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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.

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"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
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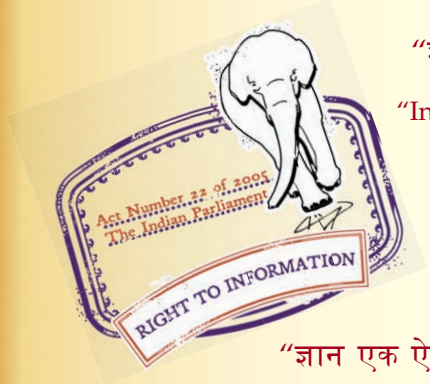
IS 2553-1 (1990): Safety Glass, Part 1: General Purpose
[CHD 10: Glassware]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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Indian Standard

SAFETY GLASS — SPECIFICATION

PART 1 GENERAL PURPOSE

(*Third Revision*)

First Reprint AUGUST 1991

UDC 666.155

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

June 1990

Price Group 4

FOREWORD

This Indian Standard (Part 1) (Third Revision) was adopted by the Bureau of Indian Standards on 15 April 1990, after the draft finalized by the Glassware Sectional Committee had been approved by the Chemical Division Council.

This standard was adopted from BS 857; 1954 'Specification for safety glass for land transport' in 1963 and was published as IS 2553:1964 (*revised*). During the second revision in 1971, optical requirements were added and nominal thickness and tolerance were modified in accordance with IS 2835 : 1977 'Specification for flat transparent sheet glass (*second revision*)'. To cater to the needs of the present land transport and of architectural and other uses, and subsequent to the revision of IS : 2835, the committee decided to further revise this standard in two parts : Part 1 dealing with general purposes, and Part 2 dealing with safety glass for land transport.

In this revision (Part 1) the use of float glass has been permitted. Warp and resistance to shock for toughened glasses have been included. To make the boil test more stringent, the sampling plan for the test has been modified. Spectrophotometric method has been introduced as an alternative method to the use of CIE Standard Illumination (A) for measuring visual transmission. Quartz glass mercury lamp of 750 ± 50 watt has been prescribed in place of Hanovia S 500 lamp as a source of ultra violet radiation in the light stability test. The procedure for fragmentation test has been modified. The uniformity test has been deleted as the quality of toughening is being tested in the subsequent fragmentation test and the points of impact have been marked in the fragmentation test. The nominal thickness of the laminated safety glass has been rationalized taking in view the thickness of the foil and the tolerance in the nominal thickness of the sheet glass. Dimensional tolerances on cut sizes (length and width) have been specified for both toughened and laminated safety glass. Marking clause has been modified. Sampling plan has also been modified.

Part 2 of this standard (under preparation) will cover the requirements for the safety glass for land transport. Till such time as Part 2 is published, the requirements as laid down in this standard along with the terminology and optical requirements as covered in **2** and **4.4** of IS 2553 : 1971 'Specification for safety glass (*second revision*)' shall be applicable for the safety glass including wind screen for land transport.

In preparing this standard assistance has been derived from:

a) JIS 3205 : 1983 Laminated glasses issued by Japanese Industrial Standard.

b) JIS 3206 : 1983 Tempered glasses issued by Japanese Industrial Standard.

c) BS 857 : 1967 Safety glass for land transport issued by British Standards Institution.

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.

AMENDMENT NO. 5 JANUARY 2006
TO
IS 2553 (PART 1) : 1990 SAFETY GLASS — SPECIFICATION

PART 1 GENERAL PURPOSE

(Third Revision)

(*First cover page. Title*) — Substitute the following for the existing title and wherever it appears subsequently:

SAFETY GLASS — SPECIFICATION

PART 1 ARCHITECTURAL, BUILDING AND RAILWAY USES

(Third Revision)'

(*Page* 1, *clause* **2**) — Substitute the following for the existing clause:

'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 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*
1382 : 1981	Glossary of terms relating to glass and glassware (*first revision*)
2835 : 1987	Specification for flat transparent sheet glass (*third revision*)'

(CHD 10)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 4 APRIL 2005
TO
IS 2553 (PART 1): 1990 SAFETY GLASS — SPECIFICATION
PART 1 GENERAL PURPOSE

(Third Revision)

[*Page* 1, *clause* **4**(a)] — Insert the word 'Sheet' in between the words Toughened' and 'Safety'.

