

FOAMGLAS® INSULATION

TEROSTAT System



FOAMGLAS®



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The FOAMGLAS® - TEROSTAT insulation system

The FOAMGLAS® - TEROSTAT insulation system combines the unique physical properties of Pittsburgh Corning's FOAMGLAS® ONE™ cellular glass insulation with the flexibility and protective properties of a TEROSTAT PC® FRI pre-applied coating to create a monolithic, virtually impermeable system.

TEROSTAT PC® FRI

One of the two system components of the FOAMGLAS® insulation system is TEROSTAT PC® FRI.

TEROSTAT PC® FRI is a highly flexible, silicone coating, adhesive and sealant. This product is factory-applied to FOAMGLAS® ONE™ insulation and is also used to glue and seal off the insulation pieces on-site. Coating, glue and joint sealant cure into a monolithic, impermeable and flexible system.

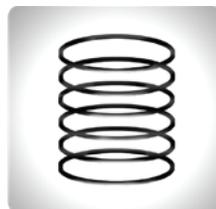
Benefits

User friendly



Easy to apply without the need of any special tools.
Reduces job-site wastage and mess.

Flexible



Cures to a rubber consistency, does not become hard and brittle
Maintains long-term flexibility to ensure that joints & penetrations remain sealed over a wide range of operating temperatures

Weather Resistant



The durable FOAMGLAS® Terostat system has an excellent UV and weather resistance.
Provides long-term protection against chlorid environments and mechanical abuse.

Fire resistant



The FOAMGLAS® Terostat system received a Class O fire rating as per BS 476.

Environmentally Friendly



Certified as a non-hazardous material, environmentally friendly, solvent-free and odorless
No harmful effects in confined spaces. Safe for the workforce and natural surroundings.

Cost effective



The easiness of application reduces the on-site labour costs and the durability of the system greatly reduces any possible maintenance costs.

Temperature range

Terostat PC® FRI keeps its full properties up to temperatures of 120 °C continuous service temperature and 150 °C for short durations.

FOAMGLAS® 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 incompressible without deformation even with long-term loads due to its cell geometry.
Advantage: use as load-bearing thermal insulation without risk.

4 Incombustible

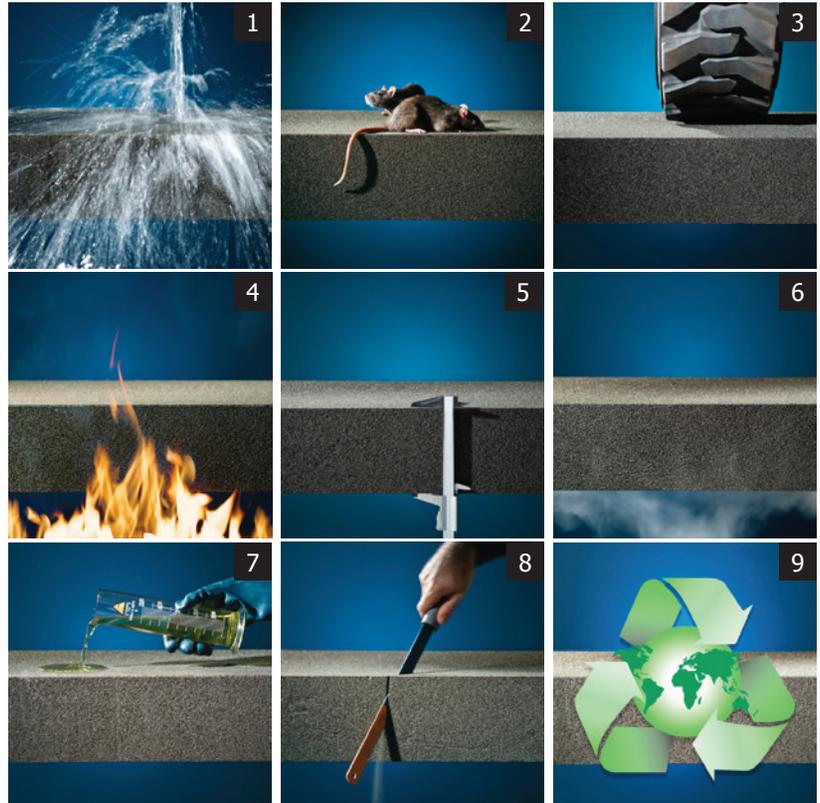
FOAMGLAS® insulation cannot burn because it consists of pure glass. Fire behaviour classification: EN 13501: A1. ASTM E84 flame spread 0 /Smoke development 0.
Advantage: storage and processing not hazardous. No propagation of flames in the event of fire, protects process pipework and vessels.

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.

