IS 1121-3 (1974): Methods of Test for Determination of Strength Properties of Natural Building Stones, Part III: Tensile Strength [CED 6: Stones]

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भारतीय मानक

प्राकृतिक निर्माण पत्थरों के सामर्थ्य गुणों को ज्ञात करना — परीक्षण पद्धतियाँ

भाग 3 तनन सामर्थ्य

(दूसरा पुनरीक्षण)

Indian Standard

DETERMINATION OF STRENGTH PROPERTIES OF NATURAL BUILDING STONES — METHODS OF TEST

PART 3 TENSILE STRENGTH

(Second Revision)

ICS 91.100.15

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 2012 **Price Group 2**

Stones Sectional Committee, CED 6

FOREWORD

This Indian Standard (Part 3) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Stones Sectional Committee had been approved by the Civil Engineering Division Council.

Building stones are available in large quantity in various parts of the country and 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 strength properties of various stones. This standard covering compressive, transverse and shear strength properties was published in 1957 and was subsequently revised in 1974 where property of tensile strength was also added as the same was also important for assessing the suitability of stone; the revision was issued in four parts. Other parts are:

Part 1 Compressive strength
Part 2 Transverse strength
Part 4 Shear strength

This standard is brought out to incorporate the experience gained based on the use of the standard since its last revision. The major modifications incorporated in this revision are as follows:

a) SI units have been used,
b) Size of the samples has been specified as 'stones of adequate size' in place of the requirement of at least 25 kg specified earlier,
c) Surface finishing requirement of specimen has been modified by making reference to IS 9179 : 1979 'Method for preparation of rock specimen for laboratory testing',
d) Vacuum saturation in water has been specified for conditioning of the test specimens in place of normal immersion,
e) Rate of loading has been modified in line with IS 10082 : 1981 'Method for the determination of tensile strength by indirect tests on rock specimens',
f) The word 'rift' has been replaced with 'plane of anisotropy', and
g) The minimum number of test specimen has been revised from three to five for test for each of the set of conditions.

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

Indian Standard

DETERMINATION OF STRENGTH PROPERTIES OF NATURAL BUILDING STONES — METHODS OF TEST

PART 3 TENSILE STRENGTH

(Second Revision)

1 SCOPE

This standard (Part 3) lays down the procedure for determination of split tensile strength of natural building stones used for constructional purposes.

2 REFERENCE

The standard listed below contains provision which through reference in this text, constitutes provision of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below:

IS No.	*Title*
IS 9179 : 1979	Method for preparation of rock specimen for laboratory testing

3 SELECTION OF SAMPLES

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

3.2 The sample shall be selected from the quarried stone or taken from the natural rock, as described in **3.2.1** and **3.2.2** and shall be of adequate size to permit the preparation of the requisite number of test specimens.

3.2.1 *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 of adequate size of the unweathered specimens shall be obtained from all strata that appear to vary in colour, texture and structure. Specimens that have been damaged by blasting, driving wedges, heating, etc, shall not be included in the sample.

3.2.2 *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 stones and their conditions 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.

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

4 TEST SPECIMENS AND CONDITIONING

4.1 Test specimens shall be made from samples selected in accordance with **3** and shall be in the form of cylinders. They shall be drilled from the samples. The diameter of the test specimen shall be not less than 50 mm and the ratio of diameter to height shall be 1:2.

4.2 The specimen shall be prepared in accordance with IS 9179.

4.3 Five test specimens shall be used for conducting the test in each of the conditions mentioned in **4.3.1** and **4.3.2**.

4.3.1 The test specimens shall be saturated by vacuum saturation by immersing in water maintained at 20 °C to 30 °C in an evacuation vessel under a vacuum of about 50 mm of Hg to 100 mm of Hg. Specimens shall be initially immersed continuously for about 4 h to 5 h in vacuum and then its mass is measured at an interval of 1 h (sample being replaced back in evacuation vessel after weighing) till constant mass. Constant mass is considered to have been achieved when two consecutive hourly measurement of mass do not vary by more than 0.1 percent of the saturated mass. Vacuum may be created by a suitable air suction pump.

4.3.2 The test specimens shall also be tested in a dry condition and shall be dried in an oven at 70 ± 5 °C for 48 h and cooled in a desiccator to room temperature (20 °C to 30 °C) to constant mass. Constant mass is considered to have been achieved when two consecutive hourly measurement of mass do not vary by more than 0.1 percent.

