



# PAROC® FATIO™ & LINIO™

For Well Insulated Rendered Facades



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## PAROC® Energywise House™

With the Energywise House™ concept, Paroc would like to give advice and instructions about what you can do to reduce energy consumption when building new houses or when renovating. An energywise solution means that higher requirements than those stipulated in the building regulations are fulfilled, which is a good investment for the future. So, when you want to build energywise, think PAROC® Energywise House™.

Cover page ©photo: Pia Nordlander, bildN







# Energy Efficient and Fire Safe Rendered Facades

The acceleration of climate change and the rise in energy prices mean that improving energy efficiency in buildings is more important than ever. Buildings have an enormous energy-saving potential. For example, a properly insulated home uses only 20 % of the energy that is needed to heat a standard house.

Insulation may account for as much as 75 % of the total energy reduction potential of buildings, which means approximately 460 million tonnes of carbon dioxide (CO<sub>2</sub>) a year. With our new range of products for rendered facades, PAROC FATIO and PAROC LINIO, we introduce even lower lambda to secure good energy saving performance. With this wide range of products and structural configurations the right insulation for any rendering solution can easily be found.

A rendered facade is a traditional, attractive and, most importantly, seamless surface. A rendered façade also creates an effective and durable climate shield, when combined with the right thermal insulation solution. Modern rendered insulation combines an elegant appearance with all the latest technical features. It is possible to identify several common requirements that all external wall structures should be able to meet. Cold, wind, precipitation, sound and fire should all be prevented from penetrating through the wall structure into the building.

With the right choice of thermal insulation, these are requirements that can be met by any external wall. In addition, the use of the correct insulation can generate significant

financial and environmental benefits. With well-insulated external walls the amount of energy needed to heat a building is reduced, thereby saving money on energy bills and contributing towards a reduction in emissions at the energy generation level. Of course the more tangible environmental benefits of a warm, dry, draught-free and quiet building will be felt and appreciated by everybody throughout the entire lifetime of the structure.

## Combining Experience and the Latest Know How

The insulation solutions outlined in this brochure have been developed in cooperation with the rendering system owners and have been used successfully for years. In addition, we have over 70 years experience of using energy-saving stone wool.

Since Paroc offers only stone wool insulation, the solutions concerning the other components of the structure are presented as an example. We recommend that system owners' type approvals or solutions are followed when designing the structural solutions for both new building and renovation. By system owner we mean the company responsible for the rendered facade system incorporating the various components, such as insulation reinforcements, fasteners and the rendering layers.



# The Design of a Good Functional Rendered Facade

## External Walls Provide Protection against the Elements

The external walls of a building function as a climate shield and should protect against cold, precipitation, strong winds, noise and fire. A good external wall structure, with the right insulation solution, is a prerequisite for a healthy and pleasant indoor climate.

## The Economics of Thermal Insulation

The thermal insulation of a building can be seen as an investment that is expected to yield a return. The cost of the insulation is the capital employed while the future savings on energy bills are the return. The thermal insulation of a building typically amounts to about 3-5 % of total building costs. The pay back time for thermal insulation is fairly short in comparison to the life expectancy of the building. It has been calculated that the cost of building a house that uses 50 % less energy than average is only 5 % higher than the cost of building a standard house.

## A Better Environment Through the Use of Thermal Insulation

More than industry or transport, it is a fact that buildings are the biggest single user of energy in Europe. The

energy used in the heating and air conditioning of buildings accounts for more than 40 % of all energy used in Europe. This implies that a proportional amount of emissions are generated by the energy used by buildings.

The European Parliament passed the Energy Performance Directive in response to concerns over emissions and in order to comply with commitments to the Kyoto Protocol. This will have profound implications on the insulation of buildings. The directive compels Member States to develop thermal insulation regulations into energy-use regulations, thereby setting requirements on the amount of energy used in the heating and air conditioning of buildings.

## Fire Protection

Both external and internal walls need to offer protection against fire. When selecting insulation for exterior walls, two factors should be taken into consideration: how the material reacts with fire and how the material resists fire. Almost all types of mineral wool are classified as a non-combustible material, but PAROC® Stone wool has an exceptionally high melting temperature of around 1000 °C, providing longer protection.

Therefore, rather than adding to the fire load, PAROC® Stone wool offers an effective fire resistant, thermal insulation solution.

## Sound Insulation

As traffic noise and other low frequency sounds have increased, requirements for effective sound insulation in walls have become stricter. Stone wool is a fibrous material which provides excellent sound absorption performance and when covered with external rendering creates a structure that protects against outside noise.

## Additional Insulation

The question of additional thermal insulation is often raised during renovation. Additional thermal insulation is usually chosen in order to increase living standards, improve energy efficiency or as part of facade repair and maintenance.

