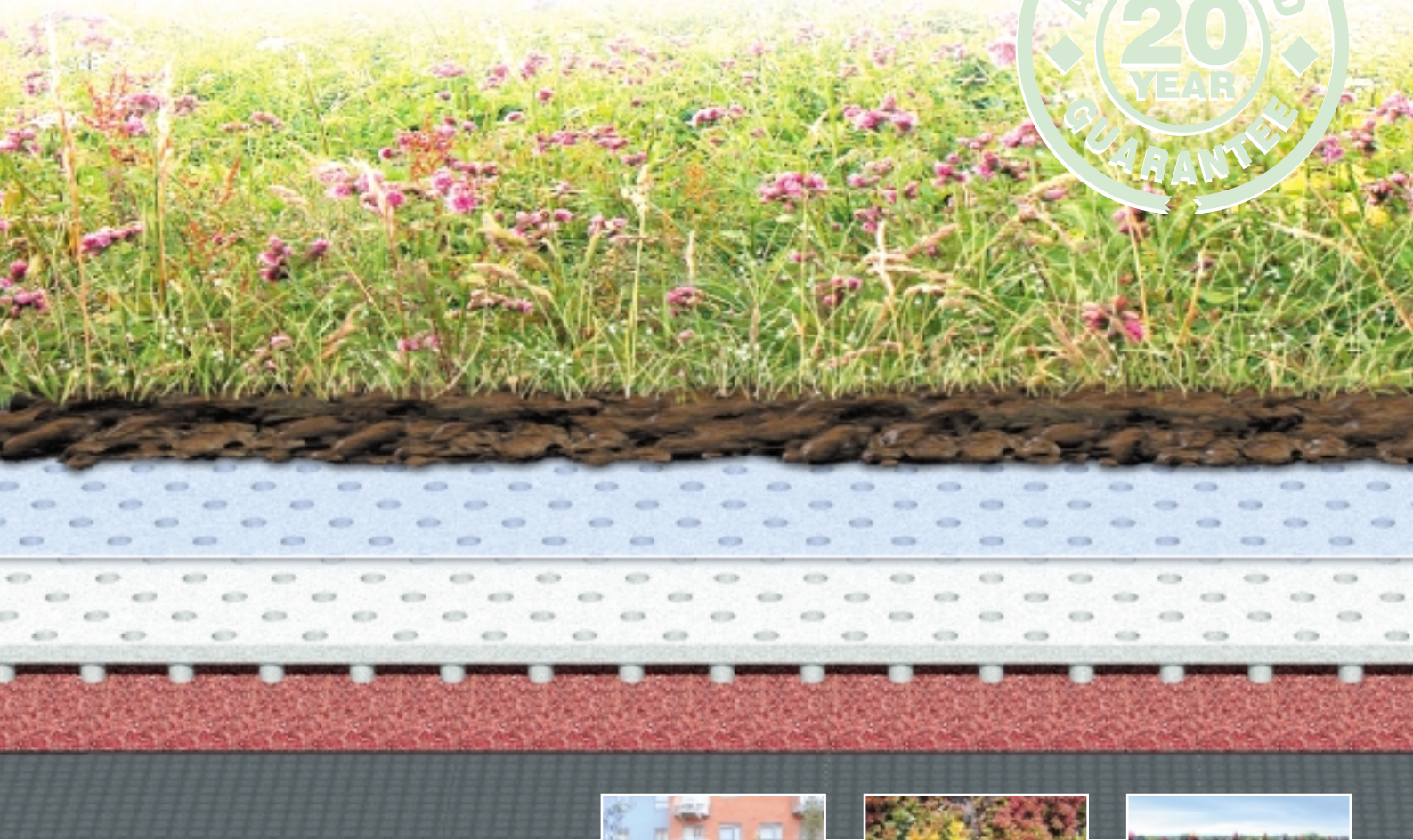


Extensive and Intensive Green Roof Technology

The Green Roof Concept

In general a green roof is one with plants growing on its surface. This can range from the spontaneous occurrence of lichen and moss on a roof surface to a fully landscaped space including trees, shrubs and hard landscaping. There are many variations but in general green roofs have been divided into *extensive*, *intensive* and *brown*.

