BRITISH STANDARD

BS EN
13748-2:2004

Terrazzo tiles —

Part 2: Terrazzo tiles for external use

The European Standard EN 13748-2:2004 has the status of a British Standard

ICS 91.100.30

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 13748-2:2004. It supersedes BS 4131:1973 and BS 4357:1968 which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/524, Precast concrete products, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

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EUROPEAN STANDARD

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English version

Terrazzo tiles - Part 2: Terrazzo tiles for external use

Carreaux de mosaïque - Partie 2: Carreaux de mosaïque de marbre à usage extérieur

Terrazzoplatten - Terrazzoplatten für die Anßenverwendung

This European Standard was approved by CEN on 1 April 2004.

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Foreword

This document (EN 13748-2:2004) has been prepared by Technical Committee CEN/TC 229 “Precast concrete products”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2004, and conflicting national standards shall be withdrawn at the latest by December 2004.

This document has been prepared under Mandates M119 and M122 given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

EN 13748 consists of the following parts, under the general title *"Terrazzo tiles"* :

— *Part 1: Terrazzo tiles for internal use*

— *Part 2: Terrazzo tiles for exterior use*

Terrazzo tiles for exterior use are different from concrete paving flags covered by EN 1339, *Concrete paving flags*. Main differences are that the priority is given in EN 13748-2 to decorative aspects and mechanical requirements are different. For information, decorative products, similar to flags, with limited mechanical properties intended to be used in exterior for exclusive pedestrian circulation are covered by EN 13198.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard specifies materials, properties and methods of testing for unreinforced cement-bound terrazzo tiles which are factory made and sold ready to be placed.

The tiles are intended for external use (including roofing applications) in pedestrian areas, e.g. walkways, terraces, commercial centres and swimming-pools, etc, where the decorative aspect of the covering is predominant.

NOTE This standard applies to ex-factory products and does not take into account the laying of the product.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 197-1, *Cement – Part 1: Composition, specifications and conformity criteria for common cements.*

EN 450, *Fly ash for concrete – Definitions, requirements and quality control.*

EN 934-2, *Admixtures for concrete, mortar and grout – Part 2: Concrete admixtures – Definitions, requirements, conformity, marking and labelling.*

prEN 10083-2, *Quenched and tempered steels – Part 2: Technical delivery conditions for unalloyed quality steels.*

EN 12620, *Aggregates for concrete.*

EN 13369, *Common rules for precast concrete products.*

EN ISO 6506-1, *Metallic materials – Brinell hardness test – Part 1: Test method (ISO 6501-1:1999).*

ISO 48, *Rubber, vulcanised or thermoplastics – Determination of hardness (hardness between 10 IRHD and 100 IRHD).*

ISO 4662, *Rubber – Determination of rebound resilience of vulcanizates.*

ISO 7619, *Rubber – Determination of indentation hardness by means of pocket hardness meters.*

ISO 8486-1, *Bounded abrasives – Determination and designation of grain size distribution – Part 1: Macrogrits F4 to F220.*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1
terrazzo tiles
suitably compacted elements of uniform shape and thickness, which conform with this standard. The tiles may be single – or dual – layered.

They are either individually produced by compression and/or vibration, or cast as large cement-bound mineral aggregate sheets or blocks by means of vibration and/or compression and/or vacuum, before being cut to size

3.2
single-layered terrazzo tiles
terrazzo tiles made in a single homogeneous layer of granules or chippings of a suitable aggregate embedded in a paste of grey or white cement and water. Admixtures and additions may be used

3.3
dual-layered terrazzo tiles
terrazzo tiles made up of a facing or wear layer whose composition is similar to single-layered terrazzo tiles and a second layer known as the backing or base concrete layer whose surface is not exposed during normal use and which in the case of a calibrated tile will be partially removed by specialised processing

3.4
work dimension
any dimension of a terrazzo tile specified for its manufacture to which the actual dimension should conform within specified permissible deviations

3.5
actual dimension
dimension of a terrazzo tile as measured

3.6
format
dimensions of a terrazzo tile as specified in commercial terms, mostly in rounded figures

3.7
thickness
distance between the upper face and the bed face of the terrazzo tile

3.8
upper face
surface intended to be seen when in use

3.9
bed face
surface generally parallel to the upper face and in contact with the bedding after laying

3.10
facing layer
layer of concrete on the face of a tile of materials and/or properties different to the main body or backing layer of a terrazzo tile

3.11
slip resistance
property of the surface to maintain the adherence of a pedestrian foot

3.12
declared value
value for a requirement as declared by the manufacturer, taking into account the accuracy of the test and the variability of the manufacturing process

3.13
textured upper face
not flat upper face, with a regular texture pattern

4 Requirements

4.1 Materials

4.1.1 General

Only materials with established suitability shall be used.

The suitability requirements of the materials used shall be given in the manufacturer's production control documentation.

The suitability of materials shall be established in terms of their properties and performance.

Where, by conformity with relevant specifications, the properties and performance of materials have been demonstrated, further testing need not be performed.

4.1.2 Cement

EN 197-1 shall be applied. The suitability of cement shall be established in accordance with 4.1.1.

4.1.3 Aggregates

EN 12620 shall be applied. Natural stone or other aggregates may be used provided that their suitability has been assessed according to 4.1.1.

4.1.4 Mixing water

The suitability of mixing water shall be established in accordance with 4.1.1.

In general in Europe, water from the public supply is suitable.

4.1.5 Admixtures

EN 934-2 shall be applied. The suitability of admixtures shall be established in accordance with 4.1.1.

4.1.6 Additions (including mineral fillers, pigments and polymers)

Where applicable, fly ash shall conform to EN 450. The suitability of the other additions shall be established in accordance with 4.1.1.

4.2 Finished product requirements

4.2.1 General

When tested in accordance with the methods described in clause 5, the tiles shall comply with the following requirements at the minimum age of 28 days or at the age declared suitable for use by the manufacturer if earlier.

4.2.2 Geometrical requirements

4.2.2.1 General

The work dimensions of the tiles shall be specified by the manufacturer.

4.2.2.2 Thickness

Thickness class I (Th I) : The thickness of the facing layer of the manufactured tile shall be at least 4 mm for a product that will not be ground after laying.

Thickness class II (Th II) : The thickness of the facing layer of the manufactured tile shall be at least 8 mm for a product that will be ground after laying.

Isolated particles of aggregates protruding into the facing material shall be ignored. No thickness requirements are applicable to single layered tiles.

NOTE If the surface of the terrazzo tiles contains ridges, grooves or other surface features as shown in Figure 1, the minimum thickness of the upper face from the bottom of the grooves to the bottom of the facing layer should be 2 mm.

4.2.2.3 Dimensional deviations

Individual units when tested in accordance with 5.2 shall conform to the manufacturer's declared work dimensions within the permissible deviations. These deviations of the actual dimensions from the declared work dimensions shall be in accordance with Table 1.

Table 1 – Deviation of actual dimensions

Dimension	Tolerance
Edge length	± 0,3 %
Thickness of the unit	± 2 mm (for a thickness < 40 mm) ± 3 mm (for a thickness ≥ 40 mm)

The difference between any two measurements of the thickness of a single tile shall be ≤ 3 mm.

Tiles specified as calibrated shall have a tolerance on thickness of ± 1 mm.

4.2.2.4 Shape tolerances

4.2.2.4.1 General

The format of the terrazzo tiles shall be specified by the manufacturer, including at least the length, the width and the thickness. For non-square or non-rectangular tiles, the manufacturer shall also specify all the work dimensions that are required to define the tile.

4.2.2.4.2 Straightness of edges of the upper face

When measured in accordance with 5.3, the maximum discrepancy between the edge and the ruler shall not exceed ± 0,3 % of the length of the considered edge.

4.2.2.4.3 Flatness of the upper face

When measured in accordance with 5.4, no point shall deviate from the surface by more than 0,3 % of the length of the considered diagonal. This does not apply to textured upper faces.

4.2.3 Surface characteristics and appearance

In natural daylight and dry condition, no projections, depressions, flakes or crazes shall be visible from a distance of 2 m.

Permanent filling of minor voids is allowed.

Colourings, where applied, shall be provided in a facing layer or throughout the tile. Slight variations in the colour consistency between batches of tiles can be caused by unavoidable variations in the shade and properties of cement and aggregates, by the manufacturing process or by time. The manufacturer shall define what he considers as a batch.

NOTE Special attention should be given to correct storage of the tiles before placing them into the works.

4.2.4 Mechanical strength

4.2.4.1 Breaking strength

The breaking strength shall be tested in accordance with 5.5.

4.2.4.2 Breaking strength requirements

The breaking strength is deemed sufficient when the tiles comply with the following requirements when tested in accordance with 5.5:

— the mean breaking strength for four specimens shall be more than or equal to the values in Table 2 for the appropriate strength class ;

— no individual result shall be lower than the values in Table 2 for the appropriate strength class.

Table 2 — Breaking strength classes for external use

Class	Marking	Average bending strength MPa	Minimum bending strength MPa
1	ST	3,5	2,8
2	TT	4,0	3,2
3	UT	5,0	4,0

NOTE Guidance on application may be provided on a national basis.

4.2.4.3 Breaking load requirements

When tested in accordance with the test method described in 5.5, the tiles shall comply with the following requirements:

— the average breaking load for four specimens shall be more than or equal to the values in Table 3 for the appropriate breaking class;

— no individual result shall be lower than the values in Table 3 for the appropriate breaking class.

Table 3 — Breaking load classes

Class	Marking	Average breaking load kN	Minimum breaking load kN
30	3T	3,0	2,4
45	4T	4,5	3,6
70	7T	7,0	5,6
110	11T	11,0	8,8
140	14T	14,0	11,2
250	25T	25,0	20,0
300	30T	30,0	24,0
NOTE For design considerations special attention should be paid to the possible loading conditions on flags larger than 600 mm and if class 30 is required, it is only recommended for use with a continuous rigid foundation.			

4.2.4.4 Abrasion

Abrasion shall be verified in accordance with the wide wheel test method described in 5.6.1 (modified Capon test) which is the reference test; alternatively, the Böhme test method described in 5.6.2 may be used. The abrasion requirement is assumed satisfied:

— if no individual test result exceeds the values in Table 4 for the appropriate abrasion class, when tested in accordance with the wide wheel test (5.6.1 modified Capon test);

— if no individual test result exceeds the values in Table 4 for the appropriate abrasion class, when tested in accordance with the Böhme test (5.6.2).

Table 4 — Abrasion resistance classes

Class	Marking	Individual abrasion
1	F	no performance measured
2	G	≤ 26 mm measured in accordance with the test method described in 5.6.1 **or alternatively** ≤ 26 $cm^3/50\ cm^2$ measured in accordance with test method described in 5.6.2.
3	H	≤ 23 mm measured in accordance with the test method described in 5.6.1 **or alternatively** ≤ 20 $cm^3/50\ cm^2$ measured in accordance with test method described in 5.6.2.
4	I	≤ 20 mm measured in accordance with the test method described in 5.6.1 **or alternatively** ≤ 18 $cm^3/50\ cm^2$ measured in accordance with test method described in 5.6.2.

