

PAROC PRO LOCK PIPE SECTIONS

ALL THE BENEFITS OF A DOUBLE LAYER INSULATION SYSTEM
IN A SINGLE LAYER APPLICATION



HEAT LOSS UNDER
LOCK AND KEY



PAROC®

SAVING TIME AND MONEY

PAROC Pro Lock Pipe Sections provide the benefit of a double layer insulation system, but in a single layer application – saving time and money. This unique Paroc pipe insulation system can reduce heat losses by up to 25% and installation time by up to 30%.



Within the European Union, the industrial sector accounts for over 27% of final energy consumption.

Steam and other high temperature media are regularly processed in most industrial plants. Hence requiring a high performing thermal insulation system, in order to maintain optimal process temperatures and prevent heat and energy losses.

Pipe insulation systems are often being installed during maintenance downtime. As a result, the temperature of the process pipes are similar to the ambient temperature during this installation phase.

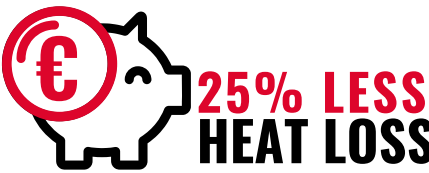
When the systems are being heated to operating temperature, a thermal expansion of the pipes will take place. This can lead to serious heat and energy losses, if not considered from an insulation perspective.

Industrial insulation specifications are often duplicated from project to project. Opportunities for reducing heat losses, reducing CO₂ emissions, minimizing downtime and saving money are missed. Updating insulation specifications to include innovative solutions like PAROC Pro Lock pipe sections would offer great benefits to the process owner as well as the environment.

BENEFITS COMPARED TO WIRED MATS:

- **Technically superior solution without cold bridges**
- **25% less heat loss compared to wired mat insulation solutions**
- **Thinner insulation solution**
 - Less surface area and cladding material
 - Takes less space in processes
 - Lower installation costs, less installation time (compared to 2 layer solution)
- **No supporting structure needed**
- **Thermal expansion of metal pipe does not open the z-lock joints**
- **Reduction in downtime on the plant during maintenance**
- **Contributes to sustainability**

*compared to standard pipe insulation (internal testing)



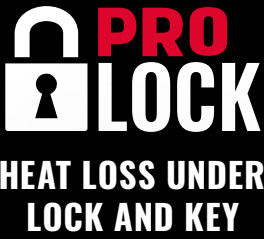
PAROC PRO LOCK – THE OPTIMAL PIPE INSULATION

PAROC Pro Lock simulates overlapping double layers in one application – saving time and money.

Optimization of energy consumption within industrial plants is essential: In every industrial process or plant, owners and operators strive to make investments which will guarantee optimal functionality and efficiency and generate the biggest possible profits.

At elevated operating temperatures, a double layer insulation system is often required to mitigate for the potential opening of the joints. Paroc offers double-layer solutions, and - additionally - offers the innovative PAROC Pro Lock one layer solution.

Industrial pipelines are insulated efficiently using PAROC Pro Lock industrial pipe sections: The thermal expansion of the pipe lines is handled by the z-lock formation of the joints of the PAROC Pro Lock Pipe Sections. **The performance of a double layer solution with staggered joints is achieved with a single layer application.** PAROC Pro Lock Pipe Sections are available in densities 100, 120 and 140 kg/m³.



WATCH OUR VIDEO WITH PAROC PRO LOCK BENEFITS!



