

BS 6510:2010



BSI Standards Publication

Steel-framed windows and glazed doors – Specification

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 18, an inside back cover and a back cover.

1 Scope

This British Standard specifies requirements for the design and fabrication of steel-framed windows and glazed doors.

NOTE Performance requirements common to all windows and external pedestrian doors are specified in BS 6375.

It is applicable to windows and doors fabricated into frames in a factory from mild steel profiles, hot-rolled or cold-formed, installed vertically into the external face of buildings, as single or multi-light units, in coupled assemblies when appropriate, of the following types:

- a) fixed light;
- b) side-hung open out or in;
- c) top-hung;
- d) bottom-hung;
- e) horizontal pivot;
- f) vertical pivot;
- g) single-leaf hinged or pivoting door;
- h) double-leaf hinged or pivoting door.

It is not applicable to:

- 1) windows or doors in which any frame member is longer than 3 m;
- 2) patent glazing or curtain walls that span across structural floor elements;
- 3) kits despatched in bar form for assembly into frames on site.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 476-22, *Fire tests on building materials and structures – Part 22: Methods for determination of the fire resistance of non-loadbearing elements of construction*

BS 476-31.1, *Fire tests on building materials and structures – Part 31: Methods for measuring smoke penetration through doorsets and shutter assemblies – Section 31.1: Method of measurement under ambient temperature conditions*

BS 6206, *Specification for impact performance requirements for flat safety glass and safety plastics for use in buildings*

BS 6262 (all parts), *Glazing for buildings*

BS 6375-1, *Performance of windows and doors – Part 1: Classification for weathertightness and guidance on selection and specification*

BS 6375-2, *Performance of windows and doors – Part 2: Classification for operation and strength characteristics and guidance on selection and specification*

BS 6375-3, *Performance of windows and doors – Part 3: Classification for additional performance characteristics and guidance on selection and specification*

BS EN 13438, *Paints and varnishes – Powder organic coatings for galvanized or sherardised steel products for construction purposes*

BS EN 14449, *Glass in building – Laminated glass and laminated safety glass – Evaluation of conformity/product standard*

BS EN 14600, *Doorsets and openable windows with fire resisting and/or smoke control characteristics – Requirements and classification*

BS EN ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods*

BS EN ISO 2063, *Thermal spraying – Metallic and other inorganic coatings – Zinc, aluminium and their alloys*

BS EN ISO 9227, *Corrosion tests in artificial atmospheres – Salt spray tests*

BS EN ISO 12543 (all parts), *Glass in building – Laminated glass and laminated safety glass*

BS EN ISO 12944 (all parts), *Paints and varnishes – Corrosion protection of steel structures by protective paint systems*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS EN 12519 and the following apply.

3.1 coupled assembly

two or more windows and/or doors mechanically joined to fill an opening

NOTE This was previously known as a composite assembly.

3.2 fixing

item that is used to secure separate units of a coupled assembly to each other, or to secure a window or door into the structure of a building

3.3 glazed door

doorset, comprising leaf and frame, which has more than half its face area glazed

3.4 hardware

fitting attached to a window or door that is used to operate and/or secure it

NOTE Hardware used to close a window is often known as a fastener.

3.5 multi-light window

window incorporating two or more lights, opening and/or fixed, within one perimeter frame

3.6 ventilation device

ventilator other than an opening light incorporated into a window or door

NOTE 1 A permanent ventilation device provides continuous ventilation. A controlled device can be closed and may be adjusted to provide ventilation.

NOTE 2 A ventilation device is referred to as an “air transfer device” in BS EN 13142 and is frequently referred to as a “trickle ventilator” or “background ventilator” in the UK.

3.7 weatherseal

resilient material designed to reduce air infiltration and water penetration

NOTE This is sometimes called a weatherstrip.

4 Handing

The handing shall be in accordance with the specification provided.

Where the manufacturer is specifying the handing, the specification shall conform to Annex A.

NOTE Where the manufacturer is not specifying the handing, care should be taken to check the handing designation to avoid confusion with the conventions of BS EN 12519. See the Note to A.1.

