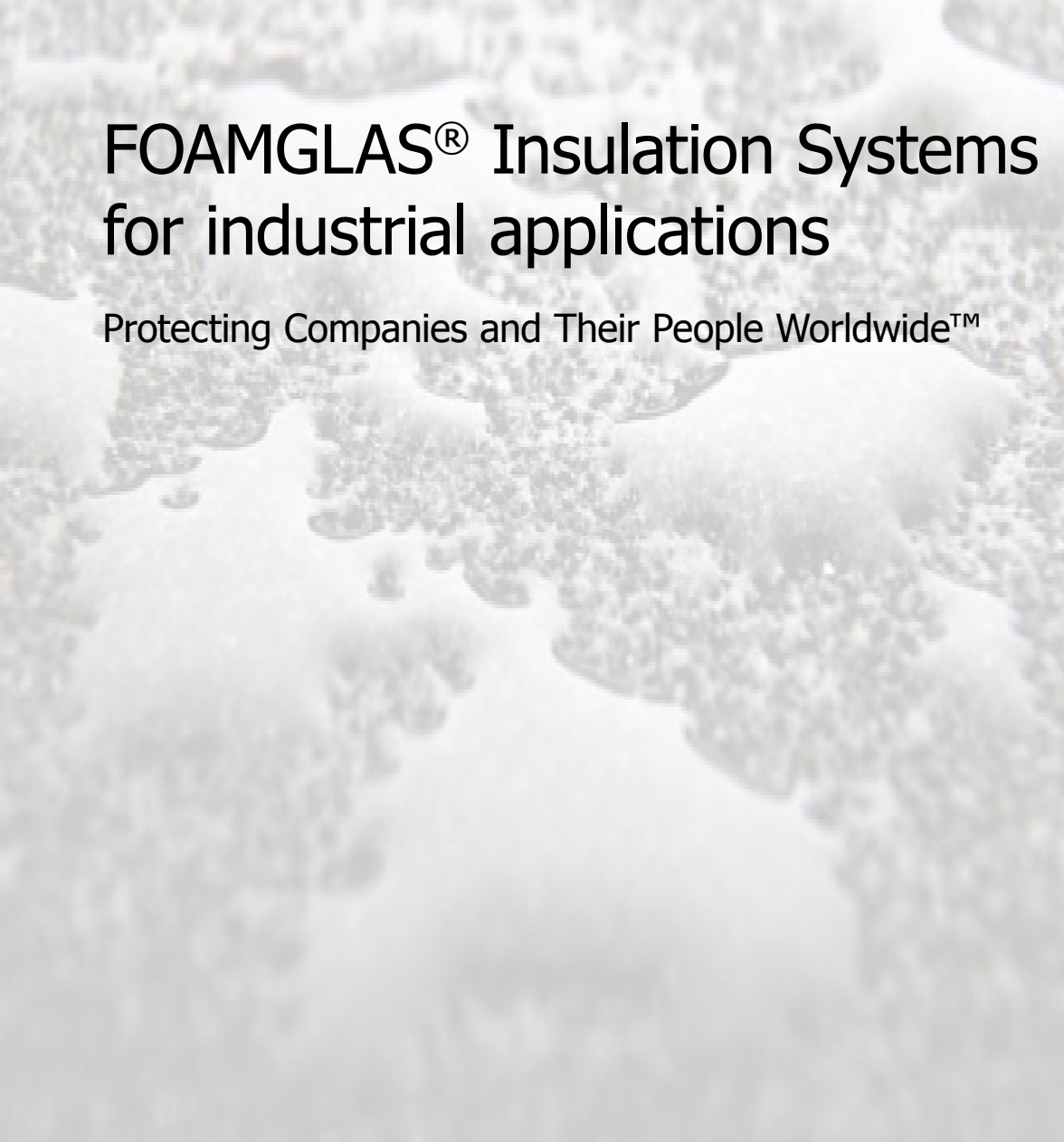


FOAMGLAS® Insulation Systems for industrial applications

Protecting Companies and Their People Worldwide™



FOAMGLAS®
Industry

Pittsburgh Corning



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Pittsburgh Corning heritage

FOAMGLAS® insulation is known worldwide for its superior quality

Pittsburgh Corning is a global leader in high performance insulation technology and applied solutions for a wide range of process industries. The Company was founded in 1937 as an equity affiliate by Corning Inc. and PPG Inc. The manufacturing of glass foam as insulation was patented as early as 1935.