[*Page* 1, *clause* **4**(c)] — Insert the word 'Sheet' in between the words 'Laminated' and 'Safety'.

(CHD 10)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 MARCH-2003
TO
IS 2553 (Part 1): 1990 SAFETY GLASS — SPECIFICATION

PART 1 GENERAL PURPOSE

(Third Revision)

(*Page* 1, *clause* **5.1.3.2** *alongwith Note*) — Substitute the following for the existing:

'**5.1.3.2** Toughened safety glass made from float glass shall not have cluster of defects more than those specified for 'AA' quality of sheet glass and toughened safety glass made from 'AA' or 'A' quality sheet glass shall not have cluster of defects more than those specified respectively for 'AA' or 'A' quality of sheet glass, as the case may be, in Table 2 A of IS 2835.'

(*Page* 3, *clause* **6.2**) — Insert the following after **6.2**(c):

'd) Name of the material used for interlayer.'

(*Amendment No,* 1) — Delete Note.

(CHD 10)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 JUNE 2001
TO
IS 2553 (PART 1) : 1990 SAFETY GLASS — SPECIFICATION

PART 1 GENERAL PURPOSE

(Third Revision)

(*Page* 6, *clause* **D-2**, *line* **4**) — Substitute 'beyond' *for* 'within'.

(*Page* 7. *clause* **E-2.1**, *line*9) — Substitute **'E-1.3'** *for* **'D-1.3'**.

(CHD 10)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 1 JANUARY 1993
TO
IS 2553 (Part 1) : 1990 SAFETY GLASS — SPECIFICATION

PART 1 GENERAL PURPOSE

(Third Revision)

(*Page 5, clause* **C-1.1**) — Insert the following Note at the end:

'NOTE — A Hanovia S-500 lamp suits the above specificaitons.'

(CHD 010)

Reprography Unit, BIS, New Delhi, India

Indian Standard

SAFETY GLASS — SPECIFICATION

PART 1 GENERAL PURPOSE

(*Third Revision)*

1 SCOPE

This standard (Part I) prescribes the requirements and the methods of sampling and test for safety glass meant for general purposes such as for use in glazing windows, doors of buildings and railway coaches.

2 REFERENCES

IS No.	*Title*
1382 : 1981	Glossary of terms relating to glass and gassware (*first revision*)
2835 : 1987	Specification for flat transparent sheet glass (*third revision*)

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 1382 : 1981, in addition to the following shall apply.

3.1.1 *Toughened Safety Glass*

A single piece of specially heat treated or chemically treated glass, with a stress pattern such that the piece when fractured reduces to numerous granular fragments, with no large jagged edges.

3.1.2 *Laminated Safety Glass*

Two or more pieces of glass held together by an interleaving layer or layers of plastic materials. The laminated safety glass will crack and break under sufficient impact, but the pieces of glass tend to adhere to the plastic and do not fly. If a hole is produced, the edges are likely to be less jagged than would be the case with ordinary glass.

3.1.3 *Central Area and Outer Area*

Area enclosed by an elipse or circle whose major or minor axes or diameter do not exceed 1/2 of length or width of the Safety Glass is considered as central area. The remaining area is considered as outer area.

4 TYPES

Safety glass shall be of four types as follows:

a) Toughened Safety (tempered) Glass (TS),

b) Toughened-Float Safety Glass (**TF**),

c) Laminated Safety Glass (**LS**), and

d) Laminated Float Safety Glass (**LF**).

5 REQUIREMENTS

5.1 General

5.1.1 *Material*

Safety glass shall be made of 'AA' and 'A' quality [*see* IS 2835 : 1987] from flat transparent glass.

NOTE — Safety glass may also be made from float glass, if agreed to between the manufacturer and the purchaser.

5.1.1.1 Safety glass may be flat or curved and tinted/coloured itself or by providing coloured interlayer(s), as agreed to between the manufacturer and the purchaser.

5.1.2 *Measurement of Thickness*

The thickness of safety glass shall be measured in accordance with the method prescribed in **5.1** and Annex B of IS 2835 : 1987.