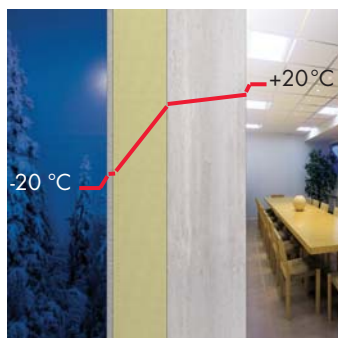
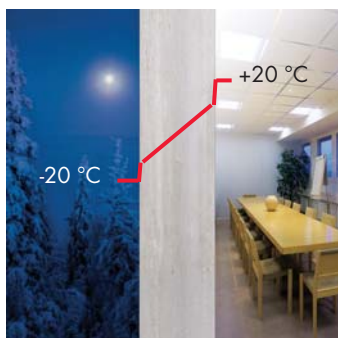
## Rendering Systems Can be Used on Various Supporting Walls

Thermal insulation rendering systems can be used on various supporting walls; on bricks, blocks or concrete and on timber or steel structures. There are a number of different commercial systems that place numerous requirements on the insulation material - Paroc can provide insulation solutions for all these systems.

## A Breathing Structure

The use of stone wool insulation allows moisture to dry out due to the high water vapour permeability of the material.

When designing the structure, ensure that water cannot enter the structure via cracks and leaking seams, and that any water inside the structure is allowed to dry out. Moistened structures dry out relatively quickly through the rendered insulation.



External insulation keeps the supporting wall structure warm and therefore its moisture content is lower. It also results in a higher internal surface wall temperature.

### How to Fasten the Insulation

The insulation can be installed on the supporting wall structure in different ways depending on the insulation solution, the supporting wall structure and rendering system owner's requirements. The main methods are gluing, mechanical fastening or a combination of both. The system owners have their own fasteners and glues specifically designed and tested for this purpose.



### Relevant European Standards and Guidelines

The following standards and guidelines give detailed instructions for components and the entire system. Our insulation solutions are designed in line with these. Based on these standards and guidelines every system owner can apply for ETA (European Technical Approval).

#### **ETAG 004: External Thermal Insulation Composite Systems with Rendering**

This guideline sets out the performance of the systems for use as external insulation of building walls, verification methods used to examine the various aspects of performance, the assessment criteria used to judge the performance and the presumed conditions for the design and execution.

#### **ETAG 014: Plastic Anchors for Fixing External Thermal Insulation Composite Systems to Rendering**

This guideline sets out the basis for assessing plastic anchors to be used

for fixing ETICS in a base material (substrate) made of concrete and masonry.

#### **EN 13500: Thermal Insulation Products for Buildings - External Thermal Insulation Composite Systems (ETICS) Based on Mineral Wool - Specification**

This standard describes product characteristics and includes procedures for testing, marking and labelling. ETICS are applied to external surfaces of new or existing walls to improve the thermal performance. ETICS also give protection against weathering and improve the appearance of buildings. They do not contribute to the stability of the walls to which they are installed. The thermal insulation is required for the load transfer to the substrate, but the standard does not cover the strength between the ETICS and the building surface to which it is fixed.



# Why choose PAROC® Stone wool?

## Stone wool is versatile non-combustible thermal insulation

PAROC® Stone wool is the most versatile and commonly used thermal insulation material in many European countries.

PAROC® Stone wool uniquely combines excellent thermal and sound insulation properties with a highly fire retardant material. In addition to construction, stone wool is used in conditions that impose extremely demanding and versatile requirements on insulation such as the shipping industry and nuclear power plants.

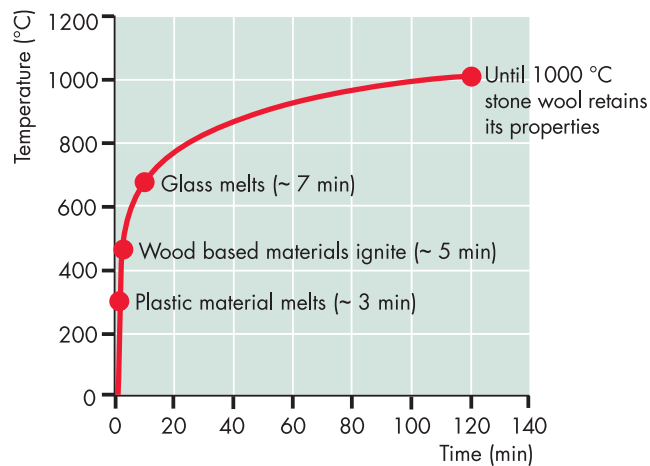
## Excellent fire resistance properties in constructions

PAROC® Stone wool is made of stone and can therefore be used as thermal insulation in applications with highly demanding fire specifications. Almost all types of mineral wool are classified as non-combustible material, but PAROC® Stone wool has an exceptionally high melting temperature of around 1000 °C, providing longer protection. Therefore, rather than adding to the fire load, PAROC® Stone wool offers an effective fire resistant thermal insulation solution. Most non-coated PAROC® Stone wool products are classified in the best Euroclass A1.

Because of its unique fire properties PAROC® Stone wool can be utilized as fire insulation and as structural protective cladding. In structures insulated with PAROC® Stone wool, the spreading of any fire is retarded or prevented altogether.

## The right products guarantee the best results

Of all mineral wools stone wool possesses the best alkali resistance properties. This is particularly important when dealing with the cement and lime-based mortars associated with rendered facades.



The behaviour of certain construction materials in a "standard" fire. A "standard fire" simulates the temperature development of a fire in normal room space.

## Life-long insulation material

PAROC® Stone wool retains its thermal insulation properties for the entire lifetime of a building. PAROC® Stone wool is a chemically robust material with a strong resistance to organic oils, solvents and alkalis.

