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Agrément Certificate

00/3750

Product Sheet 1

FLAG SINGLE-PLY TPO ROOF WATERPROOFING SYSTEMS

FLAGON EP/PR AND EP/PR-F ROOF WATERPROOFING SYSTEMS

This Agrément Certificate Product Sheet⁽¹⁾ relates to Flagon EP/PR and EP/PR-F Roof Waterproofing Systems, reinforced thermoplastic polyolefin (TPO) roofing membranes for use on flat and pitched roofs with limited access in mechanically fastened, fully adhered, loose-laid and ballasted roof garden and 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 a building (see section 6).

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

Resistance to wind uplift — the systems will resist the effects of any likely wind suction acting on the roof (see section 8).

Resistance to mechanical damage — the systems will accept the limited foot traffic and loads associated with installation and maintenance (see section 9).

Resistance to penetration of roots — the 1.5 mm membrane will adequately resist plant root penetration (see section 10).

Durability — under normal service conditions, the systems will provide a durable roof waterproofing 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 Third issue: 23 September 2019

John Albon
Chief Scientific Officer

Originally certificated on 22 September 2000

Claire Curtis-Thomas
Chief Executive

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, Flagon EP/PR and EP/PR-F Roof Waterproofing Systems, if installed, used and maintained in accordance with the provisions of 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:		On suitable substructures, the use of the systems can enable a roof to be unrestricted under the requirements of this Regulation. See sections 7.1 to 7.5 of this Certificate.
Requirement:	C2(b)	Resistance to moisture
Comment:		The membranes, including joints, will enable a roof to satisfy this Requirement. See section 6.1 of this Certificate.
Regulation:	7	Materials and workmanship (applicable to Wales only)
Regulation:	7(1)	Materials and workmanship (applicable to England only)
Comment:		The systems are acceptable. See section 12 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 use of the systems satisfies the requirement of this Regulation. See sections 11.1 and 12 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	2.8	Spread from neighbouring buildings
Comment:		The systems, when applied to a suitable substructure, can be regarded as having low vulnerability under clause 2.8.1 ⁽¹⁾⁽²⁾ of this Standard. See sections 7.1 to 7.5 of this Certificate.
Standard:	3.10	Precipitation
Comment:		The membranes, 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:	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:		Comments made in relation to 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 and the <i>Installation</i> part of this Certificate.

Regulation:	28(b)	Resistance to moisture and weather
Comment:		The membranes, including joints, will enable a roof to satisfy the requirements of this Regulation. See section 6.1 of this Certificate.
Regulation:	36(b)	External fire spread
Comment:		On suitable substructures, the use of the systems will be unrestricted by the requirements of this Regulation. See sections 7.1 to 7.5 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* (1.1) and 3 *Delivery and site handling* (3.3) of this Certificate.

Additional Information

NHBC Standards 2019

In the opinion of the BBA, Flagon EP/PR and EP/PR-F 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 and balconies*.

NHBC Standards 7.1.9 requires that for green roofs the membrane should be visually inspected and electronically tested for waterproofing integrity before further layers are placed.

CE marking

The manufacturer has taken the responsibility of CE marking the systems in accordance with EN 13956 : 2012. 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 Flagon EP/PR and EP/PR-F Roof Waterproofing Systems consist of polyester net reinforced TPO roofing membranes. A fleece-backed membrane, Flagon EP/PR-F, is available for both grades. The membranes are available in two sizes, EP/PR 1.2 and EP/PR 1.5, and are manufactured to the nominal characteristics given in Table 1.

Table 1 Access categories

Characteristic (unit)	Nominal values			
	EP/PR 1.2	EP/PR 1.5	EP/PR-F 1.2	EP/PR -F 1.5
Thickness* (mm)	1.2	1.5	1.2	1.5
Roll length* (m)	25 ⁽¹⁾	20 ⁽¹⁾	25 ⁽¹⁾	20 ⁽¹⁾
Roll width* (m)	2.1 ⁽¹⁾	2.1 ⁽¹⁾	2.1 ⁽¹⁾	2.1 ⁽¹⁾
Mass per unit area* (kg·m ⁻²)	1.15	1.40	1.30	1.65
Standard roll weight (kg)	60	59	68	69
Tensile strength* (N per 50mm)	≥ 1100	≥ 1100	≥ 1100	≥ 1100
Elongation at break* (%)	≥ 15	≥ 15	≥ 15	≥ 15
Nail tear* (N)	≥ 300	≥ 300	≥ 300	≥ 300
Low temperature foldability* (°C)	≤ -40	≤ -40	≤ -40	≤ -40
Dimensional stability* (%)	≤ ± 0.5	≤ ± 0.5	≤ ± 0.5	≤ ± 0.5
Resistance to impact* (mm)	≥ 450	≥ 800	≥ 450	≥ 800
Static loading* (kg)	≥ 20	≥ 20	≥ 20	≥ 20
Colour				
upper face	light grey	light grey	light grey	light grey
lower face	black	black	black	black

