SAFETY AND FRAGILITY OF GLAZED ROOFING:
guidance on specification

This Technical Note provides guidance on safety issues relating to access to glass roofs and maintenance of glass roofs. It describes a procedure that the specifier of a building may adopt to determine whether a glass roof is required to be non fragile and the performance requirements for a non fragile roof. These requirements must then be set out in the specification so that the designer of the roof can ensure that it provides the appropriate performance. A test procedure to assess the performance of the roof is described in Technical Note 67.

This Technical Note is one of eight describing the performance of glass. They are:

TN61 Glass types
TN62 Specification of insulating glass units
TN63 Glass breakage
TN65 Thermal fracture of glass
TN66 Safety and fragility of glazed roofing: guidance on specification
TN67 Safety and fragility of glazed roofing: testing and assessment
TN68 Overhead glazing
TN69 Selection of glass to prevent falls from height

Introduction

This Technical Note is aimed specifically at glazed roofs which are not accessible by the public but where people carrying out maintenance to the roof, or to other equipment mounted on the roof, may walk, fall or drop objects onto the glazed part of the roof.

The safety issues concern the safety of people below the roof and people who may be on the roof. People below the roof may be affected if the glass breaks and falls or if objects fall through the glass. People on the roof may fall onto the glass and be injured by contact with the glass or by falling through the glass. The more general safety issues relating to the use of glass overhead are covered in Technical Note 68.

A fragile surface is defined in the Work at Height Regulations as:

'A surface or assembly which would be liable to fail if any reasonably foreseeable loading were to be applied to it.'

For lightweight roof construction the impact of a person falling on the roof or dropping tools on the roof may be reasonably foreseeable and may be more critical than the nominal static load given in BS6399.

Glass roofing has traditionally been considered to be fragile however in recent years there has been a move to using non fragile forms of roof construction hence the fragility of glass roofing has had to be considered.

The construction of a safe roof will require:

- Sufficient strength to support all anticipated loads.
- Safe post-failure behaviour in the event of breakage.
- Sufficient rigidity to prevent deformation under load, which may cause concern to those either on or within sight of the glass.
- If the glass is to be walked on sufficient slip resistance to prevent people slipping and injuring themselves.

Glazed roofs can always be designed to withstand any specified loading or impact, typically by using glass which has higher strength, and by designing the frame and supports to carry the load. There may however, be considerable cost implications and other constraints. These include limitations from the manufacturing and fabrication processes and the ease with which heavy glass panes can be safely handled during transportation and construction.
Scope

This Technical Note specifically addresses issues relating to roofs of shallow slope where falling objects and people may be retained on the glass. Roofs of steeper slope may require a different testing regime as the static load may not be appropriate and impacts may occur in a horizontal direction.

This Technical Note is not applicable to roofs that are accessible by the public which should be designed in a similar manner to glass floors and other walk-on glass surfaces, including withstanding the appropriate design loads from BS 6399-1. Many of the issues discussed will however be relevant.

The provisions of this Technical Note are not intended for domestic conservatories although they may be relevant in some cases.

In this Technical Note the term 'glazed roof' will refer to both fully-glazed roofs and to glazed parts of roofs.

This Technical Note assumes that all glass is manufactured in accordance with European Standards and used in the UK.

Legislation and statutory requirements

The Building Regulations do not set out specific requirements in relation to glazed roofing but Regulation 7 requires that building work is carried out with materials that are appropriate for the circumstances and which are fixed so as to perform the functions for which they are designed. The scope of this requirement is limited to those aspects of performance affecting health and safety. Various means of demonstrating compliance are given including compliance with appropriate British Standards and appropriate testing. For glazed roofing to comply with this requirement, it will be necessary to ensure the safety of people both on the roof and below the roof.

The Work at Height Regulations includes specific requirements relating to fragile surfaces as follows:

1 Every employer shall ensure that no person at work passes across or near, or works on, from or near, a fragile surface where it is reasonably practicable to carry out work safely and under appropriate ergonomic conditions without his doing so.

2 Where it is not reasonably practicable to carry out work safely and under appropriate ergonomic conditions without passing across or near, or working on, from or near, a fragile surface, every employer shall:
   a) ensure, so far as is reasonably practicable, that suitable and sufficient platforms, coverings, guard rails or similar means of support or protection are provided and used so that any foreseeable loading is supported by such supports or borne by such protection;
   b) where a risk of a person at work falling remains despite the measures taken under the preceding provisions of this regulation, take suitable and sufficient measures to minimise the distances and consequences of his fall.'

