BRITISH STANDARD

Code of practice for installation and application of security glazing

ICS 13.310

Publishing and copyright information

ISBN 978 0 580 56791 9

The following BSI references relate to the work on this standard:
Committee reference B/520
Draft for comment 07/30148359 DC

Publication history

First published 1976
Second edition, 1995
This (present) edition, 2007

Amendments issued since publication

Amd. no.	Date	Text affected

Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iii, a blank page, pages 1 to 11 and a back cover.

Foreword

Publishing information

This British Standard is published by BSI and came into effect on 31 August 2007. It was prepared by Subcommittee B/520/3, *Security glazing*, under the authority of Technical Committee B/520, *Glass and glazing in building*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 5357:1995, which is withdrawn.

Information about this document

BS 5357 gives guidance to those responsible for installations involving the use of security glazing. In this revision, guidance has been updated to take account of the introduction of a number of new European Standards and other publicly available standards covering glass, windows and doors for security applications.

The recommendations in this code, cover the mounting of security glazing so that it strongly resists dislodgement from its position when under attack and give guidance to ensure that the rest of the installation provides at least as high a level of protection as the security glazing itself. The recommendations apply to bullet-resistant glazing, glazing resistant to manual attack (formerly called “anti-bandit glazing”) and glazing subject to explosions. The principles that the glazing should not be dislodged from its position under attack, and that the rest of the installation should offer at least equal protection, apply to all types of security glazing.

It is essential that any installation complies with relevant fire regulations and that adequate means of escape from fire are provided. The purpose of this code is concerned with the protection of life, and aesthetic considerations are therefore, wherever necessary, subordinate to the needs of security.

Product certification/inspection/testing. Users of this British Standard are advised to consider the desirability of third-party certification/inspection/testing of product conformity with this British Standard. Appropriate conformity attestation arrangements are described in the appropriate harmonized European Standard (e.g. EN 14449 for laminated and laminated safety glass). Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

Use of this document

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.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

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 cannot confer immunity from legal obligations.

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1 Scope

NOTE Extreme climatic conditions can affect the performance of security glazing products.

This British Standard gives recommendations for the installation and application of bullet-resistant glazing, glazing resistant to manual attack, explosion resistant glazing and aspects of construction for complete installations. Information is also given regarding other aspects of security, including physical protection and one-way vision.

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 5051-1:1988, *Bullet-resistant glazing – Part 1: Specification for glazing for interior use*

BS 5544, *Specification for Anti-bandit glazing (Glazing resistant to manual attack)*

BS 6262-4, *Glazing for buildings – Part 4: Code of practice for safety related to human impact*

BS 7950, *Specification for enhanced security performance of windows for domestic applications*

BS EN 356, *Glass in building – Security glazing – Testing and classification of resistance against manual attack*

BS EN 1063:2000, *Glass in building – Security glazing – Testing and classification of resistance against bullet attack*

BS EN 1522, *Windows, doors, shutters and blinds – Bullet resistance – Requirements and classification*

BS EN 1523, *Windows, doors, shutters and blinds – Bullet resistance – Test method*

BS EN 12600, *Glass in building – Pendulum test – Impact test method and classification for flat glass*

BS EN 13123-1, *Windows, doors and shutters – Explosion resistance – Requirements and classification – Part 1: Shock tube*

BS EN 13123-2, *Windows, doors, and shutters – Explosion resistance – Requirements and classification – Part 2: Range test*

BS EN 13124-1, *Windows, doors and shutters – Explosion resistance – Test method – Part 1: Shock tube*

BS EN 13124-2 *Windows, doors and shutters – Explosion resistance – Test method – Part 2: Range test*

BS EN 13541, *Glass in building – Security glazing – Testing and classification of resistance against explosion pressure*

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

DD ENV 1627:1999, *Windows, doors, shutters – Burglar resistance – Requirements and classification*

PAS 24-1, *Enhanced security performance requirements for door assemblies – Part 1: Single and double leaf, hinged external door assemblies to dwellings*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1 complete installation
construction providing protection to personnel on the private side against a specified level of attack, e.g. a cashier's counter, a wall, or a partition

