BRITISH STANDARD

BS 8213-1:2004

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

ICS 91.060.50

Confirmed
February 2012

BSI
British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee B/538, Doors, Windows, Shutters, Hardware and Curtain Walling, upon which the following bodies were represented:

Association of Building Engineers
Association of Building Manufacture
British Plastics Federation
British Wood Preserving and Damp-Proofing Association
British Woodworking Federation
Building Research Establishment
Centre for Window and Cladding Technology
Construction Fixing Association
Consumer Policy Committee of BSI
Council for Aluminium in Building
Flat Glass Manufacturers' Association
Glass and Glazing Federation
Guild of Architectural Ironmongers
Health and Safety Executive
LHC Building Components and Services
National House Building Council
Police Scientific Development Branch
Royal Institute of British Architects
Scottish Office — Construction and Buildings
Society of Chief Architects of Local Authorities
Steel Window Association
Timber Research and Development Association

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 1 October 2004

Amendments issued since publication

Amd. No.	Date	Comments

The following BSI references relate to the work on this British Standard:
Committee reference B/538
Draft for comment 99/102416 DC

ISBN 0 580 44492 9

Contents

Foreword

This part of BS 8213 has been prepared under the direction of Technical Committee B/538. It supersedes BS 8213-1:1991, which is withdrawn.

In this revision, a risk assessment approach to window design is recommended. Greater emphasis has been placed upon the use of safety restrictor devices to limit the initial opening of windows to minimize the risks of persons falling out of open windows.

NOTE 1 Attention has been drawn to these needs following a number of incidents where fatalities have occurred due to the lack of suitable fittings.

A clause on security (Clause **7**) has been added to cover related safety issues.

The guidance given in this standard is in addition to legislative requirements, which take precedence, and is suitable for new buildings and for upgrading and refurbishment works. It is aimed at all those involved in the specification, design, selection and use of windows, including public authorities, house-builders, architects, surveyors, window designers, window installers, glazing contractors and building owners. It may also be useful to building occupiers.

The guidance is primarily intended for use in residential accommodation, but many of the recommendations are applicable to other building types, to which health and safety legislation applies (see Note 2).

Attention is drawn to the fact that statutory legislation such as the Building Regulations 2000 [1] (applicable to England and Wales), the Building Standards (Scotland) Regulations 1990 [2], and the Building Regulations (Northern Ireland) 1994 [3] might impose requirements in certain circumstances. Planning or other constraints in some situations might necessitate special provisions for cleaning and safety.

All involved in the design and installation of windows need to be aware of the Construction (Design and Management) Regulations 1994, as amended by the Management of Health and Safety at Work Regulations 1999 and the Construction (Design and Management) (Amendment) Regulations 2000 [4]. These require designers, in a very broadly defined sense of the term, to minimize foreseeable risks to people doing the work or people affected by the work from any project arising from building maintenance and cleaning.

Guidance for professional window cleaners is prepared by the Health and Safety Executive and is listed in the Bibliography. The recently adopted Directive on Temporary Work at Height [5] will be implemented through new regulations governing all such work including that of window cleaners.

NOTE 2 The Workplace (Health, Safety and Welfare) Regulations 1992 [6] contain specific safety requirements which apply to window safety, in particular regulation 14 on the risk of injury from breakage of windows, regulation 15 on safety in opening, closing and adjusting windows and regulation 16 which requires that all windows are designed and constructed so that they can be cleaned safely. The Health and Safety Executive Workplace (Health, Safety and Welfare) Regulations 1992 Approved Code of Practice and Guidance 1992 L24 [7] on these Regulations gives guidance.

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 21 and a back cover.

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1 Scope

This part of BS 8213 gives recommendations on the design, construction, operation and maintenance of windows, including door height windows, for safety in use and during cleaning, including safe opening characteristics and the arrangement of window controls, to safeguard occupants and passers-by. The recommendations for safety for windows also apply to roof windows, where relevant. Guidance on safety for rooflights is excluded from this document.

Annex A gives examples of reach capabilities. Annex B gives recommendations on safety restrictors. Annex C sets out basic guidance on design for safe cleaning and maintenance of external and internal glazing at height. Annex D sets out recommendations for safe working practices in the use of portable ladders where necessary, after assessment of the use of the other methods of safe temporary access given in Annex C.

NOTE This code of practice is not intended to offer comprehensive guidance for maintenance and redecoration of windows, where more specific safety measures are required.

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 4873, *Aluminium alloy windows.*

BS 5974, *Code of practice for temporarily installed suspended scaffolds and access equipment.*

BS 6037, *Code of practice for the planning, design, installation and use of permanently installed access equipment — Suspended access equipment.*

BS 6100-1.3.5, *Glossary of building and civil engineering terms — Part 1: General and miscellaneous — Section 1.3: Parts of construction works — Subsection 1.3.5: Doors, windows and openings.*

BS 6100-1.3.6, *Glossary of building and civil engineering terms — Part 1: General and miscellaneous — Section 1.3: Parts of construction works — Subsection 1.3.6: Jointing products, builders' hardware and accessories.*

BS 6180, *Barriers in and about buildings — Code of practice.*

BS 6375-2, *Performance of windows — Part 2: Specification for operation and strength characteristics.*

BS 6399-1, *Loading for buildings — Part 1: Code of practice for dead and imposed loads.*

BS 6399-2, *Loading for buildings — Part 2: Code of practice for wind loads.*

BS 644, *Timber windows — Factory assembled windows of various types — Specification.*

