*भारतीय मानक* **IS 18649 : 2024**

***Indian Standard***

# दरवाजे, खिड़कियाँ और स्लाइडर्स के लिए वर्गीकरण और कार्यकारिता अपेक्षाएँ — विशिष्टि

# Classification and Performance Requirements for Doors Windows and Sliders — Specification

ICS 91.060.50



भारतीय मानक ब्यूरो
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**April 2024** **Price Group 11**

Doors, Windows and Shutter Sectional Committee, CED 11

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Doors, Windows and Shutters Sectional Committee had been approved by the Civil Engineering Division Council.

Classification of any door, window or slider is very important in terms of their desired uses, as these classification links with performance parameters like air infiltration/exfiltration, water tightness, operating force, durability, mass, corrosion, thermal, acoustic, impact resistance, mechanical strength, etc. Standardization of the classification and performance requirements for framed doors, windows and sliders either manufactured from aluminium or uPVC is required to help the relevant professionals for arriving at decision in the installation of any type of doors, windows, and sliders.

This standard is therefore formulated to specify the classification and performance requirements of whole units of framed doors, windows and sliders made from aluminium alloy and uPVC. The whole unit includes constituent materials and glazing.

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

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 : 2022 'Rules for rounding off numerical values (*second revision*)'. 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*

# CLASSIFICATION AND PERFORMANCE REQUIREMENTS FOR DOORS, WINDOWS AND SLIDERS — SPECIFICATION

## 1 SCOPE

**1.1** This standard specifies the classification and performance requirements of whole units of doors, windows and sliders made from aluminium alloy and uPVC. The whole unit includes constituent materials and glazing. Based upon the application, the doors, windows and sliders may be non-insulated or thermally insulated.

**1.2** This standard does not apply to:

a) Windows and doors subject to regulations on smoke leakage and resistance to fire;

b) Curtain walls;

c) Industrial, commercial and garage doors;

d) Revolving doors;

e) Internal partitions including internal windows, doors and sliders; and

f) Bullet and blast resistance.

## 2 REFRENCES

The standards listed in Annex A contain provisions, which through references 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 edition of these standards.

## 3 TERMINOLGY

For the purpose of this standard, the following definitions shall apply.

**3.1 Air Permeability** — The property of a closed window to let air pass when it is subjected to a differential pressure. Air permeability is characterized by a flow of air, in standard conditions, expressed in cubic meters per hour as a function of the temperature and pressure. This flow rate is expressed in cubic meter per hour as a function of total surface area of the window or flow rate per meter with respect to crack length of the window.

**3.2 Bite** — The minimum distance by which the inner edge of a frame (or a stop) the edge of the glass panel.

**3.2.1** *Glazing Bite* — The dimension by which the framing system overlaps the edge of the glazing infill.

**3.2.2** *Structural Sealant Bite* — Structural bite is the minimum width or contact surface of the silicone sealant on both the infill material and the frame.

**3.3 Casement (Operable)** — Framed window which is hinged or pivoted.

**3.4 Coupled Window** — Window where casements in at least two levels are operated by one-action, but can be disconnected for specific purposes such as maintenance or cleaning.

**3.5 Design Pressure** — It is the applicable load per unit area on the window taking into consideration the various parameters as per IS 875 (Part 3).

**3.6 Double Window** — Window with casements in at least two layers that operate independently.

**3.7 Frame** — Non movable or fixed portion of the window attached to the wall and to which the sash is assembled.

**3.8 Frontal Deflection** — Maximum frontal displacement of a frame member minus half the sum of the frontal displacements at each end of the member.

**3.9 Frontal Displacement** — Movement of a point on a frame member measured normal to the component.

**3.10 Glazing Bead** — Profile which holds the glass or any other partition material.

**3.11 Length of Opening Joint (Crack Length)** — Length of the line of discontinuity as defined in opening joint. The actual length of gaskets or seals fitted into the underlying profiles of the components or joints of components built into opening parts are not relevant.

**3.12 Mullion** — Profile used within the frame, vertically, in a frame and/or sash.

**3.13 Opening Joint** — Line of discontinuity between either a frame and its matched component or two components which can be opened by means

of their building hardware. This discontinuity is as seen from the opening face of the test specimen.

**3.14 Overall Area** — Area of the test specimen measured parallel to the glazing or the leaf.

**3.15 Permanent Deformation** — The displacement or change in dimension of the specimen after the applied load has been removed and the specimen has relaxed for the specified period of time.

**3.16 Reinforcement** — Material added to individual sash or frame members to increase strength and/or stiffness.

**3.17 Relative Frontal Deflection** — Frontal deflection of a frame member divided by the length of the member over which the frontal deflection was measured, example distance between the ends of the member.

**3.18 Sash** — Movable part in a window/door.

**3.19 Sliding Window/Door** — Framed window/door in which the sash slides either vertically or horizontally are on a track.

**3.20 Standard Laboratory Conditions** — Ambient temperature of 27 °C ± 2 °C and a relative humidity of 65 percent ± 5 percent.

**3.21 Tack-Free Time** — The duration of time from when the sealant was first applied and tooled into the template until the time the sealant is no longer picked up by the film is called tack-free time.

**3.22 Test Pressure (Positive)** — When static air pressure differential between the outside face of the specimen and the back face of the specimen is higher, then a positive pressure differential is considered to be applied on the specimen.

**3.23 Test Pressure (Negative)** — When static air pressure differential between the outside face of the specimen and the back face of the specimen is lower, then a negative pressure differential is considered to be applied on the specimen.

**3.24 Thermal Barrier Profile** — Profile composed of two or more metal sections connected by at least one connected by thermally insulating (non-metallic) part.

NOTES

**1** The thermal barrier contributes to load transmission.

**2** The thermal barrier can be continuous or in parts.

**3.23 Transom** — Profile used within the frame, horizontally, in a frame and/or sash.

**3.24 Water Penetration** — Penetration of water beyond the vertical plane intersecting the innermost projection of the test specimen, not including interior trim and hardware, under the specified conditions of air pressure difference across the specimen.

**3.25 Water Tightness** — Ability of the closed test specimen to resist water penetration.

**3.26 Weather Pile Strip** — Strip designed to reduce air infiltration and water penetration.

**3.27 Wind Load Resistance** — The ability of a window, door or slider to resist the structural effects of differential air pressure. Resistance is usually determined relative to a design pressure derived from IS 875 (Part 3) or wind tunnel report or computational fluid dynamics analysis.

NOTE — This standard requires the wind load resistance to be measured at design pressure and also requires that the specimen be tested a second time at 150 percent of design pressure, which is defined as the safety/proof test pressure.

## 4 TYPES AND HANDING

### 4.1 Type of Windows

a) Fixed type (FW);

b) Hinged type:

   1) Side-hung (SHW) (also known as casement window);

   2) Bottom-hung (BHW);

   3) Top-hung (THW); and

   4) Tilt and turn (TTW).

c) Pivoted type:

   1) Horizontal (HPW); and

   2) Vertical (VPW).

d) Parallel opening (POW); and

e) Sliding type:

   1) Horizontal (HSW); and

   2) Vertical (VSW).

NOTES

**1** Hinged and pivoted windows may be inside or outside opening.

**2** Windows can be single or multi light, left hand or right-hand opening.

**3** For side hung windows and doors and bottom hung windows, the designations shall have a suffix of "-OO'' for open-out and "-OI" for open in types.

### 4.2 Types of Doors

a) Single sash:

1) Single-swing hinged door (SSHD);
2) Double-swing hinged door (SDHD);
3) Single-swing pivoted door (SSPD); and
4) Double-swing pivoted door (SDPD).

b) Double sash:

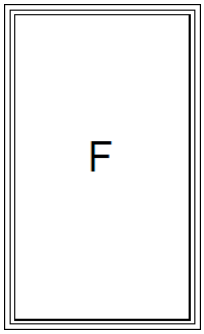
1) Single-swing hinged door (DSHD);
2) Double-swing hinged door (DDHD);
3) Single-swing pivoted door (DSPD); and
4) Double-swing pivoted door (DDPD).

c) Sliding doors (SD) including tilt and slide (TS), lift and slide (LS) and shift and slide (SS); and

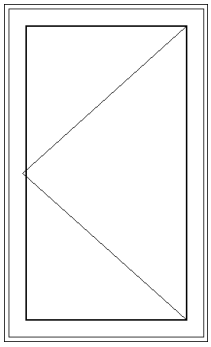
d) Sliding folding doors (SFD).

NOTE — Single-swing or double-swing hinged or pivoted doors may be with or without side lights and top lights.

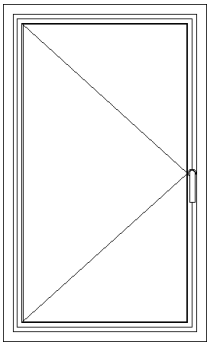
**4.3** Symbolic designations of various types of windows and doors are given in Fig. 1 and Fig. 2 respectively.




FIXED TYPE (FW)

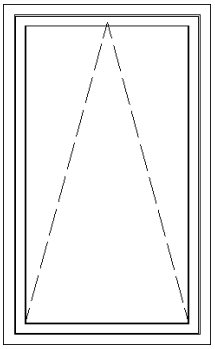


VIEW FROM OUTSIDE

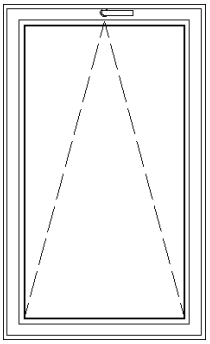


VIEW FROM INSIDE

SIDE-HUNG (SHW)

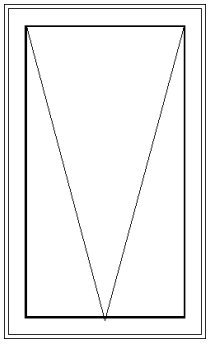


VIEW FROM OUTSIDE

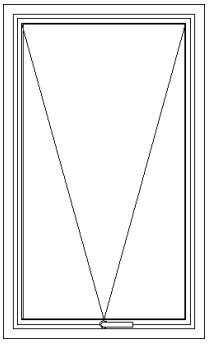


VIEW FROM INSIDE

BOTTOM-HUNG (BHW)

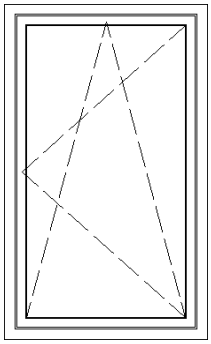


VIEW FROM OUTSIDE

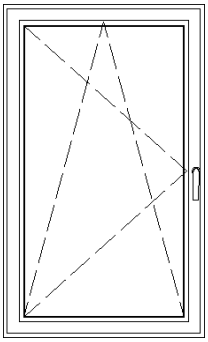


VIEW FROM INSIDE

TOP-HUNG (THW)

