

INSULATION SOLUTIONS FOR INDUSTRIAL APPLICATIONS



CONTENTS

Protecting your investment and the environment.	3
PAROC® stone wool solutions — an energy-efficient choice for industrial applications.	4
Service and knowhow.	7
Applications	8
Insulation solutions for pipework	10
Insulation solutions for pipe elbows	13
Insulation solutions for tanks.	14
Insulation solutions for process equipment.	15
Insulation solutions for boilers.	16
Insulation solutions for flue ducts.	17
Insulation solutions for equipment and filters.	18
Insulation solutions for industrial chimneys	19
Product selection for process industry applications.	19

In any industrial process or plant, owners and operators want to ensure that their investment delivers optimal functionality, efficiency and, of course, profit. A simple way of increasing the efficiency and performance of a process is to ensure that it is properly insulated. Minimum energy consumption and maximum effective lifetime of a plant are highly valuable benefits of a well-insulated process.



PROTECTING YOUR INVESTMENT AND THE ENVIRONMENT

INCREASED RELIABILITY AND EFFICIENCY

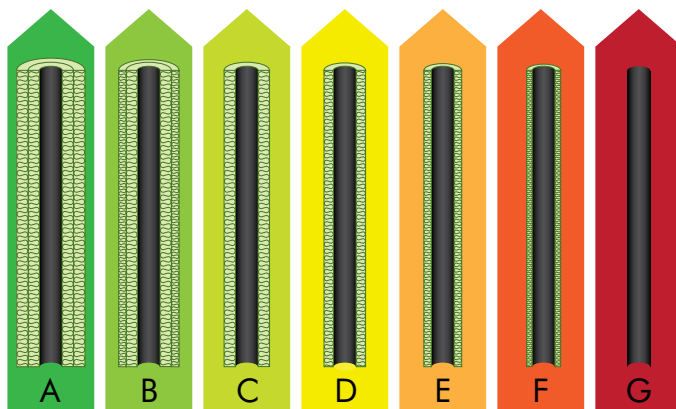
Keeping thermal losses in heat transfer and storage to the absolute minimum considerably reduces energy consumption. In processes where temperatures in pipes and storage tanks must remain within narrow margins, proper insulation makes the task much easier. Consequently, the overall process efficiency becomes more stable. Proper insulation also helps reduce plant and process maintenance work. Corrosion caused by moisture penetrating the insulation can be significantly reduced by using the right insulation solution, further increasing the efficiency and lifetime of the plant.

BETTER BUILT ENVIRONMENT

In a more environmentally aware world, the benefits of the right insulation solution cannot be overstated. By consuming less energy, the plant contributes to reducing greenhouse gas emissions at the level of power generation, as well as reducing emissions from its own processes. A plant that operates in an environmentally aware manner is more likely to get planning approval and will more easily keep pace with increasingly strict environmental regulations.

By improving industrial insulation solutions we can reduce CO₂ emissions significantly. According to studies carried out by the EU, just by insulating the uninsulated parts of processes and replacing broken insulation with new, energy-efficient solutions, we would save the same amount of CO₂ as 10 million cars produce in a year.

Insulation thickness can have a remarkable effect on the energy efficiency of a process. Investment in the appropriate insulation products and thicknesses can result in a huge improvement in energy efficiency with significant cost savings.



PAROC technical insulation products save up to 500 times as much energy during their lifetime as is used to produce them.

SUSTAINABILITY POWERED WITH EIIIF

Paroc Group is a Premium Member of the European Industrial Insulation Foundation (Eiif). The Eiif is a non-profit foundation established to promote the benefits of industrial insulation as a means of achieving sustainability. www.eiif.org



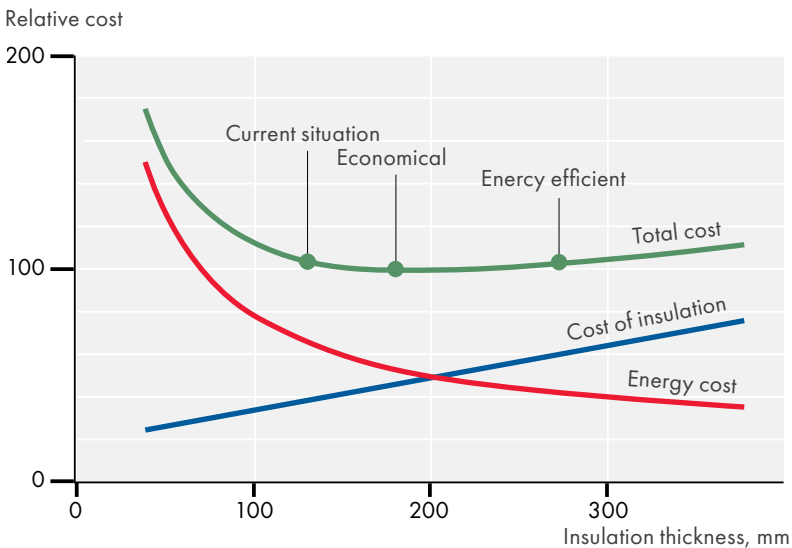
PAROC® STONE WOOL SOLUTIONS – AN ENERGY-EFFICIENT CHOICE

Paroc manufactures stone wool insulation – the most effective and widely used insulation in process industries. The excellent thermal insulation qualities and high-temperature durability of stone wool insulation is highly valued and make it especially well-suited to demanding industrial applications. As non-combustible material, the stone wool insulation also has a positive impact on overall fire safety.

EXCELLENT THERMAL INSULATION IN A WIDE SERVICE RANGE

The main purpose of thermal insulation is to prevent heat flow to or from the application to the surroundings. The thermal conductivity of the insulation material is one of its most important properties. Stone wool has low thermal conductivity, which makes it highly resistant to heat transfer. Reducing heat transfer results in direct savings in energy usage and costs.

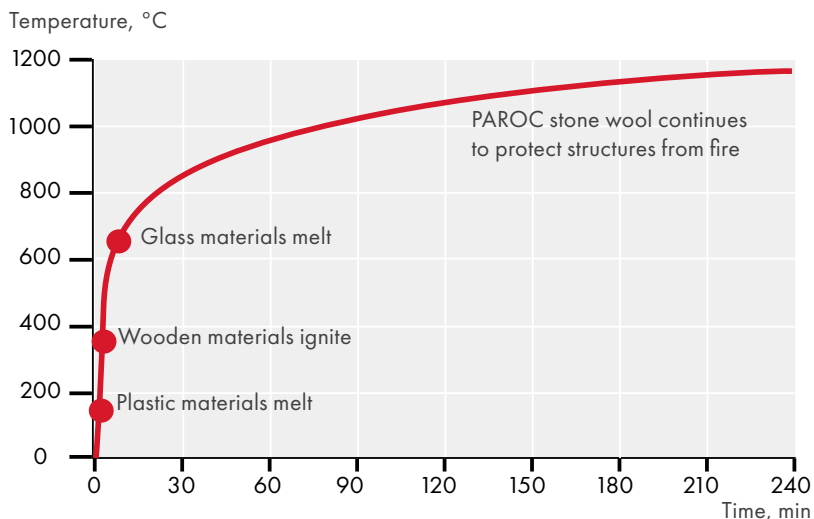
Graph 1. The effect of economical and energy-efficient insulation on energy costs in industry.



