IS : 1125 - 1974
(Reaffirmed 1998)

Indian Standard

METHOD OF TEST FOR DETERMINATION OF WEATHERING OF NATURAL BUILDING STONES

(First Revision)

Second Reprint SEPTEMBER 1989

UDC 691.21:620.193.21

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

Gr 2

March 1975

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Indian Standard

METHOD OF TEST FOR DETERMINATION OF WEATHERING OF NATURAL BUILDING STONES

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 8 October 1974, after the draft finalized by the Stones Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Building stones are available in large quantity in various parts of the country. To choose and utilize them for their satisfactory performance it is necessary to know the various strength properties determined according to standard procedure. This standard has, therefore, been formulated to cover the standard method for determining the weathering of various stones. This standard was first published in 1957 and has been revised based on its actual use in the past 17 years and the experience gained in testing of building stones for this property in the various research laboratories of this country. This test method is prescribed to find out the resistance of stone towards corrosive ground water, wetting and drying, sulphate attack and temperature variations.

0.3 In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

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1. SCOPE

1.1 This standard lays down the procedure for testing weathering of natural building stones used for constructional purposes.

*Rules for rounding off numerical values (*revised*).

2. SELECTION OF SAMPLE

2.1 The sample shall be selected to represent a true average of the type or grade of stone under consideration.

2.2 The sample shall be selected from the quarried stone or taken from the natural rock, as described in **2.2.1** and **2.2.2**, and shall be of adequate size to permit the preparation of the requisite number of test pieces.

2.2.1 *Stones from Ledges or Quarries* — The ledge or quarry face of the stone shall be inspected to determine any variation in different strata. Differences in colour, texture and structure shall be observed. Separate samples of stone weighing at least 25 kg each of the unweathered specimens shall be obtained from all strata that appear to vary in colour, texture and structure. Pieces that have been damaged by blasting, driving wedges, heating, etc, shall not be included in the sample.

2.2.2 *Field Stone and Boulders* — A detailed inspection of the stone and boulders over the area shall be made where the supply is to be obtained. The different kinds of stone and their condition at various quarry sites shall be recorded. Separate samples for each class of stone that would be considered for use in construction as indicated by visual inspection shall be selected.

2.3 When perceptible variations occur in the quality of rock, as many samples as are necessary for determining the range in properties shall be selected.

3. TEST PIECES

3.1 The test pieces shall be either cylinders, 50 mm in diameter and 50 mm in height, or 50 mm cubes.

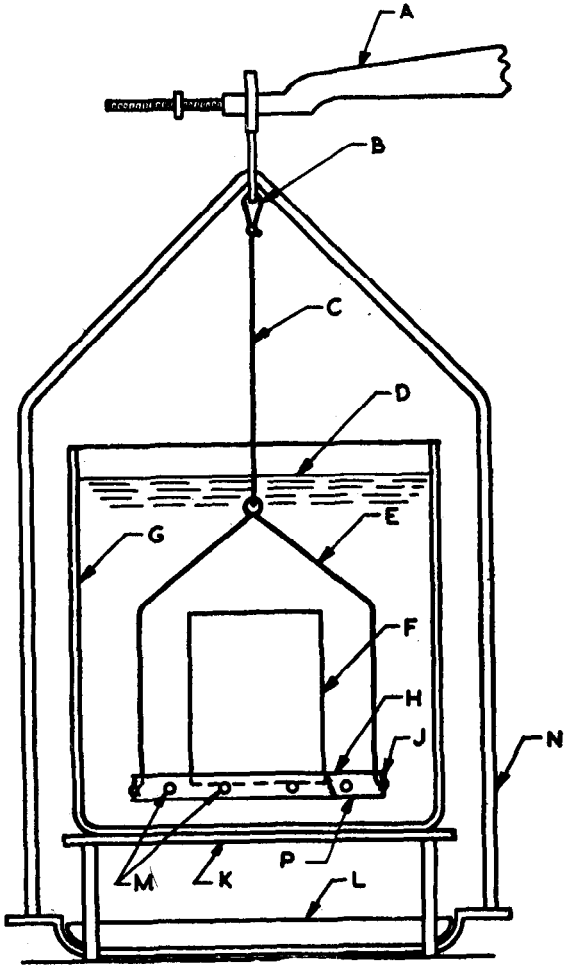
3.2 The test pieces shall be finished smooth and the edges shall be rounded to a radius of approximately 3 mm by grinding.