3.2 edge cover
width of the strip of security glazing covered by the glazing joint, i.e. the distance between the edge of the glass and the sight line

3.3 glazing
glass or plastics glazing sheet material for installation into a building

3.4 manual attack
use of ropes, grappling irons, baulks of timber, crowbars, wrecking bars, sledge hammers, either individually, or in combination for a specified time in order to enter the private side

3.5 private side
side of a security glazing which faces the private space

3.6 private space
part of the premises in which a person is protected by the complete installation

3.7 public side
side of a security glazing designed to face an attack

3.8 public space
part of the premises normally occupied by members of the public

3.9 screening material
material other than security glazing used in the construction of complete installations

3.10 security glazing
glazing which affords protection against a specified level of attack

3.11 Venetian striped glass
glass with broad silvered stripes with narrow clear areas in between

4 Glazing, framing and support

4.1 General

The complete installation for the security glazing, including the framing and support, should provide at least the equivalent resistance to attack as the security glazing it is designed to hold in place.

Any method used to hold framed or unframed security glazing in place should be of sufficient strength to resist dislodgement by any anticipated means of manual attack.

NOTE Glazing resistant to attack by firearms might not necessarily be resistant to manual attack.

Where security glazing is installed within 1 m of a personnel workstation, the danger of spalling from the glazing material should be considered.

4.2 Framed security glazing

The frame should be of sufficient strength and stiffness to hold the glazing securely in place when either the frame or the glazing is subjected to the specified level of attack.

The depth of the rebate should be sufficient that, after allowance for edge clearance around the glazing, there is adequate edge cover to prevent the glazing being levered out of the frame when subjected to the specified level of attack.

NOTE The depth required depends on the strength and stiffness of the rebate upstand and the glazing bead.

The bead should be fixed, preferably on the private side, in a manner which ensures that it cannot be removed or dislodged when subjected to the specified level of attack.

Glazing gaskets and sealants should be checked for compatibility with the security glazing. Where possible, chemically curing sealants with good adhesion to the glazing and the framing material should be used.

4.3 Fixing methods for explosion resistant glazing

4.3.1 Fixings where the glass is intended to remain unbroken

Where the glass is intended to remain unbroken (except for any sacrificial layer), the support system should be designed so that it resists the forces of the explosion transmitted through the glass, i.e. the full blast overpressure, without significant distortion, maintaining the glass in position.

NOTE 1 The fixing method for this design is usually of a much heavier duty than those used to resist wind forces. This is particularly important with conventional glazing frames, where the frames themselves, the attachment of the frame to the building, and the attachment of beads to the frame, might need to be considerably stronger than normal.

The installation of such glazing also has consequences for the building structure, since the full force of the blast is transmitted to the structure, which should be designed to resist it.

NOTE 2 This might only be practical for new buildings.

4.3.2 Fixings where the glass is allowed to fracture

Where the glass is allowed to fracture, glazing with deep rebates on all edges of the glass is recommended. The beads holding the glass in place should be of sufficient strength to remain intact and hold the glass in position.

NOTE If the glass is allowed to fracture, the forces transferred to the frame and the structure is reduced and might result in a practical economical option.

It is recommended that a tested framing system and proven fixing method is adopted but, in general, increasing the edge cover to the glass and bolting the bead at frequent intervals is sufficient.

4.4 Unframed bullet-resistant security glazing

Unframed bullet-resistant security glazing should have no gaps, except as described in **5.4**, between the edges. Butt joints should not be used for bullet-resistant glazing.

Note Guidance edge finishes of laminated glass can be found in BS EN ISO 12543-5 and defects on edges that will not be framed in BS EN ISO 12543-6.

4.5 Supports

All fixings to ceilings, walls, floors and junctions should be of sufficient strength to securely hold in place all components of the installation, when subjected to the specified level of attack.

Vertical supports (mullions) should be securely fixed at ceiling and floor levels.

Alternatively, if a counter is provided and it is strong enough to provide satisfactory anchorage, fixings may be made at the counter level rather than at floor level. Vertical supports should generally be taken through suspended ceilings and raised floors in order to achieve satisfactory anchorage.

Horizontal supports (transoms) should be securely fixed at each junction with the vertical supports and walls where appropriate.

