BRITISH STANDARD

BS EN
14158:2004

Natural stone test methods — Determination of rupture energy

The European Standard EN 14158:2004 has the status of a British Standard

ICS 73.020; 91.100.15

National foreword

This British Standard is the official English language version of EN 14158:2004.

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 international/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.

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EUROPEAN STANDARD

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EN 14158

April 2004

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English version

Natural stone test methods - Determination of rupture energy

Méthodes d'essai pour pierres naturelles - Détermination de l'énergie de rupture

Prüfverfahren für Naturstein - Bestimmung der Bruchenergie

This European Standard was approved by CEN on 16 January 2004.

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Contents

Foreword

This document (EN 14158:2004) 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of an identical text or by endorsement, at the latest by October 2004, and conflicting national standards shall be withdrawn at the latest by October 2004.

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:

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 method – Determination of real density and apparent density and of total and openporosity*

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 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 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*

EN 14147:2003, *Natural stone test methods – Determination of resistance to ageing by salt mist*

prEN 14157:2001, *Natural stone test methods – Determination of the abrasion resistance*

EN 14158:2003, *Natural stone test methods – Determination of rupture energy*

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

prEN 14579:2002, *Natural stone test methods – Determination of sound speed propagation*

prEN 14580:2002, *Natural stone test methods – Determination of the static elastic modulus*

prEN 14581:2002, *Natural stone test methods – Determination of thermal expansion coefficient*

No existing European Standard is superseded.

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1 Scope

This European Standard specifies a method for determining the energy of rupture by impact of natural stones. The standard contains provision for both an identification test and a technological test (for FPC of finished products).

2 Principle

After drying each specimen to a constant mass the energy of rupture by impact is determined by the dropping of a spherical steel ball from given increasing heights until the specimen breaks.

3 Symbols

m mass of a spherical steel ball, in kilograms

h_i initial height of fall of the steel ball, on the test specimen, in millimetres

h_t height of fall of the steel ball at the moment of rupture of the control specimen in millimetres

h height of fall of the steel ball at the moment of rupture of the test specimen in millimetres

W energy of rupture by impact, in joules.

4 Apparatus

4.1 Apparatus for determining the energy of rupture by impact, consisting of:

4.1.1 A spherical steel ball, having a mass of (1,00 0,01) kg.

4.1.2 A container with minimum dimensions 400 mm x 400 mm x 150 mm, in which a bed of silica sand (grain size between 2 mm and 0,076 mm) of 100 mm minimum thickness is placed. The container shall have a system for centring the specimen.

4.1.3 A metal column of 1,5 m length, graduated every 50 mm, attached to the container.

4.1.4 A sliding frame, also attached to the metal column, which consists in a device capable of dropping the steel ball in a vertical direction (A system based on an electromagnet can be used) (Figure 1).

4.2 A ventilated oven capable of maintaining a temperature of (70 5) °C.

4.3 A weighing instrument with an accuracy of 0,1% of the mass to be weighed.

4.4 A bubble level.

5 Preparation of the specimens

5.1 Sampling

The sampling is not the responsibility of the test laboratory, except where specially requested. The specimens will be selected from a homogeneous batch.

For identification test, six specimens shall be selected.

For technological test, the number of specimens shall be in accordance with the size of the control lot.

5.2 Test specimens

5.2.1 Surface finish

For identification test the surface finish of the faces of the specimens shall be sawn, honed or polished.

For technological test the surface finish of the faces of the specimens shall be as required for application.

5.2.2 Dimensions

For identification test the specimens shall be rectangular prisms of 200 mm x 200 mm x 30 mm 1 mm.

For technological test the dimensions of the specimens shall be commercial sizes.

5.2.3 Planes of anisotropy

For the identification test the major faces of the specimens shall be parallel to the anisotropy planes (e.g. bedding, foliation, etc.).

For the technological test the orientation of the major faces of the specimens with respect to the anisotropy planes shall be as in use.

5.3 Drying the specimens

The specimens shall be dried at a temperature of (70 5) °C to constant mass.

This is assumed to have been attained, when the difference between two successive weighings at an interval of (24 2) h, is not greater than 0,1% of the first of the two masses.

6 Procedure

One of the 6 specimens to be tested is selected as “control specimen”. It is put on the sand bed in a position so that the centre of its major faces be on the vertical line through the centre of the ball. The bubble level is used to check that the top is horizontal.

The steel ball is dropped from an initial height of 100 mm, measured from the lowest point of the ball.

If the specimen does not break the height of fall is increased in 50 mm steps until a break is produced. The height at which the control specimen breaks (h_t) is recorded. The test shall be repeated with the other five specimens beginning from an initial height of $h_i = (h_t - 150)$ mm and minimum of 100 mm. The height of rupture for each specimen, h, is recorded.

If a specimen breaks on the first impact then the result shall be rejected.

7 Expression of the results

The energy of rupture (W) shall be calculated for each one of the five specimens using the following formula:

$$W = m \quad g \quad h$$

where

W is the energy of rupture, in joules to the nearest 1 joule

m is the mass of the ball, in kilograms

g is the acceleration of gravity (9,806 m/s^2)

h is the height of rupture in metres with two decimal places.

If any specimens have been broken by the first impact produced from the initial height, h_i, this shall be recorded.

8 Test report

The test report shall contain the following information:

a) unique identification number of the report;

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

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

d) name and address of the client;

e) it is 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 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 of the specimens;

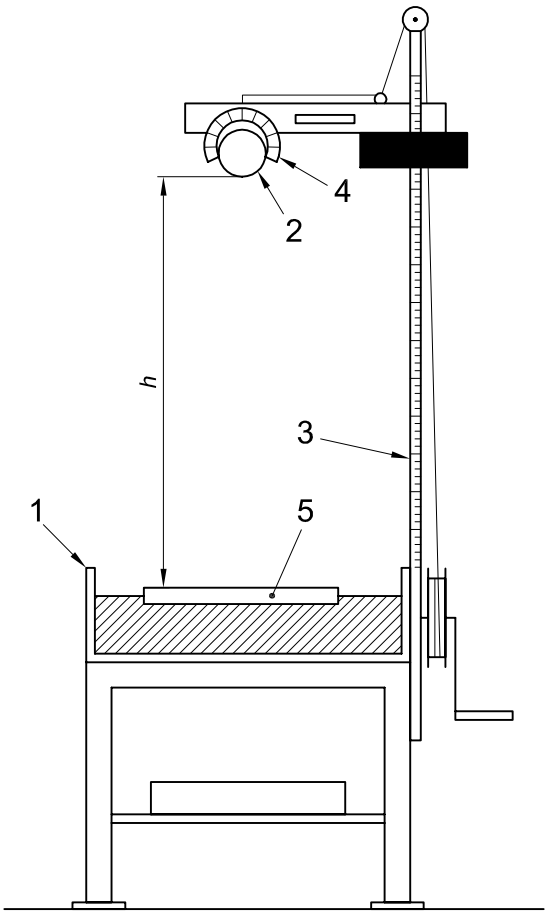
j) for each specimen the energy of rupture in joules;

k) mean value of the individual values of energy of rupture;

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.



Key

1 Container with a bed of silica sand

2 Steel ball

3 Graduated metal column

4 Electromagnet

5 Test specimen

h height of fall

Figure 1 — Apparatus for determining the energy of rupture by impact

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