



ONDUGREEN EN-10/2017/1.000/001

- Established in **1944**
- **Worldwide leader** in lightweight roofing
- More than **70** years of industry experience
- Around **1600** employees from **43** nations
- **10** plants in **8** countries, fully certified
- Present in over **120** countries via **45** subsidiaries
- Over **150** million m² of roofing solutions sold every year

Onduline Avrasya A.Ş. is a subsidiary of Onduline Group which is operating in more than 120 countries with plants in 8 different countries. With rapidly growing product range since its establishment in 1994, Onduline Avrasya has wide range of solutions for the needs of clients for roofing, siding and waterproofing applications. Roofing sheets ONDULINE HR, ONDULINE ANDROMEDA, ONDULINE ZIGANA, ONDULINE ZIGANA TILE, ONDULINE XHR, ONDULINE FIT, waterproofing sheet for clay tiles ISOLINE, waterproofing membrane BITULINE and lightweight tile ONDUVILLA are manufactured by Onduline Avrasya in Sapanca plant.

System **ONDUGREEN®** Green Roof

- Environment friendly
- Thermal protection
- Eco friendly
- Aesthetical



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Onduline®

ZinCo

Çatılarda Hayat Var

Onduline®



Zorlu - Zincirlikuyu / İstanbul



Göksu Park Evleri / İstanbul

ONDUGREEN®



Fast urbanization in the cities all over the world has resulted in the loss of green lands. Natural surroundings that should normally exist have been replaced by concrete buildings. Air pollution has become a major worldwide problem.



Every year, natural surroundings are sacrificed in favour of urban developments whereas Green Roofs constitute the ideal solution for offsetting the loss of nature. That is why we have found in technically innovative and practicable solutions for integral use of the roof- from the so called extensive landscaped roof as an ecological protection layer up to beautiful "Roof Garden" which can be combined with footpaths and road surfaces.

To compensate the functions of the missing ground is the main requirement in view of establishing a durable vegetation on roof surfaces. Technically perfected Green Roof Systems from ZinCo Ingenieurwerkstatt + Gruendachsysteme combined with the experience of Onduline Avrasya in the roofing systems guarantee a durable success of landscaped roofs.

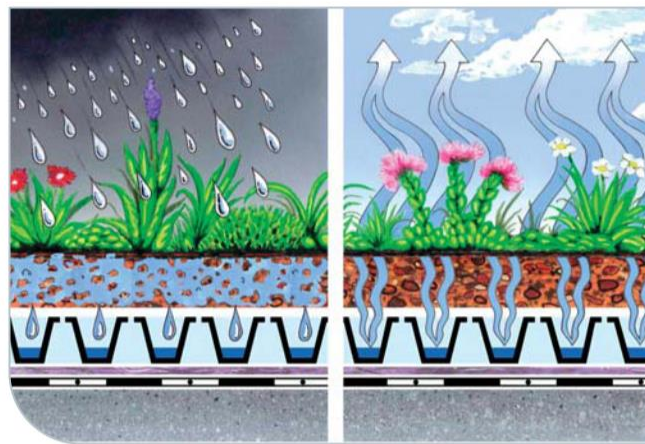
The Green Roof system helps twice to protect the environment: by using recycled products on the one hand relieving disposal sites and on the other hand giving nature the chance to reconquer space in the crowded cities.

Apart from the attractive appearance of a Green Roof there are also a lot of solid economical and ecological benefits, provided that there is a technically perfected Green Roof build-up which guarantees a durable success. Green Roofs are worth being installed- from small surfaces on garages or car ports up to large industrial surfaces.

ZinCo

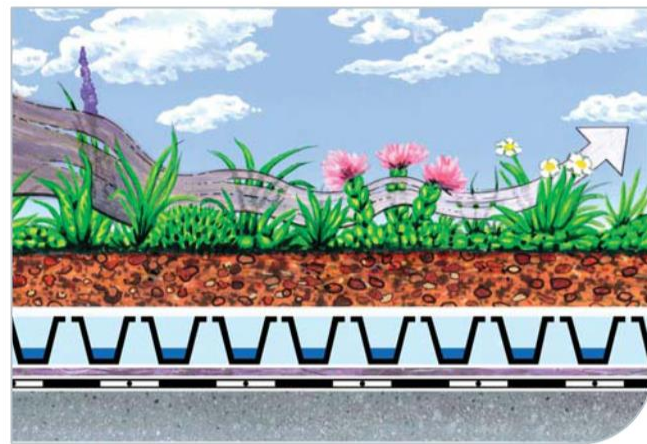


WHY A GREEN ROOF ?



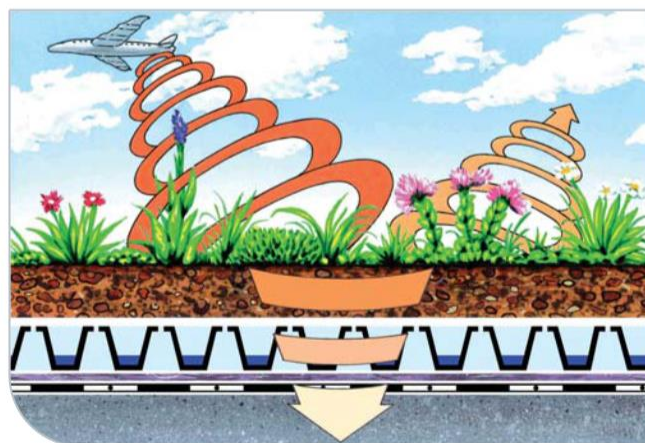
A- Reduced Sewer Cost

A Green Roof build-up reduces the water run-off to 50-100 %. The remaining water flows off with a time difference. So, with Green Roofs, it is ensured that the rainwater remains in the natural water cycle thereby reducing sewer cost.



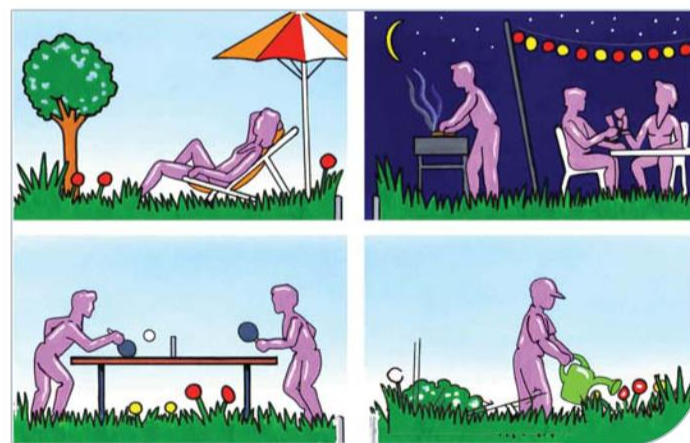
B- Reduction of Dust

A Green Roof helps to filter the dust particules in the atmosphere. The nitrates and other environmentally harmful substances on the air or the rainwaters are absorbed.



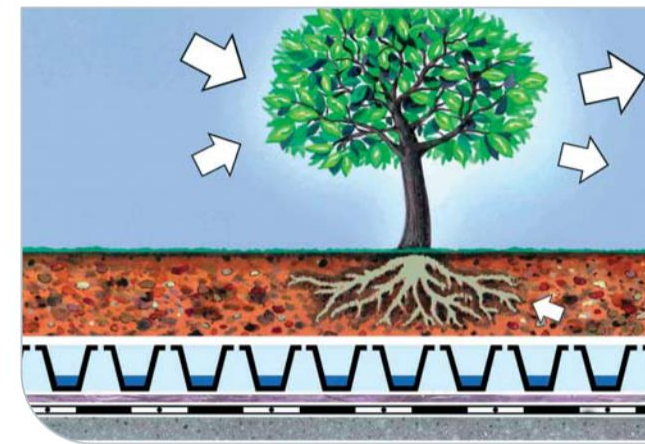
C- Reduced Noise Level

Due to the soft plant level of Green Roofs there is sound absorption instead of sound reflexion. Moreover, the sound insulation of a building can be reduced up to 8dB.