5 Materials**5.1 Steel**

Frame profiles shall be:

- a) hot-rolled from mild steel conforming to BS EN 10025-2; or
- b) cold-formed from mild steel conforming to BS EN 10111; or
- c) cold-formed from zinc-coated steel strip conforming to BS EN 10346:2009, designation Z200 or Z275.

After rolling or forming the frame profiles shall be cold-straightened.

5.2 Hardware

Metallic materials used for hardware shall have at least the equivalent corrosion resistance to BS EN 1670:2007, grade 3 (96 h) when subjected to a neutral salt spray test as specified in BS EN ISO 9227. Tests shall be carried out on complete hardware items as supplied.

NOTE 1 For environments in very polluted localities such as those subject to combinations of industrial and coastal pollution, BS EN 1670:2007, grade 4 (240 h) should be used.

NOTE 2 Requirements and test methods for window and door hardware are specified in BS EN 13126.

NOTE 3 Changes to hardware such as hinges, pivots, handles, stays, bolts or catches can have an effect on the performance of the window.

5.3 Weatherseals and glazing gaskets

Weatherseals and glazing gaskets shall meet the requirements of BS EN 12365-1.

NOTE Guidance on the application of BS EN 12365-1 to the selection of appropriate materials is provided in DD 8455.

5.4 Fixings

Appropriate fixings shall be supplied.

The fixings shall be adequate to ensure that after installation in the building the windows and doors are judged capable of maintaining their specified performance with respect to security, safety, weathertightness, operation and strength.

NOTE The fixings recommended in Annex B are deemed to meet this requirement. Other fixings may be used if they can be shown to give similar results.

5.5 Glazing materials

The glazing type and thickness of all glass shall be selected, using the recommendations given in BS 6262-1, BS 6262-2, BS 6262-3, BS 6262-4 and/or BS 6262-7, as appropriate, or glass manufacturers' published data, to withstand a design wind pressure of 1 200 Pa unless otherwise specified. When the window or door supplier is responsible for specifying the design wind pressure, it shall be calculated in accordance with BS 6375-1.

When the window or door supplier is responsible for supplying the glass, it shall conform to the following standards as appropriate:

- a) BS EN 572 for basic glass products;
- b) BS EN 12150 for thermally toughened glass;
- c) BS EN 1863 for heat-strengthened glass;
- d) BS EN 12337 for chemically strengthened glass;
- e) BS EN 14449 and BS EN ISO 12543 for laminated glass.

Insulating glass units shall conform to BS EN 1279.

Where safety glass is fitted, it shall have an appropriate impact resistance determined in accordance with BS 6206 or BS EN 12600 and shall be fitted in accordance with the recommendations given in BS 6262-4.

NOTE Attention is drawn to the Building Regulations 2010 [1], and to the corresponding Building (Scotland) Regulations 2004 [2] and Building Regulations (Northern Ireland) 2000 [3], in respect of glazing safety.

6 Fabrication

6.1 Work sizes and manufacturing tolerances

The work sizes for overall length and height shall be documented.

The size of an assembled frame shall be within ± 2 mm of the documented work size. The difference between the diagonals of rectangular frames shall be not more than 4 mm.

NOTE Recommended maximum sizes are given in the Steel Window Association's Specifier's guide [4].

6.2 Frame joints

Welded frame joints shall have significant surfaces dressed square and flat.

NOTE 1 Significant surfaces are those visible after installation when windows and doors are closed and viewed from a distance of 1 m, unless specified otherwise by the purchaser.

When tested for bending resistance and torsional strength (see Note 2), sample welded corner pieces, selected at intervals appropriate to production volume and batch quantity (see Note 3), shall have their parent metal tear before failure of the welded joint.

NOTE 2 The test methods given in BS 4872-1:1982, Clause 18 and Clause 19, or BS EN 287-1:2004, Clause 6, or adaptations thereof, would be appropriate.

