Cellular Glass Insulation Guide

FOAMGLAS® for the Building Envelope

www.foamglas.com

FOAMGLAS®
Building

FOAMGLAS®

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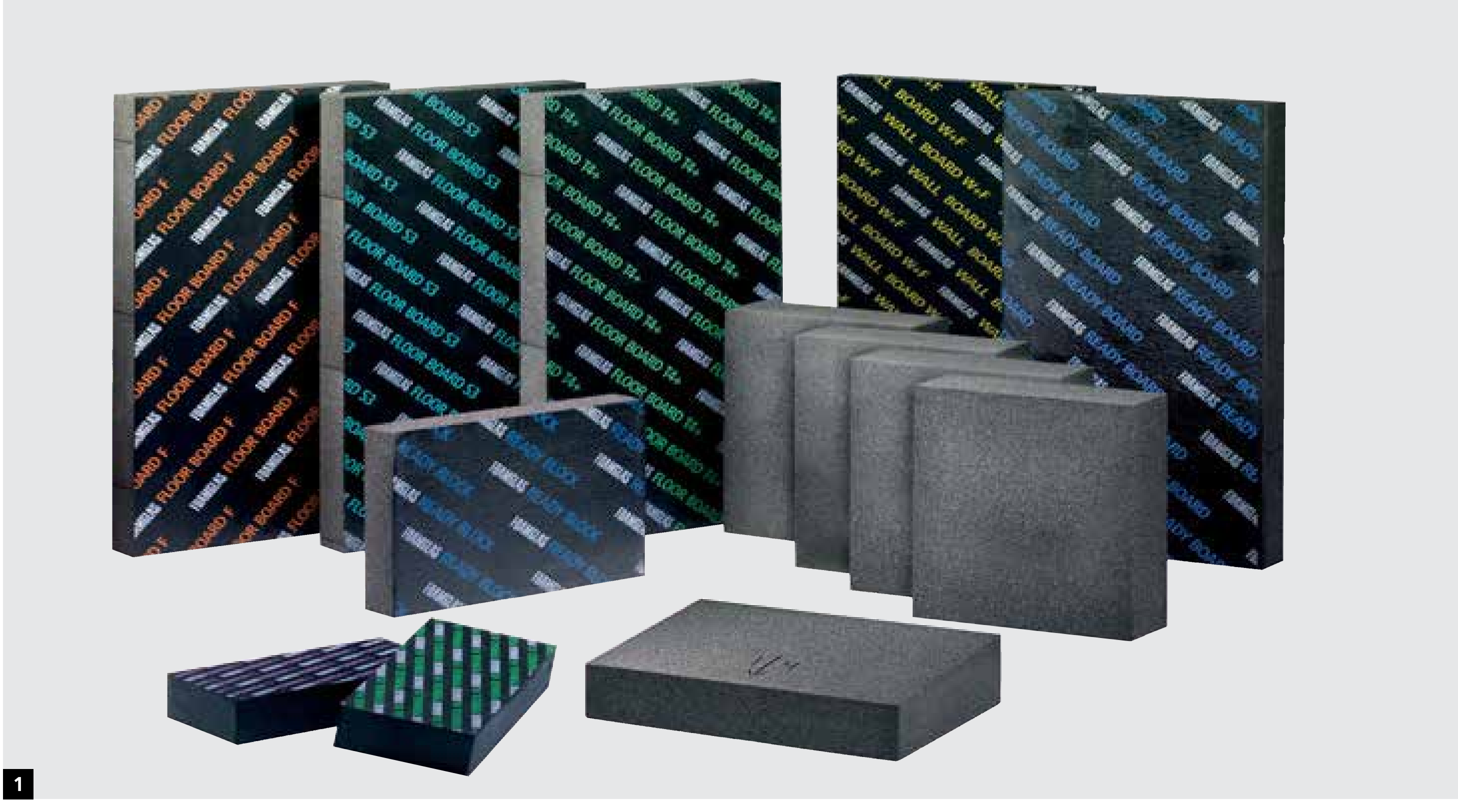


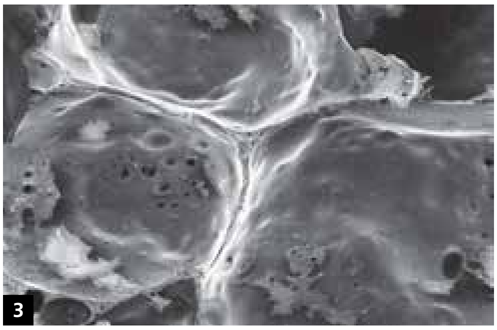
What is FOAMGLAS® Cellular Glass Insulation?

In 1937, Pittsburgh Corning Corporation built their first cellular glass manufacturing facility in Pittsburgh, USA.
FOAMGLAS® cellular glass insulation is the result of more than 75 years of proven performance and continual product improvement. FOAMGLAS® is supplied from the European production plants; the newest opened in 2008 at Klášterec in the Czech Republic. Looking toward the future, the construction of new production facilities and technical offices are planned to service expanding economies around the world, the latest in Yantai, China.

A resilient building material

FOAMGLAS® cellular glass insulation is a light and rigid insulating material. The hermetically sealed glass walled cells will not allow the transmission of liquid, gas or vapour through the material.

1 FOAMGLAS® product range.
2 FOAMGLAS® insulation block inspection during production.
3 Microscope image of FOAMGLAS® cellular glass.
4 Quality control of the finished product.



Completely inorganic and 100% closed cell, FOAMGLAS® provides a unique combination of physical properties. This highly resilient building material withstands the most demanding conditions to be found in construction today.
FOAMGLAS® has proven longevity and reliability over the lifetime of the building.

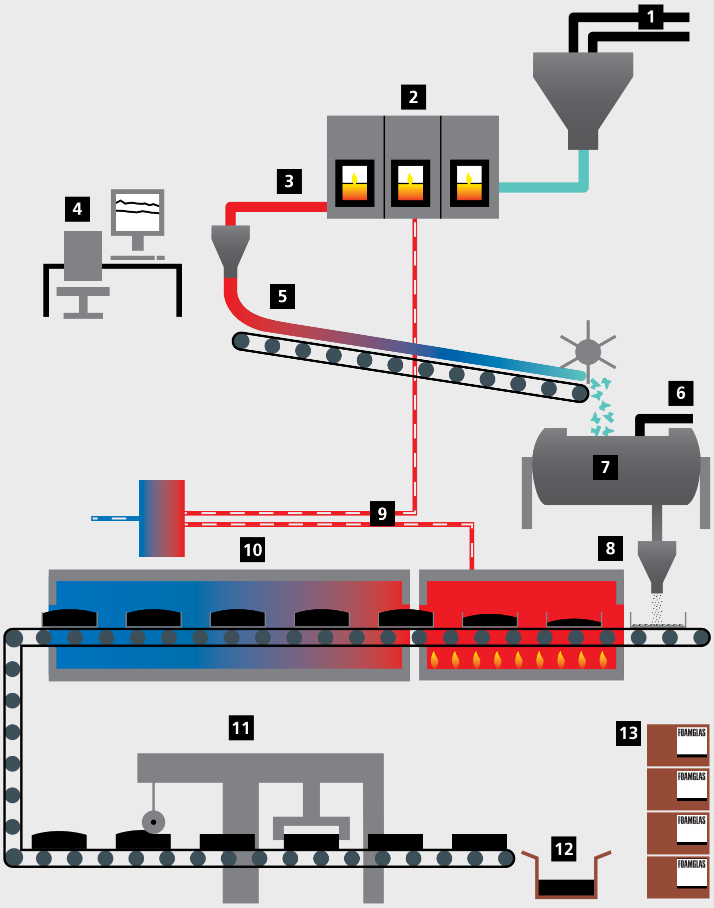
Adjustments during the manufacturing process alter the density of the cellular glass; this in turn changes the thermal conductivity. Low density materials have a lower thermal conductivity value and are used for soffits, walls and façades. Where a higher compressive strength is required, you would specify a higher density cellular glass material.

Manufacturing Process

FOAMGLAS® is manufactured primarily from minimum 60% recycled glass and abundant natural raw materials.

The mix of raw materials and adjustments during the manufacturing process determine the unique combination of FOAMGLAS® properties.
Millions of hermetically sealed glass cells make up the cellular structure; resulting in a vapour tight, waterproof material with an extraordinary structural strength.

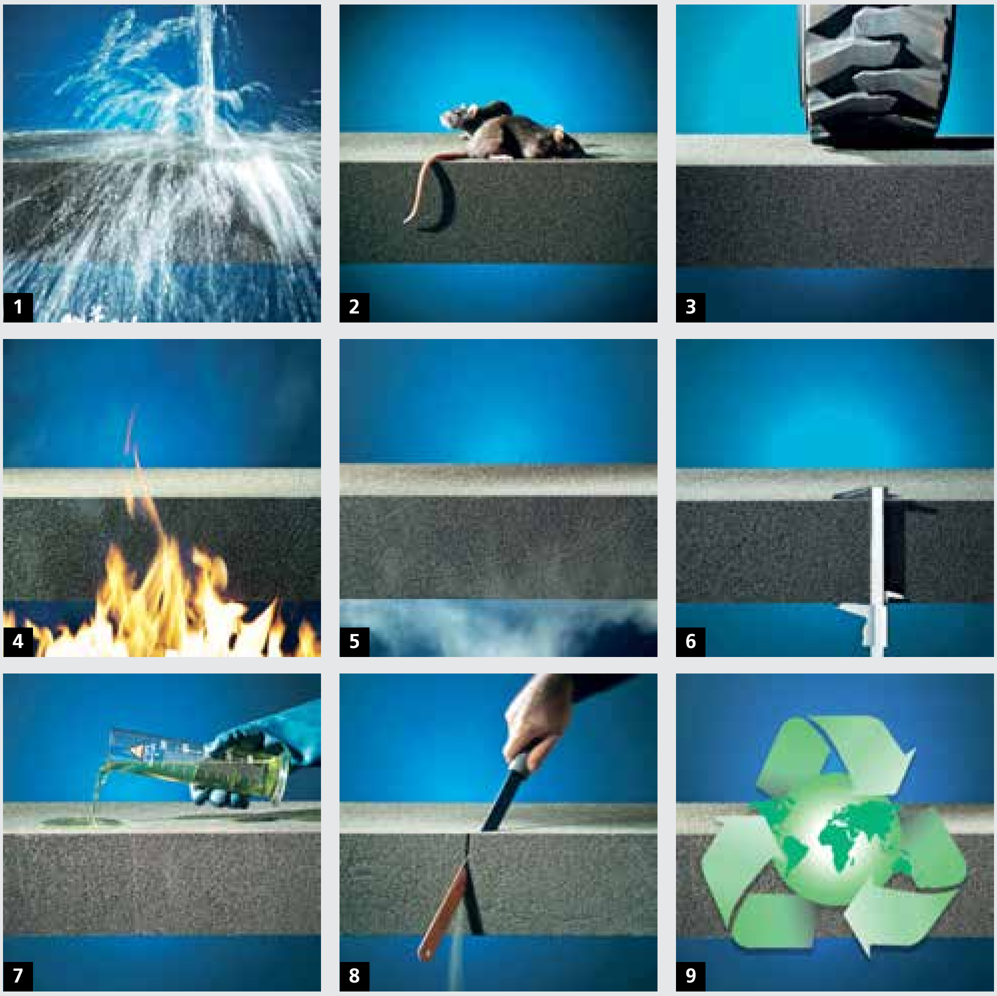
For the building market, a range of Slab, Block and Board insulation products are available in a wide variety of types and thickness.



FOAMGLAS® Manufacturing Process

1 The raw materials are batched and mixed.
2 The smelting furnace.
3 Molten glass is tapped off from the smelting furnace.
4 Control room for monitoring the production.
5 The glass is tapped off onto the conveyor belt, where it cools down before entering into the ball (crushing) mill.
6 The ball mill is loaded with the cooled glass.
7 The ball mill grinds all the ingredients into a fine powder before it is loaded into stainless steel trays.
8 The filled trays pass through an 850° C oven and the natural process of oxidisation takes place. Hermetically sealed vacuum cells are formed within the molten glass, generating the unique cellular structure.
9 Recovery of heat energy.
10 To remove thermal stresses, the FOAMGLAS® passes through a closely controlled cooling (annealing) process.
11 The FOAMGLAS® is cut to size, any off-cuts are returned to the beginning of the production process.
12 FOAMGLAS® products are packaged and labelled.
13 The finished FOAMGLAS® products are stored and prepared for transport.

FOAMGLAS® Features and Benefits



1 **Waterproof** FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed cell, glass structure. It is watertight.
Advantage: The closed cell structure prevents water absorption, penetration or tracking by capillary action.

2 **Vermin proof** FOAMGLAS® cannot rot, it is inorganic, vermin-proof, and can't support plant growth.
Advantage: It is the ideal choice for situations where insulation is behind a façade or in contact with the ground.

3 **Compressive loads** FOAMGLAS® supports high compressive loads without deflection or movement.
Advantage: It is the ideal insulation material for load bearing areas, such as foundations, floors, walkways, terraces, podium roofs, balconies, vehicle parking, and for supporting M&E equipment.

4 **Fire and fumes** FOAMGLAS® consists of pure glass, it is non-toxic and non-combustible.
Advantage: It does not combust, support fire, produce fumes, or present a fire risk in the building structure. Fire behavior: Classification according to EN 13501: A1, non-combustible; classification according to ASTM E 84, smoke development and flame spread - zero.

5 **Vapour control** FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed cell, glass structure. It is gas and vapour tight.
Advantage: FOAMGLAS® is vapour tight, providing both an insulation and high performance vapour barrier in one material.

6 **Dimensionally stable** FOAMGLAS® has a low coefficient of thermal movement, in the same range as concrete and steel.
Advantage: It can be adhesive bonded onto the structure, no mechanical fixings, therefore no thermal bridging.

7 **Acid and chemical resistant** FOAMGLAS® consists of pure glass, it is resistant to organic solvents and acids.
Advantage: It can withstand aggressive mediums and demanding environments.

8 **Easy to cut** FOAMGLAS® consists of pure glass.
Advantage: It is non-toxic, non-hazardous, it does not contaminate the water table; and is easily cut using hand tools.

