Axter Limited
West Road
Ransomes EuroPark
Ipswich
Suffolk IP3 9SX

Tel: 01473 724056 Fax: 01473 723263
e-mail: info@axterltd.co.uk
website: www.axter.co.uk

Agrément Certificate
15/5222
Product Sheet 1

AXTER BITUMEN ROOF WATERPROOFING SYSTEMS

FORCE DALLE GREEN ROOF AND BLUE ROOF WATERPROOFING SYSTEMS

This Agrément Certificate Product Sheet(1) relates to Force Dalle(2) Green Roof and Blue Roof Waterproofing Systems, consisting of SBS modified bitumen membranes with polyester reinforcement, used as single layer roof waterproofing or as part of a built-up system, for use on protected, cold roofs, warm roofs or inverted roofs, flat roofs, terraces, balconies and podia, including zero fall roofs, green roofs, roof gardens and blue roof specifications in combination with a stormwater attenuation system(3).

(1) Hereinafter referred to as 'Certificate'.
(2) Force Dalle is a registered trademark.
(3) Stormwater attenuation system is outside the scope of this 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 into the interior of a building (see section 6).

Properties in relation to fire — the systems may enable a roof to be unrestricted under the national Building Regulations (see section 7).

Resistance to wind uplift — resistance to wind uplift is dependent on the ballast layers of the roofing specification (see section 8).

Resistance to mechanical damage — the systems will accept, without damage, the limited foot traffic and loads associated with installation, maintenance and pedestrian traffic (see section 9).

Resistance to penetration of roots — the systems (excluding Force 4000 Dalle) will resist the penetration by plant roots and rhizomes (see section 10).

Durability — under normal service conditions, the systems will provide a durable waterproof covering with a service life in excess of 30 years (see section 12).

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

Date of Second issue: 6 May 2022

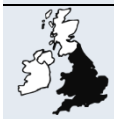
Originally certificated 24 June 2015

Hardy Giesler
Chief Executive Officer

British Board of Agrément
Bucknalls Lane
Watford
Herts WD25 9BA
©2022
tel: 01923 665300
clientservices@bbacerts.co.uk
www.bbacerts.co.uk

Regulations

In the opinion of the BBA, Force Dalle Green Roof and Blue 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(1)**	**External fire spread**
Comment:		The systems are restricted by this Requirement in some circumstances. See section 7.5 of this Certificate.
Requirement:	**B4(2)**	**External fire spread**
Comment:		The systems, when used with suitable surface protection, may enable a roof to be unrestricted under this Requirement. See sections 7.1 to 7.3, 7.4 (Wales only) and 7.7 of this Certificate.
Requirement:	**C2(b)**	**Resistance to moisture**
Comment:		The systems will enable a roof to satisfy this Requirement. See section 6 of this Certificate.
Requirement:	**7(1)**	**Materials and workmanship**
Comment:		The systems are acceptable. See section 12.1 and the *Installation* part of this Certificate.
Regulation:	**7(2)**	**Materials and workmanship**
Comment:		Use of the systems on balconies is restricted under this Regulation. See section 7.7 of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)(2)**	**Durability, workmanship and fitness of materials**
Comment:		Use of the systems satisfies the requirement of this Regulation. See sections 11.1 and 12.1 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	2.2	Separation
Comment:		Use of the systems on balconies is restricted under clause 2.2.7(1) of this Standard. See section 7.7 and the Installation part of this Certificate.
Standard:	2.6	Spread to neighbouring buildings
Comment:		The systems are restricted under clause 2.6.4(1) of this Standard, in some circumstances. See section 7.6 of this Certificate.
Standard:	2.8	Spread from neighbouring buildings
Comment:		When used in suitably protected specifications, the systems may enable a roof to be unrestricted under this Standard, with reference to clause 2.8.1(1)(2). See sections 7.1 to 7.3 of this Certificate.
Standard:	3.10	Precipitation
Comment:		The use of the systems 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 of this Certificate.
Standard:	7.1(a)	Statement of sustainability
Comment:		The systems can contribute to satisfying 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:		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 12.1 and the *Installation* part of this Certificate.
Regulation:	**28(b)**	**Resistance to moisture and weather**
Comment:		The systems will enable a roof to satisfy the requirements of this Regulation. See section 6 of this Certificate.
Regulation:	**36(b)**	**External fire spread**
Comment:		The systems, when used with suitable surface protection, may enable a roof to be unrestricted under the requirements of this Regulation. See sections 7.1 to 7.4 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* (3.3) of this Certificate.