NOTE 3 Welded corner pieces tested at the start of each new production order, and at least once weekly per welding machine thereafter, would be an acceptable sampling rule for small batch production.

Joints effected by mechanical means, such as cleating and screwing, shall be sealed.

When tee glazing bars of solid hot-rolled steel profile are incorporated, they shall be riveted and/or welded to frames, and shall interlock with rigid joints displaying face gaps of no more than 1 mm.

6.3 Weatherseals

Weatherseals shall be clipped, clamped, or secured by adhesives.

6.4 Hardware

Double-point or multi-point fasteners shall be fitted on opening windows over 1 200 mm long or 1 500 mm high.

7 Protective finishes

7.1 Rust-protection

Frames and ancillary profiles shall be rust-protected using one of the following methods, or otherwise treated to provide rust protection of demonstrably equivalent or superior performance:

- a) hot dip galvanizing after fabrication in accordance with BS EN ISO 1461; or
- b) hot dip galvanizing before cold-forming in accordance with BS EN 10346:2009, coating designation Z200 or Z275; or
- c) hot melt zinc spraying in accordance with BS EN ISO 2063; or
- d) stoved epoxy zinc priming in accordance with BS EN ISO 12944 suitable for moderate environments and always over-coated with a colour finish.

NOTE One way of demonstrating "equivalent or superior performance" could be to compare specimen sample pieces of conventionally protected steel and of the proposed new finish, subjecting both simultaneously to a BS EN 1670:2007, grade 4 (240 h) salt spray test.

7.2 Colour-coating

Frames and ancillary profiles shall be colour-coated, when required, either:

- a) in accordance with either BS 6497 or BS EN 13438 with a paint thickness over zinc on significant surfaces of not less than 60 μm ; or
- b) otherwise treated to provide a colour coating of demonstrably equivalent or superior performance.

NOTE Significant surfaces are those visible after installation when windows and doors are closed and viewed from a distance of 1 m, unless specified otherwise by the purchaser.

8 Design for installation

NOTE A guide to installation of steel windows is published by the Steel Window Association as Fact Sheet 3 [5]. BS 8213-4 provides guidance on the survey and installation of replacement windows and external pedestrian doors.

8.1 Perimeter joint design gap

Windows and doors shall be provided with a perimeter design gap as shown in Figure 1 that allows for thermal movement, fabrication size variance and aperture construction tolerance.

NOTE 1 Gaps may vary to rationalize frame sizes measured to fit existing similar but not identical openings.

Perimeter design gaps shall be not less than 2 mm and not greater than 8 mm once the frame is centralized in its opening, unless otherwise agreed (see Notes 3 and 4).

