



## CHARACTERISTICS

- Permanent solutions for pitched and steep green roofs.
- Different system solutions depending on construction conditions.
- Cost-efficient and safe anti-slip systems.

RECEIVED

06 MAR 2015

SUPPORT SERVICES

## TECHNICAL DATA → SEDUM ROOF

Weight*:	1.0–1.3 kN/m <sup>2</sup>
Layer height:	80–100 mm
Roof pitch:	5–45° (9–84 %)
Vegetation form:	Moss - sedum - herbs
Water retention / discharge coefficient / water storage	
40–60 %	C = 0.6–0.4 approx. 35 l/m <sup>2</sup>
Ecological value:	■ □ □ □ □
Maintenance costs:	■ □ □ □ □
Cost factor:	■ ■ ■ □ □

## TECHNICAL DATA → NATURE ROOF

Weight*:	1.6–1.9 kN/m <sup>2</sup>
Layer height:	130 mm
Roof pitch:	5–35° (9–70 %)
Vegetation form:	Sedum - grass - herbs
Water retention / discharge coefficient / water storage	
50–70 %	C = 0.5–0.3 approx. 40–50 l/m <sup>2</sup>
Ecological value:	■ ■ ■ □ □
Maintenance costs:	■ ■ □ □ □
Cost factor:	■ ■ ■ □ □

## BRIEF DESCRIPTION

- ... m<sup>2</sup> Optigreen Protection and Storage Fleece Type RMS 500 as protective layer over the root-resistant roof membrane or Optigreen Root Barrier Membrane
- ... m<sup>2</sup> Optigreen Structured Storage Fleece Type SSV 800 for protection and storage
- Required for roofs with pitch greater than approx. 15°\*\*:**
- ... m<sup>2</sup> Optigreen Anti-Slip System Type ... (as and when required, see page 29) to secure and stabilise the substrate layer
- ... m<sup>2</sup> 60–80 mm (for vegetation mats) and 80–100 mm (for seeding) Optigreen Extensive Substrate Type E\* as vegetation layer
- ... m<sup>2</sup> pre-cultivated Optigreen Vegetation Mat Type SM/ KG for the rapid and safe establishment of vegetation
- Alternative for 5–15°\*\*:
- ... m<sup>2</sup> Seeding with Optigreen Seed Type E and 50 g/m<sup>2</sup> sedum shoots for the rapid and safe establishment of vegetation
- ... m<sup>2</sup> maintenance care

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- ... m<sup>2</sup> Optigreen Anti-Slip System Type ... (as and when required, see page 29) to secure and stabilise the substrate layer
- ... m<sup>2</sup> 110 mm (for Vegetation mats) – 130 mm (for seeding) Optigreen Extensive Substrate Type E\* as vegetation layer
- ... m<sup>2</sup> pre-cultivated Optigreen Vegetation Mat Type SKG/G for the rapid and safe establishment of vegetation
- Alternative for 5–15°\*\*:
- ... m<sup>2</sup> Seeding with Optigreen Seed Type E and 50 g/m<sup>2</sup> sedum shoots for the rapid and safe establishment of vegetation
- ... m<sup>2</sup> maintenance care

\* Depending on the load capacity of the substructure, Optigreen "High Density (HD)" or "Low Density (LD)" substrates can be used. Weight specifications refer to saturated conditions; dry weight is approx. 60–70 % of the saturated weight.





1

#### Optigreen Vegetation Mat (5 – 15° seeding)

- Pre-cultivated sedum (herbs/grasses) mat for the rapid establishment of vegetation, with decomposable lining material (for roofs with a pitch greater than 15°)



2

#### Optigreen Extensive Substrate Type E

(60 – 100 mm for sedum roof, 110 – 130 mm for nature roof)

- On specified extensive design-designated substrate with high water-storage capacity and good air porosity



3

#### Optigreen Anti-Slip System (as and when required, see page 29)\*\*

- Prevents the slipping of the green roof structure and stabilises the substrate layer

Systems: Net and sills	Type N
Carrier/Load-bearing and sills	Type T
Cable and sills	Type S
Inverted-roof = U-roof	Type U

from 15°  
Roof pitch\*\*



4

#### Optigreen Structured Storage Fleece Type SSV 800

- Protects the roof membrane against damage and stores water
- Omitted for roofs from 15° roof pitch and replaced with a Structured Storage Fleece Type SSV 800

