



Technical Guideline 05 (TG05) v11_2025-03-13

Technical Guidelines

Inverted Roof Systems



Inverted roof applications

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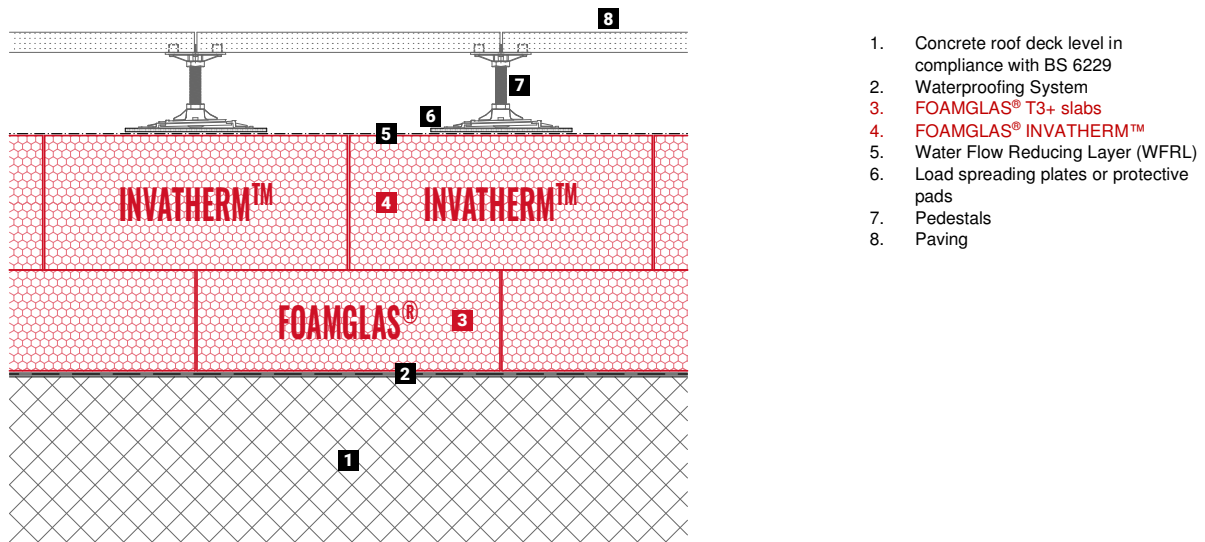
1. Introduction

Inverted roofs are designed with the waterproofing layer beneath the loose laid insulation.

FOAMGLAS® inverted roof insulation is loosely laid on top of the roof waterproofing and then weighted down with paving slabs on pedestals (TDS 4.8.2 and TDS 4.8.4), gravel ballast (TDS 4.8.1 and TDS 4.8.3) or an extensive green roof (TDS 4.8.5 and TDS 4.8.6). In these systems, a single or a double insulation layer are possible, where the top layer is always FOAMGLAS® INVATHERM™.

The product has to be used in conjunction with a Water Flow Reducing Layer (WFRL) before the finishes are applied. This is a water-control membrane that should be placed on top of the insulation to minimise the rainwater flowing underneath the insulation and consequently additional heat loss (BS 6229). Rain falling on the roof percolates through the ballast on the Water Flow Reducing Layer (WFRL). It then drains away through rainwater outlets.

The WFRL is taken into consideration when determining the U-value of the roof. Due to the characteristics of FOAMGLAS® cellular glass insulation, FOAMGLAS® INVATHERM™ is a particularly suitable product for an inverted roof design described as above. FOAMGLAS® INVATHERM™ is Euroclass A1 rated, non-combustible and, as such, does not contribute to flame spread in case of fire. This inverted roof system can also be used for zero falls and standard roof slopes with limited access, balconies and terraced roofs, subject to pedestrian access only in accordance with BS 6229.