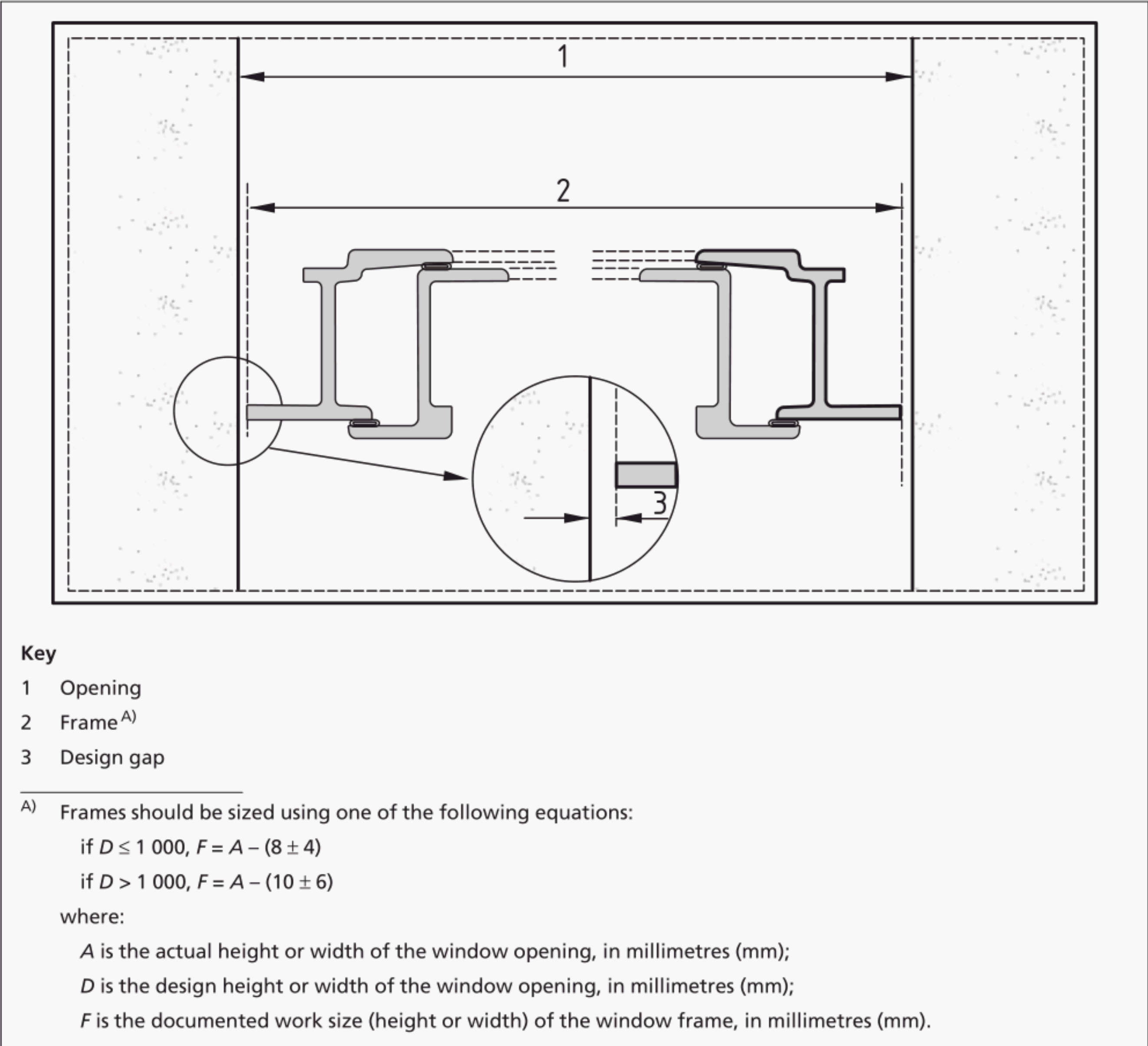
NOTE 2 To achieve this, the following rules should be observed.

- a) *For design opening heights and widths up to 1 m, frames should be sized 8 mm less than the design opening; actual opening heights and widths should vary by no more than ± 4 mm from the design opening.*
- b) *For design opening heights and widths over 1 m, frames should be sized 10 mm less than the design opening; actual opening heights and widths should vary by no more than ± 6 mm from the design opening.*

NOTE 3 When replacing windows in existing buildings, the “design” opening is the median of the range of sizes measured from actual heights or widths that are notionally similar but not identical. Actual perimeter gaps between frame and irregular openings outside the limits specified in 8.1 can be acceptable, and effectively sealed by specialist contractors, on agreement between installer and client.

NOTE 4 Fire-resistant doors and windows require wider perimeter design gaps, generally of at least 10 mm.

Figure 1 Perimeter design gap



8.2 Fixing positions

Suitable fixing positions shall be prepared for the frames, to maximize the likelihood of the windows and doors maintaining their specified performance after installation in the building.

NOTE 1 The recommended maximum pitch for steel frames of hot-rolled solid section is 175 mm from corners, and then at 750 mm intervals; and for steel frames of cold-formed hollow section it is 200 mm from corners, and then at 900 mm intervals.

NOTE 2 Not all holes pierced around the frame perimeter for fabrication and assembly purposes will necessarily require a fixing screw.

8.3 Coupled assemblies

NOTE 1 Coupled assemblies are usually delivered to site as separate window units, to ease handling and minimize damage.

