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Agrement Certificate

21/5886

Product Sheet 1

OPTITEC ROOF WATERPROOFING SYSTEMS

OPTIPLAN PVC SINGLE PLY SYSTEM

This Agrément Certificate Product Sheet⁽¹⁾ relates to the OptiPlan PVC Single Ply System, a range of polymer-modified bitumen waterproofing membranes, insulation boards and vapour control layers (VCLs) for use on flat and pitched roofs in extensive or intensive green roof specifications with limited or pedestrian access and with suitable protection.

(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 system, including joints, will resist the passage of moisture to the interior of the building (see section 6).

Thermal performance — the system can be used to improve the thermal performance of a roof (see section 7).

Condensation risk — roofs incorporating the system will adequately limit the risk of interstitial and surface condensation (see section 8).

Properties in relation to fire — the system, when used in a suitable specification, can enable a roof to be unrestricted under the national Building Regulations (see section 9).

Resistance to wind uplift — the system will enable a roof to be unrestricted under the national Building Regulations (see section 10).

Resistance to foot traffic — the system will accept, without damage, the limited foot traffic and loads associated with installation and maintenance (see section 11).

Resistance to penetration of roots — the system will resist the penetration of roots (see section 12).

Durability — under normal service conditions, the system will provide a durable waterproof covering with a service life in excess of 25 years (see section 14).

The BBA has awarded this Certificate to the company named above for the system described herein. This system has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 25 May 2021

Hardy Giesler
Chief Executive Officer



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 MUST check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA directly.

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Regulations

In the opinion of the BBA, the OptiPlan PVC Single Ply System, 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: Comment:	B4(1)	External fire spread The system is restricted by this Requirement in some circumstances. See section 9.3 of this Certificate.
Requirement: Comment:	B4(2)	External fire spread On a suitable substructure, the use of the system can enable a roof to be unrestricted under this Requirement. See sections 9.1 and 9.2 of this Certificate.
Requirement: Comment:	C2(b)	Resistance to moisture The system, including joints, will enable a roof to satisfy this Requirement. See section 6.1 of this Certificate.
Requirement: Comment:	C2(c)	Resistance to moisture The system can contribute to enabling a roof to satisfy this Requirement. See sections 8.1 and 8.2 of this Certificate.
Requirement: Comment:	L1(a)(i)	Conservation of fuel and power The system is acceptable. See sections 7.2 and 7.3 of this Certificate.
Regulation: Comment:	7(1)	Materials and workmanship The system is acceptable. See section 14 and the <i>Installation</i> part of this Certificate.
Regulation:	26	CO₂ emission rates for new buildings
Regulation:	26A	Fabric energy efficiency rates for new dwellings (applicable to England only)
Regulation:	26A	Primary energy consumption rates for new buildings (applicable to Wales only)
Regulation: Comment:	26B	Fabric performance values for new dwellings (applicable to Wales only) The system can enable a construction to satisfy the requirements of this Regulation. See sections 7.2 and 7.3 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation: Comment:	8(1)(2)	Durability, workmanship and fitness of materials The use of the system satisfies the requirements of this Regulation. See sections 13 and 14 and the <i>Installation</i> part of this Certificate.
Regulation: Standard: Comment:	9 2.6	Building standards applicable to construction Spread to neighbouring buildings The system is restricted under clause 2.6.4 ⁽¹⁾⁽²⁾ of this Standard in some circumstances. See section 9.4 of this Certificate.
Standard: Comment:	2.8	Spread from neighbouring buildings On suitable non-combustible substructures, the use of the system can be unrestricted by the requirements of clause 2.8.1 ⁽¹⁾⁽²⁾ of this Standard. See sections 9.1 and 9.2 of this Certificate.

