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मानक

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“Step Out From the Old to the New”

IS 13630-6 (2006): Ceramic Tiles - Methods of test, Sampling and Basis of Acceptance, Part 6: Determination of modulus of rupture (see IS 13630 : Parts 1 to 15) [CED 5: Flooring, Wall Finishing and Roofing]



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Bhartḥari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS 13630 (Part 6) : 2006

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

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BUREAU OF INDIAN STANDARDS
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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 6 DETERMINATION OF MODULUS OF RUPTURE
AND BREAKING STRENGTH***(First Revision)***1 SCOPE**

This standard (Part 6) covers a method of test for determining the modulus of rupture and breaking strength of all ceramic tiles.

2 REFERENCE

The standard listed below is necessary adjunct to this standard:

<i>IS No.</i>	<i>Title</i>
3400 (Part 2) : 1995	Methods of test for vulcanized rubbers: Part 2 Hardness (<i>second revision</i>)

3 PRINCIPLE

Determination of modulus of rupture and breaking strength of a whole tile by means of three-point loading, the central point being in contact with the proper surface of the tile.

4 APPARATUS

4.1 **Drying Oven** — Capable of operation at $110 \pm 5^\circ\text{C}$.

4.2 **Recording Gauge** — Accurate to 2 percent.

4.3 **Two Cylindrical Support Rods** — It shall be made of metal and the parts in contact with the test specimen shall be covered with rubber having a hardness of 50 ± 5 IRHD, measured in accordance with IS 3400 (Part 2). One rod shall be slightly pivotable (*see Fig. 1*) and the other shall be slightly rotatable about its own axis (*see Table 1 for relevant dimensions*).

4.4 **Central Cylindrical Rod** — It shall be of the same diameter as the support rods and covered with similar rubber, which transmits the load F . This rod shall also be slightly pivotable (*see Fig. 1*) (*see Table 1 for relevant dimensions*).

5 TEST SPECIMENS

5.1 Whenever possible, whole tiles shall be tested. However, it may be necessary to cut exceptionally large tiles (that is those greater than 300 mm in length) and some non-rectangular shapes in order to fit them in the apparatus. Rectangular test specimens of the largest possible size shall then be cut, having their centres coinciding with the centres of tiles.

5.2 In case of doubt, results obtained using whole tiles

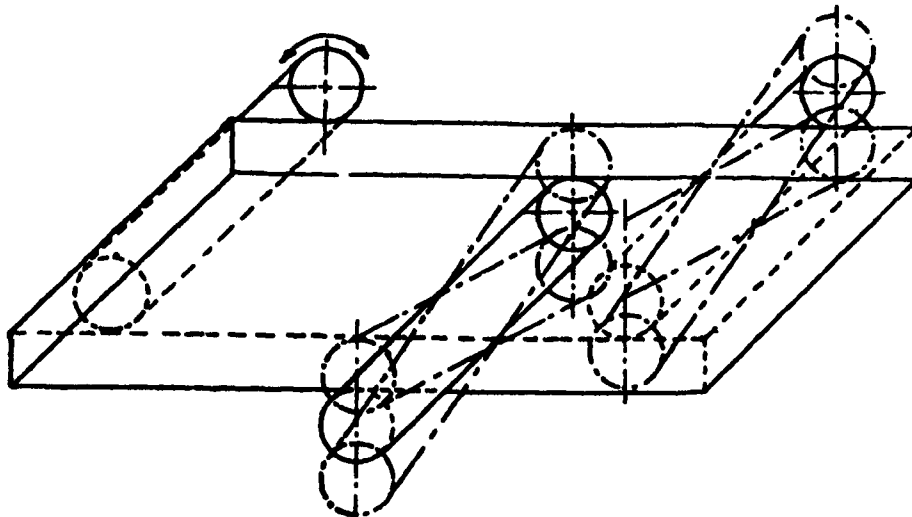


FIG. 1 APPARATUS FOR MEASUREMENT OF MODULUS OF RUPTURE

Table 1 Diameter of Rods, Thickness of Rubber and Length
(Clauses 4.4, 6.2 and 6.6)

Sl No.	Dimension of Tile mm	Diameter of Rod d mm	Thickness of Rubber t mm	Overlap of Tile Beyond the Edge Supports l mm
(1)	(2)	(3)	(4)	(5)
i)	≥ 95	20	5	10
ii)	$< 95 \geq 48$	10	2.5	5
iii)	$< 48 \geq 18$	5	1	2

shall always be preferred to results obtained with cut tiles.

