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Agrément Certificate

10/4744

Product Sheet 2

BAUDER BITUMINOUS ROOFING SYSTEMS

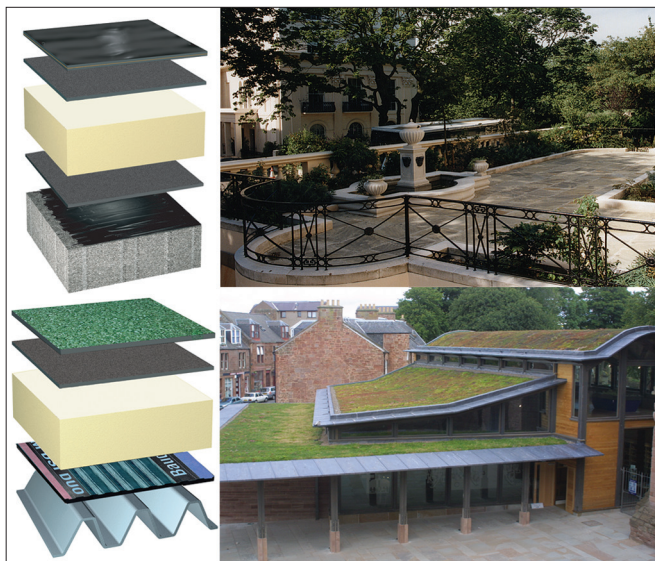
BAUDER TOTAL GREEN ROOF WATERPROOFING SYSTEMS

This Agrément Certificate Product Sheet⁽¹⁾ relates to Bauder Total Green Roof Waterproofing Systems, elastomer modified bitumen waterproofing membranes and vapour control layers for use on pitched, flat and zero-pitched roofs in roof garden or green roof specifications.

(1) Hereinafter referred to as 'Certificate'.

CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.



KEY FACTORS ASSESSED

Weathertightness — the systems will resist the passage of moisture to the interior of the building (see section 6).

Condensation risk — the systems incorporate a vapour control layer which adequately limits the risk of internal surface condensation (see section 7).

Properties in relation to fire — in the opinion of the BBA, the systems, when used in a suitable specification, will enable a roof to be unrestricted under Building Regulations (see section 8).

Resistance to wind uplift — results of tests indicate that the systems will enable a roof to be unrestricted under Building Regulations (see section 9).

Resistance to foot traffic — the systems will accept, without damage, the limited foot traffic and loads associated with installation and maintenance (see section 10).

Resistance to plant growth — the systems adequately resist plant root penetration (see section 11).

Durability — under normal service conditions the systems will provide a durable waterproof covering with a service life in excess of 35 years (see section 13).

The BBA has awarded this Certificate to the company named above for the systems described herein. These systems have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

John Albon — Head of Approvals

Construction Products

Claire Curtis-Thomas

Chief Executive

Date of Fourth issue: 11 February 2016

Originally certified on 26 March 2010

The BBA is a UKAS accredited certification body — Number 113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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Regulations

In the opinion of the BBA, Bauder Total Green Roof Waterproofing Systems, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



The Building Regulations 2010 (England and Wales) (as amended)

