Date: 19 -11-12

TECHNICAL DATA SHEET

Bauder Xero Flor XF301 Sedum Blanket

DESCRIPTION

The Bauder Xero Flor XF301 vegetation blanket is a unique sedum mat product developed for use directly over the waterproofing system without the need for a secondary substrate growing medium, making XF301 the lightest self-contained sedum blanket system available.

It incorporates a polypropylene mesh bonded to a vapour permeable base carrier sheet. This ensures that the blanket substrate is contained, doesn't compact and helps to maintain the vegetation in optimum condition.

The product also has an integral moisture retention fleece that can absorb and retain up to 5 L/m² of water. The vegetation within this product is a mix of hardy sedum species with some grasses and moss also present.

TECHNICAL DATA:

Composition

Mineral component	selected porous aggregate
Organic component	composted green waste

Technical Performance

pH value	6.5 – 7
Vegetation support layer	geo-textile carrier filter layer with bonded UV resistant nylon loops
Moisture retention fleece	recycled fibres (80%man-made, 20% organic)

Weights and sizes

Standard roll width	1 m
Standard roll length	2 m
Non-standard lengths	up to 10m (cut only in increments of 1m) installed with a crane attachment that is available from Bauder Ltd.
Thickness:	ca. 28mm (excluding vegetation)
Saturated weight:	44Kg/m²

Fire Rating

BS 476 Part 3:2004	Ext. F. AA Ext. S. AA

Supply Form Rolls of blanket to specified lengths (as above)

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DELIVERY INFORMATION

- Deliveries of the Bauder XF301 Sedum Blanket are made from Tuesday to Friday.
- In exceptional weather we are unable to harvest the product for delivery until conditions improve. We are only able to advise the day before delivery if such a problem occurs.
- Order no more blanket to be delivered to site than can be installed within 24 hours of delivery.
- Should the blanket be considered faulty it is imperative that the Bauder sales office is informed on the day of delivery.
- If, for any reason, it is not possible to install the blanket on the day of delivery, the product should be rolled out on a flat, level surface, lightly watered and left out overnight before re-rolling for use early the following morning.

INSTALLATION INSTRUCTIONS – 2 X 1M ROLLS

- Ensure that the waterproofing has first been given and passed Final inspection by the Bauder Site Technician and that all waterproofing attached accessory items such as edge trims or retention stripes are installed.
- If large areas are to be installed then watering and installation should be done in sections of as much area as can be completed within four hours.
- It is important to ensure that width rolls are used at all roof perimeters i.e. no thin strips or small pieces that would otherwise present a wind uplift risk. Any 'cutting in' of thinner strips must be made in the field area, with the cut being made opposite to the selvedge to maintain continuity during installation.
- Working from the bottom left hand corner of the roof and taking care not to stand on the vegetated surface, unroll the blanket apply firmly onto the waterproofing, ensuring that the selvedge is unfolded and cleaned to remove any over-growing vegetation. This is important to ensure that the blankets are installed tightly butted together with no gaps.
- The blanket is fully inserted in to SS40 edge retention trim where this is installed.
- Continue on up the slope with the next roll, taking care to ensure that the junction between the two rolls is tightly butted. Full any gaps with the extra substrate provided.
- When the first row of blankets are installed and the selvedges unfolded, the contractor is to use a short piece of 50 x 50mm or similar softwood timber to run up and down the selvedge, lightly pressing up against the substrate and vegetation adjacent to remove all surplus material and leave a clean edge to butt the next blanket up to. The surplus substrate and vegetation is to be collected and set aside for future use.

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- Upon completion of the area, the previously collected surplus substrate is to be used to dress into and make good any joints where the blanket edges are not tightly butted. Excess vegetation spouts removed from cleaning the selvedge can be applied to filled gaps/joints or any bare areas and these will usually root and establish within a couple of weeks.

- In order to keep all joints correctly spaced and well-made it is recommended that no more than three rolls should be installed before adjacent rolls are added to the installation.

- Commence the next row of blankets with a ½ roll, to create a staggered brick-bond laying pattern with the row previously installed.

- At abutments and penetrations the blanket may be cut using a sharp knife and straight edge. It is generally easier to cut up through the carrier on the underside of the blanket than to cut through the vegetation. Alternatively, a disc cutter can be used (using the appropriate safety equipment i.e. gloves and eye protection). Before cutting using this method, ensure that protection is applied to the waterproofing beneath using a timber plank or plywood sheet.

- In situations where the vegetation barrier secures the blanket edges against wind uplift, the 20/40 mm pebble loading must extend onto the leading edge of the blanket by a minimum of 100mm.

- Upon the completion of an area installed over a maximum 4 hour period the installation is to be heavily watered to ensure that the blanket and substrate are saturated before moving on to the next area.

- Upon completion of the installation apply Bauder organic slow release fertilizer at a rate of 80g/m2 using the approved applicator trolley and thoroughly watered in.

- Care is to be taken to avoid the blanket being walked or stood upon unnecessarily or trafficked by other trades during and after the installation, as this will have an adverse effect on the vegetation.

INSTALLATION OF LONG ROLLS

- The Bauder XF301 blanket can be supplied in long rolls in 1m increments from 3m to 10m.

- It is the contractor's responsibility to ensure that adequate unloading facilities and storage space on site will be available before the product is ordered.

- It is the contractor's responsibility to ensure that the appropriate crane with sufficient reach, load capacity and the Bauder crane attachment are present on site at the time of delivery.

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- In addition to the crane driver, a workforce of 3 or 4 is required to carry out the installation efficiently. One of the operatives on the roof will need to give directions to the crane driver.

- If you have not previously carried out a Bauder long roll installation, please ensure that the Bauder Site Technician responsible for the project is informed at least 2 weeks before installation is due to commence, to ensure that the correct level of site support is provided.

- The general principals of installation for long rolls are the same as for 2 x1m rolls, with the exception that the roll ends must be staggered a minimum 1m in length instead of ½ roll, to ensure staggered joints.

ESTABLISHMENT MAINTENANCE

- After completion of the installation it will be necessary to keep the substrate and blanket damp for a period of at least 4 weeks immediately afterwards, and it may be necessary to irrigate for longer than this if installation is followed by a warm, dry spell of weather.

- Please do not over-water! It is equally important to ensure that the green roof substrate does not become totally saturated by either excessive watering through periods of cool, wet weather. Further information on watering requirements for this product is available to view or download from the Bauder web site www.bauder.co.uk. Log in and visit our Technical Centre and review the document "**Watering Requirement Guidelines for Extensive and Bio-diverse Green Roof installations**"

- To encourage the plants to survive without too much irrigation and to harden them off in readiness to survive winter, it is important to start cutting back on watering from early September.

- The maintenance requirement in the following years will depend upon the weather experienced through the winter and early spring of each year and should follow our standard biodiversity green roof maintenance guidelines.

SUPPORT

- Modern extensive and bio-diverse green roof installations will normally require only minimal maintenance. Bauder is happy to offer advice on any issues concerning your green roof and enquiries should be forwarded to our Green Roof Technical Department at the address below.

- We believe our products and systems are of the highest standard and are always prepared to discuss any queries or concerns that may arise. Providing photographs or drawings to accompany your queries will help speed our response.

Please note: In the event of any query arising which it is thought may affect the condition of the system, then Bauder Ltd should be contacted at the address below. We cannot accept responsibility for any problem or failure due to use outside those parameters for which the system was designed or 'acts of god' beyond our control e.g. extreme weather conditions or damage through pests.

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GREEN ROOF LANDSCAPING

EXTENSIVE TECHNICAL GUIDE

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PRODUCT SELECTOR

The following table highlights the specific features and benefits of the various Bauder extensive green roof systems and may be of some assistance when determining the suitability for a particular project. In addition, we have a team of experienced technical managers and office based technicians who are happy to offer more detailed advice.

	Bauder Sedum Blanket	Bauder SDF Mat	Bauder DSE 20	Bauder DSE40	Bauder Reservoir Board (75mm)
Planting issues					
Plug planting option	n/a	●	✓	✓	✓
Hydro-planting option	n/a	✓	●	●	
Fully established blanket vegetation	✓	✓	●	●	●
Option of choosing plants		P	P	P	P
Est. establishment period 12 months		P	P	P	P
Establishment period 18 - 24 months		H	H	H	
Fertilise annually	✓	✓	✓	✓	✓
Irrigation required*	✓				
Fast installation	✓	H	H	H	
Specific system features					
Suitable for paved walkways	✓		✓	✓	✓
Very lightweight	✓				
Additional water retention			✓	✓	✓
Integral protection/filtration layer	✓	✓			
Roof falls					
Zero falls				✓	
Slopes between 1 - 5°	✓	✓	✓	✓	
Slopes between 6 - 15°	✓				✓
Slopes up to 25°	✓				
Roof areas up to 1000 m²	✓	P	P	P	P
Roof areas 1000 - 3000 m²	✓	P or H	P or H	P or H	P or H
Roof areas 3000 m²+	✓	H	H	H	H

P = Plug planted
H = Hydro-planted

✓ = Recommended

● = Possible option where design conditions dictate

* applicable only if specification circumstances dictate i.e. steep slopes, exposed locations and within 50 miles of east coast of UK.

XERO FLOR SEDUM BLANKET

Xero Flor sedum blanket was first introduced in Germany over 20 years ago and is now the largest selling sedum blanket in Europe with millions of square metres installed not only in Europe, but also in the USA and Canada.

Bauder has been growing Xero Flor vegetation blankets in the United Kingdom since 1997; and currently have approximately 150,000 m² under cultivation to cater for the ever increasing demand for this living product.

Our unique patented lightweight carrier fleece and specially developed growing medium provides one of the few sedum blankets available that can be installed and retained on slopes as steep as 25°, using our special retention strips and drainage edge trims.

A broad mix of sedum species together with some mosses and grasses present, all of which are selected to suit our local climate and ensure a diversity in the flower and foliage colour regardless of location. The chosen varieties also keep the weight and maintenance of the system to a minimum.

▲ View looking along one of the banks of mature XF301 ready for harvesting.

▲ Rolls being harvested and prepared for delivery.

▲ Examples of some of the plant species to be found within Bauder XF301 sedum vegetation blankets.

▲ Long length rolls being craned into position and installed.

- Cultivated by the UK's leading specialists.
- Proven range of green roof systems.
- Wide existing portfolio of projects in the UK and Republic of Ireland
- EXT. F.AA and EXT. S.AA fire rated system.
- Delivery to site within 24 hours of harvesting (not imported).
- Fully trained and approved installers.
- Free monitoring and support through to final establishment.
- Free from foreign insects and plant species.

SPECIFICATION SUPPORT

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SEDUM BLANKET SYSTEMS

BAUDER XF301 COMBINATION SEDUM BLANKET

The Bauder XF301 is our highly successful Xero Flor sedum blanket system with a variety of sedum species, herbs, moss and grasses specifically selected to flourish in our climate. The multi-functional sedum blanket combines the vegetation support layer with a moisture retention fleece to provide the perfect base for all lightweight roofing scenarios and a labour efficient installation. The blanket is available either in standard, manually handled 2 x 1 m rolls or larger, crane installed 3 m - 10 m rolls, for speed of installation when working on larger roof areas.

The patented geo-textile carrier fleece with its ultraviolet resistant nylon loops provides a support base for the specially developed substrate growing medium and gives stability to the established vegetation, whether on a low pitch flat roof or slopes up to 25°.

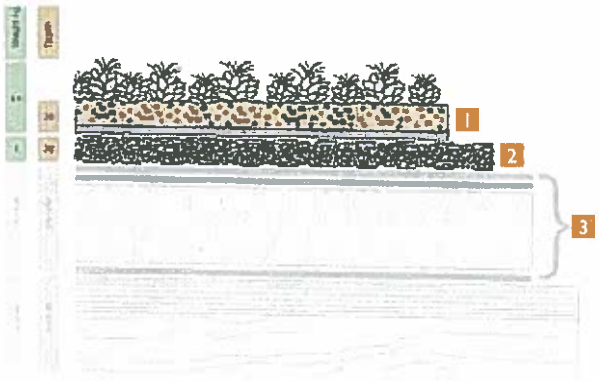
The pre-attached fleece is a unique feature of our sedum blankets, retaining moisture after rainfall thus allowing the plants time take up the water for future storage. The sedum plants grow to maturity in the blanket before harvesting, which ensures that they acclimatise quickly to their new rooftop location.

ROOFS WITH MINIMAL FALLS >1° AND UP TO 2°

Extensive green roofs should be designed with a minimum fall of 1:60, and even then, small areas of standing water may still occur. In these instances it is imperative to ensure that the plant roots do not become permanently immersed, otherwise they will rot and the plants will eventually die.

Bauder SDF Mat drainage layer is specified within the system to lift the blanket clear of any standing water, allowing it to disperse during periods of prolonged heavy rain. As the SDF Mat assists in free drainage, it ensures that the correct levels of moisture and air within the moisture retention fleece are maintained, providing the plant roots with the best conditions in which to develop.

