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Steel Window Association

Specifier's Guide to Steel Windows

Secured by Design
SBD
Official Police Security Initiative

Another Window to the World

Contents

The Steel Window Association (SWA)

The Steel Window Association (SWA) represents UK steel window manufacturers, ranging in size from the smallest, craft-based companies which specialise in replacement and repair work through to large, multi-site companies that manufacture and install windows in all types of buildings.

The SWA works with English Heritage to promote the important conservation message that metal windows can be cost effectively renovated or replaced by skilled tradesmen.

The *Specifier's Guide to Steel Windows* is published by the SWA to assist architects, contractors and other members of the building supply chain to select the right steel windows for their projects in both the private and public sectors.

Whilst this guide focuses primarily on new steel windows, it is possible to renovate and upgrade existing frames – even those dating back to the start of the 20th century. This can be particularly desirable in listed buildings and buildings in conservation areas where the existing windows need to be preserved but there is a desire for enhanced acoustics, thermal insulation, draughtproofing and security, which do not compromise the aesthetics of the building. Further information on renovating steel windows can be found on page 16.

Introducing Steel Windows

For over a century, steel windows and doors have been specified for a range of settings with their unique, timeless qualities being used to evoke classic, old-world themes or make bold, modern statements.

Long Lasting

Original steel windows in buildings constructed at the beginning of the 20th century are still in good working order today. The advent of galvanizing in the 1940s has banished the spectre of rust which bedevilled earlier examples where maintenance was neglected during two World Wars. Hardware is still available to repair and renovate them, and their gradual evolution has ensured that sympathetic replacement is possible with modern high performance versions which retain a similar shape and style.

Strong

The strength of steel is a prime reason for its success as a window and door framing material. Steel framed windows, tested to the latest European standards for resistance to racking and twist, exceed all recommended UK requirements and satisfy maximum class 4 ratings.

Narrow Sightlines

There is no quality more readily associated with steel windows and doors than narrow sightlines. Their slender lines have been incorporated into all types of buildings over the years with an elegance which is rarely matched by the bulky profiles of aluminium, wood or pvc-u. The minimalist aspect of steel windows derives from the superior strength-to-volume ratio of the material.

High Thermal Performance

The slender lines of steel frames enhance the glass-to-frame ratio. As the thermal performance of windows is dictated more by the choice of insulating glass than the material of the frame, even solid hot-rolled steel windows can demonstrate compliance with the energy conservation requirements of the Building Regulations. Thermal barriers within cold-formed tubular profile frames provide advanced solutions to the most demanding needs for thermal insulation.

Safe and Secure

Steel is the first choice for keeping intruders out. The SWA is an accredited group organisation of Secured by Design, the official UK Police initiative focusing on the design and security of new and refurbished homes, which promotes products such as steel windows that have passed its security tests. Steel windows and doors offer superior resistance to impact from accidental collision as well as proven solutions for fire resistance of 30, 60 and 90 minutes with respect to integrity only or integrity and insulation.

Sustainable

The source of steel billet, rod and strip, from which steel window profiles are formed, is basic steel smelted from almost 100% recycled steel scrap. The hardware, generally of brass or rust resistant steel, has evolved throughout the history of steel windows so that components of long-standing installations can be replaced and their life prolonged. Many listed buildings commissioned by patrons of the Arts & Crafts Movement, civic monuments of the Edwardian era, innovative designs of the Modern Movement, and examples of 1930s Art Deco, are characterised by steel windows which are still in good working order, demonstrating their longevity when properly serviced and maintained. When they are finally replaced, the original windows can be systematically dismantled and the frames, fittings and glass recycled. The ‘green’ credentials of steel windows are recognised by the Building Research Establishment’s ‘Green Guide’ which gives them an above average B rating.

Products

W20

W20 is the traditional heavy-duty framing system, 32mm wide with 5mm thick flanges, originally developed for commercial and industrial applications. It accommodates single and insulating glass units up to 16mm thick in the same profiles simply with a change of bead. All glazing, whether in fixed lights or casements, is in the same plane. It can be divided into small panes with tee glazing bars, having a table face width of no more than 29mm. Hinged casements, hung at top, bottom or side, and swing windows pivoted horizontally or vertically, can all be constructed from the same kit of profiles. Elemental coupling is achieved with simple slender transoms and mullions.

W30

A slimline derivative of W20, W30 is suitable for outward opening double glazed domestic and light commercial applications. It incorporates double weatherseals plus fully drained and ventilated glazing. Its ability to house 18mm sealed units whilst offering a narrow 51mm sightline on opening windows allows W30 to attain an exceptional energy performance rating.

W40

An evolutionary development from W20, W40 offers continuity of style with the same casement sightlines as W20 but the 40mm wide profiles permit double glazing with 26mm thick units. The insulating glass units are drained and ventilated in accordance with modern best practice and gasket glazed to ensure consistent neatness and reliability of seal. In addition to improved thermal performance, weathertightness is significantly enhanced and fittings can be less obtrusive with variable geometry hinges, friction pivots and multi-point locking cremone bolts concealed within the profiles. W40 achieves the Secured by Design standard.

SMW

Steel was the favoured framing material for residential windows during the first half of the 20th century and is still specified in many high-class homes. Standard Metal Windows (SMW) are particularly suitable for renovation work as similar profiles, 25mm wide with 3mm thick flanges and the same standard 500 or 600mm modules, remain available today.

Tubular Profile Systems

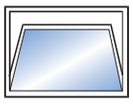
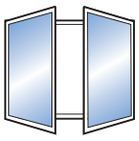
Cold-formed tubular profiles in a variety of sight lines and frame depths extend the scope of steel construction into heavy-duty doors, screens and curtain walls. Retaining the attraction of long spans and slender lines, bringing maximum lightness and transparency to a façade, tubular profile systems lend themselves well to high traffic showcase entrances and use in fire protection. Insulated profiles incorporating thermal barriers are available to respond to ever tightening energy conservation requirements.

Choosing the Right Steel Window

With different characteristics of frames resulting in variations in aesthetics and performance, choosing the right steel window for a project is important. The matrix below is designed to help with the decision making process. After identifying the specification that meets the project requirements, please turn to the appropriate product section for further details.

	Commercial Applications	Domestic Applications	Single Glazed	Double Glazed	Corrosion Protection	Colour Coating	Energy Conservation	Enhanced Security	Fire Rating
W20	✔	✔	✔	✔	✔	✔	✔		✔
W30	✔	✔	✔	✔	✔	✔	✔		✔
W40	✔	✔		✔	✔	✔	✔	✔	✔
SMW		✔	✔		✔	✔			✔
Tubular Profile	✔	✔	✔	✔	✔	✔	✔	✔	✔

Maximum Sizes

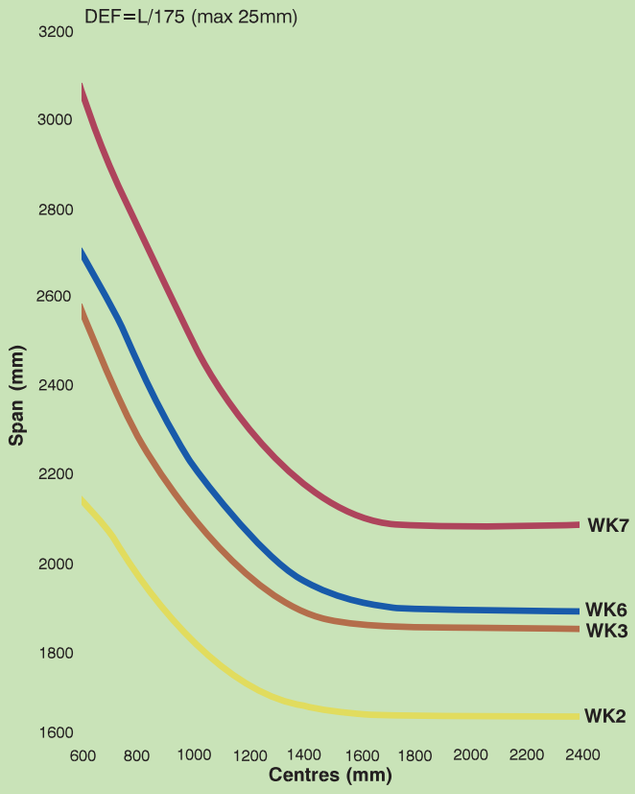
Type			W20	W30	W40	SMW	Tubular Profile
	Fixed Light	L	3000	1800	3000	2000	3000
		H	3000	1800	3000	2000	3000
		P	9200	7200	9400	6800	9600
	Side Hung casement open in or out	L	900	650	1000	650	1200
		H	2400	1350	2400	1350	3000
		P	6400	3700	6600	3700	6800
	Top Hung casement open out	L	1800	1800	2000	1250	2400
		H	1800	1300	2000	1300	2400
		P	6400	6400	6600	4600	6800
	Bottom Hung casement open in	L	1800	1300	2000	650	2400
		H	1500	1300	1600	650	1800
		P	6400	5100	6600	1300	6800
	Horizontally Pivoted casement	L	1800		1800	1500	
		H	1800		1800	1500	
		P	6400		6400	5400	
	Vertically Pivoted casement	L	1500		1500		
		H	2400		2400		
		P	6500		6500		
	Double Side Hung casements open in or out	L	1800		2000	1250	2400
		H	2400		2400	1300	3000
		P	8000		8400	5000	8800
	Single Door open in or out	L	900		1000	900	1200
		H	2500		2500	2100	3000
		P	6600		6600	6000	6800
	Double Doors open in or out	L	1800		2000	1250	2400
		H	2500		2500	2100	3000
		P	8400		8600	6600	8800