Additional Information

NHBC Standards 2022

In the opinion of the BBA, Force Dalle Green Roof and Blue Roof Waterproofing Systems, 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, terraces and balconies.*

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

CE marking

The Certificate holder has taken the responsibility of CE marking the membranes in accordance with harmonised European Standard EN 13707 : 2013.

Technical Specification

1 Description

1.1 Force Dalle Green Roof and Blue Roof Waterproofing Systems comprise styrene-butadiene-styrene (SBS) modified bitumen membranes with a polyester reinforcement:

- Force 4000 Dalle — an SBS modified bitumen membrane with a polyester reinforcement (nominal 180 g·m^{-2}), with a thermofusible film on the upper and lower faces, for use in fully bonded, partially bonded and loose-laid and ballasted applications including applications on zero fall roofs and blue roofs

- Force Dalle Flame Free — an SBS modified bitumen membrane with anti-root additive and a polyester reinforcement (nominal 180 g·m^{-2}) with a macro-perforated film and sand finish on the upper face and a silicone release film on the lower face for use in self-adhesive and loose-laid and ballasted applications including applications on zero fall roofs, green roofs, roof gardens and blue roofs
- Force Dalle — an SBS modified bitumen membrane with anti-root additive and a polyester reinforcement (nominal 180 g·m^{-2}) with a thermofusible film on the upper and lower faces, for use in fully bonded, partially bonded and loose-laid and ballasted applications including applications on zero fall roofs, green roofs, roof gardens and blue roofs.
- Force 4000 Trafic — an SBS modified bitumen membrane with anti-root additive, a polyester reinforcement (nominal 250 g·m^{-2}) with a slate mineral finish on the upper face and a thermofusible film on the lower face, for use in fully bonded, partially bonded and ballasted applications including applications on zero fall roofs, green roofs, roof gardens and blue roofs.

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

Table 1 Nominal characteristics

Characteristic (unit)	Force 4000 Dalle	Force Dalle	Force Dalle Flame Free	Force 4000 Trafic
Thickness (mm)	4	4	4	4
Roll width (m)	1	1	1	1
Roll length (m)	8	8	8	5 and 8
Roll weight (kg)	42	42	39.2	25 and 40
Watertightness	Pass	Pass	Pass	Pass
Tensile strength (N per 50 mm) longitudinal transverse	700600	700 600	700 600	900 900
Elongation at break (%) longitudinal transverse	35 35	35 35	35 35	45 50
Nail tear (N) longitudinal transverse	180 230	— —	— —	250 300
Low temperature flexibility (°C)	≤ -16	≤ -16	≤ -16	≤ -16
Flow resistance (°C)	100	100	100	100
Dimensional stability (%)	≤ 0.5	≤ 0.5	≤ 0.3	≤ 0.5
Impact (mm) (method A)	1250	1250	—	1000
Static loading (kg) (method A)	20	20	—	20
Tensile strength of joint (N per 50 mm) selvedge end joint	600 700	600 700	600 600	900 900
Root penetration	-	Pass	Pass	Pass

1.3 The following membranes, covered in other Product Sheets of this Certificate, can be used in conjunction with Force Dalle membranes:

Hyranger membranes
- Hyranger 25/25 RE
- Hyranger 35 PY
- Hyranger 25/25 TS
- Hyranger TS CPV
- Hyranger TS
- Hyranger TS PY
- Hyranger 40 PY FP

Matflex membranes
- Matflex PY

Topfix membranes

- Topfix FMP
- Topfix FMP (sanded)
- Topfix PY FMP

Force membranes

- Force 4000 S.

