



# RAVATHERM<sup>TM</sup> XPS

## INVERTED FLATROOF GUIDE



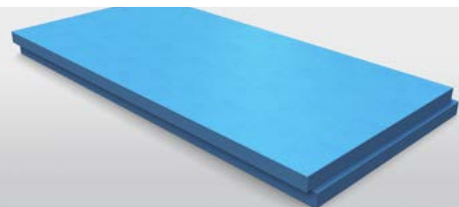
<sup>TM</sup> A Ravago S.A. védjegye

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RAVATHERM XPS 500 SL  
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# ABOUT RAVAGO BUILDING SOLUTIONS

Ravago Building Solutions is the building materials manufacturer and distribution division of the Ravago group. Besides the building material distribution activities which have been present in Ravago's life almost since the beginning, manufacturing quality building materials has become increasingly important over the last 10 years. With 15 factories and a sales service, Ravago Building Solutions provides high-level service to its partners in 18 European countries.

Since 2014 we have been manufacturing our products under the RAVATHERM XPS brand at our extruded polystyrene foam manufacturing plant in Balatonfűzfő, which has a history of more than 30 years. From February 2016, RAVATHERM XPS products with high thicknesses of 120-320 mm have been manufactured using revolutionary technology.

Closed cell polystyrene foam is produced using a strict quality assurance system to ensure long service life and reliability.

At the end of the extrusion process, a homogeneous closed cell material structure is produced, the thermal insulation properties and durability of which lasts until the end of the life of the building. Ravago Building Solutions is committed to environmental protection, RAVATHERM XPS products are manufactured and marketed in accordance with ISO 14001 environmental management and ISO 50001 energy management systems.





# INTRODUCING RAVATHERM XPS PRODUCTS

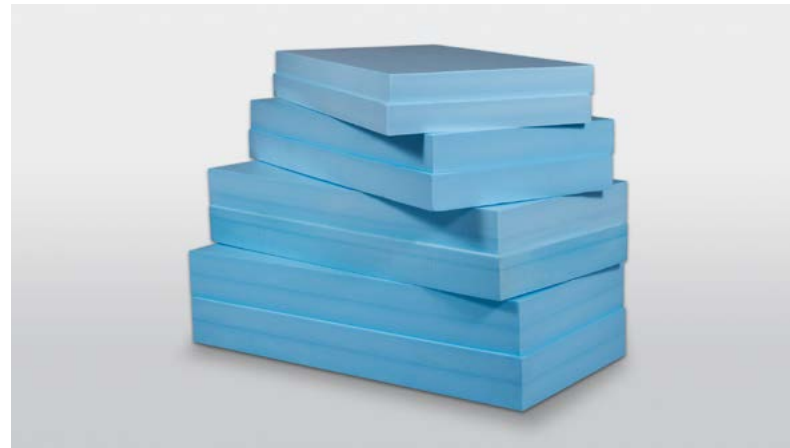
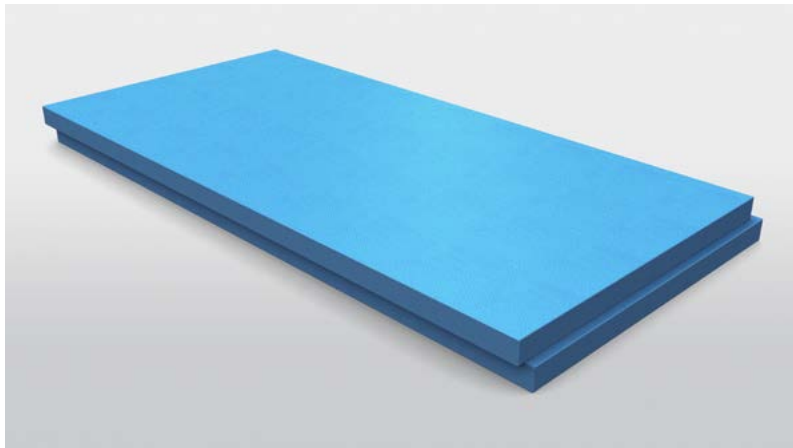
RAVATHERM XPS thermal insulation is a closed cell polystyrene foam manufactured using the latest extrusion technology. Made exclusively with quality materials, the "blue foam" significantly reduces the heat loss of our buildings. The special material structure guarantees efficient thermal insulation properties. Due to the closed crystalline cell structure, RAVATHERM XPS is non-sensitive to moisture, resistant to freezing, anti-corrosive and can bear heavy loads.

We offer a wide range of products in different thicknesses, surfaces and compressive strengths to fit the demands of the functional requirements of different buildings. Products from the RAVATHERM XPS extruded polystyrene foam thermal insulation range are suitable for roofs, flat roofs, terraces, floors, base slabs, underground building structures, thermal bridges and plinth walls. Our products have high compressive strength thus, they are step-resistant.

Ravago Building Solutions provides professional help, advice and information to help you achieve your goals and find the solutions that best suit you.

In addition to our professional commitment, we place great emphasis on the protection of our environment. Our products play an active role in reducing CO2 emissions globally, through significant energy savings.

RAVATHERM XPS products are manufactured according to the ISO 14001 environmental management system and the ISO 50001 power management system.



# THE CONCEPT OF INVERTED FLAT ROOF

## The flat roof

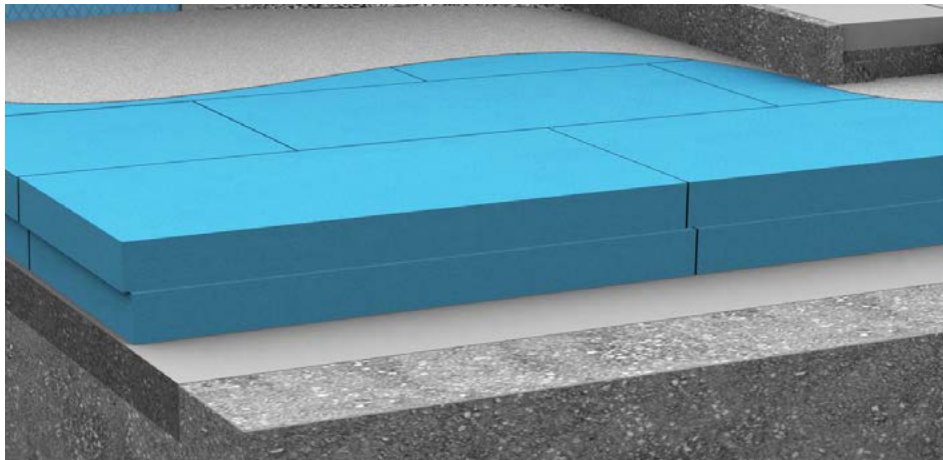
In general, flat roofs are mainly determined by their functional lifespan by the durability of waterproofing and thermal insulation. Therefore is of paramount importance the position of these layers within the layer build-up.

In the case of normal flat roofs (warm roof), the thermal insulation is installed under the waterproofing, thus the waterproofing is subject to significant temperature fluctuations. In addition, waterproofing is subject to additional mechanical loads, as well as UV radiation. In this structure, a water vapour barrier membrane is also required, thus avoiding moisture absorption due to condensation in the thermal insulation layer.

## What is inverted flat roof? What's the difference?

**In the case of inverted flat roof**, on the reinforced concrete slab, a slope has to be made of at least 2%, followed by waterproofing. On top of it is placed the thermal insulation material – preferably RAVATHERM XPS closed-cell polystyrene foam, with suitable thickness and compressive strength according to the function of the roof. As a next layer, a surface stabilizer - separating layer is needed, which can be geotextile or water flow reducing layer, on which (in the classic case) at least 5 cm of gravel ballast is loaded. In the case of a walkable roof, a 3-4 centimeter crushed stone bed must be placed on the separating layer, which also acts as a vapour diffusion and drainage layer, on which the planned pavement will be placed.

In the case of an inverted flat roof, the probability of roof insulation failure is minimal. Green roofs, roof terraces and parking roofs, i.e. utilized flat roofs, are best designed as inverted flatroofs. In this case, the long-term safe operation of the roof and the advantages offered by the inverted layer build-up can be fully taken into account; such as mechanical protection of waterproofing or advantageous building physical properties.



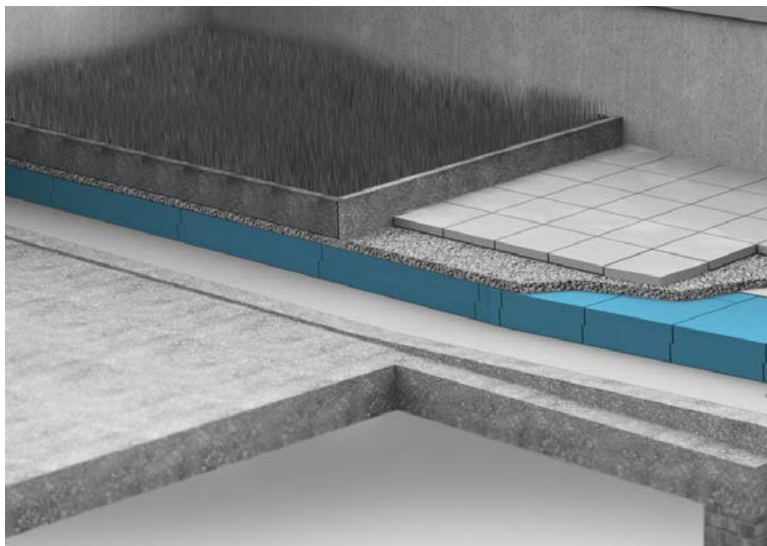
# ADVANTAGES

If we want to briefly summarize what are the advantages of an inverted roof, then first and foremost we should mention the [protection](#) of the waterproofing, both from mechanical effects and UV radiation. Such a layer build-up is also favorable from the point of view of building physics: there is no need to install a separate water-vapour barrier membrane, and since the waterproofing is located on the warm side of the thermal insulation, there is no need to worry about condensation here. Waterproofing under the thermal insulation layer is not exposed to high temperatures changes, further increasing its lifespan.

After the waterproofing is completed, the installation of additional layers can be carried out even in adverse weather conditions. Finally, it is worth considering that in case of a change of function – either additional floors or repairs – it is easy to dismantle the structure above the thermal insulation. The layers on top can be simply picked up and put back without breaking the waterproofing.