Notes

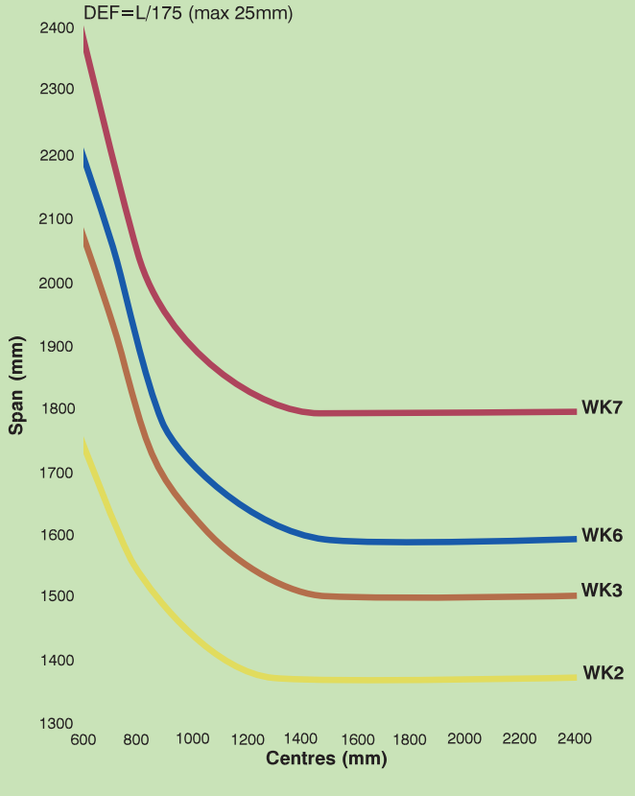
1. All sizes given are maximum practicable manufacturing limits using normal construction. Safety, security, thermal and weather performance criteria may impose tighter restrictions.
2. Minimum sizes also apply, dictated by tooling and hardware, and individual manufacturers should be consulted for details.
3. Multi-point fasteners are recommended on all widths over 1200mm and all heights over 1500mm.
4. Concealed variable geometry friction hinges may not be suitable for the largest hinged casements, which will require face mounted butt hinges.
5. Vertically pivoted casements mounted off centre are limited to a maximum length from pivot to jamb of 800mm.
6. Doors framed in hot-rolled steel need stiffening with lock rails and kicking panels.

Coupling Bar Spans and Spacing

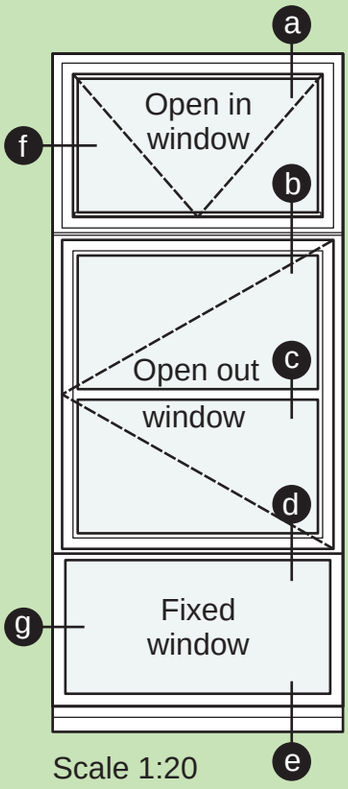
1200 Pa unsupported



2000 Pa unsupported



W20



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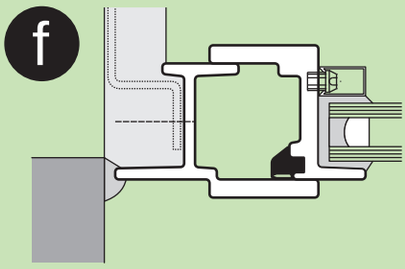
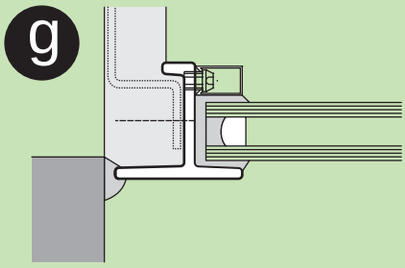
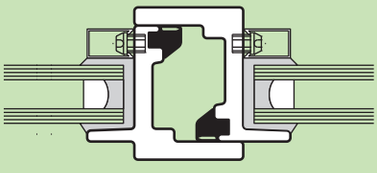
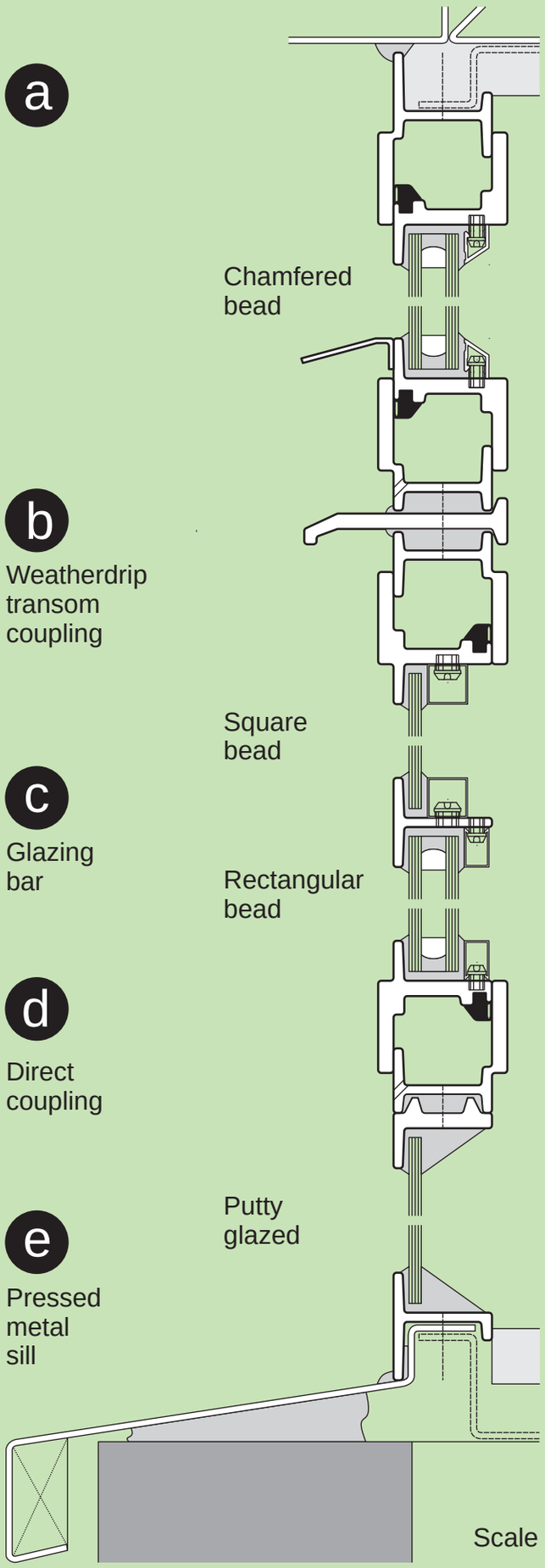






Double leaf meeting stile

Scale 1:2



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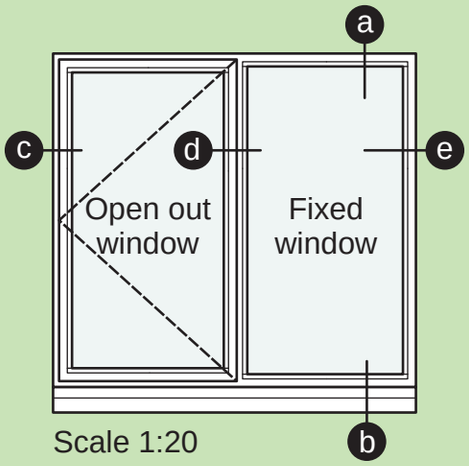
W30



