

Guide to the use of FILON GRP Rooflights to meet HSE Construction (Design and Management) Regulations 1994 (CDM)

Introduction

The HSE explanatory guide for designers which interprets the requirements of the above Regulations, recommend that *fragile* roofs should be avoided.

The test to determine whether a roof assembly is non-fragile or otherwise, is detailed in the **Advisory Committee for Roofing, Material Standard ACR(M) 001:2000 'Test for Fragility of Roofing Assemblies'**. This test has been endorsed by the HSE.

As this is an impact test on a completed fixed roof assembly rather than the testing of individual components, it is essential that rooflights are fixed in accordance with the specifications illustrated in this guide.

The Health and Safety Act requires all employers to consider the health, safety and welfare of their employees. An important part of these duties is to ensure that lighting levels are adequate for the tasks and activities involved.

As recommended in the "**HSE 38 Lighting at Work**", good lighting is essential to provide health and safety at work and to reduce hazards, visual fatigue and discomfort. Natural daylighting makes a major contribution to meeting these requirements.

Whilst side lighting can partially meet these objectives when used on narrow single span buildings, the only way to obtain daylighting into wide and multispan buildings is by *Top Lighting*.

This Guide considers the requirements of providing safe *Top Lighting* in relation to the **HSE CDM Regulations**, and details how FILON's products are used to meet these requirements.

Durability - Non-Fragility

The CDM Regulations require that the roof is designed to be non-fragile for the design life of the roof. The **ACR(M)001:2000 Test for Fragility**, will generally only test assemblies when new. No recognised and approved test has been devised to test existing structures. Note that removing an old sheet off a roof and subjecting it to the Fragility Test is not a valid test since you will not be testing the assembly, only the sheet from the assembly. Long term *non-fragility* will be effected by the original sheet specification, the quality of the fixings and washers, the environmental conditions e.g. saline atmosphere, and the quality of the workmanship at installation.

Statements on long term *non-fragility* for sheeting are difficult to apply and must always be subject to the understanding that the assembly is made up of a number of components which all may have a bearing on long term non-fragility.

To satisfy the requirement of CDM, designers need to specify what the design life of the roof is. Is it when the building falls down, or when the roof generally fails due to corrosion, or to a specified period say 5 years, 15 years, 25 years when the designer considers the roof will have achieved its design purpose?

What is critical is that designers should ensure that when specifying the roof, all the components that make up the entire roof have a design life that will provide a *non-fragile* assembly for the required period.

For GRP rooflights, *non-fragility* performance radically improves with the weight (thickness) of the sheet. GRP sheets do not corrode. Performance reduces over time by the slow thinning process caused by general weathering. Thus by increasing thickness, *non-fragility* performance is improved by increasing the factors of safety and delaying the point in time when the *non-fragile* sheet may become fragile.

To assist designers with their rooflight specification, we detail in **Table 1 on page 2** three principle categories of non-fragility:

- a) **Minimum weight for *non-fragility* when new and some indication of expected *non-fragile* life.**
- b) **Minimum weight for a *non-fragile* design life of 25 years.**
- c) **Products designed to be *non-fragile* for the expected usable life of the roof.**

Designers, contactors and building owners must be aware that the stated periods are for guidance only. Non-fragility will depend on all the components within the roof structure and any components that are not installed correctly or have suffered unduly with the passage of time due to corrosion or physical damage, could lead to the assembly becoming *fragile* within this period. For this reason product guarantees on *non-fragility* will not be generally offered, and guarantees that may be offered should be carefully read to see what is covered. Remember the only way you will know that the roof is *non-fragile* will be when someone falls through the roof usually leading to death. No guarantee will bring that person back to life. Guarantees provide a false sense of security.

Regardless of the expected *non-fragile* life stated in **Table 1** building owners, maintenance engineers, roof inspectors, roofing contractors should be very aware that any component on the roof may have been damaged or deteriorated, which could make the roof fragile. Always tread the roof as *fragile* unless a competent person has determined that the roof is safe. Even a *non-fragile* roof in wet or icy conditions can easily lead to slipping and sliding off the roof slope. All work on roofs must be treated with the utmost caution.