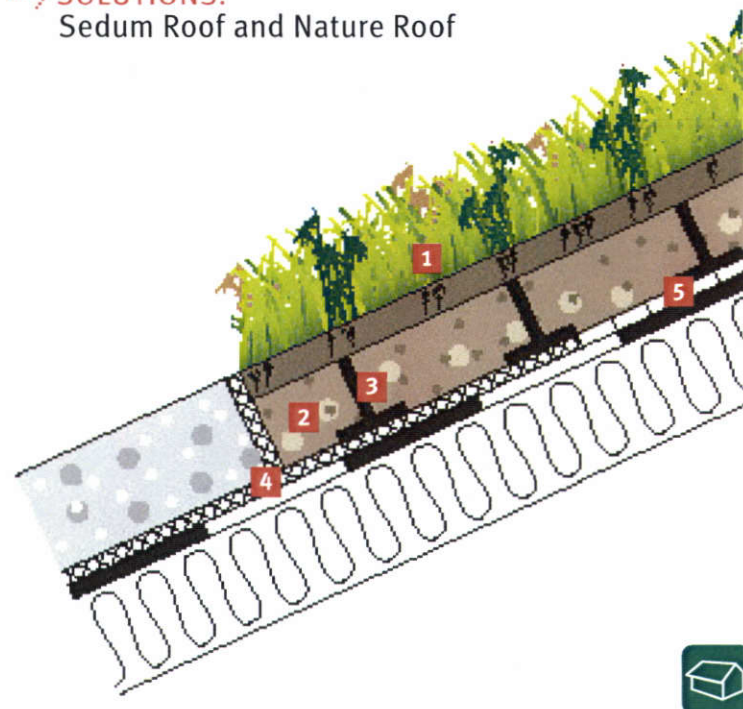


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#### Optigreen Protection and Storage Fleece Type RMS 500

- Protects the roof membrane against damage and stores water
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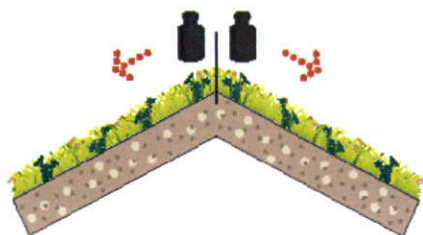
## → SOLUTIONS: Sedum Roof and Nature Roof



\*\* As a rule, Optigreen Anti-Slip Systems (see page 29) and Optigreen Vegetation Mats need to be used in cases of a roof pitch of at least 15°. No tension should be applied to the roof membrane.

## System selection based on load-bearing capacity

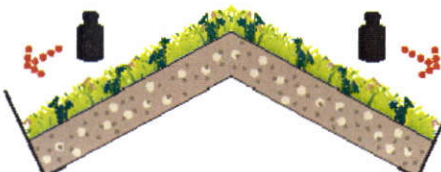
### 1 SHEAR STRESS DISTRIBUTION AT THE RIDGE



Optigreen Anti-Slip System  
Type S (Page 30)

Optigreen Anti-Slip System  
Type N (Page 31)

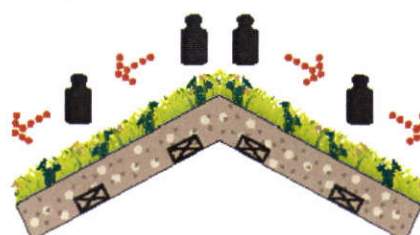
### 2 SHEAR STRESS DISTRIBUTION AGAINST THE EAVES



Optigreen Anti-Slip System  
Type U (Page 32)

Optigreen Anti-Slip System  
Type T (Page 32)

### 3 SHEAR STRESS DISTRIBUTION OVER THE SURFACE



Optigreen Anti-Slip System  
Type N and Type S (Page 30 and 33)

Sealed shear sills





## 1. Basic principles

Pitched green roofs require special attention during the planning phase. Roof pitch, roof construction, roof structure, statics, safety and necessary anti-slip measures for the desired vegetation plan all need to be considered. When combined with the anti-slip system elements, the mesh-like effect of the Optigreen Extensive Substrate Type E results in a safe and stable layer that is easily penetrable by vegetation roots. The installation height is based on climate, roof position in relation to the sun, and – when necessary – it can also determine the positioning of green aspects of the ridges and eaves. It is also important to note that security measures for maintenance personnel must be provided.



