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भारतीय मानक मसौदा
दृढ़ जालीदार तापीय ऊष्मारोधी सामग्री की परीक्षण पद्धति
भाग 11 संपीडन शक्ति
[IS 11239 (भाग 11) का पहला पुनरीक्षण]

Draft Indian Standard

**Methods of Test for Rigid Cellular Thermal
Insulation Materials**

Part 11 Compressive Strength

[First Revision of IS 11239 (Part 11)]

(ICS 27.220, 91.120.10)

Thermal Insulation Materials Sectional Committee, CHD 27

Last Date for Comments: **5 July 2024**

Thermal Insulation Materials Sectional Committee, CHD 27

FOREWORD

(Formal clauses will be added later)

This standard was originally published in 1985. The committee responsible for formulation of this standard decided to revise this standard based upon the experience gained in last three decades.

In this revision, following changes have been incorporated:

- Conditioning time of the test specimens has been changed;
- Test specimen preparation method has been updated; and
- References have been updated.

In reporting the result 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: 2022 'Rules for rounding off numerical values (*second revision*)'.

Draft Indian Standard
**METHODS OF TEST FOR RIGID CELLULAR THERMAL
INSULATION MATERIALS**
PART 11 COMPRESSIVE STRENGTH
[*First Revision of IS 11239 (Part 11)*]

1 SCOPE

This standard (Part 11) prescribes the method for the determination of compressive strength and corresponding relative deformation, and compressive stress at 10 percent relative deformation of rigid cellular thermal insulation materials.

2 REFERENCES

The standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revisions, and parties to agreements based on this Indian Standard are encouraged to investigate the possibility of applying the most recent editions of these standards indicated below:

<i>IS No</i>	<i>Title</i>
IS 3069 : 2020	Glossary of Terms, Symbols and Units Relating to Thermal Insulation Materials (<i>Second Revision</i>)

3 TERMINOLOGY

3.1 For the purpose of this standard, the following definitions in addition to those given in IS 3069 shall apply.

3.1.1 *Relative Deformation* (ϵ)

Quotient of the reduction in thickness of the test specimen by its initial thickness expressed as percentage.

3.1.2 *Compressive Strength* (σ_m)

Quotient of the maximum compressive force (FM) reached when the relative deformation is less than 10 percent by the initial surface area of the cross section of the test specimen.

3.1.3 *Compressive Stress at 10 Percent Relative Deformation* (σ_{10})

Quotient of the compressive force (F_{10}) at 10 percent relative deformation by the initial surface area of the cross-section of the test specimen.

4 PRINCIPLE

Rigid cellular material is subjected to increasing compression at a fixed rate up to 10 percent relative deformation over its entire area, and the maximum stress sustained by the test specimen is calculated. If this maximum occurs before 10 percent relative deformation is reached the result is reported as 'compressive strength' otherwise 'compressive stress at 10 percent relative deformation' is reported.

5 CONDITIONING

Unless otherwise specified, the test specimens shall be conditioned at $27\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$ and (65 ± 5) percent relative humidity for at least 24 hours. The test shall be carried out at an ambient temperature of $27\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$ immediately after conditioning.

6 APPARATUS

6.1 Any suitable compression testing machine, with the movable head capable of operating at a constant rate of motion, may be used. The dimensions of both the plattens shall be large than the test specimen. The machine should have the following:

- a) Load indicating mechanism that will permit continuous measurement of force during compression to an accuracy of ± 1 percent of the compressive strength or compressive stress at 10 percent relative deformation, as the case may be; and
- b) Deformation indicating mechanism that will permit continuous measurement of displacement of the movable head with an accuracy of ± 0.1 mm.

6.1.1 It is recommended that the testing machine be equipped with a device for continuously recording force and deformation graphically.

7 TEST SPECIMEN

7.1 The test specimen shall have a cross section area of $50 \text{ mm} \pm 1 \text{ mm} \times 50 \text{ mm} \pm 1 \text{ mm}$ and a height of at least 25 mm, preferably $50 \text{ mm} \pm 1 \text{ mm}$. The test specimen shall be obtained from the sample by sawing without deformation of the cellular structure. The specimen shall be cut so that direction of application of force is parallel to the direction of compression of the product in its intended use.