BS 6510, *Specification for steel windows, sills, window boards and doors.*

BS 7412, *Plastics windows made from unplasticized polyvinyl chloride (PVC-U) extruded hollow profiles — Specification.*

BS EN 364, *Personal protection equipment against falls from a height — Test methods.*

BS EN 795, *Protection against falls from a height — Anchor devices — Requirements and testing.*

BS EN 1670, *Building hardware — Corrosion resistance — Requirements and test methods.*

BS EN 13049, *Windows — Soft and heavy body impact — Test method, safety requirements and classification.*

DD CEN/TS 13126-1:2004, *Building hardware, fittings for windows and door height windows — Part 1: Requirements and test methods — Requirements common to all types of fittings.*

DD CEN/TS 13126-5:2004, *Building hardware, fittings for windows and door height windows — Part 5: Requirements and test methods — Devices that restrict the opening of windows.*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS 6100-1.3.5 and BS 6100-1.3.6, and the following apply.

NOTE Some of the terms given in BS 6100 have been replicated for convenience.

3.1
accessible opening light
opening light, any part of which is 1 500 mm or less above floor level

3.2
arris edge
small bevel of width not exceeding 1.6 mm at an angle of approximately 45° to the surface of the glass

3.3
configuration
width and height, including from floor level, of a window light or assembly of lights (fixed and opening)

3.4
coupled light
two superimposed lights that form a single opening light and can be separated for cleaning

3.5
design
consideration of one or more of the following: location, configuration, dimensions, specification and product selection

3.6
designer
person/s responsible for design

3.7
door height window
window that allows access or passage for pedestrians

3.8
light
individual glazed unit of a window

3.9
opening light
light that opens

3.10
retaining catch
device to retain an opening light firmly in an open position

3.11
reversing catch
device that automatically engages when an opening light is fully opened into a reversed position and holds the light firmly in that position until released by deliberate action

3.12
roof window
construction for closing an opening in the plane of a pitched roof that admits light and might admit fresh air

3.13
rooflight
construction for closing an opening in a flat roof or low pitched roof intended primarily for lighting and consisting of a frame and glazing

3.14
safety restrictor (restricted opening device)
mechanical device which is intended to limit the initial movement of an opening light so that a clear opening of not more than 100 mm is achieved at any point

3.15
secondary window
inner window where two separate windows are superimposed in the same opening

4 General principles

4.1 Essential considerations

Windows are generally installed to provide natural light and ventilation. These functions should be satisfied together with full consideration of the need for:

a) design for safety in use (see Clause **5**);

b) means of escape from fire (see Clause **6**);

c) security from unauthorized entry (see Clause **7**);

d) design for safety when cleaning (see Clause **8**);

e) maintenance (see Clause **9**).

4.2 Risk assessment

A risk assessment should be carried out, taking account of the relative priority needs established in each situation. For instance, unauthorized entry is not normally a risk with windows to the first floor and above unless there is a ready means of external access (see **7.2**). Falls, however, even from relatively low heights, can have serious consequences.

The risk assessment should take into account the type of occupancy and age range of both occupants and visitors to a building, where this can reasonably be predicted. One example might be young children visiting older people in sheltered accommodation and using furniture to gain access to windowsills.

If a significant change of use of the building occurs, the risks should be reassessed.

A written record of the risk assessment signed by the client and the designer should be retained with the window documentation. This should be kept with the Health and Safety File where appropriate, or passed to purchasers, and a copy kept by the contractors responsible for the design. The responsibility for the risk assessment should lie with the designer.

NOTE In the case of domestic replacement windows the designer is the person or organization taking the order from the client.

4.3 Inclusive design

When designing windows they should be operable by as wide a range of the appropriate population as reasonably possible.

NOTE 1 Appropriate populations normally exclude young children.

NOTE 2 BS 8300:2001 gives guidance on various aspects of inclusive design.

5 Design for safety in use

5.1 Basis of design

Windows should be easy to operate, open safely without being a hazard to passers-by, and minimize the risk of falling through. The design of the windows including their location within the building, overall dimensions, opening types, and heights of sill and opening lights above ground or floor level can have important consequences and should be carefully determined. Safe use depends on:

— window location (see **5.2**);
— window type (see **5.3**);
— safety fittings (see **5.4**);
— guarding (see **5.5**);
— window construction and installation (see **5.6**).

5.2 Window location

Safe access should be provided for window operation and cleaning. Particular care should be taken when designing windows for rooms incorporating built-in fixtures such as kitchen or bathroom fittings, which might restrict access.

NOTE 1 Fixtures in front of windows can also provide a platform for children to climb onto, enabling them to reach a window, with consequent risk.

NOTE 2 Windows on upper floors that can be safely cleaned from the inside allow for possible future extensions below, such as conservatories.

Appropriate types and configuration of windows should be provided to help to reduce vertigo-related problems, such as the choice of narrower, inward-opening lights with external guarding to 1 100 mm above floor level.

NOTE 3 Some people can suffer vertigo-related problems induced whilst using or cleaning an opening light or fixed sub-light in windows on higher floors.

When windows are located where it is difficult to provide safe access from inside, e.g. on a staircase, consideration should be given to providing a window type that allows for the inside to be safely cleaned from the outside. The recommendations in Annex C should be followed for methods of safe temporary access; access by ladder should only be considered after assessing the use of these methods. This also applies in situations where there might be high level windows or fixed lights where access from either inside or outside is necessary. Where a portable ladder is used, suitable and secure anchorages should be provided, along with instructions to the owner and occupier on inspection and maintenance (see Annex C).