Requirement: B4(2)	External fire spread
Comment:	Test data indicate that on suitable non-combustible substructures the systems will enable a roof to be unrestricted under this Requirement. See sections 8.1 to 8.5 of this Certificate.
Requirement: C2(b)	Resistance to moisture
Comment:	Data for water resistance on the systems, including joints, indicate that the systems meet this Requirement. See section 6.1 of this Certificate.
Requirement: C2(c)	Resistance to moisture
Comment:	The vapour control layer component of the systems can contribute to enabling a roof to satisfy this Requirement. See section 7 of this Certificate.
Regulation: 7	Materials and workmanship
Comment:	The systems are acceptable. See section 13.1 and the <i>Installation</i> part of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation: 8(1)(2)	Durability, workmanship and fitness of materials
Comment:	The systems satisfy the requirements of this Regulation. See sections 12.1 and 13.1 and the <i>Installation</i> part of this Certificate.
Regulation: 9	Building standards applicable to construction
Standard: 2.8	Spread from neighbouring buildings
Comment:	Test data indicate that on suitable non-combustible substructures the systems will be regarded as having low vulnerability under clause 2.8.1 ⁽¹⁾⁽²⁾ of this Standard. See sections 8.1 to 8.5 of this Certificate.
Standard: 3.10	Precipitation
Comment:	Data for water resistance of the systems indicate that their use will enable a roof to satisfy the requirements of this Standard, with reference to clauses 3.15.1 ⁽¹⁾ , 3.15.3 ⁽¹⁾ , 3.15.5 ⁽¹⁾ and 3.15.8 ⁽¹⁾ . See section 7 of this Certificate.
Standard: 3.15	Condensation
Comment:	The vapour control layer component of the systems can contribute to enabling a roof to satisfy this Standard, with reference to clauses 3.15.1 ⁽¹⁾ , 3.15.3 ⁽¹⁾ , 3.15.5 ⁽¹⁾ and 3.15.6 ⁽¹⁾ . See section 7 of this Certificate.
Standard: 7.1(a)	Statement of sustainability
Comment:	The systems can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6 and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard.
Regulation: 12	Building standards applicable to conversions
Comment:	All comments given for the systems under Regulation 9, Standards 1 to 6 also apply to this Regulation, with reference to clause 0.12.1 ⁽¹⁾⁽²⁾ and Schedule 6 ⁽¹⁾⁽²⁾ . (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).



The Building Regulations (Northern Ireland) 2012 (as amended)

Regulation: 23(a)(i)(iii)(b)(i)	Fitness of materials and workmanship
Comment:	The systems are acceptable. See section 13.1 and the <i>Installation</i> part of this Certificate.
Regulation: 28(b)	Resistance to moisture and weather
Comment:	Data for water resistance on the systems indicate that their use will enable a roof to satisfy the requirements of this Regulation. See section 6.1 of this Certificate.
Regulation: 29	Condensation
Comment:	The vapour control layer component of the systems can contribute to enabling a roof to satisfy the requirements of this Regulation. See section 7 of this Certificate.
Regulation: 36(b)	External fire spread
Comment:	Test data indicate that on suitable non-combustible substructures the use of these systems will be unrestricted by the requirements of this Regulation. See sections 8.1 to 8.5 of this Certificate.

Construction (Design and Management) Regulations 2015

Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, Principal Designer/CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See sections: 1 *Description* (1.2) and 3 *Delivery and site handling* (3.3) of this Certificate.

Additional Information

NHBC Standards 2016

NHBC accepts the use of Bauder Total Green Roof Waterproofing Systems, provided they are installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards, Chapter 7.1 Flat roofs and balconies*.

CE marking

The Certificate holder has taken the responsibility of CE marking the waterproofing membranes and water vapour control layers in accordance with harmonised European Standards BS EN 13707 : 2013 and BS EN 13970 : 2004 respectively. An asterisk (*) appearing in this Certificate indicates that data shown are given in the manufacturer's Declaration of Performance.

Technical Specification

1 Description

1.1 Bauder Total Green Roof Waterproofing Systems comprise the following waterproofing membranes and vapour control layers:

- Bauder Plant E — a chemically-treated, heavy-duty elastomer modified bitumen torch-on mineral finish cap sheet, incorporating expandable graphite fire retardant, and reinforced with 250 g·m⁻² spunbond polyester fleece
- Bauder K5E — an elastomer modified bitumen, torch-on mica finish cap sheet reinforced with 250 g·m⁻² spunbond polyester fleece, for use in protected specifications
- Bauder G4E — an elastomer modified bitumen, torch-on underlay reinforced with 200 g·m⁻² woven glass
- BauderTEC KSA DUO — an elastomer modified bitumen, heat-activated, self-adhesive underlay reinforced with 200 g·m⁻² glassfibre/polyester-coated aluminium
- BauderTHERM DS1 DUO — an elastomer modified bitumen, heat-activated, self-adhesive vapour control layer reinforced with 125 g·m⁻² glassfibre/polyester coated aluminium
- Bauder VB4 Expal — an elastomer modified bitumen, torch-on vapour control layer reinforced with 60 g·m⁻² glass fleece and aluminium/polyester foil
- BauderTEC KSD mica — an elastomer modified bitumen, cold self-adhesive vapour control layer reinforced with aluminium foil and 200 g·m⁻² glass fleece.