4.2.5 Slip/Skid resistance

4.2.5.1 General

Terrazzo tiles for external use have satisfactory slip/skid resistance, provided their whole upper surface has not been ground and/or polished to produce a very smooth surface.

If in an exceptional case the unpolished slip/skid resistance value (USRV) is required, the product shall be tested according to 5.7 and the result declared.

If the surface of the terrazzo tile contains ridges, grooves or other surface features which prevent testing by pendulum friction equipment, the product is deemed to satisfy the requirements without testing.

NOTE The slip/skid resistance value relates to the tiles as manufactured.

4.2.5.2 Durability of slip/skid resistance

Under normal conditions of use, terrazzo tiles provide satisfactory slip/skid resistance during the working life of the product, provided they are subjected to normal maintenance that does not modify their initial slipperiness.

4.2.6 Weathering resistance

The weathering resistance is determined by test in accordance with 5.8 for water absorption and in accordance with 5.9 for freeze-thaw resistance.

The terrazzo tile shall comply with the requirements in Table 5.

Table 5 — Weathering resistance classes

Class	Marking	Water absorption % by mass	Mass loss after freeze/thaw test kg/m^2
1	A	No performance measured	No performance measured
2	B	≤ 6 as a mean	No performance measured
3	D	No performance measured	≤ 1,0 as a mean with no individual value > 1,5

NOTE The National Annex of a country may state the class(es) of weathering resistance required to ensure durability for that country.

4.2.7 Fire performance

4.2.7.1 Reaction to fire

Terrazzo tiles for external use are considered to be reaction to fire class A1fl without the need for testing according to EC Decision 96/603/EEC, as amended.

4.2.7.2 External fire performance

Terrazzo tiles for external use used as roof covering are deemed to satisfy the requirements for external fire performance without the need for testing according to EC Decision 2000/553/EC.

4.2.8 Thermal conductivity

If terrazzo tiles for external use are intended to contribute to the thermal performance of an element, the manufacturer shall declare the thermal conductivity using data given in Table L2 of EN 13369.

5 Physical test methods

5.1 Sampling plan and compliance criteria

Table 6 details the sampling and compliance criteria for the testing of each requirement.

Table 1 — Sampling plan and compliance criteria for initial and further type testing

Property	Requirements	Test method	Number of tiles	Compliance criteria
Appearance, dimensions and shape	4.2.2 and 4.2.3	5.2 and 5.3 and 5.4	8*	4.2.2 and 4.2.3 Each tile shall meet the requirements
Breaking strength	4.2.4.2	5.5	4	See 4.2.4.2
Breaking load	4.2.4.3	5.5	4	See 4.2.4.3
Abrasion resistance	4.2.4.4	5.6	3	See 4.2.4.4
Slip/skid resistance (only where tested)	4.2.5	5.7	5	The mean of the five tiles shall be declared
Weathering resistance	4.2.6	5.8	3	See 4.2.6
* These tiles may be used for subsequent tests.				

5.2 Dimensional deviations

5.2.1 Dimensions

5.2.1.1 Apparatus

A steel rule with an accuracy of 0,5 mm.

Callipers with an accuracy of 0,1 mm.

5.2.1.2 Procedure

The dimensions shall be measured at 3 points. The maximum and minimum values shall be recorded.

5.2.2 Thickness of surface layer

5.2.2.1 Apparatus

Measuring equipment capable of measuring with an accuracy of 0,5 mm.

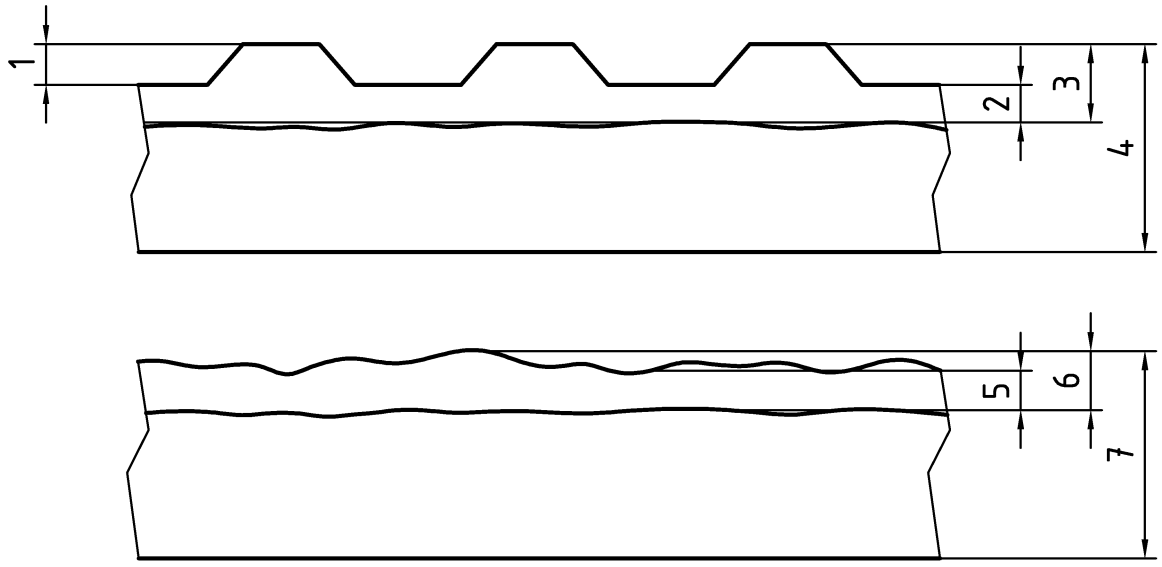
5.2.2.2 Procedure

Take a tile that has been broken.

Measure the thickness of the surface layer on the split face at the point where, by visual inspection, the value will be a minimum. Record the measurement to the nearest millimetre.

The thickness of the surface layer shall not be measured on the chamfer.

Dimensions in millimetres



Key

1 Depth of channels
2 Minimum thickness upper face
3 Thickness upper face
4 Thickness
5 Minimum thickness upper face
6 Thickness upper face
7 Thickness

Figure 1 — Examples of measurement of the thickness of non-flat surface flags

5.3 Straightness of edges

5.3.1 Measuring device

A set of feeler gauges with an accuracy of 0,1 mm.

5.3.2 Testing method

The ruler is placed along the edge and the maximum discrepancy i.e. between the edge and the ruler is noted (see Figure 2).

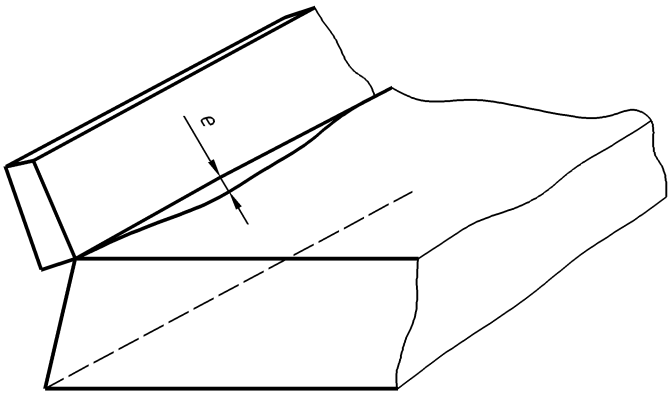


Figure 2 — Measurement of edge straightness

5.4 Flatness of the upper face

5.4.1 Measuring device

Measuring equipment with an accuracy of 0,1 mm.

5.4.2 Testing method

The maximum convex or concave deviations shall be determined along the two diagonal axes of the upper face (see Figure 3).

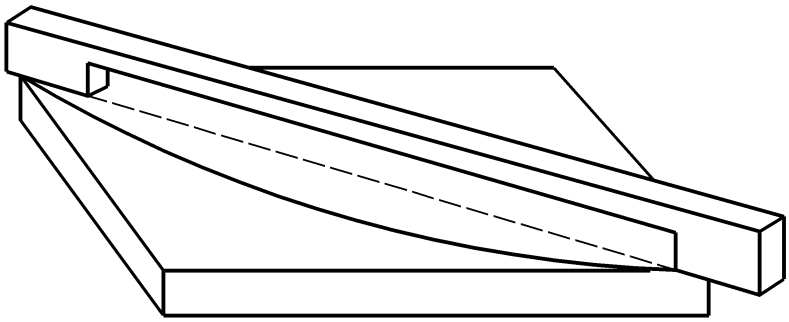


Figure 3 — Measurement of upper face flatness

5.5 Breaking strength and breaking load

5.5.1 Apparatus

The transverse testing machine shall have a scale with an accuracy of ± 3 % over the range of the anticipated test loads and be capable of increasing the load at specified rates.

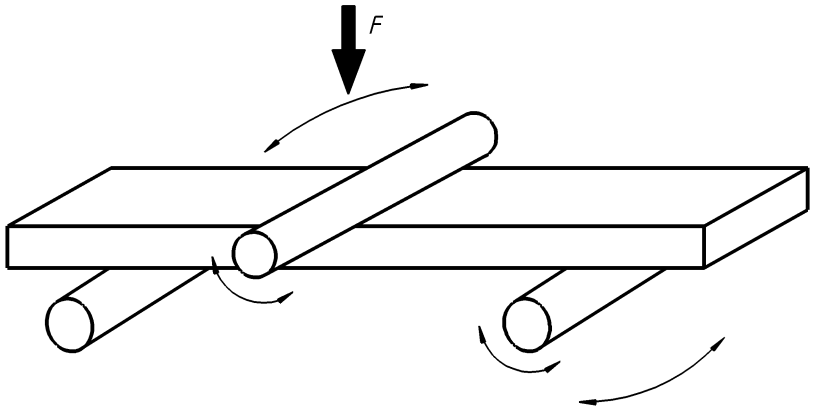
It shall be constructed in such a way that it can induce 3 point bending into the sample without torsion.

The load inducing bar shall be equidistant between the supports.

The length of the supports and the load inducing bar shall be at least equal to the width of the sample to be tested (see Figure 4).

The upper and lower bearers shall be parallel and rigid, and round or rounded to a radius of (20 ± 1) mm.

If packing pieces are used, they shall be medium density fibreboard and their width shall not exceed 25 mm. Their thickness shall be (4 ± 1) mm and they shall be approximately 10 mm longer than the size of the specimen's plane.



KEY
F Load

Figure 4 — Principle of testing

The actual span between the bearers shall be within 0,5 % of the specified span rounded to the nearest millimetre.

5.5.2 Preparation

Use whole tiles when their plan shape includes at least two parallel straight edges. In other cases, use sawn samples with the largest possible plan area which includes two parallel straight edges.

If necessary, remove any burrs, high spots, etc. Immerse the tiles under water at (20 ± 5) °C for (24 ± 3) h, remove, wipe dry and test immediately.

If a face is rough, textured or curved, prepare it by grinding or capping until fully flat.

Other methods of preparation may be used for routine testing providing there is a correlation between the results of the two methods, e.g. using unground rough, textured or curved tiles instead of ground tiles.

5.5.3 Procedure

The distance between the supports shall be 2/3 of the length of the tile, with an accuracy of ± 0,5 %.

Place the sample with its upper face uppermost, symmetrically on the bearers of the testing machine and with its shorter side parallel to the supporting bearers.

Depending on the surface profile of the tile any one of the following shall be used at the discretion of the manufacturer:

— no packing;

— packing;

— capping or grinding.

