DIADEM®

The ultimate eco-friendly roof exclusively from

icb

The name behind the Ultimate Green Roof

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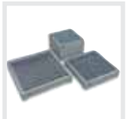

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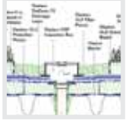


Introduction

I.C.B. (International Construction Bureau) Ltd. produces a comprehensive range of flat roofing products including: single ply waterproofing membranes from Alwitra® in Germany who also manufacture rainwater outlets, roof vents, paving slab supports, wall cappings & flashings; sophisticated engineered perimeter profiles for fascias in their Artline range, with the option of colour coating, and rooflights incorporating a wide variety of products from ventilated units to access hatches, sun blind/blackout screens and automatic smoke venting systems. The Alwitra® Roofing System has at its core two waterproofing membranes, the EVA based Evalon (V) and the EPDM based Evalastic (V).

Both membranes offer excellent waterproofing properties and both can be covered with a choice of warranties; product, insurance backed or latent defects. These guarantees provide the option for complete cover for; product, design and workmanship for periods of 10, 15 or 20 years, subject to a premium.

The waterproofing system is also ideal for 'green roof' designs, being root resistant. Included is the necessary drainage/reservoir layer together with the appropriate growing medium substrate to accommodate the 'Extensive' (sedum) or 'Intensive' (plants, shrubs, turf, etc.) roof-garden finish required.

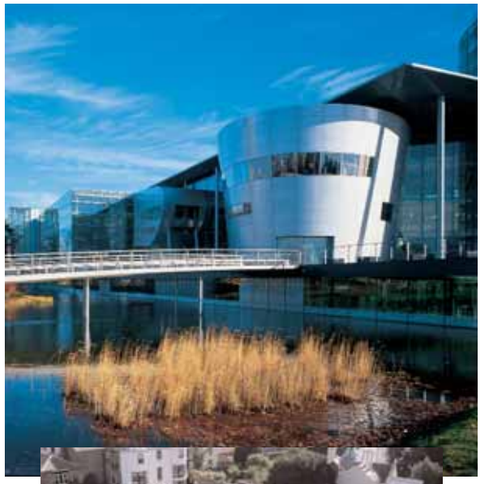
With the current concerns of global warming combined with rising energy costs, a timely innovation in the Alwitra® Roofing System is Evalon® Solar. This waterproofing membrane incorporates flexible thin film amorphous silicon photovoltaic cells, giving the opportunity to provide electricity into the building whilst at the same time making the building watertight.

The Evalon® Solar membrane is therefore classified as a Building Integrated Product and as such, is favoured by the Department of Trade and Industry (D.T.I.) when it comes to the decision regarding the awarding of and level of grants available through the Energy Savings Trust (E.S.T.) for solar installations. In addition to providing savings on energy costs, there are, of course, the environmental benefits in the resultant reduction of carbon emissions. Building Integrated Photovoltaic (B.I.P.V.) and Green Roof systems help towards creating a sustainable environment.

All of our installations are carried out by trained and licensed roofing contractors and our products carry all the necessary certifications. In addition, a full technical back up service is provided including: the production of specifications/NBS plus, wind uplift, roof drainage capacity, 'U' Value insulation and condensation risk analysis calculations. We can also provide advice on insulation and cut to falls/tapered schemes.

For a complete overview of the system, a CPD seminar can be booked. The seminar, titled 'A Flexible Approach', covers all aspects of good flat roofing design with the emphasis on sustainability through the use of modern materials with a long life expectancy and minimal impact on the environment.

All your roofing needs are encompassed in the I.C.B. Alwitra® Roofing System.



Providing space – preserving values: essential functions of a roof. To protect the things valuable to him, man has built roofs from leaves, snow, stone, wood, cloth, - whatever nature or technology made possible. Thus he created space for living, culture, individual forms of expression and aesthetics.

Roofs are a part of our history and our tradition, but they also reflect the development of new technologies and progress. That is why for Alwitra® a roof is not merely a roof but an expression of human creativity which can lead to fascinating architecture.

Advantages of a complete system
- Guarantee
- Easy organisation
- Product harmony

For this reason, most products have been rigorously tested for essential properties. Test certificates prove that the recycled materials used fulfil the most stringent criteria. Our portfolio of completed projects, which covers several European countries, displays ample proof that ecological construction has an ever larger role to play in a world where resources are limited.

The roof-garden products are manufactured by APP and are made from recycled materials. Great value is laid not only on environmental criteria, but also on the quality.

Harmony of Brand Products

Alwitra's Evalastic® EPDM roofing membrane in combination with APP's Diadem roof garden range provide the ultimate sustainable flat roof.

...IT MAKES ECONOMIC SENSE

Save on drainage charges

Increase the utility and value of the building

Increase the lifespan of the roof

Insulate: keep the cold out in winter, the heat out in summer

Reduce noise pollution

Reduce smog through absorption.

... IT MAKES ECOLOGICAL SENSE

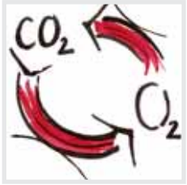
Retain plants and microhabitats on an area left to nature

Create new habitats for plants, animals and people

Reduce the strain on the sewerage system by improving water retention.

Improve the climate by the resulting evaporation.

Filter out dust and pollutants



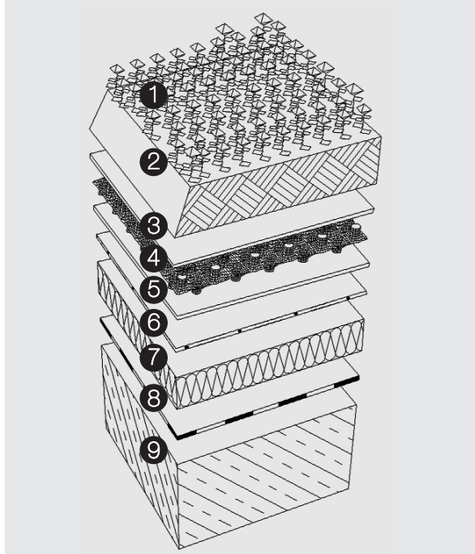
Oxygen produced and CO_2 absorbed via photosynthesis

Roof Gardens

Plants	1
Substrates	2
Filter Fleeces	3
Drainage - Reservoir Boards	4
Protective Fleeces	5
Evalastic V (Waterproof Membrane)	6
Insulation	7
Vapour Control Layer	8
Roof Deck	9

Intensive Roof Gardens

Intensive roof-gardens include plantings of small and medium shrubs, grassed areas and occasionally, trees. They may cover whole areas at the same level, be stepped or form islands. In their flexibility of layout and use, they offer just as many possibilities as a garden on the ground. The plants used make substantial demands on the layers, and they require regular watering and feeding. This type of cultivation can only be made to last by regular care.

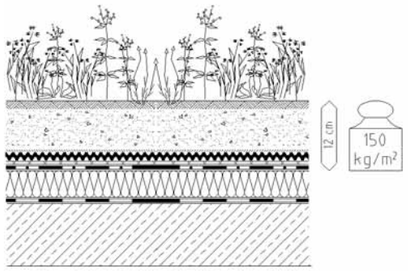


Extensive Roof-Gardens

Extensive roof-gardens are areas of vegetation close to those found in nature, and which to a great extent, look after themselves and develop naturally. They require plants that are particularly suitable to extreme conditions and have a high capacity for regeneration. These mainly self-contained areas are made up from mosses, succulents, herbs and grasses. The vegetation is left at the mercy of natural conditions. The costs of establishing Extensive roof-gardens are lower than of Intensive ones.

