PAROC®

YOUR ENERGY IN MIND

Ventilated Facades

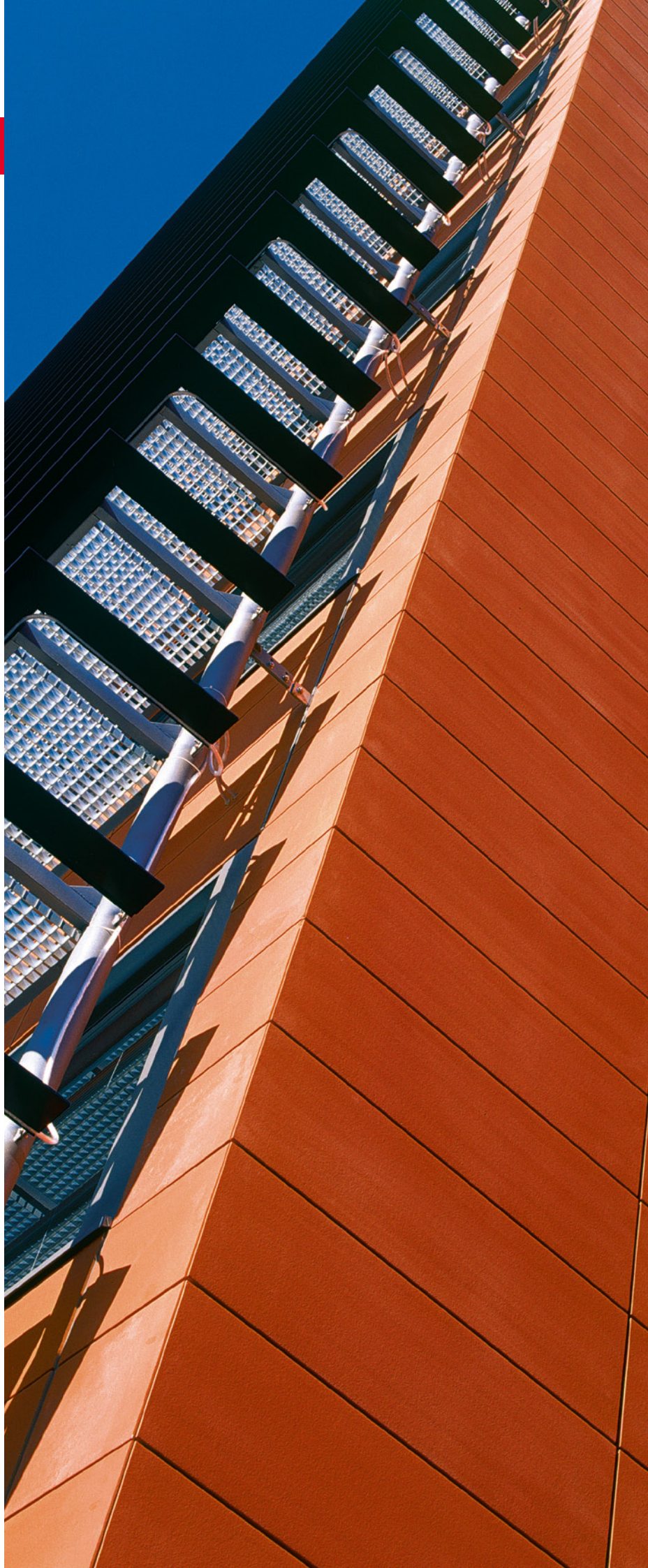
Building Insulation

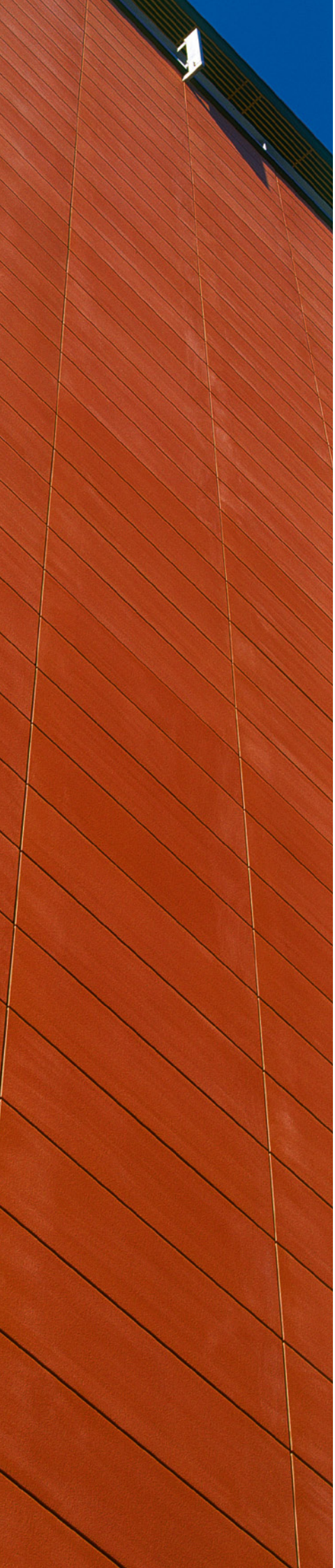
April 2013

Contents

PAROC® Energywise House™

With the Energywise House™ concept, Paroc would like to give advice and instructions about what you can do to reduce the 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™.





Ventilated Walls

In a ventilated exterior wall an air gap is placed behind the façade cladding. The purpose of the gap is by the flow of air to remove excess moisture from the structure and keep it dry for the proper functioning. The flow of air in the gap is normally from down to upwards. Openings are designed in the bottom part to allow the air to enter the gap. In the gap the air warms up picking the moisture, and flows up until released trough the openings at the top part of the wall.

The air tightness of the wall structure should fulfill the air tightness requirements before installation of thermal insulation. Any works of installation of the façade elements should not reduce the air tightness of the building.

Thermal insulation must fill up the whole of it's space. There must be no air gaps. It is particularly important to avoid air gaps on the warm side of the insulation. Thermal insulation products must be mounted into the frame and/or mechanically fixed to the insulating surface. No any possibility must be left for movement of these products during all service life and create the gaps and air pockets between products. If the insulation does not fill up the whole of its space, air can begin to circulate, starts a convection that can seriously decrease the intended insulation efficiency and moisture conditions.

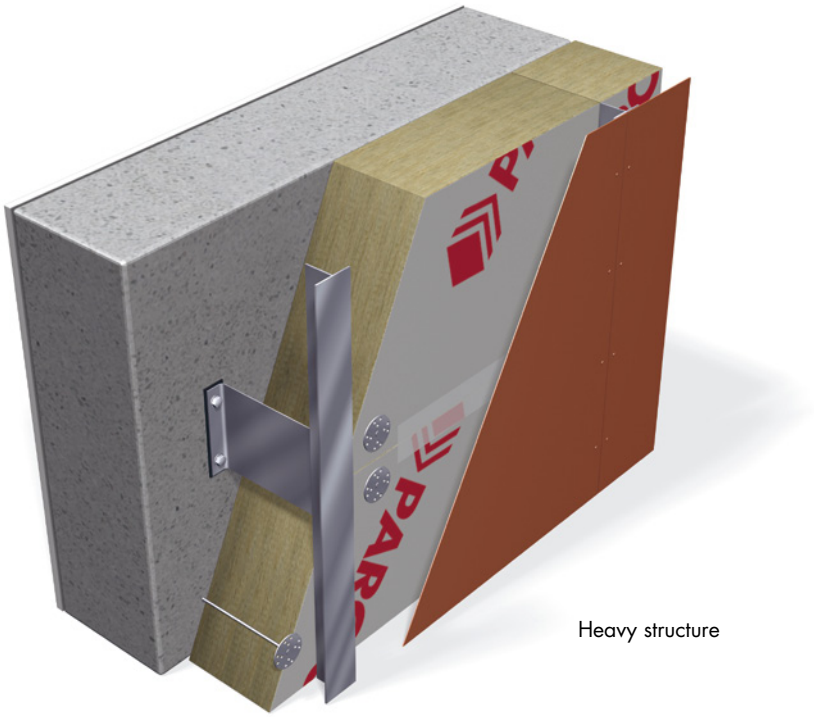
In some cases in order for the cold air not to intrude the porous thermal insulation and causing the deterioration of the thermal insulation capacity, a wind protection of the surface is necessary. The properties of the wind protection need to be designed to fit the flow in the gap. In ventilated walls the wind protection can either be a structural board, wind protection slabs or a foil surface. The requirement for wind protection depends on the size of the air movement to be expected behind the façade layer. The requirements for wind protection are given in National building regulation. Mainly they are depending on position (open or closed area) and height of the building, type (open or close porous) and air permeability of thermal insulating product, method of installation of thermal insulation layer.

Components of Ventilated Facades

Substrate/wall
Wall element which already meets the necessary air tightness and mechanical strength requirements. There are several types of substrates/walls.

a. Heavy weight walls/structures
Masonry walls – which are constructed from units (blocks or bricks) of clay, concrete, calcium silicate, aerated concrete or stone. They are mounted together using concrete mortar or adhesive.

Concrete walls – walls made of concrete either cast in situ or prefabricated at the factory.

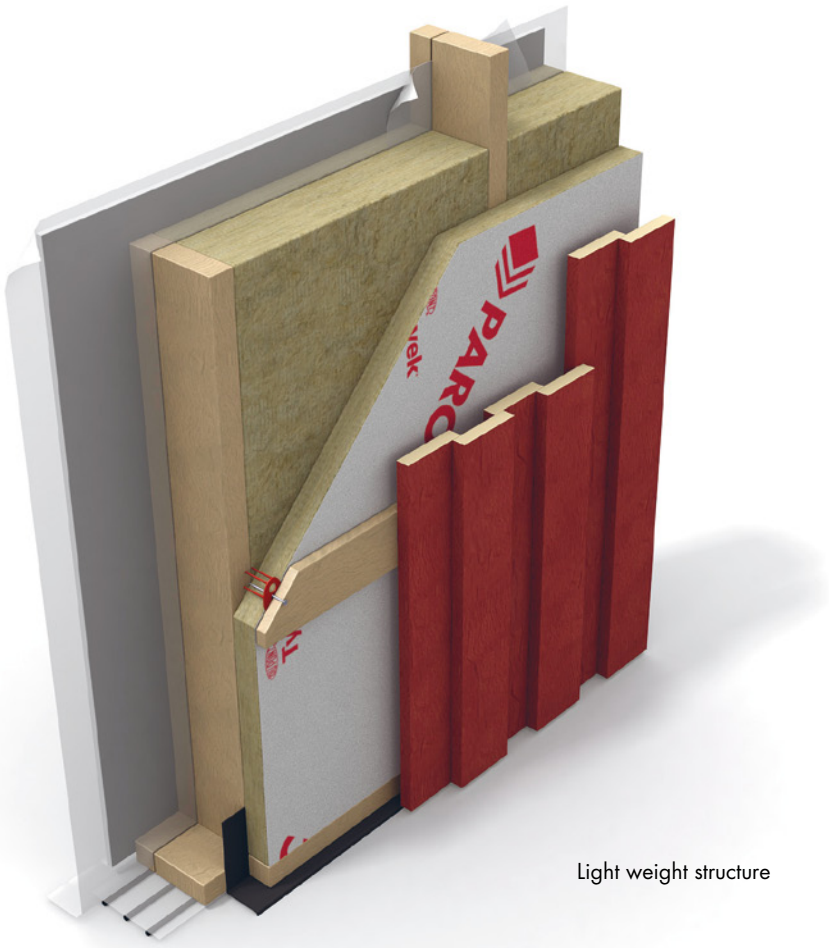


Heavy structure

b. Light weight walls/structures
The air tightness of such structures has to be secured with the help of air/vapor barrier which is placed from the internal side of the wall.

Timber frame – walls made of wood-based materials such as studs and beams.

Metal frame – wall made of steel or aluminum alloy profiles.



Light weight structure

Frame or sub frame
An assembly of vertical and horizontal profiles made of wood or metal and they are placed in between the wall and finishing material or cladding of the final façade.

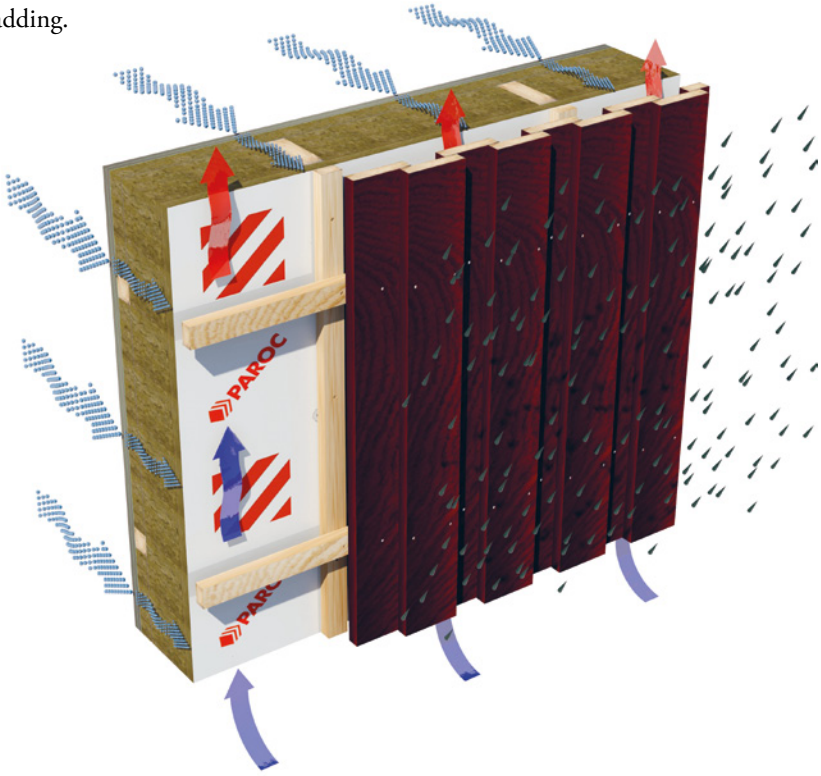
Thermal insulation
PAROC® Stone wool insulation, placed between the frame studs or installed directly to the wall and fixed with the fasteners. Air gaps should be avoided between the insulation and the wall as well as between several layers of thermal insulation. The thickness of the insulation should be in accordance with the National building codes.

Wind insulation/protection
PAROC® Stone wool insulation or tight membranes. Main purpose is to protect the thermal insulation from the airflow movement. The wind protection must be adapted to the insulation material without air gaps in between and it has to form entire layer without open joints. Wind protection should be chosen such that it allows moisture go out from inside of the building and at the same time to protect from the wind coming from the outside. During installation of wind protection, pay more attention to the corners of the building, where the difference in wind pressure between both sides can be great.

