भारतीय मानक

जल-पोत निर्माण और समुद्र में प्रयोग हेतु संरचनाएं—जल-पोत की आयताकार खिड़की के लिए गर्म की जाने वाली कांच फलक

Indian Standard

SHIPBUILDING AND MARINE STRUCTURES—HEATED GLASS PANES FOR SHIPS' RECTANGULAR WINDOWS

ICS 47.020.90, 81.040.30

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

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Price Group 6

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Shipbuilding Sectional Committee had been approved by the Transport Engineering Division Council.

Heated glass panes are used on ships principally for the windows of wheel-houses and bridges, and also in enclosed locations used for look-out and manoeuvring purposes. In order to achieve harmony with the international practices this standard is based on ISO 3434:1992 'Shipbuilding and marine structure—Heated glass panes for ships' rectangular windows' published by the International Organization for Standardization (ISO).

Annex A and Annex B form an integral part of this standard.

Annex C of this standard is for information only.

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

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SHIPBUILDING AND MARINE STRUCTURES — HEATED GLASS PANES FOR SHIPS' RECTANGULAR WINDOWS

1 SCOPE

1.1 This Indian Standard specifies construction characteristics, optical qualities and heating circuit, dimensions for interchangeability (outer dimensions and glass thickness), tests, marking and designation of heated glass panes for ships' rectangular windows.

1.2 This standard specifies heated glass panes which are intended for use at temperatures down to – 40°C. It includes the conditions with which they are required to comply to ensure the safety of ships in times of frost or snow, particularly during manoeuvres in port.

2 REFERENCES

The following standards 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 revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
196 : 1966	Atmospheric conditions for testing (*revised*)
6640 : 1972	Specification for toughened safety glasses for ships' windows
8886(Part 1) : 1978	Specification for ships' ordinary rectangular windows: Part 1 Types and dimensions
8886(Part 3) : 1979	Specification for ships' ordinary rectangular windows: Part 3 Positioning
10242(Part 1/ Sec 1) : 1997	Electrical installation in ships: Part 1 General, Section 1 Definitions and general, requirements (*first revision*)
12063 : 1987	Classification of degrees of protection provided by enclosures of electrical equipment

3 OPTICAL REQUIREMENTS

3.1 General

When fixed in a window which is installed on board a ship, heated glass panes shall comply with the optical requirements given in **3.2** and **3.3**.

All the optical requirements shall apply whether the temperature control gear is cyclic or whether the heated glass pane is equipped with a temperature-regulating device (for example, a thermostat).

However, these optical qualities are not required at the periphery of the glass pane within a band 50 mm wide measured from the edge of the window frame.

3.2 Visibility

Heated glass panes shall ensure perfect visibility in all weathers, avoiding the formation of mist or frost, in relation to the power loading (*see* Table 5). They shall, in addition, ensure maximum efficiency of the windscreen wipers when operating in conditions of frost or snow. They shall not cause any significant reduction in the resolving power of the eye or of binoculars when a distant object is observed at normal incidence through the glass.

Tinted glass shall not be used.

When discrepancies of interpretation about visibility arise, they are subject to agreement between the purchaser and the manufacturer.

3.3 Deterioration in Colour

Heated glass panes shall not cause any marked deterioration in perception of colour, in particular of beacons and lights on buoys.

When discrepancies of interpretation about deterioration in colour arise, they are subject to agreement between the purchaser and the manufacturer.

4 CONSTRUCTION OF GLASS PANE

4.1 General

A complete mountable heated glass pane that meets the requirements of this Standard is a component unit, consisting of a laminated glass pane and a firmly mounted device for the electrical connection.

4.2 Composition, Types and Materials

The composition of the laminated glass pane shall be as shown in Figure 1 and Table 1.

A distinction is made between Type A, with two glass panes, and Type B, with three glass panes.

