

SLOVENSKI STANDARD

SIST EN 1926:2007

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SIST EN 1926:2000

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Natural stone test methods - Determination of uniaxial compressive strength

Prüfverfahren für Naturstein - Bestimmung der einachsigen Druckfestigkeit

Méthodes d'essai des pierres naturelles - Détermination de la résistance en compression uniaxiale

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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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English Version

Natural stone test methods - Determination of uniaxial compressive strength

Méthodes d'essai des pierres naturelles - Détermination de la résistance à la compression uniaxiale

Prüfverfahren für Naturstein - Bestimmung der einachsigen Druckfestigkeit

This European Standard was approved by CEN on 9 November 2006.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, 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 United Kingdom.

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Foreword

This document (EN 1926:2006) 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of an identical text or by endorsement, at the latest by June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

This document supersedes EN 1926:1999.

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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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1 Scope

This European standard specifies a method for determining the uniaxial compressive strength of natural stones.

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

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

EN 12670:2001 *Natural stone - Terminology*

EN 13383-1:2002, *Armourstone - Part 1: Specification*

3 Principle

The specimens, after mechanical preparation of surfaces or, if needed, after capping, are laid and centred on the plate of a testing machine. A uniformly distributed load is applied and increased continuously until failure occurs.

4 Terms and Definitions

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For the purposes of this document, the terms and definitions given in EN 12670:2001 apply.

5 Symbols

h height of the specimen, in millimetres;

\bar{l} mean value of the lateral dimension, i.e. the distance between opposite vertical faces of the specimen (if cubic), in millimetres;

\bar{d} mean value of the diameter of the specimen (if cylindrical), in millimetres;

A cross-sectional area of the specimen before testing, in square millimetres;

F failure load, in Newtons;

R uniaxial compressive strength of the specimen, in Megapascals;

\bar{R} mean value of the uniaxial compressive strength, in Megapascals;

s standard deviation;

ν coefficient of variation.

6 Apparatus

- 6.1 A surface grinder.
- 6.2 A lapping machine if final preparation of the specimens is needed.
- 6.3 A test machine of appropriated force, in accordance with EN 12390 and calibrated according to this standard.
- 6.4 A time counter accurate to 1 s.
- 6.5 A ventilated oven which can maintain a temperature of $(70 \pm 5) ^\circ\text{C}$.
- 6.6 A weighing instrument which has an accuracy of 0,1 g.
- 6.7 A linear measuring device with an accuracy of 0,05 mm.
- 6.8 Air conditioned room with a temperature of $(20 \pm 10) ^\circ\text{C}$.

7 Preparation of specimens

7.1 Sampling

The sampling is not the responsibility of the testing laboratory, unless specially requested.

At least 10 specimens are to be tested and the direction of any existing plane of anisotropy recorded.

7.2 Test specimens

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Test specimens shall be cubes with (70 ± 5) mm or (50 ± 5) mm edges or right circular cylinders whose diameter and height are equal to (70 ± 5) mm or (50 ± 5) mm.

The lateral dimension or the diameter of the specimen shall be related to the size of the largest grain in the rock by the ratio of at least 10:1. If the maximum observed dimension of the grains exceeds 7 mm, it is recommended to have a larger number of specimens in order to obtain representative results.

The axis of the specimen shall be normal to the planes of anisotropy, e.g. bedding planes, foliation, etc. (figure 1a and 2a). If a test with orientation of loading parallel to the planes of anisotropy is required, another set of specimens with the same dimensional characteristics shall be prepared (Figure 1b and 2b).

7.3 Surface preparation

7.3.1 General

The faces to which the load is to be applied shall be flat to a tolerance of 0,1 mm in any 100 mm and such that the top surface lies between two parallel planes which are parallel to the bottom surface, and not greater than 1mm apart for every 100 mm. The sides of the specimen shall be smooth and free of abrupt irregularities and straight to within 0,3 mm over the full length of the specimen.

To meet the above requirements the specimens shall be finished on either a lathe or surface grinder, with final preparation on a lapping machine if needed.

Capping with mortar according to the procedures indicated in 7.3.2 is to be used only if the indicated tolerances are not obtainable with the prescribed mechanical preparation. This condition shall be clearly indicated in the test report.

7.3.2 Capping with mortar

It is possible to cap the specimen using a mortar made with cement CEM I 52,5 R according to EN 197-1 and then waiting until the cement has hardened.

7.4 Conditioning of specimen before testing

Specimens, whether capped or uncapped, shall be dried at $(70 \pm 5) ^\circ\text{C}$ to constant mass. This is assumed to have been attained when the difference between two weighings at an interval of $(24 \pm 2) \text{ h}$ is not greater than 0,1% of the mass of the specimen. 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 tests shall be performed within 24 h.

8 Procedure

8.1 Measuring the specimen

The cross-sectional dimensions of the test specimen (lateral dimension for cubic diameter for cylindrical test specimens) shall be measured to the nearest 0,1 mm by averaging two measures taken at right angles to each other at about the upper-height and two about the lower-height h of the specimen. The average lateral dimension \bar{l} or the average diameter \bar{d} shall be used for calculating the cross-sectional area. The height of the specimen shall be determined to the nearest 1,0 mm.

8.2 Placing the specimen in the testing machine

Wipe the bearing surfaces of the testing machine clean and remove any loose grit from the bed faces of the specimen. Align the specimen carefully with the centre of the ball-seated platen, so that a uniform seating is obtained. Do not use any packing material.

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8.3 Loading

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Load on the specimen shall be applied continuously at a constant stress rate of $(1 \pm 0,5) \text{ MPa/s}$. The maximum load on the specimen shall be recorded to the nearest 10kN.

9 Expression of results

The uniaxial compressive strength R of each specimen is expressed by the ratio of the failure load of the specimen and its cross-sectional area before testing, by the equation:

$$R = \frac{F}{A} \quad (1)$$

The result shall be expressed in Megapascals with at least two significant figures. The mean value R shall be calculated to the nearest 1 MPa.

10 Test report

The test report shall contain the following information:

- a) unique identification number for the report;
- b) number, title and date of issue of this European standard;
- c) name and address of the testing laboratory and the address where the test was carried out if different from the testing laboratory;
- d) name and address of the client;
- e) it is the responsibility of the client to supply the following information:
 - petrographic name of the stone;
 - commercial name of the stone;
 - country and region of extraction;
 - name of the supplier;
 - direction of any existing plane of anisotropy (if relevant to the test), clearly indicated on the sample or on each specimen by means of two parallel lines;
 - name of the person or organization which carried out the sampling;
 - surface finish of the specimens (if relevant to the test);
- f) date of delivery of the sample or of the specimens;
- g) date when the specimens were prepared (if relevant) and the date of testing;
- h) number of specimens in the sample;
- i) dimensions \bar{l} (or \bar{d}) and h in millimetres and the failure load F of each specimen, in kiloNewtons measured without any decimal place;
- j) surface preparation of the specimens and their conditioning before testing;
- k) orientation of the axis of loading with respect to the existing planes of anisotropy;
- l) compressive strength R of each specimen, in Megapascals with at least two significant figures;
- m) mean value \bar{R} of compressive strength, in Megapascals to the nearest 1 MPa;
- n) standard deviation s , in Megapascals to the nearest 1 MPa, and the variation coefficient v ;
- o) all deviations from the standard and their justification;
- p) remarks.

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