

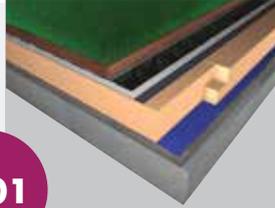
# Section 2.5

## Green Roofs

### Warm deck green roof with single ply membrane

**Product:** Polyfoam ECO  
Roofboard Extra

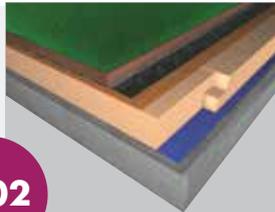
**Gr01**



### Protected membrane green roof

**Product:** Polyfoam ECO  
Roofboard Extra and Polyfoam  
Slimline Membrane

**Gr02**



# Green roofs

## Green roof design

### Types of green roofs

There are three main types of green roof:



#### 1. Extensive

These have shallow (typically 70mm) soils and support sedums, moss, herbs and grasses and are used where roof access is not required, they are also the lightest type of green roof. Extensive green roofs provide attractive protection to the waterproof membrane and significantly reduce water run-off. When the green roof is completed, the building owner must water and weed on a regular basis for the first year until the plants are established to ensure proper growth and success.



#### 2. Semi-intensive

A deeper soil layer (typically 150mm) than extensive roofs enables a wider variety of plants to be grown, including shrubs and woody plants. They are ideal where the roof is overlooked and year-round colour is required with only periodic maintenance. Where access is required, areas of paving can be included in the design.



#### 3. Intensive

With a deeper soil layer (150mm upwards) than semi-intensive roofs an even wider variety of plant types can be grown, from lawns to semi-mature trees. The type of planting will determine the depth of soil required, the need for an irrigation system and the level of maintenance required. Regular roof access is normally provided on this type of green roof, so paved areas, walls and even water features are incorporated in the design.

### Regulatory compliance

There are no regulations or British Standards specifically relating to green roofs in the UK. Most suppliers of green roof components comply with the FLL, German Green Roof standards. However, a building with a green roof is of course subject to the same Building Regulation requirements as a building with a conventional flat or pitched roof.

### Roof loadings

Table 25 indicates typical loadings on a green roof. Advice on particular green roof schemes and systems should be sought from the green roof supplier.

Manufacturers/suppliers of green roof systems will be able to supply product details on each of the components comprising any particular green roof system.

Table 25 - Design loads on a green roof

Type of green roof	Weight (kg/m <sup>2</sup> )
Extensive design	60-150
Gravel surface	90-150
Paved surface	160-220
Intensive design	200-550

### Warm or inverted build-up

It is possible to design a green roof system above both warm and inverted roof constructions. The green roof elements are the same in both cases, only the demands on the insulation and the position of waterproof membrane change.

## Thermal insulation

The thermal insulation should be capable of resisting both the dead load of the green roof and any additional live loads especially if regular access to the roof is planned.

In a protected insulation roof, the insulation should also be impervious to water, making extruded polystyrene the ideal choice.

The soil in a green roof does offer some insulation value but is ignored in U-value calculations because the insulation value of the soil varies with the water content.

## Waterproof membrane

With a green roof it is difficult and expensive to renew and repair the waterproof membrane. The waterproof membrane, therefore, should be selected for its high performance and longevity.

The waterproofing system beneath any green roof should preferably be root resistant in the long term to the German FLL standards. If the waterproofing is not root resistant then the green roof system must include a separate root barrier, usually immediately above the waterproof membrane. The waterproofing system must be leak tested and certified as such immediately before the installation of the green roof.

The design of the waterproofing and its detailing to perimeters, outlets and protrusions through the roof etc, should take into account the depth of the green roof build up. The waterproofing should always be a minimum of 150mm above soil level at upstands and protrusions, and at least 50mm at external perimeters. A 300 to 500mm wide layer of gravel or paving is recommended at all junctions with upstands, rooflights etc.

## Drainage

Green roofs should be designed with a fall of at least 1:60. This prevents the risk of ponding in deflections in the roof deck, which can be harmful to the plants.

Each roof area should contain at least two roof outlets, or a roof outlet and an overflow. An inspection chamber should be constructed over each outlet to allow regular inspection and cleaning of vegetation from the outlet grating. Consult the supplier of the green roof components for their recommendations on the number of drainage outlets.

## Sustainable drainage (SUDS)

A green roof can absorb and store a high proportion of the rainwater that falls onto it,

helping to prevent local flooding.

Rainwater is retained and stored in the growing medium thus reducing the pressure on sewer systems and the cost of water treatments.