5.3 The minimum number of test specimens for each sample is given in Table 2.

Table 2 Minimum Number of Test Specimens

Sl No.	Dimension of Tile mm	Minimum Number of Test Specimens
(1)	(2)	(3)
i)	≥ 48	7
ii)	$< 48 \geq 18$	10

6 PROCEDURE

6.1 If cut test specimens are to be measured, dry them in the oven at $110 \pm 5^\circ\text{C}$ until constant mass is reached, that is when the difference between two successive weighing at intervals of 24 h is less than 0.1 percent.

6.2 Place a test specimen on two supporting rods, with the glazed or proper surface uppermost so that the test specimen projects by the length l (see Table 1 and Fig. 2) beyond each support rod.

6.3 Position the central rod equidistant between the support rods. Apply the load evenly in such a way as to obtain a rate of increase of stress of $1 \pm 0.2 \text{ N/mm}^2/\text{s}$; the actual rate per second can be calculated by the expression given in 7.

6.4 Note the load to break, F .

6.5 For extruded tiles, place the tiles so that the projecting ribs are at right angles to the support rods. For all other rectangular tiles the greater side is at right angles to the support rods.

6.6 For tiles with relief surfaces, place a second layer of rubber, of the appropriate thickness given in Table 1, on the central rod in contact with the relief surface.

7 EXPRESSION OF RESULT

7.1 Only the results for test specimens that break within a central portion of length equivalent to the

diameter of the central rod shall be used to calculate the average breaking strength and average modulus of rupture.

7.2 A minimum of five acceptable results is necessary to calculate the average value.

7.3 If there are fewer than five acceptable results, a second sample shall be tested consisting the double the number of tiles.

7.4 A minimum of ten acceptable results is then required to calculate the average value.

7.5 The breaking strength (S), expressed in newtons, is calculated by means of the expression:

$$S = FL/b$$

where

F = load required to break the tile, in N;

L = span of the support rods, in mm (see Fig. 2);
and

b = width of the tile, in mm.

7.6 The modulus of rupture (δ), expressed in newtons/mm², is calculated by means of the expressions.

$$\delta = 3FL/2bh^2$$

where

F = load required to break the tile, in N;

L = span of the support rods, in mm (see Fig. 2);

b = width of the tile, in mm; and

h = minimum thickness of the test specimen measured after the test along the broken edge, in mm.

NOTE — The calculation of the modulus of rupture is based on a rectangular cross-section. In the case of tiles of variable thickness along the broken edge, approximate results only are produced. The shallower the relief, the more exact is it possible to make the approximations.

7.7 Note all results for breaking strength and modulus of rupture.

7.8 Calculate the average breaking strength and average modulus of rupture of the samples as the average of the acceptable results.

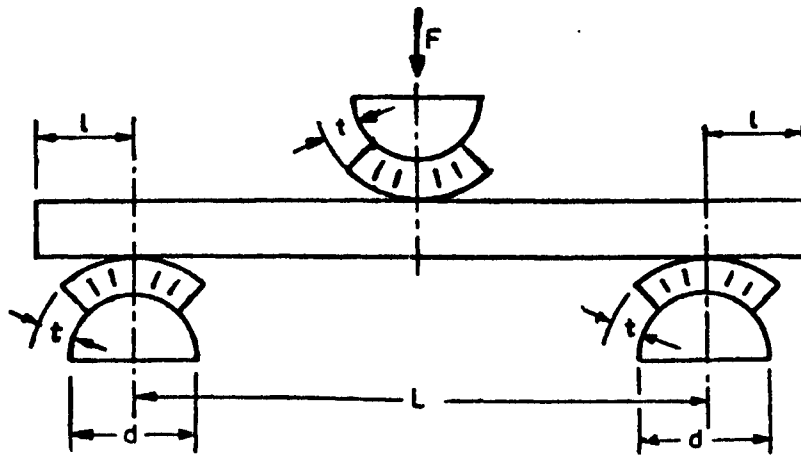


FIG. 2 SECTION ACROSS MODULUS OF RUPTURE APPARATUS

8 TEST REPORT

The test report shall contain the following:

- a) Description of the tile;
- b) Number of test specimens;
- c) Values of d , t , l , L and F ;
- d) Modulus of rupture and breaking strength of each test specimen; and
- e) Average modulus of rupture and breaking strength.

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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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