Typical Roof Garden Build up

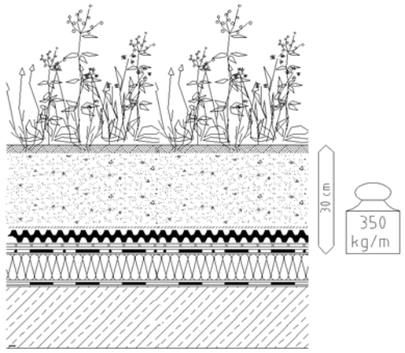
Extensive Roof-Garden Set Diadem-150



- Vegetation
  Sedums-Herbs-Grasses
- Multi-layered Extensive Substrate
- VLF-150 Filter Fleece
- Diadrain-25 Drainage and Reservoir Board
- VLU-300 Protective Fleece

Saturated weight: c. 150 kg/m²
Total height: c. 120 mm

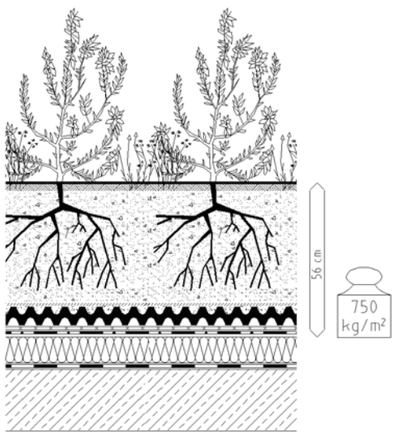
Simple Intensive Roof-Garden Set Diadem-350



- Vegetation
  Grasses-Shrubs-Small Trees
- Multi-layered Intensive Substrate
- VLF-200 Filter Fleece
- Diadrain-40 Drainage and Reservoir Board
- VLS-500 Protective and Reservoir Fleece

Saturated weight: c. 350 kg/m²
Total height: c. 300 mm

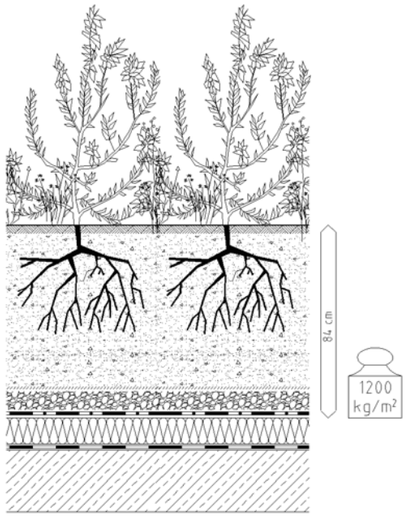
Intensive Roof-Garden Set Diadem-750



- Vegetation
  Shrubs-Small Trees-Lawns-Trees
- Multi-layered Intensive Substrate
- VLF-200 Filter Fleece
- Diadrain-60 Drainage and Reservoir Board
- VLS-800 Protective and Reservoir Fleece

Saturated weight: c. 750 kg/m²
Total height: c. 560 mm

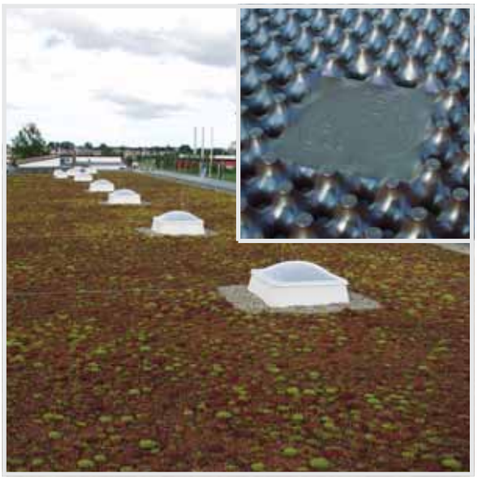
Underground garage roof-garden set Diadem-1200



- Vegetation
  Shrubs-Small Trees-Lawns-Trees
- Multi-layered Intensive Substrate
- VLF-150 Filter Fleece
- Garda-25/30 Drainage and Protection Mat

Saturated weight: c. 1200 kg/m²
Total height: c. 840 mm

Diadrain Drainage and Reservoir Boards



iDE Drainage and Reservoir Boards

ICB offers various drainage boards for Extensive and Intensive roof-top garden projects. All drainage boards are made from high-quality recycled materials. External laboratories, whose tests adhere to the most stringent requirements, confirm this quality.

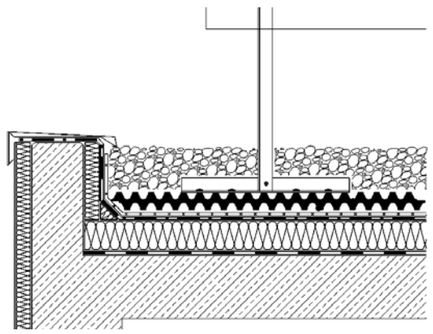
The drainage boards are generally laid adjacent to one another on a protection membrane. On roofs with a minimal pitch, the boards should be laid with an overlap of 1-2 rows. In order to prevent the silting away of the roof-garden, a filter layer of 130-200 g/m² needs to be added. The substrate is layed on top of this, and finally these are topped by the vegetation layer.

Advantages

- The most widely used solution, due to its optimal technical values regarding water retention, load bearing capacity and drainage
- Water-retentiveness, ventilation and drainage of excess water all in one
- Great load bearing capacity augmented by the egg-box structure
- Eco-friendly recycled plastic material
- Low weight and installation height compared with mineral dranage layers
- Easy, quick installation
- Economical delivery and storage format, because the sheets can be packed together without leaving any spaces.

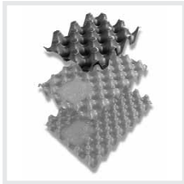
MDE-60

Suitable for the formation of broad foundations on flat or gently sloping roofs to which various items can be fixed by means of rivets or screws. The foundations provide load-distribution, and after completion of the installation, a wind resistant base.



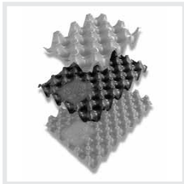
Diadrain-60

Recommended for use in Intensive roof-gardens with a medium to high regularity of use, e.g. public terraces, roof-top playgrounds, subterranean garages, exotic gardens, etc.



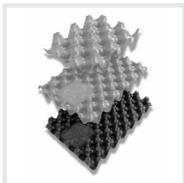
Diadrain-40

For installation in multi-layered Intensive roof-gardens with a low to medium regularity of use, e.g. private garden patios, roof walkways, roof-gardens with water features etc.



Diadrain-25

Recommended for use in multi-layered Extensive roof-gardens and directly under terrace tiles.



Technical Data

	Dim	Dd-25	Dd-40	Dd-60	MDE-60
Height	[mm]	25	40	60	60
Areal dimensions	[mm]	1960˜900			
Volume ca.	[l/m²]	11.8	19.2	28.5	28.5
Load bearing capacity	[kN/m²]	484	330	270	560
Water drainage value*	[l/m˜s]	4.0	6.5	8.1	8.1
Water drainage value**	[l/s/m]	0.8	1.31	1.62	1.62
Material		recycling-polystyrol			ABS
Colour		anthracite			magenta
Packaging unit	[m²/Pal.]	700	500	350	200
Laying		slope 0-1°: adjacent, 2-3°: overlapped by one row			
Fulfils DIN 4095 prescriptions for drainage values. (DIN 4095 standard values: 0.3 l/m²•h in front of walls, 0.03 l/m²•h on ceilings, 0.003 l/m²•h under floor-tiles)					

*DIN 4095 **i=1

Drainage and Protection Mats

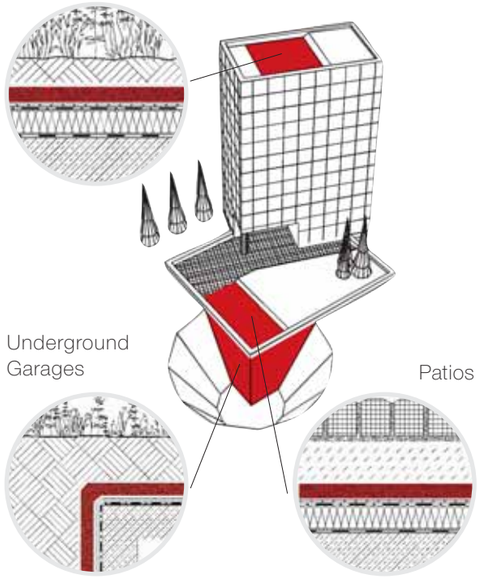
Garda Drainage and Protection Mats

The Garda mat series is made from tiny leftovers from the production of a polystyrene foam, rather like camping mats. There is no need for an additional protective layer.

- Drainage and protection are provided in one layer
- Can take the weight of construction vehicles
- Additional value as thermal insulation
- Water drainage values comply with DIN 4095
- Protective values comply with DIN 18195/T.10
- Sound insulation
- Rot-proof
- Resistant to acids, microbes and insects

Applications

Extensive and Intensive Roof-Garden Projects



Technical Data

	Dim	Garda-25/30 Garda-25/30-V	Garda-50/55 Garda-50/55-V
Width	[mm]	800	800
Length	[mm]	1500	1500
Thickness	[mm]	25-30	50-55
Density	[kg/m³]	81.2	81.2
Weight per area	[kg/m²]	2.1	4.1
Load bearing at 10% compression	[kN/m²]	62	56
Drainage capacity DIN 4095	[l/m•h]	0.47	0.38
Water storage capacity	[m%]	7	4.5
Water absorption	[V%]•24h	3.8	3.8
Relative steam diffusion coefficient	μ		10.1
Thermal conductivity	[W/mk]	0.06	
Steam resistance	[m²hPa/kg]	$2.6 \cdot 10^9$	
Packaging unit	[m²]	12	6
**Satisfies DIN 4095 standard values for drainage (DIN 4095 standard values: 0.3 l/m•h in front of walls, 0.03 l/m²•h on ceilings, 0.003 l/m²•s under floor tiles)			
Protection layer per DIN 18195/T.10			

Range

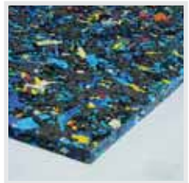
Garda Drainage and Protection mats come in two different strengths, supplied either with or without a laminated layer. The selection of strength is dependent on the composition of the layers, while the choice of combination is determined by the requirements of the fitter.