Technical data	
Total build up height *(excluding waterproofing)*	48 mm
Saturated weight of landscaping	45 kg / m²



1. Bauder XF 301 Sedum Blanket
2. Bauder SDF Mat, drainage layer
3. Bauder Waterproofing System

ROOF SLOPES 3° TO 9°

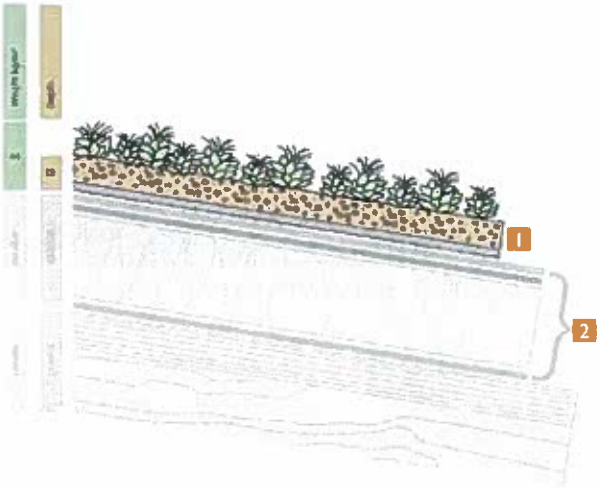
For roof slopes exceeding 2° standing water should not be an issue, allowing the SDF Mat drainage layer to be eliminated and the Bauder XF301 combination blanket to be installed directly over the waterproofing.

Standard 2 x 1 m rolls can be used up to 5° but above this slope, long rolls, available in lengths up to 10 m and cut to the nearest metre are recommended as they reduce the number of joints and are more wind resistant. A crane that is capable of reaching all areas of the roof is imperative when using long rolls.

When installed over either a 'barrel vault or 'dual-pitched' roof, the long length blanket may be applied over the ridge without additional mechanical retention of the blanket, as the forces imposed are counterbalanced. For all other situations, Bauder sedum blanket retention strip should be used.

In some instances it is not possible to use the long length roll, i.e. if there are numerous rooflights or interruptions or if crane access is impossible. In these situations the standard 2 x 1 m lengths may be used in conjunction with the sedum blanket retention strips to mechanically prevent slippage of the blanket.

Technical data	
Total build up height *(excluding waterproofing)*	28 mm
Saturated weight load of landscaping	44 kg / m²



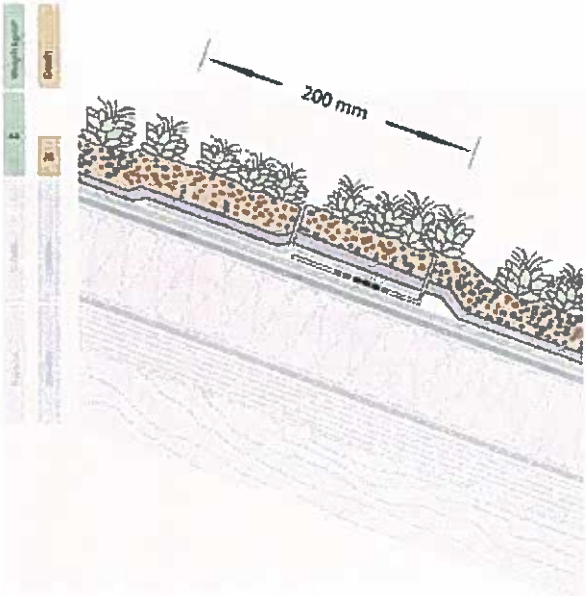
1. Bauder XF 301 Sedum Blanket
2. Bauder Waterproofing System

ROOF SLOPES 10° AND UP TO 25°

Where the XF301 blanket is to be installed on a monopitch slope of between 10° and 25°, it is essential to mechanically restrain the blanket against the shear forces created by the slope. This is achieved by using the Bauder retention strip, a simple stainless steel device for securing the blankets without impeding drainage or creating visual surface undulations once installed. Each retention strip is set in a staggered pattern 200 mm below the leading edge of the blanket, the strip being secured by a 200 mm wide strip of cap sheet which is bonded through the holes of the base plate of the strip to the waterproofing underneath. The teeth of the retention strip penetrate the underside of the blanket and ensure that no post-installation slippage can occur. A protective plastic cover strip is provided and remains in place until the blankets are ready to be installed.

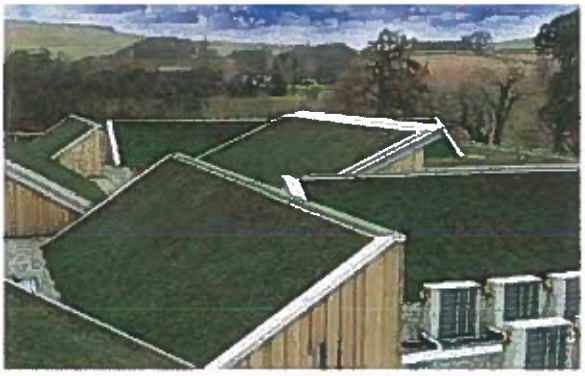
When the XF301 blanket is installed either on a barrel vault or a dual pitched roof, the longer length blankets may be applied over the ridge without additional mechanical retention, as the forces imposed are counterbalanced. In all other applications where the XF301 blanket is to be used on slopes of 10° or more, it is essential that the Bauder retention strip is used as described above.

Technical data	
Total build up height *(excluding waterproofing)*	28 mm
Saturated weight of landscaping	44 kg / m²



ROOF SLOPES > 25°

Sedum plants can thrive on slopes exceeding 25°, however increasing the steepness of the roof slope above this will introduce issues in relation to maintenance and fertilising that must be taken into account within the design. It is very difficult to stand on a roof above this pitch without damaging the plants in the process and fertiliser can be washed out of the blankets during heavy rainfall, necessitating additional applications. Not all roof designs are suitable and therefore it is important to first establish suitability through design and planning to ensure that these additional aspects are both practical and achievable. Should you be considering a green roof installation on an extreme slope we would suggest that you contact our green roof technical department in the first instance for guidance.



IRRIGATION REQUIREMENTS

The vegetation species selected within the Xero Flor blankets are hardy, drought tolerant and will survive on normal rainfall. Artificial irrigation on slopes up to 5° is unnecessary, although where practical a hose and sprinkler may be used during prolonged dry spells to maintain appearance. However, please note that it is a natural characteristic of these plants that they maintain hardiness by experiencing dry or extreme cold conditions during the course of the year.

Between 5 and 10 degrees it may be that the vegetation would benefit from irrigation, dependant upon the location, height and aspect of the roof and for all installations in excess of 10 degrees or south facing aspects, we would recommend that irrigation is always provided. We would recommend that a drip feed/leaky pipe-type irrigation system is used and our green roof technical department can provide information and specialist contacts to assist you in designing this item.

SPECIFICATION SUPPORT

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SEDUM BLANKET ON WARM ROOF CONSTRUCTION

GENERAL DETAILING

The British and European standards and industry codes of practice for traditional flat roof waterproofing apply equally to all forms of green roof construction. For the landscaping element, the well respected and independent German FLL standards are the most widely recognised and have been fully adopted by Bauder.

The minimum required upstand height is 150 mm. This must be observed at all times and taken from the finished landscape surface and not that of the waterproofing. Perimeter kerbs featuring mechanically fixed capping must also be treated as upstands and given a minimum height of 150 mm.

The only exceptions to this are perimeter kerbs, where the waterproofing terminates in a traditional welted drip or a GRP trim or beneath door thresholds, where a lineal drainage channel is incorporated.

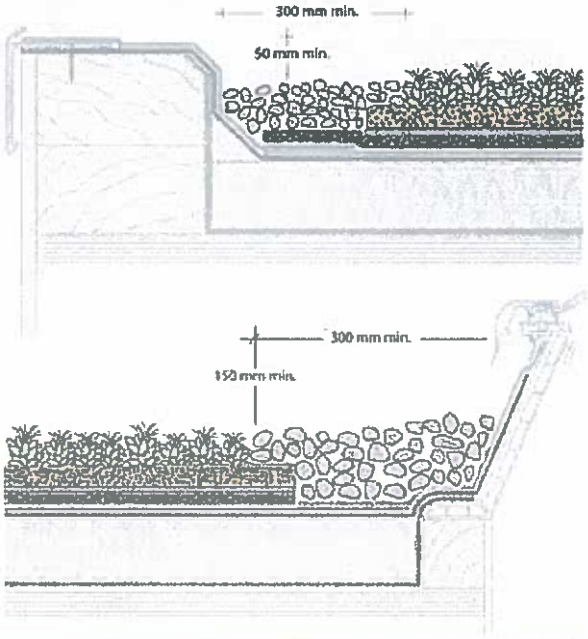
Round washed pebbles, graded 20-40 mm, or other Bauder approved aggregate, should be used at all borders to a recommended width of 500 mm, to provide vegetation free edging around all upstand abutments, roof lights, rainwater outlets and all other penetration points.

To conform to current Health and Safety legislation, either a handrail or fall prevention system should be incorporated within the design. If a portable ladder is to be the main means of access then a wall mounted fixing point for securing the ladder must be included.

VEGETATION BARRIERS

Vegetation barriers provide several important functions for extensive green roofs:

- Protection of the vegetation layer from water running down vertical upstands.
- Rapid drainage during and after heavy rainfall.
- Ease removal of encroaching vegetation during routine maintenance.
- Protection of the waterproofing from mechanical damage.
- Provision of a fire break.
- Resistance to wind uplift by increasing the imposed loading at roof perimeters.



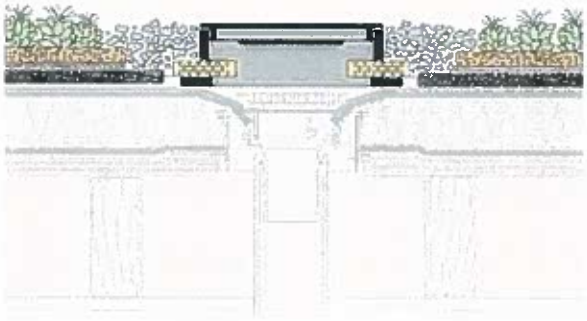
Salt Grammar School
Bradford

BAUDER INSPECTION CHAMBERS

These should be installed above all internal rainwater outlets to provide access for inspection and cleaning. The chamber lid has finger holes for easy removal with a blanking plate beneath, preventing sunlight from allowing any washed through seeds to germinate within the outlet and obstruct drainage. The unit also features perforated piping that allows excess water to reach the outlet quickly during heavy rainfall.

▲ Bauder inspection chamber with surrounding pebble vegetation barrier

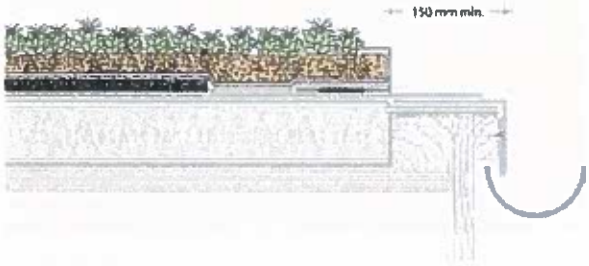
Bauder inspection chambers are available as either a full size unit for internal outlets or a semi-circular alternative for outlets positioned close to abutment walls or kerbs. If required, the height of the chambers can be raised in 50 mm increments by use of height adapter rings.



BAUDER SS40 DRAINAGE AND EDGE TRIM

Bauder SS40 is a perforated stainless steel trim used to retain the sedum blanket at open perimeters with external gutters and is suitable for both bitumen and single ply scenarios. It is automatically used on specifications where the roof slope exceeds 5°.

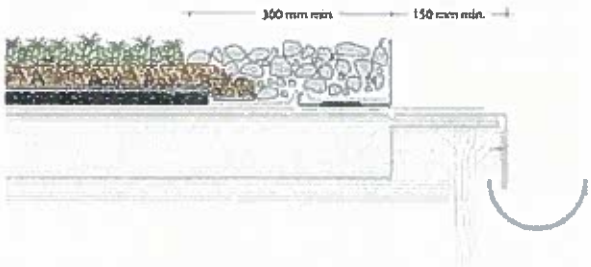
Bauder SS40 prevents substrate erosion at the exposed edges of the blanket and, due to the excellent wind uplift and fire characteristics of the Bauder sedum blanket, may be used where the pebble vegetation barrier is impractical. The trim should be set back from the drip edge by 150 mm to prevent vegetation overhanging the gutter and impeding drainage.



▲ Bauder SS40 Drainage and Edge Trim

BAUDER AL80/100 DRAINAGE TRIM

Bauder AL80/100 is a perforated aluminium trim that retains pebble vegetation barriers at open perimeters. The product is suitable for use with both bitumen and single ply waterproofing systems.



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BAUDER DSE20 - FOR ROOF SLOPES OF 1 - 5°
Also for extensive roofs with some hard landscaping

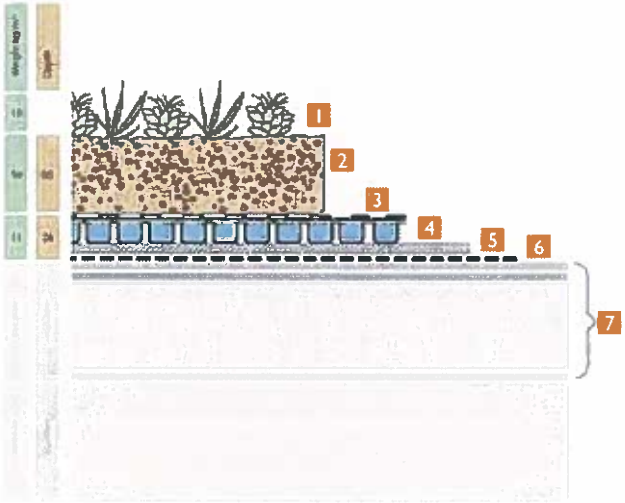
Bauder DSE20 is manufactured from high density polyethylene (HDPE) where the cupped profile provides water storage whilst allowing the water to drain through the channels on the underside. The design features of Bauder DSE20 means that it requires additional filtration, protection and separation layers within the specification.

