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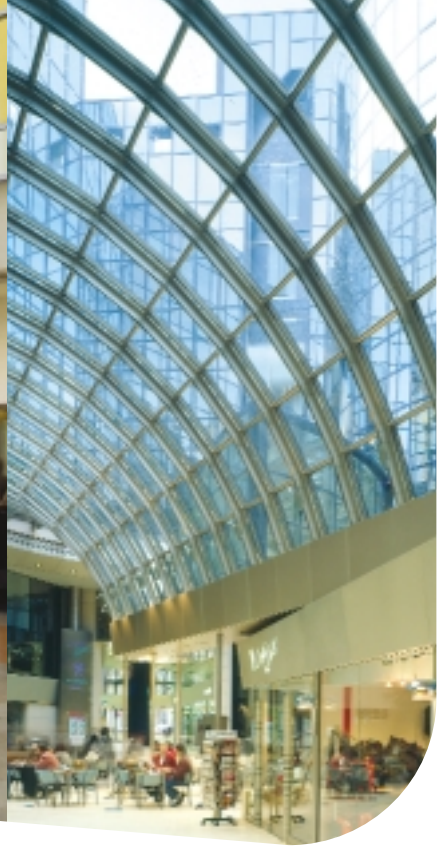
Guide to Glazing for Safety & Security

PILKINGTON



Safety and Security

Safety and security are closely linked topics, but for the right safety or security glass to be specified, a clear distinction has to be drawn between the two.

Safety
In glazing terms, the word safety is applied to glass which is capable of reducing the risk of injury from accidental actions by impact, fracture, shattering or fire.

Security
The term security, however, applies specifically to glazing which is designed with deliberate forms of attack in mind. The primary security needs can be classified as:

- Physical attack: protecting people or goods against deliberate forms of close-quarter attack
- Blast resistance: where there is a danger of explosions, both internal and external

Products

- Pilkington T glass & Pilkington **Pyroshield**™ Safety.
  Used to address safety requirements, i.e. accidental damage. Toughened glass is up to five times stronger than ordinary glass and, when broken, forms relatively harmless granules. Pilkington **Pyroshield**™ Safety holds the glass in place with wire, to reduce the risk of injury, if the glass is broken.
- Pilkington **Optilam**™, **Pyrodur**™ & **Pyrostop**™.
  Laminated glass consists of a sandwich of glass and interlayers that remain in place after impact, to reduce the possibility of injury. Pilkington **Optilam**™ can be used for safety, security and noise control. Pilkington **Pyrodur**™ & **Pyrostop**™ offer additional varying levels of fire resistance, as well as the impact resistance of laminated glass.

Building Regulations

Safety

England and Wales – Part N

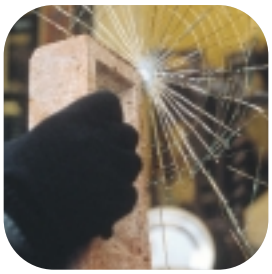
- Glazing – safety in relation to impact, opening and cleaning

Scotland – Part P

- Building standards (Scotland) regulations – 1990, Part P ‘Miscellaneous hazards’

Northern Ireland – Part V

- Glazing – safety in relation to impact, opening and cleaning



Satisfying the requirement in critical locations

1 Glazing in doors

Glazing in doors which is wholly or partially within 1500mm from floor level shall be: Minimum Class C to BS 6206:1981 and marked according to BS 6206.

2 Glazing adjacent to doors

Glazing which is wholly or partially within 300mm of the edge of a door and wholly or partially within 1500mm of floor level shall be: Minimum Class C to BS 6206 and marked to BS 6206.
Note: In both 1 & 2, if the smaller dimension of the pane is greater than 900mm it shall be: Minimum Class B to BS 6206 and marked according to BS 6206.

3 Low level glazing (excluding guarding) not covered by 1 or 2

Glazing which is wholly or partially within 800mm of the floor level shall be: Minimum Class C to BS 6206 and marked according to BS 6206.

