



Fire Regulations and Product Performance

Hambleside Danelaw
Building Products
40+ YEARS OF ROOFING INNOVATION



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Fire Regulations and Product Performance

The performance and reaction of buildings in situations where fire breaks out is heavily dependent upon the way in which a building is designed, and the materials from which it is constructed. There are some key considerations that should be taken into account; everything from restricting the way in which fire can propagate and spread, to providing safe access routes so that the occupants of the building can escape to safety.

While the regulations relating to fire are constantly under review, the requirements can be found by reference to Approved Document B, (England), Approved Document B (Wales), Technical Booklet E (Northern Ireland) and Technical Handbook, Non-Domestic - Fire (Scotland).

Section B2 (England), Section B2 (Wales), Section 3 (Northern Ireland) and Clause 2.5.1 and Annex 2.E (Scotland) cover internal fire spread and apply to linings of roofs and walls; in general, these are fire resistance requirements to BS476-7 (excluding England) or to BS EN13501-1.

Section B4 (England), Section B4 (Wales), Section 5 (Northern Ireland) and Clause 2.8.1 and Annex 2.F (Scotland) cover external fire spread and apply to external coverings of roofs and walls; in general, these are fire resistance requirements to BS476-3 (excluding England) or to BS EN13501-5.



General Guidance

The following information is for guidance only, and whilst applicable for most industrial buildings, it is the responsibility of the designer to ensure that compliance is achieved on each specific project.

Non-domestic applications: England, Wales and Northern Ireland

The normal requirement for non-domestic applications in England, Wales and Northern Ireland is that:

- A rooflight liner should achieve either Class 1 to BS 476-7 (excluding England) or Class C-s3; d2 to BS EN13501-1 (Class D-s3, d2 England) or achieve TP(a) rigid.
- A rooflight outer skin should achieve either AC to BS 476-3 (excluding England); or $B_{ROOF}(t4)$ to BS EN13501-5 (the requirements which apply to the outer skin of the whole roof); or achieve TP(a) rigid.

Since the withdrawal from Approved Document B (England) of the BS 476 series of fire tests to demonstrate compliance with the Building Regulations, MHCLG has determined alternative routes to compliance for thermoset materials when used as GRP rooflight liners set out on the GOV.UK website: *Approved Document B: Fire safety - frequently asked questions*.

FAQ 8 defines how the TP(a) rigid classification can be used for thermoset rooflights in industrial and storage buildings (purpose Groups 6 and 7(a), that feature large open internal areas, single-storey designs (including galleries), and high ceilings) where this classification rating is used to demonstrate compliance with functional requirement B2(1) in accordance with AD B Volume 2, Table 6.2.

There are no restrictions on use of GRP materials for roofs except for the use as rooflight liners within 1.5m of a compartment wall

There are concessions to allow use of lower ratings if the area of each rooflight is small, and rooflights are sufficiently well separated, and not within 6m of a boundary.

A single skin rooflight must meet the requirements for both the inner ceiling and outer roof surfaces.

Non-domestic applications: Scotland

The guidance contained in the Scottish Building Standards Technical Handbook (Section 2) for fire spread on linings of walls, ceilings and rooflights is based on the European EN13501 classification system.

The Technical Handbook also states that this guidance only indicates one means of complying with the mandatory building standards and alternative means can be used to demonstrate compliance.

The Scottish Government Building Standards Division have confirmed that the use of the BS 476 parts 3, 6 and 7 remain an acceptable method of demonstrating compliance with the latest Technical Handbook requirements.

- For most non-domestic applications, the rooflight liner should achieve Class C-s3, d2 to BS EN13501-1, Class 1 to BS 476-7 or be rated TP(a) rigid. For Class 1 storage buildings (i.e. those which contain hazardous goods or materials), the rooflight liner should achieve Class B to BS EN13501-1 or Class 1 when tested to BS476-7 and, when tested in accordance with BS 476-6 have an index of performance (I) not more than 12 and a sub-index (i1) not more than 6, equivalent to Class 0.
- Generally, depending on application, the outer skin of a rooflight that achieves $B_{ROOF}(t4)$ to BS EN13501-5 (or equivalent AC rating to BS 476-3) can be used without restriction.