Bauder DSE20 will also provide a pressure resistant stable base for paved walkways or support for roof mounted equipment without compression of the drainage layer. The board depth of Bauder DSE20 provides excellent drainage characteristics, a high water storage capacity and is suitable for roofs with a minimum fall of 1°. This product may also be used on flat roof projects where standing water does not exceed 10 mm.

Planting options are: hydroplanting, where a wide variety of pre-selected plants are incorporated, plug-planting, where specific plants may be chosen, or pre-cultivated vegetation mats, where a mature vegetation sward is installed over the substrate.

Material	High density polyethylene
Board size	1.06m x 2.36m
Thickness	20 mm
Weight	ca. 1.2kg/m²
Water storage capacity	ca. 7.4 litres/m²
Compressive strength	ca. 110kN/m²

Landscaping Technical Data	
Total build up height *(excluding waterproofing)*	105 mm
Maximum water storage capacity of entire system	45 litres/m²
Saturated total weight	117 kg/m²



1. **Plug Planting, Hydroplanting or Vegetation Mat**
   Selected sedum herb species to suit the project and site locality.
2. **Bauder Extensive Substrate**
   Lightweight growing medium, nominal depth 80 mm. Manufactured and used in accordance with FLL guidelines.
3. **Bauder Filter Fleece**
   Filtration layer prevents substrate fines from washing into the drainage layer.
4. **Bauder DSE 20**
   Water storage and drainage, 20 mm thick.
5. **Bauder FSM 600**
   A 4 mm thick protection layer.
6. **Bauder PE Foil**
   A polyethylene foil separation and slip layer manufactured from recycled granules. *(Not used if the roof fall is over 3°)*
7. **Bauder Waterproofing System**
   High performance waterproofing membranes suitable for green roof systems.

KEY FEATURES

- Suitable for roofs from 1 - 5° slope.
- Provides a stable base where plant or pathways are incorporated.
- Compression resistant.
- 7.4 litres/m² water storage.

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BAUDER DSE40
The Zero Falls Solution

Material	Recycled HDPE
Board size	1.04m x 2.03m
Thickness	40 mm
Weight	ca. 1.8 kg/m²
Water storage capacity	13.5 litres/m²
Compressive Strength	80kN/m²

SLOPES OF 0° – 5°

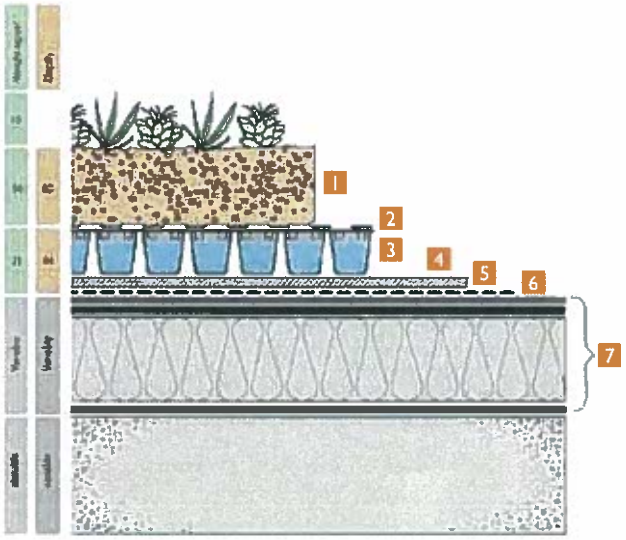
Providing an extensive green roof installation to a zero falls roof necessitates that the substrate must be held clear of any standing water that collects on the roof surface, to prevent the plant roots from becoming saturated and rotting away. This can most easily be achieved using the Bauder DSE40 drainage/reservoir board, which is manufactured from environmentally friendly recycled high density polyethylene (HDPE), with a profile that provides lightweight water retention and multi-directional drainage. DSE40 is generally used for roof slopes between 0°-5°, but can be used up to a maximum of 10° if planting is predominately drought tolerant.

Bauder DSE40 provides an effective method of retaining low system weight, whilst at the same time providing excellent water retention. If the chosen planting is predominantly sedum, it is possible to reduce the substrate depth on roof slopes between 0-10° down to 60 mm to reduce the overall system weight by a further 24 kg/m², or can be used to increase the volume of water stored within the system, thus allowing for a more diverse plant mix.

Bauder DSE40 is ideal for projects where the overall system weight is a critical factor or where the extensive planting schedule is to be more diverse and to include species such as herbs and grasses that require more water than typical drought tolerant plants like sedums.

Planting options are: hydroplanting, where a wide variety of pre-selected plants are incorporated, plug-planting, where specific plants may be chosen, or pre-cultivated vegetation mats, where a mature vegetation sward is installed over the substrate.

Landscaping Technical Data	
Total build-up height (excluding waterproofing)	125 mm
Maximum water storage capacity of entire system	51.5 litres/m²
Saturated total weight	124kg/m²



1. **Vegetation**
   Selected species to suit the project and site locality.
2. **Bauder Extensive Substrate**
   Lightweight growing medium, nominal depth 80 mm.
   Manufactured and used in accordance with FLL guidelines.
3. **Bauder Filter Fleece**
   Filtration layer prevents substrate fines from washing into the drainage layer.
4. **Bauder DSE40**
   Water storage and drainage 40 mm in depth.
5. **Bauder FSM 600**
   A 4 mm thick protection layer.
6. **Bauder PE Foil**
   A polyethylene foil separation and slip layer manufactured from recycled granules. *(Not used if the roof fall is over 3°)*
7. **Bauder Waterproofing System**
   High performance waterproofing membranes suitable for green roof systems.

KEY FEATURES

- Suitable for roofs from 0 - 5° slope.
- Excellent drainage and water storage.
- Compression resistant.
- 13.5 litres/m² water storage

SPECIFICATION SUPPORT

NBS SPECIFICATIONS
www.bauder.co.uk/technical-centre

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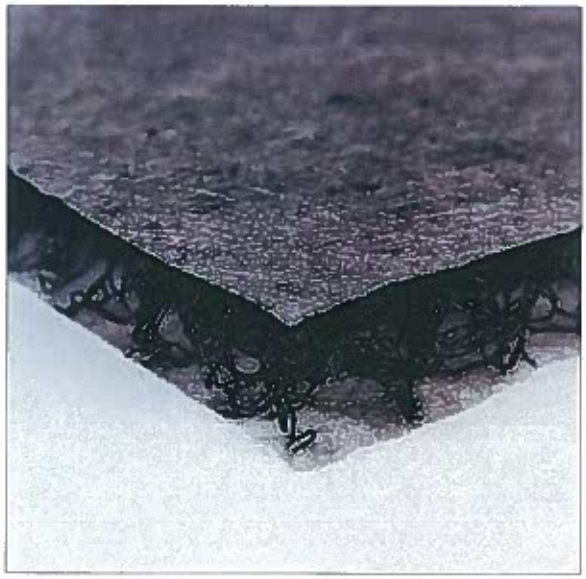
E: technical@bauder.co.uk

BAUDER SDF MAT
The cost effective solution for large roof areas



SLOPES OF 1° - 5°

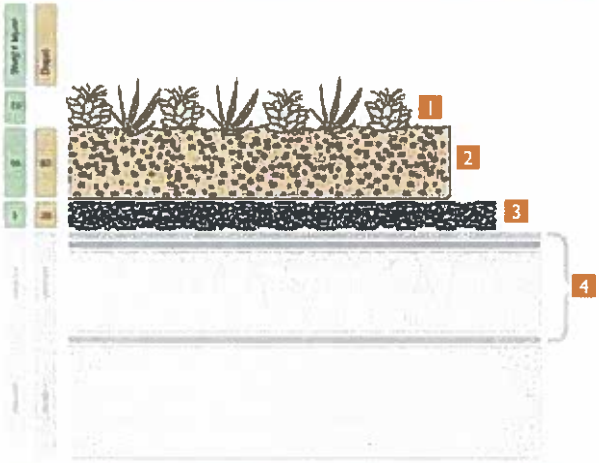
Bauder SDF Mat is a multi-functional drainage/filtration layer which also provides protection to the waterproofing system. The product is manufactured from ultraviolet resistant nylon woven loops which are thermally bonded to geo-textile filter fleece facings. On larger projects with modest falls and where maintenance only foot traffic is anticipated, the SDF Mat offers a very cost-effective solution for lightweight extensive green roof construction.

On roofs where paved walkways or platform mounted equipment are proposed, Bauder DSE20 can be used in the specific areas to provide support. A separate filter fleece layer will be required, which is to be dressed across the DSE20 and lapped onto the adjoining Bauder SDF mat.

Planting options are: hydroplanting, where a wide variety of pre-selected plants are incorporated, plug-planting, where specific plants may be chosen, or pre-cultivated vegetation mats, where a mature vegetation sward is installed over the substrate.

Material	Geo-textile facings with UV resistant woven nylon loops	
Roll size	1 m x 20 m	1 m x 50 m
Thickness	20 mm	20 mm
Coverage	20 m²	50 m²
Weight	ca. 600 g/m²	
Pressure resistance	ca. 20 kN/m²	

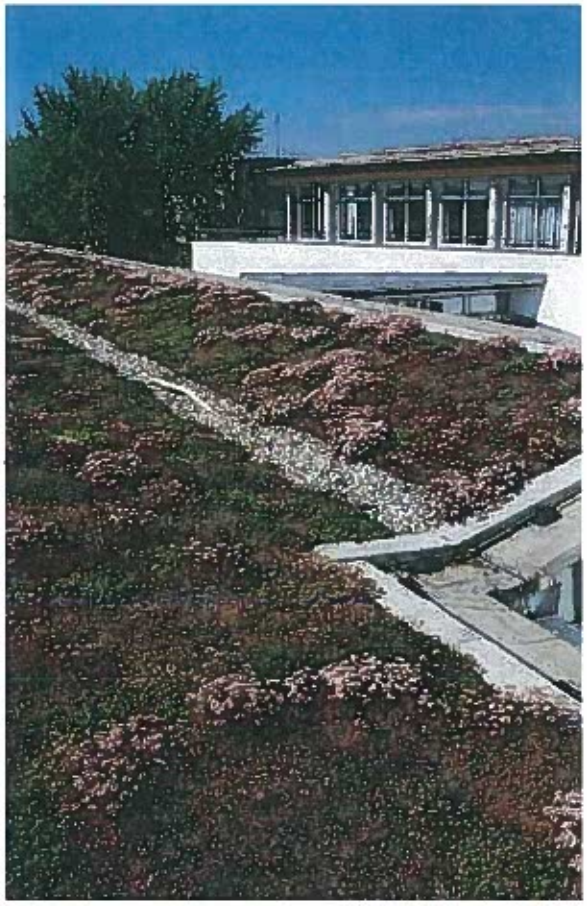
Landscaping Technical Data	
Total build up height	100 mm
(excluding waterproofing)	
Water storage capacity	38 litres/m²
Saturated weight	107.0 kg/m²



1. **Vegetation**
   Selected species to suit the project and site location.
2. **Bauder Extensive Substrate**
   Lightweight growing medium, nominal depth 80 mm.
   Manufactured and used in accordance with FLL guidelines.
3. **Bauder SDF Mat**
   Multi-functional drainage, filtration and protection layer, 20 mm thick.
4. **Bauder Waterproofing System**
   High performance waterproofing membranes suitable for green roof systems.

KEY FEATURES

- Utilised on roofs with 1 - 5° slope.
- Suitable only for lightly trafficked areas.
- Drainage, filtration and protection from a single product.
- Cost effective construction.
- Excellent drainage.



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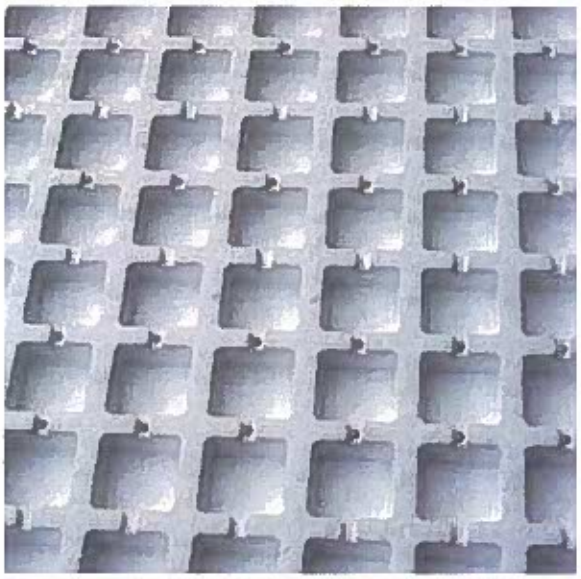
BAUDER RESERVOIR BOARD
The Slope Roof Solution



The Bauder Reservoir Board, originally developed and still used to offer maximum water retention within flat green roof systems, is now most commonly used in extensive green installations on roofs with falls of in excess of 5°. This necessitates that the substrate must be held firmly in place, to manage the shear loads that arise which could otherwise cause it to slide off the roof. It is also essential to the performance of the system that the drainage board is sufficiently rigid to avoid flexure in its length as the slope and shear load increases. These requirements are easily met by the Bauder 75 mm Reservoir Board, which is manufactured from rigid expanded polystyrene foam, with a profile that is lightweight, provides good water retention and allows multi-directional drainage. The product allows 50 mm of substrate to be packed into the profile and thus reduces the shear load on slopes of up to 15° to a point where no additional substrate restraint, other than at the perimeters, is required. For slopes of in excess of 15° the sheer performance of the reservoir board should be further enhanced by the incorporation of a timber trellis within the substrate to be installed above the profile of the board.