1.4 Primers for use with the systems, but which are outside the scope of this Certificate, include:

- Vernis SA — a synthetic rubber based primer for use with flame-free systems
- Vernis Antac — a solvent-based, quick-drying bitumen primer
- Vernis Antac GC — a solvent-based elastomeric bitumen primer modified with adhesive
- Vernis Seal — a synthetic resin-based rapid drying pigmented primer.

1.5 Ancillary items which can be used with the membranes, but which are outside the scope of this Certificate, include:

- additional Axter roofing membranes which can be used in conjunction with Axter Force Dalle Green Roof and Blue Roof Waterproofing Systems — Excel (also known as Alpal Décor CPV), Arma CPV, Topaz 25, Armalu and Paxinox
- Hyranger 35PY Angle Reinforcement
- Thermecran — a perforated membrane for use in partially bonded applications
- Planivent — a perforated membrane for use in partially bonded applications
- Axter Adjustable or Fixed-Height Paving and Decking Support System including Euroclass reaction to fire A1 non-combustible options
- Axter Dalle Ceramic — a specialist range of Euroclass reaction to fire A1 non-combustible ceramic pavers for use with the Axter Adjustable or Fixed-Height Paving and Timber Decking Support System
- Axter Drainage Membranes and Boards — Axter DRAIN, Hydrodrain/12/20/40, Hydrodrain D500 and Bac Canalis
- Geotextile Filter layer — a 170 $g \cdot m^{-2}$ polyester protection or separation layer for use under heavy protection or paving slabs on supports
- Axter Air and Vapour Control Layers (AVCLs) — VAP AL, VAP AL SK, VAP ALU ADH, Hyranger Spot ADH, Hyranger 25/25 TS, Rollstick 21, Roll 25 Alpa, Roll 25 Alpa Alu, Rollstick 31 Alpa, Rollstick 31 Alpa Alu, Stickflex Alu, Stickflex, Stickflex Sanded, Force SA, Vap IND, SK Vap, Antivap and VAP
- Hytherm insulation products – a wide range of thermal insulation products. Details are available from the Certificate holder
- Hyrastick EVO — cold-applied liquid polyurethane adhesive for installing EPS, PUR and PIR insulation boards
- Starcoat R — cold-applied liquid single-component bitumen resin with anti-root additive for waterproofing complex details
- Mastic Hyrene — cold bitumen bonding compound
- Mastic Hyraflex — elastomeric compound for pitch pocket detailing and joint filling
- Starcoat QC and Starcoat PMMA Liquid Membranes — cold-applied liquid resins for complex detailing (covered by BBA Certificate 13/5031 and 16/5322)
- Excel Joint and Excel Park — a polyamide-reinforced elastomeric membrane and jointing system for movement and expansion joints including prefabricated junction pieces (Inter-L and Inter-R)
- prefabricated accessories — rainwater outlets, leaf guards, SVP covers, cable penetration units, hot and cold pipe penetration units, Axtrim roof edge trims and termination bars.

2 Manufacture

2.1 The waterproofing membranes are manufactured by saturating and coating the reinforcement with styrene-butadiene-styrene (SBS) modified bitumen, then calendering to the correct thickness. The lower and upper surface finishes 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 Axter SAS has been assessed and registered as meeting the requirements of EN ISO 9001 : 2015 and EN ISO 14001 : 2015 by AFAQ (Certificates QUAL/1996/5190.12 and No 2011/40665.4 respectively).

3 Delivery and site handling

3.1 The membranes are delivered to site in rolls with tape bands bearing the product name, roll dimensions, production date, batch number and the Certificate holder's name.

3.2 The rolls are packaged on pallets and shrink wrapped in polythene.

3.3 Rolls should be stored upright on a clean, level surface and kept dry, away from excessive heat and under cover. Flame free self-adhesive membranes should be stored out of direct sunlight.

