BRITISH STANDARD

BS EN
13373:2003

Natural stone test methods — Determination of geometric characteristics on units

The European Standard EN 13373:2003 has the status of a British Standard

ICS 73.020; 91.100.15

National foreword

This British Standard is the official English language version of EN 13373:2003.

The UK participation in its preparation was entrusted to Technical Committee B/545, Natural stone, 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.

Cross-references

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13373

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ICS 73.020; 91.100.15

English version

Natural stone test methods - Determination of geometric characteristics on units

Méthodes d'essai pour pierres naturelles - Détermination des dimensions et autres caractéristiques géométriques

Prüfverfahren für Naturstein - Bestimmung der Maße und anderer geometrischer Merkmale von Gesteinen

This European Standard was approved by CEN on 2 January 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 13373:2003 E

Contents

Foreword

This document (EN 13373:2003) has been prepared by Technical Committee CEN/TC 246 "Natural stones", the secretariat of which is held by UNI.

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 October 2003, and conflicting national standards shall be withdrawn at the latest by October 2003.

This draft standard is one of the series of draft standards for tests on natural stone.

Test methods for natural stone consist of the following parts:

EN 1925, *Natural stone test methods - Determination of water absorption coefficient by capillarity*.

EN 1926, *Natural stone test methods - Determination of compressive strength.*

EN 1936, *Natural stone test methods - Determination of real density and apparent density and of total and open porosity.*

EN 12370, *Natural stone test methods - Determination of resistance to salt crystallisation.*

EN 12371, *Natural stone test methods - Determination of frost resistance.*

EN 12372, *Natural stone test methods - Determination of flexural strength under concentrated load*.

EN 12407, *Natural stone test methods - Petrographic examination.*

EN 13161, *Natural stone test methods - Determination of flexural strength under constant moment.*

EN 13364, *Natural stone test methods - Determination of the breaking load at dowel hole.*

EN 13755, *Natural stone test methods - Determination of water absorption at atmospheric pressure.*

EN 13919*, Natural stone test methods - Determination of resistance to ageing by SO2 action in the presence of humidity*.

EN 14066, *Natural stone test methods - Determination of resistance to ageing by thermal shock.*

prEN 14146, *Natural stone test methods - Determination of the dynamic modulus of elasticity (by measuring the fundamental resonance frequency).*

prEN 14147, *Natural stone test methods - Determination of resistance to ageing by salt mist.*

prEN 14157, *Natural stone test methods - Determination of the abrasion resistance..*

prEN 14158, *Natural stone test methods - Determination of rupture energy.*

prEN 14205*, Natural stone test methods - Determination of Knoop hardness.*

EN 14231, *Natural stone test methods - Determination of the slip resistance by means of the pendulum tester.*

prEN 14579, *Natural stone test methods - Determination of sound speed propagation.*

prEN 14580, *Natural stone test methods - Determination of static elastic modulus.*

prEN 14581, *Natural stone test methods - Determination of thermal dilatation coefficient.*

It is intended that other ENs should call up this EN 13373 as the basis of evaluation of conformity. (Nevertheless it is not intended that all natural stones products should be subjected regularly to all the listed tests. Specifications in other standards should call up only relevant test methods).

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

1 Scope

This European standard describes methods for verifying the geometric characteristics of products of natural stone such as blocks, rough slabs, finished products for cladding, flooring, stairs and modular tiles. These methods are to be applied in the case of a dispute between two parties, they are not compulsory for production control, where simplified methods can be applied provided a correlation with the methods of this standard could be demonstrated.

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 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).

prEN 1467, *Natural stone products- Rough blocks - Requirements.*

prEN 1468, *Natural stone products- Rough slabs - Requirements*.

prEN 1469, *Natural stone products - Slabs for claddings - Requirements*

prEN 12057, *Natural stone products - Modular tiles – Requirements*.

prEN 12058, *Natural stone products - Slabs for floors and stairs – .Requirements*

prEN 12059, *Natural stoneproducts - Dimensional stone work - Requirements*.

3 Measurement of the dimensions of rough blocks

3.1 General

These methods are to be used for the measurement of the gross dimensions and the net dimensions of rough blocks that conform with prEN 1467.

3.2 Measurement of the gross dimensions of rough blocks

3.2.1 General

Measurement of the dimensions of the smallest parallelepiped (P_1) that contains a rough block.

3.2.2 Apparatus

- A rigid rule of appropriate size graduated in 10 mm.

- Two flat metal reference straight-edges

3.2.3 Procedure of measurement

An orthogonal reference system is chosen (*x, y, z*) (Figure 1).

The height z_i and the length x_i (or the width y_i) of each face i of the block are measured in the following manner:

The straight-edges show the two parallel sides of the smallest rectangle containing the face of the block. Measurements are taken in the plane of the corresponding face of the parallelepiped P_1. The distance between the straight-edges is measured to the nearest 10 mm (Figure 2).

The gross dimensions of the block are the smallest value of x_i, y_i and z_i, expressed in metres.