The reservoir board is ideal for both flat and slope roof projects both where the overall system weight is critical factor and the extensive planting schedule is more diverse, to include species such as herbs and grasses that require more water than typical drought tolerant plants like sedums.

Planting options are: hydroplanting, where a wide variety of pre-selected plants are incorporated, plug-planting, where specific plants may be chosen, or pre-cultivated vegetation mats, where a mature vegetation sward is installed over the substrate.

KEY FEATURES

- Suitable for roofs from 5 - 25° slope.
- Lightweight.
- Good water storage capacity.
- Wider range of plant options.
- Additional protection to the waterproofing.
- Rot resistant and root tolerant.

Material	Expanded polystyrene
Board size	0.780 m x 1.283 m
Thickness	75 mm
Water storage capacity	21.5 litres/m²
Weight	ca. 0.95 kg/m²
Pressure resistance	60 kN/m²

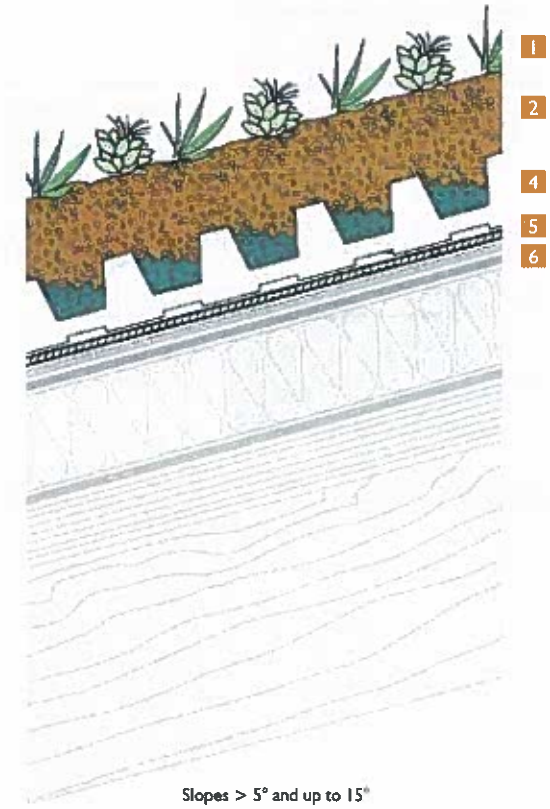
Landscaping Technical Data	
Minimum build up height	134 mm
Water storage capacity of entire system	32 litres/m²
Total weight *(exc. Waterproofing)*	112.4 kg/m²

SLOPES OF >5° AND UP TO 15°

Of all the substrate based Bauder extensive green roof systems, only our 75 mm Reservoir Board has the water storage capacity and substrate retention characteristics to be used on slopes that exceed 5°.

For roof slopes between 5-15°, Bauder extensive substrate can be applied directly to the profiled surface of the reservoir board. No filter fleece or PE Foil separation layer are used. The special board profile helps to retain the growing medium, which is further stabilised once the plants have fully rooted into the substrate.

Planting options are: plug-planting, where specific plants may be chosen, or pre-cultivated vegetation mats, where a mature vegetation sward is installed over the substrate.



Slopes > 5° and up to 15°

1. **Vegetation**
   Selected species to suit the project and site locality.
2. **Bauder Extensive Substrate**
   Lightweight growing medium, nominal depth 80 mm.
   Manufactured and used in accordance with FLL guidelines.
3. **Timber Trellis**
   Frabricated from untreated timber for substrate retention.
4. **Bauder Reservoir Board**
   Water storage and drainage, 75 mm thick.
5. **Bauder Eco-Mat Protection Fleece**
   A 6 mm thick protection layer.
6. **Bauder Waterproofing System**
   High performance waterproofing membranes suitable for green roof systems.

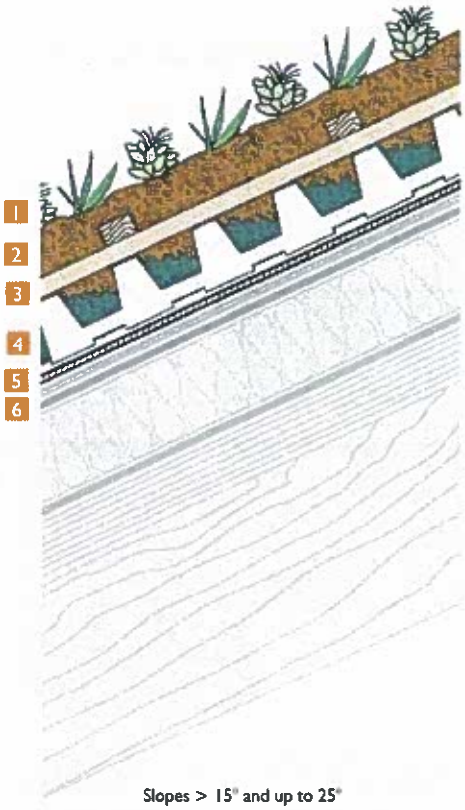
SLOPES OF >15° AND UP TO 25°

The greening of more severe slopes is becoming increasingly popular and can add a striking additional dimension to the view of a building.

As with 5-15 degree slopes, only the Bauder 75 mm reservoir board has sufficient water capacity to be used on slopes of in excess of 15 degrees. In order to overcome the shear problems within the depth of the substrate it is necessary to incorporate an untreated timber trellis, which will remain until the plant roots have established, after which time it is superfluous and will rot away.

When planning to install a green roof on a slope of in excess of 15 degrees, careful thought must be given as to how maintenance, both during initial establishment and afterwards for the ongoing support of the vegetation, is to be carried out safely.

Planting options are: plug-planting, where specific plants may be chosen, or pre-cultivated vegetation mats, where a mature vegetation sward is installed over the substrate.



Slopes > 15° and up to 25°

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PLANTING OPTIONS

With the increased requirement to meet Biodiversity Action Plans for planning or to secure eco-points for sustainable homes or BREEAM via the vegetation, the method of application and its timing has become increasingly more important. This is particularly the case when native species of wild flowers, grasses and herbs are to be incorporated and their effective establishment is critical to meeting the long-term environmental credentials of the development. Whilst the climate in the United Kingdom is comparatively temperate when compared to Europe and some types of vegetation will be able establish and grow through much of the year, the optimum period to install vegetation onto a green roof is in the periods of April/May and September/October.

HYDRO-PLANTING

Hydroplanting is the term used to describe the application of vegetation cuttings and seeds to roof areas previously prepared with a green roof build-up including Bauder Extensive Substrate as the growing medium. The depth and quality of the Bauder substrate meets all requirements of the current FLL standards.

Hydroplanting is achieved by casting seeds and cuttings onto the prepared substrate; which can either be done by hand casting on smaller roofs or by mechanical means on medium to larger areas. If required, a bio-degradable mulch can be applied onto the vegetation, to secure the seeds and cuttings to the substrate surface and provide water retention and nutrition to the vegetation during it's early establishment. On very large roof areas the seeds and cuttings can be incorporated into the mulch and spray-applied to the substrate. Growth of the vegetation will commence immediately after installation and is generally fully established after two full growing seasons.

▲ Applying the special spray mix to the substrate growing medium.

Seeds and plant cuttings spray applied to recently prepared substrate growing medium.

▲ After one day

▲ After two months

▲ After one week

▲ 12 - 18 months

The various stages of plant development in a Bauder hydro-planted extensive green roof system.

PLUG PLANTING

Where the client wishes to choose the particular type and species of vegetation, Bauder can supply plug plants as an alternative to the pre-selected random mix associated with the hydroplanting system. The 'plugs' are then planted by hand to a density specified by the client. The more plants per square metre the faster the vegetation will establish to cover the roof entirely.

VEGETATION MAT

Where an immediate dense, lush sedum vegetation is required which will not require irrigation, then the Bauder XF300 vegetation blanket may be used. The product can be installed either manually in 2m x 1m rolls, or with crane assistance in longer lengths when required.

Pre-cultivated plug plants are also available as an alternative option to hydroplanting

▲ Measuring the correct depth of growing medium

▲ Individual plug planting by hand

PLANT LIST - BOTANICAL NAMES

Herb species
- Sedum Acre
- Sedum Album
- Sedum Album Coral Carpet
- Sedum Cauticolum
- Sedum Ewersii
- Sedum Floriferum
- Sedum Hyspanicum
- Sedum Kamtschatikum
- Sedum Reflexum
- Sedum Sexangulare
- Sedum Spurium
- Sedum Telephium
- Geranium macrorrhizum
- Inula ensifolia
- Jovibarba hirta
- Lychnis alpina
- Linum perenne
- Origanum vulgaris
- Petrorhagia saxifraga
- Potentilla aurea
- Prunella vulgar.
- Saxifraga aizoon
- Sempervivum
- Thymus vulgaris
- Veronica teucrium

Assorted grasses
- Carex flacca
- Carex montana
- Festuca cinerea
- Festuca amethystina
- Festuca ovina
- Koelena glauca

Herbaceous Species
- Achillea tomentosa
- Allium schoeneprasum
- Alyssum saxatile
- Antennaria dioica
- Campanula rotundifolia
- Dianthus alpinus
- Dianthus plumarius
- Gypsophylla repens

Mixed plants for shade
- Allium schoeneprasum
- Campanula porten.
- Carex sysvatica
- Fragaria vesca
- Hosta sp
- Geranium sp
- Hyssopus officinalis
- Prunella vulgaris
- Sedum floriferum
- Sedum hybridum
- Sedum spurium i. Sorten
- Sedum cauticolum

Above is a selection of common plant species, typically used on the Bauder green roofs. Please either visit our website or contact us for a copy of our full list.

BIODIVERSITY ROOFS

Many native species of plants, birds, insects and other wildlife are in decline due to years of urban development that has claimed increasing areas of their natural habitat. Environmentalists, ecologists and local government planners now recognise the potential offered by roof landscaping as a method of replicating this lost natural habitat and there is now a growing interest in landscaping roofs designed specifically to meet local biodiversity needs.

This interest has developed in part from conservation work carried out in London on the rare Black Redstart. As a protected species of bird its future has become a planning consideration when building proposals are put forward for the development of brown-field sites, its natural habitat.

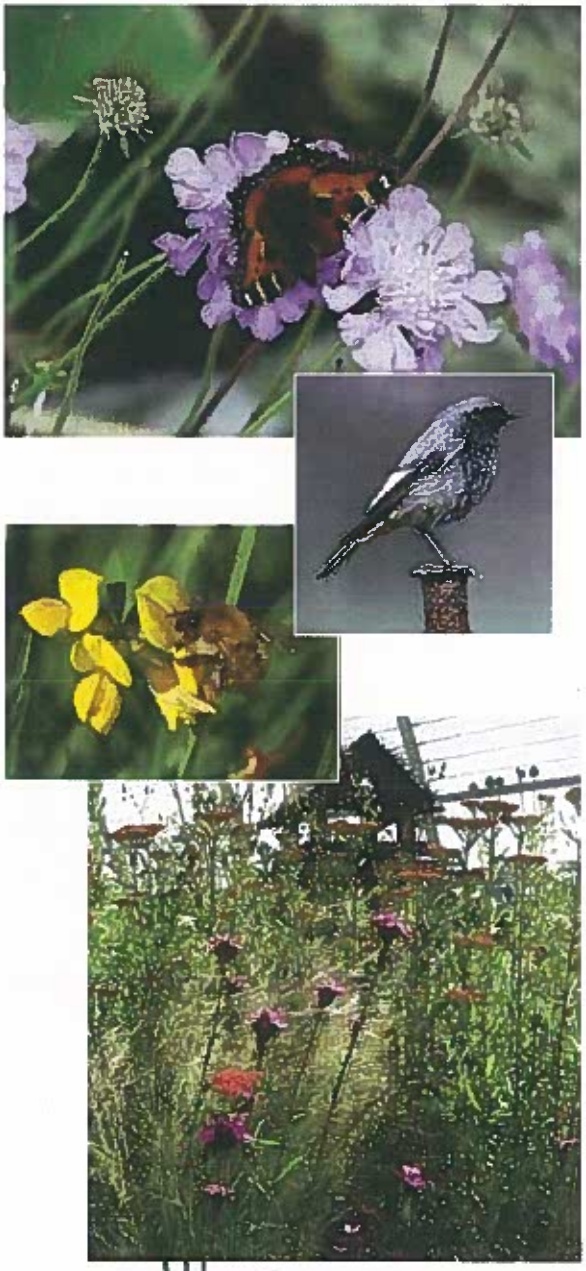
A biodiverse green roof finish can now form part of a biodiversity action plan for many local authorities, is seen as a solution to planning issues by developers and can often be a prerequisite for planning consent.