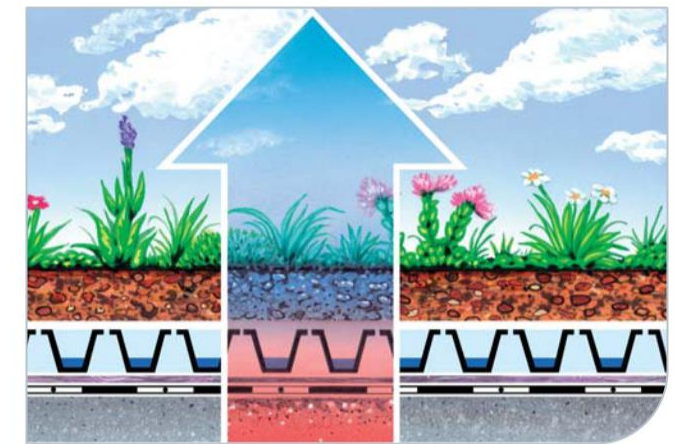
D- Use of Space

Roof Gardens offer additional space for leisure activities- without spending money on new and expensive building grounds.



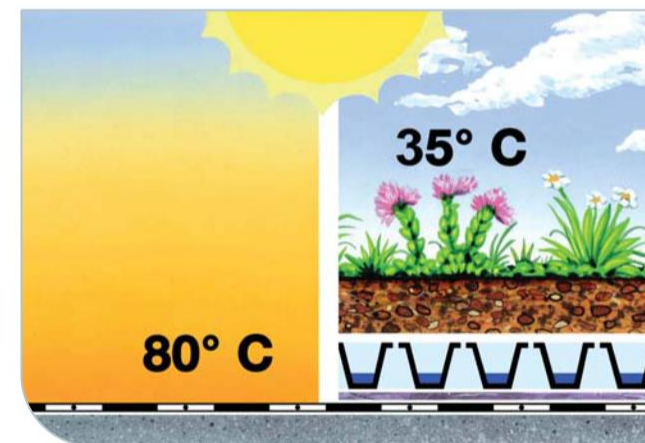
E- Reduction of Urban Heat Island Effect

The surfaces of Green Roofs improve the microclimate by cooling and humidifying the surrounding air. In addition the plants capture solar energy, extract carbon dioxide from the air, and combine it with water to produce organic substances. Through this process, plants release oxygen which guarantees more purified air.



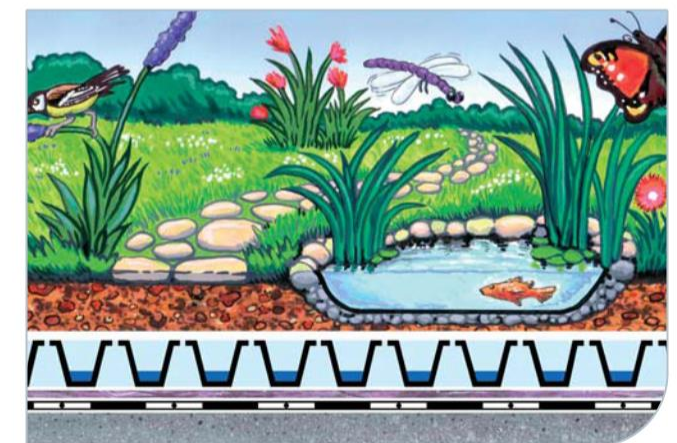
G- Reduced Energy Cost

Thermal insulating Green Roof build-up with official property values are allowed to be added to the conventional thermal insulation. Due to this special build-up, the building owner saves up to 50 % of the energy cost.



F- Reduced Renovation Cost

The waterproofing's life expectancy is increased, because it is better protected from UV-rays, hail and extreme temperature differences. It can be presumed, that the life expectancy of waterproofings is increased to more than 40 years if a Green Roof is installed.



H- Natural Habitat for Animals and Plants

At least a part of green surfaces which were sacrificed to building developments can be compensated by landscaped roofs, thereby reducing the quantity of sealed surfaces and encourage limited wildlife development.

GREEN ROOF SYSTEMS FOR EXTENSIVE AND INTENSIVE LANDSCAPED ROOFS



There are two methods of Green Roofs Systems; Intensive landscaping or Extensive landscaping. In Intensive landscaping if there is enough load bearing capacity it is possible to realize roof gardens (with higher maintenance): From lawn and demanding shrubs to bushes and even trees and ponds in combination with driveways and terrace surfaces. Provided that the right technology is used! Because the load bearing capacity of the roof has to be approx. 300 kg/sqm. Extensive

landscaped roofs are an ecological alternative for conventional surface protections such as gravel. And the load that has to be supported by the roof is less than 100 kg/sqm. Regarding installation and maintenance they cause only small additional costs. Suitable plants are mosses, sedum-species, herbs and some grasses. After installation the maintenance is limited to 1 or 2 inspection checks a year.



FUNDAMENTAL BUILD-UP LEVELS

1- Plant Material

Suitable plants to the climate of the area when installed in proper system will last for years.

2- Growing Medium (vegetation level)

A roof planting soil which is adapted to the plant level. The base of each roof planting soil is "Zincolit" which is completely mineral material on the basis of crushed clay bricks, enriched with the organic material "Zincohum".

3- Filter and Drainage Levels

Prevents fine particles from being washed out of the substrate soil, thereby ensuring efficiency of the drainage layer. Profiled drainage elements retain rainwater for dry periods in troughs on the upperside. The surplus-water is drained off through the channel system on the underside. Special holes ensure evaporation and the necessary ventilation. The extra large water retaining troughs on the upperside supply the plants in dry periods.