Standard: Comment:	3.10	Precipitation The use of the system, including joints, will enable a roof to satisfy the requirements of this Standard, with reference to clauses 3.10.1 ⁽¹⁾⁽²⁾ and 3.10.7 ⁽¹⁾⁽²⁾ . See section 6.1 of this Certificate.
Standard: Comment:	3.15	Condensation The system will enable 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 sections 8.1 and 8.3 of this Certificate.
Standard: Standard: Comment:	6.1 6.2	Carbon dioxide emissions Building insulation envelope The system can contribute to satisfying the requirements of these Standards, with reference to clauses, or parts of, 6.1.2 ⁽²⁾ , 6.1.6 ⁽¹⁾ , 6.2.1 ⁽¹⁾⁽²⁾ , 6.2.3 ⁽¹⁾ , 6.2.4 ⁽²⁾ , 6.2.5 ⁽²⁾ , 6.2.6 ⁽¹⁾ , 6.2.7 ⁽¹⁾ , 6.2.8 ⁽¹⁾⁽²⁾ , 6.2.9 ⁽¹⁾⁽²⁾ , 6.2.10 ⁽¹⁾⁽²⁾ , 6.2.11 ⁽¹⁾⁽²⁾ , 6.2.12 ⁽²⁾ and 6.2.13 ⁽¹⁾⁽²⁾ . See sections 7.2 and 7.3 of this Certificate.
Standard: Comment:	7.1(a)(b)	Statement of sustainability The system 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. In addition, the system can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾], 7.1.6 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾] and 7.1.7 ⁽¹⁾⁽²⁾ [Aspect 1 ⁽¹⁾⁽²⁾]. See sections 7.2 and 7.3 of this Certificate.
Regulation: Comment:	12	Building standards applicable to conversions All comments given for the system 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: Comment:	23(a)(i)(iii)(b)	Fitness of materials and workmanship The system is acceptable. See section 14 and the <i>Installation</i> part of this Certificate.
Regulation: Comment:	28(b)	Resistance to moisture and weather The system, including joints, can enable a roof to satisfy the requirements of this Regulation. See section 6.1 of this Certificate.
Regulation: Comment:	29	Condensation The system can contribute to a roof satisfying this Regulation. See section 8.1 of this Certificate.
Regulation: Comment:	36(b)	External fire spread On suitable non-combustible substructures, the use of the system can enable a roof to be unrestricted under the requirements of this Regulation. See sections 9.1 and 9.2 of this Certificate.
Regulation: Regulation: Comment:	39(a)(i) 40(2)	Conservation measures Target carbon dioxide Emissions Rate Roofs incorporating the system can satisfy or contribute to satisfying these Regulations. See sections 7.2 and 7.3 of this Certificate.

Construction (Design and Management) Regulations 2015

Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See sections: *1 Description (1.2) and 3 Delivery and site handling (3.4 and 3.5) of this Certificate.*

Additional Information

NHBC Standards 2021

In the opinion of the BBA, the OptiPlan PVC Single Ply System, if installed, used and maintained in accordance with this Certificate can satisfy or contribute to satisfying the relevant requirements in relation to *NHBC Standards*, Chapter 7.1 *Flat roofs and balconies*.

The NHBC Standards do not cover the use of the products in the refurbishment of existing roofs.

CE marking

The Certificate holder has taken the responsibility of CE marking the system in accordance with harmonised European Standards EN 13165 : 2012, EN 13707 : 2013 and EN 13970 : 2011.

Technical Specification

1 Description

1.1 The OptiPlan PVC Single Ply System consists of:

- OptiPlan-FB32 — a PVC roof waterproofing membrane reinforced with fibreglass mat. Also available in a fleece backed version
- OptiPlan-MF21/42 — a PVC roof waterproofing membrane reinforced with polyester mesh. Also available in a fleece backed version
- OptiTherm PIR-TU — a polyisocyanurate insulation board available in a range of thicknesses, foil faced on both surfaces, for use in fully adhered systems
- OptiTherm PIR-FL — a polyisocyanurate insulation board available in a range of thicknesses, foil faced on both sides, for use in mechanically fastened systems
- OSA-Vapour Control Layer — a polymer modified bitumen membrane reinforced with fibreglass felt couple to an aluminium lamina to act as a VCL
- OL-Vapour Control Layer — a low density polyethylene film for use as a VCL
- OptiPlan-FB Adhesive — a single component, polyurethane adhesive for bonding the membrane to the substrate
- OSA5/10/25-Primer — bituminous primer for preparation of the substrate before application of the VCL
- UA-fasteners — for use with the mechanically fixed membrane.