5 APPARATUS

A testing machine of sufficient capacity for the tests and capable of applying load at the specified rate

shall be used. The machine shall be equipped with two steel bearing plates not less than 10 mm thick with hardened faces. One of the plates (preferably the one that normally bears on the upper surface of the test specimens) shall be fitted with a ball seating in the form of a portion of a sphere, the centre of which coincides with the central point of the face of the plate. The other compression plate shall be plain rigid bearing block. The bearing faces of both plates shall be of width greater than 25 mm and the length at least equal to the length of the test specimen. The bearing surface of the plates when new, shall not depart from a plane by more than 0.012 5 mm at any point. The movable portion of spherically seated compression plate shall be held on the spherical seat, but the design shall be such that it is possible to rotate the bearing face freely and tilt it through small angles in any direction.

6 PROCEDURE

6.1 Each test specimen to be tested is sandwiched in between two steel plates of width 25 mm, thickness 10 mm and length equal to the length of test specimen (*see* Fig. 1). The load shall be applied without shock and increased continuously at a uniform rate of 200 N/s until the specimen splits and no greater load is sustained. The maximum load applied to the specimen shall be recorded in Newton with one percent accuracy.

7 EVALUATION AND REPORT OF TEST RESULTS

7.1 The split tensile strength of the specimen shall be calculated as follows:

$$S = \frac{2W}{\pi dL}$$

where

S = split tensile strength in N/mm^2,
W = applied load in N at which specimen splits,
d = diameter of specimen in mm, and
L = length of specimen in mm.

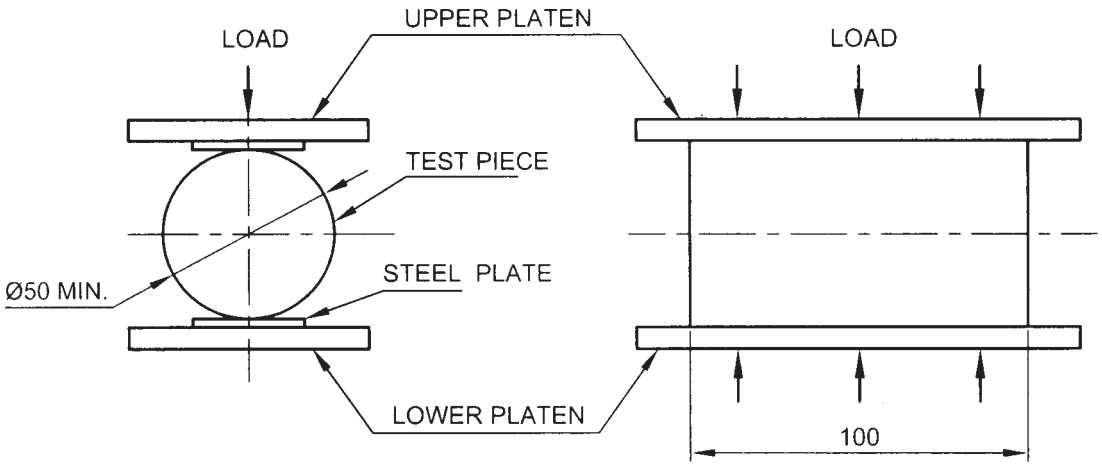
7.2 The average of all the five results separately for each condition shall be taken as the split tensile strength of the sample.

7.3 The average of the five results in each condition separately (*see* **4.3)** shall be taken for purposes of reporting the tensile strength of the sample provided the individual variation is not more than ±15 percent of the average. Otherwise repeat tests shall be made.

7.4 The split tensile strength of the sample shall be expressed in N/mm^2.

7.5 Identification of the sample, date when the sample was taken and type of the stone shall be reported.

7.6 The size and shape of test specimen used in the tests shall be indicated.



All dimensions in millimetres.

FIG. 1 GENERAL ARRANGEMENT FOR TESTING TENSILE STRENGTH OF BUILDING STONE

ANNEX A
(*Foreword*)

COMMITTEE COMPOSITION

Stones Sectional Committee, CED 6

Organization	*Representative(s)*
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This Indian Standard has been developed from Doc No.: CED 6 (7720).

Amendments Issued Since Publication

Amendment No.	Date of Issue	Text Affected

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Published by BIS, New Delhi