

## Process, Marine & Offshore



“...the choice of industry experts for over 35 years...”

Here at SIG Technical Insulation, we pride ourselves on being a leading distributor in thermal insulation products. We offer thermal insulant solutions for industrial processes, heating, ventilation & air conditioning, fire protection and refractory/high temperature applications.

As well as our large range of market leading products, we are also able to help you with all of your logistical needs thanks to our network of branches that are strategically situated throughout the UK, so along with our highly experienced team of expert employees, we are uniquely equipped to service all of your technical insulation needs.

#### **SIG Business Support**

SIG has teamed up with a number of carefully selected third parties to offer our customers a combined, unique and market leading package of financial services. SIG customers can exclusively benefit from discounted rates and in some cases privileged access to business enhancing products not freely available elsewhere to help secure additional finance, increased cash flow and enhanced internal risk processes.

Visit us today at: [www.sigfinancetools.co.uk](http://www.sigfinancetools.co.uk) to find out how you can achieve competitive advantage and ensure your business is protected and financed for future growth.



# Power Generation

The secret to successfully supplying the power generation industry is having the right stock on the ground at the right time – especially during annual shutdowns.

Here at SIG Technical Insulation, we have demonstrated our capabilities in this area time and time again by our commitment to a close dialogue with our customers, backed up with the largest stockholding and distribution network in the industry.

With the right stock on the ground, market-leading logistics, technical expertise and a wide range of products, it's easy to see why SIG Technical Insulation sets the standard that others try to follow.

Successful contracts that we have recently supplied to include:

- **De-commissioning – Dounreay**
- **SSE – Boddam**
- **SSE – Ferrybridge**
- **EDF – Hinckley Point**
- **EDF – Hunterston**
- **Scottish Power – Longannet**
- **EDF – Torness**



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# Brewing and Distilling

Due to the requirement to use grades of stainless steel that contain the lowest level of “taint”, and because of tightly controlled fermentation temperatures, these industries produce ideal conditions for stress corrosion as well as a whole range of new insulation challenges.

Hygiene is also of the highest importance, and in areas where insulated equipment needs to be thoroughly cleaned on a regular basis, this can be difficult to achieve without the correct insulation systems.

SIG Technical Insulation has a wealth of experience in this area, meaning that we have the solution for any insulation problem that may arise.

SIG has helped with the successful completion of many contracts over the years for companies such as:

- **Carlsberg**
- **Diageo**
- **Heineken (incorporating Scottish and Newcastle Breweries)**
- **Tennent Caledonian Breweries**





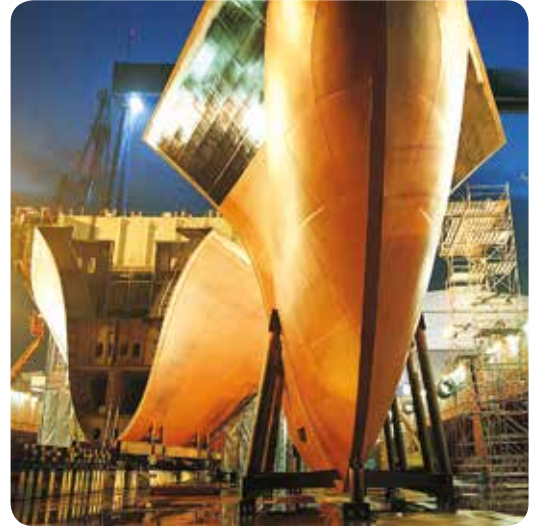
# Offshore and Marine

This is a specialised area of insulation where the importance of safety is paramount. Low temperature requirements are rare, but many high temperature and personnel protection issues need to be dealt with. Fire protection in this offshore environment is always taken very seriously, with many authorities involved in the certification of bulkhead and deckhead insulation, such as IMO/SOLAS, Lloyds, Det Norsk Veritas and the British Admiralty.

Other applications include exhaust insulation, hydrocarbon fire insulation, fire seals and drench systems, as well as the insulation of accommodation. SIG Technical Insulation has been the leader in this field for many years. We have introduced many innovations to the offshore market, in particular where corrosion under insulation is a serious problem and time saving solutions are at a premium due to the additional costs associated with offshore contracts.

Our recent contracts include:

- **Babcock Marine refits**
- **BP Andrew**
- **Britannia Oil**
- **Deep Panuke**
- **HMS Argus**
- **Irish Fishery Protection Vessels**
- **Maersk Griffin**



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# Pharmaceutical

In this industry, the selection of appropriate insulation products and finishes is absolutely vital. From the large number of pressure vessels and fittings needed, to the higher grades of stainless steel required, great care must be taken in the product selection process – particularly where cold or cryogenic processes are involved.

The team here at SIG Technical Insulation has the experience, knowledge and relationships with the manufacturers to know which products are suited to each application, from the point of view of cost, safety and efficiency. They can also advise about products and installation methods that can reduce the amount of down-time during shutdowns or routine maintenance.

On a daily basis, SIG Technical Insulation supply material for use on plants across the UK, including:

- **Astra Zeneca**
- **BASF**
- **Eli Lilly**
- **Glaxo Smith Kline**
- **Novartis**
- **Organon**
- **Pfizer**
- **Roche Products**



# Petrochemical

As with offshore and marine, corrosion under insulation can be a major problem in petrochemical plants as a source of added maintenance costs, down-time and as a major safety hazard. This problem can be made worse by the difficulty in identifying when and where the corrosion is taking place as it is often hidden under insulation and cladding.

Modern methods in pipe coating and more highly evolved equipment can help to reduce this headache but, based on many years of experience in the field, at SIG Technical Insulation, we can also be of assistance by suggesting preventative insulation and cladding solutions that can help to minimise this expensive threat.

Insulation requirements on petrochemical plants are very diverse, from large specialised storage tanks, to jettylines, fractionation columns, pressure vessels, cat crackers and even storage spheres, with applications across a wide temperature range. Over the years, we have supplied material to all of the UK's petrochemical plants, from Sullom Voe in the Shetlands Islands to Exxon Fawley and BP Wytch Farm in the South of England.

We also have experience being involved in many of the major and most prestigious refinery and gas storage construction projects, for example:

- **Aurora Project**
  - Sullom Voe Oil Terminal
- **Conoco Immingham**
- **BP Grangemouth**
  - KGXX Project
- **Shell Stanlow**
- **Syngenta**
- **Texaco Pembroke**
- **Total St Fergus**



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# Specialised Applications

Not all process insulation falls into predictable categories. Whether it is subsea pipelines, filling voids, the frost protection of switch boxes, tank bases, insulation of internal tank decks, or any other unusual application, SIG Technical Insulation has the experience and contacts to provide a solution.

