



**SLOVENSKI STANDARD**  
**SIST EN 12371:2010**

**01-september-2010**

**Nadomešča:**  
**SIST EN 12371:2002**

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**Preskušanje naravnega kamna - Ugotavljanje odpornosti proti zmrzovanju**

Natural stone test methods - Determination of frost resistance

Prüfverfahren für Naturstein - Bestimmung des Frostwiderstandes

Méthodes d'essai des pierres naturelles - Détermination de la résistance au gel  
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**Ta slovenski standard je istoveten z: ~~SIST EN 12371:2010~~ EN 12371:2010**

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**ICS:**

91.100.15      Mineralni materiali in izdelki      Mineral materials and products

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**en,fr,de**

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EUROPEAN STANDARD

**EN 12371**

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2010

ICS 73.020; 91.100.15

Supersedes EN 12371:2001

English Version

**Natural stone test methods - Determination of frost resistance**Méthodes d'essai pour pierres naturelles - Détermination  
de la résistance au gelPrüfverfahren für Naturstein - Bestimmung des  
Frostwiderstandes

This European Standard was approved by CEN on 20 February 2010.

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

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, 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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COMITÉ EUROPÉEN DE NORMALISATION  
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## Foreword

This document (EN 12371:2010) 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 2010, and conflicting national standards shall be withdrawn at the latest by September 2010.

This document supersedes EN 12371:2001.

This European Standard is one of the series of standards for tests on natural stone.

Test methods for natural stone consist of the following European Standards:

- 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 and open porosity.
- EN 12370 Natural stone test methods – Determination of resistance to salt crystallisation
- 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 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 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 the abrasion resistance
- EN 14158 Natural stone test methods – Determination of rupture energy
- EN 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
- 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

It is intended that other ENs should call up this European Standard as the basis of evaluation of conformity.

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NOTE 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, Bulgaria, Croatia, 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 to assess the effect of freeze/thaw cycles on natural stones (see EN 12670 for terminology, and EN 12440 for denomination). The standard contains provision for both a shorter technological test (Test A) to assess the effect of freeze/thaw cycles on the relevant performance characteristics and an identification test (Test B).

NOTE Some marbles, as defined in EN 12440, undergo changes in physical properties as a result of the test conditions rather than the freeze/thaw cycles. In these cases, additional tests (for example EN 14066) should be applied.

## 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 1926, *Natural stone test methods — Determination of uniaxial compressive strength*

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

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 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)*

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## 3 Principle

The frost resistance of natural stone units is determined by a test comprising cycles of freezing in air and thawing in water.

## 4 Symbols

$M_{d0}$  mass of the dry specimen before immersion in water and before starting the cycles, in grams

$M_{s0}$  mass of the saturated specimen after immersion in water and before starting the cycles, in grams

$M_{h0}$  apparent mass of the specimen in water before starting the cycles, in grams

$M_{dn}$  mass of the dry specimen at  $N_c$  cycles, in grams

$M_{sn}$  mass of the saturated specimen at  $N_c$  cycles, in grams

$M_{hn}$  apparent mass of the specimen in water at  $n$  cycles, in grams

$V_{b0}$  apparent volume of the specimen before freezing, in millilitres

$V_{bn}$  apparent volume of the specimen at  $N_c$  cycles, in millilitres

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- $\Delta V_b$  change in apparent volume of the specimen, as a percentage
- $E_0$  dynamic elastic modulus of the dry specimen before freezing, in Megapascals
- $E_n$  dynamic elastic modulus of the dry specimen at  $n$  cycles, in Megapascals
- $\Delta E$  change in dynamic elastic modulus, as a percentage
- $N_c$  number of cycles completed before failure for identification test

**5 Apparatus**

**5.1** A freezing tank of sufficient capacity to hold the required number of specimens, possibly with an automatic control system to programme the freezing and thawing cycles within the chamber with a tolerance of  $\pm 2,0$  °C.

NOTE The tests can be executed manually if no suitable automated system is available.

**5.2** A temperature recording system capable of measuring temperature to  $\pm 0,1$  °C.

**5.3** A device for measuring dynamic elastic modulus in accordance with EN 14146.

**5.4** A weighing instrument with an accuracy of at least 0,01 % of the mass to be weighed.

**5.5** A ventilated oven capable of maintaining a temperature of  $(70 \pm 5)$  °C.

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**6 Preparation of the specimens**

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**6.1 Sampling**

The sampling is not the responsibility of the test laboratory except where specially requested.

For technological tests the number of specimens shall be in accordance with the appropriate standard (see also Table 1). Two sets of specimens are required, one to be tested after being subjected to the freeze/thaw cycles, the other to be tested without freeze/thaw cycling. Each set shall be randomly selected from the body of stone to be tested. In addition, one extra specimen is used to monitor the temperature of the specimens.

For an identification test, seven specimens, which are considered representative of the body of stone being tested, shall be selected. Use one of the seven specimen to monitor the core temperature.



**Table 1 — Summary of the application of the freeze/thaw test**

	Technological test (Test A)		Identification test (Test B)
	Flexural strength	Compressive strength	
Specimen size in mm	50 × 50 × 300 (see Note 1 and 3)	(see Note 2)	50 × 50 × 300 (see Note 3)
Minimum number of specimens	21	21	7
NOTE 1 Specimen size according to EN 12372 or EN 13161.			
NOTE 2 Specimen size according to EN 1926.			
NOTE 3 For specific stones with tendency to split (shale, phyllite, ...), the thickness can be reduced to the thickness of use with a minimum of 13 mm. If the thickness is less than the minimum thickness required in EN12372 or EN 13161, the span for testing the flexural strength should be equal to (180 ± 1) mm			

## 6.2 Size of specimens

### 6.2.1 Technological test (Test A)

Where the test is carried out to determine the effect of freeze/thaw cycles on performance characteristics the specimens shall be in accordance with the appropriate standard. The appropriate standards are EN 12372 or EN 13161 for flexural strength, EN 13364 for breaking load at a dowel hole, EN 14066 for resistance to thermal shock, and EN 1926 for compressive strength.

### 6.2.2 Identification test (Test B)

The specimens are in the form of rectangular prisms with dimensions of 50 mm × 50 mm × 300 mm (except for Note 3 in Table 1). The long axis shall be parallel to the anisotropy planes.

### 6.2.3 Putting reference marks on the specimens

Initial defects and all irregularities have to be marked with indelible marks on the specimens.

To ensure that the various dynamic elastic modulus measurements performed before and after the freeze/thaw cycles are done at the same points on the specimens, make indelible marks, in the form of points, on the relevant faces of the specimens.

Trace an indelible line at the point of the axis of the two supports on which the specimens will be placed during the determination of the dynamic elastic modulus (in flexural mode).

## 6.3 Monitoring core temperature

One specimen shall be fitted with a device (for example a thermocouple) to measure the temperature of the specimen during freezing and thawing cycles. The device shall be placed in a hole that is drilled parallel to the long axis of the specimen. The diameter of this hole has to be appropriate to the diameter of the device. The centre of the hole shall be equidistant from the edges of the specimen to a minimum depth of 50 mm from the top. If cubes are being used, the hole shall be (25 ± 5) mm deep. The device shall be placed in the hole which is then sealed to avoid water penetration.