The recommendations in Annex D should be followed on safe use of ladders.

Open windows projecting externally beyond the outer face of a building at or below 2 m above adjacent ground level are a potential hazard; pedestrian traffic should be directed around them by means of barriers, deterrent surfaces or planting. Projecting windows should be avoided in public circulation areas such as communal access balconies.

When designing windows and associated hardware in communal areas such as stairways and deck accesses advice from the relevant local fire authorities should be sought.

5.3 Window type

5.3.1 *General*

A summary of window types is given in Table 1, including recommendations on appropriate safety fittings together with comments on risks in use and during cleaning.

All windows that open inwards or reverse for cleaning should be fitted with catches, automatically engaging wherever possible, to secure them when so positioned.

The type and configuration of the windows, including associated hardware, should take into account wind-loading and any wind-gusting that might occur.

Care should be taken to ensure that blinds, curtains, pelmets and other fixtures do not prevent the correct operation of windows, especially when cleaning.

Table 1 — Window types: risks in use and when cleaning the outside of the window from inside

Window type	Risk in use	Risk in cleaning	Comments
Side hung, open-out with non-projecting butt hinges	Collision with windows outside Falling out of window Window slamming open/shut	Only cleanable from adjacent light (see **8.2.4**)	Safety restrictor should be fitted depending on risk assessment
Side hung, open-out with offset projecting hinges (non-friction)	Collision with windows outside Falling out of window Window slamming open/shut	Falling out of window Entrapment	Gap between casement and frame should be at least 95 mm Safety restrictor should be fitted depending on risk assessment A restraint can be fitted to reduce the risk of entrapment whilst cleaning
Side hung open-out with projecting friction stay	Collision with windows outside Falling out of window	Falling out of window	Gap between casement and frame should be at least 95 mm Safety restrictor should be fitted depending on risk assessment
Side hung, open-in	Collision with windows inside Falling out of window Window slamming shut	Falling out of window Window slamming shut	Safety restrictor should be fitted depending on risk assessment A retaining device can be fitted for cleaning depending on risk assessment
Tilt and turn	In turn mode, collision with windows inside and falling out of window In both modes window slamming shut	In turn mode falling out of window and window slamming shut	Tilt and turn windows are designed to provide limited ventilation in the tilt mode and access for cleaning and maintenance in the turn mode However turn mode may also be used for ventilation, and a safety restrictor should be fitted depending on risk assessment Devices are available to restrict ability to enter turn mode A retaining device can be fitted for cleaning depending on risk assessment Anti-slam devices should be considered depending on window size
Top hung open-out with non-projecting butt hinges	Collision with windows outside Falling out of window Window slamming open/shut	Only cleanable from adjacent light (see **8.2.4**)	Safety restrictor should be fitted depending on risk assessment

Table 1 — Window types: risks in use and when cleaning the outside of the window from inside (*continued*)

Window type	Risk in use	Risk in cleaning	Comments
Louvres	Falling through window depending on configuration (glazing only restrained on two short edges)	Falling through window depending on configuration (glazing only restrained on two short edges) Entrapment Lacerations	Louvres should have a positive hold open position to avoid danger of shutting during cleaning Openings between louvres should be minimum 95 mm and maximum 100 mm All glass should be arris edged Fixings and glazing should be suitable to withstand impacts comparable to those for a light of the same configuration restrained on all edges (see **5.6**)
Bottom hung open-in (on releasable side arms)	None identified	None identified	In cleaning position the window should be supported by stays Size or weight of sash are limiting factors
Bottom hung open-in (on fixed side arms or hoppers)	None identified	Entrapment	Gap between top of open sash and frame should be a minimum of 95 mm
Top hung open out with projecting friction stay	Collision with windows outside Falling out of window	Falling out of window Entrapment	Gap between casement and frame should be at least 95 mm Safety restrictor should be fitted depending on risk assessment
Top hung or side hung fully reversible	Falling out of window Collision with windows outside	Falling out of window during reversing operation	Safety restrictor should be fitted depending on risk assessment Some top hung windows have an integral safety restrictor A reversing catch should always be fitted to hold the sash during cleaning
Horizontally or vertically pivoted fully reversing	Falling out of window Collision with windows inside and outside Window slamming shut	Falling out of window during reversing operation	Safety restrictor should be fitted depending on risk assessment A reversing catch should always be fitted to hold the sash during cleaning
Vertically or horizontally pivoted nominal 90° opening	Falling out of window Collision with windows inside and outside Window slamming shut	Falling out of window during cleaning	If windows are to be cleaned from the inside, they should always have a retaining device to hold the sash securely in the cleaning position Safety restrictor should be fitted depending on risk assessment

Table 1 — Window types: risks in use and when cleaning the outside of the window from inside (*concluded*)

Window type	Risk in use	Risk in cleaning	Comments
Horizontal sliding and vertical sliding	Falling out of window	Cleaning only possible if all sashes pass Falling out of window during cleaning	Safety restrictor should be fitted depending on risk assessment
Vertical sliding with tilting sashes for cleaning	Falling out of window	None	Tilt restrictor stays should be fitted Safety restrictor should be fitted depending on risk assessment
Vertical sliding with side-hinged sashes for cleaning	Falling out of window	Falling out of window	Safety restrictor should be fitted depending on risk assessment A restraint can be fitted to reduce the risk of entrapment whilst cleaning
Fixed light	None	Only cleanable where suitable opening light(s) adjacent with associated risk	See **8.2.4**
NOTE 1 Configuration, including size, of opening and fixed lights should be related to reach capabilities (see Annex A). NOTE 2 Descriptions of window types are as UK industry usage; descriptions in European standards might differ.			