Maintenance of glass roofs will require access to the roof surface. Adopting more robust forms of construction will reduce the risk of falling through the roof and should be adopted in preference to measures such as fall arrest systems that reduce the consequences of a fall. Fall arrest equipment may still be required if there is a residual risk of falling.

For more detailed advice reference can be made to the HSE publication Health and Safety in roofwork HSG33.

Roof types

The loads that a roof will be subjected to will depend on the type of building and in particular the maintenance strategy. In formulating the maintenance strategy and the requirements for the glass roof, the following issues should be addressed

- What methods of access are proposed for maintenance? (Note: gantries allow access for cleaning without applying loads to the glass but gantries often do not provide suitable access for activities such as close inspection.
and sealant repairs).

- Is it possible that persons will walk on the glazed part of the roof for some activities?
- Is placement of maintenance and/or cleaning loads onto or across the glazed part of the roof avoidable?
- Replacement of glass will often require different methods of access from those used for routine maintenance and will require additional safety precautions as there will be an opening in the roof when the glass is removed.
- Is it possible that people on adjacent non-glazed roofing will walk or fall on glazed areas of roof?
- Is there potential for unauthorised use of the glazed roof as a working platform or vantage point?
- Is there any part of the building, or an adjacent building, from which objects may fall, be dislodged or be thrown by vandals on to the glazed roof?
- Is there a risk that objects may be thrown onto the glazed roof from below?

Depending upon the particular risk it is possible to assess the likely impacts that may occur, and to specify glass appropriately.

In the event of an accident occurring there should be a procedure for recovering an injured person which must be incorporated into the cleaning/maintenance strategy of the building. This should not impose greater loads or impacts on the glass than allowed for in the design.

In this Technical Note glazed roofs are classified into four classes. These are:

**Class 0**
Roofs which are designed for unrestricted access by building occupants. Roofs of this type must be designed as floors and are outside the scope of this Technical Note.

**Class 1**
Roofs which will be walked on for occasional cleaning/maintenance activities and which will therefore need to support both the weight of people on the glass and their equipment. Such roofs could be subject to impact from a person, and/or any object carried, falling onto its surface.

Such roofs must be designed to be non-fragile and should be able to resist both static and impact loads safely. As it is intended that the glass will be walked on, some impacts may be expected and the roof should resist the impacts without damage i.e. at a serviceability level.

Roofs of this type would allow unrestricted access to the area below the roof during routine maintenance activities. Maintenance work requiring removal of glass panes would clearly require additional safety measures to prevent or mitigate the fall of a person through the opening. People below should be excluded from the area.

If glass roofs are designed to be walked on it is necessary to consider damage arising to the glass surface and slip resistance.

**Class 2**
Roofs where people are not intended to walk on the glass, but which are required to be non-fragile to protect people in the following circumstances:

- Where maintenance personnel walking adjacent to the glass roof could trip or fall onto the glass surface.
- Where maintenance personnel working on the glass roof could fall onto the glass surface from crawler boards or other access equipment.

Such roofs must be non-fragile but as any impact or loading from maintenance workers would be accidental or in contravention of approved methods, the main requirement would be to ensure safety rather than to prevent damage to the glass. The glass may therefore fracture but should remain in place with sufficient integrity to retain foreseeable loads.

All maintenance of roofs of this type must be possible without walking on the glass.

Roofs of this type would allow unrestricted access to the area below the roof during routine maintenance activities. Maintenance work requiring removal of glass panes would clearly require additional safety measures as described for a Class 1 roof.

**Class 3**
Roofs which are fragile. Under the CDM regulation the client and designer should be looking to remove fragile roofing materials however this is not always practicable. Where fragile materials are used, barriers and appropriate notices are required to warn people and prevent them from walking on or falling onto the fragile surface under all circumstances except when alternative measures are in place to ensure safety both of people on the roof and within the building.

Routine maintenance such as cleaning may be carried out from behind the barrier with long handled equipment or from a gantry or access platform. During such operations maintenance
workers should not be able to fall onto the glass surface but equipment could fall or be dropped so the glass should be able to resist a hard body impact.

