volumes of concentrated hydrochloric acid, 10 volumes

of distilled water and 8 volumes of hydrofluoric acid [40 percent (*v/v*)].

A-2.1.1.2 *Cacotheline solution* — 0.10 percent (*v/v*) cacotheline in distilled water.

A-2.1.2 *Method*

Place 2 or 3 drops of the etching solution on the glass surface followed by 1 or 2 drops of the cacotheline solution.

In 5 to 10 s purple colour will be seen on the float bath side; otherwise the solution will remain yellow.

A-2.2 UV Method

View the glass surface in a dark room when illuminated by ultraviolet light as shown in Fig. 3. The float bath side exhibits a slight fluorescence.

NOTE — Ultraviolet light in the region 254 nm to 365 nm will damage the eyes and suitable protective UV — filter goggles must be worn.

A-2.3 Energy Dispersive Analysis (EDA) Method

Examine the glass surface by energy dispersive analysis. The float bath side is identified by its tin content.

A-3 PROCEDURE

Calibration of the abrasion apparatus may be performed by measuring either the loss in mass (*see* **A-3.1**) or the change in gloss (*see* **A-3.2**). Eight float glass test specimens measuring 100 mm × 100 mm shall be abraded on the float bath side using the abrasive load given in **4.1** of the main text.

A-3.1 Mass Loss

Dry the test specimens in the drying oven at 110 ± 5°C and measure the mass of the each. Abrade the specimens for 6 000 revolutions. Rinse and then dry the test specimens again at 110 ± 5°C and determine the loss in mass of each specimen and calculate the mean loss. Measure the abraded area of each specimen.

The abrasion apparatus is satisfactory, if the mean loss in mass is 0.032 ± 0.002 mg/mm^2 of the abraded area.

A-3.2 Gloss Change

Measure the 60° specular gloss on the float bath side at the centre of each test specimen backed by a matt black surface (for example, black velvet). Abrade the specimen for 1 000 revolutions. Rinse and then dry the specimens and remeasure the 60° specular gloss. Calculate the percentage loss in gloss for each specimen and the mean loss in gloss.

The abrasion apparatus is satisfactory, if the mean loss in gloss at the centre of the abraded area is 50 ± 5 percent.

If any difficulty is experienced in obtaining stable initial gloss values, the glass may first be cleaned by immersion in water containing a trace of detergent for at least 1 h at 75 ± 5°C followed by rinsing with warm water.

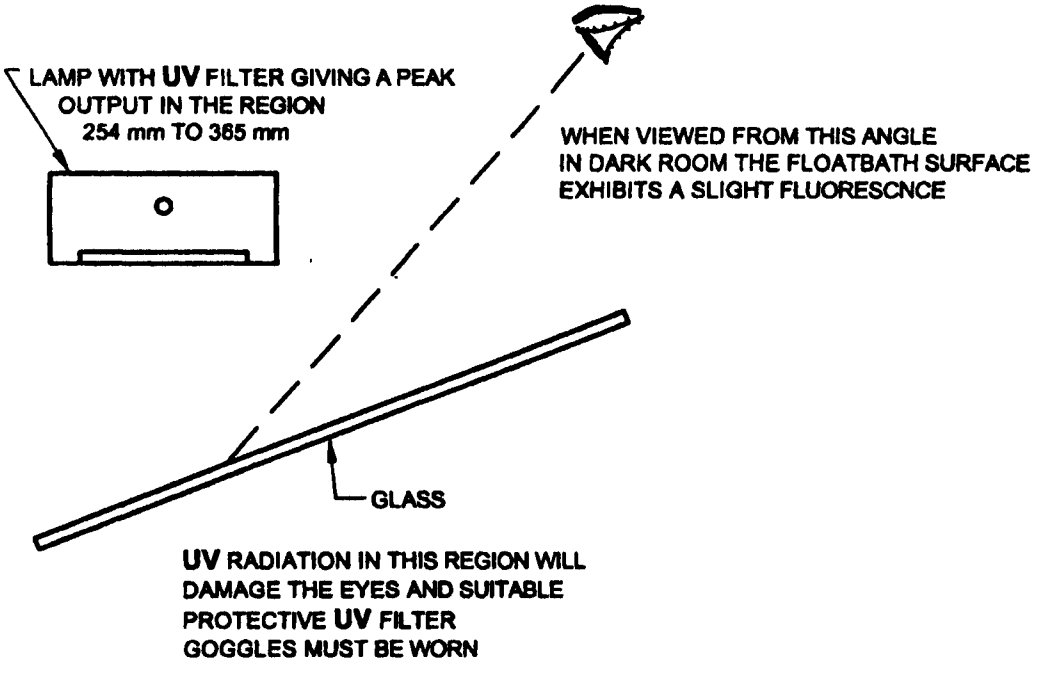


FIG. 3 UV METHOD

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc: No. **CED 5 (7358 to 7372).**

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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