(1) Other roll lengths and widths are available upon request.

1.2 Ancillary items for use with the systems and within the scope of this Certificate are:

- Flagon Corners — preformed Flagon EP membrane internal and external corners
- Flagon Metal Sheet — Flagon EP compound-coated material metal sections for use in forming perimeter and other details
- Flag Bar — perforated fixing bars for use at perimeters of the roof in combination with a retaining cord
- Flag Bar End Protectors — for capping the ends of Flag Bar
- Flexocol EP Adhesive — a contact adhesive for use in detailing of the membranes
- Flexocol W — a single-component, polyurethane adhesive for bonding membranes to the substrate.

1.3 Ancillary items for use with the systems but outside the scope of this Certificate are:

- Vaporflag — 0.3 and 0.4 mm thick black polyethylene vapour control layers
- Flag Geotextile — a 200 g·m⁻² non-woven polyester for use as a separation layer
- Flagon TPO Walkway — a TPO membrane with anti-slip surface for use as a walkway for maintenance traffic
- Flag Butyl Tape — for use in sealing vapour control layers
- Pyramidal Profile — used to create architectural features in detailing of the membranes
- Wall Outlet/Round Wall Outlet — TPO finishing element to detail at water drainage points through parapet walls
- Rain Water Outlet — TPO finishing element to detail at water drainage points in the roof field
- scuppers, vent and pipe collars.

1.4 Fasteners, fixing plates and perforated fixing bars used to install the systems must be approved by the Certificate holder.

2 Manufacture

2.1 The membranes are manufactured by laminating the reinforcement between sheets of TPO passed through a calender.

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 Flag SpA has been assessed and registered as meeting the requirements of EN ISO 9001 : 2015 by SGS (Certificate FR18/81842815).

2.4 The systems are manufactured by Flag SpA, Via Industriale Dell'Isola, 1, 24040 Chignolo D'Isola (BG), Italy, tel: 00 39 035 494 0949, fax: 00 39 035 494 0649, e-mail: info@flag.it and website: www.flag.it

3 Delivery and site handling

3.1 The membranes are delivered to site in rolls wrapped in polythene on pallets. Labels bear the manufacturer's name and address, product identification, dimensions, batch number and the BBA logo incorporating the number of this Certificate.

3.2 Rolls should be stored on their side, on a clean, level surface, and under cover.

3.3 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 Flagon EP/PR and EP/PR-F Roof Waterproofing Systems.

Design Considerations

4 General

4.1 Flagon EP/PR and EP/PR-F Roof Waterproofing Systems are satisfactory for use as mechanically fastened, fully adhered or loose-laid and ballasted waterproofing membranes for:

- exposed flat and pitched roofs with limited access
- protected flat roofs with limited access
- inverted flat roofs with limited access
- green roofs and roof gardens (1.5 mm membranes only).

4.2 Decks to which the systems are to be applied must comply with the relevant requirements of BS 6229 : 2018, BS 8217 : 2005 and, where appropriate, *NHBC Standards* 2019, 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 wild flower species.

4.4 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 membranes must be provided (see section 9).

4.5 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, direction of falls, etc.

(1) *NHBC Standards* 2019 require a minimum fall of 1:60 for green roofs and roof gardens.

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

4.7 Structural decks to which the systems are to be applied must be suitable to transmit the dead and imposed loads experienced in service.

4.8 Imposed loads, dead loading and wind loads are calculated 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.

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

- provision made for access for maintenance purposes
- dead loads for green roof 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*.

4.11 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 used in accordance with that Certificate.