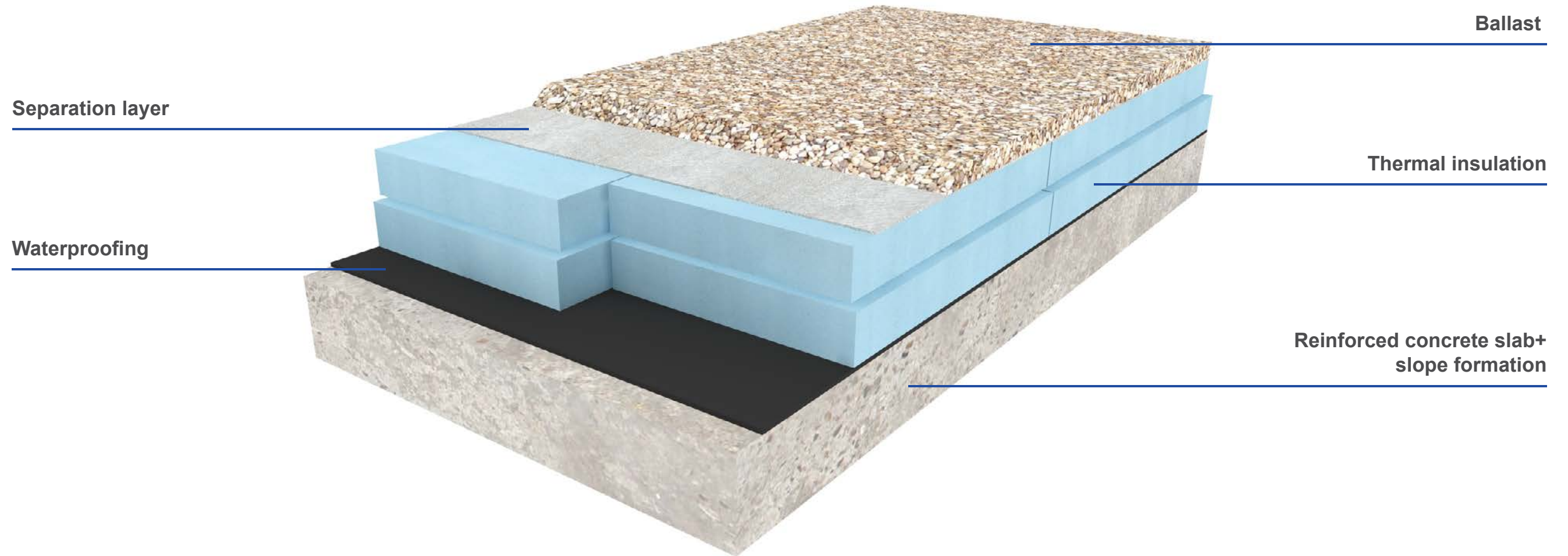
In the process of construction, the fact that waterproofing receives mechanical protection after laying thermal insulation can be of great importance: racks can even be placed on XPS material can also be adjusted, materials, equipment and tools necessary for the placement of the machinery on the roof can also be placed on it.

In the case of utilized roofs – terrace roofs, green roofs – it is also important for the future function that the layer order is load-bearing and the waterproofing is protected.





# PART OF THE INVERTED FLAT ROOF



# LAYERS OF THE INVERTED FLAT ROOF

## Ballast

Wind suction on the surface of flat roofs that occurs at an uneven rate in different part of the roof causes increased stress. The expected wind load and the method and extent of fastening against wind loads shall be determined by the designer.

On inverted roofs, wind suction loads must always be applied. In the general case, this is a layer of washed gravel at least 50 mm thickness with a diameter of 16/32.

Additional ballast with concrete tiles along the edges of the roof, around roof superstructures or mechanical fixation of thermal insulation boards is required.

In the case of a walkable roof, frost-resistant concrete slabs of at least 40/40/4 cm in size laid on the minimum 4 cm thick crushed stone bed provides the load.

## Separation layer

It is recommended to use vapor-permeable, non-absorbent polypropylene geotextile (or water flow reducing membrane) laid in one layer between thermal insulation and ballast, without fastening, with an overlap of 15 cm. The separating layer protects the surface of the thermal insulation boards from the ingress of gravel grains, as well as prevents fine sand particles wash-in between/under thermal insulation boards, which may obstruct the path of rainwater towards roof drains.

## Separation layer - water flow reducing membrane

It is known that in the case of walkable inverted, a significant part of rainwater drains under the thermal insulation boards, which causes extra heat loss during the heating period. Previously, this had to be compensated by oversizing the thermal insulation by 1-2 cm.

Today, however, there is a solution for this. In a similar way to pitched roofs, by using a vapour-permeable, but watertight [water repellent membrane](#), which, laying on the top of the thermal insulation instead of geotextile, with a 20 cm overlap, diverts most of the rainwater to the roof drain on the roof, thus avoiding heat loss during the cold precipitation flowing under the boards.





# LAYERS OF THE INVERTED FLAT ROOF

## Thermal insulation - XPS

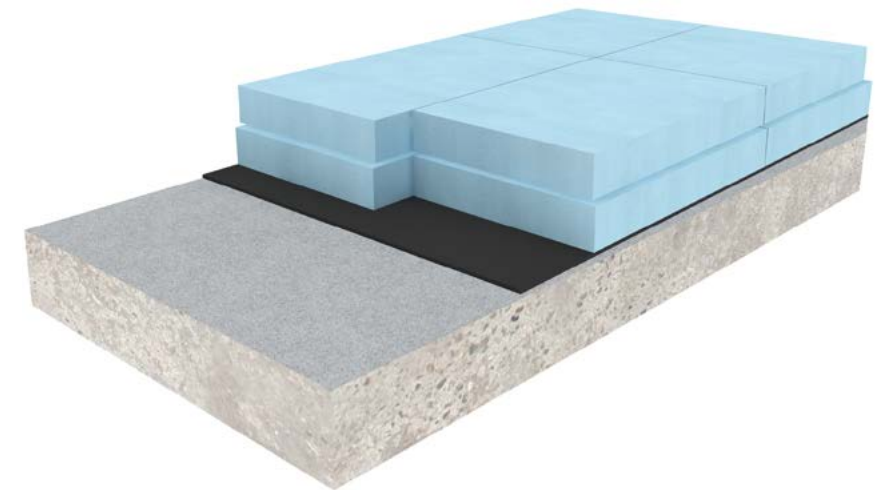
Why do we recommend using closed-cell polystyrene foam for an inverted flatroof? This is mainly because if the thermal insulation is placed above the waterproofing, it is basically placed in a humid environment. The XPS absorbs very small amount water due to its closed-cell material structure formed during the extrusion process. (1 to 3 % vol., depending on thickness). The advantageous property of XPS is its good thermal insulation capacity ( $\lambda = 0.033\text{-}0.035 \text{ W/mK}$ ). The high load capacity of the material, i.e. its compressive strength, is suitable for creating a walking surface over it even with high public traffic.

The energy requirements can only be met with thermal insulation thicker than 22 cm on a flat roof. Currently, our product range includes RAVATHERM XPS closed-cell polystyrene foam thermal insulations from 22 cm up to 32 cm thickness, which are made by thermoplastic welding of several layers of thermal insulation boards. This process maintains the homogeneous structural properties of the material and maintains the thermal conductivity coefficient of the XPS over the entire thickness range.

## Load-bearing structure + slope

The advantages of inverted flatroof in building physics can be best exploited if we are thinking about using a heavy load-bearing layer, such as a reinforced concrete slab. With the proper thermal insulation of the entire load-bearing building structure, we get a large heat storage mass, which is even more advantageous from the point of a building energy point of view.

The importance of proper drainage is decisive during the prolonged use of flat roofs. The minimum degree of slope mainly depends on the type of the waterproofing layer, in accordance with the Roof Insulation Guidelines, the roof must also comply with the recommendations of construction standards for roof construction. The construction of an inverted roof without slopes is not recommended, min. 2-2.5% is recommended by the profession. The drainage of the roof should be planned so that the thermal insulation boards do not stand in water for a long time.



# LAYERS OF THE INVERTED FLAT ROOF

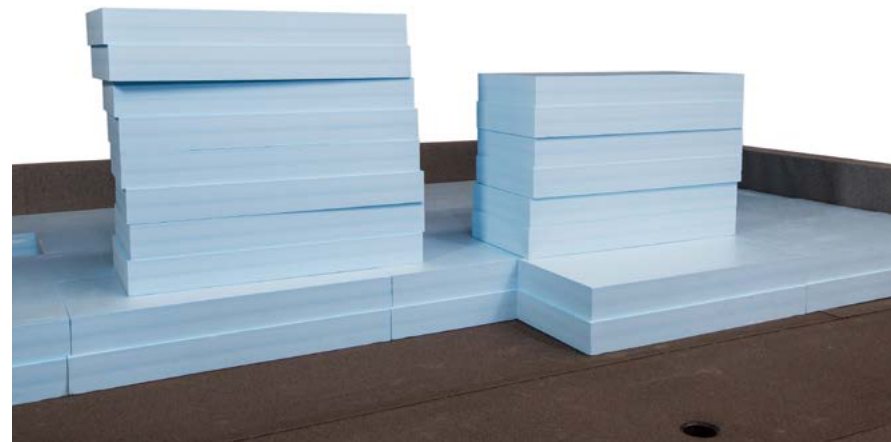
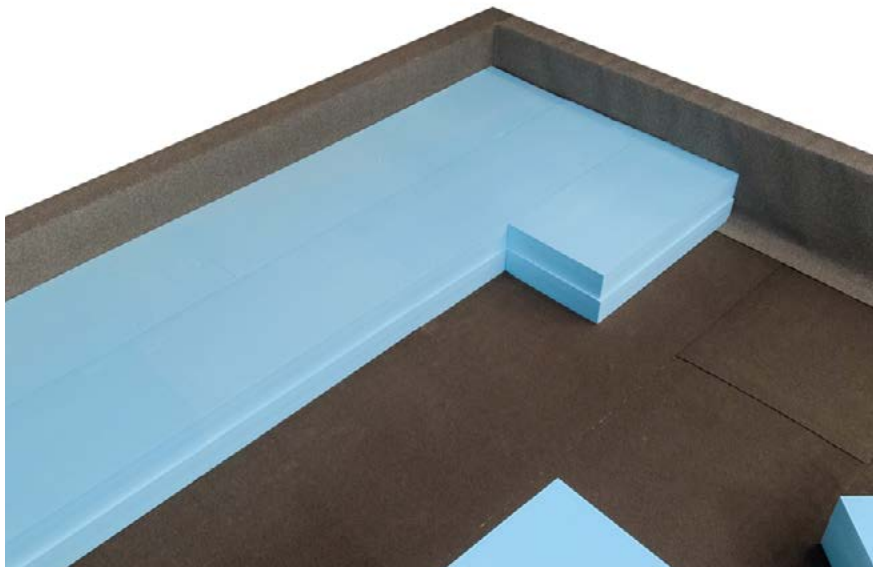
## Waterproofing / water drainage

The drainage of the roof must be designed in such a way that the thermal insulation boards do not remain submerged in water for extended periods. Short-term water loads, for example, during intense rainfall, does not pose a problem. The water drainage should be designed to prevent the RAVATHERM™ boards from being submerged under water for their full thickness. A water accumulation due to heavy rain does not pose a problem in a short period. The placement and determination of the drainage capacity of roof drains suitable for collecting water flowing over the thermal insulation and waterproofing should also follow the Roof Insulation Guidelines. Inverted roofs can be interpreted as flat roofs up to a maximum slope of 5%. For steeper slopes, the principles applicable to pitched roofs, especially in the case of external water drainage (fastening, etc.), must also be taken into account.

A wide range of waterproofings can be applied to the inverted roof insulation system:

Primarily, the use of two layers of modified bitumenous membranes is recommended, reinforced with glass veil, glass fabric, or polyester (membranes with a decomposable carrier layer are not suitable). The waterproofing should be adhered to the concrete surface using torch bonding over the entire surface.

For single-layer plastic sheet insulation (PVC), it is strongly recommended to apply a layer of glass veil or polyester veil between the waterproofing and XPS insulation to prevent softener migration between the plastics. Before installation, it is necessary to consult with the manufacturer of the specific PVC sheet.





# THERMAL INSULATION SELECTION ASPECTS - PHYSICAL CHARACTERISTICS

## Energetics aspects

According to the EU building energy regulations, the energy requirements for flat roofs can only be met with insulation thicker than 20 cm thermal insulation. Considering the heat bridge correction factors arising from the design of the flat roof, in the case of an inverted flatroofs, we should consider a minimum thickness of 22 cm, but preferably 24-28 cm of thermal insulation.

Currently, our product range includes RAVATHERM XPS closed-cell polystyrene foam insulation with a thickness of 32 cm, which is produced using a special welding process.