## **SIG Exports**

Founded over 20 years ago, SIG export services has sent material to over 50 different countries across Europe, the Middle and Far East, Australasia, Africa, North and South America, and the South Atlantic.

We offer a comprehensive and competitively priced service across sourcing, packing and logistics, consolidation and certification. Whatever the application, SIG Technical Insulation can supply the answer for every insulation need. For more information contact your local branch or visit

[www.sigtechnicalinsulation.co.uk](http://www.sigtechnicalinsulation.co.uk)



# Process, Marine & Offshore Product Overview

**ULTIMATE™  
Mineral Wool**  
(Ambient to +620°C)

**EPDM Foam**  
(-50 to +150°C)

**Class “O” Flexible  
Elastometric Foam  
(FEF)**  
(-50 to +110°C)

**Phenolic Foam**  
(-180 to +120°C)

**Rigid Isocyanurate  
Foam (PIR)**  
(-180 to +120°C)

**Rigid Polyurethane  
Foam (PUR)**  
(-180 to +100°C)

**LTD Foam**  
(-200 to +110°C)

**Foamglas®**  
(-268 to +430°C)

**Pyrogel® XT-E & XTF**  
(Ambient to +650°C)

**Stone Wool**  
(Ambient to 700°C)

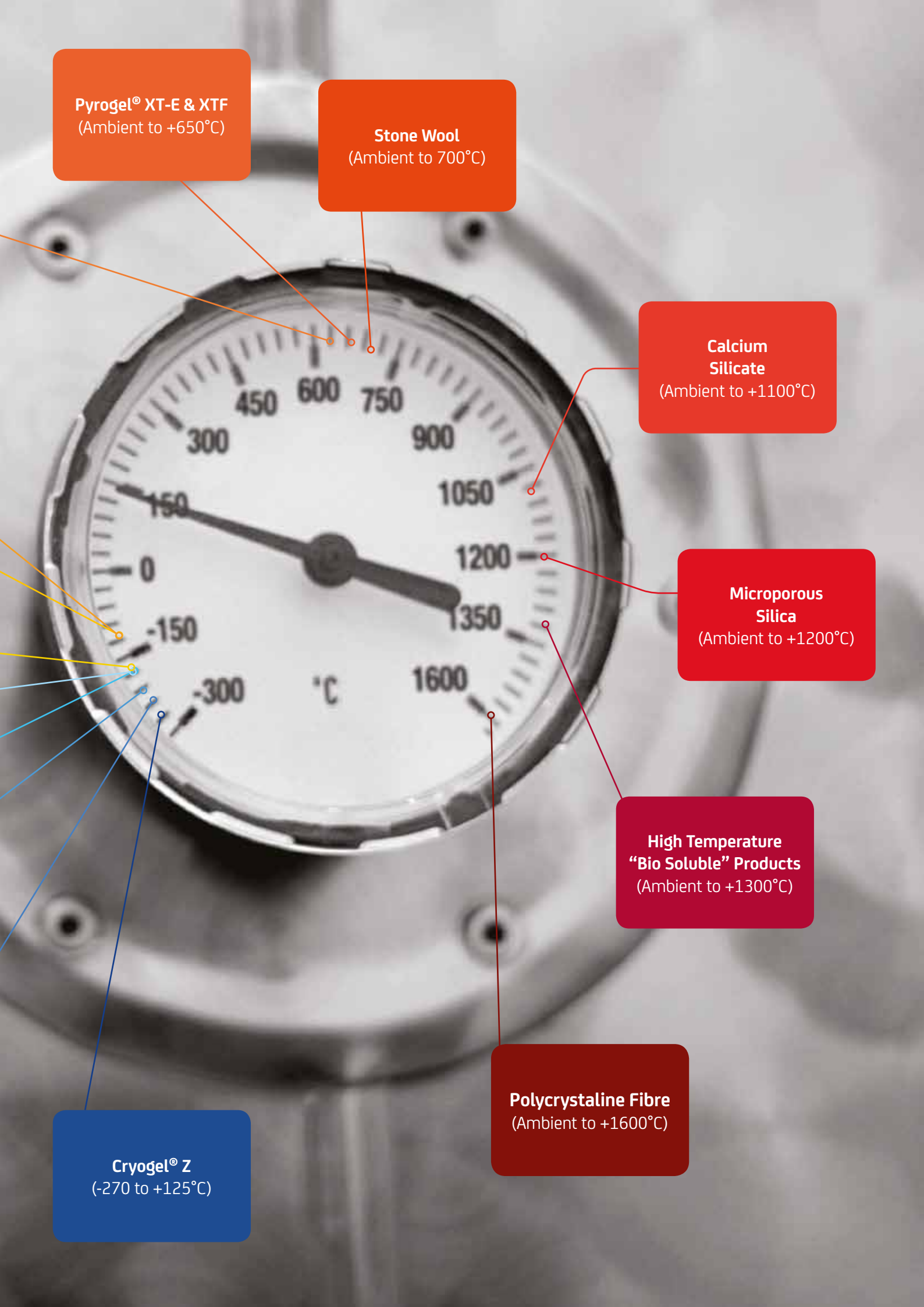
**Calcium Silicate**  
(Ambient to +1100°C)

**Microporous Silica**  
(Ambient to +1200°C)

**High Temperature  
"Bio Soluble" Products**  
(Ambient to +1300°C)

**Polycrystalline Fibre**  
(Ambient to +1600°C)

**Cryogel® Z**  
(-270 to +125°C)





# Process, Marine & Offshore Products

## Cryogel® Z

-270 to  
+125°C



Cryogel® Z is a highly efficient low temperature Aerogel product with an integral vapour barrier facing.

### Application

Designed for use on pipes and equipment running at below 0°C. It is also suitable for use in applications up to 125°C if required.

## LTD Foam

-200 to  
+110°C



Highly-flexible, closed-cell cryogenic insulation material for use in nitrile insulation systems, providing reliability and performance on industrial process pipework and tanks.

### Application

Cryogenic insulation for pipes, tanks, vessels (including elbows, flanges etc.) in production plants for petrochemicals, industrial gases and agricultural chemicals. This product is specially designed for use on the import/export pipelines and process areas of LNG facilities.

## Foamglas®

-268 to  
+430°C



Foamglas® cellular glass is an inorganic insulant which can be fabricated into a range of shapes, including pipes and equipment used in applications from minus 268°C to plus 430°C where a totally closed-cell product is required.

### Application

Foamglas® insulation is used in a wide range of applications on hot and cold pipes and equipment and tank bases. There are Foamglas® insulation systems including Foamglas® XP which are also intended for use as passive fire protection.