Extensive

Extensive green roofs have low management requirements and do not usually require artificial irrigation. Based on thin soil or substrate layers, planting styles are naturalistic with the object of establishing a self-sustaining plant community, such as sedums or hardy wildflower mixtures. An alternative is Axter's HYDROPACK ready planted modular tray (see separate HYDROPACK brochure). The main reasons for installing an extensive green roof are visual, creating habitat for native flora and fauna, and enhancing the building performance.

Left: Extensive roof garden to office development. Range of rockery type plants with wooden duckboard paving.

Centre: Semi-intensive roof garden on an industrial roof. Lavender used as a single plant species.

Intensive

Intensive green roofs need similar management to a ground level garden, usually comprise a deep soil or growing medium and require artificial irrigation. They can be adapted to accommodate virtually any type of plant and often include hard surfaces for access. The main reason for installing an intensive green roof is to provide amenity space.

Brown roofs

It is possible to replicate, on the roof, the environmentally diverse brown field sites associated with demolished buildings. In this way building rubble can be easily recycled and vegetation associated with such sites can colonise a range of low-fertility substrates, i.e. rubble, sand, rotting timber, etc.

Axter specialises in the design of green roofs and in conjunction with horticultural experts will produce bespoke design specifications for each construction, covering all aspects of waterproofing and insulation, water management and hard and soft surfacing.

ENVIRONMENTAL BENEFITS

Depending upon the type of roof garden required the advantages include:

- ◆ Improved rainwater management
- ◆ Use of roof area as additional space
- ◆ Visually attractive with a range of plants and foliage effects
- ◆ Low maintenance (extensive roofs only) with little or no artificial irrigation
- ◆ Improved thermal performance
- ◆ Reduction in sound transmission through the roof
- ◆ Improvement in air quality through absorption of carbon dioxide and release of oxygen
- ◆ Provision of habitat for wildlife; particularly important in city centre developments
- ◆ Reduces the environmental impact of the building within its surroundings



INSTALLATION AND VALUE CHAIN PARTNERING

Embracing the ethos of Sir John Egan's report Rethinking Construction, Axter actively promotes partnerships with participating contractors in order to deliver quality and value for money. AXTERSIELD Installers are fully trained in the installation of Axter materials and are chosen because of their workmanship quality, their integrity and their ability to complete installations with a minimum of technical or programming conflicts.

AXTERSIELD Installers will usually carry out installation of the insulation and waterproofing membranes although specialist horticultural experts may complete the landscaping aspects.

GUARANTEE

Comprehensive 20 year or longer guarantees are available if the waterproofing is installed by an AXTERSIELD Installer.

These cover failure due to water ingress as a result of a latent product or installation defect. Material warranties are also available for 10 or 15 years.

REFERENCES

Axter's green roof systems have been used worldwide. Recent contracts in the UK include:

- ◆ BedZED, the Beddington Zero Energy Development, Sutton, Surrey
- ◆ Procter and Gamble HQ Weybridge, Surrey
- ◆ BBC White City, London
- ◆ Paddington Basin Development, London
- ◆ Northampton Academy
- ◆ West One Development, Devonshire Green, Sheffield
- ◆ Primary School, Hadleigh, Suffolk
- ◆ Ecology Building Society, Keighley, Yorks
- ◆ Tong High School, Bradford
- ◆ Riverside Quarter, Wandsworth
- ◆ Alibone Recycling Plant, Northampton
- ◆ Scottish Parliament Building, Edinburgh
- ◆ Wallsgrave Hospital, Coventry
- ◆ Bath Street, London
- ◆ Healthy Living Centre, Derby
- ◆ Salmon Smokery, Bow
- ◆ Kew Gardens



Right: Intensive roof garden over housing. Range of both hard and soft surfaces.

Roof design

Irrespective of the type of green roof system the waterproofing and insulation requirements are broadly similar. It is important to remember that the supporting structure must be designed to resist the extra weight loading that a saturated green roof will impose and the general principles can be found in British Standard Code of Practice BS 8217. The important factor is to ensure that the chosen waterproofing membranes are root resistant. The waterproofing and insulation specification will depend upon the requirement for thermal insulation; there are three choices:-

No insulation – WILOTEKT-PLUS – typically used where green roofs are required over underground car parks, cut and cover tunnels etc.

Warm roof – ALPAFLORE – with flat or tapered board insulation between the deck and the waterproofing, used where the thickness of the layers above the deck needs to be kept as thin as possible. However as the waterproofing is above the insulation care must be taken to protect the membranes from maintenance tools etc.