Apply the load without shock and increase the load uniformly so that the required load is reached within (45 ± 15) s.

5.5.4 Testing of non-rectangular tiles

Non rectangular tiles should be cut to be rectangular.

5.5.5 Calculation of results

Calculate the strength T (in MPa) of the tile tested from the equation:

$$T = \frac{3 \times P \times L}{2 \times b \times t^2}$$

where

T is the strength, in MPa;

P is the breaking load, in N;

L is the distance apart of the supports, in mm;

b is the width of the tile at the failure plane, in mm;

t is the thickness of the tile at the failure plane, in mm.

Record the individual result T in MPa and the breaking load in kN.

5.5.6 Test report

Report the strength of the specimens and their mean value to the nearest 0,1 MPa.

5.6 Abrasion resistance

5.6.1 The wide wheel abrasion test

5.6.1.1 Principle of wide wheel abrasion test

The test is carried out by abrading the upper face of a tile with an abrasive material under standard conditions.

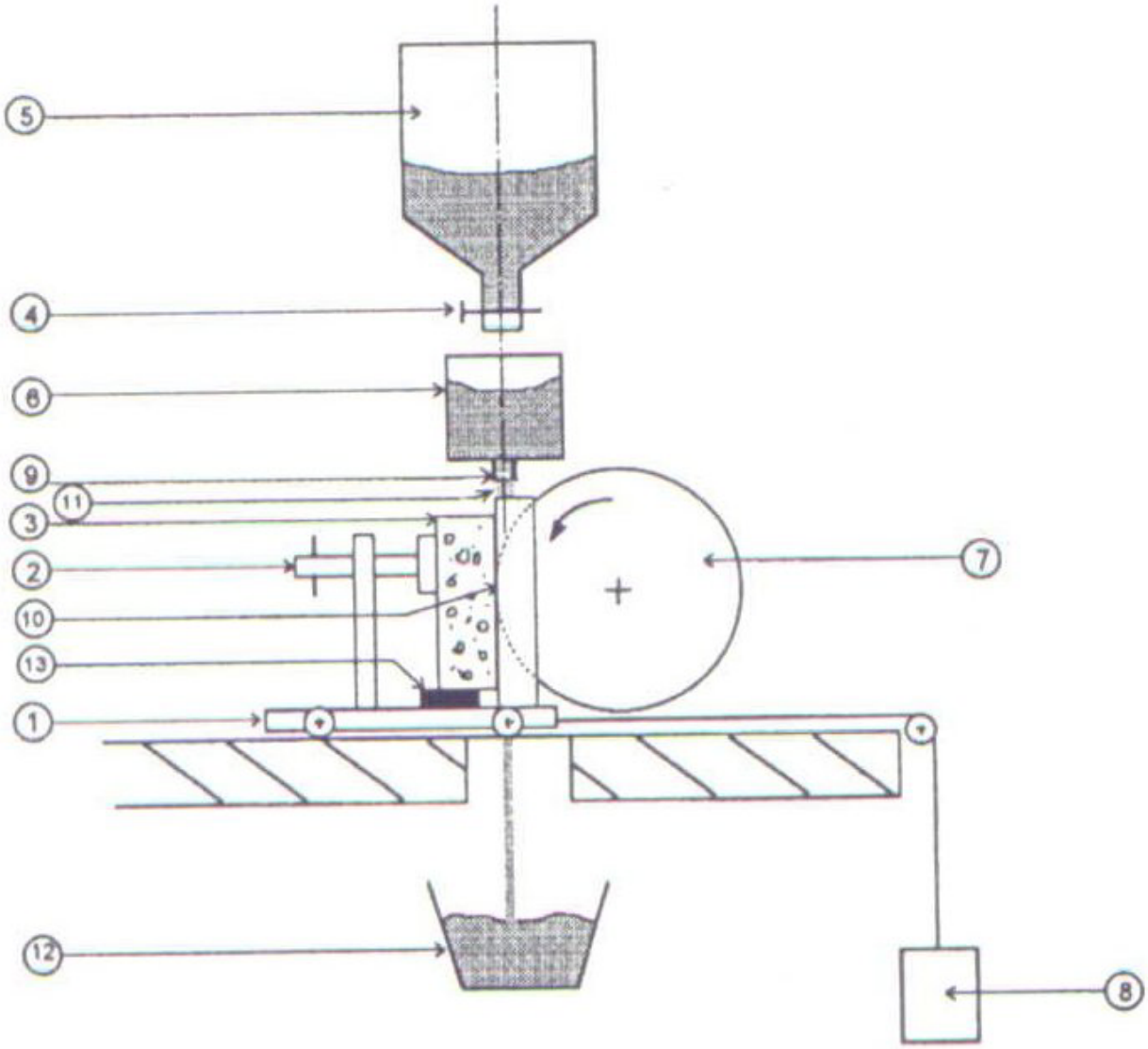
5.6.1.2 Abrasive material

The abrasive required for this test consists of a material comprising fused white fused alumina with a grit size of 80 in shall be in accordance with ISO 8486-1. It shall not be used more than three times.

5.6.1.3 Apparatus

The wearing machine (see Figure 5) is essentially made of a wide abrasion wheel, a storage hopper with one or two control valves to regulate the output of the abrasive material, a flow guidance hopper, a clamping trolley and a counterweight.

When two valves are used, one shall be used to regulate the rate of flow and can be permanently set while the other is used to turn the flow on and off.



Key

1 Clamping trolley
2 Fixing screw
3 Specimen
4 Control valve
5 Storage hopper
6 Flow guidance hopper
7 Wide abrasion wheel
8 Counterweight
9 Slot
10 Groove
11 Abrasive material flow
12 Abrasive collector
13 Wedge

Figure 5 — Principle of wearing machine

The wide abrasion wheel shall be made of steel E360 in accordance with prEN 10083-2. The hardness of the steel shall be between 203 HB and 245 HB. Its diameter shall be (200 ± 1) mm and its width shall be (70 ± 1) mm. It shall be driven to rotate 75 revolutions in (60 ± 3) s.

A mobile clamping trolley is mounted on bearings and forced to move forwards to the wheel by a counterweight.

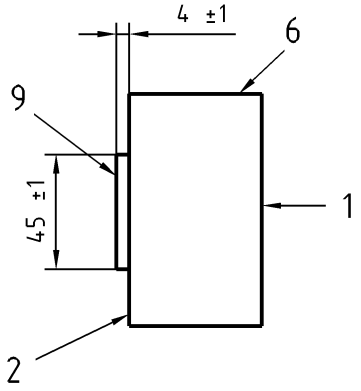
The storage hopper containing the abrasive material feeds a flow guidance hopper.

The flow guidance hopper may be cylindrical and shall have a slotted outlet (see Figure 6, Example 1). The length of the slot shall be (45 ± 1) mm and the width shall be (4 ± 1) mm. The body of the flow guidance hopper shall be at least 10 mm bigger than the slot in all directions. In the case of a rectangular hopper with at least one of the sides inclined down to the length of the slot, these dimensional limitations are not necessary (see Figure 6, Example 2).

Dimensions in millimetres

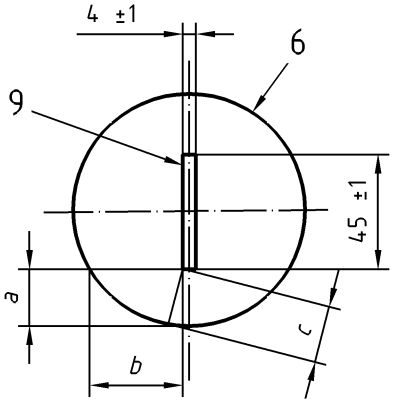
Example 1

Plan view : rectangular hopper



Example 2

Plan view : cylindrical hopper



Key

1 Inclined side
2 Vertical side
6 Flow guidance hopper
9 Slot
a, b, c > 10

Figure 6 — Position of slot in the base of the flow guidance hopper

The distance of the fall between the slot and the axle of the wide abrasion wheel shall be (100 ± 5) mm and the flow of the abrasive shall be (1 to 5) mm behind the leading edge of the wheel (see Figure 7).

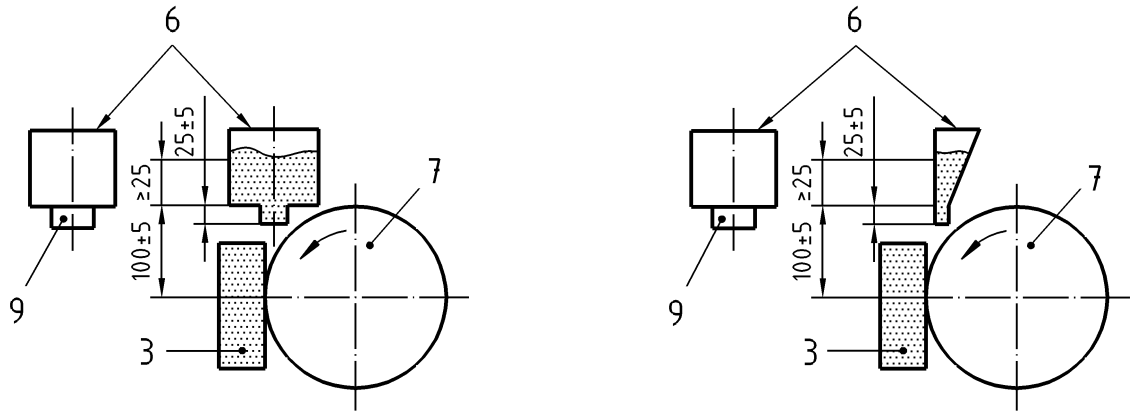
Dimensions in millimetres

Example 1

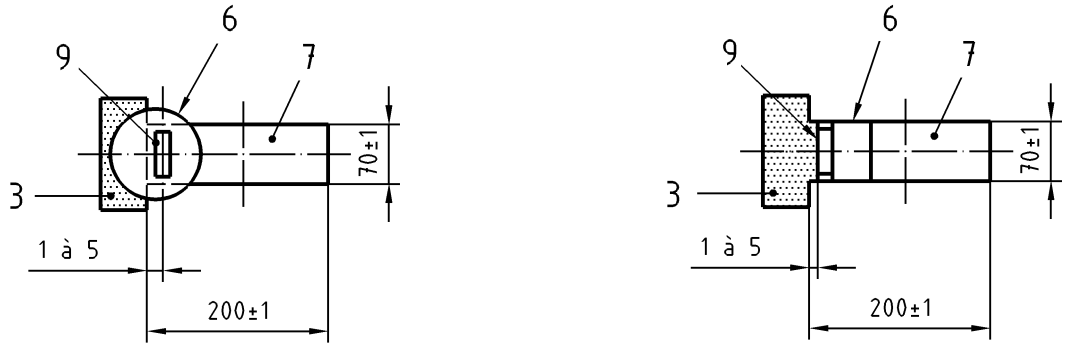
(with cylindrical hopper)

Example 2

(with rectangular hopper)



Side view



Plan view

Key

3 Specimen
6 Flow guidance hopper
7 Wide abrasion wheel
9 Slot

Figure 7 — Position of slot relative to wide abrasion wheel

The flow of the abrasive material from the flow guidance hopper shall be at least at a minimum rate of 2,5 l/min onto the wide abrasion wheel. The flow of abrasive shall be constant and the minimum level of the abrasive in the flow guidance hopper shall be 25 mm (see Figure 7).