## Retains its form

PAROC® Stone wool does not expand or shrink, even as a result of dramatic changes in temperature or humidity. Therefore no cracks will form at the joints of the slabs and consequently there is no risk of heat leakage or moisture condensation.



PAROC® PROTECTION is our concept for Nordic designed Stone wool, a material with superior properties when it comes to protection against fire and moisture. Living in a home with PAROC® Stone wool insulation provides increased protection against moisture. Stone wool namely does not absorb water particularly well and due to its high steam permeability, it dries quickly if exposed to water. PAROC® Stone wool insulation is also non-combustible and is therefore classified in best Euroclass A1.

### Does not absorb or accumulate moisture

PAROC® Stone wool does not absorb or accumulate moisture in a capillary way, ensuring rapid evaporation in regular structures. A building insulated with PAROC® Stone wool stays dry, ensuring healthy internal air quality and the longevity of the building. Extensive research carried out in Finland by Tampere University of Technology (Microbial Growth in the Insulation of Concrete Panel Facades, 1999) and Turku University (Microbial contamination in rendered insulation layer of concrete walls, 1999) confirms that PAROC® Stone wool is a poor environment for microbe growth.

### Efficient sound insulation

Due to its porous fibre structure and high density, PAROC® Stone wool provides excellent insulation against external noise through walls and roofs as well as internal noise through partitions, intermediate floors and acoustic ceilings.



PAROC® Stone wool withstands very high temperatures. The image shows a test sample of the PAROC® UNS product before and after an EN ISO 1182 non-combustion test where the test sample is burned at a temperature of 750 °C. On several of our markets PAROC® UNS is developed into PAROC® eXtra™ with the same or better fire properties.

### Sustainable

PAROC® Stone wool is sustainable throughout its lifecycle. Stone wool is a proven, durable insulation material that provides significant energy saving, fire protection and excellent sound insulation properties for a multitude of applications. Stone wool does not contain any ingredients or chemicals that prevent or impede recycling.

### Paroc – an expert in insulation

As one of the leading thermal insulation manufacturers, Paroc, together with the top researchers and institutions in the field, has developed considerable expertise in the thermal insulation sector.



Stone wool does not melt even in a fire. Thus a structure can withstand a fire considerably longer, which can critically improve the chance of rescue and limit damage.

### PAROC® Stone wool and indoor air quality

PAROC® Stone wool is an extremely clean material and as such has been selected as the insulation material for houses built for people with allergies and respiratory illnesses. The Finnish Building Information Foundation and the Indoor Air Association both classify PAROC® Stone wool as the best M1 grade in the emission classifications as it does not pollute internal air.



Due to a “breathing”, air-permeable structure, moisture evaporates quickly in correctly realized constructions.

## Why PAROC® FATIO™ and PAROC® LINIO™?



Our new range of thermal insulation products offer an effective solution to the challenges of rendered facades. With this wide range of products and structural configurations the right insulation for any rendering solution can easily be found. The benefits listed below are especially worth noting.

### **Saves energy**

Low thermal conductivity secures good energy saving performance.

### **Protects against fire**

Fire resistant PAROC® Stone wool is non-combustible and has a melting temperature of around 1000 °C. Therefore, together with the rendering, a PAROC® Stone wool insulation application creates an extremely fire resistant facade.

### **A durable facade**

PAROC® Stone wool is moisture resistant and ensures the longevity of the facade. Thanks to the dimensional stability Paroc products do not change dimensions over time thereby avoiding open joints in the insulation layer.

### **Fast and easy installation**

Easy to handle and install thanks to mechanical stability and low weight.

### **Flexible design**

Enables to use of dark plaster on facades.

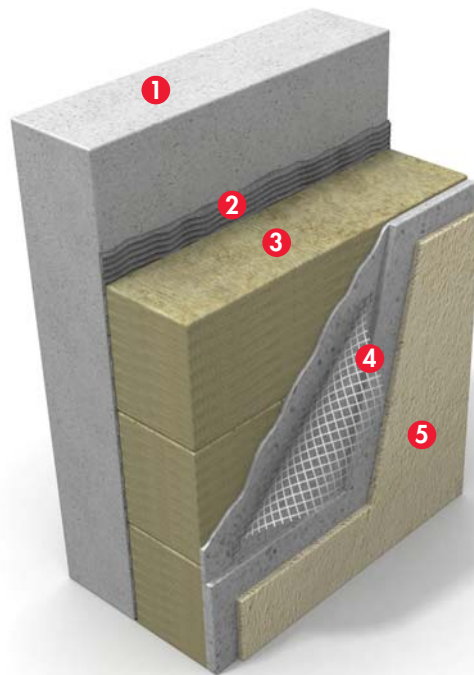
### **Efficient sound insulation**

PAROC® Stone wool is a porous material and therefore an excellent choice to increase sound absorption and improve the level of comfort.



# Thin Rendered Application

## – Lamella Insulation PAROC® LINIO 80



- 1 Supporting wall structure (Brick, Block, Concrete, etc)
- 2 Adhesive mortar
- 3 Thermal insulation PAROC® LINIO 80
- 4 Reinforcement
- 5 Finishing layer

The thin rendered application is the most common thermal rendering system in Europe, both in new buildings and renovations.