5.13 *Distribution of Allowable Defects*

Safety glass made from AA or A quality sheet glass shall not have defects greater than those specified for AA or A quality of sheet glass as the case may be in Table 2 of IS 2835 : 1987.

NOTE — Safety glass made from float glass shall not have waviness more than 8 mm (refer IS 2835 : 1987, test for waviness) both in central and outer area and for other defects it shall not have more than those specified for AA quality of sheet glass of IS 2835 : 1987.

5.1.3.1 *Allowable cluster of defects*

5.1.3.2 Toughened safety glass made from AA or A quality sheet glass shall not have cluster of defects more than those specified for AA or A quality of sheet glass as the case may be in Table 2A of IS 2835 : 1987.

NOTE — Toughened safety glass made from float glass shall not have cluster of defects more than those specified for AA quality sheet glass in Table 2A of IS 2835 : 1987.

5.1.3.3 As the laminated safety glass contains two pieces or more of sheet glass, cluster of defects in the product made from AA or A quality of sheet glass or float glass as the case may be, shall be as agreed to between the purchaser and the manufacturer.

5.2 Requirements Specific to Toughened Safety Glass

5.2.1 *Thickness*

Toughened safety glass shall be of nominal thickness and range of thickness as specified in Table 1 of IS 2835 : 1987.

5.2.2 *Dimensional Tolerances on Cut Size* (*Length and Width*)

Tolerance on length and width of the toughened safety glass shall be in accordance with Table 1 of IS 2835 : 1987.

5.2.3 *Fragmentation Test*

It shall pass the fragmentation test as prescribed in Annex A.

5.2.4 *Warp*

It shall not exceed 0.5 percent for arc and 0.3 percent for wave pattern for flat glasses. It shall be measured by erecting the test specimen vertically and attaching a ruler there horizontally. The warp shall be indicated by the percent ratio of the height of arc to the length of chord for arch pattern and by the percent ratio of the height from bottom to top of the wave, to the distance from top to top (or from bottom to bottom) for wavy pattern. This test is meant for flat safety glass only.

5.2.5 *Resistance to Shock Test*

It shall pass the test for resistance to shock as prescribed in Annex B.

NOTE — This test shall apply to the toughened safety glasses having a thickness of 5.0 mm and above. For glasses having a thickness of less than 5.0 mm, adoption of the test and interpretation of the results shall be as agreed to between the purchaser and the manufacturer.

5.3 Requirement Specific to Laminated Safety Glass

5.3.1 *Thickness*

Laminated safety glass shall be of thickness as specified in Table 1.

5.3.1.1 If agreed between the purchaser and the supplier, nominal thickness of laminated safety glass, other than those specified in Table 1 may also be supplied. In such cases the range of thickness shall be those which are applicable to immediately lower thickness as specified in Table 1.

5.3.2 *Cut Sizes*

For matching the edges of laminates in laminated safety glass, the tolerance limit within which overlapping of edges shall be maintained shall not exceed ±1.5 mm, but overall dimensional tolerance on the cut sizes (length and width) shall be subjected to the limit specified in col **4** of Table 1.

5.3.3 *Light Stability Test*

Laminated safety glass shall pass the requirements of light stability test as prescribed in Annex C.

Table 1 Nominal Thickness, Range of Thickness, Dimensional Tolerance on Length and Width of Laminated Safety Glass
(*Clauses* 5.3.1, 5.3.1.1 *and* 5.3.2)

SI No.	Nominal Thickness	Range of Thickness	Dimensional Tolerance on Cut Size (Length and Width)
(1)	(2)	(3)	(4)
	mm	mm	mm
i)	3.5	3.1 to 3.7	2.5
ii)	4.0	4.0 to 4.8	2.5
iii)	5.0	5.0 to 5.8	2.5
iv)	6.0	6.0 to 6.8	2.5
v)	8.0	8.0 to 8.8	3.0
vi)	10.0	9.8 to 11.0	3.5

5.3.4 *Boil Test*

Laminated safety glass shall pass the requirements of boil test as prescribed in Annex D.

5.3.5 *Fracture and Adhesion Test*

Laminated safety glass shall pass the requirements of fracture and adhesion test as prescribed in Annex E.