4.12 Contact with bituminous and oil-based products must be avoided as the membrane is not compatible with lower grades of bitumen. If contact with such products is likely, a separating layer must be interposed before installing the waterproofing sheet. When doubt arises, the advice of the Certificate holder should be sought.

5 Practicability of installation

Installation of the systems must be carried out only by installers trained and approved by the Certificate holder.

6 Weathertightness



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

6.2 The membranes are impervious to water and will achieve a weathertight roof capable of accepting minor structural movement.

7 Properties in relation to fire



7.1 A system comprising a 0.7 mm thick trapezoidal metal deck, a 1000 gauge polyethylene vapour barrier, a 80 mm mineral wool insulation board mechanically fastened, and a layer of Flagon EP/PR 1.2 mm membrane mechanically fastened⁽¹⁾ will be designated as unrestricted, by the national Building Regulations.

(1) Fire test report reference TE93817, conducted by LPC Laboratories (BRE). A copy is available from the Certificate holder on request.

7.2 When tested, the following systems achieved:

- a flat 18 mm thick plywood deck, a 1200 gauge polyethylene vapour barrier, two 90 mm polyisocyanurate insulation boards bonded with a polyurethane adhesive (300 g·m⁻² application rate) and a layer of Flagon EP/PR-

F 1.2 mm membrane with a polyurethane adhesive ($300 \text{ g}\cdot\text{m}^{-2}$ application rate) is classified⁽¹⁾ under BS EN 13501-5 : 2016 as B_{ROOF}(t4)

- a sloping 18 mm thick plywood deck, a 1200 gauge polyethylene vapour barrier, two 90 mm polyisocyanurate insulation boards bonded with a polyurethane adhesive ($300 \text{ g}\cdot\text{m}^{-2}$ application rate) and a layer of Flagon EP/PR-F 1.2 mm membrane with a polyurethane adhesive ($300 \text{ g}\cdot\text{m}^{-2}$ application rate) is classified⁽²⁾ under BS EN 13501-5 : 2016 as B_{ROOF}(t4).

(1) Fire test report reference 199110, conducted by Exova Fire. A copy is available from the Certificate holder on request.

(2) Fire test report reference 199109, conducted by Exova Fire. A copy is available from the Certificate holder on request.

7.3 The products, when used in protected or inverted roof specifications, including an appropriate inorganic covering listed in the Annex of Commission Decision 2000/553/EC, can be considered to be unrestricted under the national Building Regulations.

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

- a roof garden covered with a drainage layer of gravel 100 mm thick and a soil layer 300 mm thick
- irrigated roof gardens
- irrigated green roofs.

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

7.6 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 suitable plants for the roof. Appropriate planting irrigation and/or protection should be applied to ensure the overall fire-rating of the roof is not compromised.

8 Resistance to wind uplift

8.1 The resistance to wind uplift of a mechanically fastened waterproofing layer is provided by the fixing bar and fasteners passing through the membranes into the substrate. Fasteners, fixing plates and perforated fixing bars are approved by the Certificate holder for use with the systems. The number and position of fixings will depend on a number of factors including:

- wind uplift forces to be restrained
- pull-out strength of the fasteners
- tensile properties of the membranes
- appropriate calculation of safety factors.

8.2 The wind uplift forces are calculated in accordance with BS EN 1991-1-4 : 2005 and its UK National Annex. On this basis, the number of fixings required should be established using a maximum permissible load of 0.4 kN per fixing.

8.3 Wind uplift load results from testing on an installed system are given in Table 2.

Table 2 Wind uplift results

System	Fastener	Washer	Load per fixing (N)	Admissible load per fixing (N)
1 ⁽¹⁾	Guardian PS-48090	Guardian R(P)45	1500	780
2 ⁽¹⁾	Guardian DBT(A)-48120	Guardian SP(A)-8240	1500	780
3 ⁽²⁾	Guardian BS 5.5 x 85	Guardian Centrix CT 060	1400	983
4 ⁽³⁾	OMG XHD 004B	OMG RBST 040 plastic sleeve OMG RBP 80TS 040 TP0 washer	1200	800

(1) The substrate used was a 0.75 mm thick profiled steel deck, with a 100 mm thick, mechanically fastened mineral wool insulation and a fastener fixing pattern of 250 mm by 1980 mm, with the fasteners within the heat-welded joint overlap.