PROTECTION AGAINST FIRE

Stone wool is non-combustible as it is made of stone, which does not burn and cannot be ignited. Stone wool insulation does not contribute to the spread of fire; on the contrary, it protects against fire. PAROC stone wool is classified in Euroclass A1, which is the highest class of fire performance for building material.

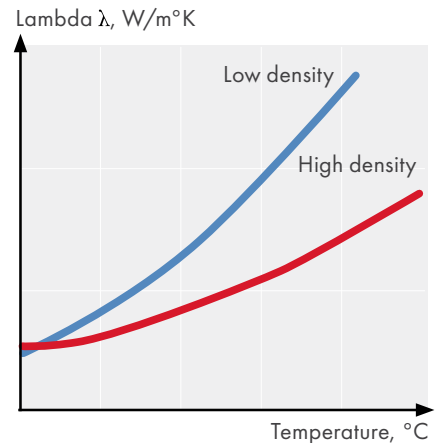
Graph 2. The behaviour of certain construction materials in a “standard fire”. A “standard fire” simulates the development of temperatures in a fire in a normal room space according to the standard combustion curve ISO 834.



LONG-LASTING SOLUTIONS WITH UNCHANGING PROPERTIES

In demanding industrial applications, it is absolutely essential that an insulation solution withstands very high temperatures without sagging. With a maximum service temperature of up to 680 °C, PAROC high-density products retain their form, compressive stress and thermal resistance over the entire lifetime of the plant.

Graph 3. Thermal conductivity of stone wool. At higher temperatures it is important to use high-density products.



PAROC stone wool withstands very high temperatures. On the left, a stone wool sample before a non-combustibility test and, on the right, after the test.



COMPRESSIVE STRENGTH

In industrial applications, good compressive strength can be important to the long-term performance of insulation products. In pipe insulation solutions, this property helps the products retain their nominal thickness during and after installation particularly in use on higher temperature pipes. It also helps to ensure that cladding materials can be accurately fitted with good uniformity and helps resist the effects of mechanical distortion of the cladding. In tank insulation especially, insulation slabs for walkable roofs shall have good resistance to compression and need to fulfill requirements according to specifications. The declared values for compressive stress have been determined in accordance with EN 14303.

EFFECTIVE NOISE REDUCTION

High-speed air, steam and liquid movements in industrial processes create a lot of noise, which can adversely affect the working environment of employees. Due to their porous fibre structure and high density, PAROC products – especially when installed as multi-layer solutions – provide good sound insulation, which creates a more pleasant working environment.

ENVIRONMENTALLY FRIENDLY

PAROC stone wool products are made from clean, natural material. They are environmentally friendly throughout their lifecycle, causing no harm to nature during or after use. Stone wool does not contain any ingredients or chemicals that prevent or impede recycling.

CLASSIFIED SAFETY

PAROC products are safe to use. No CFCs or HCFCs are used in the production of the products. PAROC products also fulfill the requirements of Note Q of EU Commission Directive 97/69/EC. This means that stone wool fibres are biodegradable and are not classified as a possible carcinogen to humans. They do not contain asbestos. Health and safety data sheets for PAROC stone wool products are available on our website at: www.paroc.com

LOW WATER ABSORPTION

Low water absorption is a very important property, since most industrial insulation solutions are located outdoors, where they may be exposed to water, high humidity or other liquids.

If any damage happens to the cladding used on top of the insulation, water can penetrate the insulation system. If the insulation absorbs water, this may cause damage to the equipment, e.g. corrosion, and also dramatically lower the insulating capacity of the product. Therefore, the water absorption of the insulation should be as low as possible.

Tests according to EN 1609 and EN 13472 prove that the water absorption of PAROC stone wool products is within accepted limits and clearly below the allowed maximum of 1 kg/m². Our WR (Water Repellent grade) products fulfill all requirements of BS 2972 even when preheated up to 250 °C before testing.

SOLUTIONS TO PREVENT CORROSION

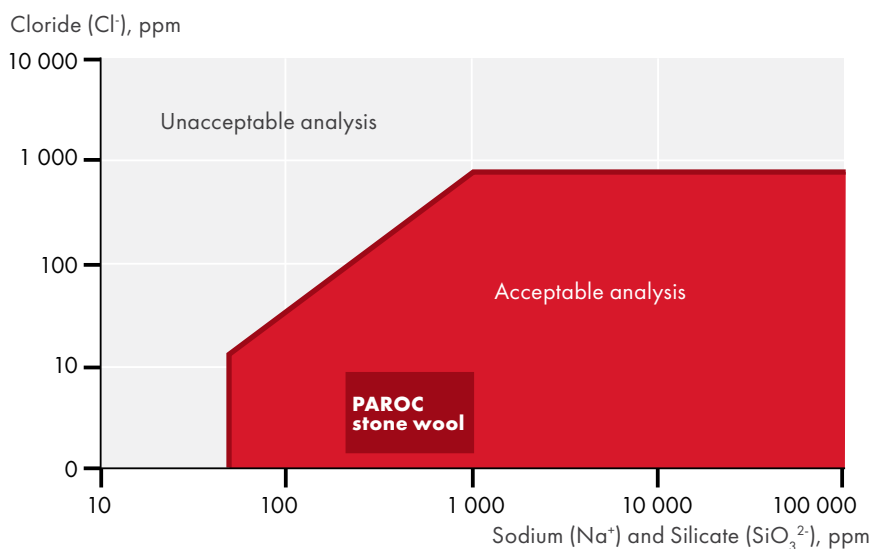
Moisture results in corrosion in uninsulated or poorly insulated process pipes, ducts and equipment causing huge maintenance and repair costs and production losses in industry.

PAROC stone wool is non-capillary and does not absorb or store water.



The key to protecting insulated metal surfaces from exposure to moisture and other harmful substances is to use highly water-repellent, non-hygroscopic, chemically robust and durable insulation material. According to the standard ASTM C 795 the content of water-leachable ions is acceptable in the area shown in the diagram below. According to AGI Q 132, the maximum content of chloride ions (Cl⁻) shall not exceed 10 ppm. PAROC stone wool fulfills this requirement. In addition, the range of protective facings and foils increase process functionality and minimise the risk of corrosion.

Graph 4. The allowed content of water-leachable ions according to the standard ASTM C 795.