Video
www.youtube.com/watch?v=0XgJWnGgkJI

**PAROC PRO LOCK
JOINTS ARE INTERLOCKED**

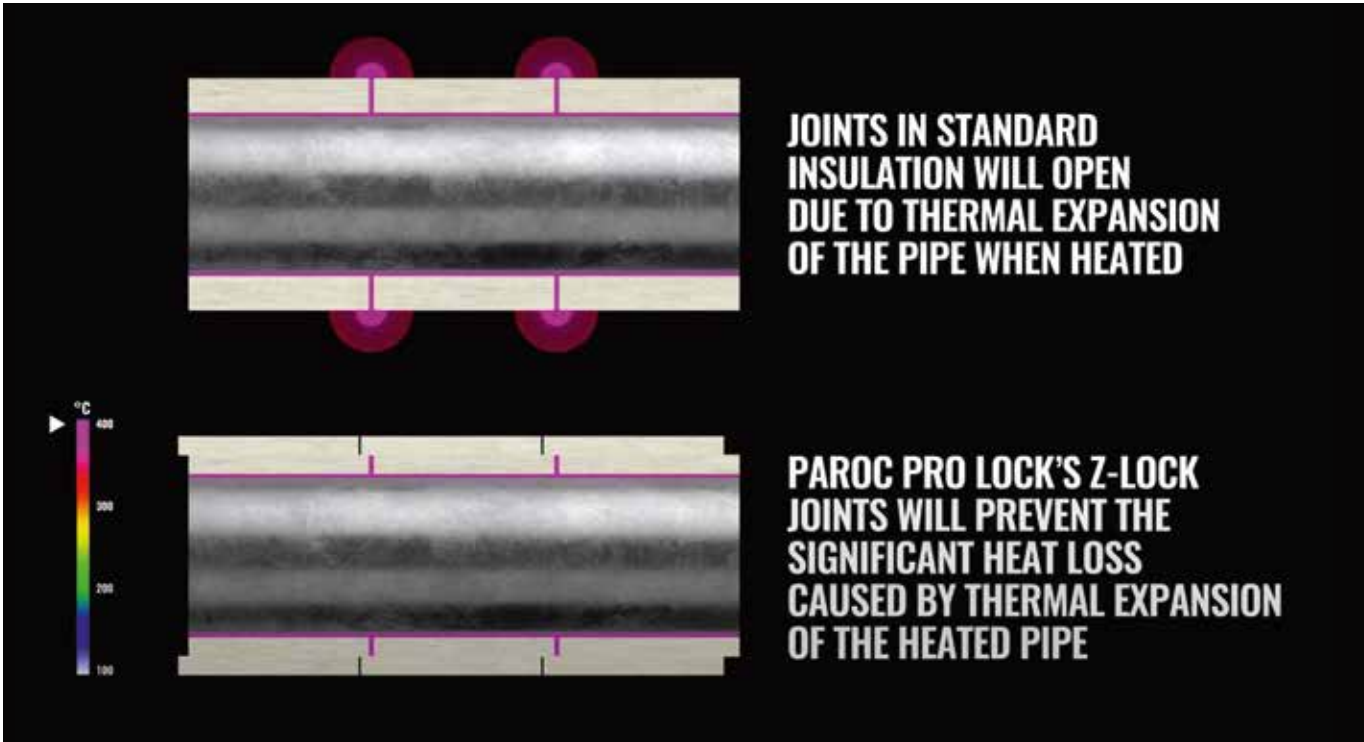
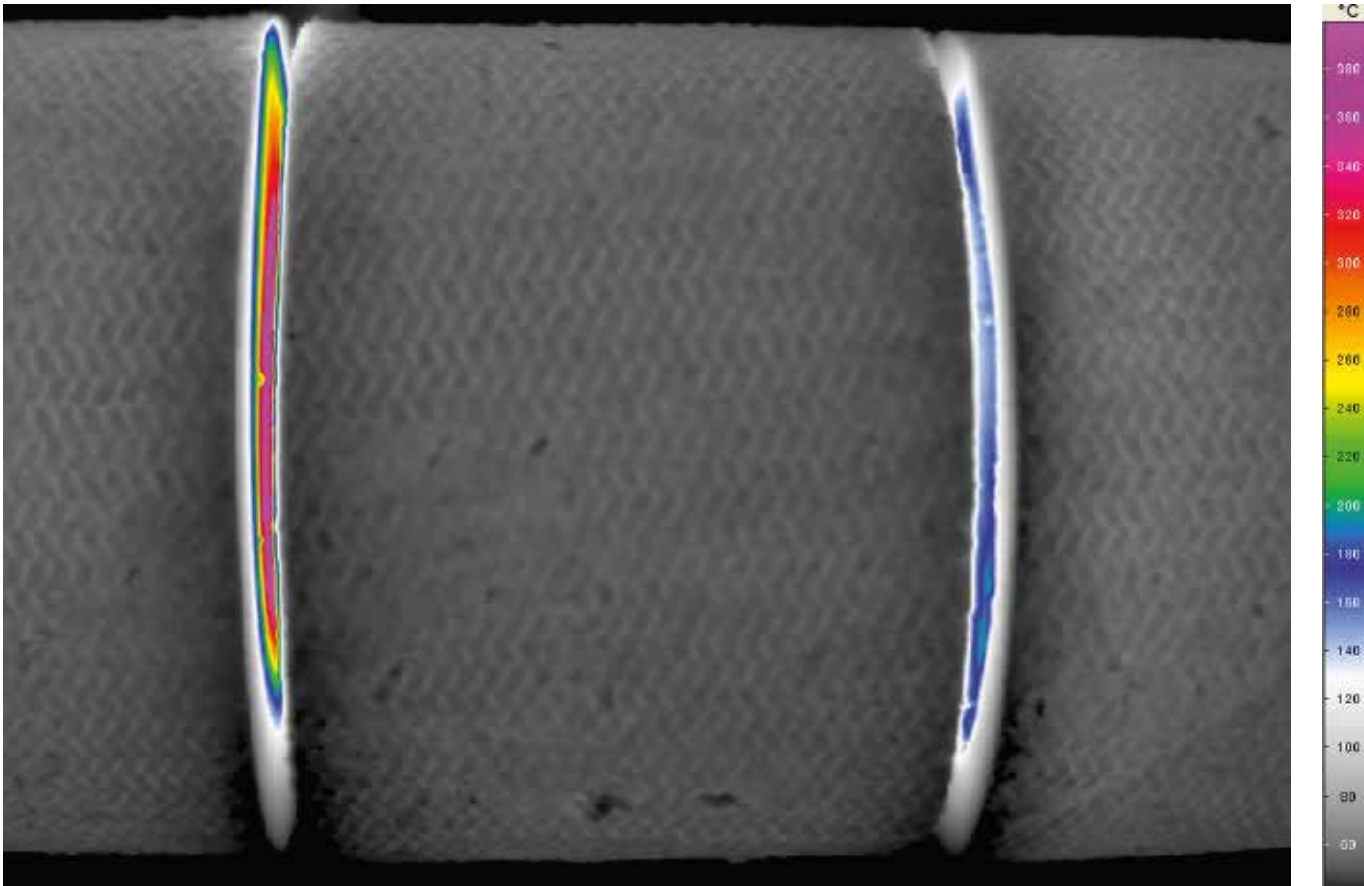
**THE Z-LOCK GUARANTEES
INSULATION EFFECTIVENESS
AND PROVIDES THE BENEFITS
OF A 2 LAYER INSULATION SYSTEM
BY A 1 LAYER APPLICATION**