In the mid-1940s, FOAMGLAS® Insulation was introduced in the U.S.A. Because of a growing global demand for the product, Pittsburgh Corning expanded its presence into Europe with a large Belgian manufacturing facility in 1965.

Since then, two additional factories have been added in Europe. The U.S. manufacturing has included an acquisition in 2005 and significant capacity improvements. In addition, Pittsburgh Corning Asia has become an important part of the company's operations in response to global demands of our industrial clientele.

Our global presence and growth have uniquely positioned Pittsburgh Corning to serve large end users with global operations. Our growth has given us the financial strength to support large, complex projects and allows us to reinvest for future growth. Our current and future technology initiatives are among the results of this strength.

Among our greatest accomplishments has been the development of cellular glass, a material that offers a unique blend of physical strength and thermal properties. We continue to develop innovative products and application solutions based on our customers' insulation issues.

From cryogenic cold to super-heated steam temperatures, FOAMGLAS® cellular glass is the insulation which can address end user's "mission critical" facility demands.

Fire Safety, Process Control, Corrosion Protection, and Sustainability are all FOAMGLAS® Insulation added value features. With the finest technical services in the world you have superior quality from engineering to product production to project start up to project completion and post-project consultation.

All of the above combine into what we call "**Protecting Companies and Their People Worldwide™**".



Global presence and sustainable production

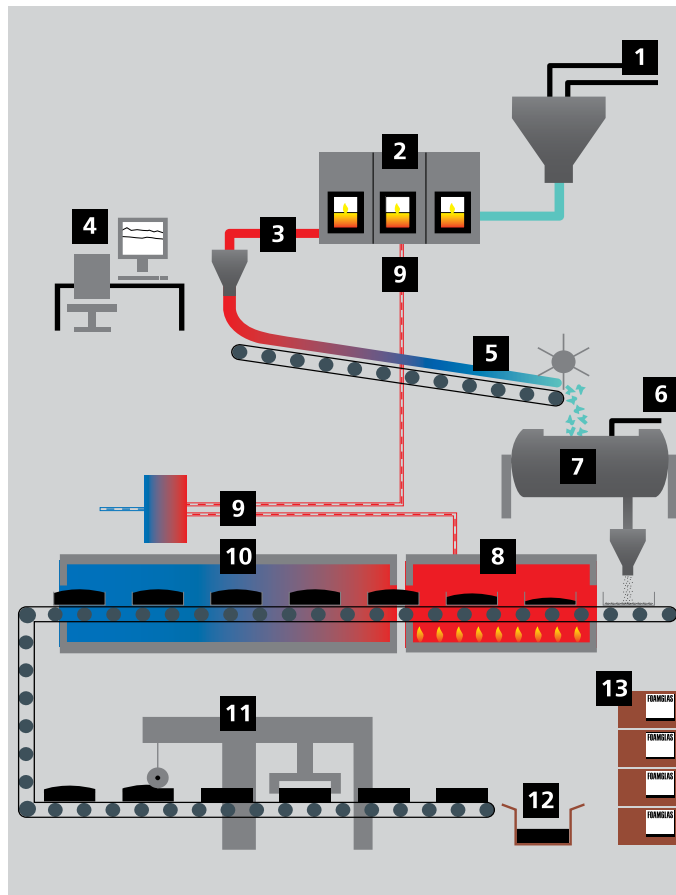
Sustainable design is becoming more important, and the demand for sustainable products with low environmental impact continues to grow.

FOAMGLAS® insulation is a totally inorganic insulation that contains no propellants harmful to the ozone layer, no flame retardants or binding agents. FOAMGLAS® insulation earns an excellent rating in its overall performance assessment. Due to its unique combination of physical characteristics, which provide safety, durability, sustainability, and long term economic benefits, FOAMGLAS® insulation is the preferred insulating material for industrial projects.