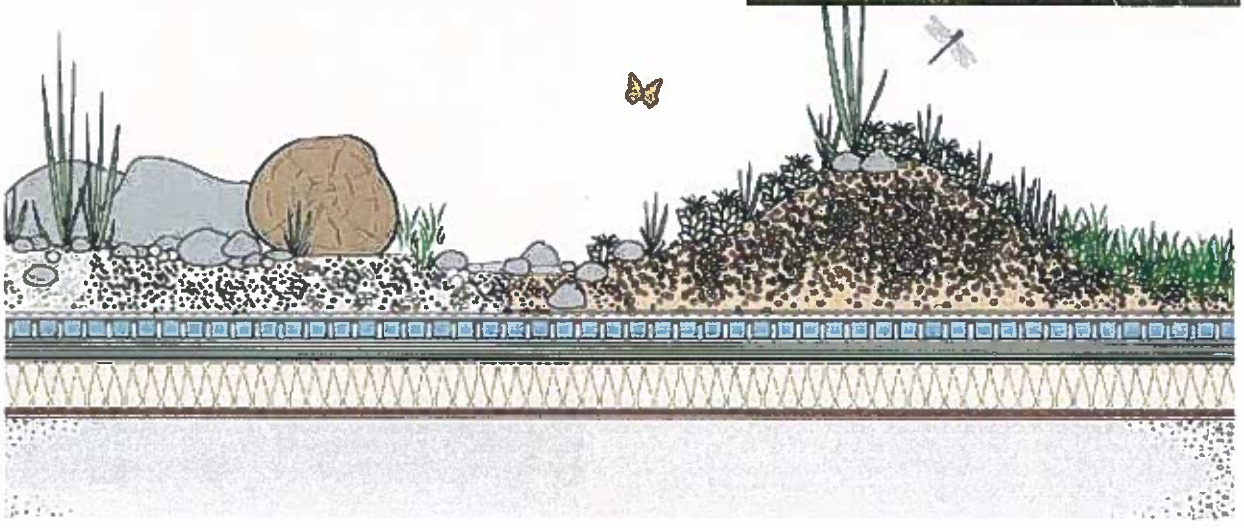
Flat and moderately sloped roofs are ideal for developing into biodiversity landscapes and the Bauder Total Green Roof is the recommended system build-up. The options available provide different drainage layers to meet all weight limitations and roof falls.

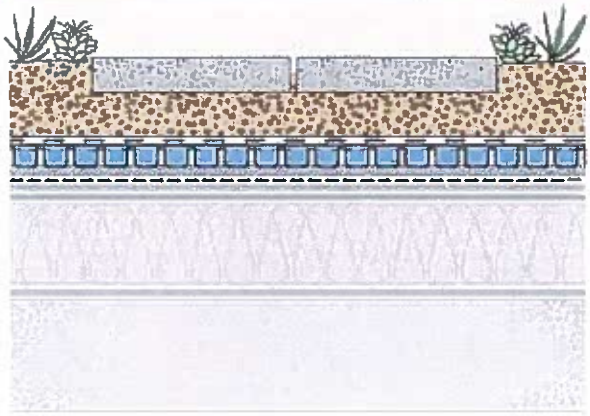
The substrate and vegetation should closely replicate the natural habitat of the differing species the roof is designed to attract. Whilst it was previously considered acceptable to re-use site waste produced from the building demolition by crushing the brick and concrete to form a growing substrate, recent legislation relating to the contamination present in these materials means that other sources of brick and recycled materials should now be used.

Nature generally needs a helping hand to get the required mix of vegetation and this can be most easily achieved by hand-seeding a chosen mix of grasses and flowers. To give the biodiversity landscape an element of "design", tree branches, small piles of stones, and lengths of hemp rope, etc. can all be incorporated into the landscaping. These items also provide micro-habitats for the differing wildlife.

Bauder can supply advice on all waterproofing and drainage related issues. Specific advice on the biodiversity aspects can be obtained from two leading independent organisations, the London Biodiversity Partnership, **www.lbp.org.uk** and English Nature, **www.english-nature.org.uk**



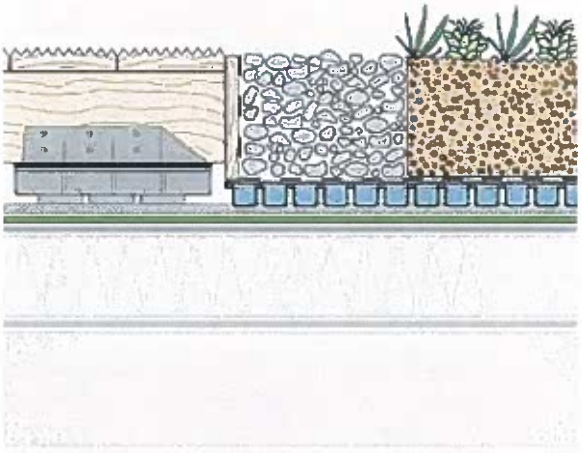




PATHWAYS AND ROOF MOUNTED PLANT

Extensive green roofs on commercial or industrial buildings often require defined access to service roof mounted plant and equipment. Paving can be laid directly on to extensive substrate or in a 2 - 5 mm angular crushed bedding gravel laid directly beneath the slabs, but it is important that the drainage layer is very stable. We recommend Bauder DSE 20 for these situations.

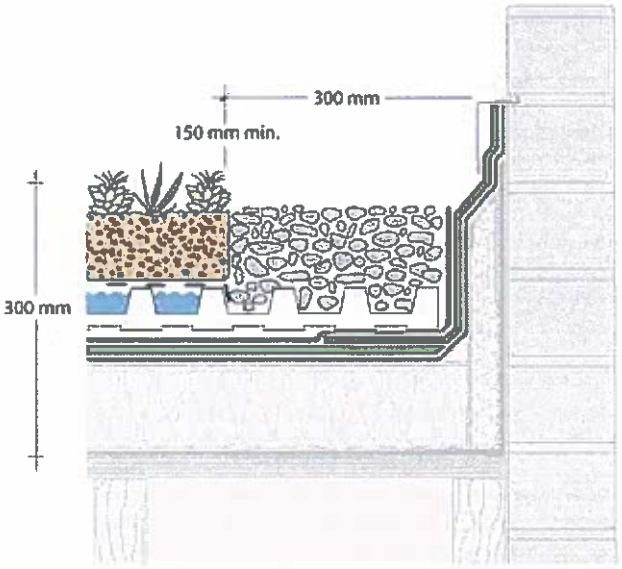
For regularly trafficked pathways or for permanently sited items of plant, such as air conditioning units, another option is to lay mortar or a no fines concrete bedding layer directly over DSE 20 and then install the paving slabs. This prevents them from moving or becoming dislodged.



TIMBER DECKING

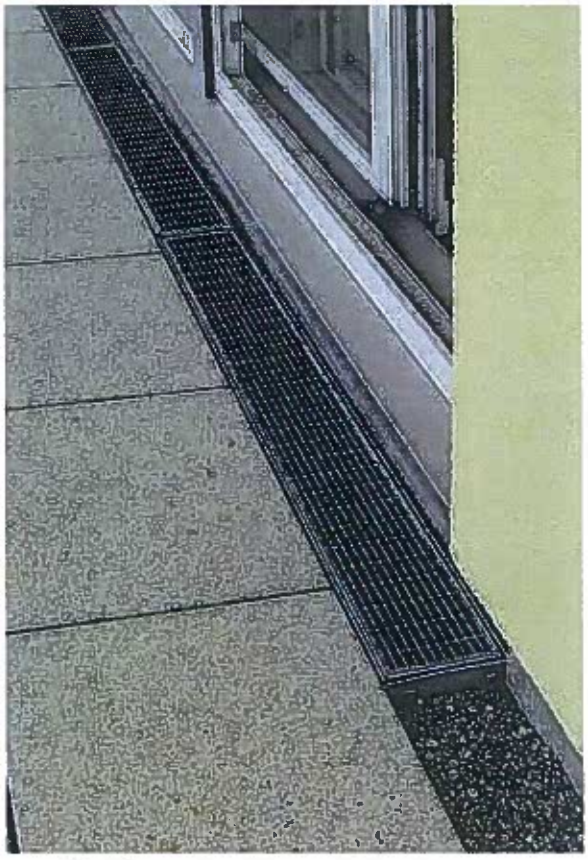
Timber decking should be constructed with a slight fall to disperse rainwater. The timber framework should be raised off the roof surface so that water can flow freely to rainwater outlets and prevent the bearers from eventually rotting.

The suggested method is to place the decking framework on Bauder Versijack adjustable support units positioned on Ecomat or FSM 600.



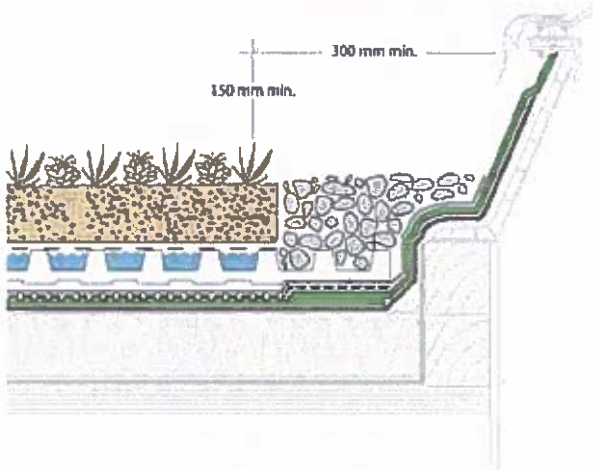
ABUTMENT WALL DETAIL

To conform to current 'Part L' requirements, it may be necessary to insulate the upstand at abutment walls, to compensate for unavoidable cold bridging created within the construction. This requirement can be achieved using the appropriate thickness of Bauder PIR insulation encapsulated within the upstand waterproofing that is at least 300 mm in height from the base of the structural deck. We have developed a special metal wall mounted bracket to secure the top of the insulation and protect the exposed leading edge, so it can be waterproofed. This bracket ensures that the visual appearance of the finished upstand is neat and regular.



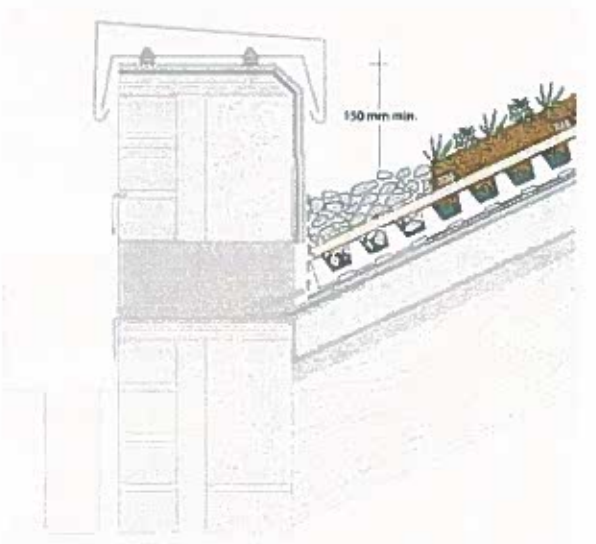
▲ This picture is showing the Bauder Linear Drainage System

DRAINAGE DETAILING



CONSTRUCTION OF ROOFLIGHT UPSTANDS

Due to the combined depth of the waterproofing system and soft landscaping, the proprietary kerbs supplied with most standard rooflights may be insufficient in height. In these situations the problem can be overcome by using timber to raise the kerb height and then fixing the proprietary kerb. A lining board can be used to conceal the exposed timber frame.

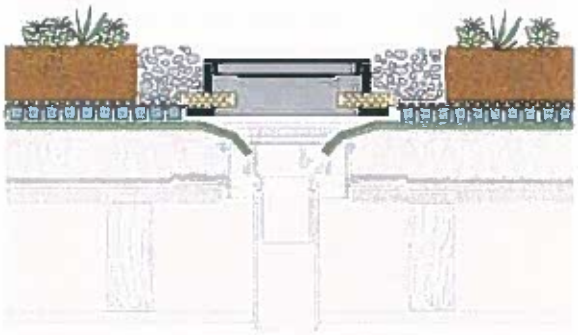


BASE SUPPORT FOR SLOPED ROOF SYSTEMS

Where Bauder Reservoir Board system is specified to provide substrate retention and a degree of water storage on slopes exceeding 5°, it is important that the first board is supported by a kerb or parapet wall at the base of the slope. This base support helps to prevent the load being transferred to the surface of the waterproofing that would otherwise result in slippage.

This support is equally important where an untreated timber retention trellis is incorporated to provide initial support for planting and protection against substrate erosion (applicable for all slopes between 16 - 25°).

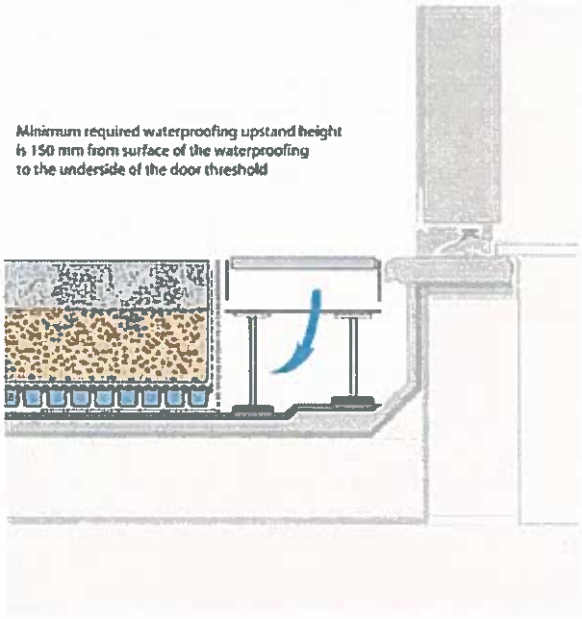
The detail above shows a typical parapet wall with a lead box chute outlet. Note the perforated stainless steel grille over the chute opening.



INSPECTION CHAMBERS

Bauder inspection chambers restrain the pebble vegetation barrier and provide ease of access to inspect and maintain rainwater outlets and drainage down pipes. Two sizes are available, the full standard circular unit and a half circular unit for outlets positioned close to abutments. A perforated pipe provides additional flow to the outlet during periods of heavy rainfall.