(2) The substrate used was a 0.75 mm thick profiled steel deck, with a 100 mm thick, mechanically fastened mineral wool insulation and a fastener fixing pattern of 500 mm by 500 mm, with the fasteners within the field of the membrane. Membrane joints were heat welded.

(3) The substrate used was a 0.75 mm thick profiled steel deck, with a 100 mm thick, mechanically fastened mineral wool insulation and a fastener fixing pattern of 500 mm by 640 mm, with the fastenings heat welded to the membrane within the field of the membrane. Membrane joints were heat welded.

8.4 The Certificate holder provides a design service which takes into account all the relevant information supplied and gives assistance for the preparation of drawings for the positioning of fastening bars or washers, and the number of fixings required. The Certificate holder assumes liability for the calculations of the design of the mechanically fastened system.

8.5 When fully bonded, the fleece-backed membrane will have sufficient adhesion to resist the effects of wind suction, elevated temperature and thermal shock conditions likely to occur in practice.

8.6 When the systems are bonded to insulation boards the resistance to wind uplift will be dependent on the cohesive strength of the insulation and the method by which it is secured to the roof deck. This should be taken into account when the insulation material is selected.

8.7 The ballast requirements for inverted roof systems should be calculated in accordance with the relevant parts of BS EN 1991-1-4 : 2005 and its UK National Annex. When gravel ballast is used, the system should always be loaded with a minimum depth of 50 mm of aggregate. In areas of high-wind exposure, the Certificate holder's advice should be sought. Alternatively, concrete slabs on suitable supports can be used.

8.8 The soil 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.

8.9 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

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

10 Resistance to penetration of roots

Results of tests on the Flagon EP/PR and EP/PR-F 1.5 membrane indicate that it is resistant to root penetration and can be used in a roof waterproofing system for roof gardens and green roofs.

11 Maintenance



11.1 The systems should be the subject of biannual inspections and maintenance in accordance with BS 6229 : 2018, Chapter 7.

11.2 Where damage has occurred, it should be repaired in accordance with section 19 and the Certificate holder's instructions.

11.3 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. Guidance is available within the latest edition of *The GRO Green Roof Code — Green Roof Code of Best Practice for the UK*.

12 Durability



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

13 Reuse and recyclability

The systems components comprise thermoplastic polyolefin and polyester, which can be recycled.

Installation

14 General

14.1 Installation of Flagon EP/PR and EP/PR-F Roof Waterproofing Systems must be carried out by trained and approved installers working in accordance with the relevant clauses of the Certificate holder's instructions, BS 8000-0 : 2004 and BS 8000-4 : 1989.

14.2 Conditions on site should be those for normal roof waterproofing work. Deck surfaces must be dry, clean and free from sharp projections such as nail heads and concrete nibs. When used over a rough substrate, a suitable protection layer should be placed over the substrate.

14.3 In all cases, a vapour control layer should be used directly over the deck. When internal temperatures and humidity conditions will exceed 22°C/50% RH, special precautions should be taken and the Certificate holder should be consulted.

14.4 Insulation boards should be fixed to the substrate in such a way as not to impair the performance of the waterproofing membrane.

14.5 Installation should not be carried out during wet weather (eg rain, fog or snow) nor when the temperature is below 0°C.

14.6 All flashings should be formed in accordance with the Certificate holder's instructions.

14.7 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.

15 Procedure (fully adhered system)

15.1 The EP/PR-F membrane is unrolled onto the substrate, without ripples, with a 80 mm overlap.

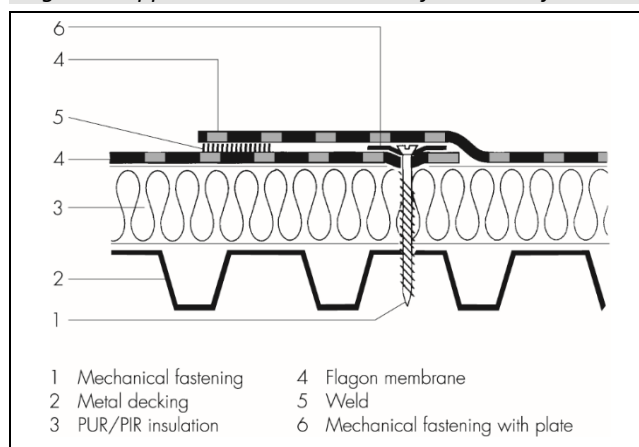
15.2 The membrane is folded back, and Flexocol EP adhesive applied to the membrane and substrate at a rate of 0.4 kg·m⁻².