Where a counter or other non-glazed component is provided as part of the glazed security screen, it should be securely supported and fixed to the walls and floors.

5 Complete installations

5.1 General

Protection against the specified level of attack, whether by security glazing or other material, should extend to a minimum of 2 m above the floor level on the public side. Above a height of 2 m, protection should be of a kind that can prevent an attacker climbing or vaulting the screen, or throwing objects over the screen, or aiming or firing a firearm directly or indirectly at anyone in the private space, and it should be continued up to the ceiling (or through a suspended ceiling).

5.2 Screening material

The resistance of brickwork, wood, and other building materials, varies considerably. To ensure that the screening material in a complete installation (for example, in counter screens and fronts) provides at least as good a level of protection as the security glazing, it should be backed by, for example, mild steel at least 6 mm thick or other material offering equivalent protection of security glazing in accordance with BS 5051-1:1988, class G2 or below or class S86.

If security glazing of BS 5051-1:1988, class R1 or R2 is used in the installation, the screening material should be backed by, for example, at least 8.5 mm thick armour steel or a sufficient thickness of metal plate to give an equivalent performance.

5.3 Counter tops

Counter tops, when forming an integral part of the security screen, should have an equivalent level of protection to that provided by the rest of the installation. The protection should be continuous from finished public floor level to a height of at least 2 m above that level.

The abutment of the glass in the counter screen to the counter top is a critical area, which could be hit in the event of an accidental discharge. To reduce or eliminate the possibility of a projectile penetrating immediately below the glass and into the person intended to be protected, there should be suitable protection within the counter top.

Particular care should be taken to protect butt joints.

5.4 Speaking and transaction apertures

Speaking and transaction apertures in security glazing should fulfil their intended purpose and should be designed to prevent a firearm being aimed through them at anyone in the private space. They should also counter the effects of possible ricochet.

Where transaction apertures are recessed into the counter top, they should provide the same level of protection as recommended in **5.2** and **5.3** for counter fronts and tops.

Consideration should be given to providing electrical speech facility, inclusive of an Induction Loop, and transfer facilities that can be closed off.

NOTE Attention is drawn to the Disability Discrimination Act, 1995 [1].

5.5 Doors and means of access

Doors allowing direct or indirect access into the private space should provide the same level of protection as the screening material. Such doors should open towards the public space and should be self-locking and capable of being opened from the public space only with a security key or equivalent, or directly (or by remote control) by staff on the private side.

NOTE Instant single-handed egress is usually required from the private side.

5.6 Windows and lights

When considering bullet-resistant glazing, any window or ceiling light which would permit a person on the exterior of the building, or in the public space, to aim a firearm at anyone in the private space, should be glazed with security glazing of the same category as that used in the complete installation.

Specialist advice should be obtained from the glazing manufacturer if security glazing is used externally.

5.7 Maintenance

The manufacturer's recommendations for cleaning and maintenance of security glazing should be followed. All accessible parts of the installation should be inspected at regular intervals for wear or deterioration which could lower the level of protection.

5.8 General advice

Advice on complete installations should be obtained from both the Police Crime Prevention Officer and the Fire Prevention Officer of the area in which the premises are situated.

5.9 Installer's certification

It is recommended that the installer should certify to the customer compliance with the appropriate standard, e.g. BS EN 1063 for the glass and BS EN 1522 for the window. A greater level of confidence in the installation might be reached if the installer has third-party approval through a notified certification body.

Consideration should be given to certification schemes that apply to the whole system rather than a single element such as glass.

6 Application of security glazing

6.1 General

Security glazing is used in situations where a high degree of protection either to persons or property is required, either against violent, malicious manual attack, or the use of firearms, or against the effect of explosions.

6.2 Manual attack

6.2.1 Manual attack on glass

Where it is necessary to protect an installation from manual attack for a period of time, the security glazing should be tested in accordance with BS EN 356.

NOTE The test methods given in BS EN 356 are not intended to replicate real-life human attack conditions, but to provide a comparative resistance of products.

6.2.2 Manual attack on other glazing material

Glazing materials other than glass (e.g. plastics glazing sheet materials) should meet the requirements of BS 5544 which specifies requirements and test methods for glazing resistant to manual attack.