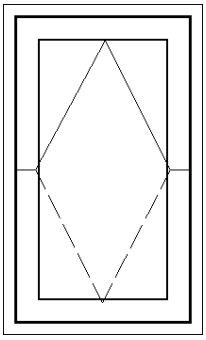


VIEW FROM OUTSIDE

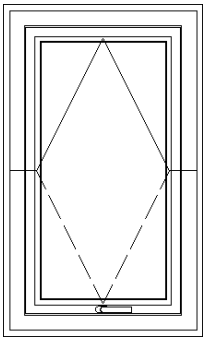


VIEW FROM INSIDE

TILT AND TURN (TTW)

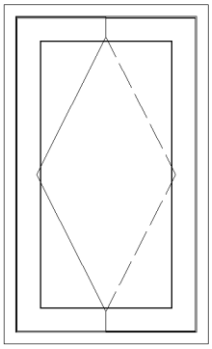


VIEW FROM OUTSIDE

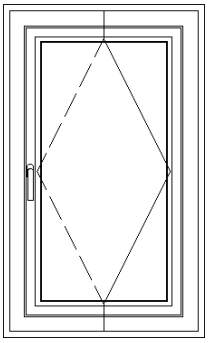


VIEW FROM INSIDE

HORIZONTAL (HPW)

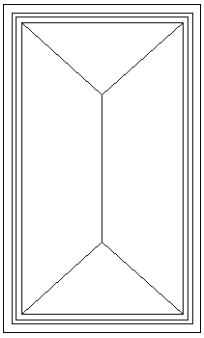


VIEW FROM OUTSIDE

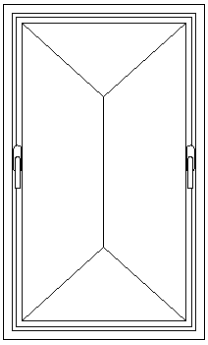


VIEW FROM INSIDE

VERTICAL (VPW)

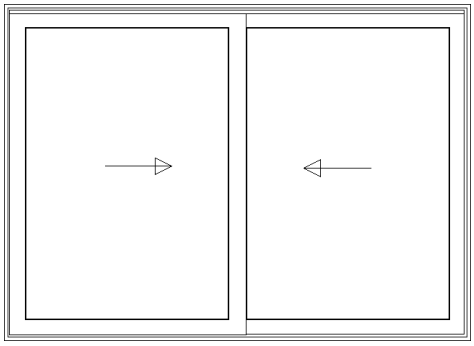


VIEW FROM OUTSIDE

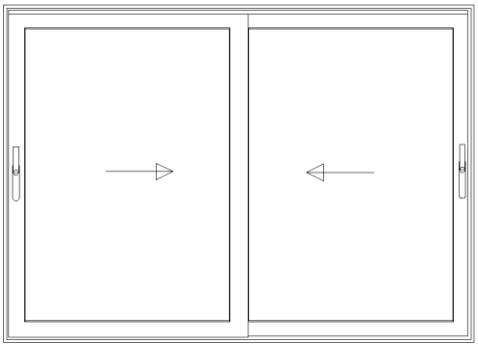


VIEW FROM INSIDE

PARALLEL OPENING (POW)

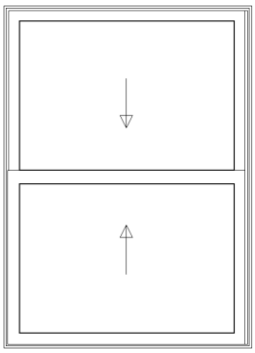


VIEW FROM OUTSIDE

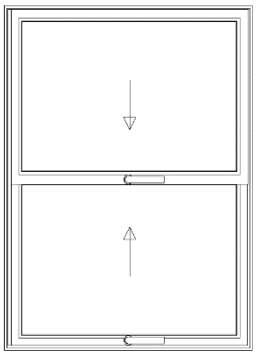


VIEW FROM INSIDE

HORIZONTAL (HSW)



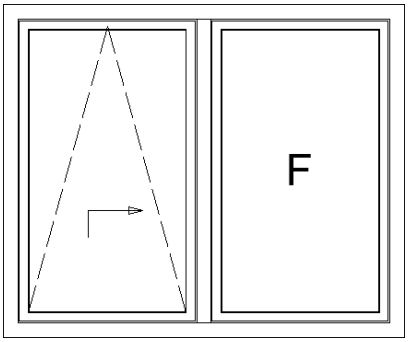
VIEW FROM OUTSIDE



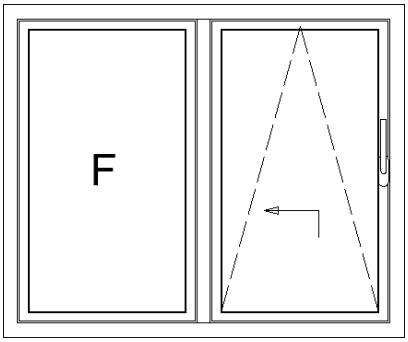
VIEW FROM INSIDE

VERTICAL (VSW)

FIG. 1 SYMBOLIC DESIGNATIONS OF WINDOWS

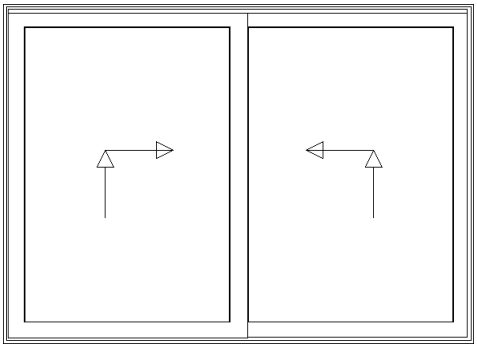



VIEW FROM OUTSIDE

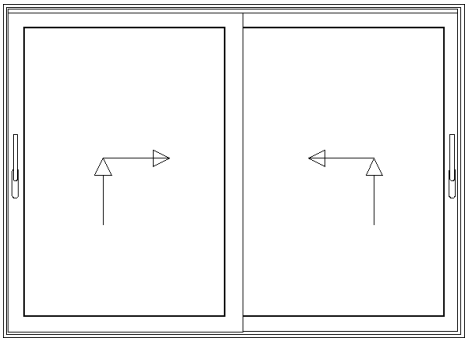



View from Inside

TILT AND SLIDE DOOR (NO. OF SASH AND CONFIGURATION MAY VARY)

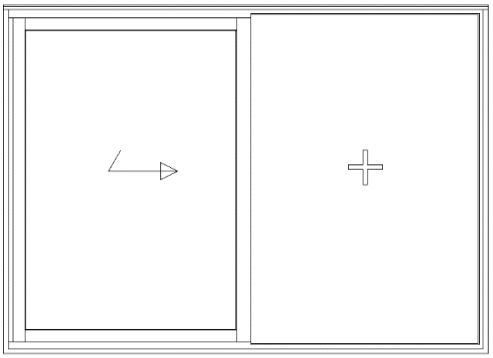


VIEW FROM OUTSIDE

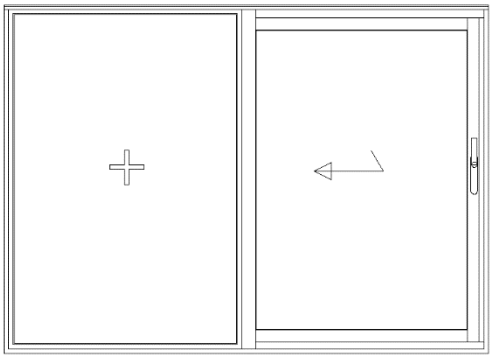


VIEW FROM INSIDE

LIFT AND SLIDE DOOR (NO. OF SASH AND CONFIGURATION MAY VARY)

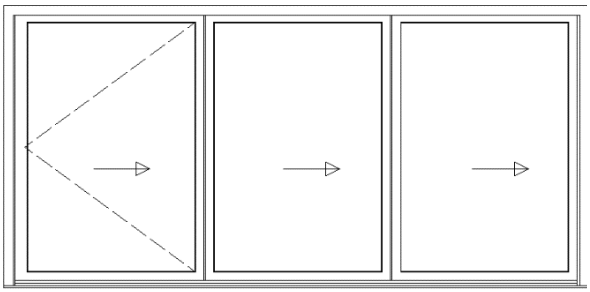


VIEW FROM OUTSIDE

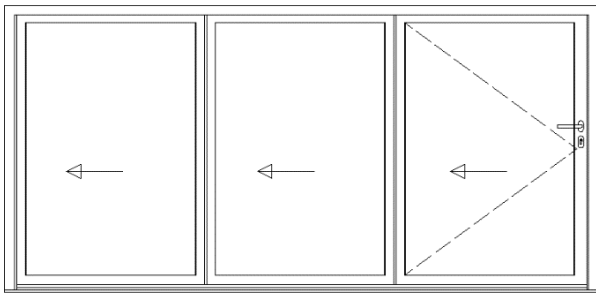


VIEW FROM INSIDE

SHIFT AND SLIDE DOOR (NO. OF SASH AND CONFIGURATION MAY VARY)

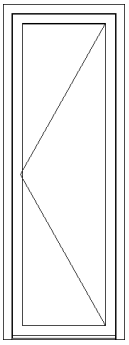


VIEW FROM OUTSIDE

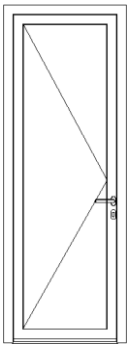


VIEW FROM INSIDE

SLIDING FOLDING DOOR (NO OF SASH AND CONFIGURATION MAY VARY)

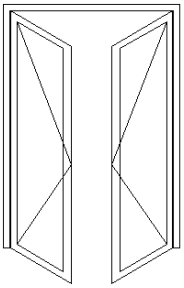


VIEW FROM OUTSIDE

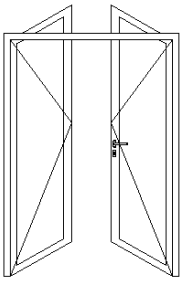


VIEW FROM INSIDE

SINGLE LEAF DOOR OPEN OUT (OPEN IN WITH DASHED LINE)



VIEW FROM OUTSIDE



VIEW FROM INSIDE

DOUBLE LEAF DOOR OPEN OUT (OPEN IN WITH DASHED LINE)

FIG. 2 SYMBOLIC DESIGNATIONS OF DOORS

### 4.4 Handing

#### 4.4.1 *Left Hand Opening*

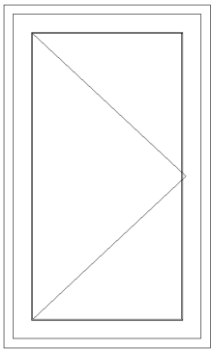
Any window or door which opens inside or outside and has hinge located on the left side when viewed from outside on plan. For projected side hung window, when viewed from inside the location of the handle on the jamb shall determine the handing.

#### 4.4.2 *Right Hand Opening*

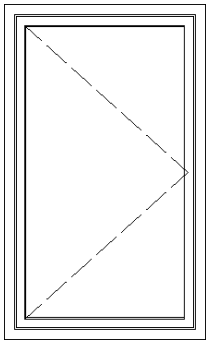
Any window or door which opens inside or outside and has hinge located on the right side when viewed from outside.