Ventilated air space
A layer of air between the wind protection layer and cladding elements of the façade, which purpose is to remove the excess moisture from the structure and to ventilate away any rain water that has penetrated and to prevent it from reaching other moisture sensitive construction components. The air space should be at least 25 mm wide and must not be packed with lath or mortar remains.

Cladding element
Sheet, plank, tile, board, panel or cassette made of durable material when applied at the external face of a wall such as: wood based panels, fibre cement, concrete, stone, slate, ceramics, metal, plastics, laminates and brick slips. Façades which have less openings such as brick façade will provide significantly lower air movements than a wooden panel or other types of cladding.

Additional materials
Consist of various fixing elements for frames and thermal insulation as well as materials for outside tightening of joints of wind insulation and corners of the building.



Processes in Ventilated Facades

Natural convection

Natural convection is a mechanism, or type of heat transport, in which the air motion is not generated by any external source like wind but only by density differences in the air occurring due to temperature gradients. In natural convection, air surrounding a heat source receives heat, becomes less dense and rises. The surrounding, cooler air then moves to replace it. This cooler air is then heated and the process continues, forming convection current; this process transfers energy from the bottom of the convection cell to top. The driving force for natural convection is buoyancy, a result of differences in air density.

Forced convection

Forced convection is caused by wind, which creates pressure gradients in the building envelope. Role of forced convection in energy efficiency and the explanation of wind protection (air tight but still diffuse open, fire class).

When referring to forced convection, two processes of thermal transfer can take place. Infiltration of air through the building envelope depends on the pressure gradient over the building fabric and the air tightness of it. Air intrusion into the building fabric from outside is a function of the pressure gradient in the ventilation gap and the air permeability of the wind barrier and the thermal insulation.

Moisture convection

The presence of air in the material or a construction part does not bring about many difficulties. The effects become more negative if the air containing moisture is migrating in and through the structure. Moving air entrains water vapour into the partition where it may condense, causing an increased moisture presence (moisture convection). Air, which has any temperature θ, contains a quantity of heat, depending on specific heat of air and difference between air temperature and absolute temperature. Air displacement is responsible for a heat flow through construction (thermal convection).

The moisture transport mechanisms through the structure are moisture diffusion and moisture convection. The transportation of water vapour as a result of compensation of steam content or steam pressure is moisture diffusion. This type of moisture transport is relatively slow process. The transportation of water vapour as result of air movement due to differences in air pressure is moisture convection. This type of moisture transport is relatively quick process. Moisture convection refers to the fact that the water vapour content of the air follows the air travelling through the construction. If the air travels from a warmer area to a colder area, the water vapour in the air might condense on the cold surfaces. If the air travels from a cold to a warm area, condensation will not take place.

Bear in Mind!

Build air tight - Good air tightness of the building envelope safeguards against the air infiltration through structure. The air seal must be planned in a way allowing uninterrupted installation throughout the outer shell. Penetrations through air seal should be avoided. Requirements for the air tightness of the building are given in the National building regulations.

Built wind tight – in order to minimize the effect of forced convection, proper wind barrier has to be used on top on thermal insulation. We recommend using wind protection slabs which has special covering with good wind protection properties. The requirements for the air permeability of the wind barrier are given in the building regulations. For example in Finland, the maximum air permeability factor of wind barrier is $l_k < 10 \cdot 10^{-6}$ m³/m² s Pa.

Protect against moisture – It is important that thermal insulation is protected against outside moisture as well as the moisture coming from inside of the building. The moisture travelling from warm area to colder area may condensate on cold surfaces, therefore the wall has to be designed in such a way that excess of moisture is easily removed from the wall. The wind protection layer should also have sufficiently high moisture transfer capability to avoid water vapor condensation.

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.

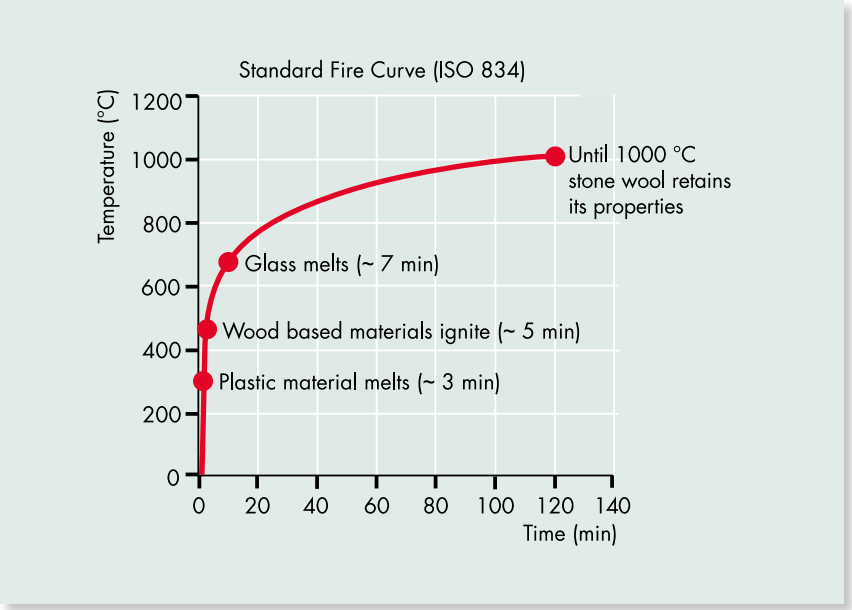
Excellent fire resistance properties in constructions

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 highest Euroclass A1.

Unique fire properties of 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 façades systems.



The behavior of certain construction materials in a "standard" fire. A "standard fire" simulates the development of temperature 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 there is consequently no risk of heat leakage or moisture condensation.

PAROC® PROTECTION™ is our concept for Nordic designed Stone wool, a material that has got superior properties when it comes to protection of 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 highest Euro Class 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 Façades, 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 fiber structure 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.

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.

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.

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

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.

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

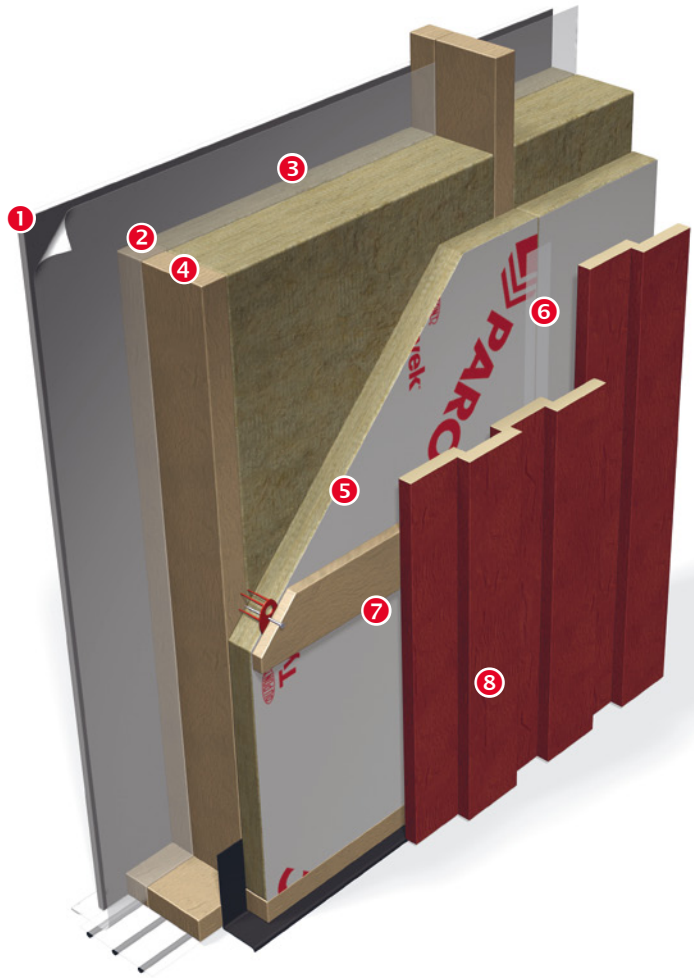
Ventilated Facades – Solutions

The solutions for Ventilated Facades are recommended depending on the type of the building. We have developed solutions for individual houses, multi-storey buildings and industrial buildings. Solutions for ventilated façades has to be designed and chosen to fulfill U-value requirements, fire requirements, should be air and wind tight and prevent moisture condensation within the structure. In addition, especially in colder climates, the insulation should be able to minimize or even eliminate the effect of thermal bridges caused by components, such as concrete, steel or wooden studs, that pass through the various layers of the wall structure.

Individual Houses. Timber Frame Walls

One of the most popular types of walls for building individual houses is timber frame walls. Timber frame structure is used for carrying the load as well as for thermal insulation layer. Insulation layer of PAROC® eXtra™ has to fill the space between wooden studs. Wall made of timber frame wall has to be designed so that it meets structural requirements, has proper U-value, and is air and wind tight and does not accumulate moisture inside the structure. Different type of cladding may be used for timber frame walls. A ventilation gap is placed behind the cladding and opening in the wall has to ensure good ventilation level. Therefore we recommend the use of wind protection insulation, such as PAROC® WPS 3n or PAROC® WPB 3n on top of the studs as external continuous thermal insulation layer. This continuous layer reduces significantly cold bridges and the amount of moisture on the timber studs. The seams of wind protection slabs have to be tightened with tape (PAROC® XST 020 or PAROC® XST 021). The inside air tightness is ensured with sealed air/vapor barrier. Both inside and outside air tightness is essential in this type of structure.

Timber Frame Walls



1. Internal surface; plaster board
2. Studding cc 600/PAROC® eXtra™
3. Air/vapor barrier
4. Timber frame cc 600/PAROC® eXtra™
5. Wind protection insulation; PAROC® WPS 3n or PAROC® WPB 3n
6. Taped seams; PAROC® XST 020
7. Spacer + ventilation gap ≥ 20 mm
8. Timber cladding

PAROC® eXtra™ (studding)	50	50	mm
PAROC® eXtra™ (frame)	175	200	mm
PAROC® WPS 3n	55	55	mm
U-value	**0,13**	**0,12**	W/m²K

Calculation parameters:

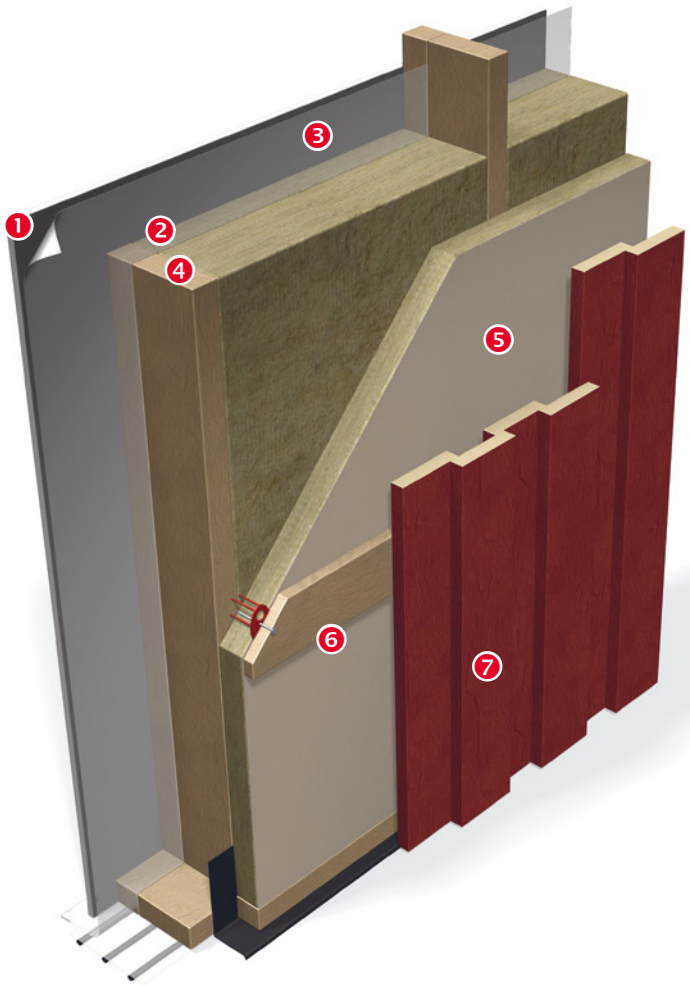
Vapour barrier	λ_U = 0.33 W/mK	d = 0.25 mm	R = 0.001 m²K/W
Plaster board	λ_U = 0.25 W/mK	d = 13 mm	R = 0.052 m²K/W
PAROC® eXtra™	λ_U = 0.036 W/mK		
PAROC® WPS 3n	λ_U = 0.032 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W
Timber	λ_U = 0.12 W/mK		

U-value corrections:

Timber frames 48×48/150/175/200 mm, cc 600

The effect of the mechanical fasteners is less than 3 % -> no need for correction.

Timber Frame Walls



1. Internal surface; plaster board
2. Studding cc 600/PAROC® eXtra™
3. Air/vapor barrier
4. Timber frame cc 600/PAROC® eXtra™
5. Wind protection insulation; PAROC® WAS 25t
6. Spacer + ventilation gap ≥ 20 mm
7. Timber cladding

PAROC® eXtra™ (studding)	50	50	mm
PAROC® eXtra™ (frame)	175	200	mm
PAROC® WAS 25t	50	50	mm
U-value	**0,14**	**0,13**	W/m²K

Calculation parameters:

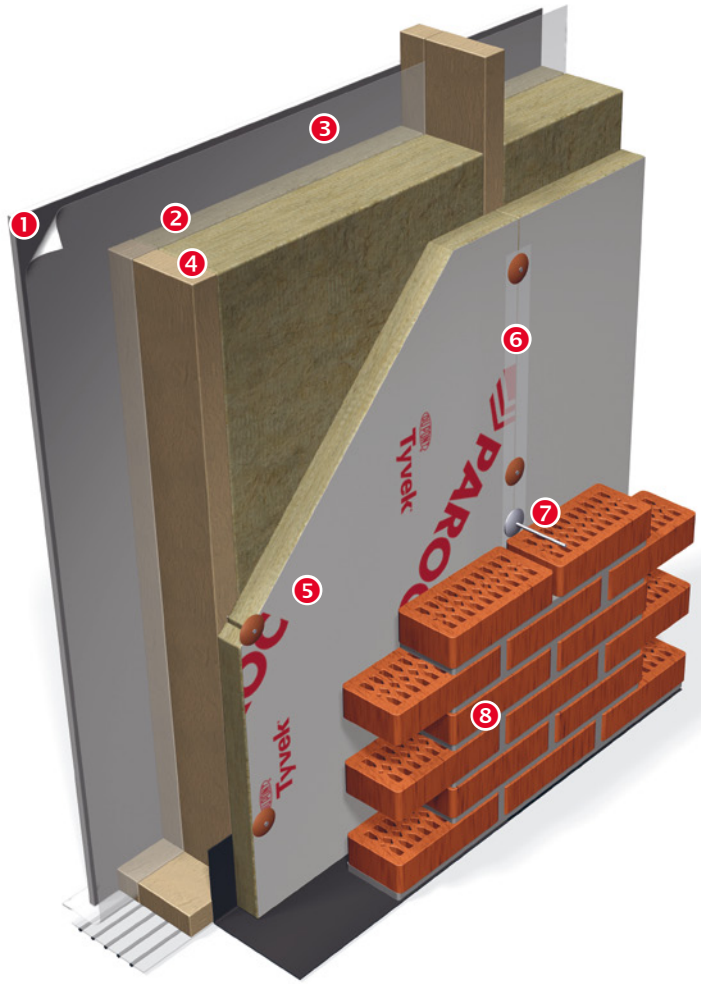
Vapour barrier	λ_U = 0.33 W/mK	d = 0.25 mm	R = 0.001 m²K/W
Plaster board	λ_U = 0.25 W/mK	d = 13 mm	R = 0.052 m²K/W
PAROC® eXtra™	λ_U = 0.036 W/mK		
PAROC® WPS 3n	λ_U = 0.034 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W
Timber	λ_U = 0.12 W/mK		

U-value corrections:

Timber frames 48×48/150/175/200 mm, cc 600

The effect of the mechanical fasteners is less than 3 % -> no need for correction.

