BRITISH STANDARD

BS EN
14147:2003

Natural stone test methods — Determination of resistance to ageing by salt mist

The European Standard EN 14147:2003 has the status of a British Standard

ICS 73.020; 91.100.15

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National foreword

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Summary of pages

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14147

November 2003

ICS 73.020; 91.100.15

English version

Natural stone test methods - Determination of resistance to ageing by salt mist

Méthodes d'essai pour éléments en pierre naturelle - Détermination de la résistance au vieillissement accéléré au brouillard salin

Prüfverfahren für Naturstein - Bestimmung der Beständigkeit gegen Alterung durch Salzsprühnebel

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Foreword

This document (EN 14147:2003) 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of an identical text or by endorsement, at the latest by May 2004, and conflicting national standards shall be withdrawn at the latest by May 2004.

This Standard is one of the series of 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*

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 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 13755, *Natural stone test methods – Determination of water absorption at atmospheric pressure*

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

EN 13919, *Natural stone test methods – Determination of resistance to ageing by SO_2 action in the presence of humidity*

EN 14066, *Natural stone test methods – Determination of resistance to ageing by thermal shock*

prEN 14157, *Natural stone test methods – Determination of the abrasion resistance*

prEN 14158, *Natural stone test methods – Determination of rupture energy*

prEN 14205, *Natural stone test methods - Determination of Knoop hardness*

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

prEN 14581, *Natural stone test methods – Determination of thermal expansion coefficient*

prEN 14579, *Natural stone test methods – Determination of sound speed propagation*

prEN 14580, *Natural stone test methods – Determination of the static elastic modulus*

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1 Scope

This European Standard specifies a method to assess the resistance of natural stones to ageing by salt mist.

2 Normative references

Non applicable.

3 Principle

The specimens are placed in a chamber and sprayed with a salt solution for 4 hours and, afterwards, dried for 8 hours. This cycle is repeated successively.

4 Symbols

M_0 - mass of the dried specimen in grams.

M_n - mass of the dried specimen after n exposure cycles in grams.

M - percentage of mass loss.

5 Apparatus

- Chamber capable to perform alternating cycles of salt mist atmosphere and drying (Figure 1), at a temperature of (35 5)°C.

- System for spraying the salt solution into the chamber which includes atomizing nozzles and deflecting plates to avoid direct spraying of the specimens.

- Two fog collectors having a horizontal collecting area of about 8000 mm^2 (e.g. 100 mm diameter glass funnels with stems inserted into graduated cylinders).

- Ventilated oven capable of maintaining a temperature of (70 $\pm$ 5) °C

- Weighing instrument capable of weighing the specimens with an accuracy of 0,1 g.

- Conductivity meter, capable of measuring the conductivity of the water used to prepare the salt solution and of the rinsing water.

- Sodium chloride solution prepared using sodium chloride with a purity grade not less than 95% and distilled or deionised water having a conductivity less or equal to 20 S/cm at (25 2) °C. The solution shall be prepared by dissolving 10 1 parts by mass of sodium chloride in 90 parts of distilled or deionised water, in order to obtain a concentration of (100 10) g/l. After preparation the solution is filtered or decanted.

6 Preparation of specimens

6.1 Sampling

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

At least six test specimens, which are considered representative of the body of stone being tested shall be selected.

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6.2 Dimensions of test specimens

Cubes of (50 ± 1) mm sides shall be prepared.

6.3 Washing

All loose material shall be washed from the surface of the specimen using de-ionised water.

6.4 Drying

The specimens edges are marked with a permanent marker pen for easier visual observation of loss of material and then the specimens are dried at a temperature of (70 ± 5)°C to constant mass. 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 of these two masses.

They are then left to cool to room temperature and weighed. The weight of the dry specimen is the initial value M_0.

7 Test Procedure

Before using the chamber perform a preliminary set-up test, placing the two fog collectors into the chamber (one of them near the nozzles, the other one far from them) and spraying the salt solution for at least 16 hours. At the end verify that each collector has collected (1,0 to 2,0) ml of solution per hour.

Place the dry specimens into the chamber over non-corrosive supports (glass, plastic etc.), each one apart from the others and in such conditions as to be subject only to salt fog (avoid direct spraying or drop falling zones).

Then expose the specimens to salt fog for 4 hours 15 minutes. switch off the salt spraying system and dry the specimens in the chamber for 8 hours 15 minutes. This constitutes one cycle.

During the cycle, the temperature of the chamber is maintained at (35 5)° C.

The test consists of 60 cycles, although it can be concluded earlier if, by visual inspection, at least two of the specimens crack or disintegrate completely.

Every 15 cycles, the specimens are taken from the chamber for a visual inspection.

At the end of the test, the specimens are carefully removed from the chamber and immersed in de-ionised water so that all the deposited salts can be removed. The volume of the rinsing water in the container shall be comprised between two and three times the total volume of the specimens.

