BRITISH STANDARD

BS EN
12370:1999

Natural stone test methods — Determination of resistance to salt crystallization

The European Standard EN 12370:1999 has the status of a British Standard

ICS 91.100.15

National foreword

This British Standard is the English language version of EN 12370:1999.

The UK participation in its preparation was entrusted to Technical Committee B/545, Natural stone, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 4, an inside back cover and a back cover.

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English version

Natural stone test methods — Determination of resistance to salt crystallization

Méthodes d'essai pour pierres naturelles — Détermination de la résistance par un essai de cristallisation des sels

Prüfverfahren für Naturstein — Bestimmung des Widerstandes gegen Kristallisation von Salzen

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

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 12370:1999 E

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of an identical text or by endorsement, at the latest by September 1999, and conflicting national standards shall be withdrawn at the latest by September 1999.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 1926, *Natural stone test methods — Determination of compressive strength.*

EN 1936, *Natural stone test methods — Determination of real density and apparent density and of total and open porosity* .

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 13364 (WI 00246011), *Natural stone test methods — Determination of thermal dilatation coefficient.*

prEN 13364 (WI 00246012), *Natural stone test methods — Determination of sound — speed propagation.*

prEN 13364 (WI 00246014), *Natural stone test methods — Determination of abrasion resistance.*

prEN 13364 (WI 00246015), *Natural stone test methods — Determination of Knoop hardness.*

prEN 13364 (WI 00246016), *Natural stone test methods — Determination of thermal shock resistance.*

prEN 13364 (WI 00246017), *Natural stone test methods — Determination of slip coefficient.*

prEN 13364 (WI 00246018), *Natural stone test methods — Determination of static elastic modulus.*

prEN 13364 (WI 00246019), *Natural stone test methods — Determination of rupture energy.*

prEN 13364 (WI 00246030), *Natural stone test methods — Determination of surface finishes (rugosity).*

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

prEN 13373 (WI 00246032), *Natural stone test methods — Determination of resistance to ageing by salt mist.*

prEN 13373 (WI 00246033), *Natural stone test methods — Determination of resistance to ageing by humidity, temperature,* SO_2 action.

prEN 13373 (WI 00246035), *Natural stone test methods — Determination of dynamic elastic modulus (by fundamental resonance frequency).*

prEN 13373 (WI 00246036), *Natural stone test methods — Determination of water absorption at atmospheric pressure.*

It is intended that other ENs should call up this EN 12370 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).

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.

Contents

Introduction

This test is designed to assess the salt crystallization resistance of natural stones where it is considered relevant. The test can not be used in isolation and results will be considered with other physical tests to indicate durability, these include prEN 12371, Determination of frost resistance.

1 Scope

This European Standard specifies a test method to assess the relative resistance of natural stones with an open porosity of greater than 5 %, measured in accordance with EN 1936, to damage caused by the crystallization of salts. The test is not necessary for low porosity stones.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. The 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 incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 1936, *Natural stone test methods — Determination of real density and apparent density and of total and open porosity.*

prEN 12371, *Natural stone test methods — Determination of frost resistance.*

prEN 12440, *Denomination of natural stone.*

3 Principle

After drying to constant mass, the specimen is immersed in a solution of sodium sulfate, dried and allowed to cool to room temperature. This cycle is carried out 15 times and the percentage mass change measured.

4 Symbols

M_d is the mass of the dried specimen, in grams.

M_{d1} is the mass of the dried specimen with label before first cycle, in grams.

M_f is the mass of the dried specimen with label, after 15 cycles, in grams.

ΔM is the relative difference of masses before and after testing (mass loss or mass gain), in percent.

5 Apparatus

5.1 *Ventilated oven*, capable of maintaining a temperature of (105 ± 5) °C.

5.2 *Weighing instrument*, capable of weighing the specimens to $\pm$0,001 g.

5.3 *Room or water bath*, capable of maintaining the temperature of the specimens and solution to $(20 \pm 0{,}5)$ °C.

5.4 *14 % solution of sodium sulfate decahydrate*, (i.e. 14 g of $Na_2SO_4.10H_2O$ for every 86 g de-ionised water). The density of this solution at 20 °C is 1 055 kg/m^3.

6 Preparation of specimens

6.1 Sampling

Sampling is not the responsibility of the test laboratory except where specially requested. At least six test specimens, which are considered representative of the body of stone being tested, shall be selected.

6.2 Dimensions of test specimens

Cubes of (40 ± 1) mm sides shall be prepared. Specimens shall be wet diamond sawn and any surface irregularities removed by grinding.

6.3 Washing

All loose material shall be washed from the surface of the specimen using potable water.

6.4 Drying

The specimens are to be dried in an oven at a temperature (105 ± 5) °C until a constant mass is reached. This is assumed to have been attained when the difference between two weighings at an interval of (24 ± 2) h is not greater than 0,1 % of the first weighing. They are then allowed to cool to room temperature and weighed to $\pm$0,01 g (M_d). Each specimen is then labelled with a durable tag that is wired on to the cube. The specimen is then re-weighed to $\pm$0,01 g (M_{d1}).

7 Procedure

The procedure entails the use of a 14 % solution of sodium sulfate decahydrate. The density of the solution shall be checked prior to use. The solution shall only be used for one test cycle.

Each of the dried specimens is placed in a 250 ml container and covered with the sodium sulfate solution to a depth of (8 ± 2) mm above the top of the specimen and the container covered to reduce evaporation. Alternatively, the specimens may be placed in a single container provided that there is a minimum of 10 mm between specimens and at least 20 mm between the specimens and the sides of the container. The specimens are then left to soak for 2 h at $(20 \pm 0{,}5)$ °C.

NOTE Changing the soaking temperature can markedly affect the results.

After immersion the specimens are removed from the solution and dried in an oven. The oven shall be arranged to provide a high relative humidity in the early stages of drying and to raise the temperature of the specimens to (105 ± 5) °C in not less than 10 h and not more than 15 h. The initial high relative humidity may be obtained by placing a tray of water in the cold oven, and switching on the heater for (30 ± 5) min before putting in the specimens; (300 ± 25) ml has been found to be adequate in an oven capable of holding 48 specimens, for example a 125 l capacity.

The specimens are left in the oven for at least 16 h and then they are cooled at room temperature for $(2{,}0 \pm 0{,}5)$ h before resoaking in fresh sodium sulfate solution. The cycle of operation is carried out 15 times in all, except when the specimens break up before this. After the 15th cycle the specimens are removed from the oven and stored for (24 ± 1) h in water at (23 ± 5) °C, finally, they are washed thoroughly with flowing water. The specimens are weighed after drying to constant mass (as in **6.4**) if they are sufficiently coherent. If the test is to be interupted at any time, the specimens are to be left in the oven at (105 ± 5) °C.

8 Expression of results

The results are expressed as relative mass difference ΔM (mass loss or gain) as a percentage of the initial dry mass M_d or as the number of cycles required to induce failure if the specimen is too shattered to weigh after the final drying.

$$\Delta M = \frac{M_f - M_{d1}}{M_d} \times 100$$

If failure has occurred or the specimen has fractured during testing, then this shall be recorded together with the number of completed cycles of testing.

A photographic record of the initial and final condition shall be made.

9 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 test laboratory and the address of 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 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 of the specimens;

j) for each test specimen, the percentage mass change;

k) the arithmetic mean of the results for the test specimens;

l) all deviations from the standard and their justification;

m) 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 test laboratory.

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