### Advantages

- PAROC® Stone wool retains its form during temperature changes.
- It normally requires no mechanical fasteners (Please, check the system owners' instructions!) The lamellas are glued to the supporting wall using adhesive mortar.
- It is fast and easy to install.
- It provides an even basis for the rendering because the surface of the lamella is sawn.
- Especially recommended for buildings where a high insulation thickness is needed.
- The lamellas have very high tensile strength, which makes them suitable for situations where high mechanical strength is required.

### U-values according to EN-standards (W/m<sup>2</sup>K)

		Insulation PAROC® LINIO 80, thickness (mm)							
		0	50	60	80	100	120	150	200
Supporting wall structure	Aerated concrete-block, 200 mm	0.66	0.36	0.33	0.28	0.25	0.22	0.19	0.15
	Bricks, 250 mm	1.68	0.54	0.48	0.39	0.32	0.28	0.23	0.18
	Reinforced concrete, 150 mm	4.08	0.67	0.57	0.45	0.36	0.31	0.25	0.19

The U-values have been calculated using Lambda-design values. For stone wool Lambda-design = Lambda-declared. National Building Codes and EN 6946 may require an additional delta-U correction in order to take into consideration air gaps, convection, incorrect installation, fasteners etc. In these calculation the U-value is 0.

Thermal values used in the calculation :

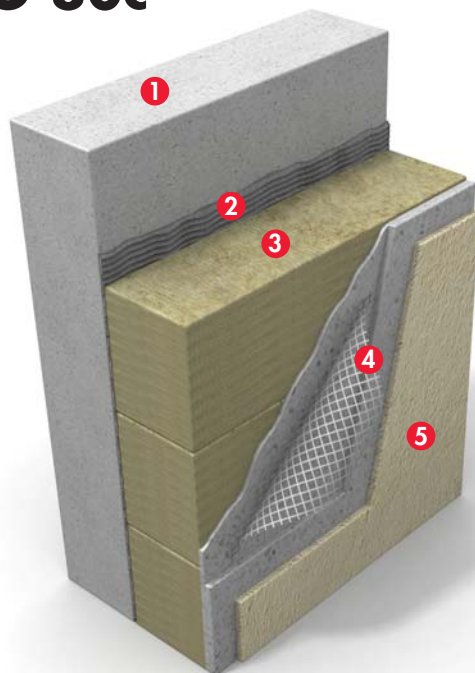
- Internal surface resistance 0.130 m<sup>2</sup>K/W
- Supporting wall structure
  - Aerated concrete-blocks 200 mm,  $\lambda = 0.15$  W/mK
  - Bricks 250 mm,  $\lambda = 0.60$  W/mK
  - Reinforced concrete 150 mm,  $\lambda = 2.30$  W/mK
- PAROC® LINIO 80,  $\lambda_{\text{design}} = 0.040$  W/mK ( $\Delta\lambda = 0$ )
- Rendering layers 10 mm,  $\lambda = 1.00$  W/mK
- External surface resistance 0.040 m<sup>2</sup>K/W

### Design

When designing the structural solution it is important to check with the relevant system owner!

For detailed product information, please see pages 14–15.

# Thin Rendered Application – Lamella Insulation Coated on One Side PAROC® LINIO 80c



- 1 Supporting wall structure (Brick, Block, Concrete, etc)
- 2 Adhesive mortar
- 3 Thermal insulation PAROC® LINIO 80c
- 4 Reinforcement
- 5 Finishing layer

The thin rendered application, coated on one side, is a common thermal rendering system in Europe, both in new buildings and renovations.

## Advantages

- PAROC® Stone wool retains its form during temperature changes.
- It normally requires no mechanical fasteners (Please, check the system owners' instructions!). The lamellas are glued to the supporting wall using adhesive mortar.
- The coating on one side of the product shortens the installation time.
- Most system owners allow mechanical spraying of mortar direct to the supporting wall when the surface of the lamella is coated.
- It is fast and easy to install.
- It provides an even basis for the rendering because the surface of the lamella is sawn.

## U-values according to EN-standards (W/m<sup>2</sup>K)

		Insulation PAROC® LINIO 80c, thickness (mm)							
		0	50	60	80	100	120	150	200
Supporting wall structure	Aerated concrete-block, 200 mm	0.66	0.36	0.33	0.28	0.25	0.22	0.19	0.15
	Bricks, 250 mm	1.68	0.54	0.48	0.39	0.32	0.28	0.23	0.18
	Reinforced concrete, 150 mm	4.08	0.67	0.57	0.45	0.36	0.31	0.25	0.19

The U-values have been calculated using Lambda-design values. For stone wool Lambda-design = Lambda-declared. National Building Codes and EN 6946 may require an additional delta-U correction in order to take into consideration air gaps, convection, incorrect installation, fasteners etc. In these calculation the U-value is 0.

Thermal values used in the calculation :

- Internal surface resistance 0.130 m<sup>2</sup>K/W
- Supporting wall structure
  - Aerated concrete-blocks 200 mm,  $\lambda = 0.15$  W/mK
  - Bricks 250 mm,  $\lambda = 0.60$  W/mK
  - Reinforced concrete 150 mm,  $\lambda = 2.30$  W/mK
- PAROC® LINIO 80c,  $\lambda_{\text{design}} = 0.040$  W/mK ( $\Delta\lambda = 0$ )
- Rendering layers 10 mm,  $\lambda = 1.00$  W/mK
- External surface resistance 0.040 m<sup>2</sup>K/W

- Especially recommended for buildings where a high insulation thickness is needed.
- The lamellas have very high tensile strength, which makes them suitable for situations where strong mechanical properties are required.