Inverted insulated roof – WILOTEKT-PLUS – with the insulation on top of the waterproofing. The insulation can be designed to resist the heaviest of loads and the waterproofing is well protected from the effects of garden maintenance.

WATERPROOFING

Axter's ALPAFLORE and WILOTEKT-PLUS waterproofing systems are perfectly adapted to the needs of green roofs with particular resistance to impact, root action, fertilizers and insecticides.

ALPAFLORE and WILOTEKT-PLUS conform to all standards and have third party certification.

They can be used under all forms of inaccessible and accessible green roofs, including the use of hard surfaces on the following substrates: concrete and masonry, timber and timber derivatives, profiled metal.

ALPAFLORE is normally installed as a two-layer system in its own right or as a single layer protection onto asphalt or over liquid-applied waterproofing systems. WILOTEKT-PLUS is ideal for use on inverted and on non-insulated roofs.

ALPAFLORE can also be used to protect underground works such as basements.

Axter actively encourages the principles of *value engineering through design* to ensure best value is achieved by our clients. Through early design and specification participation in projects Axter guarantees delivery of cost effective solutions to meet the most onerous of design briefs and budgets thus eliminating the necessity for expensive and time consuming value engineering exercises later on in the development process.

WATER MANAGEMENT

Water management is determined by whether the green roof is to be intensive or extensive. In some cases a hybrid system between the two may be required. A high proportion of rainwater that falls on landscaped roofs is retained by the soil/reservoir system thus reducing the strain on the surface water drainage system. Roofs can be constructed down to zero degree slope but provision should be made for internal or external gutters, roof outlets and overflow weirs.