PAROC PRO LOCK - A COMPARISON

Image by high-resolution infrared camera (Infratec VarioCam high resolution)
Test setup according to EN 14707
Medium temperature 600 °C gap simulation about 10 mm
Insulation thickness 100 mm / D=219 mm



- left gap PAROC Pro Section 100 (without z-lock)
- right gap PAROC Pro Lock 100



PAROC PRO LOCK IN PRACTICAL APPLICATION

Also available
with
market-leading
water-repellency
features

MARKET LEADING
WATER REPELLENCY

CALCULATION OF ENERGY EFFICIENCY

Utilisation of PAROC Pro Lock in comparison to open joints of conventional single layer insulation



Presumed situation on site:
Stainless steel pipe D = 219.1 x 3.0 mm (linear expansion coefficient $\alpha = 0.017$ mm/mK)
Overall length 100 m, medium temperature max. 400 °C & min. 10 °C, ambient temperature 10 °C
Insulation PAROC Pro Lock 100 – insulation thickness 160 mm

Calculation of expansion in circumferential joints of single layer insulation:
 $\Delta l = \alpha \cdot l_0 \cdot \Delta T$
(α -linear expansion coefficient in mm/mK, l_0 -initial length in m, ΔT -change in temperature in K)
 $\Delta l = 0.017$ mm/mK x 100 m x 390 K
 $\Delta l = 663$ mm, about 0.66 m

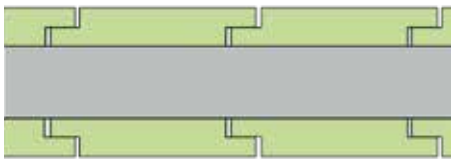
Calculation of expansion in longitudinal joints of single layer insulation:
 0.017 mm/mK x diameter 0.2191 x 390 K
= 1.5 mm increase in diameter = 4.6 mm increase in circumference
x 100 m >> about 0.46 m²

Estimation of heat losses in both scenarios
Medium 400°C, ambient temperature 10°C, wind speed 5 m/s, cladding galvanized steel sheet.

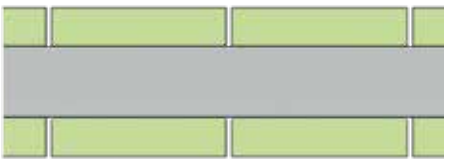
Presumed power source – dry natural gas 5 cent/kWh, operating hours 8760/year, uninsulated length of open circumferential joints 0.66 m, plus 0.46 m² of open longitudinal joint (application of insulation where joints open in service).

	Linear expansion of 0.66 m open (c)ircumferential joints, plus 0.46 m² open (l)ongitudinal joint	
	General application, thickness 160 mm	Total at joints on 100 m pipe
Mineral fibre pipe insulation with open joints	192 W/m	(c) 8514 W + (l) 5612 W
PAROC Pro Lock 100 with z-locked joints	192 W/m	(c) 207 W + (l) 155 W

In the joint area PAROC Pro Lock 219 x 160, included in the calculation, in comparison to standard insulation, features a z-lock which, with an effective insulation thickness of 80 mm, keeps the insulation system intact in the event of linear expansion of the pipe and minimises heat loss according to the table.