Advantages of the Laminated Mats

- One job instead of two
- The filter fleece cannot shift during the laying, which makes laying it more suitable for rollers and similar machines.

Advantages to the Non-Laminated Mats

- Materials less expensive.
- Fewer impacts and overlaps
- Quicker to lay



Installation Advice

The Garda mats are laid on the root-proof barrier loosely and without overlap. Sections can be easily cut to shape with a sharp knife.

Quality Guarantee

ICB supplies various non-woven fleeces, appropriate for a range of applications. The production of the non-woven fleeces is tested according to the strict ISO 9001 quality certificate. In addition, regular checks by independent testing laboratories such as the TBU Germany confirm consistent fleece quality. The products are made from polypropylene fibres, which are bitumen resistant, and are biologically and chemically neutral, and fulfil the demands of the Guidelines for the Planning, Execution and Upkeep of Green Roof Sites.

VLT-130 Separation Fleece

The VLT-130 non-woven fleece separates the chemically incompatible layer on the roof and prevents sweating of the PVC plasticiser agent. On one side, it is thermally hardened, rot-proof, and chemically and biologically neutral.

Guidelines for Roof-Gardens

Sheets of non-woven fabrics laid as a filter course must overlap by a minimum of 10cm, and they must be brought up at the edge to beneath the surface of the vegetation support course.

VLF-150 and VLF-200 Filter Fleeces

These polypropylene filter fleeces inhibit the leaching of fine particles from the substrate into the drainage layer. Other properties include: low weight per unit area and high permeability (breathability). A variety of fleece weights may be used, dependent upon the maximum load required. The filter layers may also be used on inverted roofs.

		Separator	Filter	
	Dim	VLT-130	VLF-150	VLF-200
Application			Filter layer for extensive roof-garden projects	Filter layer for intensive roof-garden projects
Weight by unit area	[g/m²]	130	150	200
Thickness	[mm]	1.7	1.9	2.1
Tensile strength weft	[kN/m]	7	8	11
Tensile strength warp	[kN/m]	9	12	14
Elasticity	[%]	60/80	60/70	70/60
CBR	X	1550	1850	2300
CBR	x-s	1400	1700	200
Robustness class	GRK	2	3	3
Effective opening width	[mm]	0.14	0.13	0.09
Water permeability (2 kpa m/s)	[m/h]	$5.3 \cdot 10^{-3}$	$5.3 \cdot 10^{-3}$	$3.1 \cdot 10^{-3}$
Water retention capacity	[l/m²]			
Material		polypropylene		
Density	[g/mm³]	9	9	9
Melting point	[°C]	±165	±165	±165
Manufacturing process		mechanically non-hardened, thermally non-treated		
Roll width	[m]	2.5	2.5	2.5
Roll length	[m]	150	100	100
Roll area	[m²]	375	250	250
Roll weight	[kg]	49	40	50
Roll diameter	Ca.	50	45	45
Colour		white	white	white

VLU-300, VLU-500 and VLU-800 Protection Fleeces

Protection Fleeces guard the surface of the roof from damage. The greater the stress to which the installation is subjected, the stronger the protection fleece will need to be. The protection layer is laid over a root-resistant seal or root barrier. The fleeces inhibit root growth after installation.

VLS-500/800 Storage and Protection Fleece

The VLS fleece, which is made from very thin fibres, protects the roof membrane and retains water and nutrients for the plants. It is installed above the root-proof barrier. The fleece can absorb seven times its own weight of water. A certificate for this performance is available.

	Protection			Storage and Protection	
	VLU-300	VLU-500	VLU-800	VLS-500	VLS-800
Application	Protection layer for extensive roof-garden projects	Protection layer for intensive roof-garden projects RGP	High-grade (Hi-G) Protection layer for intensive RGP	Protection and Reservoir for extensive or intensive RGP	Protection and Reservoir for extensive or intensive RGP Hi-G
Weight by unit area	300	500	800	480	800
Thickness	3.0	4.5	5.5	3.3	4.8
Tensile strength weft	20	29	35	0.7	0.85
Tensile strength warp	28	49	50	0.85	1.50
Elasticity	60/60	70/65	50/80	90/80	120/80
CBR	3600	7000	9684	2700	3700
CBR	3300	6500	9060		
Robustness class	4	5	5	4	5
Effective opening width	0.08	0.11	-	0.06	0.07
Water permeability (2 kpa m/s)	$2.4 \cdot 10^{-3}$	$2.3 \cdot 10^{-3}$	$3.1 \cdot 10^{-3}$	5.0	8.0
Water retention capacity					
Material	polypropylene				
Density	9	9	9	-	-
Melting point	±165	±165	±165	±165	±165
Manufacturing process	mechanically hardened, thermally treated			mechanically hardened	
Roll width	2.5	2.5	2.5	2.2	2.2
Roll length	50	50	50	50	25
Roll area	125	125	125	110	55
Roll weight	40	65	100	55	48
Roll diameter	45	50	50	50	48
Colour	white	white	white	melange-grey	melange-grey

Different weights per unit area and roll dimensions may be produced to the customer's requirements. The products should not be exposed to direct sunlight for longer than four weeks, as they are not UV-stabilised. All the values presented in this table are averages from standard tests. In practice, slight fluctuations occur in actual production. Consistency in production according to DIN ISO 9001 is assured. We reserve the right to change or amend specifications.

Environmental Consciousness Starts At The Top

Increasingly, ecologically conscious building owners and specifiers are unwilling to compromise products and quality when specifying for new build and refurbishment works. They demand a superior waterproofing that represents up to date technology. Alwitra® offers an advanced, environmentally friendly roofing and waterproofing system.

EVALASTIC® is an outstanding roofing membrane, first introduced to the roofing market in 1986, which has already shown excellent long term performance.

The EDPM based polymer's suitability for building and construction purposes has been proven over decades. Its performance is particularly good with regard to chemical resistance, low temperature flexibility and outstanding weather resistance. The 'internal flexibilisation' of this thermoplastic elastomer eliminates the use of plasticisers, guaranteeing superior long term performance even under severe conditions.

New building or refurbishment, warm deck or inverted roofs, roof-gardens or industrial roofs - EVALASTIC® roofing membranes are the ecologically sound choice for all roof configurations. The high quality of EVALASTIC® roofing membranes is not impaired by internal reinforcement or lamination of layers. Homogeneously heat-welded laps provide roofing systems of superior performance.

Depending on roofing system and use, it can be advisable to select EVALASTIC®V, the membrane with polyester fleece backing for additional strength and protection.

A true alternative for roof-gardens: root-resistant EVALASTIC® membranes.

Besides the ecological and performance benefits, ease of installation is another major requirement for a successful roofing membrane. EVALASTIC® roofing sheets are user-friendly and are heat-welded to produce roof coverings that are effectively seamless.

EVALASTIC® roofing membranes are suitable for all roofing applications. Due to their elastic characteristics, EVALASTIC® roofing membranes resist extreme variations of temperature without any damage: the surface temperature resistance ranges from -40ºC up to +100ºC.

Substrate Delivery Formats

- Blown on the roof from a silo or tipped loose from a truck.

- In big bags (unloading optional).

- Available in sacks for the smallest projects

Installation-Sedum Mat

Delivery:
Palletised 11 – 15 rolls per pallet. For deliveries in the months May – Sept, sedum mat can only be held in the rolled state for 48 hrs max. For deliveries during late September to end April, rolled state can be extended to 96 hrs depending on temperature.

Plant composition:
Approx 30 species can be used. In general each roll will contain 8 – 10 species. For Extensive type roof applications these species will be predominantly from the genus sedum.

Installation:
Sedum mat must be unrolled carefully on to correctly installed drainage and substrate layer. The newly installed sedum mat must then be irrigated to ensure the drainage layer/substrate is to full capacity. This process may need to be repeated until, the sedum mat is established – dependent on environmental conditions.

Lead Time:
Dependent on quantity. To ensure requirements can be met, please advise as early as possible.

Membrane

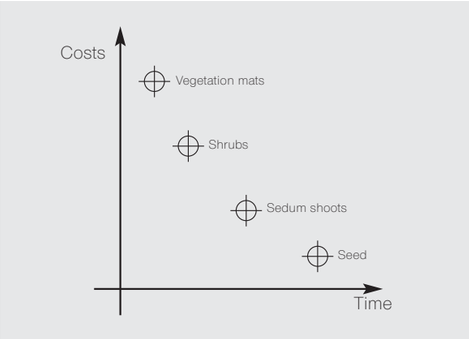
Always install to ICB's instructions. Usually loose laid and ballasted. All laps to be welded. A non-destructive leak detection test should be carried out prior to installation of further layers as a precautionary measure.