Advantages of the FOAMGLAS® - TEROSTAT insulation system

Conventional insulation solutions for cold systems

Insulation materials such as plastic foams, which are not impermeable to water vapour, require a vapour retarder to protect against moisture ingress. This vapour retarder generally consists of a very fragile, thin foil, mastic or non-metallic wrap. These types of vapour retarders need additional impact and weather protection (strong enough to resist rain, hailstorms, snow, sunshine or other attack).

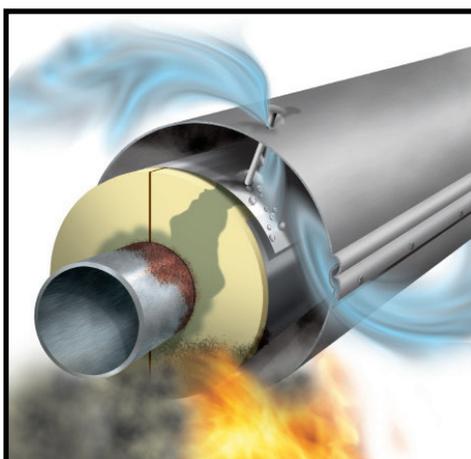
Conventional insulation solutions for hot systems

Insulation materials such as mineral fibre (MF) or glass fibre (GF) are fully permeable to water vapour and can trap significant amounts of liquid water throughout their entire thickness.

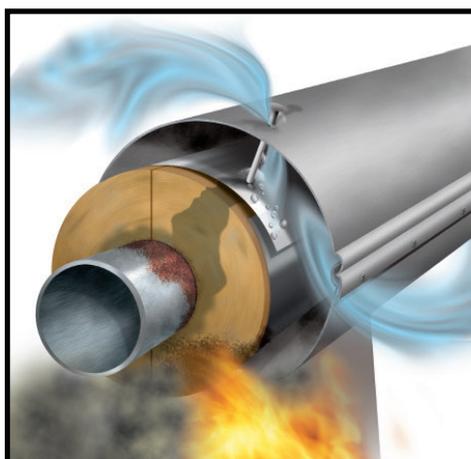
These insulation materials need effective weather protection. Traditionally metal and non-metallic cladding has been the preferred option. Metallic and non-metallic claddings are very vulnerable to distortion/damage, particularly when installed on fibrous insulation materials and this then allows moisture to enter the joints which cannot escape easily from the fibres inside. The moisture is held captive around the pipe causing ideal conditions of humidity and temperature to promote corrosion under insulation (CUI).

The FOAMGLAS® - Terostat PC® FRI system

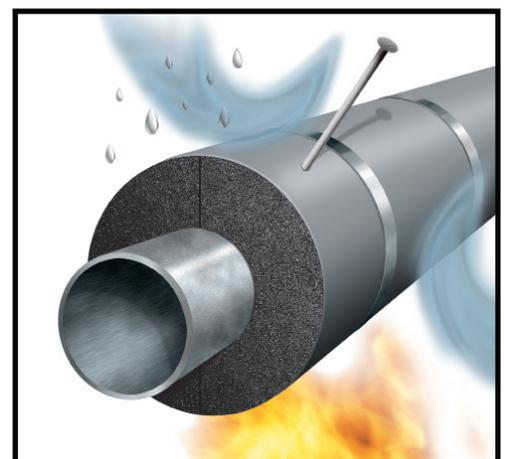
- One system: above ambient, cold and cryogenic systems / indoor and outdoor / combining exceptional physical properties of both materials in the system / vapour tight, 100% closed cell, pre-coated with Terostat PC® FRI (also a joint sealant) which is physically tough, exhibits good elongation and water resistance
- Using pre-fabricated pre-coated insulation sections reduces installation time and improves installed quality as the sections and fittings are easy to fit (even for more complex shapes) and quicker to install.
- Man-hour savings can result in lower installed costs than competitive systems.
- Quality control improvements are significant because of a reduction in field fabricated and coated segments. Also, inspection is simplified because of the immediate detection of failures and open joints would be obvious to visual checks. Corrosion Under Insulation (CUI) risks are reduced because of the water resistant monolithic characteristics of the system.
- High pressure water "wash down"? No problem. The monolithic water resistant nature of the finished system minimizes water ingress into the system. The same characteristics can help minimize potential ice buildup in cryogenic systems and CUI in above ambient systems.
- The overall fire performance of the FOAMGLAS® - Terostat PC® FRI System is excellent compared with other cold and hot insulation mastic or wrap coated systems. It will not absorb flammable liquids either, protecting the system from potential internal ignition.