## Compressive strength

The nominal compressive strength value provided in the technical documentation indicates the resistance of the products to short-term loads during laboratory tests. For thermal insulation foams, this short-term (nominal) compressive strength value cannot be used for structural calculations; it serves solely for the strength and comparative categorization of individual products.

In the case of an inverted flat roof, the load caused by pedestrians or even vehicles can be considered short-term. However, for roofs subjected to heavy vehicular traffic, it is essential to consider using insulation with higher compressive strength. (RAVATHERM XPS 500/700 SL)

## Long-Term Water Absorption

In addition to its excellent thermal insulation properties, it is equally important that XPS insulation fully meets the compressive strength and water absorption requirements set by the application standards. The EN 7574 standard for inverted roofs not only specifies adequate compressive strength, but also demands minimum sustained compressive strength (90 kPa/m<sup>2</sup>), resistance to freeze-thaw cycles, and compliance with water absorption values in case of immersion and also for diffusion.

As the part of the structure above the waterproofing is exposed to prolonged contact with water, especially during heavy rainfall, the absorbed moisture during long-term water immersion testing must not exceed 0.7% by volume.





# THERMAL INSULATION SELECTION ASPECTS - ECONOMIC ASPECTS

## Building function

In an inverted roof, regardless of its function, the installation of adequate thermal insulation is of utmost importance, as the building experiences its greatest heat loss through the roof. According to energy requirements, the thickness of thermal insulation should be at least 22 cm, but the thermal bridge effect may vary based on the quantity and size of structures piercing the flat roof.

## Durability

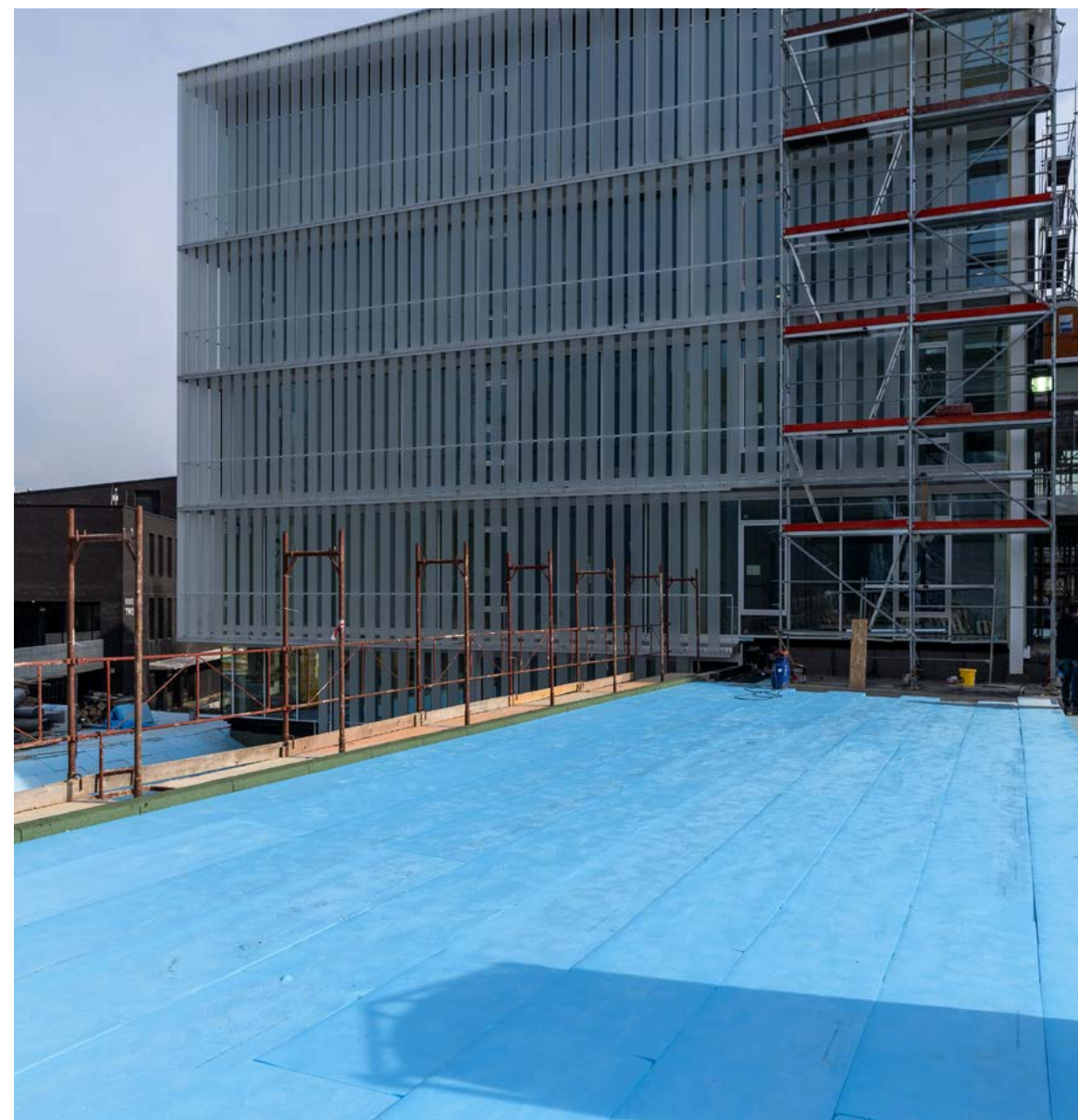
In the case of an inverted flat roof, due to the positioning of the layers, the waterproofing is mechanically protected by the thermal insulation and is not exposed to significant thermal fluctuations. Overall, in this manner, the durability of the whole structure is greatly enhanced by the use of XPS thermal insulation.

## Cost Efficiency

RAVATHERM XPS can be placed on the roof easily, enabling quick and efficient work. Thanks to its meg high thermal insulation capacity, the building's operation will be more effective, resulting in significant energy savings. It allows for complete, thermal-bridge-free joint construction at the parapet and other roof structures, thus with careful execution, energy savings can be further increased.

## Environmental Aspects

RAVATHERM XPS products actively contribute to reducing global carbon dioxide emissions through significant energy savings. RAVATHERM XPS products are manufactured and distributed in compliance with ISO 14001 environmental management and ISO 50001 energy management systems, which aim to maintain the lowest possible and optimal levels of energy consumption and material biological footprint during production.



# CONSTRUCTION ADVICES

## Parapet wall

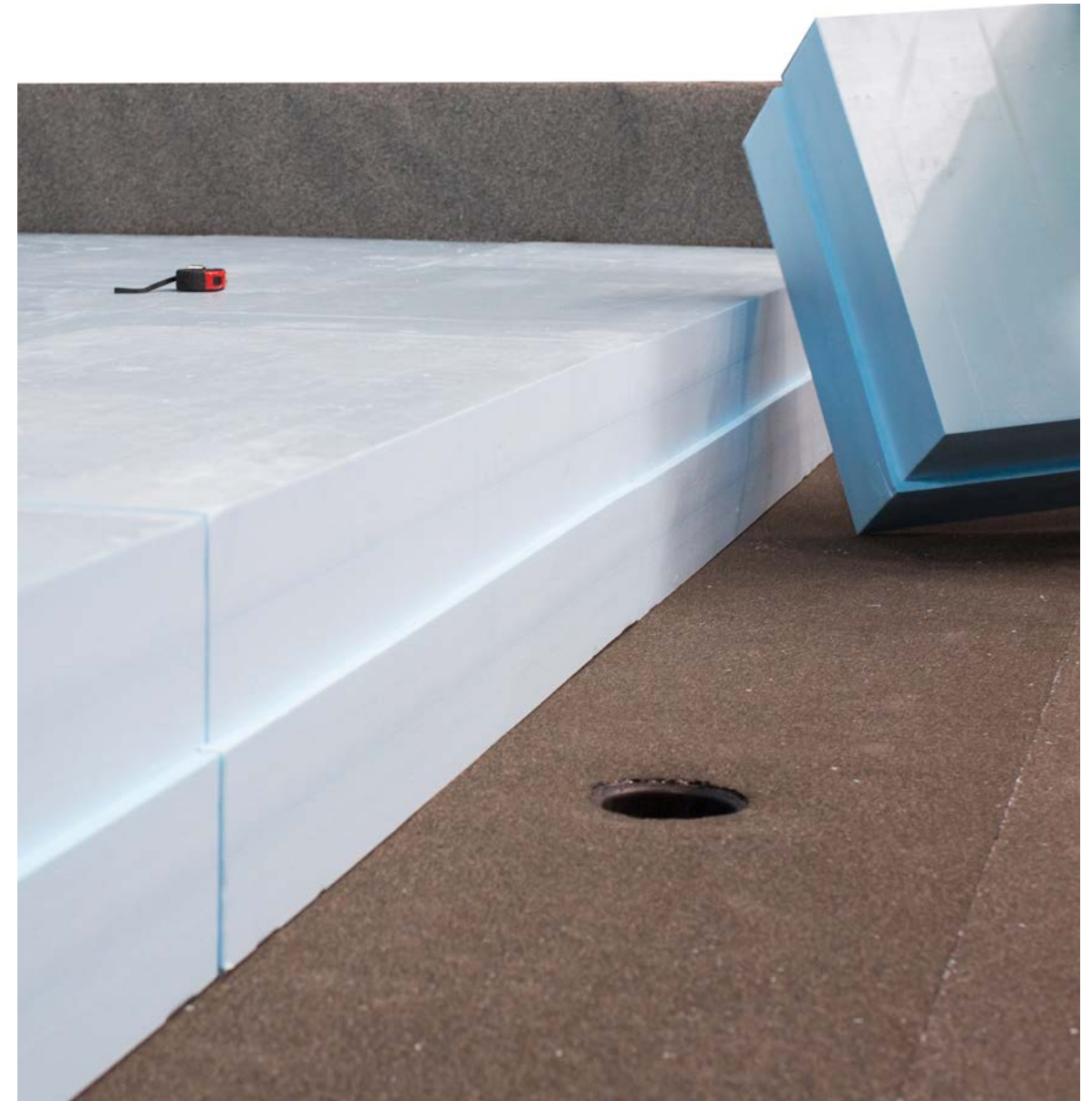
When designing an inverted flat roof, it's important to allow for the creation of an appropriate parapet wall with enough height. The slope-inducing layer, the thick insulation, and the total thickness of additional load-bearing layers must be considered during the planning phase. A height difference of at least 15-20 cm should be provided between the top of the layer structure and the top of the parapet wall.

## Proper Slope Formation

Before the layers of the flat roof are installed, it's essential to establish a suitable slope on the load-bearing structure. The slope formation also needs to serve as a stable foundation, ideally constructed from gravel concrete or lightweight concrete. A crucial element for the roof's long lifespan is a minimum 2% slope formation; otherwise, stagnant water could damage the structure.

## Inner Water Drainage

In the case of an inverted roof, the so-called "warm roof" principle should be followed. The emphasis should be on achieving internal water drainage during the design process. Designing external water drainage can lead to structurally sensitive solutions due to the arrangement of the building's layers. If external water drainage is the only viable option, care must be taken to prevent freezing of the water drainage channel.



# OUR XPS PRODUCTS FOR INVERTED ROOF THERMAL INSULATION

DEPENDING ON THE DEFINED LOADS AND INTENDED FUNCTION, WE RECOMMEND THE FOLLOWING PRODUCTS FOR INVERTED ROOF THERMAL INSULATION:

## RAVATHERM XPS 300 SL

Extruded polystyrene thermal insulation

Field of application: inverted flat roofs, terraces, roofs, balconies, floors, industrial floors, and basement walls.