Drainage Reservoir Layer (See page 8&9)

Backfill material should not contain sharp objects. Normal compaction can be used adjacent to the drainage sheet. On horizontal surfaces the backfill should be placed on an advancing face. If mechanical plant is to be operated directly on the drainage sheet, refer to ICB for advice.

Supply Formats

A roof-garden which is showing bare patches can be restored most rapidly with vegetation mats, and most cheaply, with seed.



English Name	Botanical Name	Height	Flowers
Stonecrop	*Sedum hybridum*	100 mm	June-August
Stonecrop	*Sedum sexangulare*	150 mm	June-August
Houseleek	*Sempervivum ssp.*	100 mm	June-July
Stonecrop	*Sedum spurium*	150 mm	July-August
Wild Oregano	*Origanum vulgare*	150 mm	June-August
Dianthus	*Dianthus pontederae*	150 mm	June-August
Golden-Flowered Yarrow	*Achillea tomentosa*	200 mm	June-July
Basket-of-gold	*Alyssum saxatile*	300 mm	April-May
Carpathian Harebell	*Campanula carpatica*	200 mm	June-August
Gypsophila	*Gypsophila repens "Rosea"*	200 mm	June-July
Koelaria	*Koeleria glauca*	400 mm	June-July
Phlox	*Phlox douglasii*	100 mm	April-May
Spring Cinquefoil	*Potentilla verna*	200 mm	March-April
Soapwort	*Saponaria ocymoides*	150 mm	May-July
Winter Savory	*Satureja montana*	300 mm	June-July
Lavender	*Lavandula angustifolia*	400 mm	June-August
Thyme	*Thymus vulgaris*	200 mm	May-July

The list is just a small selection from the types available.

Dianthus deltoides
Maiden Pink
Height 150 mm
Flowers May-June

Geranium x magnificum
Cranesbill
Height 500 mm
Flowers June-July

Sedum album
Stonecrop
Height 150 mm
Flowers June-July

Iberis sempervirens
Evergreen Candytuft
Height 300 mm
Flowers April-July

Cerastium tomentosum
Taurus Cerastium
Height 100 mm
Flowers May-June

Sedum floriferum
Stonecrop
Height 150 mm
Flowers June-August

Thymus serpillum
Wild Thyme
Height 100 mm
Flowers June-September

Sedum reflexum
Stonecrop
Height 200 mm
Flowers July-August

KSE Inspection Boxes (Extensive)

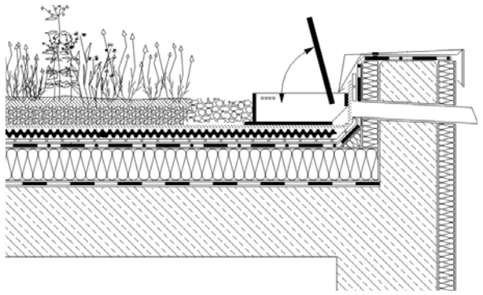
These square inspection boxes satisfy the requirements of FLL standard values, and can be manufactured in various heights up to 300 mm.

KSR Inspection Boxes (Intensive)

These inspection boxes are round, and of larger dimensions than the square ones to ease access to the downpipes. These boxes, which comply with FLL standards, have a minimum height of 300 mm.

KSE Inspection Box Extension Element

Extension elements are particularly suitable for intensive roof installations on different levels. Installation is tool-free and clips along two sides ensure a precise and problem-free extension of the inspection box. Height: 100 mm.



Inspection Boxes

Inspection boxes are manufactured in accordance with the FLL Guidelines for the Planning, Execution and Upkeep of Green-Roof Sites.

Guidelines for Roof Planting

As a rule, roof outlets should be located in areas away from vegetation and free from gravel. Where roof outlets are located within vegetation areas, an inspection box will need to be installed, to prevent contamination and to stop plants from growing over the outlet.

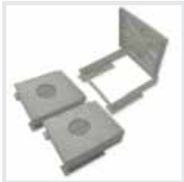
TGS Underground Garage Boxes

Appropriate for:
Heavily trafficked roof-gardens
Roof-gardens in locations susceptible to damage.
Characteristics:

- May be walked on
- Extremely strong material
- Expanded footprint
- Lockable cast iron lid
- Other details as KSE

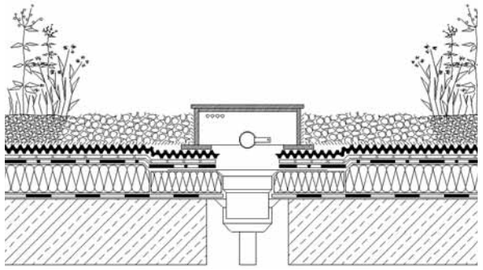
KSA Fascia Boxes

Fascia boxes are installed above downpipes near the parapet and in front of drainage outlets.



There are two pre-defined cutting lines on the fascia boxes. These are to accommodate alternative sizes of fillets.

Parapet areas can be subject to extreme wind suction. For this reason, fascia box covers are hinged and are not removable.



Correct Installation

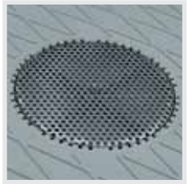
Inspection boxes have to be placed on the water-carrying layer: they need to be placed on the protective layer for linear drainage. No additional fixing is required. The boxes are surrounded with round gravel to prevent the cultivated areas washing way. Do not run the filter-fleece up along the sides of the inspection boxes, because this might lead to standing water building up in heavy rain.

Drainage openings

Drainage openings are pre-cut. They should be pressed out prior to installing the drainage pipe.

Drainage of Surface water

Drainage of surface water is essential. "Drainage facilities must be capable of collecting both overflow from the drainage course and surface water from the vegetation support course and of conveying it away" (FLL). The openings may have a maximum diameter of 2 mm.



Lockability

Lockable boxes prevent unauthorised opening of the lids, and locks offer additional security against wind suction and accidents. They are especially recommended for intensive planting projects, which may also be enjoyed by children.

Drain bar

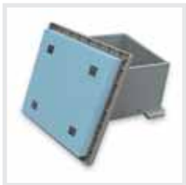
Bars ensure that the pipe remains attached to the inspection box.

Natural stone cover

To satisfy the most stringent requirements, inspection boxes are also available with a robust and frost-resistant multicoloured granite cover.

Thermal Insulation

Thermal insulation, made from 30 mm extruded hard polystyrene foam with a thermal value of 0.027 W/mK, is an optional add-on for every inspection box.



Technical Data

	Dim.	KSE	KSR	KSA	TGS
Height	[mm]	100, 150, 200, 300	350, 450, 550, 650	100, 150, 200, 300, 400, 500	50-2000
Length x Width	[mm]	300x300	ø400	350x300	300x300 / 400x400
Screws		stainless steel	stainless steel	stainless steel	stainless steel
Material		PP	PP	PP	PP
Colour		RAL 7032	RAL 7032	RAL 7032	anthracite / RAL 7032
Lid		stainless steel+PP	stainless steel+PP	stainless steel+PP	cast iron
Drainage opening		4xø52 mm	4xø52 mm	3xø52 mm	4xø52 mm
Drainage bolt		yes	yes	yes	yes
Surface water openings	[mm²]	4000	4000	4000	1500 / 2000
Thermal insulation		optional	optional	optional	no
Lockable		yes	yes	yes	yes
Stackable		yes	yes	no	no
Automatic irrigation		optional	optional	no	optional

Irrigation Boxes as Conduits

If water supply is achieved by a build up of water in the drainage layer, inspection boxes must be used to protect the roof run-off with a built-in accumulation regulator.

The following inspection boxes can be equipped with automatic irrigation systems:
- KSE Extensive Inspection Boxes
- KSR Intensive Inspection Boxes
- TGS Underground Garage Boxes

The boxes must be at least 300 mm high

Setting the Water-Level

Fine adjustment of the correct water level is achieved by twisting the polystyrene float.

Angle Valve with Filter

The angle valve supplied includes a filter to separate dirt from the fresh water. We recommend that during inspections, the filter be removed with a screwdriver and cleaned.

Extension Element

Material: thermoplast, bitumen-resistant
Extension height
c. 30-40m

Automatic Irrigation Systems

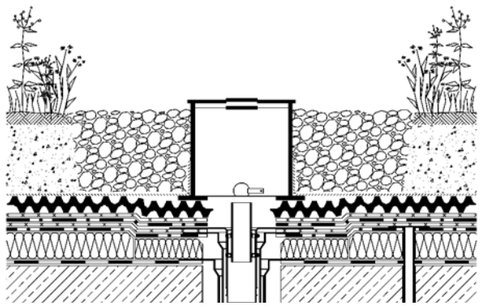
Intensive roof planting projects often have a water supply built in. For this type of construction, ICB offers an eco-inspection box with servo-controlled mechanical water level regulation. A polystyrene float permits the desired amount of water to be maintained on the roof. When the angle valve is closed, the flow of water directly to the shaft is interrupted.