NOTE 1 BS 5544 does not give different classes of performance, i.e. a material either passes or fails.

NOTE 2 LPS 1270 describes tests for classifying the intruder resistance of security glazing and has been developed primarily for the insurance industry. The classification system in LPS 1270 can be used to determine whether the resistance to manual attack provided by security glazing is commensurate with that provided by security products and systems rated in accordance with LPS 1175.

6.3 Ballistic attack

6.3.1 Ballistic attack on glass

Where an installation could be subject to ballistic attack, security glazing should meet the requirements of BS EN 1063. For external applications, the likely environmental conditions (e.g. temperature, weathering, etc.) should be considered.

NOTE BS EN 1063:2000 specifically covers three handguns (classifications BR2, BR3 and BR4), four rifles (BR1, BR5, BR6 and BR7) and two shotguns (SG1 and SG2). The classifications BR1 to BR7 are in the order of the level of protection provided (BR1 being the lowest and BR7 the highest). Hence, a glass that achieves a classification of BR3 is also automatically assumed to achieve BR1 and BR2. However, there is not necessarily any direct relationship between the BR and SG classes, due to the different types of ammunition used.

6.3.2 Ballistic attack on other glazing material

Glazing materials other than glass (e.g. plastics glazing sheet materials), should meet the requirements of BS 5051-1 which specifies performance requirements and type tests for six classes of bullet-resistant glazing.

6.4 Explosion resistance for glass

Where installations are required to be resistant to explosion, the glazing should meet the requirements of BS EN 13541 which specifies performance requirements and test methods for glass resistant to explosion pressure

The risk/threat should be assessed by appropriate specialists. Advice on the use of special glass types and fixing systems should be obtained.

NOTE There is no specific test method for plastics glazing sheet materials.

6.5 Other security glazing applications

6.5.1 Data protection

Where security applications require protection of sensitive data from electronic eavesdropping, it is recommended that a coating that provides thermal insulation, which can also affect radio wave transmission, is applied to the glass offering improved performance over uncoated glass. In addition to reflecting long wavelength radiation from heaters and electrical equipment, low emissivity coatings on glass also tend to reflect parts of the electromagnetic spectrum used for radio transmissions, particularly those in the VHF and UHF bands. When the building is purposely designed as a Faraday cage (i.e. all surfaces conductive and electrically connected), multiple low emissivity coatings in an insulating glass unit can be used to prevent the transmission of radio waves. Where any partial Faraday cage effects are likely to interfere with the work of the emergency services within the building, specialist advice should be sought.

6.5.2 One-way vision

A one-way vision effect is desirable in some security glazing applications, e.g. observing suspects in a police station, and can be generally achieved by two approaches. Both approaches rely, primarily on the lighting levels on either side of the intermediate material. The side being observed should be as brightly lit as possible, whereas the observer's side is kept as dark as possible.

The first approach uses a partially reflecting mirror, a coated glass that has a relatively high reflectance from the coated surface and a relatively low light transmittance. The reflectance is usually similar from both surfaces and the transmittance is the same in both directions. Lighting levels should be controlled on either side of the glass so a one-way vision effect can be achieved.

In the second approach, Venetian striped glass is used. When viewed from the observed side, the appearance is one of a mirror; the reflection from the silver tends to overwhelm any transmitted image through the smaller clear stripes. On the other hand, when viewed from the observer's side, reflection from the matt dark backing paint to the silver provides little visual hindrance to the transmitted image seen through the stripes.

6.6 Safety

Applications where security glazing is required might also be subject to safety glass considerations. Where safety glass is necessary in critical locations (i.e. low level glazing, glazing in and around doors) the recommendations given BS 6262-4 should be followed.

Where safety glass is used in buildings it should be tested against human impact in accordance with BS EN 12600 which provides a test method that classifies flat glass products used in buildings, by performance under impact and by mode of breakage.

Security glazing generally achieves the highest classification (i.e. Class 1) for pendulum body impact resistance. However, this should be confirmed by consulting the glass manufacturer or supplier.