South and north sides with varying types of vegetation

## 2. Anti-Slip System

As a rule, it should be assumed that shear forces due to roof greening and snow loads will affect the roof construction and/or roof membrane in roofs with a pitch of at least 3°. These effects must be taken into consideration. In cases of a slope greater than 3°, roof membranes need to be secured at the base in accordance with applicable guidelines or the manufacturer's instructions if they are subject to tension by applied loads. In the case of steep roofs, the shear stress distribution from the green roof can be transferred to the roof structure in a number of ways. These shear forces are summarised as follows:

- Build-up load of the green roof structure  
(Substrate Type E = approx.  $0.13 \text{ KN/cm} \times \text{m}^2$ )
- Vegetation ( $0.1 - 0.15 \text{ KN/m}^2$ )
- Snow load (DIN 1055)
- Dependency on roof pitch and drainage flow length
- Type of roof membrane surface

### Roof pitches up to 15°:

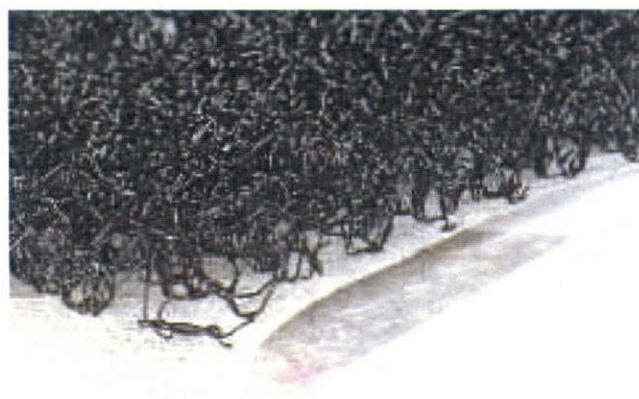
On slightly pitched roofs with up to 15° slope, shear forces can be transferred to the roof membrane if it is firmly bonded to the substructure, either partially (in strips) or wholly (total surface) with the use of metal sheeting. There is a risk that the green roof build-up on roofs with a pitch of 10-15° and flow lengths exceeding 6 metres can slip under the influence of extreme weather conditions such as, for instance, heavy rainfall. Constructional measures are therefore necessary to prevent this from happening. Optigreen claw fabric mats can be used on saddle roofs to spread the load evenly by laying them across the roof ridge and filling them with substrate.

### Example of loads from shear forces

(Roof pitch of 25°, 10 m space from the eaves/ridge, and an assumed snow load of  $0.85 \text{ KN/m}^2$ )

- **Optigreen Sedum Roof** (Weight approx.  $1.15 \text{ KN/m}^2$ )  
Load on eaves =  $8.5 \text{ KN/m}$
- **Optigreen Nature Roof** (Weight approx.  $1.65 \text{ KN/m}^2$ )  
Load on eaves =  $10.6 \text{ KN/m}$

Depending on roof pitch and the possibility of shear forces affecting the supporting structure, the following Optigreen system solutions have been developed:



Optigreen Claw Fabric Mats for saddle roofs up to a maximum pitch of 15°



## Roof pitches over 15°:

Depending on the roof structure, the corresponding designated Optigreen Anti-Slip System should be used: Type N (net), Type S (cable), Type T (carrier/load-bearing), and Type UK (inverted roof).

Depending on the possible construction and statics, anti-slip measures for pitched roofs with a slope of greater than 15° are classified in accordance with the type of shear stress distribution:

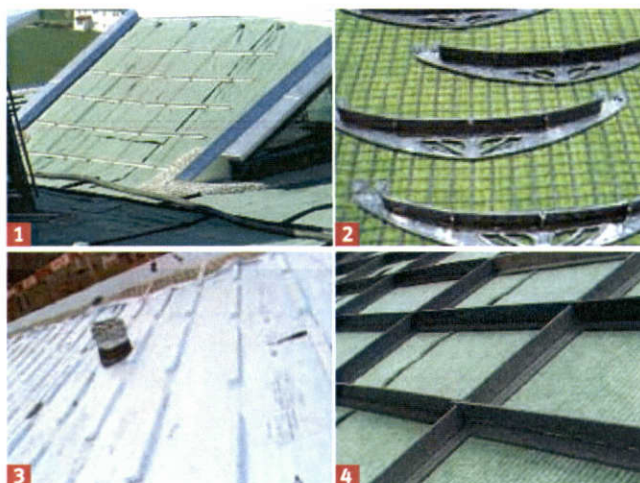
Suspended or fastened over the ridge  
= shear stress distribution to the ridge  
Type S **1** Type N **2**



Supported against the eaves  
= shear stress distribution against eaves  
Type U **3** Type T **4**



Secured to the roof area surface  
= shear stress distribution over the surface  
Type S **1** Type N **2**



## 3. Drainage

The drainage of a pitched roof should be limited to the necessary minimum to ensure that vegetation is not unnecessarily deprived of water. In the Optigreen system the water storage and drainage of surplus water occurs via the Optigreen Structured Storage Fleece Type SSV 800. The underside of the mat is comprised of 50 drainage grooves and a water storage filter fleece capable of storing up to 6 litres of water per square meter. The Structured Storage Fleece Type SSV 800 is built-in underneath the Optigreen Anti-Slip System. This ensures a continuous filtering and storage of water, as well as drainage of surplus water all the way to the eaves. See also page 73.

Depending on the design of the eaves, the filtered water is directed either to the internal drainage conduit or to the external roof gutter. In the case of extreme drainage flow lengths (over 20 m), the maximum possible roof length must be calculated during the planning phase and, if applicable, additional measures to meet drainage needs must be taken.



Internal Optigreen Drainage Conduit, with Structured Storage Fleece Type SSV 800 placed above

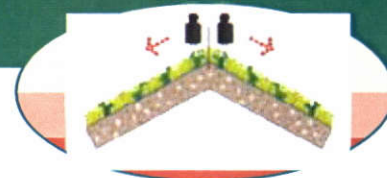
## 4. Irrigation

With the exception of thin-layered structures located in dry climates, additional irrigation measures are generally not necessary.

In the Optigreen system, the water supply is ensured by a designated substrate, tailored to pitch roof constructions. The Optigreen Extensive Substrate Type E is comprised of strong mesh-like material with varied mineral granulations, it also has a high water-holding capacity.

(approx. 38 l/m<sup>2</sup> at a height of 100 mm), which greatly surpasses those of storage and drainage elements.





## Optigreen Anti-Slip System Type N (Net) for barrel, monopitch, saddle and cupola roofs

The Optigreen Anti-Slip System Type N consists of an extra-tough and rot-proof net. Its purpose is to transfer tensile force to the ridge (i.e. for barrel roof constructions).

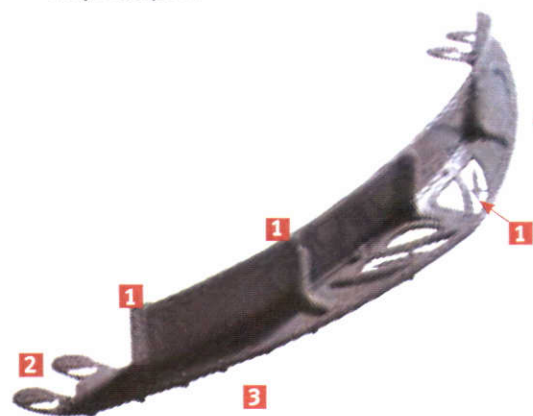
The special Optigreen Anti-Slip sill is mounted by securing it to the net, using its integrated mountain hooks. It is then either draped over the ridge or secured via anchor system. The advantage of the system lies in its easy transferability and notable flexibility. The distance between sills is easily adapted to suit the roof pitch. Due to the high level of standardisation, cost-efficient pitched roofs are made possible.