15.3 The Flexocol EP adhesive is moisture curing and therefore, in dry conditions, a fine spray of water should be applied to the adhesive before the installation of the membrane, to aid curing.

16 Procedure (mechanical fastening)

16.1 The membrane should be laid flat onto the substrate without folds or ripples, and fixed to the deck by fasteners and plates through the overlap of the membrane or, alternatively, within the field of the membrane using a suitable fastening system. The overlap is a minimum of 120 mm (see Figure 1).

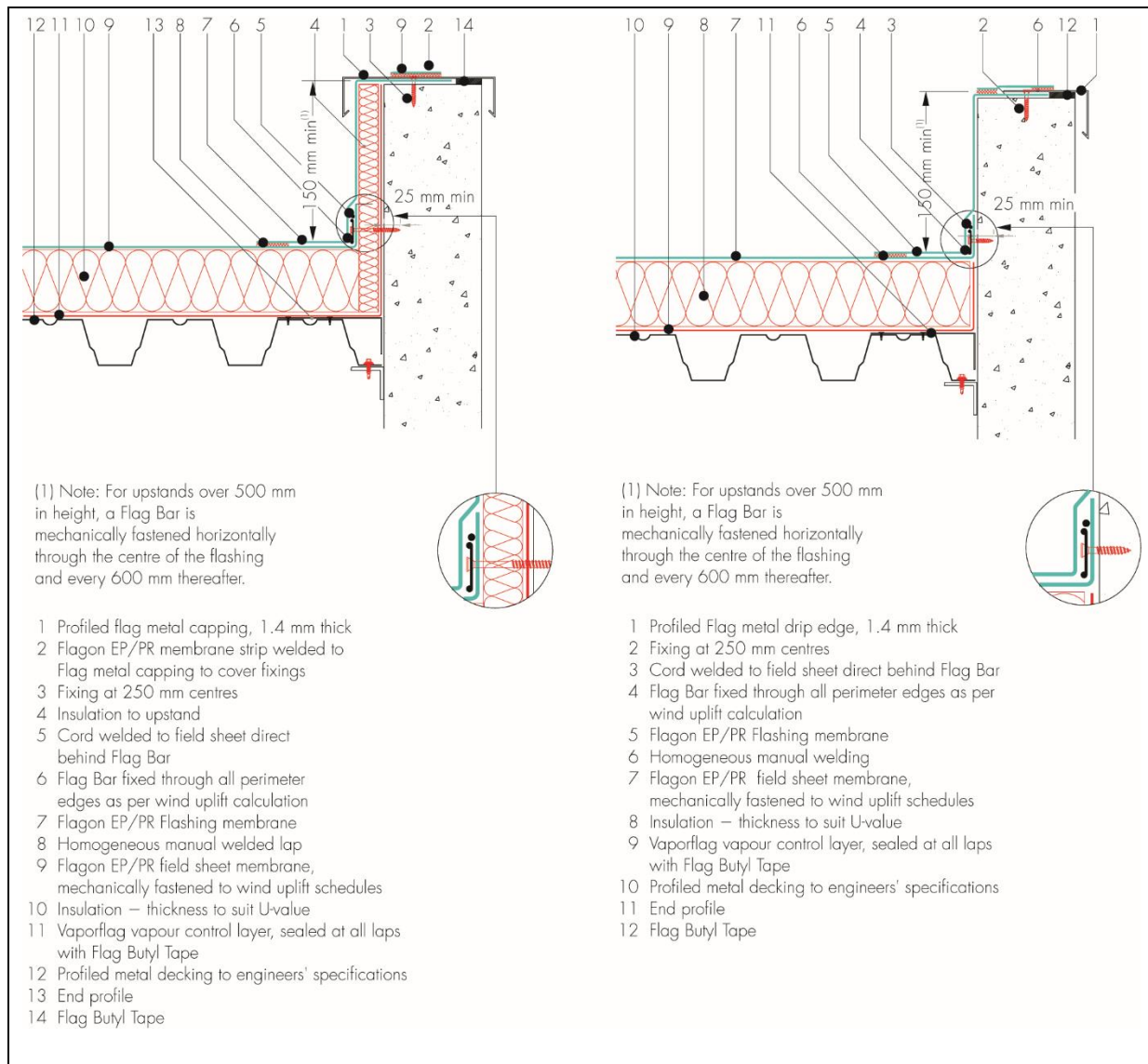
Figure 1 Application to steel decks – fastener in joint



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

16.3 At a vertical flashing and at a penetration of the roof, the horizontal membrane requires additional fixing bars (see Figure 2). On the perimeter the membrane must be secured against tearing by welding a 4 mm diameter retaining cord to the membrane beyond the Flag Bar.