9 **Ecological** FOAMGLAS® is manufactured using minimum 60% recycled glass. It has a GWP < 1,5 and ODP = 0. It is free of environmentally damaging flame retardants and gas propellants.
Advantage: FOAMGLAS® can be recycled or used in landscaping.

EOTA

BBA APPROVAL INSPECTION TESTING CERTIFICATION

DCL PRODUCT CONFORMITY

AIA MIDDLE EAST

ASTM

FM APPROVED

AIA

1 Kew Gardens, London; Temperate House. Photo: David Iliff.

2 FOAMGLAS® is produced with certified green energy from hydropower plants.

Ecology and Sustainability

Selecting truly sustainable products is now part of the design process. FOAMGLAS® insulation meets with the highest standards.

FOAMGLAS® insulation is manufactured from minimum 60% locally sourced recycled glass, including scrap vehicle glass and off-cuts from the window industry. Raw materials are mineral based and an abundant natural resource.

Commitment to environmental stewardship

Certified green electricity from Norwegian and French hydropower plants supply power to the FOAMGLAS® factory at Tessenderlo in Belgium. This introduction of green energy is just one part of our commitment to reducing the amount of embodied energy required in the manufacturing process. Further information on our energy strategy may be found within the 'Environmental Product Declaration'.

The hermetically sealed FOAMGLAS® glass cell structure is naturally produced, it's free from ecologically harmful blowing agents and flame retardants. Mutagenic, or carcinogenic chemicals are not used during production.
FOAMGLAS® cellular glass insulation does not contain organic compounds, oil or oil by-products, or toxic or flammable materials.
FOAMGLAS® is an inert non-toxic material. At the end of the building's life FOAMGLAS® can be safely incorporated into hardcore or landscaping.

The European organisation '**natureplus**' examines the origin of all recycled and raw materials used by a manufacturer. Natureplus considers both the environmental impact of the manufacturing process and building works at the construction site. Natureplus reviews existing and forthcoming environmental policies. Natureplus lobby government for a new approach to all construction works and promote the use of recycled and sustainable building materials: http://www.natureplus.org/

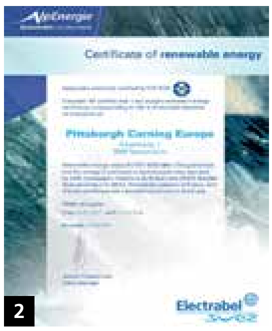
The FOAMGLAS® manufacturing facilities conform to strict environmental compliance and are registered for ISO 14001 accreditation. Full details are within the FOAMGLAS® **Environmental Product Declaration (EPD)**, an independently produced report, which is used for assessing the "green credentials" of all materials.

FOAMGLAS® insulation has a Global Warming Potential of less than 1.5 and an Ozone Depleting Potential of Zero!

natureplus

CLIMATEACTION

PASSIVE HOUSE



LEED® v4 and FOAMGLAS® insulation as a green building material.

LEED® is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across all the metrics that matter most: energy savings, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.

FOAMGLAS® insulation can contribute toward earning LEED® v4 points on a project because it is made from recyclable and sustainable resources. While no one product or material alone can earn LEED® credit points, FOAMGLAS® insulation can be used as part of a strategy to earn points in several credit categories.

Other green rating programs

FOAMGLAS® cellular glass insulation has been named a certified **Living Building Challenge** RED LIST FREE product. This certification is part of the ingredient transparency program, administered by the International Living Future Institute's Living Building Challenge. The Living Building Challenges Declare program requires participating manufacturers to provide a material ingredients list, fostering transparency in the marketplace. FOAMGLAS® cellular glass insulation does not contain CFCs, HCFCs or other hazardous materials or compounds. The RED LIST FREE labels for FOAMGLAS® products can be found in the International Living Future Institute's database: FGL-0001 / FGLz-0002.

FOAMGLAS® cellular glass insulation is **GreenSpec® Listed**, and was awarded as the TOP 10 Green Building Product by BuildingGreen, Inc.

In Russia FOAMGLAS® insulation products have been awarded the **e3 label**, for approved eco-quality.

Institut Bauen und Umwelt e.V.

LEED® v4 credit category options for FOAMGLAS® insulation

Sustainable Sites – Vegetated Roof
LEED-NC Credit 6 – stormwater management
LEED-NC Credit 7.1 – roof heat island effect
FOAMGLAS® insulation can be part of a vegetated roof design, which is one sustainable strategy that can be used to earn both of these Sustainable Sites credits.

Energy & Atmosphere – Energy Performance and Refrigerant Management
LEED-NC Prerequisite 2 – minimum energy performance
LEED-NC Credit 1 – optimize energy performance
In the LEED® rating system, up to 19 points can be awarded for improved energy efficiency. FOAMGLAS® insulation can be used as one strategy to help achieve the required energy performance and to further reduce the amount of energy consumed.

LEED-NC Credits 4.1 and 4.2 – recycled content
FOAMGLAS® insulation that incorporates recycled materials can be included in this calculation of the total recycled content in all building materials.

Materials & Resources – Recyclable, Recycled Content and Regional Material
LEED-NC Credits 2.1 and 2.2 – construction waste management
FOAMGLAS® insulation scrap waste can be recycled.

LEED-NC Credit 4 – enhanced refrigerant management
LEED-NC Credits 5.1 and 5.2 – regional materials
Nearly 75% (by weight) of raw materials used to make FOAMGLAS® cellular glass insulation come from within 500 miles of the manufacturing facilities.

Indoor Environmental Quality – Low-Emitting Materials
LEED-NC Credit 4 – low-emitting materials
Though insulation is not considered in this section, using FOAMGLAS® insulation eliminates another potential source of VOCs in a building. Low-VOC sealants and adhesives sold by Pittsburgh Corning could be used as part of this strategy.

Pittsburgh Corning FOAMGLAS® is committed to conducting its business in an environmentally responsible manner that protects the public, its employees, and our country's natural resources. Therefore, Pittsburgh Corning's environmental practices are in compliance with all applicable environmental laws and regulations.

FOAMGLAS® Applications

1

Flat Roofing:
Flat Roofs on Concrete, Timber and Metal Structures

The roof is a very important element of the building envelope. Flat roofs perform many tasks, such as car parking, walkways, playgrounds, terraces and platforms for M & E equipment. The flat roof must provide reliable thermal and weatherproof protection for the entire service life of the building.

FOAMGLAS® cellular glass insulation is ideal for the most demanding roof situations. With a closed cell vapour tight internal structure, its capability to withstand high compressive loads and to provide a permanent thermal performance; FOAMGLAS® is proven to stand the test of time.

Technical features and benefits

■ **Compressive loads**
FOAMGLAS® supports high compressive loads without deflection or movement. It is the ideal insulation material for load bearing areas, such as, foundations, floors, walkways, terraces, podium roofs, balconies, vehicle parking and for supporting M & E equipment.

1 One New Change building, St. Paul's, London. Concept Architect: Jean Nouvel Executive Architect: Sidell Gibson FOAMGLAS® insulation gives peace of mind. Photo: EG Focus.
2 Atocha Station, Madrid, Spain. Architect: Rafael Moneo.
3 Vnukovo International Airport, Moscow. Architect: Borzenkov Leonid Leonidovich.
4 Benedictine Monastery of Tabgha, Sea of Galilee, Israel. Architect: Prof. Alois Peitz & Hubertus Hillinger, Trier, Germany.

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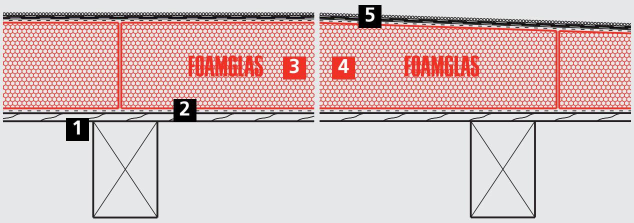
FOAMGLAS® flat and tapered insulation can be used on concrete, timber and metal structures.

■ Fire and fumes
FOAMGLAS® consists of pure glass, it's non-toxic, does not combust, support fire, produce fumes, or present a fire risk within the building structure.

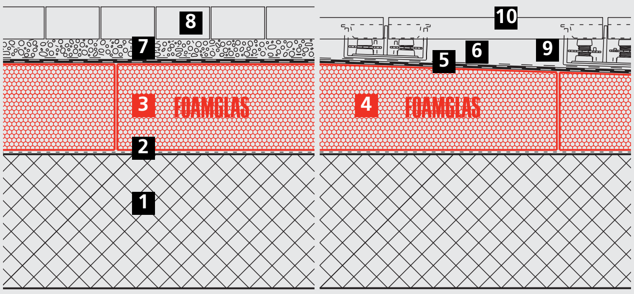
■ Water and vapour control
FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed glass cell structure. It is gas and vapour tight. The close cell structure prevents water penetration or tracking by capillary action. FOAMGLAS® and its adhesive are vapour tight, providing both an insulation system and high performance vapour barrier in one material.

■ Dimensional stability
FOAMGLAS® has a low coefficient of thermal movement, in the same range as concrete and steel, and therefore is simply bonded onto the building structure with adhesive, therefore no thermal bridging, and no corrosion of mechanical fixings.



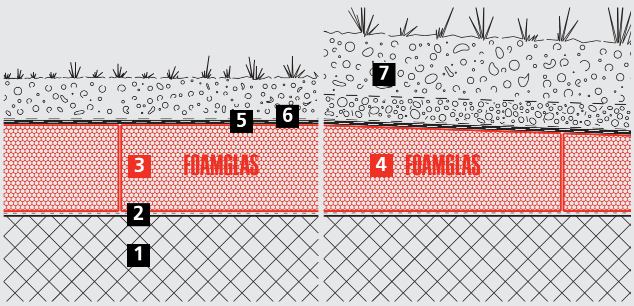
FOAMGLAS® Compact Roof with membrane waterproofing

1 Timber structure
2 Separating layer nailed on or self-adhesive layer
3 FOAMGLAS® slabs / blocks / boards laid in hot bitumen or bonded with PC® cold adhesive
4 FOAMGLAS® TAPERED slabs / blocks laid in hot bitumen or bonded with PC® cold adhesive
5 Two layers of bitumen waterproofing membranes, top layer UV-resistant



FOAMGLAS® Compact Roof with paving slabs or interlocking paving stones

1 Structure
2 Primer coat
3 FOAMGLAS® slabs / blocks laid in hot bitumen or bonded with PC® cold adhesive
4 FOAMGLAS® TAPERED slabs / blocks laid in hot bitumen or bonded with PC® cold adhesive
5 Two layers of bitumen waterproofing membranes
6 Separation / protection layer
7 Bedding layer
8 Interlocking paving stones
9 Support pads
10 Paving



FOAMGLAS® green roof on concrete deck

1 Structure
2 Primer coat and FOAMGLAS® adhesive
3 FOAMGLAS® slabs, blocks or boards or
4 FOAMGLAS® TAPERED blocks or slabs
5 Two layers of bitumen waterproofing
6 Separation / protection layer
7 Planting system (extensive or intensive)

1 Carpet Museum, Baku, Azerbaijan. Architect: Hoffmann - Janz ZT GmbH, Vienna.
2 Shopping Mall Southside, Wandsworth under construction.
3 FOAMGLAS® READY BOARD, for fast-track installation.
4 Torch-on waterproofing.

Ready-Roof Solutions on steel-deck

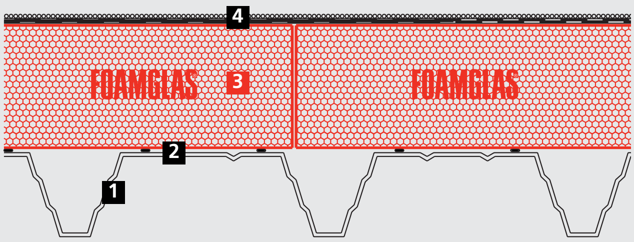
FOAMGLAS® READY BOARD or FOAMGLAS® ROOF BOARD can be applied with an adhesive to metal decks. These systems have excellent resistance to wind uplift and are ideal for buildings with internal high humidity conditions. The advantage is a lightweight, fast track, vapour tight roof with a long service life.

Fast track installation

FOAMGLAS® READY BOARD or ROOF BOARD installed on a metal deck ensures that the deck is considerably stiffened, reducing deflection caused by wind uplift or roof traffic.

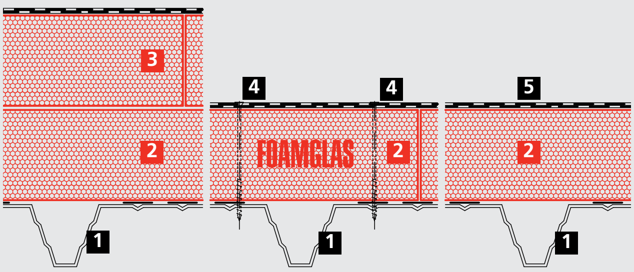
The fast installation of the FOAMGLAS® READY BOARD / ROOF BOARD ensures a quicker build program which benefits the contractor and the client alike.

5 Ready-Roof cross section.
6 FOAMGLAS® READY BOARD, 600 x 1200 mm.
7 FOAMGLAS® READY BLOCK, 450 x 600 mm.
8 FOAMGLAS® READY BLOCK tapered.
9 FOAMGLAS® READY BOARD G1 and G2, 600 x 1200 mm.
10 FOAMGLAS® READY BLOCK G1 and G2, 450 x 600 mm.