The opening (inside/outside) symbolic representation may be as given in Fig. 3. The pointed side always represents the opposite side of the hinge.

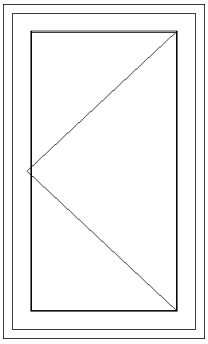
Vertically pivoted casement windows shall be handed according to the position of the pivots in relation to the open-out portion, and the proportion opening outwards shall be stated. Default representation shall be as viewed from outside, unless or otherwise explicitly stated.



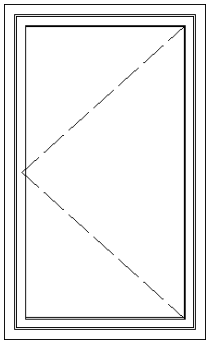
LH OUTWARD OPENING



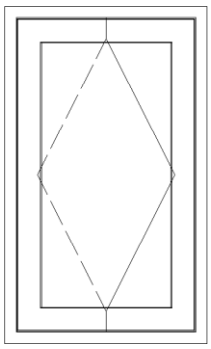
LH INWARD OPENING



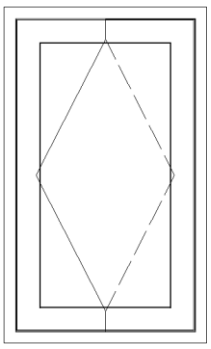
RH OUTWARD OPENING



RH INWARD OPENING



VERTICAL PIVOT LEFT HAND OPENING



VERTICAL PIVOT RIGHT HAND OPENING

FIG. 3 SYMBOLIC REPRESENTATION OF OPENING OF SIDE HUNG CASEMENT, VERTICAL PIVOT WINDOWS

## 5 DIMENSIONS AND TOLERANCE

**5.1** Fabrication and assembly tolerances shall conform to as specified in the relevant product specification standard.

### 5.2 Installation Tolerance

The tolerances given for installation are deemed to include manufacturing tolerances. The below tolerances are not cumulative to total number of floors. For representations, (*see* Fig. 4 and Fig. 5).

a) Linear dimensions: ± 2 mm;

b) Level: ± 2 mm;

c) Plumb: + height/1 000 or < 3 mm between floors and ceiling;

d) Steps in-plane: ± 2 mm;

e) Steps out of plane: ± 1 mm;

f) Joint widths: ± 2 mm; and

g) Cumulative error every third bay should not exceed 5 mm.

## 6 CLASSIFICATION AND REQUIREMENTS

### 6.1 Classification

For the purpose of classification, windows, doors and sliders as a whole shall be classified in accordance with the Table 1A, Table 1B and Table 1C given below in the table.

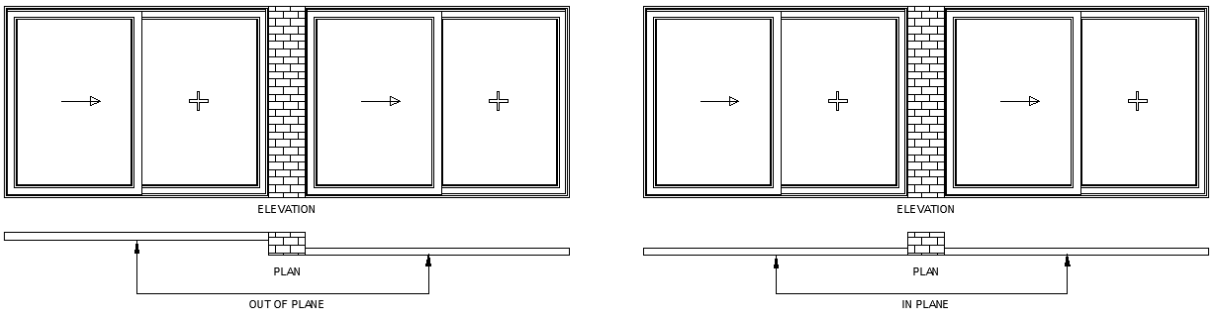



FIG. 4 REPRESENTATION OF IN-PLANE AND OUT-OF-PLANE

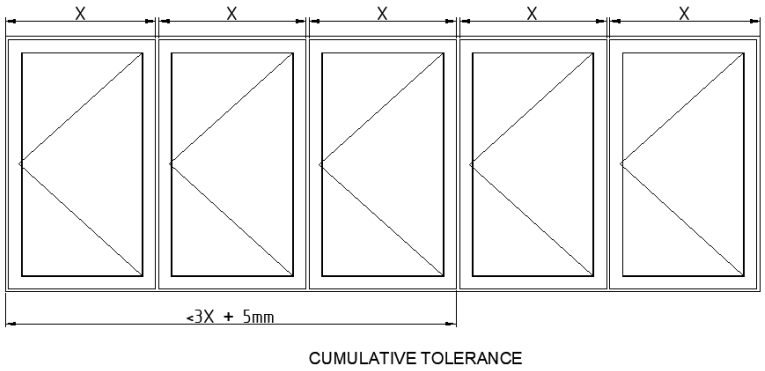



FIG. 5 REPRESENTATION OF CUMULATIVE TOLERANCE

**Table 1A Classification of Window, Door and Slider – Product Basic Classification**

(*Clause* 6.1)

| 1 | 2 | 3 |
|---|---|---|
| Product type | Test size | Design load |
| 4 | 5 | 6 |
| Air permeability | Water tightness | Operating force |

*Example*:

Side hung open out window with test size of 900 mm × 1 500 mm, with a design load class of DL2500, air permeability Class AC4, water tightness Class W450AA and operating force Class 1 shall be represented as below:

| Product type | W × H |  |  |  |  |
|---|---|---|---|---|---|
| SHW-OO | 900 × 1 500 | DL2500 | AC4 | W450AA | 1 |

**Table 1B Classification of Window, Door and Slider – Product Performance Classification**

(*Clause* 6.1)

| 1 | 2 | 3 |
|---|---|---|
| Product type | Test size | Design load |
| 4 | 5 | 6 |
| Air permeability | Water tightness | Operating force |
| 7 | 8 | 9 |
| Durability | Mass, kg | Corrosion class |

*Example*:

Side hung open out window with test size of 900 mm × 1 500 mm, with a design load class of DL2500, air permeability Class AC4, water tightness Class W450AA and operating force Class 1, durability Grade 1, mass 100 kg, corrosion Class 4 shall be represented as below:

| Product type | W × H |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
| SHW-OO | 900 × 1 500 | DL2500 | AC4 | W450AA | 1 | 1 | 100 | 4 |

**Table 1C Classification of Window, Door and Slider – Product Performance Classification (Optional Performance Requirements)**

(*Clause* 6.1)

| 10 | 11 | 12 |
|---|---|---|
| Thermal conductivity | Acoustics | Impact resistance |
| 13 | 14 | 15 |
| Mechanical strength | Anti-fallout (Yes/No) | Window restrictor for children (Yes/No) |

*Example*:

Side hung open out window with test size of 900 mm × 1 500 mm, with a design load class of DL2500, air permeability Class AC4, water tightness Class W450AA and operating force Class 1, durability Grade 1, mass 100 kg, corrosion Class 4, thermal conductivity of 3.0 W/m$^2$k, acoustics of $R_w$ 30 dB, impact resistance

Class 4, mechanical strength Class 1, anti-fallout Yes, window restrictor for children Yes shall be represented as below:

| Product type | W × H |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|
| SHW-OO | 900 × 1 500 | DL2 500 | AC4 | W450AA | 1 | 1 | 100 |
|  |  |  |  |  |  |  | |
| 4 | 3.0 W/m$^2$k | $R_w$ 30 dB | 4 | 1 | Yes | Yes | |

**6.1.1** *Product Type*

Shall be expressed in accordance with 4.

**6.1.2** *Test Sizes*

The system size which was tested for the minimum product performance as per Table 6 shall be mentioned.

**6.1.3** *Design Load*

Design load shall be in accordance with IS 875 (Part 3). The wind load classification shall be as per 7.5.

**6.1.4** *Air-Infiltration/Exfiltration*

In accordance to permeability classification ranging from Class A0 to Class A4 or B0 to B4, refer 7.3 for detailed classification.

**6.1.5** *Water Tightness*

In accordance to water tightness classification ranging from Class W150AA/W150AB/W150BA/ W150BB to Class WxxxAA/WxxxAB/WxxxBA/ WxxxBB refer 7.4.1.

**6.1.6** *Operating Force*

The operating forces shall comply as per the Table 2 when tested as per test given in IS 18268/ ISO 9379.

**6.1.7** *Durability* (*Resistance to Repeated Opening and Closing*)

The durability or resistance to repeated opening and closing shall be classified as per Table 3, when tested in accordance with IS 17909/ISO 8274.

**Table 2 Operating Forces**

(*Clause* 6.1.6)

| Sl No. | Description | Class 1 | | | Class 2 | | |
|---|---|---|---|---|---|---|---|
| | | Force to Initiate | Force to Maintain Motion N | Opening Torque Nm | Force to Initiate | Force to Maintain Motion N | Opening Torque Nm |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| i) | Sliding window | 110 | 90 | 10 | 22 | 18 | 5 |
| ii) | Sliding door with sash weight < 200 kg | 135 | 80 | 10 | 22 | 18 | 5 |
| iii) | Sliding door with sash weight > 200 kg | 180 | 110 | 10 | 22 | 18 | 5 |
| iv) | Door | 100 | 80 | 10 | 22 | 18 | 5 |
| v) | Window with lever handle | 100 | 80 | 10 | 22 | 18 | 5 |
| vi) | Window finger operated | 50 | 40 | 5 | 22 | 18 | 5 |
| vii) | Vertical sliding window | 200 | 160 | 10 | 22 | 18 | 5 |

NOTE — Operating Force test can also be done on the same element before air permeability test.

**Table 3 Classification for Durability**

(*Clause* 6.1.7)

| Sl No. | Grade | No. of Cycles |
|---|---|---|
| (1) | (2) | (3) |
| i) | Grade 0 | 5 000 cycles |
| ii) | Grade 1 | 10 000 cycles |
| iii) | Grade 2 | 15 000 cycles |
| iv) | Grade 3 | 25 000 cycles |
| v) | Grade 4 | 35 000 cycles |
| vi) | Grade 5 | 50 000 cycles |
| vii) | Grade 6 | 75 000 cycles |
| viii) | Grade 7 | 100 000 cycles |
| ix) | Grade 8 | 200 000 cycles |
| x) | Grade 9 | 500 000 cycles |
| xi) | Grade 10 | 1 000 000 cycles |

NOTE — Grade 4 to Grade 10 will be applicable only for doors.