Thickness:	30-320 mm
Compressive strength (CS):	300 KPa
Compressive creep (CC):	130 KPa
Thermal conductivity:	$\lambda = 0,033-0,035 \text{ W/mK}$
Reaction to fire:	E
Capillary water absorption:	0
Frost resistance:	FTCD 1
Water absorption by immersion:	VL(T) 0,7
Water absorption by diffusion:	$\leq 40 \text{ mm VD(V) 3}$
	50-60 mm VD(V) 2
	$\geq 100 \text{ mm VD(V) 1}$

EN product code (EN 13164:2012+A1:2015):

30-40 mm:  
T1 - CS(10\Y)300 - CC(2/1,5/50)130 - DS(70,90) - DLT(2)5 - WD(V)3 - WL(T)0,7 - FTCD1  
50-60 mm:  
T1 - CS(10\Y)300 - CC(2/1,5/50)130 - DS(70,90) - DLT(2)5 - WD(V)2 - WL(T)0,7 - FTCD1  
80-280 mm:  
T1 - CS(10\Y)300 - CC(2/1,5/50)130 - DS(70,90) - DLT(2)5 - WD(V)1 - WL(T)0,7 - FTCD1

[Declaration of performance](#)

[Technical datasheet](#)

## RAVATHERM XPS 500 SL

Extruded polystyrene thermal insulation

Field of application: heavy-duty floors, industrial floors, and parking roofs.

Thickness:	40-200 mm
Compressive strength (CS):	500 KPa
Compressive creep (CC):	180 KPa
Thermal conductivity:	$\lambda = 0,034-0,035 \text{ W/mK}$
Reaction to fire:	E
Capillary water absorption:	0
Frost resistance:	FTCD 1
Water absorption by immersion:	VL(T) 0,7
Water absorption by diffusion:	$\leq 40 \text{ mm VD(V) 3}$
	50-60 mm VD(V) 2
	$\geq 100 \text{ mm VD(V) 1}$

EN product code (EN 13164:2012+A1:2015):

40 mm:  
T1 - CS(10\Y)500 - CC(2/1,5/50)180 - DS(70,90) - DLT(2)5 - WD(V)3 - WL(T)0,7 - FTCD1  
50-60 mm:  
T1 - CS(10\Y)500 - CC(2/1,5/50)180 - DS(70,90) - DLT(2)5 - WD(V)2 - WL(T)0,7 - FTCD1  
80-200 mm:  
T1 - CS(10\Y)500 - CC(2/1,5/50)180 - DS(70,90) - DLT(2)5 - WD(V)1 - WL(T)0,7 - FTCD1

[Declaration of performance](#)

[Technical datasheet](#)

## RAVATHERM XPS 700 SL

Extruded polystyrene thermal insulation

Field of application: heavy-duty floors, industrial floors, and parking roofs.

Thickness:	40-160 mm
Compressive strength (CS):	700 KPa
Compressive creep (CC):	250 KPa
Thermal conductivity:	$\lambda = 0,034-0,035 \text{ W/mK}$
Reaction to fire:	E
Capillary water absorption:	0
Frost resistance:	FTCD 1
Water absorption by immersion:	VL(T) 0,7
Water absorption by diffusion:	$\leq 40 \text{ mm VD(V) 3}$
	50-60 mm VD(V) 2
	$\geq 100 \text{ mm VD(V) 1}$

EN product code (EN 13164:2012+A1:2015):

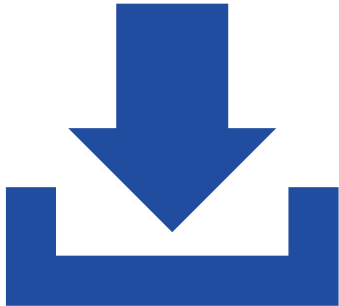
40 mm:  
T1 - CS(10\Y)700 - CC(2/1,5/50)250 - DS(70,90) - DLT(2)5 - WD(V)3 - WL(T)0,7 - FTCD1  
50-60 mm:  
T1 - CS(10\Y)700 - CC(2/1,5/50)250 - DS(70,90) - DLT(2)5 - WD(V)2 - WL(T)0,7 - FTCD1  
80-160 mm:  
T1 - CS(10\Y)700 - CC(2/1,5/50)250 - DS(70,90) - DLT(2)5 - WD(V)1 - WL(T)0,7 - FTCD1

[Declaration of performance](#)

[Technical datasheet](#)



# DOWNLOADABLE CONTENT



Declaration of performance

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**RAVATHERM XPS 300 SL**  
**RAVATHERM XPS 500 SL**  
**RAVATHERM XPS 700 SL**

Technical datasheet

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**RAVATHERM XPS 300 SL**  
**RAVATHERM XPS 500 SL**  
**RAVATHERM XPS 700 SL**

Brochure

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Pricelist

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ISO 14001 certification

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Product catalogue

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Declarations

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VOCs-free declaration  
HCFCs-free declaration  
EPD  
Silicon free declaration

LEED, BREAM data request,  
ISO certifications of supplier  
partners

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# UTILIZED ROOF - TERRACE ROOF

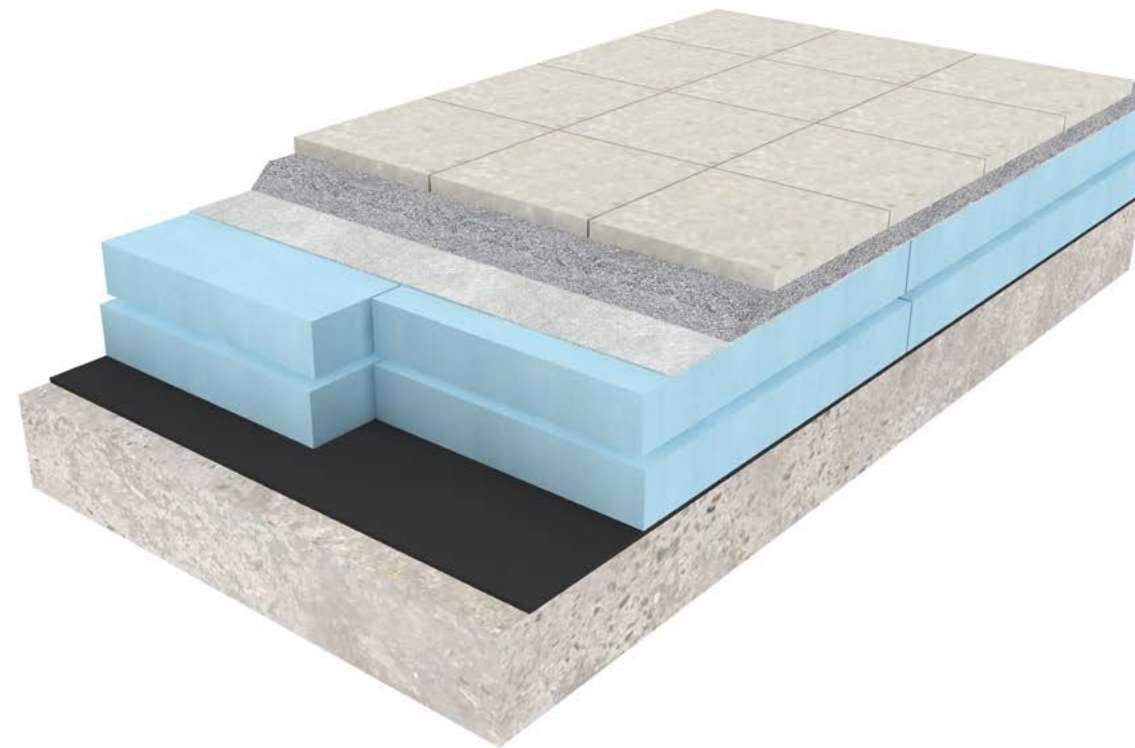
Terrace roofs are flat roofs that provide various utilizations on the top of the building. A heat- and waterproof structure is always covered with a material that serves the utilization purpose adequately, depending on the nature of the substrate.

Flat roofs constructed with a reversed (inverted) layer structure are particularly suitable for establishing utilized flat roofs and rooftop terraces. The thermal insulation not only offers mechanical protection to the waterproofing during construction but also during intensive use.

During the design phases of a rooftop terrace, the reversed layer structure and the high compressive strength of RAVATHERM XPS used as insulation provide exceptional flexibility and freedom to the designer. Walkable and green surfaces, dense vegetation, shading supports, railing posts, and street furniture can be easily installed anywhere without compromising waterproofing or creating thermal bridges. During later modifications, the rooftop terrace can be rearranged as desired without endangering the building's operational integrity, meaning that waterproofing doesn't need to be disturbed during the work.

## General Layer Structure:

1. Pavement
2. Crushed Stone Bedding
3. RAVATHERM XPS MK / Geotextile
4. [RAVATHERM XPS 300 SL](#)
5. Waterproofing
6. Slope Formation
7. Reinforced Concrete Slab



# UTILIZED ROOF - GREEN ROOF

During the design phase of buildings, it's becoming more and more important to use architectural tools to maximize the green area occupied by the building. The creation of green roofs and rooftop gardens holds particular significance, primarily in urban environments. Green roofs can provide expanded living spaces, contribute to air purity, and have substantial rainwater-retaining and water-releasing effects. The root systems of plants retain rainwater, thereby relieving the load on the drainage system.

During summer, the vegetation cover absorbs a significant portion of heat radiation, offering protection against excessive heating and enhancing the local microclimate through increased humidity.

The reversed layer structure has proven to be a durable structural solution for both extensive and intensive green roofs. Its main advantage lies in the combined thermal and mechanical protection of the waterproofing, facilitated by the insulation boards.

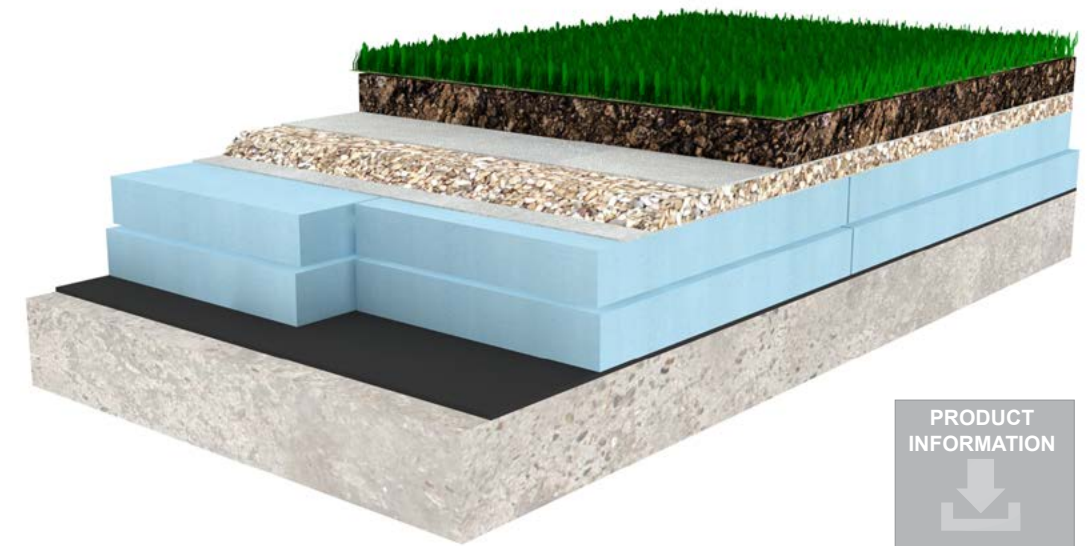
It's essential that the waterproofing of green roofs uses materials resistant to root penetration (e.g., FLL certification). Additionally, when designing slope and water drainage, it's crucial to ensure that RAVATHERM XPS insulation boards are not consistently submerged in water.