ACR(M)001:2000 Test for Fragility of Roofing Assemblies

Test Procedure

The above details the test rig, *non-fragile* classifications and impact procedures which involves dropping a 300mm dia. bag, weighing 45kg, twice from a height of 1.2m on to the zone considered to be the weakest point of the roof assembly.

Classification

- If the bag passes through the sample, it is classified as *fragile*.
- If the bag is retained on the assembly after one test, the assembly is classified as **Class C non-fragile**.
- If the bag is retained after two drops the assembly is classified as **Class B non-fragile**.
- If there is no significant damage to the assembly which would affect long-term strength or weatherability after two drops, it is classified as **Class A non-fragile**.

The drop test is severe on all traditional profiled cladding products such that surface protection, fixings or some structural damage will occur on all steel, aluminium and rooflight products making these products generally designated as Class B.

Table 1: FILON Rooflights to Meet *Non-Fragile* Specification

	<i>Non-Fragile</i> Classification	Min.Weight for <i>Non-Fragile</i> when New	Min.Weight for <i>Non-Fragility</i> for 25 Years	Min.Spec. for <i>Non-Fragility</i> for Life of Roof
Single Skin Sinusoidal Profile for use with Fibre Cement	Class C	2.44kg/m ²	3.06kg/m ²	FILON Supasafe
Single Skin Trapezoidal Profile for use with Metal Roofs	Class B	3.06kg/m ²	3.66kg/m ²	FILON Supasafe
Double Skin and Fermacore Site Assembled used in conjunction with 0.4mm Steel Liners				
- Performance of Liner Panel Alone	Class C	2.44kg/m ²	2.44kg/m ²	2.44kg/m ²
- Assembly with Class C Liners (lining out first)	Class B	Outer 1.83kg/m ² Liner 2.44kg/m ²	Outer 2.44kg/m ² Liner 2.44kg/m ²	Outer Filon Supasafe or 1.83kg/m ² + Mesh Liner 2.44kg/m ²
- Assembly (not lining out first)	Class B	Outer 2.44kg/m ² Liner 1.83kg/m ²	Outer 3.06kg/m ² Liner 1.83kg/m ²	Outer Filon Supasafe or 1.83kg/m ² + Mesh Liner 1.83kg/m ²
Double Skin and Fermacore Site Assembled used in conjunction with 0.7mm Steel Liners				
- Performance of Liner Panel Alone	Class B	3.06kg/m ²	3.06kg/m ²	3.06kg/m ²
- Assembly with Class B Liners	Class B	Outer 1.83kg/m ² Liner 3.06kg/m ²	Outer 1.83kg/m ² Liner 3.06kg/m ²	Outer Filon Supasafe or 1.83kg/m ² + Mesh Liner 3.06kg/m ²
Factory Assembled Double Skin and Fermacore				
- For use with Composite Panels with Liners over purlins	Class B	Outer 2.44kg/m ² Liner 1.53kg/m ²	Outer 3.06kg/m ² Liner 1.53kg/m ²	Outer FILON Supasafe Liner 1.53kg/m ²
- For use with Liner Box between the purlins	Class B	Outer 3.06kg/m ² Liner 1.53kg/m ²	Outer 3.66kg/m ² Liner 1.53kg/m ²	Outer FILON Supasafe Liner 1.53kg/m ²
FILON Monarch Factory Assembled Barrel Vaults	Class B	Outer 1.83kg/m ² Liner 1.83kg/m ²	Outer 2.44kg/m ² Liner 2.44kg/m ²	Outer FILON Supasafe Liner 1.83kg/m ²

Notes to Table 1

1. All specifications stated are based on purlin centres of 1.35m to 2.0m. Both closer and extended purlin centres can adversely effect performance of the *non-fragility* rating. Specific tests may be carried out to verify the requirement, but a safe rule is to increase the rooflight sheet weight.
2. Curved roofs will adversely affect sheet performance since the sheet is stiffer. A safe rule is to increase the rooflight sheet weight.
3. Current fibre cement sheets manufactured in the UK are currently Class C. These sheets may not provide *non-fragility* for 25 years or for the life of the roof.
For repair work on asbestos cement roofs, regardless of rooflight thickness, the whole roof will be *fragile*.
4. For external profiled sheets with a profile depth less than 25mm, the sheet weight should be increased to 2.44kg/m² to achieve structural span capabilities.