6 PACKING AND MARKING

6.1 Packing

Safety glass shall be packed as agreed to between the manufacturer and the purchaser.

6.1.1 The packet shall be marked with the following information:

a) Indication of the source of manufacture,
b) Nominal thickness of glass,
c) Code or batch number,
d) Month and year of manufacture, and
e) Type of glass.

6.2 Marking

Each piece of safety glass shall be marked indelibly and distinctly with the following information:

a) In the case of toughened safety glass, it shall be marked either with the letter 'TSA' for toughened sheet of A quality or 'TSAA' for toughened sheet of AA quality or 'TF' for toughened float quality:

b) In the case of laminated safety glass, it shall be marked either with the letter 'LSA' for laminated sheet of A quality or 'LSAA' for laminated sheet of AA quality or 'LF' for laminated float quality; and

c) Indication of the source of manufacture.

7 SAMPLING

7.1 Representative samples of the material shall be drawn as prescribed in Annex F.

ANNEX A
(*Clause* 5.2.3)

FRAGMENTATION TEST

A-0 PRINCIPLE

Toughened glass is broken by giving it a sudden punch and number of broken particles per unit area are counted.

A-1 PROCEDURE

A-1.1 Three glasses from each lot having the same thickness are to be tested for this purpose. The specimen shall be supported as far as possible over its whole area, means being provided to prevent any substantial spreading of the fragments (*see* Note). The three glasses shall be broken by means of a centre punch of 0.2 ± 0.05 mm in radius of curvature at its tip by giving a severe blow to cause fracture, the points of impact shall be as specified in Fig. 1

NOTES

1 In case glass has tong mark, either of the points 1 and 3 of Fig. 1 shall be on the tong mark side.

2 In case of a flat glass, the specimen may be laid on any convenient flat surface and spreading of the particles prevented by a loose wooden frame. In the case of curved glass, the specimen may be wrapped in a sheet of paper, and sealed in such a manner that the package may be readily opened from one side and placed for breaking on a suitable supporting frame.

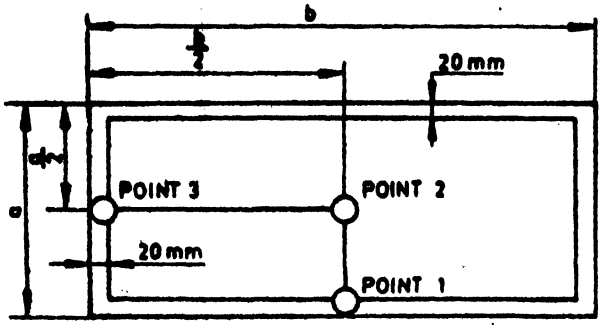


FIG. 1 POINTS OF IMPACT FOR FRAGMENTATION TEST

A-1.2 The particle count determination on any one piece of glass sheet shall be completed within 3 minutes of the fracture of that glass. No magnifyins lense or other aid to vision (except spectacles if normally worn) shall be used when making the particle count as described below.

A-1.3 When broken as described above, the particles in a square of side 5 cm shall be counted. A fragment on the side line of the square, shall be counted as half. The particle count shall be made in the region of coarsest fracture excluding the areas, within 20 mm from the periphery of the glass and within 75 mm in radius from the point of impact.

A-2 INTERPRETATION OF RESULTS

A-2.1 Glasses up to 4.0 mm Thickness

The material shall be taken as having satisfied the requirement of the test if:

a) there are not more than 400 and not less than 40 particles in a square of side 5 cm in the coarsest area as defined in **A.1.3**; and

b) if the count is between the limits of less than 40 but not less than 30 per 25 cm^2, the count in the embracing square of side 10 cm shall be not less than 160 particles.

A-2 2 Glasses Above 4.0 mm Thickness

The material shall be taken as having satisfied the Requirement of the test if:

a) there are not more than 400 particles and not less than 60 particles in a square of side 5 cm in the coarsest area as defined in **A-1.3**; and

b) if the count is between the limits of less than 60 but not less than 40 per 25 cm^2 the count in the embracing square of side 10 cm is not less than 240 particles.

A-2.1 If the fragmentation of any glass proves to be unsatisfactory, three additional glasses shall be taken from the lot, and the test repeated.