## General Layer Structure:

1. Extensive Vegetation
2. Approximately 6-8 cm plant substrate
3. Filter/Drainage Layer
4. Water Retention drainage Layer
5. Vapor-Permeable Separation Layer
6. [RAVATHERM XPS 300 SL](#)
7. Root-Resistant Waterproofing
8. Reinforced Concrete Load-Bearing Layer

## General Layer structure:

1. Intensive Vegetation
2. Approximately 30-50 cm Plant Substrate
3. Filter/Drainage Layer
4. Water Retention Drainage Layer
5. Vapor-Permeable Separation Layer
6. [RAVATHERM XPS 300 SL](#)
7. Root-Resistant Waterproofing
8. Reinforced Concrete Load-Bearing Layer





# UTILIZED ROOF - PARKING ROOFS

For flat roofs open to vehicle traffic, the use of XPS insulation is particularly justified, regardless of the layer structure. This is due to the high compressive demands and sliding forces generated by vehicular movement, which high-performance XPS can endure consistently and safely. The specialty of this type of flat roof lies in being subjected to larger static and dynamic loads than typical roof terraces (concentrated wheel loads of vehicles, dynamic effects from movement). The layer buildup and installation process are the same as for walkable roof terraces, up to the waterproofing. However, considering the loads, the compressive strength of the insulation should be:

- At least 300 kPa for load-distributing reinforced concrete slab.
- At least 500 kPa when concrete pavers laid on a bed of crushed basalt (minimum 10 cm thickness) are used.

The choice of material must be determined through design calculations.

To prevent displacement, drainage channels and various vertical structures should be bordered with reinforced concrete edges. During planning phase, the anticipated load, sliding forces from vehicular movement, thermal expansion, and slope conditions should all be taken into account.

For rooftop parking areas, the selection of RAVATHERM XPS 300 SL, 500 SL, and 700 SL boards depends on the specific load and pavement design.

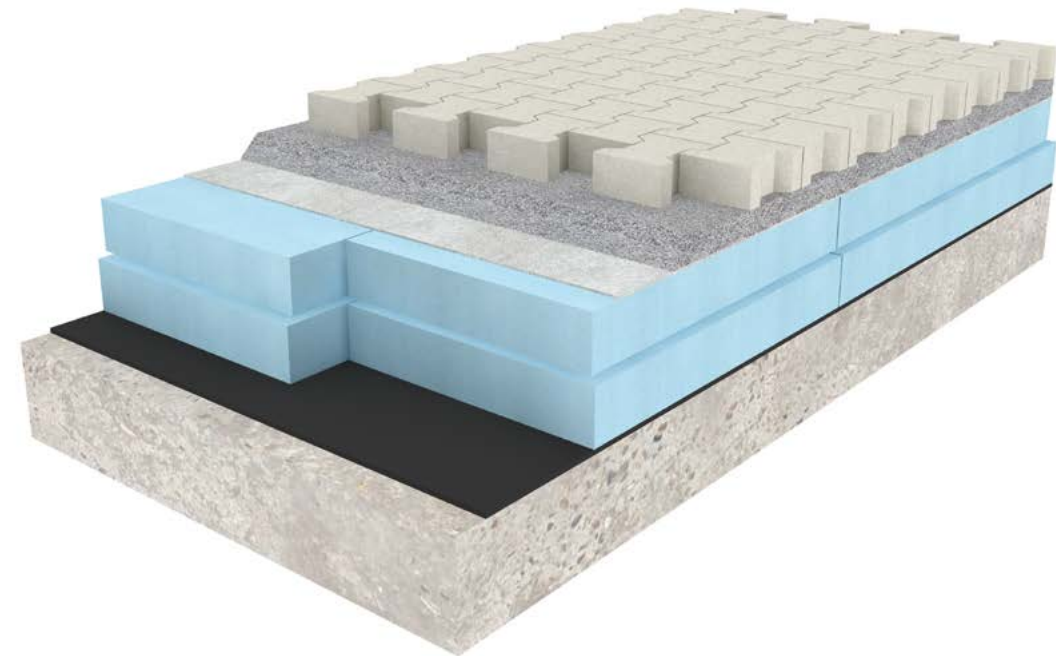
	Paving elements placed on a bed of gravel.	Concrete slab paving placed on underlay elements.	Load-distributing reinforced concrete slab.
Pedestrian and cyclist pathways, as well as traffic surfaces subject to similar loads.	RAVATHERM XPS 300 SL	RAVATHERM XPS 500 SL	RAVATHERM XPS 300 SL
Sidewalks, car parking areas, and traffic surfaces accessible by passenger vehicles.	RAVATHERM XPS 500 SL	RAVATHERM XPS 700 SL	RAVATHERM XPS 300 SL
Traffic surfaces located along the edges of roads.	RAVATHERM XPS 700 SL	RAVATHERM XPS 700 SL	RAVATHERM XPS 500 SL

## UTILIZED ROOF - PARKING ROOFS

For a rooftop parking area paved with concrete elements, RAVATHERM XPS 500 SL insulation with a minimum compressive strength of 500 kPa should be applied. The minimum 100 mm thick concrete paving stone elements are to be laid on a compacted bed of 4/8 mm aggregate, with a 50 mm layer thickness, leaving 3-5 mm gaps. The use of spacer-profiled elements is recommended. These gaps should be filled with fine sand of particle size 0/2 mm, which needs to be refilled after six months. The horizontal movement of the pavement and the opening of gaps can be prevented by using reinforced concrete edges and separating strips functioning as framing for the paved surfaces. Drainage channels and various vertical structures should also be bordered with reinforced concrete edges. Surfaces paved with concrete pavement should undergo regular periodic inspections with immediate maintenance actions when needed. The walking surface and the type of paving vary based on the anticipated use of the surface.

### Layer structure recommendation with stone pavement:

1. Concrete pavement, minimum 100 mm
2. Crushed stone bedding, 4/8 mm, 50 mm
3. Vapour-permeable, non-absorbent plastic geotextile
4. RAVATHERM XPS 500 / 700 SL thermal insulation
5. Waterproofing
6. Reinforced concrete slab



# LAYERED RECOMMENDATION WITH PAVER ELEME

## Parking roof - With Load-Distributing Reinforced Concrete Slab

For a rooftop parking area with a load-distributing reinforced concrete slab, it's recommended to create a compacted 4/8 mm crushed stone bedding, 3-4 cm thick, underneath the slab. This vapour diffusion bedding layer can be omitted if the load-distributing reinforced concrete slab is designed to be waterproof, equipped with waterproof sealing along dilations, and has been checked and confirmed to meet moisture-related structural requirements.

A 110-140 g/m<sup>2</sup> vapour-permeable polypropylene geotextile should be used as a separation layer between the XPS insulation and the bedding, as well as between the bedding and the load-distributing reinforced concrete slab.

The slope conditions of the reinforced concrete structural slab or the slope concrete must be designed according to Roof Insulation Guidelines; a minimum of 2% slope is recommended.

### Layer structure recommendation with Load-Distributing Reinforced Concrete Slab:

1. Load-distributing reinforced concrete slab
2. Vapour-permeable, non-absorbent plastic geotextile
3. Crushed stone bedding, 4/8 mm, 30-40 mm
4. Vapour-permeable, non-absorbent plastic geotextile
5. **RAVATHERM XPS 500 / 700 SL thermal insulation**
6. Waterproofing
7. Reinforced concrete structural slab

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# ROOF RENOVATION - INVERTED FLAT ROOFS WITH XPS LAYERS

When renovating flat roofs, a fundamental question arises about the possibility of retaining the existing structure. In the case of older inverted roofs, the general experience during energy renovations suggests that the XPS insulation within the structure continues to perform its function effectively. Therefore, it's possible to add a new layer of thermal insulation over the existing one. The advantage lies not only in utilizing the existing structure but also in significant savings on waste disposal costs.

During renovation, the first step is always to examine the feasibility of retaining existing layers. When conducting these examinations, it's advisable to focus on the two main elements of the roof - the waterproofing and the thermal insulation - excluding the structural components. Critical areas for waterproofing include connections to walls, dilations, edges, and around roof drains. Regarding insulation, it's worth checking its strength and moisture content. In some cases, it might be necessary to repair or replace existing waterproofing or insulation before renovation. When renovating an inverted roof, it's particularly recommended to use a water diversion foil (RAVATHERM XPS MK), ensuring that no moisture reaches between the two layers of XPS boards.

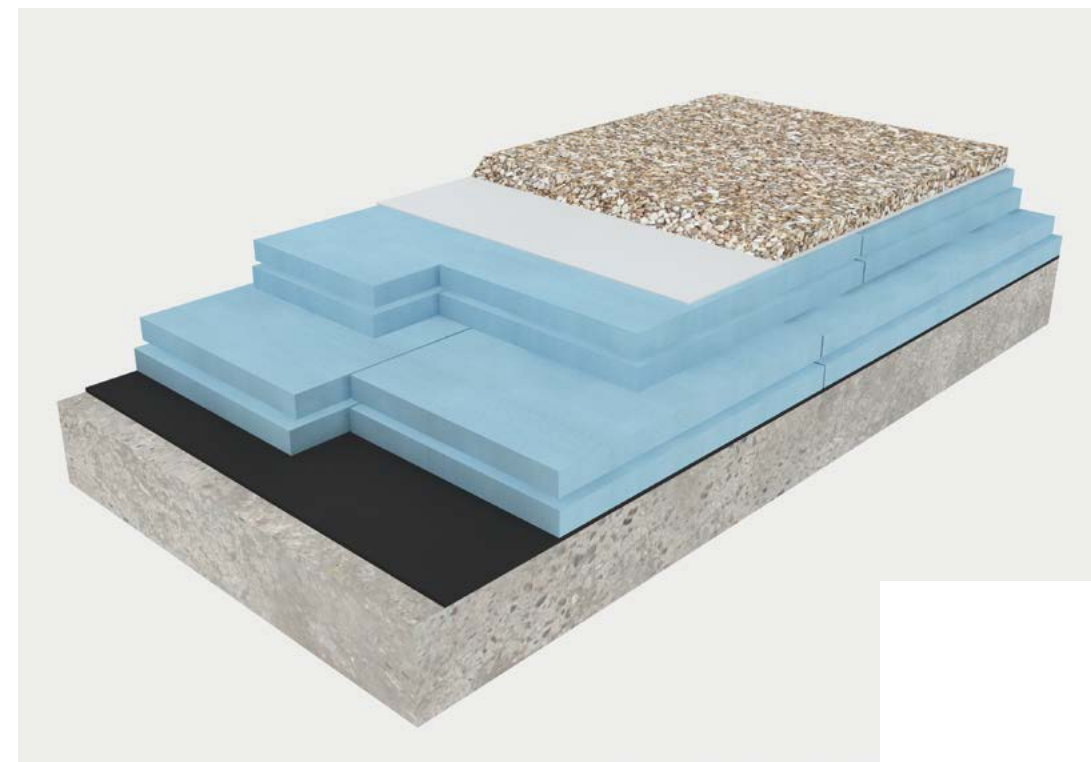
## General Layer Structure:

1. Gravel ballast
2. RAVATHERM XPS MK foil
3. RAVATHERM XPS 300 SL - used
4. RAVATHERM XPS 300 SL - New Layer
5. Used Waterproofing
6. Used Slope Formation
7. Used Reinforced Concrete Slab

## Advantages:

- Retention of existing insulation, allowing it to be preserved
- No waste disposal issues
- Cost-effective

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# ROOF RENOVATION - DUO ROOF

While the inverted roof remains an inverted roof after renovation, a conventional flat roof becomes a "duo roof." In the case of renovating a conventional flat roof, the principle of an inverted roof is applied using the concept of a "duo roof," which involves adding additional XPS thermal insulation on top of the existing structure without dismantling it.