### Sill spacing for Type N

Roof pitch	Sill spacing
up to 20°	1000 mm
21 – 25°	500 mm
26 – 35°	330 mm
36 – 45°	250 mm

- Layer height 60 mm, sill width 700 mm, effective width 600 mm
- Curved form – prevents overturning due to substrate pressure
- Space-saving transport thanks to stackable profiles
- Very flexible in use depending on roof shape and pitch

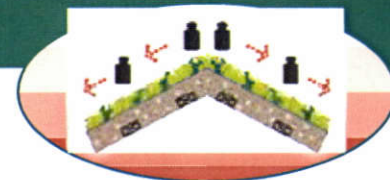


#### Features of the Anti-Slip Sill Type N:

- 1** Two extendable rods for security against vegetation mat slip-page for use with 60 and 80 mm substrate structures
- 2** Staggered positioning of anti-slip sills
- 3** Drainage provided by spacer studs located underneath the profile







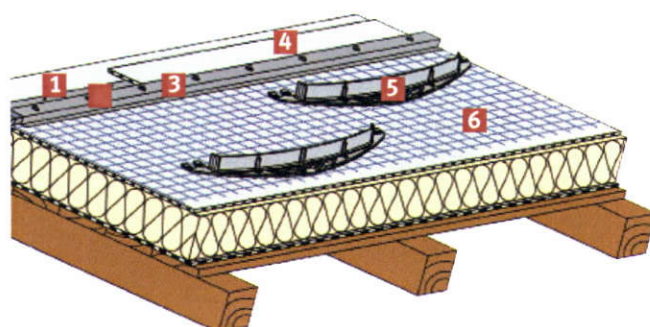
## Optigreen Anti-Slip System Type N for applications with mechanical fixing

The stainless steel Optigreen Fastening Profile permits mounting that is flush to the substructure. The Optigreen Fastening Profile is screwed into a statically effective point in the substructure. It is sealed into the roof membrane according to the waterproofing manufacturer's recommendations. The Optigreen Anti-Slip Systems are simply hung and fixed into the multi-purpose support profile. This permits the Optigreen Anti-Slip System Type N (Net) to be easily attached. The maximum possible load transfer must be calculated during the planning phase.

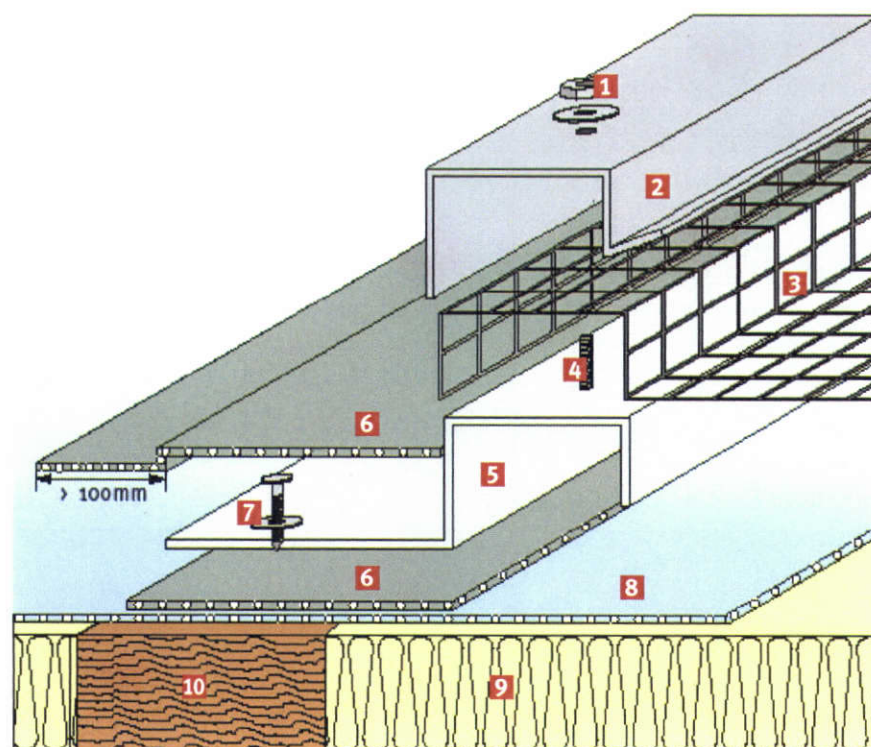


### Sill spacing for Type N

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26 – 35°	330 mm
36 – 45°	250 mm