When the window or door supplier is responsible for installation, sealing materials shall be supplied and shall be placed within the profile cavity of the coupled joint during the site assembly operation.

NOTE 2 It is not sufficient to rely solely on external pointing for a weathertight joint.

9 Design for glazing

Steel windows and doors shall be designed for conformity to the recommendations given in BS 8000-7.

NOTE Attention is drawn to the glazing safety recommendations of BS 6262-4, particularly the requirements for marking the glass.

Glazing beads shall be supplied either temporarily attached close to their final position in the frame, or bundled and labelled to indicate their intended position. Glazing bead corner clips shall be supplied to cover corner joints, or beads shall be profiled and cut to length so that visible corner joint gaps do not exceed 3 mm.

10 Security

10.1 Basic security

When a completed window or door is subjected to the basic security test specified in BS 6375-3, it shall not be possible to gain entry.

10.2 Enhanced security

When enhanced security is required, windows shall conform to BS 7950 and doors to PAS 24.

NOTE This is the requirement specified in BS 6375-3. Alternative specifications for burglar resistance can be found in DD EN 1627 where resistance class 2 or 3 might be appropriate.

11 Safety in case of fire

NOTE This clause is relevant to Essential Requirement 2 of the European Construction Products Directive [6].

11.1 Resistance to fire

Any steel-framed glazed window, screen or door designed to resist fire shall be classified after test or assessment as to its time period of resistance with respect to integrity and/or insulation in accordance with either BS EN 14600 or BS 476-22.

NOTE 1 The Building Regulations 2010 [1] recommend that any such test, assessment and classification be undertaken independently by a suitably qualified and accredited authority. Attention is also drawn to the corresponding Building (Scotland) Regulations 2004 [2] and Building Regulations (Northern Ireland) 2000 [3].

NOTE 2 A fact sheet on fire safety which illustrates some steel framing solutions is published by the Steel Window Association as Fact Sheet 5 [7].

11.2 Smoke leakage control

Any steel-framed window or door designed to control smoke leakage shall be classified after test or assessment as to its time period of resistance with respect to smoke leakage in accordance with either BS EN 14600 or BS 476-31.1.

NOTE The Building Regulations 2010 [1] recommend that any such test, assessment and classification be undertaken independently by a suitably qualified and accredited authority. Attention is also drawn to the corresponding Building (Scotland) Regulations 2004 [2] and Building Regulations (Northern Ireland) 2000 [3].

12 Safety in use

NOTE 1 BS 8213-1 gives guidance on the safety in use and in cleaning of windows and door height windows.

NOTE 2 This clause is relevant to Essential Requirement 4 of the European Construction Products Directive [6].

12.1 Impact resistance

Impact resistance shall be declared in accordance with BS 6375-2.

NOTE The purpose of the test required to make this declaration is to assess the interactions between all components with regard to safety in use. It is particularly relevant when the window or door serves as a barrier to provide protection from falling. BS EN 13049:2003, Class 3, following impact from a drop height of 450 mm, would usually be appropriate.

12.2 Safety device loading

If a safety restrictor is fitted, it shall remain secure when subjected to a force of 350 N applied for 60 s in the most unfavourable way.

NOTE 1 This is the performance requirement specified in BS EN 14351-1. BS 6375-2 specifies BS EN 14609 as the relevant test method.

NOTE 2 The fitting of a safety restrictor is recommended wherever children might have access to a window.

12.3 Ability to release

When fitted, emergency exit and panic devices mounted on doors placed along escape routes shall conform to BS EN 179 or BS EN 1125.

NOTE This is the requirement specified in BS 6375-3. Requirements for electrically operated devices are specified in prEN 13633 and prEN 13637, currently in preparation.

13 Weathertightness

The completed window or door shall be tested and classified in accordance with BS 6375-1.

NOTE 1 The weathertightness class required should be related to the site location. It should be not less than exposure category 1 200 for windows and 800X for doors unless otherwise specified.