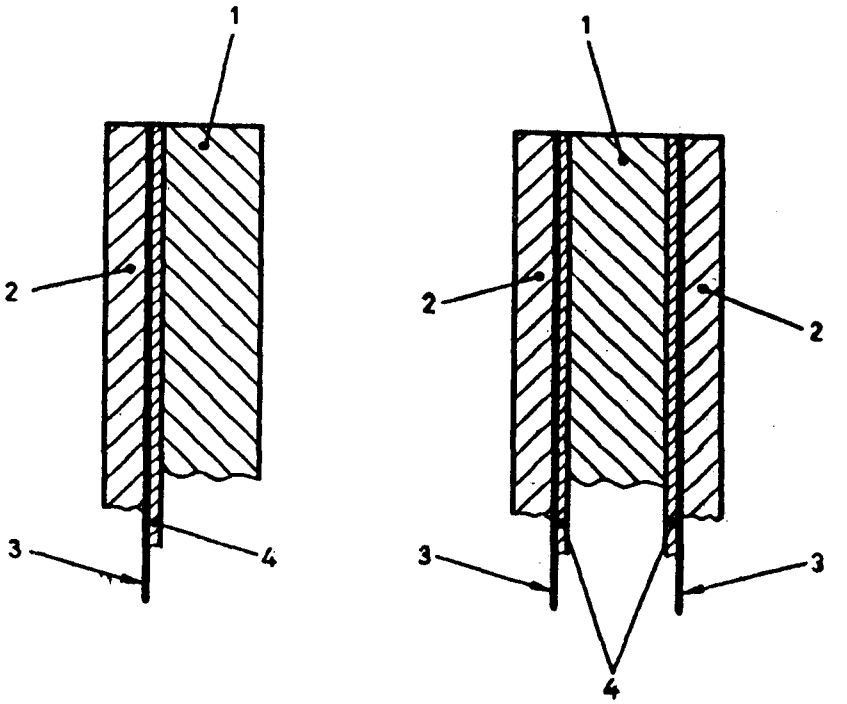


FIG. 1 CROSS-SECTION OF HEATED GLASS PANES (NOT TO SCALE)

Table 1 Components of Heated Glass Pane
(*Clause* 4.2)

Component No. (*see* Fig. 1)	Term
(1)	(2)
1	Carrier pane
2	Cover pane
3	Heating element
4	Inter-layer

4.2.1 *Carrier Pane*

The carrier pane shall be manufactured from clear toughened safety glass in accordance with IS 6640. It shall have the glass pane thickness specified in IS 6640 with regard to the location of the rectangular window in the ship as specified in IS 8886 (Part 3).

The maximum allowable pressure of the carrier pane shall be in accordance with Annex A or Annex B as appropriate.

4.2.2 *Cover Pane*

The cover pane carries or protects the heating element. It is thinner than the carrier pane. The material shall be clear toughened or semi-toughened safety glass.

4.2.3 *Heating Element*

The heating element consists of a thin wire, a transparent conductive film or a transparent conductive coating.

4.2.4 *Inter-Layer*

The inter-layer consists of a thin plastic material (foil) of 0.76 mm minimum thickness.

4.3 Protection of Edges

In order to avoid any penetration of humidity or any other form of chemical attack between the layers of the laminate, and to protect the edges against impact as well as to ensure durable electrical insulation, the periphery of the glass pane shall be protected by materials, such as silicone, rubber, polysulphides or similar, compatible with the plastics inter-layers of the laminate.

This edge protection shall be bonded to the edge and not thicker than 3 mm (*see* Fig. 2).

4.4 Dimensions

4.4.1 *Main Dimensions and Thicknesses*

The main dimensions of a heated glass pane shall be as shown in Fig. 3, and given in Tables 2 and 3.

The dimensions w, h, r and t_1 shown in Fig. 3 are in accordance with IS 6640. For the carrier pane using thickness t_1, glass panes in accordance with IS 6640 shall be used.