Conventional cold system with plastic foam insulation



Conventional hot system with fibrous insulation



The FOAMGLAS® - Terostat system

Advantages of the FOAMGLAS® - TEROSTAT insulation system

Cost-effectiveness of the FOAMGLAS® - Terostat PC® FRi system

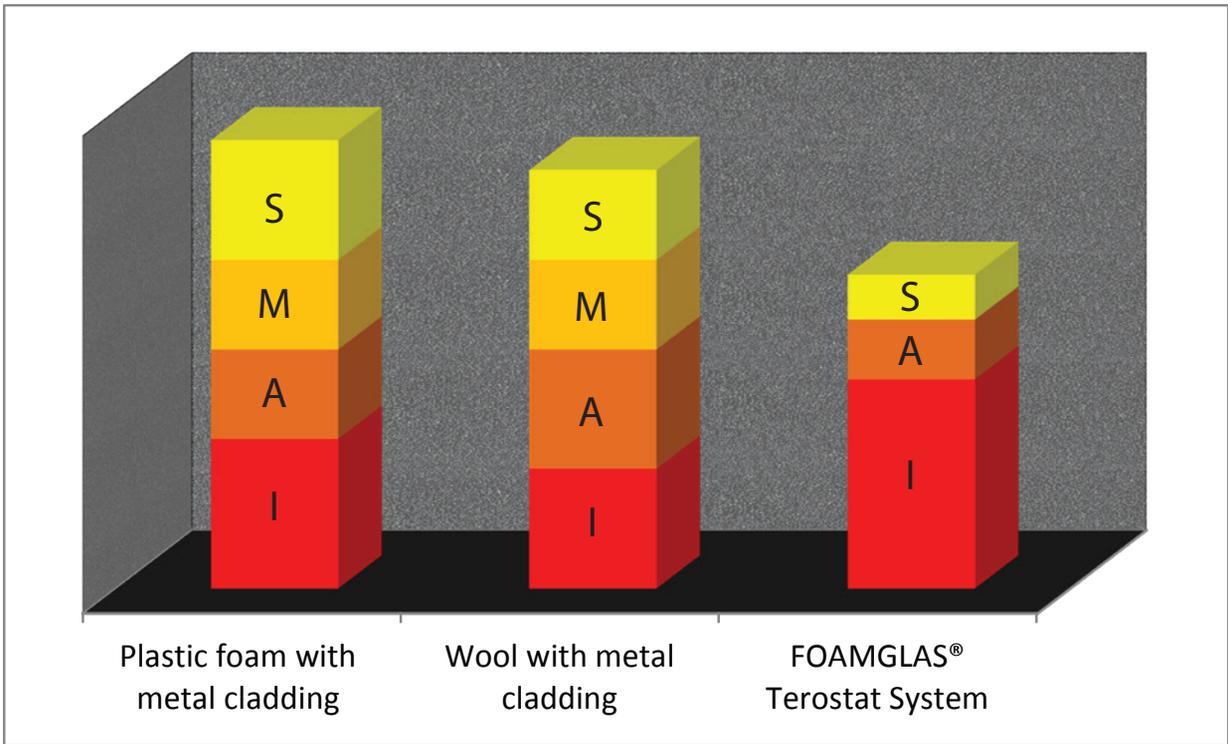
Totally closed-cell, vapour-tight FOAMGLAS® cellular glass can be installed as a single-layer insulation system in most cases, which is a more cost-effective solution than other typical multi-layer insulation and coating systems. Vapour retarders, metal cladding, non-metallic cladding and all cladding-related operations (measurement, prefabrication) can be eliminated. The Terostat PC® FRi factory pre-applied coating on FOAMGLAS® insulation is a viable alternative to "traditional" clad or mastic-coated systems. FOAMGLAS® insulation itself is an effective vapour barrier even before the coating is added. The impermeable FOAMGLAS® insulation system prevents any displacement of the dew point into the insulation; and optimal lifetime performance can be achieved with less insulation thickness if lifetime thermal conductivities are considered. The FOAMGLAS® -Terostat PC® FRi system is simpler, gives greater security, and minimizes field labour.

Labour economics

The FOAMGLAS® - Terostat PC® FRi system meets all the technical requirements of an insulation system with a minimum of field labour and avoidance of all cladding-related operations (measurement, prefabrication). There are significant economic benefits of decreased labour requirements, giving not only labour cost savings but also benefits for the project construction programme.

Reduced site application time helps planning, reduces costs and improves flexibility.

Installed cost comparison per linear meter



I = Insulation
 A = Accessories (foil, spacers, cushioning material, screws, sealant)
 M = Metal cladding
 S = On-site installation work

Factory prefabrication of the FOAMGLAS® - Terostat system

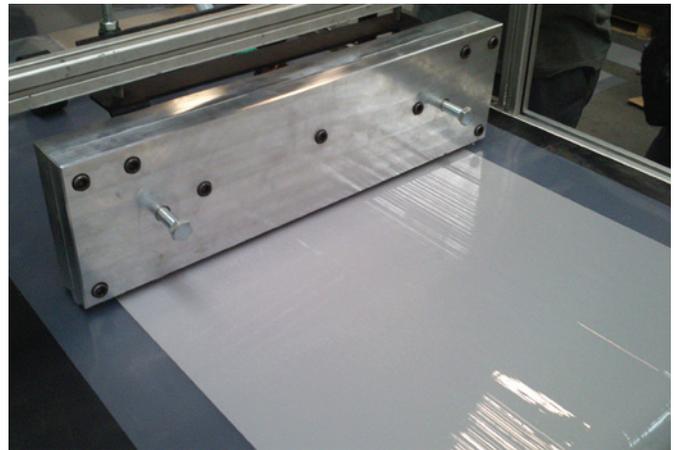
Regular surfaces (flat and straight parts)

A uniform Terostat PC® FRI layer with a constant thickness is extruded onto a plastic foil by an automated coating machine which is located in our fabrication shop.