## Rigid Polyurethane Foam (PUR)

-180 to  
+100°C



Rigid Polyurethane Foam is a strong and efficient form of CFC/HCFC-free foam insulation.

### Application

This product can be supplied cut into many different shapes for:

- Insulated panels and composites
- Temperature and hygiene controlled environments
- Bodywork and refrigerated vehicles
- Pipework and equipment
- Cold and cryogenic pipework and equipment



## Rigid Isocyanurate Foam (PIR)

-180 to  
+120°C



A rigid foam material that retains all the benefits of rigid polyurethane insulation, but with considerably increased resistance to burning and the spread of flames. Both products are lightweight, easy to transport, handle and install.

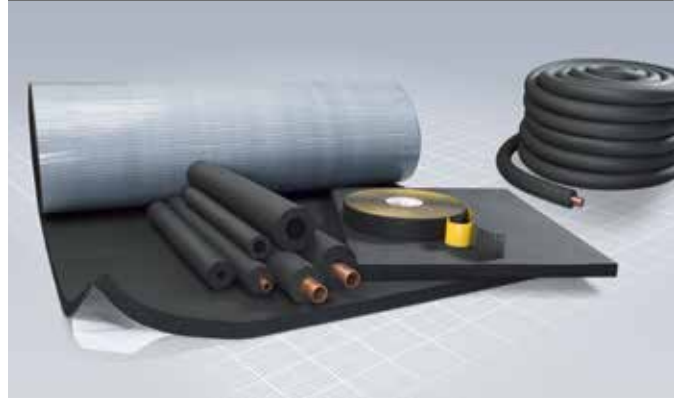
### Application

Suitable for:

- Industrial processes, chemical plants
- Cryogenic, LNG, LPG, petrochemical, ethylene and ammonia production
- Outdoor building services/HVAC applications
- Any PUR application where an improved fire performance is required

## Class “O” Elastometric Foam (FEF)

-50 to  
+110°C



A flexible, closed cell, elastomeric insulation material that offers reliable protection against condensation, and effectively prevents energy loss.

### Application

For energy conservation, condensation control and frost protection of:

- Hot and cold water services
- Chilled water lines
- Heating systems
- Air-conditioning ductwork
- Refrigerated pipework

## Phenolic Foam

-180 to  
+120°C



Phenolic Foam is a rigid foam with a strong resistance to burning and the spread of flames. It also has the lowest thermal conductivity of any commonly available rigid foam insulant at 0.025 W/m<sup>2</sup>/K.

### Application

For use on building services/HVAC and industrial projects including:

- Public sector (health, education, leisure)
- Private sector (hotels, casinos, offices, commercial and public buildings)
- 316 stainless steel pipes and equipment particularly in food, beverage, brewery and pharmaceutical applications

## EPDM Foam

-50 to  
+150°C



A flexible insulation with superior weathering characteristics and suitable for higher temperature applications of up to 150°C.

### Application

For the thermal insulation of pipework, vessels and ducts, where flexible insulation is required at slightly higher temperatures, as well as many other outdoor applications including solar panels.

# Process, Marine & Offshore Products

## ULTIMATE™ Mineral Wool

Ambient  
to +620°C



ULTIMATE™ is a new generation mineral wool that combines all the advantages of conventional thermal and acoustic insulation with increased fire protection.

### Application

The ULTIMATE™ product range consists of slabs and wired mats that offer fire protection for both rectangular and circular ductwork systems, as well as roll and slab products for bulkheads and deckheads.

## Stone Wool

Ambient  
to +700°C



A versatile, cost effective and easy-to-install range of products for thermal and acoustic insulation as well as fire protection:

- Pipe sections, Pipe section mat (PSM) and Bevelled lags
- Wired mat
- Slabs
- Industrial handfill

### Application

Thermal and acoustic insulation of pipes, ducts, vessels and equipment. Also suitable for fire protection of bulkheads and equipment.

## Pyrogel® XT-E & XTF

Ambient  
to +650°C



Pyrogel® XT-E is a high-temperature insulation blanket formed with silica aerogel applied to a reinforced non-woven, high-temperature matrix. Pyrogel® XTF has been specially formulated to provide exceptional protection against fire.

### Application

Ideal for insulating piping, vessels, tanks and equipment, Pyrogel® XT-E and XTF are the most efficient hot insulants currently available.

## Calcium Silicate

Ambient  
to +1100°C



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Strong, monolithic insulation suitable for higher temperatures.

### Application

Available in pipe sections, segments, slabs and blocks for power generation and furnace linings.

## Microporous Silica

Ambient  
to +1200°C



Copyright Promat 2013

An insulation material with very good thermal properties for higher temperature applications.

### Application

For use on pipes and equipment in:

- The petrochemical industry
- Power generation
- CSP (Concentrated Solar Power)
- Fuel cells

## Polycrystalline Fibre

Ambient  
to +1600°C



Polycrystalline fibres designed for use in applications up to 1600°C.

### Application

Used to form stack bonded and convoluted modules for use in the lining of kilns, furnaces and heaters in all industry sectors.

## High Temperature "Bio Soluble" Products

Ambient  
to +1300°C



Available as a range of blankets, felts, papers and boards, "Bio Soluble" products are used on a wide range of pipes and equipment in the higher temperature ranges.

### Application

These products are used where high temperature resistance, relatively low thermal conductivity or low shrinkage properties are important.



# Cryogel<sup>®</sup> Z



## -270 to +125°C

Cryogel<sup>®</sup> Z is a type of Aerogel product – a totally new and innovative insulation material that offers a market leading thermal performance.

Cryogel<sup>®</sup> Z is designed to be used at low temperatures, and so comes supplied with an integral total vapour barrier, with the total seal being completed by the use of matching tape. Its low thermal conductivity means that substantial savings in insulation thickness can be made when compared to other cryogenic insulation materials.

Cryogel<sup>®</sup> Z stays resilient and flexible at low temperatures, is resistant to mechanical abuse and is easy to fit.

### Physical Properties

Thickness	Material form	Max. use temp.	Colour	Density	Hydrophobic
5mm	1.45m wide x 76.88m long rolls	125°C	White	130 kg/m <sup>3</sup>	Yes
10mm	1.45m x 44.85m long rolls	125°C	White	130 kg/m <sup>3</sup>	Yes

Cryogel<sup>®</sup> Z is also available in the form of pre-made bends and fittings.