4- Moisture Retention and Protection Mat

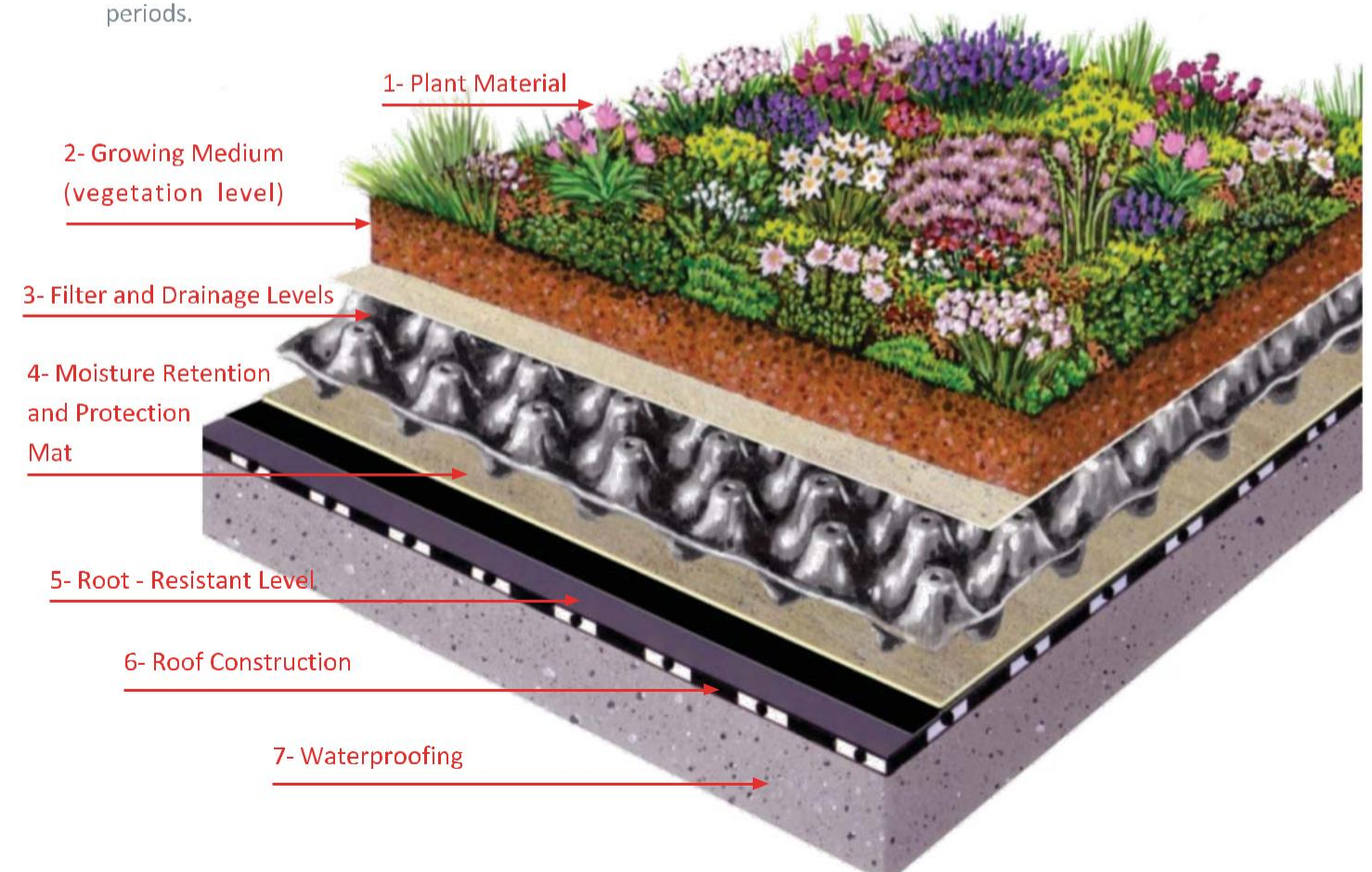
Provides mechanical protection and retains moisture and nutrients.

5- Root - Resistant Level

Prevents roots from affecting the efficiency of the waterproofing in case there is not a root-resistant one.

6-7- Roof Construction and Waterproofing

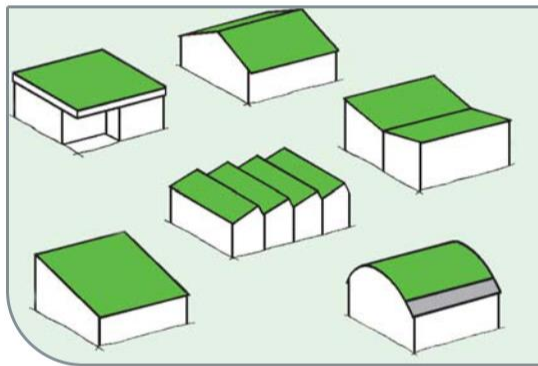
The Green Roof can be build-up on a strong and well waterproofed roof structure. The use of Bituline waterproofing membranes gives a perfect waterproofing to the roofs.



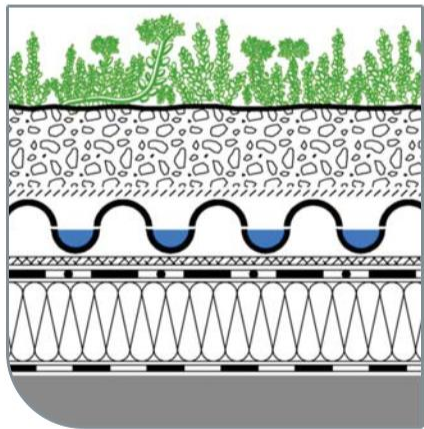
ROOF TYPES



In most of the cases the Green Roof is build-up on a minimum 2% pitched and well waterproofed flat roofs. However the Green Roof can be build up in all type of roofs from gable to hip, gambrel or shed up to 51° (123%). For higher pitched roofs particular preventions are suitable. There is also particular methods for flat roofs without drainage.

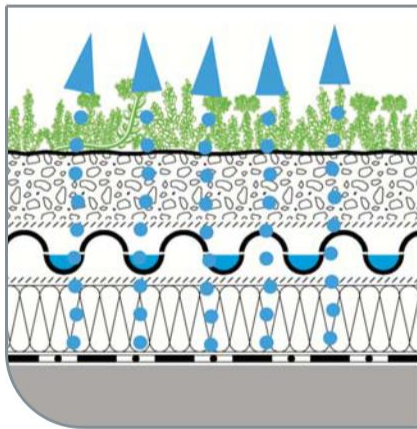


There are not only different types of roofs, they show also differences of building systems and used materials. In principle, there is always a method for building a green roof on any type of roof. For application of a green roof system on multistorey car parkings, warehouses and storage buildings, shadings, etc. the only limitation is the weight carriage capacity of the structure. For heat insulated roofs there are several types of methods of green roof system.



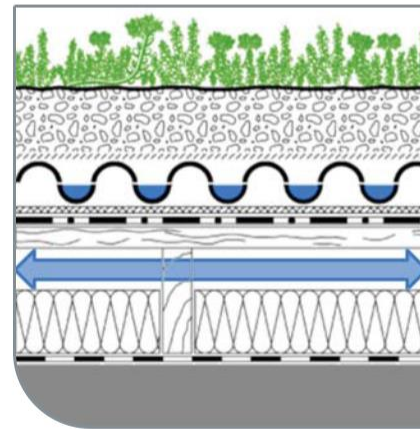
Single Shell Roofs Without Ventilation

This type of traditional "warm roof" is very commonly used. In order to apply green roof system in a single shell non insulated roofs a vapor barrier membrane of resistance of at least $s_d=100$ m should be applied under the heat insulation layer. All types of green roof system could be applied on traditional warm roofs.



Single Shell in Inverted Roofs

This type of roof has the heat insulation on top of the water insulation and are used more often. The materials used for the green roof system have to be chosen carefully in order to let the heat insulation material dry easily which is getting always wet. For this reason the anti-root layer should never be installed over the heat insulation layer.



Double Shell Roofs With Ventilation

This type of roof commonly named "cold roofs" there is an empty space over the heat insulation for ventilation purposes. The water insulation is applied over the second roof structure. This system causes no any particular problem for green roof application. The only particular point to respect is that the material used for the second roof shell structure as OSB, plywood, etc should have the carriage capacity of the additional weight caused by the green roof system.



