इंटरनेट मानक

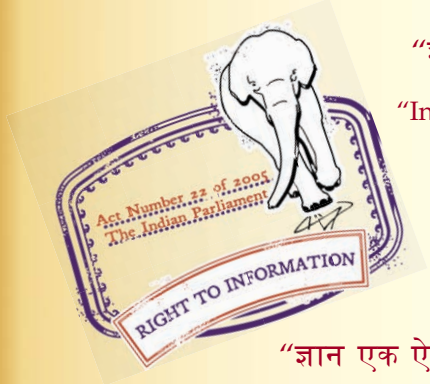
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 11239-10 (1985): Method of test for cellular thermal insulation materials, Part 10: Flexural strength [CHD 27: Thermal Insulation]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

PROTECTED BY COPYRIGHT

IS : 11239 (Part 10) - 1985

Indian Standard

(Reaffirmed 2001)

METHODS OF TEST FOR RIGID CELLULAR THERMAL INSULATION MATERIALS

PART 10 FLEXURAL STRENGTH

UDC 662·998 : 678·077-405·8 : 620·174

© *Copyright* 1986

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

Gr 2

December 1986

Indian Standard

METHODS OF TEST FOR RIGID CELLULAR THERMAL INSULATION MATERIALS

PART 10 FLEXURAL STRENGTH

Thermal Insulation Materials Sectional Committee CDC 37

Chairman	*Representing*
DR B. C. RAYCHAUDHURI	Indian Institute of Technology, New Delhi
Members	
SHRI U. C. AGRAWAL	Synthetic Foams Ltd, New Delhi
SHRI RAJEEVA KANSAL (*Alternate*)	
CHEMIST AND METALLURGIST	RDSO, Ministry of Railways, Lucknow
ASSTT RESEARCH OFFICER (CM-II) (*Alternate*)	
SHRI K. GANGADHARAN	Mettur Beardsell Ltd, Madras
SHRI R. P. SINGH (*Alternate*)	
SHRI N. N. GOYAL	FGP Limited, Bombay
SHRI G. K. TAKIAR (*Alternate*)	
SHRI A. K. GUPTA	Hyderabad Asbestos Cement Products Ltd, Hyderabad
SHRI K. V. GURUSWAMY	Indian Oil Corporation, New Delhi
SHRI R. K. LAKHANPAL (*Alternate*)	
SHRI A. V. HINGORANI	Steel Authority of India Ltd, Ranchi
SHRI B. S. VANKATARAMIAH (*Alternate*)	
SHRI I. K. KAPOOR	Directorate General of Technical Development, New Delhi
SHRI K. V. SAMPATH (*Alternate*)	
SHRI A. S. R. MURTHY	Ministry of Energy, New Delhi
SHRI S. M. C. PILLAI	National Thermal Power Corporation, New Delhi
SHRI RAM GOPAL (*Alternate*)	
DR M. PRASAD	Central Mechanical Engg Research Institute (CSIR), Durgapur
SHRI R. N. BANERJEE (*Alternate*)	

(*Continued on page* 2)

© *Copyright* 1986
INDIAN STANDARDS INSTITUTIONS
This publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

(*Continued from page* 1)

Members	*Representing*
SHRI R. P. PUNJ	Punj Sons Pvt Ltd New Delhi
SHRI J. K. CHOPRA (*Alternate*)	
DR H. C. ROY	Projects and Development India Ltd, Sindri
SHRI S. P. KHALSA (*Alternate*)	
SHRI P. ROY	Bakelite Hylam Ltd, Bombay
SHRI G. S. SRINIVASAN (*Alternate*)	
SHRI R. SHANKARAN	Bharat Heavy Electricals Ltd, Hyderabed
SHRI S. S. VIDYARTHI (*Alternate* I)	
SHRI B. K. DUBEY (*Alternate* II)	
DR G. K. SHARMA	Indian Institute of Technology, Bombay
SHRI N. SRINIVAS	Lloyd Insulations (India) Pvt Ltd, New Delhi
SHRI C. P. KHANNA (*Alternate*)	
SHRI M. BALA SUBRAMANIAM	BASF India Limited, Bombay
SHRI R. N. GANJOO (*Alternate*)	
SHRI V. A. SURA	Newkem Products Corporation, Bombay
SHRI NIMISH V. SURA (*Alternate*)	
SHRI T. UDAYAKUMAR	PIBCO Ltd, New Delhi
SHRIMATI U. ROY (*Alternate*)	
DR V. V. VERMA	Central Building Research Institute (CSIR), Roorkee
SHRI S. P. JAIN (*Alternate*)	
SHRI V. P. WASAN	National Physical Laboratory (CSIR), New Delhi
SHRI K. N. BHATNAGAR (*Alternate*)	
SHRI SATISH CHANDER, Director (Chem)	Director General, ISI (*Ex-officio Member*)