1.2 The nominal characteristics of the waterproofing and water vapour control layers are shown in Tables 1 and 2 respectively.

Table 1 Nominal characteristics – waterproofing membranes

Characteristic (unit)	Waterproofing membrane		
	Bauder Plant E	Bauder G4E	BauderTEC KSA DUO
Thickness (mm)	5.2	4.0	3.0
Roll width (m)	1.0	1.0	1.0
Roll length (m)	5.0	7.5	7.5
Mass per unit area (kg·m ⁻²)	6.0	4.8	3.5
Roll weight (kg)	30.0	36.0	26.25
Tensile strength* (N·50 mm ⁻¹)			
longitudinal	≥ 1000	≥ 1200	≥ 1000
transverse	≥ 1000	≥ 1200	≥ 1000
Elongation* (%)			
longitudinal	≥ 45	≥ 2	≥ 2
transverse	≥ 45	≥ 2	≥ 2
Watertightness*	pass	pass	pass
Low temperature flexibility* (°C)	≤ -36	≤ -30	≤ -30
Flow resistance (°C)	≥ 120	≥ 110	≥ 100
Upper surface finish	green mineral chippings	mica	foil
Lower surface finish	thermofusible polyethylene	thermofusible polyethylene	peel-off film covering self-adhesive bitumen

Table 2 Nominal characteristics — water vapour control layers

Characteristic (unit)	Water vapour control layer		
	BauderTHERM DS1 DUO	Bauder VB4 Expal	BauderTEC KSD mica
Thickness (mm)	3.5	3.5	2.5
Roll width (m)	1.0	1.0	1.08
Roll length (m)	7.5	7.5	10.0
Roll weight (kg)	36.5	33.8	32.4
Mass per unit area (kg·m ⁻²)	4.5	4.5	3.0
Tensile strength* (N·50 mm ⁻¹)			
longitudinal	≥ 400	≥ 400	≥ 1000
transverse	≥ 300	≥ 400	≥ 1000
Elongation* (%)			
longitudinal	≥ 2	≥ 2	≥ 2
transverse	≥ 2	≥ 2	≥ 2
Watertightness*	pass	pass	pass
Low temperature flexibility* (°C)	< -25	< -20	< -25
Water vapour diffusion-equivalent air layer thickness* (m)	> 1500	> 1500	> 1500
Upper surface finish	mica and heat-activated adhesive strip	mica	mica and 80 mm width thermofusible strip
Lower surface finish	perforated peel-off film covering heat-activated self-adhesive bitumen	thermofusible polyethylene	peel-off film covering self-adhesive bitumen and 80 mm width glass fleece strip

1.3 Other materials for use with the systems, but which are outside the scope of this Certificate, are:

- Bauder intensive substrate — a lightweight growing medium for roof garden specifications
- Bauder extensive substrate — a lightweight growing medium for plug planting, seeding or hydroplanting or for use beneath XF300 or XF118 (see below) for green roof specifications
- Bauder seed bed substrate — top dressing layer for use when sowing seeds
- Bauder KS Plus seed mix — a blend of seeds of 27 species of wildflowers and herbs
- Bauder Plug Plants — pre-cultivated sedum, native species and perennial vegetation grown in plug format
- Bauder Xero Flor XF301 and XF300 Sedum Blanket — pre-cultivated vegetation blankets on a nylon loop and geotextile base carrier with special substrate for use in green roof specifications
- Bauder XF118 Wildflower Blanket — 24 species of wildflowers and herbs incorporated into a vegetation blanket
- Bauder FSM 600 and FSM1100 Protection Mat — recycled polyester/polypropylene fibre mix mats for protection of the waterproofing layer
- Bauder Eco-Mat Protection Fleece — a recycled polyester/polypropylene fleece for protection of the waterproofing layer when used in green roof specifications
- Bauder Pro-mat Protection Mat — a recycled shredded rubber mat for protection of the waterproofing layer when used in green roof specifications
- Bauder PE Foil Separation Layer — a polyethylene membrane used in a double layer between the waterproofing layer and the protection layer
- Bauder Filter Fleece — a polypropylene fleece for use as a protection layer, preventing fines from washing into the drainage layer
- Bauder SDF Mat — ultraviolet-resistant nylon loops thermally bonded to geotextile facings for use as a filter and drainage layer in green roof specifications
- Bauder PLT 10 — a high-density polyethylene studded board (10 mm depth), with a geotextile fleece attached to the top face of the studs, for use as a filter and drainage layer
- Bauder DSE 20 — a profiled high-density polyethylene studded board (20 mm depth), for use as a water storage and drainage layer in roof garden specifications
- Bauder DSE 40 — a profiled high-density polyethylene studded board (40 mm depth), for use as a water storage and multi-directional drainage layer in roof garden specifications
- Bauder DSE 60 — a profiled high-density polyethylene studded board (60 mm depth), for use as a water storage and multi-directional drainage layer in roof garden specifications
- Bauder Vericell 20 — a recycled polypropylene drainage and protection board (20 mm depth) for high loading applications in roof garden systems
- Bauder Reservoir Board — a profiled expanded polystyrene board (75 mm depth) for use as a water storage and drainage layer
- Bauder Drainage Board — a profiled expanded polystyrene board (50 mm depth) for use as a water drainage layer
- Bitumen grade 95/25 — for use in bonding insulation