FILON Single Skin Rooflights

As illustrated in **Fig.1** 2.44kg/m² and 3.06kg/m² single skin FILON rooflights fixed to purlins spaced at 1.35m to 2.0m centres will be *non-fragile* provided that :

- Sheets are secured to purlins with fasteners not exceeding 200mm centres.
- Fasteners incorporate minimum 29mm dia. round washers or saddle washers.
- Primary fasteners are at least 50mm from sheet edges.
- Side laps are stitched and sealed at centres not exceeding 450mm.

FILON Site Assembled Double Skin Rooflights and FILON Fermacore

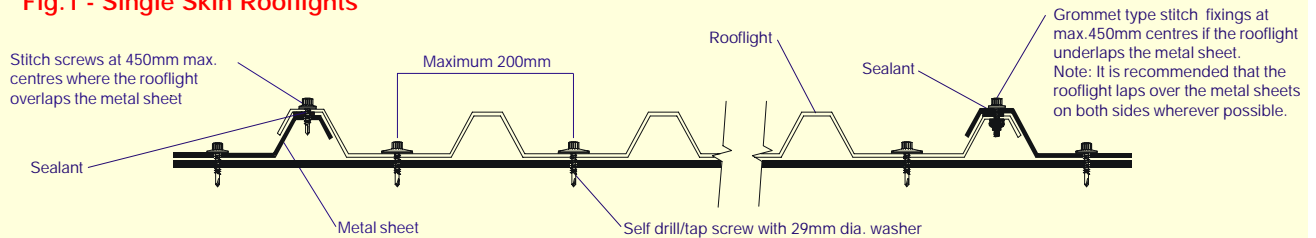
As illustrated in **Figs.2 and 3**, an in situ double skin or multi skin rooflight consists of two or more skins of FILON sheeting separated by a metal "standoff" spacer. FILON liners and top

sheets, in accordance with the specification in **Table 1**, secured to purlins spaced at 1.35m to 2.0m centres, will be *non-fragile* provided that :

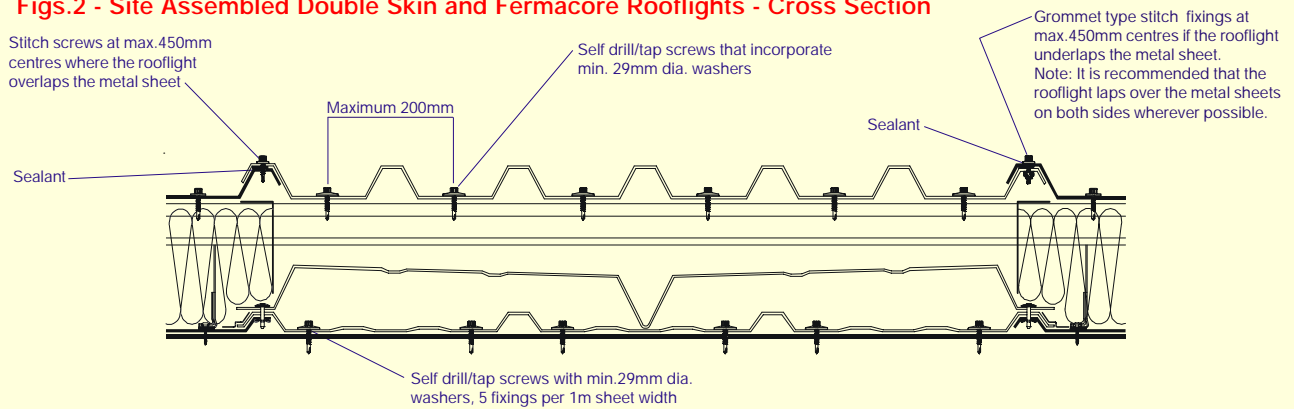
- Fix lining panels to purlins and top sheets to **standoff** spacers with fasteners not exceeding 200mm centres. When securing lining panels, "standoff" brackets would be considered as a fixing.
- Fasteners to incorporate minimum 29mm dia. round washers or saddle washers.
- Primary fasteners to be at least 50mm from sheet edges.
- Stitch side laps in external sheet at centres not exceeding 450mm, seal side laps on liners with self adhesive tape.