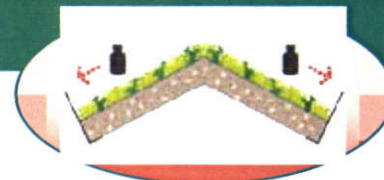


- 1 Statically effective fastening to the substructure
- 2 Screw with support and nut to attach the profiles
- 3 Optigreen Multi-Purpose Support Profile
- 4 Cover strips for sealing the fastening points
- 5 Anti-Slip Sill Type N with fastening clips
- 6 Optigreen Safety Net



- 1 Nut for profile
- 2 Clamp profile, upper part
- 3 Safety net clamped in profile
- 4 Fastening screw for profile (pre-assembled)
- 5 Clamp profile, lower part
- 6 Root-resistant moisture seal with polyester fleece insert
- 7 Statically effective fastening
- 8 Roof membrane (root-resistant in accordance with FLL)
- 9 Thermal insulation
- 10 Statically effective substructure





## Optigreen Anti-Slip System Type T (carrier/load-bearing) for monopitch and saddle roofs

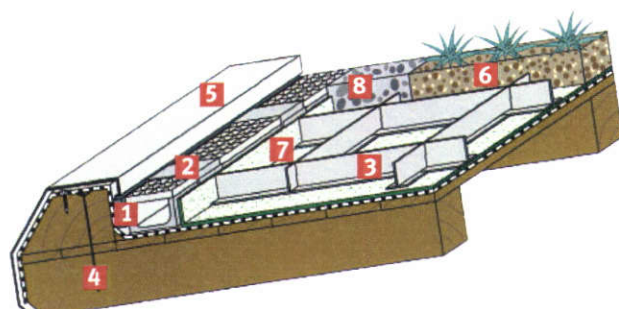
The Optigreen Anti-Slip System Type T consists of root-proof recycled materials. The simple connector system consists of anti-slip beams (3250 mm length) and anti-slip sills (1070 mm length) with a height of 80 mm.

The sills are inserted into the support beams, accommodating for the necessary maximum distance and spacing dimensions, in accordance with the roof slope and structure height. The water storage and drainage of surplus water takes place below the system through the Optigreen Structure Storage Fleece Type SSV 800.



### Sill spacing for Type T

Roof pitch	Sill spacing
up to 15°	1500 mm
16 – 20°	1000 mm
21 – 30°	500 mm
31 – 40°	250 mm



- 1 Drainage groove, height-adjustable from 75 – 105 mm
- 2 Optigreen Anti-Slip Safety Shoe
- 3 Optigreen Anti-Slip Element
- 4 Statically effective fastening based on calculations
- 5 Cover plate
- 6 Optigreen Substrate Type E
- 7 Optigreen Structured Storage Fleece Type SSV 800
- 8 Gravel strips

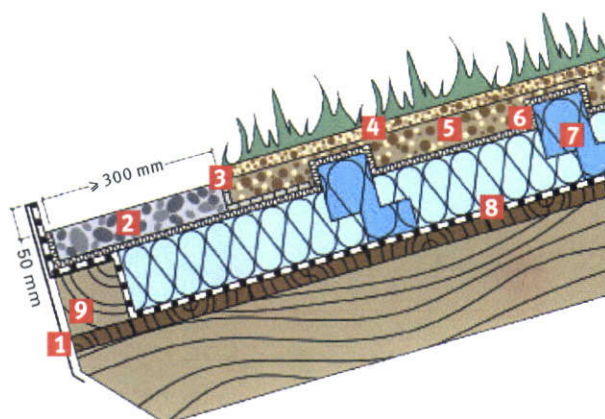
## Optigreen Anti-Slip System Type U (Inverted roof) for monopitch and saddle roofs

The Optigreen Anti-Slip System for inverted and DUO roofs is especially easy to install. It eliminates the fitting and covering of insulation material in wooden structures visible from below, and the integration of anti-slip sills through the roof membrane.