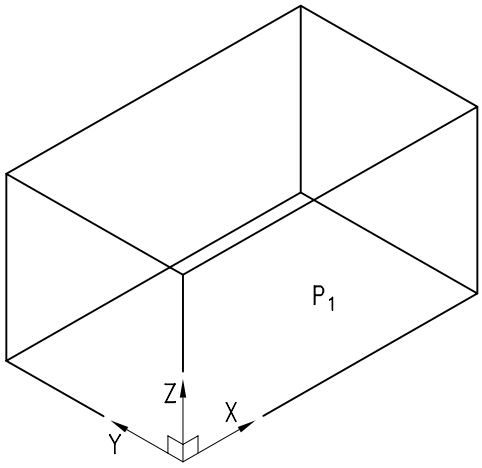


Figure 1 — Orthogonal reference system defining the planes of measurement (parallelepiped P_1)

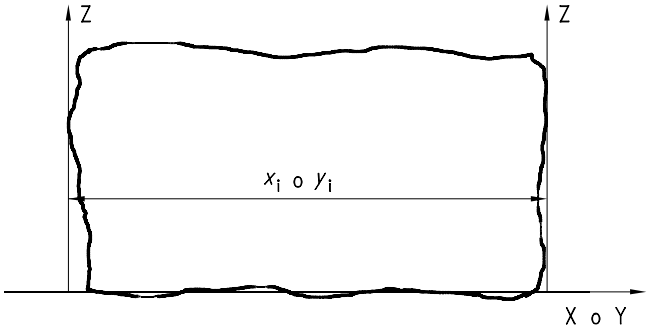


Figure 2 — Measurement of the gross length x_i (or of the gross width y_i) of a face of a rough block

3.3 Measurement of net dimensions of rough blocks

3.3.1 General

Measurement of the dimensions of the largest parallelepiped (P_2) that can be inscribed within a rough block.

3.3.2 Apparatus

- A rigid rule of appropriate size graduated in 10 mm.

- Two flat metal reference straight-edges.

3.3.3 Procedure of measurement

An orthogonal reference system is chosen (x, y, z) (Figure 3).

The height z_i and the length x_i (or the width y_i) of each face i of the block are measured in the following manner :

- the straight-edges show the two parallel sides of the largest rectangle that can be inscribed within the face of the block. Measurements are taken in the plane of the corresponding face of the parallelepiped P_2. The distance between the straight-edges is measured to the nearest 10 mm (Figure 4);

- the net dimensions of the block are the smallest values of x_i, y_i,z_i, expressed in metres.

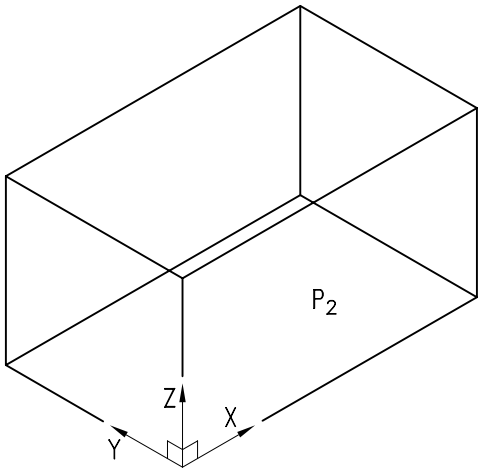


Figure 3 — Orthogonal reference system defining the planes of measurement (parallelepiped P_2)

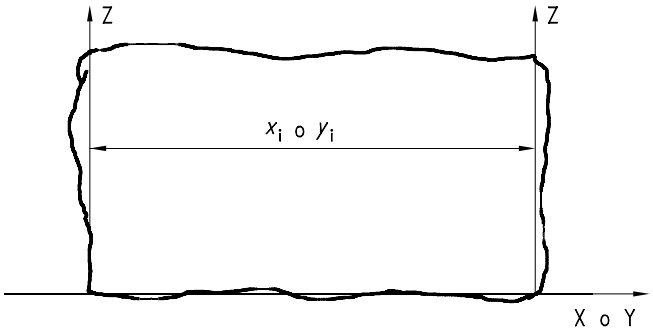


Figure 4 — Measurement of the net length x_i (or of the net width y_i) of a face of a rough block

4 Measurement of the dimensions of rough slabs

4.1 General

These methods are to be used for the measurement of the gross dimensions and net dimensions of rough slabs that conform with prEN 1468.

4.2 Measurement of the gross dimensions of rough slabs

4.2.1 General

Measurement of the dimensions of the smallest rectangle that contains a slab.

4.2.2 Apparatus

- A rigid rule of appropriate size graduated in 10 mm.

- Two flat metal reference straight-edges.

4.2.3 Procedure of measurement

An orthogonal reference system is chosen (x, z).

The height (z_i) and the length (x_i) of the slab are measured in the following manner :

- with the straight-edges show the two parallel sides of the smallest rectangle containing the slab, the distance between the straight-edges is measured to the nearest 10 mm (Figure 5);

- the gross dimensions of the rough slab are: the smallest values of x_i; and z_i, expressed in millimetres.

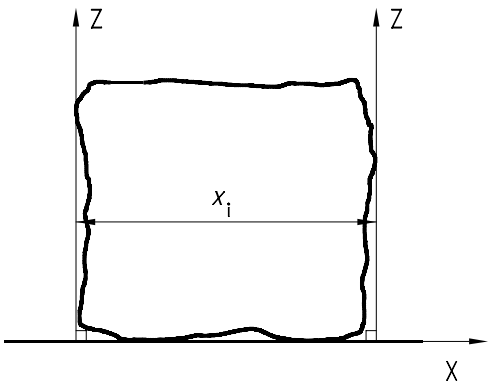


Figure 5 — Measurement of the gross length x_i of a rough slab

4.3 Measurement of the net dimensions of rough slabs

4.3.1 General

Measurement of the dimensions of the largest rectangle that can be inscribed within a slab.

