



**SLOVENSKI STANDARD**  
**SIST EN 1926:2000**  
**01-april-2000**

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Definicija in metode preskušanja za določitev tlačne trdnosti

Natural stone test methods - Determination of compressive strength

Prüfverfahren für Naturstein - Bestimmung der Druckfestigkeit

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

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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

**SIST EN 1926:2000**

**en**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

EN 1926

March 1999

ICS 73.020; 91.100.15

English version

## Natural stone test methods - Determination of compressive strength

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

Prüfverfahren für Naturstein - Bestimmung der Druckfestigkeit

This European Standard was approved by CEN on 12 February 1999.

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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

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ALTERNATIVE ANTICORRUPT  
 ORGANIZZAZIONE INTERNAZIONALE  
 DI STANDARDIZZAZIONE  
 INTERNATIONAL ORGANIZATION  
 OF STANDARDIZATION  
 ISO



**Foreword**

This European Standard 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 September 1999, and conflicting national standards shall be withdrawn at the latest by September 1999.

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 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
prEN 12371	Natural stone test methods - Determination of frost resistance
EN 12372	Natural stone test methods - Determination of flexural strength under concentrated load
prEN 12407	Natural stone test methods - Petrographic description
prEN 13161	Natural stone test methods - Determination of flexural strength under constant moment
prEN 13364	Natural stone test methods - Determination of the breaking load at a dowel hole
prEN ....(WI 00246011)	Natural stone test methods - Determination of thermal dilatation coefficient
prEN ....(WI 00246012)	Natural stone test methods - Determination of sound - speed propagation
prEN ....(WI 00246014)	Natural stone test methods - Determination of abrasion resistance
prEN ....(WI 00246015)	Natural stone test methods - Determination of Knoop hardness
prEN ....(WI 00246016)	Natural stone test methods - Determination of thermal shock resistance
prEN ....(WI 00246017)	Natural stone test methods - Determination of slip coefficient
prEN ....(WI 00246018)	Natural stone test methods - Determination of static elastic modulus
prEN ....(WI 00246019)	Natural stone test methods - Determination of rupture energy
prEN ....(WI 00246030)	Natural stone test methods - Determination of surface finishes (rugosity)
prEN 13373	Natural stone test methods - Determination of geometric characteristics on units
prEN ....(WI 00246032)	Natural stone test methods - Determination of resistance to ageing by salt mist
prEN ....(WI 00246033)	Natural stone test methods - Determination of resistance to ageing by humidity, temperature, SO <sub>2</sub> action
prEN ....(WI 00246035)	Natural stone test methods - Determination of dynamic elastic modulus (by fundamental resonance frequency)
prEN ....(WI 00246036)	Natural stone test methods - Determination of water absorption at atmospheric pressure

It is intended that other ENs should call up this EN 1926 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).

This European standard has an annex A (normative), an annex B (informative), an annex C (normative) and an annex D (informative).

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, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## 1 Scope

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

## 2 Normative references

This European standard incorporates by dated or undated references, 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.

ENV 197-1	Cement - Composition, specifications and conformity criteria - Part 1: Common cements
prEN 12390	Testing concrete - Determination of compressive strength - Specification for compression testing machines
prEN 12670	Natural stones - Terminology
prEN 13383-1:1998	Armourstone - Part 1: Specification
prEN 12440	Denomination of natural stone

## 3 Principle

The specimens, after mechanical preparation of the 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 Definitions

For the purposes of this standard, the definitions in accordance with prEN 12670 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;
$v$	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 prEN 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  $(70 \pm 5)$  °C.

6.6 A weighing instrument which has an accuracy of 0,1g.

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

6.8 Air conditioned room with a temperature of  $(20 \pm 5)$  °C.

## 7 Preparation of specimens

### 7.1 Sampling

The sampling is not the responsibility of the testing laboratory except where it is especially requested to undertake this.

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

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**7.2 Test specimens** <https://standards.iteh.ai/catalog/standards/sist/3c2f6d88-7a97-413f-8a82-da5faebdaa55/sist-en-1926-2000>

Test specimens shall be cubes with  $(70 \pm 5)$  mm or  $(50 \pm 5)$  mm edge or right circular cylinders whose diameter and height are equal to  $(70 \pm 5)$  mm or  $(50 \pm 5)$  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 through which the load is to be applied shall be flat to a tolerance of 0,1 mm and shall not depart from perpendicularity to the axis of the specimen by more than 0,01 radian or 1 mm in 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 7.3.1 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 utilizing a mortar made up with cement CEM I 52,5 R according to ENV 197-1 and waiting until the cement has hardened.

## 7.4 Conditioning of specimen before testing

Specimens, whether capped or uncapped, shall be dried at  $(70 \pm 5)$  °C to constant mass. Constant mass shall be considered to have been reached when the difference between two weighings made at an interval of  $(24 \pm 2)$  h is no greater than 0,1% of the mass of the specimen. After drying and prior to testing the specimens shall be stored at  $(20 \pm 5)$  °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

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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.

### 8.3 Loading

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

## 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:

$$R = \frac{F}{A}$$

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) the number, title and date of issue of this European standard;
- c) the name and address of the testing laboratory and the address where the test was carried out if different from the testing laboratory;
- d) the name and address of the client;
- e) it is the responsibility of the client to supply the following information:
  - the petrographic nature of the stone;
  - the commercial name of the stone in accordance with prEN 12440;
  - 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  $\bar{l}$  (or  $\bar{d}$ ) and  $h$  in millimetres and the failure load  $F$  of each specimen, in newtons;
- j) the surface preparation of the specimens and their conditioning before testing;
- k) the orientation of the axis of loading with respect to the existing planes of anisotropy;
- l) the compressive strength  $R$  of each specimen, in Megapascals with at least two significant figures;
- m) the mean value  $\bar{R}$  of compressive strength, in Megapascals to the nearest 1 MPa;
- n) the 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) 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 testing laboratory.