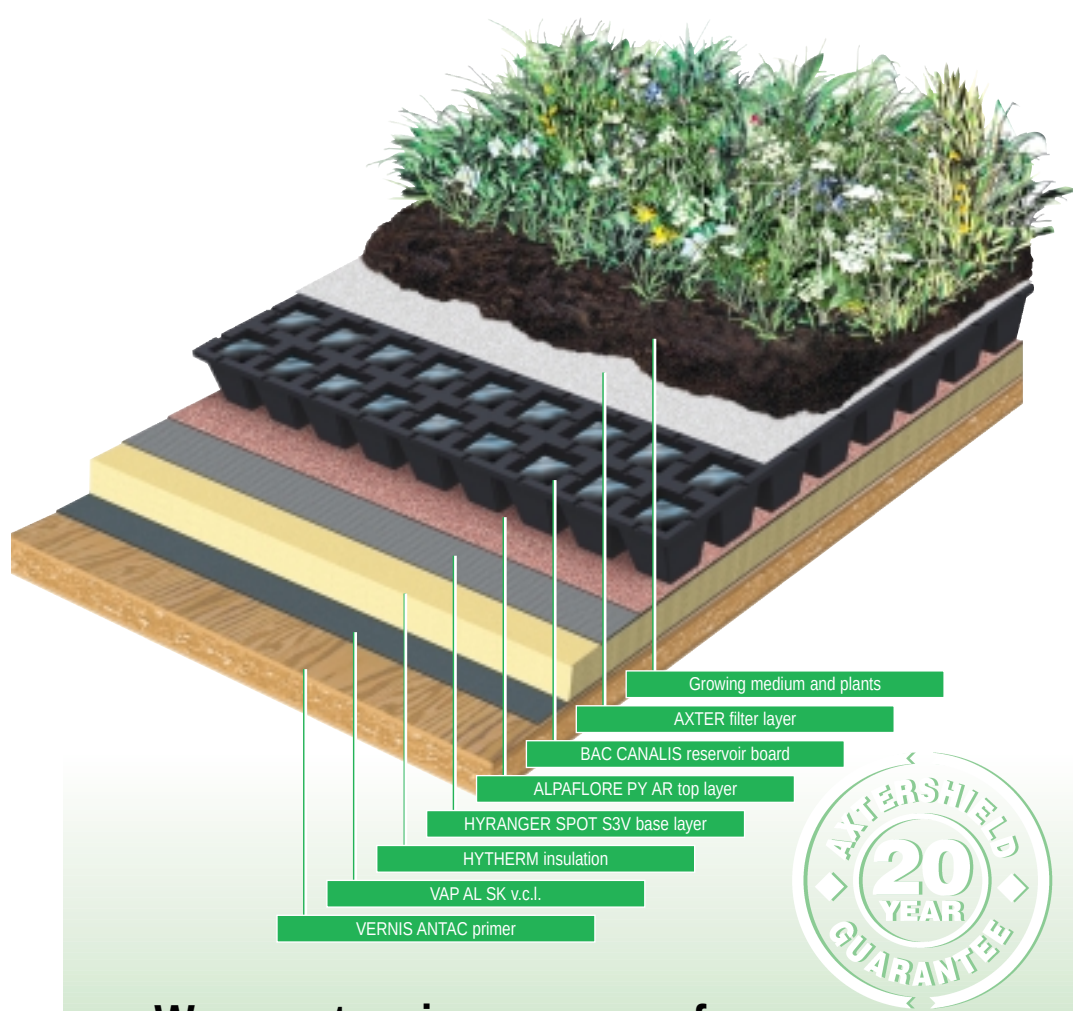


For **extensive** roofs, where the soil thickness is a minimum, water needs to be retained and therefore a specialist reservoir board, BAC CANALIS, is used below the growing medium. On slopes it is necessary to provide a barrier to resist slippage. The HYDROPACK trays incorporate a water reservoir.

For **intensive** systems the growing medium normally holds moisture sufficient for plant needs, although irrigation is often incorporated into the design, and drainage must be provided to allow storm water to quickly drain. Axter provides a specialist drainage board, AXTER DRAIN, which, whilst strong enough to withstand imposed loads, allows water to drain away freely.

HARD AND SOFT LANDSCAPING

As with all landscape gardening the opportunities are limitless. Axter works with a number of experts in their field who aim to achieve your goals. These experts will give planting and hard standing advice based on the building's position, roof orientation, height of the roof above the ground, roof pitch, weight limitations, preferred planting, component sustainability, maintenance levels and performance required from the plant and hard standing layers.



Warm extensive green roof



Design flexibility
to create outstanding
green roofs

Design Requirements

Listed below are some of the items that need to be considered when designing a green roof. Further information can be found in the ALPAFLORE Avis Technique No. 5/02-1595 and the WILOTEKT-PLUS ETA No. ETA-03/0049.

Upstands

As in all flat roofs the waterproofing should be taken up at least 150 mm above the finished surface be it soil, paving, gravel etc. It is advisable to have a plant free area immediately adjacent to upstands, this can be achieved by infilling with gravel instead.

Roof penetrations

Ideally roof penetrations, pipes, extract vents, air conditioning units, etc., should be concentrated in one area. This simplifies the waterproofing details and gives greater unbroken space for plants.