4.3.2 Apparatus

- A rigid rule of appropriate size graduated in 10 mm.

- Two flat metal reference straight-edges.

4.3.3 Procedure of measurement

An orthogonal reference system is chosen (x, z).

The height (z_i) and the length (x_i) of the slab are measured in the following manner:

- with the straight-edges show the two parallel sides of the largest rectangle that can be inscribed within the slab; the distance between the straight-edges is measured to the nearest 10 mm (Figure 6). The net dimensions of the rough slab are: the smallest values of x_1 and z_1 expressed in millimetres.

4.3.4 Measurement of the thickness of a rough slab

See clause 5.3.

4.3.5 Verification of the flatness of a rough slab

See clause 5.4.

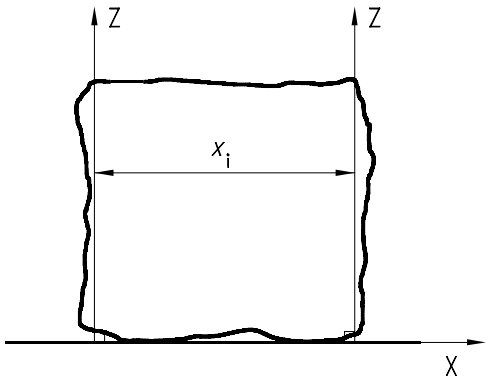


Figure 6 — Measurement of the net length x_i of a rough slab

5 Measurement of the dimensions and verification of other geometric characteristics of finished products

5.1 General

These methods are to be used for the measurement of dimensions, and verification of flatness and squareness of finished products that conform to prEN 1469, prEN 12057, prEN 12058 and prEN 12059.

5.2 Measurement of the dimensions of finished products

5.2.1 General

Measurement of the length, width and thickness of parallelepiped elements in solid stone.

Measurement of the length and width of the following rectangular elements with sawn edges: slabs for cladding, slabs for floors and stairs and modular tiles.

Measurement of the thickness of slabs for claddings, slabs for floors and stairs and modular tiles, but only when these products have a ground, honed or polished finish. For measuring thickness in the case of a textured or riven surface finish, see clause 5.3.

5.2.2 Apparatus

- A sliding calliper gauge accurate to 1/20 mm with a measuring range at least equal to the size of the element to be measured (up to 1000 mm).

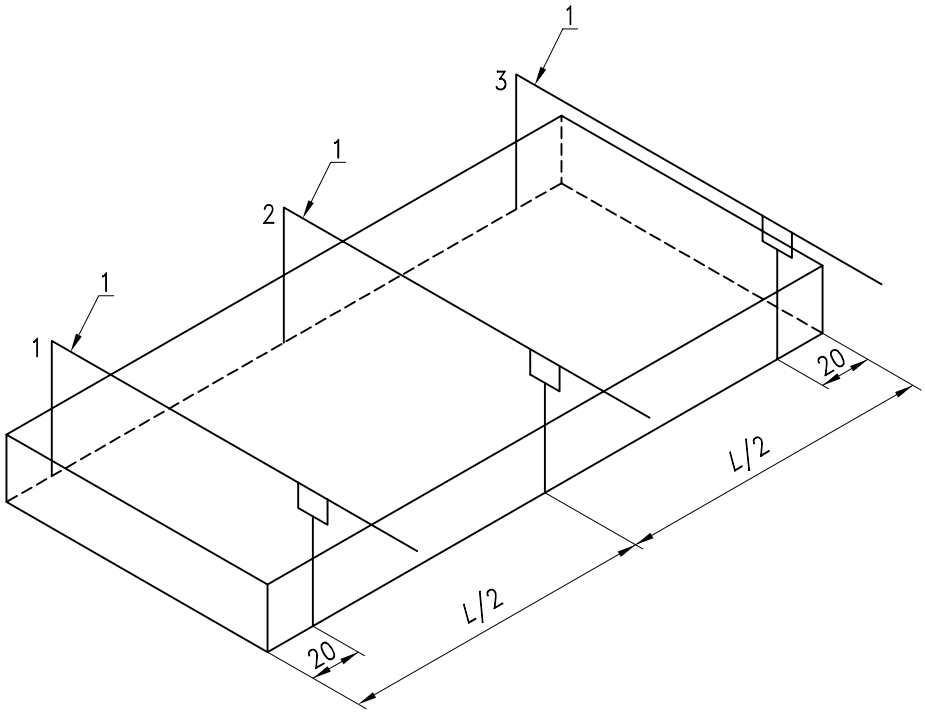
5.2.3 Procedure of measurement

- All measurements are made to the nearest 0,1 mm.

- For the length and width, three measurements per face are taken (Figure 7).

- For the thickness, measurements are taken at 8 positions (Figure 8).