The width of the chamber and vegetation barrier should be taken in to account when calculating the design width of internal box gutters or gullies. A centrally located chamber requires a gutter width of 500 mm. If the outlet is located 'in-field', allow one square metre to accommodate both chamber and vegetation barrier.



BAUDER LINEAR DRAINAGE SYSTEM

For drainage close to walls or beneath door thresholds, linear drains can be used to collect surface water and discharge it directly into the drainage layer. The channel sections are perforated to allow water to seep through, and in the event of heavy rain, can direct water to outlets or drainage channels. The channel can be supplied separately for bedding on Bauder Mineral Drain (landscape depths exceeding 90 mm) or with adjustable support legs with an adjustment between 60 - 170 mm. A stainless steel closer is also available for this version if required, to bridge the space above the angle fillet.

ANNUAL MAINTENANCE

Annual maintenance is normally carried out in spring and autumn. It is important to ensure that safe access can be gained to the roof and that relevant health and safety procedures are followed. Safety harness attachment points or man safe systems should be provided in the construction where appropriate.

FERTILISING

A granular fertilizer, either organic or slow release, should be applied during spring, but no later than the beginning of May. It is an essential part of the maintenance routine, providing the plants with nutrients allowing them to become hardy enough to resist extreme cold, heat and drought. On small roof areas, fertiliser can be scattered by gloved hand from a bucket or a hand held spreader. For roofs over 100m², we recommend using a trolley applicator for a faster distribution that provides accurate coverage.

Information regarding suitable fertilisers can be found on our web site www.bauder.co.uk or through our technical department who will be pleased to offer advice concerning maintenance issues.

DEBRIS

All debris and leaves should be removed from the roof surface, rainwater outlets, chutes and gutters. Roofs in the vicinity of deciduous trees will require a further visit at the end of the autumn to remove any leaves that are covering underlying plants.

PLANT ENCROACHMENT

Any plants that have encroached into areas surrounding rainwater outlets, walkways, pebble vegetation barriers, gutters, etc. must be removed in order to prevent blockage or impeded drainage.

WEEDING

Any unwanted vegetation such as weeds, grass or saplings can be removed either by hand or by using a 'weed wipe'. Large areas of weeds most often occur after a wet and warm summer and do not cause any damage to the waterproofing or roof structure.

REPAIRING BARE PATCHES

Any bare patches that remain after the removal of large weeds or grass will eventually be covered over by the remaining retained vegetation. This coverage process may be speeded up by taking cuttings or small clumps from surrounding plants and placing them on the effected area and then covered with substrate, fine sandy soil, or compost and watered in. After 3 - 4 weeks, the cuttings will become fully rooted. Works to bare patches should be undertaken during spring or late autumn, as the cuttings will not establish in extreme climatic conditions such as frost or hot sun.

MONITORING COLOUR AND GROWTH

The vegetation will naturally change colour, depending upon the time of year and prevailing weather conditions. For example, Sedum album 'coral carpet', one of the more prominent species, changes in appearance from green during spring, to blushing red in the summer months.

The colour and rate of growth should be examined to determine the condition of the plants. If the plants are shrunk back and dark crimson in colour, this may indicate a lack of water or inadequate nutrition. A simple application of water and fertiliser should resolve this problem. If severe degradation has occurred, Bauder Limited should be contacted to advise on the appropriate course of action.

VEGETATION BARRIER

If settlement of the vegetation barrier has occurred then additional washed pebbles, grade 20/40 mm must be added.

PROMENADE TILES OR PAVING SLABS

Where promenade tiles or paving slabs have been incorporated it is important to ensure that they are still secure in their original position and are in good condition.

RAINWATER PIPES

All rainwater pipes must be free of blockages to enable water to flow freely through them. Any protective metal flashings or termination bars should still be securely fixed into place. The mastic sealant should be examined for signs of degradation and renewed where appropriate.

For clarification on any maintenance issues please contact our Green Roof Technical Department for advice, Tel: +44 (0)1473 257671

Any alterations to the system without consultation with Bauder may invalidate the guarantee. Bauder should be advised of any modifications that are planned to be made to the roof so that we can provide the correct procedure for their instalment, thus ensuring the guarantee will not be affected

TECHNICAL SERVICES AND APPROVED CONTRACTORS

TECHNICAL SERVICES

At Bauder we pride ourselves on our complete "no obligation" service package. Through our national team of Technical Managers and highly trained office based technicians, we can provide for all your likely requirements, from initial design advice on waterproofing or landscaping related issues thorough to a detailed and comprehensive specification package, supplied in National Building Specification format (NBS). The package will include drawings and, where appropriate, thermal and condensation risk calculations that are specific to your project and dispatched with a high level of quality and efficiency, which is unrivalled within our industry.

We are increasingly being asked by our clients to assist their consultants with the development of ecological roof systems to meet a Biodiversity Action Plan required for planning consent or where sustainable homes or BREEAM points are required from an installation to achieve a higher rating than might otherwise be achieved by the structure. This has lead to us gaining valuable experience from working closely with specialist advisors and contractors in the areas of landscape, horticulture and the environment, which in turn has been of major benefit to other clients when considering how best to proceed with a new project. Whatever your requirement may be for a green or biodiverse roof landscape, it is certain that we will be able to assist you from the conceptual stage in developing a practical solution which will be cost-effective whilst also delivering long-term performance.

APPROVED CONTRACTORS

The design and specification contribute greatly to the performance and longevity of a new waterproofing and green roof system. However, the quality and experience of the installing operative is essential to ensuring a successful project. Bauder has always operated a policy where we train and approve the individual installer and not just the company he works for, by taking installers with proven experience and demonstrating the techniques particular to our system, we can ensure the quality of workmanship that meets our client's expectations.

With our Green Roof systems, each installer is required to have a good level of knowledge and understanding of the products and systems that we supply and will regularly deal with our drainage and moisture retention layers, growing mediums and hard and soft landscaping. Regular training and updating is provided to ensure that all work undertaken by our installers is done to the highest standard.

Individual application tuition from our instructors will be provided and following successful assessment the operative will receive an identity badge that must be readily available at all times, providing proof of competence to install Bauder Green Roof Systems.

Our selection of the contracting company is given careful attention, enabling us to guarantee that they possess the technical expertise and organizational skills to maintain an efficient and well-run site.

ON-SITE SUPPORT

Inspections are carried out at key stages of the contract by our own site surveyors to satisfy the requirements of our insurance backed company guarantee on our waterproofing systems and also ensure adherence to the specification for the landscaping.

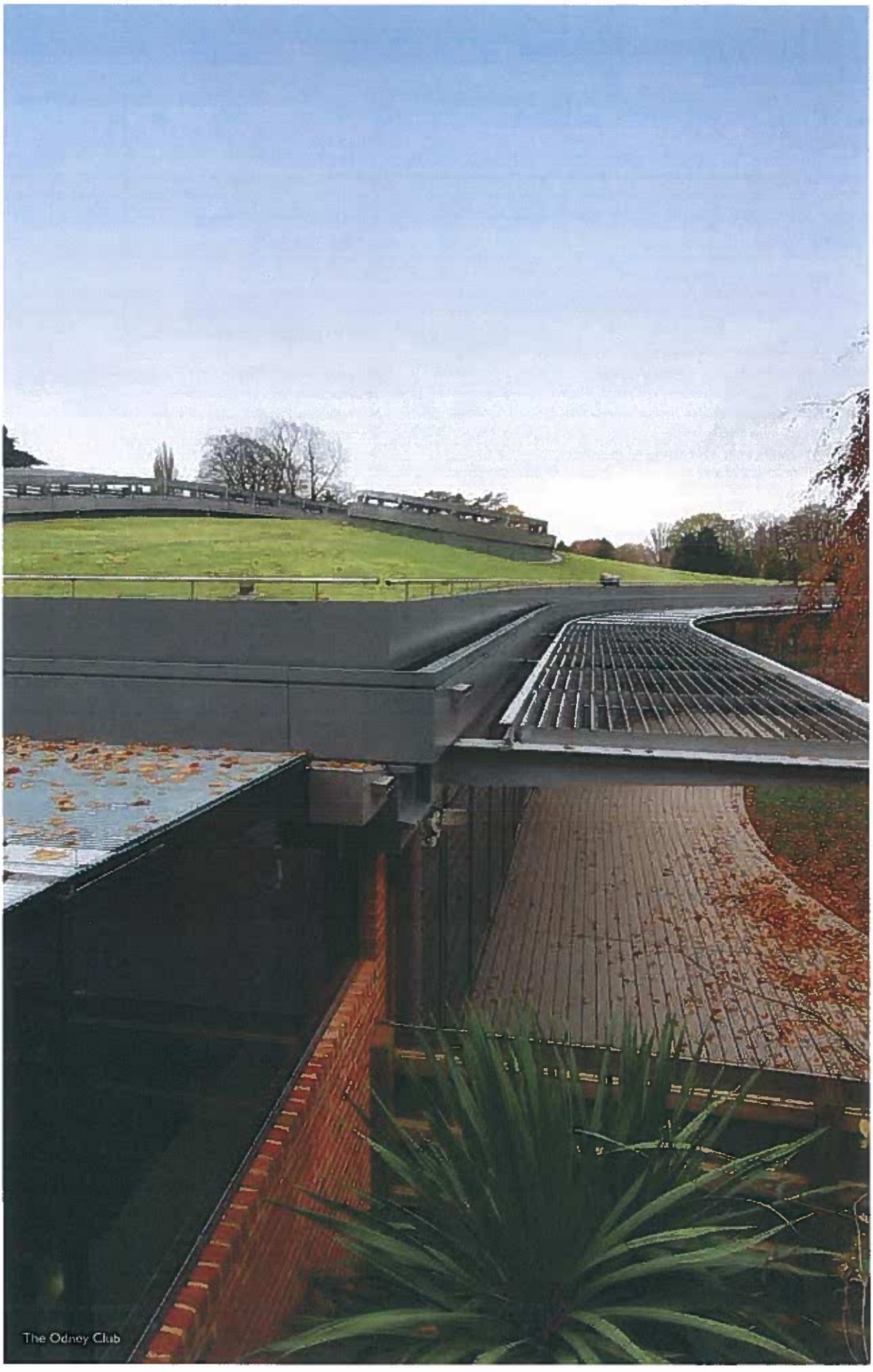
SPECIFYING THE BAUDER GREEN ROOF SYSTEM

Specifying Bauder materials for your project could not be easier. Simply contact your local Technical Manager or our Technical Department with details of your project and leave the rest to us.

- Design advice on waterproofing, planting and landscaping.
- Information on saturated loadings.
- Advice on drainage related issues.
- Thermal calculations.
- Condensation risk analysis.
- Detailed CAD drawings.
- Comprehensive project specifications.

IMPORTANT

If you do decide to specify our materials without seeking our advice, it is important that we are advised in order for your project to be eligible for the insurance backed guarantee.



The Odney Club

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Rev. 4 dated 28.8.14

Watering Requirement Guidelines for Extensive and Bio-diverse Green Roof Installations

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1. INTRODUCTION

It is essential that all types of green roof, regardless of the planting specified, receives the correct level of care and attention immediately after completion, to ensure that the plants installed can rapidly and healthily establish within their new rooftop environment.

Essential to this process is the provision of an adequate water supply of sufficient pressure to roof level, to deliver either temporary watering during the proposed period of plant establishment or otherwise a permanent installed irrigation system that can provide watering on demand.

The type required is dependent upon the landscaping system specified and this is outlined in the sections below.

The following information is intended as a guide to assist in the planning of establishment watering and where installed, permanent irrigation, as being part of the long-term management and maintenance of all Bauder Extensive green roof systems.

It is recommended that this document is read alongside the appropriate Bauder installation and establishment maintenance guidelines together with general maintenance guidelines for the proposed vegetation type.

2. WATERING REQUIREMENTS PARTICULAR TO SPECIFIC BAUDER EXTENSIVE LANDSCAPING SYSTEMS

XERO FLOR XF301 LIGHTWEIGHT SEDUM BLANKET SYSTEM

This product does not require installation over a substrate growing medium, as the growing medium and moisture retention are self-contained, making this system the lightest of its type currently available. Bauder SDF Mat drainage layer is incorporated if the roof falls are less than 2°, otherwise the blanket is applied directly to the waterproofing.

A key advantage of XF301 is that it can be installed on slopes of up to 25°, without needing a heavily constructed and expensive landscape retention system, instead using a unique spiked retention component attached at set intervals to the waterproofing surface.

One consequence of being so lightweight and of shallow build-up, is the importance of annual maintenance, particularly fertilizing, as the system has little inherent nutrient.

The benefit of applying a shallow build-up on steeper slopes can also have a consequence in respect of water retention capacity and therefore provision for artificial irrigation should be allowed for under certain conditions. These are outlined below: -

Sedum blanket being applied to a steep sloped roof, fitted with both retention strips and drip line irrigation.

- **Roof falls up to 2°** - No artificial irrigation required
- **Roof Slopes in excess of 5 degrees, exposed locations or south facing** – Consider
- **Roof Slopes in excess of 10 degrees** – provision for irrigation considered essential
- **Slopes from 1-5 degrees coastal or exposed locations** – Consider
- **Slopes in excess of 5 degrees coastal, south facing and exposed locations** – provision for irrigation considered essential

For roofs less than 50 m² in area and single storey in height, irrigation can be achieved using a simple hose and sprinkler arrangement, but for larger areas it is more practical and cost effective to install a permanent drip line system.