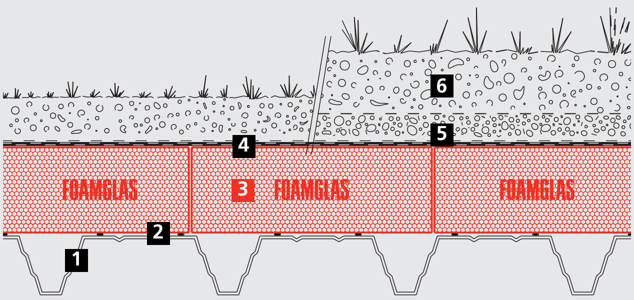
FOAMGLAS® READY BOARD on metal deck

1 Metal deck
2 Suitable cold adhesive
3 FOAMGLAS® READY BOARD, bonded with FOAMGLAS® adhesive
4 Waterproofing, 2 layers of torch-on bitumen roofing membrane



FOAMGLAS® ROOF BOARD / READY BOARD on metal deck

1 Metal deck
2 FOAMGLAS® ROOF BOARD G2 or FOAMGLAS® ROOF BLOCK G1, bonded with adhesive
3 FOAMGLAS® READY BOARD or FOAMGLAS® READY BLOCK (in case of multi layer system)
4 Waterproofing membrane, mechanically fixed
5 Fleece backed waterproofing membrane, bonded with a cold adhesive



FOAMGLAS® READY BOARD on metal deck, Green Ready Roof

1 Metal deck
2 Suitable cold adhesive
3 FOAMGLAS® READY BOARD, bonded with FOAMGLAS® adhesive
4 Waterproofing, 2 layers of torch-on bitumen roofing membrane
5 Separation or protection layer
6 Planting system

1

Tapered Insulation for Flat Roofs

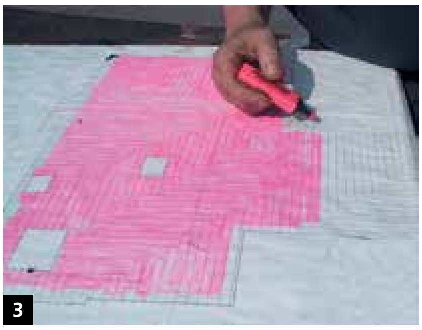
Where we have a level structure, the cellular glass insulation can be supplied with a tapered top surface to ensure water runs off the roof surface, this is the FOAMGLAS® TAPERED Roof Insulation System.

Typically for new build projects, architectural details and drawings are used as the starting point for the proposed design. A detailed site survey may also be required.
At door thresholds, water outlets and parapets the maximum and minimum heights are taken into account. We consider the slope, the direction of drainage, the locations of gutters and drains, all this is done while ensuring the overall average thickness of the tapered insulation system meets the required thermal performance.

A design drawing is produced showing the tapered insulation layout, the critical heights and dimensions. During manufacture each block of cellular glass insulation is individually machine tapered, and it is given a unique part number which matches up with its position on the tapered design drawing.

1 FOAMGLAS® TAPERED insulation for public concourse: Entrance to London Bridge Station and the Shard Tower. Design Architects: Renzo Piano Building Workshop. Executive Architects: Adamson Associates, London.
2 Pavilion's Hall of Volokolamskaya Metro Station, Moscow. Architect: Nekrasov Alexander Vasilyevitch.
3 Labeling extends down to each FOAMGLAS® TAPERED block and corresponds to the layout drawing.
4 The direction of fall is indicated on each FOAMGLAS® TAPERED slab.

2



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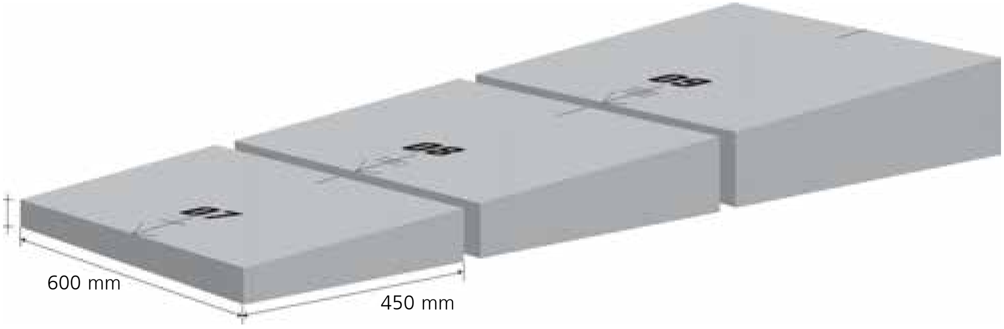


Where can I use FOAMGLAS® TAPERED insulation?

FOAMGLAS® TAPERED insulation is suitable for both new build and refurbishment projects. Older flat roofs get a new lease of life; the thermal performance, water management and drainage is improved.

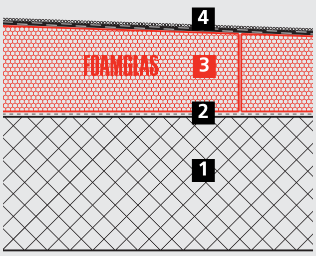
Gradients / Taper / Falls / Slope

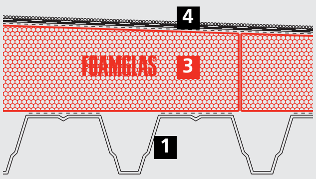
FOAMGLAS® is available in a range of standard tapered slopes, to suit every design situation.

Design assistance

For assistance in designing your FOAMGLAS® TAPERED insulation system, please contact FOAMGLAS®, Pittsburgh Corning UK.

The design drawings are produced using a bespoke CAD system.





FOAMGLAS® TAPERED insulation system

1 Structure / Metal deck
2 Primer coat
3 FOAMGLAS® slabs / blocks with tapered top surface, laid in hot bitumen or bonded with PC® cold adhesives
4 Two layers of bitumen waterproofing membranes, top layer UV-resistant


1

1 The Barbican Centre, London EC2, constructed 1971-1982. Architect: Chamberlain, Powell & Bon. FOAMGLAS® insulation for terraces, flat and green roofs with asphalt and plantings.

2 French War Museum, "L'Historial de la Vendée", Les Lucs-sur-Boulogne. Architects: Plan 01; and Michel Joyau.

3 Employee's Federation (Centre patronal), Paudex, Switzerland. Architect: Pierre & Fabien Steiner SA, Brent

4 Technical University, Delft, The Netherlands. Architect: Mecanoo Architecten, Delft.

Green Roofs

The FOAMGLAS® green roof can be designed as an intensive or extensive planted system. Depending on the structural conditions it is suitable for concrete, steel or wood decks. Architects choose FOAMGLAS® insulation for their green roof projects because of its almost unrivalled compressive strength and for the peace of mind that comes from using this watertight fully bonded roof construction.

Moisture demands on green roofs

Roofs with planted areas are subject to an increased amount of vapour and moisture. FOAMGLAS® cellular glass is vapour-tight, condensation can **never** form within the insulation, which means thermal aging will **not** occur.

A major benefit for vegetated roofs: resistance to roots, pests, fertilizers

FOAMGLAS® insulation is inorganic, which makes it highly resistant to all forms of infestation and vermin. The closed glass cells do not store moisture, it is an effective shield against root penetration; it's also resistant to chemicals, with no risk of fertilizer damaging the insulation.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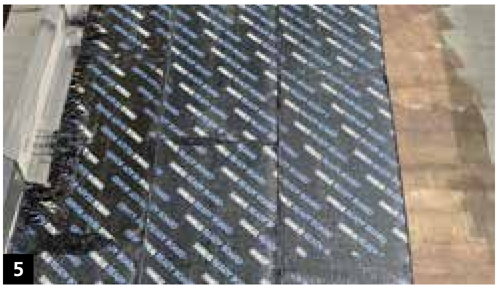


5 Installed FOAMGLAS® insulation.
6 The waterproof membrane is fully bonded.
7 Installation of a drainage layer and filter fleece.

Plantings

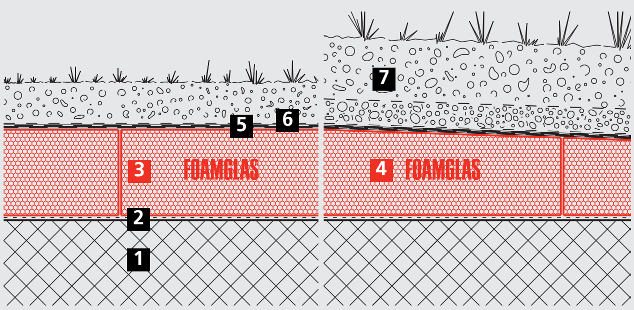
Extensive green roof systems contain low-level foliage and ground-cover plants. There's no need to replicate the soil thickness or the nutrition and irrigation requirements of a real garden. A soil thickness of 50 to 100 mm is sufficient and the plants can even grow on pitched or sloping roofs. For extensive planting systems a falling gradient of at least 1.3% is recommended.

Intensive green roof planting systems are more similar to conventional gardens and require more consideration in terms of soil, nutrition and roof durability. Intensive green roofs typically require a greater soil thickness.

The build-up of a green compact roof from the waterproofing level upward generally includes:
Soil: the planting medium for the plants
Filter layer: to prevent fine particulate soil from obstructing the drainage layer
Drainage layer: to carry off rainwater or for water retention
Building protection mat: to offer protection against mechanical damage of the anti-root membrane and the roofing sheets
Anti-root membrane: to protect the waterproofing against root penetration (not required as an additional layer, if the waterproofing itself is anti-root).

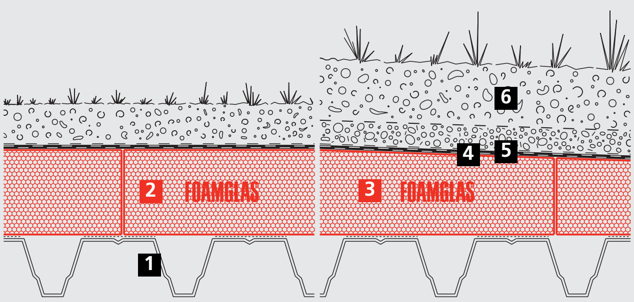
It is highly recommended to use materials that prevent moisture penetration. Fully bonded, vapour tight and waterproof FOAMGLAS® compact roof systems are the experts choice.

Solutions with synthetic membranes (PVC, TPO, EPDM, etc.) and single-ply system on request.



FOAMGLAS® green roof on concrete deck

1 Structure
2 Primer coat and FOAMGLAS® adhesive
3 FOAMGLAS® slabs, blocks or boards or
4 FOAMGLAS® TAPERED blocks or slabs
5 Two layers of bitumen waterproofing
6 Separation / protection layer
7 Planting system (extensive or intensive)



FOAMGLAS® green roof on metal deck

1 Metal deck
2 FOAMGLAS® slabs / blocks / boards laid in hot bitumen or bonded with PC® cold adhesive
3 FOAMGLAS® TAPERED slabs / blocks laid in hot bitumen or bonded with PC® cold adhesive
4 Two layers of bitumen waterproofing
5 Separation / protection layer
6 Planting system (extensive or intensive)

1 FOAMGLAS® rooftop parking.
2 FOAMGLAS® insulation for the car park of "Merter M1 Merkez Santiyesi" shopping mall, Istanbul, Turkey. Contractor builder: IS.
3 Car park of "Mercury" shopping centre, České Budějovice, Czech Republic. FOAMGLAS® S3 for heavy traffic deck of the bus terminal. Architect: Atelier 8000, České Budějovice.
4 FOAMGLAS® S3 slabs. Tesco Super Store, Sale, Cheshire.

Accessible Roofs for: Terraces, Podium, Vehicles, M & E etc.

Heavy traffic rooftops such as terraces and parking areas experience a great deal of stress from constant load and continual usage. It is crucial that the insulation and waterproofing membrane withstand all static and dynamic loads without deformation. Thermoplastic insulation materials deform gradually over time, diminishing the thermal performance and causing stress to the waterproofing membrane. FOAMGLAS® cellular glass insulation has the highest compressive strength of any insulating material. There is no risk of deformation, it is a truly structural insulation.

FOAMGLAS® flat or FOAMGLAS® TAPERED blocks or slabs – for service and parking roofs

FOAMGLAS® has a remarkable compressive strength, it has a very high resistance to edge pressure and does not creep or deform over time.

FOAMGLAS® has remarkable load bearing capabilities when subjected to dynamic movements, such as sheer force from braking and accelerating. Loads can be applied without any deformation of the cellular glass insulation.

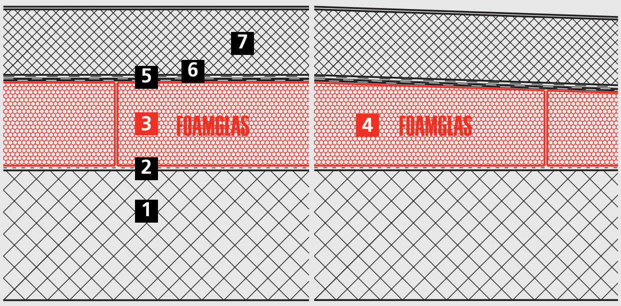
■ **Roofing membrane**

Roofing membranes or asphalt wearing surfaces are directly applied over the insulation creating a 'warm' roof. This ensures a waterproof roofing system is achieved; protecting against water and water vapour penetration.

■ **Load distribution slab**

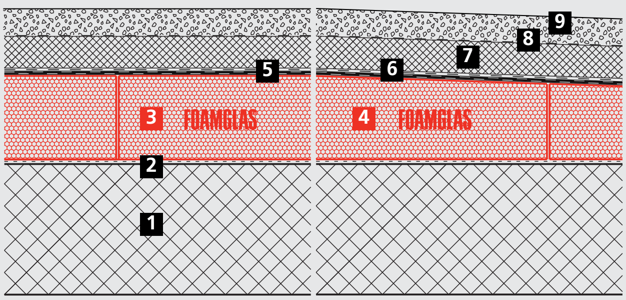
In order to create a robust structure for heavy vehicle parking decks and plazas a load distribution slab may be recommended.
The design of the load distribution slab is dependent on the structural engineers calculations and recommendations.

Compression and vapour-proof FOAMGLAS® insulation allows architects and engineers to design using a variety of trafficable finishes:
- Concrete
- Asphalt
- Pavers



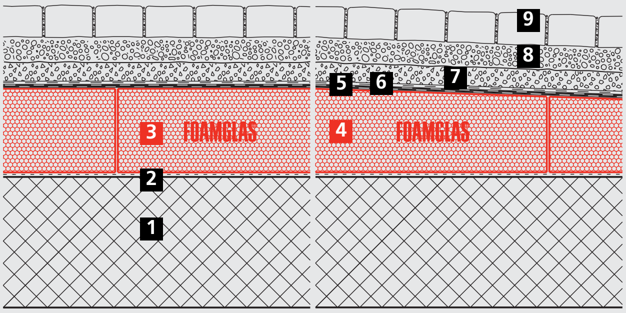
FOAMGLAS® roof top car deck

1 Structure
2 FOAMGLAS® primer coat
3 FOAMGLAS® slabs or
4 FOAMGLAS® TAPERED slabs, laid in hot bitumen
5 Two layers of bitumen waterproofing membranes
6 Separation or slip layer
7 In-situ concrete slab



FOAMGLAS® car park roof with mastic asphalt layer

1 Structure
2 FOAMGLAS® primer coat
3 FOAMGLAS® slabs or
4 FOAMGLAS® TAPERED slabs, laid in hot bitumen
5 Two layers of bitumen membranes for early waterproofing
6 Separation layer
7 Load distribution reinforced concrete slab
8 Separation layer
9 Two layers of mastic asphalt



FOAMGLAS® car park roof with paving

1 Structure
2 FOAMGLAS® primer coat
3 FOAMGLAS® slabs or
4 FOAMGLAS® TAPERED slabs, laid in hot bitumen
5 Two layers of bitumen membranes for early waterproofing, top layer heat resistant
6 Separation layer
7 Protection layer of mastic asphalt
8 Chippings or gravel
9 Pavement / interlocking paving stones

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1 FOAMGLAS® metal roof. FOAMGLAS® READY BOARD with VM Zinc standing seam. Four Seasons Hotel, Park Lane, London. Architects: Eric Parry, London.