DECLARATION OF PERFORMANCE



All PAROC industrial insulation products are CE marked with high quality properties according to Technical Insulation Mineral Wool Product Standard EN 14303. The declaration of performance (DoP) is the official document to prove the declared properties.

THE MANDATORY DECLARED PROPERTIES ARE:

- Thermal conductivity λ_D
- Reaction to fire RfF
- Dimensions and tolerances Ti
- Dimensional stability if maximum service temperature is not tested

THE DECLARED PROPERTIES FOR SPECIFIC APPLICATIONS ARE:

- Maximum service temperature ST(+) i
- Water absorption WS1
- Compressive stress CS(10)
- Water vapour diffusion MVi
- Trace quantities of water soluble ions and pH-value CLi, Fi, Sli, NAI, pHi

An example of a designation code:

MW – EN – 14303 – T2 – ST(+)650 – CS(10)20 - WS1 - MV2 - CL6 - pH9,5

All those values of properties listed in the DoP are based on official tests and controlled by the notified body. As a manufacturer, it is our responsibility that every product put on the market fulfills the declared properties. PAROC stone wool products are very stable. The properties of stone wool do not change over time; they keep the declared values throughout the lifetime of the insulation – decades upon decade.

In addition, our industrial products are tested and certified according to many other standards, such as DINCERTCO, ASTM or Russian certification.

QUALITY AND ENVIRONMENT

PAROC stone wool is known for its high quality, reliability and versatility. To process the stone and to use the material effectively in different applications require knowledge and skill. Our expert knowledge comes from many years of experience and from a clear desire to meet our customers' ever-changing needs.

Paroc factories are certified according to the ISO 9001 Quality Management System and ISO 14001 Environmental System standards. This means that we have a clear organisation and a structured system to deal with issues related to quality and the environment.

ENVIRONMENTAL PRODUCT DECLARATION

At Paroc, we have performed full Life Cycle Assessment (LCA) analyses on our products. Environmental Product Declarations (EPD) for our products are based on the standard EN 15804 and verified by an external party.

MAINTENANCE-FREE SOLUTIONS FOR YEARS TO COME

PAROC products retain their properties throughout the lifetime of the equipment being insulated, helping to reduce maintenance work and prolong service life. PAROC insulation solutions have been designed to make the installation process as quick and easy as possible. As well as making the installation itself safer and more economical, this also leads to error-free installation, thus increasing the long-term reliability of the insulation.



SERVICE AND KNOW-HOW

Only rock-hard facts and solid information about our services and support are found in our brochure. At Paroc, we are not only producers of stone wool insulation products – we also provide a wide range of insulation solutions and offer advice and services to support your profession. We have developed practical tools which have positive feedback from industry and which are widely used. If there is anything you are not sure about or if you need clarification on any topic related to our products – we are here to help! We appreciate any feedback on how we can improve our services.



TAILORED INSULATION SOLUTIONS

We provide optimal and reliable insulation solutions for various industrial applications. They are developed based on close cooperation with customers during our 75 year-long experience, and, of course, on our high quality insulation products. Paroc insulation solutions fulfill technical demands and have been tested and approved in numerous countries. They contribute to all parties involved in a project reaching satisfactory results by gaining time and money in forms of easy design, fast installation, energy-efficient insulation and low maintenance costs.

TECHNICAL SUPPORT

Each year we receive thousands of questions about insulation theory and products. No question is too difficult or too easy for our insulation experts. We can advise on the need to insulate, the right products to choose, installation methods, as well as applicable laws and regulations. If there is a question that we are not able to answer immediately, we will obtain help from our wide network of contacts in all areas of the insulation field.

SAVE ENERGY AND CALCULATE WITH PAROC CALCULUS

Paroc has made the selection of solutions and products as easy as possible. With the PAROC Calculus programme you can determine thermal insulation thickness based on the function the insulation will serve. You can make heat loss calculations for, e.g., pipes, ducts, tanks or vessels. The calculations are based on equations described in the standard EN ISO 12241, and provide insulation solutions which:

- are profitable
- give a specified heat loss
- provide a fixed surface temperature
- prevent condensation
- prevent freezing.

The PAROC Calculus technical insulation calculation programme can be downloaded for free from our website: www.paroc.com

TRAINING AT THE PAROC® ACADEMY

PAROC Academy is the name for our concept of education and awareness around insulation and energy-smart construction. During 75 years of our operation, we have collected a lot of practical experience which we are happy to share with you. We arrange customised training, e.g. in insulation theory, applicable laws and regulations, combined with practical exercises. Contact us if you are interested and we will organise a training session that meets your needs.

WWW.PAROC.COM

The latest product news and valid product information are always available on our website. At www.paroc.com you can order product declarations and approvals or brochures. On our know-how pages you will also find a broad theoretical background on essential themes such as fire safety, energy efficiency and sustainability.

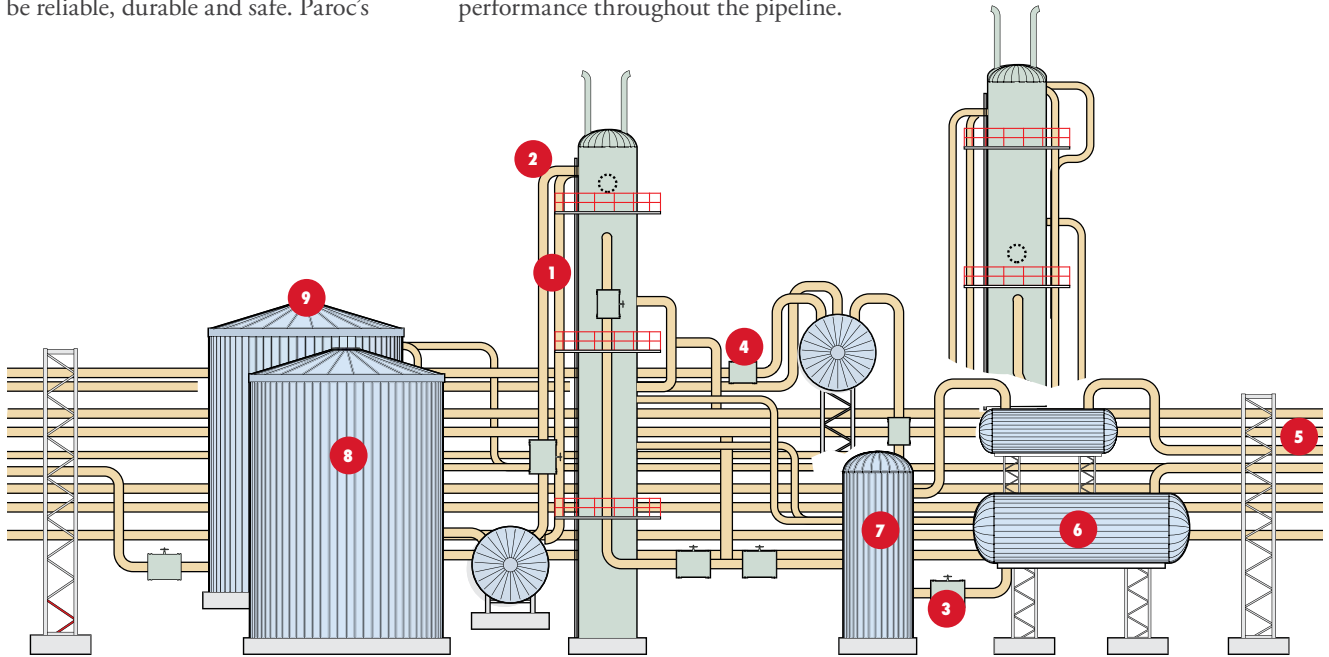


APPLICATIONS

PROCESS INDUSTRIES

Process industries demand specialist insulation solutions. The temperature in the pipelines must remain within certain parameters, heat loss must be minimised, and the whole process must be reliable, durable and safe. Paroc's