3.3 At least three test pieces shall be used for conducting the test.

3.4 The test pieces shall be dried in a well ventilated oven for 24 h at 105 $\pm$ 5°C and cooled in a desiccator to room temperature (20 to 30°C).

4. APPARATUS

4.1 The apparatus shall be as illustrated in Fig. 1. It shall consist of an enclosed balance of one kilogram capacity that is sensitive to 0·01 g and suitable accessories for weighing the specimen in water.



A — Beam of balance

B — Loop for attachment to stirrup of balance

C — Suspension wire of 0·81 mm dia brass wire

D — Water level

E — Bail of basket of 1·83 mm dia brass wire

F — Specimen

G — Water jar

H — Brass ring

J — Suspension basket

K — Water jar support

L — Balance pan

M — Bottom of basket of 1·83 mm dia brass wire (all joints soldered)

N — Balance pan suspension rod

P — Cut away section of basket

FIG. 1 APPARATUS FOR CONDUCTING WEATHERING TEST

5. PROCEDURE

5.1 The dried and cooled test pieces (*see* **3.4**) shall be weighed to the nearest 0·01 g and the weight of each recorded (W_1). The specimens shall then be submerged in water at 20 to 30°C for 24 hours. Each specimen shall be weighed (W_2) whilst totally immersed and freely suspended in water (when weighing test pieces in water, they shall be weighed suspended in such a position that air is not entrapped in the cavities). It shall then be removed, the surface water wiped off with a damp cloth and weighed again (W_3). The weighing of each specimen shall be completed within three minutes of its removal from water.

5.2 Each specimen shall be placed in a flat dish, made of glass, porcelain or glazed stonework, 9 cm in diameter and 1·5 cm in depth to which shall be added 2 g of powdered gypsum and 25 ml of water. The dishes together with specimens shall then be placed in a well ventilated oven and maintained at a temperature of 105 ± 2°C for at least 5 hours or until the water has evaporated and the powder becomes dry. The dishes shall be removed from the oven and cooled to 25 ± 5°C. This completes the first cycle. The cycle shall then be repeated 29 times in the same manner, except that only 25 ml of water shall be added for each of the subsequent cycles.

5.3 At the end of the 30 cycles, the specimens shall be cleaned by brushing with a stiff-fibre brush to remove any particles of gypsum clinging to the surface. Each specimen shall be immersed in water for 24 hours, surface dried, and weighed first in air (W_4) and then in water (W_5) as described in **5.1**.

6. EVALUATION

6.1 The increase/change in absorption and the increase in volume of each test piece after the 30 cycles of the test shall be calculated as follows:

$$A_1 = \frac{W_3 - W_1}{W_1} \times 100 \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$$V_1 = \frac{W_3 - W_2}{d} \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

$$A_2 = \frac{W_4 - W_1}{W_1} \times 100 \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

$$V_2 = \frac{W_4 - W_5}{d} \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

$$\text{Increase in absorption, percent} = \frac{A_2 - A_1}{A_1} \times 100 \quad \ldots \quad (5)$$

$$\text{Increase in volume, percent} = \frac{V_2 - V_1}{V_1} \times 100 \quad \ldots \quad (6)$$

where

A_1 = original absorption of the specimen during 24-h immersion in water, expressed as percentage by weight;

W_3 = original weight of surface-dried specimen after 24-h immersion in water (*see* **5.1**);

W_1 = original weight of the oven-dried specimen before immersion (*see* **5.1**);

V_1 = original volume of the specimen after 24-h immersion in water;

W_2 = original weight of specimen freely suspended in water after 24-h immersion (*see* **5.1**);

d = density of water at the temperature of observation (*see* **5.1**);

A_2 = final absorption of the specimen after 30 cycles of the test expressed as percentage by weight;

W_4 = final weight in air of surface-dried specimen after 30 cycles of the test and 24-h immersion in water (*see* **5.3**);

V_2 = final volume of the specimen after 30 cycles of the test; and

W_5 = final weight of the specimen freely suspended in water after 30 cycles of the test and 24-h immersion in water (*see* **5.3**).

7. REPORT OF TEST RESULTS

7.1 The average of the three individual determinations shall be reported as the percentage increase in absorption and percentage increase in volume of the sample.

7.2 The following additional information shall be reported along with the test results:

a) A description of the way in which the test pieces were prepared;

b) Size and shape of the test pieces used in the tests; and

c) Identification of the sample, including name and location of the quarry, name or position of the natural rock, date when sample was taken and trade-name or grade of stone.

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