### Thermal Conductivity Chart

Mean temp (°C)	-200	-150	-100	-50	0	50	100
W/mK	0.0098	0.0114	0.0123	0.0129	0.0138	0.0155	0.0156

### Specification, Compliance and Performance

Test procedure	Property		
ASTM C165	Compressive resistance at room temperature: 23°C	@ 10% compression @ 25% compression	52.9 kPa 130 kPa
ASTM C165	Compressive resistance at cryogenic temperature: -196°C	@ 10% compression @ 25% compression	58.0 kPa 150 kPa
ASTM C795	Insulation for use over austenitic stainless steel	Conforms	
ASTM C1101	Classifying the flexibility of insulation blankets at room temperature 23°C	Flexible	
ASTM C1101	Classifying the flexibility of insulation blankets at cryogenic temperature: -196°C	Flexible	
ASTM C1104	Water vapour sorption of un-faced insulation, procedure A	< 0.5%	
ASTM C1511	Liquid water retention after submission in water (water repellency)	< 2%	
ASTM E84	Surface burning characterisation	Class A Flame spread Smoke developed	<25 <50
ASTM E228	Coefficient of thermal expansion -160°C to 20°C	13.1 x 10 <sup>-6</sup> / °C	
ASTM E96	Water vapour permeability (for complete product with laminate foil)	Approx. 0.00 g/m <sup>2</sup> -hr mmHg	

Cryogel<sup>®</sup> Z is manufactured by Aspen Aerogels.



# Foamglas®

## -268 to +430°C

Foamglas® insulation is a cellular glass product and the only 100% closed-cell insulant currently available. It has a wide temperature range and is therefore suitable for many dual temperature applications. Its high compressive strength makes it an ideal product for use where load-bearing properties are required, such as in tank bases, and it is a popular choice for applications such as low temperature pipework and equipment, offshore warm/hot oil pipework, and asphalt storage tanks. The most common use offshore is on an anti-CUI insulation.

In its plain form, Foamglas® is 100% non-combustible, easy to cut and form and it comes in a wide range of pre-formed shapes, including pipe sections, radiused and bevelled lags, slabs and vessel sets. It is available as either plain or with a variety of pre-applied finishes, such as PET foil or fire safe polymer coatings.

Foamglas® is dimensionally stable and CFC and HCFC free.

### Physical Properties

Method		
Temperature range		
Absorption of moisture (water % by volume)	0.2%	EN1609 EN 12087
	Only moisture retained is that adhering to surface cells after immersion	
Water-vapour resistance	$\mu=\infty$	EN 12086
Acid resistance	Impervious to common acids and their fumes except hydrofluoric acid	
Capillarity	None	
Combustibility & reaction to fire	Non-combustible – will not burn Flame spread 0 Smoke development 0	EN ISO 1182 EN 13501-1 (Euroclass A1)
Composition	Soda-lime silicate glass – inorganic with no fibers or binders	
Compressive strength, block	$\geq 600$ kPa	EN826
	Strength for flat surfaces capped with hot asphalt	Method A
Apparent density	$115 \text{ kg/m}^3 \pm 10\%$	EN 1602
Dimensional stability	Excellent – does not shrink, swell or warp	EN1604 DS (70/90)
Flexural strength, block	$\geq 450$ kPa	EN 12089 (BS450)
Hygroscopicity	No increase in weight at 90% relative humidity	
Coefficient of linear thermal expansion	$9.0 \times 10^{-6}/\text{K}$ from 25°C to 300°C $6.6 \times 10^{-6}/\text{K}$ from -170°C to 25°C	EN 13471
Maximum service temperature	A 430°C	
Melting point	$>1000^\circ\text{C}$	cf DIN 4102-17
Thermal conductivity	0.041 W/mk @ 10°C	EN ISO 13787
		EN ISO 10456
Specific heat	0.084 J/kgk	ASTM E1461
Trace quantities of water soluble chloride	$<2\text{mg/kg}$	EN 13468

Note: FOAMGLAS® ONE™ is manufactured and CE marked to ensure conformity with the mandatory essential requirements of the construction products directive in EN 14305.

Foamglas® insulation is manufactured by Pittsburgh Corning.

# LTD Foam



## -200 to +110°C

LTD Foam is a recently developed closed-cell cryogenic insulation product, designed to retain its flexibility and resilience at extremely low temperatures. It is an elastomeric foam, based on synthetic rubber, typically used as the first component of a cryogenic insulation system comprising additional layers of standard flexible elastomeric foams in order to meet service temperatures down to -200°C. It is easy to form and fit, and is suitable for application to a wide range of pipework and equipment.

### Physical Properties

Colour: Blue

Applications: insulation/protection for pipes, tanks, vessels (including elbows, flanges etc.) in production plants for petrochemicals, industrial gases and agricultural chemicals. Product specially designed for use on the import/export pipelines and process areas of LNG facilities.

Remarks: a high-performance thermal insulation material designed to meet the demands of low-temperature environments.

Property	Value/Assessment								Test	Supervision	Special remarks
<b>Temperature range</b>											
Temperature range	max. service temperature		+110°C		(Temperature cycles)						
	min. service temperature		-200°C								
<b>Thermal conductivity</b>											
Thermal conductivity		$\vartheta_m$		-160	-100	-40	-20	20	40		°
	Tubes (25mm)	$\lambda$	≤	0.021	0.028	0.034	0.035	0.042	0.044		Tested according to EN 12667 EN ISO 8497
	Sheets (25mm)	$\lambda$	≤	0.021	0.028	0.034	0.035	0.042	0.044		
<b>Water vapour diffusion resistance</b>											
Water vapour diffusion resistance	sheets or tubes (25mm)		$\mu$	≥			2.000			°	
<b>Fire Performance</b>											
Reaction to fire	Tubes			Euroclass E			D 4696	°			
	Sheets			Euroclass E							
<b>Other technical features</b>											
Storage & Shelf life											Can be stored in dry, clean rooms at normal relative humidity (50% to 70%) and ambient temperature (0°C - 35°C)

LTD Foam is manufactured by Armacell UK Limited.





# Rigid Polyurethane Foam (PUR)

## -180 to +100°C

PUR is the sister product to PIR and has many of the same properties, albeit with a lower upper limiting temperature and without the excellent fire ratings. However, PUR foam is an economical, strong and relatively closed-cell solution for low temperature applications. It can be supplied in all of the combinations described for PIR.

Neither PUR nor PIR should be used on austenitic (316) stainless steel pipes or equipment in the temperature range 50°C to 120°C, because of the risk of stress corrosion as they are both relatively high in chloride content.