N.B. The HSE state in "**HSG33 Safety on Roofs**" that lining out is potentially very dangerous and should be avoided unless the lining system is designed to be *safe* as a single skin membrane. Thus, when the whole roof is lined out, prior to the fixing of the top sheet, the weight of the FILON lining panel should be increased to match the performance of the metal liners. Also note some metal liners may be considered *fragile* and likely to permanently deform if walked on.

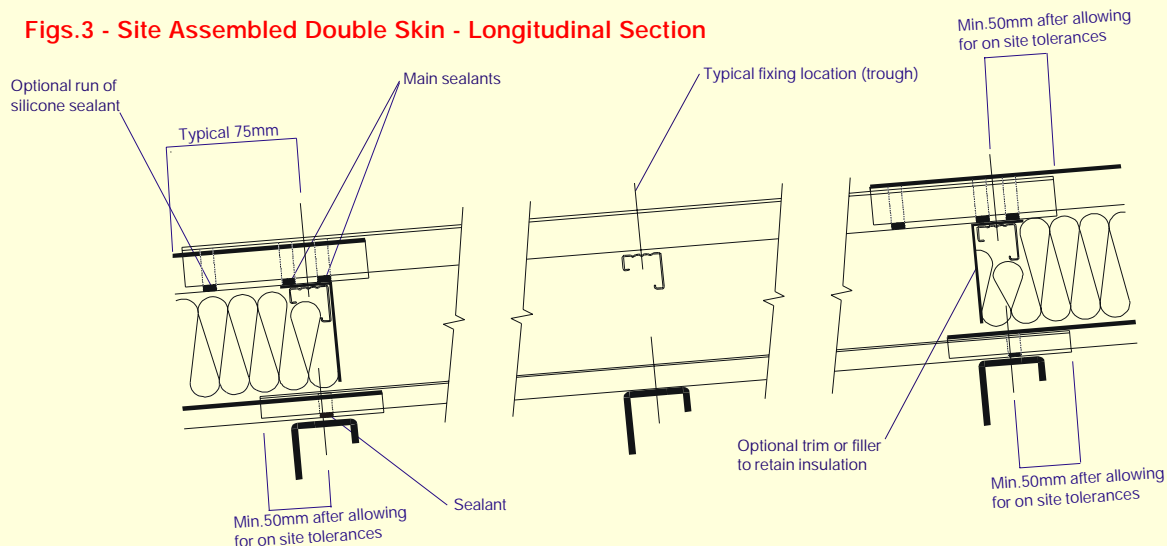
Fig.1 - Single Skin Rooflights



Figs.2 - Site Assembled Double Skin and Fermacore Rooflights - Cross Section



Figs.3 - Site Assembled Double Skin - Longitudinal Section



FILON Factory Assembled Insulating Rooflights

Figs 4, 5, and 6 illustrate the use of factory assembled double and multi skin rooflights used in conjunction with composite panels. The underlining box panels can either be :

- Fully supported or partially supported by roof purlins or support plates. or
- Unsupported, fitted between purlins.

Units Supported by Purlins or Support Plates

Manufactured from top sheets and liners, in accordance with the specifications in **Table 1**, and fixed to purlins spaced at 1.35m to 2.0m centres, they will be *non-fragile* provided that :

- Rooflights are secured to purlins with fasteners not exceeding 200mm centres.
- Fasteners incorporate minimum 29mm dia. round washers or saddle washers.