NOTES

1 Thickness t_1 is the designating thickness for heated glass panes.

2 The windows nominal sizes are clear light dimensions of windows. The sizes are given in accordance with Table 2 of IS 8886 (Part I). Other sizes not listed may be agreed to between the parties concerned.

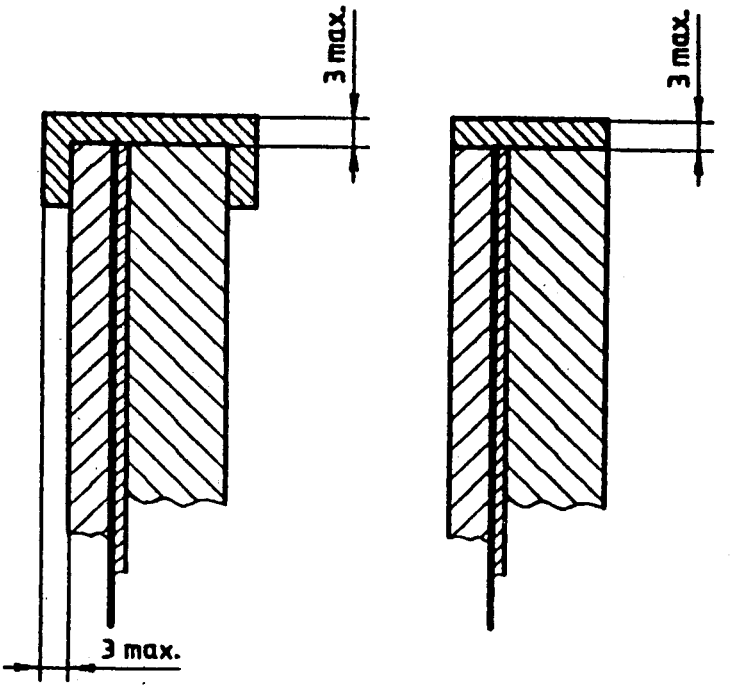
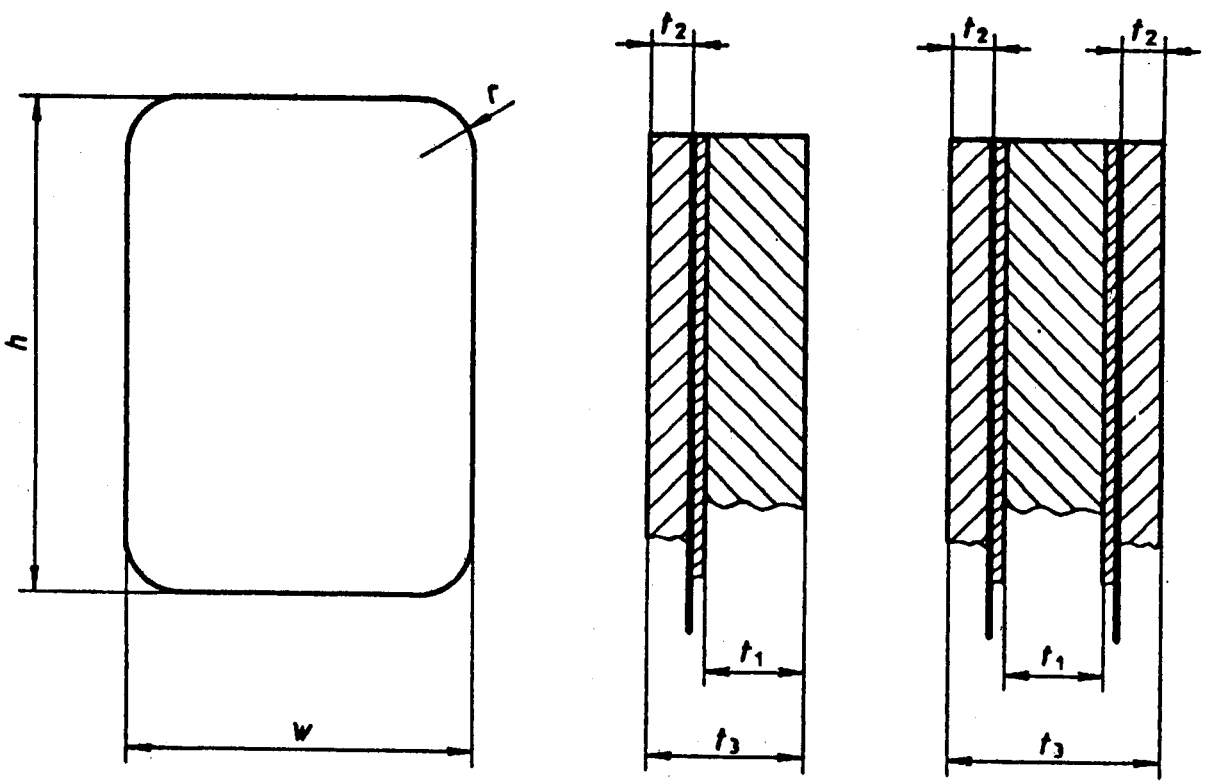