This foil is forced onto the FOAMGLAS® insulation elements, while the Terostat PC® FRI still wet, using rollers. The Terostat PC® FRI adheres to the FOAMGLAS® insulation surface, without completely filling the cells, to provide a continuous coating. The carrier foil further protects the Terostat PC® FRI coating during transportation.

Terostat PC® FRI is not an adhered wrap or cladding, but is a permanent flexible coating. There is no separate adhesive used in its fabrication, nor is it applied as a loose wrapped surface. By virtue of a solvent-free wet film application method, problems of uncured adhesive or solvent retention under the surface are avoided. As with all wet-applied systems, there can be localised blemishes/inconsistencies affecting adhesion (for example caused by minor air entrapment), but this does not affect the continuity of the weather proofing of the Terostat film.

The use of a carrier film production method ensures a consistent thickness and continuity of the Terostat coating which is the best way to ensure the long-term performance and quality of the system.



Terostat PC® FRI automated extrusion for regular surfaces



Terostat PC® FRI pipe shell application

Irregular surfaces

A uniform Terostat PC® FRI layer is hand applied onto the FOAMGLAS® insulation elements; material usage control ensures that a sufficient thickness is applied and then the surface is smoothed.



Terostat PC® FRI manual application for irregular surfaces

On-site installation of FOAMGLAS® - TEROSTAT system

Application manual

Field application requires a bead of Terostat PC® FRI to be applied from a cartridge onto the FOAMGLAS® insulation at the circumferential and longitudinal joints and then fitting the sections together. It is essential to apply pressure to the joint to spread the Terostat PC® FRI evenly through the joint and to retain this pressure until the Terostat PC® FRI is cured. Nylon luggage bands may be used but overtightening should be avoided. The excess Terostat PC® FRI jointing mastic is then smoothed with a spatula over the Terostat PC® FRI pre-applied coating. After a short curing time the pipe insulation is ready for operation. The strength of the Terostat PC® FRI joint is extremely strong and permanent bands are normally not required. If desired, stainless steel bands may be used but care should be taken to avoid crushing/breaking the FOAMGLAS® - Terostat PC® FRI bond by overtightening or impact.

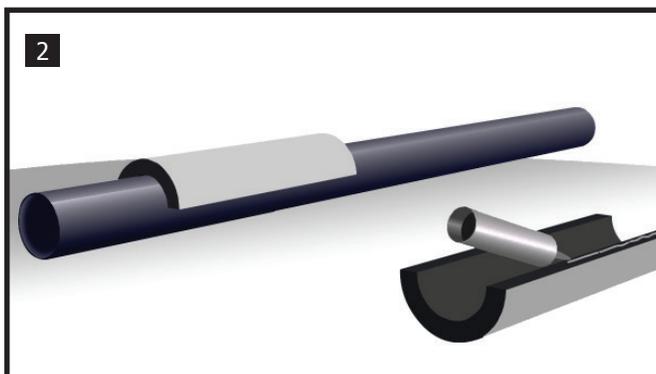
Although FOAMGLAS® - Terostat PC® FRI may be cut and adapted on site we recommend use of preformed fittings for T pieces, elbows, flanges and valve boxes.

What do you need:

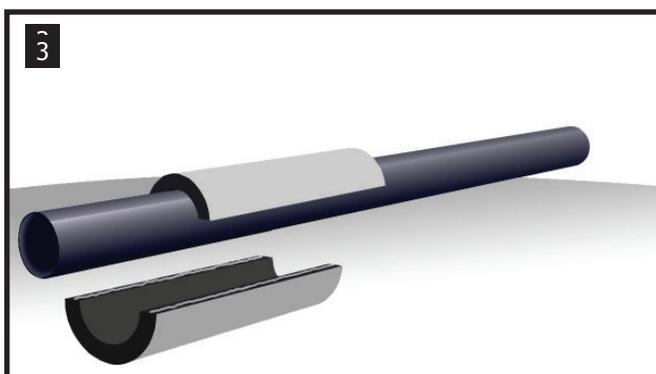


- Terostat PC® FRI sealant cartridges
- Caulking gun
- Hard-point fine-tooth woodworking saw
- Craft knife
- Glass reinforced tape or SS bands & banding tool.
- Bucket or spray bottle with soapy water used for final smoothing