Timber Frame Walls



1. Internal surface; plaster board
2. Studding cc 600/PAROC® eXtra™
3. Air/vapor barrier
4. Timber frame cc 600/PAROC® eXtra™
5. Wind protection insulation; PAROC® WPS 3n or PAROC® WPB 3n
6. Taped seams; PAROC® XST 020
7. Spacer + ventilation gap ≥ 30 mm
8. Brick cladding

PAROC® eXtra™ (studding)	50	50	mm
PAROC® eXtra™ (frame)	175	200	mm
PAROC® WPS 3n	55	55	mm
U-value	**0,13**	**0,12**	W/m²K

Calculation parameters:

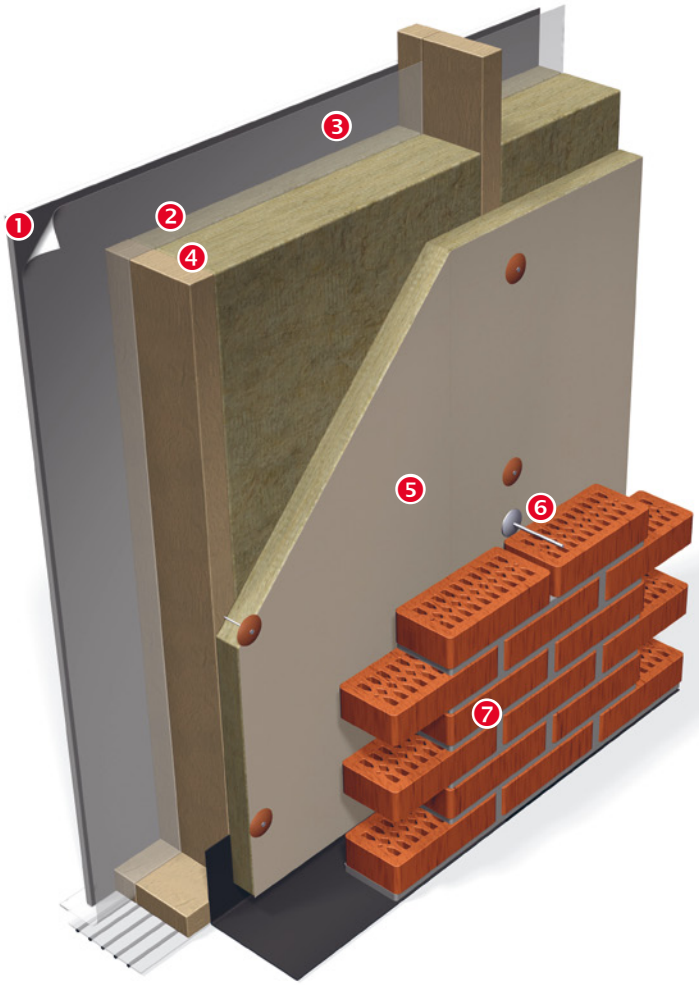
Vapour barrier	λ_U = 0.33 W/mK	d = 0.25 mm	R = 0.001 m²K/W
Plaster board	λ_U = 0.25 W/mK	d = 13 mm	R = 0.052 m²K/W
PAROC® eXtra™	λ_U = 0.036 W/mK		
PAROC® WPS 3n	λ_U = 0.032 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W
Timber	λ_U = 0.12 W/mK		

U-value corrections:

Timber frames 48×48/150/175/200 mm, cc 600

The effect of the mechanical fasteners is less than 3 % -> no need for correction.

Timber Frame Walls



1. Internal surface; plaster board
2. Studding cc 600/PAROC® eXtra™
3. Air/vapor barrier
4. Timber frame cc 600/PAROC® eXtra™
5. Wind protection insulation; PAROC® WAS 35t
6. Spacer + ventilation gap ≥ 30 mm
7. Brick cladding

PAROC® eXtra™ (studding)	50	50	mm
PAROC® eXtra™ (frame)	175	200	mm
PAROC® WAS 35t	30	30	mm
U-value	**0,14**	**0,13**	W/m²K

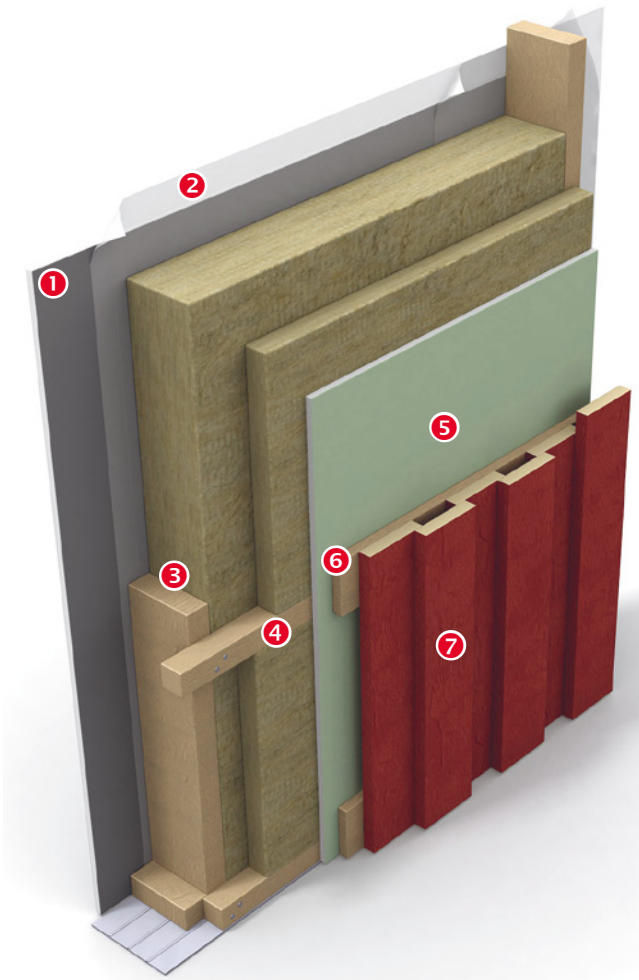
Calculation parameters:

Vapour barrier	λ_U = 0.33 W/mK	d = 0.25 mm	R = 0.001 m²K/W
Plaster board	λ_U = 0.25 W/mK	d = 13 mm	R = 0.052 m²K/W
PAROC® eXtra™	λ_U = 0.036 W/mK		
PAROC® WAS 35t	λ_U = 0.034 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W
Timber	λ_U = 0.12 W/mK		

U-value corrections:

Timber frames 48×48/150/175/200 mm, cc 600
The effect of the mechanical fasteners is less than 3 % -> no need for correction.

Timber Frame Walls



1. Internal surface; plaster board
2. Air/vapor barrier
3. Timber frame cc 600/PAROC® eXtra™
4. Horizontal timber frame cc 600/ PAROC® eXtra™
5. Wind protection (fiberboard)
6. Horizontal timber frame 22×100 mm/ ventilation gap
7. Timber cladding

PAROC® eXtra™ (horizontal studding)	50	50	50	mm
PAROC® eXtra™ (frame)	175	200	100	mm
U-value	**0,17**	**0,15**	**0,24**	W/m²K

Calculation parameters:

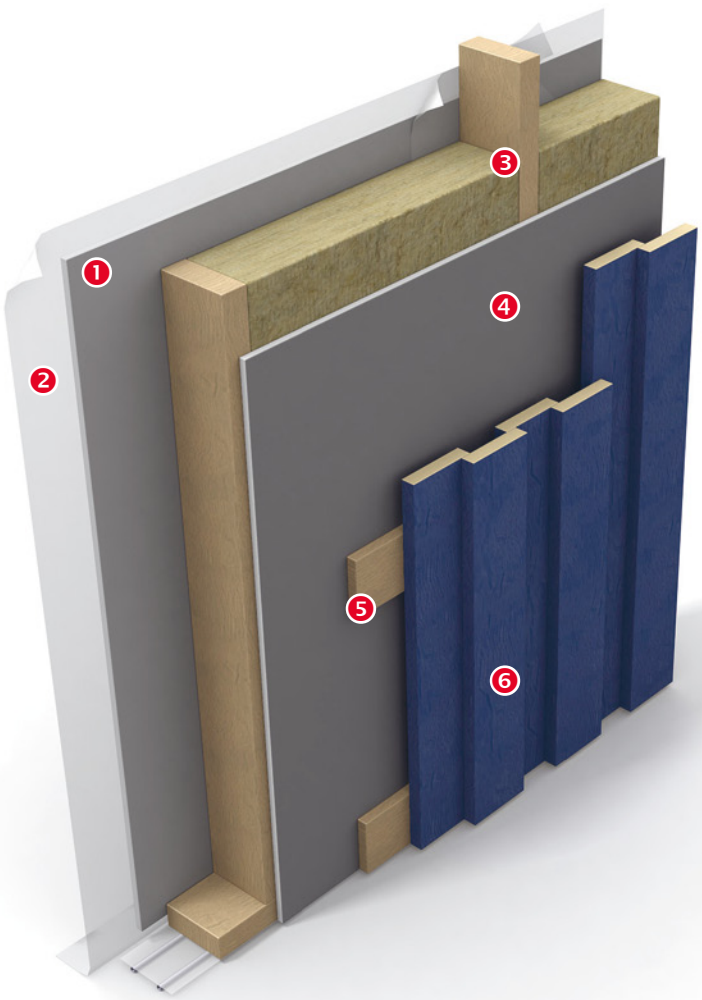
Vapour barrier	λ_U = 0.33 W/mK	d = 0.25 mm	R = 0.001 m²K/W
Plaster board	λ_U = 0.25 W/mK	d = 13 mm	R = 0.052 m²K/W
Fiberboard	λ_U = 0.055 W/mK	d = 12 mm	R = 0.218 m²K/W
PAROC® eXtra™	λ_U = 0.036 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W
Timber	λ_U = 0.12 W/mK		

U-value corrections:

Timber frames 48×48/150/175/200 mm, cc 600

The effect of the mechanical fasteners is less than 3 % -> no need for correction.

Timber Frame Walls



This basic form of ventilated timber wall contains just the most important components of a layered wall structure. The insulation is installed to the timber frame. Wind protection is made by using plaster board with sealed seams. The ventilation gap is usually formed by using timber size in size of 22×100 mm horizontally or with cross-laid double frame depending on direction of timber cladding.

1. Internal surface; plaster board
2. Air/vapor barrier
3. Timber frame cc 600/PAROC® eXtra™
4. Wind protection (plaster board or fiberboard)
5. Horizontal timber frame 22×100 mm/ ventilation gap
6. Timber cladding

PAROC® eXtra™ (frame)	50	50	50	mm
PAROC® eXtra™ (frame)	175	200	150	mm
U-value	**0,17**	**0,16**	**0,24**	W/m²K

Calculation parameters:

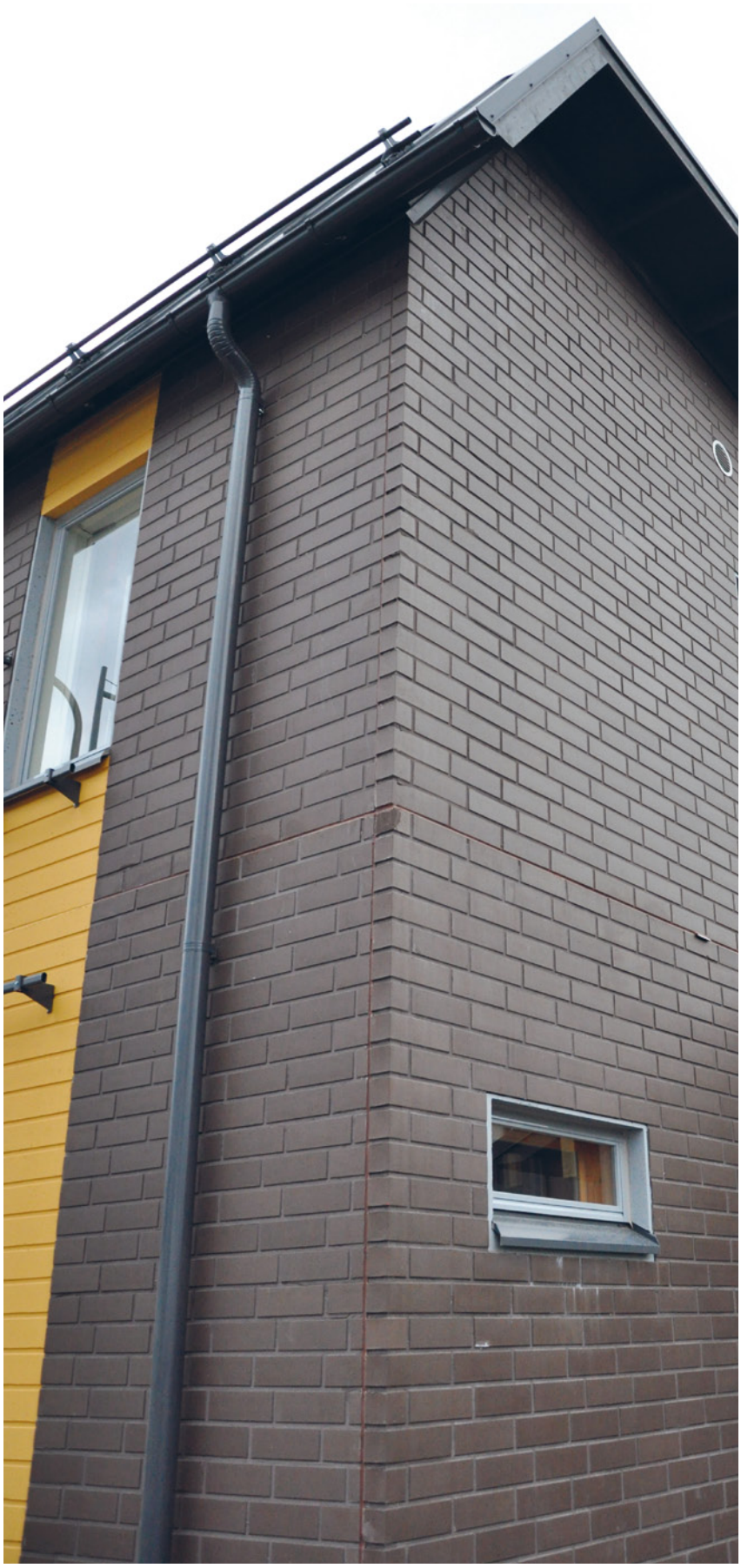
Vapour barrier	λ_U = 0.33 W/mK	d = 0.25 mm	R = 0.001 m²K/W
Plaster board	λ_U = 0.25 W/mK	d = 13 mm	R = 0.052 m²K/W
Fiberboard	λ_U = 0.055 W/mK	d = 12 mm	R = 0.218 m²K/W
PAROC® eXtra™	λ_U = 0.036 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W
Timber	λ_U = 0.12 W/mK		