- Bauder insulation adhesive — for use in bonding insulation
- Bauder SA Bonding Primer — for use in preparing substrates prior to installation of self-adhesive membranes
- Bauder Quick Dry Bitumen Primer — for use in preparing substrates prior to installation of torch-applied membranes
- BauderPIR Flatboard — a polyisocyanurate insulation board, manufactured to BS EN 13165 : 2012, for fully bonding on flat roofs
- BauderPIR Tapered — a polyisocyanurate insulation board, manufactured to BS EN 13165 : 2012, for fully bonding on flat roofs
- BauderPIR FA-TE — a polyisocyanurate insulation board, manufactured to BS EN 13165 : 2012, for partially bonding in conjunction with BauderTHERM DS1 DUO vapour control layer on flat roofs (only for use in conjunction with BauderTEC KSA DUO underlay).

2 Manufacture

2.1 The waterproofing membranes and water vapour control layers are manufactured by saturating and coating the reinforcement with SBS modified bitumen, then calendaring to the correct thickness. The lower and upper surfaces are applied as appropriate and the sheets are cooled, trimmed and rolled for packaging.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management system of Paul Bauder GmbH has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by DQS (Certificate 002735 QM).

3 Delivery and site handling

3.1 The membranes are delivered to site in rolls with either paper wrappers or tape bands bearing the product name and production code. The rolls are packed on pallets and shrink wrapped in polythene.

3.2 Rolls should be stored upright on a clean, level surface, away from excessive heat and kept under cover. The self-adhesive products should be stored out of direct sunlight.

3.3 The Certificate holder has taken the responsibility of classifying and labelling the system components under the *CLP Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures*. Users must refer to the relevant Safety Data Sheet(s).

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Bauder Total Green Roof Waterproofing Systems.

Design Considerations

4 Use

4.1 Bauder Total Green Roof Waterproofing Systems are satisfactory for use as fully-bonded roof waterproofing systems including vapour control layer on:

- pitched, flat and zero-pitched roofs in green roofs (extensive planting) with limited access
- flat and zero-pitched roofs in roof gardens (intensive planting).

4.2 Pitched roofs are defined for the purpose of this Certificate as those having a fall greater than 1:6.

4.3 Flat roofs are defined for the purpose of this Certificate as those having a minimum finished fall of 1:80.

4.4 Zero-pitched roofs are defined for the purposes of this Certificate as those having a finished fall which can vary between 0° and 0.7°.

4.5 When designing flat roofs, twice the minimum finished fall should be assumed, unless a detailed analysis of the roof is available, including overall and local deflection, direction of falls, etc.

4.6 Limited access roofs are defined for the purposes of this Certificate as those subjected only to pedestrian traffic for maintenance of the roof covering, cleaning of gutters, etc. Where traffic in excess of this is envisaged, additional protection to the membranes must be provided (see section 10).