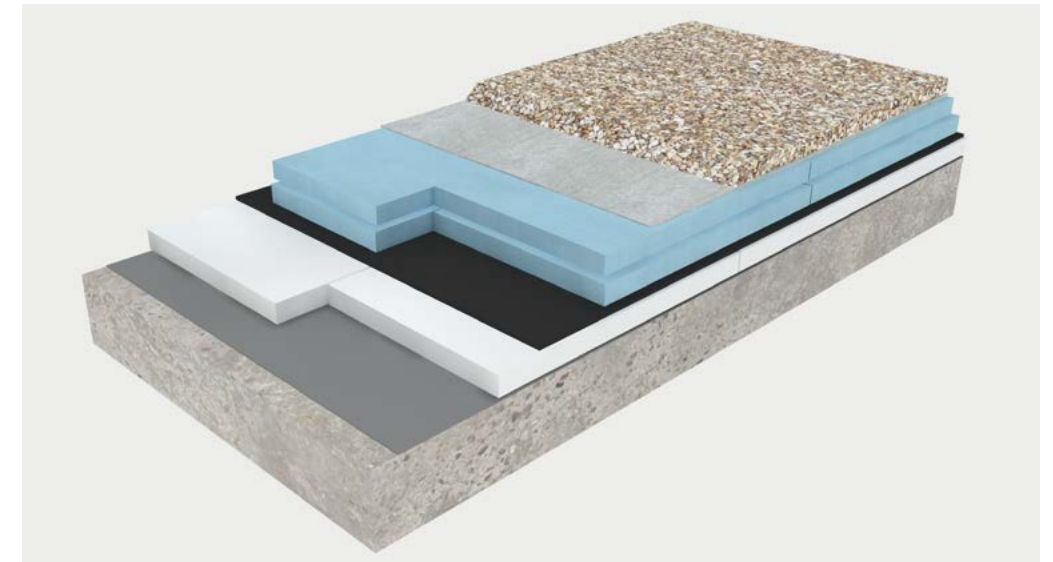
Prior to renovation, it's essential to assess the condition of the waterproofing and repair it if necessary. It's possible to incorporate green roofing on the existing structure, but in such cases, replacing the waterproofing with a new one rated as root-resistant according to the FLL method is essential. By retroactively installing RAVATHERM XPS thermal insulation boards above the waterproofing, the thermal protection of the existing roof structure can be significantly enhanced with relatively minor investment.

## Layer structure recommendation or General Duo Roof:

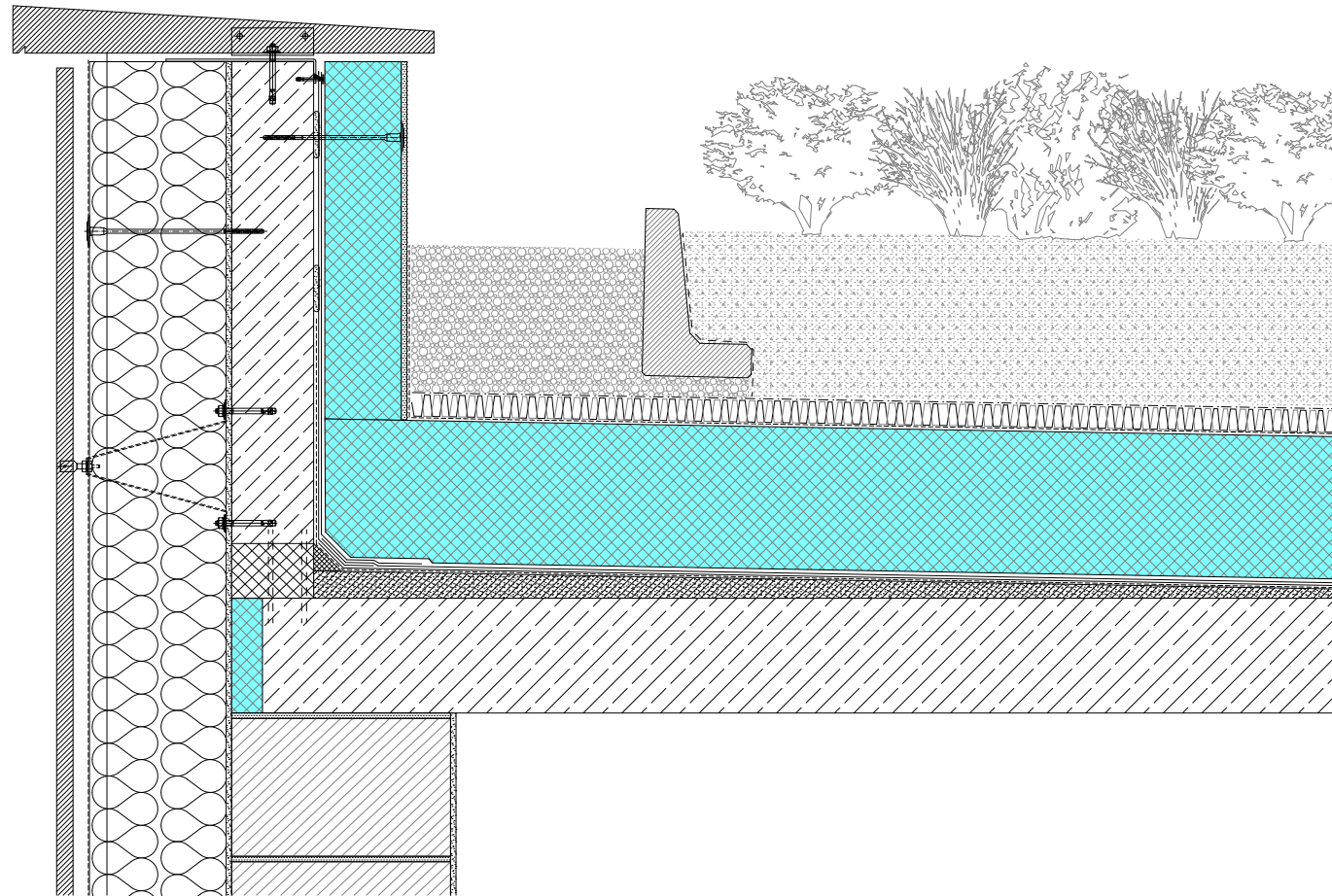
1. Gravel Load
2. [RAVATHERM XPS MK](#)
3. [RAVATHERM XPS 300 SL](#)
4. Used Waterproofing
5. Used EPS thermal insulation
6. Used Vapour Barrier Layer
7. Used Reinforced Concrete Slab

## Layer structure recommendation for Duo Roof with green roof:

1. Extensive Vegetation
2. Approx. 6-8 cm Planting Substrate
3. Filter/Drainage Layer
4. Water Retention Permeable Layer
5. Vapour-permeable Separation Layer
6. [RAVATHERM XPS 300 SL](#)
7. Root-resistant Waterproofing
8. Used EPS thermal Insulation
9. Used Vapour Barrier Layer
10. Used Reinforced Concrete Slab