Installation:



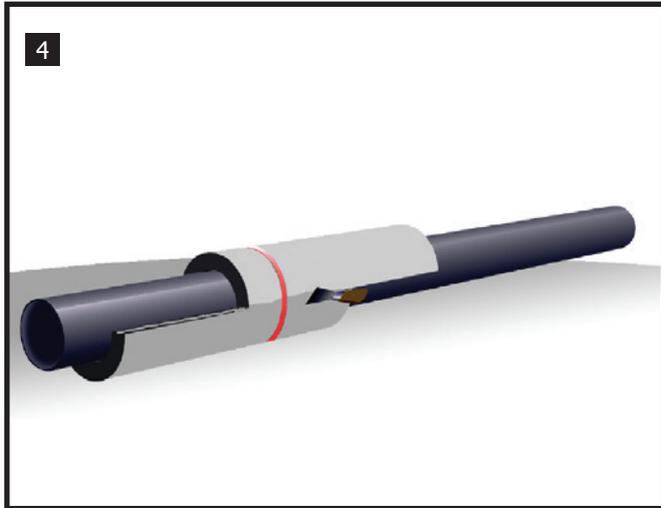
- Place a dry half shell on top of the pipe.
- Apply Terostat PC® FRI sealant 5-10 mm from the outer side of the seam to both of the longitudinal joint faces of a half shell.

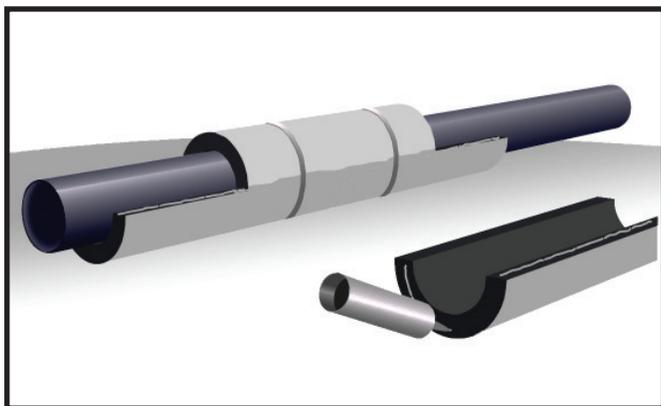


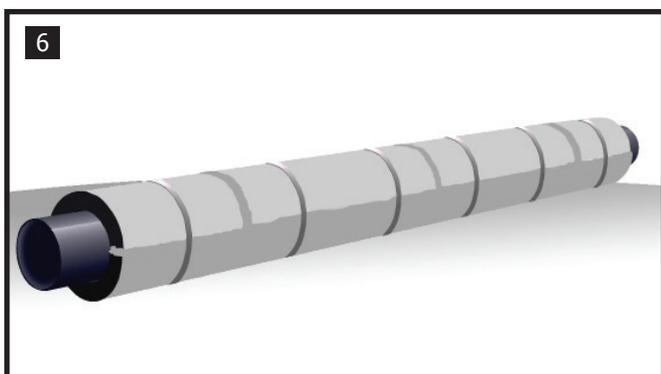
- Install the half shell, with Terostat PC® FRI on its joint face, onto another shell in staggered formation (stretcher bond) or in non-staggered formation (this is not significant for the system). When an expansion / contraction allowance is required without use of separate contraction joints it is normal to use the non-staggered formation. (consult Pittsburgh Corning for details)