U-value corrections:

Timber frames 48×48/150/175/200 mm, cc 600

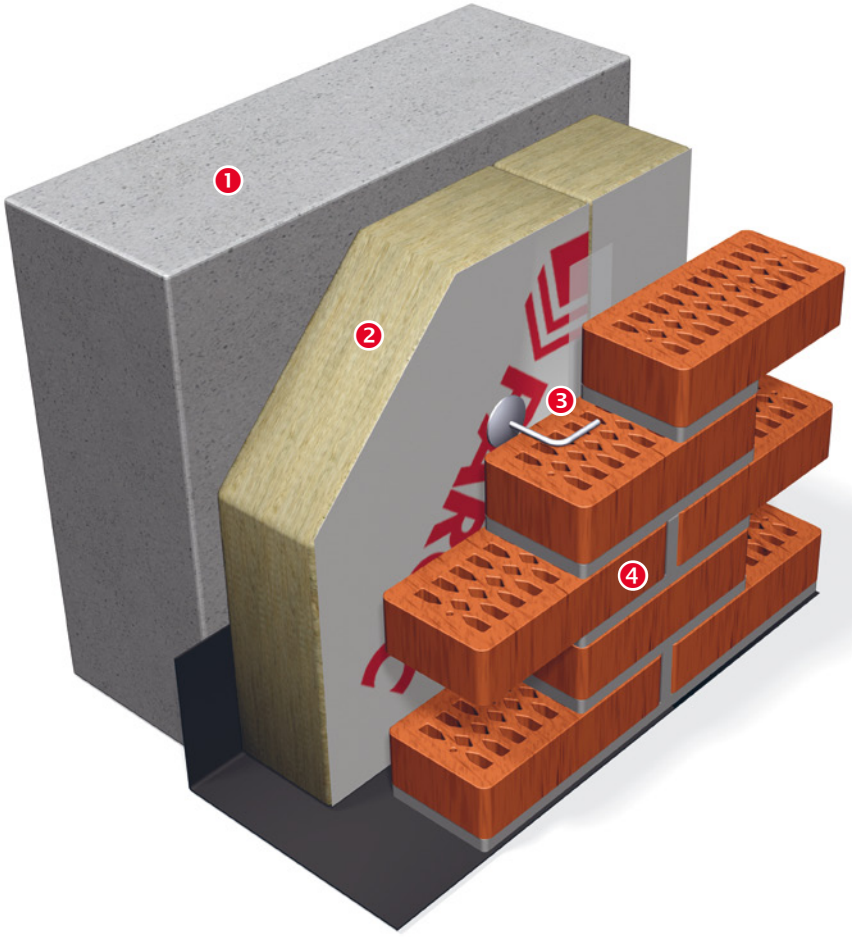
The effect of the mechanical fasteners is less than 3 % -> no need for correction.

Individual Houses. Massive Walls



Next popular solutions for individual houses are when supporting wall is made of concrete, various type of blocks or bricks. Massive walls for individual houses has to be designed so that it meets structural requirements, has proper U-value, and is air and wind tight and does not accumulate moisture inside the structure. A ventilation gap is placed behind the cladding and opening in the wall has to ensure good ventilation level. Therefore we recommend the use of wind protection insulation, such as PAROC® WPS3n or PAROC® WPB3n on top of the studs as external continuous thermal insulation layer. This continuous layer reduces significantly cold bridges and the amount of moisture on the timber studs. The seams of wind protection slabs have to be tightened with tape (PAROC® XST 020 or PAROC® XST 021).

Massive Wall



1. Supporting structure; concrete, blocks, brick or other stone based structure
2. PAROC® WAS 50t/ PAROC® Cortex One™
3. Ventilation gap ≥ 30 mm
4. Brick masonry

PAROC® WAS 50t	150	180	200	mm
U-value	**0,20**	**0,17**	**0,15**	W/m²K

PAROC® Cortex One™	150	180	200	mm
U-value	**0,19**	**0,17**	**0,15**	W/m²K

Calculation parameters:

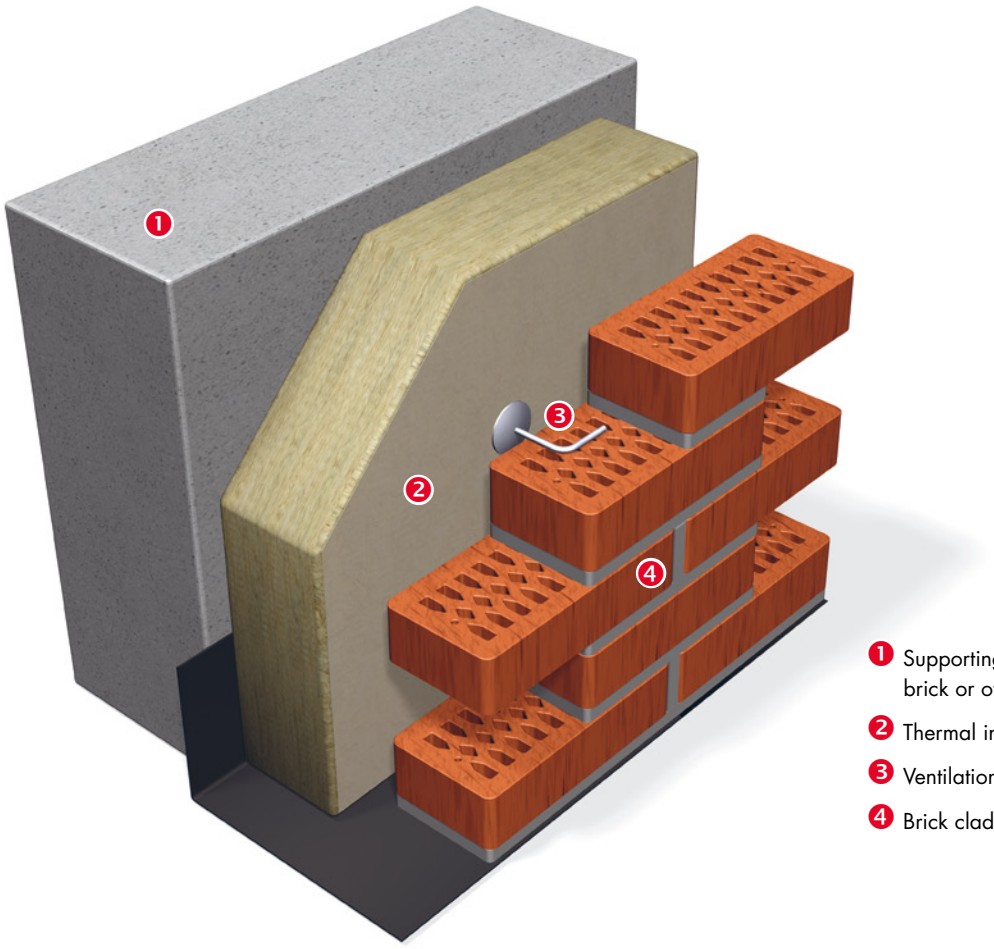
Reinforced concrete 2 %, 2400 kg/m³	λ_U = 2.5 W/mK	d = 150 mm	R = 0.060 m²K/W
PAROC® Cortex One™	λ_U = 0.033 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W

U-value corrections:

Mechanical fasteners: Ø 4 mm, 4 fasteners/m², λ_U = 17 W/mK

The effect of the mechanical fasteners is max 0.002 W/m²K = less than 3 % -> no need for correction.

Massive Wall



1. Supporting structure; concrete, blocks, brick or other stone based structure
2. Thermal insulation; PAROC® WAS 50t
3. Ventilation gap ≥ 30 mm
4. Brick cladding

PAROC® WAS 50t	200	225	250	mm
U-value	**0,16**	**0,14**	**0,13**	W/m²K

Calculation parameters:

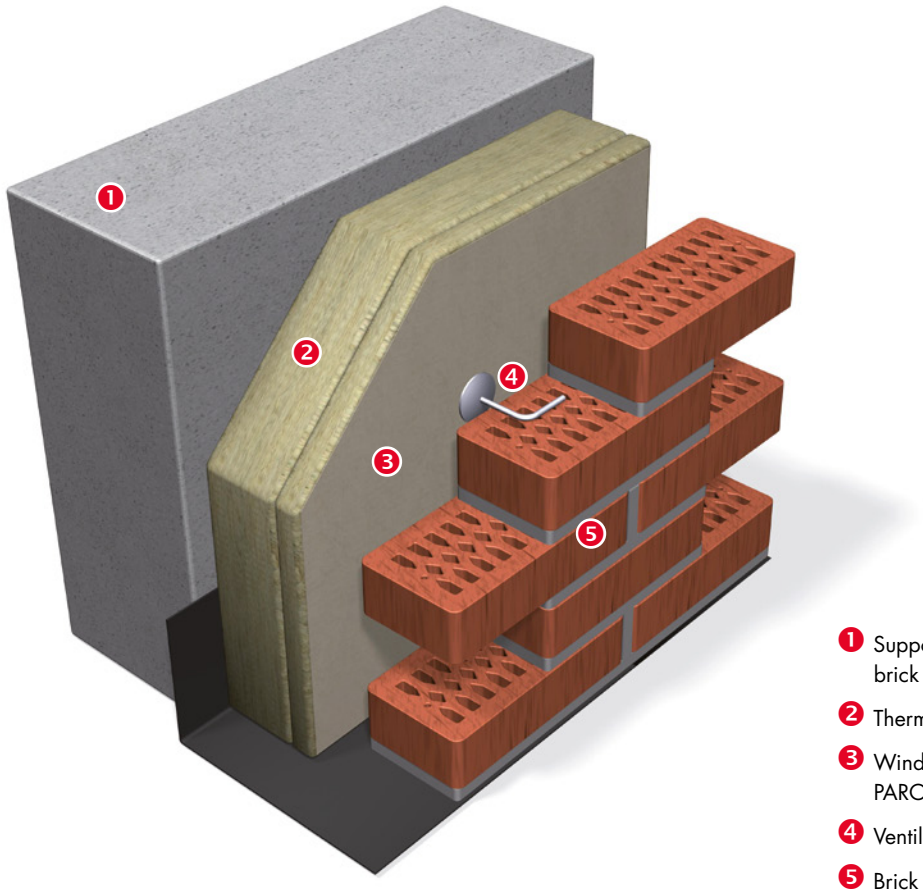
Reinforced concrete 2 %, 2400 kg/m³	λ_U = 2.5 W/mK	d = 150 mm	R = 0.060 m²K/W
PAROC® WAS 50t	λ_U = 0.034 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W

U-value corrections:

Mechanical fasteners: Ø 4 mm, 4 fasteners/m², λ_U = 17 W/mK

The effect of the mechanical fasteners is max 0.002 W/m²K = less than 3 % -> no need for correction.

Massive Wall



1. Supporting structure; Concrete, blocks, brick or other stone based structure
2. Thermal insulation; PAROC® eXtra™
3. Wind protection insulation; PAROC® WAS 35t
4. Ventilation gap ≥ 30 mm
5. Brick cladding

PAROC® WAS 35t	50	30	50	50	30	mm
PAROC® eXtra™	150	175	175	200	100	mm
U-value	**0,17**	**0,16**	**0,15**	**0,14**	**0,25**	W/m²K

Calculation parameters:

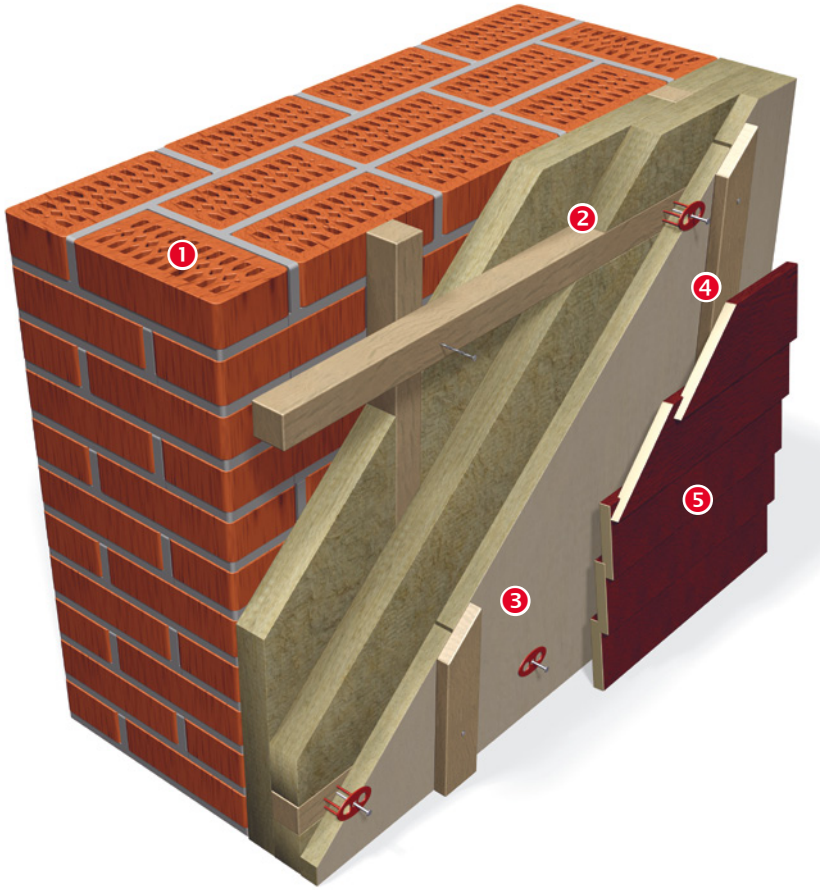
Reinforced concrete 2 %, 2400 kg/m³	λ_U = 2.5 W/mK	d = 150 mm	R = 0.060 m²K/W
PAROC® WAS 35t	λ_U = 0.033 W/mK		
PAROC® eXtra™	λ_U = 0.036 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W

U-value corrections:

Mechanical fasteners: Ø 4 mm, 4 fasteners/m², λ_U = 17 W/mK

The effect of the mechanical fasteners is max 0.004 W/m²K = less than 3 % -> no need for correction.