Height of the sills: 60 – 120 mm

### Sill spacing for Type U

Roof pitch	Sill spacing
up to 15°	1200 mm
16 – 35°	600 mm

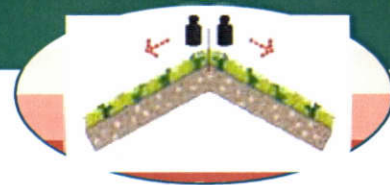


- 1 Eave profile
- 2 Gravel edge
- 3 Optigreen Filter Mat Type 105
- 4 From 15° roof pitch vegetation mat
- 5 Optigreen Substrate Type E
- 6 Optigreen Structured Storage Sleeve Type SSV 800
- 7 Optigreen Sill from extruded Polystyrene foam
- 8 Roof membrane, root-resistant in accordance with FLL
- 9 Static eaves beam



# OPTIGREEN "PITCHED ROOF" SYSTEM SOLUTION

Steep roofs with shear stress distribution at the ridge



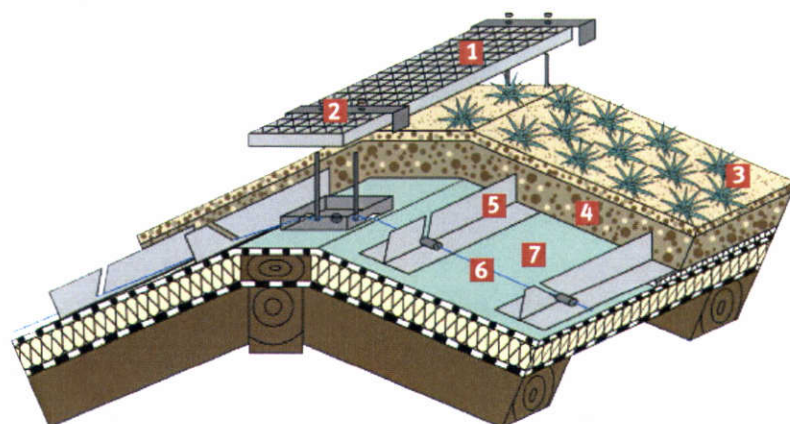
## Optigreen Anti-Slip System Type S (cable) for barrel and monopitch roofs

The Optigreen Anti-Slip System Type S consists of high-tensile-strength stainless steel cables which are fitted with stoppers. The cable is attached to specified fastening points on the building via pre-fitted loops or, in the case of equilateral loading (saddle or barrel roofs), laid over the ridge and securely anchored. T-shaped sills are positioned in front of the sill stoppers. The system is extremely simple to install and very sturdy. However, dimensioning and stopper distances must be calculated on an independent basis for every building. Height of the sills: 80 mm.

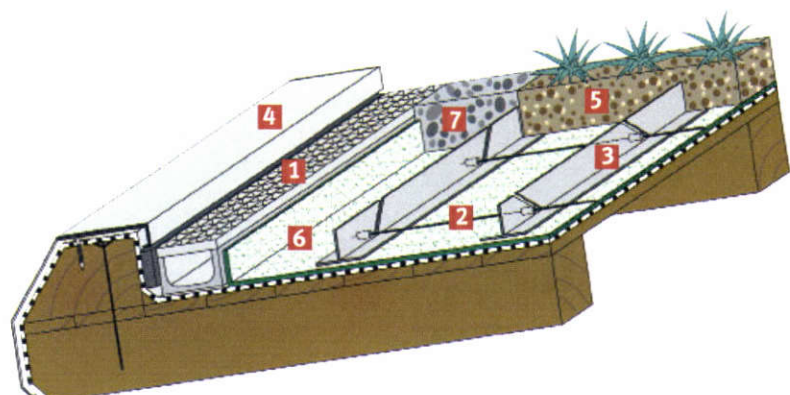


### Sill spacing Anti-Slip System Type S

Roof pitch	Sill spacing
up to 15°	1500 mm
16 – 20°	1000 mm
21 – 30°	500 mm
31 – 45°	250 mm



- 1 Maintenance bridge
- 2 Optigreen Ridge Fastening Set
- 3 Optigreen Vegetation Mat
- 4 Optigreen Extensive Substrate Type E
- 5 Optigreen Shear Sill
- 6 Optigreen Stainless Steel Cable with stopper
- 7 Optigreen Structured Storage Fleece Type SSV 800



- 1 Drainage conduit, height adjustable from 75 – 105 mm
- 2 Optigreen Stainless Steel Cable with stopper
- 3 Optigreen Shear Sill
- 4 Cover plate
- 5 Optigreen Substrate Type E
- 6 Optigreen Structured Storage Fleece Type SSV 800
- 7 Gravel strip