
Preskušanje naravnega kamna - Ugotavljanje upogibne trdnosti s koncentrirano obremenitvijo na sredini razpona

Natural stone test methods - Determination of flexural strength under concentrated load

Prüfverfahren für Naturstein - Bestimmung der Biegefestigkeit unter Mittellinienlast

Méthodes d'essai pour pierres naturelles - Détermination de la résistance à la flexion sous charge centrée

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ICS:

73.020	Rudarstvo in kamnolomsko izkopavanje	Mining and quarrying
91.100.15	Mineralni materiali in izdelki	Mineral materials and products

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Natural stone test methods - Determination of flexural strength under concentrated load

Méthodes d'essai pour pierres naturelles -
Détermination de la résistance à la flexion sous charge
centrée

Prüfverfahren für Naturstein - Bestimmung der
Biegefestigkeit unter Mittellinienlast

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 246.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (prEN 12372:2021) has been prepared by Technical Committee CEN/TC 246 “Natural stones”, the secretariat of which is held by UNI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12372:2006.

In comparison with the previous edition, the following technical modifications have been made:

— the change of the specimens’ dimensions.

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1 Scope

This document specifies a test method for determination of flexural strength under a concentrated load for natural stone. Both an identification and a technological product testing procedure are included.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12390 (all parts), *Testing hardened concrete*

3 Terms, definitions and symbols

3.1 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.2 Symbols

For the purposes of this document, the following symbols apply.

Symbol	Quantity	Unit
F	breaking load	N
L	total length of the specimen	mm
R_{tf}	flexural strength	MPa
V	loading rate	N/s
a	load rate	MPa/s
b	width of the specimen adjacent to the plane of fracture	mm
h	thickness of the specimen adjacent to the plane of fracture	mm
l	distance between the supporting rollers	mm

4 Principle

The principle of this method is to place a specimen on two rollers and to progressively load the specimen in the middle. The breaking load is measured and the flexural strength calculated.

5 Apparatus

5.1 Balance

A balance capable of weighing the specimen with an accuracy of 0,01 % of the mass of the specimen.

5.2 Ventilated oven

A ventilated oven capable of maintaining a temperature of $(70 \pm 5) ^\circ\text{C}$.

5.3 Linear measuring device

A linear measuring device with an accuracy of 0,05 mm.

5.4 Testing machine

A testing machine of appropriate force, in accordance with EN 12390 and calibrated according to this document.

5.5 Device for applying loads on the specimen by a centre-point load

A device for applying loads on the specimen by a centre-point load. It consists of two lower rollers (supporting rollers) and one upper roller (load-applying roller) which shall be centred exactly in the middle between the two supporting rollers (see Figure 1). The distance between the two supporting rollers shall be reported as requested in 6.2.2.

5.6 Room

A room which can be maintained at a temperature of $(20 \pm 10) ^\circ\text{C}$.

6 Preparation of the specimens

6.1 Sampling

The sampling is not the responsibility of the test laboratory except where specially requested. At least 10 specimens shall be selected from a homogeneous batch (see also 6.2.4).

6.2 Test specimens

6.2.1 Surface finish

As a standard reference, the surface finish of the faces of the specimens shall be sawn, honed or polished (identification test). In case of necessity to test specimens with other surface finishes (e.g. flamed, sandblasted) as required for application, this may be done (technological test). For the technological test the specimens may be final products or sawn from final products. The surface intended for use shall be in contact with the two supporting rollers (facing downwards). In any case the kind of surface finish shall be stated in the report.

6.2.2 Dimensions

For stones with a size of the largest grain lower than 25 mm, preferred dimensions are 50 mm × 50 mm × 300 mm.

Other dimensions are possible, but shall fulfil the following requirements:

- the thickness h shall be between 25 mm and 100 mm and shall be greater than twice the size of the largest grain in the stone;
- the total length L shall be equal to six times the thickness;
- the width b shall be between 50 mm and three times the thickness ($50 \text{ mm} \leq b \leq 3h$), and in no case it shall be less than the thickness.

The distance between the supporting rollers l shall be equal to five times the thickness.

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6.2.3 Tolerance

The tolerance on the distance between the supporting rollers l shall be ± 1 mm.

6.2.4 Planes of anisotropy

If the stone shows planes of anisotropy (e.g. bedding, foliation) the specimens shall be prepared in accordance with at least one of the arrangements shown in Figures 2 to 4 and the direction of the planes of anisotropy shall be marked on each specimen by at least two parallel lines.

If the use of the stone in respect of the position of the planes of anisotropy is known, the test shall be carried out with the force applied on the face that will be loaded during use.

If the way of use of the stone is not known but the position of the planes of anisotropy is indicated on the specimens (by means of at least two parallel lines), the test shall be carried out on each of the three arrangements shown in Figures 2 to 4; the total number of specimens will then be 3 times 10.

6.2.5 Conditioning before testing

The specimens shall be dried at $(70 \pm 5) ^\circ\text{C}$ to a constant mass.

Constant mass is reached when the difference between two weighing carried out (24 ± 2) h apart is no greater than 0,1 % of the first of the two masses.

After drying and prior to testing the specimens shall be stored at $(20 \pm 5) ^\circ\text{C}$ until the thermal equilibrium is reached. After that the test shall be performed within 24 h.

7 Test procedure

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Wipe the surface of the rollers clean and remove any loose grits from the faces of the specimen that will be in contact with the rollers.

The specimen is placed centrally on the supporting rollers (see Figures 1 to 4). The loading roller is placed in the middle of the specimen.

The load is increased uniformly at a rate of $(0,25 \pm 0,05)$ MPa/s until the specimen breaks.