FIG. 2 PROTECTION OF EDGES



t_1 = nominal thickness of carrier glass pane
t_2 = nominal thickness of cover glass pane

FIG. 3 DIMENSIONS OF HEATED GLASS PANE

Table 2 Outer Dimensions

(*Clause* 4.4.1)

All dimensions in millimetres.

Window		*w*		*h*		*r*
Code No.	Nominal Size[1)]	*Min*	*Max*	*Min*	*Max*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	300 × 425	314	318	439	443	58
2	355 × 500	369	373	514	518	58
3	400 × 560	414	418	574	578	58
4	450 × 630	464	468	644	648	108
5	500 × 710	514	518	724	728	108
6	560 × 800	574	578	814	818	108
7	900 × 630	914	918	644	648	108
8	1 000 × 710	1 014	1 018	724	728	108
9	1 100 × 800	1 114	1 118	814	818	108

[1)] Clear light dimension of window.

Table 3 Thicknesses of Glass Pane

(*Clause* 4.4.1)

All dimensions in millimetres.

Window		Thickness[1)]					
Code No.	Nominal Size[2)]	t_3	Type A[3)]	13	15	17	20	24
			Type B[3)]	18	20	22	25	29
		t_1[4)]		8	10	12	15	19
		t_2		4	4	4	4	4
1	300 × 425			x	x			
2	355 × 500			x	x			
3	400 × 560			x		x		
4	450 × 630			x		x		
5	500 × 710				x		x	
6	560 × 800				x		x	
7	900 × 630					x		x
8	1 000 × 710					x		x
9	1 100 × 800						x	

[1)] Standardized sizes are marked with x.
[2)] Clear light dimension of window.
[3)] *See* Fig. 1.
[4)] *See* Note 1 in **4.4.1**.

4.4.2 *Tolerances on Thicknesses*

Tolerances on thicknesses of heated glass panes shall be as given in Table 4.

Table 4 Tolerances on Thicknesses

All dimensions in millimetres.

Thickness		Tolerance	
Total, t_3		± 1.5	
Carrier pane, t_1	8 10 12	±0.3	In accordance with IS 6640
	15	±0.5	
	19	±1.0	
Cover pane, t_2		± 0.3	

4.5 Parallelism

The tolerance on parallelism between the two surfaces of the glass pane shall not exceed 1 mm/1 000 mm (*see* Fig. 4.).

4.6 Flatness

The tolerance on flatness shall not exceed 3 mm/1 000 mm (*see* Fig. 5).

5 HEATING CIRCUIT

5.1 Power Loading

The power loading given in Table 5 is specified for devices used for de-misting and de-frosting of glass at a medium wind velocity and a standard atmosphere 27°C with 65percent relative humidity as specified in IS 196, in waters situated outside the polar region.