ANNEX B
(*Clause* 5.2.5)

RESISTANCE TO SHOCK TEST

B-0 PRINCIPLE

The toughened safety glass is given a sudden shock with a smooth surface steel ball of 63.5 mm in diameter from a height of 100 cm.

B-1 APPARATUS

B-1.1 A steel ball of about 63.5 mm in diameter and weighing 1 040 ± 2 g with smooth surface.

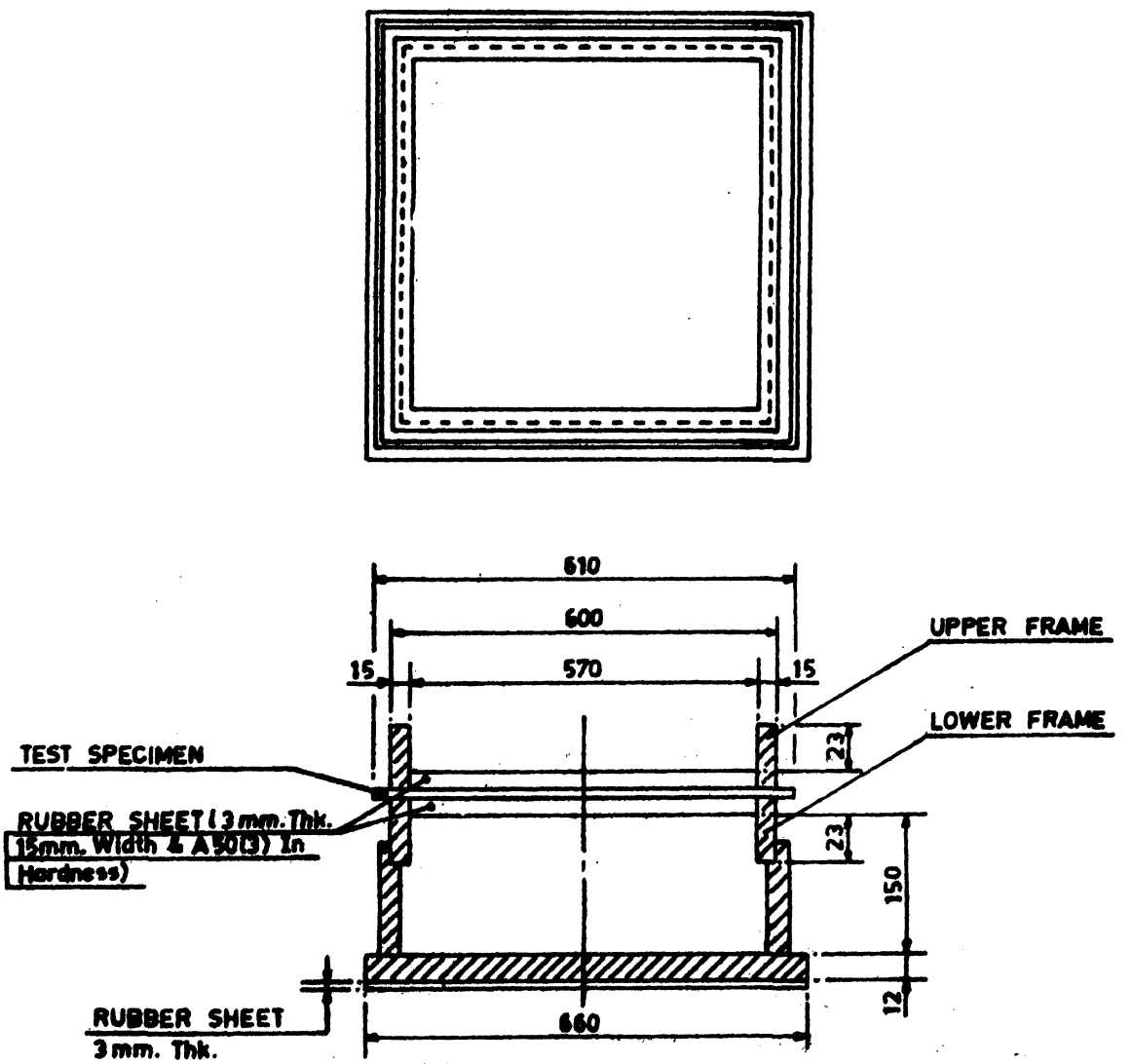
B-1.2 Test Specimen

The test specimens for use in this test shall be tempered glasses of flat or near flat of about 610 × 610 mm square having the same thickness manufactured by a method similar to the method for the product.