4.7 Roof garden (intensive roof) specifications can be used on pitches up to 20°, provided the waterproofing system and landscaping are properly supported at the base of the slope and the specification is in accordance with the Certificate holder's recommendations. Above 1:6 (10°) the waterproofing is mechanically fastened and support battens are incorporated to counteract the shear force imposed by the roof garden build-up.

4.8 Extensive green roof specifications can be used on pitches up to 25° slope (depending on the exact system used), provided that the waterproofing system and landscaping are properly supported at the base of the slope and the specification is in accordance with the Certificate holder's recommendations.

4.9 Recommendations for the design of green roofs and roof garden specifications are available within the latest edition of *The GRO Green Roof Code – Green Roof Code of Best Practice for the UK*.

4.10 When the systems are to be used in green roof and roof garden specifications, the structural decks to which the systems are to be applied must be suitable to transmit the dead and imposed loads experienced in service.

4.11 Imposed load, dead loading and wind load specifications are calculated in accordance with BS EN 1991-1-1 : 2002, BS EN 1991-1-4 : 2005 and their respective UK National Annexes.

4.12 The drainage system for both green roofs and roof gardens must be correctly designed, and provision made for maintenance purposes. Dead loads for green roofs and roof gardens can increase if the drains become partially blocked causing waterlogging of the drainage layer.

4.13 On zero-pitched roofs it is particularly important to identify the correct drainage points to ensure that the drainage provided is effective.

4.14 Insulation materials to be used in conjunction with the systems must be in accordance with the Certificate holder's instructions and be either:

- as described in the relevant clauses of BS 8217 : 2005, or
- the subject of a current BBA Certificate and be used in accordance with, and within the scope of, that Certificate.

4.15 Decks to which the membranes are to be applied must comply with the relevant requirements of BS 6229 : 2003, BS 8217 : 2005 and, where appropriate, *NHBC Standards 2016 Chapter 7.1 Flat roofs and balconies*. Additional guidance for inverted roof specifications is given in BBA Information Bulletin No 4 *Inverted roofs – Drainage and U value corrections*.

5 Practicability of installation

The systems must be installed by contractors who have been trained and approved by the Certificate holder.

6 Weathertightness



6.1 The waterproofing membranes and joints in the membranes, when completely sealed and consolidated, will adequately resist the passage of moisture to the inside of the building and so meet the requirements of the national Building Regulations.

6.2 The membranes are impervious to water and when used in the systems described will give a weathertight roofing capable of accepting minor structural movement without damage.

7 Condensation risk



The vapour control layers provide effective control to the passage of liquid water and water vapour.

8 Properties in relation to fire



8.1 In the opinion of the BBA, when used for irrigated roof gardens or green roofs the systems will be unrestricted under the national Building Regulations:

England and Wales — Requirement B4(2)

Scotland — Mandatory Standard 2.8, with reference to clause 2.8.1⁽¹⁾⁽²⁾

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

Northern Ireland — Regulation 36(b).

8.2 A system comprising a 19 mm exterior plywood substrate, a fully-bonded layer of Bauder VB4-Expal Vapour Barrier, a 100 mm thick BauderPIR insulation board bitumen bonded, a fully-bonded layer of Bauder G4E Underlay, a fully-bonded layer of Bauder PLANT E, and Bauder Xeroflor XF301 Sedum Blanket in a sloped orientation, will be unrestricted.

8.3 A system comprising a 19 mm exterior plywood substrate, a fully-bonded layer of Bauder VB4-Expal Vapour Barrier, a 50 mm thick BauderPIR insulation board bitumen-bonded, a fully-bonded layer of Bauder G4E Underlay, a fully-bonded layer of Bauder PLANT E, and Bauder Xeroflor XF301 Sedum Blanket in a flat orientation, will be unrestricted.

8.4 When tested in accordance with ENV 1187 : 2002 test 4, a system comprising a 19 mm exterior plywood substrate, a fully-bonded layer of Bauder VB4-Expal Vapour Barrier, a 100 mm thick BauderPIR insulation board bitumen-bonded, a fully-bonded layer of Bauder G4E Underlay, a fully-bonded layer of Bauder Plant E, and Bauder Xeroflor XF301 Sedum Blanket, achieved a classification to BS EN 13501-5 : 2005 of B_{ROOF}(t4).