### Physical Properties

Material property	Test method	Unit	Typical value
Nominal density	EN ISO 845	Kg/m <sup>3</sup>	35
Thermal conductivity	EN 12667 at +10°C Initial	W/(m·K)	0.020
	Aged (25 weeks @ 70°C)	W/(m·K)	0.026
Colour	-	-	Cream
Closed cell content	EN ISO 4590 Meth. 1	%	≥95
Operating temperature limits	Upper limit	°C	+100
	Lower limit	°C	-180
Compressive strength	EN 826 at +23°C Parallel	kPa	>190
	Perpendicular	kPa	>120
Tensile strength	ASTM D 1623 – spec A. at 23°C Parallel	kPa	>430
	Perpendicular	kPa	>300
Linear dimensional stability	EN 1604 +93°C for 24 hours	%	≤ 0.5
	-30°C for 24 hours	%	≤ 1
	+70°C and 95% RH for 48 hours	%	≤ 3
Friability	ASTM C 421 (10 minutes)	%	≤ 15
Linear expansion coefficient	ASTM D 696	K <sup>-1</sup>	40-70 x 10 <sup>-6</sup>
Water absorption	ISO 2896	Vol %	≤ 5.0
Water vapour permeability	ASTM E 96	ng/Pa s m	≤ 5.5

Figures courtesy of Kingspan

PUR is manufactured by a number of suppliers, including GRM Insulation Solutions and Kingspan Tarec.

# Rigid Isocyanurate Foam (PIR)



## -180 to +120°C

PIR Foams are CFC and HCFC free rigid insulation products, suitable for use on cryogenic, anti-condensation, warm pipe work and equipment. Its main benefits are a good weight-to-strength ratio, excellent flame spread and fire resistance characteristics, closed-cell construction and exceptional insulation value.

For lower temperature applications, PIR is normally produced in multi-layers, and can be covered with various factory applied vapour barriers, such as BCO or Mylar foil. These have grown in popularity in recent years due to ease, speed and cleanliness of installation.

In common with its sister product PUR Foam, PIR Foam can be supplied in a variety of densities for load-bearing applications such as pipe supports.

### Physical Properties

Material property	Test method	Unit	Typical value
Nominal density	EN ISO 845	Kg/m <sup>3</sup>	33
Thermal conductivity	EN 12667 at +10°C Initial Aged (25 weeks @ 70°C)	W/(m·K) W/(m·K)	0.020 0.026
Colour	-	-	Cream
Closed cell content	EN ISO 4590 Meth. 1	%	≥95
Operating temperature limits	Upper limit Lower limit	°C °C	+120 -180
Compressive strength	EN 826 at +23°C Parallel Perpendicular	kPa kPa	>180 >90
Tensile strength	ASTM D 1623 – spec A. at 23°C Parallel Perpendicular	kPa kPa	>350 >250
Linear dimensional stability	EN 1604 +93°C for 24 hours -30°C for 24 hours +70°C and 95% RH for 48 hours	% % %	≤ 1 ≤ 1 ≤ 3
Friability	ASTM C 421 (10 minutes)	%	≤ 30
Linear expansion coefficient	ASTM D 696	K <sup>-1</sup>	40-70 x 10 <sup>-6</sup>
Water absorption	ISO 2896	Vol %	≤ 5.0
Water vapour permeability	ASTM E 96	ng/Pa s m	≤ 5.5

\*For faced and unfaced products

Rigid Isocyanurate Foam (PIR) is manufactured by a number of suppliers, including GRM Insulation Solutions and Kingspan Tarec.



# Phenolic Foam

## -180 to +120°C

In recent years, Phenolic Foams have risen to prominence due to their usefulness in building service applications and within lines where a low chloride content is important. They have now gained prominence as a major product for the insulation of pipes, ducts, plant rooms and public buildings, as well as offices and domestic premises, due to their efficiency, fire safety and comparatively low cost.

Additionally, phenolic foams are an excellent solution for wet processes such as breweries where the use of 316 stainless steel is widespread, because of the comparatively low level of leachable chlorides. Like PIR and PUR Foams, phenolic foam can be supplied with a variety of covering materials, in particular the reinforced aluminium foil commonly applied to HVAC products.

Phenolic Foams are available in a variety of densities, used mainly in pre-fabricated pipe supports, duct supports and slabs.

### Physical Properties

Properties	Standard	Units
Nominal density	EN1602	40 kg/m <sup>3</sup> +/- 2
Thermal density	EN 12667	0.021 W/m.K +/- 0.002
Temperature limits		-180°C to +120°C
Specific heat		1.88 kJ/kg. C
Compressive strength - Parallel to rise - Perpendicular to rise	EN 826	180 kPa +/- 40 140 kPa +/- 40
Tensile strength - Parallel to rise - Perpendicular to rise	EN 1607	200 kPa +/- 40 180 kPa +/- 40
Closed cell content	EN ISO 4590	Minimum 95%

### Fire test classifications:

- EN 13501-1 : 2007+A1 : 2009, EuroClass SBI B, S1, D0
- BS476 Part 6 and Part 7 – results conform to Class 0 of the UK Building Regulations
- Epiradiateur – M1
- ASTM E84 25/50 flame and smoke up to 3 inches thick
- NEN 6065/6066 – Klasse 1/2
- DIN 4102 – B1

### Other information

This information is furnished without warranty, expressed or implied, except that it is accurate to the best knowledge of GRM Insulation Solutions. The data on this sheet relates only to the specific material designated to herein. GRM Insulation Solutions assumes no legal responsibility for use or reliance upon this data. For information regarding specific applications of the product, please contact GRM Insulation Solutions.

To the Building Regulators in England & Wales, Northern Ireland and the Republic of Ireland and a Low Risk classification to the Building Standard in Scotland.

Phenolic Foam is manufactured by a number of suppliers, including GRM Insulation Solutions and Kingspan Tarec.



# Class “0” Flexible Elastomeric Foam (FEF)



## -50 to +110°C

Flexible Foams are dust-free and are easy to install, clean, transport and supply. Despite a somewhat restricted temperature range, these products are particularly useful for HVAC refrigeration, frost protection and domestic installations. The closed-cell nature of this product makes it ideal for use where cold insulation is required down to -50°C.

They offer a resilient finish and can be used in conjunction with a propriety range of durable covering materials, many of which can be factory-applied. This is of particular importance in offshore installations where labour costs are far higher compared to those onshore, and installation methods, particularly where rope access is to be employed, need to be kept as simple as possible.

In general, the closed-cell nature of this product makes it an appealing choice for condensation control and energy saving on mechanical services equipment, where the ease of installation is important.