Exceptions

- Panes having the smaller dimension less than 250mm and of area less than 0.5m^2 may be minimum 6mm (nominal) thick glass not complying with BS 6206

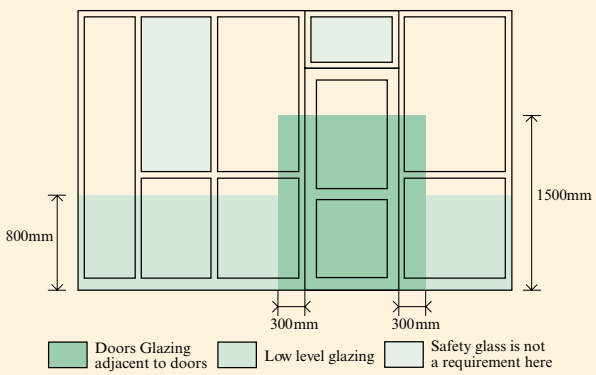
- Panes forming parts of fronts (but not other locations) to shops, showrooms, offices, factories and public buildings, supported on all edges, may be of equivalent robustness not complying with BS 6206:

8mm	must not exceed 1100 x 1100mm
10mm	must not exceed 2250 x 2250mm
12mm	must not exceed 3000 x 4500mm
15mm	(and thicker) – no limit

- Panes protected by a suitably designed barrier

4 Stairs, ramps and barriers

- England and Wales – 'The Building Regulations 1991 Part K: Stairs Ramps and Guards'



- Scotland – 'The Building Standards (Scotland) Regulations 1990 Part S: Stairs Ramps and Protective Barriers'

- Northern Ireland – 'The Building Regulations Northern Ireland 1994 Part H: Stairs Ramps and Guarding'

For new buildings and for buildings subject to major refurbishment, the requirements for glazing when incorporated in the designs for stairs, ramps and barriers can be found in the following documents: Approved document K "Protection from falling, collision and impact" BS 6180:1999 and BS 6399: Part 1: 1996 "Code of practice for dead and imposed loads".

5 Overhead glazing

In most types of buildings, in sloping or horizontal overhead glazing situations, it is generally regarded as appropriate to install glass which will either tend to stay in place if it is cracked (Pilkington **Pyroshield**™, Pilkington **Pyroshield**™ Safety or Pilkington **Optilam**™) or to fracture into relatively harmless pieces (Pilkington T glass) which are less likely to cause serious injury, if they fall, than sharp shards of annealed glass. Further guidance can be found in BS 5516, briefly summarised in Table 1.

There are some exceptions to these requirements for safety glass, based on the robustness of annealed glass.

Test methods

Safety

The impact safety performance of glass is determined in accordance with BS 6206. It requires that the glass does not break or breaks safely when subjected to impact from a lead-shot filled bag weighing 45kg. Three classification levels are achievable, with Class A being the highest.

The impact safety performance of Pilkington **Optilam**™ is detailed in Table 2. Pilkington T glass is Class A.

Note: BS EN 12600 is the new pendulum impact test standard for classifying flat glass products by performance under impact and by mode of breakage. In the future, references to BS 6206 in BS 6262-4 and relevant Building Regulations (e.g. Part N in England and Wales) are likely to be superceded by BS EN 12600:2002.

5 BS EN 12600:2002

Glass in building - Pendulum test - Impact test method and classification for float glass.

Similar to the swing bag test in BS6206 a weight cushioned with two rubber tyres is allowed to swing at the glass from 3 heights.

Table 1: Overhead glazing

Single glazing For single glazing, wired glass (Pilkington **Pyroshield**™), laminated glass (Pilkington **Optilam**™) or T glass Plus is recommended by BS 5516.
Insulating Glass Units IGUs should have either wired, laminated or T glass Plus glass as the lower pane. If the lower pane is toughened and heat-soaked glass, then the upper pane of an IGU should also be one of the three recommended single types of glass.