**6.1.7.1** *Definition of a cycle*

a) For side hung, top hung and parallel operable windows and doors:

   1) Involves opening window, including releasing any fastening systems, to the fully open position, returning to the fully closed position and re-engaging any fastening systems.

b) For tilt and turn:

   1) Same as side hung but includes the opening and closing of the tilt operation as part of one cycle.

c) For sliders and lift and slide:

   1) Operable sliding sash, releasing of any fastening systems, travel distance of 1 000 mm, return to original position and re-engaging any fastening systems.

d) For tilt and slide door:

   1) Operable sliding sash, releasing of any fastening systems, tilting to fully open position, releasing the sliding operation, sash to travel a distance of 1 m, return to original position and re-engaging any fastening systems.

e) For fold and slide:

   1) Involves opening the sash, including releasing any fastening systems, to the fully open stacked position using 3 sashes of 900 mm width each, returning to the fully closed position and re-engaging any fastening systems.

f) Free play of lever handles (after durability test):

   1) On handles with or without click mechanisms, the play perpendicular to the mounting plane after the durability test shall not exceed 6 mm.

NOTE — For equivalent classification with other standards and for extrapolating the cycle performance, classification to actual product width, the total travel distance in km can be used. Durability cycle done on a sample test element, when compared to actual product size used on the project could have a reduction in performance due to longer travel needed for the project size. By calculating the total travel distance, the performance can now be extrapolated for every project condition.

**6.1.8** *Mass*

It shall be the weight of the sash, expressed in 3 digits. For sliding rollers, the set of rollers per sash shall also be indicated.

*Example*:

2/80 where 2 denotes 2 sets of single roller with a sash carrying capacity of 80 kg.

**6.1.9** *Corrosion*

The below classification shall be determined using neutral salt spray test when tested according to IS 9844.

a) *Grade* 0 — No defined corrosion resistance. Service conditions where a defined corrosion resistance not relevant;

b) *Grade* 1 (24 h) — Low corrosion resistance service indoors in warm dry atmospheres;

c) *Grade* 2 (48 h) — Moderate corrosion resistance service indoors where condensation may occur;

d) *Grade* 3 (96 h) — High corrosion resistance service outdoors where occasional or frequent wetting by rain or dew may occur;

e) *Grade* 4 (240 h) — Very high corrosion resistance service outdoors in very severe conditions; and

f) *Grade* 5 (480 h) — Exceptionally high corrosion resistance service outdoors in exceptionally severe conditions where long-term protection of the product is required.

When all components of the window/door/slider assembly that are visible or a functional moving part conforming to Grade 4, shall be classified as a window/door/slider with corrosion Class 4. All other components to be a minimum of Grade 3.

When all components of the window/door/slider assembly that are visible or a functional moving part conforming to Grade 5, shall be classified as a window/door/slider with corrosion Class 5. All other components to be a minimum of Grade 4.

When the window/door/slider assembly is exposed to physical marine conditions, marine grade hardware to be used, the window/door/slider can be classified as marine grade quality.

**6.1.10** *Thermal Conductivity*

The overall U value of the window or door or slider when tested using hot box method and/or software simulation that has been already validated with actual tests in accordance with following referred test methods.

a) For U value:
   1) IS 17920/ISO 10077 (Part 2);
   2) IS 17910 (Part 1)/ISO 12567 (Part 1);
   3) IS 17910 (Part 2)/ISO 12567 (Part 2); and
   4) IS 17911/ISO 15099.

b) For solar factor — IS 16231 (Part 2);

c) For VLT:
   1) IS 16231 (Part 2); and
   2) IS 14900.

Solar heat gain coefficient (SHGC) of the glass alone is an acceptable alternate for compliance with the SHGC requirements for the overall fenestration product.

**6.1.11** *Acoustic*

Classification as per IS 11050 (Part 1)/ISO 717-1 and testing as per IS 9901 (Part 3). The acceptable noise levels for various buildings are as given in Table 4.

**Table 4 Recommended Indoor Noise Levels**

(*Clause* 6.1.11)

| Sl No. | Location | Noise Level (dB) |
|---|---|---|
| (1) | (2) | (3) |
| i) | Auditoria and concert halls | 20 to 25 |
| ii) | Radio and TV shows | 20 to 25 |
| iii) | Cinemas | 25 to 30 |
| iv) | Music rooms | 25 to 30 |
| v) | Hospitals and cinema theatres | 35 to 40 |

**Table 4** (*Concluded*)

| Sl No. | Location | Noise Level (dB) |
|---|---|---|
| (1) | (2) | (3) |
| vi) | Apartments, hotels and homes | 35 to 40 |
| vii) | Conference rooms, small offices and libraries | 35 to 40 |
| viii) | Court rooms and class rooms | 40 to 45 |
| ix) | Large public office, banks and stores | 45 to 50 |
| x) | Restaurants | 50 to 55 |

NOTE — Rating can be given as $R_w$ rating (weighted sound reduction index between a frequency range of 100 Hz to 3 150 Hz). C reduction factor is to account for mid and high frequency noise and $C_{tr}$ reduction factor is to account for low frequency noise. Urban road traffic noise is an example of low frequency noise, while the railway or road traffic noise at medium and high speed is an example of high frequency noise. Alternatively, STC rating (weighted sound reduction index between a frequency range of 125 Hz to 4 000 Hz) can also be used.

**6.1.12** *Impact Resistance*

Based on the drop height when tested in accordance with Annex D, window, door or slider shall be classified as given in Table 5. The window, door or slider shall be tested as an assembly consisting of the glazing, typical frame including any seals, hardware and accessories including hinges, locks, latches, etc. For location of impact, refer Annex D.

The glass used as an infill for the test element shall either be toughened or laminated safety glass. This test is used to classify the impact resistance of a window, door or slider assembly and doesn't qualify the impact resistance of the glass used. For impact resistance of glass (resistance to human impact), refer to IS 2553 (Part 1).

For the window, door or slider to be classified for impact resistance as per Table 5, the following criteria shall be met:

a) The impactor shall not pass through any opening;

b) The impactor shall not detach any wing of the test body, including fittings, glazing beads, nor shall any part be dangerously detached or shattered; and

e) The mass of a detached part, if any shall not exceed 50 g.

NOTE — The window, door or slider can be classified under impact resistance, only if both, the glass (tested separately) and the window, door or slider is tested as an assembly passes the acceptance criteria. If the glass or infill used in the test sample breaks, then the sample has to be re-tested with a new glass or infill.

**6.1.13** *Mechanical Strength*

For test methods, refer IS 19006/ISO 8248.

**6.1.13.1** *Racking and static torsion*

Racking test shall be conducted for hinged and pivoted window or door. Racking and static torsion shall be classified as per Table 6.

**6.1.13.2** *Diagonal deformation*

This is applicable to sliding windows and doors. Bottom of the sash is blocked at the opposite end, and follow the test procedure in accordance IS 19006/ISO 8248. A force of 200 N is applied to the movable sash at handle height. Follow the same procedure by now blocking the top of sash instead of bottom. The residual diagonal deformation of the sash after the loads are removed shall not exceed 5 mm. The sash shall also maintain its sliding and locking function.

**6.1.14** *Anti-Fallout*

Refer **5.6.2** of IS 1948.

**6.1.15** *Window Restrictor for Children*

Refer **5.6.1** of IS 1948.

## 7 PERFORMANCE PARAMETERS

### 7.1 General Test Requirements

The following enlists the performance tests for glazing systems of all types. The test specimen size for the purpose of classification shall be according to the Table 7. The direction of the face of the product facing the pressurized chamber shall be mutually agreed between the parties concerned or specified without ambiguities in the specifications. The outer face of the product may face the inside of the pressurized chamber or the outside of the pressurized chamber. The spray rack shall always be facing the outer face of the product.

NOTES

**1** For project testing, the sample size to be tested can be larger in width or height or both than the sizes mentioned in the Table 7, however, the sizes shown are the minimum sizes for testing. This classification shall be valid for the units equal to or lower than the actual tested sizes.

**2** For the sliding window each sash width shall not be less than 800 mm, for sliding door each sash width shall not be less than 1 000 mm.

**3** Performance classification and testing shall be conducted at an accredited lab that can either be an own lab or a third party.

**4** For projects, the test sizes shall be based upon the most commonly occurring type and it's most commonly occurring applicable wind load. If required, additional testing may be added by the stakeholder based upon the most commonly occurring wind loads on non-typical specimen size and typology.

**5** For number of samples for onsite/field testing, refer Annex B.

**6** For projects, on-site test for anchor fastener, sample size, etc refer Annex B.

**Table 5 Classification Based on Drop Height**

(*Clause* 6.1.12)

| Sl No. | Criteria | Basic | | | Architectural | | |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| i) | Classification | 1 | 2 | 3 | 4 | 5 | 6 |
| ii) | Drop height, mm | 200 | 300 | 450 | 700 | 950 | 1 200 |

**Table 6 Classification of Racking and Static Torsion**

(*Clauses* 6.1.2 *and* 6.1.13.1)

| Sl No. | Test | Class 1 | Class 2 | Class 3 | Class 4 |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| i) | Racking | 200 N | 400 N | 600 N | 800 N |
| ii) | Static torsion | 200 N | 250 N | 300 N | 350 N |

**Table 7 Minimum Test Specimen Size for the Purpose of Classification**

(*Clause* 7.1)

| Sl No. | Product Type | Minimum Test Size (W × H), mm |
|---|---|---|
| (1) | (2) | (3) |
| i) | Fixed window | 900 × 1 500 |
| ii) | Horizontal sliding window (2 track 2 shutter) | 1 800 × 1 500 |
| iii) | Horizontal sliding door (2 track 2 shutter) | 2 000 × 2 100 |
| iv) | Hung window — Vertical sliding (2 shutter) | 900 × 1 500 |
| v) | Horizontal or vertically pivoted window | 1 800 × 1 500 |
| vi) | Side hinged window (single/double leaf) | 900/1 800 × 1 500 |
| vii) | Side hung window | 750 × 1 500 |
| viii) | Projected top hung window | 750 × 1 200 |
| ix) | Parallel opening window | 900 × 1 200 |
| x) | Tilt and turn window | 900 × 1 500 |
| xi) | Single/double leaf door | 900/1 800 × 2 100 |
| xii) | Swing door — Single/double | 900/1 800 × 2 100 |
| xiii) | Fold and slide door | 900 each sash × 2 100 frame height |

NOTE — All dimensions are of outer-to-outer frame size.

### 7.2 Test Sequence

**7.2.1** *Mandatory Sequence*

a) Air permeability;

b) Static water penetration;

c) Dynamic water penetration or cyclic water penetration;

d) Resistance to wind load at design pressure;

e) Pulsating test pressure (P2) for 50 cycles;

f) Repeat air permeability;

g) Repeat static water penetration;

h) Resistance to wind load at safety/proof pressure; and

j) Controlled dismantling.

**7.2.2** *Optional Sequence* (*Choose as per Stakeholder Requirement*)

a) Air permeability;

b) Static water penetration;

c) Dynamic water penetration or cyclic water penetration;

d) Resistance to wind load at design pressure;

e) Pulsating test pressure (P2) for 50 cycles;

f) Repeat air permeability;

g) Repeat static water penetration;

j) Resistance to wind load at safety/proof pressure; and

k) Test to destruction.