Birlik Life 61 - Bayrampaşa / İstanbul



Zorlu / İSTANBUL



Micosta - Çeşme / İZMİR



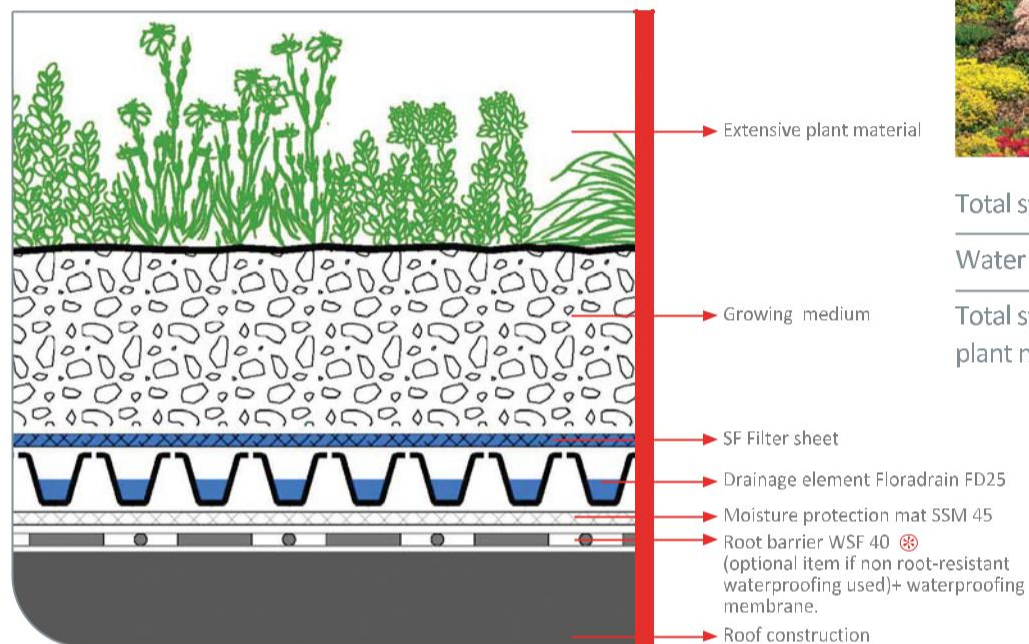


1- Extensive System Application on Flat Roofs With Minimum of 2% of Pitch

Floradrain drainage sheet should be used for green roof application on classical flat roofs with minimum of 2 % of pitch and sloped roofs with maximum of 18 % of pitch.



Total system thickness: ~ 11 - 13 cm
Water storage capacity: ~ 40 - 50 l/sqm
Total system weight including the plant material: ~ 80 - 100 kg/sqm

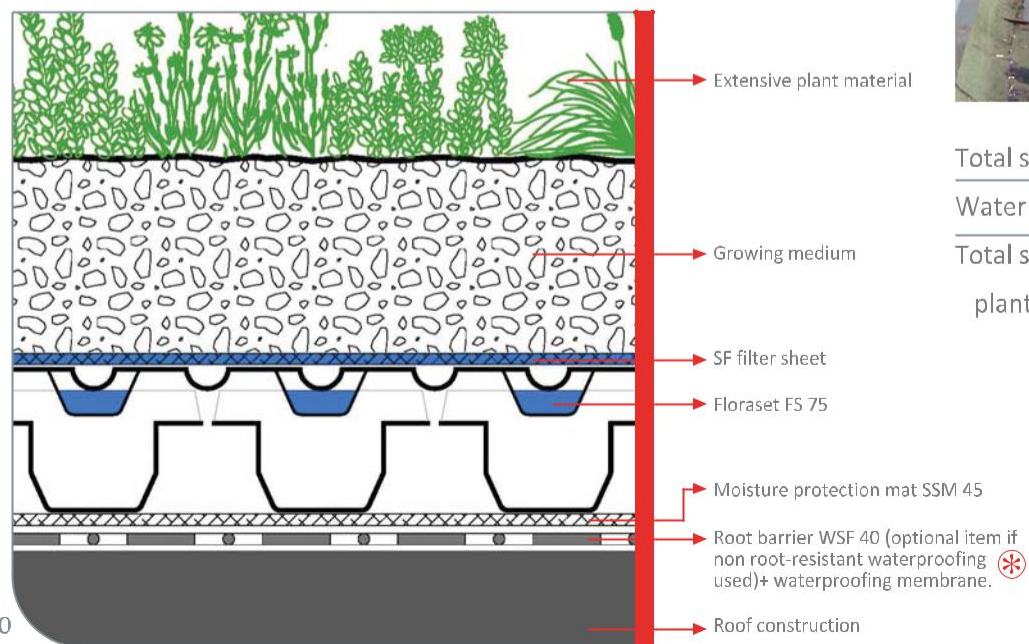


2- Extensive System Application on Flat Roofs Where Deeper Puddles Remain

The puddles could damage the plant material. To prevent this the distance between the water level and the growing medium has to be ensured by installing deeper Floraset EPS drainage elements.



Total system thickness: ~ 14 cm
Water storage capacity: ~ 10-20 l/sqm
Total system weight including the plant material: ~ 65-90 kg/sqm

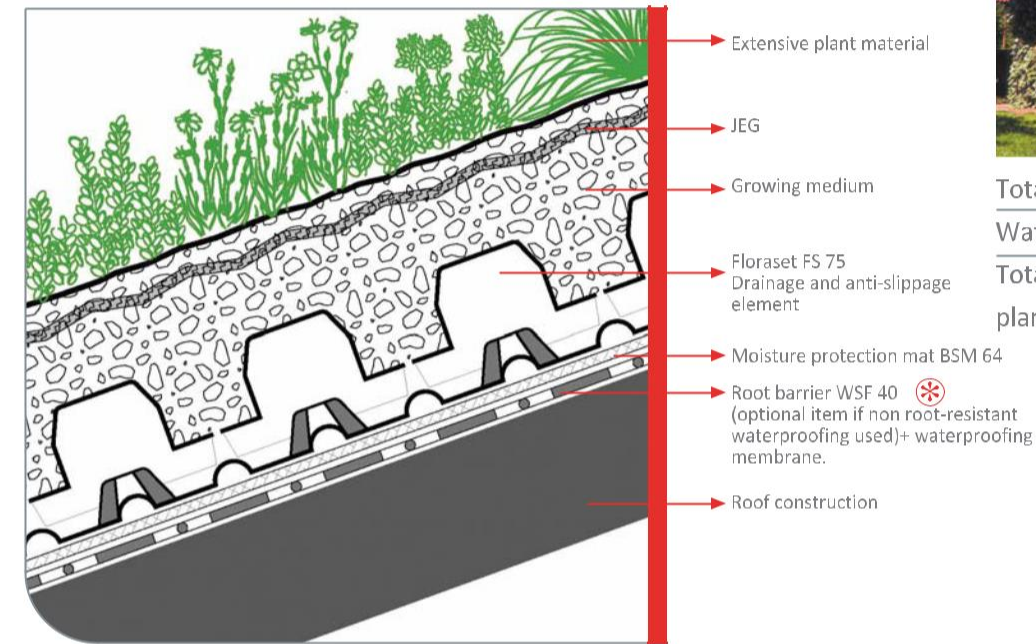


3- Extensive System Application on Sloped Roofs 20 % - 40 % of Pitch

In the sloped roofs the system has to be ensured against slippage. For this purpose Floraset polystyrene drainage and anti-slippage element should be used. In addition an anti-erosion mesh made of jute will prevent erosion.