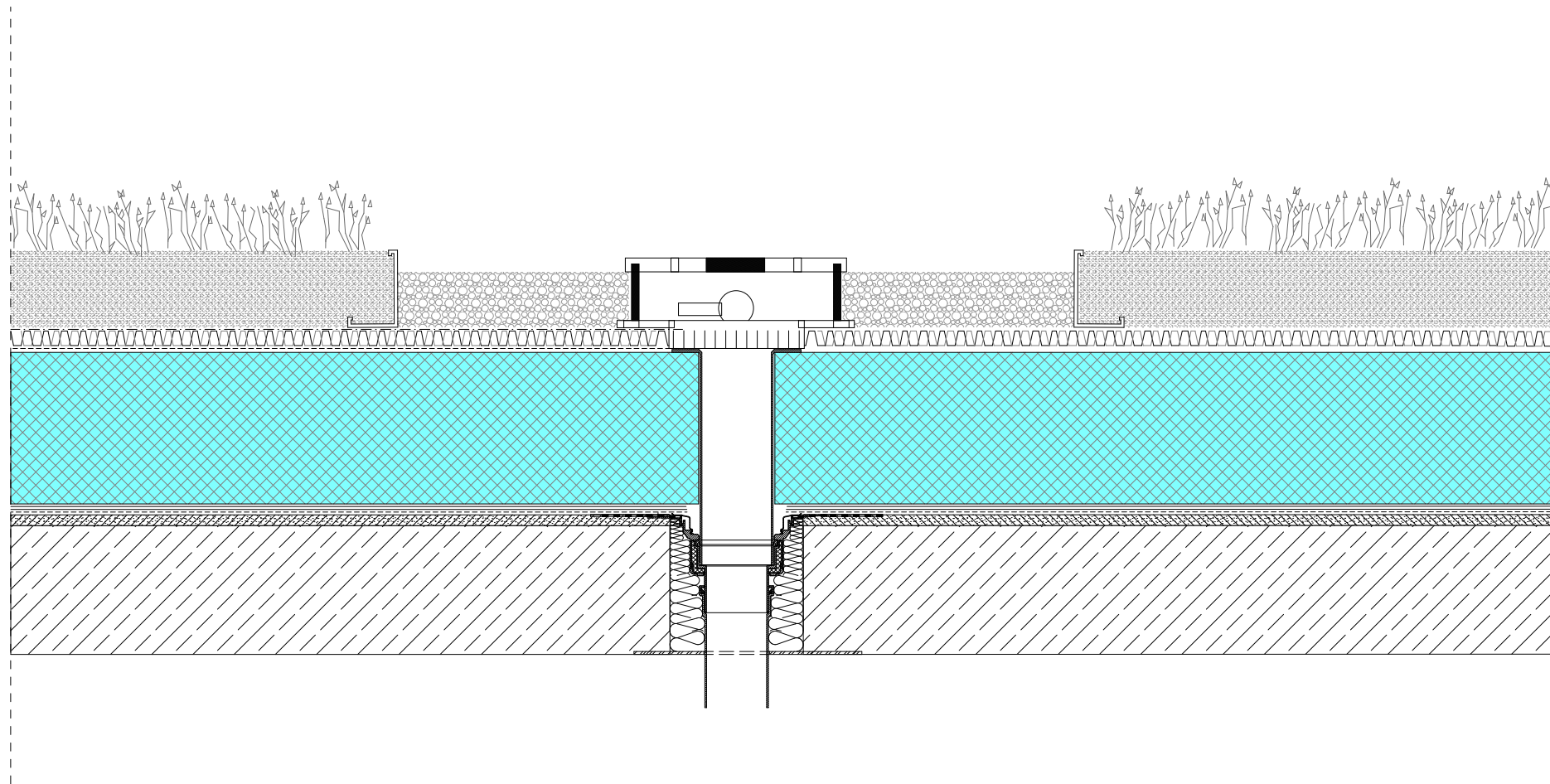


## Parapet detail - intensive green roof

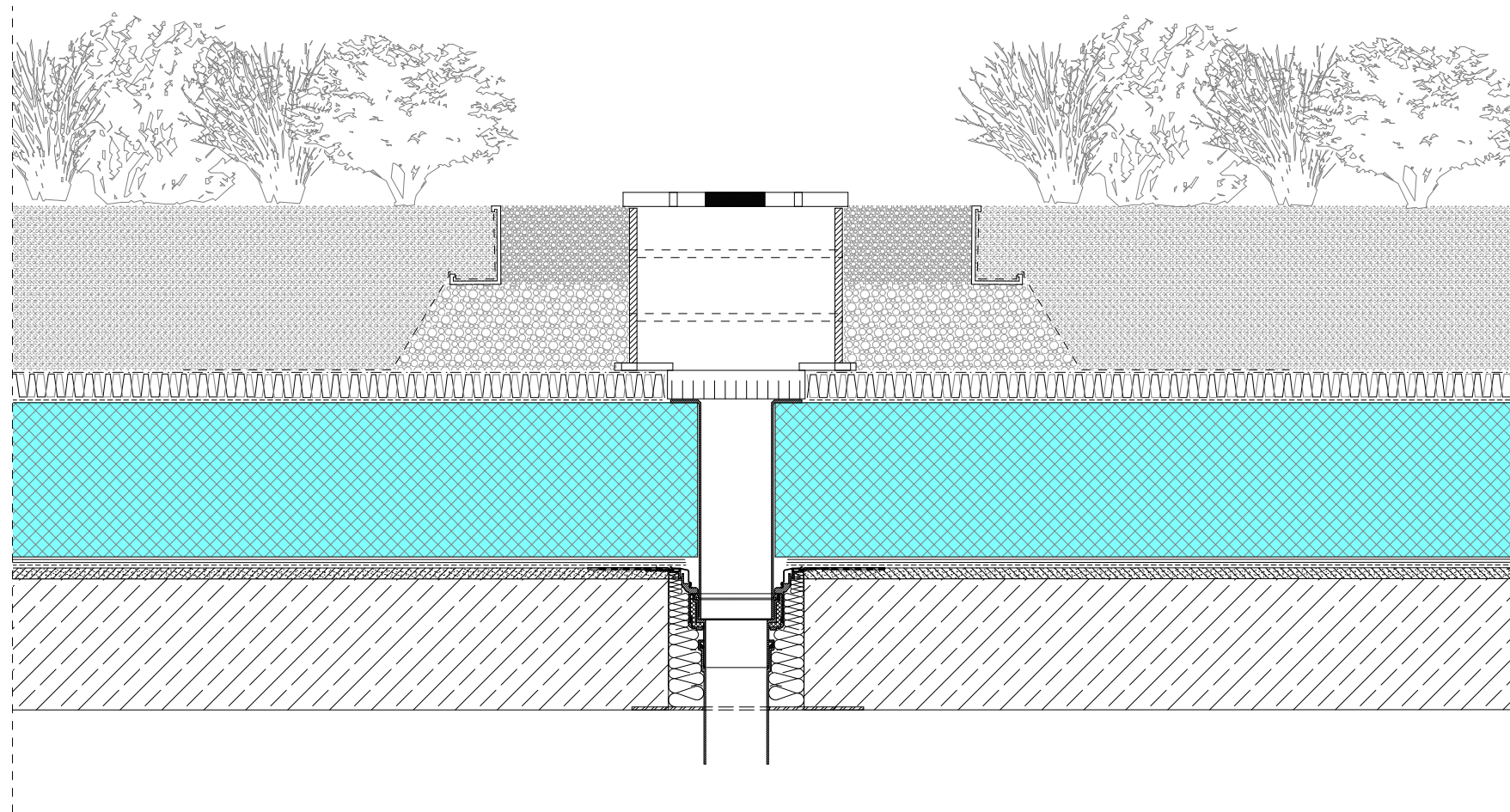




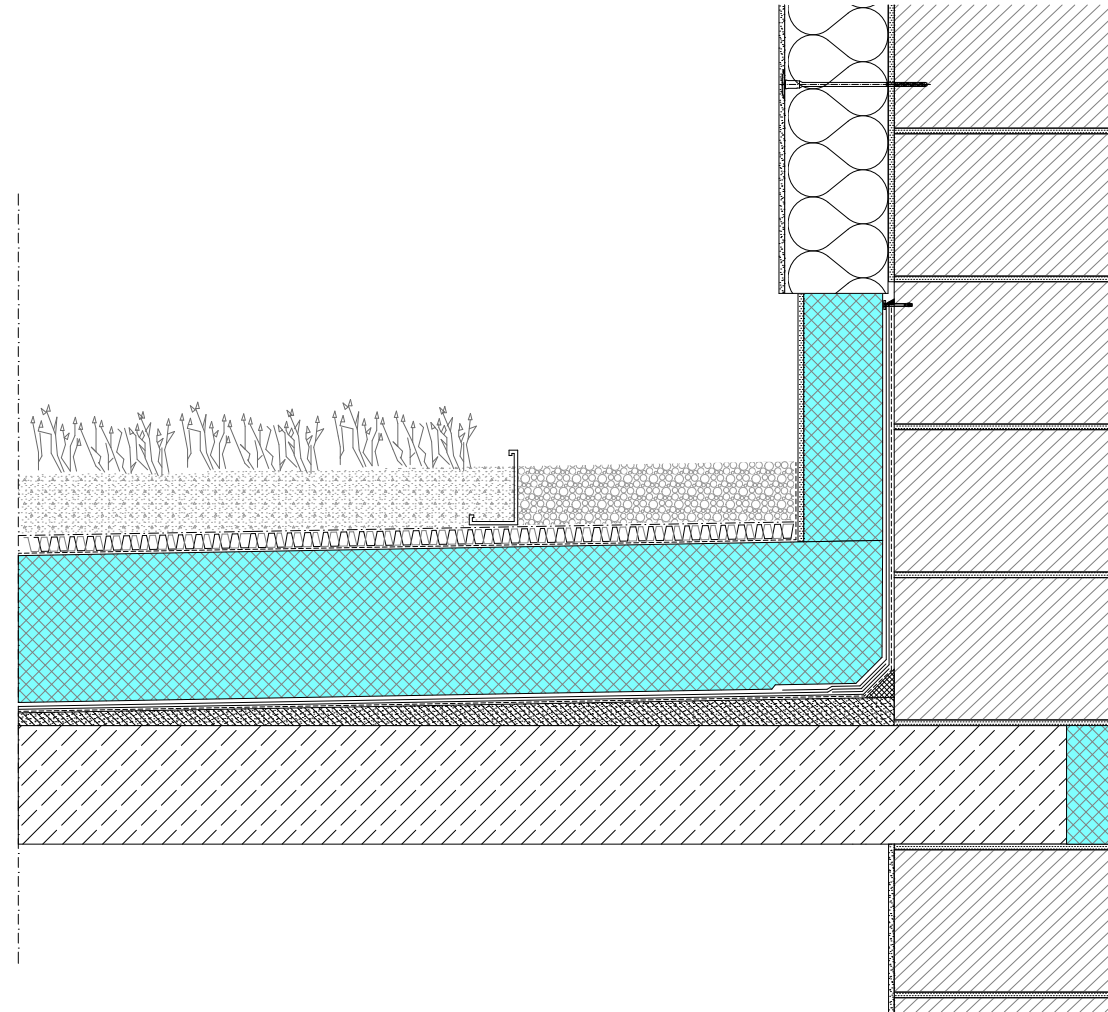
## Drainage point detail - extensive green roof