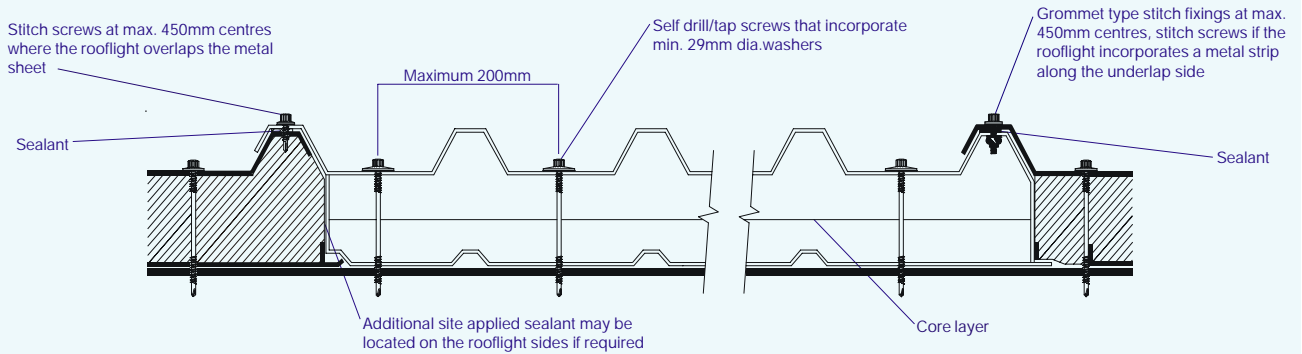
- Primary fasteners are at least 50mm from sheet edges and box panels are supported by 50mm. Where this requirement cannot be met, additional support should be incorporated as illustrated in **Fig.5**.
- Side laps are stitched and sealed at centres not exceeding 450mm.

Units where Liners are Fitted Between Purlins

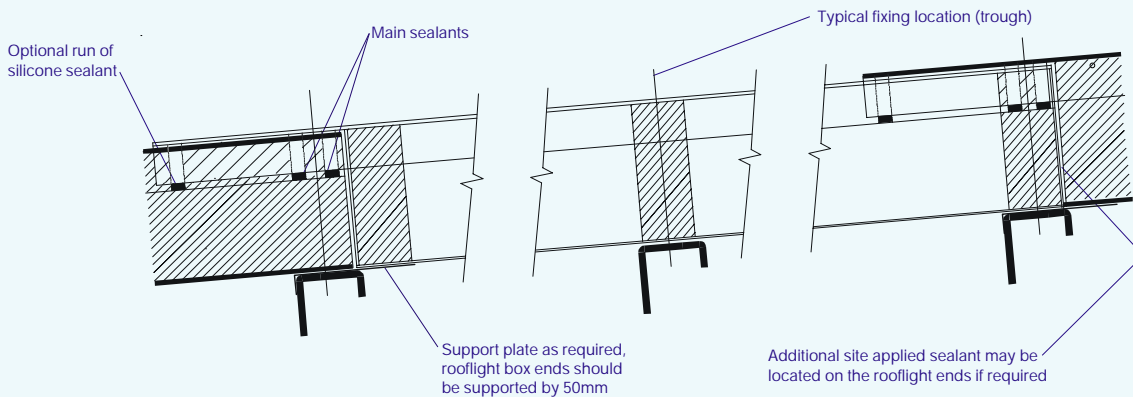
When fixing units, where the box lining panels are unsupported, such rooflights are considered to be single skin assembly and the weight of the external skin is increased to the weights specified in **Table 1**.

Fixed to purlins spaced at 1.35m to 2.0m centres, such rooflights will be *non-fragile* provided that they are fixed to the same specification as **Single Skin Rooflights**.