Run off water quality can also be improved due to the filtration of pollutants through the green roof system.

## Wind uplift

Wind uplift is greatest at the edges of roofs. At these points, paving slabs or coarse gravel are usually used to prevent wind suction displacing the soil layer in a green roof. The soil layer is most vulnerable in its early stages, before the root system of the planting material helps to provide a degree of reinforcement.

Generally, the higher the building above the ground, the greater the risk of wind uplift.

## Fire performance

The soil layer generally provides the fire protection in a green roof. For extensive roofs, the soil layer should be at least 30mm deep and contain less than 20% organic matter. Gravel strips or paving slabs are required to act as fire breaks around all rooflights and below windows to walls. They must be kept free of flammable vegetation.

## Solution optimiser and pathfinder

### Knauf Insulation solution

### U-values

0.26 0.25 0.24 0.23 0.22 0.21 0.20 0.19 0.18 0.17 0.16 0.15 0.14 0.13

U-value	0.26	0.25	0.24	0.23	0.22	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.14	0.13
<b>Warm deck green roof with single ply membrane</b> Product: Polyfoam ECO Roofboard Extra See page: 118 <b>Gr01</b>														
<b>Protected membrane green roof</b> Product: Polyfoam ECO Roofboard Extra and Polyfoam Slimline Membrane See page: 120 <b>Gr02</b>														

### Key

 Thermal insulation achievable by constructions within this document.

 Find online. Visit [knaufinsulation.co.uk](http://knaufinsulation.co.uk) and key in construction code to find the most up to date information on your chosen solution.

# Green roofs

Warm deck green roof with single ply membrane

## Polyfoam ECO Roofboard Extra



Polyfoam ECO Roofboards

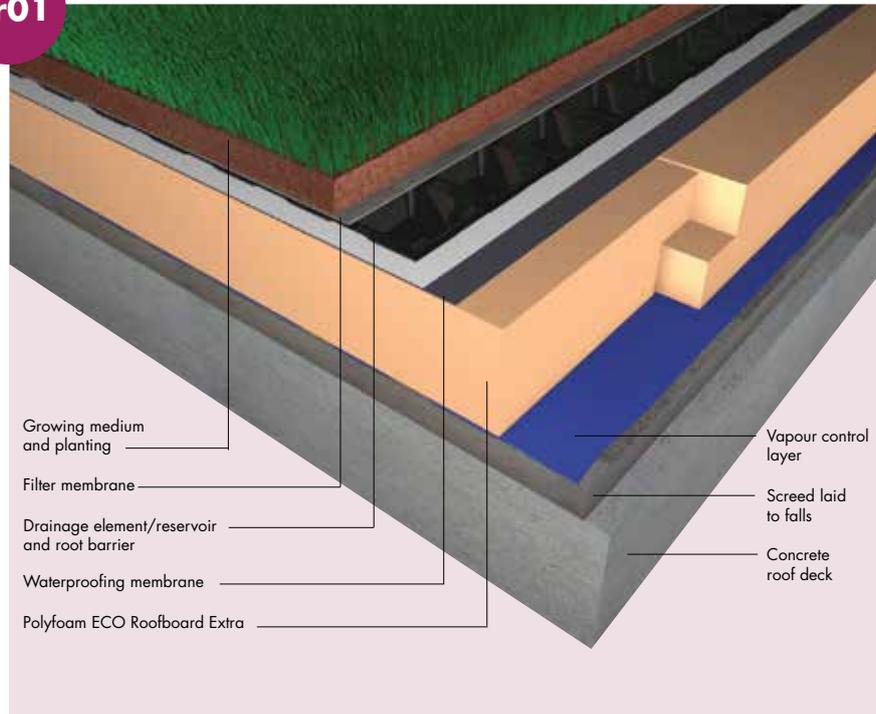


Gr01

- Light, strong, and moisture resistant
- High compressive strength to support green or garden roof
- Reduced rain water run off improves water management and reduces the risk of localised flooding

### Polyfoam ECO Roofboard Extra

- BBA certified
- Zero Ozone Depletion Potential (ODP)
- Global Warming Potential (GWP) <5



### Products

**Polyfoam ECO Roofboard Extra** is a 100% ozone friendly, extruded polystyrene, rigid insulation board that is lightweight, yet has excellent structural strength and moisture resistance. It is supplied with interlocking rebated edges.

### Typical construction

Any type of roof deck, either new build, or refurbishment, can be designed as a green or garden roof, provided the roof structure is capable of carrying the associated loads.