Manufacturing facilities worldwide:

- 1 Tessenderlo, Belgium
- 2 Schmiedefeld, Germany
- 3 Klasterec nad ohri, Czech Republic
- 4 Sedalia, Missouri
- 5 Fresno, Texas



- 1 Mixing and batching of the raw materials: Recycled glass, feldspar, sodium carbonate, ironoxide, sand, sodium sulphate, sodium nitrate.
- 2 The melting furnace has a constant temperature of 1250°C.
- 3 Molten glass is drawn out of the furnace.
- 4 Control room for monitoring the production.
- 5 The glass is drawn off and falls onto the conveyor belt where it cools down before entering into the ball mill.
- 6 Addition of "carbon black".
- 7 Ball mill grinds all ingredients into a fine powder before filling stainless steel moulds
- 8 The filled moulds pass through a cellulating oven (foaming furnace) with a temperature of 850° C. This is where the material gains its unique cell structure
- 9 Energy recovery of heat
- 10 The FOAMGLAS® blocks pass through an annealing oven to allow carefully controlled cooling of the block without thermal stress.
- 11 The blocks are cut to size and sorted by batch. Production Waste returns back into the process.
- 12 FOAMGLAS® slabs are then packaged, labelled and palletized.
- 13 Finished FOAMGLAS® products are stored and prepared for transport.

FOAMGLAS® insulation is manufactured primarily from recycled glass (>66%) and natural raw materials that occur almost without limit in nature.



Unique product properties

Unique properties make FOAMGLAS® insulation an incomparable insulation.

Thanks to its special properties, FOAMGLAS® insulation fulfils even the most stringent requirements. Because of its hermetically sealed cell structure, cellular glass is extremely incompressible, absolutely waterproof and sealed against vapour diffusion, and does not absorb any moisture. FOAMGLAS® insulation is the only insulating material in which the material structure means that the vapour barrier is already "built-in".

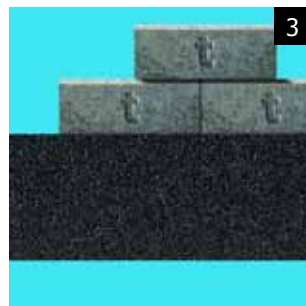
1 Waterproof FOAMGLAS® insulation is water-proof because it consists of pure glass. **Advantage:** does not absorb any moisture and does not swell.



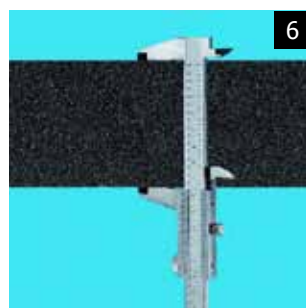
2 Pest-proof FOAMGLAS® insulation cannot rot and is pest-proof because it is inorganic. **Advantage:** insulation without risk, especially for tank bases and buried applications. No basis for nesting, breeding or seed germination.



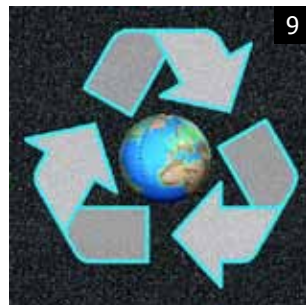
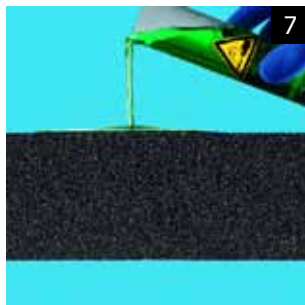
3 Compression-proof FOAMGLAS® insulation is extraordinarily in-compressible without deformation even with long-term loads due to its cell geometry. **Advantage:** use as load-bearing thermal insulation without risk.



4 Incombustible FOAMGLAS® insulation cannot burn because it consists of pure glass. Fire behaviour classification: EN 13501: A1. ASTM E84 flame spread 0 / Smoke development 0. **Advantage:** storage and processing not hazardous. No propagation of flames in the event of fire, protects process pipework and vessels.



5 Vapour-tight FOAMGLAS® insulation is vapour-tight because it consists of hermetically sealed glass cells. **Advantage:** Cannot become wet or transmit moisture. Constant thermal insulation value over decades. The vapour barrier consists of the full thickness of FOAMGLAS® insulation.