Higher power loading is required for navigation in polar regions; in such cases, the manufacturers of heated glass panes shall be consulted.

Table 5 Power Loading

Power Loading, W/dm²		Outdoor Temperature
Min	*Max*	
(1)	(2)	(3)
7	9	down to – 12 °C
12	15	down to – 28 °C
17	21	down to – 40 °C

5.2 Electrical Supply

The feed circuit of the heating for glass pane shall correspond with the supply voltage for continuous operation on board ships according to IS 10242 (Part1/ Sec1). Voltages in d.c. or a.c. may be used. For power supply identification systems, *see* Table 6.

5.3 Electrical Connections

Moisture-proof connection boxes, with a degree of protection of at least IP 22 in accordance with IS 12063,

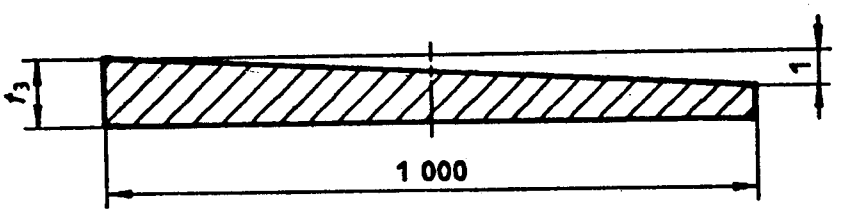


FIG. 4 PARALLELISM

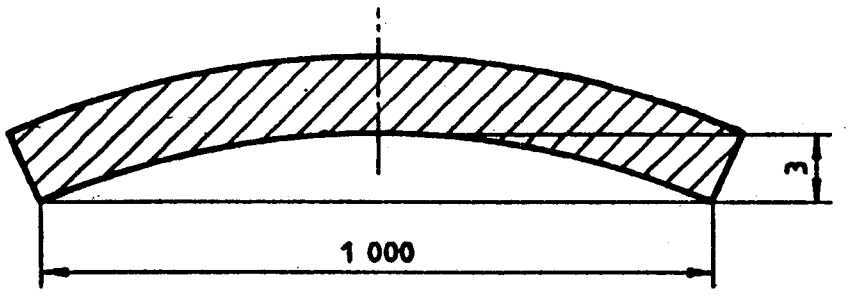


FIG. 5 FLATNESS

shall be installed between the heating circuit and the feed circuit. These boxes shall be bonded to the inner side of the heated glass pane.

All necessary precautions shall be taken concerning protection against electrical shock, insulation and earthing of the installation. For requirements, *see* IS 10242(Part1/Sec 1).

If in special cases the connection box is to be installed on the glassholder or main frame of the window, this shall be especially agreed between the purchaser and the manufacturer. In such cases, the glass pane will need to be equipped with suitable cables.

Table 6 Power Supply Identification System

Clause 5.2

Supply	Voltage V	Frequency Hz	Identification No.
d.c.	24	–	01
	110	–	02
	220	–	03
a.c single-phase	115	50	11
		60	12
	220	50	13
		60	14
a.c. three-phase	115	50	31
		60	32
	220	50	33
		60	34
	220/380	50	35
		60	36
	440	50	37
		60	38

5.4 Overheating Protection

When the temperature of a glass pane surface reaches +40° C (about luke-warm), the glass pane has to be switched off. For this purpose, heated glass panes are equipped with temperature-limitation devices (regulators). Two types of such regulators are specified:

a) *Single Regulation (S)*:—The regulator (for example, a temperature sensor) is mounted directly on the glass pane (interior-side). It affects only the relevant glass pane and is part of original equipment.

b) *Group Regulation (G)*:—A separate regulation device, not mounted directly at the window, to which several glass panes are connected appropriately. Relevant information on type and number of these regulation devices is necessary at the time of ordering.