Any drainage pipe connections are secured with pre-cut drainage openings. Water pipe connection: 1-inch pipe or hose, fitted either inside or outside the box.

A Diadem automatic irrigation system can water roof-gardens of up to approx. 400 m² (20x20 m). For larger areas, several systems should be used.

Installation Advice

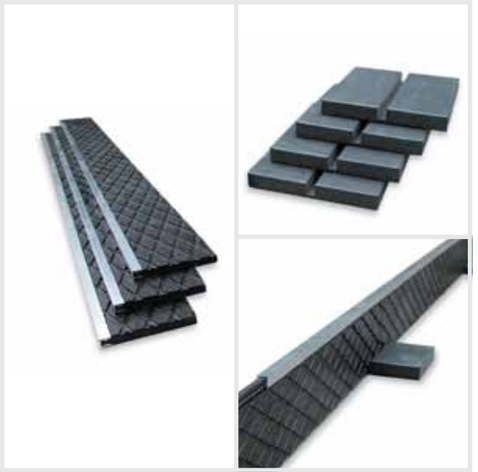
The irrigation box needs to be installed either over the run-off or, preferably, directly on the surface of the roof. Water pipes are fixed to the automatic system, either inside or outside the shaft, as desired. Care must be taken during installation that nothing impedes the movement of the polystyrene float.



Technical Data

	Dim.	
Connection	[“]	1/2
Open pressure	[bar]	min. 0.7
Closed Pressure	[bar]	max. 6.0
Watered area:		400 m² / unit

Gravel Boards



KLS-10 Recycled-PE Gravel Board

- Only for separation
- Should be banked up on both sides
- Aluminium profile for easy alignment
- Footprint demands: 1 unit per linear metre
- Cost-effective
- Easy construction of corners and irregular lines

Aluminium Profile for Lining up

A light aluminium profile is attached to the upper surface of the KLS-10 gravel board. When laying a run of these items, they should be laid in such a way that the aluminium profiles overlap the board junctions. This allows for better alignment and avoids gaps between the ends of the gravel boards.

Corners

The gravel boards are installed on the area to be marked out after the roof has been sealed and after the protective, drainage and filter layers have been laid. During installation, both sides of the element should be filled at the same time.

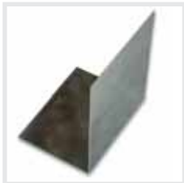
Technical Data

	Dim.	KLS-10	KLS-ES-12	KLS-AL-12	KLS-FF-12
Material		recycling-PE	stainless steel	aluminium	hot galvanized steel
Height	[mm]	100	120	120	120
Length	[mm]	1150	2000	2000	2000
Feet	[mm]	150x150	80	80	80
Thickness	[mm]	10	0.8	1.5	0.8
Water-permeability c.	[mm²]	c. 800	c. 900	c. 900	c. 900

KLS-12 Stainless Steel Gravel Board

- Separation and demarcation
- May also be used as edge pieces
- Material:
  - KLS-FF-12 hot galvanized steel
  - KLS-ES-12 stainless steel
  - KLS-AL-12 aluminium

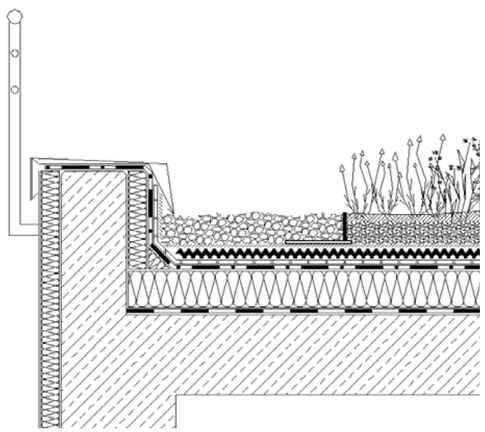
Impact Connection



The elements can be laid more effectively with the connector, which allows them to be simultaneously aligned.

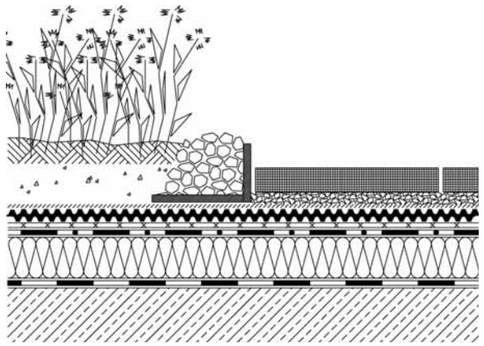
- Impact connectors facilitate alignment
- Impact connector demands: 0.5 unit / linear metre

Installation Example



Installation Example

The edge kerbs are installed along the edge of the roof or at the edges of the areas to be marked out, after the roof has been sealed and after the protective, drainage and filter layers have been laid. The filter membrane must extend to the top of the edge kerb. The pieces can be joined together using special screws.



Edge Kerbs

RDL Edge Kerbs ("L-shaped")

ICB "L-shaped" edge kerbs are used to define planted areas, to mark out pedestrian and patio surfaces, or to form troughs. Standard heights are 120 and 190 mm, but edge kerbs can be produced to any height at the customer's request. External surfaces are finished with an aesthetic diamond pattern, and are pierced with drainage slits. Where they are going to be on display, painting or polishing at the factory will enhance their looks. The recycled material is impact-resistant, and can be easily cut to size with a circular saw.

Aluminium Profile

A light aluminium profile is attached to the upper surface of the edge kerbs. When laying a run of these items, they should be laid in such a way that the aluminium profiles overlap the junction of the edge kerbs. This allows for better alignment and avoids gaps between the ends of the kerbs.

Abutment

The edge kerbs can be screwed together at the ends, but this is not necessary. Screws are delivered as an option.

Water Drainage Openings

Horizontal slits guarantee a water drainage rate of 2000 mm² / linear metre.

Technical Data

	Dim.	RDL-12	RDL-19
Height	[mm]	120	190
Width	[mm]	19	24
Length	[mm]	1150	
Thickness	[mm]	16	
Colour		anthracite	
Exterior		diamond pattern	
Water drainage openings	[mm²]	approx. 2000	
Other dimensions on request.			

Visible Surfaces:

- Anthracite-coloured diamond pattern as standard
- Finished to RAL standard
- Faced
- Stainless steel facing
- Sandstone facing

Technical Data

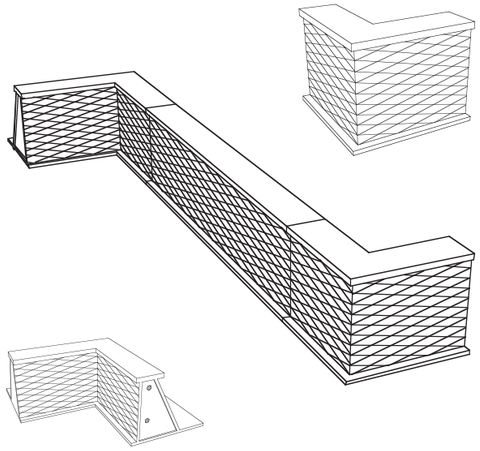
	Dim.	RDA-25	RDA-40
Height	[mm]	250	400
Length	[mm]	1150	
Weight	[kg/lfm]	11.3	20.27
Vertical visible surface		standard diamond-pattern anthracite-coloured polish varnished to RAL standard	
Horizontal visible surface		standard smooth anthracite stainless steel sandstone	
Exterior corner (LxWxH)	[mm]	300x300x250	480x480x400
Interior corner (LxWxH)	[mm]	600x600x250	960x960x400
Corner-box	[mm]	300x300x250	480x480x400

RDA Edge Kerbs

"A"- shaped edge kerbs may be used to define planted areas, pedestrian and patio surfaces, or to form troughs.
Edge Kerbs offer the following advantages:

- Minimal weight
- Pieces numbered to correspond to plan
- Rapidly laid
- Finished to RAL standard
- Polished
- Clad with stainless steel
- ...and no limits set on your imagination

Construction of Corners



Electrical and Sewage Conduits

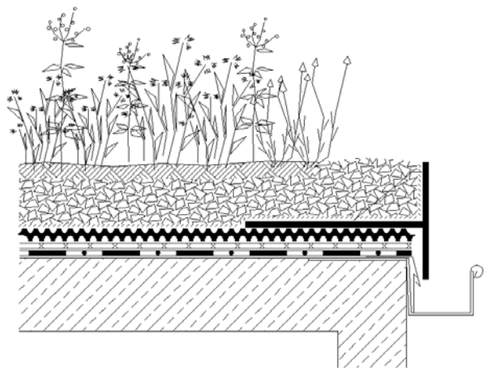
Ideal for built-in conduits and pipes.