6 Dimensionally stable FOAMGLAS® is dimensionally stable because glass neither shrinks nor swells. **Advantage:** no warping, contracting or creep. Low coefficient of expansion, nearly equal to that of steel and concrete.

7 Acid-resistant FOAMGLAS® insulation is resistant to organic solvents and acids because it consists of pure glass. **Advantage:** no destruction of the insulation by aggressive media and atmospheres.

8 Easy to work with FOAMGLAS® insulation is easy to work with because it consists of thin-walled glass cells. **Advantage:** FOAMGLAS® insulation can be cut to any desired measurement with simple tools like a saw blade or hand saw.

9 Ecological FOAMGLAS® insulation is free of environmentally damaging flame retardants and propellants, no relevant eco-toxic components. **Advantage:** After generations of use as thermal insulation, FOAMGLAS® insulation can be used again: as filler in landscaping or thermally insulating granulate. Ecologically sensible recycling through reuse.

FOAMGLAS® insulation systems

Application fields: cryogenic and cold temperatures



The superior properties of FOAMGLAS® insulation make it ideal for cryogenic systems such as Liquefied Natural Gas

Suitable for:

- Low temperature piping and equipment
- Liquid nitrogen, helium and oxygen pipes
- LNG piping and equipment
- Ethylene piping and equipment
- Hydrocarbon fire resistance at low temperature



FOAMGLAS® insulation:

- expands and contracts at a very similar rate to steel, avoiding cracks and open joints;
- is 100% impermeable and as such avoids moisture ingress when vapour retarders fail;
- is fire safe, which is critical in the presence of hydrocarbon products;
- has a high compressive strength, making it easier to perform mechanical maintenance without damage;
- has an insulation value that stands the test of time and performs for decades.

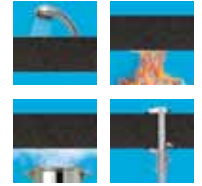
In addition, the FOAMGLAS® insulation system is surprisingly competitive, requiring only two layers in many cases where other insulation materials need three or more layers to perform adequately. As a result, less joint sealant and handling would be required.

In systems operating down to -50°C (-58°F), FOAMGLAS® insulation can be applied in a single layer, thus avoiding the costly double layering required with alternative systems.



FOAMGLAS® insulation systems

Applications: chilled water & above ambient temperatures



Suitable for hot and cold applications, even with a severe fluctuating temperature range

Chilled water and commercial projects

Above ambient



There is simply no other insulation system available in the market today which combines physical strength, fire resistance and moisture resistance to provide the safety and security superiority in chilled water pipe insulation performance.

With a certified flame spread and smoke development of zero, FOAMGLAS® insulation virtually eliminates the fire hazard potential of chilled water systems.

FOAMGLAS® insulation will not melt into a liquid fuel, which can contribute to a fire's acceleration.

Being cost-effective, FOAMGLAS® insulation does not require an additional cladding. Cladding is often only for aesthetic purposes..

People forget the qualities of FOAMGLAS® insulation when they refer to hot system conditions. The same qualities that make it so superior for cryogenic applications also apply to hot applications.

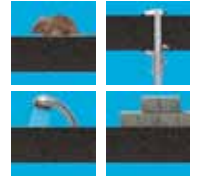
FOAMGLAS® insulation will not allow chlorides to wash into hot systems, will not become a wet blanket around a pipe, and will not sag and lose shape. For this reason many oil and gas, food and pharmaceutical companies specify that only FOAMGLAS® insulation must be used.

Thermal shock

In some cases, insulation is pushed to its limits by temperature fluctuations, especially from cryogenic to very hot. FOAMGLAS® insulation systems are fabricated with methods designed to produce a finished product which resists the thermal shock associated with drastic temperature cycling.



FOAMGLAS® insulation systems



Application fields: underground piping & all other insulation needs

The ideal underground insulation system



FOAMGLAS® insulation is impermeable to moisture, unaffected by soil acids, chemically inert and strong enough for direct burial.



Other end-use options with FOAMGLAS® insulation

FOAMGLAS® insulation: A solution for every possible insulation issue

A few examples:



- 1 FOAMGLAS® insulation for low temperature spheres
- 2 Trace heating possibilities
- 3 FOAMGLAS® insulation for tank walls and roofs
- 4 FOAMGLAS® insulation for vessels, above or below ground installation

Permeability: the untold story



The number one enemy of insulation performance is moisture. Moisture can be liquid, vapour or ice.