Total system thickness: ~ 13 - 15cm
Water storage capacity: ~ 30-40 l/sqm
Total system weight including the plant material: ~ 80 - 100 kg/sqm

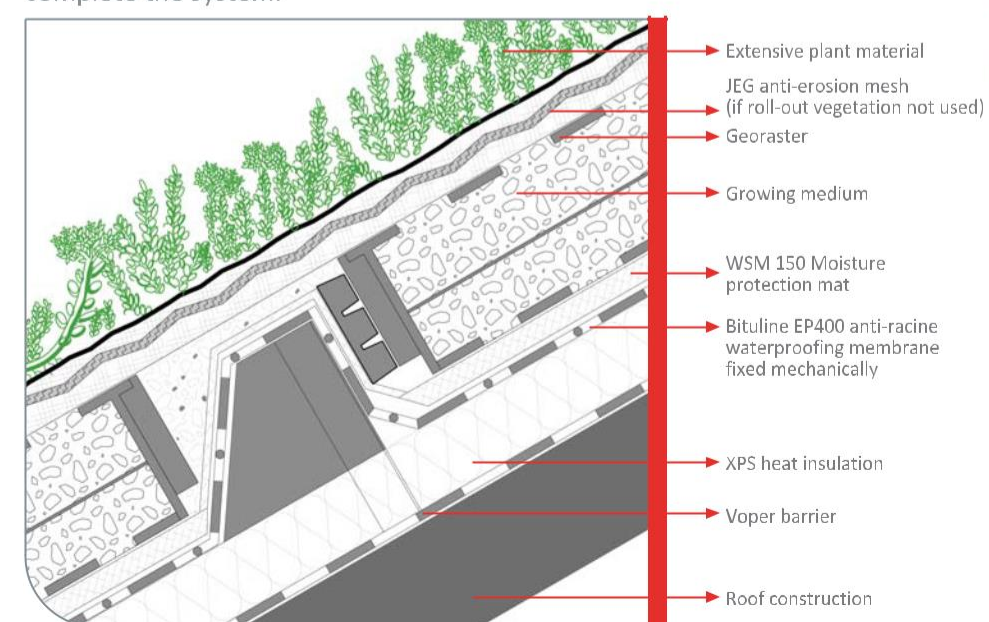


4- Extensive System Application on Steep Sloped Roofs of 40 %- 100 % of Pitch

In the steep sloped roofs the system has to be ensured against high slippage risk. For this purpose Zinco Georaster element for steep sloped roofs has to be used. This element provide a secure hold for the growing medium against water and wind erosion even in pitches of 100 % (45°). With the use of Georaster there is no need to use a root barrier, an anti-root waterproofing fixed mechanically and WSM 150 moisture protection mat for water and nutrient retention complete the system.



Total system thickness: ~ 15 cm
Water storage capacity: ~ 68 l/sqm
Total system weight including the plant material: ~ 155 kg/sqm



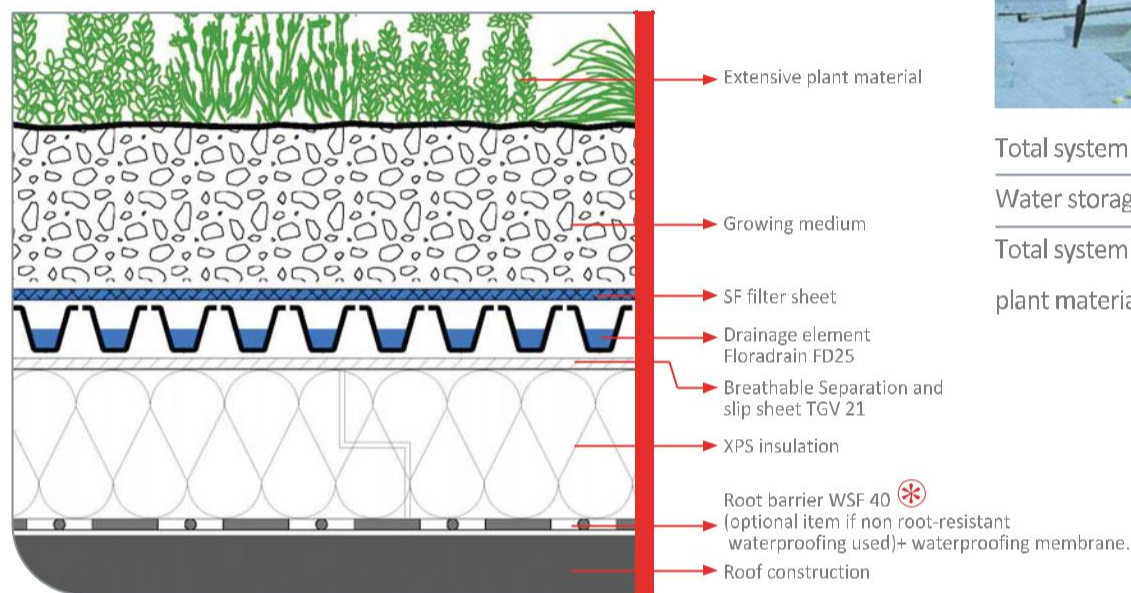


5- Extensive System Application on Inverted Roof

In the inverted roof systems commonly used for the heat insulated flat roofs, the XPS thermal insulation is placed over the waterproofing membrane and is exposed to the rain water. The layers of the system which prevent damp air from vapourizing shouldn't be installed on top of the thermal insulation boards; the insulation will stay wet. Therefore thicker water retention and protection mats must be replaced by a diffusion permitting separation and slip sheet TGV 21. If root barriers are necessary, they have to be placed underneath the insulation boards directly onto the waterproofing.



Total system thickness: ~ XPS + 11 - 13 cm
Water storage capacity: ~ 35 - 40 l/sqm
Total system weight including the plant material: ~ 80 -100 kg/sqm

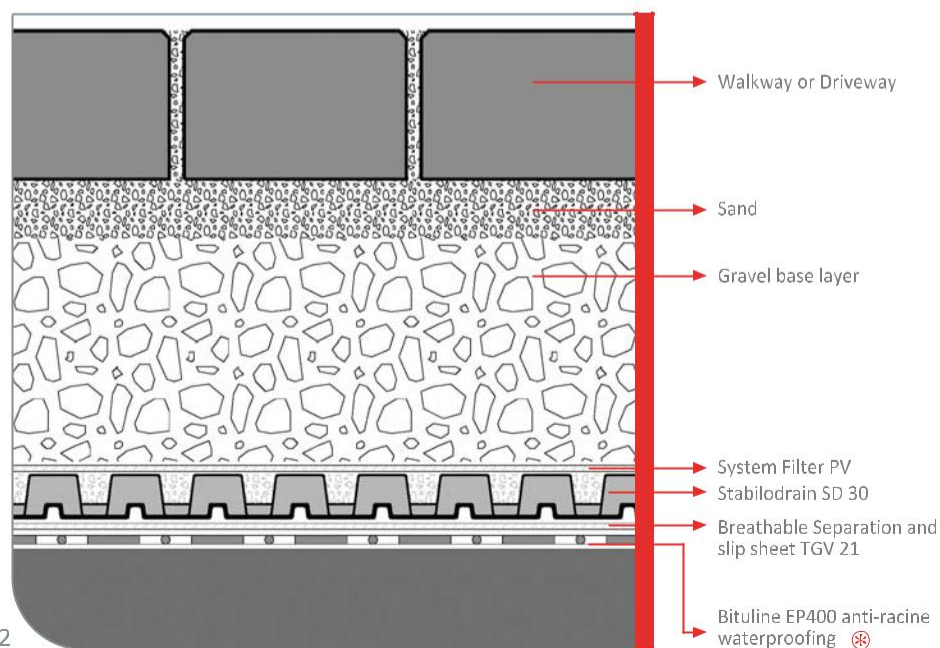


6- Application on Driveways and Walkways

The drainage layer used under the driveways and the walkways should have highest mechanical resistance. Waterproofing with anti-root membrane is inevitable in areas without plant material. The drainage under the walkways or driveways is used for draining the water retained by the concrete elements and prevents from freezing.