2 Archeological Museum, Delphi, Greece. Architect: Meletitiki - Alexandros Tombazis, Athens.

3 FOAMGLAS® for roof and façade beneath KME, Tecu Bronze cladding, The Granary, Barking, East London. Architect: Pollard Thomas Edwards Architects.

4 Aquapark Kohoutovice, Brno, Czech Republic. Architect: Atelier K4, Brno.

Metal Standing Seam Roofing

Unusual and striking roof shapes can be achieved using a wide range of materials, including metal. Metal is extremely durable, proven to withstand demanding environments, such as coastal and mountain locations. FOAMGLAS® has developed a unique method of securing the metal roof sheet to the insulation, thus eliminating thermal bridging. Metal roofing combined with FOAMGLAS® is very popular for many projects, ranging from small houses, to boutique hotels, schools and offices. The vapour tight characteristics of FOAMGLAS® make the system particularly suited to high humidity environments such as swimming pools, health spas and leisure centres.

Proven long term performance, with NO thermal bridging

Traditional metal roofs are secured to the structure with many screw fixings, each being a potential thermal bridge. Over the years the metal will take on a natural patina and removing the roofing system at a later date is highly undesirable. The insulation layer should have a proven reliable performance, this long life expectancy should be equal to the external roof sheet, FOAMGLAS® achieves this.

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Unique fixing system by FOAMGLAS®, for standing seam and for profiled sheet metal

For metal roofs FOAMGLAS® insulation has a unique fixing system. The metal roofing is secured to a metal plate inserted into the upper surface of the FOAMGLAS® insulation, this eliminates the thermal bridge between the metal roof sheet and the building structure. With its ability to withstand high structural loads, its closed cell vapour tight structure and its permanent thermal performance, FOAMGLAS® is proven to stand the test of time.

Technical features

Eliminating thermal bridging

Traditionally metal roofs are secured to the building structure with brackets and screw fixings, these pass through the insulation layer and vapour control layer; each bracket and fixing is a thermal bridge.

FOAMGLAS® cellular glass insulation has a unique fixing system for metal roofing. A plate is inserted into the surface of the FOAMGLAS®, the metal roof fixing brackets are then secured to this plate; there is no thermal path between the metal roof sheet and the structure of the building. Thermal bridging is eliminated.

Waterproof

FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed glass cell structure. It is gas and vapour tight. The closed cell structure prevents water absorption, penetration or tracking by capillary action.

Fire and fumes

FOAMGLAS® consists of pure glass, it is non-toxic, does not combust, support fire, produce fumes, or present a fire risk in the building structure.

Vapour control

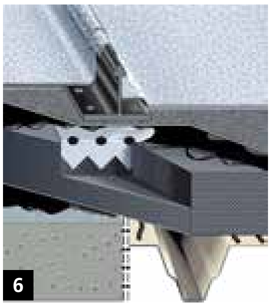
FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed glass cell structure. It is gas and vapour tight. The closed cell structure prevents water penetration or tracking by capillary action.
FOAMGLAS® and its adhesive is vapour tight, providing both an insulation system and high performance vapour barrier in one material.

Dimensionally stable

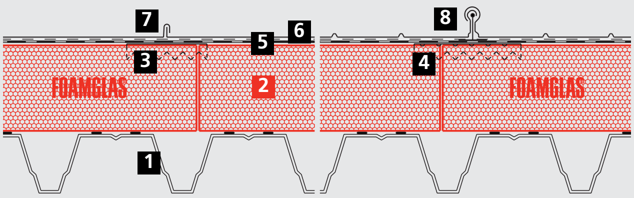
FOAMGLAS® has a low coefficient of thermal movement, in the same range as concrete and steel and is therefore simply adhesive bonded onto the building structure.

Non-toxic

FOAMGLAS® consists of pure glass. It is non-toxic, non-hazardous, it does not contaminate the water table; and is easily cut using hand tools.

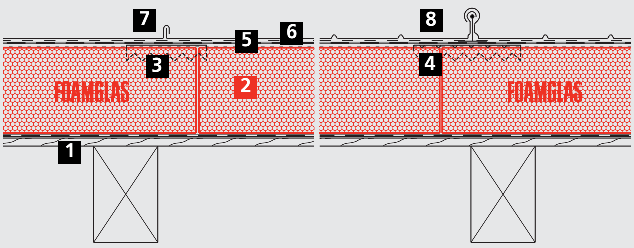


5 Fully supported standing seam roofing.
6 Aluminium roofing, e.g. KALZIP.



FOAMGLAS® Ready-Roof with standing seam roofing on trapezoidal metal deck

1 Profiled metal deck
2 FOAMGLAS® READY BOARD, bonded in FOAMGLAS® adhesive
3 FOAMGLAS® "non-coldbridge" serrated fixing plate PC® SP 150/150
4 FOAMGLAS® "non-coldbridge" serrated fixing plate PC® SP 200/200
5 Bitumen waterproofing membrane
6 Separation layer
7 Standing seam metal such as copper, zinc, stainless steel etc.
8 Aluminium standing seam



FOAMGLAS® Ready-Roof with standing seam roofing on timber deck

1 Timber substrate / multilayer composite board
2 FOAMGLAS® READY BOARD, bonded in FOAMGLAS® adhesive
3 FOAMGLAS® "non-coldbridge" serrated fixing plate PC® SP 150/150
4 FOAMGLAS® "non-coldbridge" serrated fixing plate PC® SP 200/200
5 Bitumen waterproofing membrane
6 Separation layer
7 Standing seam metal such as copper, zinc, stainless steel etc.
8 Aluminium standing seam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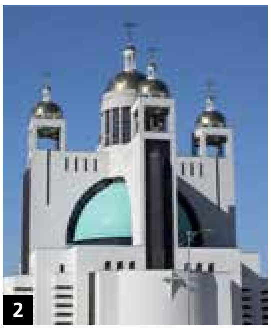
Façade:
EWI System, Insulated Renders

The external walls usually represent a large percentage of the overall surface area of a building and thus are a very important element of the total envelope. Replacing external wall insulation is an extremely costly exercise and in many cases virtually impossible. The external wall insulation must provide reliable performance for the entire service life of the building.

Ecological and permanent thermal performance with no degradation

FOAMGLAS® cellular glass insulation is ideal for the most demanding external wall situations. With its closed cell vapour tight structure and its unique capability to dramatically reduce thermal bridging; combined with its permanent thermal performance, FOAMGLAS® is proven to stand the test of time.

1 FOAMGLAS® insulated render façade (EWI) with natural hydraulic lime. Tietgens, Copenhague. Tony Fretton Architects, London.
2 Patriarchal Cathedral – Resurrection Church, Kiev, Ukraine. Architect: Nikolai Levchuk.
3 Retrofitting of FOAMGLAS® thermal insulation on private villa.
4 FOAMGLAS® insulated render for residential buildings.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Technical features

■ Reducing thermal bridging
External wall insulation systems (EWI) are typically secured to the building structure with many screw fixings. Each screw fixing is a thermal bridge, which passes through the insulation layer and vapour control layer. It is difficult to achieve air tightness and continuity of the insulation.

FOAMGLAS® is adhesive bonded onto the structure, the external reinforcing mesh is secured using a minimal quantity of thermally isolated screw fixings; the renders are then applied. Thermal bridging is minimised, air tightness and continuity of the insulation is greatly improved.

■ Vapour control
FOAMGLAS® consists of pure glass. It has a truly hermetically sealed, closed cell glass structure, it's gas and vapour tight.
FOAMGLAS® and its adhesive is vapour tight, providing both: an insulation system and high performance vapour barrier in one material.

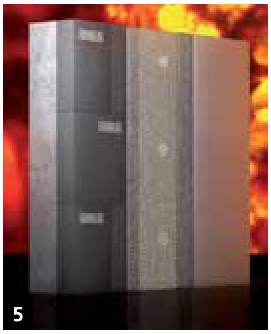
■ Waterproof
FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed cell glass structure. It is gas and vapour tight. The closed cell structure prevents water absorption, penetration or tracking by capillary action.

■ Dimensionally stable
FOAMGLAS® has a low coefficient of thermal movement, in the same range as concrete and steel, it is simply adhesive bonded onto the building structure.

■ Non-toxic
FOAMGLAS® consists of pure glass, it is non-toxic, non-hazardous, it does not contaminate the environment; and is easily cut using hand tools.

■ Fire and fumes
FOAMGLAS® is non-toxic, does not combust, support fire, produce fumes, or present a fire risk in the building structure.

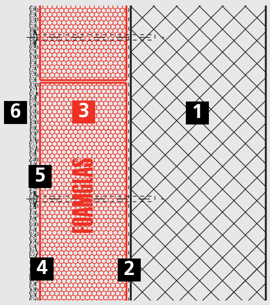
Fire safety: a non-combustible insulation FOAMGLAS® cellular glass insulation is non-combustible (ASTM E 136, ASTM E 84 and Euroclass A1).



5 The ecological and most fire safe solution: FOAMGLAS® external wall insulation (EWI) with mineral render.




Installation sequence for FOAMGLAS® external wall insulation with render.



FOAMGLAS® external wall insulation with a thick layer of mineral render

1 Solid wall (concrete/brickwork)
2 Primer coat
3 FOAMGLAS® slabs bonded in FOAMGLAS® adhesive
4 Topcoat with FOAMGLAS® adhesive
5 Reinforcing mesh, mechanically fastened
6 Thick layer of render

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Façade:
Cladding and Rainscreen Systems

FOAMGLAS® cellular glass insulation is ideal for the most demanding wall and façade situations. With its closed cell vapour tight structure and unique capability to dramatically reduce thermal bridging, FOAMGLAS® has a permanent thermal performance and is proven to stand the test of time.

Risks and hazards

Traditional façades and cladding systems are secured to the building structure with brackets and screw fixings. Each bracket and fixing is a thermal bridge, which pass through the insulation and vapour control layer.
Using this traditional system, it is very difficult to achieve long term air tightness and continuity of the insulation.

Reducing thermal bridging

FOAMGLAS® cellular glass insulation has a unique fixing system for façade and cladding systems. A plate is inserted into the surface of the FOAMGLAS® and secured back to the building structure using thermally isolated fixings. The façade or cladding system is then secured to this plate; there is no thermal path between the façade or cladding system and the structure of the building. The thermal bridging is minimised, air tightness and continuity of the insulation is greatly simplified. The concept improves overall thermal performance.

1 FOAMGLAS® insulation on roof and façade. Firstsite Visual Arts Centre, Colchester. Architect: Raphael Viñoly, London.
2 Museum, Didymoteichon, Thrace / N. Greece. Architect: MEAS S.A., P. Petrakopoulos, E. Digonis & Associates, Athens.
3 Emin Duru, Private villa, Karaman, Turkey. FOAMGLAS® insulation behind ventilated facade. Architect: Promin Architecture.
4 FOAMGLAS® slabs for cultural centre façade, Kunsthaus Graz, Austria. Architects: Peter Cook and Colin Fournier.

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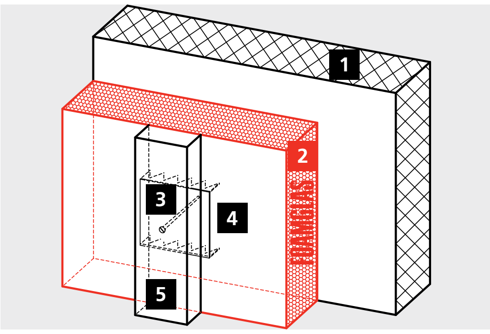
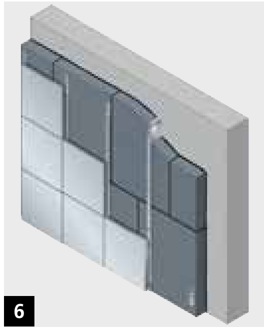


FOAMGLAS®-*plus* façade
with "non-cold bridge" fixing plate

1 Load bearing wall
2 FOAMGLAS® T4+ slabs, bonded with FOAMGLAS® adhesive
3 FOAMGLAS® fixing plate with central fixing hole (PC® SP 150/150)
4 Thermally isolated fixing connection to the wall structure
5 Support structure for the façade cladding



5 FOAMGLAS® façade with standing seam cladding.
6 FOAMGLAS® system for flat-locking cassette elements.

Technical features

■ High compressive strength

FOAMGLAS® supports high compressive loads without deflection or movement. It can be sandwiched between the façade finishes and the building structure without any deformation.

■ Fire and fumes

FOAMGLAS® consists of pure glass, it is non-toxic, does not combust, support fire, produce fumes, or present a fire risk to the building structure or the inhabitants within a building.

■ Vapour control

Due to the hermetically sealed closed glass cell structure the FOAMGLAS® product is gas and vapour tight. The closed cell structure prevents water/moisture penetration and tracking by capillary action.
FOAMGLAS® and its adhesive is vapour tight, providing both an insulation system and high performance vapour barrier in one material.

■ Waterproof

FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed glass cell structure. It is gas and vapour tight. The closed cell structure prevents water absorption, penetration or tracking by capillary action.