6 TESTS

Tests shall be carried out by the glass pane manufacturer.

6.1 Electrical Tests

A voltage test shall be carried out on each complete heated glass pane. The test voltage shall be an a.c. voltage of 1 000 V plus twice the rated voltage, with a minimum of 1 500 V. The test frequency shall be 25 to 100 Hz.

The test duration shall be 1 min, and shall cover the electrical circuit from the connection for the heating area to the edge of the glass pane.

6.2 Mechanical Tests

The carrier pane of the heated glass pane shall be tested in accordance with IS 6640.

6.3 Immersion in Water Tests

The heated glass pane shall be subjected to the following immersion in water tests subject to agreement between the purchaser and the manufacturer:

a) Insulation between sensing elements and one of the heater terminals;

b) Insulation between immersed electrodes and common terminal of sensing element; and

c) Insulation between immersed electrodes and one of the heater terminals.

6.4 Test Certification

The tests in **6.1**, **6.2** and **6.3** shall be duly certified (a model test certificate is given in Annex C).

7 MARKING

7.1 Heated glass panes, which meet the requirements of this standard, shall be marked with a single inverted equilateral triangle in accordance with IS 6640.

In addition, the following indications shall be added:

a) *Within the Triangle*—the total nominal thickness t_3 of the heated glass pane, in millimetres;

b) *Above the Triangle*—the power loading per square decimetre;

c) *The Left Side*—the voltage and the identification number; and

d) *The Right Side*—type of glass pane, Type A or Type B.

The marking shall be readable from the interior and shall be situated in a bottom corner of the glass pane.

Example

A glass pane of type A (two laminated panes) with a total thickness t_3 = 17mm, a power loading of 7W/dm² to 9 W/dm², and electrical supply of 220 V, 50 Hz, single-phase (identification number 13) shall be marked as follows:

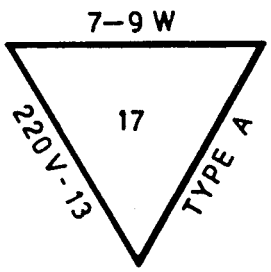


FIG. 6

Example

A glass pane of type B (three laminated panes) with a total thickness t_3 = 22 mm, a power loading for two heating elements of 12 to 15 W/dm², and electrical supply of 440V, 60 Hz, three-phase (identification number 38) shall be marked as follows:

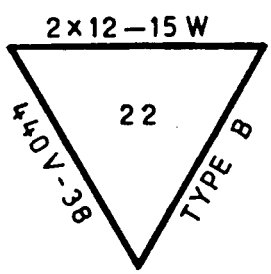


FIG. 7

7.2 BIS Certification Marking

The heated glass pane may also be marked with the Standard Mark.

7.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers, may be obtained from the Bureau of Indian Standards.

8 DESIGNATION

For reference and ordering purposes, heated glass panes conforming to this Standard shall be designated by indicating the following elements in the order given:

a) denomination (abbreviated): glass pane;
b) number of this standard IS;
c) type of glass composition: A or B (*see* 4.2);
d) number of window size, as specified in Table 2;
e) thickness t_1 of carrier pane, as specified in Table 3;
f) minimum power loading, in w/dm², as specified in Table 5;
g) overheating protection device: code-letter *S* or *G*; and
h) current rating given by the identification number as specified in Table 6.

Example

A heated glass pane, which meets the requirements of this Standard, composed of two glass panes (Type A), for window code No. 6 (nominal size 560 mm × 800 mm), with a carrier pane of glass thickness t_1 = 15 mm, minimum power loading 12 W/dm² (12W), with overheating protection device for single-regulation (*S*), for a.c. single phase supply, voltage 220V with a frequency of 60 Hz (identification No. 14), is designated as follows:

Glass pane IS 15266, A6 × 15–12WS–14.