Total system weight including the plant material: ~ 550 kg/sqm



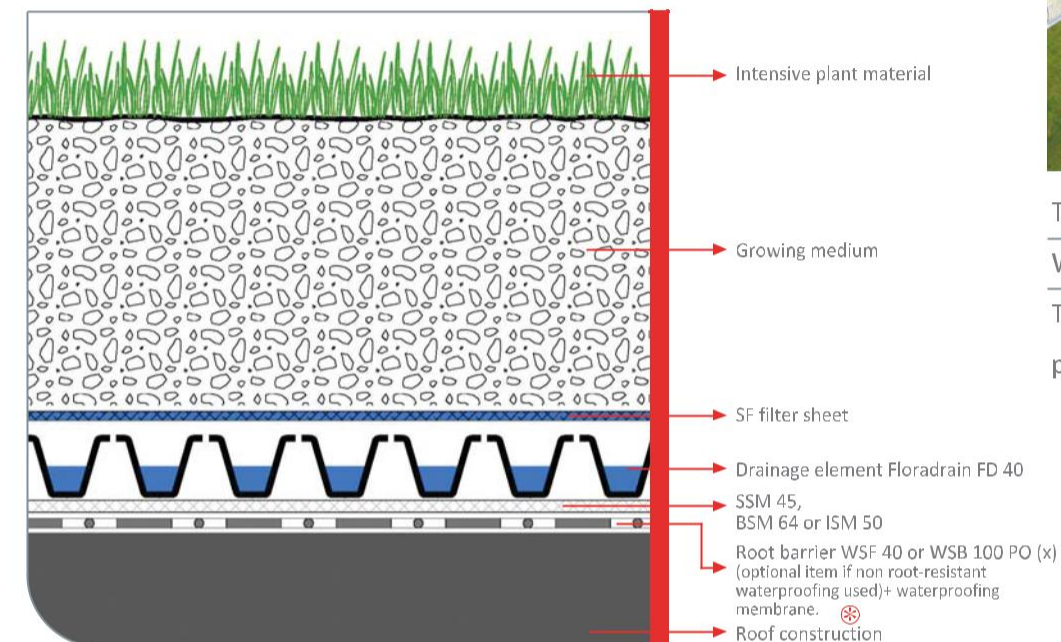
If waterproofing is provided by Bituline EP 400 +EP 400 Antiracine, additional root barrier is not necessary. For detailed information see page 16.

7- Intensive System Application on Flat Roofs With Minimum of 2 % of Pitch

Floradrain FD 40 drainage sheet should be used for Intensive green roof application with its good water retaining and drainage capacity and high mechanical resistance. The type of planting and its ultimate size will determine the moisture protection mat and root barrier types.



Total system thickness: ~ 20 - 25 cm
Water storage capacity: ~ 68 l/sqm
Total system weight including the plant material: ~ 150 - 250 kg/sqm



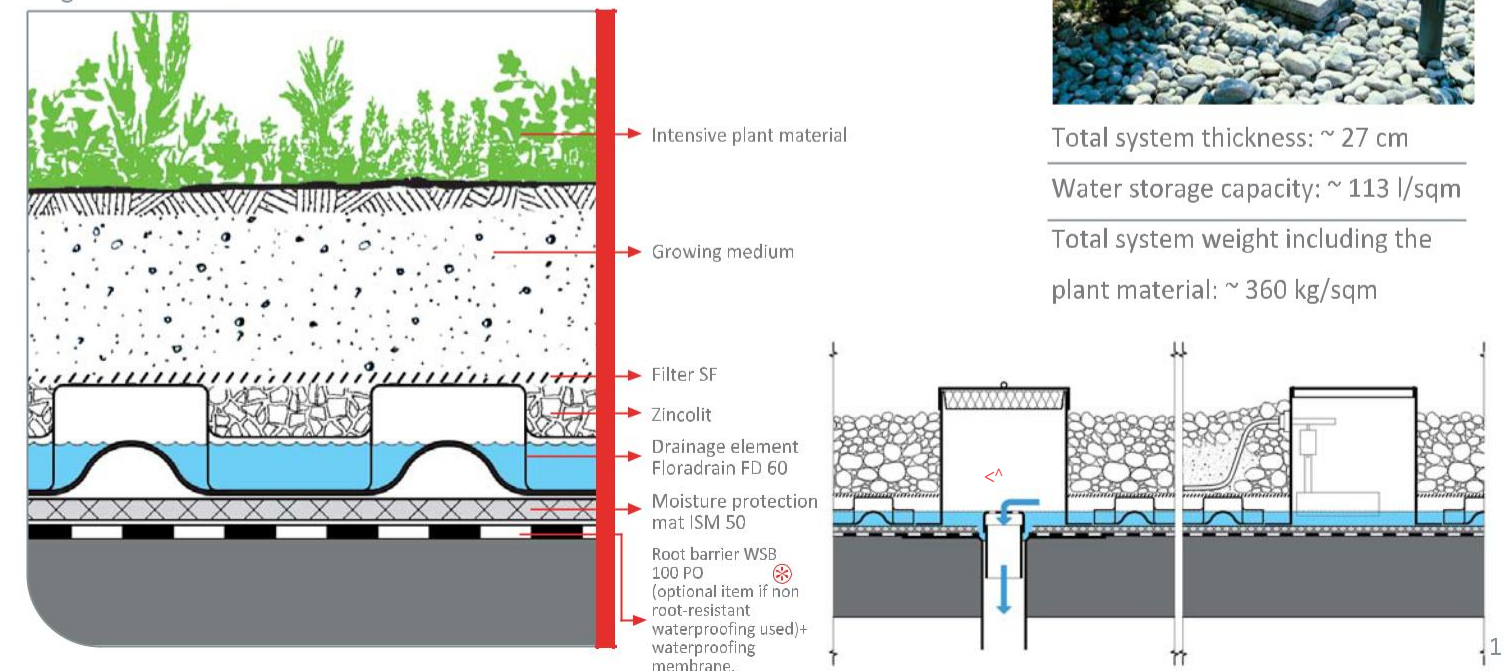
(x) For plants bigger than 50 cm EP 400 Antiracine to be used.

8- Intensive System Application on Flat Roofs With Automatic Irrigation

Floradrain FD 60 drainage sheet allows the automatic irrigation of lawns, hedges, large shrubs, large bushes and trees for the Intensive green roof application. The level of the water retained on the substrate will be maintained by use of Zinco irrigation unit BS 32



Total system thickness: ~ 27 cm
Water storage capacity: ~ 113 l/sqm
Total system weight including the plant material: ~ 360 kg/sqm



GROWING MEDIUMS: ECOLOGICAL SOLUTIONS WITH LOCAL MATERIALS



long term nutrient supply and resistant to frost and wind erosion. The duo Zincolit+Zincohum are the unchangeable contents of the green roofs.



For the growing mediums of the system Ondugreen we use recycled natural clay tile chippings instead of synthetically obtained substrate such as lava, pumice, etc. because the organic content decomposes and prevent the drainage resulting in plant failure. The choice of the materials is also essential for the ecological point of view which is behind the green roof idea; therefore the waste material of the clay tile production is utilized in an effective way for the environment.

The "Zincolit", a recycled mineral bulk material on the basis of clay tile chippings and the plant soil enriched with the organic material "Zincohum" have been chosen as the most suitable growing medium for green roofs specially for sedum species for which they provide stable

Best Suitable System Substrate for Green Roofs.