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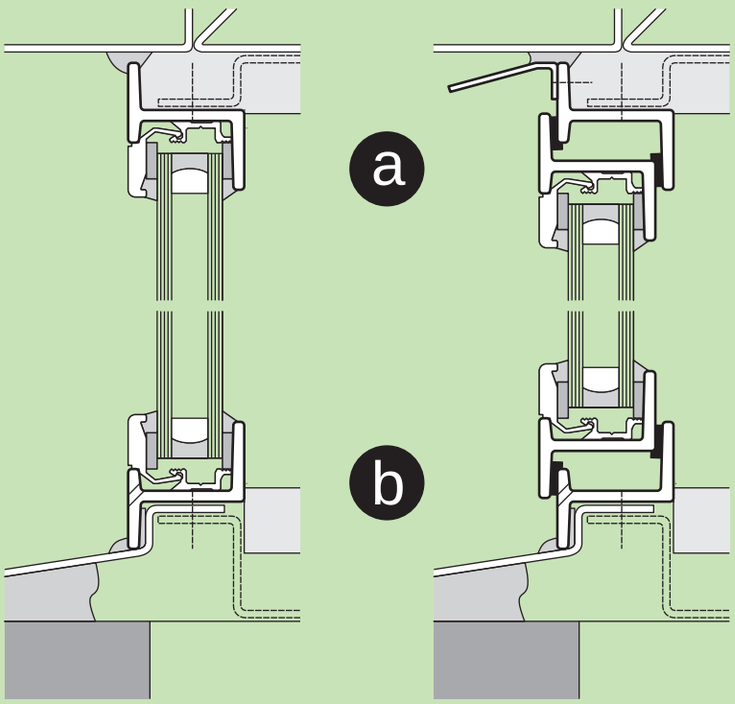
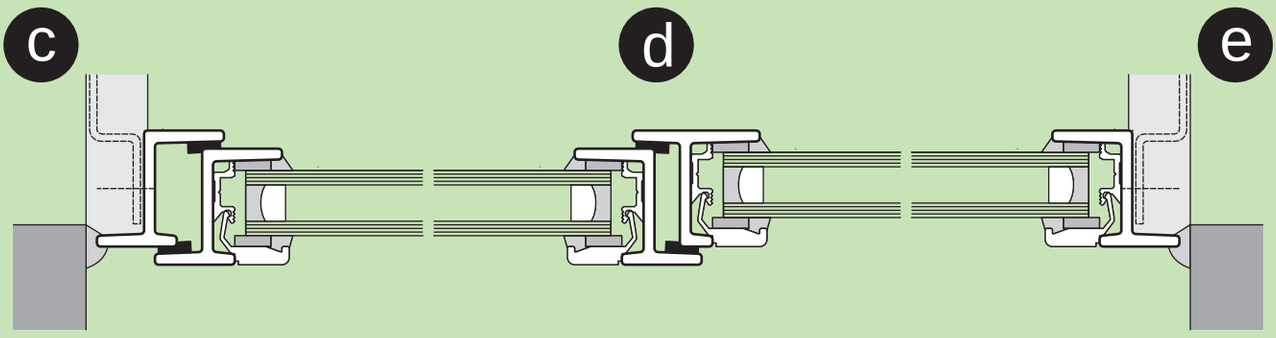
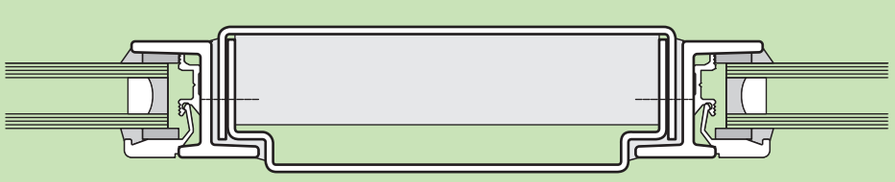
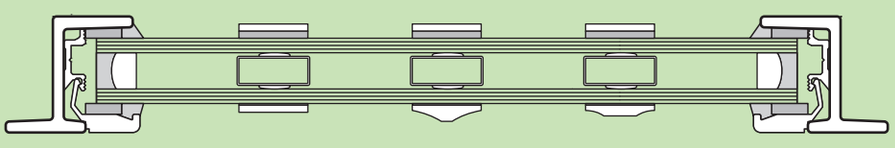






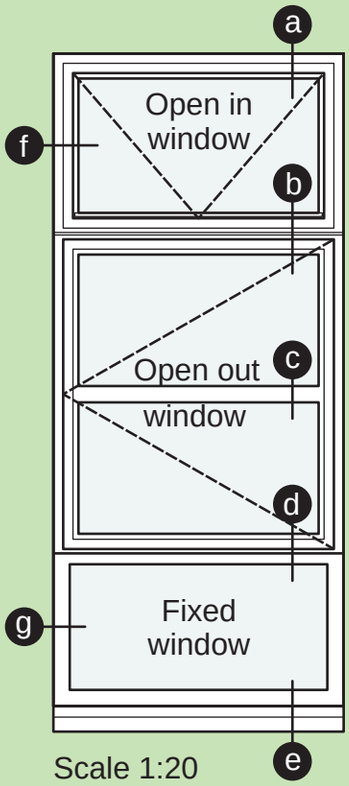
Pressed box mullion



Typical glazing bars (duplex type)

Scale 1:2

W40



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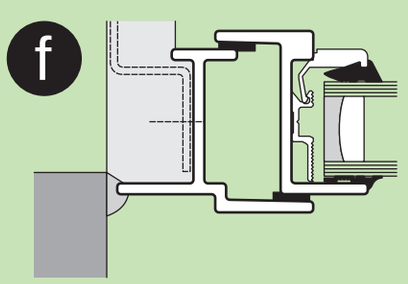

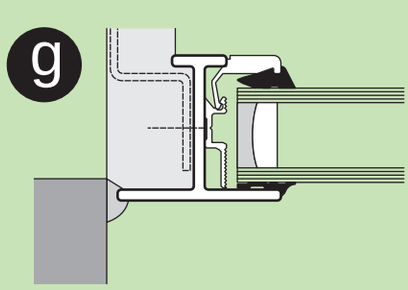

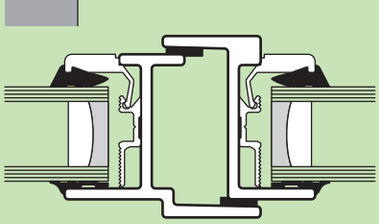

Double leaf meeting stile

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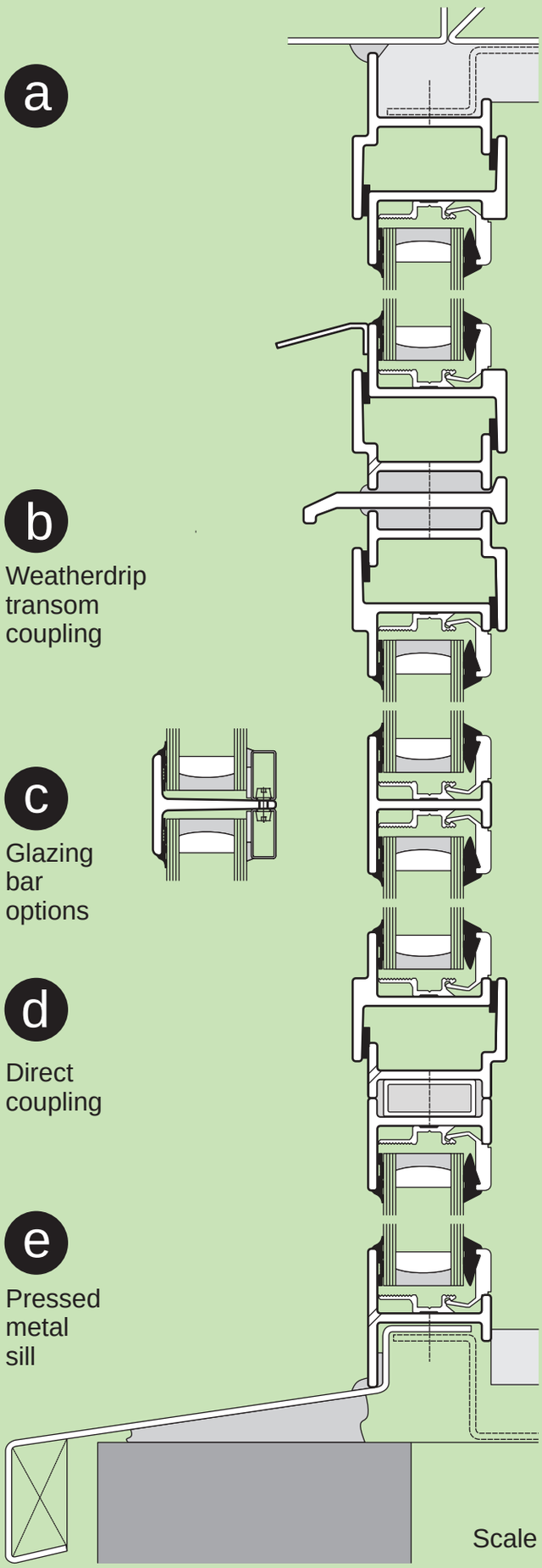

