

Specification for

Steel windows, sills, window boards and doors

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Committees responsible for this British Standard

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- Aluminium Federation
- Aluminium Window Association
- Association of Builders' Hardware Manufacturers
- British Lock Manufacturers' Association
- British Standards Society
- Cold Rolled Sections Association
- Consumer Standards Advisory Committee of BSI
- Department of the Environment (Building Research Establishment, Princes Risborough Laboratory)
- Department of the Environment (Property Services Agency)
- Flat Glass Manufacturers' Association
- Glass and Glazing Federation
- Greater London Council
- Incorporated Association of Architects and Surveyors
- London Housing Consortium
- Royal Institute of British Architects
- Steel Window Association

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Foreword

This British Standard, having been prepared under the direction of the Elements and Components (of Diverse Materials) for Building Standards Committee, supersedes BS 990-1:1967 and BS 990-2:1972 which are withdrawn.

BS 1787, BS 2503 and BS 1422 are also withdrawn as they are now incorporated in this new standard (with the exception of the subframes specified in BS 1422 which are no longer manufactured). BS 990-3 referred to in the foreword of BS 990-2:1972 edition will not now be published as performance requirements have been included in this standard.

The principle new features of this standard are as follows:

- a) the introduction of the W20 range of heavier steel window sections;
- b) the provision, if required, of a polyester powder coating before despatch to the site;
- c) the introduction of performance requirements.

Account has been taken of the principles of dimensional co-ordination given in BS 4011, BS 4330, DD 22 and PD 6444-1.

Related British Standards are BS 1285 and BS 5642.

Certification. Attention is drawn to the certification facilities described on the inside back cover of this standard.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 36, an inside back cover and a back cover.

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1 Scope

This British Standard specifies requirements for materials, construction, finishes and hardware for steel windows, sills, window boards and doors manufactured from the F range, or the heavier W20 range, of steel window sections; weathertightness performance requirements for weather-stripped opening light windows and fixed light windows are also specified. Provision is included for glazing of frames but glass is not included.

Window and door types and size limitations are given in Appendix A and details of optional features to be agreed between manufacturer and purchaser are given in Appendix B.

Recommendations for the site assembly of composites are given in Appendix C and for marking in Appendix D.

NOTE The titles of the publications referred to in this standard are listed on page 34.

2 Definitions

For the purposes of this British Standard, the definitions given in BS 2900, BS 3589 and BS 4643 apply together with the following.

NOTE 1 The definitions given in 2.4 to 2.13 are identical with those given in BS 2900 and BS 4643.

NOTE 2 The definitions given in 2.14 to 2.18 are modifications of those given in BS 3589.

2.1

casement

a window, or part of a window, that opens on hinges, pivots or variable geometry stays

NOTE See Figure 1.

2.2

composite

an assembly of two or more units coupled together by one or more mullions or transoms

2.3

double window

two separate glazed frames superimposed in the same wall opening

2.4

co-ordinating plane

a plane by reference to which a building component or assembly is co-ordinated with another¹⁾

2.5

co-ordinating space

a space bounded by co-ordinating planes allocated to a building component or assembly, including allowance for joints and tolerances

2.6

co-ordinating dimension

a dimension of a co-ordinating space or a dimension that is common to two or more building components to permit their assembly

2.7

co-ordinating size

the size of a co-ordinating dimension (length or height or a co-ordinating space)

2.8

basic space

a space bounded by reference planes assigned to receive a building component or assembly, including allowance for joints and tolerances

¹⁾ Co-ordinating planes are indicated on plan sections and elevations by co-ordinating lines (see Figure 2).

2.9

work size

the size of a building component specified for its manufacture, to which its actual size should conform within specified permissible deviations

2.10

manufacturing size

a size within the specified permissible deviations from a work size

2.11

tolerance

the difference between the limits within which a size or position should lie

2.12

deviation

the difference between a size or position (actual, limit, etc.) and a specified size or position

2.13

margin

the distance between the joint face of a building component and the joint reference plane

2.14

mullion

a vertical bar for coupling units side by side

2.15

transome

a horizontal bar for coupling units one above the other

2.16

unit

a four-sided frame that may be a fixed light or a casement or a combination of both (multi-light unit)

2.17

window sill

an external projecting pressed steel sill, extending across the full width of the window opening, to which the bottom bar of the window is fixed

2.18

window board

an internal pressed steel sill unit with nosing, extending across the full width of the window opening

3 Window types, size limitations and handing

3.1 F range and W20 range windows and their maximum manufacturing sizes shall be as given in Appendix A. Multi-light units shall have no frame member longer than 3 m.