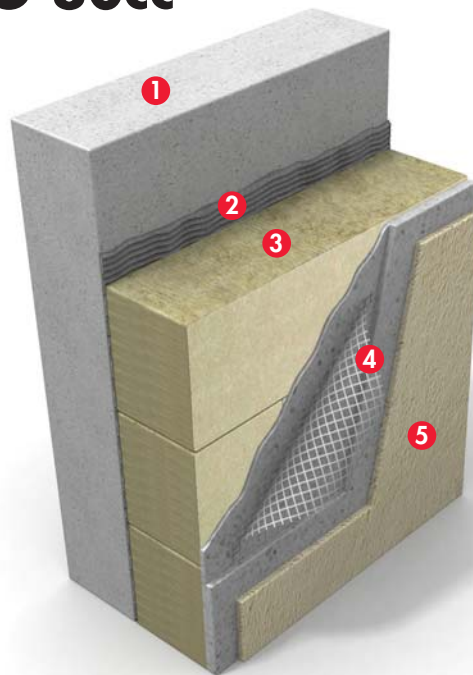
## Design

The letter c in the name LINIO 80c means that one surface of the lamella is silicate base coated.

When designing the structural solution it is important to check with the relevant system owner!

For detailed product information, please see pages 14–15.

# Thin Rendered Application – Lamella Insulation Coated on Both Sides PAROC® LINIO 80cc



- 1 Supporting wall structure (Brick, Block, Concrete, etc)
- 2 Adhesive mortar
- 3 Thermal insulation PAROC® LINIO 80cc
- 4 Reinforcement
- 5 Finishing layer

The thin rendered application, coated on both sides, is a common thermal rendering system in Europe, both in new buildings and renovations.

## Advantages

- PAROC® Stone wool retains its form during temperature changes.
  - It normally requires no mechanical fasteners (Please, check the system owners' instructions!) The lamellas are glued to the supporting wall using adhesive mortar.
  - The coated outside surface minimizes the amount of mortar needed.
  - Most system owners allow mechanical spraying of mortar direct to the supporting wall when the surface of the lamella is coated.
  - Compared to slab products, cold bridges caused by fasteners are reduced or eliminated altogether.
  - It is fast and easy to install.
- It provides an even basis for the rendering because the surface of the lamella is sawn.
  - Especially recommended for buildings where a high insulation thickness is needed.
  - The lamellas have very high tensile strength, which makes them suitable for situations where strong mechanical strength is required.

## U-values according to EN-standards (W/m<sup>2</sup>K)

		Insulation PAROC® LINIO 80cc, thickness (mm)							
		0	50	60	80	100	120	150	200
Supporting wall structure	Aerated concrete-block, 200 mm	0.66	0.36	0.33	0.28	0.25	0.22	0.19	0.15
	Bricks, 250 mm	1.68	0.54	0.48	0.39	0.32	0.28	0.23	0.18
	Reinforced concrete, 150 mm	4.08	0.67	0.57	0.45	0.36	0.31	0.25	0.19

The U-values have been calculated using Lambda-design values. For stone wool Lambda-design = Lambda-declared. National Building Codes and EN 6946 may require an additional delta-U correction in order to take into consideration air gaps, convection, incorrect installation, fasteners etc. In these calculation the U-value is 0.

Thermal values used in the calculation :

- Internal surface resistance 0.130 m<sup>2</sup>K/W
- Supporting wall structure
  - Aerated concrete-blocks 200 mm,  $\lambda = 0.15$  W/mK
  - Bricks 250 mm,  $\lambda = 0.60$  W/mK
  - Reinforced concrete 150 mm,  $\lambda = 2.30$  W/mK
- PAROC® LINIO 80cc,  $\lambda_{\text{design}} = 0.040$  W/mK ( $\Delta\lambda = 0$ )
- Rendering layers 10 mm,  $\lambda = 1.00$  W/mK
- External surface resistance 0.040 m<sup>2</sup>K/W

## Design

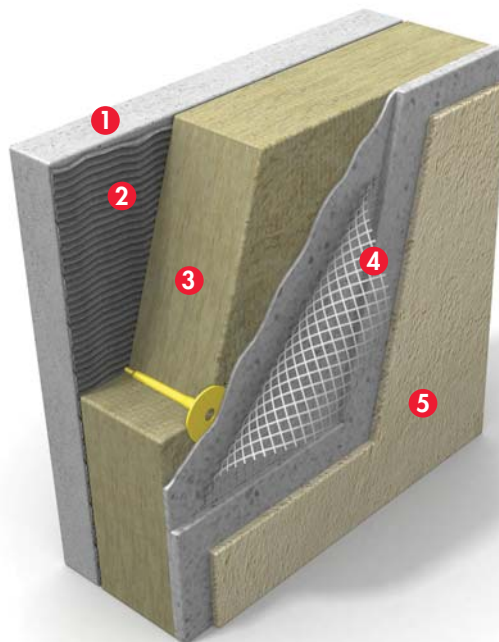
The letters cc in the name LINIO 80cc mean that both surfaces of the lamella are silicate base coated

When designing the structural solution it is important to check with the relevant system owner!