■ Dimensionally stable

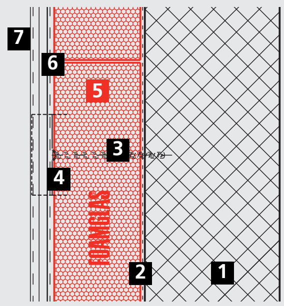
FOAMGLAS® has a low coefficient of thermal movement, in the same range as concrete and steel and is therefore simply adhesive bonded onto the building structure.

■ Vermin proof

FOAMGLAS® cannot rot, it is inorganic, it's vermin-proof and cannot support plant growth. It's the ideal choice for locations where the insulation is behind a façade.

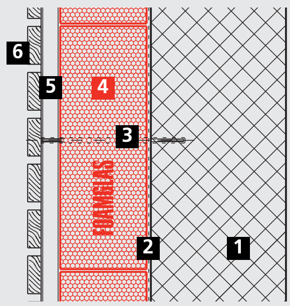
■ Non-toxic

FOAMGLAS® is non-toxic, non-hazardous, it does not contaminate the environment and is easily cut using hand tools.



FOAMGLAS® façade system with standing seam or profiled metal cladding

1 Solid wall (concrete/brickwork)
2 Primer coat
3 Thermally isolated fixing
4 FOAMGLAS® fixing plate (PC® SP 150/150)
5 FOAMGLAS®, bonded with FOAMGLAS® adhesive
6 Separation layer
7 Standing seam or profiled metal cladding with fixing brackets/clips



FOAMGLAS® insulation for ventilated facade with timber cladding

1 Solid wall (concrete/brickwork)
2 Primer coat
3 Thermally isolated fixing screws
4 FOAMGLAS®, bonded with FOAMGLAS® adhesive
5 Timber substructure
6 Wood cladding

Underground Structures: Below Ground Walls

It is important to choose an insulation system which will ensure long-term protection of the building and allow full use of the below ground floor levels. The insulation should resist soil pressure and moisture. In combination with a waterproofing system and / or drainage membrane FOAMGLAS® cellular glass provides an excellent risk free system. It is an insulation system and vapour barrier in one material; it prevents water absorption, penetration or tracking by capillary action. Many different systems are available, providing improved performance for waterproof wall constructions and retaining walls.

Resilient system for below ground walls

The unique material properties of FOAMGLAS® insulation ensure the best long term insulation performance for below ground walls, offering a high resistance to difficult underground conditions.

1 One New Change flagship store, St. Paul's London. Architect: Jean Nouvel. FOAMGLAS® retaining wall insulation. Photo: Paul Riddle

2 Extension building of Deutsches Historisches Museum, Berlin. Architect: I.M. Pei

3 British Library, London. Architect: Sir Colin St. John Wilson. Photo: Patche99z.

4 British Embassy in Berlin. The below ground walls are FOAMGLAS® insulated, giving a high resistance to underground conditions. Architect: Ridge and Partners, Oxford.

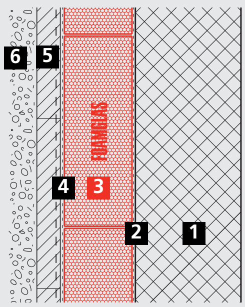
5 Spreading a cold adhesive on the edges of the FOAMGLAS® slabs.
6 Insulation of below ground concrete walls: a thick adhesive coating is spread on the FOAMGLAS® surface.
7 Below ground walls and M&E plant roof are insulated with FOAMGLAS® READY BOARD.
8 Insulation of a retaining wall with FOAMGLAS® boards.

Cellular glass insulation is totally impervious to both water and water vapour, it retains its initial insulation value (thermal conductivity), under all soil moisture conditions.
FOAMGLAS® is inorganic and thus resistant to mould, vermin and chemical or corrosive substances.
FOAMGLAS® will withstand the pressure of soil and groundwater, even at considerable depths below ground.

Technical features
(below ground wall and structure)

- Vermin proof
- High compressive strength
- Vapour control
- Waterproof
- Dimensionally stable
- Resistant to organic solvents and acids
- Non-toxic, non-hazardous and does not contaminate the water table.

FOAMGLAS® is resistant to the harsh conditions below ground.



FOAMGLAS® slabs or boards for below ground walls

1 Concrete wall
2 Primer coat
3 FOAMGLAS® slabs, bonded in FOAMGLAS® adhesive or FOAMGLAS® boards, bonded in FOAMGLAS® adhesive
4 Topcoat of FOAMGLAS® adhesive (for FOAMGLAS® slab insulation)
5 Protection layer / cavity drainage membrane
- or alternatively: a waterproofing membrane and protection layer
6 Soil / backfill

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Underground Structures: Below Ground Floors

Below ground is usually a difficult environment for an insulation, it may be subjected to vermin, water, moisture and high compressive loads. There is only one opportunity to get the specification right; replacing below ground insulation would be extremely costly. The insulation must provide reliable thermal performance for the entire service life of the building.

For demanding below ground situations

FOAMGLAS® cellular glass insulation is ideal for the most demanding below ground situations. With its ability to withstand high structural loads, its closed cell vapour tight structure and unique ability to reduce thermal bridging, FOAMGLAS® has permanent thermal performance; it is proven to stand the test of time.

1 Porsche Centre, Solihull, West Midlands. FOAMGLAS® applied below ground as underslab insulation. Architects: Axis 3 Design Ltd., Warwick.
2 Centre for Virtual Engineering (ZVE), Fraunhofer Institute, Stuttgart, Germany. Architect: UNStudio, Amsterdam: Van Berkel en Bos U.N. ASPLAN Architekten, Kaiserslautern.
3 Chelsea Football Club, training facilities. Architect: AFL Architects.
4 FOAMGLAS® floor insulation for Watersports Centre, Colwyn Bay; K2 Architects, Liverpool.

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There are different installation methods, depending on soil moisture and groundwater conditions:

5 FOAMGLAS® boards with sealed joints on a levelling layer of sand.

6 FOAMGLAS® boards with dry joints on a bed of fine gravel.

Technical features

■ Vermin proof
FOAMGLAS® cannot rot, it is inorganic, it is vermin-proof and can't support plant growth. It's the ideal choice for situations where insulation is in contact with the ground.

■ High compressive strength
FOAMGLAS® supports high compressive loads without deflection or movement. It is the ideal insulation material for load bearing areas, such as, foundations and floors.

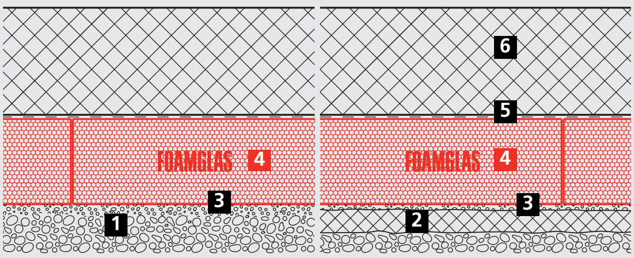
■ Vapour control
FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed cell, glass structure. It is gas and vapour tight.
FOAMGLAS® and its adhesive is vapour tight, providing both: an insulation system and high performance vapour barrier in one material.

■ Waterproof
FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed glass cell structure. It is gas and vapour tight. The closed cell structure prevents water absorption, penetration or tracking by capillary action.

■ Dimensionally stable
FOAMGLAS® has a low coefficient of thermal movement in the same range as concrete or steel, the insulation is therefore simply adhesive bonded onto the building structure.

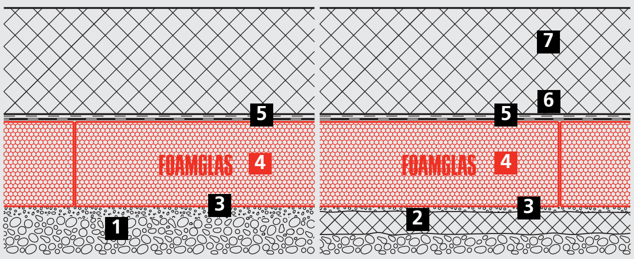
■ Acid-resistant
FOAMGLAS® is resistant to organic solvents and acids.

■ Non-toxic
FOAMGLAS® is non-toxic, non-hazardous, it does not contaminate the environment; and is easily cut using hand tools.



FOAMGLAS® insulation under load bearing structure on lean concrete mix or levelling compound

1 Subsoil or compacted hardcore
2 Lean concrete mix
3 Levelling compound of chippings, stabilized sand or mortar
4 FOAMGLAS® FLOOR BOARD insulation
5 Separation / slip layer
6 Concrete slab



FOAMGLAS® insulation under load bearing structure with waterproofing on lean concrete mix or levelling compound

1 Subsoil or compacted hardcore
2 Lean concrete mix
3 Levelling compound of chippings, stabilized sand or mortar
4 FOAMGLAS® BOARD insulation
5 Waterproofing
6 Separation / slip layer
7 Concrete slab

Interiors:
Walls, Floors and Soffits

For new build or interior refurbishment FOAMGLAS® cellular glass insulation offers the specifier reliable solutions for every internal environment, including steam rooms, spas and swimming pools. The unique FOAMGLAS® system minimises thermal bridging, provides air tightness, vapour control and a reliable thermal performance, all from one easily installed product.

The insulation for walls, soffits and floors

FOAMGLAS® cellular glass insulation has the ability to withstand high structural loads; its closed cell vapour tight structure and its permanent thermal performance are proven to stand the test of time.
FOAMGLAS® systems have been developed for interior walls, soffits and floors.

1 Château Cos d'Estournel, Saint-Estèphe, France. FOAMGLAS® interior insulation on walls. Architects: Wilmotte et Associés and Atelier BPM. Photo: Cos d'Estournel.
2 British Museum extension, London. Architect: Rogers Stirk Harbour & Partners, London.
3 Three Quays Building, London. Axis Architects, London.
4 Science Centre, Wolfsburg, Germany. Architect: Zaha Hadid Architects, London. Photo: phaeno, Klemens Ortmeyer.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Technical features

■ High compressive strength

FOAMGLAS® supports high compressive loads without deflection or movement. It is the ideal insulation material for load bearing areas, such as internal floors for heavy storage or vehicle parking.

■ Fire and fumes

FOAMGLAS® consists of pure glass, it is non-toxic, does not combust, support fire, produce fumes, or present a fire risk to the building structure.

■ Waterproof

FOAMGLAS® has a truly hermetically sealed, closed cell, glass structure. It is gas and vapour tight. The closed cell structure prevents water absorption, penetration or tracking by capillary action.

■ Vapour control

FOAMGLAS® is gas and vapour tight. FOAMGLAS® and its associated adhesives provide both an insulation system and high performance vapour barrier in one material.

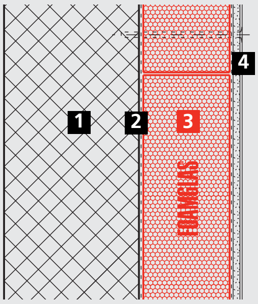
■ Dimensionally stable

FOAMGLAS® has a low coefficient of thermal movement, in the same range as concrete and steel. It is simply adhesive bonded onto the building structure.

■ Non-toxic

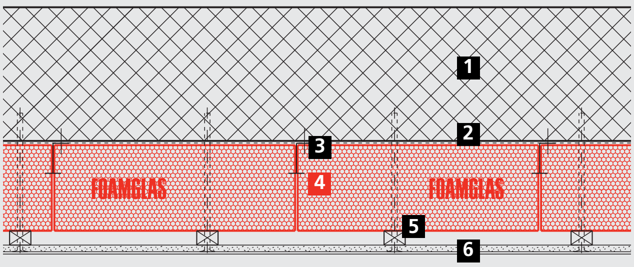
FOAMGLAS® is non-toxic, non-hazardous, and is easily cut using hand tools.

5 Vapour proof FOAMGLAS® internal wall insulation for spas and swimming pools.
6 FOAMGLAS® cellular glass insulation is a natural mineral product, meeting health, indoor-air and quality requirements.



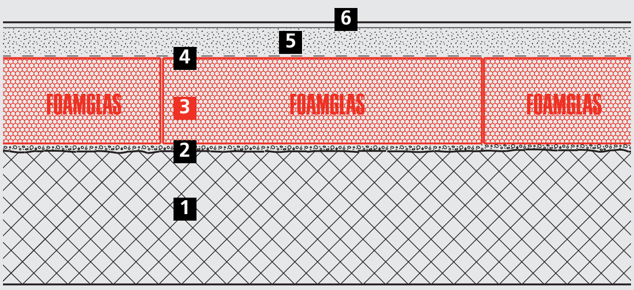
FOAMGLAS® interior wall insulation with plasterboards / fibre reinforced boards

1 Solid wall (concrete / brickwork)
2 FOAMGLAS® primer coat
3 FOAMGLAS® slabs, bonded in FOAMGLAS® adhesive
4 Plasterboards / fibre reinforced boards bonded with a FOAMGLAS® adhesive and mechanically fixed with thermally isolated fixings



FOAMGLAS® soffit insulation with plasterboard or panels mounted on timber or metal substructure

1 Concrete deck
2 FOAMGLAS® primer coat
3 FOAMGLAS® hidden fixings
4 FOAMGLAS® slabs, bonded in FOAMGLAS® adhesive
5 Timber / metal substructure mechanically fixed with thermally isolated fixings
6 Panelling



FOAMGLAS® interior floor insulation on levelling compound with screed

1 Concrete slab
2 Levelling layer
3 FOAMGLAS® FLOOR BOARD, loosely laid
4 Separation layer
5 Screed
6 Floor finish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1 Cardiff International Pool. S & P Architects, London. Photo: Welsh Government, Llywodraeth Cymru.
2 Splash Point Leisure Centre, Worthing. Wilkinson Eyre Architects, London.
3 Swimming pool "Kravi Hora", Brno, Czech Republic. FOAMGLAS® wood deck insulation. Architect: Atelier DRNH, Brno.
4 Sauna at a Vacation Home on "Easter Island", Kaltene, Latvia. Architects: Zaiga Gaile, Agnese Sirmã.

High Humidity Buildings: Reducing the Risk of Interstitial Condensation

FOAMGLAS®, Cellular Glass insulation, with its typical closed cell structure has reassured both building owners and specifiers alike for well over fifty years.

Internal temperature and humidity have significant effects upon the design of the building structure. Standard FOAMGLAS® roof, walls and floors designs are proven to work in all building designs, irrespective of the environmental conditions.