- 60,290 € over 10 years

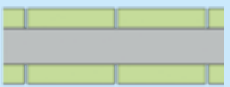


+ 60,290 € over 10 years

Annual energy costs & CO₂ emissions savings, 100 m pipe



PAROC Pro Lock



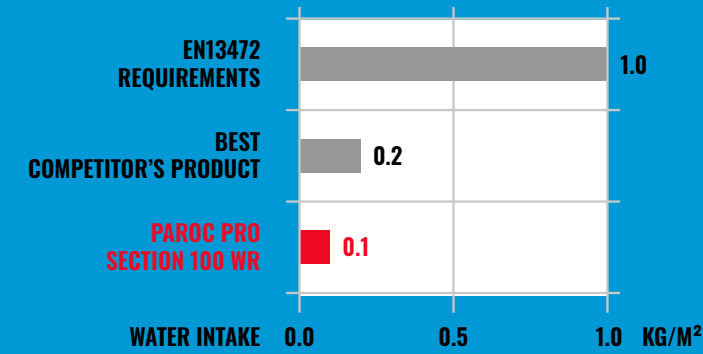
Insulation (open joints)

Energy costs 5 cents/kWh
Savings vs standard
CO₂ emissions 202 g/kWh
Savings vs standard

6029 €/year
24.4 tonnes/year

PAROC WR PRODUCTS:

- 10 × less water absorption than the requirements of the toughest standard (EN13472/24h)
- 2 × less water absorption than best competitor according to EN13472/24h
- Highest temperature range <300°C / 572°F
- Safe to use during painting operations and certified according to the requirements of the coating compatibility standard VDMA 24364
- More than 20 years' experience with WR mineral wool products for industrial applications
- Broadest WR offering range on the market including pipe sections, wired mats, mats and slabs



MARKET-LEADING WATER ABSORPTION PROPERTIES FOR STONE WOOL INSULATION
10 × BETTER THAN THE REQUIREMENTS OF THE TOUGHEST STANDARD AVAILABLE (EN13472)*

PAROC PRO LOCK WR 100

Water repellent stonewool pipe section with a z-joint on the longitudinal and circumferential seams



Application

- Insulation of industrial pipework at high temperatures

Technical Data

- Melting point > 1000 °C according to DIN 4102-17
- Non-combustible EN 13501-1: A1_L
- Upper application temperature limit according to EN 14707 and AGI Q 132 max. 640 °C
- Non-wicking according to EN 13472
- AS-quality according to EN 13468 and AGI Q 132
- Safe to use in combination with painting operations
- Insulation material index number 10.04.03.40.10
- Quality monitored according to VDI 2055
- CE-designation code: MW-EN 14303-T8/T9-ST(+)-640-WS1-CL10



MARKET LEADING WATER REPELLENCY



Datasheet
www.paroc.com/products/technical-insulations/ti-pipe-sections/paroc-pro-lock-wr-100

Nominal value of thermal conductivity λ according to EN ISO 8497

t	°C	50	100	150	200	250	300
$\lambda_{N,P}$	W/mK	0.039	0.045	0.054	0.064	0.077	0.092

PAROC PRO LOCK WR 140

Water repellent stonewool pipe section with a z-joint on the longitudinal and circumferential seams



Application

- Thermal insulation of industrial pipework at high temperatures

Technical Data

- Melting point > 1000 °C according to DIN 4102-17
- Non-combustible EN 13501-1: A1_L
- Upper application temperature limit according to EN 14707 and AGI Q 132 max. 680 °C
- Non-wicking according to EN 13472
- AS-quality according to EN 13468 and AGI Q 132
- Safe to use in combination with painting operations
- Insulation material index number 10.04.03.40.10
- Quality monitored according to VDI 2055
- CE-designation code: MW-EN 14303-T8/T9-ST(+)-680-WS1-CL10



MARKET LEADING WATER REPELLENCY



Datasheet
www.paroc.com/products/technical-insulations/ti-pipe-sections/paroc-pro-lock-wr-140

Nominal value of thermal conductivity λ according to EN ISO 8497

t	°C	50	100	200	300	400
$\lambda_{N,P}$	W/mK	0.041	0.047	0.063	0.085	0.110

PAROC PRO LOCK 100

Stonewool pipe section with a z-joint on the longitudinal and circumferential seams



