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# Glass Specification in Flat Rooflights

[First edition]

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Advisory Committee  
for **Roofsafety**

**Introduction**

Over recent years there has been a huge surge in the popularity of modular rooflights which are widely specified for domestic and commercial projects - and with good reason. There's a range of excellent, very high quality examples available from reputable suppliers, all of which offer superb aesthetics and very high performance, with excellent U-values.

There have however been a number of product performance issues with a minority of products reported by individuals who have installed or commissioned what they believed to be high quality products, only to be disappointed. More importantly, a number of these instances have also revealed major safety concerns; a minority of 'rogue' manufacturers appear to be ignoring important safety considerations when marketing their products.

This document gives guidance on the safety considerations for glass rooflights.

The main concerns relate to:

- (i) The use of inner panes made of toughened (rather than laminated) glass which can shatter under a number of circumstances (including, on occasion, spontaneously), falling into the room beneath
- (ii) The use of glass specifications which may be appropriate for use in vertical glazing, but are unsuitable for use in overhead glazing where glass can be almost horizontal, significantly increasing the stress on the pane
- (iii) Insufficient support for the inner glass pane, potentially allowing a whole glazed unit to fall into the room beneath if the outer pane is broken, jeopardizing both safety and security

**Safety of Building Occupants**

To ensure those below the rooflights are safe, the inner pane of a rooflight should be a laminated glass, as this minimises the risk of any glass falling into the room beneath and consequent injury if the inner pane should break.

Whilst toughened glass breaks into rounded fragments rather than razor sharp shards, there are still a number of factors that can cause toughened glass to shatter. These factors include for example, impact, but also include inclusions from the glass manufacturing process, some of which can cause glass to break if overstressed, and others such as nickel sulphide, which although rare can cause toughened glass to shatter spontaneously, sometimes a number of years after manufacture. This risk can be reduced by heat soak testing but cannot be eliminated completely. If a toughened glass pane shatters, it will fall onto anyone beneath the rooflight as illustrated in Figure 1 and can fall in large clumps as well as individual fragments.



Figure 1. Examples of shattered rooflights

Use of laminated glass minimises this risk. Whilst laminated panes can crack or even shatter when abused, the interlayer ensures that the pane remains intact and minimises the risk of shards or fragments dropping into the room beneath, protecting the occupants.

## British Standard Recommendations

BS 5516-2: 2004 *Patent glazing and sloping glazing for buildings - Code of practice for sloping glazing* defines that inner panes must always be laminated wherever rooflights are more than 5 metres above floor level (increased to 13 metres for panes less than 3 square metres) or are located over water (e.g. swimming pools). The Standard permits the use of toughened inner panes in other applications (for example where rooflights are less than 5 metres from floor level), but only where a stringent risk assessment for the particular application has been completed and has concluded that the use of toughened glass does not give any additional risk to those below the rooflight.

It is difficult to see how the use of a toughened rather than laminated glass inner pane doesn't present a risk to anyone beneath the rooflight. The ACR, in common with the Centre for Window and Cladding Technology (CWCT) and the National Association of Rooflight Manufacturers (NARM), strongly believes that any realistic risk assessment will lead to the selection of laminated glass.

The ACR believe that at its next review, BS 5516-2 should be amended to clarify that all overhead glazing should always have a laminated inner pane.

## Mounting of Glass

Some more economic designs consist of nothing more than a double-glazed unit stepped on all four sides with no perimeter frame, with the outer pane sealed/bonded to the top of an upstand and the inner pane hanging inside the upstand. Such designs are not recommended, having much greater reliance on the quality of the site installation, but if they are used it is essential that the installer provides a continuous support for the inner pane on all four sides to avoid risk of the whole rooflight dropping into the building beneath if the outer pane should be broken. Should this be overlooked, or the work carried out to a poor standard, there is a serious risk of injury to anybody below should the outer pane of glass break or the edge seal fail. This risk exists regardless of whether the inner pane is laminated.

## Safety for Personnel Accessing the Roof

In addition to using a laminated inner pane to protect building users, rooflights can also be specified and designed to be non-fragile (see Note) in accordance with ACR[M]001 *The Red Book - Test for Non-Fragility of Large Element Roofing Assemblies* and CWCT TN66 *Safety and Fragility of Glazed Roofing: Guidance on Specification* (and the test procedures defined in CWCT TN67 and CWCT TN92). This is intended to ensure that anyone accidentally walking or falling onto a rooflight will not fall through it, even if it results in the glass being broken or the rooflight being damaged.

**Note:** It is important to note that the term 'non-fragile' can be applied to a wide range of rooflight types offering varying degrees of durability and impact resistance. Glass, polycarbonate and GRP rooflights can all be supplied with non-fragile classifications. A non-fragile rooflight is **not** designed to be walked upon and the term should not be confused with rooflights which are specifically designed for foot traffic. These 'walk-on' rooflights are very high specification glass structures designed to floor loadings and installed in-plane with external floors on roof decks and roof terraces where pedestrian access is unrestricted.

Refer to ACR[M]001 for guidance on how to determine if roofing assemblies are non-fragile. For glass rooflights, this document cross references CWCT procedures TN67 and TN92.

In addition to defining a test method, CWCT TN92 defines criteria for glass specification which can be deemed non-fragile without test. These require a 9.5mm or 11.5mm laminated inner pane together with specific requirements for the 1.5mm interlayer (depending on the rooflight size). The type and thickness of the interlayer used within the laminate, and the method of retention of the inner glass pane within the frame are key to non-fragility classification, ensuring the glass will be retained in position when broken and having sufficient residual strength to continue to support the weight of a person having fallen onto the rooflight.

The CDM Regulations require that a risk assessment should be carried out for every construction project, and this should define the measures required to prevent significant risk of anyone falling through a rooflight.

Wherever there may be a risk of anyone ever being on a roof and near a rooflight that they could accidentally step or fall onto (e.g. for maintenance purposes), a non-fragile rooflight should be specified.

### Security

For domestic properties, Building Regulations (Approved Document Q) states that rooflights deemed as easily accessible need to be proven to resist criminal attack or incorporate features that are proven to reduce crime. It is important that this requirement is brought to the attention of specifiers. Even rooflights supplied with a laminated inner pane may not pass Part Q testing as the outer could be broken and then the inner pane just lifted out of the hole. Equally, rooflights that can open need their opening/locking mechanism to be able to resist attack. It is therefore not sufficient to just specify a laminated glass - the whole assembly must be tested.

### **Remember: A Great Looking Rooflight Isn't Necessarily a Great Rooflight!**

The ACR has noted that in many cases where complaints have occurred, the manufacturer is targeting homeowners by using sophisticated websites and literature that focuses heavily on the aesthetics of the product, often claiming excellence in quality standards. Some have even referenced Trade Association documents on their marketing materials.

Some manufacturers heavily promote the use of triple skin glazing, but this often comprises of three plies of 4mm toughened glass, often in relatively large pane sizes. This glass is often intended for vertical glazing applications and is not suitable for horizontal overhead applications where stresses are higher. Excessive deflection can occur in large thin panes, leading to ponding and aesthetic issues with the rooflights, in addition to the safety risks.

In a crowded marketplace, where some manufacturers are making confusing or untrue claims, careful consideration needs to be given to rooflight choice if problems of inadequate safety are to be avoided.

The good news is that there are many excellent, trustworthy UK suppliers of properly designed rooflights which will offer years of safe and reliable service. To ensure a product is fully compliant with Building Regulations and meets all required specification and safety standards, request test data to demonstrate the performance claims being made by the supplier. Any reputable manufacturer should be more than willing to provide this information to a bona fide customer.