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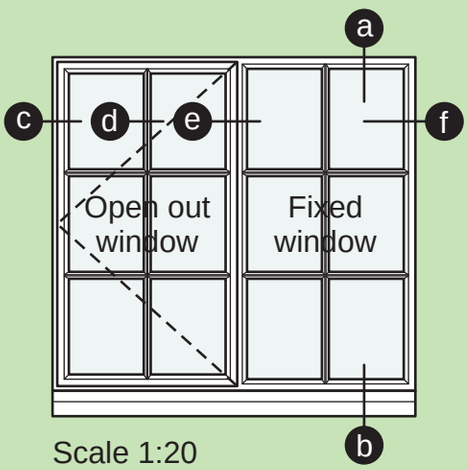
SMW



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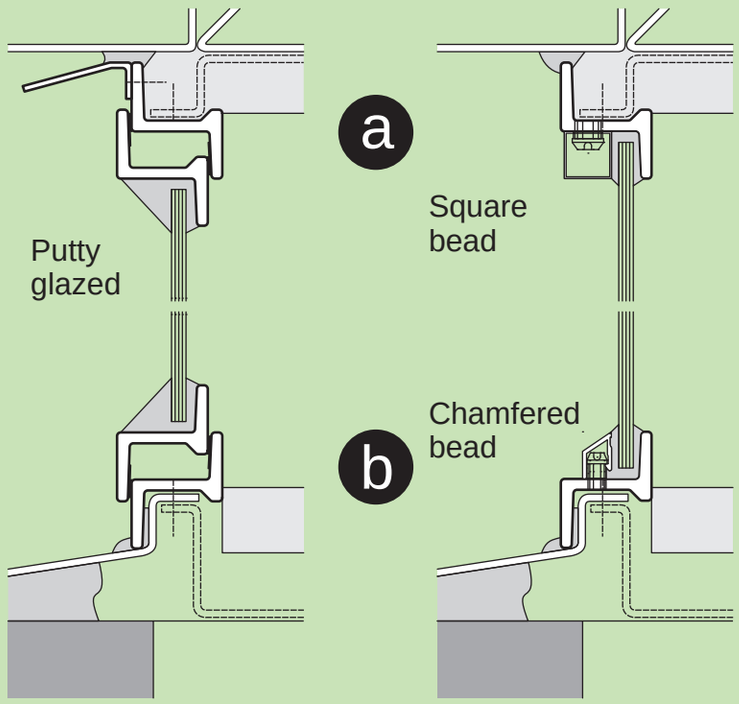
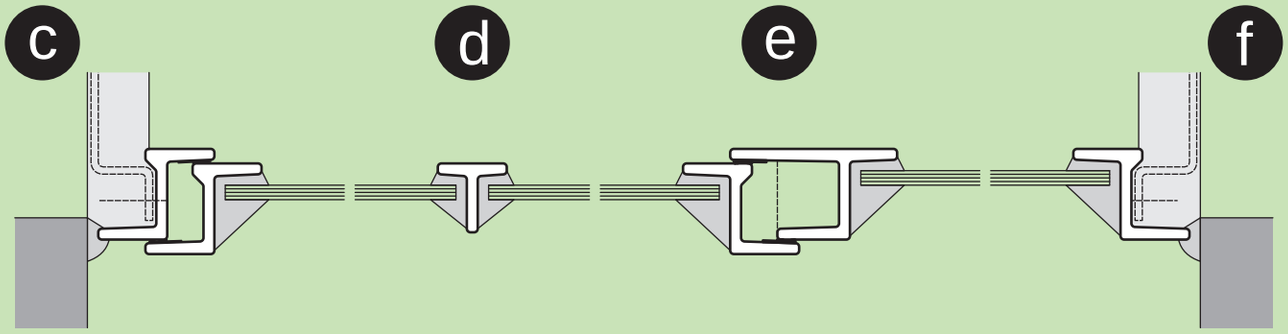
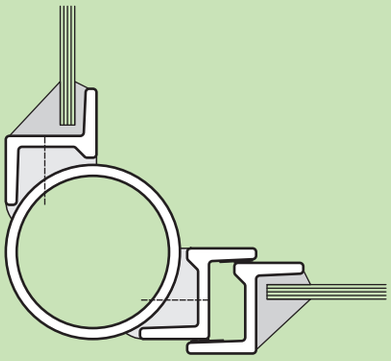
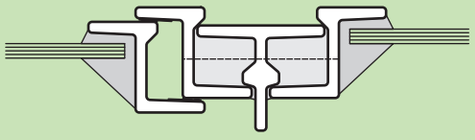


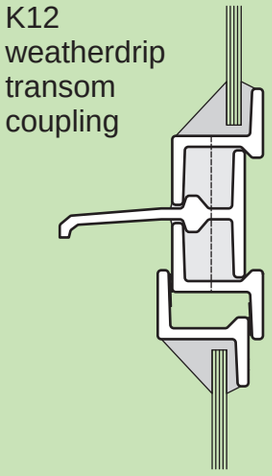




Typical
circular hollow section
tubular mullion coupling



K11
mullion coupling



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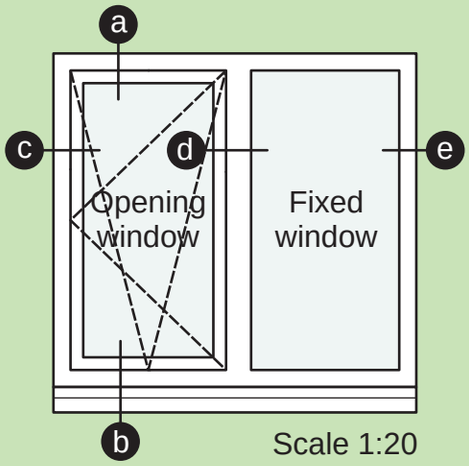
Tubular Profile Windows