Watering with an irrigation system is still periodic and only necessary during prolonged periods of drought or otherwise to maintain appearance. Over-watering will encourage grass and other weeds to establish and is not generally good for sedum plant health, as the plants need to go through the drought process to become hardy for surviving extreme weather conditions. Therefore watering once every 4-6 days during hot, dry periods, during dawn or dusk is recommended.

3. VEGETATION OVER A SUBSTRATE GROWING MEDIUM

This applies to the following Bauder vegetation finishes: -

- **Xero Flor XF118 wild flower blanket**
- **Xero Flor XF300 sedum blanket**
- **Bauder Traditional and UK Native Species plug plants**
- **Bauder KS Plus seed mix**

All of the above vegetation options are installed either over or within Bauder Extensive Substrate growing medium. These extensive green roof systems are generally intended to persist without any form of artificial irrigation once the vegetation is established.

However, aspect and location are factors that have a bearing and together with consideration towards our changing climate over the long-term means that provision for watering needs careful assessment. The broader range of vegetation now being used and the visual appearance sometimes demanded there will be projects that will require or benefit from the inclusion of a permanent irrigation system or water feed to roof level fitted during construction.

This does not necessarily mean a requirement for regular irrigation, but it does ensure that during times when additional watering above and beyond normal rainfall is required, this can be provided.

In particular, this applies to sloped roofs over 5° and the system types where permanently installed irrigation provision should be considered, are listed below: -

- **Bauder XF118** – Consider for enhanced visual appearance
- **Bauder UK Native Species Plug Plants** – Consider for enhanced visual appearance
- **Bauder KS Plus seed mix (both during and after planting has become established)** – Consider for enhanced visual appearance

Regardless of the green roof system specified, we would always recommend that sufficient watering points of adequate pressure are always provided at roof level to allow the entire roof area to be irrigated by hose and sprinkler during particularly prolonged periods of drought. It is cheaper periodically to add water than to replace planting.

4. WATERING DURING AND IMMEDIATELY FOLLOWING INSTALLATION

For all applications involving substrate growing medium, the substrate should be thoroughly watered to moisten it before the planting is installed and also to fill the underlying water storage board, so that some water retention is provided.

Once the planting has been installed, apply Bauder Xero Flor organic fertilizer at a rate of 80g/m², by using the recommended applicator trolley which ensures adequate and even pellet coverage.

Thoroughly water the vegetation immediately after installation or as soon as a sufficient area of planting is installed that can be watered using sprinklers.

Initial watering must be by surface mounted sprinklers to water in the fertilizer. Do not over-water the fertilizer if the substrate is already well moistened. Use just enough to wash the fertilizer pellets off any vegetation leaves to prevent burning.

Special note Regarding Bauder KS seed mix

This seed mix is provided in a formulation that allows it to be applied direct to a moist substrate and should **not** be watered in after installation, but left to germinate and establish at its own pace, requiring irrigation only in prolonged drought conditions once established.

5. ESTABLISHMENT WATERING

Establishment watering needs to be correctly managed to ensure that the landscaping is kept sufficiently moist to encourage strong root development whilst ensuring that the system never becomes too wet.

All newly installed sedum blanket vegetation will require watering for at least the first month after completion.

The wild flower, herb and rockery vegetation species used in all other extensive/bio diverse green roofs will need to receive irrigation for at least 10 weeks after completion, and will require close attention over the first 4 weeks to ensure that the system is kept moist without becoming over-saturated.

Frequency of watering is dependent upon the time of year and current weather conditions, but with sedum vegetation this is usually only required every 4-6 days during the summer months. With all other species it is possible that watering could be required on a more frequent basis in hot weather, which can only be determined by a visual inspection to review if the plants are wilting.

Water the vegetation for a period of approximately 1-2 hours to ensure that the growing medium is fully saturated. If the green roof has a leaky pipe or drip line irrigation system fitted then this can be employed to provide the required post-installation watering.

Please note that drip line irrigation is not suitable for initial watering in of the fertiliser, and therefore surface sprinklers should be used - see item 4 above.

6. METHODS OF WATERING AND THE EQUIPMENT REQUIRED

Temporary watering

There are a number of methods that can be used to facilitate temporary watering on site and these would be employed for establishment watering, for those landscapes not requiring any permanent irrigation, or otherwise when the permanent irrigation is not yet operational.

It is important to have a main's feed (or several mains feeds) to roof level of sufficient pressure to water the total vegetated area. A hub may be set up to then distribute water to the various areas via a set of secondary feeds.

Example opposite of a temporary watering system hub rigged up on site to provide adequate mains watering feeds to different roof areas.

These help the contractor managing installation and establishment watering to control irrigation from a central point, whilst retaining flexibility if the apparatus needs to remain mobile.

In situations where the mains water pressure is found to be insufficient, a Bowser can be used together with a pump, to provide water at the required pressure to roof level.

Image supplied courtesy of Morclean Ltd

Mobile Bowsers are fine as a solution for temporary watering during installation where a mains feed is not yet available or for short term watering i.e. establishment watering of XF301 sedum blankets.

However, for longer term establishment watering as is required for XF118 wildflower blankets, where this can be required for up to 10 weeks, a permanent feed to roof level of the required minimum pressure is necessary.

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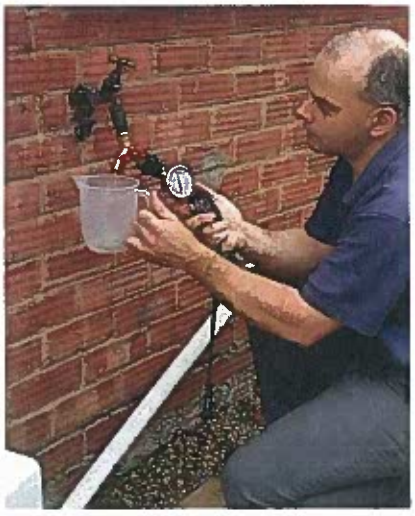
Requirements for mains water supply

A supply of mains water must be provided on site prior to the delivery and installation of the vegetation.
A minimum of 3 bar pressure at roof level is required to provide sufficient pressure to enable up to four sprinkler units to operate simultaneously. This is sufficient to cover an area of approximately 450 m² at any time, depending upon the water supply available.



Testing the water pressure

The water pressure and flow available from the mains feed must be checked with a suitable pressure gauge (see opposite) to confirm that the system is adequate in advance of the installation of the vegetation.

Multiple Hose connectors

Three-way multiple brass hose connectors provide a quick and efficient method of connecting up several hoses to the mains supply simultaneously.

Heavy duty hose pipe

Sufficient lengths of heavy duty hose to be provided to reach all roof areas

Pipe joiners

Hose pipe can be extended to the length required using these proprietary brass pipe joiners

Small Areas up to 20m²

An adjustable spray head is suited for very small areas and for watering in fertilizer

Areas under100m²

Used with narrower head nozzles or alternatively use domestic oscillating sprinklers

Areas over 100 m²

Surface mounted sled riser units with changeable sprinkler heads give variable spray pattens

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Watering roof areas over 100m²

Riser units can be 'daisy chained' together to irrigate the length of the roof. Sprinkler heads can be changed to enable different spray patterns to be employed to suit each roof area as required.

Several roof areas can be watered simultaneously using a multi-connector at the mains, so long as sufficient water pressure and flow is available for each separate feed.

When watering large roofs on public buildings such as schools, these will often have water meters fitted. The occupiers may wish a meter reading to be taken before watering commences, so that the cost of the water usage can be separated and later reimbursed.

Time control for evening irrigation

Battery operated timer control units are available to help control watering efficiency. These can be set to allow watering at dawn or dusk when wind and evaporation levels are at their lowest, thus preventing unnecessary water loss.

This facility is important for installations carried out during the dry summer months, as it enables the water to saturate the sedum blanket or substrate system which gives the plants the opportunity to take on and store water.

A separate timer will be required for each hose run in operation.

Permanent Drip line irrigation

This system can be installed for both occasional and regular watering. The system layout and components required for any individual green roof system will be dependent upon a number of factors, including vegetation type, substrate depth and roof slope. We would strongly recommend seeking project-specific advice from a specialist irrigation company to ensure that the proposed system will meet required criteria.

A minimum of 2 bar pressure at roof level is required for most systems to operate correctly. The system must be fully operational with all operational controls easily accessible for use. The irrigation system would normally require Category 5 back-flow prevention.

A permanent drip line system (where installed) is not suitable for the task of carrying out the initial surface watering after fertilizer has been applied. Fertilizer should be properly watered in using surface watering sprinklers to prevent burning the leaves and damaging the plants.

Watering is best carried out automatically at dawn or dusk using a timer control unit.

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7. SPECIALIST ADVICE

Advice and Supply of Irrigation equipment

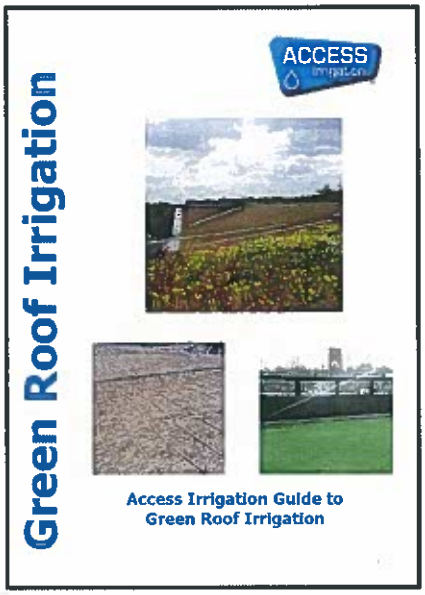
Access Irrigation Ltd is one of the country's longest established irrigation specialists and has considerable experience in many types of irrigation, including green roofs.

They are happy to provide irrigation advice on any Bauder project and can supply a wide range of irrigation products and technical advice.

Please contact: -

Access Irrigation Ltd
Crick
Northampton
NN6 7XS

T: 01788 823811
F: 01788 824256
E: sales@access-irrigation.co.uk
W: www.access-irrigation.co.uk



Technical Advice on Installation and maintenance of Extensive green roof systems

For project specific advice relating to establishment watering and irrigation issues that relate specifically to Bauder Green Roof systems, please contact our Technical Department using the details below.

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GREEN ROOF MAINTENANCE SERVICES

BAUDER GREEN ROOF SERVICE

A green roof is a real asset to a building and for it to continue to deliver the environmental and aesthetic benefits for which it was originally designed it is important to carry out maintenance on a regular basis.

A well maintained green roof will:

- Look its best and ensure the optimum range of species for maximum coverage and longer flowering periods
- Sustain healthy plant growth to provide a habitat for wildlife
- Improve air quality by reducing airborne dust and help local air cooling
- Offer protection to the waterproofing beneath
- Improve both acoustic and thermal insulation performance of the roof
- Help conserve and control rainwater runoff
- Maximise the building's asset value

SOME ISSUES RESULTING FROM A POORLY MAINTAINED ROOF

Unwanted Plant Encroachment

Saplings and other invasive plants can spoil your green roof and potentially damage the waterproofing or other building elements if not removed. Vegetation barrier functionality as a firebreak and fast drainage provision during high intensity rainfall is also affected by plant encroachment.

Fallen Leaves and Debris

The removal of leaf litter from overhanging trees and other accumulated debris is essential during Spring and Autumn to prevent plants from being suffocated and drainage outlets and gutters becoming blocked.

Lack of Nutrients

Lack of nutrients can lead to unhealthy plants, loss of vegetation coverage leading to bare patches and a reduction in the variety of species present.

An annual application of a slow release organic granular fertiliser is important for continual plant health. It helps to promote good vegetation cover which in turn helps with moisture retention, flowering and seeding and plant tolerance to temperature extremes.

Impeded Drainage

Functional drainage is important for plant health, as well as roof performance. Unimpeded outlets ensure the growing medium remains free-draining and does not become too wet, which could lead to unwanted vegetation, such as grass clumps and larger weeds establishing.

Regular maintenance and inspection checks ensure that the outlets and areas surrounding outlet inspection chambers remain clear and perform as intended.

WHY CHOOSE BAUDER TO MAINTAIN YOUR ROOF?

With over 30 years' experience in the design and supply of green roofs throughout the UK and Ireland Bauder can offer unparalleled experience and expertise in green roof maintenance.

Having established the largest UK facility cultivating green roof vegetation blanket we have unique knowledge and horticultural expertise for roofscape vegetation. With national coverage of over 50 field personnel, you can be assured of a prompt reliable service to fully meet your requirements.

OUR SERVICE

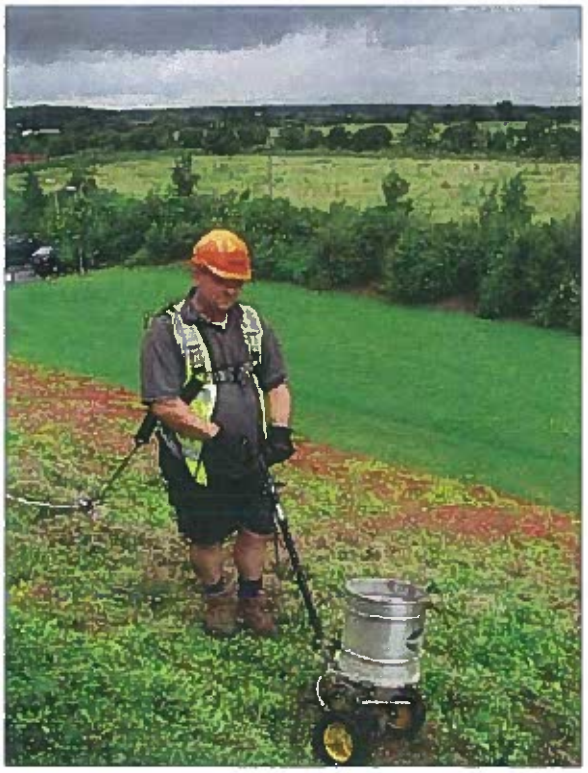
Bauder's experienced team will provide you with a tailor-made maintenance programme for your roof.