On-site installation of FOAMGLAS® - TEROSTAT system

Application manual

<p>4</p> 	<ul style="list-style-type: none">• Make sure you press it well so that excess sealant is squeezed out.• You can apply tape or luggage straps to hold the sections in place and to apply pressure to assist the Terostat PC® FRi to spread throughout the joint.• Pull back the polyethylene transit film from your joint area.• Use your spatula to spread the sealant that has been squeezed out.• Use soapy water to finalize the smoothing process.• Remove the remaining film after the curing process is finished. <p>Note: If extra sealant needs to be applied on the joints after installation then too little sealant has been applied.</p>
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	<ul style="list-style-type: none">• Apply Terostat PC® FRi sealant on both the longitudinal joint face as well as on the circumferential end face and place this shell on the bottom of the other two shells• Mechanical fixation is not required thanks to the excellent adherence characteristics• It is recommended not to use steel retaining band, as overtightening may damage the insulation and/or coating• If use of bands is absolutely required make sure to avoid overtightening
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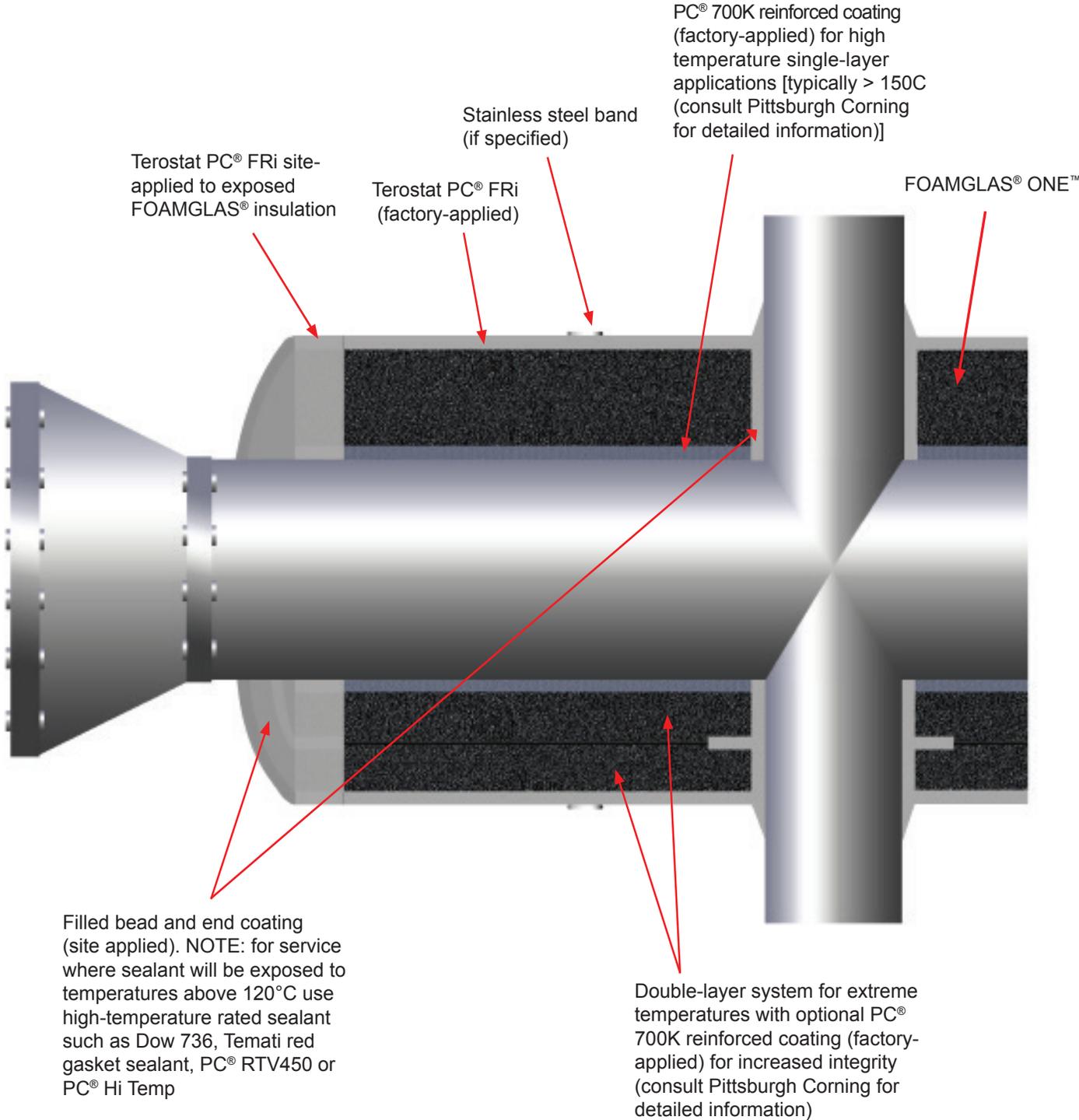
<p>6</p> 	<ul style="list-style-type: none">• Keep repeating this process and this is what your final result should look like.• Terminations and penetrations must be sealed
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Application of Terostat PC® FRi on-site

Terostat PC® FRi is available in cartridges and can be site-applied onto plain FOAMGLAS® insulation. The material is solvent free and moisture-curing.

During this curing process, a skin will develop on the outside of the coating. This means that it is recommended to limit repetitive manual smoothing of the same areas. The best way to obtain an even coated surface is to apply one layer, let it cure and apply the next layer afterwards. Because Terostat PC® FRi is moisture-cured, you need to smooth the surface with some soapy water. This can be done by hand or by using a spatula, preferably a PE or Teflon one.

Terminations and penetrations



Inspection and repair procedures

Integrity of joints is essential to the security of the system. The FOAMGLAS® Terostat PC® FRI system ensures that joints are visible and easily inspected. Inspection must ensure that there are no perforations or gaps in joints. Exceptionally where there has been poor installation and unsealed joints, water may be trapped between the FOAMGLAS® insulation and Terostat PC® FRI surface. If this exists for some time then water may be trapped under the impermeable Terostat PC® FRI surface causing it to stretch. Such occurrences should be immediately rectified by cutting out and drying the FOAMGLAS® insulation, recoating with Terostat PC® FRI and locating and correcting/sealing the source of the ingress.