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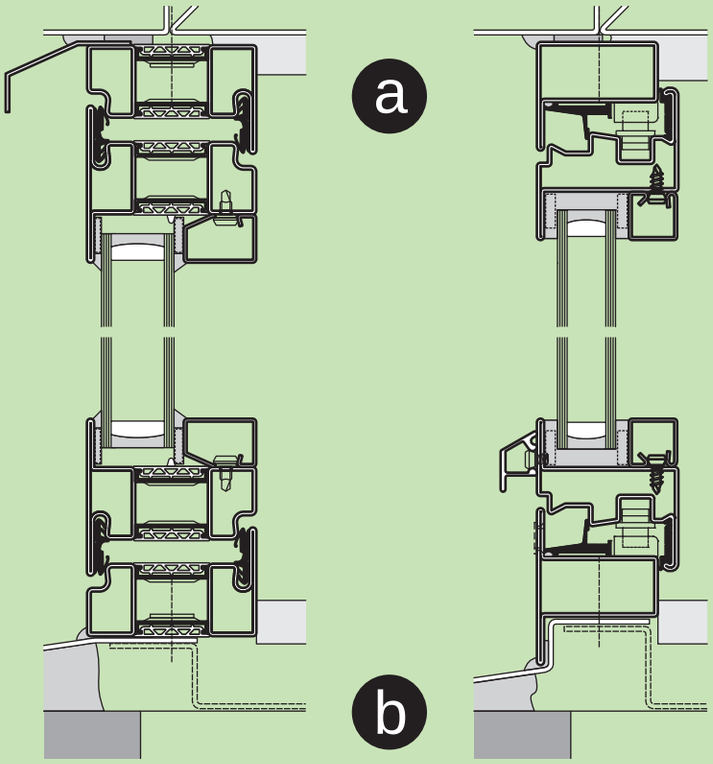
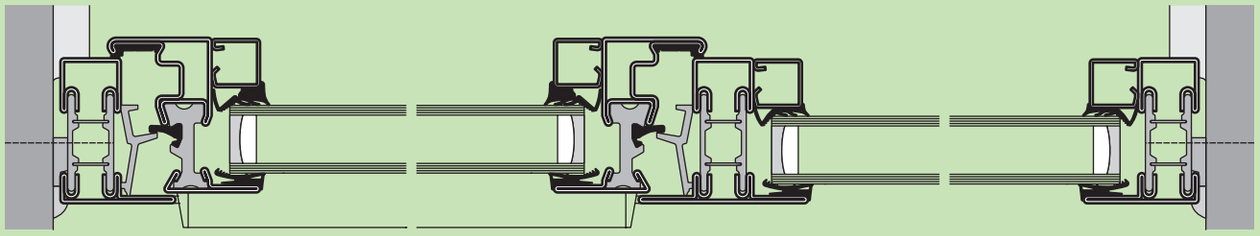
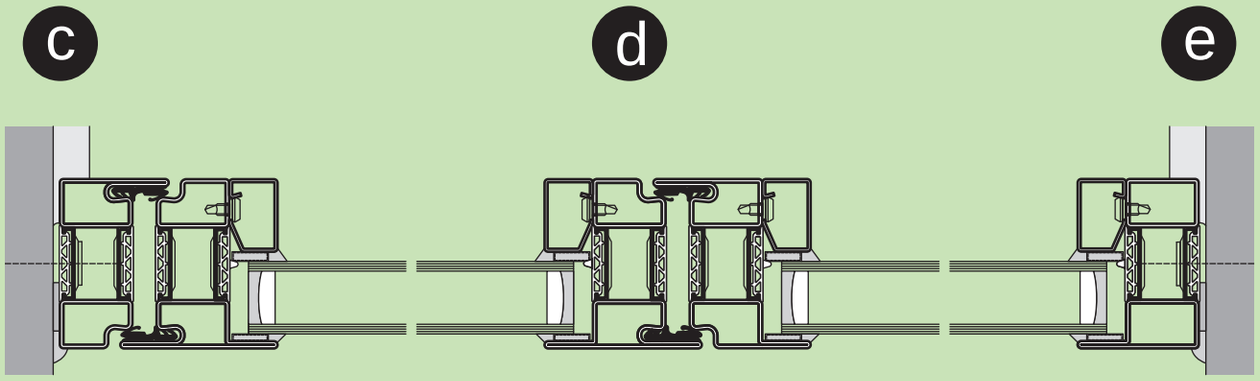


Typical open out casement with thermal barrier

Typical open in casement



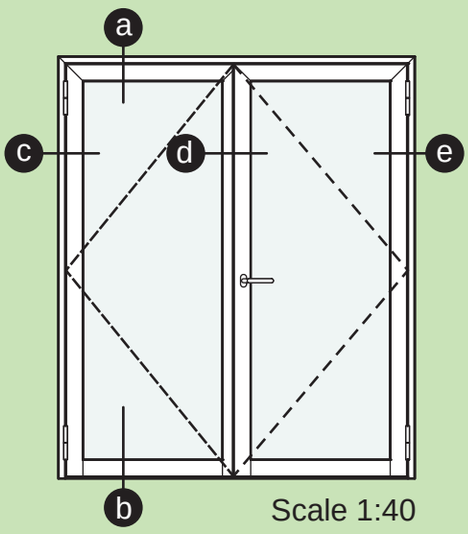
Typical tilt and turn casement with thermal barrier



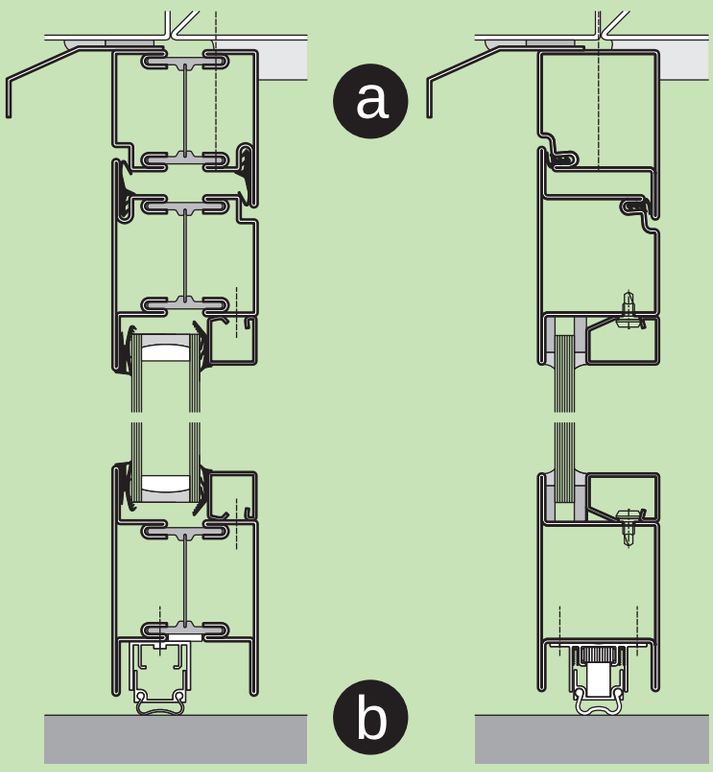
Typical open out casement with thermal barrier

Scale 1:3

Tubular Profile Doors

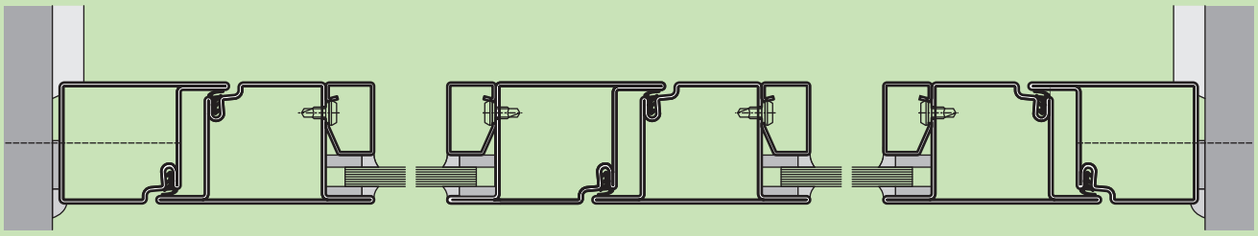


Scale 1:40

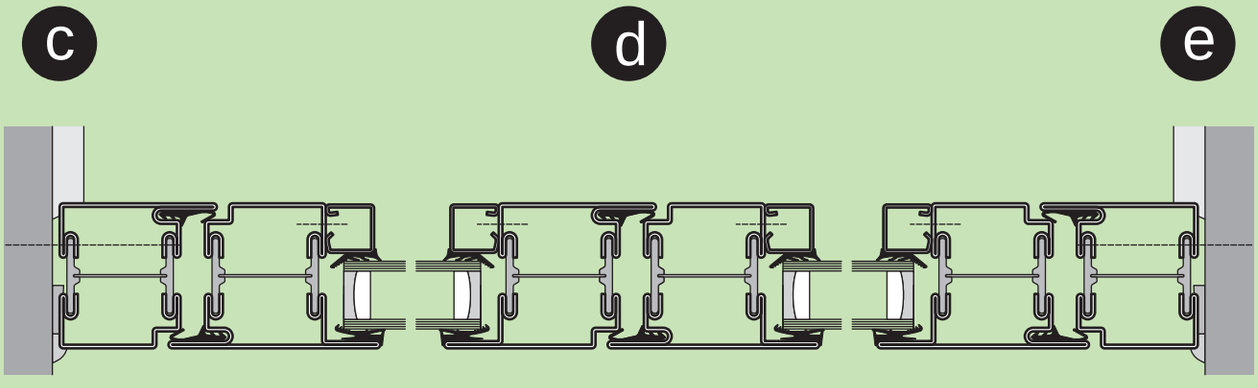


Typical open out door with thermal barrier

Typical open out door



Typical open out door



Typical open out door with thermal barrier

Scale 1:3

Performance Characteristics

Weather Performance

Experience has shown that steel windows are suitable for the majority of sites and exposure conditions in the UK, where an exposure rating of 1200 Pascals satisfies most locations. Extensive laboratory prototype and production audit testing give typical results tabulated below, classified in accordance with BS 6375-1. The extra weatherseals introduced in W40 to provide an external rainscreen, internal airseals and a pressure equalised cavity have significantly improved resistance to air and water penetration in severe exposure conditions, particularly for windows that open inwards.