7 Application of security glazing – Windows and doors

7.1 General

Where security glazing is required for windows and doors, it should meet the performance characteristics given in BS EN 14351-1. In terms of security, performance characteristics that might be of relevance include manual attack, ballistic attack and explosion resistance.

7.2 Manual attack on windows and doors

Where security glazing for windows and doors could be subject to manual attack, they should meet the requirements of DD ENV 1627 which specifies requirements and classification for burglar resistant properties of doors, windows and shutters.

NOTE 1 DD ENV 1627 also makes recommendations as to the type of security glazing required in windows and doors. These recommendations are summarized in Table 1.

Table 1 **Minimum requirements for infillings of glass in accordance with DD ENV 1627:1999**

Anticipated resistance class of window, door or shutter in accordance with DD ENV 1627:1999	**Resistance of class of glazing in accordance with BS EN 356**
1	No requirement
2	P4A
3	P5A
4	P6B
5	P7B
6	P8B

NOTE It is anticipated that DD ENVs 1627, 1628, 1629 and 1630 will be progressed to full BS ENs. If this is the case, Table 1 might be subject to change.

Where domestic casement tilt/turn windows are required to provide enhanced security against unauthorized forced entry the requirements of BS 7950 should be applied.

Where enhanced security is required in domestic applications, products that meet the requirements of BS 7950 for windows and PAS 24-1 for doors should be used.

If a property is at greater risk (for example, due to contents), consideration should be given to specifying and installing windows and doors that meet the requirements of DD ENV 1627.

NOTE 2 Products that comply with many of the classes defined within DD ENV 1627 might not be suitable for most domestic properties.

NOTE 3 Direct manual attack of the glazing is not covered by BS 7950 or PAS 24-1.

7.3 Ballistic attack on windows and doors

Ballistic attack should be tested in accordance with BS EN 1523 and meet the requirements of BS EN 1522 which specifies the requirements and classification for windows, doors and shutters which have been tested in accordance with BS EN 1523.

7.4 Explosion resistance for windows and doors

Where installations are required to be resistant to explosion, the windows and doors should meet the requirements of BS EN 13123-1 and BS EN 13123-2 which specify requirements and classification for explosion resistance of windows, doors and shutters.

The installations should also be tested in accordance with BS EN 13124-1 and BS EN 13124-2 for shock tube and range testing.

NOTE 1 The shock tube test covers simulated blasts having durations greater than 20 ms with medium pressure and high impulse. It represents the effects of explosive charges from 100 kg to 2 500 kg at distances from about 35 m to 50 m. The shock tube provides a consistent and repeatable means of testing.

Subject to a risk assessment, the application of suitable films to the glass or blast curtains or drapes located behind the glass may be possible. For guidance on the explosion resistance of these products, the manufacturer or supplier should be consulted.

NOTE 2 The Glass and Glazing Federation has developed a set of standards and datasheets covering adhesive backed polymeric film applied to glass for a range of applications, including security. It covers, for example, adhesive backed polymeric film designed so that when applied to a glass pane the final product can be classified in accordance with an appropriate standard for security glazing, such as BS EN 356 and BS EN 13541.

Bibliography

Standards publications

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

BS EN 356, *Glass in building – Security glazing – Testing and classification of resistance against manual attack*

BS EN ISO 12543-5, *Glass in building – Laminated glass and laminated safety glass – Part 5: Dimensions and edge finishing*

BS EN ISO 12543-6, *Glass in building – Laminated glass and laminated safety glass – Part 6: Appearance*

DD ENV 1628, *Windows, doors, shutters – Burglar resistance – Test method for the determination of resistance under static loading*

DD ENV 1629, *Windows, doors, shutters – Burglar resistance – Test method for the determination of resistance under dynamic loading*

DD ENV 1630, *Windows, doors, shutters – Burglar resistance – Test method for the determination of resistance to manual burglary attempts*

Other publications

[1] GREAT BRITAIN. Disability Discrimination Act, 1995. London: The Stationery Office.

LPS 1270 (Draft) *Specification for testing and classifying the burglary resistance of security glazing and glazing films*

LPS 1175 *Requirements and Testing Procedures of Burglary Resistance Building Components, Strongpoints and Security Enclosures*

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