Application

- Pipework for Industry and power plants, district heating and exhaust lines

Technical Data

- Melting point > 1000 °C according to DIN 4102-17
- Non-combustible EN 13501-1: A1_L
- Upper application temperature limit according to EN 14707 and AGI Q 132 max. 640 °C
- Non-wicking according to EN 13472
- AS-quality according to EN 13468 and AGI Q 132
- Insulation material index number 10.04.03.40.10
- Quality monitored according to VDI 2055
- CE-designation code: MW-EN 14303-T8/T9-ST(+)-640-WS1-CL10



Datasheet
www.paroc.com/products/technical-insulations/ti-pipe-sections/paroc-pro-lock-100

Nominal value of thermal conductivity λ according to EN ISO 8497

t	°C	50	100	150	200	250	300
$\lambda_{N,P}$	W/mK	0.039	0.045	0.054	0.064	0.077	0.092

PAROC PRO LOCK 140

Stonewool pipe section with a z-joint on the longitudinal and circumferential seams



Application

- Thermal insulation of industrial pipework at high temperatures

Technical Data

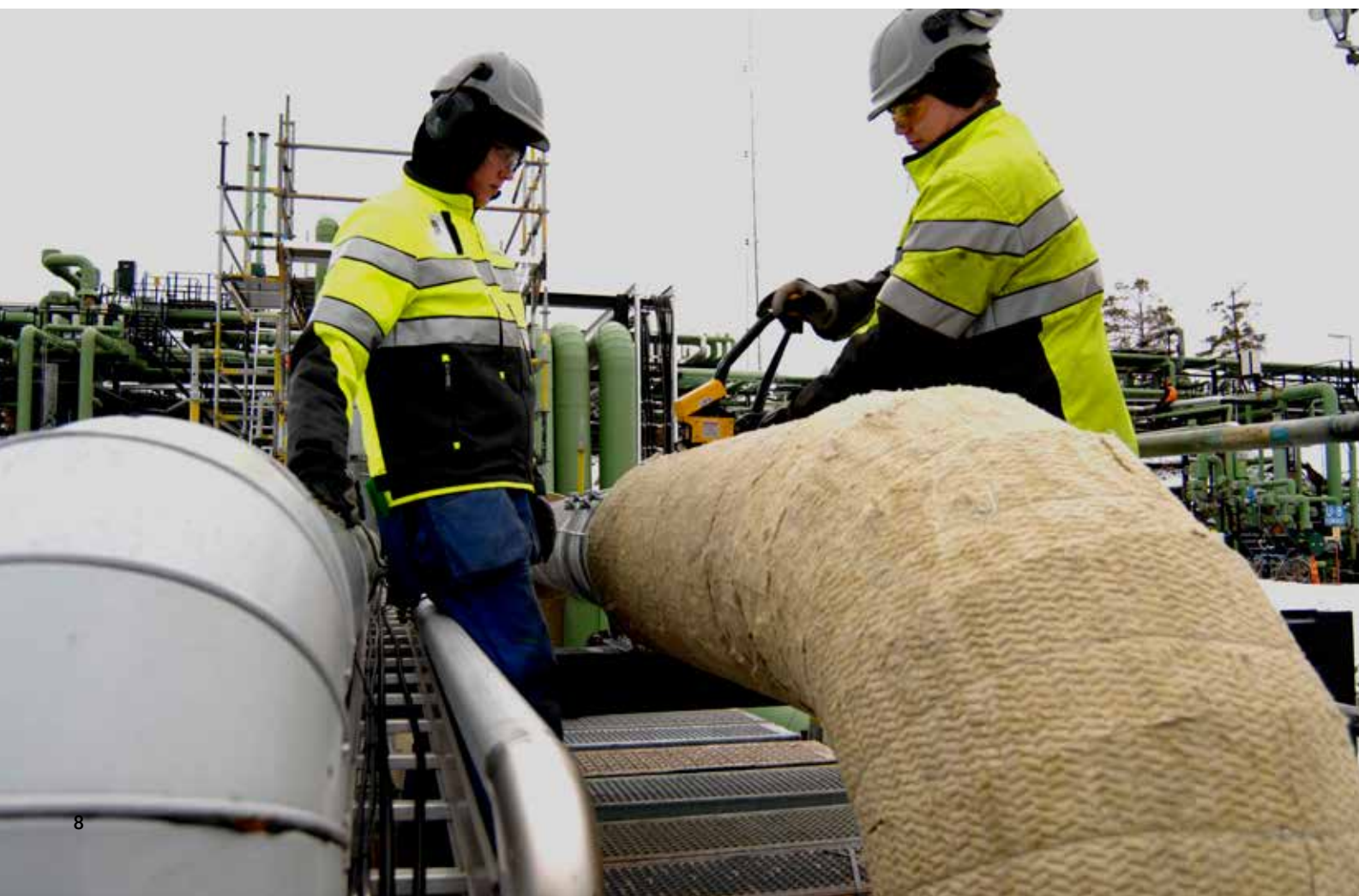
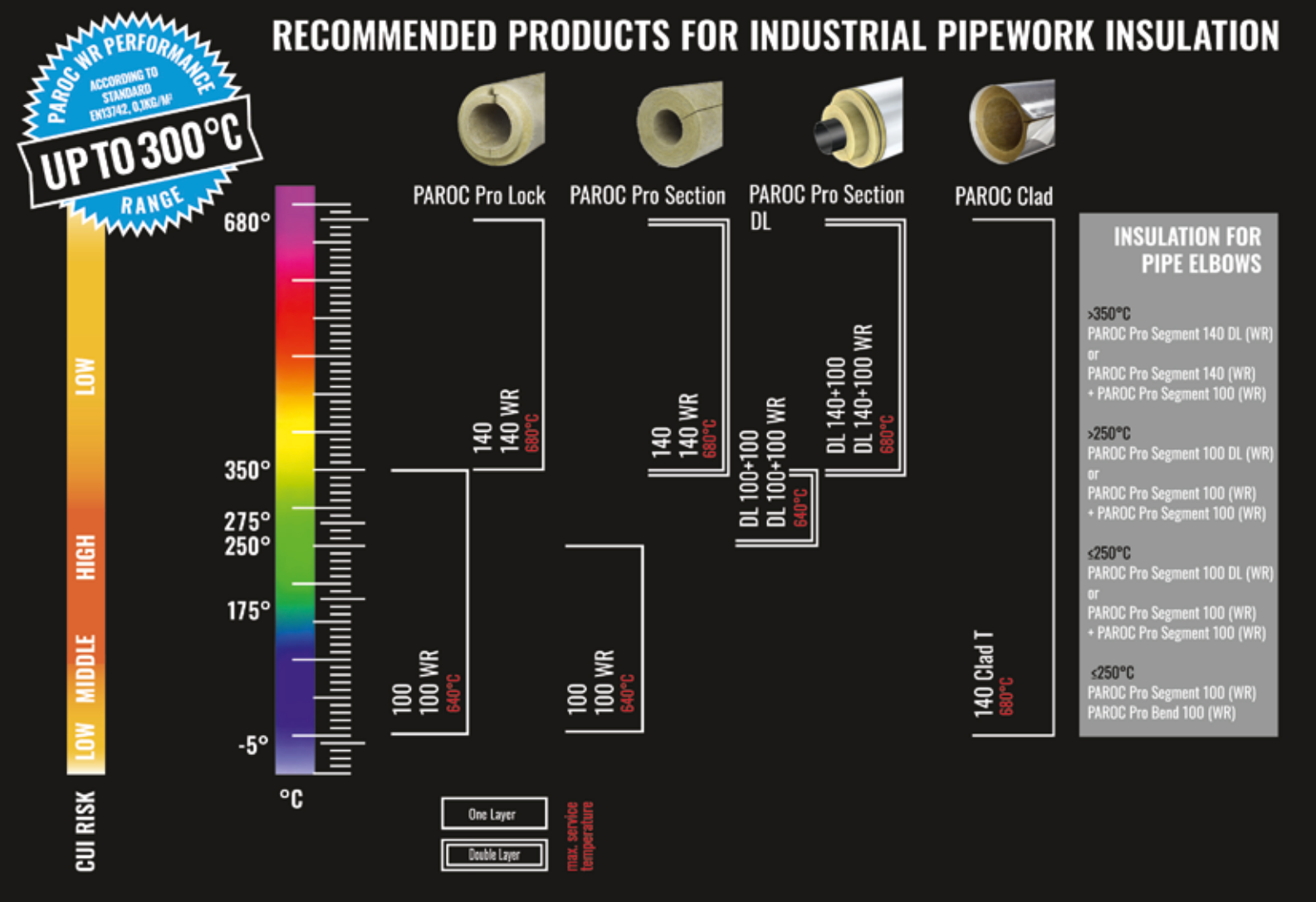
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PAROC CALCULUS: PROGRAM FOR DIMENSIONING THERMAL INSULATION

PAROC® Calculus is a technical insulation calculation program for dimensioning thermal insulation for different HVAC, Process Industry and Marine applications e.g. pipes, ventilation ducts and process industry tanks. With PAROC Calculus it is also possible to calculate the heat loss for insulated and uninsulated valves and flanges, which usually increases the risk of heat loss. Also the heat loss caused by thermal bridges in pipe and duct suspensions can be taken into account.