- 1-Crushed brick
- 2- Plants
- 3- Harrow and sifter
- 4- Compost facility
- 5- Mineral content
- 6- Organic content

CHEMICAL AND PHYSICAL PROPERTIES	ZINCOLIT	ZINCOHUM
Weight/unit Dry Wet	approx 1000-1200 g/l approx 1200-1350 g/l	approx 500 g/l approx 800 g/l
Water/air quantities Cavity volume Water retention capacity Air volume Water permeability capacity	approx % 60 approx % 20 approx % 40 at last 0.75 cm/sec.	approx % 60
PH valour Salt Quantity	6.5 - 8.0 Maximum 2.0 g/l	6.5 - 7.5 Maximum 2.0 g/l
Nutriments Nitrogen Phosphor potassium magnesium	100 - 200 mg/l 200 - 400 mg/l 300 - 800 mg/l 150 - 300 mg/l	

IDEAL PLANTS FOR ROOF GARDENS

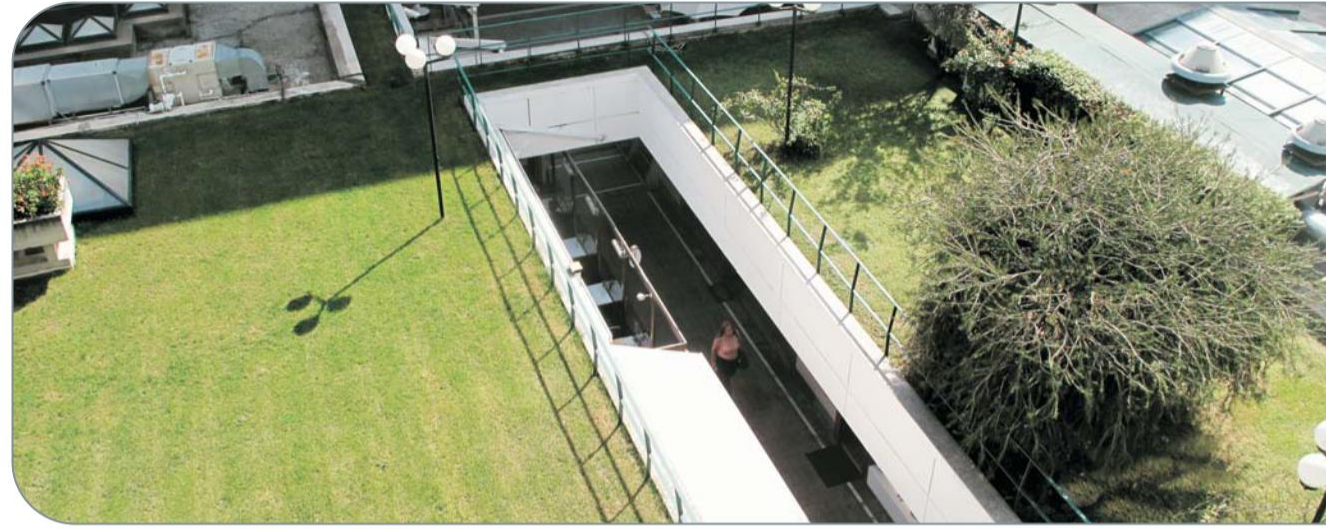


In extensive green roofs plant material should be chosen from maintenance free species. Sedum Carpet" is a low, ground-covering extensive green roof vegetation on a substrate layer of approx. 60 mm which is mainly applied where - apart from low weight - also low maintenance costs are demanded. There are a wide variety of sedums, herbs and grasses that meet these requirements. They come in a wide range of leaf and flower colours and they root quickly. In general planting should be done between spring and early fall but the fastest growing result can be obtained by planting in March-April. The main flowering season of the "Sedum Carpet" is in early summer. The dominating colours are yellow and red/white.



Plant List "SEDUM CARPET"				
Botanical name	Height (cm)	common name	colour of blooms	flowering time (monthly)
Sedum album varieties	5-10	White Stonecrop varieties	White	June - August
Sedum floriferum varieties	10-15	Russian Stonecrop	Yellow	July - August
Sedum hybridum	10-15	Stonecrop hybrid	Yellow	July - August
Sedum reflexum	10-15	Crooked Yellow Stonecrop	Yellow	June - July
Sedum sexangulare	5-10	Tasteless Yellow Stonecrop	Yellow	June - July
Sedum spurium in Sorten	10-15	Two-row Stonecrop varieties	Red-White	June - August

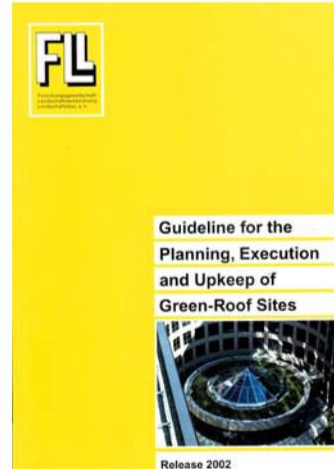
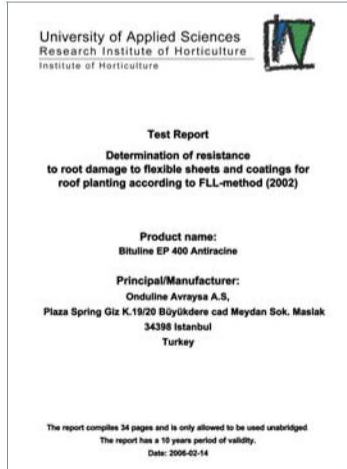
The 6 or 7 different low-growing Sedum species which belong to the plant community "Sedum Carpet" are spread as shoots or applied as plants with small root balls over the Zincolit substrate layer and covered with 10-15 l/sqm Zincohum plant soil and irrigated. With this method by using 50 g/sqm of sedum carpet we may obtain a perfect roof garden within 2-3 years. For bigger roof surfaces it is possible to spread the shoots of sedums, seeds of mosses, herbs and grasses with pressurized water pump.



In extensive or intensive green roof applications the waterproofing of the roof has to be protected against root damages. The use of protective concrete layer applied on familiar waterproofing membranes is not the effective solution for preventing most of the plant roots to damage the waterproofing. Therefore the use of a special root barrier on top of the existant waterproofing or an anti-root waterproofing membrane is necessary.

The Bituline EP400 Anti-racine membranes are used for intensive or extensive roof planting of gardens and are resistant to root perforation or penetration damages. The Bituline Anti-racine membranes have been tested during two years by Forschungsgesellschaft für Landschaftsentwicklung und Landschaftsbau (University of Applied Sciences Research Institute of Horticulture) in Germany by FLL method and granted FLL root resistance Certificate. (x)

With the use of Bituline EP400 anti-racine in the waterproofing of the green roof application another root barrier is not necessary. And the result is more safe and economic.



(x) Except bambou species. There is no any anti-root product for these species. Therefore it is better do not use these species in the green roof systems or the use of stainless steel tanks is recommended.



FLORADRAIN FD 25
Drainage and Water-Retaining Element

Width: 1 m Length: 2 m
Weight: ~ 1,7 kg/sqm
no overlapping is necessary.
Article nr: 04160003025



FLORADRAIN FD 40
Drainage and Water-Retaining Element

Width: 1 m Length: 2 m
Weight: ~ 1,9 kg/sqm
no overlapping is necessary.
Article nr: 04160003040



STABILODRAIN SD 30
High Pressure Resistant Drainage and Water-Retaining Element

Width: 0,94 m Length: 2 m
Weight: ~ 3 kg/sqm
no overlapping is necessary.
Article nr: 04160003330



FLORADRAIN FD 60
Drainage and Water-Retaining Element

Width: 1 m Length: 2 m
Weight: ~ 2,3 kg/sqm
no overlapping is necessary.
Article nr: 04160003060



FLORASET FS 75
Drainage and Anti-Slippage Element for 0% Roof and Sloped Roofs of 20% - 40% of Pitch.

Width: 1 m Length: 1 m
Weight: ~ 1 kg/sqm
no overlapping is necessary.

Article nr: 04160003075



GEORASTER
Antierosion Element for Steep Sloped Roofs of 40% - 100% of Pitch

Dimensions of module: 54 X 54 cm
Grid dimension: 62,5 cm
Weight: ~ 1,8 kg/pcs
1 sqm :2,56 Pcs.