Some activities such as detailed inspection and sealant repairs may not be possible when working from behind a barrier or from a gantry or mobile elevating work platform. In such circumstances crawler boards may be used but these must either have adequate guard rails or alternative protection such as harnesses must be in use. Where harnesses are used they should be used as a restraint to prevent the person falling through the roof. Where this is not possible and they are used to arrest a fall through the roof, the roof materials should be selected to minimise injury to the falling person. If there is a risk of workers or heavy equipment falling onto the glass surface the area below the glass must be kept clear.

A flowchart to aid the selection of the appropriate class of roof is given in Figure 1. A risk assessment should be applied as part of the selection process to ensure that the selected roof design is appropriate.

Testing for fragility

To be classed as non-fragile, a material must be able to resist reasonably foreseeable loads. Calculations should be produced to show that static loads can be resisted, however, for lightly loaded roofs, impact loads are likely to be more critical and these are best assessed by testing.

At the present time there are no British or European standards for assessing the impact resistance of glazed roofing systems.

The Advisory Committee for Roofwork (ACR) is an industry body originally set up by the HSE to provide advice on roofwork. It maintains a website at www.roofworkadvice.info and has published a number of guidance documents including ACR [M]001 ‘Test for non-fragility of profiled sheeted roofing assemblies’. This fragility test was developed to represent the impact of a person accidentally falling onto a roof surface. The test was developed without input from the glass industry and hence does not address all issues relevant to glass roofs. However the test does represent the forces applied to a roof by a person falling onto the roof surface from a standing position. These forces will be the same for any roofing material including glass.

Test methods that have been commonly used for impact testing using soft body tests are summarised in Appendix 1, while test methods for hard body tests are summarised in Appendix 2. These tests are highlighted for background information and comments on their relevance to glazed roofs are given.

All these tests have their limitations and to overcome these, a fragility test sequence for glazed roof assemblies has been developed by the CWCT. The test sequence must be carried out on a test sample incorporating framing representative of the roof assembly as changes in the rigidity of the supporting structure and retention of the glazing will affect the performance of the roof.

The CWCT Test sequence is described in Technical Note 67. The test sequence includes the following elements:

- ACR soft body test to represent impacts from people,
- hard body test to represent impacts from tools and equipment,
- a static load test to demonstrate residual strength of the glazing if the glass breaks.

The test sequence should always be specified, overseen and reviewed by a competent person to ensure that it is appropriate for the particular roof assembly. A number of specific aspects which the competent person should check are given in a checklist in Technical Note 67.

Because residual strength is dependent on the performance of laminated glass interlayers which is temperature dependent, there is a requirement to carry out tests at temperatures likely to be encountered in service.

Guidance on glass configuration

A glass specifier may find the following guidance useful when deciding on a glass configuration to test. The information should not be used in lieu of undertaking a test.

Class 1 roofs

For a Class 1 roof, the glazing should be able to resist impacts without any fracture of the glass and remain retained by the supporting framework. It is accepted that a glass configuration that remains unbroken during a test may fail in service due to the variable nature of glass. It is therefore a requirement that the glass should be able to resist a static load when fractured.

As maintenance staff may fall onto the surface, the upper pane should be a safety glass. Damage to the glass may also be minimised by use of special footwear which is only used for work on the glass
roof. The upper pane also needs to provide adequate slip resistance and this is considered later.

It is possible to select glass that will resist the impacts specified in Technical Note 67 without breaking. The required thickness will vary with the size and type of pane. For an opening 1.5m x 1.5m, 6mm panes of toughened glass and 8.76 mm panes of laminated annealed glass supported on four edges have resisted the specified impacts.

To resist a static load when the glass is broken requires a laminated glass of suitable composition. For glazing units this only needs to be used for the lower pane.

After breakage the laminated glass may sag under load and pull free from the frame. This can be prevented by bonding the glass to the frame but this may result in tearing of the interlayer.

Behaviour of the laminated glass after breakage depends on both the interlayer and the glass type. Laminated glass with only annealed or heat strengthened glass will be stiffer, after breakage, than laminated glass that includes a ply of toughened glass and will not sag so much. Laminated glass consisting of only toughened glass will give the lowest stiffness after the glass has broken. Performance of interlayers depends on the type and thickness of material used and temperature.

Design of ventilation of atria assumes that warm air will rise and collect below the roof. Air temperatures of up to 38°C may therefore be expected to occur below the glazing for long periods of time. A glass temperature of at least 40°C for the lower pane of a glazing unit is therefore likely and significantly higher temperatures have been observed in some cases. Solar control glass in the outer pane may be expected to reach higher temperatures. Canopies may be subjected to lower temperatures. The maximum temperature that the glass is likely to reach during maintenance work should be evaluated and the glass should be tested at this temperature.