Figure 2 Perimeter upstands



16.4 For continuous fixing, the fixing bars should be positioned with a 10 mm gap to allow for expansion. Ends of the bars should be fixed with screws and Flag Bar End Protectors.

Steel decks

16.5 Steel decks must be manufactured from galvanized steel with a minimum thickness of 0.7 mm.

16.6 Self-drilling and self-tapping screws should be selected in accordance with the Certificate holder's instructions.

Reinforced concrete decks

16.7 Concrete decks will require pre-drilling. The diameter of the holes should not be less than 6 mm and nylon dowels or self-drilling anchors are recommended.

16.8 When re-roofing on concrete decks, dowels must be anchored for their full length in solid concrete. This should be noted particularly when using cement screeds or intermediate layers.

Timber decks

16.9 Fixing bars should be positioned above and fixed to beams or joists. If this is not possible, fastening bars must be positioned across the direction of timber planks, provided the planks are sufficiently fastened to withstand the imposed wind loads.

16.10 Fixing bars must be fixed by screws; nails are not suitable for this purpose. Acceptable loads on each screw and corresponding space between screws in each case are calculated before installation.

17 Procedure (loose-laid and ballasted)

17.1 The membrane is unrolled onto the substrate, without ripples, on top of any protective or isolating layer and ensuring adequate overlaps for jointing (see section 18).

17.2 A suitable protection layer should be laid over the membrane prior to application of the ballast.

17.3 Loose-laid applications should be covered by at least a 50 mm depth of well-rounded gravel. In areas of high-wind exposure, paving slabs set on a suitable support may be considered.

17.4 When using a loose-laid application, normal account should be taken in the design of the deck of the extra dead loading owing to the weight of the ballast.

17.5 Details of perimeter upstands should be mechanically fastened.

18 Jointing and flashing procedure

Jointing

18.1 Jointing should be, wherever possible, by a hand-held hot-air gun and roller, or an automatic welder. The temperature (400°C to 500°C) should be set in accordance with the Certificate holder's instructions, depending on the thickness of the membrane and the ambient temperature.

18.2 The welding area should 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.

18.3 The welded width of the joint must be a minimum of 50 mm. Care should be taken that overheating of the membrane does not occur, as possible impairment of the membrane may result.