According to BS 5516 toughened glass should not be used over swimming pools. T glass Plus is toughened and then heat-soaked glass. Both SGUs and IGUs are subject to height and glass area considerations.

Table 2: Impact safety performance of Pilkington **Optilam**™

	Glass thickness (mm)	Classification to BS 6206
Pilkington **Optilam**™	6.4, 8.4	Class B

Table 3: Resistance to manual attack categories

Category of resistance	Drop height (mm)	Total number of strikes	Code designation of resistance class
P1A	1500	3 in a triangle	BS EN 356 P1A
P2A	3000	3 in a triangle	BS EN 356 P2A
P3A	6000	3 in a triangle	BS EN 356 P3A
P4A	9000	3 in a triangle	BS EN 356 P4A
P5A	9000	3 x 3 in a triangle	BS EN 356 P5A
P6B	N/A	From 30 to 50	BS EN 356 P6B
P7B	N/A	From 51 to 70	BS EN 356 P7B
P8B	N/A	More than 70	BS EN 356 P8B

Classification 3	Drop height 190mm
Classification 2	Drop heights 190 and 450mm
Classification 1	Drop heights 190, 450 and 1200mm

The classification has three components:

1) The first is the drop height class (i.e. 1, 2 or 3) at which the product did not break or where it broke in accordance with the first two types of breakage as follows:

a) Numerous cracks appear, but no shear or opening that allows 76mm diameter sphere to pass through when a maximum force of 25N is applied. There is also a measurement of glass spall weight taken after a period from the impact.

b) Disintegration occurs and the 10 largest crack free particles are collected within a period after impact and weighed all together and found to be under a proscribed limit.

2) The second is the mode of breakage defined as:

TYPE A - numerous cracks appear forming separate fragments with sharp edges, some of which are large. Typical of annealed glass.

TYPE B - numerous cracks appear, but the fragments hold together and do not separate. Typical of laminated glass.

TYPE C - disintegration occurs, leading to a large number of small particles that are relatively harmless. Typical of toughened glass.

3) The third is the highest drop height at which the product did not break or when broke, broke in accordance with the style of break a) from the paragraph 1) above. If a glass breaks at the minimum drop height and the breakage is not in accordance with style of break a) from the paragraph 1) above then the last classification figure is zero.

Examples
Laminated may be 2 (B) 2
Toughened may be 1 (C) 3

Refer to BS EN 12600:2002 for full details of the tests.

Building Regulations

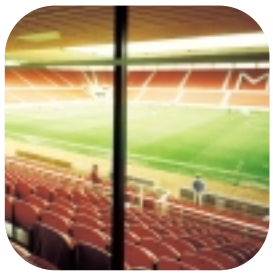
Safety
Security glass is currently outside the scope of Building Regulations in the UK. However, there is an increasing awareness of the role glass can play in preventing or delaying unwanted access through windows and providing protection against attack from bullets and explosions. Initiatives such as Secured By Design also recognise the benefits of laminated glass in buildings to improve security.

These are three test standards which cover the testing and classification of security glass for use in buildings.

Security
BS EN 356 specifies the requirements and test methods for glass designed to be resistant to manual attack. The glass is subjected to impact from a hard body impactor of mass 4.11kg for categories P1A to P5A and an axe for categories P6B to P8B. These categories are summarised in Table 2. Depending on its configuration and the required category of resistance, Pilkington **Optilam**™ can be used in applications where resistance to attack is necessary.

BS EN 1063 specifies performance requirements and test methods for the classification of bullet resistant glass, based on attack by handguns, rifles and shotguns.

BS EN 13541 specifies a test method, performance requirements and classification for explosion resistant glazing for use in buildings. The standard concerns a method of test against blast waves generated using a shock tube to simulate a high explosive detonation.



PILKINGTON

Pilkington Building Products - UK
Prescot Road St Helens WA10 3TT United Kingdom
Telephone 01744 692000 Fax 01744 692880
pilkington@respond.uk.com
www.pilkington.com