B-1 3 Testing Frame

The test specimen shall be supported with an iron frame of the type shown in Fig. 2 so that it becomes horizontal. An auxiliary frame may be used for curved glasses, if necessary.

B-1.4 A means for dropping the ball freely from a height of 100 cm so as to strike the specimen withm 25 mm from its centre is required. An



All dimensions in millimetres.

FIG. 2 FRAME FOR RESISTANCE TO SHOCK TEST

electro-magnet may conveniently be used for this purpose.

B-2 PROCEDURE

B-2.1 Place the test specimen on testing frame. The steel ball is placed at a height of 100 cm from the surface, allowed to fall towards the centre of the surface of the test specimen from standstill state without any force applied. The presence of breaking is observed.

B-2.2 The number of impact per test specimen shall be limited to one time and the test shall be carried out at ordinary temperature.

B-2.3 Five specimens are to be tested for this test.

NOTE — For toughened safety glasses made of figured glasses as material, the impact surface shall be the surface having no pattern.

B-3 INTERPRETATION OF RESULTS

The product shall be accepted when not more than one sheet is broken and rejected when 3 or more sheets of them are broken. When 2 sheets are broken, another sample of 5 sheets shall be tested and the lot accepted if all the 5 sheets pass the test.

ANNEX C
(*Clause* 5.3.3)

LIGHT STABILITY TEST

C-0 GENERAL

The purpose of this test is to ensure that laminated safety glass is resistant to the effects of exposure to light encountered in service.

C-1 APPARATUS

C-1.1 A Source of Ultra Violet Radiations

A radiation source consisting of a medium pressure mercury vapour arc lamp with a tubular quartz bulb of ozone-free type; the bulb axis shall be vertical. The nominal dimensions of the lamp shall be 360 mm in length and 9.5 mm in diameter. The arc length shall be 300 ± 14 mm. The lamp shall be operated at 750 ± 50 W. Any other source of radiation which produces the same effect as the lamp specified above may be used. To ensure that the effects of another source are the same, a comparison shall be made by measuring the amount of energy emitted within a wavelength range of 300 nm to 400 nm, all other wavelengths being removed by the use of suitable fihers.

C-1.2 Visual Transmission Apparatus

C-1.2.1 *CIE Standard Illuminant* (*A*)

A gas filled incandescent lamp with colour temperature of 2 854 ± 50°K is suitable.

C-1.2.2 *Alternate to CIE Standard Illuminant* (*A*)

Spectrophotometer covering the wavelength from 380 to 770 nm.

C-1.2.3 *Equipment for Measuring Visual Transmission*

C-1.2.3.1 *Visual transmission measurement using standard illuminant*

Measure the transmitted light beam and the incident light beam of the specimen. Express the ratio of the two values in percent, and take it as the 'visible light transmission'.

C-1.2.3.2 *Visual transmission measurement using spectrophotometer*

Measure the light transmission of the specimen covering the wavelength from 380 to 770 nm at an interval of 10 nm using a suitable spectrophotometer and express the value of tristimulus *Y* m percent under the standard illuminant (A) which shall be taken as the visible light transmission. Value for *Y* under standard illuminant (A) is to be calculated as follows:

$$Y = \Sigma P_\lambda T_\lambda \bar{Y}_\lambda$$

where

T_λ = spectral transmission of glass at each wavelength.

P_λ = spectral energy distribution of the incident light at each wavelength.

??? = distribution co-efficient defined by CIE.