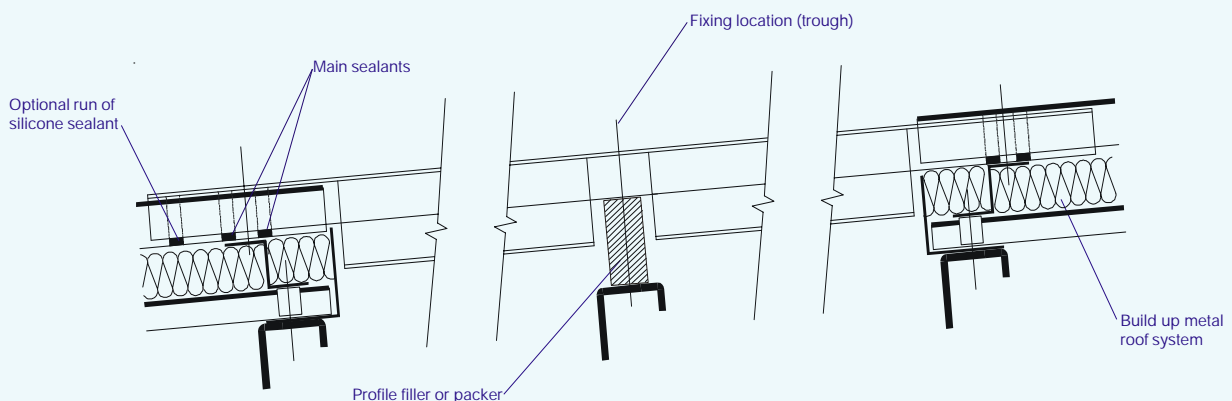
Figs.4 - Factory Assembled Fermacore - Cross Section with One Core Layer



Figs.5 - FADS Longitudinal Section - Liners Supported by Purlins or Plates



Figs.6 - FADS Longitudinal Section - Liners Fitted Between Purlins



Note : These details are mainly applicable when replacing existing rooflights.

FILON SupasaFe - Roof Life Non-Fragility

FILON SupasaFe is a laminated composite GRP sheet which offers physical strength, impact resistance and durability exceeding that of 0.7mm thick steel sheeting.

In addition to randomly distributed glassfibres present in standard GRP, **SupasaFe** incorporates two extra reinforced layers, including a stitched woven glass mat to form a composite with high strength, rigidity and resistance to impact.

This composite enables the sheet thickness to be kept to a minimum providing good profile definition with other roofing products, ensuring a good end lap and minimising the risk of water ingress.

SupasaFe will provide rooflights which will remain *non-fragile* for the life of the roof, which under normal U.K. environmental conditions would be in excess of 30 years prior to necessary refurbishment.

An unfixed single width **SupasaFe** rooflight, supported at 2.0m purlin centres, will support a person carrying a heavy load without damage. When fixed in a roof in conjunction with similar profiled sheeting, these loads would be distributed and the safety margin increased.

The superior impact strength and durability of **SupasaFe** can be illustrated by :

- The rooflight will satisfy the HSE impact test independent of fixings.
- The rooflight will retain a 90kg bag (14 stone) dropped from a height of 2.4m on to a single width fixed sheet. This impact test confirms that **SupasaFe** is 4 times stronger than standard GRP sheeting and stronger than 0.7mm profiled steel.
- Independent accelerated weather tests completed under ISO.4892 and EN.1013-1 1997 "**Light Transmitting Profiled Sheets for Single Skin Roofing**", confirms that **SupasaFe** rooflights meets the highest durability classification under this standard.
- **SupasaFe** rooflights will retain their durable *non-fragile* designation generally in excess of 30 years.

If roof life *non-fragility* is required **SupasaFe** sheets should not exceed 2.5m purlin centres.

The primary sheet fasteners should incorporate minimum 19mm dia. washers, with suitable sealing rings, fixed at centres not exceeding 400mm. Side laps to be stitched at approximately 450mm centres.

When this specification can not be complied with consult Filon Products Technical Services Dept. for alternative recommendations.