FOAMGLAS® insulation is resistant to water and vapour. As an all-glass, 100% closed cell material it retains all the water-resistant properties of glass. This means no moisture absorption, no condensation, no swelling of FOAMGLAS® insulation and it helps to prevent corrosion under insulation. On cold and cryogenic systems, FOAMGLAS® insulation is the best choice for avoiding ice build up as well.



When an insulation material is wet, it may never fully dry out. When insulation remains wet, it does not perform as advertised, a costly consequence to the owner.

Each glass cell of FOAMGLAS® insulation is hermetically sealed during the manufacturing process.

FOAMGLAS® insulation resists the development of corrosion by:

- minimizing water intrusion and retention
- not contributing to the corrosion of carbon or stainless steels
- being an integral component of a corrosion resistant barrier



Time Tested, Proven, and Trusted

For decades FOAMGLAS® insulation has been selected as the best material to protect against the dangers of **corrosion under insulation**.

FOAMGLAS® is completely impermeable and will not absorb water. It is acid resistant to organic solvents and acids.

A FOAMGLAS® insulation system can be simpler than systems using permeable insulation materials. FOAMGLAS® insulation does not rely on secondary protection methods to keep moisture out: it is an effective and reliable barrier for temperatures ranging from -270°C to + 480°C (-450°F to +900°F).



Load bearing insulation



A compressive strength up to 1.60N/mm² (232 psi).

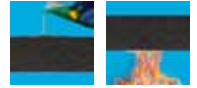
FOAMGLAS® insulation can eliminate the need for special treatment at pipe supports or cradles and allows for insulation to be continuous without interruption. Its strength also means that cladding or other weather coats are better protected against failures caused by impact and point loading.

Thanks to its high compressive strength, FOAMGLAS® insulation is the dominant insulation material for LPG, LNG, LOX, ammonia, ethylene and liquid nitrogen tanks. FOAMGLAS® insulation gives easily obtained additional energy savings for hot tank bases.

FOAMGLAS® insulation for tank bases has a reputation of being an insulation material which is both durable and of high compressive strength.



Fireproof insulation



FOAMGLAS® insulation is Class A1 in accordance to EN 13501-1:2007. It is non-combustible according to ASTM E136, E84.

FOAMGLAS® insulation is not only non-combustible, it is also non-absorbent. As an inorganic material, FOAMGLAS® insulation will not burn or support combustion. It ensures additional fire protection so that inflammable liquids and gases cannot pass through FOAMGLAS® insulation (no wicking effect).



Industrial fire safety is more important now than ever before. Production demands require facilities to run continuously without fear of costly safety issues. Many companies are also assigning a greater priority to communicating their successful safety records both internally and externally.

To address these needs, Pittsburgh Corning has introduced several insulation systems to complement any safety programme by delivering a reliable, low-cost, low-maintenance passive solution

Fire tests verify that FOAMGLAS® cellular glass insulation has outstanding fire protection properties. Specific relevant test certificates can be requested from Pittsburgh Corning.

No development of smoke



Smoke development is a serious threat in case of a fire. With most other insulation materials, exit signs become unreadable almost instantly.

With FOAMGLAS® insulation, the exit signs are still fully visible after one hour.



Undeniable proof of fire safety in the wicking test. Flammable liquids wick through and soak insulation materials

Certified for up to two hours of fire resistance for fire-wall pipe penetrations

FOAMGLAS® insulation systems have been extensively tested for stopping fire spread through wall penetrations.

Depending on the thickness and the materials used, our systems provide fire resistance for fire-wall pipe penetrations of up to two hours, according to DIN4102-11, for pipes of up to 600 mm diameter.



Fire resistance for fire-wall pipe penetrations

LNG Pool fire solution

FOAMGLAS® Pool Fire Suppressant: a reliable, low-cost, low-maintenance passive solution for the reduction of thermal radiation and flame height in contained liquid natural gas (LNG) fires. FOAMGLAS® PFS is easy to install and can provide immediate mitigation of the thermal flux, rate of combustion, view and overall size of an LNG pool fire.