The standard value of $P\bar{Y}_\lambda$ at each wavelength from 380 to 770 nm at an interval of 10 nm under standard illuminant (A) is given below. The light transmission is the ratio of Y tristimulus of the light transmitted by the glass and that of the illuminant alone,

$$\text{Light transmission} = \frac{\Sigma T_\lambda P_\lambda \bar{Y}_\lambda}{P_\lambda \bar{Y}_\lambda}$$

Wavelength in nm	*Standard Value of* $P_\lambda \bar{Y}_\lambda$ *under Standard Illuminated 'A'*	*Wavelength in nm*	*Standard value* $P_\lambda \bar{Y}_\lambda$ *under Standard Illuminated 'A'*
380	0.000 0	580	9.225 7
390	0.000 1	590	8.543 0
400	0.000 5	600	7.546 0
410	0.001 9	610	6.359 9
420	0.008 0	620	5.064 9
430	0.026 5	630	3.712 2
440	0.060 9	640	2.558 7
450	0116 7	650	1.638 9
460	0.209 8	660	0.970 6
470	0.362 4	670	0.532 7
480	0.619 8	680	0.289 6
490	1.039 3	690	0.146 7
500	1.795 6	700	0.074 4
510	3.084 9	710	0.039 8
520	4.761 4	720	0.019 5
530	6.323 0	730	0.010 0
540	7.598 5	740	0.006 2
550	8.570 7	750	0.002 1
560	9.220 1	760	0.001 1
570	9.457 4	770	0.000 0

C-2 PROCEDURE

Take three specimens measuring 300 × 300 mm (*see* **C-2.1**) and determine their visual transmission.

Next place the specimens at a distance of 23 cm from the source of ultra violet radiation. Expose the specimens to ultra violet radiation for a period of 100 hours, maintaining a temperature between 38°C and 49°C throughout the test. After the exposure again test the irradiated specimen, for visual transmission as before.

NOTE — All the three irradiated specimens shall be retained for boil test.

C-2.1 Interpretation of Results

C-2.1.1 The specimens shall be considered to have passed the requirements of the test if the following criteria are satisfied:

a) After the irradiation remarkable discolouration (judged against a white background), blister and turbidity detrimental to service shall not appear.

b) After irradiation, reduction ratio of transmission for colourless laminated safety glass should be not more than 10 percent of the original transmission.

NOTE — For laminated safety glass using tinted foil, the transmission after irradiation may be higher or lower than original transmission by 10 percent.

The reduction ratio (l) shall be calculated from the following formula:

$$\text{Reduction ratio } (l), \text{ percent} = \frac{a-b}{a} \times 100$$

where

a = transmittance (visible) before UV irradiation, and

b = transmittance (visible) after U V irradiation.

ANNEX D
(*Clause* 5.3 4)

BOIL TEST

D-1 PROCEDURE

Immerse all the three irradiated specimens (*see* **C-2** Note) from light stability test, vertically on the edge first in water at 65 ± 2°C for three minutes and then immediately in boiling water for two hours and then removed.

NOTE — The specimens shall be kept in the vessel of boiling water in such a way as not to touch the bottom of the testing vessel directly. A suitable arrangement may be used.

D-2 INTERPRETATION OF THE RESULTS

Upon immersing the specimens in boiling water for two hours, the glass itself may crack but neither bubbles nor any other defects shall be found within 15 mm from the edges or beyond 10 mm from the cracks. When the specunens have been from bigger pieces, 25 nun from the new edge will be cheeked.

NOTE — Any specimen in which the glass cracks to such an extent as to confuse the results, shall be discarded without prejudice and the test repeated on another specimen after irradiation.

ANNEX E
(*Clause* 5.3.5)

FRACTURE AND ADHESION TEST

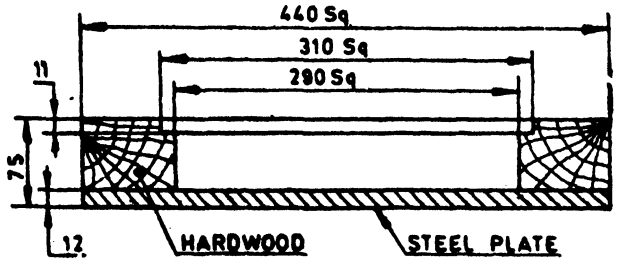
E-0 PRINCIPLE

The laminated safety glass is given a sudden punch and fragments from the under surface are collected and weighed.

E-1 APPARATUS

E-1.1 A hardened steel ball with a diameter of 38 mm and weighing about 225 g shall be used for the test.