For detailed product information, please see pages 14–15.



# Thin Rendered Application – Slab Insulation PAROC® LINIO 10/LINIO 15



- 1 Supporting wall structure (Brick, Block, Concrete, etc. or timber/steel frame and building board)
- 2 Adhesive mortar
- 3 Thermal insulation PAROC® LINIO 10, PAROC® LINIO 15
- 4 Reinforcement
- 5 Finishing layer

Slab insulation is the classical insulation solution in thin rendered applications both in new buildings and renovations.

### Advantages

- Slab insulation is suitable for insulation of all types of walls.
- This type of insulation is particularly recommended when the surface of the supporting wall structure is uneven.
- The insulation slabs are fastened to the supporting wall structure by gluing and using mechanical fasteners.
- You can choose between PAROC® LINIO 10, LINIO 15 depending on the desired properties of the Product. (pages 14-15).

### U-values according to EN-standards (W/m²K)

		Insulation PAROC® LINIO 15, thickness (mm)							
		0	50	60	80	100	120	150	200
Supporting wall structure	Aerated concrete-block, 200 mm	0.66	0.34	0.31	0.27	0.23	0.21	0.18	0.14
	Bricks, 250 mm	1.68	0.50	0.44	0.35	0.30	0.25	0.21	0.16
	Reinforced concrete, 150 mm	4.08	0.61	0.52	0.41	0.33	0.28	0.23	0.17

		Insulation PAROC® LINIO 10, thickness (mm)							
		0	50	60	80	100	120	150	200
Supporting wall structure	Aerated concrete-block, 200 mm	0.66	0.34	0.31	0.27	0.23	0.21	0.18	0.14
	Bricks, 250 mm	1.68	0.50	0.44	0.35	0.30	0.25	0.21	0.16
	Reinforced concrete, 150 mm	4.08	0.61	0.52	0.41	0.33	0.28	0.23	0.17

The U-values have been calculated using Lambda-design values. For stone wool Lambda-design = Lambda-declared. National Building Codes and EN 6946 may require an additional delta-U correction in order to take into consideration air gaps, convection, incorrect installation, fasteners etc. In these calculations we have taken into account only the effect of fasteners.

Thermal values used in the calculation :

- Internal surface resistance 0.130 m²K/W
- Supporting wall structure
  - Aerated concrete-blocks 200 mm,  $\lambda = 0.15$  W/mK
  - Bricks 250 mm,  $\lambda = 0.60$  W/mK
  - Reinforced concrete 150 mm,  $\lambda = 2.30$  W/mK
- PAROC® LINIO 10,  $\lambda_{\text{design}} = 0.036$  W/mK
- PAROC® LINIO 15,  $\lambda_{\text{design}} = 0.037$  W/mK
- Rendering layers 10 mm,  $\lambda = 1.00$  W/mK
- External surface resistance 0.040 m²K/W

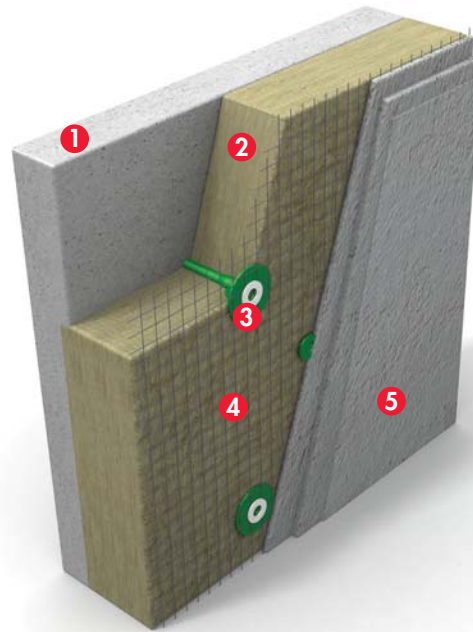
### Design

When designing the structural solution it is important to check with the relevant System Owner!

For detailed product information, please see pages 14–15.

# Thick Rendered Application

## – Slab Insulation PAROC® FATIO/FATIO PLUS



- 1 Supporting wall structure (Concrete, brick, block etc. or wooden/steel frame and building board)
- 2 Thermal insulation PAROC® FATIO and PAROC® FATIO PLUS
- 3 Steel fasteners
- 4 Steel wire net attached through insulation to supporting wall structure
- 5 Three separate lime cement based rendering layers

An external wall structure with a thick rendered application is an excellent solution for both new constructions and renovation work. The thickness of the rendering layer is more than 25 mm, which creates an extremely strong and shock resistant facade.

### Advantages

- In thick rendering applications the insulation is not glued on the surface, but is fastened mechanically. The weight of the rendering layers is borne by the supporting wall structure via the steel net and the mechanical fasteners. Mechanical fasteners adapt to any potential movements in the rendering.
- When the insulation thickness is greater than 120 mm, we recommend the use of two layers of slabs. Two insulation layers result in overlapping joints and reduce cold bridges.
- This method enables partial winter construction; insulation work can be carried out during winter time and the rendering work, including installation of the steel net, can be carried out in spring.