3.2 The handing shall be specified as shown in Figure 3.

NOTE 1 For typical W20 and F range windows, see Figure 4 and Figure 5.

NOTE 2 Single side-hung and vertically pivoted casement windows and single casement doors can be supplied right-handed or left-handed.

NOTE 3 Two-light wide windows can be supplied with the casements handed on either the right or the left-hand side of the window. Windows including side-hung and top-hung casements are handed according to the hinge of the side-hung casement.

3.3 Side-hung casements shall not be hinged on the intermediate vertical bars.

4 Materials

4.1 Rolled steel sections

Windows and doors shall be manufactured from hot rolled steel sections that, when tested in accordance with BS 18-2, have an ultimate tensile strength of 355 N/mm² to 510 N/mm². The steel shall be rolled in bars of the F and W20 sectional forms with dimensions as shown in Figure 12 and Figure 13 respectively, subject to the tolerances given.

NOTE The mean mass per metre is shown for guidance.

4.2 Brackets, etc.

Handle plates, stay pegs, brackets and stayrests shall be of steel grade HRP1 or HR4 complying with BS 1449-1 or leaded brass stampings CZ122 (condition M) complying with BS 2872.

4.3 Hinges and pivots

4.3.1 Hinges for side-hung and top-hung casements and doors shall be either of steel grade HRP1 complying with BS 1449-1 or of leaded brass CZ121 (condition M) complying with BS 2874. Hinge pins shall be manufactured from one of the following:

- a) aluminium alloy wire 5056A (condition H4) complying with BS 1475;
- b) aluminium alloy 5056A (condition H2) complying with BS 1473;
- c) stainless steel grade 303S31 or 325S31 complying with BS 970-1;
- d) common brass CZ108 (condition H) complying with BS 2873;
- e) rolled carbon steel category 040A04 complying with BS 970-1.

4.3.2 Pivots or shoes for horizontally pivoted, vertically pivoted or projected top-hung casements shall be manufactured from one of the following:

- a) leaded brass stampings or extrusions CZ122 (condition M) complying with BS 2872 or CZ121 (condition M) complying with BS 2874 respectively;
- b) zinc die casting alloy A complying with BS 1004.

4.4 Hardware

Materials and finishes for the manufacture of hardware shall be one of the following:

- a) leaded brass CZ122 (condition M) complying with BS 2872, with barrelled finish;
- b) leaded brass CZ122 (condition M) complying with BS 2872, nickel-chromium plated in accordance with service condition no. 3 of BS 1224;
- c) zinc die casting alloy A complying with BS 1004, nickel-chromium plated in accordance with service condition no. 3 of BS 1224;
- d) aluminium alloy 5251 For 6063 complying with BS 1472 or BS 1474;
- e) cast leaded gunmetal, LG2-C complying with BS 1400, with barrelled and satin finish, nickel-chromium plated in accordance with service condition no. 3 of BS 1224.

4.5 Panels

Lock panels and kicking panels for doors shall be fabricated from pre-galvanized steel sheet (minimum thickness 0.90 mm) of grade Z2 G275 N or M complying with BS 2989.

4.6 Weather bars

Weather bars shall be manufactured from one of the following materials:

- a) steel sheet (minimum thickness 0.90 mm) of grade HR14 complying with BS 1449-1, hot-dip galvanized after manufacture in accordance with BS 729 to a minimum coating mass of 460 g/m² or pre-galvanized steel sheet (minimum thickness 0.90 mm) of grade Z2 G275 N or M complying with BS 2989;
- b) aluminium alloy sheet or extrusions 5251 (condition H3) or 6063 (condition TF) complying with BS 1470 or BS 1474 respectively;
- c) rigid polyvinylchloride type A1 complying with BS 3757.