90kg Bag Dropped from 2.4m



FILON SupasaFe Without Fixings Supports a Person Carrying a Heavy Load



FILON SupasaFe Showing the Stitched Glass Mat Reinforcement



FILON SupasaFe Fitting to EP 32/1000 Illustrating the Good Profile Definition

FILON Monarch Barrel Vault Rooflights

Double skin, factory assembled **FILON Monarch** rooflights are fabricated from two skins of FILON sheeting. They are supplied in lengths up to 4.2m to simplify and reduce erection costs. They can be butt jointed to form continuous strip lighting.

Monarch rooflights are suitable for use with low pitched roofing, metal standing seam systems, flat roofs, continuous ridge applications and for replacements of thermoplastic barrel vaults.

As illustrated in **Fig.7 Monarch** rooflights are designed to

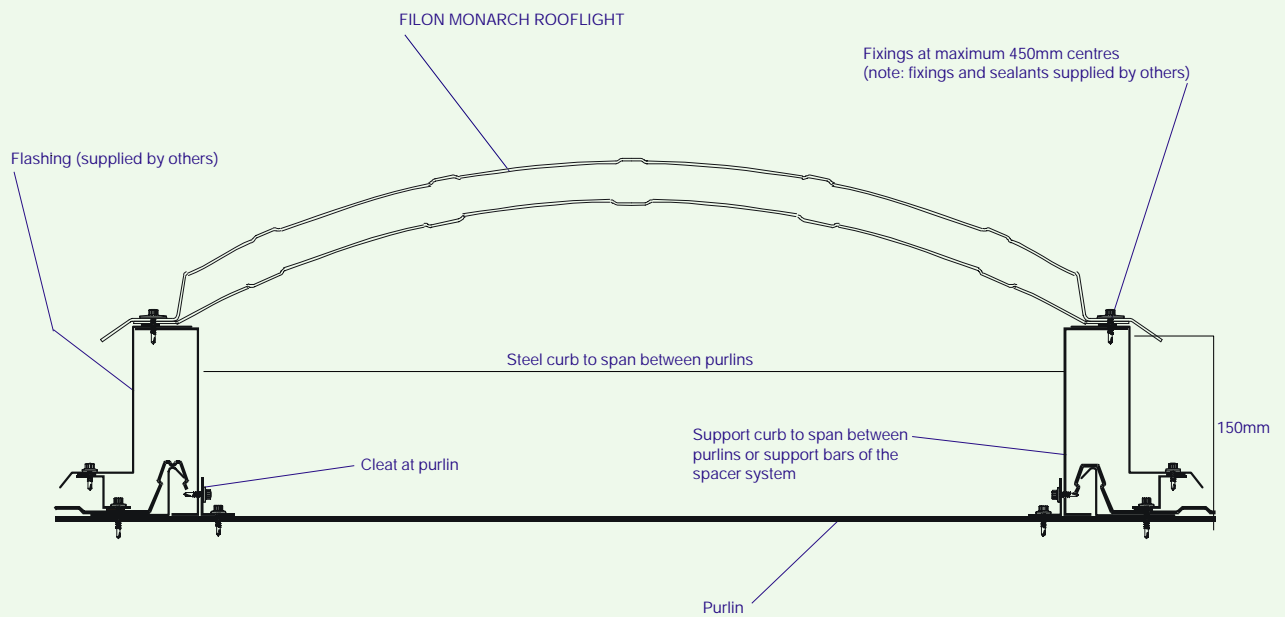
project above the plane of the roof to suit openings up to 1200mm.

They meet the **HSE non-fragile** requirements when :

- They are secured to a metal curb upstanding with fasteners not exceeding 450mm centres.
- Fasteners incorporate minimum 29mm dia. washers with suitable sealing rings.

Where additional strength is required, **FILON Monarch** rooflights can be fabricated from **FILON SupaSafe** sheeting.

Figs.7 - FILON Monarch Barrel Vault - Cross Section



Typical FILON Monarch Application at the Ridge

FILON In Situ Double Skin with Additional Steel Mesh

The long term impact resistance of in situ double skin rooflights can be improved and extended by the use of galvanised welded steel mesh fitted between the layers of a double skin assembly.