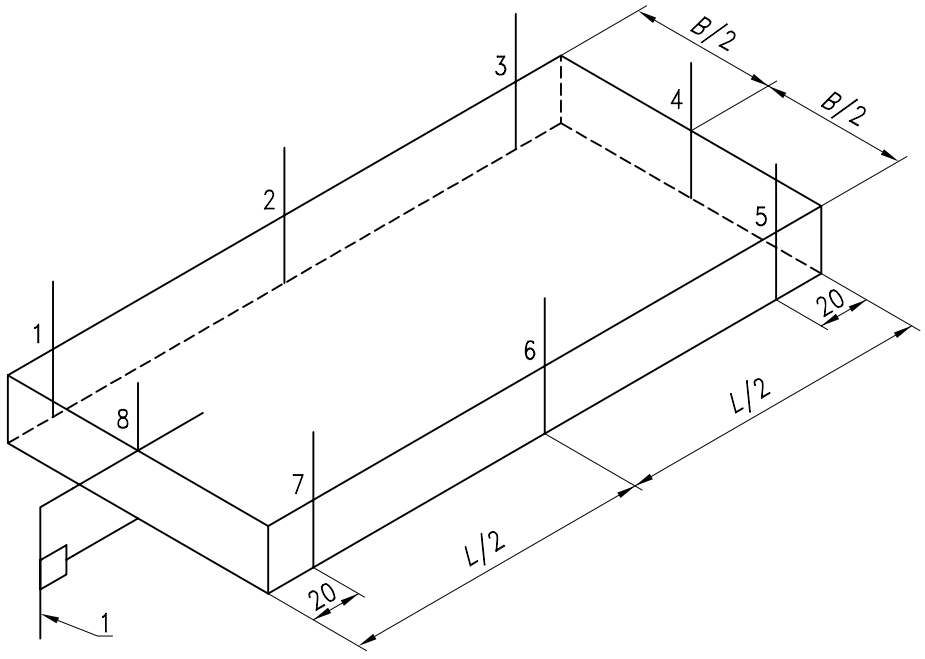
Dimensions in millimetres



Key
1 Sliding calliper gauge
L Length of the element

Figure 7 — Measurement of the length of finished products at three points

Dimensions in millimetres



Key
1 Sliding calliper gauge
L Length of the element
B Width of the element

Figure 8 — Measurement of the thickness of finished products at eight points

5.3 Measurement of the thickness for a textured finish

5.3.1 Measurement of surface irregularities

5.3.1.1 General

Measurement of surface irregularities for slabs for claddings and for floors and stairs, and modular tiles with a textured surface finish (flame-textured, bush-hammered etc.).

5.3.1.2 Apparatus

- A profile gauge (comb) > 500 mm long.

- A rigid rule of appropriate size graduated in millimetres.

5.3.1.3 Procedure of measurement

- Place the element to be measured on a reference surface.

- Place the profile gauge support onto the spacing shims and press the fingers on the base.

- Measure the distance (measurement *e*) between the end of the blade and the gauge support to the nearest 1 mm.

- Divide the facing surface of the element into at least four areas, place the gauge on one of these areas and press all the blades onto the surface (see Figure 9).

- Remove the gauge and measure the highest and lowest points (measurements *c*).

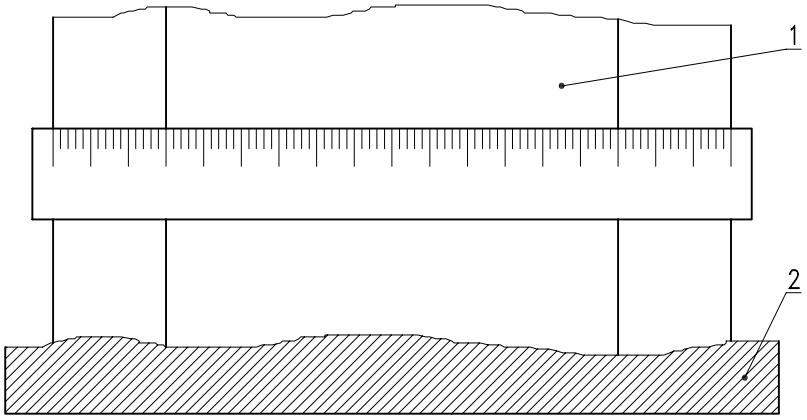
- Take the difference between the result of the measurement *e* and the result of the measurements *c* to obtain the maximum and minimum profiles.

- Repeat the operation for the other areas.

5.3.2 Measurement of resulting thickness

- A rough measurement of the thickness of the element is taken according to the method described in clause 5.2.

- The resulting thickness to be taken into account, is the rough thickness reduced by the biggest depth of hollows obtained with the profile gauge.



Key
1 Profile gauge
2 Unit being measured

Figure 9 — Measurement of surface irregularities

5.4 Verification of flatness

5.4.1 Verification of flatness for a regular surface finish

5.4.1.1 General

Measurement of the deviation from flatness for the following elements with sawn edges and having a ground, honed or polished surface finish: slabs for claddings and for floors and stairs and modular tiles.

5.4.1.2 Apparatus

- A flat metal rule perforated at 100 mm intervals, having a length at least equal to that of the element to be measured (Figure 10) (maximum 1500 mm).

- A set of thin shims accurate to 1/10 mm.

- A gauge accurate to 1/10 mm with a flat contact.