Window Type	Range	BS 6375-1 Test Pressure Class						BS 6375-1 Exposure Category	
		Air		Water		Wind			
		1989 edition	2009 edition	1989 edition	2009 edition	1989 edition	2009 edition	1989 edition	2009 edition
Fixed Light	W40		4		300		C5		2000
	W30		4		300		A5		2000
	W20	600		300		2400		2400	
	SMW	600		300		2400		2400	
Top Hung	W40		3		300		C5		2000
	W30		3		200		A4		1600
	W20	300		200		2000		2000	
	SMW	300		200		2000		2000	
Side Hung open out	W40		4		300		C5		2000
	W30		4		750		A4		1600
	W20	300		200		2000		2000	
	SMW	300		200		2000		2000	
	Tubular Profile		2 (door)		900 (door)		C2 (door)		800 (door)
Side Hung open in	W40		4		300		C5		2000
	W20	200		100		1600		1200	
	Tubular Profile		3 (door)		150 (door)		C3 (door)		1200 (door)
Bottom Hung	W40		4		300		C5		2000
	W20	200		100		1600		1200	
	SMW	200		100		1600		1200	
Horizontal pivot	W40		4		300		C5		2000
	W20	200		100		1600		1200	
	SMW	300		300		2400		2400	
Vertical pivot	W40		2		150		C5		1200
	W20	200		50		1600		1200	
Tilt & Turn	Tubular Profile		4		750		C4		1600

BS 6375-1:1989

Air permeability was measured in terms of opening joint length ($m^3/h/m$) against progressively increasing test pressures through 200Pa (class A), 300Pa (class B) up to 600Pa (class C). Class B, or a maximum value at 300Pa of about 16 $m^3/h/m$, was the UK standard requirement. Watertightness was measured in resistance to leakage at progressively increasing test pressures, 300Pa being considered the most severe UK requirement. Wind load resistance entailed deflection and gusting tests at pressures ranging from 1200Pa to 2400Pa.

BS 6375-1:2009

Air permeability is measured in terms of both area ($m^3/h/m^2$) and opening joint length ($m^3/h/m$) against progressively increasing test pressures through 300Pa up to 600Pa for classes 3 and 4. Class 2, or a maximum value at 300Pa of 13 $m^3/h/m$, is the UK standard requirement. Watertightness is measured in resistance to leakage at progressively increasing test pressures, 300Pa being considered the most severe UK requirement. The values tabulated in Pascals can also be expressed in classes ranging from 2A (50Pa) through 8A (600Pa) to exceptional resistance up to a maximum of E1050. Wind load resistance entails a deflection test (at 2000Pa for class 5), a repeated pressure test of 50 positive and 50 negative gusts at half the deflection test pressure, and a safety test at 150% of the deflection test pressure (i.e. 3000Pa for class 5). The prefix C means that deflection of the longest frame member was less than 1/300 with less than 1/150 (prefix A) considered adequate in the UK.

The 2009 edition of BS 6375-1 clarifies and supersedes the 2004 edition but does not change either the test methods or the basis of classification. This means that test results declared in conformity with BS 6375-1:2004 remain valid according to BS 6375-1:2009.

Thermal Performance

Steel windows glazed with advanced insulating glass units can be shown to have a thermal performance which complies with the energy conservation requirements of the Building Regulations. Concern is sometimes expressed about the occasional risk of condensation through cold bridging. Given an extreme temperature differential from -5ºC outside to +20ºC inside and no ventilation air movement, condensation will form on internal frame surfaces when relative humidity is above 33%. Although this may be inconvenient, it does not harm the window and should encourage people to seek more ventilation as the appropriate means of control.

Thermal transmittance is expressed in typical U-values calculated in accordance with BS EN ISO 10077-2 for a standard reference window as defined in the European window product standard BS EN 14351-1. Some examples are tabulated below.

Product	Specification	U-value
W40	Double glazed with Argon filled low-E warm edge insulating glass units	2.0
	Triple glazed with Krypton filled low-E alu spacer insulating glass units	1.7
W30	Double glazed with Krypton filled low-E warm edge insulating glass units	1.7
W20	Double glazed with Argon filled soft coat low-E insulating glass units	2.9
Tubular Profile	Double glazed with Argon filled low-E warm edge insulating glass units	1.6
	Triple glazed with Argon filled low-E warm edge insulating glass units	1.3

Strength

European harmonised testing methods are specified in the window and door product standard BS EN 14351-1, and guidance on their application in the UK can be found in BS 6375-2 Performance of Windows and Doors – Operation and Strength.

Strength is measured by subjecting casements to twisting with three corners held tight whilst the fourth is moved by a calibrated force. The idea is to simulate attempts to release a jammed sash. W40 casements achieve the maximum class 4, surviving a 350 Newton force on one corner with negligible deflection, exceeding the UK requirement of class 3 (the ability to resist a force of 300 Newtons).

W40 steel windows have also been subjected to weights hung from the handle jamb, designed to simulate an accidental vertical load. Casements barely moved out of square and promptly returned to their original shape when the load was removed. The UK requirement is class 3, resisting a load of 600 Newtons, and W40 steel windows satisfied the highest class 4 (a load of 800 Newtons).

Throughout the test programme for weathertightness and strength, units were continuously checked to ensure they satisfied ease of operation requirements by measuring the forces required to open and close them. All met class 1 requirements, a torque of no more than 10 Newton metres to turn the handle and a maximum force of 100 Newtons to push them open or pull them closed.

Security

The inherent strength of steel ensures maximum rigidity once the window frames have been installed and glazed. The most secure steel window is a regular, standard window fitted with key operated locking devices and divided into small panes of glass, with vertical and horizontal bars tenon-riveted or welded into the frame and strong intersecting joints. Even if the glass is broken, entry cannot be gained through this type of window. Specifying laminated glass makes it even more resistant to intrusion.

A high measure of security can be achieved with large pane steel opening windows by using multi-point locking devices. A supplementary ventilator, mounted in the top glazing rebate, will give permanent or controlled ventilation with locked window security.

Following successful tests for enhanced security to BS 7950, W40 products, both open in and open out, fitted with concealed multi-point locking bolts and friction stay hinges or brass butt hinges, satisfy the Secured by Design standard.

Doors of cold-formed tubular steel have been tested in conformity with EN 1627 for burglar resistance to classes 1, 2 and 3.

Safety in Use

To ensure that a window holds its glass in place and remains closed even under impact from a heavy body, it can be tested to BS EN 13049 where a heavy impactor, consisting of two lorry tyres enclosing a steel cylinder and weighing 50kg, is swung into the window. Five classes are defined for this test, ranging from dropping the impactor from 200mm (class 1) to raising the impactor to 950mm before letting it go (class 5). The full range of W40 steel windows has been submitted for this test, including fixed lights, hinged and pivoted casements, and they survived the maximum impact to satisfy class 5.

It is important to verify that safety restrictor devices are sufficiently robust to withstand abuse. Those fitted to steel windows by the manufacturer have been tested to ensure that they remain engaged when subjected to a horizontal load in excess of 350 Newtons (35 kg).

Safety in Fire

Where there is a requirement for fire safety combined with maximum daylight and vision, steel framed fire resistant glazing is the preferred choice. The SWA has developed a hot-rolled steel framing system offering 60 minutes fire resistance, which complements adjacent hot-rolled steel windows and doors that may not be fire-rated. The SWA system can be used either internally or externally where its weather and corrosion resistance qualities will be important.

Alternative fire resistant glazing systems using cold-formed tubular steel profiles, all backed by authenticated test evidence, are offered by a number of SWA members for both integrity only and integrity with insulation. For details, please contact the SWA.

Operation and Control

The long life of steel windows is supported by the fittings that are used. The fittings are not only durable; they complement the elegant and timeless appearance that is unique to the steel window. Made from high quality noble materials such as brass and stainless steel, the fittings are highly sustainable and available in a range of hard-wearing, attractive finishes to suit any application.

There are matching styles of casement fasteners and stays for commercial and domestic applications. A selection of handles, stays, folding openers, hinges, pivots, catches and bolts enable the window to open in a variety of ways. Concealed friction stay hinges and multi-point locking bolts present a clean uncluttered appearance, enhancing the slender lines of several product ranges.

The concealed multi-point locking system provides higher security for the W40 range, enabling it to meet the Secured by Design standard. Its handle can be locked in the cracked open out position to give background trickle ventilation. Key lockable bolts, face-mounted or concealed in double leaf applications, are available in extra long lengths for high reach applications.

The combination of established durable materials and modern manufacturing methods offers a range of fittings, providing traditional appearance, high security and long life.