Zenon Pro and Zenon Evolution sheets are available in a range of internal fire grade classifications from Class 3 to Class 0 in accordance with BS476-6 and BS476-7, and TP(a) rigid in accordance with BS 2782-0 Method 508A. External fire grade classifications up to S.AA in accordance with BS476-3 and $B_{ROOF}(t4)$ in accordance with BS EN 13501-5 to accommodate all UK Building Regulation requirements for exposure to fire.

Please note: It is the responsibility of the designer of the building to ensure that the requirements of the Building Regulations are implemented correctly. Should there be any doubt, Hambleside Danelaw recommend that the guidance of the relevant Local Authority Building Control Department be sought.

Fire Rating Identification of Zenon Pro and Zenon Evolution GRP Sheets

With GRP rooflight materials, different fire-retardant grades can be specified to meet the different requirements for inner and outer sheets. For other materials (e.g. polycarbonate) the same grade of material is usually supplied for both inner and outer skins.

The fire performance classification of all Hambleside Danelaw GRP rooflight sheets is printed on each rooflight; in addition a coloured thread is incorporated to identify this:

Red: identifies sheets which are rated AB to BS 476-3, Class 3 to BS 476-7 and $B_{ROOF}(t4)$ to BS EN13501-5.

Green: identifies sheets which are rated AA to BS 476-3, and Class 1 to BS 476-7, $B_{ROOF}(t4)$ to BS EN13501-5 and TP(a) rigid to BS 2782-0 Method 508A.

Blue: identifies sheets that are rated Class 0 to BS 476-6+A1 and TP(a) rigid to BS 2782-0 Method 508A.

Combustion of GRP Rooflight Sheeting

GRP (Glass Reinforced Polyester) is a composite material comprising glass reinforcement strands encapsulated in a polyester resin. This polyester resin is a 'thermoset' type of plastic and fundamentally different to 'thermoplastic' materials such as polycarbonate that soften and eventually melt when exposed to increasing temperatures.

The thermoset material is inherently much more stable than a thermoplastic material and can withstand the application of heat up to around 400°C subject to composition, albeit the material will darken significantly and have a charred surface appearance. Above these temperatures, the material will burn, but only with the continued application of the heat source. When the heat source is removed, the GRP will self-extinguish.

Typical Heat Exposure Behaviour of GRP

In tests conducted to identify the reaction of GRP to heat, a sample of translucent GRP sheeting manufactured using Class 1 resin with a high resin to glass ratio of 2.4:1 was supplied. Half the laminate was placed on a support in a muffle furnace with a temperature of 300°C for five minutes.

Within the first few minutes of placing the laminate sample in the furnace, smoke was observed. The smoke emission continued throughout the duration of the five-minute exposure period.

The laminate was removed from the furnace and allowed to cool to an ambient temperature and the appearance was compared with the other half of the sample. The tested sample was opaque, charred orange/brown in appearance, with a rough, gritty texture to the surface.

To confirm the effects of this high temperature exposure the flexural strength, modulus and Barcol hardness properties were determined before and after exposure. The results were as follows:

Test	Unit	Standard	Heat Aged
Flexural Strength	MPa	378	294
Modulus	MPa	6870	5200
Barcol Hardness	934-1	30-40	42-55

GRP Rooflights and Sprinkler Systems

LPC Rules for Automatic Sprinkler Protection (2015) incorporating BS EN 12845 Fixed firefighting systems. Automatic sprinkler systems. Design, installation and maintenance issued by the Fire Protection Association and RISC Authority includes a requirement that rooflights should be capable of resisting a temperature of 300°C for five minutes where sprinkler systems are used. This is consistent with the requirements of all hoses, pipes and fittings used in a sprinkler system.

Unlike thermoplastic rooflight materials, rooflights manufactured from GRP do meet this requirement.



By-Products of Combustion

There are, as with all plastics materials, toxic substances produced as a result of burning. It is not possible to manufacture any rooflight material for this type of application without this occurring.

The main by-products of combustion of the polyester resins used in the manufacture of GRP in-plane rooflights are carbon dioxide, water and carbon monoxide. In addition to these, there may also be some phosphorous halides given off from the halogens added to the material. These halogens are a necessary part of the composition of the material and are essential to improve the fire resistance.

The more halogens the product contains, the better the fire resistance will be.

It is not possible to be precise in stating exactly what substances will be produced and in what proportion as this will depend on the burning conditions of the material and the levels of oxygen present.

In selecting a product manufactured for high strength, such as our Zenon Evolution range, and where the glass to resin ratio is much higher than traditional GRP laminates, there is a reduction in the noxious materials produced.