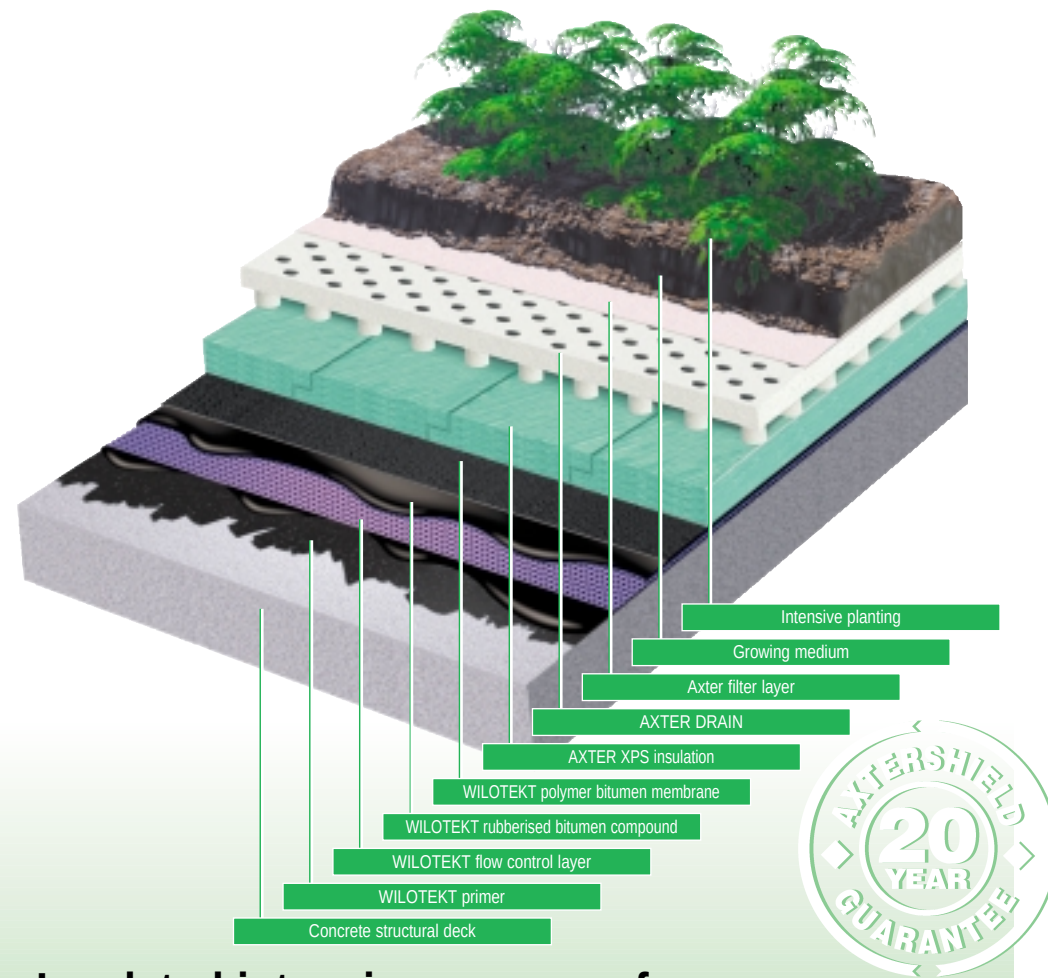
Fire

Intensive roofs with deep soil and which are regularly irrigated are accepted as fire resistant.

Extensive roofs are accepted as fire resistant so long as basic rules are followed. These include the depth and type of soil, provision for horizontal firebreaks, gravel strips around penetrations, etc. Axter can give advice for any particular roof design.

Safety

Intensive roofs used as amenity areas are likely to have sufficiently high parapets to make supplementary safety provision



Insulated intensive green roof



With Axter's ALPAFLORE and WILOTEKT-PLUS systems there is virtually no limit to green roof design, be it over commercial, industrial or domestic buildings, cut and cover tunnels or buried earth (underground) structures. Most landscape designs possible on the ground can be achieved on the roof so long as the supporting structure is designed to take the load. This could be a formal garden with planted and paved areas, an extensive roof with a wide range of rockery plants or even a replication of the unique environmental aspects of a brown field site.

Axter has the expertise to turn your dreams into reality, call today for a detailed specification.

unnecessary. Extensive roofs are generally inaccessible and therefore a man safe system may be required to enable maintenance to take place. On both types care must be taken to ensure sufficient provision for safety around large openings such as rooflights. Axter can provide a range of rooflights, access hatches, smoke and fire evacuation systems designed to resist the force of people falling against them.

Wind uplift

Careful consideration needs to be given to the effect of wind in the design of a green roof. Wind uplift pressure varies from an extreme at the edge and/or corner and around major penetrations to a minimum in the centre of the roof. In some cases it may be necessary to provide for additional paving slabs or coarse gravel around the edge of a roof to provide sufficient wind resistance.

System loading

The load of an intensive system is dependent on the depth of soil, types of plants, hard surfaces etc. Extensive roofs can range from 25 to 110kg/m² depending on design.