**7.2.3** *Special Tests*

a) Operating force;

b) Durability;

c) Corrosion class;

d) Thermal conductivity;

e) Mechanical strength;

f) Impact resistance;

g) Acoustics;

h) Anti-fallout; and

j) Window restrictor for children.

NOTE — Each of the above test can also be conducted and reported in isolation. However, for product classification purposes, mandatory tests in sequence has to be fulfilled with the same test specimen.

### 7.3 Air Permeability

The following gives the classification when tested as per IS 18472. For classification of windows, doors and sliders, minimum air permeability shall be:

a) For zones with 33 m/s, 39 m/s and 44 m/s — Minimum shall be Class A1 or B1 (150 Pa); and

b) For zones with 47 m/s, 50 m/s and 55 m/s — Minimum shall be Class A2 (300 Pa) or B2 (300 Pa) irrespective of building height.

Class A0 and B0 is for information purpose.

Only air infiltration during positive test pressure shall be considered for the purpose of classification. Air exfiltration during negative test pressure shall be optional and used for the purpose of heating/cooling load calculations.

For permissible air permeability of onsite/field testing, refer IS 18434 for test methodology. When onsite/field air permeability test is carried out, the permissible air permeability parameters shall be 1.5 times the laboratory test parameters.

All test data shall be normalized to standard conditions for the purpose of comparison with test results irrespective of climate and altitude.

Permissible air leakages are defined into 10 classifications and grouped into Class A and Class B. Class A is for high performance and Class B is for nominal performance.

Air permeability is calculated as follows,

$$Q = Q_{100} \times \left(\frac{P}{100}\right)^{2/3}$$

where

$Q$ = the air permeability in $m^3/h/m^2$ for area (in $m^2$) or in $m^3/h/m$ for joint length (in m) based calculation;

$Q_{100}$ = the reference air permeability rate at 100 Pa as shown in Table 8A and Table 8B; and

$P$ = the pressure in Pa.

**Table 8A $Q_{100}$ for Class A**

(*Clause 7.3*)

| Sl No. | Pressure Pa | Class A0 | | Class A1 | | Class A2 | | Class A3 | | Class A4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m³/h/m² | m³/h/m | m³/h/m² | m³/h/m | m³/h/m² | m³/h/m | m³/h/m² | m³/h/m | m³/h/m² | m³/h/m |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| i) | 75 | 31.00 | 7.75 | | | | | | | | |
| ii) | 150 | | | 16.67 | 4.17 | | | | | | |
| iii) | 300 | | | | | 9.00 | 2.25 | | | | |
| iv) | 450 | | | | | | | 5.33 | 1.33 | | |
| v) | 600 | | | | | | | | | 3.00 | 0.75 |

**Table 8B $Q_{100}$ for Class B**

(*Clause 7.3*)

| Sl No. | Pressure Pa | Class B0 | | Class B1 | | Class B2 | | Class B3 | | Class B4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m³/h/m² | m³/h/m | m³/h/m² | m³/h/m | m³/h/m² | m³/h/m | m³/h/m² | m³/h/m | m³/h/m² | m³/h/m |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| i) | 75 | 93.00 | 23.25 | | | | | | | | |
| ii) | 150 | | | 50.00 | 12.50 | | | | | | |
| iii) | 300 | | | | | 27.00 | 6.75 | | | | |
| iv) | 450 | | | | | | | 16.00 | 4.00 | | |
| v) | 600 | | | | | | | | | 9.00 | 2.25 |

**7.3.1** *Classification Graph*

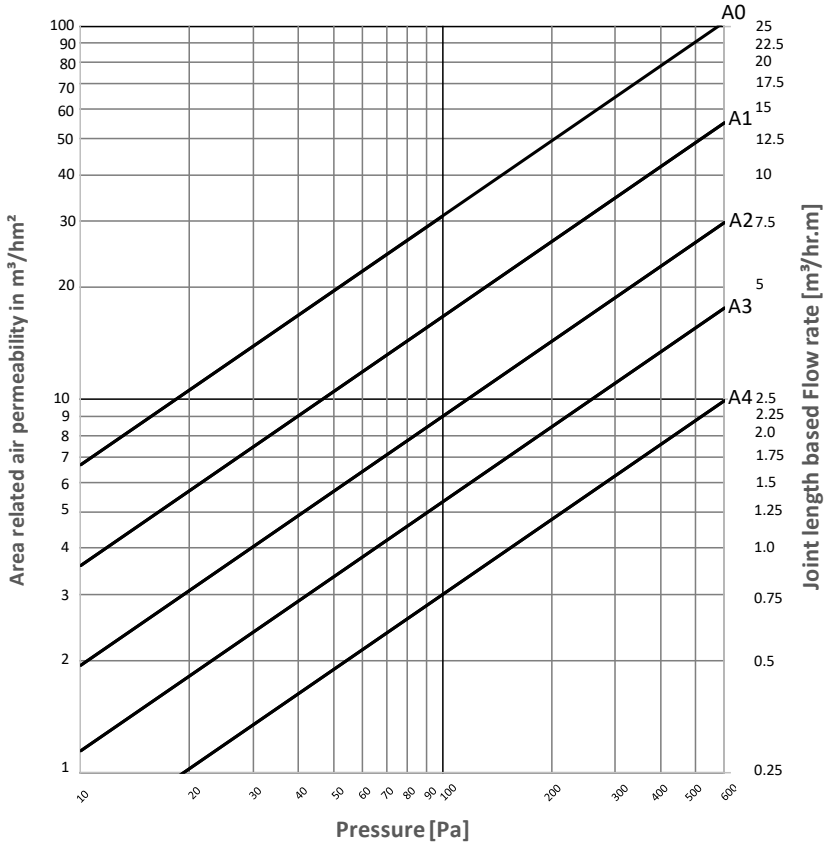



FIG. 6A CLASS A — GRAPH TO PLOT ACTUAL FLOW RATES OF THE SPECIMEN

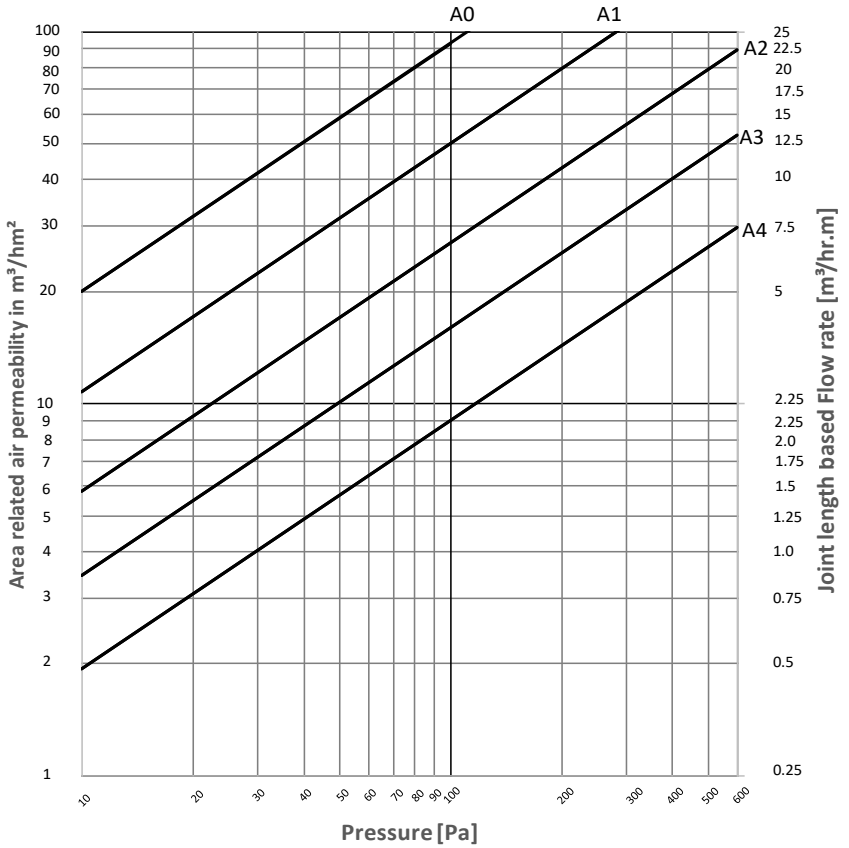



FIG. 6B CLASS B — GRAPH TO PLOT ACTUAL FLOW RATES OF THE SPECIMEN

**7.3.2** *Steps to Plot the Graph*

a) Obtain total flow rate from actual testing for each of the pressure steps from minimum 50 Pa for the purpose of plotting only;

b) Calculate flow rate for:

1) Surface area

$Q_{\text{surface area}} = \frac{\text{total flow rate}}{\text{total surface area}}$ (in $m^3/hr/m^2$); and

2) Joint length

$Q_{\text{joint length}} = \frac{\text{total flow rate}}{\text{joint length}}$ (in $m^3/hr/m$).

where

total flow rate, in $m^3/h$;
total surface, in $m^2$; and
joint length, in m.

c) Plot the actual flow rate values obtained for both surface area and joint length in Fig 6A for Class A and Fig 6B for Class B;

d) The class curve occurring above the actual data curve shall be considered as the respective class for that data group. Example, for surface area data, if the curve for the actual values lies between Class A3 and Class A4, then Class A3 shall be considered for the surface data. Similarly, if the curve for the actual values lies below the Class A4 curve, then Class A4 shall be considered. The same methodology applies to joint length based classification;

e) The final classification is a combination of surface area based and joint length based classification for the product. The window/door/slider is classified based upon the rules below:

1) Same class — the specimen shall be classified under one and the same class;
2) Two adjacent classes — the specimen shall be classified in the higher class;
3) A difference of two classes — the specimen shall be classified in the mean class; and
4) A difference of more than two classes — the specimen shall not be classified.

f) Examples for classification under difference scenarios are mentioned in Annex C.

## 7.4 Water Tightness

**7.4.1** *General*

The product shall be classified as per classes mentioned below, after being tested in accordance to 7.4.2, 7.4.3, 7.4.4.

Class A: Laboratory testing rate — 3.4 litre/min/$m^2$ when tested in accordance with IS 18459; onsite/field testing rate — 2.2 litre/min/$m^2$ when tested in accordance with IS 18434.

Class B: Laboratory testing rate — 2.0 litre/min/$m^2$ when tested in accordance with IS 18459; onsite/field testing shall be single spray rack test in accordance with IS 18434.

Spray rack shall be placed 400 mm away from face of glass, nozzles shall be spaced on a uniform grid, shall wet all of the test specimen uniformly and especially wet those areas vulnerable to water penetration. Nozzle spray angle to be chosen accordingly.

The classification of the product shall be test pressure with prefix “W” and with a suffix of “A” or “B” depending upon the chosen class and test Method “A” or “B” in accordance with IS 18459.

*Example*:

> Water tightness tested to 300 Pa for Class A and Method A shall be classified as “W300AA” and for Method B as “W300AB”.