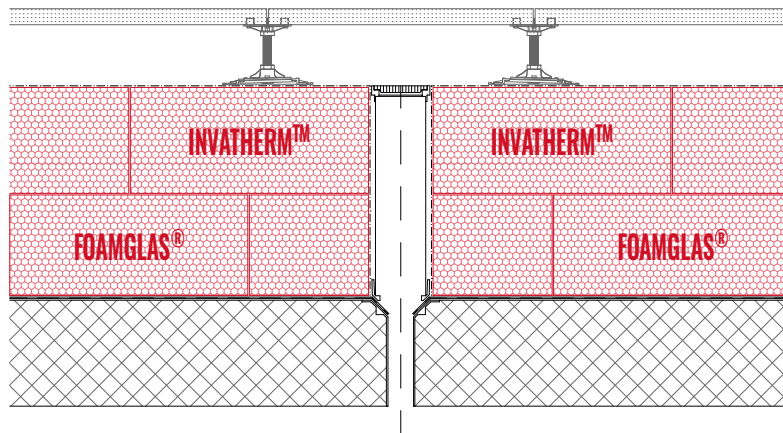


principle scheme

2. Design and installation recommendations

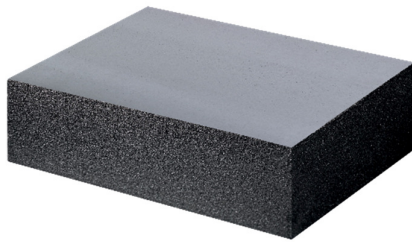
- Calculations of thermal transmittance (U-value) of FOAMGLAS® inverted roof applications should be conducted in accordance with the local regulations.
- The roof must be designed with adequate falls. Reference should be made to the local regulations for Inverted Roofs. Roof decks in accordance with BS 6229 are allowed with the FOAMGLAS® INVATHERM™ system.
- The deck of flat roofs must be in compliance with BS 6229 to avoid ponding and consequent risk of freeze and thaw.
- The FOAMGLAS® INVATHERM™ inverted roof insulation system is designed for use upon buildings with an internal temperature of minimum +8°C. Please contact FOAMGLAS® Technical Department for more information and calculation assistance.
- In the case of double layer systems, the thickness of the 1st and 2nd layer must be in accordance with the FOAMGLAS® recommendations: ratio thickness bottom layer vs thickness top layer (refer to our typical U-value charts).
- The flatness and the general conditions of the substrate are important criteria when using FOAMGLAS® INVATHERM™. FOAMGLAS® Technical Department can be consulted for further guidance. Under a straight (reference) bar of 2 m, the unevenness should be less than 5 mm or 3 mm under a straight (reference) bar of 0.6 m.
- Installers of the product must be careful not to damage the roof waterproofing, particularly in the case of thin single-layer materials that can be easily damaged.
- A protective foot or crawl board must be used to distribute the loads on top of the FOAMGLAS® INVATHERM™ during the installation of the covering layers.
- WFRL to be installed in according to the manufacturers guidelines and BS 6229 to reduce water ingress.
- Adequate precautions need to be taken during installation to prevent any damage of the insulation top coating. Point loads need to be avoided at all times during the installation and specifically when installing the WFRL, drainage membrane and load spreading plates.
- Roof finishes should be installed to prevent wind uplift and provide complete protection to the WFRL from UV degradation.
- If gravel is to be applied as the ballast, use of rounded gravel is then mandatory as well as a ballast bearing drainage layer.
- Ballast such as gravel or paving should meet local regulations for wind uplift.
- Gravel ballast (rounded low fines of nominal size 16 mm to 32 mm) should be washed and laid to a minimum thickness of 50 mm but should be at least in accordance with the local regulations. Paving ballast should also meet the local regulations.
- Care must be taken to ensure that upgraded roofs can carry the increased load and depth of the installed system.

- It is vital that the roof is adequately drained to prevent ponding. The location, size and number of rainwater outlets should be designed in accordance with BS EN 12056-3:2000.



Principle scheme outlet

3. Materials



FOAMGLAS® INVATHERM™



FOAMGLAS® T3+

FOAMGLAS® INVATHERM™ (Picture 1) is a cellular glass insulation with a pre-applied coating on the topside and is a non-combustible, Euroclass A1 rated product. FOAMGLAS® INVATHERM™ is always the top layer in the system, coating side is the upper side. Colour: Shade of grey cannot be guaranteed and can vary in batch.