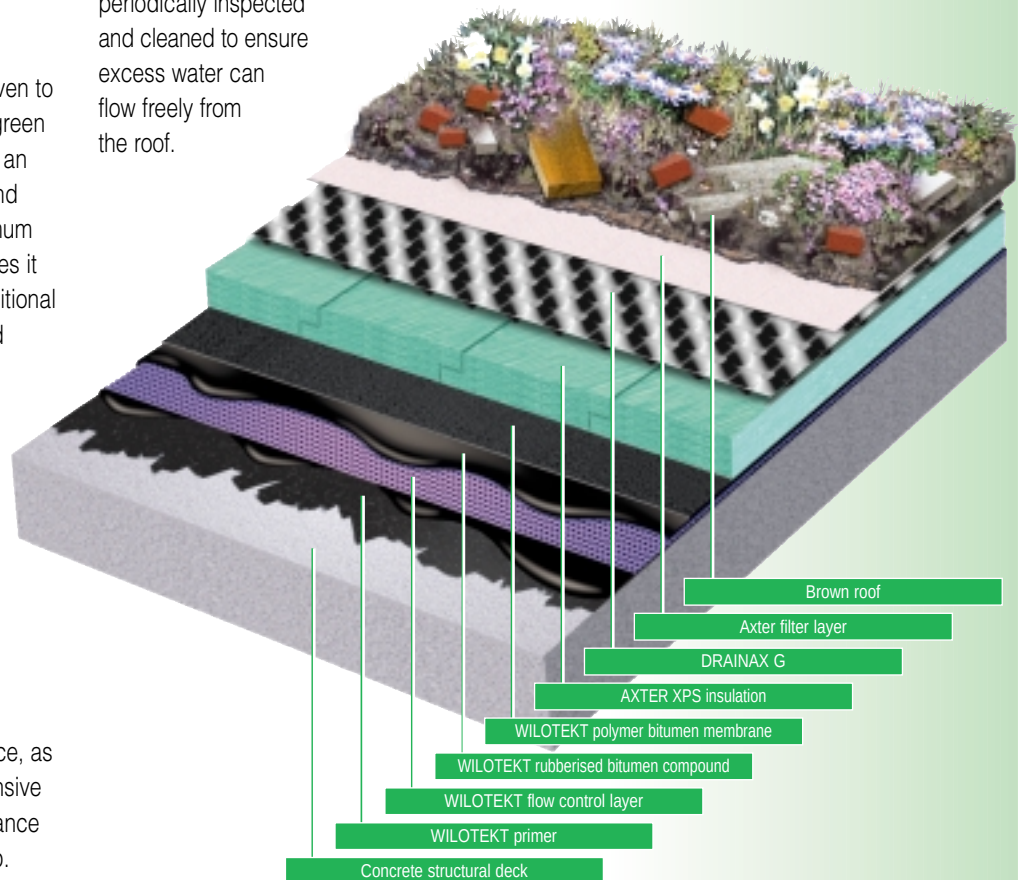
Maintenance

Intensive roofs will require maintenance, as would any ground level garden. Extensive roofs whilst in general being maintenance free do require some periodic upkeep.

Axter can provide a full maintenance schedule designed for the specific needs of each roof. Mowing of grassed areas, removal of unwanted plants, re-planting, irrigation, fertilising, providing additional material etc. may all be required from time to time to maintain the roof in a good vegetative state. Fire breaks and gravel areas should be kept weed free and all roof outlets should be periodically inspected and cleaned to ensure excess water can flow freely from the roof.

WILOTEKT-PLUS is a unique, second generation structural waterproofing system ideal for use without screeds on concrete decks with slopes from 0° - 5°.

Awarded European Technical Approval No. ETA-03/0049, WILOTEKT-PLUS can be used under extensive and intensive roof gardens and brown roofs.



Insulated inverted brown roof

Products

Description and usage of ALPAFLORE			
	HYRANGER SPOT S3V	ALPAFLORE PY AR	EXCELFLOR VV AR
Roll dimensions	10 m x 1 m	10 m x 1 m	10 m x 1 m
Roll weight	37 kg	44 kg	43 kg
Thickness	3.0 mm	2.8 mm	2.8 mm
Surface	Macro perforated film + sand	Mineral chippings	Mineral chippings
Under surface	Peel-off silicone film	Sand	Sand
Usage	Base layer	Capsheet	Capsheet

Complementary Products				
	AXTER DRAIN	BAC CANALIS	FILTER LAYER	DRAINAX G
Dimensions	114 x 105 x 0.36 cm	59.8 x 38 cm		
Number per package	20	220 (50 m ²)		
Packet weight	12 kg	Approximately 220 kg		
Roll			100 m x 2 m	15 m x 2 m
Roll weight			41 kg	19 kg
Usage	Drainage	Reservoir* (max 20 l/m ²)	Over AXTER DRAIN or BAC CANALIS	Drainage
Axter Limited can advise on a range of ancillary products, outlets, soil barriers, edge trims etc. *BAC CANALIS can also be used as permanent shuttering under access areas				

For description of WILOTEKT-PLUS, see separate brochure

Axter also specialises in the design and manufacture of **waterproofing membranes, acoustic roofing & cladding panels, continuous rooflights, domed rooflights, roof access units, smoke & fire ventilation equipment and external wall insulated cladding panels.**

Further details on the above and the specifications contained in this document can be obtained from Axter Ltd.

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