'Segment' plant containers

From a minimum height of 250mm, curved boundaries should be planned along with 'Segment' plant containers. The flow of curves is not disturbed by joints.

Visible Surfaces

The visible surfaces, which are finished to RAL standards, may be coloured to individual taste.



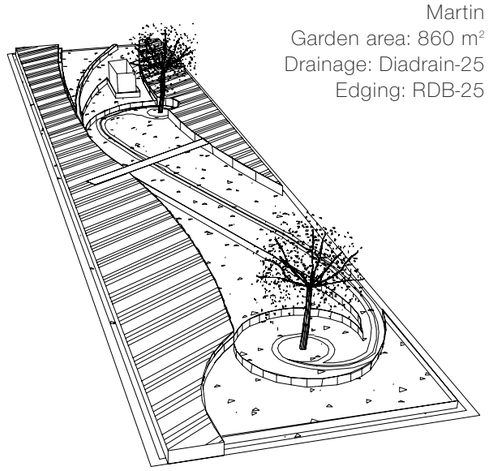
Possible Radius

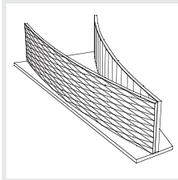
Radius	[m]	3	6	10	12	15	18	20
Extent	[m]	18.85	37.70	62.83	75.40	94.25	113.10	125.66
Pieces/circle		17	34	57	68	85	102	113
Length	[m]	1.11	1.11	1.10	1.11	1.11	1.11	1.11

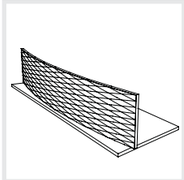
RDB Rounded Edge Sections

Edge sections allow an individual design to be laid out on the roof. The anthracite coloured sections are manufactured from high quality recycled material, and blend unobtrusively into the roof-garden. For the completed project illustrated left, the architect used exclusively recycled materials, which is characteristic of his ecological building methods.

Fitzwilliam Hotel,
Stephens Green, Dublin
Architect: Brady Shipman Martin
Garden area: 860 m²
Drainage: Diadrain-25
Edging: RDB-25







Roof Edge Definition as Fascia Substitute

Edge Kerbs

Concrete Kerb

The concrete kerb serves as an earth-retention barrier where paths adjoin planted terraces. They are laid on the drainage layer, which is covered by gravel. Use a rubber-headed mallet for fine positional adjustments.

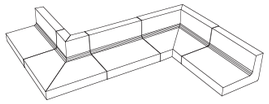
Advantages:

- Conforms to DIN 1045
- Heavy
- Economical
- Aesthetically pleasing
- Durable
- Widely available

Possible Arrangements

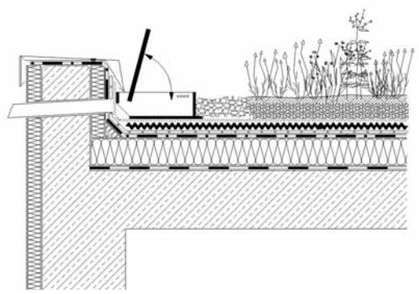
Construction of Corners

It is simple to construct corners by using combinations of interior and exterior corner elements.



Barrier Height

The sides are of differing heights, and depending upon which is upright, the barrier can be either 200mm or 600mm high.



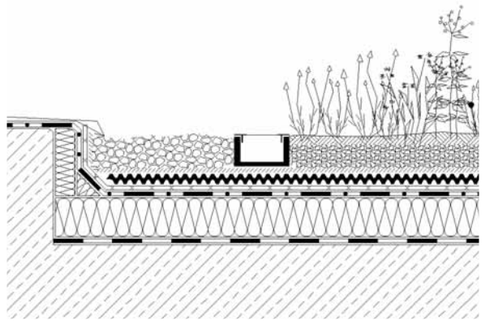
Technical Data

		BW-30	BW-40	BW-60
Length	[mm]	400	400	400
Sides	[mm]	20x30	40x40	60x40
Weight	[kg]	25	55	72
Conforms to		DIN 1045	DIN 1045	DIN 1045
Concrete Quality		B25	B25	B25
Coverage	[pcs/meter]	2.5	2.5	2.5
Properties		mounted, rough		
Loading		only as an earth retention barrier, without traffic load		
Colour		grey		
Delivery	[pcs/pal]	40	24	24

Terrace Channels

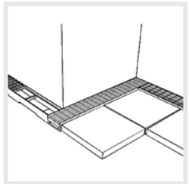
Terrace Channels

Channels allow fast and reliable water drainage. The channels are manufactured from high quality recycled materials. The channel gratings with a mesh size of 40x10mm are fully galvanised steel, cast iron or stainless steel. The channel system can be walked upon.



Creating Corners

Various angles may be cut with a circular saw direct on site. The cut edges of the grille should afterwards be treated with a zinc spray.

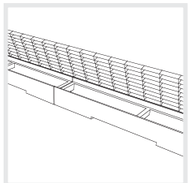


Channel Base

- Channels open as standard
- Solid base at extra cost

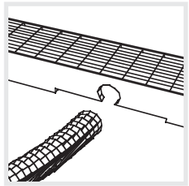
Abutment of Channels

The channels should be laid in such a way that the gratings overlap the ends of the channels. This allows the channel to be aligned better and avoids gaps between the ends of the channels.



Drainage Openings

For channelled pipe drainage, the pipes are often led into the channels. For an extra charge, the channels can be supplied from a height of 80mm with 52mm drainage openings, which can be pressed out by the customer.



Technical Data

	Dim.	RNS-05	RNS-08	RNF-05	RNF-08	RNF-10	RNH-8-12
Height	[mm]	50	80	50	80	100	80-120 adjustable
Width	[mm]	135	135	150	150	150	145
Length	[mm]	1000	1000	1000	1000	1000	1000
Grating		fully galvanised die-stamped grating		fully galvanised with a mesh width of 40x10 mm			
Load-Class		A15	A15	A15	A15	A15	A15
Stainless steel		yes	yes	yes	yes	yes	yes

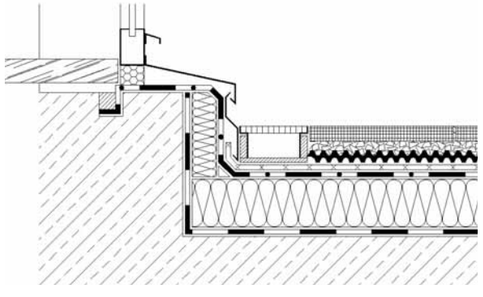
Terrace Channels

Terrace Channels

The channel system channels the water away immediately, and also reduces the danger of slipping in case of frost or heavy rainfall. Channel abutments should be screwed together where they are subject to flexing. The screw holes are positioned as standard for a channel height of 80mm.

Installation Example

Channels should be installed in front of the terrace doors or deep set window frontages, and where roof and walls join, to keep rainwater away from the building. The channel system channels the water away immediately, and also reduces the danger of slipping in case of frost or heavy rainfall.



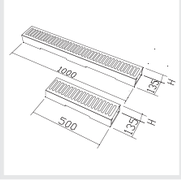
Height Adjustment

Adjustments are made with a spanner for the appropriate height and to finish flush with the surroundings.

A nut must be released and, after the adjustments, be tightened up again. The height is infinitely adjustable between 80 and 120mm. This is only valid for RNH-models!

Lengths to Fit

The channels are available in 1 metre lengths. Other lengths to fit can be produced on request.



Technical Data

	Dim.	RNS-FF-03	RNS-FF-05	RNS-FF-08	RNF-FF-03	RNF-FF-05	RNF-FF-08	RNSV / RNFV
Height	[mm]	30	50	80	30	50	80	connector for RNS and RNF channels, fully-galvanized / stainless steel
Width	[mm]	135	135	135	140	140	140	
Length	[mm]	1000	1000	1000	1000	1000	1000	
Grating		fully galvanized die-stamped grating			fully galvanized with a mesh width of 40x10 mm			
Full channel base		hot galvanized steel						
Load-Class		A15	A15	A15	A15	A15	A15	
Stainless steel		yes	yes	yes	yes	yes	yes	

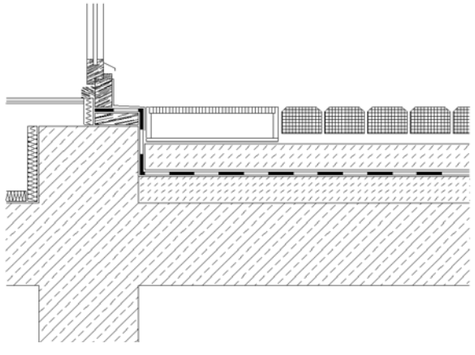
Doorstep Grilles

Water Drainage

Surface water falling into the trough is channelled into the main drainage system, by passage through drainage holes in the middle (ø100) and at the four corners (ø52) of the foot-scraper. All openings are pre-prepared and can easily be knocked through with a hammer.