5.3.2 *Configuration*

Any light large enough to fall through when open can be dangerous, as can any areas of glazing wide enough to fall through during cleaning, even if closed or fixed. Consideration should be given to the choice of configuration to manage this risk, and the use of appropriate glazing to withstand possible impact (see **5.6.3**).

5.3.3 *Window controls*

It is important that window controls designed for hand operation are easily operated and within comfortable reach in both open and closed positions, normally while standing on the floor, or for some types of occupancy, from a seated position. Where the position of a window means that its controls would be out of comfortable reach, then the window design and associated hardware should provide for operation by some form of easily-operated linked or remote control.

In order to establish criteria for comfortable use of window controls by the majority of the UK adult and older adult population, reach and force statistics such as those published by the Department of Trade and Industry Adultdata: The Handbook of Adult Anthropometric and Strength Measurements — Data for Design Safety [9], Older Adultdata — The Handbook of Measurements and Capabilities of the Older Adult: Data for Design Safety [10], Strength Data for Design Safety: Phase 1 [11] and Strength Data for Design Safety: Phase 2 [12] are available. For indications of reach capabilities see Annex A.

NOTE 1 Generally for windows with a head height no greater than 2 100 mm the operating handle can be at mid-point, especially where multipoint locking is used. Multipoint locking also allows handle height/position to be varied, which is useful when reaching over an obstruction.

NOTE 2 See BS EN 13115:2001 for classification of operating forces.

Where a window is fitted with two separate cockspur handles to ensure a tight closing action, the reach needed to the top handle should be determined and the window's suitability for that location established. If the reach is excessive only the bottom handle is likely to be used which could eventually distort the casement, leading to maintenance problems. Some situations need the provision of particular window types, or the use of special tools or mechanical gear to open the window.

Window controls and hardware should be designed to take account of possible wind and gusting loads, including provision for intermediate stop positions beyond the initial limit of a safety restrictor where appropriate.

NOTE 3 In exposed locations, for example in high-rise buildings, some window types can be difficult to operate safely in windy conditions.

5.4 Safety fittings

5.4.1 *Safety restrictors*

Safety restrictors in accordance with Annex B should be fitted to accessible opening lights where children or adults are at risk of falling out.

NOTE Restrictors can be either an integral part of the window operating gear or a separate item of hardware which can be fitted to a window at the time of manufacture or later.

5.4.2 *Reversing/retaining catches*

Reversing and retaining catches should be fitted wherever possible and used to hold an opening light firmly in position for cleaning. Release should require deliberate action.

5.5 Guarding

When assessing risks, factors including the configuration and location of the opening light, the sill height above floor and adjacent ground level, and the likely occupancy should be determined. These factors could indicate the need for guarding to 1 100 mm above floor level for stability when leaning out (this height corresponds approximately to the centre of mass of an adult).

The height above floor level of the lowest part of any opening light is a particular factor to consider. It is recommended that where this is below 1 100 mm the opening should be guarded to that level, unless giving safe access to ground level or a fully guarded area.

NOTE 1 Legislation permits unguarded opening heights down to 800 mm above floor level in some situations.

Where there is a drop of more than 600 mm from floor level to adjacent ground level (in dwellings; less in other types of residential accommodation), inward-opening door height windows should have guarding 1 100 mm high conforming to BS 6180 (unless giving access to fully guarded areas). This applies to other window types that allow access or passage for occupiers (depending on sill and head heights), including inward-opening side-hung casements, vertical or horizontal sliding sashes and tilt and turn windows.

Guarding should be designed so that it is not easily climbable by children, e.g. by the use of vertical rather than horizontal bars, or by sheet material. The tops should be formed to discourage use as temporary seats. There should be no opening in the guarding through which a sphere of 100 mm diameter could pass. Guarding should be permanently fixed and should not be detachable to permit windows to be opened. The location of the guarding and choice of window type should be considered together to avoid obstruction when opening the window.

Guarding can also act as permanent screen protection for non-safety glazing but in this case any opening in the guarding should be less than that through which a sphere of 75 mm diameter could pass.

NOTE 2 Guidance on the design of guarding is given in BS 6180 and BS 6399-1.

5.6 Window construction and installation

5.6.1 *Strength of framing and fastening*

The strength and rigidity of the framing and its fastening to the structure, including loading imposed by the operation of the window, by impacts, or by the effects of wind should conform to an appropriate standard suitable for the application, e.g.

— BS 644 for wooden windows;
— BS 4873 for aluminium alloy windows;
— BS 6510 for steel windows;
— BS 7412 for PVC-U windows;
— BS 6375-2 for performance of windows;
— BS 6399-1 for dead and imposed loads;
— BS 6399-2 for wind loads;
— BS EN 13049 for soft and heavy body impact.

NOTE 1 Other standards might be suitable for some applications.

A check should be made to ensure that other relevant standards are considered.

NOTE 2 Guidance on the installation of windows can be found in BS 8213-4 and in trade standards.

5.6.2 *Building hardware*

The building hardware selected should be fit for its purpose, particularly to restrict openings where specified and take account of the technical recommendations for selection, installation, operation and maintenance of the window given by the window manufacturer, window system supplier and hardware manufacturer. The hardware and its attachment to framing should be designed to sustain the performance of the window for its maintained life. The design, construction and installation of the hardware and the fastenings should also prevent any opening light from becoming accidentally detached from the frame.