ANNEX A

(*Foreword*, and *Clause* 4.2.1)

MAXIMUM ALLOWABLE PRESSURE FOR RECTANGULAR WINDOWS WITH STANDARDIZED DIMENSIONS

A-1 The maximum allowable pressure p to which rectangular windows in accordance with this standard may be subjected is given in Table 7.

Table 7 Maximum Allowable Pressure

Type	No.	Rectangular Window		Maximum Allowable Pressure
		Nominal Size mm × mm	Glass Thickness mm	kPa
E Heavy	1	300 × 425	10	99
	2	355 × 500	10	71
	3	400 × 560	12	80
	4	450 × 630	12	63
	5	500 × 710	15	80
	6	560 × 800	15	64
	7	900 × 630	19	81
	8	1 000 × 710	19	64
F Light	1	300 × 425	8	63
	2	355 × 500	8	45
	3	400 × 560	8	36
	4	450 × 630	8	28
	5	500 × 710	10	36
	6	560 × 800	10	28
	7	900 × 630	12	32
	8	1 000 × 710	12	25
	9	1 100 × 800	15	31

ANNEX B

(*Foreword*, and *Clause* 4.2.1)

MAXIMUM ALLOWABLE PRESSURE FOR RECTANGULAR WINDOWS WITH DEVIATING DIMENSIONS

B-1 For rectangular windows with non-standardized dimensions, the maximum allowable pressure, p, in kilopascals, shall be determined using the following equation:

$$p = \frac{40\,000t^2}{\beta b^2}$$

where

t = is the nominal thickness of the glass pane, in millimetres;

β = is the factor obtained from the graph in Fig. 8; and

b = is the minor dimension of the window, in millimetres.