Inspection procedure:

Removing insulation for inspection, section wise

- Make two circumferential and longitudinal cuts in the Terostat PC® FRI coating and remove the sheet
- Remove the insulation (recommended to be 20 mm from the Terostat PC® FRI cut)
- Inspect object
- Reinstall insulation:
 1. When using a precoated section, insert sufficient Terostat PC® FRI in the joint, and smooth to close surface
 2. When using uncoated material or when reusing a Terostat PC® FRI sheet, adhere it onto the FOAMGLAS® insulation with Terostat PC® FRI or simply hand apply Terostat PC® FRI to the surface
- Make sure coating is well closed and no holes remain

Repair procedure:

Removing insulation for inspection, locally (inspection, repair)

- Cut a cross in the Terostat PC® FRI coating and peel it back, it must be of sufficient size to remove the required amount of insulation
- Remove the insulation (use pipe drill or can to cut out core)
- Inspect
- Reinstall insulation
- Apply Terostat PC® FRI under the cut Terostat PC® FRI film, and close the film; remove excess material and smooth with soapy water



Surface repairs

Crushing damage or other effects can sometimes cause localised delamination of the Terostat PC® FRI surface. This is not a cause for concern but heat/solar heating can result in the surface lifting and stretching; entrapped air is dry. Since Terostat PC® FRI is a continuous flexible coating this will not diminish the weather protection and, when desired, can be easily corrected:

- Cut out the affected area of Terostat PC® FRI film completely or as a flap
- Remove any dust
- Re-coat with Terostat PC® FRI or re-adhere the Terostat PC® FRI film.

Localised abrasion or damage to Terostat edges/corners may be rectified by local reapplication of Terostat PC® FRI



FOAMGLAS® - Terostat system applications

Above ambient and hot service applications

The FOAMGLAS® - Terostat PC® FRI system can be used for all above ambient and hot service applications as it withstands temperatures up to +120 °C. For applications in a higher temperature range a second layer of FOAMGLAS® insulation will be added with only the outer layer being factory pre-coated with Terostat PC® FRI.



Below ambient and cold service applications

The FOAMGLAS® - Terostat PC® FRI system can be used for all below ambient and cold service applications as it remains flexible for temperatures down to -50 °C. For applications in a lower temperature range a second layer of FOAMGLAS® insulation will be added with only the outer layer being factory pre-coated with Terostat PC® FRI. Correctly installed, the risk of ice formation on the pipe or equipment is virtually eliminated making it highly suitable to use in cryogenic applications.



Corrosion Under Insulation prevention

It is the best system to eliminate Corrosion Under Insulation, for all temperature ranges, as it will not allow water ingress, it retains no water. Because it's a continuous coating, the joints and coating will become one, preventing all possibilities of water ingress. It also acts as a vapour barrier so no vapour can enter, condense and create a moist environment where corrosion will develop.



FOAMGLAS® - Terostat system applications

The ideal insulation for offshore applications

Because Terostat PC® FRI is a moisture-cured product it can be used for offshore applications all around the world. The elasticity of the coating protects the insulation from damage from harsh weather conditions. The continuous Terostat PC® FRI coating makes sure that there is no possibility for water ingress which is vital on a offshore platform. Because it's completely waterproof and UV-resistant, it can withstand the harshest weather conditions and can be rinsed off when necessary.



Ideal for food and beverage installations

The unpredictable moisture conditions under metal cladding create a considerable risk for the spread of bacteria. Terostat PC® FRI is an ideal coating for applications in the food and beverage industries. It prevents the risk of micro-organisms growing in grooves and overlaps of metal jackets. Terostat PC® FRI is an easily-applied surface finish which is also easy to clean; it gives a continuous (seamless) coating and seal. This means that leaks or deficiencies can be rapidly detected, without extensive dismantling works, thus meeting the stringent health and sanitation requirements of these industries.



TEROSTAT PC® FRi

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1. Description and area of application

Terostat PC® FRi is a one component sealant, coating and adhesive, silicone based, which cures by reaction with humidity to a soft elastic product.

Terostat PC® FRi is an odorless coating, free of solvents, isocyanates and PVC. Terostat PC® FRi demonstrates good weathering, UV and mechanical resistance, as well as excellent chemical resistance.

Terostat PC® FRi is not sensitive to temperature changes, and has excellent crack-bridging capabilities. Terostat PC® FRi is a flame retardant sealant and coating (class O as per BS476).



2. Processing

2.1 Pre-treatment of the surface

The surface to be insulated should be clean, dry and free from all traces of grease, rust, dust, oil and moisture.

2.2 FOAMGLAS® insulation - Terostat system may be supplied factory applied. FOAMGLAS® insulation is covered with a factory applied layer of Terostat PC® FRi.