Useful utensils for measuring the results are a magnifying glass, preferably equipped with a light, a steel ruler and a digital caliper.

5.6.1.4 Calibration

The apparatus shall be calibrated after grinding 400 grooves or every two months whichever is the lesser and every time there is a new operator, a new batch of abrasive, or a new abrasion wheel.

The abrasive flow rate shall be verified by pouring the material from a height of approximately 100 mm into a pre-weighed rigid container with a smooth rim, of height (9 ± 10) mm and of known volume when filled to the top, this shall be approximately 1 l. As the container fills up, the pourer shall be raised to maintain approximately the 100 mm fall. When the container is filled, the top shall be struck off level and weighed to determine the mass of abrasive for a known volume, i.e. the density. The abrasive shall be run through the wearing machine for (60 ± 1) s and collected below the abrasion wheel in a pre-weighed container of at least 3 l capacity. The filled container shall be weighed and from the density determined above, the rate of abrasive flow can be verified as more than or equal to 2,5 l/min.

The apparatus shall be calibrated against a reference sample of "Boulonnaise Marble"[1)] using the procedure in 5.6.1.6 and the counterweight adjusted so that after 75 revolutions of the wheel in (60 ± 3) s the length of the groove produced is (20,0 ± 0,5) mm. The counterweight shall be increased or decreased to increase or decrease the groove length, respectively. The clamping trolley/counterweight assembly shall be checked for undue friction.

The groove shall be measured using the procedure in 5.6.1.7 to the nearest 0,1 mm and the three results averaged to give the calibration value.

An alternative material may be used for the reference sample if a good correlation is established with a reference sample of "Boulonnaise Marble".

At every calibration of the apparatus the squareness of the sample supports shall be checked.

The groove on the reference sample shall be rectangular with a difference between the measured length of the groove at either side not exceeding 0,5 mm. If necessary check that:

— sample has been held square to the wheel;

— clamping trolley and the slot from the flow guidance hopper are parallel to the wheel axle;

— flow of abrasive is even across the slot;

— friction in the trolley/counterweight assembly is not undue.

5.6.1.5 Preparation of the specimen

The test specimen shall be a whole product or a cut piece measuring at least 100 mm × 70 mm incorporating the upper face of the unit.

The test piece shall be clean and dry.

The upper face, to be tested, shall be flat within a tolerance of ± 1 mm measured in accordance with 5.4 in two perpendicular directions, but over 100 mm.

If the upper face is outside this tolerance, it shall be ground to produce a smooth flat surface within tolerance.

---

1) The "Boulonnaise Marble reference is:

Lunel demi-clair, thickness: 5 cm, c/passe 2 faces ground with a diamond grit size 100/120, rugotest class N7 (Ra = 1,6 μm) in accordance with EN ISO 4288:1997.

Immediately before testing, the surface to be tested shall be cleaned with a stiff brush and covered with a surface dye to facilitate measuring the groove (e.g. painting with a marker pen).

5.6.1.6 Procedure

Fill the storage hopper with dry abrasive material, moisture content not exceeding 1,0 %. Move the clamping trolley away from the wide abrasion wheel. Position the specimen on it so that the groove produced is at least 15 mm from any edge of the specimen and fix the specimen on a wedge to let the abrasive flow pass under it. Place the abrasive collector beneath the wide abrasion wheel.

Bring the specimen into contact with the wide abrasion wheel, open the control valve and simultaneously start the motor so that the wide abrasion wheel achieves 75 revolutions in (60 ± 3) s.

Visually check the regularity of the flow of the abrasive material during the test. After 75 revolutions of the wheel, stop the abrasive flow and the wheel. Whenever possible, two tests shall be performed on each specimen.

5.6.1.7 Measuring the groove

Place the specimen under a big magnifying glass nominally at least 2 times magnification and preferably equipped with a light to facilitate the measuring of the groove.

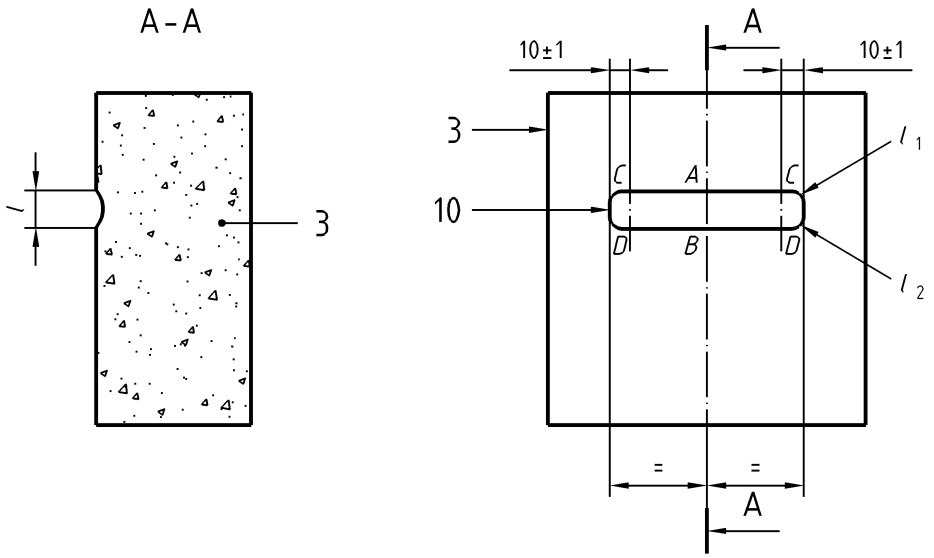
With a pencil with a lead diameter of 0,5 mm and hardness 6H or 7H, draw the external longitudinal limits (l_1 and l_2) of the groove using a ruler (see Figure 8).

Then draw a line (A B) in the middle of the groove perpendicular to the centreline of the groove.

Position a digital calliper with square tips on the points A and B to the inside edge of the longitudinal limits (l_1 and l_2) of the groove and measure and record the dimension to the nearest ± 0,1 mm.

Repeat the measurement (10± 1) mm from the ends of the groove (C D) to give three readings.

Dimensions in millimetres



Section A – A Face view

Key

3 Specimen
10 Groove

Figure 8 — Example of a tested specimen showing a groove

Some surface dyes may be removed above the groove by action of the abrasive. This shall be ignored in producing line l_1 which should be drawn where the sample surface is abraded.

5.6.1.8 Test result

The result is the dimension corrected by a calibration factor and then rounded to the nearest 0,5 mm.

The calibration factor is the arithmetic difference between 20,0 and the recorded calibration value.

For example, if the calibration value is 19,6 mm and the dimension is 22,5 mm, the result is $22,5 + (20,0 - 19,6) = 22,9$ mm, rounded to 23,0 mm. If two grooves have been cut in a specimen, the larger value shall be taken as the result.

5.6.1.9 Test report

The test report shall include the length(s) of the groove(s).

5.6.2 Böhme test method

5.6.2.1 Principle

Square sheets or cubes are placed on the Böhme disk abrader, on the test track of which standard abrasive is strewn, the disk being rotated and the specimens subjected to an abrasive load of 294 N for a given number of cycles (see 5.6.2.5).

The abrasive wear is determined as the loss in specimen volume.

5.6.2.2 Abrasive material[2)]

The standard abrasive used shall be an artificial corundum designed to produce an abrasive wear of 1,10 mm to 1,30 mm when testing standard granite specimens and of 4,20 mm to 5,10 mm when testing standard limestone specimens. Compliance with these requirements, the homogeneity of the material and the uniformity of bulk density and grading of the abrasive shall be checked.

5.6.2.3 Apparatus

5.6.2.3.1 Thickness measuring device. To establish the reduction in thickness, a dial gauge, the plunger of which shall have a spherical bearing and an annular contact face of 8 mm outside and 5 mm inside diameter, and a measuring table, shall be used.

5.6.2.3.2 Disk abrader. The Böhme disk abrader as shown in Figure 9 consists essentially of a rotating disk with a defined test track to receive the abrasive, a specimen holder and a loading device.

Rotating disk. The rotating disk shall have a diameter of approximately 750 mm and be flat and positioned horizontally. When loaded, its speed shall be (30 ± 1) revolutions per minute. The disk shall be provided with a revolution counter and a device that switches off the disk automatically after 22 revolutions.

Test track. The test track shall be annular, with an inside radius of 120 mm and an outside radius of 320 mm (i.e. be 200 mm wide), and be replaceable.

The track shall be made of cast iron with a perlitic structure, a phosphorus content not exceeding 0,35 % and a carbon content of more than 3 %. The track shall have a Brinell hardness of 190 HB to 220 HB 2,5/187,5 as

2) Source where information can be obtained:

— Materialprüfungsamt Nordrhein-Westfalen, Marsbruchstrasse 186, D-44287 Dortmund, Germany.

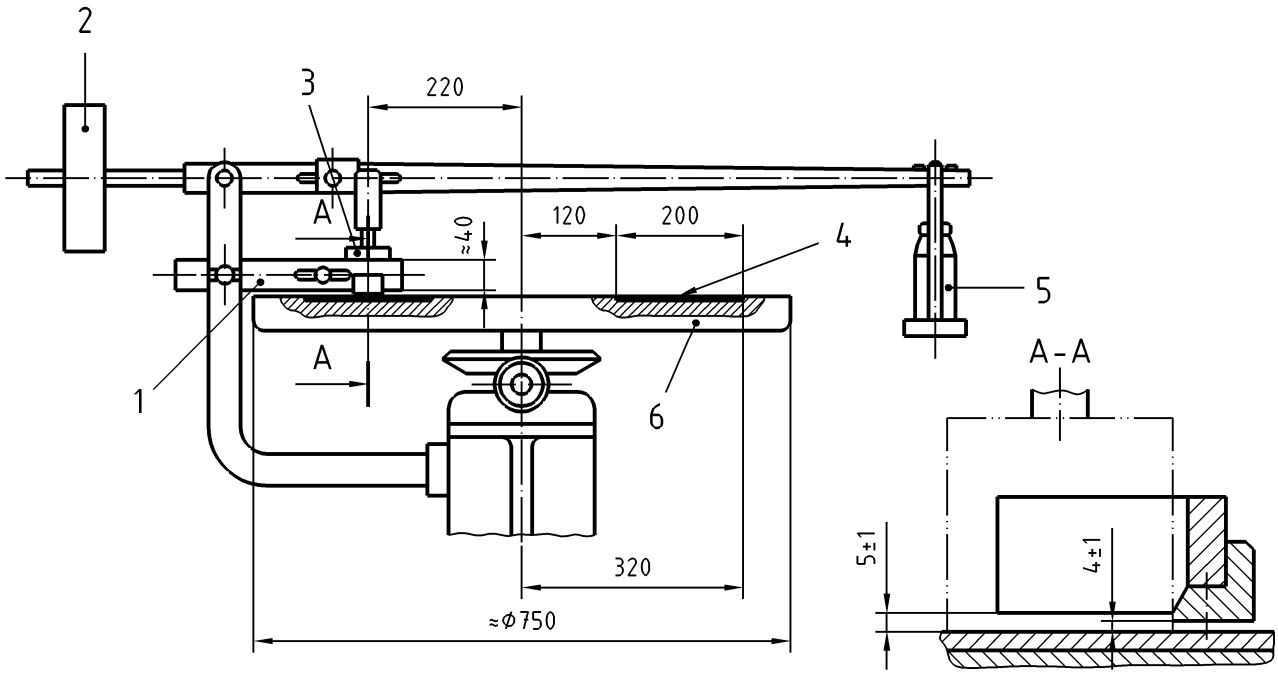
defined in EN ISO 6506-1, determined as the mean from measurements taken at not less than ten points along the edge of the track.