Massive Wall



1. Supporting wall, made from bricks
2. Timber frame both directions cc 600/ PAROC® eXtra™
3. Wind protection (plaster board or fiberboard)
4. Horizontal timber frame 22×100 mm/ ventilation gap
5. Timber cladding

Multi-storey Buildings

The requirements for multi-storey building concerning wind protection and fire protection are much higher than in other type of the buildings. Therefore we have developed the premium solution for Ventilated Facades which can meet high demands for wind and fire protection. This solution can be used for insulation of the façades for buildings which are located in windy areas (open areas or cost line) and multi-storey buildings.

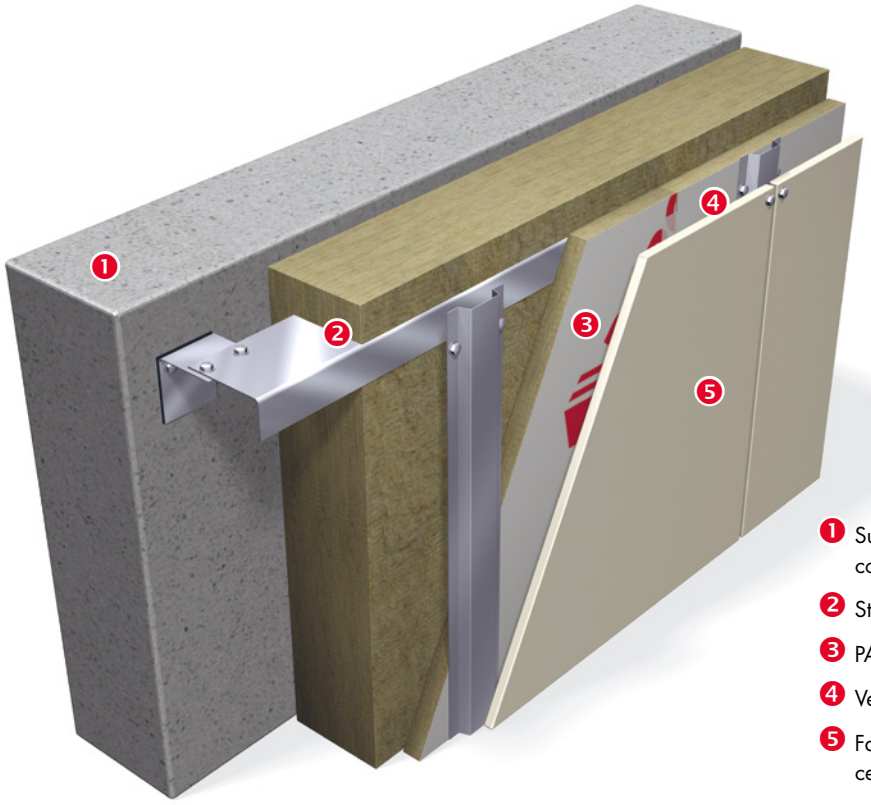
Premium solution for ventilated façades consists of those products:

PAROC® Cortex™ or PAROC® Cortex One™ – stone wool insulation slabs.

PAROC® XST 020 – tape for wind tightening of the joints of the thermal insulation.

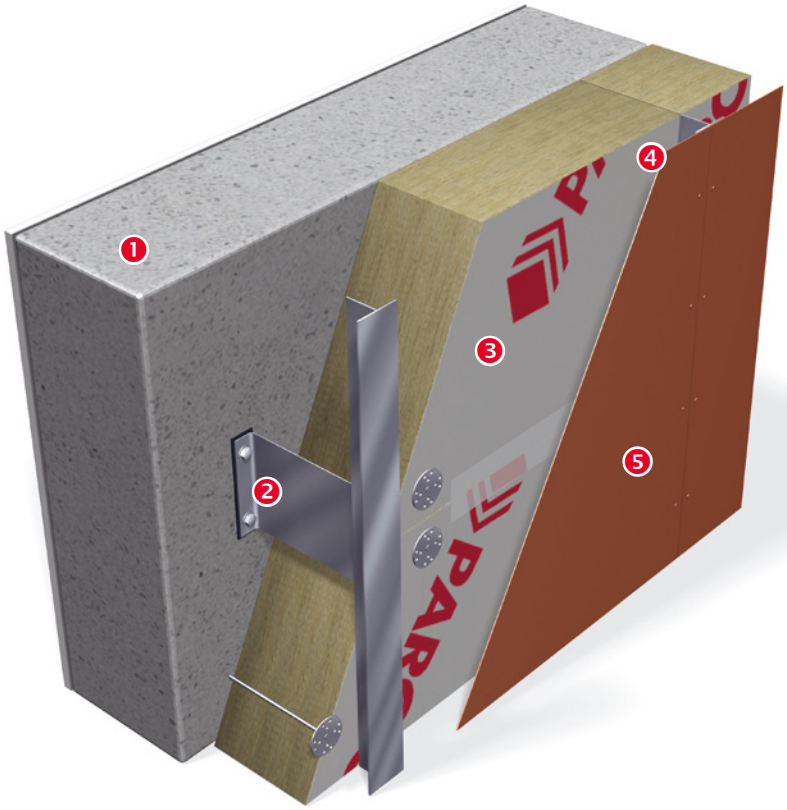
PAROC® XST 021 – tape for wind tightening around corners of the building or window openings.

Horizontal Frame System

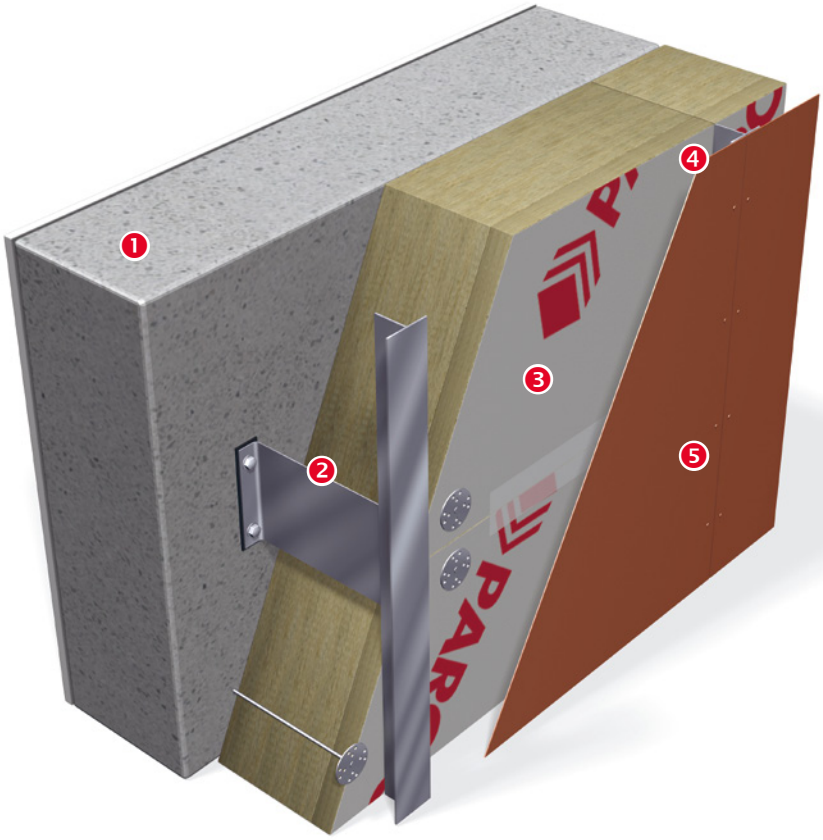


1. Supporting structure; blocks, bricks, concrete, etc.
2. Steel frame/PAROC® eXtra™
3. PAROC® Cortex™
4. Ventilation gap
5. Façade cladding (steel cassette, fiber cement board, ceramic/stone plate)

Vertical Frame System

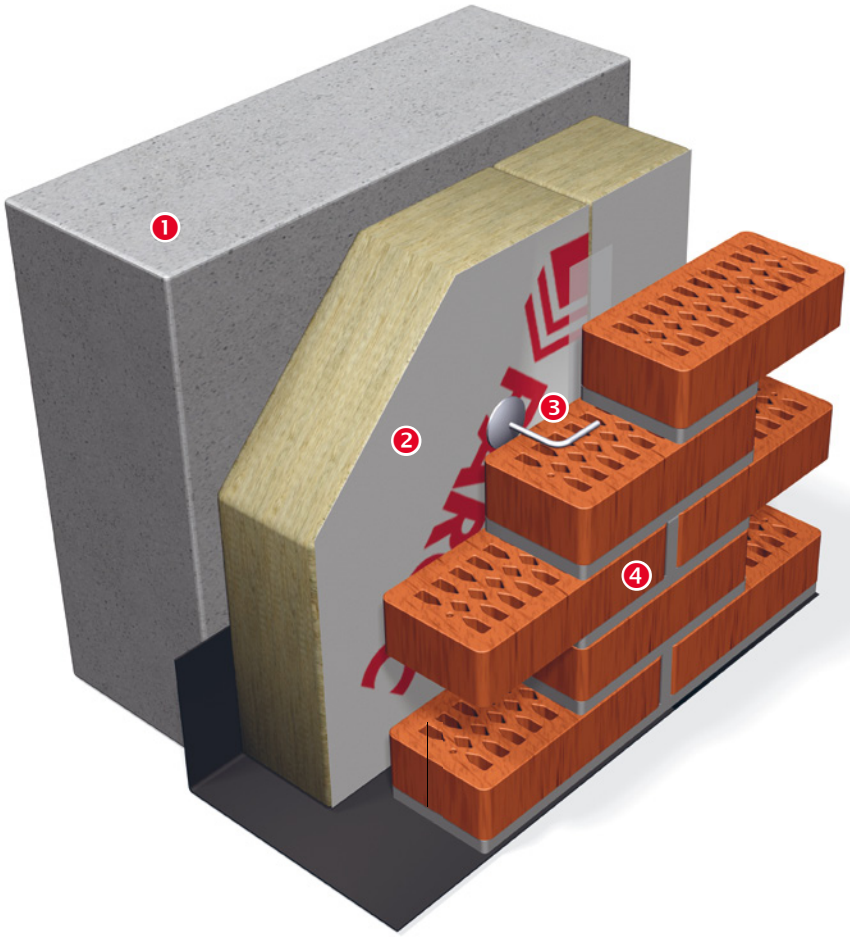


1. Supporting structure; blocks, bricks, concrete, etc.
2. Steel frame
3. PAROC® Cortex One™
4. Ventilation gap
5. Façade cladding (steel cassette, fiber cement board, ceramic/stone plate)



1. Supporting structure; blocks, bricks, concrete, etc.
2. Steel frame/PAROC® eXtra™
3. PAROC® Cortex™
4. Ventilation gap
5. Façade cladding (steel cassette, fiber cement board, ceramic/stone plate)

Massive Wall with Brick Cladding



1. Supporting structure; Blocks, bricks, concrete, etc.
2. PAROC® Cortex One™
3. Ventilation gap
4. Façade cladding (bricks)

PAROC® Cortex One™	175	180	200	mm
U-value	**0,18**	**0,17**	**0,16**	W/m²K

Calculation parameters:

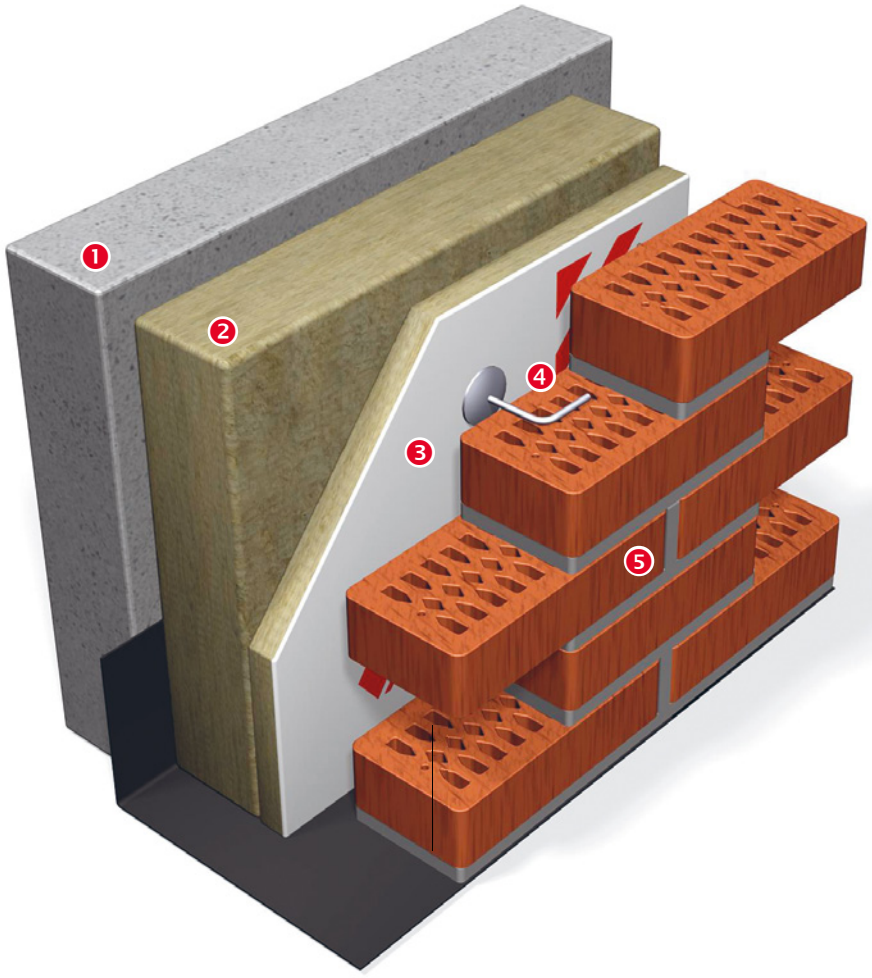
Reinforced concrete 2 %, 2400 kg/m³	λ_U = 2.5 W/mK	d = 150 mm	R = 0.060 m²K/W
PAROC® Cortex One™	λ_U = 0.033 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W

U-value corrections:

Mechanical fasteners: Ø 4 mm, 4 fasteners/m², λ_U = 17 W/mK

The effect of the mechanical fasteners is max 0.002 W/m²K = less than 3 % -> no need for correction.