8.5 The designation of other specifications (eg on combustible substrates) should be confirmed by:

England and Wales — test or assessment in accordance with Approved Document B, Appendix A, clause 1

Scotland — tests to confirm compliance with Mandatory Standard 2.8, with reference to clause 2.8.1

Northern Ireland — test or assessment by a UKAS-accredited laboratory, or an independent consultant with appropriate experience.

8.6 If allowed to dry, the plants used in a roof garden may allow flame spread across the roof. This should be taken into consideration when selecting suitable plants for the roof. Appropriate planting irrigation and/or protection must be applied to ensure the overall fire-rating of the roof is not compromised.

9 Resistance to wind uplift

9.1 The adhesion of the bonded membranes is sufficient to resist the effects of wind-suction, elevated temperature and thermal shock conditions likely to occur in practice.

9.2 The soil used in intensive planting should not be of a type that will be removed, or become localised, owing to wind scour on the site.

9.3 It should be recognised that the type of plants used could significantly affect the expected wind loads experienced in service.

10 Resistance to foot traffic

10.1 Prior to installation of the upper layers of the systems the waterproofing can accept the limited foot traffic and light concentrated loads associated with installation operations.

10.2 Where regular foot traffic is envisaged, paving on bearer pads or similar suitable pedestrian surface should be used.

11 Resistance to plant growth

11.1 Results of test data indicate that the waterproofing membranes will adequately resist penetration by plant roots.

11.2 Where there is a run-off from a large sill or gully onto the roof surface, the build-up of silt may allow the germination of seeds; therefore, this type of detail should be avoided. Any growth occurring will be restricted and will not normally affect the performance of the roof, and will be no worse than that occurring on normal flat roofs.

12 Maintenance



12.1 Roofs should be inspected twice a year, in autumn after leaf fall and in the spring, to ensure that vegetation and other debris are cleared from the roof and drainage outlets cleared. Guidance is available within the latest edition of *Guidelines to Green Roofing*, published by The Green Roof Organisation (GRO).

12.2 It is imperative that the drainage system of the green roof or roof garden is designed correctly, and provision is made for access for maintenance purposes. Inspection of the drains should be carried out regularly to avoid waterlogging of the garden and the subsequent increase in dead weight load.

13 Durability



13.1 The systems have been used since 1982 in Germany, and evidence from tests confirms that exposed waterproofing membranes will have a life in excess of 35 years. When fully protected and subject to normal service conditions in roof garden and green roof specifications, the systems can provide an effective barrier to the transmission of liquid water and water vapour transmission for the design life of the roof in which they are incorporated.

13.2 Bauder Plant E, when exposed, may suffer some localised loss of mineral surfacing in areas where complex detailing of the roof design is incorporated.

14 Reuse and recyclability

The membranes are made from bitumen and polyester, which can be recycled.

Installation

15 General

15.1 Installation of Bauder Total Green Roof Waterproofing Systems is carried out in accordance with the Certificate holder's instructions and the relevant clauses of BS 8000-0 : 2014, BS 8000-4 : 1989 and BS 8217 : 2005.

15.2 Deck surfaces must be dry, clean and free from sharp projections such as nail heads and concrete nibs. The substrate should be prepared using Bauder SA Bonding Primer, Bitumen Primer or Fast Drying Bitumen Primer as specified and at the recommended rate, prior to the installation of the vapour control layer.

15.3 Systems may be laid in conditions normal to roofing work and must not be laid in rain, snow or heavy fog. If the temperature is below 5°C, suitable precautions must be taken against the formation of condensation on the substrate.

15.4 The waterproofing layers must always be installed with staggered overlaps and in such a manner that no counter-seams in the direction of the outlets are made.

15.5 At falls in excess of 5° (1:11) precautions against slippage, and requirements for mechanical fixing as required by BS 8217 : 2005, should be observed. For slopes above 10° (1:5.7) the Certificate holder's Technical Service Department should be contacted for advice.

15.6 Installation of the insulation boards must be carried out in accordance with the insulation manufacturer's instructions.

15.7 Soil or other bulk material should not be stored on one area of the roof prior to installation, to ensure that localised overloading does not occur.