Pvb interlayers soften with increasing temperature and at 40°C are much softer than at lower temperatures. Pvb is available in different grades and stiffer grades used for structural applications should give better performance. Increasing the thickness of the interlayer will also improve performance. Even so it may be difficult to meet the requirement of the static load test for large panes of glass laminated with a pvb interlayer. Ionoplast is stiffer than pvb and does not soften to the same extent at moderate temperatures likely to be experienced in roof glazing. It should therefore give better performance. Currently ionoplast is available in sheets up to 2.5 m wide and 5.7m long but not all processors are able to laminate glass of this size.

Class 2 roofs
For a Class 2 roof the glass may be permitted to break under impact but must still withstand a static load after fracture. As the static load requirement is more onerous, the same type of glass as used for Class 1 roofs will be required. As the glass is not intended to be walked on it will not be necessary to consider slip resistance.

Class 3 roofs
A class 3 roof is fragile. A worker on the roof should always be provided with a safe means of access which does not rely on the worker standing directly on the glass.

When work is carried out on the roof there will be a risk of equipment falling on the roof and penetrating the roof or causing broken glass to fall. A Class 3 roof is therefore required to prevent falling equipment penetrating the glass. To satisfy this requirement the glass should be able to prevent a hard body impactor from penetrating the glass. A single pane of toughened glass may be able to resist an impact without breaking but it is not considered acceptable to rely on a single pane of glass as there will always be a risk of failure. For single glazing a laminated pane is required to provide adequate safety for maintenance purposes. For double glazing two panes of toughened glass which are each able to resist the hard body impact may be considered to give an adequate level of impact safety. However, toughened glass may not be appropriate as it can fail spontaneously and the guidance on general safety issues of overhead glazing in Technical Note 68 should be considered. The normal solution for a glazing unit would be a toughened upper pane and a laminated lower pane.

Reducing slippages
If it is intended to walk on a glass roof for maintenance it is necessary to ensure that the surface provides adequate slip resistance to reduce the risk of slips.

Guidance on the evaluation of slip resistance is given in CIRIA Report C652 Safer surfaces to walk on; reducing the risk of slipping.
Slip resistance depends on the nature of the glass surface, the slope of the glass pane and the nature of footwear used. It is unlikely that normal footwear will provide adequate slip resistance on untreated glass in external situations where the glass surface may be wet.

Restricting access to people with specially selected footwear may be acceptable but it will be necessary to evaluate footwear at the design stage to ensure that adequate footwear is available.

The slip resistance of glass surfaces can be increased by fritting and other processes such as sandblasting or etching. All of these processes will increase the retention of dirt and increase the difficulty of cleaning the glass which may make their use impractical.

**Signage**

The work at height regulations state:

‘Where any person at work may pass across or near, or work on, from or near, a fragile surface, every employer shall ensure that:

a) prominent warning notices are as far as is reasonably practicable affixed at the approach to the place where the fragile surface is situated; or

b) where that is not reasonably practicable, such persons are made aware of it by other means’.

Where a glazed roof is designed to be walked on it must be clearly labelled as such, as it may otherwise give the impression to onlookers that it is safe to walk on all other glazed roofs. Signage should also indicate limitations to the permitted access and may take the form of ‘Access permitted in accordance with maintenance manual only’.

It is not normally considered good practice to mix walk-on and non-walk on glass in a single roof. In the event that a glazed roof is not labelled it should be assumed that it is not safe to walk on.

**Risk assessment**

This Technical Note considers the safety risks arising from maintenance work on glazed roofing. The design and selection of glass for glazed roofs should also involve the preparation of a risk assessment, to consider safety issues arising at all stages in the life of the roof including, construction, operation, maintenance and deconstruction. This is considered in Technical Note 68.

**Summary**

The designer of a building with a glass roof should consider the maintenance requirements for the roof and any other equipment sited on adjacent areas of solid roofing to establish whether there is a risk that people may walk, fall or drop things on the glass and hence the appropriate non fragility performance required for the glazed roof.

This Technical Note gives a classification system for glass roofs which can be used as part of this process. The required class of roof must be stated in the specification so that the roof can be designed for the appropriate performance.