Material	Typical values	Remarks
Material	Foamed nitrile rubber	
Max. surface temperature	+110°C	
Max temperature for flat surface	+85°C	
Min surface temperature	-50°C	
Thermal conductivity at 0°C	0.034 W/(m·K)	Test acc. To EN ISO 8497
Thermal conductivity at +20°C	0.036 W/(m·K)	Test acc. To EN ISO 8497
Thermal conductivity at +40°C	0.038 W/(m·K)	Test acc. To EN ISO 8497
Water vapour permeability	Moisture resistance factor $\mu$ 7,000 BS EN ISO 9346:1996 2.79 – 10 (-14) kg/(m s Pa)	
Water absorption	0.2% by volume	Test acc. ASTM C 209
Surface spread of flames	Class 1	Surface spread of flame acc. BS 476 Part 7: 1997
Fire propagation	Total index performance (1) $\leq 12$ Sub index (1) $\leq 6$	Fire protection acc. BS 476 Part 6: 1989
Fire performance acc. to building regulation	Class O	Test results for surface spread of flames and fire propagation meets: <ul style="list-style-type: none"> <li>• Building regulation 2000 (England and Wales)</li> <li>• Building standard (Scotland) regulation 1990</li> <li>• Building regulations 2000 (Northern Ireland)</li> <li>• Building regulations 1997 (Republic of Ireland) for the Class O fire category</li> </ul> Testing in accordance with UL 94
Reaction to fire	Self-extinguishing, does not drip	
Noise reduction	Sound absorption coefficient ISO 345:2003 up to 0.8	Also suitable for use in the prevention of sound passage
Resistance to	Building materials – very good Chemicals – consult product test list Ozone – very good	
Environmental aspects	ODP zero, GWP zero	
Health aspects	Dust & fibre free	

Class “0” Flexible Elastomeric Foam are manufactured by a number of suppliers, including Armacell UK Limited, NMC Industries and Kaimann.



# EPDM Foam

## -50 to +150°C

EPDM Foam is a higher temperature form of flexible elastomeric foam with superior weathering qualities, and it remains flexible at both the high and low extremes of its temperature range. As well as being suitable for a range of applications up to 150°C such as frost protection, condensation control and domestic hot water, this product is also suitable for use in sub-zero temperatures down to -50°C.

It has good resistance to oil, ozone and ultraviolet, has a zero ozone depletion potential and is very easy to use, with self-adhesive and pre-covered options.

EPDM Foam is available as pipe sections, coils, continuous sheet and tape.

### Physical Properties

Material	Values	Remarks
	<b>Foamed EPDM rubber</b>	
Max. surface temperature	150°C	For multi-layer applications above 130°C please contact the manufacturer
Min. surface temperature	-50°C	
Thermal conductivity at 0°C Thermal conductivity at 40°C	0.040 W/(m·K) 0.045 W/(m·K)	Test according to BS 874 Part 2 1986
Water vapour permeability	Moisture resistance factor $\mu > 3,000$	Test according to DIN 52 615
Water absorption	0.2% by volume	Test according to ASTM C 209
Surface spread of flames	Class 1	Test according to BS 476 Part 7: 1997
Reaction to fire	Self-extinguishing, does not drip	
Noise reduction	Sound absorption coefficient ISO 354:2003 up to 0.8	Also suitable for use in the prevention of sound passage
Resistance to	Building materials Chemicals Ozone UV	Very good Consult manufacturer Very good Very good
Health aspects	Dust & fibre free	

EPDM Foam is manufactured by a number of suppliers, including Armacell UK Limited and Kaimann.

# ULTIMATE™ Mineral Wool



## Ambient to +620°C

The ULTIMATE™ range of products is a new concept in thermal, acoustic insulation and fire protection, covering a wide range of densities in slabs, rolls and wired mats. This innovative range of products, offering weight and/or thickness reductions provides new options, particularly for offshore engineers and contractors.

The range of ULTIMATE™ Marine slabs is easier to work with and lighter than some other products, the Marine wired mat and rolls offer the potential extra benefits of being able to lag bulkheads from top to bottom in one operation, rather than the traditional slower method or installation using slabs. Also, the flexible nature of these products makes them easy to form around awkward shapes, cutting down labour and fabrication times.

The ULTIMATE™ Marine products come in a range of finishes, including reinforced aluminum foil, white glass fabric and glass tissue. The potential optimisation of weight offered by these products is extremely important in terms of lifetime fuel costs and stability for ships, and can significantly increase the top speed of naval vessels.

From the point of view of logistics, the extremely compressible nature of ULTIMATE™ rolls and mats means that the products are extremely compact for maximum transportation efficiency.

Characteristic	Symbol	Unit	Quantities and measure volumes									Standard
			10	50	100	150	200	300	400	500	600	
Thermal conductivities	T λN,R	[°C] [W/(m•K)]	0.030	0.035	0.040	0.047	0.054	0.072	0.096	0.126	0.162	EN ISO 12667
Thermal behaviour	–	–	Maximum service temperature: Tmax = 620°C under 500Pa, Tmax = 650 °C under 250 Pa From 150 °C on the binder begins to volatilise									EN 14706
Behaviour in fire	–	–	Non combustible Euroclass A1									EN 13501
Specific thermal Capacity	C	[kJ/(kg•K)]	~ 1									–
Acoustics	A	dB	Sound absorption, αW = 0.99 Specific Airflow resistance AFR ≥ 50									EN 11654 EN 29053
Chemical behaviour	–	–	AS-Quality according to AGI Q 132 Hydrophobic Sulphide-free Free of corrosion supportive material Silicone-free on request									AGI Q 132
Facing	–	–	U TECH Wired Mats are stitched on one side with austenitic wire on galvanized wire mesh Stainless wire mesh (X-X) on request									–
Quality management	–	–	Insulating material for industrial systems according to AGI Q 132 CE-marked according to EN 14303 Quality control according to VDI 2055 Isover has been certified according EN ISO 9001									AGI Q 132 EN 14303 VDI 2055 EN ISO 9001
Miscellaneous	–	–	Insulating material identification number: 10.01.03.54.05 CE-marking designation code: MW-EN-14303-T2-ST(+)-540-WS1-CL10									–

### Delivery form: dimensions/packaging

Thickness (mm)	20	30	40	50	60	70	80	90	100	120
Width (mm)		600	600	600	600	600	600	600	600	600
Length (m)		10.0	7.5	6.0	5.0	4.3	3.7		3.0	2.5
m <sup>2</sup> /pack		12.00	9.00	7.20	6.00	5.16	4.44		3.60	3.00
m <sup>2</sup> /pal		216.00	162.00	129.60	108.00	92.88	79.92		64.80	54.00
Rolls/pck		2	2	2	2	2	2		2	2
Pck/pal		18	18	18	18	18	18		18	18

ULTIMATE™ Mineral Wool is manufactured by Isover.