The track surface is subject to wear in service; the resulting reduction in thickness shall not exceed 0,3 mm and any grooves shall not be deeper than 0,2 mm. If these values are exceeded, the track shall be replaced or refinished. When the track has been refinished three times, its hardness shall be determined anew.

Specimen holder. The specimen holder shall consist of a U-frame approximately 40 mm high, with a clear distance of (5 ± 1) mm from the test track. The frame shall be positioned so that the centreline distance between specimen and disk is 220 mm and the angle bead of the specimen holder, which supports the specimen, is located at a distance of (4 ± 1) mm above the disk. The mounting of the specimen holder shall ensure that, during testing, no vibration occurs.

Loading device. The loading device shall consist of a lever of two arms of different length, a loading weight and a counterweight, the lever being pivoted with as little friction as possible and positioned almost horizontally during the test. The system shall be designed to ensure that the load is transferred vertically via the plunger to the centre of the specimen. The self-weight of the lever is balanced by the counter-weight and the scale to receive the loading weight. The force acting on the specimen results from the loading weight multiplied by the leverage ratio, the mass of the weight being selected to produce a test force of (294 ± 3) N (corresponding to 5,88 N/cm^2 or about 0,06 N/mm^2), which shall be verified by calculation.

Dimensions in millimetres



Key

1 Specimen holder
2 Counterweight
3 Specimen
4 Test track
5 Loading weight
6 Rotating disk

Figure 9 — Principle of Böhme disk abrader

5.6.2.4 Preparation of specimens

Use square slabs or cubes with an edge length of (71 ± 1,5) mm as specimens.

The contact face and the opposite face of the specimen shall be parallel and flat. For determining the reduction in thickness as described in 5.6.2.6, the opposite face shall, if appropriate, be ground parallel or otherwise machined so as to be parallel.

Generally, the specimens shall be dried to constant mass at a temperature of (105 ± 5) °C, regrinding of the contact face by four cycles (see 5.6.2.5) being usually required.

NOTE For the exceptional case of testing specimens in the wet or water-saturated condition (5.6.2.5), the specimens will be immersed for not less than seven days and wiped with a damp cloth or sponge prior to each weighing so that all specimens appear equally damp.

One specimen each shall be taken from no less than three different samples or workpieces of the same type.

Prior to testing, determine the density of the specimen, ρR , by measurements, to the nearest 0,1 mm, and by weighing, to the nearest 0,1 g.

In the case of multi-layer specimens, determine the density for specimens taken separately from the wearing layer, such specimens also being ground prior to testing where necessary.

5.6.2.5 Procedure

Prior to the abrasion test and after every four cycles, weigh the specimen to an accuracy of 0,1 g.

Pour 20 g of standard abrasive on the test track. Clamp the specimen into the holder and, with the test contact face facing the track, load centrally with (294 ± 3) N.

Start the disk, taking care that the abrasive on the track remains evenly distributed over an area defined by the width of the specimen.

Test the specimen for 16 cycles, each consisting of 22 revolutions.

After each cycle, clean both disk and contact face, and turn the specimen progressively through 90° and pour new abrasive on the track as described in 5.6.2.2.

When testing damp or water-saturated specimens, prior to each cycle, the track shall be wiped with a lightly damp sponge and moistened before being strewn with abrasive. From the start of the test, water shall be caused to drip, at a rate of approximately 13 ml of water (corresponding to 180 drops to 200 drops) per minute onto the track from a container with an adjustable pivoting nozzle. The drops shall fall through a distance of approximately 10 cm on the middle of the track at a point 30 mm in front of the specimen. When testing in accordance with this method, care shall be taken to ensure that the abrasive is continuously returned to the effective area of the track (see 5.6.2.3).

5.6.2.6 Determination of results

Calculate the abrasive wear after 16 cycles as the mean loss in specimen volume ΔV, from the equation:

$$\Delta V = \frac{\Delta m}{\rho_R}$$

where

ΔV is the loss in volume after 16 cycles in cubic millimetres;

Δm is the loss in mass after 16 cycles in grams;

ρ_R is the density of the specimen or, in the case of multi-layer specimens, the density of the wearing layer in grams per cubic millimetre.

5.6.2.7 Test report

Report the abrasive wear to the nearest whole number of $cm^3/50\ cm^2$.

5.7 Slip resistance: Method for the determination of unpolished slip resistance value (USRV)

5.7.1 Principle

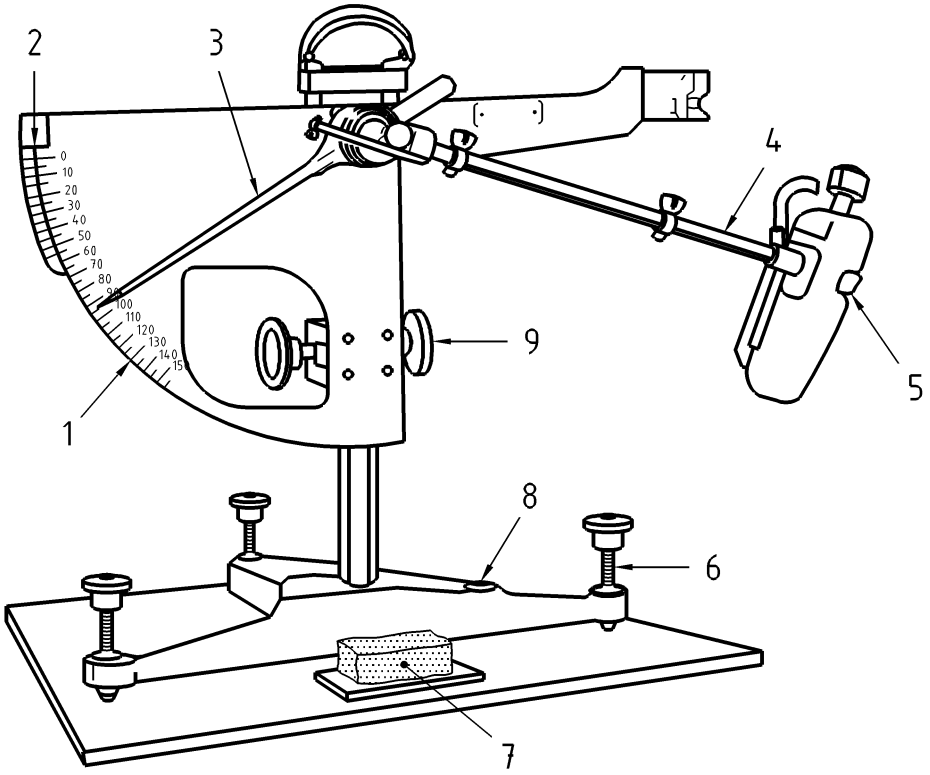
The measurement of USRV on the specimen is made using the pendulum friction test equipment to evaluate the frictional properties of the specimen.

The pendulum friction test equipment incorporates a spring loaded slider made of a standard rubber attached to the end of the pendulum. On swinging the pendulum, the frictional force between the slider and test surface is measured by the reduction in length of the swing using a calibrated scale.

5.7.2 Apparatus

5.7.2.1 Pendulum friction test

5.7.2.1.1 The pendulum friction test equipment shall be manufactured as shown in Figure 10. All bearings and working parts shall be enclosed as far as possible, and all materials used shall be treated to prevent corrosion under wet conditions.



Key

1 C scale (126 mm sliding length)
2 F scale (76 mm sliding length)
3 Pointer
4 Pendulum
5 Rubber slider
6 Levelling screw
7 Test specimen holder
8 Spirit level
9 Vertical adjustment screw

Figure 10 — Pendulum friction test equipment

5.7.2.1.2 The pendulum test equipment shall have the following features:

1) A spring loaded rubber coated slider as specified in 5.7.2.1.4 to 5.7.2.1.10. It shall be mounted on the end of a pendulum arm so that the sliding edge is (510 ± 1) mm from the axis of suspension.

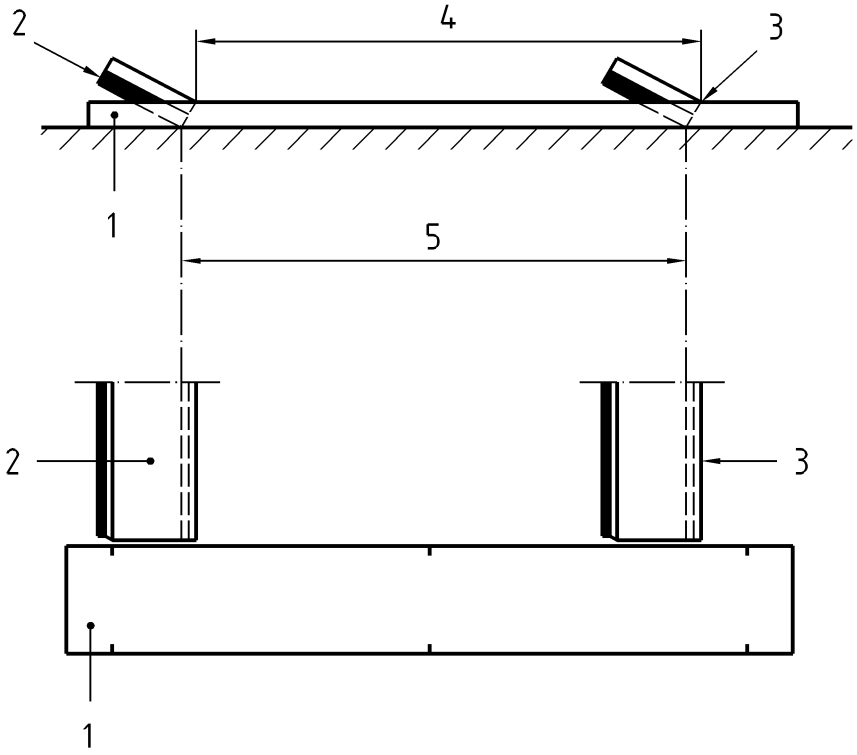
2) Means of setting the support column of equipment vertical.

3) A base of sufficient mass to ensure the equipment remains stable during the test.

4) Means of raising and lowering the axis of suspension of the pendulum arm so that the slider can:

   — swing clear of the surface of the specimen; and

   — be set to traverse a surface over a fixed length of (126 ± 1) mm. A gauge with this distance marked is required as shown in Figure 11.



Key

1 Gauge
2 Slider
3 Reference edge
4 Sliding length measured
5 Actual sliding length

Figure 11 — Sliding length gauge

5) Means of holding and releasing the pendulum arm so that it falls freely from a horizontal position.

6) A pointer of nominal length 300 mm, balanced about the axis of suspension, indicating the position of the pendulum arm throughout its forward swing and moving over the circular scale. The mass of the pointer shall be not more than 85 g.