3.4 The Certificate holder has taken the responsibility of classifying and labelling the systems 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 Force Dalle Green Roof and Blue Roof Waterproofing Systems.

Design Considerations

4 General

4.1 Force Dalle Green Roof and Blue Roof Waterproofing Systems are satisfactory for use as a single layer waterproofing layer or as part of a built-up system in conjunction with other bitumen underlayers, base layers and AVCLs, in fully bonded, self-adhesive partially bonded or loose laid and ballasted applications on flat, including protected zero fall, roofs with limited or pedestrian access in:

- inverted roof specifications using aggregate ballast and paving on flat roofs, including zero fall roofs with limited access
- protected warm and cold roof specifications, eg covered by pavers or other suitable protection on flat roofs, including zero fall roofs
- green roof (extensive), biodiverse roof and brown roof specifications on warm and cold roofs, flat roofs, including zero fall roofs with limited access or pitched roofs with limited access, and roof garden (intensive) specifications
- blue roof specifications in combination with a stormwater attenuation system(1), on warm, inverted and cold roofs, flat roofs, including zero fall roofs
- Combined blue roof and green roof specifications in combination with a stormwater attenuation system(1), on flat roofs, including zero fall roofs
- balconies and terraces.

(1) The stormwater attenuation system is outside the scope of this Certificate.

4.2 Decks to which the systems are to be applied must comply with the relevant requirements of BS 6229 : 2018 and BS 8217 : 2005 and, where appropriate, *NHBC Standards* 2022, Chapter 7.1.

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

- roof garden (intensive) — a roof with a substantial layer of growing medium with planting that can include shrubs and trees, generally accessible to pedestrians
- green roof (extensive) — a roof with a shallow layer of growing medium planted with low-maintenance plants such as mosses, sedums, grasses and some wildflower species
- biodiverse roof — a roof planted with the aim either to recreate the habitat that was lost when the building was erected or to enhance it
- brown roof — a roof with a growing medium selected to allow indigenous plant species to inhabit the roof over time; no deliberate planting is undertaken
- blue roof — a flat roof designed to allow controlled attenuation of rain fall during heavy and storm events, as part of sustainable urban drainage systems (SUDS). Guidance for the design and construction of blue roofs is available in the NFRC *Technical Guidance Note for the construction and design of Blue Roofs*.

4.4 Blue roofs are defined for the purpose of this Certificate as flat, including zero fall, roofs designed to allow controlled attenuation of rain fall during heavy and storm events, as part of sustainable urban drainage systems (SUDS). Guidance on the design of blue roofs is available in *NFRC Technical Guidance Note for the construction and design of Blue Roofs – Roofs and podiums with controlled temporary water attenuation*.

4.5 Limited access roofs are defined for the purpose of this Certificate as those subjected only to pedestrian traffic for maintenance of the roof covering and cleaning of gutters, etc. Where traffic in excess of this is envisaged, additional protection to the membrane must be provided (see section 9). Pedestrian access roofs are defined for the purpose of this Certificate as those not subjected to vehicular traffic.

4.6 Flat roofs are defined for the purpose of this Certificate as those having a minimum finished fall of 1:80[(1)]. For design purposes, twice the minimum finished fall should be assumed, unless a detailed analysis of the roof is available, including overall and local deflection and direction of falls, etc.

(1) *NHBC Standards* 2022 require a minimum fall of 1:60 for green roofs and roof gardens.

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

4.8 Zero fall roofs are defined for the purpose of this Certificate as those having a finished fall which can vary between 0 and 1:80[(1)]. Reference should also be made to the appropriate clauses in the Liquid Roofing and Waterproofing Association (LRWA) Note 7 – *Specifier Guidance for Flat Roofs.*

(1) *NHBC Standards* 2022 require a minimum fall of 1:60 for green roofs and roof gardens.