NOTE — When test specimens less than the standard thickness need to be tested, the results obtained will not necessarily be directly comparable with those obtained on standard specimens. Playing up of test specimen is not permissible.

7.2 The distance between two faces of a test specimen shall not vary by more than 1 percent of its thickness.

7.3 A set of three test specimens shall be tested. When testing anisotropic materials, two sets of specimens shall be prepared having axes parallel to and normal to the direction of anisotropy.

8 PROCEDURE

Place the test specimen centrally between the two parallel plattens of the compression testing machine and compress it at a fixed rate, the value of which should be as near to one-tenth of the initial thickness of test specimens as possible, per minute until a relative deformation of 10 percent is reached. Note the value of force and corresponding relative deformation continuously during compression.

9 CALCULATION

9.1 Compressive Strength and Corresponding Relative Deformation

9.1.1 Compressive Strength

Calculate compressive strength (σ_M), in kilo Pascals, by the formula:

$$\sigma_M = 10^3 \times \frac{F_M}{S_0}$$

where

F_M = maximum force reached, newtons; and

S_0 = initial area of the cross section of the test specimen, mm^2 .

9.1.2 Relative Deformation

Calculate relative deformation (ϵ_M) by the formula:

$$\epsilon_M = \frac{X_M}{h_0} \times 100, \text{ percent}$$

where

X_M = displacement corresponding to the maximum force reached, mm; and

h_0 = initial thickness of the test specimen, mm.

9.2 Compressive Stress at 10 percent Relative Deformation-

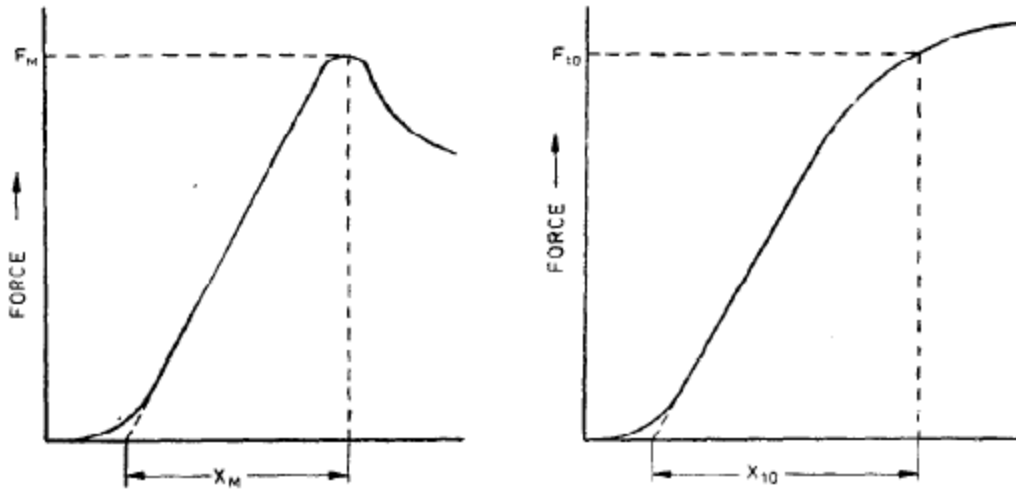
Calculate compressive stress at 10 percent relative deformation, σ_{10} , in kilo Pascals by the formula:

$$\sigma_{10} = 10^3 \times \frac{F_{10}}{S_0}$$

where

F_{10} = force, corresponding to a relative deformation of 10 percent, N; and
 S_0 = initial area of the cross section of the test specimen, mm².

9.3 Zero deformation point shall be determined in both cases as indicated in Fig. 1.



F_M = maximum force

X_M = displacement for maximum force

F_{10} = force at 10 percent deformation

X_{10} = displacement for 10 percent deformation

FIG. 1 ZERO POINT DETERMINATION

10 REPORT

The report shall include the following:

- a) Reference to this standard;
- b) Identification of the material;
- c) Dimensions of the test specimen, if other than standard;
- d) Direction of application of force in relation to anisotropy, if any;
- e) Average of the test results, shall be expressed as compressive strength and corresponding relative deformation; or compressive stress at 10 percent deformation;
- f) Presence of any surface skins, and if so, location; and
- g) Any deviation from the procedure specified in this standard.