7) The friction in the pointer mechanism shall be adjustable so that, with the pendulum arm swinging freely from a horizontal position, the outward tip of the pointer may be brought to rest on the forward swing of the arm at a point (10 ± 1) mm below the horizontal. This is the 0 reading.

8) A circular C scale, calibrated for a sliding length of 126 mm on a flat surface, marked from 0 to 100 at intervals of five units.

5.7.2.1.3 The mass of the pendulum arm, including the slider, shall be (1,50 ± 0,03) kg. The centre of gravity shall be on the axis of the arm at a distance of (410 ± 5) mm from the axis of suspension.

5.7.2.1.4 The slider shall consist of a rubber pad (76,2 ± 0,5) mm wide; (25,4 ± 1,0) mm long (in the direction of swing) and (64 ± 0,5) mm thick, the combined mass of slider and base shall be (32 ± 5) g.

5.7.2.1.5 The slider shall be held on a rigid base with a centre pivoting axis which shall be mounted on the end of the pendulum arm in such a way that, when the arm is at the lowest point of its swing with the trailing edge of the slider in contact with the test surface, the plane of the slider is angled at (26 ± 3) degrees to the horizontal. In this configuration the slider can turn about its axis without obstruction to follow unevenness of the surface of the test specimen as the pendulum swings.

5.7.2.1.6 The slider shall be spring-loaded against the test surface. When calibrated, the static force on the slider as set by the equipment calibration procedure shall be (22,2 ± 0,5) N in its median position. The change in the static force on the slider shall be not greater than 0,2 N per millimetre deflection of the slider.

5.7.2.1.7 The initial resilience and hardness of the slider shall comply with Table 7, and shall have a certificate of conformity including the name of the manufacturer and date of manufacture. A slider shall be discarded when the IRHD value measured in accordance with ISO 7619 fails to comply with the requirements of the table or not later than three years after manufacture.

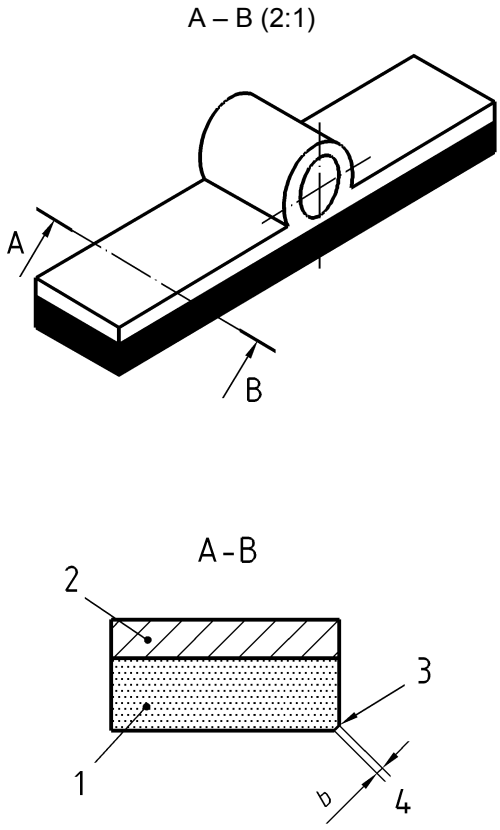
Table 7 — Properties of the slider rubber at 20 °C

Resilience (%)[a]	66 to 73
Hardness (IRHD)[b]	53 to 65
a Lüpke rebound test shall be in accordance with ISO 4662.	
b International Rubber Hardness Degrees shall be in accordance with ISO 48	

5.7.2.1.8 The edges of the slider shall be square and clean-cut, and the rubber free from contamination by, for example, abrasive or oil. The slider shall be stored in the dark at a temperature in the range 5 °C to 20 °C.

5.7.2.1.9 Before using a new slider, it shall be conditioned to produce a minimum width of striking edge of 1 mm as shown in Figure 12.

This shall be achieved by setting up the tester and carrying out five swings on a dry surface with a friction value above 40 on the C scale followed by a further 20 swings on the same surface after wetting.



Key

1 Rubber slider
2 Aluminium backing
3 Striking edge
4 Worn width

Figure 12 — Slider assembly illustrating the maximum wear or striking edge

5.7.2.1.10 The slider shall be discarded when the width of the striking edge as shown in Figure 12 exceeds 3 mm or becomes excessively scored or burred. The slider can be reversed to expose a new edge, which will need to be conditioned.

5.7.2.2 Potable water at (20 ± 2) °C in a container for wetting the surfaces of the test specimen and slider

5.7.3 Calibration

The apparatus shall be recalibrated at least annually.

5.7.4 Sampling

Obtain a representative sample of five units.

If the sample to be tested has plan dimensions less than 86 mm × 42 mm, larger specimens of the same materials, production processes and surface finish shall be tested and this shall be noted in the test report.

If the surface of the terrazzo tile contains ridges, grooves or other surface features, select the test area in order to obtain a maximum flat surface over the specified swept length.

NOTE In the case of large units, representative samples will be cut from them for test.

5.7.5 Procedure

Keep the friction test equipment, and slider, in a room at a temperature of (20 ± 2) °C for at least 30 min before the test begins.

Immediately prior to testing with the friction tester, immerse the sample in water at (20 ± 2) °C for at least 30 min.

Place the friction tester upon a firm level surface and adjust the levelling screws so that the pendulum support column is vertical. Then raise the axis of suspension of the pendulum so that the arm swings freely, and adjust the friction in the pointer mechanism so that when the pendulum arm and pointer are released from the right-hand horizontal position, the pointer comes to rest at the zero position on the test scale.

Before using a new slider, condition it using the method described in 5.7.2.1.9.

Discard any slider that exceeds the requirements given in 5.7.2.1.10.

Rigidly locate the test specimen with its longer dimension lying in the track of the pendulum, and centrally with respect to the rubber slider and to the axis of the suspension of the pendulum. Ensure that the track of the slider is parallel to the long axis of the specimen across the sliding distance.

Adjust the height of the pendulum arm so that in traversing the specimen the rubber slider is in contact with it over the whole width of the slider and over the specified swept length. Wet the surfaces of the specimen and the rubber slider with a copious supply of water, being careful not to disturb the slider from its set position. Release the pendulum and pointer from the horizontal position, catch the pendulum arm on its return swing. Record the position of the pointer on the scale. Perform this operation five times, rewetting the specimen each time, and record the mean of the last three readings. Relocate the specimen after rotating through 180° and repeat the procedure.

5.7.6 Calculation of unpolished slip resistance value USRV

When the slider is used over a swept length of 126 mm, calculate the pendulum value of each specimen as the mean of the two recorded mean values measured in opposite directions to the nearest 1 unit on the C scale.

The USRV is the mean pendulum value obtained on the 5 specimens.

5.7.7 Test report

The test report shall include the following information:

— mean pendulum test value of each specimen;

— mean USRV of the sample.

5.8 Water absorption

5.8.1 Objective

The method serves to determine the water absorption per unit area (absorption capacity) under atmospheric pressure and the dry bulk density.

5.8.2 Principle

To determine the dry bulk density, the samples are weighed and measured after drying. The determination of the density of samples with asymmetrical thickness is done by the water displacement method.

The side faces of the samples shall be sealed (so as to be water-impermeable) and the capillary water absorption per unit area is measured within a fixed period via the surface (suction face) of the sample. The samples are, thereafter, completely immersed under water and stored to achieve constant mass. The absolute water absorption in % (absorption capacity) is to be determined from the absolute quantity of water taken up under atmospheric pressure and the dry mass of the samples.

5.8.3 Sampling

The surface of the sample (testing area) shall be plane and be at least 100 cm^2. The thickness of the samples depends on the thickness of the floor tiles which shall be maintained even when the floor tiles are cut into halves.

5.8.4 Apparatus and materials

— Potable water with a temperature of (20 ± 2) °C;

— paraffin wax or similar for sealing the side faces (so as to be water-impermeable);

— brush;

— soft, absorbent cloth;

— measuring gauge or narrow slider;

— precision balance reading in grams;

— drying oven with a controllable temperature range (105 ± 5) °C;

— flat based vessel or basin for storage in water.

5.8.5 Preparation of the test specimens

Remove all dust, flashing, etc. with a stiff brush. Dry the specimen at a temperature of (105 ± 5) °C until it reaches constant mass. This is considered to be achieved when the mass of the sample does not change more than 0,1 % within 24 h. The drying time shall be at least 3 days.

The samples are cooled down to room temperature prior to weighing. The mass finally established is the decisive dry mass m_d. Then the measurements (length = L, width = W and height = H) of the specimens are made and expressed in cm.

5.8.6 Procedure

Side faces of the samples are sealed (so as to be water-impermeable) and weighed again (m_{ds}).

After that the specimen is immersed with the upper face down 2 mm to 10 mm deep in a water bath at (20 ± 2) °C. To avoid air accumulating under the sample, it is immersed in a slanting position (starting with one edge). The depth of the immersion is fixed either by means of spacers or a grid adjustable in height placed in the water bath.

The sample is taken out of the water without wetting the back and any water adhering to the upper face is removed with a moist sponge after (24 ± 0,5) h.

After weighing ($m_{h,24h}$), the sample is immersed under a layer of water of 25 mm to 50 mm deep until constant mass is reached (change of mass less than or equal to 0,1 % in 24 h) and during at least 3 days. The sample is weighed ($m_{h,c}$) after adhering water drops have been removed with a moist sponge.

5.8.7 Calculation of the results

5.8.7.1 Capillary water absorption per unit area under atmospheric pressure.

The capillary water absorption is calculated using the formula:

$$W_{24h} = \frac{m_{h,24} - m_{d,s}}{S}$$

where

W_{24h} capillary water absorption per unit under atmospheric pressure after 24 h [g/cm^2];

$m_{h,24h}$ mass of sample after 24 h capillary water suction over the testing area S [g];

m_{ds} dry mass of sample sealed [g];

S surface (suction face) of sample [cm^2].

5.8.7.2 Absolute water absorption or absorption capacity.

The absolute water absorption is calculated using the formula:

$$W_{m,a} = \frac{m_{h,c} - m_{d,s}}{m_{d,s}} \times 100\%$$

where

$W_{m,a}$ water absorption capacity based on mass [mass %];

$m_{h,c}$ mass of the sample waterlogged under atmospheric pressure [g];

$m_{d,s}$ dry mass of sample [g].

5.8.8 Test report

The test report shall include the following details:

a) marking of sample (type, date of production, number of batch, …);

b) date of testing;

c) date of test report;

d) surface (suction area) of sample;

e) capillary water absorption per unit area after 24 h;

f) water absorption capacity based on mass %.

5.9 Freeze/thaw resistance with de-icing salt

5.9.1 Principle

The specimen is preconditioned and then subjected to 28 freeze thaw cycles while the surface is covered with a 3 % NaCl solution. The material that has scaled off is collected and weighed and the result expressed in kilograms per square metre.

5.9.2 Specimen

The specimen shall incorporate an upper face area greater than 7 500 mm^2 but less than 25 000 mm^2, which shall be the test surface and shall have the thickness of the tile. If the specimen has to be taken from a unit to meet this requirement, it shall be taken when it is at least 20 days old.