4.9 Balconies and terraces, to which the systems are to be applied, must be designed in accordance with BS 8579 : 2020.

4.10 Structural decks to which the systems are to be applied must be suitable to transmit the dead and imposed loads experienced in service. Imposed loads, dead loading and wind loads must be calculated by a suitably experienced and competent individual in accordance with BS EN 1991-1-1 : 2002, BS EN 1991-1-3 : 2003 and BS EN 1991-1-4 : 2005, and their UK National Annexes.

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

4.12 The drainage systems for inverted roofs, zero fall roofs, blue roofs, green roofs or roof gardens must be correctly designed, and the following points should be addressed:

- provision made for access for maintenance purposes
- for zero fall roofs, it is particularly important to identify the correct drainage points, to ensure that drainage is sufficient and effective in accordance with the relevant clauses of BS 6229 : 2018
- dead loads for green roofs and roof gardens can increase if the drains become partially or completely blocked causing waterlogging of the drainage layer
- additional guidance for inverted roof specifications is given in BBA Information Bulletin No 4 *Inverted roofs — Drainage and U value corrections*.

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

- as described in the relevant clauses of BS 6229 : 2018, or
- the subject of a current BBA Certificate and used in accordance with, and within the scope of, that Certificate.

4.14 The NHBC requires that the waterproofing membranes, once installed, are inspected in accordance with the *NHBC Standards* 2022, Chapter 7.1, Clause 7.1.12, and undergo an appropriate integrity test, where required. Any damage to the membrane is repaired in accordance with section 15 of this Certificate and reinspected.

5 Practicability of installation

The systems are designed to be installed by a competent roofing contractor, experienced with these types of systems, and trained and approved by the Certificate holder.

6 Weathertightness

The systems, including joints, when completely sealed and consolidated, will adequately resist the passage of moisture into the interior of a building and will enable a roof to comply with the requirements of the national Building Regulations.

7 Properties in relation to fire

7.1 When tested to DD CEN/TS 1187 : 2012, Test 4[(1)(3)], and classified in accordance with EN 13501-5 : 2016 [(2)(4)], for slopes below 10° and, the following specifications achieved a classification of B_{ROOF}(t4), and so are unrestricted with respect to proximity to a boundary by the documents supporting the national Building Regulations:

- a system comprising 18 mm OSB board, a Vap Alu ADH self-adhesive vapour control layer, a Hytherm (PIR) insulation board (50 mm or greater thickness) adhered with Hyrastik EVO Adhesive, a 4.0 mm thick fully bonded capsheet – Force Dalle or Force Dalle Flame Free or Force 4000 Dalle, covered with a 20 mm thick layer of Axter Dalle Ceramic porcelain roof tiles.

  (1) Warrington Fire 20295AB, copies are available from the Certificate holder
  (2) Warrington Fire 20295AD, copies are available from the Certificate holder

- a system comprising 18 mm OSB, a 4.0 mm thick fully bonded capsheet – Force Dalle or Force Dalle Flame Free or Force 4000 Dalle, covered with a 20 mm thick layer of Axter Dalle Ceramic porcelain roof tiles.

  (3) Warrington Fire 20295AF, copies are available from the Certificate holder.
  (4) Warrington Fire 20295AG, copies are available from the Certificate holder.

7.2 In the opinion of the BBA, a roof incorporating the systems will also be unrestricted under the national Building Regulations in the following circumstances:

- protected or inverted roof specifications, including 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 roof gardens and green roofs.

7.3 The designation and permissible areas of use of other specifications should be confirmed by reference to the documents supporting the national Building Regulations.

7.4 In Wales and Northern Ireland, exposed areas of the capsheet, when used with one of the surface finishes below, would also be deemed to be unrestricted:

- bitumen-bedded stone chippings covering the whole surface to a depth of not less than 12.5 mm
- bitumen-bedded tiles of non-combustible materials

- sand and cement screed
- macadam.

7.5 In England and Wales, the systems, when used in pitches of greater that 70°, excluding upstands, should not be used on buildings that have a storey at least 18 m above ground level and which 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.