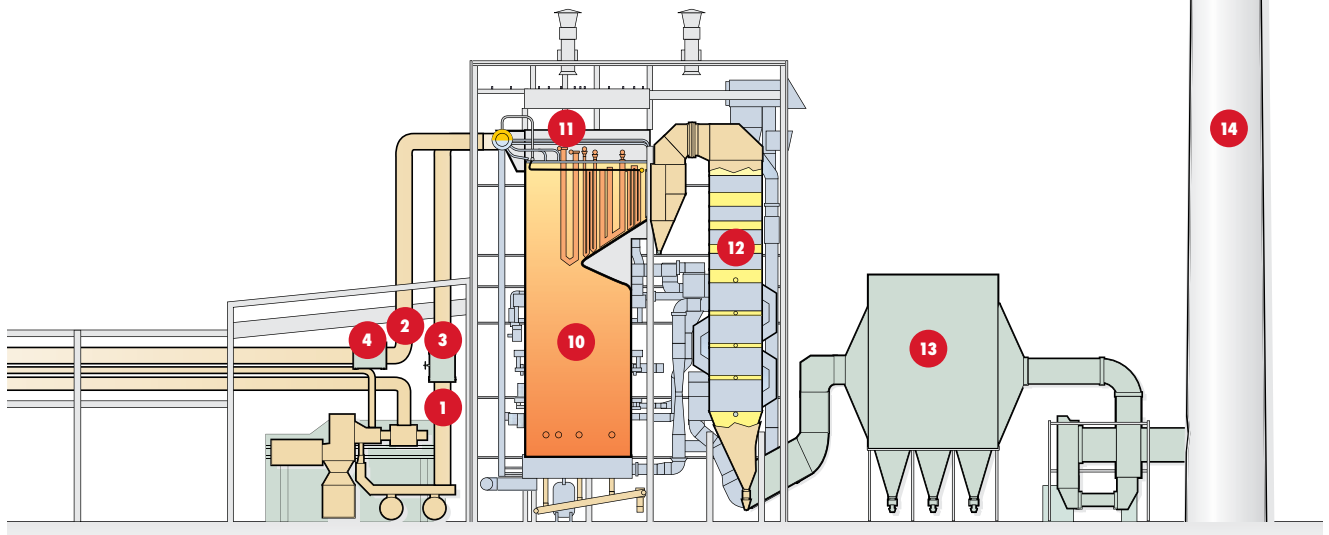
industrially manufactured, mutually compatible insulation components provide the same insulation capacity both for straight pipe sections and pipe elbows, helping to maintain optimal performance throughout the pipeline.



POWER PLANTS

The high service temperatures involved in power generation, together with the variety of components that require insulation demand a wide range of special insulation solutions. For example, boilers need flexible, multi-layer solutions, whereas tanks require a

range of varying density slabs with high compressive stress. Paroc has developed insulation solutions for boilers, tanks, flue ducts, chimneys, and other plant equipment that can increase the efficiency, service lifetime and reliability of the plant.



1 High-temperature pipeline



2 High-temperature pipe elbow



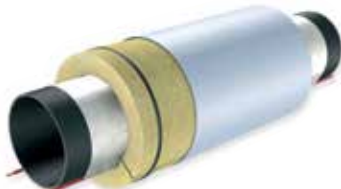
3 Valve insulation box



4 Flange insulation box



5 Heated pipeline



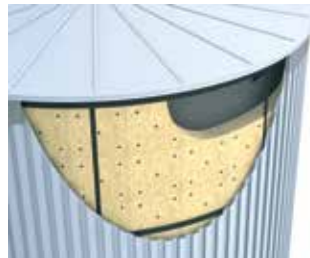
6 Heat exchanger



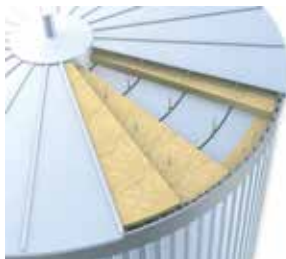
7 Pressure vessel



8 Tank wall



9 Tank roof



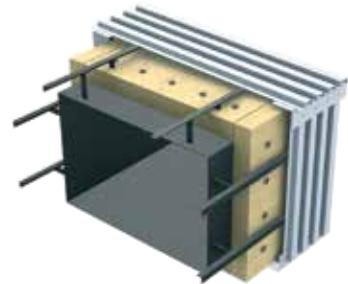
10 Boiler wall



11 Boiler penthouse



12 Flue duct



13 Exhaust gas filter wall



14 Industrial chimney



INSULATION SOLUTIONS FOR PIPEWORK

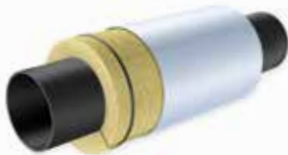
Pipes are a crucial component in industrial processes. Whether in power plants or process industries, well-designed and efficient pipework is a prerequisite for a properly functioning operation and low maintenance costs. For industrial use, we have a large range of pipe section solutions designed for various requirements consisting of industrially manufactured, mutually compatible insulation components for straight pipes and pipe elbows.

EFFECTIVE PAROC PIPE INSULATION SOLUTIONS

Insulation products are chosen according to the operating temperature of the pipe. Insulation can be implemented with standard products or, for high temperatures, with high-density pipe sections. Often one-layer solutions are suitable, but according to more demanding specifications, double- or even multi-layer solutions are required. Double-layer insulation as well as PAROC Pro Lock insulation are tight without any gaps due to overlapping in lengthwise and crosswise joints.

Our solutions comprise standard pipe insulation, double or multi-layer pipe insulation and pipe elbow insulation. The table shows the main products and combinations of products for different applications.

Pipeline insulated with pipe sections in one layer.



RAPID AND ECONOMICAL INSTALLATION

PAROC pipe sections are dimensionally accurate and compatible with factory-made components, such as bends and segments. Installation is straightforward, easy and results in technically superior insulation performance. The components do not need to be further measured or modified on-site, nor do they require any additional metal support structure associated with wired mats. This eliminates a common cause of heat loss.