5.9.3 Materials

5.9.3.1 Potable water

5.9.3.2 Freezing medium, consisting of 97 % by mass of potable water and 3 % by mass of NaCl.

5.9.3.3 Adhesive for gluing the rubber sheet to the concrete specimen. The adhesive shall be resistant to the environment in question.

NOTE Contact adhesive has proved to be suitable.

5.9.3.4 Silicon rubber or other sealant to provide a seal between the specimen and the rubber sheet and to fill in any chamfer around the perimeter of the specimen.

5.9.4 Apparatus

5.9.4.1 Diamond saw, for cutting the concrete specimen.

5.9.4.2 Climate chamber, with a temperature of (20 ± 2) °C and a relative humidity of (65 ± 10) %. In the climate chamber the evaporation from a free water surface shall be (200 ± 100) g/m^2 in (240 ± 5) min. The evaporation shall be measured from a bowl with a depth of approximately 40 mm and a cross sectional area of (22 500 ± 2 500) mm^2. The bowl shall be filled up to (10 ± 1) mm from the brim.

5.9.4.3 Rubber sheet, (3,0 ± 0,5) mm thick which shall be resistant to the salt solution used and sufficiently elastic down to a temperature of – 20 °C.

5.9.4.4 Thermal insulation, Polystyrene (20 ± 1) mm thick with a thermal conductivity between 0,035 W/(mK) and 0,04 W/(mK) or equivalent other insulation.

5.9.4.5 Polyethylene sheet, 0,1 mm to 0,2 mm thick.

5.9.4.6 Freezing chamber, with time controlled refrigerating and heating system with a capacity and air circulation such that the time-temperature curve presented in Figure 14 can be followed.

5.9.4.7 Thermocouples, or an equivalent temperature measuring device, for measuring the temperature in the freezing medium on the test surface with an accuracy within ± 0,5 °C.

5.9.4.8 Vessel for collecting scaled material. The vessel shall be suitable for use up to 120 °C and shall withstand sodium chloride attack.

5.9.4.9 Paper filter, for collecting scaled material.

5.9.4.10 **Brush**, 20 mm to 30 mm wide paint brush with the bristles cut down to about 20 mm long for brushing off material that has scaled.

5.9.4.11 **Spray bottle**, containing potable water for washing off scaled material and washing salt out of scaled material.

5.9.4.12 **Drying cabinet**, capable of operating at a temperature of (105 ± 5) °C.

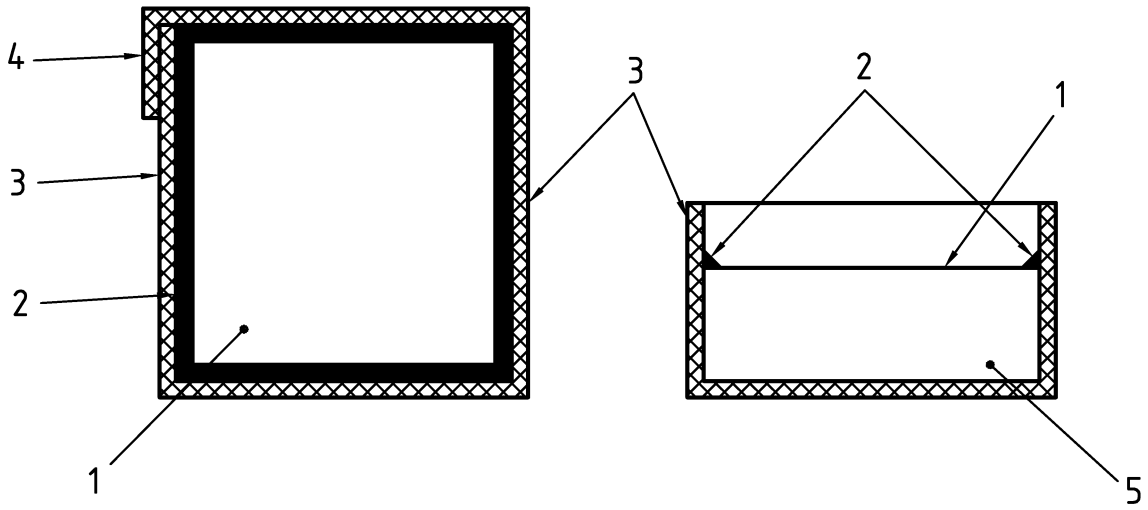
5.9.4.13 **Balance**, with an accuracy within ± 0,05 g.

5.9.4.14 **Vernier calipers**, with an accuracy within ± 0,1 mm.

5.9.5 Preparation of test specimens

When at least 28 and, except for receiving inspection, not more than 35 days old remove any flashings and loose material and then cure the samples for (168 ± 5) h in the climate chamber with a temperature of (20 ± 2) °C, relative humidity of (65 ± 10) % and an evaporation rate in the first (240 ± 5) min of (200 ± 100) g/m^2 measured in accordance with 5.9.4.2. There shall be a minimum 50 mm air space between the samples. During this time the rubber sheet is glued to all surfaces of the specimen except the test surface and remains glued during the test. Use the silicon rubber or other sealant to fill in any chamfer around the perimeter of the specimen and to provide a seal around the test surface in the corner between the concrete and the rubber sheet to prevent water penetration between the specimen and rubber. The edge of the rubber sheet shall reach (20 ± 2) mm above the test surface.

NOTE The adhesive is normally spread on the concrete surfaces as well as on the rubber surfaces. The manner of gluing the rubber sheet illustrated in Figure 13 has proved suitable.



Key

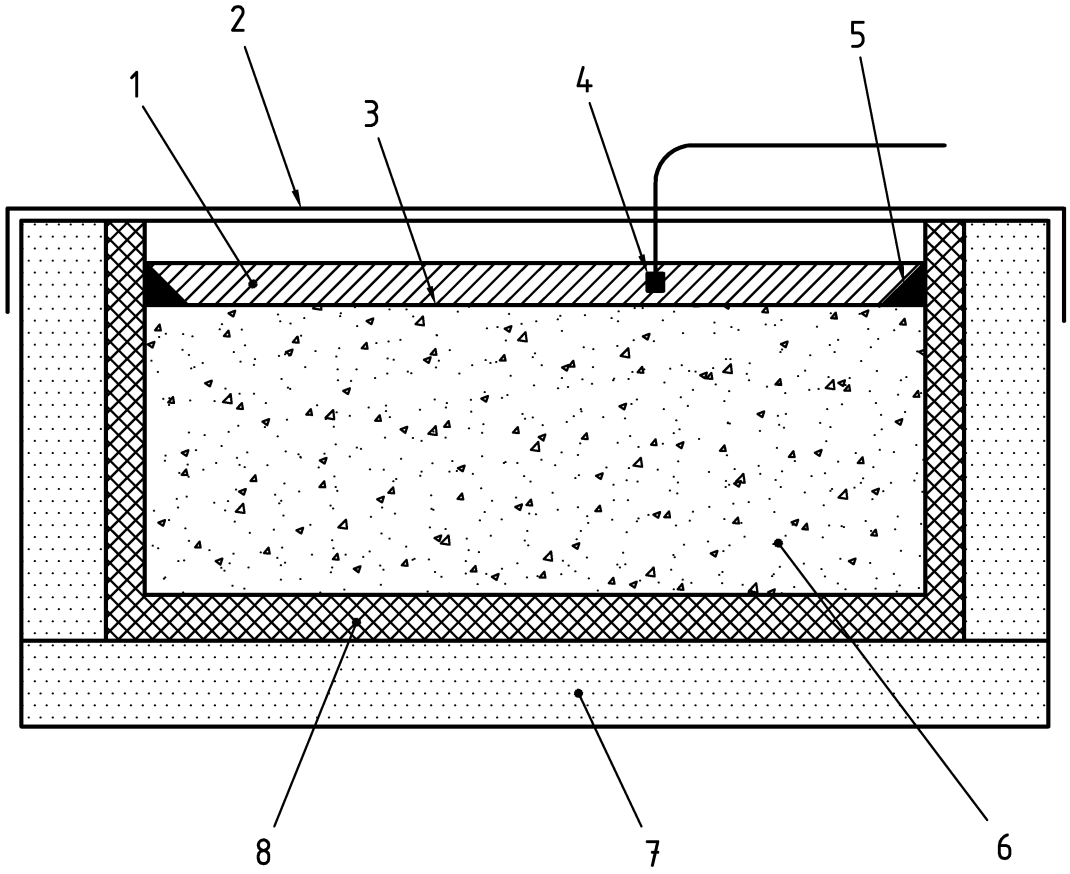
1 Test surface
2 Sealant string
3 Rubber sheet
4 Overlap
5 Specimen

Figure 13 — An example of the cross section of a specimen with the rubber sheet and a sealant string (right) and a specimen seen from above (left)

The tested area A shall be established from the mean of three measurements of its length and width to the nearest millimetre. After curing in the climate chamber, potable water with a temperature of (20 ± 2) °C shall be poured on the test surface to a depth of (5 ± 2) mm. This shall be maintained for (72 ± 2) h at (20 ± 2) °C and can be used to assess the effectiveness of the seal between the specimen and the rubber sheet.

Before the freeze/thaw cycling all surfaces of the specimen except the test surface shall be thermally insulated. This may be carried out during curing. The insulation shall be as described in 5.9.4.4.

15 min to 30 min before the specimens are placed in the freezing chamber, the water on the test surface shall be replaced with a (5 ± 2) mm layer, measured from the top surface of the specimen, of 3 % NaCl in potable water. This shall be prevented from evaporating by applying a horizontal polyethylene sheet as shown in Figure 14. The polyethylene sheet shall remain as flat as possible throughout the test and not come into contact with the freezing medium.