1.2 The membranes are supplied in rolls and are manufactured to the nominal characteristics given in Table 1.

Table 1 Nominal characteristics – membranes

Characteristic (unit)	OptiPlan-FB32	OptiPlan-MF21/42	OSA-Vapour Control Layer	OL-Vapour Control Layer
Standard CE marked against	EN 13956	EN 13956	—	—
Thickness (mm)	1.2, 1.5, 1.8, 2.0,	1.2, 1.5, 1.8, 2.0	3.5	0.2
Length (m)	20, 16.5, 15, 10	20, 16.5, 15, 10	10	100
Width (m)	2.05	2.1	10	4
Mass per unit area (kg·m ⁻²)	1.5, 1.8, 2.2, 2.5	1.5, 1.8, 2.2, 2.5	4.5	0.187
Roll weight (kg)	77, 74, 68, 51	77, 74, 68, 51	45	75
Tensile strength				
longitudinal	≥11 N.mm ⁻²	1000 N.50mm ⁻²	350 N.50mm ⁻²	23 N.mm ⁻²
transverse	≥11 N.mm ⁻²	1100 N.50mm ⁻²	210 N.50mm ⁻²	23 N.mm ⁻²
Elongation at break (%)				
longitudinal	≥200	18	2	—
transverse	≥200	20	2	—
Nail tear (N)				
longitudinal	≥150	200	—	—
transverse	≥150	220	—	—
Dimensional stability (%)	≤0.1	≤0.3	—	—
Impact resistance (mm)	≥500	≥2000	—	—
Static indentation (kg)	≥20	≥20	15	—
Low temperature flexibility (°C)	-30	-25	—	—
Root resistance	Pass	Pass	—	—
Water vapour permeability Sd (m)	—	—	1750	48

1.3 The insulation boards are supplied to site with the nominal characteristics shown in Table 2.

Table 2 Nominal characteristics – insulation boards⁽¹⁾⁽²⁾

Characteristic (unit)	OptiTherm PIR-FL	OptiTherm PIR-TU
Standard CE marked against	EN 13165	EN 13165
Length (mm)	2400	2400, 1200 and 600
Width (mm)	1200	600 and 1200
Thickness (mm)	25 to 160 in 5 mm increments	25 to 160 in 5 mm increments
Compressive strength at 10% compression (kPa)	150	150
Density (kg·m ⁻³)	32	32

(1) Board sizes other than those shown may be available on request.

(2) The declared thermal conductivities (λ_D) are given in Table 3.

1.4 Ancillary items or components which may be used with the system, but which are outside the scope of this Certificate, are:

- OptiPlan-DR — a PVC membrane without reinforcement for detailing
- OptiPlan Internal/External - moulded internal and external corners
- OptiDrain PVC Outlets — a range of outlets, scuppers, vets and pipe collars compatible with OptiPlan PVC membranes
- PVC Metal Sheet — a zinc coated sheet, 0.6 mm thick with a layer of flexible PVC 0.6 mm thick for anchoring and finishing elements of water stop roofing system
- OptiPlan-WM — a PVC embossed membrane for use on access walkways ≥2.3 mm thick.

2 Manufacture

2.1 The membranes are manufactured by extruding the PVC compound into sheets and laminating two sheets together with either polyester or glass fibre reinforcement.

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.

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 UV-protective (white) polythene.