The benefits of PAROC pipe insulation solutions are particularly significant when insulating pipe elbows. The same material, with the same properties is used, but without the need for on-site cutting and supporting rings that make installing traditional mat insulation so time-consuming.

Table 1. Recommended insulation products for industrial pipework insulation.

PAROC SOLUTIONS FOR INDUSTRIAL PIPEWORK INSULATION		
Temp. °C	Insulation for straight pipes	Insulation for pipe elbows
≤250	PAROC Pro Section 100	PAROC Pro Segment 100, PAROC Pro Bend 100
≤250	PAROC Pro Lock 100	PAROC Pro Segment 100 DL ¹⁾ or PAROC Pro Segment 100 + PAROC Pro Segment 100
>250	PAROC Pro Section 100 DL ¹⁾ or PAROC Pro Section 100 + PAROC Pro Section 100	PAROC Pro Segment 100 DL ¹⁾ or PAROC Pro Segment 100 + PAROC Pro Segment 100
>350	PAROC Pro Lock 140 or PAROC Pro Section 140 + PAROC Pro Section 100	PAROC Pro Segment 140 DL ¹⁾ or PAROC Pro Segment 140 + PAROC Pro Segment 100

¹⁾ Products which have DL in their product name are single products based on two product pieces, one fitted inside the other.

DOUBLE-LAYER PIPE INSULATION SOLUTIONS

Double-layer insulation solutions are needed for temperatures higher than 250 °C and when the insulation thickness is over 80 - 100 mm.

PAROC products which have DL in their product name are single products based on two product pieces, one fitted inside the other. Layers are installed separately. The parts are precisely measured during production to ensure compatibility and a good fit guaranteeing perfect insulation.

Double-layer products (DL) are handled as one e.g. each package includes all of the product pieces required for both the inner and outer layers, eliminating unnecessary waste. This eases the logistics, both in delivery to the building site and at the site itself. The solution, therefore, saves on costs, helps keep the site tidy and provides first-class insulation properties.

MULTI-LAYER PIPE INSULATION SOLUTIONS

If the total insulation thickness is so great that the thickness of available products in two layers is not sufficient, three or more layers of insulation are used.

High-temperature pipeline insulated with pipe sections in two layers.



Double-layer insulation can be replaced with PAROC Pro Lock 100 or 140 (z-lock), a tongue-and-groove pipe insulation that can be installed in a single work period.



- For service temperatures of over 250 °C, at least two layers of insulation are recommended.
- If the total insulation thickness is 80 - 100 mm or more, we recommend using double-layer products (DL) or PAROC Lock Sections.
- We strongly suggest to use products with a density of 140 kg/m³ as the first layer when the pipe temperature exceeds 350 °C.

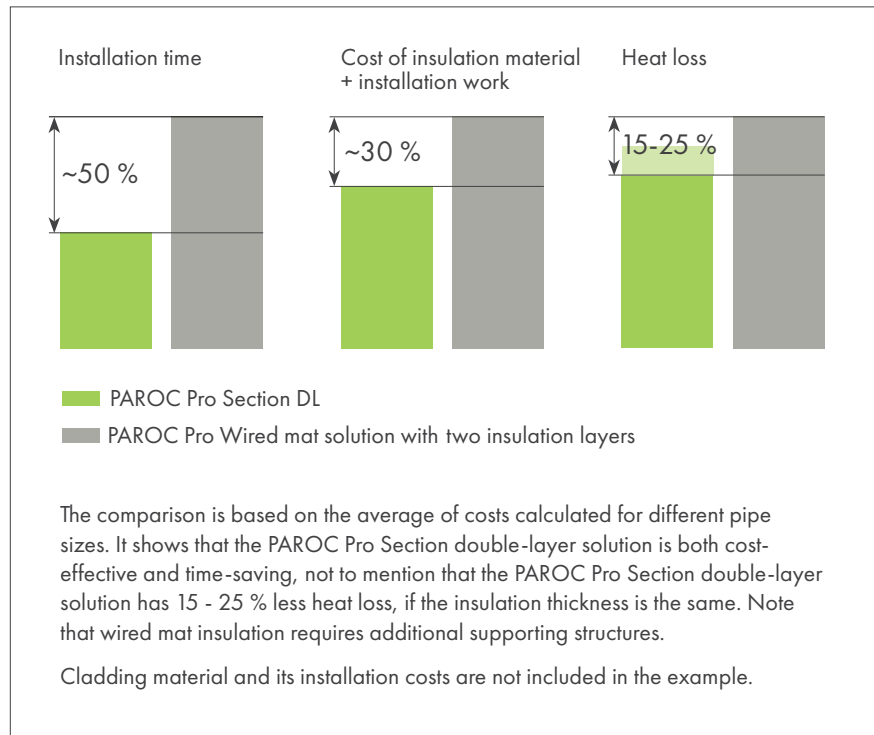
PAROC PIPE SECTION SOLUTION COMPARED TO WIRED MAT INSULATION

One of the primary advantages of PAROC pipe section solution over wired mat insulation is the ease and accuracy of the installation process. By using PAROC Pro Section double-layer solution, heat loss can be reduced by at least 15 - 25 % compared to wired mat insulation with the same insulation thickness.

Insulating pipes with the PAROC Pro Lock solution also brings other benefits compared to the PAROC Pro Wired Mat solution. The insulation thickness can be reduced significantly with the pipe section insulation solution. This also reduces the insulation material costs, cladding costs and labour costs.

With pipe sections, the installation time is shorter. This means that scaffolding and other equipment is needed for a shorter period and general on-site costs are lower. Furthermore, the pipe section insulation does not sag over time, so its thickness and effectiveness remain stable over the whole lifetime of the pipeline.

Graph 5. Comparison of PAROC Pro Section double-layer solution and PAROC Pro Wired Mat solution with the same insulation thickness.



BENEFITS OF PAROC INDUSTRIAL PIPEWORK INSULATION SOLUTIONS:

- Full product range for pipes and pipe elbows – rapid, easy design process
- Tight solutions without gaps in joints – minimum heat loss
- Solutions without supporting structures – improved energy efficiency
- Controlled process temperature – process works efficiently
- Environmentally effective solution – reduced CO₂ emissions
- Compatible pipe sections and elbow insulations – time and money saved on installation, minimum waste on-site
- Exact dimensioning – fits with pre-fabricated cladding
- Double-layer (DL) products delivered nested, one inside the other – more effective logistics
- Very low water absorption and low chloride content in products – eliminate risk of corrosion
- Long-lasting solutions with low maintenance costs – investment for life



INSULATION SOLUTIONS FOR PIPE ELBOWS

Paroc has developed special solutions for pipe elbow insulation which perform as effectively as straight pipe insulation. Prefabricated PAROC Pro Segments and PAROC Pro Bends are a technically effective, fast and economic way to insulate pipe elbows.