Condensation
Buildings prone to high humidity are always at a high risk of interstitial condensation, this risk can lead to expensive and inconvenient building refurbishments.
Internal water vapour always attempts to migrate through to the exterior of a building. If the moisture remains as interstitial condensation within the structure, it significantly reduces the thermal performance of the building.

The causes of interstitial condensation
- Poor installation of vapour control layers, causing moisture vapour to pass into the structure.
- Insufficient insulation causing the dew point to occurr within the structure, so increasing the risk of interstitial condensation.
- Presence of penetrating mechanical fastenings (thermal bridge).
- Gradual loss of thermal performance, due to thermal ageing.


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The advantages of FOAMGLAS® in a high humidity environment

Waterproof
FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed cell, glass structure. It is watertight and air tight. It cannot soak up water, the closed cell structure prevents water absorption, penetration or tracking by capillary action.

Vapour control
FOAMGLAS® consists of pure glass, it has a truly hermetically sealed, closed cell, glass structure, FOAMGLAS® is totally vapour tight. Vapour diffusion and interstitial condensation cannot occur within the material. It provides both an insulation and high performance vapour barrier in one material.

Proven long term thermal performance
FOAMGLAS® is totally vapour tight. Vapour diffusion and interstitial condensation cannot occur within the material. Thermal ageing does not take place. The thermal performance of FOAMGLAS® is permanent for the lifetime of the building.

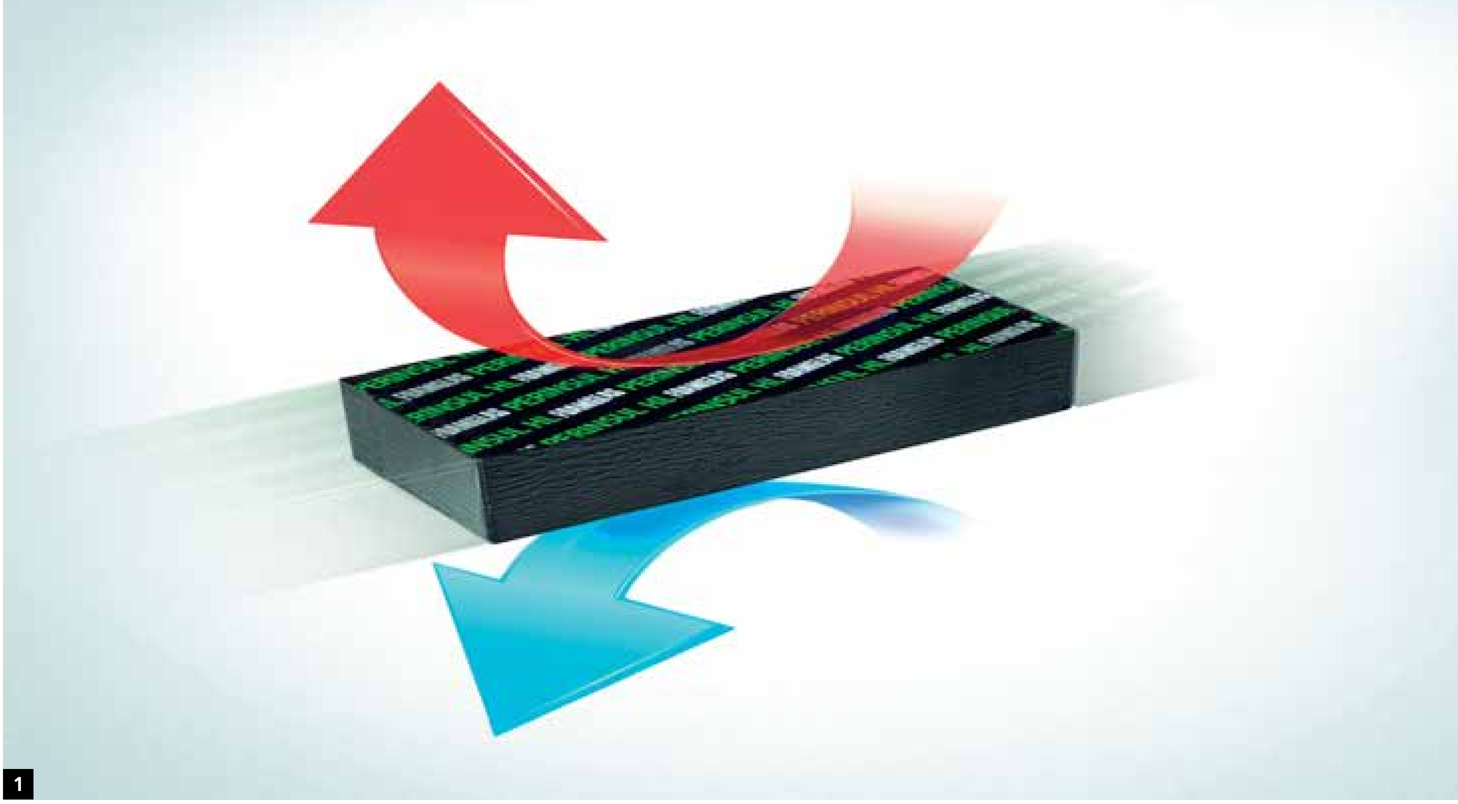
No mechanical fixing
FOAMGLAS® is adhesive bonded onto the building structure, mechanical fixings are not required, there is no risk of fixings corrosion or thermal bridging.

Low co-efficient of thermal movement
Buildings with a humid internal environment often have high internal temperatures. FOAMGLAS® is dimensionally stable it has a low co-efficient of thermal movement, in the same range as concrete and steel. It can be adhesive bonded onto the structure, no mechanical fixings, therefore no thermal bridging.

An insulation suitable for all environments
FOAMGLAS® is the insulation material which can perform in all types of building, and in all environments.

Preventing interstitial condensation
Your local FOAMGLAS® representative can prepare a U value calculation and condensation risk analysis to show there is no risk of interstitial condensation whatever the external or internal conditions may be.

5 Paper mill Emin Leydier, Nogent sur Seine, France. Engineering: Chleq et Froté.


1

Reducing Thermal Bridging in Load Bearing Conditions: Inner and Outer Wall Leaf, Parapets, Thresholds etc.

Where walls, door thresholds and timber frame meet the building structure, there is a significant structural thermal bridge. FOAMGLAS® PERINSUL HL has the solution.

FOAMGLAS® PERINSUL HL, the insulation that thinks it's a brick

European Technical Approval, ETA-13/0163

BBA Certificate due 2014

To stop thermal bridging, use load bearing FOAMGLAS® PERINSUL HL

To eliminate thermal bridges, the horizontal and vertical insulation layers should meet, however in this unique location, the insulation will be subjected to significant compressive loads. FOAMGLAS® cellular glass insulation easily supports uniformly distributed compressive loads without moving or flexing. FOAMGLAS® PERINSUL HL is positioned beneath the structural load, linking the horizontal and vertical insulation layers, thus eliminating the thermal bridge.

1 FOAMGLAS® PERINSUL HL prevents thermal bridging.
2 Dogs Trust Rehoming Centre, Loughborough. Architects Peter Napier & Co., Shrewsbury.
3 Residential homes in Cambridge.
4 Cuttens Barn, Tonbridge, Kent. A self-build timber frame home, adopting Passivhaus standards, using FOAMGLAS® Perinsul HL.


2


3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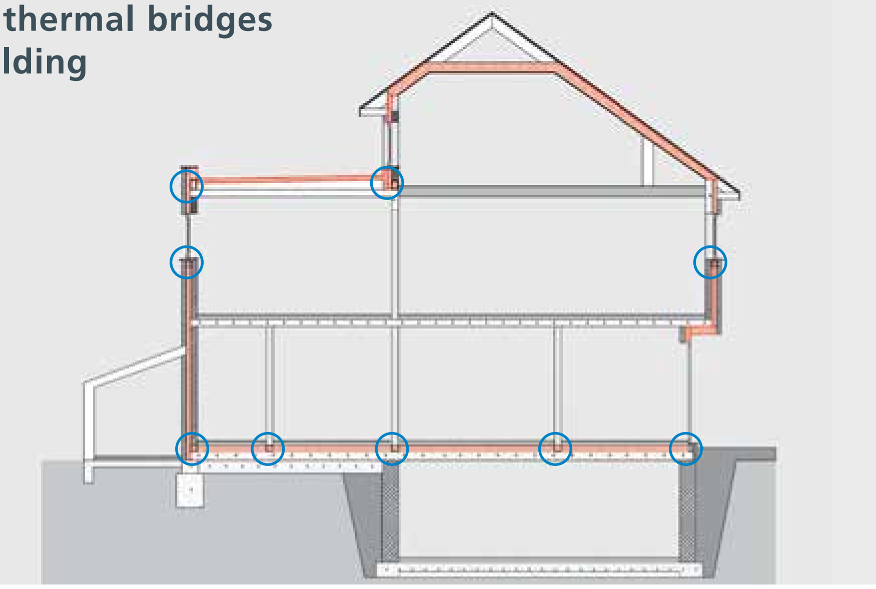
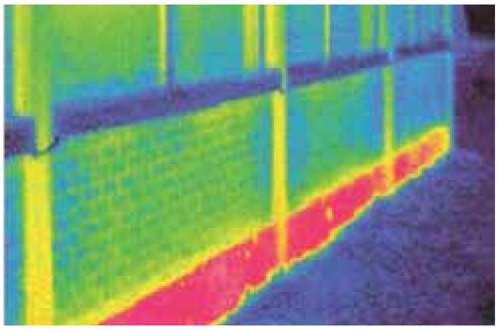
Typical thermal bridges in a building



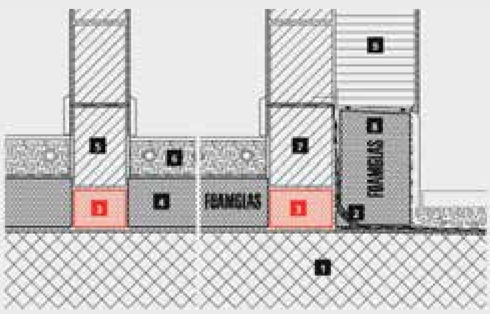
All applications have to be considered regarding design load and local requirements. For specific approvals etc. please read the ETA and BBA certificates, and FOAMGLAS® Perinsul HL technical literature.

- European Technical Approval, ETA-13/0163
- BBA Certificate due 2014
- Fire Testing Certificates

ETA-13/0163
May 2018



FOAMGLAS® PERINSUL HL thermal break can be used beneath common types and sizes of masonry and prefabricated walls.
It is an intelligent solution to avoid heat loss in passive house and traditional construction.



FOAMGLAS® PERINSUL HL, load bearing insulation: typical application

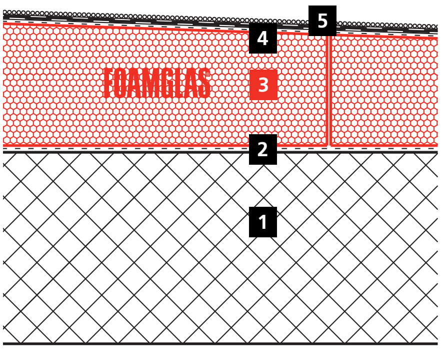
1 Concrete structure
2 DPC, damp course, can be dressed above or below FOAMGLAS® Perinsul HL
3 FOAMGLAS® PERINSUL HL, bedded in mortar
4 FOAMGLAS® floor insulation
5 Internal wall
6 Screed
7 External wall
8 FOAMGLAS® insulation to the lower wall
9 Exterior insulation

Compact roof, FOAMGLAS® TAPERED

Metro Station "Alma-Atinskaya", Moscow, Russia

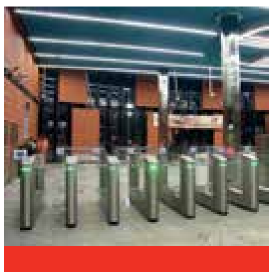
Owner GUP "Moskovsky metropoliten"
Architect Shumakov Nikolay Ivanovich
Construction 2011-2012
FOAMGLAS® application Compact roof;
FOAMGLAS® READY BLOCK TAPERED T4+, 1,7%, 1000m²
Roofing Two layers of bituminous membranes, fully adhered in hot bitumen

The Moscow Metro is considered as one of the most interesting sights of the Russian capital. The underground passenger transport system of Moscow consists of 12 lines, which extend to more than 300 kilometers of track and 194 stations in total. 44 of these stations are recognized as part of the cultural heritage of Russia.
In the early years the fundamental architecture reflected significant historical events and the power of the state of Russia, this was replaced by easier architectural styles combining beauty and functionality, necessary for the comfortable movement of inhabitants of the huge megalopolis.
Modern requirements of performance and safety on the subway, defined the decision for the choice of construction materials. Reliable and durable, FOAMGLAS® cellular glass was an easy choice. FOAMGLAS® has been widely used on a number of new construction sites on the Moscow Metro, both as insulation for above ground and underground systems. FOAMGLAS® was also used as the thermal insulation for a roof of one of Alma-Atinskaya station halls.
FOAMGLAS® cellular glass conforms to the strict requirements imposed on thermal insulation materials needed for the construction of passenger transport facilities. This material is totally non-combustible and also prevents the spread of fire and smoke. It does not contain harmful substances and binding materials, but is easy to work with. Not only will it significantly decrease operational expenses, but will also reduce future maintenance which often are the cause of transport delay and inconvenience.