3.2 Rolls must be stored upright on a clean, level surface, away from excessive heat and under cover.

3.3 The insulation boards are delivered to site packaged shrink-wrapped in plastic and must be stored on a firm, clean, level base, off the ground and under cover until required for use. Care must be taken when handling to avoid damage.

3.4 The boards must be protected from prolonged exposure to sunlight, either by storing opened packs under cover or re-covering with opaque polythene sheeting. Care must be taken to avoid contact with solvents or materials containing volatile organic components. The boards must not be exposed to open flame or other ignition sources.

3.5 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 the OptiPlan PVC Single Ply System.

Design Considerations

4 Use

4.1 The OptiPlan PVC Single Ply System is satisfactory for use as a partially or fully bonded, warm roof waterproofing system incorporating VCLs and thermal insulation in:

- green roof specifications on flat roofs with limited or pedestrian access or pitched roofs with limited access
- roof garden specifications on flat roofs.

4.2 The following terms are defined for the purpose of this Certificate as:

- green roof (extensive) — a roof with a substantial layer of growing medium with planting that can include shrubs and trees, and generally accessible to pedestrians
- roof garden (intensive) — a roof with a shallow layer of growing medium planted with low-maintenance plants such as mosses, sedums, grasses and some wild flower species.

4.3 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, such as

pedestrian access roofs, additional protection must be provided (see sections 11 and 15.6 of this Certificate and the relevant clauses of the Certificate holder's installation instructions).

4.4 Pedestrian access roofs are defined for the purposes of this Certificate as those not subjected to vehicular traffic.

4.5 Flat roofs are defined for the purpose of this Certificate as those having a minimum finished fall of 1:80. Pitched roofs are defined for the purpose of this Certificate as those having falls greater than 1:6. When designing flat roofs, twice the minimum finished fall should be assumed, unless a detailed analysis of the roof is available including, for example, overall and local deflection and direction of falls.

4.6 Structural decks to which the system is to be applied must comply with the relevant requirements of BS 6229 : 2018, BS 8217 : 2005 and, where appropriate, *NHBC Standards 2018*, Chapter 7.1.

4.7 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*.

4.8 Structural decks to which the system is to be applied must be suitable to transmit the dead and imposed loads experienced in service. Allowance needs to be made for loading deflections to ensure that the free drainage of water is maintained.

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

5 Practicability of installation

The system must only be installed by contractors who have been trained and approved by the Certificate holder or their appointed agent.

6 Weathertightness



6.1 The waterproofing membranes, including joints, 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 will give a weathertight roofing capable of accepting minor structural movements without damage.

7 Thermal performance

7.1 Calculations of thermal transmittance (U value) must be carried out in accordance with BS EN ISO 6946 : 2017 and BRE Report BR 443 : 2006, using the declared thermal conductivity (λ_D value) of the insulation components as shown in Table 3.

Table 3 Thermal conductivity (λ_D values)

Product	Insulation thickness (mm)	Thermal conductivity ($W \cdot m^{-1} K^{-1}$)
OptiTherm PIR-FL	all	0.022
	< 80	0.026
OptiTherm PIR-TU	$\geq 80 < 120$	0.025
	≥ 120	0.024



7.2 The U value of a completed roof will depend on the type and thickness of insulation used, the number and type of fixings and the insulating value of other roof components/layers. Example U values of roofs incorporating the system are shown in Tables 4 and 5.

Table 4 Example U values for OptiTherm PIR-FL and OptiTherm PIR-TU — mechanically fixed

U value ($W \cdot m^{-2} \cdot K^{-1}$) ⁽¹⁾	Deck construction/ insulation thickness (mm)					
	Concrete ⁽²⁾⁽³⁾		Timber ⁽²⁾⁽⁴⁾		Metal ⁽²⁾⁽⁵⁾	
	OptiTherm PIR-FL	OptiTherm PIR-TU	OptiTherm PIR-FL	OptiTherm PIR-TU	OptiTherm PIR-FL	OptiTherm PIR-TU
0.13	210	215	205	215	210	225
0.16	170	175	165	175	170	185
0.18	150	155	145	155	155	165
0.20	130	140	130	135	140	145
0.25	100	110	100	110	110	120

(1) OptiTherm PIR-FL and OptiTherm PIR-TU Roofing boards.