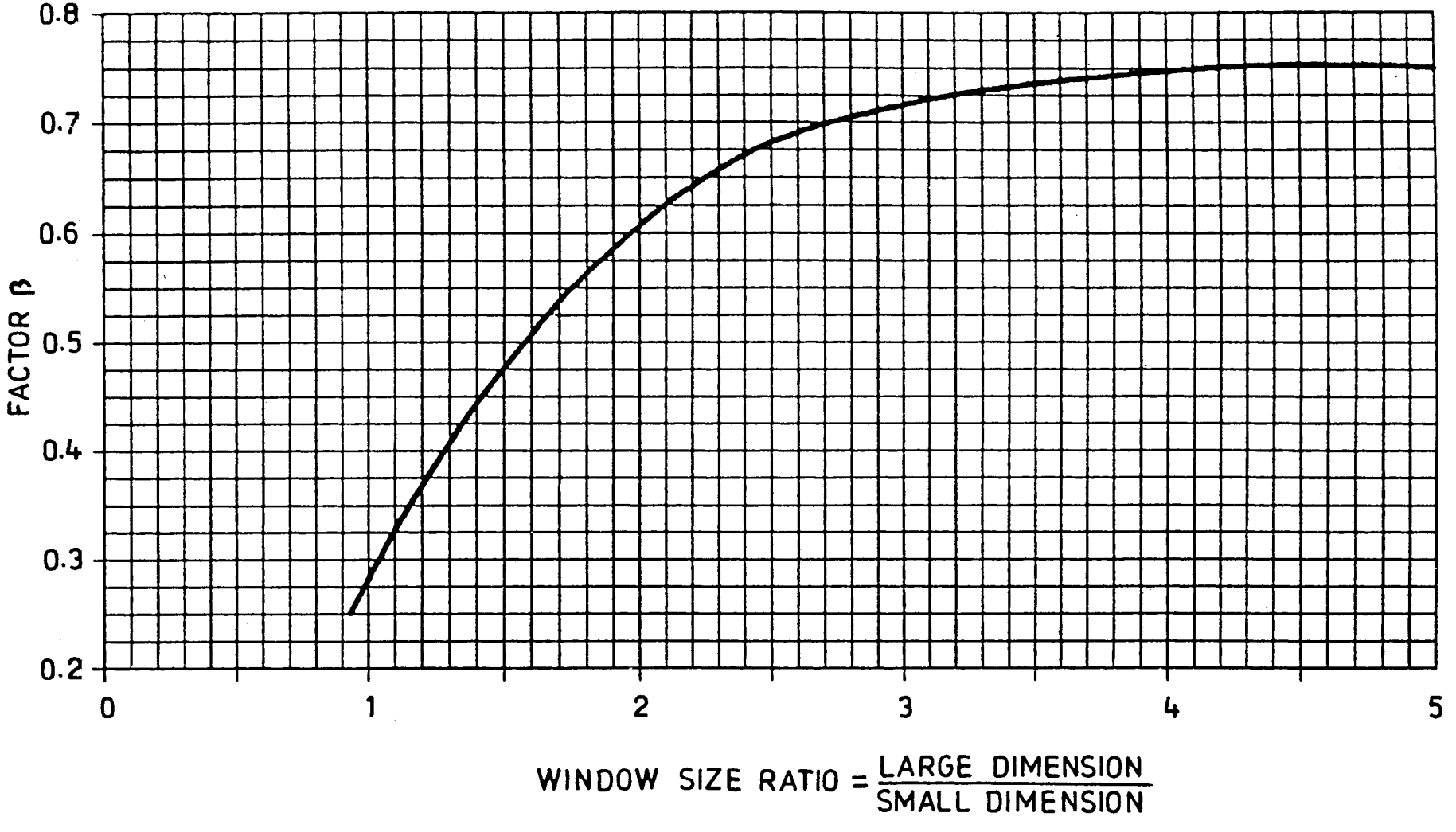


FIG. 8 CURVE FOR DETERMINATION OF FACTOR ß BASED ON WINDOW SIZE RATIO

ANNEX C (Informative)

(*Foreword,* and *Clause* 6.4)

MODEL TEST CERTIFICATE FORMAT

Manufacturer	Electrically Heated Bridge Windows	Inspection	Date	Name

TEST CERTIFICATE

Customer: Agent:
Contract number:
Order number:
Drawing number:
Date of manufacture:
Standard: IS 15266
Specification: Laminated semi-toughened glass

	Specified	Actual
Mechanical		
Size of Window		
Thickness		
Corner radius		
Number of panes		
Electrical		
Voltage		
Loading		
Size of heated area		
Resistance of sensing elements at 20°C		
Resistance of heating element		
Insulation between heating and sensing elements		
Immersion in Water		
Insulation between sensing elements and one of the heater terminals		
Insulation between immersed electrode and common terminal of sensing element		
Insulation between immersed electrode and one of the heater terminals		
Optical Tests		
Freedom from scratches		
Clear undistrorted vision		
Plastics film defects		
OBSERVATIONS:		

ANNEX D

(Foreword)

COMMITTEE COMPOSITION

Shipbuilding Sectional Committee,TED 17

Organization	*Representative(s)*
Shipping Corporation of India, Mumbai	SHRI K. K. PALIT (***Chairman***) SHRI B. N. ADVANI (*Alternate* I) SHRI N. K. CHUGH (*Alternate* II)
American Bureau of Shipping, Mumbai	SHRI MADAN LAL KOCHAR SHRI R. C. BAVNANI (*Alternate*)
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Oil & Natural Gas Commission, Dehra Dun	SHRI R. S. RAHATE
Small Shipyards Association, Mumbai	SHRI JAYWANT Y. CHOWGULE
The Institute of Marine Engineers (India), Mumbai	SHRI Y. N. INAMDAR
The Indian National Shipowners Association, Mumbai	SHRI Y. NATH
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Member Secretary
SHRI M. M. BANSAL
Joint Director (TED), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 323 01 31, 323 3375, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	323 76 17, 323 38 41
Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi KOLKATA 700054	337 84 99, 337 85 61 337 86 26, 337 91 20
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