If water is observed in the operable sash drainage path or in the track for sliders and the same is drained through slots after the spray is stopped, it shall be considered as pass. Penetration of water beyond a plane parallel to the glazing (the vertical plane) intersecting the innermost projection of the test specimen, not including interior trim and hardware, under the specified conditions of air pressure difference across the specimen, shall be considered as a failure. However, for sliders, due to bubbling, total volume of water that spills beyond the innermost projection of the test specimen per test shall not be greater than 5 ml. Splashing within the outer-frame of the track is also acceptable. Overflow for any reason will be deemed failure.

In the case of repeat of the test due to failure, it is allowed to apply up to 150 percent of water test pressure without water spray for a period of 5 min to flush out any residual water accumulated in the product.

For onsite/field testing for buildings greater than 20 storeyed, the window/door/slider shall be tested using a chamber (*see* IS 18434), as per procedure 1 or 2. For buildings less than 20 storeyed, the window/door/slider can be tested using the chamber (procedure 1 or 2) or using a single spray bar (Method 3) installed at the head of the sample as per in IS 18434. For the chamber test, the water flow rate shall be according to the specified class and the differential test pressure shall be the same as the laboratory water test pressure.

For project testing, when the window, door, slider is setback or has horizontal shading or vertical shading, the projection factor can be applied to determine the effective area of rain considering the angle of incidence of the rain (θ) 73.5° ± 6.6°/68.2° ± 7.6° /53.0° ± 11.5° to the plane of the window, on the element. This reduced area of testing has to be mutually agreed between the concerned parties. The end user reserves the right to test for full exposure.

**7.4.2** *Static Water Penetration*

For water flow rate, spray rack arrangement, leakage criteria and classification refer general criteria above.

When tested in accordance with the test method given in IS 18459, the product can be tested to Method A or Method B.

Test pressure shall be 20 percent of positive design pressure but not less than the pressure mentioned in Table 9 to Table 12 below or exceeding 1 000 Pa. Minimum test pressure shall be as per below tables:

**Table 9 Minimum Water Tightness Test Pressure for Category 1 [Refer IS 875 (Part 3)]**

(*Clause* 7.4.2)

| Sl No. | Height in m | 33 m/s | 39 m/s | 44 m/s | 47 m/s | 50 m/s | 55 m/s |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| i) | 10 | 150 Pa | 200 Pa | 250 Pa | 250 Pa | 300 Pa | 400 Pa |
| ii) | 15 | 150 Pa | 200 Pa | 250 Pa | 300 Pa | 350 Pa | 400 Pa |
| iii) | 20 | 150 Pa | 200 Pa | 250 Pa | 300 Pa | 350 Pa | 450 Pa |
| iv) | 30 | 150 Pa | 200 Pa | 300 Pa | 350 Pa | 350 Pa | 450 Pa |
| v) | 50 | 150 Pa | 250 Pa | 300 Pa | 350 Pa | 400 Pa | 500 Pa |
| vi) | 100 | 200 Pa | 250 Pa | 350 Pa | 400 Pa | 450 Pa | 550 Pa |
| vii) | 150 | 200 Pa | 300 Pa | 350 Pa | 400 Pa | 500 Pa | 600 Pa |

**Table 10 Minimum Water Tightness Test Pressure for Category 2 [Refer IS 875 (Part 3)]**

(*Clause* 7.4.2)

| Sl No. | Height m | 33 m/s | 39 m/s | 44 m/s | 47 m/s | 50 m/s | 55 m/s |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| i) | 10 | 150 Pa | 150 Pa | 200 Pa | 250 Pa | 300 Pa | 350 Pa |
| ii) | 15 | 150 Pa | 200 Pa | 250 Pa | 250 Pa | 300 Pa | 400 Pa |
| iii) | 20 | 150 Pa | 200 Pa | 250 Pa | 300 Pa | 300 Pa | 400 Pa |
| iv) | 30 | 150 Pa | 200 Pa | 250 Pa | 300 Pa | 350 Pa | 450 Pa |
| v) | 50 | 150 Pa | 200 Pa | 300 Pa | 350 Pa | 400 Pa | 450 Pa |
| vi) | 100 | 200 Pa | 250 Pa | 350 Pa | 400 Pa | 450 Pa | 550 Pa |
| vii) | 150 | 200 Pa | 250 Pa | 350 Pa | 400 Pa | 450 Pa | 550 Pa |

**Table 11 Minimum Water Tightness Test Pressure for Category 3 [Refer IS 875 (Part 3)]**

(*Clause* 7.4.2)

| Sl No. | Height in m | 33 m/s | 39 m/s | 44 m/s | 47 m/s | 50 m/s | 55 m/s |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| i) | 10 | 150 Pa | 150 Pa | 150 Pa | 200 Pa | 200 Pa | 300 Pa |
| ii) | 15 | 150 Pa | 150 Pa | 200 Pa | 200 Pa | 250 Pa | 300 Pa |
| iii) | 20 | 150 Pa | 150 Pa | 200 Pa | 250 Pa | 300 Pa | 350 Pa |
| iv) | 30 | 150 Pa | 200 Pa | 250 Pa | 250 Pa | 300 Pa | 400 Pa |
| v) | 50 | 150 Pa | 200 Pa | 250 Pa | 300 Pa | 350 Pa | 450 Pa |
| vi) | 100 | 150 Pa | 250 Pa | 300 Pa | 350 Pa | 400 Pa | 500 Pa |
| vii) | 150 | 200 Pa | 250 Pa | 350 Pa | 400 Pa | 450 Pa | 550 Pa |

**Table 12 Minimum Water Tightness Test Pressure for Category 4 [Refer IS 875 (Part 3)]**

(*Clause* 7.4.2)

| Sl No. | Height m | 33 m/s | 39 m/s | 44 m/s | 47 m/s | 50 m/s | 55 m/s |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| i) | 10 | 150 Pa | 150 Pa | 150 Pa | 150 Pa | 150 Pa | 200 Pa |
| ii) | 15 | 150 Pa | 150 Pa | 150 Pa | 150 Pa | 150 Pa | 200 Pa |
| iii) | 20 | 150 Pa | 150 Pa | 150 Pa | 150 Pa | 150 Pa | 200 Pa |
| iv) | 30 | 150 Pa | 150 Pa | 200 Pa | 200 Pa | 250 Pa | 300 Pa |
| v) | 50 | 150 Pa | 200 Pa | 250 Pa | 300 Pa | 350 Pa | 400 Pa |
| vi) | 100 | 150 Pa | 250 Pa | 300 Pa | 350 Pa | 400 Pa | 500 Pa |
| vii) | 150 | 200 Pa | 250 Pa | 350 Pa | 400 Pa | 450 Pa | 550 Pa |

*Category* 1

Exposed open terrain with few or no obstructions and in which the average eight of any object surrounding the structure is less than 1.5 m. The equivalent aerodynamic roughness height, (z0, 1) for this terrain is 0.002 m. Typically this category represents open sea-coasts and flat plains without trees.

*Category* 2

Open terrain with well scattered obstructions having heights generally between 1.5 m and 10 m. The equivalent aerodynamic roughness height, (z0, 2) for this terrain is 0.02 m. This is the criterion for measurement of regional basic wind speeds and represents airfields, open park lands and undeveloped sparsely built-up outskirts of towns and suburbs. Open land adjacent to sea coast may also be classified as Category 2 due to roughness of large sea waves at high winds.

*Category* 3

Terrain with numerous closely spaced obstructions having the size of buildings/structures up to 10 m in height with or without a few isolated tall structures. The equivalent aerodynamic roughness height, (z0, 3) for this terrain is 0.2 m. This category represents well wooded areas, and shrubs, towns and industrial areas full or partially developed.

*Category* 4

Terrain with numerous large high closely spaced

obstructions. The equivalent aerodynamic roughness height, (z0, 4) for this terrain is 2.0 m. This category represents large city centers, generally with obstructions above 25 m and well developed industrial complexes.

**7.4.3** *Dynamic Water Penetration*

For water flow rate, spray rack arrangement, leakage criteria and classification refer general criteria above. Test pressure shall be same as static water penetration pressure. Testing shall be in accordance with the test method given in IS 18647.

**7.4.4** *Cyclic Water Penetration*

Cyclic water penetration is an alternative/optional to dynamic water test for windows, doors and sliders.

For water flow rate, spray rack arrangement, leakage criteria and classification refer general criteria above. The test pressure shall be the same as static water penetration pressure. Test methodology shall be in accordance with the test Method A given in IS 18459. However, the time duration and sequence shall be as follows:

a) Wetting phase at zero pressure for 5 min;

b) 3 phases, each phase consist of 5 min with 2 min intervals between phases;

c) Zero to test pressure reached in 15 s resulting in 4 cycles/min; and

d) Test pressure differential created from within the chamber.

**7.5 Resistance to Wind Load**

**7.5.1** The specimen shall be tested in accordance with IS 18473. For the purpose of the tests, three sets of test pressure are defined:

a) P1, applied pressure to measure deflection of parts of the test specimen;

b) P2, pulsating test pressure, applied for 50 cycles to assess performance under repeated wind load and is equal to 0.5 P1;

c) P3, Safety test pressure, applied to assess safety under extreme conditions and is equal to 1.5 P1;

d) The values of P1, P2 and P3 are related as follows: P2 = 0.5 P1 and P3 = 1.5 P1;

e) P1 to be determined using IS 875 (Part 3) or wind tunnel report or computational fluid dynamics analysis with simulation software that has already been validated;

f) Classification shall be according to the results of wind resistance tests to positive and negative test pressures. The classification of the product shall be test pressure with prefix “DL”. For example, design load pressure of 2 000 Pa shall be classified as “DL2000”. This classification will only be valid if the deflection criteria and the safety/proof pressure test is passed;

g) Structural test at design pressure is used to determine compliance to deflection parameters while in safety/proof test, deflections are not measured but this is used to verify compliance to stress capacity; and

h) Recommended requirements for deflection readings are as follows:

   1) For products: framing member deflections for mullions (except outer frame), handle locations, transoms, interlock and meeting stile in sliders;

   2) For projects: framing member deflections for mullions (except outer frame), handle locations, transoms, interlock, meeting stile in sliders and glazing panels;

   3) The transducer locations shall be mutually agreed between the stakeholders and shall be part of the test report; and

   4) Elevation, plan, sectional drawings with all the reinforcement indications and glass specification should be part of the test report.

j) For test to destruction, steps of pressure increase shall be agreed and results recorded. Any breakage, disengagement, permanent deformation of profiles, accessories or hardware shall be noted.

k) Post controlled dismantling, any deviation from the pre-test design shall be duly recorded and mentioned in the test report

m) In the event of specimen failure at “resistance to wind load at design pressure” and subsequent rectification requiring change in design, testing to commence from air permeability. However, for projects, with the mutual understanding between the specifier and the manufacturer, repetition of air permeability and/or water tightness can be avoided.

n) In the event of specimen failure at “resistance to wind load at safety/proof

pressure" and subsequent rectification requiring change in design, testing to commence from air permeability. However, for projects, with the mutual understanding between the specifier and the manufacturer, repetition of previous successfully completed tests in the test sequence can be avoided. In the event design change is not required but replacement of components such as glass, anchor/fastener size, anchor/fastener quantity is adequate is adequate, then, only repetition of resistance to wind load at safety/proof pressure is sufficient.