(2) Includes 5.55 steel fixings per m² and 3.55 steel waterproofing fixings per m², with a 4.8 mm cross-sectional head diameter and full insulation penetration depth.

(3) Concrete decking 2.0 $W \cdot m^{-2} \cdot K^{-1}$, 38 mm timber battens (15%), VCL, 1.5 mm single-ply waterproofing membrane, 12.5 mm plasterboard.

(4) 18 mm decking, 150 mm timber joists (12.5%) with 150 mm airspace (87.5%), VCL, 1.5 mm single-ply waterproofing membrane, 12.5 mm plasterboard.

(5) Metal deck (not included in calculation), VCL, 12.5 mm plasterboard or 1.5 mm single-ply waterproofing membrane.

Table 5 Example U values for OptiTherm PIR-FL and OptiTherm PIR-TU — adhesively fixed

U value requirement ($W \cdot m^{-2} \cdot K^{-1}$) ⁽¹⁾	Deck construction/insulation thickness (mm)		
	Concrete ⁽²⁾⁽³⁾	Timber ⁽²⁾⁽⁴⁾	Metal ⁽²⁾⁽⁵⁾
0.13	170	170	175
0.16	135	135	145
0.18	120	120	130
0.20	115	110	120
0.25	90	90	95

(1) OptiTherm PIR-FL and Paraqtherm G Roofing Boards.

(2) Adhesively fixed with no metal fixings.

(3) Concrete decking 2.0 $W \cdot m^{-2} \cdot K^{-1}$, 38 mm timber battens (15%), VCL, 1.5 mm single-ply waterproofing membrane, 12.5 mm plasterboard.

(4) 18 mm plywood decking, 150 mm timber joists (12.5%) with 150 mm airspace (87.5%), VCL, 1.5 mm single-ply waterproofing membrane, 12.5 mm plasterboard.

(5) Metal deck (not included in calculation), VCL, 1.5 mm single-ply waterproofing membrane.

Junctions



7.3 Care must be taken in the overall design and construction of junctions with other elements and openings to minimise thermal bridges and air infiltration. Detailed guidance can be found in the documents supporting the national Building Regulations.

8 Condensation risk

Interstitial condensation



8.1 The system will adequately reduce the risk of interstitial condensation when designed and constructed in accordance with BS 5250 : 2011, Appendix D and Appendix H Section H9, and BRE Report BR 262 : 2002, in England and Wales. When carrying out condensation risk analysis calculations to BS 5250 : 2011, the following vapour resistance values should be used:

- VCL 8750⁽¹⁾, 240⁽²⁾ MN·s·g⁻¹
- individual foil layers of the boards 80 MN·s·g⁻¹
- insulation core of the boards 300 MN·s·g⁻¹
- capsheet 102 MN·s·g⁻¹.

(1) Ade vapor AL35.

(2) Vaporfoil.

Surface condensation



8.2 Roofs will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed $0.35 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point, and the junctions with other elements are designed in accordance with the guidance referred to in section 6.3.



8.3 For buildings in Scotland, constructions will be acceptable where the thermal transmittance (U value) does not exceed $1.2 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point, and the junctions with other elements are designed in accordance with the guidance referred to in BS 5250 : 2011, Annex H. Further guidance may be obtained from BRE Report BR 262 : 2002 and section 6.3 of this Certificate.

9 Properties in relation to fire



9.1 In the opinion of the BBA, a roof incorporating the systems will also be unrestricted under the national Building Regulations with respect to proximity to a boundary in the following circumstances:

- protected with an inorganic covering listed in the Annex of Commission Decision 2000/553/EC,
- a roof garden covered with a drainage layer of gravel 100 mm thick and a soil layer 300 mm thick
- irrigated green roofs and roof gardens.