4.7 J and JB filler panels

J filler panels and the internal covers used to form JB filler panels shall be made from pre-galvanized steel sheet (minimum thickness 1.5 mm) of grade Z2 G275 N or M complying with BS 2989.

4.8 Sills

Sills shall be manufactured from mild steel sheet (minimum thickness 1.6 mm) of grade HR14 complying with BS 1449-1 that is either:

- a) pre-galvanized in accordance with grade Z2 G275 N or M of BS 2989; or
- b) hot-dip galvanized after manufacture in accordance with BS 729, to a minimum coating mass of 460 g/m².

4.9 Window boards

Window boards shall be manufactured from mild steel sheet (minimum thickness 1.2 mm) of grade HR14 complying with BS 1449-1 that is either:

- a) pre-galvanized in accordance with grade Z2 G275 N or M of BS 2989:1982; or
- b) hot-dip galvanized after manufacture in accordance with BS 729, to a minimum coating mass of 460 g/m².

5 Construction

5.1 Frames

5.1.1 Windows and doors shall be constructed of bars that have been cut to length and mitred. All corners shall be welded to form right angles; the surplus weld metal shall be neatly cleaned off. All frames shall be square subject to manufacturing tolerances (see **6.3**).

NOTE 1 Size limitations are given in Appendix A.

NOTE 2 Holes are made in the webs of sections of doors and windows for location purposes during manufacture, for fixing and coupling, for slotting of intermediate bars, for bead and weather stripping studs and for the location of spring glazing clips.

5.1.2 Internal bars shall be tenoned and riveted or be welded to the outer frames.

5.2 Hinges and pivots

5.2.1 Side-hung casements in F range sections shall be fitted with projecting friction hinges as shown in Figure 6, adjusted by the window manufacturer at his works to require a minimum force of 25 N on the handle to move the casement. The distance between the casement and frame, when the casement is open to 90°, shall be not less than 95 mm when measured as shown in Figure 6.

NOTE Figure 6 also shows an alternative detail to give adequate clearance between hinge and reveal if the latter is rendered or rough cast.

5.2.2 Side-hung casements in W20 range sections shall be hung on non-projecting friction or non-friction hinges. Friction hinges shall be adjusted by the window manufacturer at his works to require a minimum force of 25 N on the handle to move the casement.

5.2.3 Pivots for reversible casements in F range sections shall be of the friction type and shall hold the casement in any position up to the length of the safety arm and thereafter restrain it while being reversed (see Figure 7).

5.2.4 Pivots for horizontally and vertically pivoted W20 casements shall be friction or non-friction cups.

5.2.5 Door leaves shall each be hung on friction or non-friction hinges as shown in Figure 8.

5.2.6 Friction hinges and pivots shall be re-adjustable unless the fittings are designed so as not to need adjustment throughout the life of the window.

5.3 Hardware

5.3.1 Casements and doors shall normally be supplied complete with hardware attached (see clause 8) except where the manufacturer is also responsible for fixing, when they shall be attached, or not, according to his option. Casements and doors shall be fitted to their frames so as to provide face contact all round allowing for the finished condition. The hardware shall be checked and adjusted by the manufacturer, so that the casements or doors function as designed. Casements and doors shall be secured in the closed position before despatch.

5.3.2 Stays and handles and spring catches shall be detachable and replaceable without disturbing the glass.

5.4 Weather bars

Where a top-hung casement occurs over a side-hung casement within a unit, a weather bar shall be fixed to the bottom bar of the top hung casement.

NOTE It is essential that any weather bars required at the lintels are specially ordered (see Appendix B).

Weather bars shall be supplied separately for subsequent fitting by the installer on site.

5.5 Panels

Doors and side-lights shall be provided with kicking panels and lock panels, welded, riveted, or screwed to the frames.

NOTE Typical details are shown in Figure 8.

5.6 Sills and window boards

Sills and window boards shall be formed to profiles, of which typical designs are shown in Figure 9, to lengths corresponding to the work sizes of the windows for which they are specified. The ends of the sills and window boards shall have returns to form end fillers and location gauges.