### U-values according to EN-standards (W/m<sup>2</sup>K)

		Insulation PAROC® FATIO, thickness (mm)							
		0	50	60	80	100	120	150	200
Supporting wall structure	Aerated concrete-block, 200 mm	0.66	0.35	0.31	0.26	0.23	0.20	0.17	0.14
	Bricks, 250 mm	1.68	0.51	0.43	0.35	0.29	0.25	0.20	0.16
	Reinforced concrete, 150 mm	4.08	0.63	0.51	0.40	0.32	0.27	0.22	0.17

		Insulation PAROC® FATIO PLUS, thickness (mm)							
		0	50	60	80	100	120	150	200
Supporting wall structure	Aerated concrete-block, 200 mm	0.66	0.33	0.30	0.25	0.22	0.19	0.17	0.13
	Bricks, 250 mm	1.68	0.47	0.41	0.33	0.28	0.24	0.19	0.15
	Reinforced concrete, 150 mm	4.08	0.57	0.48	0.37	0.31	0.26	0.21	0.16

The U-values have been calculated using Lambda-design values. For stone wool Lambda-design = Lambda-declared. National Building Codes and EN 6946 may require an additional delta-U correction in order to take into consideration air gaps, convection, incorrect installation, fasteners etc. In these calculations we have taken into account only the effect of fasteners.

Thermal values used in the calculation :

- Internal surface resistance 0.130 m<sup>2</sup>K/W
- Supporting wall structure
  - Aerated concrete-blocks 200 mm,  $\lambda = 0.15$  W/mK
  - Bricks 250 mm,  $\lambda = 0.60$  W/mK
  - Reinforced concrete 150 mm,  $\lambda = 2.30$  W/mK
- PAROC® FATIO,  $\lambda_{\text{design}} = 0.035$  W/mK
- PAROC® FATIO PLUS,  $\lambda_{\text{design}} = 0.033$  W/mK
- Rendering layers 25 mm,  $\lambda = 1.00$  W/mK
- External surface resistance 0.040 m<sup>2</sup>K/W

### Design

When designing the structural solution it is important to check with the relevant System Owner!

For detailed product information, please see pages 14–15.

# Product Information

## PAROC® LINIO 10

Rigid, fire-safe stone wool slab with high thermal insulation performance.



<b>Width x Length</b> 600 x 1200 mm	<b>Thickness</b> 50 – 240 mm
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Thickness class T5. Tolerances in accordance with EN 13162.

### Packaging

Plastic package or packages on a pallet.

<b>Lambda, declared, <math>\lambda_{10}</math></b> In accordance with EN 13162	0.036 W /mK
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<b>Reaction to Fire</b> In accordance with EN 13501-1	A1
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<b>Water absorption (short term), WS</b> In accordance with EN 1609	<1 kg/m <sup>2</sup>
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<b>Water absorption (long term), WL(P)</b> In accordance with EN 12087	<3 kg/m <sup>2</sup>
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<b>Water vapour transmission, MUI</b> In accordance with EN 12086	1
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<b>Compressive stress, <math>\sigma_{10}</math></b> In accordance with EN 826	≥20 kPa
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<b>Tensile Strength, <math>\sigma_{mT}</math></b> In accordance with EN 1607	≥10 kPa
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## PAROC® LINIO 15

Rigid fire-safe stone wool slab with excellent thermal insulation and alkali resistance properties. It does not accumulate moisture or react to changes in temperature.



<b>Width x Length</b> 600 x 1200 mm	<b>Thickness</b> 20 – 160 mm
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Thickness class T5. Tolerances in accordance with EN 13162.

### Packaging

Plastic package or packages on a pallet.

<b>Lambda, declared, <math>\lambda_{10}</math></b> In accordance with EN 13162	0.037 W /mK
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<b>Reaction to Fire</b> In accordance with EN 13501-1	A1
--	----

<b>Water absorption (short term), WS</b> In accordance with EN 1609	<1 kg/m <sup>2</sup>
--	----------------------

<b>Water absorption (long term), WL(P)</b> In accordance with EN 12087	<3 kg/m <sup>2</sup>
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<b>Water vapour transmission, MUI</b> In accordance with EN 12086	1
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<b>Compressive stress, <math>\sigma_{10}</math></b> In accordance with EN 826	≥30 kPa
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<b>Tensile Strength, <math>\sigma_{mT}</math></b> In accordance with EN 1607	≥15 kPa
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## PAROC® LINIO 80 (c) (cc)

Rigid fire-safe stone wool lamella with excellent thermal insulation and alkali resistance properties. It does not accumulate moisture or react to changes in temperature. PAROC® LINIO 80c is coated on one side and PAROC® LINIOcc on both sides.



<b>Width x Length</b> 200 x 1200 mm (LINIO 80c and LINIO 80cc max thickness 220 mm)	<b>Thickness</b> 40 – 250 mm *)
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Thickness class T5. Tolerances in accordance with EN 13162.

### Packaging

Plastic package or packages on a pallet or loose product on a pallet.