Massive Wall with Brick Cladding



1. Supporting structure; Blocks, bricks, concrete, etc.
2. PAROC® eXtra™
3. PAROC® Cortex™
4. Ventilation gap
5. Façade cladding (bricks)

PAROC® Cortex™	50	30	50	50	30	mm
PAROC® eXtra™	150	175	175	200	100	mm
U-value	**0,17**	**0,16**	**0,15**	**0,14**	**0,25**	W/m²K

Calculation parameters:

Reinforced concrete 2 %, 2400 kg/m³	λ_U = 2.5 W/mK	d = 150 mm	R = 0.060 m²K/W
PAROC® Cortex™	λ_U = 0.033 W/mK		
PAROC® eXtra™	λ_U = 0.036 W/mK		
Surface resistance			$R_{si} + R_{se}$ = 0.26 m²K/W

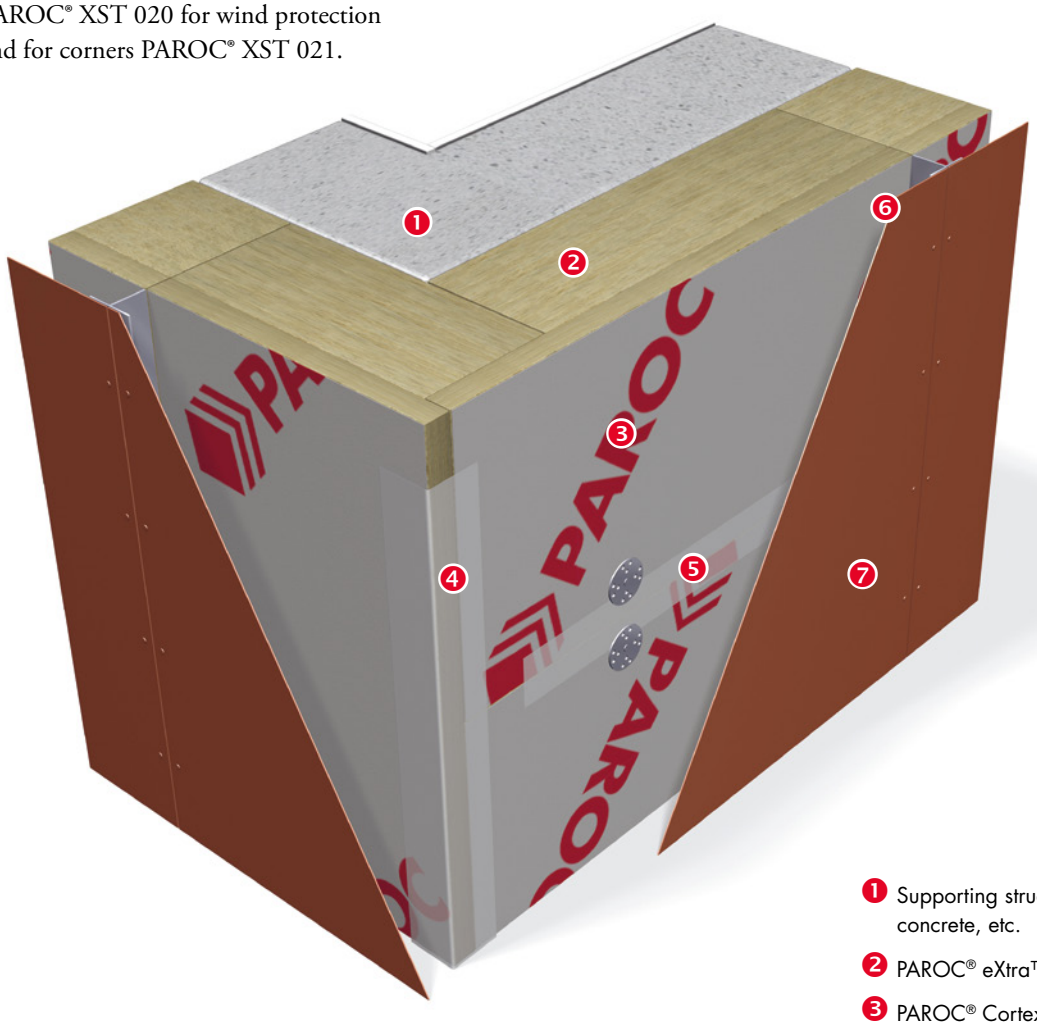
U-value corrections:

Mechanical fasteners: Ø 4 mm, 4 fasteners/m², λ_U = 17 W/mK

The effect of the mechanical fasteners is max 0.004 W/m²K = less than 3 % -> no need for correction.

Corners

Corners of the building are critical places; therefore they have to be taken into account during installation of thermal insulation. We recommend using outside tightening tape PAROC® XST 020 for wind protection and for corners PAROC® XST 021.

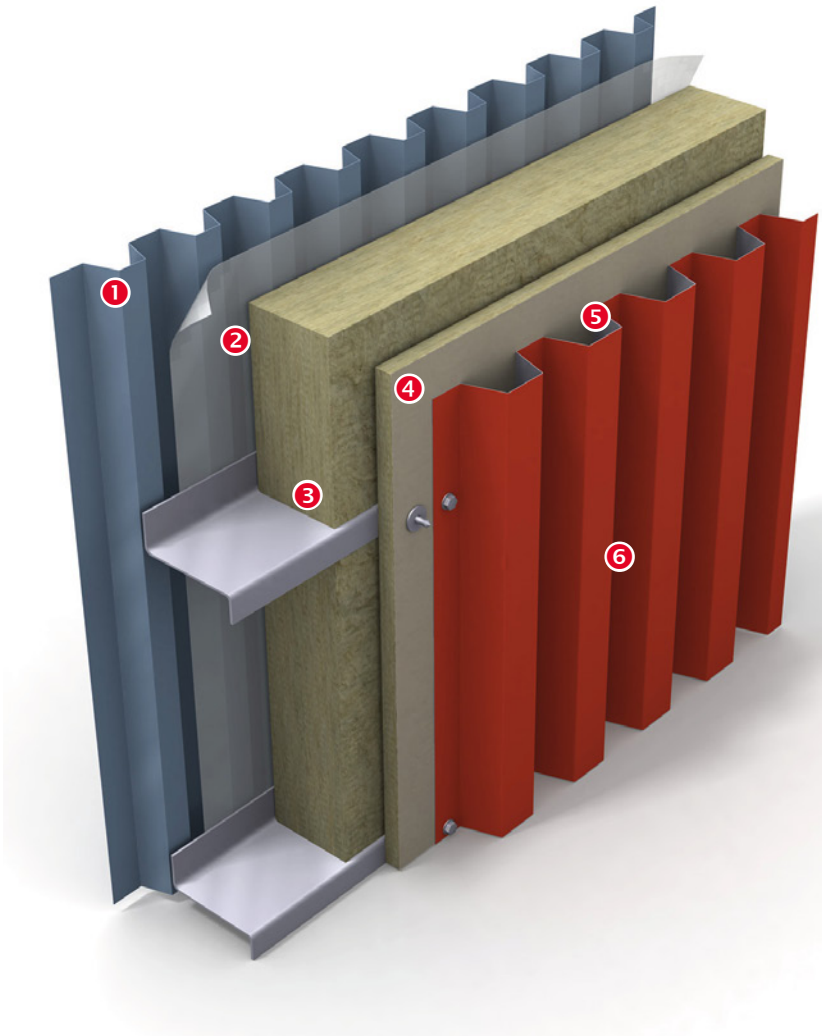


1. Supporting structure; blocks, bricks, concrete, etc.
2. PAROC® eXtra™
3. PAROC® Cortex One™
4. Taped seams; PAROC® XST 021
5. Taped seams; PAROC® XST 020
6. Ventilation gap ≥ 30 mm
7. Façade cladding (steel cassette, fiber cement board, ceramic/stone plate)

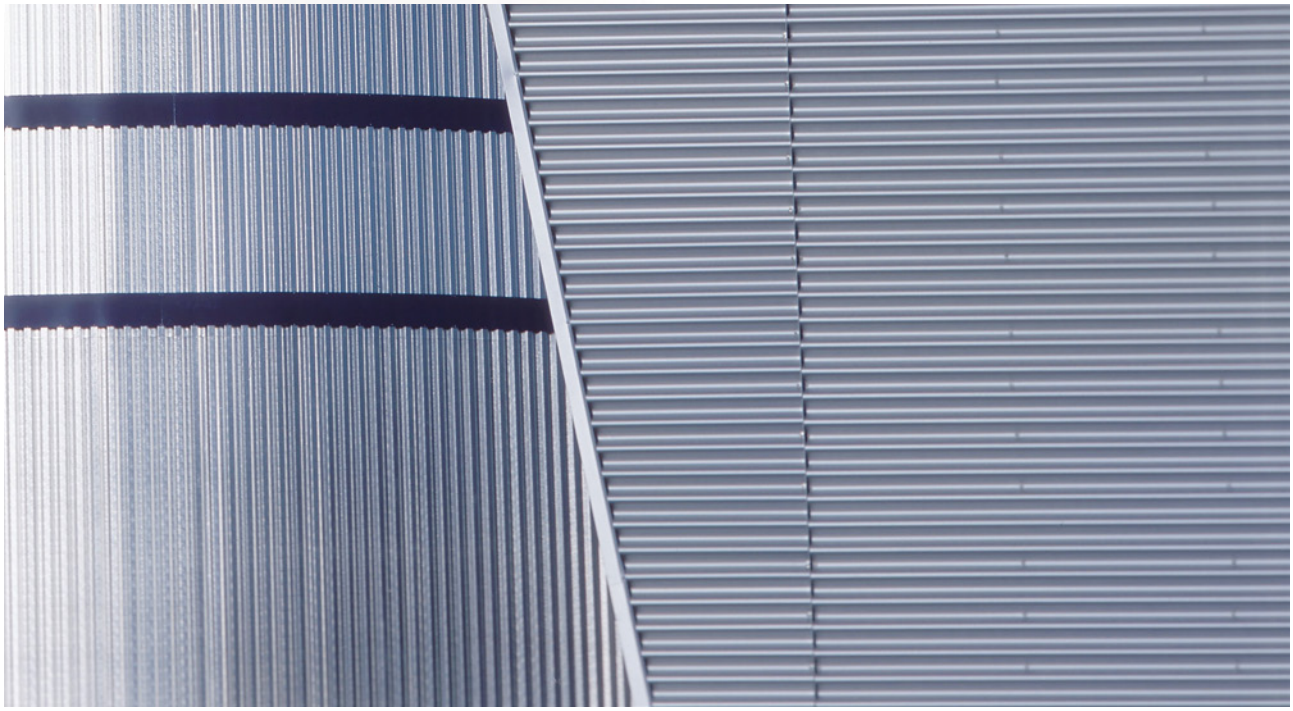
Industrial Buildings

This is typical solution for industrial buildings and warehouses. The thermal resistance of the structure can be significantly improved by adding continuous wall insulation layer to the top of the studs to prevent the thermal bridges. In buildings where the indoor air conditions are demanding; for example high humidity and/or temperature, it is especially important to design a proper, tight vapour barrier and adequate ventilation of the façade.

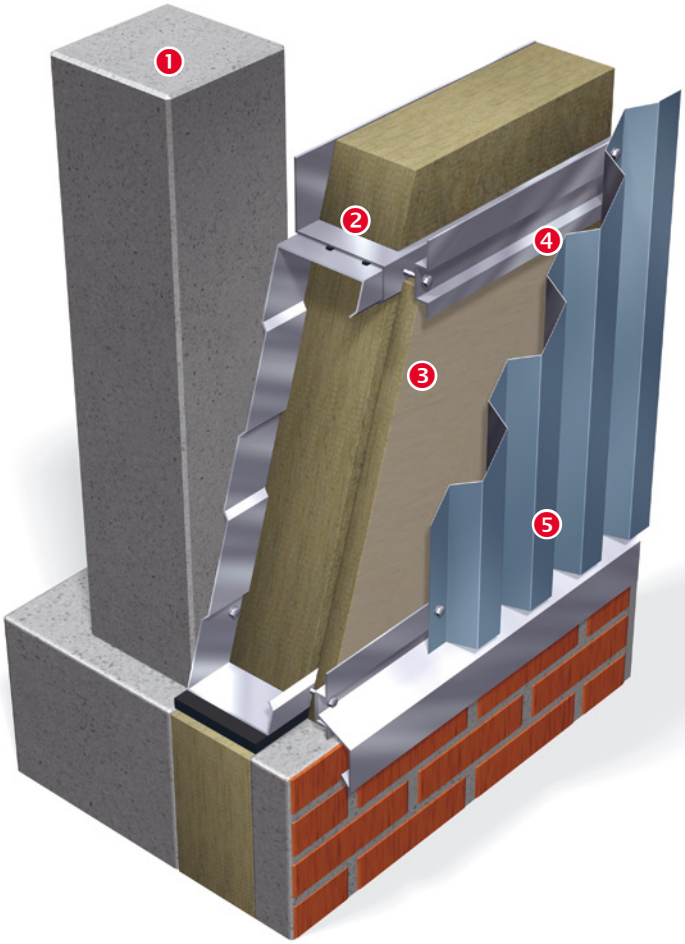
Metal Frame Wall



1. Sheet metal.
2. Air/vapor barrier
3. Supporting structure; steel frames/ PAROC® eXtra™
4. PAROC® WAB 10t
5. Ventilation gap
6. Sheet metal