7.6 In Scotland, the systems, when used in pitches greater than 70°, excluding upstands, should not be used on buildings that have a storey more than 11 m above ground level.

7.7 In England and Wales and Scotland, the use of the systems on balconies is restricted by the documents supporting the national Building Regulations.

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

8 Resistance to wind uplift

8.1 The systems, when used within a suitable specification, will adequately resist the effects of wind uplift likely to occur in practice.

8.2 In loose-laid and ballasted, and inverted roof systems, the precise ballast requirements should be calculated by a suitably experienced and competent individual in accordance with the relevant parts of BS EN 1991-1-4 : 2005 and its UK National Annex.

8.3 The growing medium used in roof gardens. and ballast on inverted/protected roofs, must not be of a type that will be removed or become delocalised owing to wind scour experienced on the roof.

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

9 Resistance to mechanical damage

9.1 The systems can accept, without damage, the limited foot traffic and light concentrated loads associated with installation and maintenance. Reasonable care should be taken to avoid puncture of the membranes by sharp objects or concentrated loads. Where traffic in excess of this is envisaged, such as for maintenance of lift equipment or in pedestrian areas, suitable protection, for example, using concrete slabs supported on Axter Adjustable or Fixed-Height Paving and Decking Support System, must be used.

9.2 Once a green roof or roof garden is installed, it can be regarded as a suitable protection for the membrane in use.

9.3 When used over construction or expansion joints, the systems can accommodate without damage the minor structural movement likely to occur under normal service conditions.

10 Resistance to penetration of roots

10.1 Force Dalle, Force Dalle Flame Free and Force 4000 Trafic are suitable for use as root-resistant membranes and, when used with Force Dalle Green Roof and Blue Roof Waterproofing Systems in roof garden, green roof, biodiverse roof and brown roof applications, will provide adequate protection from penetration by roots.

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

11 Maintenance

11.1 The systems must be the subject of six-monthly inspections and maintenance in accordance with BS 6229 : 2018, Chapter 7, and the manufacturers own maintenance requirements, where relevant, to ensure continued satisfactory performance.

11.2 For green roofs, biodiverse, brown roofs and roof gardens, guidance is available within the latest edition of *The GRO Green Roof Code – Green Roof Code of Best Practice for the UK.*

11.3 Where damage has occurred, it should be repaired in accordance with section 16 and the Certificate holder's instructions.

11.4 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.

12 Durability

12.1 Under normal service conditions, the systems will have a service life in excess of 30 years.

12.2 Exposed capsheets may suffer some localised loss of mineral/ceramic surfacing in areas where complex detailing of the roof design is incorporated.

13 Reuse and recyclability

The membranes comprise bitumen and polyester, which can be recycled.

Installation

14 General

14.1 Installation must be in carried out in accordance with the relevant clauses of BS 6229 : 2018, BS 8000-0 : 2014, BS 8000-4 : 1989 and BS 8217 : 2005, the Certificate holder's instructions and the provisions of this Certificate.

14.2 Substrates to which the membranes are to be applied must be sound, dry and clean, and free from sharp projections such as nail heads and concrete nibs. The substrate should be prepared using the specified Axter primer at the recommended installation rate, prior to the installation of the AVCL.

14.3 Installation should not be carried out during inclement weather (eg rain, fog or snow), or when the temperature is below 5°C, unless suitable precautions against surface condensation are taken.

14.4 If the roof is likely to be subjected 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 Clauses 8.19 and 9.2 of the Code must be used.

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

14.6 Growing medium, ballast 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.

15 Procedure

15.1 The systems are installed with torch-bonded joints or hot-air welded joints (Force Dalle Flame Free) with 100 mm side laps and 150 mm end laps. A minimum 2 mm bead of molten material must exude from all laps to indicate a satisfactory homogeneous seal.

15.2 The systems must always be installed with end laps staggered by a minimum of 300 mm and in such a manner that no counter-seams are made in the direction of outlets.

