भारतीय मानक **IS 11239 (Part 11) : 2024**

Indian Standard

दृढ़ जालीदार तापीय ऊष्मारोधी सामग्री — परीक्षण पद्धति

भाग 11 संपीडन शक्ति

(पहला पुनरीक्षण)

Rigid Cellular Thermal Insulation Materials — Methods of Test

Part 11 Compressive Strength

(First Revision)

ICS 27.220, 91.120.10

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

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Thermal Insulation Materials Sectional Committee, CHD 27

FOREWORD

This Indian Standard (first Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Thermal Insulation Sectional Committee had been approved of the Chemical Division Council.

This standard was first 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:

a) Conditioning time of the test specimens has been changed;

b) Test specimen preparation method has been updated; and

c) References have been updated.

The composition of the Committee, responsible for the formulation of this standard is given in Annex A.

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*)'.

Indian Standard

RIGID CELLULAR THERMAL INSULATION MATERIALS — METHODS OF TEST

PART 11 COMPRESSIVE STRENGTH

(First Revision)

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 given below contain provisions which, through reference in this text, constitute 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 edition of these standards:

IS No.	*Title*
IS 3069 : 2020	Glossary of terms, symbols and units relating to thermal insulation materials (*second revision*)

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* (σm) — 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

4.1 Rigid cellular material is subjected to increasing compression at a fixed rated 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 °C ± 2 °C and (65 ± 5) percent relative humidity for at least 24 h. The test shall be carried out at an ambient temperature of 27 °C ± 2 °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 mm ± 1 mm × 50 mm ± 1 mm and a height of at least 25 mm, preferably 50 mm ± 1 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

8.1 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:

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

where

F_M = maximum force reached, newtons; and

S_O = 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:

$$\varepsilon_M = \frac{X_M}{h_o} \times 100, \text{ percent}$$

where

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

h_o = 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:

$$\Vert\ \sigma_{10}\ 10^3 \times \frac{F_{10}}{S_o}$$

where

F_{10} = force, corresponding to a relative deformation of 10 percent, N; and

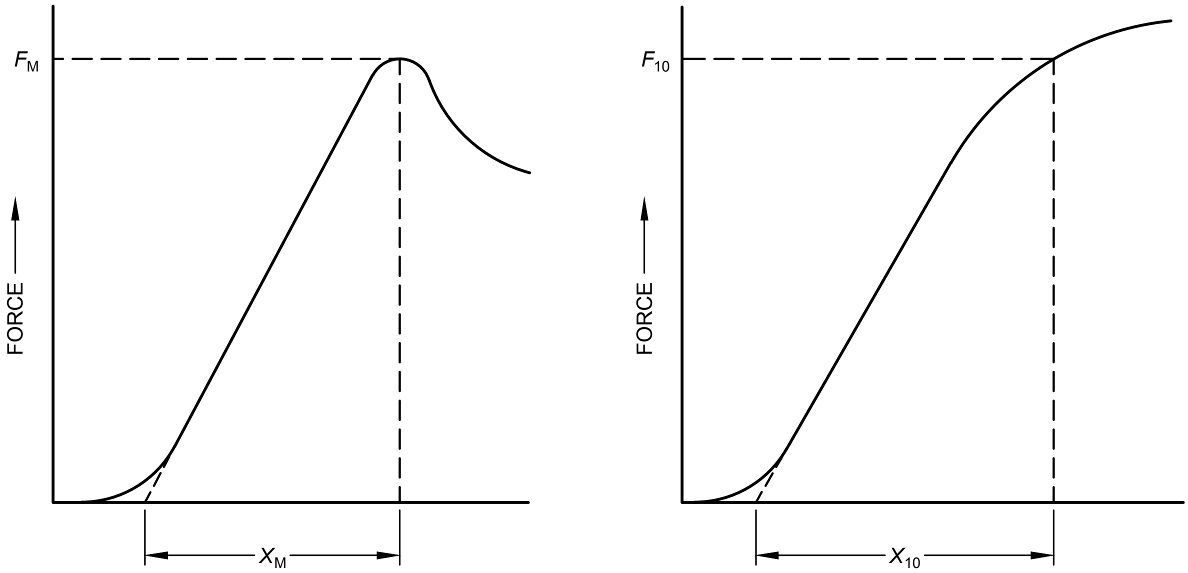
S_o = initial area of the cross section of the test specimen, mm^2.

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

10 REPORT

10.1 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.



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 DETERMINATON

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Thermal Insulation Sectional Committee, CHD 27

Organization	*Representative*(*s*)
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In Personal Capacity (*D-3, Friends Apartment, 49-IP Extension, Patparganj, Delhi-110092*)	SHRI P. P. LAHIRI
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Member Secretary
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SCIENTIST 'D'/JOINT DIRECTOR
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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
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Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: Manakalya, 5th Floor/MTNL CETTM, Technology Street, Hiranandani Gardens, Powai Mumbai 400076	25700030 25702715

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