The outer skin will normally be 1.83kg/m² or 2.44kg/m² if designing for a durable life beyond 30 years. The liner weight will be determined by the method of construction to ensure *non-fragility* as installed.

The mesh size should not exceed 75mm x 150mm with a wire diameter of not less than 3mm. When fixed, the retaining fasteners must be located at least 150mm from the top and bottom edges of the mesh.

Whilst the addition of a mesh will extend the long term non-fragile life of a rooflight and prevent a person falling through, if the rooflight is stepped on both top sheet and mesh may be damaged and need repair.

In Situ Double Skin Rooflights with Additional Steel Mesh



Durability : Weathering

All external weathering sheets are normally supplied with a highly durable UV resistant *Melinex* film to the weather face. This extends the durable working life of the sheet and the UV resistance limits sheet yellowing. Under normal atmospheric conditions sheet life should be in excess of 30 years.

Independent accelerated weathering tests completed under ISO 4892 and EN 1013-1 1997 **Light Transmitting Profile Sheeting**, confirms that FILON rooflights meet the highest durability classification under this standard.

Where very aggressive chemical environments exist FILON sheets can be provided with gel coats to the weather face and the internal face of lining panels. FILON Citadel Isoflex gel coats are chemically inert to most aggressive chemical environments and can be used in opaque format to substitute for metal sheets that would otherwise readily corrode.

Design

Single skin, in situ double skin and FAIRS rooflights, which are likely to become *fragile* during the life of the roof, should not be fixed adjacent to eaves or where other roof traffic is likely.

It is recommended that no rooflights should be fixed adjacent to exposed eaves and verges, other wise edge protection will be necessary when the rooflights require cleaning.

Support Centres

The properties of FILON sheets differ from metal sheeting and they do not necessarily have the same span capabilities.

Refer to '**FILON Translucent GRP Roofing and Cladding**' datasheet for recommended spacings of purlin and cladding rails.

Siteworks

Transport, Handling and Storage

Sheets are generally supplied loose. Store sheets on flat, clean, level battens located at 1.5m centres. Secure against theft and from being blown away.

Continuously protect sheets stored in open with waterproof opaque covers, otherwise even on relatively dull days sheet stacks will act as a **solar battery** boiling any entrapped moisture and discolouring the sheets. Inspect regularly to ensure that moisture has not penetrated the stack.

Technical Services

Technical and advisory services are available from Area Sales Managers and Technical Services Department.

Health and Safety

Roof works should be completed in accordance with the recommendations published in the Health and Safety Executive Guidance Note HS (G) 33 "Safety in Roof Work".

Many accidents occur during maintenance and cleaning. Very often work is carried out by those who have no experience or understanding of working at heights.

Roofs are dangerous places to work and it is recommended that the following information be included in the "**Health & Safety File**".

No person should have access to a roof unless under the direct supervision of an experienced roofer who should be sufficiently competent to assess any risks and take the necessary action to reduce such risks.

Although designed to be *non-fragile* when installed, foot traffic on rooflights may damage and weaken the sheets and is likely to damage the UV resistant weather coating thereby reducing the life and translucent qualities of the sheet.

Do NOT walk on rooflights at any time, ALWAYS use crawling boards.

As rooflights require periodical cleaning to maintain designed daylighting, the **Health and Safety File** should also contain the following information :

- Layout of the roof sheeting plan showing location of rooflights, together with the colour of washers and caps of the rooflight fixings.
- To maintain light levels within the building the rooflight should be periodically cleaned using warm soapy water, or for more persistent stains, white spirit together with a stiff brush.
- When access on to a roof is required, roof boards must be used unless it has been clearly established by a recognised competent person that the total roof is safe to walk on.
- Where a prescribed access point has been designed and built, its location should be stated.

Information Services

For further information about the Company, its Products and Services please visit our web site www.filon.co.uk.

In addition, there is a general product datasheet entitled "**FILON PRODUCTS - More than just glassfibre sheet for roofing and cladding**" outlining the range of products manufactured by the Company and their applications.

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