5.6.3 *Glass and glazing*

Glass or other glazing material should be of appropriate type, adequate quality and thickness and properly installed to withstand loads imposed by the operation of the window, cleaning, impact and wind.

NOTE Various performance levels and guidance on these matters is given in BS 6262 and in BS 6262-4.

Where glazing performs the function of guarding, the recommendations given in BS 6180 and BS 6399-1 should be followed.

5.6.4 *Commissioning and routine inspection*

Installation and operation of windows and associated safety devices should be checked by the contractors responsible for the installation before use by others, and regularly thereafter by building owners and occupiers to ensure correct and safe operation (see Clause **9**).

6 Means of escape from fire

Opening lights can provide a means of escape/rescue in case of fire, depending on window type and associated hardware, configuration and location including height above adjacent ground or other safe level.

NOTE Attention is drawn to the fact that legislation requires means of escape windows in particular situations.

Lockable handles and any restrictors released by removable keys or other tools should not be fitted to opening lights suitable as a means of escape in case of fire.

Windows suitable as means of escape should operate in the following sequence:

a) release window handle/s;

b) release of any restrictor;

c) window fully open to egress position;

d) window move to any other position, e.g. for cleaning.

7 Security from unauthorized entry

7.1 Levels of security

Windows should be designed to achieve an appropriate level of security. A risk assessment should be carried out to determine the level of security necessary to windows vulnerable to unauthorized entry (see **7.2**). The risk assessment should ensure that any of the security measures implemented to provide security from unauthorized entry do not endanger occupants by delaying or obstructing egress in case of fire.

7.2 Vulnerable windows

Windows that provide a means of escape from fire (see Clause **6**) and are accessible from ground level, flat roofs or balconies, may be vulnerable to intruders and increased security measures should be considered. It is important to ensure that any additional security measures do not hinder or delay the occupants' escape. One solution might be the provision of laminated glass for security in lieu of locking handles that are operated by means of removable keys or other tools, which if lost might prevent the opening of the window.

Windows that are vulnerable but cannot readily be used as a means of escape can have locks and safety devices of a type fitted with a removable key or tool not casually available. To reduce the risk of entry by intruders the removable key or tool should not be kept in the locking mechanism. Designers and building owners should ensure that occupiers are made aware of any potentially vulnerable windows and the importance of ensuring that the removable keys or tools to open the windows are kept out of reach of young children and any potential intruder.

NOTE Recommendations for security against intruders are given in BS 8220-1, and for security testing of windows in BS 7950.

8 Design for safety when cleaning

8.1 Accident risks during cleaning

The risk assessment should take account of the following:

a) Falls account for most accidents whilst cleaning windows. These include internal falls, falling out of or through a window from inside the building, or from an external position on a sill or ledge. These accidents are usually due to loss of balance, inadvertent slippage, or as a result of a breakage of part of the building fabric.

b) Accidents involving ladders usually result from sudden unexpected movements of the ladder such as the top sliding sideways, or the foot slipping outwards, sometimes with fatal consequences.

c) Accidents can occur due to the breakage of glazing whilst it is being cleaned, resulting in injury to arms or hands.

8.2 Cleaning from inside

8.2.1 *General*

Unless there is a safe external approach the window should be designed such that both external and internal surfaces can be cleaned safely from inside. The window design and location should ensure that it is possible for cleaning to be carried out while standing on the floor, preferably without the need for a stepladder or other such foothold. Consideration of reach capabilities is described in **5.3.2** and Annex A.

NOTE 1 Safe external approach is usually from ground level or from a balcony, but other means may also be safe.

NOTE 2 Where implements are used to extend reach, it can be difficult for people with limited strength to apply sufficient pressure to ensure effective cleaning.

Where high level windows or glazing are designed, safe internal access should be provided as described in Annex C.

Table 1 gives an analysis of the criteria that should be considered when cleaning the outside of different types of windows from within the building. Cleaning of the external surface of windows from the inside can be achieved by:

a) reversing the window (see **8.2.2**);

b) opening the window inwards (see **8.2.3**);

c) access through the opening light (see **8.2.4**);

d) access through an adjacent light (see **8.2.5**).

8.2.2 *Reversing the window*

Automatically engaging reversing catches should be fitted to secure the window whilst in the cleaning position.

NOTE Windows that fully reverse can be easy to clean but might leave large unobstructed openings whilst reversing.

8.2.3 *Opening the window inwards*

A retaining device to secure the opening light during cleaning should be fitted if there is a possibility of the light moving and causing danger to the cleaner.

NOTE Inward opening windows can be easy to clean but might leave large unobstructed openings during cleaning.

Windows that tilt inwards for cleaning, including some vertical sliding windows, can be heavy and should be supported by a stay during cleaning.

8.2.4 *Access through the opening light*

Windows should be configured to minimize the risk of loss of balance and falling when reaching through an opening light in order to clean the outside.

NOTE Cleaning the outside of windows such as top hung projecting, or horizontally pivoted windows which only open to 90° from the plane of the elevation, is difficult and potentially dangerous. Fatal accidents have occurred due to over-reaching when working on these types of window, exerting loads on the frames and causing failure.

Where access for cleaning is to be provided between the casement and the frame, for example on side hung opening lights with projecting hinges, it is necessary to have sufficient clearance for an arm to pass comfortably between the frame and the opening light.