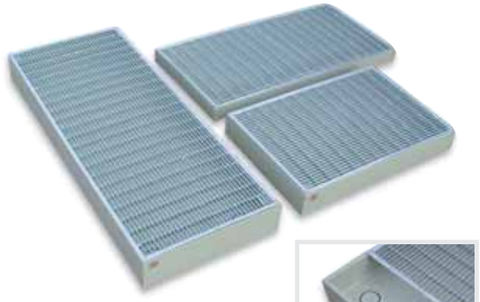
Installation Example

Doorstep grilles should be installed in front of the terrace doors to keep rainwater away from the building. The channel system drains the water away immediately, and also reduces the danger of slipping in case of frost or heavy rainfall. The grilles can be taken out and are easy to clean.



Doorstep Grille TRS

- Easily bedded
- Bitumen, acid and chemical resistant
- Frost-resistant
- Fire resistance class B2
- Load bearing capacity A15
- With high-value meshed grille
- Easy-clean



Other Possible Uses

The width of the grille prevents water splashing up against and dirtying deep set windows, especially where they are adjacent to cultivated areas.

Technical Data

	Dim.	TRS-60	TRS-75	TRS-100
Length	[mm]	600	750	1000
Width	[mm]	400	500	500
Height	[mm]	up 50	up 50	up 50
Mesh Size	[mm]	40 x 10	40 x 10	40 x 10
Grating		fully galvanised		
Channel Body		high quality rec-PE		

Terrace Grilles

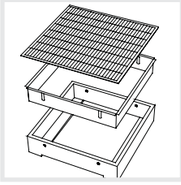
Terrace Grilles

Patio grilles, which match the most common size of terrace tiles on the market, comprise three elements:

- The base, out of respect for the environment, is high-quality plastic made 100% from recycled material.
- The grille (40mmx10mm mesh) is fully galvanized or made from stainless steel to guarantee a long life.
- A hot-galvanized adjuster provides height flexibility. (Only for TRH-Models)

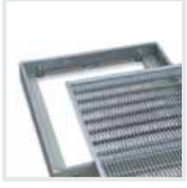
Installation example

The terrace grilles are installed after the roof has been sealed and after the protective, drainage and filter layers have been laid, always centrally over every downpipe. The removable, hot-galvanised grille eases maintenance and care of the, downpipes and leads the water away perfectly.



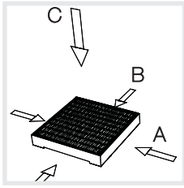
Height Adjustability

Because of height adjustability, it is possible to ensure that they are installed to match exactly flush with the top of the surrounding units. The height is infinitely adjustable between 80 and 120mm. Adjustments are made with a spanner for the appropriate height and to finish flush with the surroundings. The release nut must be tightened up after any adjustments.



Drainage

A. Drainage by drain-pipes, if available
B. Drainage between base feet
C. Drainage of surface water



Holes have been cut into the 8cm-high patio grilles in the factory for connection to the drains. These need to be broken open before insertion of the drain-pipes.

After insertion of the drain-pipe, a bar ensures that it remains fixed into the patio grille.

Technical Data

		TRF-30	TRF-40	TRF-50	TRH-30	TRH-40	TRH-50
Height	[mm]	from 50mm fixed height			80-120 adjustable height		
Length	[mm]	300	400	500	300	400	500
Width	[mm]	300	400	500	300	400	500
Mesh Size	[mm]	40 x 10			40 x 10		
Base		high quality recycling PE					
Grille		fully galvanised or stainless steel					

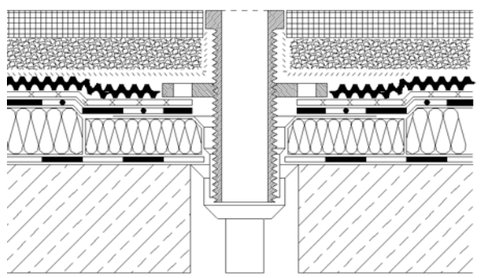
Balcony Drainage

Run off for Balconies and Terraces

- Stainless steel grille (100mm x 100mm)
- Height infinitely adjustable from 4-30cm permits tight closure to the level of tiles.
- Perfect installation on most downpipes because the grille includes spaces for nuts and bolts from the downpipe.
- Rapid and secure water drainage through channels and drill-holes.
- Easy-clean
- Threaded pipe can be shortened on site with a saw

Installation Example

Balcony kits should be placed centrally over the downpipes, so that the butterfly nuts fit into the holes drilled into the base. The height should then be adjusted by twisting the threaded pipe. Any excess thread can be sawn off. The patio tiles should be laid directly abutting against the stainless steel deck grille.



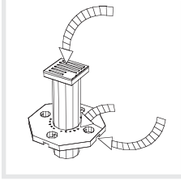
Adjustable Height

The correct height for the grille can be achieved by twisting the threaded pipe.

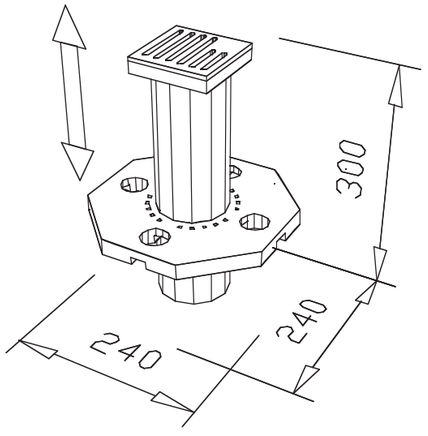
Base and Water Abstraction

The channels and holes cut into the base also help to abstract moisture from the water-carrying layer.

Surface water is drained by means of the stainless steel deck grille.



Dimensions



Technical Data

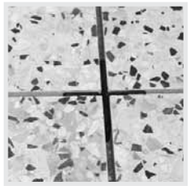
	Dim.	BLH-30
High	[mm]	40-300 infinitely adjustable
Grille dimensions	[mm]	100x100
Base	[mm]	200x200
Material (grille)		stainless steel
Material (base)		polypropylene
Outer diameter (Threaded pipe)	[mm]	90

Paving Cross Joints

Paving Cross Joints

One arm of the cross joint has a notch cut into it. To turn a cross joint into an edge cross, this arm is broken off.

Installation Example



Technical Data

	Dim.	FK-1,5	FK-3	FK-5	FK-10
Size	[mm]	50x50x18	50x50x18	70x70x20	80x80x20
Arm thickness	[mm]	1.5	3	5	10
Colour		grey-black			
Material		recycled PS			
Slab size		units required / m^2			
50x50	[units]	4.00			
40x40	[units]	6.25			
30x30	[units]	11.10			
Delivery unit	[units]	4000	3000	1600	1000

Plant Containers

Sample Colours

(NB. Check colour match before ordering)

Applications

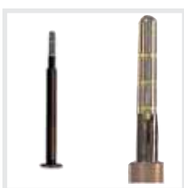
- Arrangement of roof-gardens and underground garage plantings
- Demarcation of various footpaths and driveways
- Containers for hydrocultures
- Interior planting

Advantages

- Light and manageable
- Frost-resistant and toughened
- Various arrangement options
- Clad with stainless steel
- Lacquered in accordance with RAL
- Polished
- Handrail
- Irrigation system
- Rollers, for interior planting

Water Level Gauge

The water level in the bottom of the container can easily be checked by reference to a float.



Technical Data

Description	Shape	Dimensions	Weight	Product Number
PGE-68	round	→50x35	5.25	170201
PGE-86	square	70x35x35	7.40	170202
PGE-88	square	50x50x35	6.40	170203
PGE-110	square	90x35x35	10.35	170204
PGE-111	hexagonal	→70x35	7.45	170205

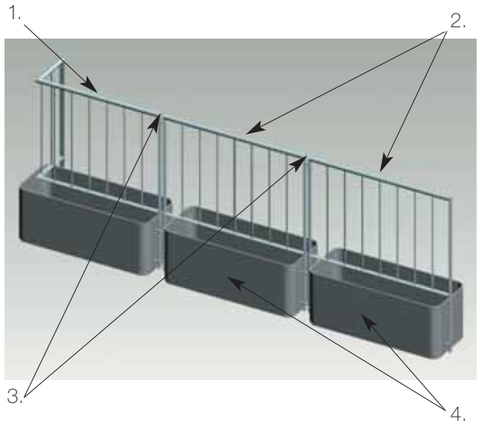
Roof Edge Safety System

DRS Roof Edge Safety System

Special crack-proof eco-planting troughs, made from 100% recycled materials, and with hot-galvanised safety railings, are designed for the edges of roofs. These provide an environmentally friendly alternative to safety railings. An advantage of the safety railings is that there is no need to drill through the waterproofing layers for the reinforcement fittings and secondly, they allow the roof to be used as a pleasing garden area.
The modular construction allows both interior and exterior angles to be created as well as straight runs.