The reliable FOAMGLAS® compact roof is made to last
www.foamglas.com

Build-up
1 Concrete roof deck
2 Primer coat
3 FOAMGLAS® TAPERED slabs, laid in hot bitumen
4 Top coat of hot bitumen
5 Two layers of bituminous waterproofing membranes, top layer UV-resistant



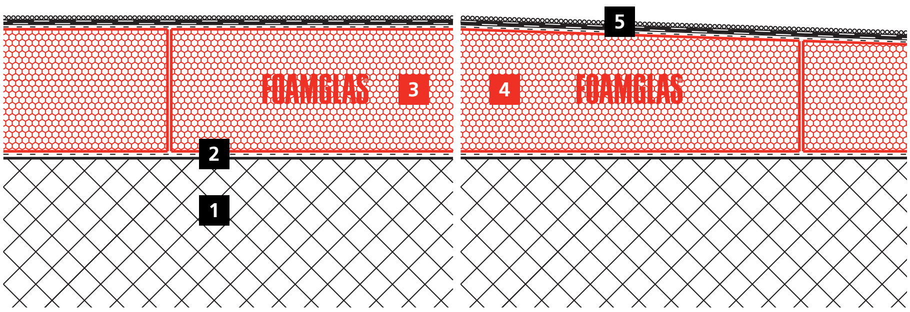
Roof,
FOAMGLAS®
TAPERED

Shard Tower, level 75, Building Maintenance Platform, London

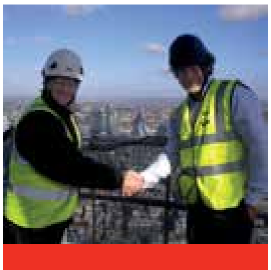
Design Architects Renzo Piano Building Workshop
Executive Architects Adamson Associates, London
Main Contractor Mace; **Roofing Contractor** AC PLC
Construction 2012
Application Roof, FOAMGLAS® TAPERED, slab T4+
Finish Bitumen membranes

At 310 m, Shard Tower currently holds the title of Western Europe's tallest building; exposed to extremes of temperature the revolutionary structure sways up to 50 cm in high winds. The building maintenance platform on level 75 is located directly above the viewing galleries, and essentially forms the Shard's roof. To shed water, the flat metal platform required an insulation with a tapered top surface. In this extremely exposed location, and with significant loads upon the platform, a truly reliable solution was needed. FOAMGLAS® insulation combines compressive strength, long-term insulation performance, and is available with a pre-cut taper in the upper surface. Using our "in house" CAD systems, FOAMGLAS® designed a bespoke Tapered Insulation system. Taking full advantage of its low coefficient of expansion, and to eliminate thermal bridging, FOAMGLAS® and its membranes were adhesive bonded onto the metal structure. The almost unique ability of FOAMGLAS® to withstand high compressive loads ensures regular maintenance work can be safely carried out without damage to the insulation or the membranes.
Adamson Architects commented on this project: "FOAMGLAS® has proved itself to be the ultimate solution for the difficult loadbearing areas of the Shard. Specifying cellular glass insulation ensured complete integrity and performance in key areas of the Shard Tower.

FOAMGLAS® TAPERED – outstanding technical and environmental credentials
www.foamglas.com



Build-up
1 Metal structure
2 Adhesive
3 FOAMGLAS® slabs
4 FOAMGLAS® TAPERED slabs, adhesive bonded
5 Bitumen membranes



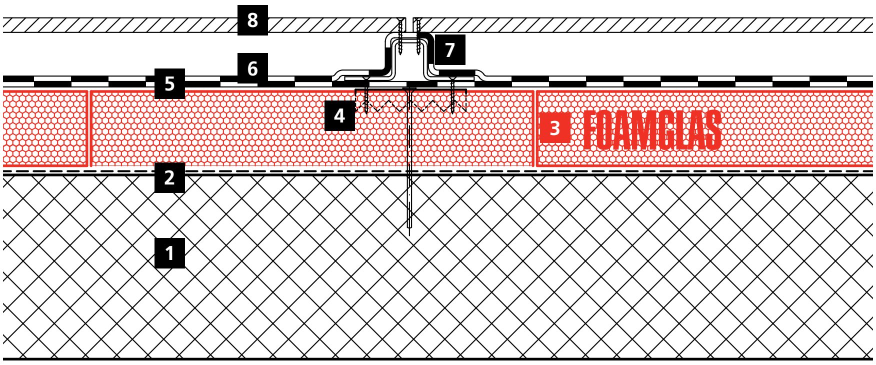
Compact roof with aluminium panels

'Mercury City Tower', Moscow International Business Center, Russia

Location of property "Moscow-City", section 14, Russia
Architect M.M. Posokhin, Frank Williams
Construction 2009 - 2012
FOAMGLAS® application Flat roof, 3000 m², FOAMGLAS® READY BOARD T4+, 180 mm thick
Covering Aluminium honeycomb panel

The "Mercury City Tower", is a part of the Moscow International Business Center architectural complex also known as "Moscow City". The skyscraper designed by architects Mikhail Posokhin and Frank Williams opened in 2012, taking the European record from "The Shard" in London, It stands at 339 meters above the city and has become an iconic landmark. It is the highest building in Europe.
The total floor area of a 75-storey building is around 180 000 sq.m., half of which is occupied by class "A+" offices. More than 20 000 sq.m. are used for luxury apartments with far reaching views of the city. The remaining area is used for parking, shopping and public areas.

For the thermal insulation of the roof FOAMGLAS® cellular glass was chosen as the compact system is among the very few thermal insulation materials which does not require mechanical fastening but can meet the high wind load requirements needed for high-rise buildings of this kind. FOAMGLAS® was chosen because of its excellent long term thermal performance, fire safety and durability, along with a proven track record of low maintenance.



Good investments help you save money!
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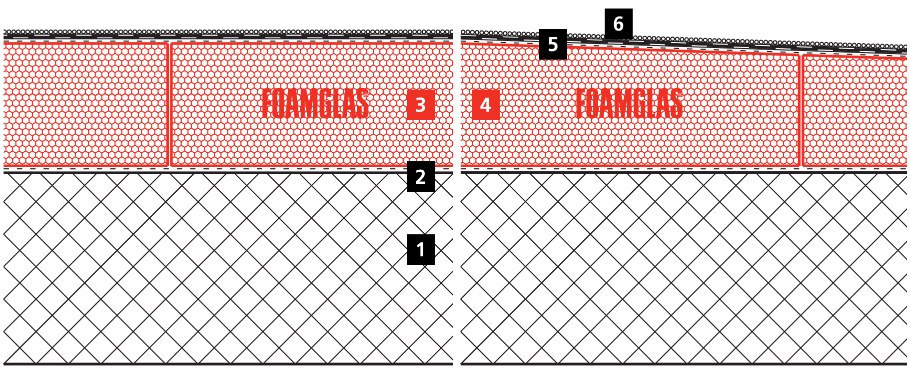
Build-up
1 Reinforced concrete
2 PC® 88 adhesive
3 FOAMGLAS® READY BOARD T4+
4 Metal plates PC® SP 150 / 150
5 Bituminous waterproofing membrane
6 Resitrix® SBS / EPDM membrane
7 Stainless steel brackets
8 Aluminium honeycomb panel (AHP)

Mondi SCP Paper Mill, Ružomberok, Slovakia

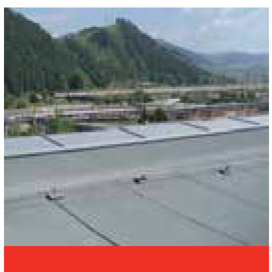
Architect Ing. Ujmiak, LIMBUS s.r.o.
Contractor Hydroizol s.r.o.
FOAMGLAS® application Flat roof upon paper machine PM18, FOAMGLAS® T4+, 2 x 70 mm thick
Refurbishment 2009-2011, 3 phases

The paper mill is situated in northern Slovakia, in the Tatras mountains. The site contains one production plant and a paper machine. In Ružomberok, paper has been produced for more than 130 years. Rich resources of wood, water and skilled people changed the small local mill to the industrial leader within its industry.
The atmosphere in a paper mill is hot, humid, caustic and/or acid. Roofs are subject to heavy condensation. During a typical winter the outside temperatures can drop to under -25°C and whilst inside the searing heat generates clouds of hot steam making the ceiling hardly visible. That is the fact of the situation, leaving the designer with no other viable option than to design in a water vapour resistant compact roof with thermal insulation from FOAMGLAS®.
The compact roof technique avoids condensation in the insulation thus maintaining a constant thermal barrier on the surface to prevent the formation of the acidic condensation, that can fall on the equipment.
This unique and safe roof system with FOAMGLAS® insulation has been used in modern paper mills across Europe from Spain to Sweden and has a track record of failsafe performance in the most arduous of conditions.

FOAMGLAS® – excellent solution for severe conditions
www.foamglas.com



Build-up
1 Concrete roof deck
2 Primer coat
3 FOAMGLAS® slabs or
4 FOAMGLAS® TAPERED slabs, laid in hot bitumen
5 Top coat of hot bitumen
6 Two layers of bituminous waterproofing membranes, top layer UV-resistant



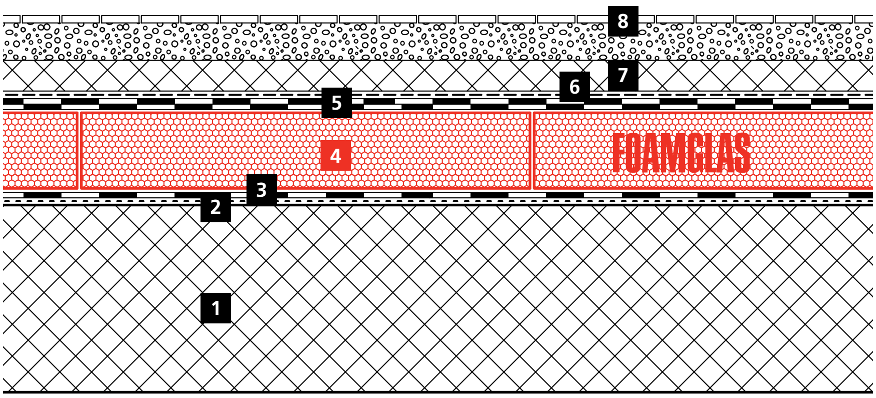
Compact roof, trafficable

Pedestrian Terrace for Emergency Vehicle Access Congress centre Zlín, CZ

Architect Prof. Ing. arch. Eva Jiřičná, CBE
Construction 2010
FOAMGLAS® application Compact roof, approx. 600 m^2,
Type S3, 80 mm thick, adhered by hot bitumen
Finish Vehicle accessible wearing course

Zlín city, the home town of the renown shoe factory BATA, is a remarkable city because of the unique architecture from 1930's. Mr Tomas Bata invited many world famous architects to design the landscape (incl. Le Corbusier) and Zlín city is full of functionalistic architecture. Contrary to this architectural heritage several new buildings with a modern architectural look were constructed in the last few years.
The Congress centre from award winning architect Eva Jiřičná creates a unique contrast to the 90 years old functionalistic backdrop.
The entrance area in front of congress centre is designed for both pedestrians and heavy vehicle traffic. FOAMGLAS® Insulation was chosen as the best and most reliable thermal insulation for this exposed part of the building, FOAMGLAS® compact roof protects the high-end architecture, by providing **a balanced solution – high performance, long life and the most reliable accessible roof**.

Reliable FOAMGLAS® compact roof is in symbiosis with the high-end architecture
www.foamglas.com



Build-up
1 Concrete structure
2 Bituminous primer
3 Temporary waterproofing
4 FOAMGLAS® S3, 80 mm, Compact roof system, in hot bitumen
5 Waterproofing - two layers, modified bituminous membrane, adhered by hot bitumen
6 Separation layer, 2 x PE foil
7 Protection concrete screed
8 Granite mosaic paving, 50 x 50 mm, to sand layer

Compact roof, accessible to foot traffic

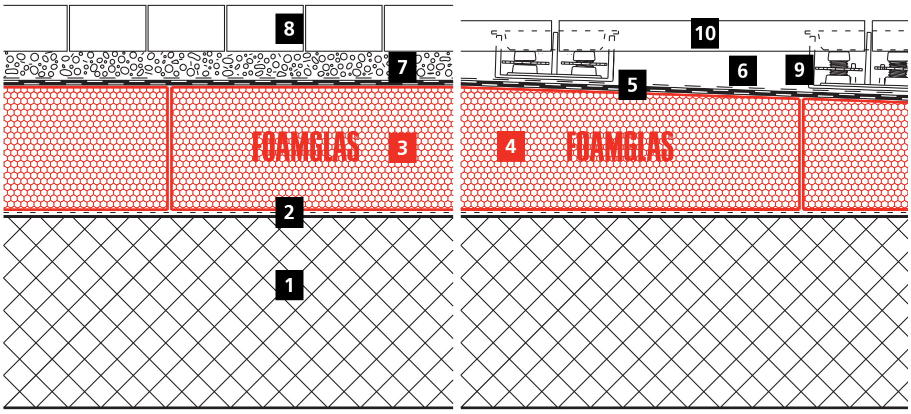
Olympic Stadium, Kiev, Ukraine

Owner National Enterprise Olympic NSC
General Designer gmp, Hamburg (Germany) and architect Yuri Seregin (Ukraine)
FOAMGLAS® application Compact roof; type slabs T4+
Construction 2012; General Contractor, "Kievmiskbud" Corp. Ltd., "AK Engineering", LLC "Plant Master Profi Ukraine"
Finish layer Granite Pavels

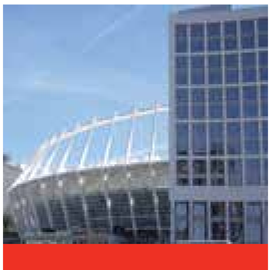
The Olympic National Sports Complex (also known as "Olympic Stadium") is a multi-use sports facility in Kiev, located on the right bank of the river Dnieper. On 18 April 2007, Ukraine and Poland were chosen by UEFA to co-host the finals of Euro 2012, with the Olympic Stadium as the venue for the final.
The capacity of the stadium after the reconstruction is now 70,050 seats.

Reconstruction of the stadium delivered a modern arena, a new symbol of Euro-2012 but still based around the original features of the site.
One face of the stadium has a glass frontage and the roof has a hanging canopy made of translucent synthetic membrane which covers 100% of spectator area.
FOAMGLAS® was used to insulate under the spectator stairways to improve the energy efficiency of the Stadium.
When thermal efficiency needs to be combined with heavy duty performance (trafficked service decks), FOAMGLAS® cellular glass insulation is a key player.