The waterproofing is installed above the insulation to create a warm deck construction. The waterproofing layer is then covered with moisture reservoirs (and in some cases, root barriers). These are then overlaid with a filtration membrane, and planting to create a green or garden roof.

A green roof (or extensive roof) constitutes lightweight growing matter, e.g. sedum.

A garden roof (or intensive/semi intensive roof) can vary from simple plants to mature trees and shrubs which will impose higher loads on the structure and thus the insulation layer.

Green or garden roof systems may differ by supplier. In all cases, the insulation layer needs

to have high compressive strength in order to offer the right level of long term structural support to the growing layer.

### Installation

The vapour control layer should be laid over the structural deck and all joints lapped and sealed.

Polyfoam ECO Roofboard Extra is then laid in a staggered pattern from one corner of the roof.

If a PVC membrane is being used the membrane should be separated from Polyfoam ECO Roofboard Extra to prevent plasticiser migration from the membrane.

Where a mechanically fixed membrane is being used, Polyfoam ECO Roofboard Extra should be mechanically fixed to the deck with two centrally placed fixings in each board to secure the boards in place before the membrane is fixed.

Where a fully bonded membrane system is used, each layer of Polyfoam ECO Roofboard Extra must be bonded as well as the waterproof membrane itself. A polyurethane based adhesive is recommended.

The specified green roof system is then installed, with each layer being laid on an advancing front in order to protect the waterproofing

membrane from mechanical damage as the materials are transported across the roof.

### Performance

#### Compression resistance

Polyfoam ECO Roofboard Extra has a minimum compressive strength of 300 kPa.

Polyfoam ECO Roofboard Extra is highly resistant to compression and withstands both occasional and long term static loads. Load bearing construction elements should be designed to adequately support the combination of imposed and dead loads without creating excessive deflection.

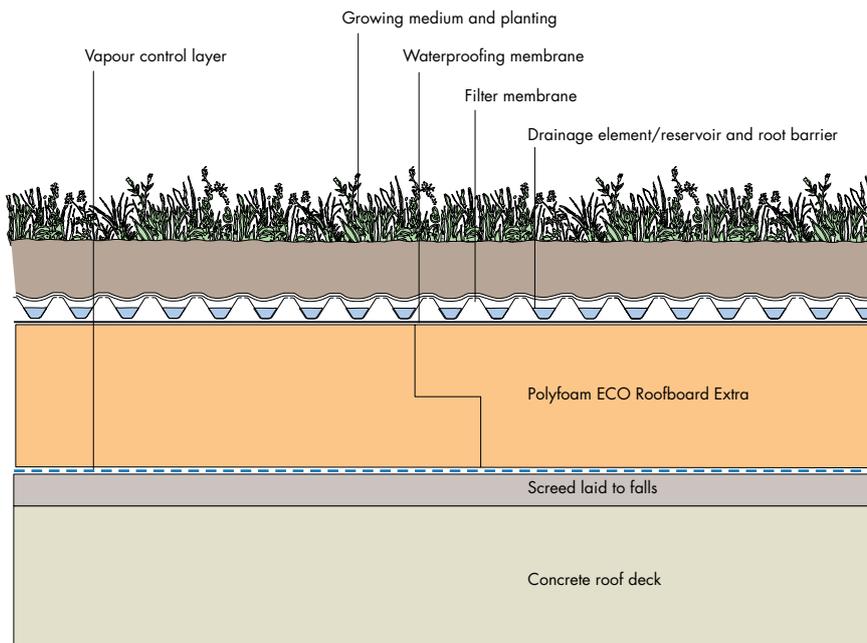
#### Thermal performance

Polyfoam ECO Roofboard Extra has a thermal conductivity of 0.033 W/mK.

#### Fire performance

When Polyfoam ECO Roofboard Extra is installed in a green roof it will not contribute to the development stages of a fire.

## Typical section



## Typical specification

The vapour control layer and Polyfoam ECO Roofboard Extra, thickness ...mm to be mechanically fixed\*/ adhered\* to the roof deck.

(\*delete as required)

The single ply membrane should be applied over the insulation in accordance with the appropriate manufacturer's recommended specification.

The single ply membrane to be overlaid with a root barrier/ moisture reservoir as specified ensuring there are no gaps and edges are overlapped. The single ply membrane to be covered with a filtration layer, and growing matter as specified to comply with client requirements.



Alternatively, consult the National Building Specifications, Standard version clause/clauses... J42/415.....