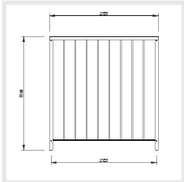
System Components

1. Railing corner
2. Railing
3. Spacer
4. Plant container



Railings

These troughs are supplied with railings with vertical bars. Being vertical, these bars hinder attempts to climb on to the railings.



Spacer

Using made-to-measure railing connectors, any required length can be supplied. All connectors, spacers and fixing-screws are included in the despatch.

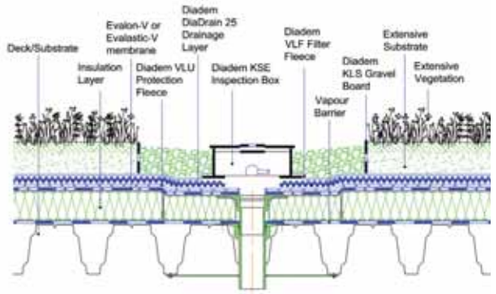
DRS System Containers

Containers at the edge of the roof present an opportunity for intensive planting and enhance the pleasure of the roof-garden. The drainage fleece, filter layer and filter fleeces for inside the trough are included in the despatch.

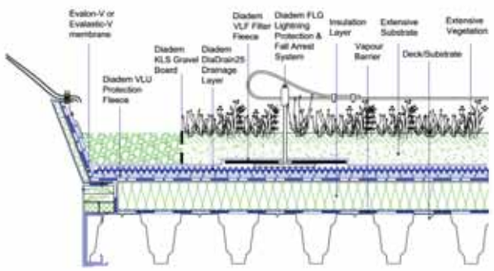
Assembly Instructions

The plant containers should be distributed evenly over the demarcation line. The railings and end pieces should then be mounted against the containers. Finally, the spacers should be cut to size and screwed on to the railings. If the container's clearance should exceed the space between the bars, a smaller bar is fixed between the two modular components.

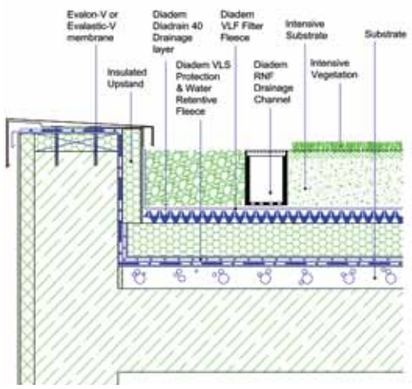
Inspection box



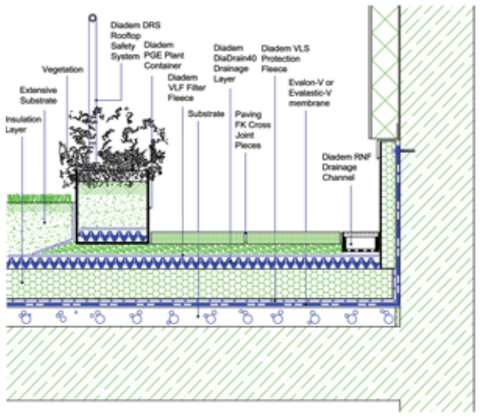
Lightning protection and fall arrest system



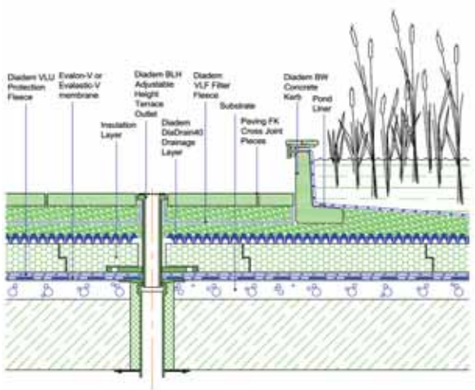
Drainage channel



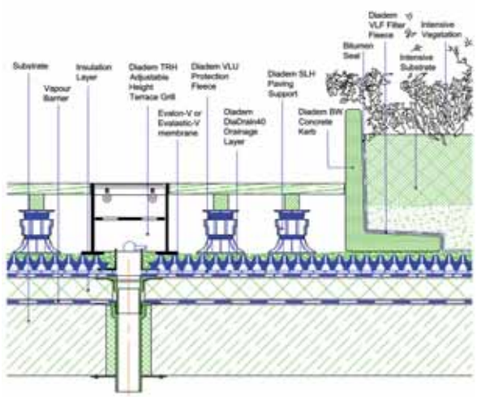
Terrace with planters



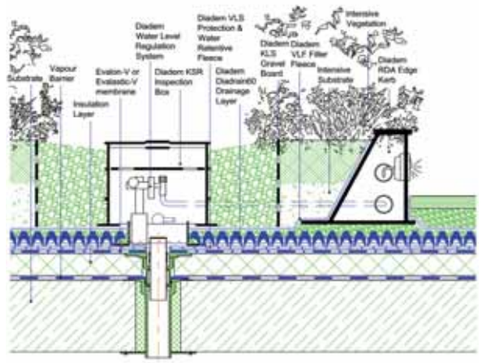
Adjustable drain and concrete kerb



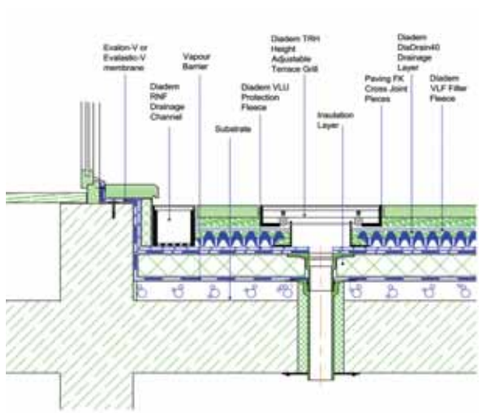
Terrace grill with adjustable supports



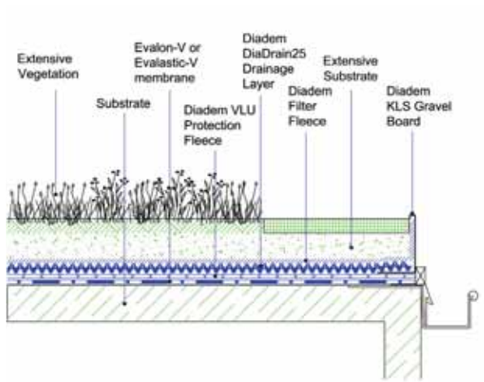
Inspection box with irrigation and edge kerb



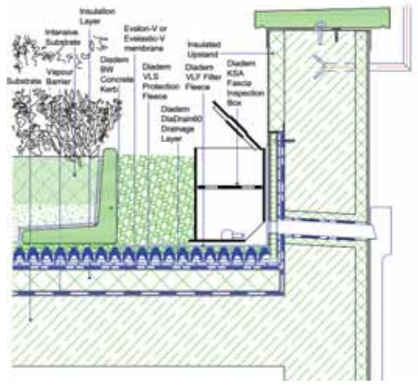
Terrace grill and rain water outlet cover



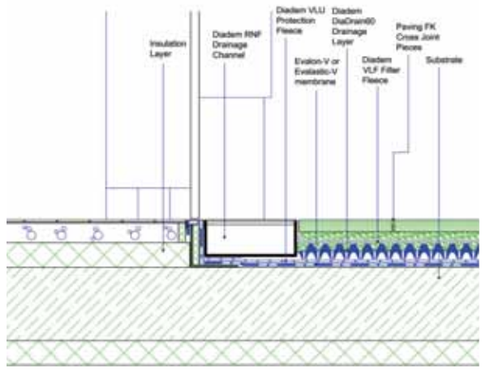
Perimeter drip edge



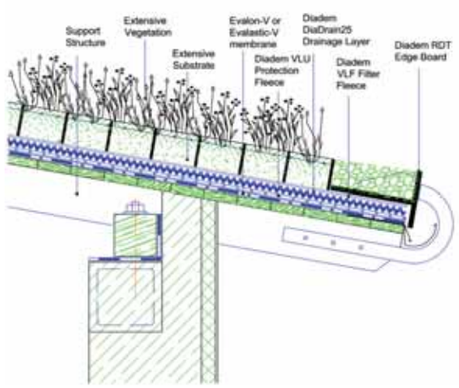
Chute inspection box



Perimeter drainage channel outlet



Perimeter gravel board



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