Key

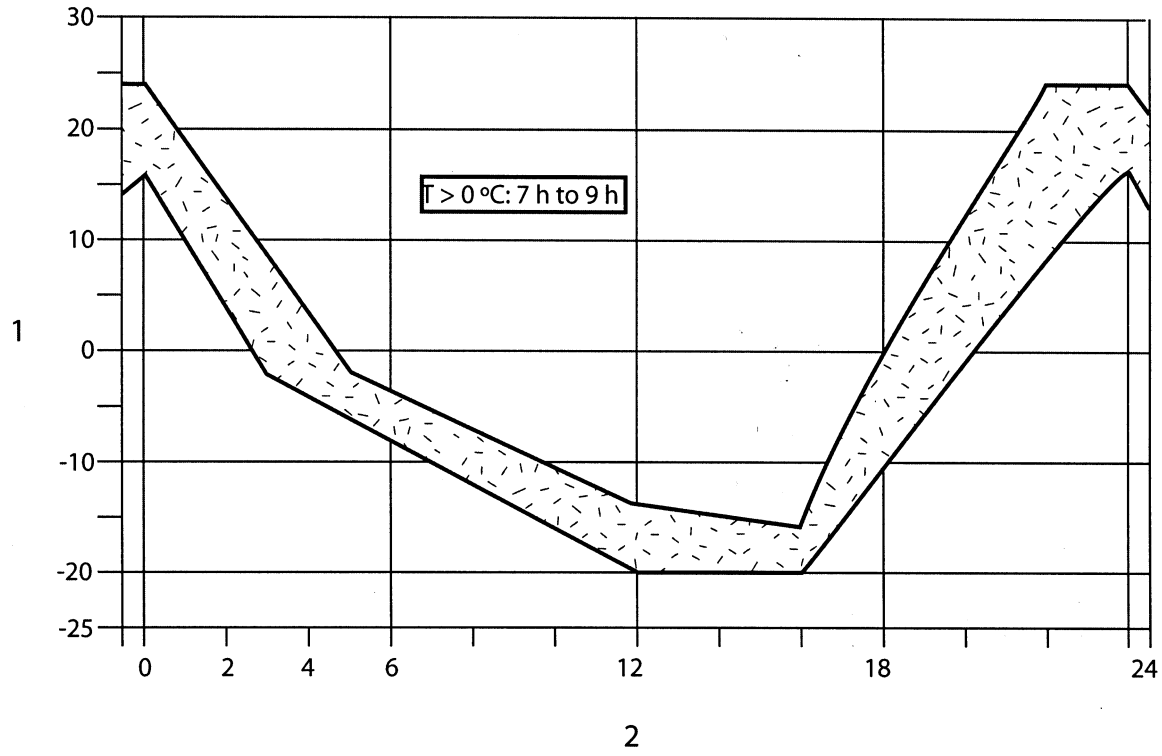
1 Freezing medium (salted water)
2 Polyethylene sheet
3 Test surface
4 Temperature measuring device
5 Sealant string
6 Specimen (concrete)
7 Thermal insulation
8 Rubber sheet

Figure 14 — Principle of set-up used for the freeze/thaw test

5.9.6 Procedure

Place the specimens in the freezing chamber in such a way that the test surface does not deviate from a horizontal plane by more than 3 mm/m in any direction and they are subjected to repeated freezing and thawing. During the test the time-temperature cycle in the freezing medium at the centre of the surface of all specimens shall fall within the shaded area in Figure 15. Furthermore the temperature shall exceed 0 °C during each cycle for at least 7 h but not more than 9 h. Record the temperature continually in the freezing medium at the centre of the test surface for at least one specimen which shall be located in a representative position in the freezing chamber. Record the air temperature in the freezer during the test. Start the timing of the first cycle of the test on a specimen within (0 ± 30) min of it being placed in the freezing chamber. If a cycle has to be interrupted keep the

specimen in the frozen state between – 16 °C and – 20 °C. If this interruption is for more than three days the test shall be abandoned.



Key

1 Temperature (°C)

2 Time (hours)

Figure 15 — Time-temperature cycle

The break points specifying the shaded area are given in Table 8.

Table 8 — Co-ordinates of break points

Upper limit		Lower limit	
Time (hours)	Temperature (°C)	Time (h)	Temperature (°C)
0	24	0	16
5	–2	3	–4
12	–14	12	–20
16	–16	16	–20
18	0	20	0
22	24	24	16

To obtain the correct temperature cycle for all the specimens ensure good air circulation in the freezing chamber. If only a few specimens are to be tested, fill the empty places in the freezer with dummies, unless it has been shown that the correct temperature cycle is achieved without them.

After 7 and 14 cycles, during the thaw period add further 3 % NaCl in potable water if necessary in order to keep a (5 ± 2) mm layer on the surface of the samples.

After 28 cycles the following procedure shall be carried out for each specimen:

a) collect material which has been scaled from the test surface by rinsing into the vessel using the spray bottle and brushing into the vessel until no further scaled material is removed;

b) pour the liquid and scaled material in the vessel carefully through a filter paper. Wash the material collected in the filter paper with a minimum of 1 l of potable water to remove any remaining NaCl. Dry the filter paper and collected material for at least 24 h at (105 ± 5) °C. Determine to ± 0,2 g the dry mass of the scaled material, making due allowance for the filter paper.

5.9.7 Calculation of test results

Calculate the mass loss per unit area of the specimen in (L) kilograms per square metre from the equation:

$$L = \frac{M}{A}$$

where

M is the mass of the total quantity of material scaled after 28 cycles, in kilograms;

A is the area of the test surface in square metres.

5.9.8 Test report

The test report shall include the following information:

a) mass loss per unit area of the specimen (L) in kilogram per square metre;

b) mass of total quantity of material scaled after 28 cycles in milligrams;

c) area of the test surface in square millimetres.

6 Evaluation of conformity and compliance criteria

6.1 General

The compliance of terrazzo tiles with the requirements of this standard and with the declared values for the tiles shall be demonstrated by carrying out:

— type testing of the tiles (see 6.2);

— factory production control by the manufacturer (see 6.3).

In addition, compliance with this European Standard may be assessed by third party certification of the units or by customer acceptance testing in accordance with clause 5 (e.g. in case of dispute).

6.2 Type testing of the tiles

6.2.1 Age for type testing

The age of tiles for type testing shall be at least 28 days.

6.2.2 Initial type testing

Initial type testing shall be performed to show conformity with this standard. Tests previously performed in accordance with the provisions of this standard (same product, same characteristic(s), same or more demanding test method, sampling procedure, system of attestation of conformity, etc.) may be taken into

account. In addition, initial type testing shall be performed at the beginning of the production of a new tile type (unless a member of the same family) or at the beginning of a new method of production (where this may affect the stated properties). Sampling for initial type testing shall be representative of normal production.

NOTE Products may be grouped into families where it is considered that the selected property is common to all products within that family.

The type tests shall be the reference tests given in this standard.

When the manufacturer's testing equipment is reliably calibrated, type testing is normally carried out with that equipment.

The results of the initial type tests shall be recorded and available for inspection.

6.2.3 Further type testing

Whenever a change occurs in the raw materials, the proportions used or the production equipment or process, which would change significantly some or all the properties of the finished tiles, the type tests shall be repeated for the selected property.

NOTE Examples of major changes:

1) change from river gravel to crushed rock aggregates or change of cement type or class;
2) partial substitution of cement by additions.

6.3 Factory production control

The manufacturer shall establish, document and maintain a factory production control system to ensure that the tiles placed on the market will conform with the specified or declared values.

The factory production control system shall consist of procedures, regular inspection and tests and the utilisation of the results to control raw and other incoming materials, equipment, the production process and the product.

The results of inspections requiring action and the results of tests shall be recorded.

The action to be taken when control values or criteria are not met shall be given.

7 Marking and labelling

The following particulars relating to tiles supplied in accordance with this standard shall be marked clearly on the delivery note, invoice, manufacturer’s or supplier’s certificate or brochure supplied with the consignment of tiles:

a) identification of the producer;

b) identification of this standard;

c) indication of date of production;

d) identification of marking, on each package or at least 3 % of the units;

e) identification of the product;

f) format and classes if applied.

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/119 "Floorings" and Mandate M/122 “Roof coverings, rooflights, roof windows and ancillary products”, given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard, shown in this annex, meet the requirements of Mandates M/119 and M/122 given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the construction products covered by this European Standard for its intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

WARNING — Other requirements and other EU Directives, not affecting the fitness of intended use(s), can be applicable to the construction product falling within the scope of this European Standard.

NOTE In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply. *An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm).*

This annex has the same scope as clause 1 of this standard with regard to the products covered. It establishes the conditions for the CE marking of terrazzo tiles intended for the use indicated below and shows the relevant clauses applicable (see Table ZA.1).

Construction product : terrazzo tiles.

Intended uses : for external uses, including roofing applications in pedestrian areas.

Table ZA.1 — Relevant clauses for terrazzo tiles for external floorings

Essential characteristics	Requirement clause in this European Standard	Mandated levels and/or classes	Notes	Specific use
Reaction to fire	4.2.7.1	Class $A1_{fl}$	No test required[1]	
External fire performance	4.2.7.2	None	Deemed to satisfy	Roofing
Weathering resistance	4.2.6.	None	Class	
Breaking strength	4.2.4.2	None	Class	
Slip/skid resistance	4.2.5	None	Satisfactory or declared value	
Thermal conductivity	4.2.8	None	Where applicable: declared value	

[1] No test required, see Decision 96/603/EEC, as amended.

Some requirements, considered in the above table, are not applicable in those Member States (MSs) where there are no regulatory requirements (on that characteristic) for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option "No performance determined" (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

ZA.2 Procedure for attestation of conformity

ZA.2.1 System of attestation of conformity

Terrazzo tiles, for the intended uses listed below, shall follow the attestation of conformity system shown in Table ZA.2.

Table ZA.2 — Attestation of conformity system

Products	Intended uses	Levels or classes	Attestation of conformity system
Terrazzo tiles	As external floorings Roofing	$A1_{fl}$*** and F	4
*** Products/materials that do not require to be tested for reaction to fire (e.g. products/materials of Class A1 according to Commission Decision 96/603/EC, as amended)			
System 4 : See Directive 89/106/EEC (CPD) Annex III.2.(ii), Third possibility.			

The attestation of conformity of the terrazzo tiles in Table ZA.1 shall be based on the evaluation of conformity procedures indicated in Table ZA.3 resulting from application of the clauses of this European Standard indicated therein.

Table ZA.3 — Assignment of conformity tasks for terrazzo tiles under system 4

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (F.P.C)	Parameters related to all relevant characteristics of Table ZA.1	6.3
	Initial type testing	All relevant characteristics of Table ZA.1	6.2

ZA.2.2 EC Declaration of conformity

When compliance with this annex ZA is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which authorises the affixing of the CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

— description of the product (type, identification, use …), and a copy of the information accompanying the CE marking;

— provisions to which the product conforms (i.e. annex ZA of this EN);

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions);

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

The above mentioned declaration shall be presented in the official language or languages of the Member State in which the product is to be used.

ZA.3 CE marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE conformity marking consists exclusively of the letters “CE” in the specified form of the Directive 93/68/EEC.

The CE marking symbol for terrazzo tiles shall appear on the packaging and/or the accompanying commercial documents and shall be accompanied by the information shown below:

— name or identifying mark and registered address of the producer;

— last two digits of the year in which the marking was affixed;

— reference to this EN 13748-2;

— description of the product: e.g. generic name, dimensions and intended use;

— information on those characteristics listed in Table ZA.1 which are to be declared (as relevant):

  — reaction to fire;

  — external fire performance;

  — weathering resistance;

  — breaking strength;

  — slip/skid resistance;

  — thermal conductivity;

  — the “No performance determined” (NPD) statement for characteristics where this is relevant.

The “No performance determined” (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

Figure ZA.1 gives an example of the information to be given on the packaging and/or accompanying commercial documents.

CE	*CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.*
AnyCo Ltd, PO Box 21, B-1050 **03**	*Name or identifying mark and registered address of the producer* *Last two digits of the year in which the marking was affixed*
EN 13748-2 Terrazzo floor tiles for external use, thickness class I	*No. of European standard* *Description of product and*
Reaction to fire $A1_{fl}$	*information on regulated characteristics*
Weathering resistance Class B	
Breaking strength TT	
Slip/skin resistance Satisfactory	
Thermal conductivity NPD	

Figure ZA.1 — Example CE marking information

In addition, the product shall also be accompanied, when and where required and in the appropriate form, by documentation listing legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE European legislation without national derogations need not be mentioned.

Bibliography

EN ISO 4288:1997, *Geometrical product specifications (GPS) – Surface texture: Profile method – Rules and procedures for the assessment of surface texture (ISO 4288:1996).*

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