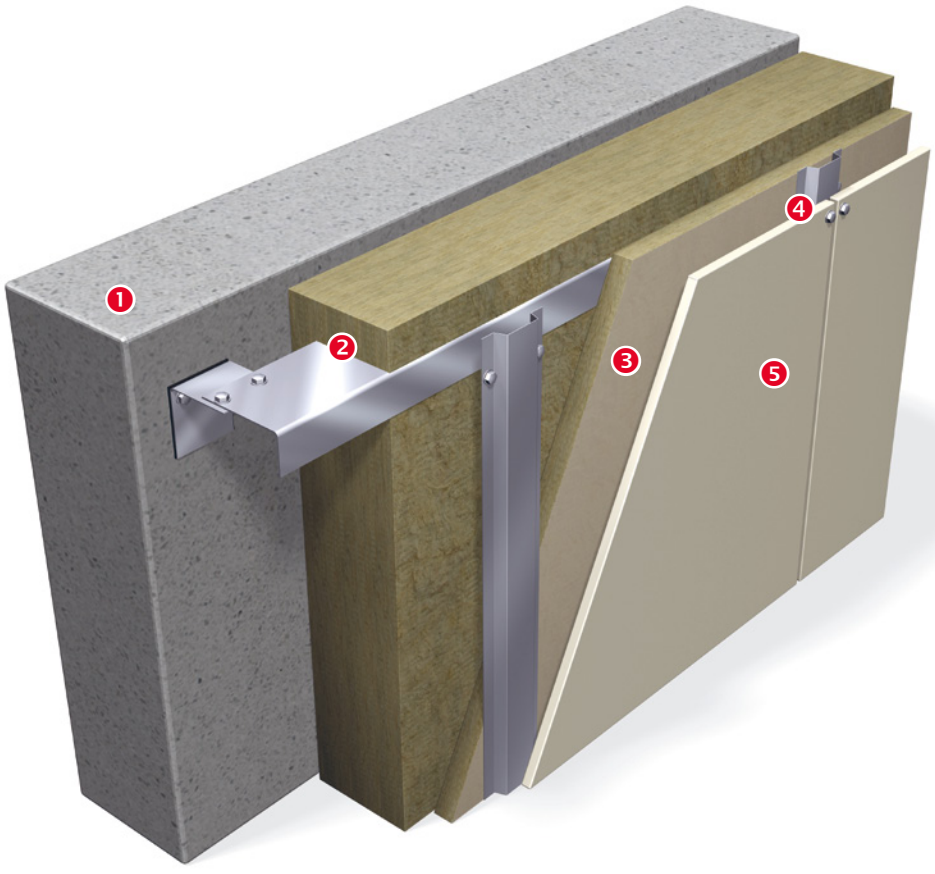


Metal Frame Wall



Industrial walls can also be made from metal covered building elements which are installed to the column structure.

1. Supporting structure; Concrete or Steel columns
2. Metal covered building element/ PAROC® eXtra™
3. PAROC® WAB 10t, PAROC® WAS 25t
4. Ventilation gap
5. Sheet metal



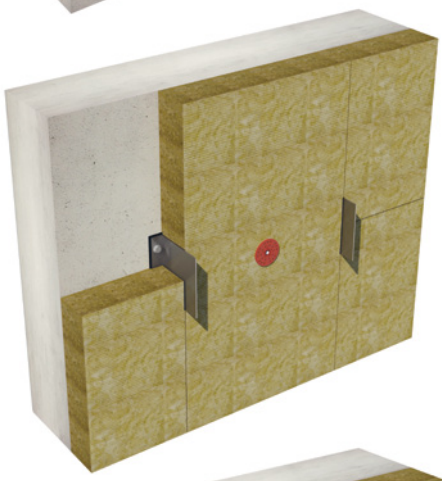
PAROC® Cortex™ is a non-combustible product and has good fire class A2, s1-d0 and therefore it is suitable for high rise buildings.

1. Supporting structure; Blocks, bricks, concrete, etc.
2. Steel frame/PAROC® eXtra™
3. PAROC® WAS 25t or PAROC® Cortex™
4. Ventilation gap
5. Façade cladding (steel cassette, fiber cement board, ceramic/stone plate)

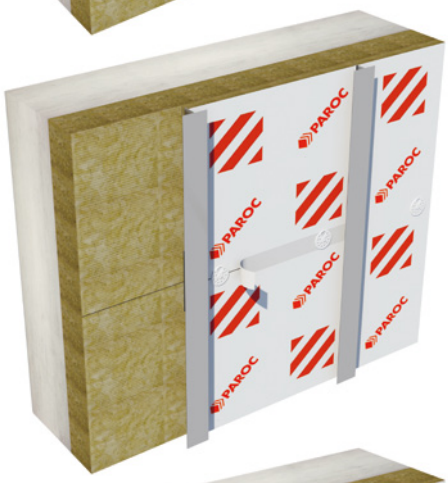
Installation of Massive Wall with Single Metal Frame

Type of metal frame, distances (layout), thickness of metal frame elements, needed screws has to be chosen and calculated according National regulation, taking into consideration type of wall, wind loads in particular area, height of the building, type of cladding element, etc.

1. Use separation between metal element and wall.



2. Mount thermal insulation PAROC® eXtra™ and wind protection insulation PAROC® Cortex™ on top of metal elements or use only one layer solution PAROC® Cortex One™.



3. Seal the joints of wind protection layer and around the corner of the buildings by using PAROC® XST 020 and PAROC® XST 021.
Use up to 4 fasteners per m2 to fix thermal insulation layers.

4. Fix sub-frame element of the system, which forms air gap within the structure at least 20 mm.

5. Mount façade cladding.

Installation of Massive Wall with Double Metal Frame

Type of metal frame, distances (layout), thickness of metal frame elements, needed screws has to be chosen and calculated according National regulation, taking into consideration type of wall, wind loads in particular area, height of the building, type of cladding element, etc.

1. Use separation between metal details and wall.
2. Mount metal profiles to metal detail so that it forms a needed horizontal frame for thermal insulation.

3. Install PAROC® eXtra™ into the frame.

4. On top of this use PAROC® Cortex™ as wind protection insulation.
5. Seal the joints of wind protection layer and around the corner of the buildings by using PAROC® XST 020 and PAROC® XST 021.
6. Use 4 fasteners per m² to fix thermal insulation layers.
7. Fix sub-frame element of the system, which form air gap within the structure at least 20 mm.

8. Mount façade cladding.

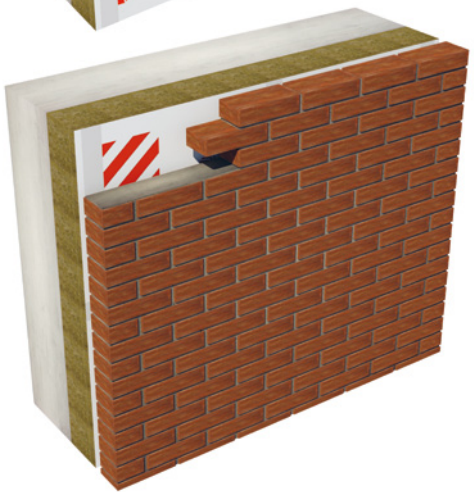
Installation of Massive Wall with no Frame

1. Fix the required number metal anchors to existing wall according the structural design.

2. Mount thermal insulation PAROC® eXtra™ and wind protection insulation PAROC® Cortex™ on top of metal anchors or use only one layer solution PAROC® Cortex One™.

3. Seal the joints of wind protection layer and around the corner of the buildings by using PAROC® XST 020 and PAROC® XST 021.

4. Leave the air gap of at least 30 mm.



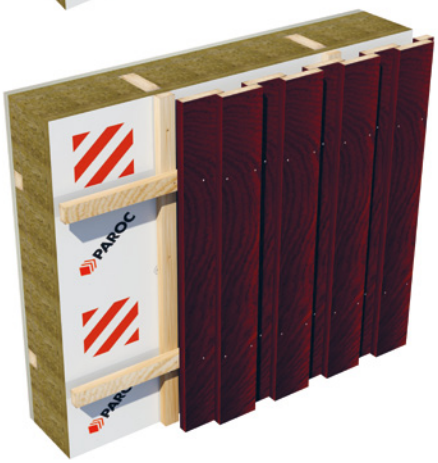
5. Install façade cladding from bricks.

Installation of Timber Frame Wall

Installation from outside of the building

1. Install PAROC® eXtra™-slabs between the timber frames. It must fulfil the frame, no gaps are allowed.

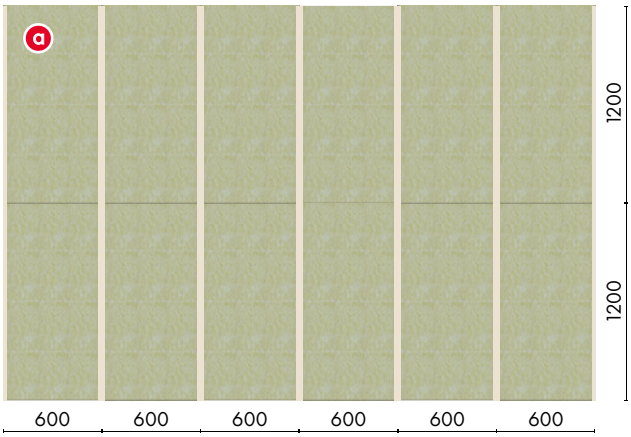
2. On top install wind protection slab. PAROC® WAS 25 or PAROC® WPS 3n.
3. Use nails or screws and washers for preliminary fastening.
4. When PAROC® WPS solution is used seal the joints with PAROC® XST 020.

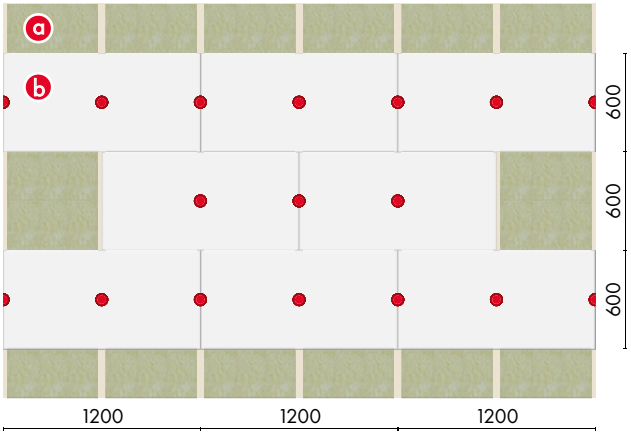


5. Use spacer at a distance of ca. 600 mm (according to timber frame).
6. If you will have vertical cladding outside, nail a horizontal grid siding through spacer.
7. If you will have a horizontal cladding, nail at first a horizontal grid siding and then another in vertical directions.
8. Install the cladding.

Fastening of insulation

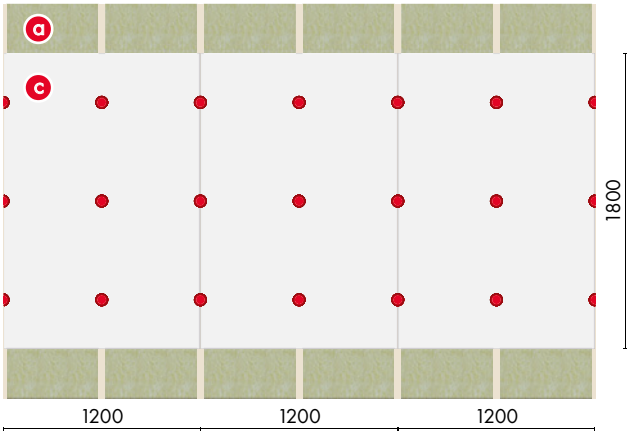
Wooden frame
Double layer solution





a Thermal insulation (PAROC® eXtra™)

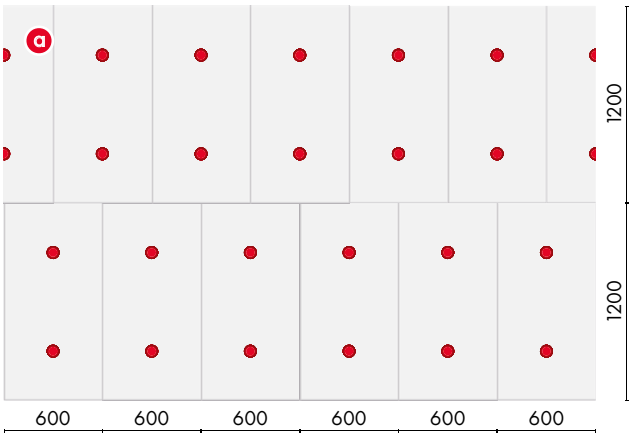
b Wind protection (PAROC® WAS 25t, PAROC® WAS 35t(b), PAROC® WPB 3n)



a Thermal insulation (PAROC® eXtra™)

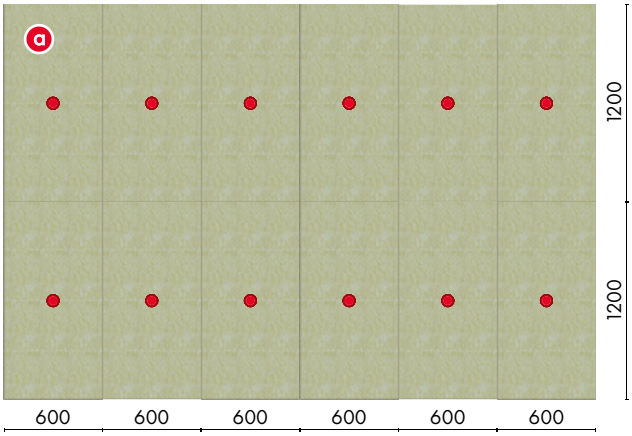
c Wind protection (PAROC® Cortex™)

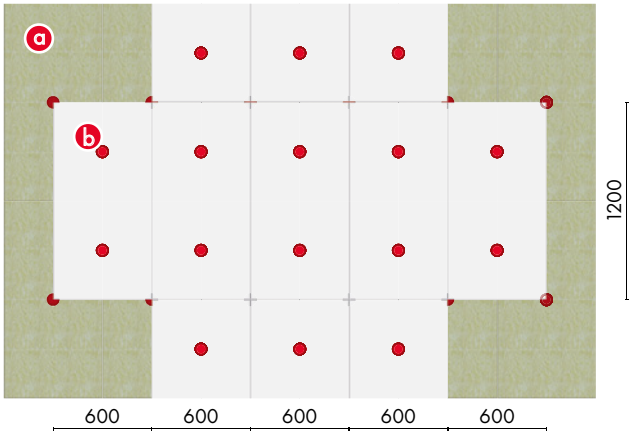
No Frame
Single layer solution



a Thermal insulation and wind protection (PAROC® WAS 35t(b), PAROC® WAS 50t, PAROC® Cortex One™)