Secretary
SHRI P. S. ARORA
Joint Director (Chem), ISI

Panel for Terminology and Methods of Test for Thermal Insulation, CDC 37 : P1

Convener	
DR B. C. RAYCHAUDHURI	Indian Institute of Technology, New Delhi
Members	
DR K. N. AGRAWAL	Central Building Research Institute (CSIR), Roorkee
DR V. V. VERMA (*Alternate*)	
SHRI U. C. AGRAWAL	Synthetic Foams Ltd, New Delhi
SHRI RAJEEV KANSAL (*Alternate*)	
SHRI A. K. GUPTA	Hyderabad Industries Ltd, Hyderabad
SHRI M. SAMBASIVA RAO (*Alternate*)	
SHRI D. K. KANUNGO	National Test House, Calcutta
SHRI TRIDIB CHAUDHURI (*Alternate*)	

(*Continued on page* 7)

Indian Standard

METHODS OF TEST FOR RIGID CELLULAR THERMAL INSULATION MATERIALS

PART 10 FLEXURAL STRENGTH

0. FOREWORD

0.1 This Indian Standard (Part 10) was adopted by the Indian Standards Institution on 30 December 1985, after the draft finalized by the Thermal Insulation Materials Sectional Committee had been approved by the Chemical Division Council.

0.2 The procedure specified in this standard may be used for assessing the flexural behaviour of rigid cellular materials. It is carried out using a 3-point loading on a bar-shaped test specimen. Since the loading is not a pure flexural loading, it does not permit calculation of apparent flexural modulus. The test cannot be used for determining absolute properties of rigid cellular material since the value of flexural stress and flexural strength are valid only for the loading conditions specified in the test. The test, however, does provide useful information on the flexural behaviour of rigid cellular materials.

0.3 In reporting the result of a test made 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*.

1. SCOPE

1.1 This standard (Part 10) prescribes the method for the determination of flexural stress and flexural strength of rigid cellular thermal insulation materials.

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

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 3069-1965* and the following shall apply:

2.1.1 *Limiting Flexural Stress* — Stress at limiting deflection of $20 \pm 0{\cdot}2$ mm.

2.1.2 *Flexural Strength* — Stress at breaking point.

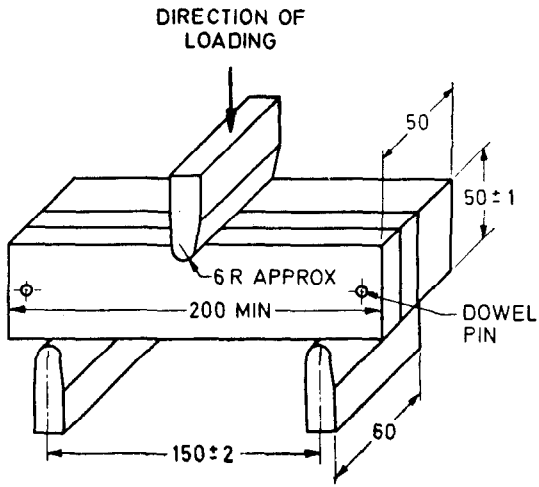
2.1.3 *Deflection at Break* (f_B) — Deflection in the centre of the test specimen obtained at this instant of break.

3. CONDITIONING

3.1 The test specimens shall be conditioned at 27 ± 2°C and 65 ± 5 per-cent relative humidity for at least 16 hours.

4. APPARATUS

4.1 A compression testing machine to which a loading edge and supports can be adapted as indicated in Fig. 1 may be used. Alternatively, a bending test machine suitable for application of flexural load as indicated in Fig. 1 and capable of measurement of load with an accuracy of 2 percent may be used. The loading edge and the support edges shall have cylinderical edges with edge radius as shown in Fig. 1. The



All dimensions in millimetres.

FIG. 1 TEST ARRANGEMENT

*Glossary of terms, symbols and units relating to thermal insulation materials.

supports shall be 150 mm apart. The loading edge shall be located centrally between the supports.