5.4.1.3 Procedure of measurement

- Place the rule on two shims of known thickness, these being placed so as to be adjacent to the edges (Figure 11 and Figure 12).

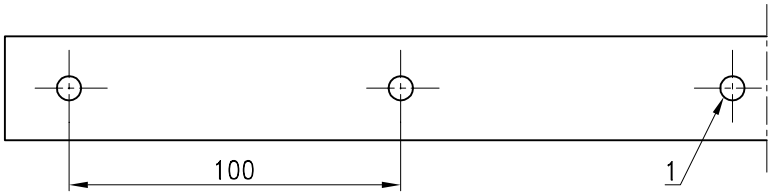
- Place the gauge (Figure 12) or a set of thin shims (Figure 11) at the points of measurement. Measurements are taken at 8 positions to the nearest 0,5 mm (Figure 13).

- Note the results for positions 1 to 8.

5.4.2 Verification of flatness for an irregular finish

In the case of an element with a textured finish, the method described in 5.4.1 is followed, taking care to use shims with sufficient width so as not to be between two peaks in the irregularities.

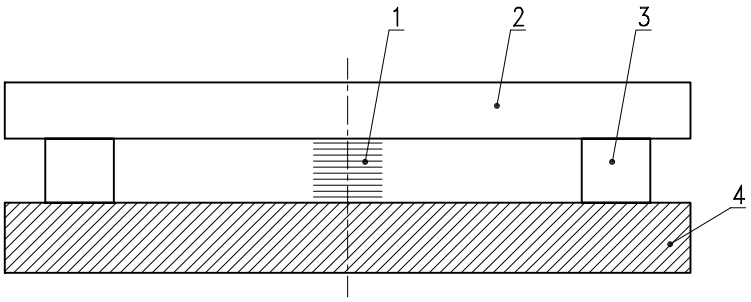
Dimensions in millimetres



Key

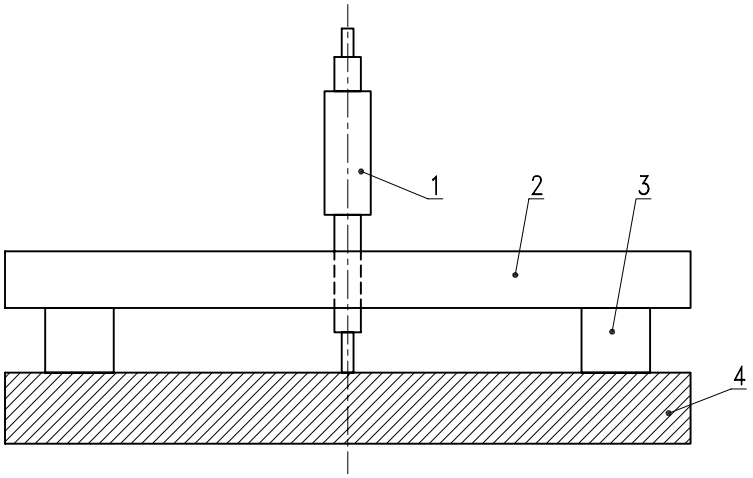
1 Hole for the gauge

Figure 10 — Perforated flat rule



Key
1 Thin shims to 1/10 mm
2 Rule
3 Shims of known thickness placed at the corners of the area to be measured
4 Unit being measured

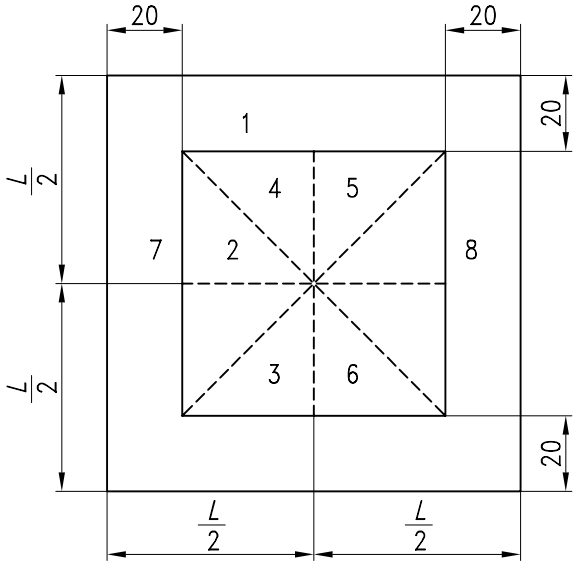
Figure 11 — Measurement of the deviation from flatness with thin shims



Key
1 Gauge to 1/10 mm
2 Rule
3 Shims of known thickness placed at the corners of the area to be measured
4 Unit being measured

Figure 12 — Measurement of the deviation from flatness with gauge

Dimensions in millimetres



Key

L = length of the unit

Figure 13 — Positions for measurement of deviation from flatness

5.5 Verification of the squareness of faces

5.5.1 General

Measurement of the difference, in the plane of the face seen, between the angle formed by two adjacent edges and a right angle, for the following rectangular elements with sawn edges: slabs for claddings and for floors and stairs and modular tiles.