9.2 The designation of other specifications should be confirmed by reference to the requirements of the documents supporting the national Building Regulations.



9.3 A green roof system, when used in pitches of greater than 70° , excluding upstands, should not be used on buildings in England and Wales that have a storey at least 18 m above ground level and contain: one or more dwellings, an institution, a room for residential purposes (excluding any room in a hostel, hotel or boarding house), student accommodation, care homes, sheltered housing, hospitals or dormitories in boarding schools.



9.4 A green roof system, when used in pitches of greater than 70° , excluding upstands, should not be used on buildings in Scotland that have a storey at least 11 m above ground level.

9.5 If allowed to dry, plants used in roof garden may allow flame spread across a 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.

10 Resistance to wind uplift

10.1 The membranes, when used with a suitable roof garden or green-roof specification, will adequately resist the effects of wind uplift likely to occur in practice.

10.2 The soil used in roof gardens must not be of a type that will be removed or become delocalised owing to wind scour experienced on the roof.

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

11 Resistance to foot traffic

11.1 The system can accept the limited foot traffic and light concentrated loads associated with installation and maintenance. Where traffic in excess of this is envisaged, such as for maintenance of lift equipment, a walkway must be provided (for example, using concrete slabs supported on bearing pads or manufacturer's walkway sheets). Reasonable care must be taken to avoid puncture of the membranes by sharp objects or concentrated loads.

11.2 For design purposes, the insulation boards may be assumed to have an allowable compressive strength of 150 kPa at 10% compression.

11.3 The insulation boards have not been assessed for use with permanent distributed or concentrated loads above those exerted by the upper layers of the green roof/roof garden system, such as air conditioning units, mechanical plants, water tanks, etc. Such loads must be supported directly on the roof construction or design support system.

11.4 When profiled decking is used, boards will need to span ribs. Maximum permissible spans between ribs for various board thicknesses are shown in Table 6.

Maximum clear span (mm)	Minimum board thickness (mm)
< 75	25
> 75 ≤ 100	30
> 100 ≤ 125	35
> 125 ≤ 150	40
> 150 ≤ 175	45
> 175 ≤ 200	50
> 200 ≤ 225	55
> 225 ≤ 250	60

12 Resistance to penetration of roots

12.1 Results of tests on OptiPlan-MF21/42 and OptiPlan-FB32 indicate that they are suitable for use as a root-resistant membranes and, when used with the OptiPlan PVC Single Ply System in roof garden applications, will provide adequate protection against penetration by roots.

12.2 Advice on suitable planting specifications can be obtained from the Certificate holder.

13 Maintenance



Green roofs and roof gardens must be the subject of regular inspections, particularly in autumn after leaf fall and in spring, to ensure that unwanted vegetation and other debris are cleared from the roof and drainage outlets (see section 4.8). Guidance is available in the latest edition of *The Green Roof Code* — *Green Roof Code of Best Practice for the UK*.

14 Durability



Under normal service conditions, the system will have a service life in excess of 25 years.

Installation

15 General

15.1 Installation of the OptiPlan PVC Single Ply System must be carried out by installers trained and approved by the Certificate holder in accordance with the relevant clauses of BS 8000-0 : 2014, BS 8000-4 : 1989, BS 8217 : 2005, the Certificate holder's or appointed agent's instructions and this Certificate.

15.2 Substrates to which the system is to be applied must be sound, dry, clean and free from sharp projections such as nail heads and concrete nibs. Wet insulation boards must not be used. For the tapered boards to be effective in providing a uniform fall, it is essential that the structural deck is true and even. Any hollows, depressions or backfalls found in the roof deck must be rectified prior to laying the insulation.

15.3 Installation must not be carried out during inclement weather (eg rain, fog or snow). When the temperature is below 5°C, suitable precautions against surface condensation must be taken.