Where a glazed roof is required to be non-fragile it should be tested for fragility.

A CWCT fragility test sequence has been devised to provide a standard industry approach to the testing of glazed roofs. The test sequence includes the following elements:

- A soft body impact test to represent impacts from people.
- A hard body impact test to represent impacts from tools and equipment.
- A static load test to demonstrate residual strength of the glazing if the glass breaks.

The test may need modification if it does not reflect the circumstances in which the glazed roof is to be used and a competent person is required to review the test sequence for each application.

Where fragile glazing is used in roofing warning notices should be provided and it should be protected by suitable barriers to prevent access. Additional safety precautions will be required during maintenance work.

**References**

BS 6399 Loading for buildings -


Health and safety in roof work. HSG 33, HSE 1998 ISBN 978 0 7176 6250 0


BS 8200:1985 Code of practice for design of non-loadbearing external vertical enclosures of buildings


**Note:**

This guidance may not cover all aspects of the safety of glazed roofing due to differences in building design and use, and to changes in good practice, which may develop over time in light of new product developments, methods, ideas, etc.

It is emphasized that it is the duty of all employers and of people who have control over workplaces to reduce building risks 'so far as is reasonably practicable' under the Health and Safety at Work 1974 and 'where necessary for reasons of health or safety' under the Workplace (Health, Safety and Welfare) Regulations 1992.
Is the roof accessible to building users
Yes
Class 0 roof
Seek specialist advice

Is it intended that maintenance staff will walk on the glass without the use of crawler boards?
Yes
Class 1 roof
Glazing should be able to:
- Resist static loads
- Resist hard body impacts without breaking
- Resist soft body impacts without breaking
- Resist static load with all glass plies broken
- Break safely
- Provide slip resistance

No

Is there a barrier to prevent people walking or falling on the glass roof when working on a non glazed area of roof?
No
Class 2 roof
Glazing should be able to:
- Prevent penetration of hard body
- Prevent penetration of soft body
- Break safely
- Resist static load with all glass plies broken

Yes

When carrying out work to the glass roof, is the glazing required to protect workers from falling? (For example if someone falls off a crawling board)

No

When carrying out work to the glass roof could someone fall onto the glass causing it to fall onto an area where people are present?

No

When carrying out work to the glass roof, could equipment be dropped onto the glass over an area where people are present?

No

See TN 68

Yes

Class 3 roof
Glazing should be able to prevent penetration of hard body

See TN 68

Figure 1 Flowchart for selection of roof type
## Appendix 1: Commonly used soft body impact tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Details</th>
<th>Impactor(s)</th>
<th>Impact energy</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACR[M]001:2005</td>
<td>The test is designed to represent the effect and impact energy of a person accidentally slipping/tripping and falling onto a roof surface. The person being in a standing position on the roof surface before impact. The impactor is dropped from a single height of 1200 mm. Roofing assemblies are classified as:</td>
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<tr>
<td></td>
<td></td>
<td>300 mm cylindrical bag filled with sand of mass 45 kg.</td>
<td>530 J</td>
<td>This test method requires a glazing expert to assess its applicability to glazed roofs. The test does however simulate the force that a 90kg person would apply if he/she fell onto the roof from a standing position with a factor of safety of 1.15.</td>
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<tr>
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<td></td>
<td>Test samples are required to be ‘conditioned to ensure that they are tested in a condition which could reasonably exist in service and which would be the worst case for impact strength’. These conditions, such as elevated or low temperatures which may affect the performance of laminated glass, are not defined and are left to the judgement of the competent person.</td>
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<td></td>
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<td></td>
<td>The impactor is left in its fallen position for a period of five minutes but this may be too short to simulate the time a person may lie on broken glazing before being rescued.</td>
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<td>The mass of the impactor is 45 kg, which is less than the normal allowance for a workman and will affect the validity of the assessment of load bearing capacity after impact.</td>
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<td></td>
<td>The test does not simulate the potential hard body impact that may occur as a result of a workman’s tools for example hitting the glass and causing breakage before the person impacts the glass.</td>
</tr>
<tr>
<td>BS 8200:1985</td>
<td>This is a standard test for ensuring the safety of people who may accidentally impact wall cladding. In the test an impactor is allowed to swing against the cladding surface from different heights and locations. To pass the test the structural safety of the building should not be affected by damage, cladding should not have the potential to fall or to cause serious injury to people inside or outside the building and the impactor should not pass through the cladding. Note that there is also a serviceability test which has an impact energy of 120J.</td>
<td>400 mm spherocnical bag filled with glass spheres of mass 50 kg.</td>
<td>350 or 500 J</td>
<td>This test method is not specifically designed for glazing and may therefore require a glazing expert to assess its applicability to glazed roofs.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>The test does not have a provision for assessing the load bearing capacity of the assembly after impact/breakage.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>The test does not simulate the potential hard body impact that may occur as a result of a workman’s tools for example hitting the glass and causing breakage before the person impacts the glass.</td>
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</tbody>
</table>
### Appendix 1: Commonly used soft body impact tests (cont’d)