Article nr: 04160003400



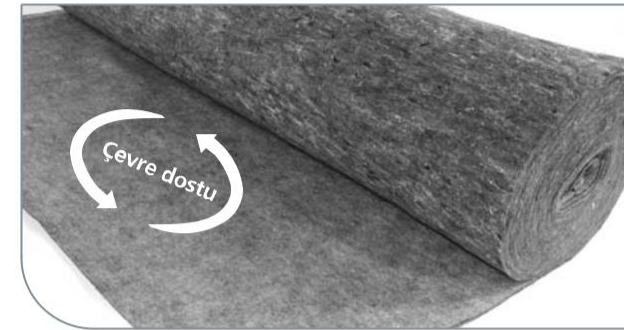
Breathable Separation and Slip Sheet TGV 21

Width: 1,60 m Length: 250 m
Weight: ~ 80 g/sqm
10 cm of overlapping is necessary.
Article nr: 04160002180



SSM 45
Moisture Protection Mat for Flat Roofs

Width: 2 m Length: 50 m
Weight: ~ 470 g/sqm
10 cm of overlapping is necessary.
Article nr: 04160002045



BSM 64
Moisture Retention and Protection Mat

Width: 2 m Length: 25 m
Weight: ~ 650 g/sqm
10 cm of overlapping is necessary.
Article nr: 04160002064



ISM 50
Moisture Retention and Protection Mat

Width: 2 m Length: 25 m
Weight: ~ 850 g/sqm
10 cm of overlapping is necessary.
Article nr: 04160002050



WSM 150
Moisture Retention and Protection Mat for Steep Sloped Roofs

Width: 1 m Length: 15 m
Weight: ~ 1500 g/sqm
10 cm of overlapping is necessary.
Article nr: 04160002015



PV
System Filter High Pressure Resistance

Width: 2,25 m Length: 50 m
Weight: ~ 330 g/sqm
10 cm of overlapping is necessary

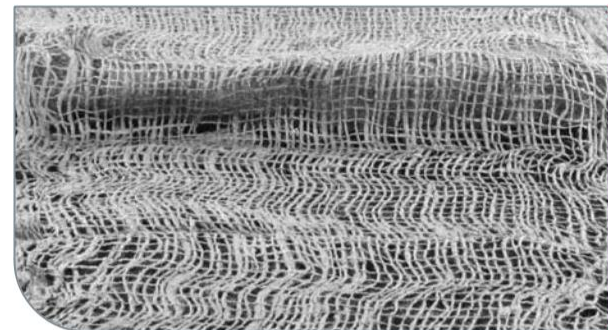
Sipariş Kodu: 04160002131



WSF 40
Optional item if non root-resistant waterproofing used
Width: 8 m Length: 25 m
Weight: ~ 320 g/m²
1,5 m of overlapping is necessary
Sipariş Kodu: 04160001040



WSB 100-PO
Optional item if non root-resistant waterproofing used
Width: 2,44 m Length: 30,50 m
Weight: ~ 1,13 kg/m²
10 cm of overlapping is necessary
Sipariş Kodu: 04160001084



JEG
Anti Erosion Mesh

Width: 1,22 m Length: 70 m
Weight: ~ 500 g/sqm
10 cm of overlapping is necessary

Article nr: 04160002856



KS6 - KS10
Inspection Chamber

Chamber Size : 30 x 30 cm
Flange Size : 30 x 54 cm
Weight : ~ 3 kg/pcs - 3.3 kg/pcs
Height : 6 cm - 10 cm

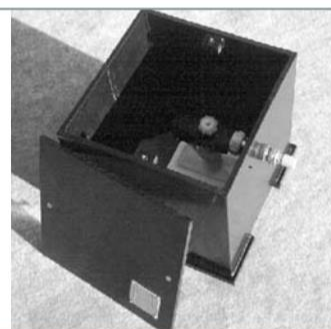
KS6 Article nr: 04160004006

KS10 Article nr: 04160004010



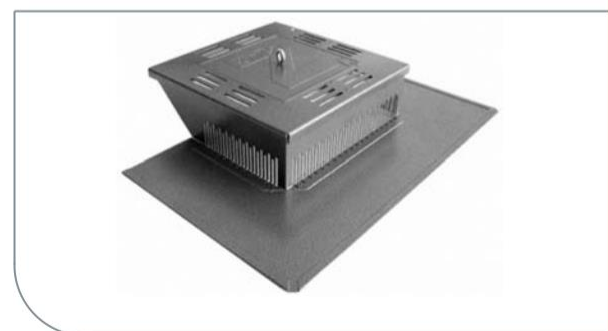
KS 30
Inspection Chamber

Width : 30 cm Length: 30 cm
Weight : ~ 4 kg/pcs.
Height : 30 cm
Article nr : 04160004035



B 32
Automatic Irrigation Unit

Width : 30 cm Length: 30 cm
Weight : ~ 7 kg/pcs.
Height : 32 cm
Article nr : 04160004031



AKS 8 Inspection Chamber for parapets

Chamber size: 30 cm x 30 cm
Flange size: 39 cm x 47 cm
Height: 8 cm
Weight: ~ 2.5 kg/pcs
KS A 8 Article nr: 04160004007



KS A 8 - KS A 20
Inspection Chamber

Width : 30 cm Length: 30 cm
Height : 8 cm - 20 cm
KS A 8 Article nr: 04160004008
KS A 10 Article nr: 04160004020



ZINCOLIT EKSTENSİF
Growing Medium
Article nr: 04160005000



ZINCOLIT İNTENSİF
Growing Medium
Article nr: 04160005010



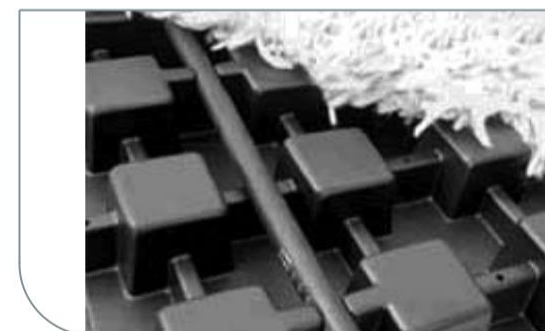
SF System Filter
Width: 2 m Length: 100 m
Weight: ~ 100 g/sqm
20 cm of overlapping is necessary.
Article nr: 04160002100



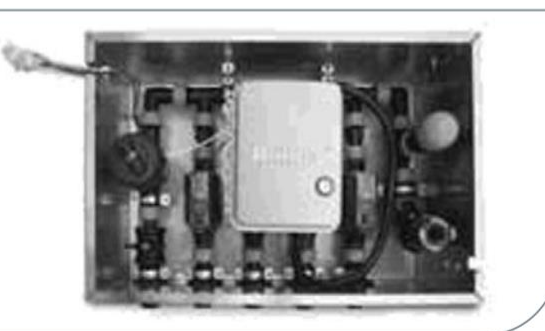
AQUATEC AT 45
Width: 1 m
Length: 2 m
Weight: ~2 kg/m²
Height: 45 mm



WICKING MAT DV 40
Width: 2,10 m (10 cm bini payı)
Length: 25 m
Weight: 600 g/m²
Height: 40 mm (lifler dahil)



DRIPPERLINE 100-L1
inside Diameter: 13,7 mm
Outside Diameter: 16,1 mm
Roll Length: 100 m



IRRIGATION CONTROL UNIT
BM4
Width: 580 mm
Length: 390 mm
Weight: 14 kg
Water pressure. 1,5 bar