FOAMGLAS® T3+ slab insulation (Picture 2) is manufactured from specially graded recycled glass and natural raw materials which are available in abundant supply (sand, dolomite, lime...). The insulation is totally inorganic, contains no ozone depleting propellants, flame resistant additives or binders, without VOCs or other volatile substances. FOAMGLAS® T3+ slab is a Euroclass A1 rated product. This product is only used as the base layer of a double layer system and is restricted to a maximum thickness.

Both products are manufactured with the dimensions of 600x450mm, thicknesses are dependent on the requested U-value adhering to the top and base layer thickness ratios previously described. For recommendations and assistance please contact our Technical Department. See section 7 for installation guidelines.

4. Safety measurements and PPE

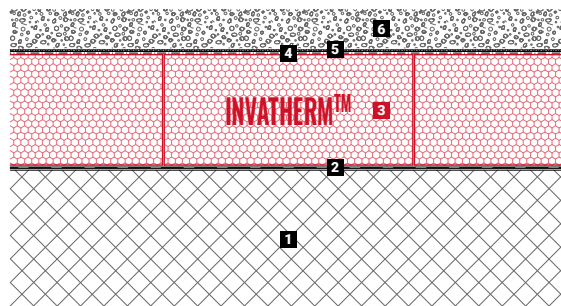
Wear the PPE required for the construction site. The wearing of PPE is required to meet site specific regulations. Gloves and normal protective work clothing with long sleeved shirt and safety glasses while handling. Safety glasses are a must. When cutting, grinding, crushing, or drilling FOAMGLAS® insulation, wear safety glasses with side shields or dust goggles in dusty environments. Wear goggles for dust protection while cutting or abrading in wind.

Although the use of a face mask is required when handling and installing FOAMGLAS® products, the dust is not toxic. Follow the safety instructions as indicated in our SDS. Always follow the safety instructions valid for the construction site.

5. FOAMGLAS® Inverted Roof applications

These systems are all FOAMGLAS® Inverted Roof Systems with Non-Combustible Insulation on a continuous support in concrete. FOAMGLAS® INVATHERM™ Loose Laid.

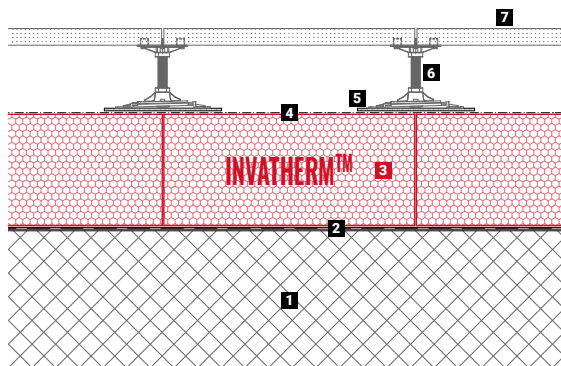
5.1 One layer inverted roof insulation with gravel on reinforced concrete deck TDS 4.8.1



TDS_4-8-1

1. Concrete roof deck level in compliance with BS 6229
2. Waterproofing membrane
3. FOAMGLAS® INVATHERM™
4. Water Flow Reducing Layer (WFRL)
5. Perforated protection layer
6. Ballast (rounded gravel, paving slabs...)

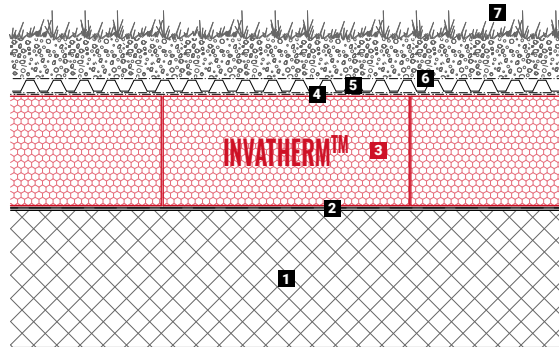
5.2 One layer inverted roof Insulation with paving slabs on reinforced concrete deck TDS 4.8.2



TDS_4-8-2

1. Concrete roof deck level in compliance with BS 6229
2. Waterproofing membrane
3. FOAMGLAS® INVATHERM™
4. Water Flow Reducing Layer (WFRL)
5. Load spreading plates or protective pads
6. Pedestals
7. Paving