NOTE It is essential that any sills and window boards required are specially ordered (see Appendix B).

Sills and window boards shall be supplied separately for subsequent fitting by the installer on site.

6 Work sizes and manufacturing tolerances

6.1 General

Where sizes are quoted length shall be given before height.

6.2 Work sizes

Each work size shall be 6 mm less than the corresponding co-ordinating size (see Figure 2).

6.3 Manufacturing tolerances

The sizes of an assembled frame shall be within a permissible deviation of ± 1.5 mm from the work sizes and the maximum difference between the diagonals of the assembled frame shall be 4 mm.

7 Composites

7.1 General

NOTE Composites can be assembled at the manufacturer's works before despatch (see 7.1.2) or on site.

7.1.1 Coupling. Units to form composites shall be coupled in bedding mastic and fixed with screws and nuts through the fixing holes of the units and corresponding holes in the mullions and transoms at positions specified by the manufacturer. Screws and nuts shall be supplied by the window manufacturer if assembly is to be on site. In composites where both mullions and transoms occur, the shorter span shall be dominant.

NOTE Recommendations for site assembly of composites are given in Appendix C.

7.1.2 Assembly at manufacturer's works. At the discretion of the manufacturer, composites or parts of composites can be assembled in the works before despatch. For reasons of transportation and handling, in any such assembly there shall be:

- a) no single item with a size greater than 2 500 mm × 1 800 mm;
- b) not more than two mullions spanning the full height, nor more than two transoms spanning the full length;
- c) not more than one reversible or pivot casement.

J filler panels and their ancillary components shall be despatched loose. Composites formed of windows and doors finished with factory-applied organic coatings shall be despatched unassembled.

7.2 Mullions and filler panels

Mullions and filler panels shall be of the following types:

- a) K11 or K11X sections as shown in Figure 8 or WK2, WK4 or WK15 sections as shown in Figure 13;
- b) J filler panels as shown in Figure 10;
- c) JB filler panels as shown in Figure 10.

NOTE 1 Mullions and filler panels are not designed to carry vertical loads.

NOTE 2 The overall thickness of JB filler panels can be increased (i.e. to a larger thickness than is shown in Figure 10), if the height of the assembly exceeds 1 500 mm, or to meet any horizontal loading, particularly that due to wind.

NOTE 3 The internal covers of JB filler panels should be riveted or screwed to the J filler panel by the manufacturer unless specified by the purchaser to be supplied unfitted.

7.3 Transoms

Transoms shall be of section K12, WK2, WK4 or WK7 (see Figure 8 and Figure 13).

NOTE The mullion section K11 can be supplied as a transom above a fixed light not exceeding 1 200 mm in length.

7.4 Work sizes

7.4.1 Length. The work size of the length of a composite shall be the sum of the work sizes of the units plus 6 mm for each K section mullion plus 106 mm for each J or JB filler panel when used.

7.4.2 Height. The work size of the height of a composite shall be the sum of the work sizes of the units plus 6 mm for each K section transom.

8 Hardware

8.1 General

The hardware specified in 8.2 to 8.12 for the various types of window and door is the minimum that shall be provided.

NOTE 1 Additional hardware may be required to achieve a minimum level of performance for a particular location.

NOTE 2 Security and safety requirements are specified in clauses 13 and 14.

NOTE 3 Alternative types of hardware can be fitted (see Appendix B).

8.2 Side-hung casements (open out)

Side-hung casements (open out) shall have a lever handle providing limited or “crack” ventilation by engaging with a bevelled striking plate on the fixed frame. The striking plate shall be fixed in such a position in relation to the handle that, with the latter bearing against its stop, it shall hold the casement tight to its frame when closed. W20 casements shall, additionally, have a peg stay.

8.3 Side-hung casements (open in)

Side-hung casements (open in) shall have a lever handle engaging with a keep on the fixed frame.

8.4 Top-hung casements

Top-hung casements shall be provided with and operated by a stay that shall hold the casement tight to its frame when closed.