## Drainage point detail - intensive green roof

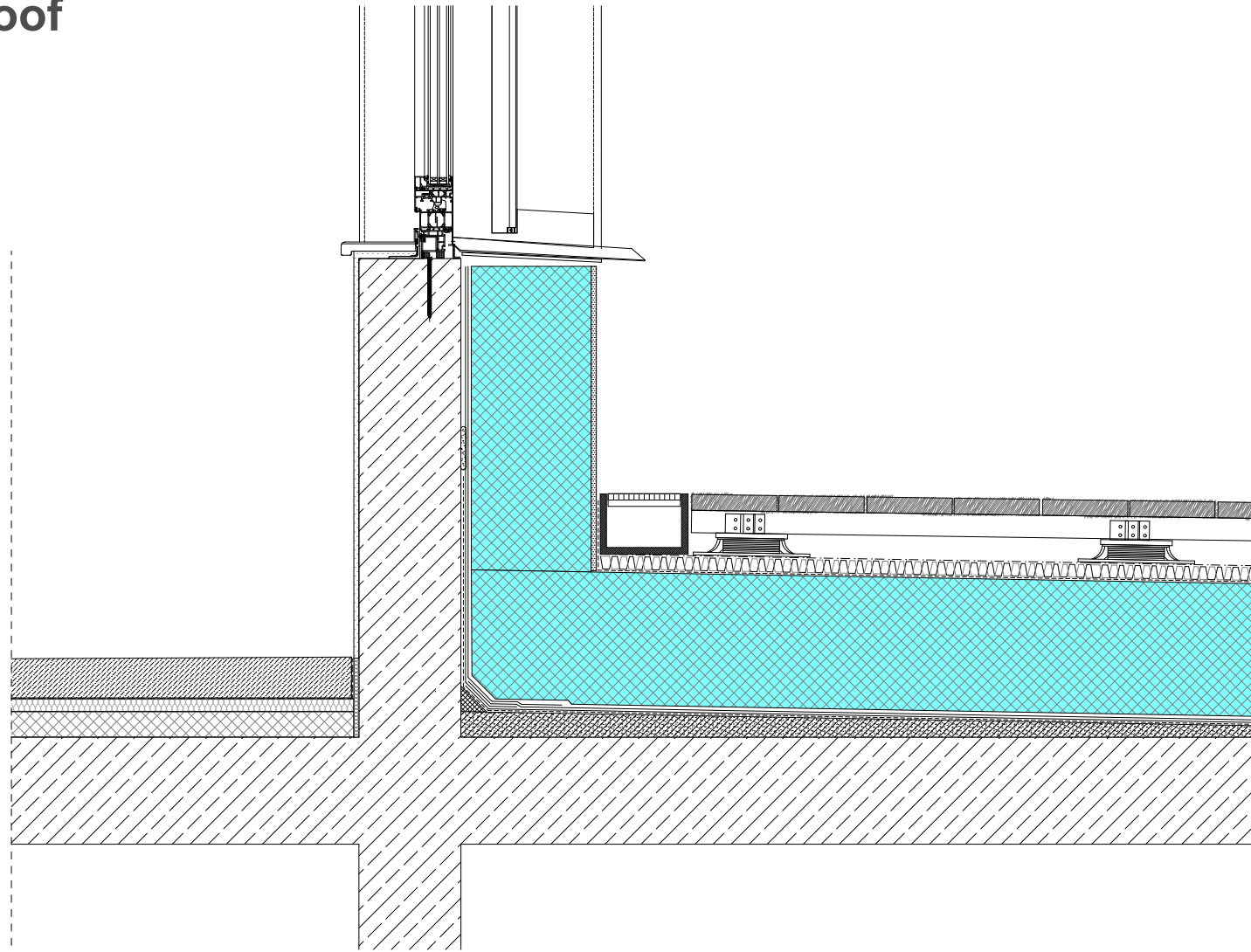


## Roof structure connection - extensive green roof

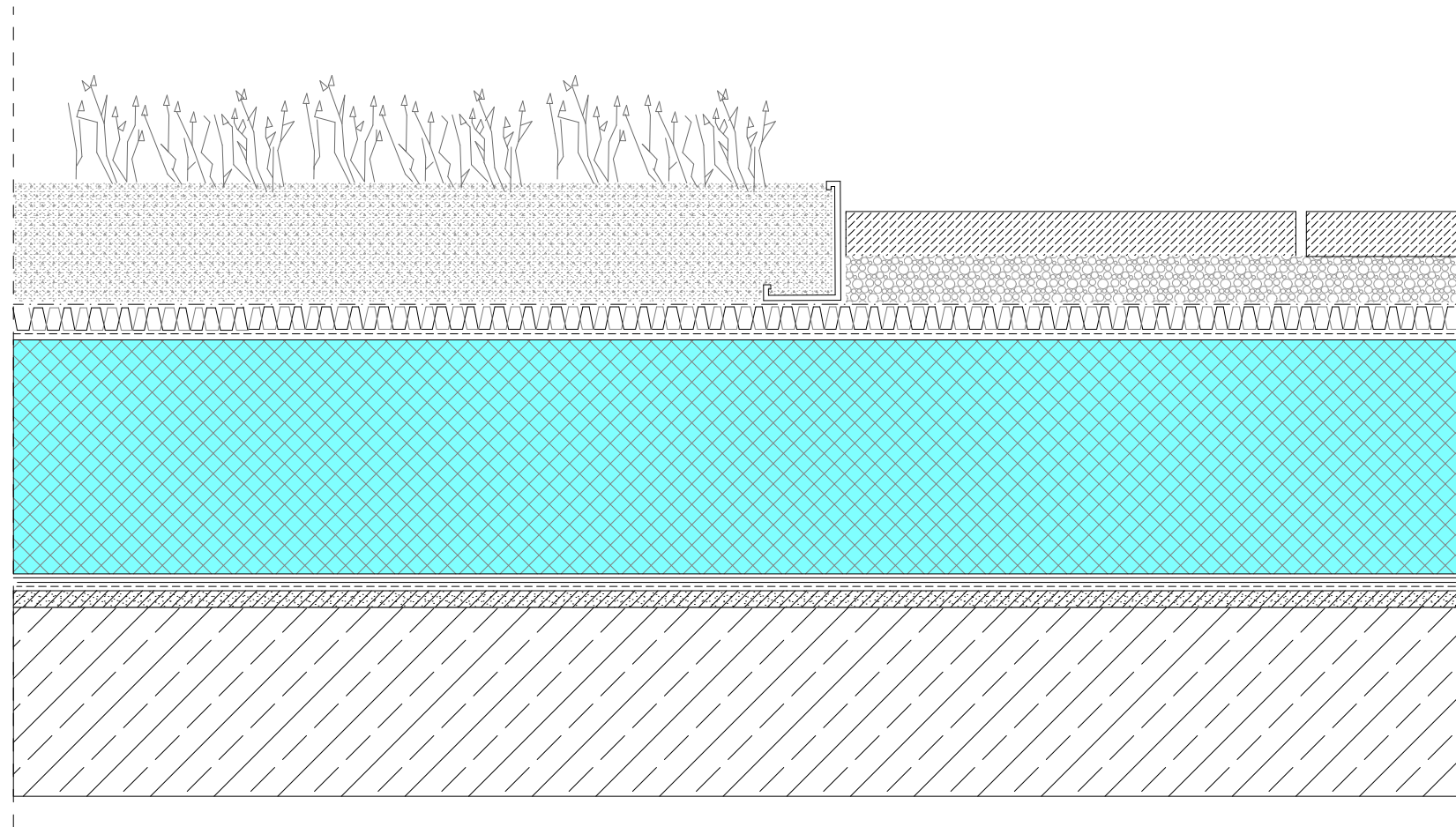




## Window detail - terrace roof



## Meeting point of terrace roof and green roof



# CONSTRUCTION ADVICES

## Material handling

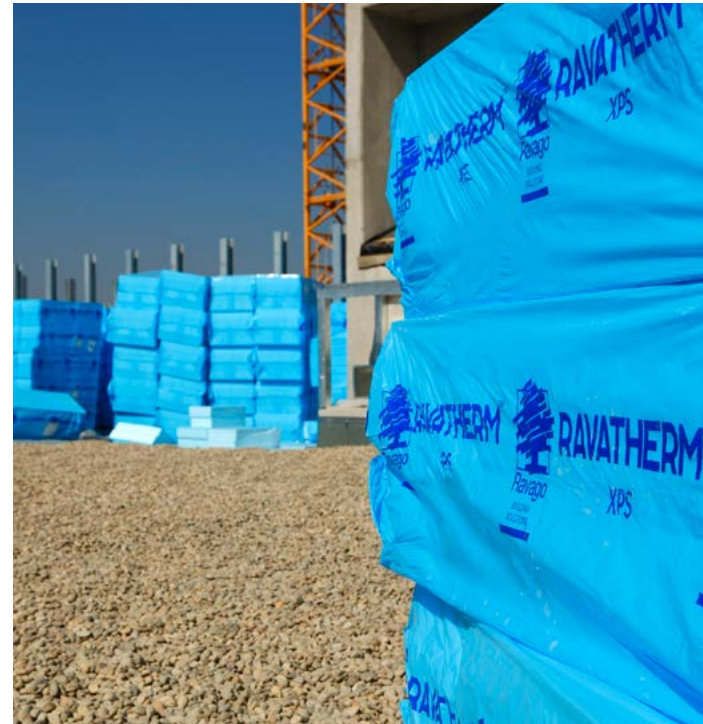
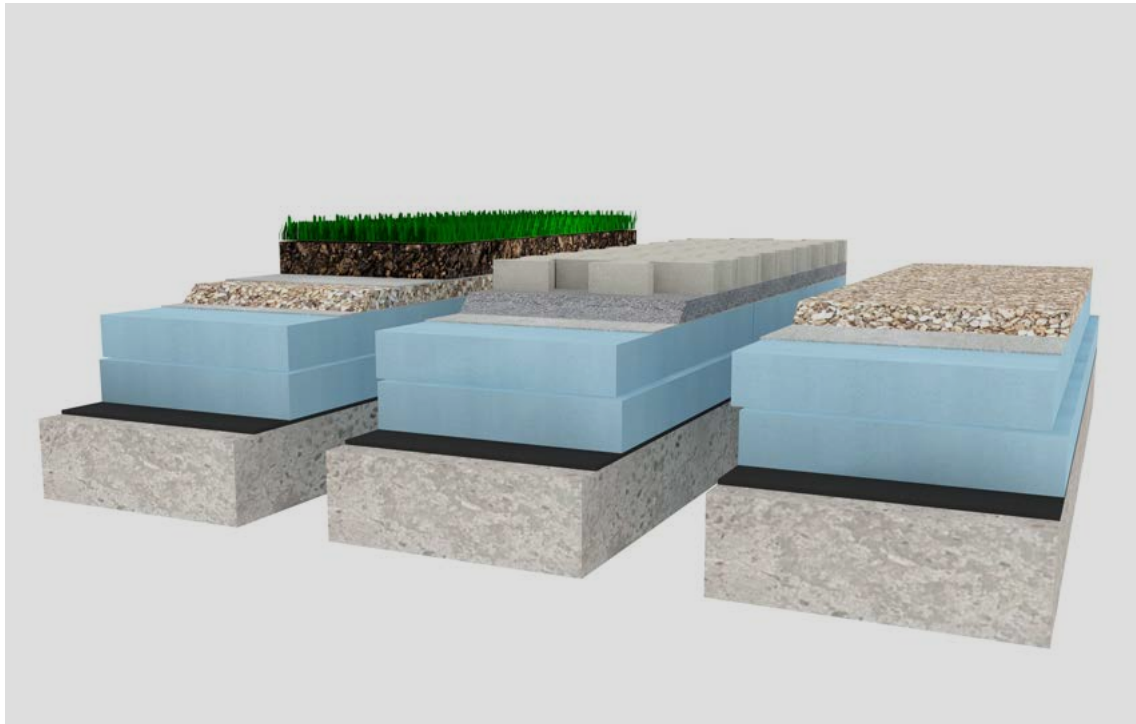
Thermal insulation boards can be laid easily and quickly under any weather conditions. To cut the boards to size, a handsaw or electric saw (but not a chainsaw!), or a hot wire cutting knife should be used. The cut surfaces can be precisely aligned next to each other. RAVATHERM XPS boards are resistant to pressure or other impacts which may occur during transport to the place of construction and therefore the risk of damage to the boards is also reduced.

## Laying the boards

The RAVATHERM XPS boards are laid right on the waterproofing layer.

The surface of the waterproofing must be free of any construction rubble, contamination or other types of dirt.

The light-weight boards are easy to handle, can be installed without any adhesives. On top of the thermal insulation layer, a water vapour-permeable geotextile separation layer is strongly recommended!





# IMPORTANT INFORMATIONS

## Design

or inverted roofs, it is recommended to design the layer arrangement above the thermal insulation in an open configuration from a vapour diffusion perspective. This way, moisture from precipitation on the waterproofing surface can easily diffuse through the insulation to the cold side.

Do not place vapour-tight (e.g., PE foil) or highly moisture-absorbent (e.g., geotextile) layers directly on the thermal insulation boards.

## Important

- The sustained operating temperature for RAVATHERM XPS products is a maximum of +75°C. At higher temperatures, the boards can melt and undergo permanent deformation.
- RAVATHERM XPS products contain environmentally safe flame retardants, which allow them to catch fire under direct flame exposure, but they behave self-extinguishing below their ignition temperature. During application, always adhere to the applicable fire safety regulations.
- RAVATHERM XPS products resist commonly used solvent-free and plasticizer-free materials in the construction industry. (Solvent-free bituminous components, water-based wood preservatives, lime, cement, mortar for masonry and plaster, anhydrite-gypsum, etc.)
- Certain organic materials, solvent-based wood preservatives, paint additives, solvents (acetone, ethyl acetate, petroleum, gasoline, etc.) can damage the boards, causing softening, blistering, and material degradation.
- Use solvent-free adhesives and refer to the manufacturer's guidelines for gluing polystyrene foam. XPS products should not be exposed to direct and sustained intense sunlight.





# IMPORTANT INFORMATIONS

## General Information - Fire Protection

RAVATHERM XPS products comply with the EU regulations regarding substances that deplete the ozone layer. RAVATHERM XPS products contain flame-retardant additives that prevent them from igniting easily under minor fire sources. However, the insulation boards themselves are combustible and can burn rapidly when exposed to strong flames. The flammability classification is based on laboratory tests, which may not accurately represent the material's behavior in larger fire scenarios. During application, it is important to adhere to the requirements of national building regulations and the fire resistance performance standards for buildings.

## General Information - Environmental Protection

RAVATHERM XPS products do not biodegrade in the environment and do not pose environmental risks to water and soil. Disposing of the waste boards can be done by placing them in landfills or, preferably, through controlled incineration in approved facilities. The products are recyclable, but they should not be mixed with other plastics.





# SHIPPING AND ORDER INFORMATION

Our company strives to maintain direct and close contact with the major players in the building construction industry. In our opinion, the secret of a mutually beneficial partnership is fast and precise service and technical support which offers effective problem solving.

We are looking forward to receiving your requests and also initiate contacts through colleagues in different fields.

We can accept requests from our construction partners for the delivery of our products through orders sent by our contracted trading partners.

For larger volume orders of several hundred cubic metres, we are happy to offer you a direct offer, but for smaller volumes we recommend contacting our trading partner nearest to the project, as they can help you quickly and flexibly based on the stock of the shorter claimed delivery times.

**When requesting a quote, please provide the following information:**

- **project name, exact address**
- **precise description of the necessary products, type and place of application,**
- **quantity, expected delivery schedule**  
(week of first and last delivery per product)

Our sales and technical consultants can process and answer your request in a short time.







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