Surface Finishes

A key part of BS 6510, adhered to by all SWA members, is positive protection from rust. Frames of hot-rolled solid steel are hot-dip galvanized after fabrication to BS EN ISO 1461. During this process, the windows are thoroughly cleaned and then dipped in a bath of molten zinc. The zinc reacts with the iron in the steel to form alloy layers which are then covered with pure zinc as the window is withdrawn. This combination of soft zinc over hard alloy layers produces a highly durable protective coating that will not flake or peel. In the event of accidental damage, the galvanized coating will corrode in preference to the steel which prevents rusting.

Frames of cold-formed tubular steel can be assembled in one of two ways. The profiles can be either hot-dip galvanized before cold-forming or fabricated first and then stoved with an epoxy zinc primer, hot metal zinc sprayed, or hot-dip galvanized.

Galvanized steel windows do not require painting for protection but their appearance is enhanced by the addition of a factory-applied polyester colour coating. Polyester coatings have a life expectancy of at least 15 years and a comprehensive range of colours is readily available, with the matt finish proving most popular because of its surface enhancing properties.

Installation

Fixing

Steel windows are suitable for fixing direct to brickwork, concrete, stone or into subframes. Windows and integral sills must be installed in accordance with good building practice, allowing for damp proof course and finishes. No load should be applied to the head of any window. A perimeter joint design gap shall be provided, generally of not less than 2mm and not greater than 8mm once the frame is centralised in its opening, that allows for thermal movement, fabrication size variance and aperture construction tolerance.

Glazing

Steel windows can be single glazed or fitted with insulating glass units. Glazing practice should comply with BS 8000-7 and reference is also recommended to the Glass and Glazing Federation's data sheets on glazing techniques, particularly the use of setting, location and distance blocks and clips. Specific glazing compounds are available for use with factory finished steel windows.

Aftercare and Maintenance

The durability and high performance of steel windows can be enhanced even further if good maintenance practices are observed.

Frames should be cleaned at regular intervals using a mild, non-alkaline detergent in warm water, applied with a soft cloth or sponge.

Glazing and perimeter sealants should be inspected on an annual basis and appropriate maintenance action taken.

Galvanized steel windows, which are not factory finished with a polyester colour coating, are manufactured with clearances to allow for up to three or four coats of paint on the meeting surfaces. When the repainting programme has exceeded this, the paint should be stripped off all meeting surfaces prior to repainting.

All hinges, pivots, handles, stays and other mechanical parts should be checked for operation, kept free of excessive paint build up and lightly lubricated.

Renovation and Modernisation

For listed buildings or buildings of special interest such as those in conservation areas, renovation is often preferable to replacement. A sympathetic refurbishment of existing steel frames can better maintain the original appearance of the building and may be more cost effective and sustainable than replica replacements.

Provided that the steel is not badly corroded, the following refurbishment work can generally be undertaken on existing windows:

- Servicing, easing and adjustment of opening windows and doors for good operation
- Replacement of defective or missing ironmongery including hinges and pivots
- Removal of broken or cracked glazing
- Replacement of lead lights
- Tightening or replacement of coupled frame intersections and perimeter fixings
- Replacement of damaged weatherseals
- Re-introduction of perimeter and window mastic seals
- Replacement of glazing beads
- Removal of glazing mastic and putty
- Treatment of rusting frames including replacement of defective sections
- Redecoration of painted surfaces.

In addition to rectification works, existing windows can also be upgraded to enhance their acoustics, thermal insulation, ease of operation and security with:

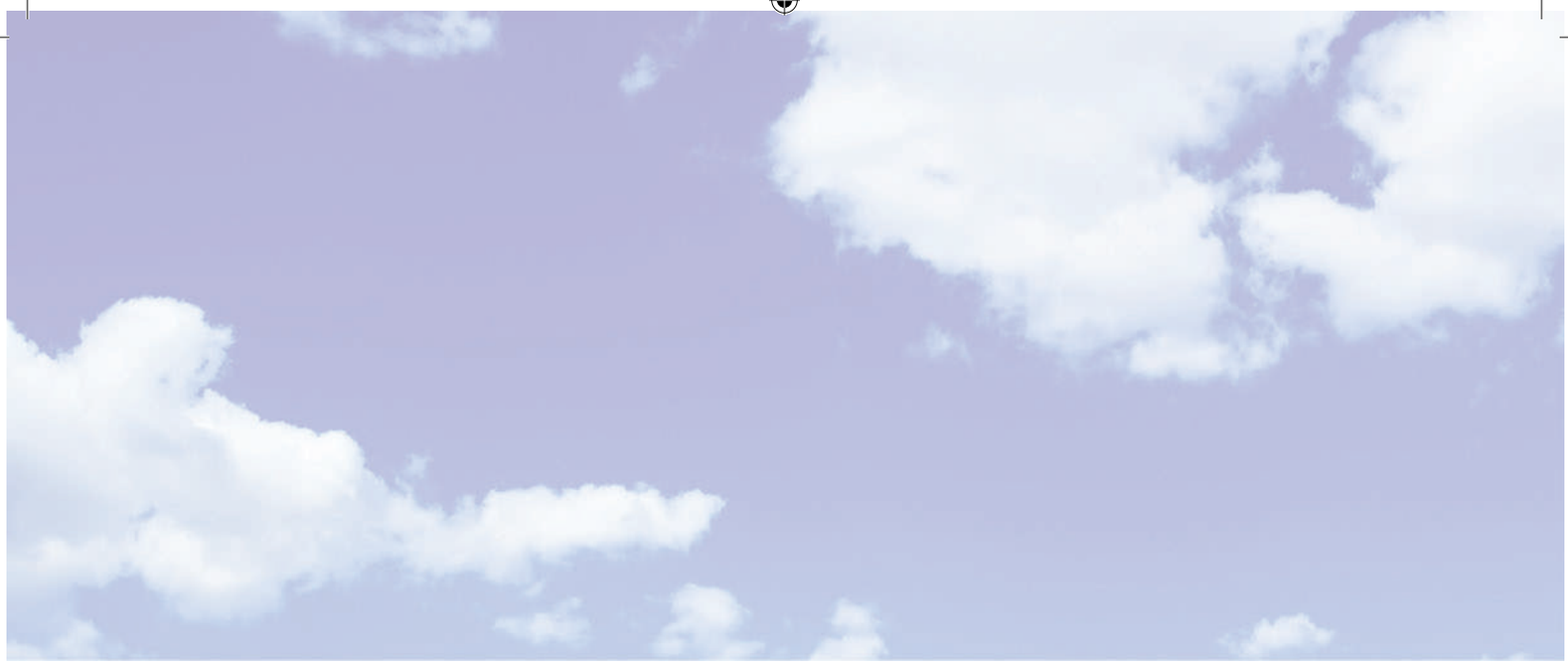
- Glazing upgrades
- Replacement of ironmongery
- Introduction of security locks
- Additional weather sealing.

For a full list of SWA members that undertake renovation work, please contact the SWA.