E-1.2 A square hard wood frame having dimensions approximating to those shown in Fig. 3 so constructed that when the test specimen rests symmetrically on the frame, 290 × 290 mm of the specimen shall remain unsupported. The frame shall be rigidly mounted on 12 mm steel plate, the screws or bolts used for attaching it to the steel plate shall not project below the undersurface of the plate. The complete frame shall stand upon a substantial concrete bed.



All dimensions in millimetres.

FIG. 3 FRAME FOR FRACTURE AND ADHESION TEST

E-1.3 A means for dropping the ball freely from a height of 4.88 m so as to strike the specimen within 25 mm from its centre. An electro-magnet may conveniently be used for this purpose.

E-2 PROCEDURE

E-2.1 Ten specimens of 300 × 300 mm *(see* 7) shall be tested. Prior to test, each specimen shall be weighed. Keep the specimen at 27 ± 2°C for 4 hours immediately preceding the test. Each specimen in turn shall be supported on the wooden frame in such a way that the plane of the test specimen when in the frame shall be substantially horizontal. The ball shall be dropped as stipulated in **D-1.3.** The fragments from the undersurface of each specimen shall be separately collected and weighed.

E-2.2 If out of 10 specimens so tested, the number of specimens shown to be pierced in the test does not exceed four of which not more than two are brittle, and if the total of the fragments from under side of the unpierced specimens does not exceed 0.5 percent of the total weight of these unpierced specimens, and if no unpierced specimen yield, any fragment which individually weighs more than 0.5 g, the consignment shall be deemed to have passed the test.

NOTE — The specimen will be deemed to have been pierced if the split or tear exceeding 38 mm in length develops in the interlayer. A pierced specimen shall be deemed to be brittle if it breaks into two or more large pieces or if the fracture is sufficient to allow the ball to pass through.

ANNEX F
(*Clause* 7.1)

SAMPLING OF SAFETY GLASS

F-1 TOUGHENED SAFETY GLASS

F-1.1 All the toughened safety glasses of the same nominal thickness and substantially equal in size or similar in shape shall be grouped together and constitute a lot. Sample shall be tested from each lot to determine its conformity to the requirements of this specification.

F-4.2 Five percent but not less than five toughened safety glasses shall be selected at random from each lot.

F-1.3 Each of the glasses selected under **F-1.2** shall be inspected for dimensional tolerance (**5.2.2**) thickness (*see* **5.2.1**), distribution of allowable defects (*see* **5.1.3**), allowable cluster of defects (*see* **5.1.3.1**) and warp (*see* **5.2.4**) resistance to stock test (*see* **5.2.5**) and shall satisfy these requirements individually.

F-1.4 Three glasses from each lot (as selected under **F-1.2**) shall be tested for fragmentation (*see* **5.2.3**). No failure shall occur in any of the three test samples if the lot is to be accepted.

F-2 LAMINATED SAFETY GLASS

F-2.1 For all the laminated safety glasses of the same nominal thickness manufactured by the same method under similar conditions, two lots shall be constituted as follows:

Lot (1) : Up to area 0.66 sqm

Lot (2) : Above area 0.66 sqm

F-2.2 Draw by random selection, minimum number of sheets from each lot, separately, so that thirteen samples of 300 × 300 mm may be taken out Mark the glasses (1) and (2) to identify the lots.

NOTE — No one single lot would be bigger than 500 sqm Bigger lots would be divided in lots of 500 sqm (and part thereof).

F-2.3 Each of the pieces as selected in **F-2.2** shall be inspected for dimensional tolerance (**5.2.2**) thickness (*see* **5.3.1**), distribution of allowable defects (*see* **5.1.3**) and allowable cluster of defects (*see* **5.1.3.1**) and shall satisfy the requirements individually.

F-2.4 Three out of thirteen specimens (*see* **F-2.2**) from each lot shall be inspected for light stability test (*see* **5.3.3**) and boil test (*see* **5.3.4** and **C-2** Note) and ten specimens shall undergo fracture and adhesion test (*see* **5.3.5**). No failure shall occur in any of the thirteen test samples if the lot is to be accepted.

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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 Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. 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.

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Regional Offices :	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110001	331 01 31 331 13 75
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