FOAMGLAS® PFS cubes are packaged in easy-to-handle UV-resistant bags



FOAMGLAS® PFS: solution to control pool fires

Jet fire protective insulation system

FOAMGLAS® XP combines the exceptional physical properties of cellular glass with the outstanding fire protection of a factory-applied flexible epoxy intumescent.

A factory-applied coating means no need for on-site spraying of multiple reinforced layers of epoxy intumescent: no mess, reduced wastage, much faster installation, immediate protection against jet fire and extended fire-protection times.



FOAMGLAS® XP: up to two hours of jet-fire resistance



1

1, 2, 3 Specialized third-party jet fire tests on FOAMGLAS® insulation in progress.

4 Graph showing the temperature evolution of a FOAMGLAS® insulated cryogenic pipe exposed to hydrocarbon poolfire.

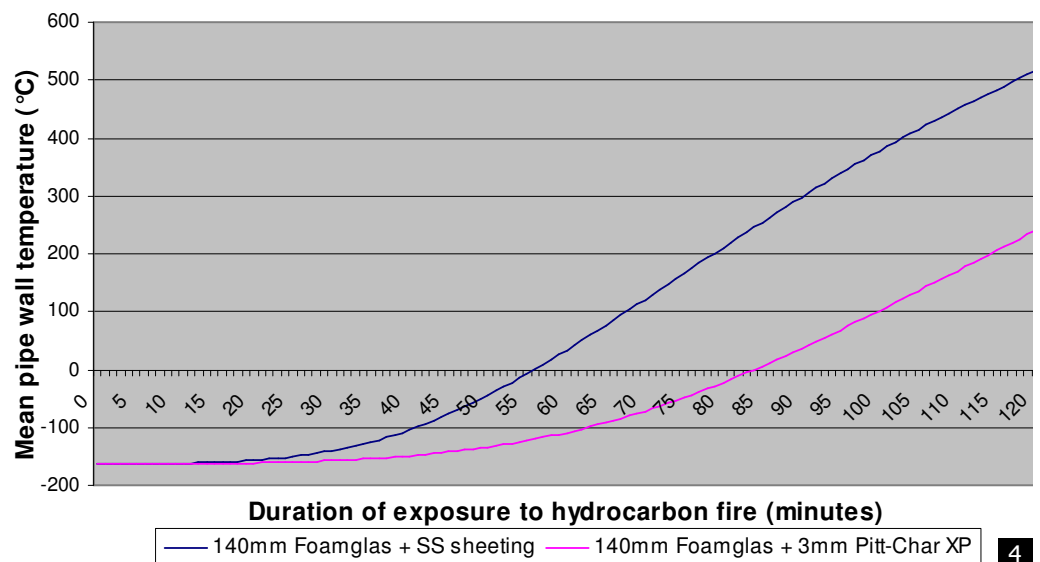
Temperature evolution of insulated 20" cryogenic pipe when exposed to hydrocarbon poolfire



2



3



4

Prefabrication: tailor-made solutions



Tailor-made FOAMGLAS® insulation delivered on site: the time- and cost-saving solution.

Due to the increasing demand for FOAMGLAS® insulation in custom-made elements, Pittsburgh Corning felt obliged to establish and expand a special prefabrication plant in Klasterec (Czech Republic), where fabricated elements are produced in accordance with our high standards.

The quality and dimensional accuracy is ensured by rigorous control and inspection. When produced in the facilities of our channel partners, every element is also engineered to exact requirements.

Lost time as a result of preparing and fitting cladding and wraps can be avoided by utilizing a factory pre-fabricated and pre-coated insulation section. These are available for both hot and cold services.



More and more customers order prefabricated FOAMGLAS® insulation materials, to take advantage of the following benefits:

- minimise the amount of on-site cutting
- Increase the speed of installation
- Easy to fit
- Removable for inspection
- Easier handling of large sections of insulation
- Virtually every size and shape is possible.

Prefabricated coatings:

- HTAA: High temperature anti-abrasive
- LTAA: Low temperature anti-abrasive
- Bituminous cell filler for outer layer
- PC® 700K: glass reinforced finish
- TEROSTAT PC FR
- Alubutyl foil
- ASJ foil









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