A Typical Bauder Maintenance Programme Includes:

- Full inspection and evaluation of your green roof
- Application of organic slow release granular fertilizer
- Removal of leaves and debris
- Removal of unwanted vegetation
- Inspection and clearance of outlets
- Examination and testing of irrigation

This work is undertaken by Bauder's experienced maintenance engineers who will carry out the necessary risk assessments and comply with all current health and safety legislation throughout the duration of the work.

Finally, you will be provided with a bespoke report with photographic verification outlining the condition of the planting and any areas requiring on going treatment.



To discuss your specific requirements please call our green roof service team for a no obligation quote.

T: +44 (0)1473 267119
E: greenmaintenance@bauder.co.uk

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MAINTENANCE PROCEDURE

BAUDER EXTENSIVE GREEN ROOF SYSTEMS

What to Expect From a Bauder Extensive Green Roof System

There is a common misconception that extensive green roofs, and sedum plants in particular, are always green and that from ground level they resemble grass. This is misleading, as they consist mainly of low growing, drought tolerant sedum plants and may also include other species such as Saxifrage, wild flowers, grasses, moss and herbs.

The appearance of the vegetation within an extensive green roof will change year on year, dependent upon fluctuations in the seasonal weather throughout the period. It should also be expected that more grass and moss will be present during the wetter months, because the conditions will be ideal for these species to exist, although they will tend to die off during the dry summer months, as free-draining extensive substrates will not hold sufficient moisture for them to survive.

It is another misconception that extensive green roofs are maintenance free, this is wrong and they are best described as 'low maintenance' rather than 'no maintenance'. As an example, the Xero Flor Sedum Blanket contains little in the way of natural nutrient, so fertiliser must be applied annually to ensure that the plants become resistant to extremes of weather and temperature.

The Bauder XF301 Sedum Blanket contains approximately 8-10 different plant species, some very similar in appearance to others but being more drought tolerant. Not every species incorporated will survive and the more dominant will be expected to prevail over time because they will adapt better to a particular location. Regardless of this, we would anticipate that at least 50% of the species will flourish.

Extensive green roofs that have a deeper substrate growing medium, where the vegetation is provided either by selected plug plant species, vegetation cuttings or seeds, will generally support a broader species mix, which can include wild flowers, grasses and herbs. An increased amount of dead vegetation will arise from this type of species mix following flowering, which will need to be cut back and removed, both to reduce the bio-mass on the roof and to encourage seed drop from the dead flower heads.

In the early spring the first signs of life returning to the vegetation within an extensive green roof are lead by any grasses present, quickly followed by a general "colouring up" of the sedum foliage, with other species following suit shortly thereafter. The growth and flowering of the individual species within the vegetation mix through the late spring and summer will be dependent upon the weather prevailing at the time, which will also determine which species will be most prominent in any given year.

In the winter, sedum plants will appear to shrink back, the leaves will become smaller and turn red/brown in colour as they prepare themselves to withstand the coming winter frosts. This gives extensive vegetation mixes a generally red/brown hue in the late autumn and winter months, which is sometimes mistaken for the plants being distressed, when in fact they are in optimum condition for the time of year.

General Maintenance

General maintenance is normally carried out annually during springtime. However, certain tasks which will be dependent upon the location of the roof, such as the removal of weeds, seedlings and accumulated leaf litter from overhanging trees may also need to be done during the autumn.

The following procedures should be carried out as indicated below, in order to ensure that the roof is maintained in good condition and to protect the validity of the guarantee.

Preliminary Maintenance Procedures:-

- Ensure safe access can be gained to the roof and that relevant Health and Safety procedures are followed when working at roof level. It is advised that the contractor should always seek proof of current maintenance for any man-safe roof access systems prior to proceeding with the work on site.

- Remove all dead vegetation and debris from the roof surface, taking particular care to ensure that all chute outlets, gutters and downpipes are clear. Where the species mix incorporates wild flowers and grasses it is recommended that all dead vegetation is strimmed off and the waste lowered to the ground and carted away.

  Please note! Roofs in the vicinity of taller trees will need more frequent maintenance. We recommend removing dead leaves during the spring and again in the autumn, to ensure that they to not damage the roof vegetation.

- Remove the lids of all Inspection chambers, ensure that all rainwater outlets and downpipes are free from blockages and that water can flow freely away.

- Ensure that any protective metal flashings and termination bars remain securely fixed in place. Advise the client of the need to repair or renew as necessary.

- Examine all mastic sealant and mortar pointing for signs of degradation. Advise the client of the need to repair or renew as necessary.

- Check that all promenade tiles and paving slabs are securely fixed to the roof surface and in good condition.

- Ensure that any new items of plant/equipment on the roof are mounted on suitable isolated slabs and that any fixings used to secure the plant/equipment in place do not penetrate the waterproofing. If in doubt, please contact Bauder for further advice.

- The Building owner should keep a record of all inspections and maintenance carried out on the roof. Any signs of damage or degradation to the waterproofing should be reported to Bauder immediately, in order that arrangements can be made for remedial work to be carried out if necessary. Damage to the landscaping should be reported to the building owner. If this damage includes Bauder components, then Bauder may be contacted for remedial advice.

- Works to adjoining areas - When carrying out maintenance to these areas, care must be taken not to damage either the landscaping or the waterproofing system. If it is considered that either has been affected, then Bauder should be contacted for advice. Any waterproofing damage caused after completion of the original installation may invalidate the guarantee.

- Alterations - Any unauthorised alterations to the waterproofing system will invalidate the guarantee. If such a situation should arise, then Bauder should be contacted so that we may advise on the alteration and how it should be incorporated without affecting the guarantee.

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VEGETATION MAINTENANCE TASKS REQUIRED

The following tasks should be carried out annually: -

1 Plant encroachment.

Any vegetation which has encroached into drainage outlets, walkways and the vegetation barriers (pebbles) should be removed. The vegetation removed may be set aside and used to repair any bare patches if required (see below). If movement/settlement of the pebble vegetation barrier has occurred, additional washed stone pebbles similar to the existing are to be added.

2 Monitor the colour and rate of growth.

The colour and rate of growth of the vegetation should be reviewed to establish the health of the plants. It should be noted that many factors can affect the growth and colour of the vegetation and that plants tend to be greener in wetter, mild conditions (springtime) and where the roof pitch is shallow.

Notes!

- During May, June and July, sedum plants flower and you will see a mixture of colours – predominantly whites, pinks and yellows with some purple. The foliage of some species of sedum, such as Sedum Album "Coral Carpet", blush red naturally during the summer and autumn, and so the vegetation can take on a more 'red/brown appearance. This becomes more noticeable once plants have flowered, leaving remnants of dry brown seed heads. The best visible indication of the health of a plant is if the leaves are fleshy and contain plenty of water.
- When exposed to extreme conditions, sedum plants have a tendency to turn a deep red colour. This is a natural phenomenon and is important to help the plant to acclimatize, ready to survive a cold winter or hot summer. This will usually occur during extreme cold weather as well as periods of prolonged drought, in very exposed locations or when the plants are in distress through lack of nutrient (fertiliser).
- If an irrigation system is fitted, it is best to run it only during prolonged dry weather and for limited periods – see 'Irrigation' information below,
- If sedums are showing signs of distress, but have received regular rainfall, then the most likely problem is a lack of nutrient and a fertiliser should be applied.
- Only a relatively few species of sedum and other plants suitable for an extensive green roof installation will persist in partial and full shade, and they will generally be greener in colour and grow "leggier" in these locations. There will be a significant variance in the growth and colour between the plants growing in full or partial shade and those in full sun and this should be recognised as a feature of the living nature of each individual roof.
- If problems with the vegetation are suspected, Bauder may be contacted for advice and, if necessary, a suggested course of action.

3 Weeding.

With the exception of saplings, which should always be removed, weeds in an extensive green roof should be considered as a problem only of aesthetics. If considered excessive, they can be removed either manually or by using a 'spot weed wipe', ensuring that care is

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taken to follow specific instructions regarding the use of any proprietary products. After the removal of weeds and saplings, treat the affected area as if it were a bare patch (see below). All extensive green roof installations will at times include some moss and grass.

4 Repairing Bare Patches.

Bare patches can be easily repaired and this is best done during the main growing seasons of March/April or from late August until the end of September. Take vegetation cuttings from surrounding areas of abundant growth and place on bare patches, pressing gently into the soil. A light sprinkling of sand mixed with compost should then be dressed over the affected area to improve the uptake of the cuttings. The best results will be achieved if this work is carried out during spring maintenance and the affected area is kept moist for a short period afterwards. Please contact Bauder for further project-specific advice.

Please note: In areas of extreme exposure or where localised wind-swirl is caused by adjacent structures, it is possible that both the vegetation and substrate will be disturbed by periods of high wind. Should this occur, consideration should be given to how best to secure the installation against similar conditions in the future prior to re-instatement. If a problem of this type is suspected, Bauder may be contacted for advice and, if necessary, a suggested course of action.

5 Fertiliser for Bauder XF301 sedum blankets

Bauder Sedum Blankets are grown in a shallow growing medium which contains very little nutrient, so the annual application of fertiliser is crucial to ensure that the plants remain healthy. Fertiliser should ideally be applied during March/April, as it helps the plants to prepare for extreme weather conditions and flowering whilst also allowing the different species to gain sufficient nutrients without competing against each other.

Organic fertilizer can be obtained direct from Bauder in 25kg bags, which is sufficient for an area of 312.5m2 when applied at the recommended rate of 80gm/m^2. Areas of up to 30m^2 may be applied using either a hand held spreader or strewn by hand from a bucket. Larger roofs should always be done using a trolley applicator, which can be purchased direct from Bauder. Always apply the fertiliser at the given rate written on bag.

It is recommended that the fertiliser is lightly 'watered in' immediately after application, to avoid "burning" of the foliage, which may occur if fertilizer pellets settle on the leaves. Dung-based organic fertilizers should be avoided.

6 Fertiliser for either plug planted or hydro-planted extensive green roofs

Use a 6-month slow release chemical fertiliser with an NPK ratio of 15, 9, 14. Areas of up to 30m^2 may be applied using either a hand held spreader or strewn by hand from a bucket. Larger roofs should always be done using a trolley applicator, which can be purchased direct from Bauder. Always apply the fertiliser at the given rate written on the bag. This product may also be used on sedum blankets.

7 Irrigation

Extensive Substrate Installations

It is generally not considered necessary to irrigate extensive substrate green roof systems. It is, however, always advisable to ensure that there is a water supply point adjacent to the green roof, both to assist with general maintenance and as a precaution against extreme

drought conditions.

Bauder XF301 Blanket Systems
The sedum plants used in the Bauder XF301 blanket system absorb and store water in their leaves, which they then use to survive during periods of drought. The purpose of the moisture retention fleece, which is incorporated into the system beneath the blanket, is to hold water after rainfall to give the plants sufficient time to take on as much water as possible. The moisture retention fleece is not a water storage medium, so you should not be concerned if it dries out during periods of dry weather. If drought conditions arise it is important to check the plant leaves to see if they are still fleshy and not completely dried out.

When the Bauder XF301 blanket system is installed we recommend the provision of either a leaky pipe or drip line irrigation system where the following conditions apply: -

- All south-facing roof slopes exceeding a 5° pitch.
- All roof slopes exceeding a 10° pitch.
- Exceptionally windy and exposed site locations, where the wind can dry out the blanket.
- Sites up to 50 miles inland of the east coast of the UK mainland.

Irrigation should only be activated during prolonged periods of hot, dry weather, or if the sedum plants are showing signs of distress. The irrigation system is best activated for 2-3 hours, preferably at dawn or dusk to minimize unnecessary evaporation. Then once every 4-6 days for the duration of the hot weather conditions. This can be easily managed by using an inexpensive battery-powered, programmable timer.

Please note - continuous daily watering is neither recommended nor necessary, and will only promote weeds and other unwanted plant species.

Advice and Supply of Irrigation Equipment

Access Irrigation Ltd is one of the country's longest established irrigation specialists and has considerable experience in green roofs. They are happy to provide irrigation advice on any Bauder project and can supply a wide range of irrigation products. Please contact:-
Access Irrigation Ltd
Crick Northampton NN6 7XS
T: 01788 823811 F: 01788 824256 E: sales@access-irrigation.co.uk
www.access-irrigation.co.uk

Support

Extensive roofs should require only minimal maintenance. Bauder is happy to offer advice on any issues concerning your green roof and any such query should be forwarded to the Bauder Green Roof Technical Department at the address below in the first instance. We believe our products and systems are of the highest standard and are always prepared to discuss any queries or concerns that may arise. It is always of great help if you can provide photographs of the affected area(s) to accompany any such queries.

Please note: In the event of any query arising which it is thought may affect the condition of the system, then Bauder should be contacted at the address below. We cannot accept responsibility for any problem or failure due to use outside those parameters for which the system was designed or 'acts of god' beyond our control e.g. extreme weather conditions or damage through pests.