With PAROC Calculus you can design energy efficient and economical insulation solutions for different HVAC and process industry applications with PAROC products.

PAROC® Calculus:

- Easy to use interface
- Works on pc, tablets and mobile phones
- Calculations for heat loss, surface temperature and temperature drop in pipes, ventilation ducts, process industry tanks, valves and flanges.
- Easy input of pipe diameters and duct dimensions (predefined)
- Thermal bridges of pipe and duct suspensions
- Print out your calculations to pdf
- All calculations are based on equations described in the EN ISO 12241 standard.

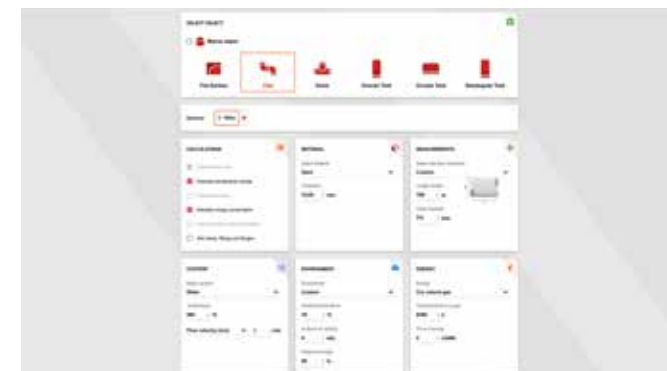
Step 1 Select application



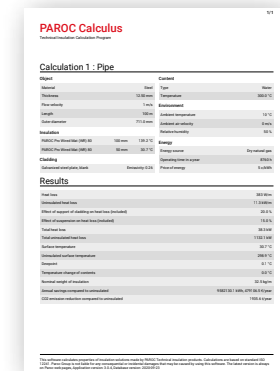
Extract of the results after the desired selection of the calculation options



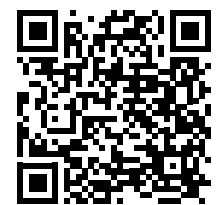
Step 2 Selection of the required calculations, environmental parameters and object dimensions



Printout in Portable Document Format (pdf)



Step 3 Calculation with surface temperature display - cladding systems, suspensions and substructures can optionally be used for the calculation



Calculus Online

A CLOSER LOOK AT ENERGY SAVING AND COST REDUCTION

Studies show that even small flaws in industrial insulation can have a much greater impact on absolute heat loss than even large flaws or insufficient insulation in building exterior walls.

According to a study commissioned by the European Industrial Insulation Foundation (Eiif), insufficient or completely lacking industrial insulation across the European Union (EU) is responsible for energy losses of approximately 480 PJ per year – the equivalent of the annual energy production of Hungary⁵.

In order to operate smoothly and in an economically optimal manner, process industries and power plants require long lasting, reliable, maintenance-free and quick-to-install insulation solutions. For the owners and plant engineers it is important that the return on investment of the process can be observed during its lifecycle as planned without losses caused by malfunctions.

So how much can a single factory save if it invests in proper, economically justified insulation of its critical process elements? TIPCHECK Program, established by the Eiif, serves to provide industry with standardised, high-quality thermal energy audit tools, focusing on the thermal performance of technical insulation systems. One of its many cases shows that even a small investment in a long-term, effective solution can bring about operational cost savings that far outweigh its capital investment and lead to rapid payback.

LEARN FROM THE POSITIVE EXAMPLES⁶

A large chemical plant in Italy had been diagnosed with 650m of piping which was uninsulated or covered with damaged insulation, as well as 300 flanges, 160 valves, and 3 tanks which lacked any insulation at all, mainly for operational and maintenance reasons. Yet, based on the audit report and the presented energy, cost and CO₂ saving potential, the plant owner decided to proceed with the full implementation of its recommendations.

Recommended actions, including installing new pipe sections, helped to save 11.100 MWh, approximately 200.000 EUR and 2.240 tonnes of CO₂ annually. **The payback period of this project was less than one year.** The client recognised that the new insulation would fulfil operational and maintenance needs, while also saving money and reducing production overheads.

BEST PRACTICE IN INDUSTRY

Original Source of an graphic www.eiif.org⁷

Chemical Plant (France)

Payback: 2–4 months

Energy savings: 12 600 000 kWh/a

Money savings: 505 000 EUR/a

Refinery (Italy)

Payback: 1–3 years

Energy savings: 1 021 958 kWh/a

Money savings: 75 000 EUR/a

Processing plant (Germany)

Payback: 3 months

Energy savings: 1 448 500 kWh/a

Money savings: 47 800 EUR/a

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.