5.5.2 Angular measurement

5.5.2.1 Apparatus:

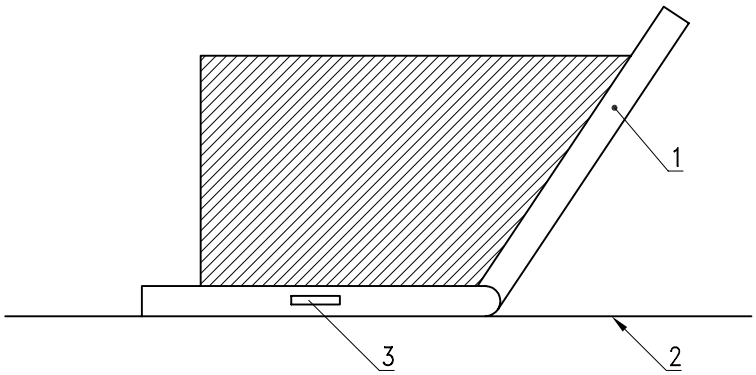
- an angle gauge of length 500 mm and calibrated to 0,1°.

5.5.2.2 Procedure of measurement:

- the element to be checked is placed on a reference surface;

- an angle is measured to the nearest 0,1° (see Figure 14);

- the operation is repeated in the corner diagonally opposite.



Key

1 Angle gauge
2 Reference surface
3 Digital angle read-out

Figure 14 — Angular measurement of the squareness of a face

5.5.3 Measurement in percentage

5.5.3.1 Apparatus:

- a set-square with arms ≥ 600 mm long;

- a dial gauge accurate to 1/50 mm, with a flat contact;

- a rigid rule of appropriate size graduated in millimetres.

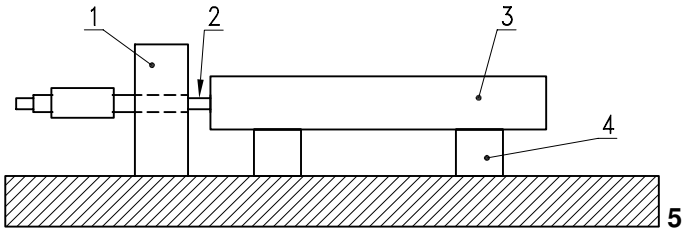
5.5.3.2 Procedure of measurement:

- the element to be checked is laid on two shims of known thickness placed on a reference surface (Figure 15);

- using a dial gauge the distance between the side of the element and the arm of the set square is measured (in millimetres to the nearest 0,1 mm) at two points situated 20 mm from the ends to be checked (Figure 16). The difference •1 ×between the two measurements is calculated in millimetres to the nearest 1 mm;

- the error of squareness as a percentage is given by $\frac{l}{l} \times 100$ to the nearest percent;

- the operation is repeated in the corner diagonally opposite.

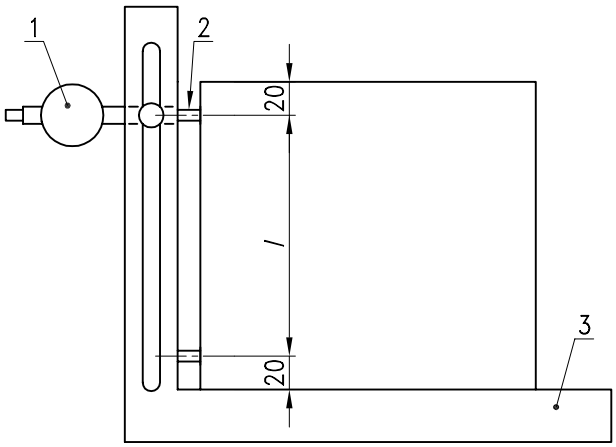


Key

1 Side of set-square
2 Contact just touching axis of thickness
3 Unit being measured
4 Shims enabling gauge to contact the axis
5 Reference surface

Figure 15 — Measurement in percentage of the squareness of a face with set-square and dial gauge

Dimensions in millimetres

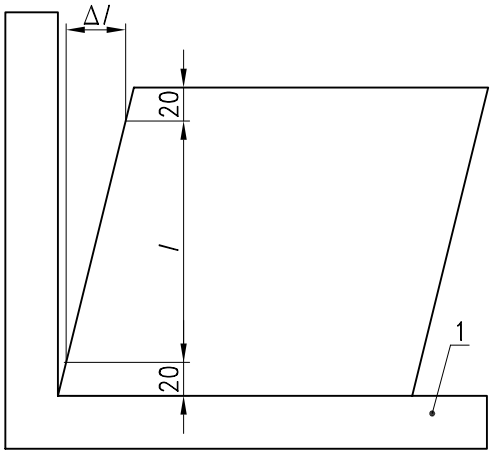


Key

l Distance of measurement
1 Dial gauge accurate to 1/50 mm
2 Flat contact
3 Set-square

Figure 16 — Measurement in percentage of the squareness of a face with set-square and dial gauge

Dimensions in millimetres



Key

l Distance of measurement
1 Set-square

Figure 17 — Measurement of the squareness of edges (set-square)

5.6 Verification of the squareness of edges

5.6.1 General

Measurement of the difference between the angle formed by the plane of the edge and the plane of the face seen and a right angle for elements with sawn edges.

5.6.2 Apparatus

- A set-square with arms ≥100 mm long.

- A set of thin shims accurate to 1/10 mm.

- A rigid rule of appropriate size, graduated in millimetres.