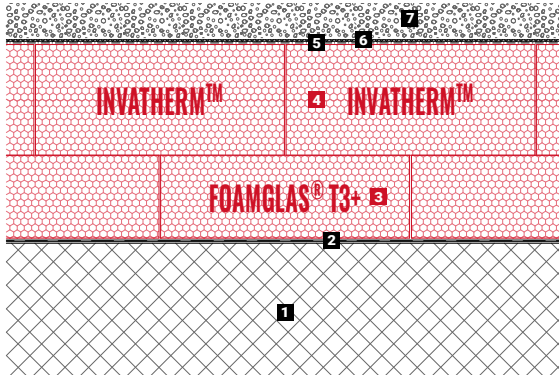
5.3 One layer inverted green roof insulation on reinforced concrete deck TDS 4.8.5



1. Concrete roof deck level in compliance with BS 6229
2. Waterproofing membrane
3. FOAMGLAS® INVATHERM™
4. Water Flow Reducing Layer (WFRL)
5. Reservoir / Drainage Board
6. Filter sheet
7. Extensive green roof system

TDS_4-8-5

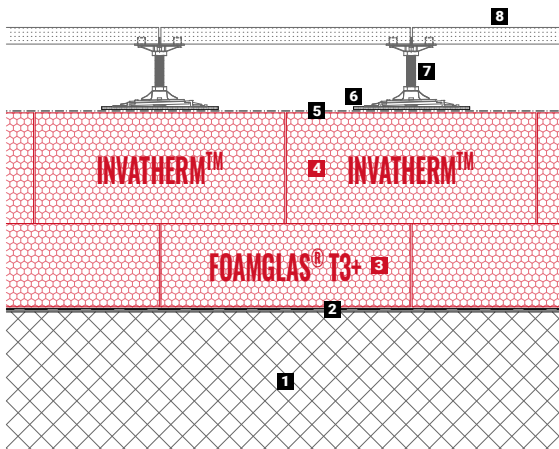
5.4 Double layer inverted roof insulation with gravel on timber substrate TDS 4.8.3



1. Concrete roof deck level in compliance with BS 6229
2. Waterproofing membrane
3. FOAMGLAS® T3+ slab
4. FOAMGLAS® INVATHERM™
5. Water Flow Reducing Layer (WFRL)
6. Perforated protection layer
7. Ballast (rounded gravel, paving slabs...)

TDS_4-8-3

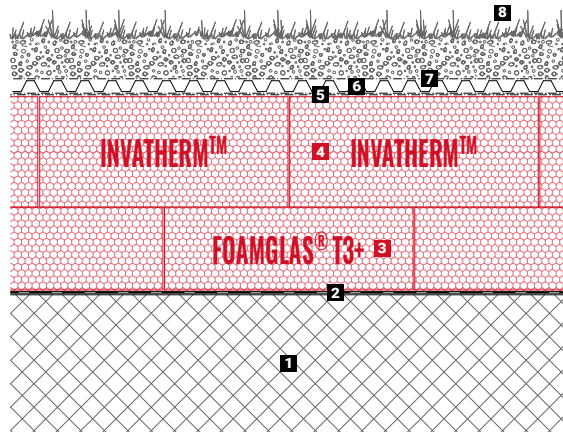
5.5 Double layer inverted roof insulation with paving slabs on timber substrate TDS 4.8.4



1. Concrete roof deck level in compliance with BS 6229
2. Waterproofing membrane
3. FOAMGLAS® T3+ slab
4. FOAMGLAS® INVATHERM™
5. Water Flow Reducing Layer (WFRL)
6. Load spreading plates or protective pads
7. Pedestals
8. Paving

TDS_4-8-4

5.6 Double layer inverted green roof insulation on timber substrate TDS 4.8.6



1. Concrete roof deck level in compliance with BS 6229
2. Waterproofing membrane
3. FOAMGLAS® T3+ slab
4. FOAMGLAS® INVATHERM™
5. Water Flow Reducing Layer (WFRL)
6. Reservoir / Drainage Board
7. Filter sheet
8. Extensive green roof system

TDS_4-8-6

6. Application of the system

6.1 Substrate

The roof waterproofing must be clean and free from any debris (e.g. pieces of brick, gravel, plastics, screws and bolts, etc.). This will result in a stable and rigid build-up, which is level and flat.