No Frame
Double layer solution



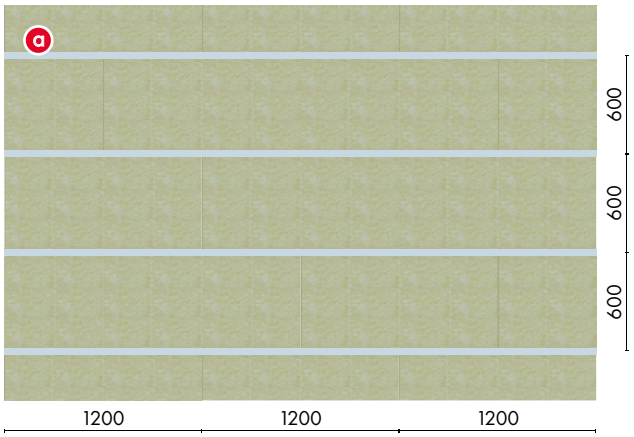


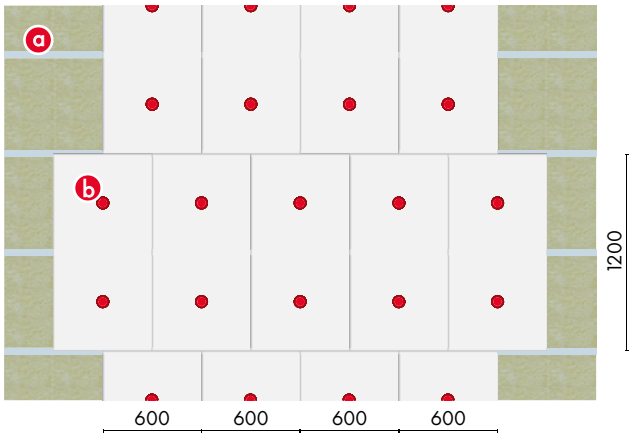
a Thermal insulation (PAROC® eXtra™)

b Wind protection (PAROC® WAS 25t, PAROC® WAS 35t(b), PAROC® WPB 3n)

Horizontal Metal Frame System

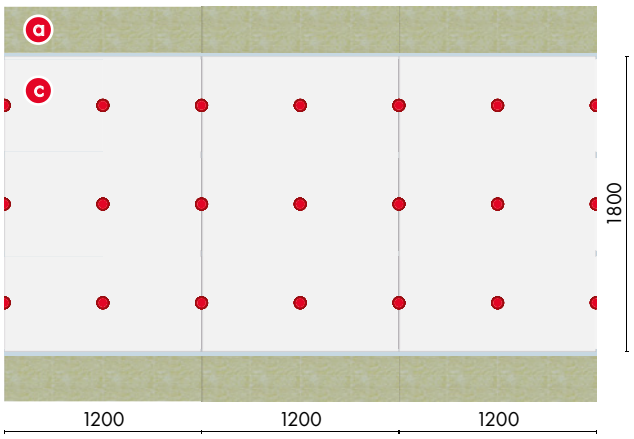
Double layer solution





a Thermal insulation (PAROC® eXtra™)

b Wind protection (PAROC® WAB 10t, PAROC® WPB 3n)

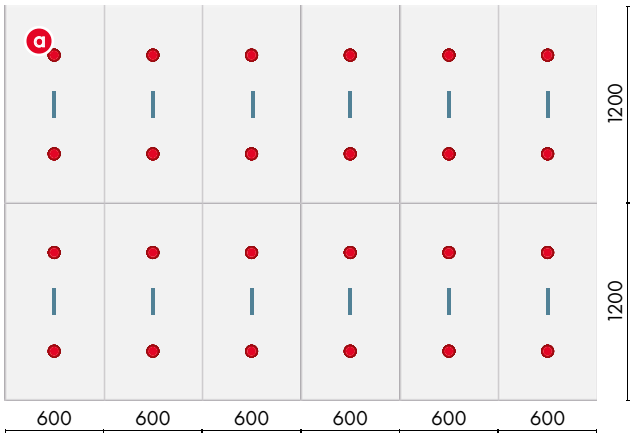


a Thermal insulation (PAROC® eXtra™)

c Wind protection (PAROC® Cortex™)

Vertical Metal Frame System

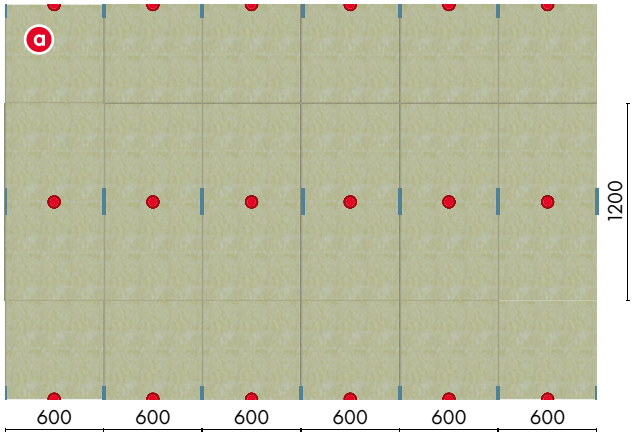
Single layer solution

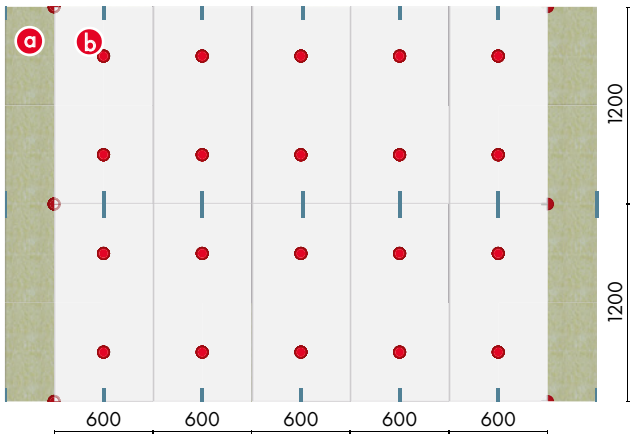


a Thermal insulation and wind protection (Paroc PAROC® One™)

Vertical Metal Frame System

Double layer solution





a Thermal insulation (PAROC® eXtra™)

b Wind protection (PAROC® WAS 25t, PAROC® WAS 35t(b), PAROC® WPB 3n)

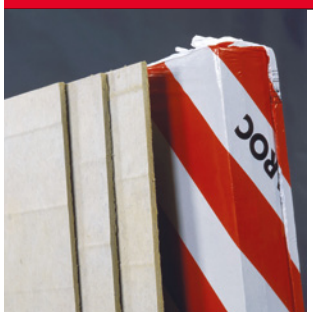
Product Information

PAROC® eXtra™

A multi-purpose general insulation for thermal insulation of external walls, ceilings and Ross floors and for sound and fire insulation for internal walls and intermediate floors. Its resiliance makes it easy to handle and install.

Width × Length	610×1220 mm
Thickness	42–150 mm
	Other sizes can be supplied on request.
Packaging	Plastic package or packages on a pallet.
Lambda, declared, λ_D	0.036 W/mK
	In accordance with EN 13162
Air permeability, l	95×10^{-6} m²/sPa
	In accordance with EN 29053
Reaction to Fire	A1
	In accordance with EN 13501-1
Water absorption (short term), declared, WS	≤1 kg/m²
Water absorption (long term), declared, WL (P)	≤3 kg/m²
Approximate weight	30 kg/m³ ±10 %

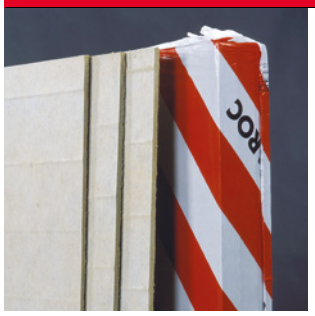
PAROC® WAB 10t



Wall board PAROC® WAB 10t is non-combustible stone wool insulation for existing and new ventilated external walls.

Width × Length	1200x2400 mm
Thickness	20 mm
	Other sizes can be supplied on request.
Package Type	Plastic package, plastic packages on a pallet or loose product on a pallet.
Lambda, Declared, λ_D	0.037 W/mK
	In accordance with EN 13162
Air Permeability, l	10×10^{-6} m²/sPa
	In accordance with EN 29053
Reaction to Fire	A1
	In accordance with EN 13501-1
Water absorption (short term), declared, WS	≤1 kg/m²
	In accordance with EN 1609
Water absorption (long term), declared, WL (P)	≤3 kg/m²
	In accordance with EN 12087
Water vapor resistance for coating, declared Zi	0.06 m² hPa/mg
Approximate weight	160 kg/m³ ±10 %

PAROC® WAS 25 (t, tb)



Wall slab PAROC® WAS 25 (t, tb) is non-combustible stone wool insulation for existing and new ventilated external walls.

Width × Length	600×1200 mm	1200×1800 mm
Thickness	30–150 mm	30–100 mm
	Other sizes can be supplied on request.	
Package Type	Plastic package or packages on a pallet.	
Lambda, declared, λ_D	0.034 W/mK	
	In accordance with EN 13162	
Air permeability, l	25×10^{-6} m²/sPa	
	In accordance with EN 29053	
Reaction to Fire	A1	
	In accordance with EN 13501-1	
Water absorption (short term), declared, WS	≤1 kg/m²	
Water absorption (long term), declared, WL (P)	≤3 kg/m²	
Approximate weight	90 kg/m³ ±10 %	

PAROC® WAS 35 (t, tt, tb)

Wall slab PAROC® WAS 35 (t, tt, tb) is non-combustible stone wool insulation for existing and new ventilated external walls.

Width × Length	600×1200 mm	1200×1800 mm
Thickness	30–150 mm	30–100 mm
	Other sizes can be supplied on request.	
Package Type	Loose product on a wooden pallet with plastic wrapping.	
Lambda, Declared, λ_D	0.034 W/mK	
	In accordance with EN 13162	
Air permeability, l	35×10^{-6} m²/sPa	
	In accordance with EN 29053	
Reaction to Fire	A1	
	In accordance with EN 13501-1	
Water absorption (short term), declared, WS	≤1 kg/m²	
Water absorption (long term), declared, WL (P)	≤3 kg/m²	
Approximate weight	70 kg/m³ ±10 %	

PAROC® WAS 50 (t, tb)

Wall slab PAROC® WAS 50 (t, tb) is non-combustible stone wool insulation for existing and new ventilated external walls.

Width × Length	600×1200 mm
Thickness	30–200 mm
	Other sizes can be supplied on request.
Package Type	Plastic package or packages on a pallet.
Lambda, Declared, λ_D	0.035 W/mK
	In accordance with EN 13162
Air permeability, l	50×10^{-6} m²/sPa
	In accordance with EN 29053
Reaction to Fire	A1
	In accordance with EN 13501-1
Water absorption (short term), declared, WS	≤1 kg/m²
Water absorption (long term), declared, WL (P)	≤3 kg/m²
Approximate weight	45 kg/m³ ±10 %

Product Information

PAROC® Cortex™

Wind protection slab PAROC® Cortex One™ is non-combustible stone wool insulation with integrated non-combustible wind tight facing for existing and new well-ventilated external walls in multi storey buildings.

Width × Length	1200×1800 mm
Thickness	30–70 mm
	Other sizes can be supplied on request.
Package Type	Plastic package, plastic packages on a pallet or loose product on a pallet.
Lambda, Declared, λ_D	0.033 W/mK
	In accordance with EN 13162
Air permeability, l_k	10×10^{-6} m³/m²/sPa
	In accordance with VTT-C/Sr 1967
Reaction to Fire	A2 - s1, d0
	In accordance with EN 13501-1
Water absorption (short term), declared, WS	≤1 kg/m²
Water absorption (long term), declared, WL (P)	≤3 kg/m²
Approximate weight	80 kg/m³ ±10 %

PAROC® Cortex One™

Wind protection slab PAROC® Cortex One™ is non-combustible stone wool insulation with integrated non-combustible wind tight facing for existing and new well-ventilated external walls in multi storey buildings.

Width × Length	600×1200 mm	600×1500 mm
Thickness	100–200 mm	100–200 mm
	Other sizes can be supplied on request.	
Package Type	Plastic package, plastic packages on a pallet or loose product on a pallet.	
Lambda, Declared, λ_D	0.033 W/mK	
	In accordance with EN 13162	
Air permeability, l_k	≤10×10^{-6} m³/m²/sPa	
	In accordance with VTT-C/Sr 1967	
Reaction to Fire	A2 - s1, d0	
	In accordance with EN 13501-1	
Water absorption (short term), declared, WS	≤1 kg/m²	
Water absorption (long term), declared, WL (P)	≤3 kg/m²	
Approximate weight	60 kg/m³ ±10 %	

PAROC® XST 020 Outside Sealing Tape

Sealing tape for outside use with polyacrylate adhesive of extremely high adhesion. On the back there is a paper release liner.

Length	25 m
Width	60 mm
Package Type	Cardboard box.
Color	White
Adhesion	30 N/25 mm
Temperature resistance	-30 °C to +90 °C
Application temperature	Optimum +5 °C to +25 °C
Reaction to fire	Combustible
Storage	Store at room temperature.
Reaction to Fire	Combustible

PAROC® XST 021 Corner Tape

Sealing tape for outside use with polyacrylate adhesive. The adhesive is applied sides of the tape and there is a paper release liner on the back.

Length	25 m
Width	350 mm
Package Type	Cardboard box.
Color	White
Adhesion	30 N/25 mm
Temperature resistance	-30 °C to +90 °C
Application temperature	Optimum +5 °C to +25 °C
Reaction to fire	Combustible
Storage	Store at room temperature.
Reaction to Fire	Combustible

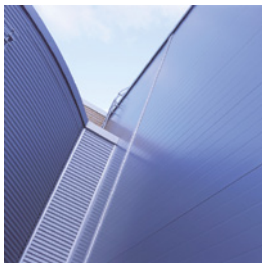
More information on our web pages www.paroc.com.

PAROC GROUP is one of the leading manufacturers of mineral wool insulation products and solutions in Europe. PAROC® products and solutions include building insulation, technical insulation, marine insulation, structural stone wool sandwich panels and acoustics products. Paroc has production facilities in Finland, Sweden, Lithuania and Poland, and sales and representative offices in 13 countries across Europe.

Building Insulation produces a wide range of products and solutions for all traditional building insulation. The building insulation is mainly used for thermal, fire and sound insulation of exterior walls, roofs, floors, 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 is used for thermal, fire and sound insulation in building techniques, industrial processes and pipe work, industrial equipment and ship structures.



PAROC® fire proof panels are lightweight steel-faced panels with a core material of stone wool. PAROC® panels are used for façades, partition walls and ceilings in public, commercial and industrial buildings.

PAROC®

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