No damage or harmful permanent deformation of any parts except sealing materials shall be found at the maximum testing pressure. Residual displacement of structural member shall not exceed span/1 000. The slippage at supports and fixing shall not exceed 1 mm.

**7.5.2** The following requirements shall also be met in order that the product can be classified.

a) Due to wind pressure P1 and P2 — No visible failures (for example, opening of the test specimen, loosening of the sash/casement or leaf, separation of hardware or glazing beads) when viewed by normal or corrected vision at a distance of 1 m in natural and/or artificial light;

   The test specimen shall remain functional and the air permeability after tests P1 and P2 shall not exceed the upper limits of the claimed air permeability class by more than 20 percent.

   If the upper limits of the class determined by the initial classification are exceeded by more than 20 percent, the manufacturer may claim a lower air permeability class than that achieved in the initial classification. In these circumstances, the report shall state that if the manufacturer wishes to claim a class for the air permeability for the product, combined with a class for resistance to wind load, only the air permeability class achieved in combination with the wind load test may be claimed.

b) Due to wind pressure P3 — Failures such as bending and/or twisting of any building hardware and splitting or cracking of framing members shall be permitted provided that no parts become detached and the test specimen remains closed. However, if glass breaks it is permitted for it to be replaced and the test to be repeated once more. If building hardware bends, twists or breaks leading to a failure (for example, opening of the test specimen, loosening of the sash/ casement or leaf, separation of hardware or glazing beads), the defective part may be replaced, but the sequence of tests has to be repeated from "repeat air infiltration";

c) Span for the sliding window/door for the purpose of calculating permissible deflection shall be taken as the height of the outer frame for full height sliders. For the purpose of deflection compliance in sliders, for the interlock combination, the individual second moment of inertia of each sash interlock profile shall be added;

d) For sliders having span above 3 m, the maximum allowable deflection shall not exceed 25 mm; and

e) The sliding sash when tested to safety/proof load shall not disengage.

**7.5.3** *Classification of Relative Frontal Deflection*

The relative frontal deflection of glass and framing member of the test specimen measured at test pressure P1 with the exception of fixed punched opening, shall be as specified below:

a) For mullions:

   1) Single height glazing — Span/175 or 19 mm, whichever is less; and

   2) Double height glazing — For spans up to 4 110 mm, same as single height glazing; and for spans above 4 110 mm, the same shall be (span/240) + 6.35 mm.

b) For transoms:

   1) Span/500 or 3 mm, whichever is the least for dead load; and

   2) Span/175 or 19 mm, whichever is the least for wind load.

c) Deflection at the center of the glass (*see* Fig. 7):

   1) Monolithic glass — Shortest span/

60 or 19 mm, whichever is the least; and

2) Double glazed unit — Shortest span/90 or 19 mm, whichever is the least.

d) Deflection at edge of the glass (*see* Fig. 7) — Maximum 15 mm.

For sliders having span above 3 m, the maximum allowable deflection shall not exceed 25 mm.

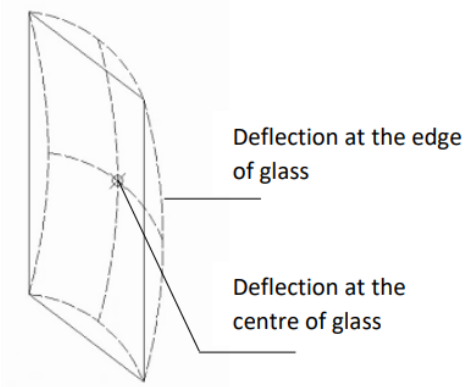



FIG. 7 DEFLECTION OF THE GLASS

## ANNEX A

(*Clause 2*)

## LIST OF REFERRED STANDARDS

| *IS No.* | *Title* |
|---|---|
| IS 875 (Part 2) : 1987 | Code of practice for design loads (other than earthquake) for buildings and structures: Part 2 Imposed loads (*second revision*) |
| IS 875 (Part 3) : 2015 | Design loads (other than earthquake) for buildings and structures — Code of practice: Part 3 Wind loads (*third revision*) |
| IS 1948 : 2024 | Aluminium framed doors, windows and sliders — Specification (*first revision*) |
| IS 8147 : 1976 | Code of practice for use of aluminium alloys in structures |
| IS 9844 : 1981 | Methods of testing corrosion resistance of electroplated and anodized aluminium coatings by neutral salt spray test |
| IS 9901 (Part 3) : 1981 | Measurement of sound insulation in buildings and of building elements: Part 3 Laboratory measurements of airborne sound insulation of building elements |
| IS 11050 (Part 1) : 2023/ISO 717-1 : 2020 | Rating of sound insulation in buildings and of building elements: Part 1 Airborne sound insulation (*first revision*) |
| IS 17346 : 2020 | Insulating glazing unit — Specification |
| IS 19006 : 2023/ ISO 8248 : 1985 | Windows and door height windows — Mechanical tests |
| IS 17909 : 2022/ ISO 8274 : 2005 | Windows and doors — Resistance to repeated opening and closing test method |
| IS 17910 | Thermal performance of windows and doors — Determination of thermal transmittance by the hot-box method: |
| (Part 1) : 2022/ ISO 12567-1 : 2010 | Complete windows and doors |
| (Part 2) : 2022/ ISO 12567-2 : 2005 | Roof windows and other projecting windows |
| IS 17911 : 2022/ ISO 15099 : 2003 | Thermal performance of windows, doors and shading devices — detailed calculations |
| IS 17920 : 2022/ ISO 10077-2 : 2017 | Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Numerical method for frames |
| IS 18268 : 2023/ ISO 9379 : 2005 | Operating forces — Test methods — Doors |
| IS 18434 : 2023 | Field measurement of air permeability and water penetration through installed curtain wall, windows, doors, sliders and skylights under static air pressure difference — Method of test |
| IS 18459 : 2024 | Water penetration of curtain walls, windows, sliders, doors and skylights by uniform static air pressure difference — Method of test |
| IS 18647 : 2024 | Water penetration of curtain walls, windows, sliders and doors by dynamic pressure — Method of test |
| IS 18472 : 2024 | Air permeability for curtain walls windows sliders doors and skylights — Method of test |
| IS 18473 : 2024 | Wind resistance for curtain walls windows sliders doors and skylights — Method of test |

# ANNEX B

(*Clause* 7.1)

## ONSITE/FIELD TESTING

### B-1 ANCHOR FASTENERS

When the profile is anchored to a substructure, forces to determine the design of the anchor shall follow IS 875 (Part 2) and (Part 3). The profile shape and thickness shall be designed to meet the design requirements and the safety load. The anchors should conform suitability of use for the given base material and the resistance of the anchor/anchor group should be adequately designed, taking into consideration all influencing parameters. The embedment depth of the anchor and selection of the appropriate anchor should be in accordance to anchor manufacturer for tested parameters. The installation should strictly be done in accordance with the manufacturer installation instruction. A representative sample of cast-in and post-fixed anchors and/or fastenings to the main structural frame should be completed prior to the installation of the window/door brackets. A minimum of 2 percent or at least 2 anchors per floor throughout the building for each type shall be tested. For critical application, specifier shall request for increased testing frequency. Testing shall be 1.5 times the calculated design loads on the anchor fasteners required for the project

Pull-out tests shall not be considered as the differentiating parameter for estimation of anchor resistance, since they do not replicate the actual job site condition of edge distance and spacing limitation.

#### B-1.1 Equipment Description

a) Pull-out test apparatus should simulate an unconfined test set-up;

b) Ensure that the legs of the test equipment are securely attached to the substrate before commencement of the test;

c) The equipment may be actuated hydraulically, pneumatically or mechanically;

d) Ensure that the load cell attached to the test equipment is calibrated to obtain accurate results;

e) Suitable adaptor shall be selected such that the inner diameter of the adapter shall be same as that of the outer diameter of the anchor. The adaptor shall completely enclose the head of the anchor; and

f) The adapter shall ensure no slippage occurs during the pullout test. Load versus displacement behavior shall be recorded continuously.

#### B-1.2 Procedure for Pull-Out Test

a) The suitable anchor has to be installed to the designed embedment depth and in accordance with the as per the manufacturer's installation instruction;

b) Suitable adapter shall be selected based on the anchor diameter;

c) All three legs of the tester shall be fixed onto to the substrate and adaptor shall be adjusted to the puller slot;

d) The lever of the tester shall be rotated to pull the adaptor attached to the anchor until the required test load is achieved;

e) Release the puller slot from adaptor after testing the anchor and noting down the result value by rotating the lever of the tester in reverse direction; and

f) Repeat the same procedure for other samples.

### B-2 WINDOW RESTRICTOR-FOR CHILDREN

For projected top hung window, parallel opening window, vertical sliding hung window and pivot window (except when used as an access door), the window restrictor shall be located such that the clear opening shall not exceed 125 mm (for human life safety especially for children). When a force of 250 N is applied in opening condition to any part of the sash a sphere of 125mm shall not pass through any part of the opening.

### B-3 SEALANT

Peel adhesion testing as per IS 17346 on structurally bonded fenestration.

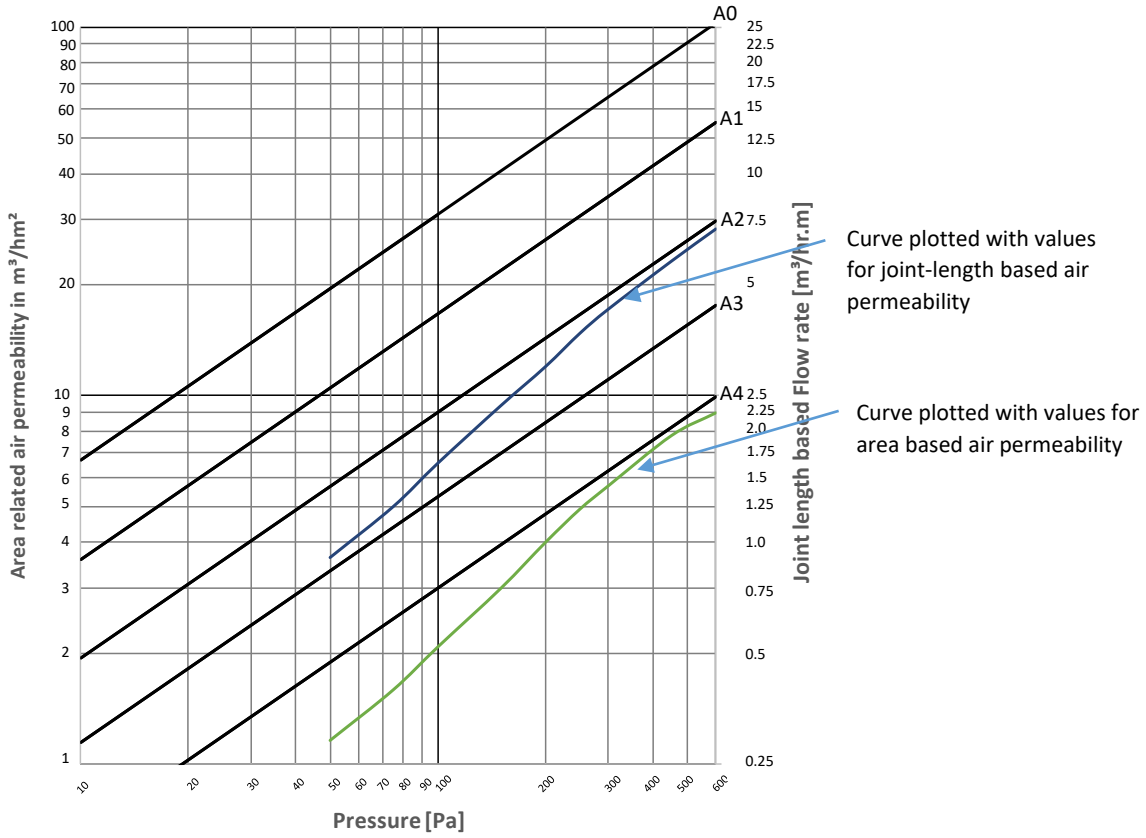
## ANNEX C

(*Clause* 7.3.2)

## EXAMPLES OF AIR LEAKAGE CLASSIFICATION

*Example* 1*:*

After testing and obtaining the flow rates of the specimen, the values are plotted in the graph as explained in 7.3.2. The resultant graph is shown in Fig 8A for Class A classification.