NOTE 2 The classifications in BS 6375-1 are relevant to the following Essential Requirements of the European Construction Products Directive [6]:

- wind resistance to Essential Requirement 1 (mechanical resistance and stability);
- watertightness to Essential Requirement 3 (hygiene, health and environment);
- air permeability to Essential Requirement 6 (energy conservation).

14 Operation and strength

Operation and strength characteristics shall be declared in accordance with BS 6375-2.

NOTE This covers ease of movement (maximum operating forces), mechanical strength (resistance to racking and torsion), and durability (resistance to repeated opening and closing).

15 Hygiene, health and environment

NOTE 1 This clause is relevant to Essential Requirement 3 of the Construction Products Directive [6].

NOTE 2 There is a requirement in BS EN 14351-1 for the manufacturer to declare if there is a risk of any potentially dangerous substances being released from the window or door during normal intended use.

The performance of any ventilation device (see 3.6) mounted within the window shall be classified in accordance with BS EN 13142 when tested in accordance with BS EN 13141-1.

NOTE 3 Attention is drawn to the Building Regulations 2010 [1], and to the corresponding Building (Scotland) Regulations 2004 [2], and Building Regulations (Northern Ireland) 2000 [3], in respect of ventilation.

16 Acoustic performance

When specified, acoustic performance shall be declared in accordance with BS 6375-3.

17 Energy conservation

NOTE 1 This clause is relevant to Essential Requirement 6 (energy economy and heat retention) of the European Construction Products Directive [6].

NOTE 2 Information on steel windows in relation to the energy conservation requirements of the Building Regulations 2010 [1] is given in Steel Window Association Fact Sheet 2 [8]. Attention is also drawn to the corresponding Building (Scotland) Regulations 2004 [2] and Building Regulations (Northern Ireland) 2000 [3].

NOTE 3 Energy rating grades for standard reference window types with specified glass characteristics can be calculated in accordance with British Fenestration Rating Council procedures [9] from 17.1 (thermal transmittance values), 17.2 (solar factor), and Clause 14 (air permeability data).

17.1 Thermal transmittance

The U value shall be declared in accordance with BS 6375-3.

NOTE Conventions for U-value calculations are published in BRE 443 [10]. Standard reference window types for these calculations are defined in the Glass and Glazing Federation's Glazing manual, Part 2.2 [11].

17.2 Solar gain and light transmittance

When values are declared for solar gain and light transmittance through the glazed portion of the whole window or door area, they shall be determined in accordance with BS EN 410.

18 Marking

Each window or door shall be identified with the following information:

- a) the number and date of this British Standard i.e. BS 6510:2010²⁾;
- b) claimed performance classifications;
- c) the name or trademark of the manufacturer or other means of identifying the manufacturer;
- d) means of traceability.

The identification shall be affixed:

- to any suitable part of the product; or
- on an attached label; or
- on its packaging; or
- on the accompanying commercial documents; or
- on the manufacturer's website; or
- in the manufacturer's published technical specifications.

²⁾ Marking BS 6510:2010 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

Annex A (normative) **Specification for handing**

A.1 View

When specifying handing, the window or door shall be viewed from the outside.

NOTE Drawing conventions for window and door types are illustrated in Figure A.1. The European designations (BS EN 12519) are significantly different and care should be taken to establish which is being used.

A.2 Side-hung windows and doors

The handing of side-hung windows and external pedestrian doors shall be described by the hinge position.

NOTE Care should be taken to avoid confusion with door handing specified in accordance with BS EN 12519, which is determined by hinge position but viewed from the opening face which may be outside or inside.