The waterproofing membrane has to be installed in accordance with the recommendations of the manufacturer. It is essential that the roof waterproofing has been installed correctly and that it is weathertight. Every joint between sheets, flashings and other details must be checked to ensure that the roof covering is suitable for an inverted roof. FOAMGLAS® INVATHERM™ must be continuously supported by a stable and levelled substrate. For a double layer system, FOAMGLAS® INVATHERM™ must be entirely supported by a stable and levelled layer of FOAMGLAS® T3+ slabs. If this is not the case, the bottom layer (FOAMGLAS® INVATHERM™ in a single layer system, FOAMGLAS® T3+ slab in a double layer system) can be adapted by abrasion so the insulation remains in full contact with the substrate beneath.

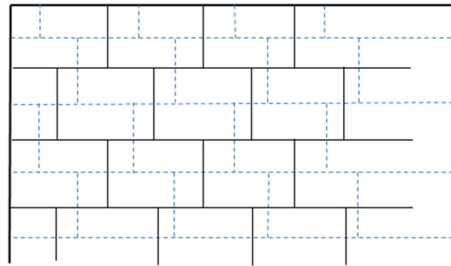
6.2 FOAMGLAS® application

Single layer system:

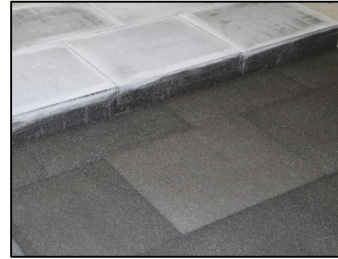
FOAMGLAS® INVATHERM™ must be installed with staggered joints. The infill pieces need to have a minimum width of 150mm. All joints between the FOAMGLAS® INVATHERM™ slabs must be tight and no gaps exist where they meet rooflights, edge details and other services which perforate the roof deck.

Double layer system:

FOAMGLAS® T3+ slabs and FOAMGLAS® INVATHERM™ must be installed with staggered joints in each layer and between the different layers. (See Pictures 1 & 2). We recommend a minimum 150mm staggered overlap. All joints between the FOAMGLAS® T3+ slab and FOAMGLAS® INVATHERM™ in all layers must be installed tightly with no gaps exist where they meet rooflights, edge details and other services which perforate the roof deck. The infill pieces to close gaps need to have a minimum width of 150mm. See Picture 1: dotted line = FOAMGLAS® T3+ slab layer, full lines = FOAMGLAS® INVATHERM™ layer:



Staggerd joints (1)



Staggerd joints (2)

6.3 Shaping and adapting the insulation in case of unevenness

The FOAMGLAS® insulation is easily shaped, so if structural unevenness appears (membrane overlaps/seams/etc.), it can be easily adapted by grinding or cutting to ensure the FOAMGLAS® slab in the first layer will not rock or move. Attention: Grinding and cutting of the insulation creates dust. It is mandatory to remove this dust from the installation area prior to the installation of the insulation.

Useful tools:



Handmade sanding board



Grater

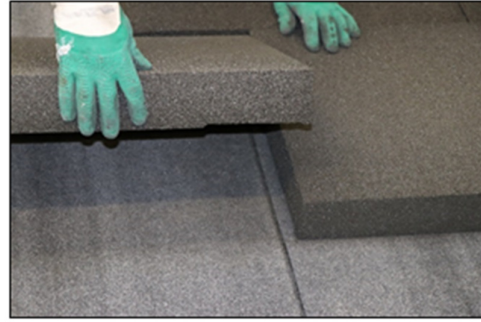


Scraping tool

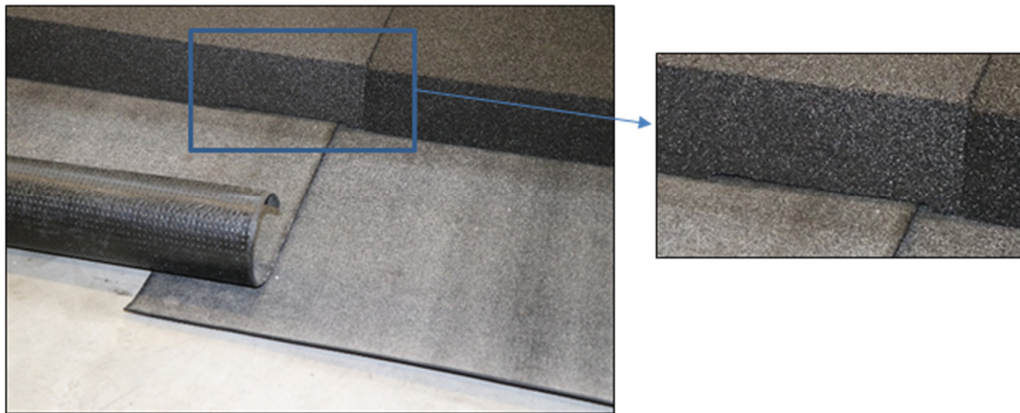
Example of abrading the bottom side of FOAMGLAS® T3+ slab sat the location of a membrane overlap. FOAMGLAS® INVATHERM™ can be easily adapted following the same procedure. (Pictures abrading & placement)



Abrading the bottom side



Placement on overlap



Correct placement on overlap

6.4 Handling and cutting FOAMGLAS® material

FOAMGLAS® insulation is easy to cut on site:

- Grinding can be used to make minimal adjustments.
- Cutting can be used to cut adjustment pieces to make fitting pieces (of minimum 15cm) and/or to create the staggered joints.

Attention: a wood cutting saw is not recommended for cutting FOAMGLAS® Slabs on site as they will wear out. For minimal quantity of fabrication (cutting) of the insulation slabs on site, a metal cutting saw with a hardened steel blade is recommended as others might bear down quicker. Make sure to guide the saw in a proper way to make a straight cut. The insulation can generally be cut on site, as follows:

- Two packs of FOAMGLAS® insulation are placed at the same height, at a few centimeters from each other.
- Measure the slab and mark the cutting line.
- Lay the FOAMGLAS® Slabs in such a way that the cutting line is in the middle of the opening between the two packs.

- A packing carton can be used as a square.
- A metal/wood guide profile is placed on the packing carton. When cutting, the saw can follow the guide profile to cut the insulation slabs to size.



Preparation for cutting FOAMGLAS®

- The FOAMGLAS® Slabs may be cut on site with regular hand tools as described above; a metal saw can be used for cutting the insulation slabs. However, a sawing machine is strongly recommended for maintaining uniform insulation slab edges and consequently the joints, if the quantity of insulation slabs to be adapted is significant.
- Saw straight both lengthways and downwards. (see picture below: green is OK, red is NOT OK)
- It's recommended to do the cutting and abrading on one working area on the roof, to avoid FOAMGLAS® insulation "dust" all over the already installed FOAMGLAS® insulation.
- The cut side of the FOAMGLAS® material has to be preferably to the outside (wall/parapet) to prevent open joints and getting misplacements of the next slabs.



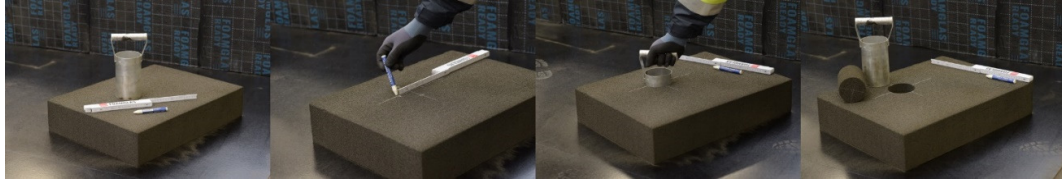
Cutting FOAMGLAS®

It is recommended to do the cutting and abrading in one working area of the roof, to avoid FOAMGLAS® "dust" over the already installed FOAMGLAS®.

The cut side of the FOAMGLAS® has to be preferably to the outside (wall/parapet) to prevent joints and misplacement of the adjoining slabs.

6.5 Pipe penetrations in FOAMGLAS® Material

To cut round holes e.g., pipe or duct penetrations, take a tube with the appropriate diameter and press it slightly through the FOAMGLAS® material. In case of the FOAMGLAS® INVATHERM™ always press from the coated side to the non-coated side to avoid damage of the coating at the edges of the hole. Bigger holes have to be cut manually in the right shape. When making holes, the inside should be protected applying SKY FIX.