Where there is a high level opening light above a main opening light, the high level light should be cleanable without opening the main light.

8.2.5 *Access through an adjacent light*

This method carries a risk of falling through the adjacent light, again depending on configuration. Particular attention should be paid to reach capabilities and the danger of over-reaching (see Annex A).

8.3 Cleaning from outside

Where windows and glazing are designed for cleaning from outside, there should be provision for safe access (see Annex C).

8.4 Secondary windows and coupled lights

Secondary windows should not interfere with cleaning or maintenance procedures. They should be capable of being moved safely to allow full access for cleaning. The weight and size of removable lights should be considered. When coupled lights are opened to permit cleaning of the internal glass faces, inner lights should be held securely in position during cleaning.

9 Maintenance

All window fittings should be regularly inspected and maintained to ensure that they remain in good working order. Failure to do so can result in malfunction and potential risk to users, e.g. where excessive force is needed to open or close a window, the consequent sudden movement could cause injury and/or glass breakage.

Annex A (informative)
Reach capabilities

Statistics published by the Department of Trade and Industry, Adultdata: The Handbook of Adult Anthropometric and Strength Measurements. Data for Design Safety [9] and Older Adultdata: The Handbook of Measurements and Capabilities of the Older Adult: Data for Design Safety [10] give reach capabilities for various populations (see Table A.1).

Table A.1 — Reach capabilities for the UK adult population (under age 65)

Dimensions in millimetres

Reach capability	Gender	Mean	5th%ile (i.e. includes 95% of adult population)
Shoulder (acromion) to grip (See Figure A.1)	Male	662.5	607.2
	Female	608.5	556.4
Overhead grip reach (See Figure A.2)	Male	2 093.2	1 941.5
	Female	1 944.3	1 824.7
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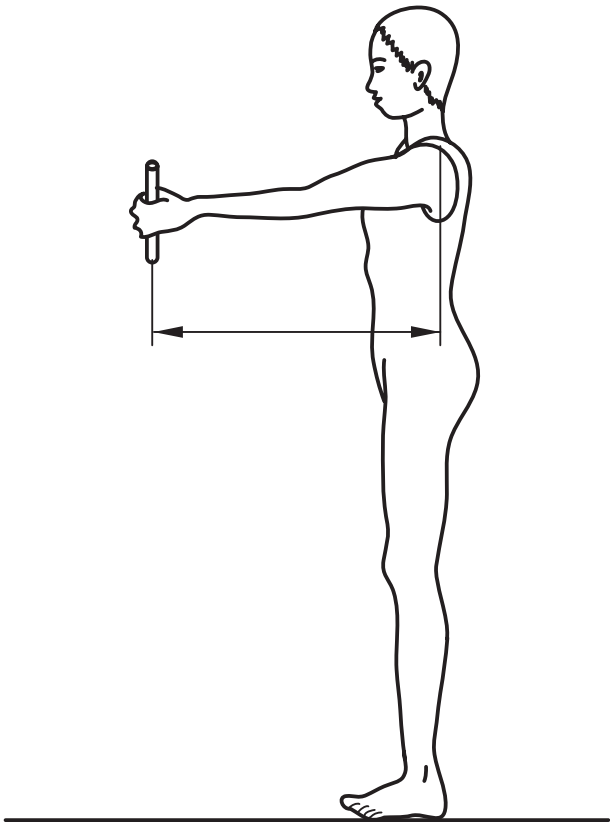
Although the shoulder to grip dimensions are slightly longer than armpit to grip, they allow for the use of, say, a sponge in establishing effective reach for cleaning.

From these statistics it appears that only around half of the adult female population would be able to reach out approximately 608 mm, without either leaning forward or using implements to extend reach. Similarly, only around half of the adult female population would be able to reach overhead to approximately 1 944 mm (approximately 1 970 mm with the use of a sponge). Reveal depths and fitted furniture affect reach.

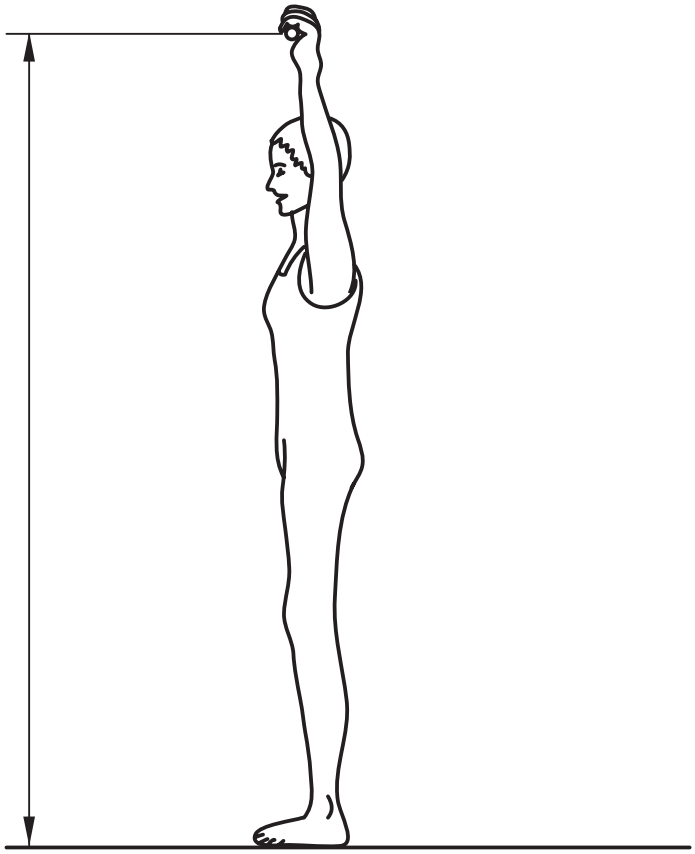
For older adults, in the 65 to 74 age group, directly comparable statistics are not available; however overhead reach is affected by lesser capability in raising the arm in line with the trunk.