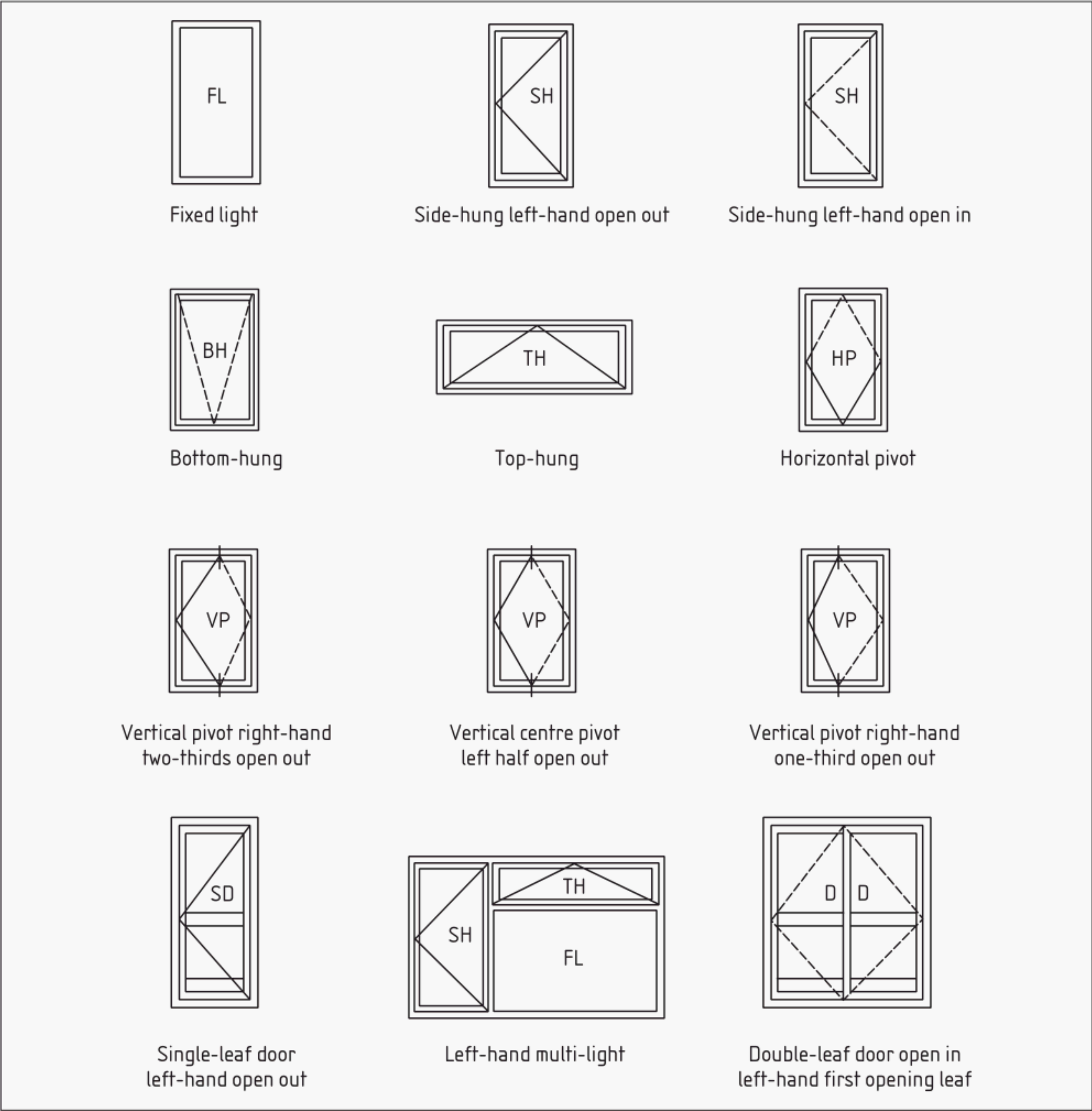
A.3 Vertically pivoted windows and doors

For windows and doors pivoted vertically off-centre, the handing shall be described by the pivot position in relation to the portion opening out. The proportion opening outwards shall be stated.

A.4 Multi-lights

The handing of a multi-light shall be described by the position of the largest opening light and its arrangement shall be shown on a drawing or diagram.

Figure A.1 Drawing conventions for window and door types



Annex B (informative)

Recommendations for fixings

Fixing lugs should be not less than 2 mm thick and should be manufactured from one of the following:

- a) rust-resistant steel, which should be either:
 - cut from continuously hot dip galvanized sheet conforming to BS EN 10346:2009, coating designation Z200 or Z275; or
 - hot dip galvanized in accordance with BS EN ISO 1461;
- b) austenitic stainless steel conforming to BS EN 10088-2:2005, grade 1.43xx (formerly 304) or 1.44xx (formerly 316).