NOTES

**1** As per the curve for area based flow rates, the values fall in Class A4.

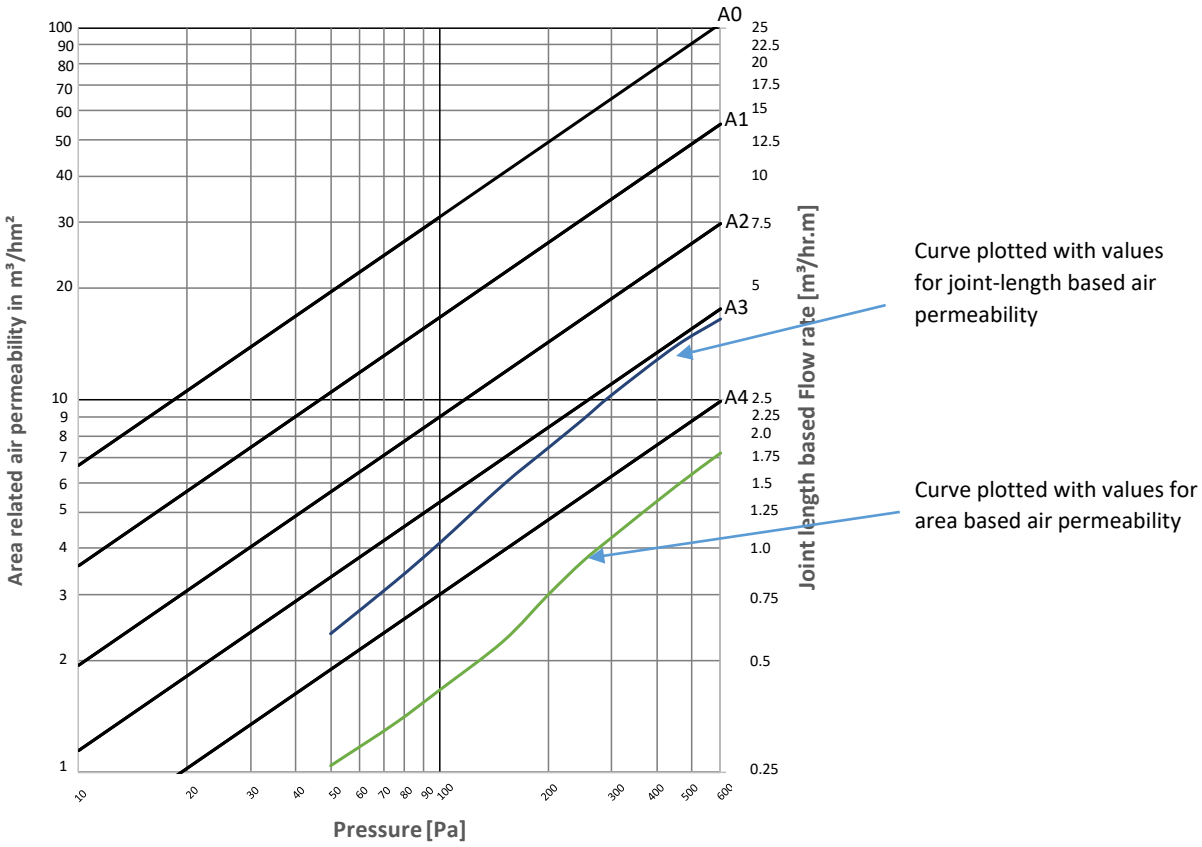
**2** As per the curve for joint length based flow rates, the values fall in Class A2.

**3** Applying the rules mentioned in 7.3.2, the overall classification for the sample shall be Class A3.

FIG. 8A CLASS A — GRAPH TO PLOT ACTUAL FLOW RATES OF THE SPECIMEN

*Example 2:*

After testing and obtaining the flow rates of the specimen, the values are plotted in the graph as explained in 7.3.2. The resultant graph is shown in Fig 8B for Class A classification.




NOTES

**1** As per the curve for area based flow rates, the values fall in Class A4.

**2** As per the curve for joint length based flow rates, the values fall in Class A3.

**3** Applying the rules mentioned in 7.3.2, the overall classification for the sample shall be Class A4.

FIG. 8B CLASS A — GRAPH TO PLOT ACTUAL FLOW RATES OF THE SPECIMEN

## ANNEX D

(*Clause* 6.1.12)

## TEST METHOD AND LOCATION OF IMPACT FOR IMPACT RESISTANCE

### D-1 TEST RIG

Shall be in a way in which doorsets of various sizes can be mounted in a manner similar to their installation in practice. The rig shall be sufficiently rigid so that any deformations that occur in the rig during testing will have a negligible effect on the test result.

### D-2 IMPACT BODY

Shall have a total mass 30 kg, consisting of a spherical leather bag of diameter approximately 350 mm, containing sand of apparent density approximately 1 500 kg/m$^3$ (sand which passes through a sieve of aperture size 2 mm).

### D-3 TEST PROCEDURE

If possible, measure deviations from planarity before and after the test. The principle of the test is illustrated in the Fig. 9. Release the impact body, which shall be in a vertical at the Start of the test, and allow it to strike the doorset. Repeat this Operation as many times as required, and, if desired, from different drop heights. Examine the doorset for damage.

### D-4 LOCATION OF IMPACT

#### D-4.1 Casement Windows

a) Geometric centre; and

b) Interface corner.

**D-4.2** Where interior mullions or other glazed section joints and/or latches are present, additional Impacts are to be performed at the following locations:

a) Centre of mullion; and

b) Base of mullion.

#### D-4.3 Swing doors

a) Near primary latch or operating mechanism;

b) Near interface hinge joint; and

c) Near upper latch point (if present).

**D-4.4** In the case of double door assemblies, an additional impact shall be performed at the following location:

a) Centre meeting point or mullion.

#### D-4.5 Sliding Window/Door

a) Near primary latch or operating mechanism;

b) Near interface sliding joint; and

c) Near upper latch point (if present).

### D-5 TEST REPORT

The test report shall include the following information:

a) Relevant details concerning the material, type, dimensions, form, construction and finish of the door and of its frame, and a description of the hardware used;

b) The number of drops;

c) The drop height (or heights) at which the test was carried out;

d) The face(s) tested and the location(s) of the position(s) of impact;

e) Details of damage resulting from the test, including the nature, location (face) and severity of such damage;

f) Test atmosphere (temperature and relative humidity).

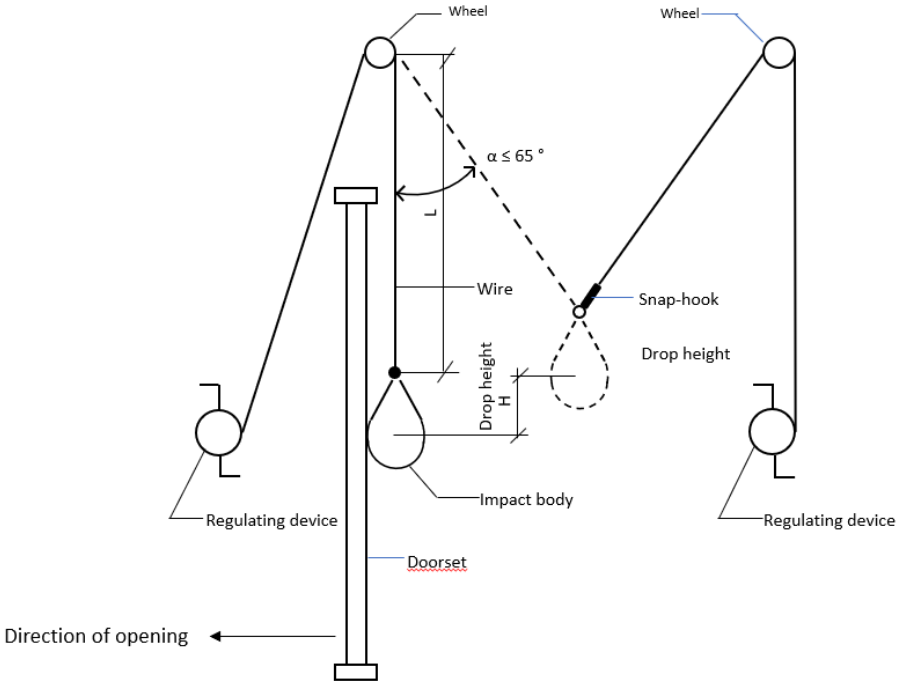



FIG. 9 TEST SETUP FOR IMPACT TEST

## ANNEX E

(*Foreword*)

## COMMITTEE COMPOSITION

Doors, Windows and Shutters Sectional Committee, CED 11

| *Organization* | *Representative(s)* |
|---|---|
| In Personal Capacity (*357, Bhera Enclave, Paschim Vihar, Delhi – 110087*) | SHRI R. K. KAKAR **(*Chairperson*)** |
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| Institute of Wood Science and Technology, Bengaluru | SHRI ANAND NANDANWAR |
| Military Engineer Services, Engineer-in-Chief's Branch, Integrated HQ of MoD (Army), New Delhi | SHRIMATI RIVOO MAHENDRU<br>SHRI KULBHUSHAN JAIN (*Alternate*) |

| *Organization* | *Representative(s)* |
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SCIENTIST 'D'/JOINT DIRECTOR
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This Indian Standard has been developed from Doc No.: CED 11 (21288).

## Amendments Issued Since Publication

| Amend No. | Date of Issue | Text Affected |
|---|---|---|
| | | |
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| Central | : 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002 | 2323 7617 |
| Eastern | : 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091 | 2367 0012<br>2320 9474 |
| 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<br>2254 1216 |
| Western | : Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093 | 2821 8093 |

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