15.4 Detailing must be formed in accordance with the Certificate holder's instructions.

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

15.6 If the roof is likely to be subject to uncontrolled pedestrian access, the substructure must satisfy the requirements of BS 8217 : 2005, and to prevent damage to the roof covering one of the appropriate surface finishes referred to in clause 6.12 of the Standard must be used.

15.7 At falls in excess of 1:11, the provision for mechanical fixings as required by BS 8217 : 2005 should be observed.

15.8 Insulation boards can be cut to fit around projections through the roof, using either a sharp knife or a fine-toothed saw.

16 Procedure

Vapour control layer

16.1 Before adhering the Ade vapor 35 VCL, the deck must be treated with OSA5/10/25-Primer.

16.2 The VCL is fully torch-bonded to the deck with side laps of 100 mm and end laps of 150 mm.

16.3 When used with mechanically fastened insulation, Vaporfoil VCL is used loose-laid.

16.4 At perimeters and penetrations the VCL is detailed to envelop the insulation boards.

Insulation

16.5 The insulation boards are installed in a close-butted, break-bonded pattern.

16.6 On metal decks the boards are laid either with the long axis at right angles to the corrugations of the metal deck or diagonally across the corrugations of the deck, ensuring that all end joints and corners are sufficiently supported on the crown flats of the decking. The thickness of the board to be used is dependent on the width of the trough openings of the metal deck as indicated in Table 6.

Fully bonded

16.7 The installed boards are bonded to the VCL using FB SF Substrate Adhesive.

Mechanically fastened

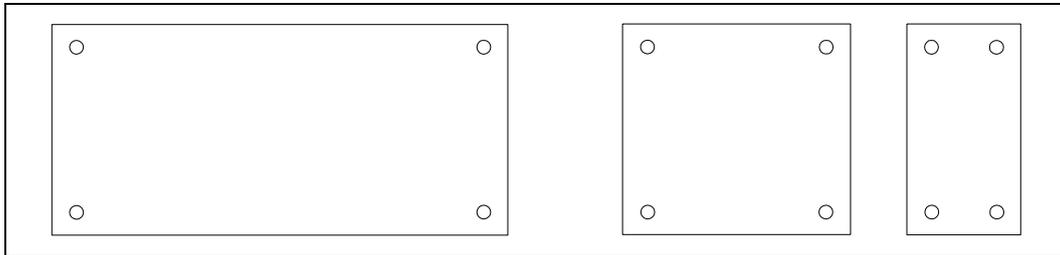
16.8 The boards are secured to the substrate by means of mechanical fastenings.

16.9 Each fixing must incorporate a minimum 50 by 50 mm square or 50 mm diameter circular plate countersunk washer, which must not restrain more than one board. The minimum number of fixings for each board size is given in Table 7 and fixing layouts are shown in Figure 1. The requirement for additional fixings must be assessed for each individual installation in accordance with BS EN 1991-1-4 : 2005 and its UK National Annex by a suitably experienced and competent individual. These are placed within the individual board area and sited more than 50 mm but less than 150 mm from the edges and corners of the board, giving a minimum fixing rate of 5.55 fixings per square metre for 1200 by 600 mm boards.

Table 7 Minimum number of fixings

Board dimensions (mm)	Minimum number of fixings
2400 x 1200	6
1200 x 1200	4
1200 x 600	4

Figure 1 Fixing layouts — minimum fixing numbers (for solely mechanically fixed specification)



Membrane

Fully bonded

16.10 The membrane is unrolled onto the substrate and folded back half the length of the roll, exposing the underside.

16.11 FB SF Substrate Adhesive is applied to the insulation substrate at a rate of 0.250 kgm⁻².

16.12 A range of metal trims are available for completing edge details. These are fixed in accordance with the Certificate holder's instructions.

