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Provningsmetoder för natursten – Bestämning av böjdraghållfasthet med fyrpunktsbelastning

Natural stone test methods – Determination of flexural strength under constant moment

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Denna standard ersätter SS-EN 13161, utgåva 1.

The European Standard EN 13161:2008 has the status of a Swedish Standard. This document contains the official English version of EN 13161:2008.

This standard supersedes the Swedish Standard SS-EN 13161, edition 1.

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EUROPEAN STANDARD

EN 13161

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2008

ICS 73.020; 91.100.15

Supersedes EN 13161:2001

English Version

Natural stone test methods - Determination of flexural strength under constant moment

Méthodes d'essai pour pierres naturelles - Détermination
de la résistance en flexion sous moment constant

Prüfverfahren für Naturstein - Bestimmung der
Biegefestigkeit unter Drittlinienlast

This European Standard was approved by CEN on 28 March 2008.

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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 CEN Management Centre has the same status as the official versions.

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Foreword

This document (EN 13161:2008) 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of an identical text or by endorsement, at the latest by October 2008, and conflicting national standards shall be withdrawn at the latest by October 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13161:2001.

This European Standard is one of the series of European 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 uniaxial compressive strength*

EN 1936, *Natural stone test methods — Determination of real density and apparent density and of total porosity 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 13364, *Natural stone test methods — Determination of the breaking load at dowel hole*

EN 13373, *Natural stone test methods — Determination of geometric characteristics on units*

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*

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

EN 14147, *Natural stone test methods — Determination of resistance to ageing by salt mist*

EN 14157, *Natural stone test methods — Determination of abrasion resistance*

EN 14158, *Natural stone test methods — Determination of rupture energy*

EN 14205, *Natural stone test methods — Determination of Knoop hardness*

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

EN 14579, *Natural stone test methods — Determination of sound speed propagation*

EN 14580, *Natural stone test methods — Determination of static elastic modulus*

EN 14581, *Natural stone test methods — Determination of linear thermal expansion coefficient*

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

1 Scope

This European Standard specifies a method to determine the flexural strength of natural stones under constant moment. This European Standard contains provision for both an identification test and for a technological test.

2 Normative references

The following referenced documents are indispensable for the application 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 12390-4, *Testing hardened concrete — Part 4: Compressive strength — Specification for testing machines*

EN 12390-5, *Testing hardened concrete — Part 5: Flexural strength of test specimens*

3 Principle

After appropriate preparation a specimen of the rock to be tested is laid and centred between two supports. Thereafter the specimen is subjected to a load using two parallel rollers acting on the top surface of the specimen. These loading rollers are centred and located a distance of one third of the length of span. The loads are steadily increased until failure.

4 Symbols

R_{tc} flexural strength at constant moment, in Megapascals;

F load at failure in Newtons;

b specimen width in millimetres;

h specimen thickness in millimetres;

L specimen length in millimetres;

ℓ distance between the supporting rollers, in millimetres.