Model Specifications

	Source and Authority	Weather Performance	Appearance	Material	Construction	Finish
W20	Windows shall be supplied by an SWA member in compliance with BS 6510 and recognised good practice to suit a design wind pressure of 1200 Pa unless otherwise specified.	Windows shall meet the air infiltration, water penetration and wind loading performance criteria set out in BS 6375-1 appropriate to the specified design wind pressure.	Steel profiles shall be selected so that typical perimeter sightlines of fixed lights shall not exceed 40mm and of hinged or pivoted casements 70mm. Fixed light and casement glazing infill shall be in the same plane.	Profiles from the W20 range, nominal width 32mm, hot-rolled from mild steel to BS EN 10025-2, and cold straightened.	Frames shall have welded corners, dressed square and flat, and be sized within tolerances of +/- 2mm. Tee glazing bars shall be tenon riveted and/or welded to frames and interlock with rigid joints displaying face gaps of no more than 1mm.	Frames and ancillary profiles shall be positively rustproofed by hot-dip galvanizing to BS EN ISO 1461 and then polyester colour coated to BS 6497 or BS EN 13438 with a minimum paint thickness over zinc on significant surfaces of 60 micrometres.
W30	Windows shall be supplied by an SWA member in compliance with BS 6510 and recognised good practice to suit a design wind pressure of 1200 Pa unless otherwise specified.	Windows shall meet the air infiltration, water penetration and wind loading performance criteria set out in BS 6375-1 appropriate to the specified design wind pressure.	Steel profiles shall be selected so that typical perimeter sightlines of fixed lights shall not exceed 40mm and of hinged casements 55mm.	Profiles from the W30 range, nominal width 32mm, hot-rolled from mild steel to BS EN 10025-2, and cold straightened.	Frames shall have welded corners, dressed square and flat, and be sized within tolerances of +/- 2mm. Tee glazing bars shall be tenon riveted and/or welded to frames and interlock with rigid joints displaying face gaps of no more than 1mm.	Frames and ancillary profiles shall be positively rustproofed by hot-dip galvanizing to BS EN ISO 1461 and then polyester colour coated to BS 6497 or BS EN 13438 with a minimum paint thickness over zinc on significant surfaces of 60 micrometres.
W40	Windows shall be supplied by an SWA member in compliance with BS 6510 and recognised good practice to suit a design wind pressure of 1200 Pa unless otherwise specified.	Windows shall meet the air infiltration, water penetration and wind loading performance criteria set out in BS 6375-1 appropriate to the specified design wind pressure.	Steel profiles shall be selected so that typical perimeter sightlines of fixed lights shall not exceed 45mm and of hinged or pivoted casements 70mm. Fixed light and casement glazing infill shall be in the same plane.	Profiles from the W40 range, nominal width 40mm, hot-rolled from mild steel to BS EN 10025-2, and cold straightened.	Frames shall have welded corners, dressed square and flat, and be sized within tolerances of +/- 2mm. Tee glazing bars shall be tenon riveted and/or welded to frames and interlock with rigid joints displaying face gaps of no more than 1mm.	Frames and ancillary profiles shall be positively rustproofed by hot-dip galvanizing to BS EN ISO 1461 and then polyester colour coated to BS 6497 or BS EN 13438 with a minimum paint thickness over zinc on significant surfaces of 60 micrometres.
SMW	Windows shall be supplied by an SWA member in compliance with BS 6510 and recognised good practice to suit a design wind pressure of 1200 Pa unless otherwise specified.	Windows shall meet the air infiltration, water penetration and wind loading performance criteria set out in BS 6375-1 appropriate to the specified design wind pressure.	Steel profiles shall be selected so that typical perimeter sightlines of fixed lights shall not exceed 40mm and of hinged casements 55mm.	Profiles from the F range, nominal width 25mm, hot-rolled from mild steel to BS EN 10025-2, and cold straightened.	Frames shall have welded corners, dressed square and flat, and be sized within tolerances of +/- 2mm. Tee glazing bars shall be tenon riveted and/or welded to frames and interlock with rigid joints displaying face gaps of no more than 1mm.	Frames and ancillary profiles shall be positively rustproofed by hot-dip galvanizing to BS EN ISO 1461 and then polyester colour coated to BS 6497 or BS EN 13438 with a minimum paint thickness over zinc on significant surfaces of 60 micrometres.
Tubular Profile	Doors and windows shall be supplied by an SWA member in compliance with BS 6510 and recognised good practice to suit the required design wind pressure within tested limits.	Doors and windows shall meet the air infiltration, water penetration and wind loading performance criteria set out in BS 6375-1 appropriate to the specified design wind pressure.	Steel profiles shall be selected so that the correct sized profiles are used to complement the height and width of the doors or windows, or to comply with appropriate test data certificates.	Profiles available in various material finishes of bright steel, continuously galvanized, or stainless steel, to BS EN 10111 or BS EN 10327.	Frames shall be sized within tolerances of +/- 2mm and generally of fully welded construction with joints dressed square and flat or, dependant on size, spigoted as per system fabrication manuals.	Frames and ancillary profiles shall be positively rustproofed by hot-dip galvanizing to BS EN ISO 1461, or by pre-treatment to specification EN ISO 12944-4, and then polyester colour coated to BS 6497, BS EN 13438 or EN ISO 12944-5 with a minimum paint thickness of 60 micrometres according to ISO 2360.

Weatherseals	Fittings	Fixing	Glazing
Ventilators shall be weather sealed with polymer rubber gaskets retained in a groove within the profile and secured by suitable adhesives.	Hinged casements shall have rustproofed steel or brass hinges, face mounted and welded, screwed or riveted to the frame. Pivoting windows open through 90 degrees on brass cup friction pivots. A variety of handles, catches, stays and openers, with locking options, are available in chromed or toned brass, anodised or painted aluminium, and chromed or painted zinc alloy. Double fasteners shall be fitted on ventilators over 1200mm long or 1500mm high.	Windows shall be supplied with rustproofed screws, plugs, and/or lugs to suit specified openings. Composite assemblies shall be delivered in separate units to be coupled together on site. When contracted to install, the manufacturer shall apply appropriate external perimeter sealants.	Windows shall be glazed on site, from inside or outside, with single glass or insulating glass units up to 16mm thick, using factory finished beads, bedding and capping sealants in accordance with BS 8000-7. Option for single glazing: glazing from outside with spring clips (supplied by the glazier) and metal casement putty fronting.
Ventilators shall be weather sealed with polymer rubber gaskets secured by suitable adhesives.	Hinged casements shall have rustproofed steel or brass hinges, face mounted and welded, screwed or riveted to the frame. A variety of handles, catches, stays and openers, with locking options, are available in chromed or toned brass, anodised or painted aluminium, and chromed or painted zinc alloy. Double fasteners shall be fitted on ventilators over 1200mm long or 1500mm high.	Windows shall be supplied with rustproofed screws, plugs, and/or lugs to suit specified openings. Composite assemblies shall be delivered in separate units to be coupled together on site. When contracted to install, the manufacturer shall apply appropriate external perimeter sealants.	Windows shall be designed for drained and ventilated glazing on site, from inside or outside, of insulating glass units up to 18mm thick, using factory finished beads and polymer rubber gaskets in accordance with BS 8000-7.
Ventilators shall be weather sealed with polymer rubber gaskets secured by suitable adhesives.	Hinged casements shall have rustproofed steel or brass hinges, face mounted and welded, screwed or riveted to the frame, or stainless steel sliding projecting friction hinges concealed within the frame. Pivoting windows open through 60 degrees on brass cup friction pivots or on concealed friction pivots with a stainless steel boss. A variety of handles, catches, stays and openers, with locking options including cremone operated concealed multi-point locking bolts, are available in chromed or toned brass, anodised or painted aluminium, and chromed or painted zinc alloy. Double or multi-point fasteners shall be fitted on ventilators over 1200mm long or 1500mm high.	Windows shall be supplied with rustproofed screws, plugs, and/or lugs to suit specified openings. Composite assemblies shall be delivered in separate units to be coupled together on site. When contracted to install, the manufacturer shall apply appropriate external perimeter sealants.	Windows shall be designed for drained and ventilated glazing on site, from inside or outside, of insulating glass units up to 26mm thick, using factory finished beads and polymer rubber gaskets in accordance with BS 8000-7.
Ventilators shall be weather sealed with polymer rubber gaskets secured by suitable adhesives.	Hinged casements shall have rustproofed steel or brass hinges, face mounted and welded, screwed or riveted to the frame. A variety of handles, catches, stays and openers, with locking options, are available in chromed or toned brass, anodised or painted aluminium, and chromed or painted zinc alloy. Double fasteners shall be fitted on ventilators over 1200mm long or 1500mm high.	Windows shall be supplied with rustproofed screws, plugs, and/or lugs to suit specified openings. Composite assemblies shall be delivered in separate units to be coupled together on site. When contracted to install, the manufacturer shall apply appropriate external perimeter sealants.	Windows shall be prepared for glazing on site from outside with single glass, using factory finished beads, bedding and capping sealants in accordance with BS 8000-7. Option for single glazing: glazing from outside with spring clips (supplied by the glazier) and metal casement putty fronting.
Ventilators shall be weather sealed with polymer rubber gaskets retained in a groove within the profile and/or secured by suitable adhesives.	Hinged casements shall have steel hinges or stainless steel tilt and turn mechanisms face mounted and screwed to the frame/vent. Doors shall have face mounted hinges welded or screwed to the frame and leaf. Doors shall be fitted with narrow stile single or twin point locks, and overhead door closers are recommended. A variety of handles with locking options are available in chromed or toned brass, anodised or painted aluminium, and chromed or painted zinc alloy.	Windows shall be supplied with rustproofed screws, plugs, and/or lugs to suit specified openings. Composite assemblies shall be delivered in separate units to be coupled together on site. When contracted to install, the manufacturer shall apply appropriate external perimeter sealants.	Doors and windows shall be designed for drained and ventilated glazing on site, from inside or outside, of insulating glass units up to 36mm thick, using factory finished clip-on glazing beads and EPDM rubber gaskets. Fire rated integrity glazing shall be wet glazed with ceramic tape and silicone sealant. Units fire rated for integrity and insulation shall be gasket glazed according to system fabrication manuals.



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