PAROC PRO SEGMENTS

PAROC Pro Segments are insulation components for large pipe elbows. The benefits of double-layer insulation can also be utilised in pipe elbows by using double-layer segments, where the seams are sealed in order to minimise heat loss.

We produce PAROC Pro Segments for 90° pipe elbows with a standard radius of 1.5D and 2.5D.

Pipe elbow insulated with pipe sections and segments.



Double-layer segment solution on a pipe elbow continues with PAROC Pro Lock 100 pipe sections.



PAROC PRO BENDS

PAROC Pro Bend 100 is used for small and medium-sized pipe elbows. It is available with a standard radius of 1.5D.

PAROC Pro Bends are designed to make installation quick, easy and efficient.



Upon request, we can produce segments or bends for any elbow radius and insulation thickness. For more information, please contact your local Paroc representative.

VALVES AND FLANGES

Valves and flanges of pipelines must be insulated using separate, easy-to-open jacketing. An aluminium foil-faced wired mat is attached to the inside surface of the jacketing, with the foil facing inwards. This makes service and maintenance work easy and clean to perform, and the same jacketing, with its insulation, can be reused several times.

Remember to insulate all valves and flanges!



HEATED PIPELINES

Viscous fluids must be heated so that they can be transferred in pipelines. Pipes equipped with heating cables or steam tracers are first covered with aluminium foil so that heat is better distributed over the surface of the pipe. Insulation is then installed over the pipe in the normal manner, taking into account the altered outer diameter.

Insulation of a heated pipeline.



SUPERHEATED STEAM PIPELINES AND TURBINE TUBES

Turbine tubes operate at high temperatures of up to 540 °C and demand a good, multi-layer thermal insulation solution. The insulation thicknesses are normally around 200 - 300 mm. The fixing of the insulation and cladding is very

demanding, not only due to the high service temperatures, but also because of vibrations during operation. High density, double or multi-layer insulation solutions are recommended for insulating very high-temperature pipelines such as turbine tubes. See the recommended insulation solution in the table on page 10.

High-temperature pipe insulation always has a multi-layer construction.



TURBINES

Turbine bodies are very complex in shape, with many outlets and round forms. This kind of high-temperature equipment should be insulated with high-density wired mats. The diverse form of the constructions make aluminium-faced wired mats a perfect solution. The fixing of the insulation and cladding is very demanding, not only due to the high service temperatures, but also because of vibrations during operation.

NOISE REDUCTION IN INDUSTRIAL PIPELINES

Pipelines transporting high-speed airflow or high-pressure steam require noise reduction insulation. PAROC high-density pipe sections are a good solution for these applications. They do not require any additional support structure on horizontal pipelines, which in many cases makes the total thermal insulation or noise reduction worse. In double or multi-layer insulation solutions, it is also good to have a heavy facing layer between the wool layers to improve noise reduction.

The most harmful low-frequency noise can be reduced considerably with a high-density multi-layer solution.



INSULATION SOLUTIONS FOR TANKS

Storage tanks of various shapes and sizes are integral parts of many industrial processes. The temperature of the stored material can vary greatly from one process to another, necessitating a thermal insulation solution that performs well over a wide service temperature range.

STONE WOOL INSULATION OFFERS LIFELONG PROTECTION

PAROC stone wool slabs represent the optimum solution for insulating storage tanks and other large cylindrical or flat surfaces. They provide superior thermal insulation over wide service temperature ranges due to low air permeability. Their high compressive stress remains effective regardless of temperature fluctuations for the entire lifetime of the tank. Thus, the insulation slabs require no additional support structures which could create cold bridges.

The water-repellent and non-combustible nature of stone wool gives further protection to the tank, and increases its operating life. Additionally, as with all PAROC industrial insulation solutions, the installation process is both cost-effective and straight forward.

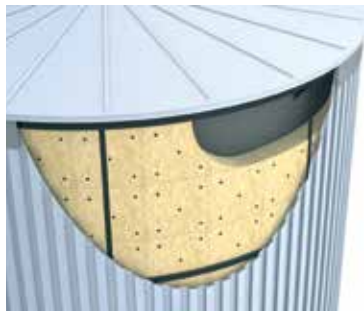
Paroc has a range of stone wool insulation slabs designed particularly for tank insulation applications. Specially made tank wall slabs are available in a range of densities to suit different tank temperatures. For roof insulation, higher-density load-bearing slabs are recommended.

INSULATION OF TANK WALLS

Due to temperature differences between the insulation and cladding, the “chimney effect”, where air flows upwards, occurs in high tank walls. Because of this, it is important to use dense enough insulation slabs to prevent air movement inside the insulation, and minimise heat convection (see graph 6). You can calculate the heat loss or cooling times of tanks with different insulation solutions with the PAROC Calculus tool. You should select the right product and density according to local requirements or insulation specifications.

Tank wall insulation can be installed with different fixing and supporting methods. These vary from country to country and depend on the specifications used.

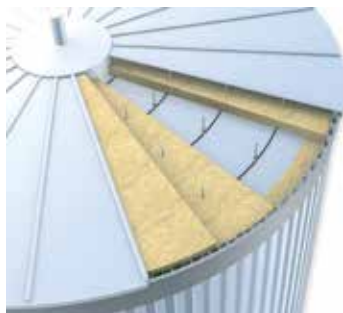
The insulation slabs can be fixed with welded pins.



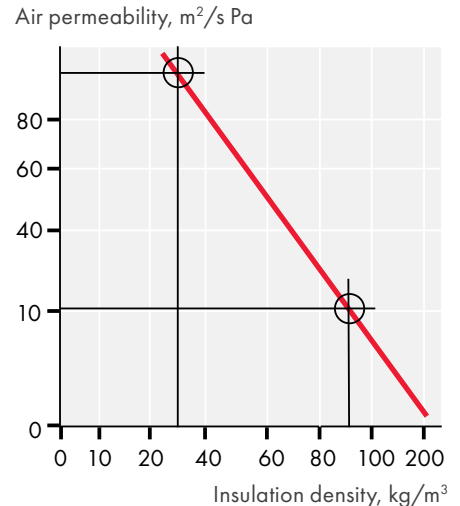
INSULATION OF TANK ROOFS

Tank roofs can be insulated with rigid PAROC Pro Roof Slabs. The slabs themselves do not need any fixing, but the cladding must be supported through the insulation. The supporting structures vary according to different specifications and standards. Insulation slabs for walkable roofs shall have good resistance to compression and need to fulfill requirements according to specifications.

Tank roofs can be insulated with rigid PAROC Pro Roof Slabs.



Graph 6. Air movement decreases when using higher-density products.