NOTE 1 The breaking load is rounded to the nearest 10 N and also the place where the fracture occurs. The width and the thickness of the specimen are measured adjacent to the fracture plane and the dimensions are expressed in millimetres to the nearest 0,1 mm.

NOTE 2 Where the loading rate (V) is needed in N/s the following equation can be used to determine the required rate in N/s:

$$V = \frac{2abh^2}{3l} \quad (1)$$

8 Expression of the results

The flexural strength R_{tf} of each specimen is calculated using the following equation:

$$R_{tf} = \frac{3Fl}{2bh^2} \quad (2)$$

The result shall be expressed in Megapascals to the nearest 0,1 MPa.

If the fracture is situated more than 15 % of the distance between the supporting rollers from the middle of the specimen and/or flaws are present (veins, fissures, etc.) it shall be mentioned in the test report.

9 Test report

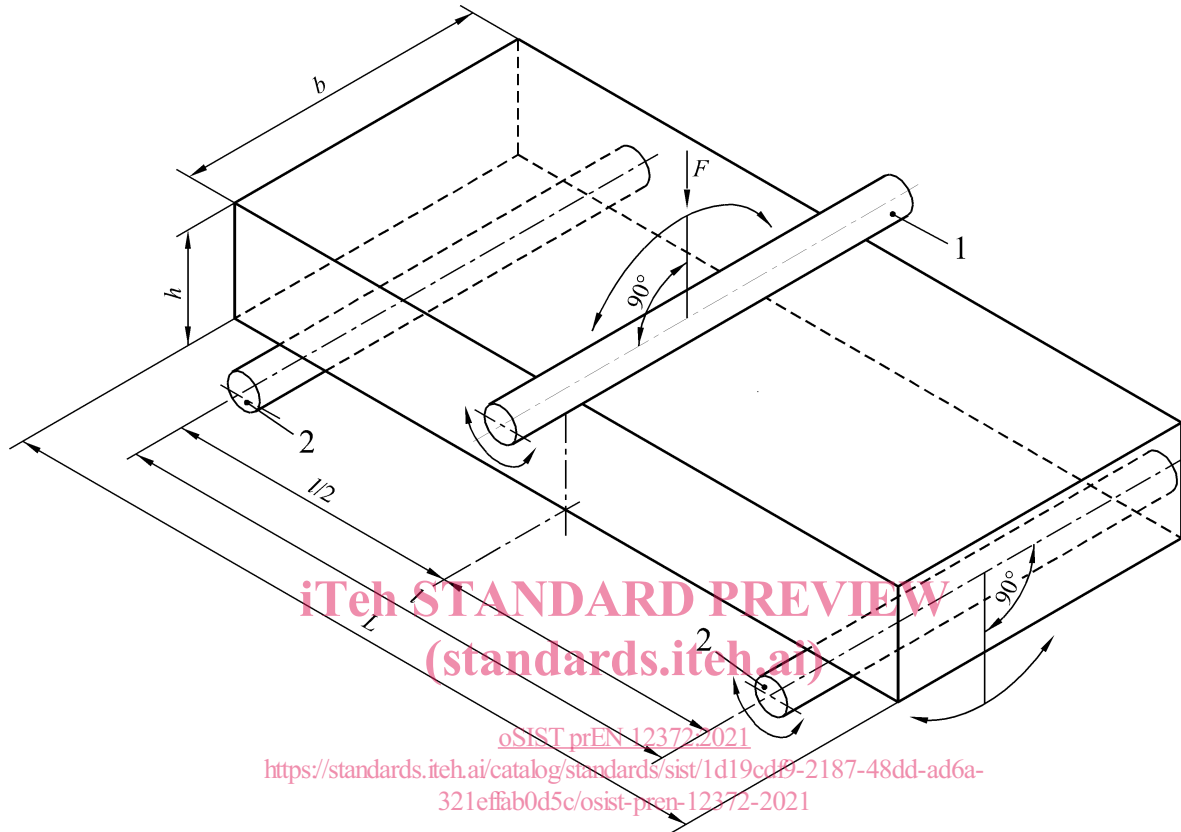
The test report shall contain the following information:

- a) unique identification number of the report;
- b) the number, title and date of issue of this document, i.e. EN 12372:202X;
- 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 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 direction of any existing plane of anisotropy (if relevant to the test) to be clearly indicated on the sample or on each specimen by means of two parallel lines;
 - the name of the person or organization which carried out the sampling;
 - the surface finish of the specimens (if relevant to the test);
- f) the date of delivery of the sample or of the specimens;
- g) the date when the specimens were prepared (if relevant) and the date of testing;
- h) the number of specimens in the sample;
- i) the dimensions of the specimens;
- j) the surface finish of the specimens;
- k) the rate of loading in Megapascals per second to the nearest 0,05 MPa/s;
- l) for each specimen: the width and thickness adjacent to the fracture plane and the distance between the supporting rollers in millimetres to the nearest 0,1 mm, the orientation of the force relatively to any plane of anisotropy following Figures 2 to 4, the breaking force in newton to the nearest 10 N, the flexural strength in Megapascals to the nearest 0,1 MPa, the location of the fracture and any anomalies observed (for additional information see Annex B);
- m) for each relevant direction of loading the mean value \bar{R}_{tf} of the flexural strength, the standard deviations, in Megapascals to the nearest 0,1 MPa and the lower expected value (E) as specified in Annex A;
- n) all deviations from the standard and their justification;

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o) remarks.

The test report shall contain the signature(s) and the role(s) of the responsible(s) for the testing and the date of issue of the report. It shall also state that the report shall not be partially reproduced without written consent of the test laboratory.



Key

- 1 loading roller
- 2 supporting roller

Figure 1 — Arrangement of loading of test specimen (centre point loading)