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Agrément Certificate
97/3430
Product Sheet 2

FLAGON PVC SINGLE-PLY ROOF WATERPROOFING SYSTEMS

FLAGON SR, SRF, SR SC and SR DE ROOF WATERPROOFING SYSTEMS

This Agrément Certificate Product Sheet(1) relates to Flagon SR, SRF, SR SC and SR DE Roof Waterproofing Systems, reinforced PVC membranes, for use as mechanically fastened and fully adhered membranes on flat and pitched roofs with limited access in exposed, protected, inverted, roof garden and green roof applications.

(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 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 — 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 root penetration — the 1.5 mm (or thicker) membranes will resist the penetration by plant roots and rhizomes (see section 10).

Durability — under normal service conditions, the systems will provide a durable roof waterproofing with a service life in excess of 35 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

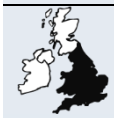
Date of Second issue: 26 May 2021

Originally certificated on 22 June 2020

Hardy Giesler
Chief Executive Officer

Regulations

In the opinion of the BBA, Flagon SR, SRF, SR SC and SR DE 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, in some circumstances, are restricted by this Requirement. See section 7.4 of this Certificate.

Requirement: B4(2) **External fire spread**
Comment: The use of the systems can enable a roof to be unrestricted under this Requirement. See sections 7.1 to 7.3 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 of this Certificate.

Regulation: 7(1) **Materials and workmanship**
Comment: The systems are acceptable. See section 12.1 and the *Installation* 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 requirements 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: 2.6 Spread to neighbouring buildings
Comment: The systems are restricted under clause 2.6.4[(1)(2)] of this Standard in some circumstances. See section 7.5 of this Certificate.

Standard: 2.8 Spread from neighbouring buildings
Comment: The systems can enable a roof to be unrestricted under clause 2.8.1[(1)(2)] of this Standard. See sections 7.1 to 7.3 of this Certificate.

Standard: 3.10 Precipitation
Comment: The membranes, including joints, can 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 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: All comments given for the systems under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1[(1)(2)] and Schedule 6[(1)(2)].

(1) Technical Handbook (Domestic).
(2) Technical Handbook (Non-Domestic).

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

Regulation:	**23(a)(i)**	**Fitness of materials and workmanship**
Comment:	**(iii)(b)(i)**	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 membranes, including joints, can 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 can enable a roof to be unrestricted by the requirements of this Regulation. See sections 7.1 to 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* (3.2 and 3.4) of this Certificate.

Additional Information

NHBC Standards 2021

In the opinion of the BBA, Flagon SR, SRF, SR SC and SR DE 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 systems in accordance with harmonised European Standard EN 13956 : 2012.

Technical Specification

1 Description

1.1 Flagon membranes included in this Certificate are:

- Flagon SR — a polyester reinforced, PVC membrane, fully bonded and mechanically fastened using approved fasteners and plates
- Flagon SRF — a polyester reinforced, non-woven polyester (200 $g \cdot m^{-2}$) fleece-backed PVC membrane for fully bonded systems
- Flagon SR DE — a polyester reinforced, PVC membrane, fully bonded and mechanically fastened using approved fasteners and plates
- Flagon SR SC — a polyester reinforced, PVC membrane, fully bonded and mechanically fastened using approved fasteners and plates.

1.2 The membranes are available in a selection of RAL colours and are manufactured to the nominal characteristics given in Table 1.