5.6.3 Procedure of measurement

5.6.3.1 Measurement using a set square

The element to be measured is placed within the arms of the set square. Using the shims the distance between the side of the element and the arm of the set square is measured (in millimetres to the nearest 0,1 mm) at two points situated 20 mm from the ends to be checked (Figure 17). The difference l between the two measurements is calculated and recorded. The distance l between the two points is measured in millimetres to the nearest 1 mm.

5.6.3.2 Measurement using a reference surface and a set-square

The element to be checked is placed on a reference surface.

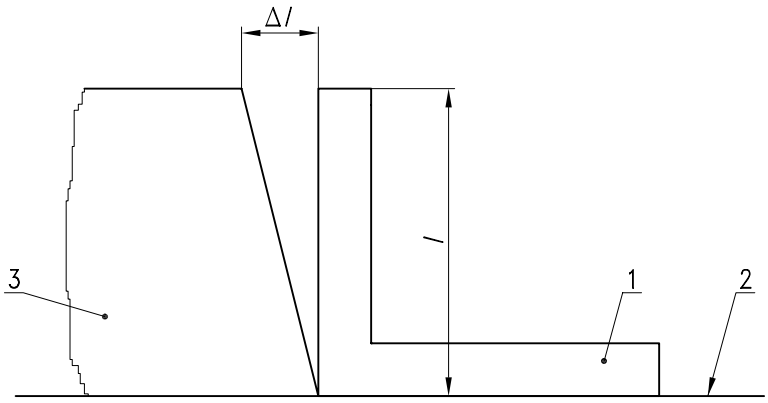
Using the set of shims, the distance *l* between the upper edge of the side and the arm of the set-square is measured (in millimetres to the nearest 0,1 mm) for a distance *l* measured in millimetres to the nearest 1 mm (Figure 18).

5.6.3.3 Expression of the results

The error of squareness as a percentage is given to the nearest percent.

The measurements are taken at 12 positions (Figure 19).

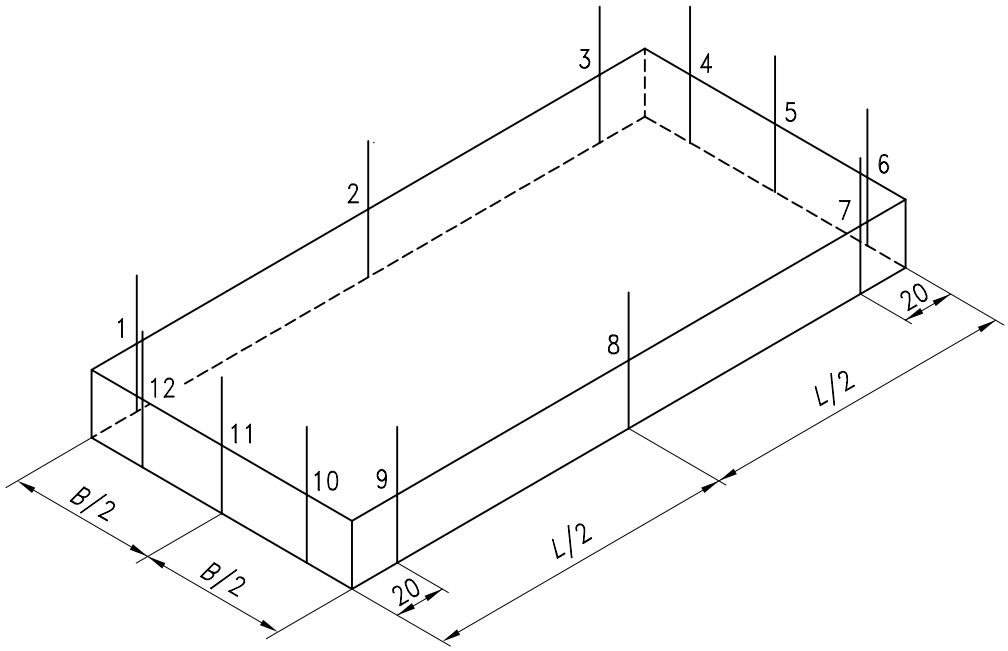
The results for positions 1 to 12 are noted.



Key
l distance of measurement
1 Set-square
2 Reference surface
3 Unit being measured

Figure 18 — Measurement of the squareness of edges (reference surface and set-square)

Dimensions in millimetres



Key

L length of the element
B width of the element

Figure 19 — Positions for measurement of squareness of edges

5.7 Verification of the geometrical characteristics of fixing holes of slabs for claddings

5.7.1 General

Measurement of the depth, position, diameter and inclination of fixing holes of slabs for claddings.

5.7.2 Depth of the hole

5.7.2.1 Apparatus

- A depth gauge accurate to 1/20 mm (Figure 20), the cylindrical end of which has a nominal diameter not greater than the diameter of the hole.

5.7.2.2 Procedure of measurement

After having taken care to clean the hole, the depth is measured to the nearest 0,5 mm.