16 Procedure

16.1 The vapour control layer is rolled out onto the primed substrate, positioned and cut to length. Where thermal break insulation is installed, the vapour control layer must extend up all upstands by a sufficient height to ensure that the insulation is encapsulated.

16.2 The vapour control layer is installed in accordance with the appropriate method for the product, ie torch-bonding for Bauder VB4-Expal and self-adhesion for BauderTHERM DS1 DUO and BauderTEC KSD mica. BauderTEC KSD mica has an 80 mm width glass fleece on the underside of one side lap and a thermofusible film on the upper surface of the other side lap. These laps are sealed together using hot air or gas torch to extrude a bituminous bead, to provide waterproofing integrity.

16.3 The underlays are installed by torch bonding for Bauder G4E and self-adhesive application for BauderTEC KSA DUO. The Bauder G4E membrane should be fully torch bonded for a distance of 400 mm at perimeters and at penetrations such as rooflights, outlets and pipes.

16.4 Head and side laps for the underlays are 100 mm wide and fully bonded, ensuring that a continuous bead of bitumen exudes from the lap.

16.5 The underlay must be taken a sufficient distance up all upstands and protrusions to ensure a secure lap with the vapour control layer, and should be a minimum height of 150 mm above the roof surface.

16.6 Bonding of the Plant E cap sheet is achieved by melting the lower surface by torching and pressing the membrane down. Care must be taken not to overheat the membrane.

16.7 Head and side laps for the cap sheet are 100 mm wide and fully bonded, ensuring that a continuous bead of bitumen exudes from the lap. Laps between the membrane and base sheets should be offset by a minimum of 300 mm.

16.8 Detailing should be carried out in accordance with the Certificate holder's instructions.

17 Repair

In the event of damage the cap sheet can be effectively repaired, after cleaning the surrounding areas, with a patch of the appropriate cap sheet torch-bonded over the damaged area in accordance with the Certificate holder's instructions.

Technical Investigations

18 Tests

Tests were conducted on the membranes used in the Bauder Total Green Roof Systems and the results assessed to determine:

- thickness
- mass per unit area
- width
- heat resistance
- slippage
- tensile strength and elongation
- nail test
- dimensional stability
- low temperature flexibility
- fatigue cycling
- watertightness
- water vapour transmission
- wind uplift
- static indentation
- dynamic impact

- shear resistance of joints
- peel strength
- effects of heat ageing
- effects of water.

19 Investigations

19.1 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

19.2 Data on fire performance were assessed.

19.3 Visits were carried out to sites to assess the durability of the systems.

Bibliography

- BS 6229 : 2003 *Flat roofs with continuously supported coverings — Code of practice*
- BS 8000-0 : 2014 *Workmanship on construction sites — Introduction and general principles*
- BS 8000-4 : 1989 *Workmanship on building sites — Code of practice for waterproofing*
- BS 8217 : 2005 *Reinforced bitumen membranes for roofing — Code of practice*
- BS EN 1991-1-1 : 2002 *Eurocode 1: Actions on structures — General actions — Densities, self-weight, imposed loads for buildings*
- NA to BS EN 1991-1-1 : 2002 *UK National Annex to Eurocode 1: Actions on structures — General actions — Densities, self-weight, imposed loads for buildings*
- BS EN 1991-1-4 : 2005 *Eurocode 1: Actions on structures — General action — Wind actions*
- NA to BS EN 1991-1-4 : 2005 *UK National Annex to Eurocode 1: Actions on structures — General action — Wind actions*
- BS EN 13165 : 2012 *Thermal insulation product for buildings — Factory made rigid polyurethane foam (PUR) products — Specification*
- BS EN 13501-5 : 2005 *Fire classification of construction products and building element — Classification using data from external fire exposure to roofs tests*
- BS EN 13707 : 2013 *Flexible sheets for waterproofing — reinforced bitumen sheets for roof waterproofing — Definitions and characteristics*
- BS EN 13970 : 2004 *Flexible sheets for waterproofing — Bitumen water vapour control layers — Definitions and characteristics*
- BS EN ISO 9001 : 2015 *Quality management systems — Requirements*

20 Conditions

20.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page — no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

20.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

20.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

20.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

20.5 In issuing this Certificate, the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

20.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.