Round holes/penetrations through FOAMGLAS®

6.6 Abrading FOAMGLAS®

Grinding can be used to do minimal adjustments to fit slabs in the application and result in a stable installation.

Advice on grinding FOAMGLAS® INVATHERM™: Be sure to grind down the coated side, because if you grind upwards with the grinding board the coating on the edges will be damaged.



Grinding FOAMGLAS®

7 Application of FOAMGLAS® insulation

7.1 Single layer system:

The FOAMGLAS® INVATHERM™ slabs are loosely laid with staggered joints on a flat substrate. Fit them in 1 by 1, be sure they are stable and adjust where necessary. Walking over the FOAMGLAS® INVATHERM™ during installation is possible but should be done with

care. It is recommended to use a rubber mat to reach the zones where you want to bring other materials such as pedestals and paving stones. In no case point loads are allowed on the coated side and adequate measurements should be taken to prevent this at all times. When large surfaces have to be covered, it is recommended to work by zones. It is recommended to have the WFRL installed over the FOAMGLAS® INVATHERM™ at the end of each working day.

7.2 Double layer system:

First layer(s)

The FOAMGLAS® T3+ slabs are loosely laid with staggered joints on a flat substrate (covered with a roof waterproofing). When installing them, be sure they are stable and adjust where necessary.

From time to time, it might be necessary to grind the top surface of the first layer of FOAMGLAS® T3+ slab. This will provide a levelled surface for the top layer of insulation, resulting in a stable and rigid system. Dust must be removed. This can be done with a compressed air tool.

Second or final layer

Once the first layer is installed correctly, the second or final layer of FOAMGLAS® INVATHERM™ is laid on top.

Full FOAMGLAS® INVATHERM™ slabs are recommended to be used where possible. All joints have to be staggered in this layer when compared to the FOAMGLAS® T3+ slabs of the previous layer. The FOAMGLAS® INVATHERM™ can be cut and adjusted as explained and described in sections 6.3 & 6.4.



Staggered joints between FOAMGLAS® layers

Walking over the FOAMGLAS® INVATHERM™ system during installation is possible but should be done with care. It is recommended to use a rubber mat to reach the zones where you want to bring all other material such as pedestals and paving stones. In no case are point loads allowed on the coated side, adequate measures must be taken to avoid damage at all times.



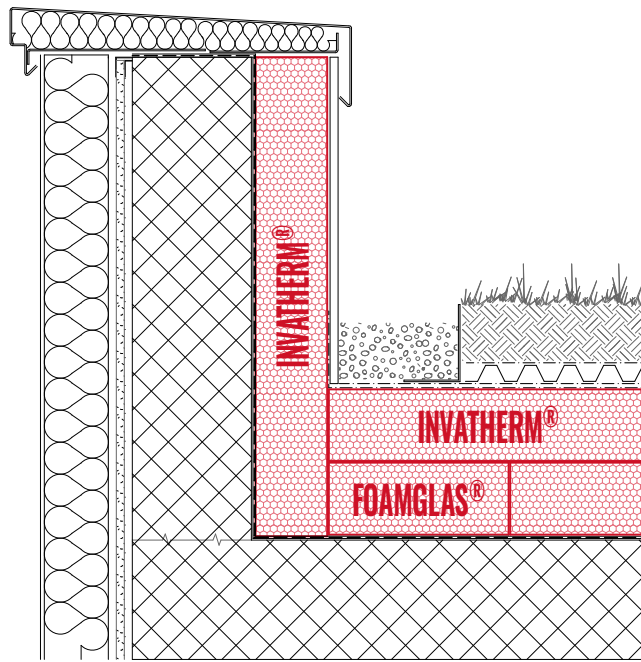
Rubber mat



Rubber mat

7.3 Parapet and upstands

Parapets and upstand elements can also be insulated following the same principles as for inverted roofs. Max. FOAMGLAS® INVATHERM™ upstand = 600 mm. The FOAMGLAS® INVATHERM™ slabs have to be installed to the parapets prior to the first horizontal layer is being installed on the horizontal surface. FOAMGLAS® INVATHERM™ parapet application is loosely laid and the idea is to “trap” the FOAMGLAS® INVATHERM™ slabs with all horizontal layers, including the pavers and/or ballast. The external face of the FOAMGLAS® INVATHERM™ upstand should be protected to prevent damage to the coating.