# Pyrogel<sup>®</sup> XT-E and XTF

## Ambient to +650°C

Pyrogel<sup>®</sup> XT-E and XTF are Aerogel products – a new family of insulants, including Cyrogel<sup>®</sup> Z, with market leading thermal efficiencies. XT-E and XTF are intended for use at temperatures from ambient to +650°C, and while these products are considerably more efficient than other insulants at the lower end of this temperature range, the efficiency differential and therefore the proportional thickness savings increase significantly as temperatures reach and exceed 300°C.

Both Pyrogel<sup>®</sup> XT-E and XTF offer significant space savings, both in the design of new plant and, more significantly, in the upgrading of existing plants and equipment where increased thicknesses are not an option.

Additionally, these products show unique characteristics with regard to the prevention of corrosion under insulation. Their extremely hydrophobic nature strongly resists the ingress of water, while their microporosity ensures that water vapour is able to pass.

XTF may be considered as a very similar product to XT-E but with slightly improved fire characteristics.

### Physical Properties

Pyrogel <sup>®</sup> XTF	
Thickness	10mm
Material form	1.5m wide x 52.65m long rolls
Max. use temperature	650°C
Colour	Grey
Density	180 kg/m <sup>3</sup>
Hydrophobic	Yes

Pyrogel <sup>®</sup> XT-E		
Thicknesses	5mm	10mm
Material form	1.5m wide x 92.90m long rolls	1.5m wide x 52.65m long rolls
Max. use temperature	650°C	
Colour	Maroon	
Density	180 kg/m <sup>3</sup>	
Hydrophobic	Yes	

### Thermal Conductivity Chart

Mean temp °C	0	100	200	300	400	500	600
W/M/°K	0.020	0.023	0.028	0.035	0.046	0.064	0.089



# Pyrogel<sup>®</sup> XT-E cont...



## Ambient to +650°C

### Specification compliance and performance

Test Procedure	Property	Results
ASTM C 165	Compressive strength	Stress at 10% strain = 14.8 psi (102 kPa)
ASTM C 356	Linear shrinkage under soaking heat	< 1.3% @ 650°C
ASTM C 411	Hot surface performance	Passed
ASTM C 447	Estimation of maximum use temperature	650°C
ASTM C 795	Insulation for use over austenitic stainless steel	Passed
ASTM C 1101	Classifying the flexibility of mineral fibre blankets	Class: resilient flexible
ASTM C 1104	Water vapour sorption	2.25% by weight
ASTM C 1338	Fungai resistance of insulation materials	Passed
ASTM C 1511	Liquid water retention after submersion	4% by weight
ASTM E 84	Surface burning characteristics	Flame spread index = 0 Smoke developed index = 0
ASTM E 1354	Cone calorimetry	No ignition at 50 kW/m <sup>2</sup>
ISO 1182:1990	Non-combustibility	Meets criteria outlined in ISO 1182:1990

In addition to the above:

When tested to ASTM C 592-04 (heat & vibration aging) Pyrogel<sup>®</sup> XT-E showed a 0.19 mass change after 6 hours vibration and passed BN EN 13501-1: 2007 (Euroclass A2)

Pyrogel<sup>®</sup> XT-E and XTF are manufactured by Aspen Aerogels.



# Stone Wool

## Ambient to +700°C

Stone Wool products are a tried and tested economical solution for many insulation applications, both on and offshore and in petrochemical, process and power station installations. The products have evolved over the years into many forms, including pipe sections, slabs, lags, mats and various pre-fabricated fittings. They are also suitable for filling insulation mattresses and include forms that are useful for fire protection and the filling of voids. They have natural sound deadening properties and have a long track record with marine contracts as an insulation and fire proofing on bulkheads and deckheads.

The main advantages of Stone Wool products are cost-effectiveness, resilience, availability, versatility, sustainability, ease of use and fire performance.

### **K value at 100°C mean temperature.**

Approximately 0.044-0.049 W/(mk) (for densities over 140 Kg per m<sup>3</sup>)

### **Limiting temperature**

700°C for densities over 80Kg

### **Fire ratings**

Typically A1 in accordance with EN 13501-1

Indicative values given as a guide only (dependent on density, manufacturer etc.).

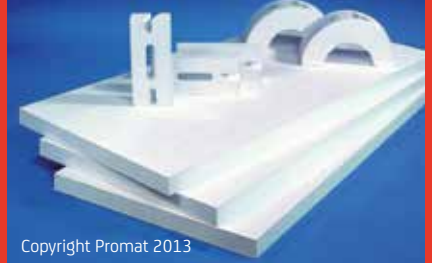
### **Absorption Coefficients for Selected Stone Wool Densities**

Density	Thickness (mm)	Mounting	Frequency (HZ)					
			125	250	500	1K	2K	4K
60 Kg	50	Direct	0.11	0.60	0.96	0.94	0.92	0.82
60 Kg	75	Direct	0.34	0.95	1.00	0.82	0.87	0.86
100 Kg	30	Direct	0.10	0.40	0.80	0.90	0.90	0.90
100 Kg	30	300 mm gap	0.40	0.75	0.90	0.80	0.90	0.85
100 Kg	75	Direct	0.40	0.75	0.90	0.80	0.90	0.85
140 Kg	50	Direct	0.20	0.75	0.90	0.85	0.90	0.85
140 Kg	50	300 mm gap	0.65	0.55	0.75	0.85	0.75	0.85

Figures courtesy of Rockwool

Stone Wool is manufactured by a number of suppliers, including Rockwool® Limited and Paroc Ltd.

# Calcium Silicate



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## Ambient to +1100°C

Calcium Silicate is a traditional insulation material that has been used for many years. Its main benefits are its relatively high temperature limits (depending on type), its strength and appearance and the fact that it can be cut or moulded into a wide range of shapes and components for hot insulation uses.

As well as being available in pipe sections, lags and slabs, this type of material is also available in a cementitious form for direct application to complicated shapes or for finishing uneven surfaces.

### Physical Properties

	Bulk density		
	245kg/m <sup>3</sup>	290kg/m <sup>3</sup>	285kg/m <sup>3</sup>
Colour	White	White	White
Classification temperature	1000°C	1000°C	1100°C
Cold crushing strength	1.4N/mm <sup>2</sup>	2.0N/mm <sup>2</sup>	1.9N/mm <sup>2</sup>
Shrinkage 1000°C	1.3%	1.3%	
At 12 hours 1050°C			1.5%
Reversible thermal expansion	5.4 x 10 <sup>-6</sup> m/mK	5.4 x 10 <sup>-6</sup> m/mK	5.5 x 10 <sup>-6</sup> m/mK
Specific heat capacity	1.03kJ.kgK	1.03kJ.kgK	1.05kJ.kgK
Thermal conductivity			
200°C	0.07 W/(m·K)	0.08 W/(m·K)	0.07 W/(m·K)
400°C	0.10 W/(m·K)	0.10 W/(m·K)	0.10 W/(m·K)
600°C	0.14 W/(m·K)	0.14 W/(m·K)	0.14 W/(m·K)
800°C	0.17 W/(m·K)	0.17 W/(m·K)	0.18 W/(m·K)
Protective gas-resistance	CO <sub>2</sub> , NH <sub>3</sub> subscript, H <sub>2</sub> subscript, CH <sub>4</sub> , N <sub>2</sub> atmosphere		

Calcium Silicate is manufactured by Promat.