<b>Lambda, declared, <math>\lambda_{10}</math></b> In accordance with EN 13162	0.040 W /mK
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<b>Reaction to Fire</b> In accordance with EN 13501-1	A1
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<b>Water absorption (short term), WS</b> In accordance with EN 1609	<1 kg/m <sup>2</sup>
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<b>Water absorption (long term), WL(P)</b> In accordance with EN 12087	<3 kg/m <sup>2</sup>
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<b>Water vapour transmission, MUI</b> In accordance with EN 12086	1
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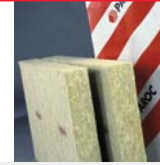
<b>Compressive Strength, <math>\sigma_{mT}</math></b> In accordance with EN 826	≥50 kPa
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<b>Tensile Strength, <math>\sigma_{mT}</math></b> In accordance with EN 1607	≥80 kPa
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\*) Greater thicknesses are available on request.

## PAROC® FATIO

Rigid fire-safe stone wool slab with excellent thermal insulation and alkali resistance properties. It does not accumulate moisture or react to changes in temperature.



<b>Width x Length</b> 600 x 1200 mm	<b>Thickness</b> 40 – 200 mm
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Thickness class T5. Tolerances in accordance with EN 13162.

### Packaging

Plastic package or packages on a pallet.

<b>Lambda, declared, <math>\lambda_{10}</math></b> In accordance with EN 13162	0.035 W /mK
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<b>Reaction to Fire</b> In accordance with EN 13501-1	A1
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<b>Water absorption (short term), WS</b> In accordance with EN 1609	<1 kg/m <sup>2</sup>
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<b>Water absorption (long term), WL(P)</b> In accordance with EN 12087	<3 kg/m <sup>2</sup>
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<b>Water vapour transmission, MUI</b> In accordance with EN 12086	1
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<b>Compressive stress, <math>\sigma_{10}</math></b> In accordance with EN 826	≥10 kPa
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<b>Tensile Strength, <math>\sigma_{mT}</math></b> In accordance with EN 1607	≥5 kPa
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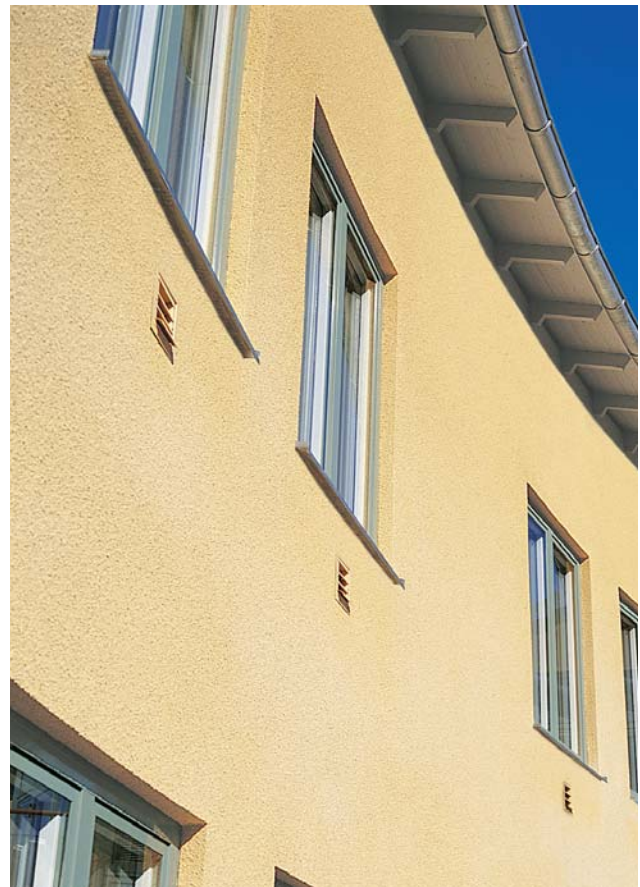


**PAROC® FATIO PLUS**

Rigid fire-safe stone wool slab with excellent thermal insulation and alkali resistance properties. It does not accumulate moisture or react to changes in temperature.



<b>Width x Length</b> 600 x 1200 mm	<b>Thickness</b> 50 – 200 mm
Thickness class T5. Tolerances in accordance with EN 13162.	
<b>Packaging</b> Plastic package or packages on a pallet.	
<b>Lambda, declared, <math>\lambda_D</math></b> In accordance with EN 13162	0.033 W /mK
<b>Reaction to Fire</b> In accordance with EN 13501-1	A1
<b>Water absorption (short term), WS</b> In accordance with EN 1609	<1 kg/m <sup>2</sup>
<b>Water absorption (long term), WL(P)</b> In accordance with EN 12087	<3 kg/m <sup>2</sup>
<b>Water vapour transmission, MUl</b> In accordance with EN 12086	1
<b>Compressive stress, <math>\sigma_{10}</math></b> In accordance with EN 826	≥5 kPa



# Installation Instructions

Visit our website to find installation instructions for both PAROC FATIO and PAROC LINIO. The brochure is available as a download and you can read more about our solutions and products.

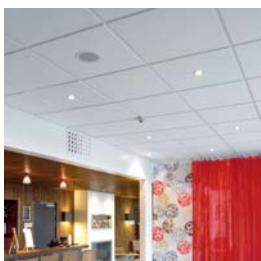


More information on our website [www.paroc.com](http://www.paroc.com).

**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 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 building techniques, industrial processes and pipe work, industrial equipment and ship structures.



**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.

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