Loose-laid

16.13 Side laps must be a minimum of 100 mm and end laps must be a minimum of 150 mm. The laps must be welded by torching the lower surface and pressing the membrane down.

16.14 With loose-laid systems the membranes must be ballasted to combat the effects of wind uplift. This can be achieved by:

- laying a 0.2 mm thick polyethylene protective sheet or non-woven polyester sheet covered by at least 50 mm of well-rounded gravel (gravel size 15/30 mm)
- laying a 0.2 mm thick polyethylene or non-woven polyester sheet (minimum mass 300 g·m⁻²) covered by a 20 mm thick layer of sand overlaid with a layer of concrete paving slabs⁽¹⁾.

(1) If paving on plastic pads, the sand is not required.

Mechanically fastened

16.15 The membrane is laid onto the substrate without folds or ripples, and fixed to the deck and through the insulation by UA-fasteners and plates through the overlap of the membrane.

16.16 The position of the number of UA-fasteners required must be in accordance with the fixing specifications provided by the Certificate holder.

16.17 The membrane should be fixed at the edges by mechanically fastening using termination bars.

Hot-air welding

16.18 Joints are made using a hand-operated machine with the temperature set in accordance with the Certificate holder's instructions.

16.19 The lap area must be dry and clean. If the membrane in the weld area has become contaminated, it must be cleaned in accordance with the Certificate holder's instructions.

16.20 The welded width of the joint must be a minimum of 30 mm. On completion of the weld, the seam should be tested with a suitable metal probe, and any weakness repaired immediately.

16.21 Flashings should be formed in accordance with the Certificate holder's instructions.

16.22 The seam is tested with a metal probe to highlight poorly welded areas. Any such areas should be made good using hot-air welding.

Subsequent layers

16.23 Subsequent layers, such as separation layers, drainage layers and growing medium, are installed in accordance with the Certificate holder's installation instructions.

17 Repair

In the event of accidental damage, repairs can be carried out by cleaning the area around the damage and applying a patch as described in the Certificate holder's instructions.

Technical Investigations

18 Tests

18.1 An assessment was made of test data for the waterproofing membranes in relation to:

- thickness
- mass per unit area
- plasticiser content
- water vapour transmission
- watertightness
- tensile strength and elongation
- tear resistance (nail)
- static loading
- dynamic indentation
- dimensional stability
- low temperature foldability
- wind uplift
- shear strength of joints
- peel of joints
- heat ageing
- UV ageing.

18.2 Data on the resistance to root penetration were assessed.

18.3 Tests were carried out on the insulation and results assessed to determine:

- reaction to fire
- thermal conductivity
- compressive strength
- dimensional stability
- wind uplift
- tensile strength perpendicular to faces
- water vapour transmission.

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 the fire performance of the system were evaluated.

19.3 U value calculations have been carried out on OptiTherm PIR-TU and OptiTherm PIR-FL insulation.

Bibliography

BRE Report 262 BR 262 : 2002 *Thermal insulation : avoiding risks*

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BS 8217 : 2005 *Reinforced bitumen membranes for roofing — Code of practice*

BS EN 1991-1-4 : 2005 + A1 : 2010 *Eurocode 1 — Actions on structures — General actions — Wind actions*

NA to BS EN 1991-1-4 : 2005 + A1 : 2010 *UK National Annex to Eurocode 1 — Actions on structures — General actions — Wind actions*

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EN 13165 : 2012 + A1 : 2016 *Thermal insulation products for buildings — Factory made rigid polyurethane foam (PU) products — Specification*

EN 13707 : 2013 *Flexible sheets for waterproofing — Reinforced bitumen sheets for roof waterproofing — Definitions and characteristics*

EN 13970 : 2011 *Flexible sheets for waterproofing — Bitumen water vapour control layers — Definitions and characteristics*

EN 13956 : 2012 *Flexible sheets for waterproofing — Plastic and rubber sheets for roof waterproofing — Definitions and characteristics*

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 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.