2.3 As a coating

Apply a coat of 1.5 to 4 kg/m² (30 to 80 lbs/100ft²) . It may be applied by trowel or cartridge. Immediately after application, the coating is smoothed using trowel, spatula, squeegee or gloves.

Use of a smoothing agent will avoid drag marks on the surface.

2.4 As a joint sealant

If necessary, the mating surfaces should be rubbed to ensure they are flat and smooth before application of sealant. Apply Terostat PC® FRi using extrusion gun, cartridges or trowel.

Apply sealant to mating surfaces of one half or both halves of the pipe insulation section. Press insulation together firmly in order to obtain a complete seal. Smooth any squeezed out sealant flush with the Terostat PC® FRi finish. A raised joint surface is also acceptable, but a recessed (low) joint isn't. Eventually apply an extra bead.

2.5 Cleaning the tools

Clean application equipment contaminated with uncured Terostat PC® FRi with a chlorinated solvent.

2.6 Limitations

Protect from freezing. Store and ship above 0°C (32°F). Avoid application at freezing conditions

Do not apply if rain or temperatures below 5°C (41°F) or above 40°C (104°F) are expected before coating cures.

2.7 Product Safety Notice

All material safety data sheets (MSDS) are available. They aim to ensure a safe handling of the product and correct disposal by the customer

TEROSTAT PC® FRI

3. Type of delivery and storage

Cartridges of 300 ml (429 g)

- Store cool and dry in well-sealed containers.
- Protect against heat and direct exposure to sunrays.
- Protect against frost. Recommended storage temperature between +10°C and +25°C (50°F and 77°F)

4. Coverage

As surface coating: approx. 3 kg/m² (60 lbs/100ft²)

As joint sealant: depends on actual situation and specific application details. One cartridge will produce approximately 6 meter of 8mm diameter bead.

These quantities are for guidance only; they depend on the properties of the substrate, the thickness of the FOAMGLAS® insulation, the application and site conditions, etc.

5. Key data

Color	Grey
Consistency	Pasty, Thixotropic
Density	Ca. 1.5 kg/dm ³ (12.5 lbs/gal)
Solids	100% volume
Skin formation	10 minutes
Cure rate at average ambient conditions	Ca. 2mm/24hr (80 mil/24hr)
Shore-A-hardness (DIN 53505)	Ca. 40
Tensile strength ISO 37	Ca. 2.4 MPa
Elongation break ISO 37	Ca. 200%
Fire class BS 476, part 6&7	Class O
In service temperature range	Minus 50 °C to above 120 °C (-58°F to above 248°F)
Short exposure	150 °C (302°F)
Application temperature range	+5°C to +40°C (41°F to 104°F)
Leachable chloride content	No chlorides
Solvents	None
VOC content	VOC free
UV resistance ISO 37	Dry UV 70 °C 6 weeks : passed QUV 70°C 6 weeks : passed
Water vapor permability	0.022 ng/Pa.s.m 0.015 Perm-in
Water vapor diffusion resistance factor	μ value: approximately 8 450

The physical properties indicated above are average values, which are measured under typical conditions. These values may be influenced by insufficient mixing, the type of laying, the layer thickness and the atmospheric conditions during and after application in particular drying times are affected by temperature, air humidity, sun irradiation, wind, etc.



Pittsburgh Corning LLC
One Owens Corning Parkway
Toldeo, OH 43659 USA
 +1 724 327 6100
 Toll Free + 1 800 327 6126
 For web-based Sales and
 Technical Service inquiries,
 please visit www.foamglas.com

To contact by phone or email:
Industrial & Commercial Sales
Americas
 +1 800 327 6126

Asia-Pacific
 Singapore: +65 9635 9184
 China: +86 (0) 21 6101 7179
 Japan: +81 3 6365 4307

Europe, Middle East & Africa
 +32 13 661 721

Technical Services
Americas & Asia Pacific
 +1 800 327 6126
Foamglastechnical@owenscorning.com

Europe, Middle East & Africa
 +32 13 611 468
Industrytechnical@foamglas.com

European Industry contacts:

Country	Phone	Email
Belux	+32 478 532 075	industry@foamglas.be
Central Europe & Africa	+32 13 355 925	pce.industry@foamglas.com
Czech Republic	+420 731 138 978	industry@foamglas.cz
France	+33 673 191 766	industry@foamglas.fr
Germany, Switzerland, Austria Central hotline	+49 2103 24957 21 0800 52 02 028	industry@foamglas.de
Italy	+39 345 3298 822	industry@foamglas.it
Middle East	+971 50 6528474	industry@foamglas.ae
Scandinavia / Nordic	+47 22 556 644	industry@foamglas.no
Spain - Portugal	+ 351 965 80 24 31	industry@foamglas.es
The Netherlands	+31 622 540 623	industry@foamglas.nl
United Kingdom - Ireland	+44 7789 507 094	industry@foamglas.co.uk