5. TEST SPECIMENS

5.1 The test specimens shall be parallelopipeds with the following dimensions:

Length	= 200 mm
Width	= 50 mm
Thickness (height)	= 50 mm

5.2 The specimens shall be obtained by cutting or sawing from the product in such a manner that the cellular structure is not deformed. The specimen shall be cut in such a way that the direction of application of flexural load is the same as the direction in which the product is likely to be subjected by flexural load in actual use.

5.3 When testing anisotropic materials, two sets of specimens shall be prepared having axes parallel to and normal to the directions of anisotropy.

5.4 Five specimens shall be tested.

6. PROCEDURE

6.1 Place the test specimen centrally in relation to the loading edge so that the height of the test specimen is in the direction of loading. Ensure that the loading edge makes contact with the test specimen over its entire width with minimum force. Apply a force through the loading edge at a constant rate of deflection of 10 ± 2 mm per minute. In case the test specimen breaks before reaching a deflection of $20 \pm 0{\cdot}2$ mm, note the value of force in Newtons within 0·5 N and deflection at break to within 0·1 mm. In case the test specimen does not break at deflection of $20 \pm 0{\cdot}2$ mm; note the value of force to within 0·5 N at this deflection. It is recommended that a load deflection curve be plotted for the complete duration of the test.

7. CALCULATIONS

7.1 In case of break, calculate flexural strength. σ_B in N/mm^2, by the formula:

$$\sigma_B = \frac{3F_B l_S}{2bh^2}$$

where

F_B = load, N;

l_s = distance between the supports, mm;

b = width of the test specimen, mm; and

h = height of the test specimen, mm.

7.2 Calculate limiting flexural stress, σ_{20}, in case the specimen does not break, by the following formula:

$$\sigma_{20} = \frac{3F_{20}l_s}{2bh^2}$$

where

F_{20} = load, N;

l_s = distance between the supports, mm;

b = width of the test specimen, mm; and

h = height of the test specimen, mm.

8. REPORT

8.1 The report shall include the following:

a) Reference to this standard;

b) Description and identification of materials including density;

c) Presence of any skins, and if so, location;

d) Direction of application of force in respect of anisotorpy, if any;

e) Individual and arithmetic mean value of limiting flexural strength round off to 1 N/mm and corresponding deflection at break rounded to 0·1 mm. Alternatively, individual and arithmetic mean value of limiting flexural stress at 20 ± 0·2 mm deflection rounded off to 1 N/mm; and

f) Any deviation from the specified test procedure.

(*Continued from page* 2)

Members	*Representing*
SHRI R. P. PUNJ SHRI J. K. CHOPRA (*Alternate*)	Punj Sons Pvt Ltd, New Delhi
SHRI R. SHANKARAN	Bharat Heavy Electricals Ltd, Hyderabad
DR S. K. SHARMA SHRI B. K. JHA (*Alternate*)	Product and Development India Ltd, Sindri
SHRI C. K. SHARMA	Indian Institute of Technology, Bombay
SHRI T. UDAYAKUMAR SHRIMATI U. ROY (*Alternate*)	PIBCO Limited, Calcutta
SHRI W. P. WASAN SHRI K. N. BHATNAGAR (*Alternate*)	National Physical Laboratory (CSIR), New Delhi

Panel for Rigid Cellular Organic Thermal Insulation Materials, CDC 37 : P7

Convener	
SHRI B. JOSHI	BASF India Limited, Bombay
Members	
SHRI U. C. AGRAWAL SHRI RAJEEVA KANSAL (*Alternate*)	Synthetic Foams Ltd, New Delhi
DR D. A. DABHOLKAR SHRI K. K. JAIN (*Alternate*)	Shri Ram Test House, New Delhi
DR R. K. JAIN DR L. K. AGRAWAL (*Alternate*)	Central Building Research Institute (CSIR), Roorkee
SHRI R. P. PUNJ SHRI J. K. CHOPRA (*Alternate*)	Punj Sons Pvt Ltd, New Delhi
SHRI P. ROY SHRI G. S. SRINIVASAN (*Alternate*)	Bakelite Hylam Ltd, Bombay
SHRI N. SRINIVAS SHRI C. P. KHANNA (*Alternate*)	Lloyd Insulation (India) Pvt Ltd, New Delhi

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity		cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s(s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2