5 Apparatus

5.1 A **balance capable** of weighing the specimen with a reading up to 0,01 % of the mass to be weighed.

5.2 A **ventilated oven** capable of maintaining a temperature of (70 ± 5) °C.

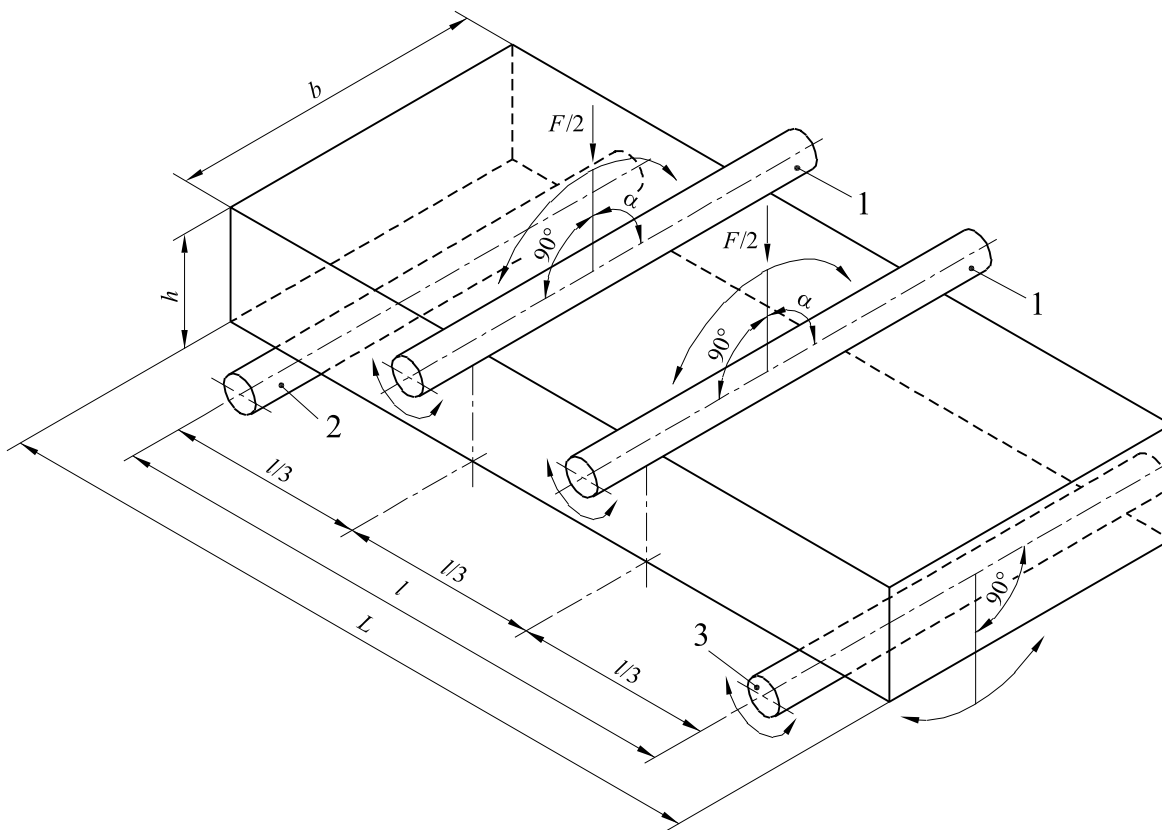
5.3 A **linear measuring device** with a reading up to 0,05 mm.

5.4 A **test machine** of appropriate force, in accordance with EN 12390-4 and calibrated according to this European Standard.

5.5 A **device** for applying loads on the specimen by a two-points load, in accordance with EN 12390-5. It consists of two upper rollers (load-applying rollers) and two lower rollers (supporting rollers): see Figure 1. The distance between the two supporting rollers shall be reported as requested in 6.2.2.

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



Key

- 1 load applying rollers
- 2, 3 supporting rollers

Figure 1 — Arrangement of loading of a test specimen (two point loading)

6 Preparation of specimens

6.1 Sampling

The sampling is not the responsibility of the testing laboratory except when it is especially 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). When it is necessary to carry out the test on final products (technological test) the surface finish of the specimens may be flamed, sandblasted etc., depending on the final use. 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). However the kind of surface finish shall be stated in the report.

6.2.2 Dimensions

The dimensions of the specimens are determined by their thickness h :

- the thickness h shall be between 25 mm and 100 mm and shall be greater than twice the size of the largest crystal in the stone;
- the total length L shall be equal to six times the thickness;
- the distance between the supporting rollers ℓ shall be equal to five 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.

6.2.3 Limit deviations

The limit deviation on the dimensions h , b , L and ℓ shall be ± 1 mm of the nominal dimensions.

In the case of identification test the faces shall not depart from perpendicularity to the axis of the specimen by more than 2 % with a maximum of 2 mm difference, when measured in any direction.

6.2.4 Planes of anisotropy

6.2.4.1 Identification test

If the stone shows planes of anisotropy (e.g. bedding, foliation), the direction of the planes of anisotropy is to 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 to 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, the test shall be carried out on each of the three arrangements shown in Figures from 2 to 4; the total number of specimens will then be 3 times 10.

6.2.4.2 Technological test

The specimens shall be tested only for the relevant product direction that is, with the force applied to the face which will be loaded during use.