FOAMGLAS® – a key player
www.foamglas.com



Build-up
1 Concrete roof deck
2 Primer coat
3 FOAMGLAS® slabs or
4 FOAMGLAS® TAPERED slabs, laid in hot bitumen
5 Two layers of bituminous waterproofing membranes
6 Separating/protective layer
7 Chippings or gravel
8 Interlocking paving stones
9 Support pads
10 Paving



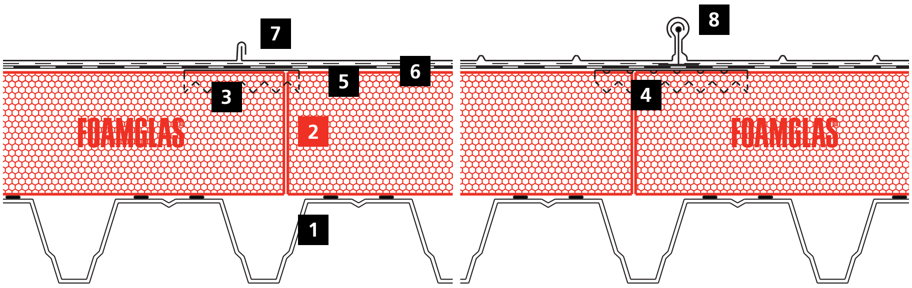
Metal roof system

Carpet Museum, Baku, Azerbaijan

Owner Client Ministry of Culture and Tourism of Azerbaijan Republic
Architect Hoffmann - Janz ZT GmbH, Wien - Vienna
Engineer's Office Gmeiner Haferl, Wien; O.Dalileh, D. Georgi, S. Latas, T. Lampl
Construction 2009 - 2012; Stahlbau ANC Klagenfurt
FOAMGLAS® application Roof and building envelope; 7500 m², Type READY BOARD, thickness 180 mm, bonded
Covering Alucobond® Gold

Azerbaijan is located on the historic Silk Road, some 3000 km from Vienna. A country with a dynamic and growing economy, that has a lot of cultural attractions and is investing in infrastructure buildings and museums. This includes the New Carpet Museum in Baku designed by architect Erich Janz, with its spectacular and unusual form: a roll of carpet.
To protect the valuable exhibits with added security, the curved steel roof has been insulated with FOAMGLAS®. FOAMGLAS® provides durability and ensures the security of the building physics for the whole structure. The insulation slabs stiffen the trapezoidal profile and reduce the vibration and the deflection. The bonding between the steel deck and the FOAMGLAS® ensures that the system is full laminated. This allows the metal standing seam roof system a totally thermal bridge free mounting so that the cladding Alucobond® elements can fit like a second skin to the buildings form.
Curved roof shapes are demanding and complex structures. Independently of whether the substrate is straight or curved, FOAMGLAS® can be installed with an optimum adhered surface to the substrate. FOAMGLAS® is easily adjusted to the desired shape by cutting simple facets. With FOAMGLAS® there are no limits to freedom of design!

Freedom of design thanks to simple processing
www.foamglas.com



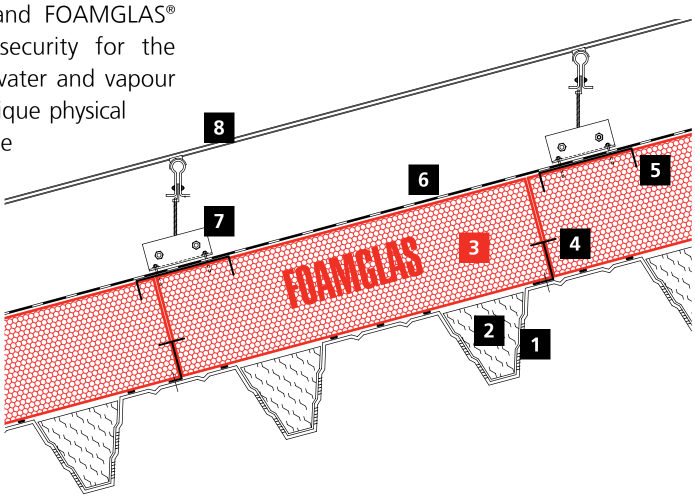
Build-up
1 Steel deck
2 FOAMGLAS® READY BOARD, glued with PC® 11
3 Metal plates PC® SP 150/150
4 Metal plates PC® SP 200/200
5 Bituminous waterproofing membranes
6 Separation layer
7 Standing seam metal sheet
8 Profiled metal sheet

Compact roof system with profiled metal sheet cladding

Enzo Ferrari Birthplace Museum, Modena, Italy

Architect FUTURE SYSTEMS arch. Jan Kaplicky + Politecnica ing. F. Camorani
Construction 2010-2011
FOAMGLAS® application Insulation covered with metal roofing;
FOAMGLAS® READY BOARD T4+, thickness 160 mm, 3.300 m²
Finish Aluminium sheeting in "Ferrari Yellow"

The project is highly innovative and every visitor´s attention is immediately drawn by the bright yellow double-curved aluminium roof. The design is in the shape of a sports car hood from a bygone era, however what remains hidden from the eye is the FOAMGLAS® insulation system protecting the roof structure. The metal roof is part of the overall building's design that not only has to protect the structure, but also the valuable assets within. The internal conditions have to be meticulously controlled in order to preserve some of Ferrari's finest designs and FOAMGLAS® offered the necessary security for the architect as it is totally water and vapour tight. Furthermore its unique physical properties allowed the architect to virtually eliminate the thermal bridges often associated with metal roofs and simplify the sub-structures within the build-up. This meant the overall thickness of the system was reduced, saving weight as well as energy. FOAMGLAS® provides high thermal inertia due to its density / thermal conductivity ratio, allowing significant reductions in energy consumption over the long term.
Due to its in-organic nature, it provides an incombustible material that contributes to high performance passive fire safety. Since FOAMGLAS® does not change over time, the insulation value you set today is assured for the entire lifetime of the building.



An iconic architectural masterpiece
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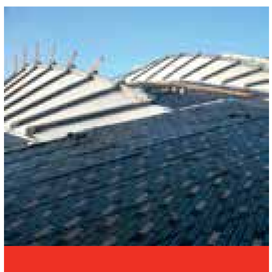
Build-up
1 Corrugated acoustic metal sheet
2 Voids filled with acoustic mineral fibre
3 FOAMGLAS® READY BOARD T4+, bonded with PC® 11
4 Mechanical anchor PC® F
5 Serrated fixing plates PC® SP 200/200
6 Bituminous waterproofing
7 Fixings for metal roofing system
8 Profiled metal sheets



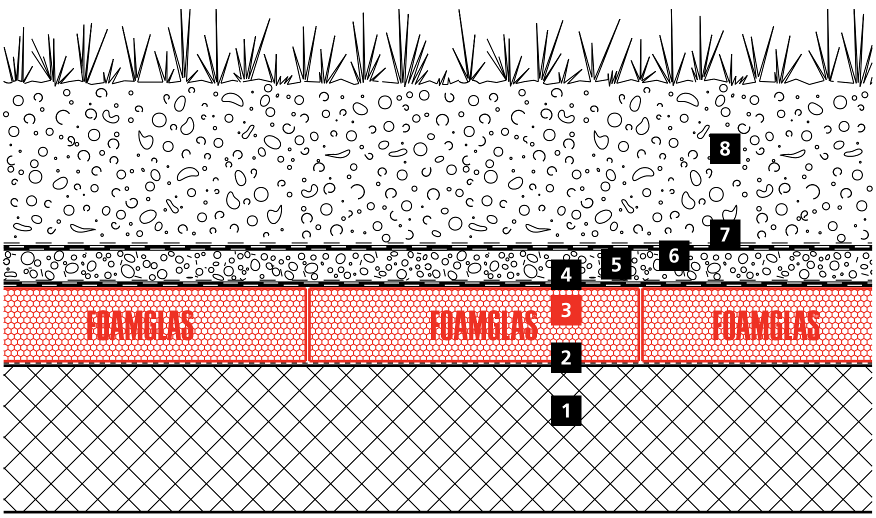
Green Compact Roof

Swarovski Group, Wattens, Austria

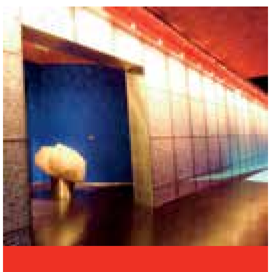
Art director Andre Heller
Architect Mag. Carmen Wiederin and Propeller Z, Vienna
Ing. Georg Malojer, Project Management GmbH & Co, Innsbruck
Built 1995/2003/2007
FOAMGLAS® application Roof insulation, about 5200 m² type T4+ slabs in hot bitumen, 100 mm thick
Roof finish Intensive greening system

As with the first building of Swarovski Crystal Worlds, FOAMGLAS® insulation systems were chosen for the extension "Sequel of Fairy Tales".
"Crystal Worlds" – an underground building – was designed with a most demanding roof structure. A critical concern was the replacement and repair work on green roofs of that scale and design could possibly require investment and shut down the enterprise. Therefore, the principal selection criteria for thermal insulation was an efficient, totally weatherproof, failure-free roof system that would last for decades. The high compressive strength of the insulation was an additional reason.
FOAMGLAS® was selected, since the filled ground topping the roof structure is meters thick and the roof has to bear considerable soil pressure.

FOAMGLAS® – Compact Roof, double security to prevent water ingress
www.foamglas.com



Roof structure
1 Concrete deck
2 Bituminous primer coat
3 FOAMGLAS® T4+ slabs, 100 mm thick, in hot bitumen
4 Bitumen roofing sheets, 2 layers
5 Building protection mat
6 Drainage layer
7 Filter layer
8 Intensive greening system



Ventilated cladding

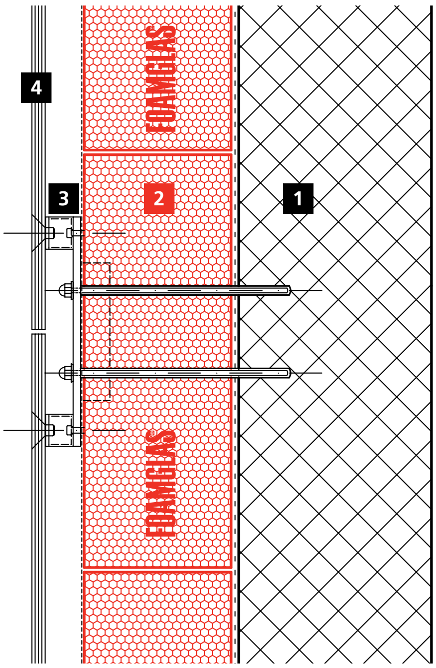
The Louis Vuitton Foundation, Paris, France

Architect Frank Gehry & Partners
Engineering Office SETEC – RFR
Building Contractors Rubéroïd – Hoffmeister – Petit
Construction 2013 - 2014
FOAMGLAS® application Insulation of façade, floors and terrace; FOAMGLAS® W+F, FOAMGLAS® T4+
Finishing Glass cladding

The superb Louis Vuitton Foundation, an extraordinary space for "Art & Culture" designed by the internationally renowned architect Frank Gehry, will open its doors in 2014.
The magnificent building, whose design is strongly influenced by the lightness and fluidity of late 19th century glass and garden architecture, is located next to the "Jardin d'Acclimatation" in the "Bois de Boulogne" park in Paris.

Gehry's glass building takes the form of a sailboat, where the assembly of blocks gives it vitality and volume. The building construction overcomes some unprecedented technological challenges – where the principles of architecture are turned upside down. The awe-inspiring vessel boasts 12 huge sails made from 3600 glass panels, each one unique and specially curved to fit the orginal shape drawn by the architect.

FOAMGLAS® has been specified for the floor and terrace insulation and behind the ventilated glass cladding.



Making complex architecture work
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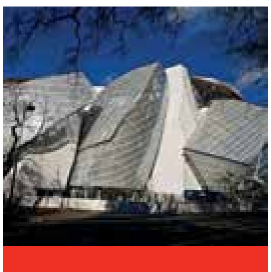
Build-up
1 Substrate
2 FOAMGLAS® W+F installed with cold adhesive PC® 56
3 Sub-structure
4 Glass cladding



Interior wall insulation, render finish

Supreme Educational Council Headquarters, Qatar

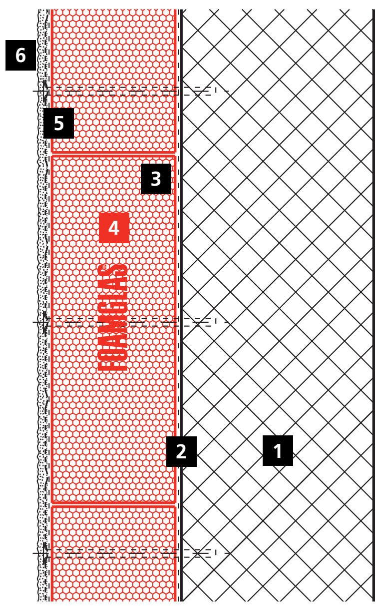
Architect WS Atkins and Partners Overseas
Construction Starting 2012, ongoing
FOAMGLAS® application Interior walls insulation, FOAMGLAS® T4+ slabs, about 180 m^2, 60 mm thick, adhesive bonded to the structural wall
Finish Render

Supreme Educational Council Headquarters have been desgined by the most renowned architect WS Atkins. The project involves construction of a headquarters' complex, comprising five administrative buildings and a substation, considering overall environmental parameters.
The architect decided to use FOAMGLAS® as interior insulation for the substation walls, with a render finish. To specify FOAMGLAS® insulation was a clear choice for this architect with international practice, because of the numerous advantages associated with a brand like FOAMGLAS®.

With its all-glass, closed cell structure, FOAMGLAS® is thermal insulation and vapour barrier in one material.
Therefore additional vapour barriers and bonding tape to make the system airtight can be neglected. This helps to save costs and time, and allows to give best lifetime guarantee for proven performance.

Finally, the non-combustibility was the all-deciding advantage of FOAMGLAS® to be applied as the best material.

Ecological and fire safe, a recommended building material
www.foamglas.com



Build-up
1 Concrete wall
2 Primer coat
3 Mechanical fastening with anchors PC® F
4 FOAMGLAS® T4+ slabs, PC® 56 adhesive bonded
5 Base coat PC® 74 A2 with reinforcing mesh PC® 150
6 Finish PC® 74 A2 render

Contact Information

Please visit our website under: www.foamglas.com/distributors

FOAMGLAS® Insulation Design & Installation Assistance

From design to installation, we can assist you in achieving your project.

During the design phase, we can help you:

- **To undertake thermal calculations**
- **To realize your technical specifications**
- **To study detailed site drawings for insulation with integrated gradient: FOAMGLAS® TAPERED system, for both small and large roofs**

Once a specification has been established and a project is ready for realization, we can provide the following services (subject to job size, application and complexity).

Assistance starting the jobsite via checklists of materials / tools and Technical Data:

- **Technical training materials via on-line and printed media**
- **Local in-country representation**
- **Site visits and operator training (for large projects)**

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