8.5 Bottom-hung casements (open in)

Bottom-hung casements (open in) shall be fitted with a spring catch for hand or pole operation and have releasable side arms that permit the vent to be dropped down for cleaning.

8.6 Horizontally pivoted casements

Horizontally pivoted casements shall be fitted with a spring catch for hand, pole or cord operation; if cord operated, cord, eye and pulley shall be provided.

NOTE Additionally, horizontally pivoted casements can be fitted with peg stays (see Appendix B).

8.7 Vertically pivoted casements (open out)

Vertically pivoted casements (open out) shall be fitted with a lever handle, and where they are fitted with non-friction pivots, they shall, additionally, be provided with a peg stay.

NOTE The pivot of vertically pivoted casements may be central or offset e.g. one-third or two-thirds; the dominant part determines whether the casement is described as open in or open out.

8.8 Vertically pivoted casements (open in)

Vertically pivoted casements (open in) shall be fitted with a handle.

8.9 Projected top-hung casements

Projected top-hung casements shall be fitted with a lever handle and an eye for hand or pole operation.

8.10 Reversible horizontally pivoted casements

Reversible horizontally pivoted casements shall be fitted with a handle at the sill and a storm catch at the head. They shall also be fitted with a limit catch and a reversing catch (see also Appendix B).

8.11 Doors: F range

Doors in the F range of sections shall be fitted with a mortice lock, lever handles and two face-operated bolts or thumbturns. Double doors shall have two concealed bolts to the first closing leaf.

The lock shall be housed in a metal panel and shall be capable of being key operated from both sides. Each door leaf shall be provided with a concealed head stay to limit opening to 90°, except where projecting hinges are fitted.

8.12 Doors: W20 range

Doors in the W20 range of sections shall be fitted with a mortice lock and lever handles. Double doors shall have two concealed bolts to the first closing leaf. Thumbturns shall be fitted to the side hung door and last closing leaf to folding doors when the height exceeds 2 250 mm.

9 Protective finishes

9.1 General

All windows, sills, window boards and doors (except when manufactured from pre-galvanized steel sheet), and where of steel, their handle plates, hinges, stay pegs, brackets, stay rests and keeps, and rolled steel coupling members shall be hot-dip galvanized after manufacture, in accordance with BS 729, to a minimum coating mass of 460 g/m². Sills and window boards manufactured from pre-galvanized steel sheet shall have cut ends protected with a metallic zinc-rich priming paint complying with BS 4652 by the manufacturer prior to despatch. If windows and doors have been subjected to post-galvanizing conversion treatment for subsequent painting, the manufacturer shall inform the purchaser of the type of treatment applied.

NOTE 1 If required, hot-dip galvanized windows, doors and ancillary steel components can be coated with polyester based powder coating complying with BS 6497 before despatch to the site (see Appendix B).

NOTE 2 Advice on the selection of paint systems is contained in DD 24.

9.2 Kicking panels, lock panels, J and JB filler panels and weather bars

Kicking panels, lock panels, J and JB filler panels and weather bars made from pre-galvanized steel sheet shall, on any area where the galvanized finish has been disturbed during the manufacturing process, be treated with metallic zinc-rich priming paint complying with BS 4652 by the manufacturer prior to despatch.

9.3 Small ferrous components

Small ferrous components, including lugs, hinge pins, washers, handle pins, coupling screws and nuts, fixing screws and side arms shall be finished by one of the following methods:

- a) zinc plating in accordance with classification no. Zn 3 of BS 1706 for non-threaded components or classification no. Zn 3 of BS 3382-7 (allowance A or D) for threaded components;
- b) sherardizing in accordance with class 1 of BS 4921;
- c) hot-dip galvanizing in accordance with BS 729, to a minimum coating mass of 460 g/m².

10 Weatherstripping

10.1 Reversible horizontally pivoted casements shall be weatherstripped using gaskets complying with type 1 of BS 4255-2:1975.

10.2 If required side-hung, top-hung and bottom-hung casements in F range sections can be supplied weatherstripped, (see Figure 3 and Appendix B) in which case gaskets complying with type 1 of BS 4255-2:1975 or formed from compounds complying with BS 2571 shall be used. Top hung casements having a perimeter greater than 1 800 mm shall be weatherstripped with gaskets formed from compounds complying with BS 2571.