Knauf Insulation specification clauses can be downloaded from [knaufinsulation.co.uk/nbs](http://knaufinsulation.co.uk/nbs)

Table 26 - Typical U-values of warm deck green roof

Product	Thickness (mm)	U-values (W/m <sup>2</sup> K)
		40mm screed 150mm concrete 13mm plaster
<b>Polyfoam ECO Roofboard Extra</b>		
	240 (140+100)	0.14
	220 (120+100)	0.15
	200 (2x100)	0.16
	180 (100+80)	0.18
	170 (100+70)	0.19
	160	0.21
	150 (80+70)	0.22
	140	0.23
	130 (70+60)	0.25



Note: For project specific calculations contact our Technical Advice and Support Centre on 01744 766666.

CERTIFICATE CB1001-2  
U Value Competency Scheme

# Green roofs

Protected membrane green roof

## Polyfoam ECO Roofboard Extra

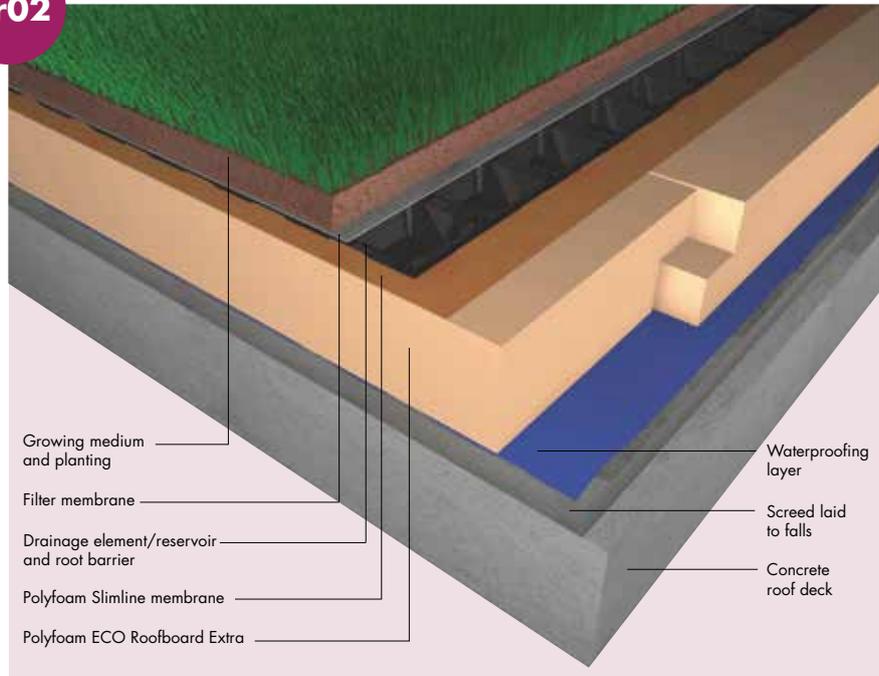


Polyfoam Slimline System  
Polyfoam ECO Roofboards



**Gr02**

- Polyfoam Slimline System enables installation of a reduced insulation thickness to achieve specified U-value
  - Light, strong, and moisture resistant
  - High compressive strength to support green or garden roof
- Polyfoam ECO Roofboard Extra
  - BBA certified
  - Zero Ozone Depletion Potential (ODP)
  - Global Warming Potential (GWP) <5



### Products

**Polyfoam ECO Roofboard Extra** is a 100% ozone friendly, extruded polystyrene, rigid insulation board that is lightweight, yet has excellent structural strength and moisture resistance. It is supplied with interlocking rebated edges.

**Polyfoam Slimline membrane** is a high performance, non woven polypropylene geotextile membrane that prevents the passage of water and is water vapour permeable.

### Typical construction

Any type of roof deck, either new build, or refurbishment, can be designed as a green or garden roof, provided the roof structure is capable of carrying the associated loads.

The waterproofing is installed below the insulation to create a protected membrane construction. The waterproof layer is overlaid with Polyfoam ECO Roofboard Extra and Polyfoam Slimline membrane. This is then covered with moisture reservoirs (and in some cases, root barriers). These are then overlaid with a filtration membrane and planting to create a green or garden roof.

A green roof (or extensive roof) constitutes lightweight growing matter, e.g. sedum.

A garden roof (or intensive/semi intensive roof) can vary from simple plants to mature trees and shrubs which will impose higher loads on the structure and thus the insulation layer.

Green or garden roof systems may differ by supplier. In all cases, the insulation layer needs to be both highly resistant to the effect of exposure to water and have high compressive strength in order to offer the anticipated level of thermal performance and structural support to the growing layer in the long term.