<table>
<thead>
<tr>
<th>Test</th>
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<th>Impactor(s)</th>
<th>Impact energy</th>
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</tr>
</thead>
<tbody>
<tr>
<td>BS 6206:1981</td>
<td>The purpose of the test is to categorise safety glasses for situations where glass may be subjected to human impact. In the test an impactor is allowed to swing against the glass from three different heights (305, 457 and 1219 mm). The test is intended to represent the impact energies of a running child. The glass must break safely or not break at all if it is to pass the test at each drop height.</td>
<td>300mm leather bag filled with lead of mass 45 kg.</td>
<td>135, 202 or 538 J</td>
<td>This test assesses the soft body impact strength of a pane of glass of standard size and not the roofing assembly. The test does not simulate the potential hard body impact that may occur as a result of a workman’s tools for example hitting the glass and causing breakage before the person impacts the glass. Glass which breaks safely and therefore passes the test (e.g. monolithic toughened glass) can have little or no residual strength. This may allow a person to fall through on impact if the glass breaks. Glass which resists breakage and therefore passes the test (e.g. thick monolithic annealed and heat strengthened glass) can have little residual strength if broken such as by a hard body impact. This may allow a person to fall through on impact if the glass breaks. The test does not have a provision for assessing the load bearing capacity of the assembly after impact/breakage. This test will be superseded by BS EN 12600, but plastics sheet glazing materials will still be tested in accordance with BS 6206.</td>
</tr>
<tr>
<td>BS EN 12600:2002</td>
<td>The test has been developed to serve the same purpose as BS 6206. The test will supersede BS 6206 as a common European standard for testing the impact safety of glasses. The impactor is allowed to swing from three different heights (190, 450 and 1200 mm). The glass is classified into both impact classes and breakage classes.</td>
<td>Double tyre with added steel weights of mass 50 kg.</td>
<td>93, 221 or 588 J</td>
<td>This test assesses the soft body impact resistance of a glass pane of standard size and not the roofing assembly. The test does not simulate the potential hard body impact that may occur as a result of a workman’s tools for example hitting the glass and causing breakage before the person impacts the glass. This test does not have a provision for assessing the load bearing capacity of the assembly after impact/breakage.</td>
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</table>
### Appendix 2: Commonly used hard body impact tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Details</th>
<th>Impactor(s)</th>
<th>Impact energy</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS 8200:1985</td>
<td>This is a standard test for assessing the impact resistance of wall cladding. The impactors are used by dropping them onto a horizontal test specimen - in each case the impact energy is a function of the height through which the impactor travels before it strikes the specimen. The test requires that the cladding should not sustain damage which is not easily repairable and which does not cause deterioration of performance. There should also be no indentation marks that are visually unacceptable from the impacts.</td>
<td>50 mm steel ball of mass 0.5 kg or 62.5 mm steel ball of mass 1.0 kg.</td>
<td>3, 6 or 10 J</td>
<td>This test method is not specifically designed for glazing and may therefore require a glazing expert to assess its applicability to glazed roofs. The test does not simulate the potential soft body impact from a person impacting the glass. The test does not have a provision for assessing the load bearing capacity of the assembly after impact/breakage.</td>
</tr>
<tr>
<td>BS EN 356:2000</td>
<td>Test is used to categorise the resistance to manual attack of glazing. The impactor is dropped from several heights, between 1500 mm and 9000 mm depending upon level of performance being tested. To pass the test the glass must resist penetration of the impactor.</td>
<td>100 mm steel ball of mass 4.11 kg.</td>
<td>60 to 363 J</td>
<td>This test does not simulate the potential soft body impact from a person impacting the glass. The test does not have a provision for assessing the load bearing capacity of the assembly after impact/breakage.</td>
</tr>
</tbody>
</table>