Bonded applications — general

15.3 If required, the substrate is primed using the specified Axter primer at the required rate prior to installation of the systems.

Fully bonded applications

15.4 Bonding is achieved by melting the lower surface by torching and pressing the membrane down. Care must be taken not to overheat the coating. Jointing is carried out as described in sections 15.1 and 15.2.

Partially bonded applications

15.5 For partially bonded applications, a layer of either Thermecran or Planivent is loose-laid over the substrate with minimum side laps of 50 mm prior to installation of the membrane.

15.6 Force 4000 Dalle/ Force Dalle are bonded to the surface of the perforated membrane as described in section 15.4. Bonding should occur regularly through the perforations to ensure even bonding of the membrane to the substrate. Jointing is carried out as described in sections 15.1 and 15.2.

Self-adhesive applications

15.7 Force Dalle Flame Free is loose laid over the substrate and positioned prior to the removal of the protective silicone release film from the underside.

15.8 The protective release film is removed as the membrane is unrolled, before adhering the membrane to the substrate with a heavy roller. Jointing is carried out as described in sections 15.1 and 15.2.

Loose-laid and ballasted applications

15.9 A separating layer of Geotextile Filter layer is loose laid over the substructure, with 100 mm loose overlapping joints, and terminating around the perimeter and upstands for a minimum distance of 500 mm.

15.10 Joints for loose-laid and ballasted systems, on slopes between 0 and 1°, have an additional 160 mm strip of either Hyranger 25/25 RE or Hyranger 25/25 TS, or other membrane approved by the Certificate holder, applied over the side joints. The strips must run in the direction of the outlets to avoid trapping water on the roof. Jointing for roofs of 1 to 5° slope is carried out as described in sections 15.1 and 15.2.

Detailing

15.11 Upstands and other detailing are carried out in accordance with the Certificate holder's installation instructions. On exposed areas, suitable protected capsheets such as Axter Force 4000 S, Force 4000 Flame Free or Force 4000 Trafic are used to protect the membranes.

16 Repair

In the event of damage, the membranes can be effectively repaired, after cleaning, by applying a patch of the same membrane, bonded to the damaged area with a suitable overlap.

Technical Investigations

17 Tests

17.1 Tests were conducted on Force Dalle Green Roof and Blue Roof Waterproofing Membranes and the results assessed to determine:

on the coating mass

- softening point (ring and ball)
- penetration at 25°C
- low temperature flexibility
- elastic recovery
- heat ageing for 168 days at 70°C — softening point (ring and ball), low temperature flexibility and elastic recover

on the membranes

- static indentation
- dynamic impact
- sliding resistance
- fatigue cycling.

17.2 Test data on Axter membranes using the same coating mass and/or reinforcement were assessed to determine:

- dimensional stability
- low temperature stability
- heat resistance
- tensile strength of joints.

18 Investigations

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

18.2 Data on CE marking for the roofing membranes to EN 13707 : 2013 were examined.

18.3 Visits were carried out to existing sites for exposed Axter membranes of similar product specification, to assess the performance in use and durability of the systems.

18.4 An evaluation was carried out of fire test data.

Bibliography

BS 6229 : 2018 *Flat roofs with continuously supported flexible waterproof 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 8579 : 2020 *Guide to the design of balconies and terraces*
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 1991-1-3 : 2003 + A1 : 2015 *Eurocode 1 : Actions on structures — General actions — Snow loads*
NA + A2 : 18 to BS EN 1991-1-3 + A1 : 2015 UK National Annex to *Eurocode 1 : Actions on structures — General actions — Snow loads*
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*

EN 13501-5 : 2016 *Fire classification of construction products and building elements — Classification using data from external fire exposure to roofs tests*

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

EN ISO 9001 : 2015 *Quality management systems — Requirements*

EN ISO 14001: 2015 *Environmental management systems — Requirements with guidance for use*

19 Conditions

19.1 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.

19.2 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.

19.3 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.

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

19.5 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.

19.6 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.