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# Microporous Silica

## Ambient to +1200°C

Microporous insulation is manufactured from Amorphous Silica and is the most efficient high temperature insulation available today, providing better insulation than still air.

Microporous insulation is engineered to provide excellent resistance to all modes of heat transfer, conduction, convection or radiation and is available in the following formats:

- Pourable
- Rigid panel
- Flexible panel
- Moulded shapes
- Machined shapes

Dependent upon application, the insulation is supplied un-encapsulated, or encapsulated, by means of shrink-wrapping or glass cloth, ensuring ease of handling and installation.

Microporous insulation is invaluable in applications where space or efficiency is at a premium. It can be used to either reduce the thicknesses of existing insulation whilst maintaining efficiency, or to replace conventional insulation in order to improve efficiency, reduce energy usage and minimise heat loss.

### Physical Properties

Finishing		Glass cloth (E-glass)
Classification temperature	°C	1000
Nominal density	Kg/m <sup>3</sup>	320
Compressive strength (ASTM C 165)	MPa = Nmm <sup>2</sup>	0,32
Thermal conductivity (ISO 8302, ASTM C177)		
200°C mean	W/(m·K)	0,022
400°C mean	W/(m·K)	0,024
600°C mean	W/(m·K)	0,029
800°C mean	W/(m·K)	0,034
Specific heat capacity		
200°C	kJ/lg·K	0,92
400°C	kJ/lg·K	1,00
600°C	kJ/lg·K	1,04
800°C	kJ/lg·K	1,08
Shrinkage		
1-sided 12h @ 1000°C	%	<0,5
Full soak 24h @ 1000°C	%	<3

Microporous Sililca is manufactured by Promat.



# High Temperature “Bio Soluble” Products



## Ambient to +1300°C

Soluble Fibres are manufactured by melting a mixture of calcia/magnesia & silica, and blowing or spinning the melt to produce fibres. These fibres can then be needled together, forming a mechanically strong binder less product or, alternatively mixed with a binder and pressed to form boards. The products offer a similar performance to Refractory Ceramic Fibres without the potential health and safety concerns.

Soluble Fibre products have a classification temperature of up to 1300°C; the classification temperature is the temperature at which the product suffers a permanent shrinkage of less than 4% over a 24 hour period.

In general, Soluble Fibre products should only be run at their classification temperature for short periods of time; advice should be sought relating to individual applications.

The fibres have been designed to be body-soluble to encourage their breakdown within the body if inhaled or ingested.

Soluble Fibre is available in a variety of formats:

- Bulk
- Paper
- Felt
- Wet felt
- Blanket
- Block
- Board
- Vacuum formed shapes
- Modules

### Physical Properties

Colour: white

Fire rating: incombustible

#### 128 kg/m<sup>3</sup> HT blanket - thermal conductivity (ASTM C-201) at a mean temperature of:

200°C	0.04 W/(m·K)
400°C	0.08 W/(m·K)
600°C	0.14 W/(m·K)
800°C	0.23 W/(m·K)
1000°C	0.34 W/(m·K)
1200°C	0.48 W/(m·K)

#### 210 kg/m<sup>3</sup> HT paper - thermal conductivity (ASTM C-201) at a mean temperature of:

200°C	0.04 W/(m·K)
400°C	0.07 W/(m·K)
600°C	0.10 W/(m·K)
800°C	0.14 W/(m·K)
1000°C	0.19 W/(m·K)
1200°C	0.25 W/(m·K)

#### 350 kg/m<sup>3</sup> HT board - thermal conductivity (ASTM C-201) at mean temperature of:

200°C	0.05 W/m.K
400°C	0.08 W/m.K
600°C	0.11 W/m.K
800°C	0.15 W/m.K
1000°C	0.20 W/m.K
1200°C	0.26 W/m.K

High temperature ‘Bio Soluble’ products are manufactured by a number of suppliers, including Morgan Thermal Ceramics and Unifrax.



# Polycrystalline Fibre

## Ambient to +1600°C

Polycrystalline Fibre is manufactured from the highest purity raw materials to provide fibres in the region of 95-97% aluminium oxide.

Polycrystalline Fibre offers unrivalled thermal efficiency at temperatures above 1400°C, minimal shrinkage and excellent chemical resistance.

In modern complex applications demanding a combination of safety, thermal efficiency and chemical resistance Polycrystalline Fibre is the ideal product.

Polycrystalline Fibre is available as:

- Bulk fibre
- Blanket
- Board
- Modules
- Vacuum formed shapes

### Polycrystalline Fibre Blanket

#### Typical Chemical Analysis (fibre wt. %)

<b>Al<sub>2</sub>O<sub>3</sub></b>	95 – 97
<b>SiO<sub>2</sub></b>	3 – 5
<b>Trace</b>	<0.5

#### Permanent linear shrinkage (%) 6 hour soak

<b>1500°C</b>	<4
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#### Physical Properties

<b>Colour</b>	White
<b>Classification Temperature (°C*)</b>	1600
<b>Loss on ignition (wt. %)</b>	
From fibre	0
From blanket*	<5
<b>Median fibre diameter</b>	3 – 4
<b>Product density (kg/m<sup>3</sup>)</b>	96
<b>Specific heat at 1000°C (J/kgK)</b>	1000

#### Thermal Conductivity (W/mK)

Mean temperature	Linear laid	Stacked
800°C	0.16	0.30
1000°C	0.23	0.42
1200°C	0.32	0.56

#### Availability

Thickness	Roll width (mm)	Roll length (m)
13	610	14.6
25	610	7.3

All product dimensions provided are nominal dimensions.

\*Classification Temperature is not a definition of the operational limit of these products, especially when long term physical or dimensional stability is a factor. For certain applications continuous use temperature limits may be significantly reduced. For assistance or clarification please contact your nearest Unifrax Engineering office.

Polycrystalline Fibre is manufactured by Unifrax.

For full technical advice, thermal calculations and support, please contact your local SIG Technical Insulation branch

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SIG is committed to the health, safety and wellbeing of our employees, customers and the general public. We operate a zero harm policy and have gained accreditation to FORS at all of our operating sites.



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