10.3 Casements in W20 range sections shall be weatherstripped and gaskets complying with type 1 of BS 4255-2 or formed from compounds complying with BS 2571 shall be used.

NOTE Weatherstripping is vulnerable to organic liquids and should not, for example, be painted.

11 Provision for fixing

11.1 Outer frames shall have holes situated centrally in the webs of the sections.

11.2 Holes for fixing or coupling shall be at not more than 900 mm centres, commencing not more than 190 mm or less than 50 mm from the end of the frame, appropriate to the manufacturer's design.

11.3 Fixing lugs and fixing screws for windows, doors, sills and window boards shall be supplied by the manufacturer.

NOTE Typical fixing details are shown in Figure 11.

12 Provision for glazing

12.1 All frames to receive glass shall be prepared for spring wire glazing clips or beads in accordance with BS 6262.

12.2 Where specified, beads shall be supplied by the window manufacturer (see Appendix B). Beads shall be structurally adequate and fixed to a sufficient number of points to withstand the design wind loading.

NOTE Spring wire glazing clips, setting blocks and distance pieces are not supplied with the window. Window manufacturers collaborate with spring clip manufacturers to ensure availability of spring clips of suitable design.

12.3 A filler piece shall be securely fixed by the manufacturer in bar sections F2, F3 and F4 to obviate the use of excessive putty.

NOTE 1 Various materials are used for filler pieces, including aluminium.

NOTE 2 Recommendations for the thickness of single and double glass and methods of glazing for various conditions are given in BS 6262.

NOTE 3 A BSI Published Document dealing with fire hazards associated with glazed areas in buildings including design advice on window glazing is in course of preparation and will replace CP 153-4.

13 Security

NOTE The purchaser should notify the manufacturer if any of the security devices given in Appendix B are to be provided.

13.1 Fasteners shall be designed so that when they are fully closed, they cannot be released from the outside by the insertion of a thin blade or other simple tool.

13.2 Opening lights shall not be operable, or removable, from the outside when fastened in the closed position except by the use of special tools or by breaking part of the window.

14 Safety

It shall not be possible for any opening light to become accidentally disengaged from the outer frame.

NOTE 1 The purchaser should notify the manufacturer if any of the safety fittings given in Appendix B are to be provided (see also 8.10).

NOTE 2 Advice on the safety of openable windows can be obtained from CP 153-1.

NOTE 3 Recommendations for glazing in risk areas are given in BS 6262.

15 Weathertightness performance

15.1 General

Requirements for weathertightness performance are specified for weatherstripped opening light and fixed light windows only. The tests shall be applied to all types of these windows and the test sequence shall be as described in clause 4 of BS 6375-1:1983.

NOTE The test pressure classes for air permeability, watertightness and wind resistance specified in 15.2, 15.3 and 15.4 are selected from those given in Tables 1, 2 and 3 respectively of BS 6375-1:1983 and are related to design wind pressures and window type as given in Table 1 of this standard.

The test pressure for a class shall be attained or exceeded by a window for the window to be included in that class.

15.2 Air permeability

Windows shall be tested in accordance with clause 5 of BS 6375-1:1983 and shall comply with the requirements for test pressure class 200 Pa, 300 Pa or 600 Pa. Double windows shall be tested with the inner window open.

15.3 Watertightness

Windows shall be tested in accordance with clause 6 of BS 6375-1:1983, and shall comply with the requirements for test pressure class 50 Pa, 100 Pa, 200 Pa or 300 Pa. Double windows shall be tested with the inner window open.

15.4 Wind resistance

15.4.1 Windows shall be tested in accordance with clause 7 of BS 6375-1:1983 and shall comply with the requirements for test pressure class 1 200 Pa, 1 600 Pa, 2 000 Pa or 2 400 Pa.

15.4.2 The design wind pressure shall be calculated in accordance with Appendix B of BS 6375-1:1983.

For double windows the test shall be performed with the inner window open and the outer window closed. The test shall then be repeated with the inner window closed and if the outer window contains opening light(s), this shall be opened.