The statistics indicate rather shorter reach capabilities than many current window designs would require for safe cleaning. In guidance on the use of data, the scenarios included with the DTI statistics suggest for example that design for reach (and force) should accommodate the 5^{th} percentile of the UK adult population, i.e. within the capabilities of 95 %. This would indicate limits of around 556 mm for reaching out, and around 1 825 mm for overhead reach. However, in some building types and circumstances other values are appropriate.



Measured from the bony tip of the shoulder (acromion) to the tip of the centre of a rod gripped vertically in the hand. The arm should be straight.

Figure A.1 — Shoulder (acromion) to grip



Measured vertically from the floor to the centre of a rod gripped horizontally in the hand. The person stands erect, weight evenly balanced with the arm extended vertically above the head.

Figure A.2 — Overhead grip reach

Annex B (normative)
Safety restrictors

Safety restrictors should operate so that they:

a) limit the initial movement of an opening light so that a clear opening of not more than 100 mm is achieved at any point;

b) are releasable only by manipulation not normally possible by a child under 5 years;

c) are readily identifiable and capable of being released by an adult (without prior instruction) on windows suitable as a means of escape in case of fire;

d) re-engage automatically when an opening light is returned to the initial restricted opening position, or to a closed position (whether latched or not);

e) are not lockable by a removable key or other device on windows suitable as a means of escape in case of fire (see Clause **6** and **7.2**).

Clear written information on the operation of the fitted safety restrictors, and any potential risks or limitations in use, should be provided to owners and occupiers by window installers. This should include recommendations stating that where a window is opened beyond the initial restricted position for cleaning it should be returned, as soon as possible, to a position where the restrictor automatically re-engages.

Safety restrictors should be designed specifically to operate on the types of window on which they are to be installed, and should meet the requirements of DD CEN/TS 13126-1.

Safety restrictors should be tested in accordance with DD CEN/TS 13126-5:2004 and should be:

a) durability tested under DD CEN/TS 13126-5:2004 **7.3**, grade 5, on the maximum leaf mass opening light to which it is to be installed;

b) strength tested under DD CEN/TS 13126-5:2004 **7.4**, together with the fasteners recommended by the restrictor manufacturer and the material type to which it is to be fixed;

c) corrosion resistance tested under DD CEN/TS 13126-5:2004 **7.5**, and conform to BS EN 1670 Class 3 (96 hours) or better.

Annex C (normative)
External and internal glazing at height: Design for safe cleaning and maintenance

C.1 General principles

A fundamental principle embedded in all modern health and safety law is that risks should be assessed, avoided where possible and then controlled to minimize them. For example, The Construction (Design and Management) Regulations [4], which cover work in cleaning buildings, require designers to avoid foreseeable risks by either eliminating the risk or combating such risks at source, and to give priority to measures that protect all persons doing such work.

In relation to the hazard of falls from height when cleaning windows, the necessary practical steps to consider are first to avoid the hazard wherever possible, for example by designing windows that can be safely cleaned on both sides from within the building. If work at height is necessary, then safe access from the building should be the next consideration, for example by the provision of permanent walkways. Personal protection such as safety harness is the last option to consider (see **C.5.1**).

NOTE The Health and Safety at Work Act 1974 [8] applies to all engaged in window cleaning (other than servants in domestic households) undertaken at work and also imposes general duties of a wide nature on employers and employees etc.

C.2 Avoiding work at height

The degree of dirtying upon the glazing differs according to the locality, the angle of inclination of the surface, its texture, and whether it is exposed to the washing action of the rain. If it is not possible to provide windows that can be safely cleaned on both sides from within the building, self-cleaning glass should be used in situations where satisfactory cleaning is likely to result. However, unless the design permits sufficient flow of water over the whole glazed surface, it is likely that manual cleaning will be necessary to remove all dirt. Window frames also need manual cleaning.

Use of long-pole systems (up to 18 metres or so in length) for cleaning glass is growing in popularity, and although not suitable for all applications, it should be used where space permits; dangers to others are minimized and there are no overhead hazards. Such equipment should be used taking into account current HSE guidance on musculo-skeletal risks to operators.

NOTE This guidance is available via www.hse.gov.uk/msd/index.htm.

Care should be taken when using pressure cleaners on windows. Their use has the potential to damage the glazing systems used in window construction.

C.3 Safe access from the building for work at height

C.3.1 *Permanent walkways*

Permanent walkways with guardrails or other suitable protective construction should preferably be 600 mm wide. Design loadings for guardrails are given in BS 6180.

NOTE Guidance is available via www.hse.gov.uk.

C.3.2 *Suspended cradles*

Suspended cradles as permanent installations have the attraction of being available for other work. Information on the design, construction and use of permanent and temporary suspended cradles is given in BS 6037 and BS 5974 respectively.

C.3.3 *Roof access*

Where a roof is used for access purposes potential users should satisfy themselves that the roof surface is strong enough to support any cleaners and their equipment, and that suitable precautions are provided to prevent falls e.g. by fixed railings at the edge of flat roofs.