### Installation

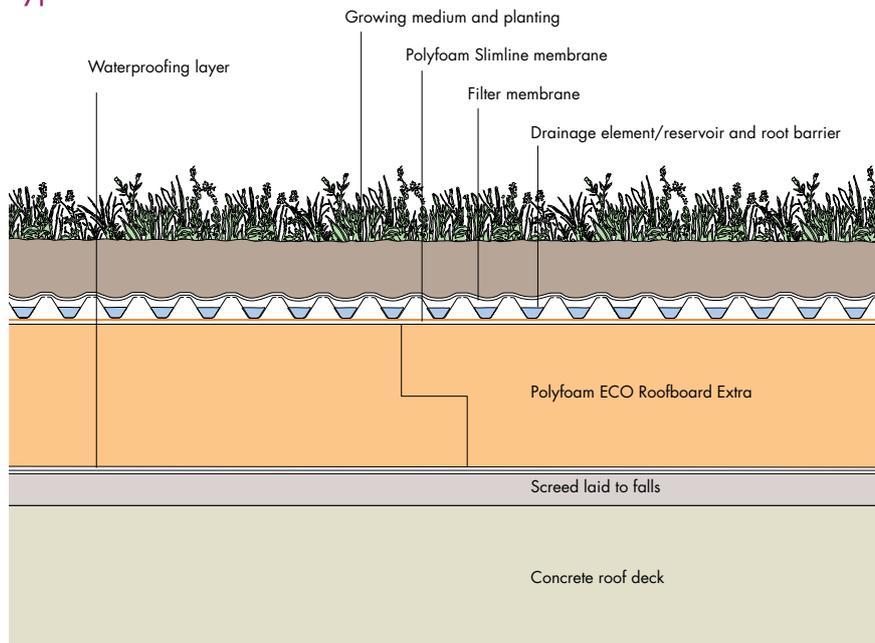
The waterproof membrane must be free of loose gravel and grit before laying Polyfoam ECO Roofboard Extra. On existing roofs, any existing chippings should be covered with a polyethylene cushioning layer, such as Floorfoam.

For mastic asphalt finishes, a separating, non-woven polyester fleece should be laid immediately below the insulation and turned up at all upstands.

Polyfoam ECO Roofboard Extra should be laid in a staggered pattern from the point of access across the roof. It is important that all joints between boards are tight fitting and there are no gaps at junctions with rooflights, upstands etc.

The specified green roof system is then installed, with each layer being laid on an advancing front in order to protect the waterproofing membrane from mechanical damage as the materials are transported across the roof and to protect the boards from wind uplift.

## Typical section



## Typical specification

The whole of the roof area to be lined with a waterproof membrane and then insulated with Polyfoam ECO Roofboard Extra.....mm thick, covered with Polyfoam Slimline membrane. The Slimline membrane to be overlaid with a root barrier/ moisture reservoir as specified ensuring there are no gaps and edges are overlapped. This to be covered with a filtration layer, and growing matter as specified to comply with client requirements.



Alternatively, consult the National Building Specifications, Standard version clause/clauses... J42/415.....

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## Performance

### Compression resistance

Polyfoam ECO Roofboard Extra has a minimum compressive strength of 300 kPa.

Polyfoam ECO Roofboard Extra is highly resistant to compression and withstands both occasional and long term static loads. Load bearing construction elements should be designed to adequately support the combination of imposed and dead loads without creating excessive deflection.

### Moisture resistance

Polyfoam ECO Roofboard Extra is highly resistant to moisture and can be laid in standing water or up against wet concrete with negligible impact on the performance of the product.

### Thermal performance

The thermal conductivity of Polyfoam ECO Roofboard Extra is 0.033 W/mK.

### Fire performance

When Polyfoam ECO Roofboard Extra is installed in a green roof it will not contribute to the development stages of a fire.

Table 27 - Typical U-values for green or garden roofs insulated with the Polyfoam Slimline System in a protected membrane roof

Product	Thickness (mm)	U-values (W/m <sup>2</sup> K)
		40mm screed 150mm concrete 13mm plaster
Polyfoam ECO Roofboard Extra	240 (140+100)	0.14
	220 (120+100)	0.15
	200 (2x100)	0.16
	180 (100+80)	0.18
	170 (100+70)	0.19
	150 (80+70)	0.21
	160	0.22
	140	0.24
130 (70+60)	0.26	



Note: For project specific calculations contact our Technical Advice and Support Centre on 01744 766666.

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