BENEFITS OF PAROC TANK INSULATION:

- Tight solutions without gaps in joints – minimum heat loss
- Low air permeability of products – maximum performance even in the most demanding conditions
- Controlled temperature of the content – energy efficiency in storing
- Environmentally effective solution – reduced CO₂ emissions
- Products with high compressive stress for tank roofs – withstand load during installation and maintenance
- Long-lasting solutions with low maintenance costs – investment for life

INSULATION SOLUTIONS FOR PROCESS EQUIPMENT

Depending on its size and operating temperature, process equipment has varying insulation requirements on the insulation and cladding. Specifications are based on experience and can also be company-based.

WIRED MAT INSULATION FOR EQUIPMENT

Wired mats are often the best insulation material for equipment with a lot of curves and outlets. Various pieces of small equipment, like heat exchangers, are insulated with flexible wired mats. A lot of this equipment is multifiform, with uneven surfaces, and therefore flexible insulation is needed to fill up all the corners. When using flexible wired mats, it is necessary to secure the cladding with structures like supporting rings, in order to prevent the insulation from sagging.

Small equipment, such as heat exchangers, is insulated with flexible wired mats.



For pressure vessels, stone wool slabs or wired mats are used depending on the sizes and dimensions in question.



INSULATION OF PRESSURE VESSELS

For pressure vessels, stone wool slabs or wired mats are used depending on the sizes and dimensions in question. Wired mats are used for smaller diameter vessels, for larger ones different density stone wool slabs can also be used according to the required temperatures.

The insulation fixing method is dependent on whether welding to the vessel's surface is permitted or not. Whenever it is possible, welded pins are the easiest choice, but an alternative method is to fix the insulation with steel bands.

BENEFITS OF PAROC PROCESS EQUIPMENT INSULATION:

- Controlled process temperature – process works efficiently
- Environmentally effective solution – reduced CO₂ emissions
- Double or multi-layer solutions – no cold bridges and reduced risk of corrosion
- Long-lasting solutions with low maintenance costs – investment for life



INSULATION SOLUTIONS FOR BOILERS

The high service temperatures and special structure of power plant boilers, together with the need to limit thermal radiation from their large surface area, places particular demands on the insulation solution. The casing and plumbing of boilers are constantly moving due to heat expansion and the vibrations caused by attached equipment such as burners and fans. In addition to the very high temperatures of boilers in general, the temperatures can vary in different parts of the construction.

SPECIAL DEMANDS – EFFECTIVE SOLUTIONS

Due to the high service temperatures involved, several layers of insulation are required in order to provide a sufficiently strong and thick solution. This demands a variable insulation solution depending on the type of boiler. Paroc has a range of stone wool insulation slabs and mats specially designed for boiler insulation applications. Usually, insulation solutions with two to four layers are needed. The inner layer is normally a wired mat and the outer layers can be wired mats or slabs.

The insulation material should be flexible in order to fill all the gaps and allow for heat expansion. In between the insulation layers, it is good to have pure aluminium foil (AL1 facing) to prevent heat radiation inside the insulation.

When put into use for the first time after the insulation has been installed, the boiler should not be heated at a rate more than 50 °C per hour.

BOILER WALLS

The insulation of boilers is demanding, as heat expansion must be taken into account in all structures. The insulation of the pipe wall is fixed with pins welded to tin tubes. The insulation structure is faced with corrugated steel or aluminium cladding. The inner layer of insulation is aluminium-faced PAROC Pro Wired Mat 80 AL1. The outer layer can be insulated with the same product or PAROC Pro Slab 80, specially developed for this purpose.

The inner layer of insulation is aluminium-faced wired mat. The outer layer can be insulated with PAROC Pro Slab 80, specially developed for this purpose.



BOILER PENTHOUSES

On the top of boilers there is a series of pipe junctions. These pipe junctions must be insulated with a special insulation structure of the boiler penthouse. The main structure is composed of flat bars and heavy-duty steel net. It is normally insulated with wired mats only, or wired mats and slabs. The whole structure is faced with heavy-duty corrugated steel plates. On the top of these are steel plates capable of bearing the weight of maintenance workers.

Boiler penthouses are normally insulated with wired mats or with wired mats and slabs.



BENEFITS OF PAROC BOILER INSULATION:

- Double or multi-layer solutions – no cold bridges and reduced risk of corrosion
- Flexibility and mechanical strength of products – proper insulation even under considerable temperature variations
- Controlled process temperature – process works efficiently
- Environmentally effective solution – reduced CO₂ emissions
- Long-lasting solutions with low maintenance costs – investment for life

INSULATION SOLUTIONS FOR FLUE DUCTS

Many process industries involve the transfer of large volumes of air or other gases. The ventilation processes of paper machines, for example, involve a lot of energy that must be recovered. The airflow volumes associated with the ventilation of industrial processes are in a class of their own when compared to major conventional structures. High flow speeds, fluctuations in temperature and pressure, together with the sheer size of the ducts and equipment, require high mechanical strength from the structures.

THE OPTIMUM SOLUTION FOR EACH APPLICATION

In process industries, energy flow management is vital for the functionality and economy of the operation. Such demanding applications require insulation solutions designed and developed specifically for that purpose. PAROC flue duct insulation solutions provide superior thermal insulation at high service temperatures and help prevent condensation. They also have good mechanical strength.

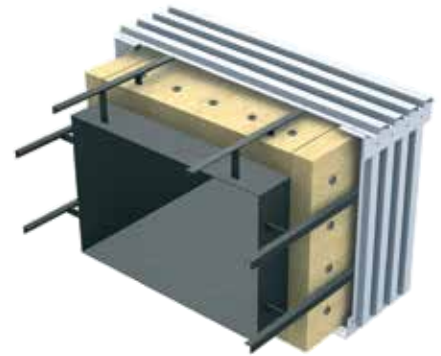
In flue duct applications, a double layer of insulation is usually used in order to prevent cold bridges. Generally, both layers are slabs, but it is possible to combine slabs with wired mats. The optimal insulation material depends on the temperatures and type of channel. For rectangular channels, slabs are easier to install, but wired mats may also be used.

Flue ducts are easy to insulate with PAROC Pro Slab 80, using either one layer or multi-layered insulation solutions. The slabs are fixed with pins and washers. The insulation construction can vary according to specifications.

BENEFITS OF PAROC FLUE DUCT INSULATION:

- Environmentally effective solution – reduced CO₂ emissions
- Long-lasting solutions with low maintenance costs – investment for life
- Controlled process temperature – process works efficiently

Flue ducts are easy to insulate with PAROC Pro Slab 80, using either one layer or multi-layer insulation solutions.



INSULATION SOLUTIONS FOR EQUIPMENT AND FILTERS

The design and installation of thermal insulation in the walls of a boiler plant's flue gas cleaning equipment is of critical importance to its service life and functionality. A good insulation solution prevents the interior walls cooling below the point where the acid contained in the flue gas condenses and forms corrosive deposits. In this respect, it is crucial that no cold areas form on the interior wall.