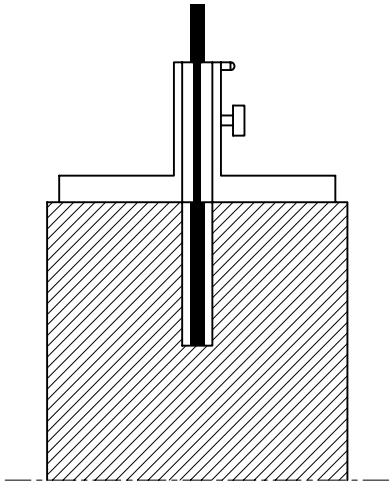


Figure 20 — Measurement of the depth of the hole with depth gauge

5.7.3 Position of the hole

5.7.3.1 Apparatus

- A sliding calliper gauge accurate to 1/20 mm with a measuring range at least equal to the size of the element to be measured (up to 1000 mm).

5.7.3.2 Procedure of measurement

The distance from the axis of the hole to one or more edges, to a face or to another reference point is measured to the nearest 0,5 mm.

5.7.4 Diameter of the hole

5.7.4.1 Apparatus

- A cylindrical clearance gauge, the diameter of which is greater than the nominal diameter by 2 mm.

- A cylindrical clearance gauge, the diameter of which is less than the nominal diameter by 2 mm.

The clearance gauges must be accurate to the nearest 0,2 mm.

5.7.4.2 Procedure of measurement

- The larger diameter clearance gauge must not enter the hole.

- The smaller diameter clearance gauge must freely enter the hole.

5.7.5 Inclination of the hole

5.7.5.1 Apparatus

- A stud with a diameter less than that of the hole and a length such that once pushed into place the stud will protrude by about 100 mm.

- A set-square with arms 100 mm long

- A set of thin shims accurate to 1/10 mm.

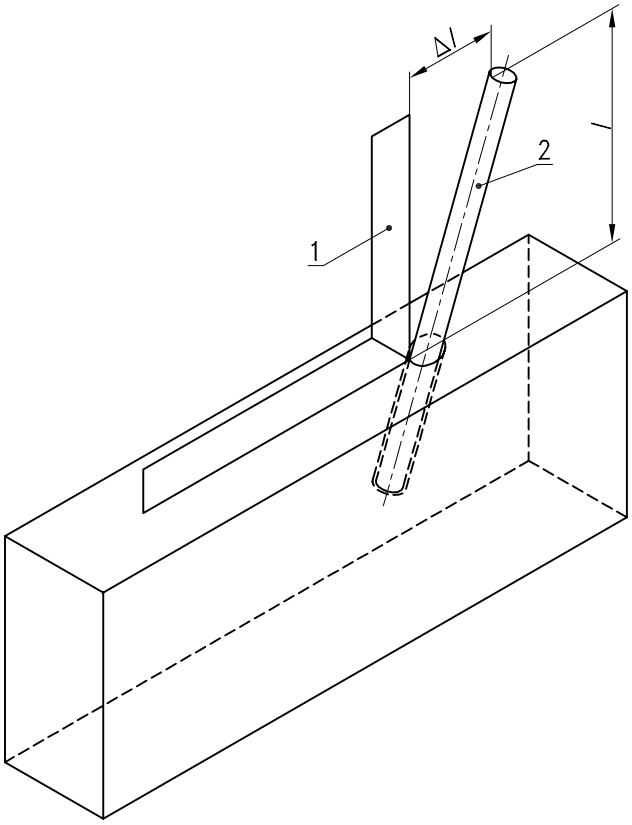
5.7.5.2 Procedure of measurement

The stud is inserted into the hole.

The set-square is placed on the element to be measured at the edge of the hole (Figure 21).

Using the set of shims the maximum distance *l* between the stud and the arm of the set-square for a distance *l* is measured (in millimetres to the nearest 0,1 mm) for a distance *l* (measured in millimetres to the nearest 1 mm).

The error of the angle as a percentage is given to the nearest percent.



Key
1 Set-square
2 Stud

Figure 21 — Measurement of the inclination of the hole

5.8 Verification of the shape of non-rectangular and curved units

5.8.1 General

Measurement of the deviation between a reference template and a control template for non-rectangular and curved units.

5.8.2 Apparatus

-A reference template and a control template made from a corrosion resistant material which is dimensionally stable within a limit of 0,05% under the effect of natural variations in ambient temperature and humidity.

- A sliding calliper gauge accurate to 1/20 mm with a measuring range at least equal to the size of the element to be measured (up to 1000 mm).

5.8.3 Procedure of measurement

Trace a control template from a stone unit during the production stage. Cut out the template in the projection. Measure the lengths on the template to the nearest 0,5 mm.

Compare the lengths measured on the control template with those on the reference template.

Note the differences.

6 Test report

The test report shall contain the following information:

a) unique identification number of the report;

b) the number, title and date of issue of this European Standard;

c) the name and address of the test laboratory and the address where the test was carried out, if different from the test laboratory;

d) the name and the address of the client;

e) it is the responsibility of the client to supply the following information:

- the petrographic name of the stone,
- the commercial name of the stone,
- the country and region of extraction,
- the name of the supplier,
- the name of the person or organisation which carried out the sampling;

f) the date of delivery of the sample;

g) the date of testing;

h) the number of units in the sample;

i) the measurements performed;

j) the results of the measurements;

k) all deviations from the standard and their justification;

l) remarks.

The test report shall contain the signatures and roles of those responsible for the testing and the date of issue of the report.

It shall also state that the report shall not be partially reproduced without the written consent of the test laboratory.

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