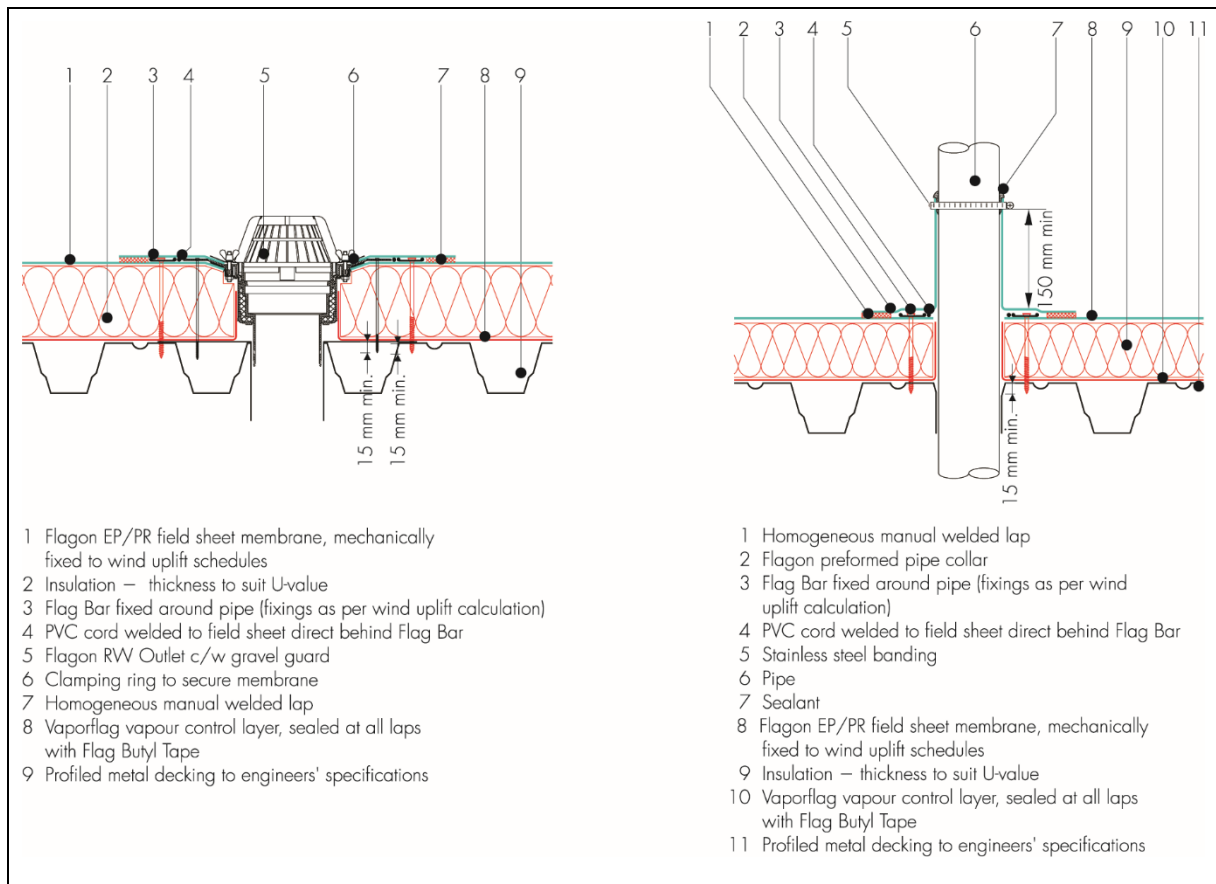
18.4 The seam should be tested with a suitable metal probe and any weakness repaired immediately.

Flashing

18.5 Flashing and detailing should be formed in accordance with the Certificate holder's instructions. Typical flashing details are shown in Figure 3.

18.6 Flagon EP/PR and EP/PR-F can be either mechanically fastened or bonded, using Flagon EP Adhesive, to upstands in accordance with the Certificate holder's instructions.

Figure 3 Roof details



19 Repair

In the event of 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

20 Tests

20.1 Tests were conducted on Flagon EP/PR and EP/PR-F membranes and the results assessed to determine:

- thickness
- width
- mass per unit area
- flatness and trueness of edges
- water resistance of joints
- water vapour transmission
- tensile strength and elongation at break
- nail tear resistance at 23, 40 and -10°C
- dimensional stability
- low temperature flexibility
- static indentation
- dynamic indentation
- capillarity
- wind uplift load per fixing
- air leakage at joints
- tensile strength of joints
- 'T' peel of joints
- peel strength from a concrete substrate

- 90 days' heat ageing at 80°C followed by tensile strength and low temperature flexibility
- 28 days' heat ageing at 80°C followed by tensile strength of joints, 'T' peel and peel from concrete
- 7 days' water soak immersion at 60° followed by tensile strength of joints
- UV aged for 1000 light hours using UVB 313 lamps and a cycle of four hours light at 50°C and four hours condensation at 50°C, followed by tensile strength and low temperature flexibility.

20.2 Samples were taken from an existing site over 15 years old. Comparison testing was carried on new products from the factory, site samples and site samples following additional UV ageing, and the results assessed to determine:

- thickness
- mass per unit area
- low temperature foldability
- resistance to dynamic impact.

20.3 Results of root resistance tests on the Flagon EP/FR 1.5 mm membrane were assessed.

21 Investigations

21.1 Existing and new data on fire performance of the membranes were evaluated.

21.2 Data on the mechanical fastenings were assessed as part of the assessment.

21.3 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.

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 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 NA to BS EN 1991-1-3 : 2003 + 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*

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

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

EN 13956 : 2015 *Flexible sheet for waterproofing — Plastic and rubber sheets for roof waterproofing — Definitions and characteristics*

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

22 Conditions

22.1 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.

22.2 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.

22.3 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.

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

22.5 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.

22.6 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.