OPTIMAL INSULATION PROPERTIES

The operational characteristics of PAROC stone wool products are ideally suited for such applications. They provide excellent thermal insulation in the temperature range of flue gases, have low air permeability, are moisture resistant and offer good compressive stress in roof structures. In addition PAROC stone wool has very low chloride and fluoride content, which helps to minimise corrosion.

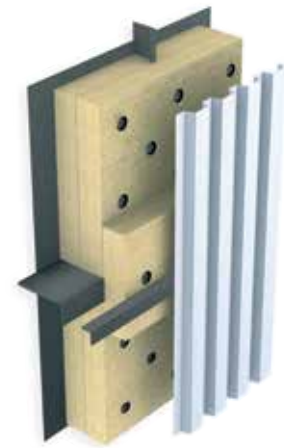
INSULATION WITHOUT THERMAL BRIDGES

It is important to avoid all possible thermal bridges, because they can create areas where acidic vapours condense. Critical areas such as wall bracing structures, adhesive surfaces, and access covers are usually insulated effectively using double or multi-layer insulation solutions with overlapping seams. Generally, both layers are slabs, but it is possible to combine slabs with wired mats. Flat surfaces can be insulated with slabs such as PAROC Pro Slab 80, or with wired mats. The installation properties of the solutions enable tight insulation of wide flat surfaces.

ELECTROSTATIC PRECIPITATORS

Paroc has developed a range of products that are suitable for use in desulphurisation equipment and electrostatic precipitators. Electrostatic precipitators can be insulated with PAROC Pro Slab 80. In some cases, wired mats or multi-layer insulation solutions combining slabs and mats, are also used. The insulation is fixed with pins and washers and it is important to minimise all possible cold bridges in the construction.

Electrostatic precipitators can be insulated with PAROC Pro Slab 80.



BENEFITS OF PAROC EQUIPMENT AND FILTER INSULATION:

- Tight solutions without gaps in joints – minimum heat loss
- Controlled process temperature – process works efficiently
- Environmentally effective solution – reduced CO₂ emissions
- Rigid slabs – easy installation
- Long-lasting solutions with low maintenance costs – investment for life

INSULATION SOLUTIONS FOR INDUSTRIAL CHIMNEYS

Most industrial plants feature concrete chimneys which need to be insulated. When insulating industrial chimneys, the primary concern is to prevent the surface temperature of the internal steel channels from dropping to the point where the gases can condense and form corrosive deposits. Preventing the formation of such deposits prolongs the service life of the chimney.

WIRED MAT INSULATION

The round internal structures of chimneys are usually insulated with flexible wired mat insulation solutions, with special attention being paid to preventing the formation of corrosive acid droplets. PAROC Pro Wired Mat 80 AL1 and 100 AL1 are ideal products for insulating the round channels inside concrete chimneys.

The aluminium foil and net of the insulation provide dust protection and a good base for attachments. This helps prevent the insulation from sagging and also results in more pleasant, dust-free conditions for any maintenance work.



PAROC Pro Wired Mat 80 AL1 and 100 AL1 are ideal products for insulating the round channels inside concrete chimneys.

BENEFITS OF PAROC CHIMNEY INSULATION:

- Wired mat insulation – easy to install on large round channels
- Aluminium foil faced insulation – easy maintenance work inside concrete chimneys

PRODUCT SELECTION FOR PROCESS INDUSTRY APPLICATIONS

Product	Application													
	Process pipelines	High temperature pipelines	Superheated steam pipelines	Valve boxes and flanges	Tank walls	Tank roofs	Heat exchangers	Pressure vessels	Boiler walls	Boiler penthouses	Flue ducts	Equipment and filters	Industrial chimneys	Special constructions
Pipe sections, Segments and Bends														
PAROC Pro Section 100	•	•												
PAROC Pro Lock 100	•	•												
PAROC Pro Segment 100	•	•												
PAROC Pro Bend 100	•	•												
PAROC Pro Section 140		•	•											
PAROC Pro Lock 140		•	•											
PAROC Pro Segment 140		•	•											
PAROC Bend 140		•	•											
Wired Mats 80 - 130 kg/m³														
PAROC Pro Wired Mats							•	•	•	•		•		
PAROC Pro Wired Mats with AL1 facing				•			•	•	•	•	•		•	
Slabs														
PAROC Pro Slabs 35 - 60					•									
PAROC Pro Roof Slabs						•								
PAROC Pro Slabs 80 - 140									•	•	•	•		
Loose Wools														
PAROC Pro Loose Wool														•
PAROC Pro Loose Wool BL														•

* Density depending on the service temperature.

More detailed information about insulation materials used in different applications can be found in the insulation specifications created by the project owner, the manufacturer of the primary equipment or the designer. For help in choosing the right insulation solution and more detailed information on all the products in our extensive range, please visit our website at www.paroc.com.

Paroc is the leading manufacturer of energy-efficient insulation solutions in the Baltic Sea region. The cornerstones of our operations are customer and personnel orientation, constant innovation, profitable growth and sustainable development. Paroc products include building insulation, technical insulation, marine and offshore insulation, sandwich panels and acoustic products. The products are manufactured in Finland, Sweden, Lithuania and Poland and as of 2013 also in Russia. Paroc has sales and representative offices in 14 European countries.



Building Insulation offers a wide range of products and solutions for all traditional building insulation. The building insulation products are mainly used for the thermal, fire and sound insulation of exterior walls, roofs, floors and basements, intermediate floors and partitions.



Sound absorbing ceilings and wall panels for interior acoustic control, as well as industrial noise control products, are available in the range.



Technical Insulation products are used for thermal, fire and sound insulation in HVAC systems, industrial processes and pipe work, industrial equipment as well as shipbuilding and offshore industry.



Sandwich panels are fire proof lightweight steel-faced panels with a core material of stone wool. Paroc panels are used for façades, partitions and ceilings in public, commercial and industrial buildings.



The information in this brochure describes the conditions and technical properties of the disclosed products, valid at the time of publication of this document and until replaced by the next printed or digital version. The latest version of this brochure is always available on the Paroc website. Our information material presents applications for which the functions and technical properties of our products have been approved. However, the information does not mean a commercial guarantee. We do not assume liability of the use of third party components used in the application or the installation of our products. We cannot warrant the suitability of our products if used in an area or conditions which are not provided in our information material. As a result of constant further development of our products we reserve the right to make alterations to our information material at any time. PAROC is a registered trademark of Paroc Group.

October 2014
Replaces: January 2014
© Paroc Group 2014
1177TIEN1014

PAROC OY AB
Technical Insulation
P.O. Box 240, FI-00181 Helsinki, Finland
Tel. +358 46 876 8000
Fax +358 46 876 8002
technical.insulation@paroc.com
www.paroc.com

A MEMBER OF PAROC GROUP