C.3.4 *Travelling ladders*

Travelling ladders can be permanently installed on the faces of buildings, either by hanging from a trolley mounted on a rail at roof level where they can be two storeys in height, or in single storey heights at each level and running in a separate rail above each window. Provision should be made on the ladder for a wire on which is fitted an automatic fall arrest device to which the cleaner can attach a safety harness. There should be a safe place at which the cleaner can step on and off the ladder.

C.4 Security

Appropriate measures should be taken to prevent unauthorized access and misuse of these provisions for safe access.

C.5 Personal protective equipment

C.5.1 *Safety harness*

Protection by means of a safety harness attached to the building should not be the first choice, as it has the disadvantages that the cleaner has to accept the discipline and restriction involved in using the equipment. In the event of an accidental fall there is still a chance of injury before the fall is arrested.

There are circumstances, however, when it is not reasonably practicable to use other means of access or to work from a safe place within the building. In such cases the use of a safety harness attached to a firm anchorage might be the only precaution that can be taken when all other methods have been considered.

Careful thought should be given to the provision of suitable anchorage points capable of sustaining the anticipated shock load. Excessive shock loads on the anchorage, the equipment and the wearer should be avoided. For this reason BS EN 364 specifies the limits for the deceleration forces when harnesses are tested. Harnesses specified in the standard are suitable for a "free fall" distance (i.e. the distance fallen by the wearer before the fall is arrested) of not more than 2 m.

NOTE The design, construction and use of safety harnesses are specified in BS EN 354, BS EN 355, BS EN 358, BS EN 360, BS EN 361, BS EN 362, BS EN 363, BS EN 364 and BS EN 365.

C.5.2 *Permanent fixed anchorages*

If permanent fixed anchorages are installed, an assessment should be made by a competent person of the suitability of the building fabric to accommodate the anchorage, since some walls might not be strong enough to sustain safely the forces resulting from a fall. In addition, the anchorages should be so arranged that in the event of a fall a cleaner would not be exposed to deceleration forces greater than those specified in BS EN 364.

Permanent fixed anchorages should conform to BS EN 795 and the recommendations for their installation given in BS 7883. They should be properly maintained, particularly where they are liable to be adversely affected by the weather.

Anchorages should be so placed that the cleaner can attach the safety lanyard (i.e. the line for connecting the harness to the anchorage) before moving to a position from which there would be a risk of falling.

Where a permanent anchorage of the type specified in BS EN 795 is not appropriate, for example if the walls or structure of the building are not strong enough, it might be possible to construct a temporary anchorage point or use a mobile anchorage such as a proprietary device consisting of concrete blocks mounted on a trolley.

C.6 Safe temporary access from outside and inside

If safe access is not built in, the building should be designed to ensure the safe use of temporary access equipment such as mobile elevating work platforms, tower scaffolds, portable ladders or rope access.

NOTE Attention is drawn to regulations on work at height. Guidance is available at www.hse.gov.uk.

For many buildings, portable ladder use is one possible option if other safer alternatives cannot be provided. If ladder use to clean the building is foreseen, designers should devise means to ensure so far as possible that portable ladders can be used safely and easily. Safety can be enhanced by building in features to allow greater ladder stability. These could include:

— suitably located and shaped indents in solid ground surfaces to positively locate ladder feet in the correct position;

— external faces of window sills having suitably angled and grooved surfaces to prevent ladders sliding sideways;

— suitably shaped mouldings on window sills to allow positive location of ladder stile(s) and prevent sideways slipping;

— recessed or raised vertical grooves in wall surfaces to allow use of ladders without risk of sideways slipping;

— suitable tying points within standing reach to allow securing of a ladder, such as eyebolts firmly fixed into the wall.

Where such means use anchorage points in the wall, written instructions should be provided for the owner and occupier on the routine inspection and maintenance of such fixings, and clear instructions on cleaning the window in this fashion. It should be noted that there is no standard applicable to the testing and maintenance of such devices, and that poor installation and deterioration of means of fixing are common. Unless these factors can be reliably dealt with, such anchorage points cannot be considered acceptable.

Annex D (normative)
Safe use of ladders

There might be high level windows or fixed lights where access by ladder, either outside or inside, is the only option. There might also be windows, particularly on staircases, where cleaning both sides of the window is safer from outside. Where windows have been installed with this means of cleaning intended, designers should provide proper means for securing any ladder in the most appropriate location to clean the windows (see Annex C).

Recognized good practice in the safe use of ladders should always be followed. This includes the following advice:

— ensure the ladder is in a safe working condition;

— support the ladder firmly at the base on level ground. Do not use the ladder on a slippery surface as its stability depends on the friction at its base;

— set the ladder at an angle of 75° (one out for every four up). Modern ladders sometimes have an indication of when this angle is achieved;

— use the equipment provided to secure the ladder firmly, for example by tying or using a purpose-built locating device (consider use of a ladder stability device if none of these is possible);

— use suitable footwear and ensure it and the ladder rungs are free of mud, grease etc.;

— never use a ladder which is too short; never stand on any of the top three rungs;

— never stand the ladder on an unstable, sloping or loose base;

— never try to overreach when working from the ladder; a very common cause of accidents;

— do not use the ladder in strong winds;

— only one person should be on the ladder at any time apart from another person footing the ladder. The person on the ladder should always have at least three limbs in contact with the ladder at any time. It is advisable to carry cleaning equipment in a tool belt or pouch.

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