Fixing screws should have a shank diameter not less than 5 mm or No. 10 and should be manufactured from one of the following:

- 1) rust-resistant steel, zinc plated in accordance with BS EN ISO 2081:2008, code Fe/Zn 12 or Fe/Zn 25, and chromate passivated in accordance with BS 6338:1982, Class 2C or 2D;
- 2) austenitic stainless steel conforming to grade A2 (304) or A4 (316) as specified in the appropriate part of BS EN ISO 3506.

Screws should be sized to penetrate at least 25 mm into timber or into plugged holes in brick, block, or masonry. Connections to steelwork up to 2 mm thick such as folded sheet lintels should be made with appropriate thread cutting screws. Connections to steelwork over 2 mm thick should be made either into pre-tapped holes with machine screws of minimum 5 mm diameter or with power-driven hardened self-drilling screws.

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Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 4872-1:1982, *Specification for approval testing of welders when welding procedure approval is not required – Part 1: Fusion welding of steel*

BS 6338:1982, *Specification for chromate conversion coatings on electroplated zinc and cadmium coatings*

BS 8213-1, *Windows, doors and rooflights – Part 1: Design for safety in use and during cleaning of windows, including door-height windows and roof windows – Code of practice*

BS 8213-4, *Windows, doors and rooflights – Part 4: Code of practice for the survey and installation of windows and external doors*

DD ENV 1627, *Windows, doors, shutters – Burglar resistance – Requirements and classification*

BS EN 287-1:2004, *Qualification test of welders – Fusion welding – Part 1: Steels*

BS EN 10088-2:2005, *Stainless steels – Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

BS EN 13049:2003, *Windows – Soft and heavy body impact – Test method, safety requirements and classification*

BS EN 13126 (all parts), *Building hardware – Requirements and test methods for windows and doors height windows*

BS EN 14351-1, *Windows and pedestrian doors – Product standard, performance characteristics – Part 1: Windows and external pedestrian doorsets without resistance to fire and/or smoke leakage characteristics³⁾*

BS EN 14609, *Windows – Determination of the resistance to static torsion*

BS EN ISO 2081:2008, *Metallic and other inorganic coatings – Electroplated coatings of zinc with supplementary treatments on iron or steel*

BS EN ISO 3506 (all parts), *Mechanical properties of corrosion-resistant stainless-steel fasteners*

DD 8545, *Materials for gaskets and weatherstripping for windows, doors, conservatories and curtain walling – Requirements and test methods*

prEN 13637, *Building hardware – Electrically controlled exit systems for use on escape routes – Requirements and test methods⁴⁾*

prEN 13633, *Building hardware – Electrically controlled panic exit systems for use on escape routes – Requirements and test methods⁴⁾*

prEN 16034, *Pedestrian doorsets, industrial, commercial, garage doors and windows – Product standard, performance characteristics – Fire resistance and/or smoke control characteristics⁴⁾*

³⁾ Part 2 is in preparation and is expected to be circulated for formal vote shortly. Part 3 (also in preparation) has been redesignated prEN 16034.

⁴⁾ In preparation.

Other publications

- [1] GREAT BRITAIN. Building Regulations 2010. London: The Stationery Office.
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- [11] GLASS AND GLAZING FEDERATION. *Glazing manual – Part 2.2: Window and door system U-values – Provision of certified data*. London: Glass and Glazing Federation, 2002.

⁵⁾ Available from the Steel Window Association, 42 Heath Street, Tamworth, Staffordshire B79 7HJ. Telephone: 01827 523 37. Fax: 01827 310 827.

⁶⁾ Available from the British Fenestration Rating Council, Octavia House, 54 Ayres Street, London SE1 1EU. Telephone: 020 7645 3702. Fax: 020 7407 8307.

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