Parapet detail

7.4 Repair of the FOAMGLAS® INVATHERM™ coating

Minor damage of the FOAMGLAS® INVATHERM™ coating can be repaired using PC® SKYFIX A2. It is mandatory to repair damaged coating. FOAMGLAS® INVATHERM™ slabs with considerable / extensive damage should not be installed. FOAMGLAS® INVATHERM™ slabs damaged after installation must be repaired or replaced. Damaged coating will result in a reduction of the properties of the insulation. The PC® SKYFIX A2 is a solvent-free 1-component synthetic resin-based coating, which is specially designed as a repair for damages on the FOAMGLAS® INVATHERM™ coating. It is packed in 25 kg buckets and has a grey colour. The PC® SKYFIX A2 is applied with a small scraper tool. After the repair, the surface has to be levelled and smooth. Once opened the PC® SKYFIX A2 will be useable for several months when applying a foil on the product before closing the bucket each time after use.



Repair of the FOAMGLAS® INVATHERM™ coating

8 WATER FLOW REDUCING LAYER (WFRL) AND FINISHING

Install the WFRL on the FOAMGLAS® INVATHERM™ according to the manufacturer's guidelines and following BS 6229. Further build-up (gravel, paving or green roofs) should also be installed according to the manufacturer's recommendations and guidance. The WFRL is a loosely laid membrane that reduces volume of water that can reach the waterproofed roof deck and it also stops fines from entering the roof system. When installed in an inverted roof, the WFRL reduces the rainwater cooling. This is taken into account in the U-value calculation.

9 IMPORTANT GUIDANCE FOR INSTALLERS

Installers of the WFRL and the finishes (gravel, paving or green roofs) must take care to avoid damages to FOAMGLAS® insulation and the FOAMGLAS® INVATHERM™ coating. Walking over the FOAMGLAS® INVATHERM™ during installation is possible but has to be avoided as much as possible. It is recommended to use a rubber mat during installation of the WFRL and finishes. Point loads are not allowed on the coated side, adequate measures must be taken to prevent this at all times. Damaged FOAMGLAS® INVATHERM™ slabs need to be repaired or replaced. (See point 7.4)



Repair of the FOAMGLAS® INVATHERM™ coating

9.1 Storage of building materials

To avoid damage, no other materials should be stored on top of FOAMGLAS® INVATHERM™.

9.2 Paving on pedestals

The pedestal system must spread the loads on top of the insulation. The accepted loads on the pedestals are in accordance with the compressive strength of the FOAMGLAS® INVATHERM™ and local regulations. The accepted design load is 200kg/pedestal. The pedestals have to meet the following requirements:

- The pedestal product must have a circular base with diameter of at least 170mm.
- The pedestal product must be certified for reaction to fire performance as either Euroclass 'A' or 'A2' in conformance with EN 13501-1: Fire Tests for Building Materials.

The pedestals need to be supported by a rubber underlayment or pad as prescribed in our Technical Data Sheet (TDS). When installing the pedestals on the FOAMGLAS® INVATHERM™, there is no minimum distance from the edge of the FOAMGLAS® INVATHERM™. Compressive strength is equal over the entire surface of the FOAMGLAS® INVATHERM™. Compressive strength is unaffected by the thickness of FOAMGLAS® INVATHERM™ and is measured in accordance with the EN826 Annex A.

9.3 Ballast

The requirements for the ballast (such as type, thickness or size) have to be in accordance with the relevant standards and guidelines. The effect of wind uplift should be checked with the structural engineer.

To protect the FOAMGLAS® INVATHERM™ from damage due to puncture of the ballast, a protection layer should be installed in accordance with the manufacturer's instructions.

9.4 Green roof

Extensive green roofs are lightweight roofs covered with low-maintenance vegetation, such as succulents like sedums, herbs and grasses that are specially adapted to the extreme weather conditions on roofs. On top of the FOAMGLAS® INVATHERM™ a reservoir / drainage board and a filter sheet should be installed, in accordance with the manufacturer's instructions. Install the extensive green roof system in accordance with the manufacturer's instructions.

10 Contact Details

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