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 and this is particularly important when they are used 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 must 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 EN14303.

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. PAROC provides competitive and certified solutions according to the industrial standard for insertion loss **ISO 15665**. PAROC products meet the requirements for Class A, B, C and D (Shell Class).

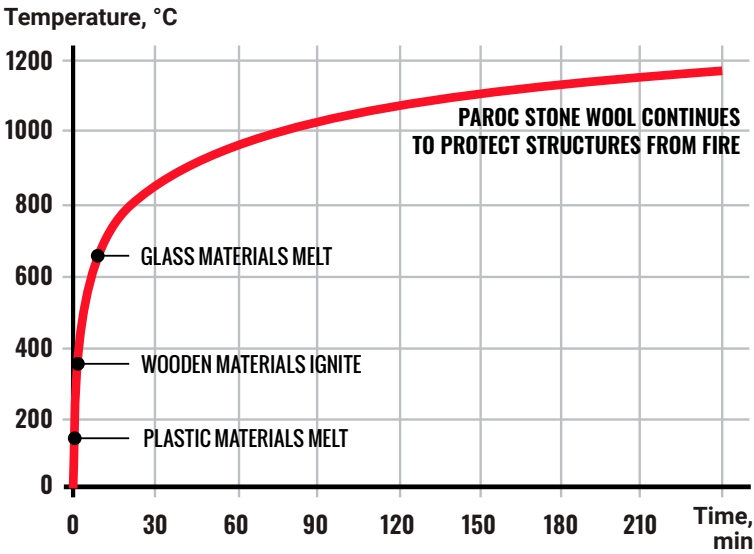
ENVIRONMENTALLY FRIENDLY

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

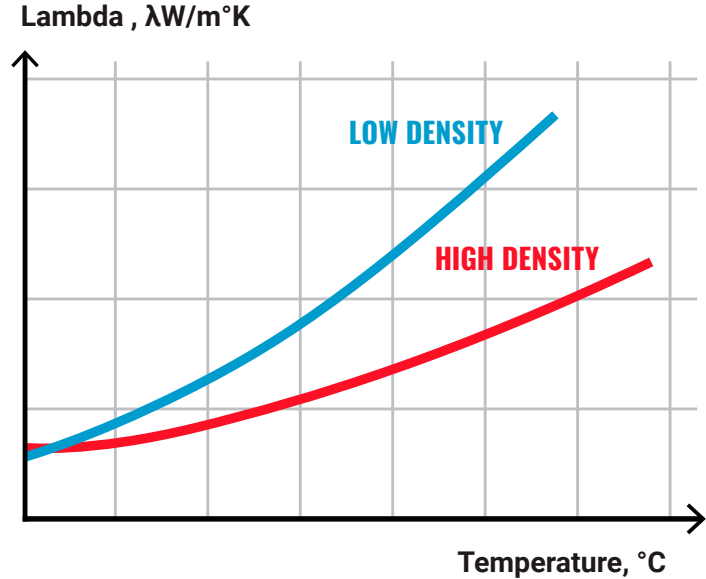
PAROC products are safe to use. No CFCs or HCFCs are used in the production of the products. PAROC products also fulfill the requirements of Note Q of EU Commission Directive 97/69/EC. This means that stone wool fibres are biodegradable and are not classified as a possible carcinogen to humans. They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

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.

THERMAL CONDUCTIVITY OF STONE WOOL. AT HIGHER TEMPERATURES IT IS IMPORTANT TO USE HIGH-DENSITY PRODUCTS



⁵ <https://data.europa.eu/euodp/data/dataset/information-on-energy-markets-in-eu-countries-with-national-energy-profiles>

⁶ https://www.eiif.org/sites/default/files/2018-11/1_TIPCHECK_Report%20%282%29ed%29.pdf

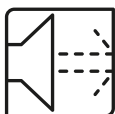
⁷ https://www.eiif.org/sites/default/files/2018-12/Eiif_ClimateProtectionWithRapidPayback_EN_online.pdf



DURABLE



REUSABLE



**SOUND
REDUCING**



FIRE PROOF



**MOISTURE
PROOF**



SAFE



**ENERGY
EFFICIENT**

PAROC® stands for energy-efficient and fire safe insulation solutions of stone wool for new and renovated buildings, marine and offshore, acoustics and other industrial applications. Behind those products, there is an 80-year history of stone wool production knowhow backed with technical insulation expertise and innovation.

Building Insulation offering covers 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 offering includes thermal, fire and sound insulation in HVAC systems, industrial processes and pipework, industrial equipment as well as shipbuilding and offshore industry.

For more information please visit www.paroc.com



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