This process is very slow, and the water must be changed everyday until the removal of the salt is complete.

Removal is considered complete when the conductivity of the solution in contact with the specimens does not exceed twice the characteristic value of the original water.

After this, the specimens are dried at a temperature of (70 ± 5)°C to constant mass, left to cool to room temperature, weighed (M_n) and visually inspected.

8 Expression of results

The results are reported in terms of the mass loss and of the results of visual inspection concerning the specimens aspect, existence of cracks or other relevant signs of degradation. The modifications in the pen marks can help in this inspection.

For each specimen, the mass loss is calculated as percentage, as follows:

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$$\text{Percentage Mass Loss}\left(M\%\right) = \frac{M_o - M_n}{M_o} \times 100 \quad (1)$$

The arithmetic mean of the results obtained for each set of specimens is also calculated.

9 Test Report

The test report shall contain the following information:

a) unique identification number for the report;

b) number, title and the date of issue of this European Standard;

c) name and address of the testing laboratory and the address of where the test was carried out if different from the testing laboratory;

d) name and address of 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) to be clearly indicated on the sample or on each specimen by means of two parallel lines;

   name of the person or organisation which carried out the sampling;

   surface finish of the specimens (if relevant to the test).

f) date of delivery of the samples or of the specimens;

g) date of preparation of the specimens (if relevant) and the date of testing;

h) number of specimens in the sample;

i) dimensions of the specimens;

j) percentage mass loss and the visual changes for each test specimen;

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

l) all deviations from the standard and their justification;

m) remarks.

Each 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 laboratory.

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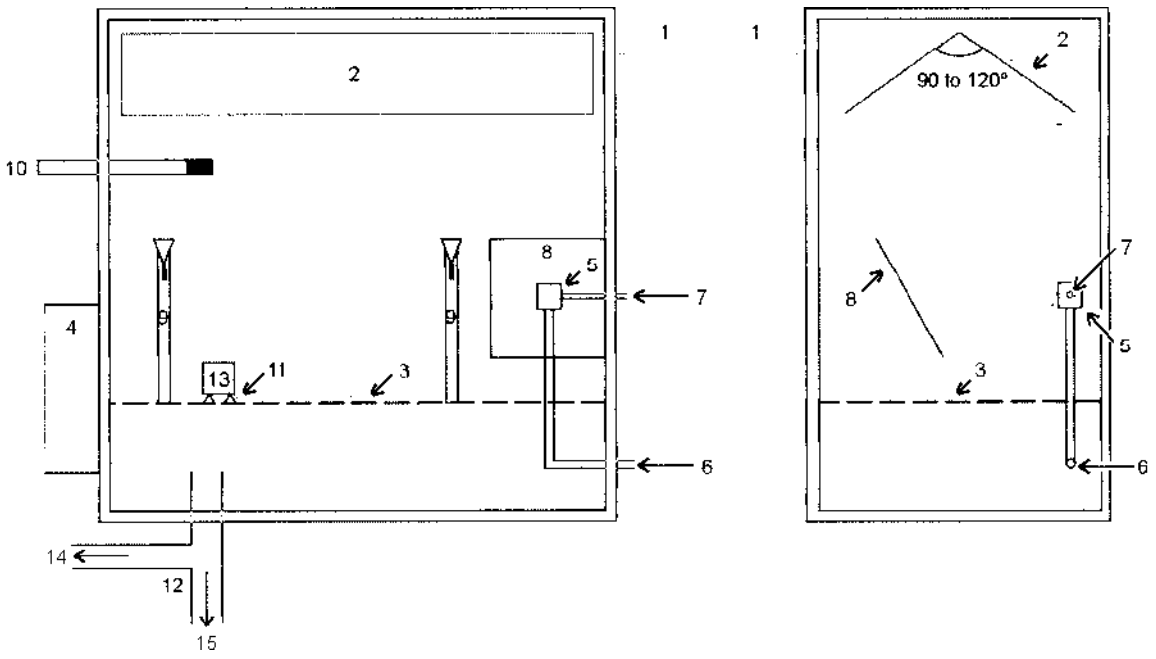

a) Front view **b) Side view**

Key

1 Sealed chamber
2 Hinged top
3 Non-corrosive specimens supporting plate (perforated glass or plastic…)
4 Controlled heater
5 Atomizing nozzle
6 Saline solution inlet
7 Dust free compressed air inlet
8 Spray deflector
9 Collecting device
10 Thermometer
11 Non-corrosive specimens supports (glass, plastic,…)
12 Drain
13 Specimen
14 Air
15 Solution waste

Figure 1 – Sketch of a salt spray chamber

Bibliography

EN 12440 – *Natural stones – Denomination criteria*

EN 12670 – *Natural stones – Terminology*

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