Table 1 Normal characteristics

Characteristic (unit)	Membrane										
	Flagon SR 1.2	Flagon SR 1.5	Flagon SR 2.0	Flagon SRF 1.2	Flagon SRF 1.5	Flagon SR DE 1.5	Flagon SR DE 1.8	Flagon SR DE 2.0	Flagon SR SC 1.5	Flagon SR SC 1.8	Flagon SR SC 2.0
Thickness (mm)	1.2	1.5	2.0	1.2	1.5	1.5	1.8	2.0	1.5	1.8	2.0
Roll width(1) (m)	1.6(2) 2.1(3)	1.6 2.1	1.6 2.1	1.6	1.6	1.6 2.1	1.6 2.1	1.6 2.1	1.6 2.1	1.6 2.1	1.6 2.1
Roll length(1) (m)	20 25	20	20	20	20	20	20	20	20	20	20
Mass per unit area ($kg \cdot m^{-2}$)	1.5	1.8	2.4	1.7	2.0	1.8	2.15	2.40	1.8	2.15	2.40
Standard roll weight(4) (kg)	48	57.6	76.8	54.4	64	58	69	77	58	69	77
Tensile strength (N per 50 mm)	≥1100	≥1100	≥1100	≥1100	≥1100	≥1100	≥1100	≥1100	≥1100	≥1100	≥1100
Elongation at break (%)	≥15	≥15	≥15	≥15	≥15	≥15	≥15	≥15	≥15	≥15	≥15
Dimensional stability (%)	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5	≤0.5
Foldability at low temperature (°C)	≤–25	≤–25	≤–25	≤–25	≤–25	≤–25	≤–25	≤–25	≤–25	≤–25	≤–25
Tear resistance (N)	≥200	≥200	≥200	≥200	≥200	≥200	≥200	≥200	≥200	≥200	≥200
Static loading (kg)	≥20	≥20	≥20	≥20	≥20	≥20	≥20	≥20	≥20	≥20	≥20
Resistance to impact (mm)	≥450	≥800	≥1250	≥450	≥800	≥800	≥900	≥1250	≥800	≥900	≥1250
Joint peel resistance (N per 50 mm)	≥200	≥200	≥200	≥200	≥200	≥200	≥200	≥200	≥200	≥200	≥200
Joint shear strength (N per 50 mm)	≥600	≥600	≥600	≥600	≥600	≥600	≥600	≥600	≥600	≥600	≥600

(1) Other roll lengths and widths are available upon request.
(2) 20 m length membrane.
(3) 25 m length membrane.
(4) Standard roll is 1.6 m wide and 20 m long.

1.3 Ancillary items for use with the membranes, and inside the scope of this Certificate, include:

- Flexocol W LV— a single-component, polyurethane adhesive for bonding fleece-backed PVC and TPO membranes to the substrate
- Flexocol C — a single-component, polyurethane contact adhesive for bonding non-fleece-backed membranes to the substrate for upstands and detail work
- Flagon Corners — preformed Flagon membrane for internal and external corners
- Flagon Flagmetal Sheet — Flagon PVC compound-coated metal sections for use at perimeter details and other detailing areas

- Flagon Walkway — a PVC membrane with anti-slip surface for maintenance traffic
- Rhinobond fasteners and plates — approved by the manufacturer for use with the systems
- Rhinobond tool — to induction-weld the membrane to all of the Rhinobond plates
- Vaporflag — a 0.3 or 0.4 mm thick, black polyethylene membrane for use as a vapour control layer
- Sopravap EVA 35 — a fully bonded SBS modified bitumen membrane with a composite aluminium and a glass fibre reinforcement. The upper surface is finished with talcum/sand, and the lower surface is protected by a thermofusible film, for use as a vapour control layer
- Soprabase SLP300 SF — a fully bonded SBS modified bitumen membrane with composite polyester reinforcement (glass mat and non-woven polyester). The upper surface is finished with talcum or sand and the lower surface is protected by a thermofusible film, for use as a vapour control layer
- Soprabase SLV200 SF — a fully bonded SBS modified bitumen membrane with a glass fibre reinforcement. The upper surface is finished with talcum or sand and the lower surface is protected by a thermofusible film, for use as a vapour control layer
- SBS Easytorch 2000 — a fully bonded SBS modified bitumen membrane with a glass fibre reinforcement. The upper surface is finished with talcum or sand and the lower surface is protected by a thermofusible film, for use as a vapour control layer
- Sopravap Global PB A30 TF — a fully bonded polymer-modified bitumen membrane with an aluminium reinforcement. The upper surface is finished with talcum or sand and the lower surface is protected by a thermofusible film, for use as a vapour control layer
- Sopravap Alu Activa 2 — an SBS modified bitumen membrane with a composite aluminium reinforcement (polyester and aluminium). SBS lanes alternated with non-stick lanes protected with a thermofusible film are laid out on the upper and lower surfaces of the membrane, for use as a vapour control layer
- Sopravap Stick Alu S16 — a self-adhesive modified-bitumen membrane with a composite glass grid/aluminium reinforcement. The upper surface has a sand finish and the lower surface is protected by a silicone release sheet, for use as a vapour control layer
- Sopravap Stick S16 — a self-adhesive SBS modified bitumen membrane with a composite glass grid polyester / glass fleece reinforcement. The upper surface is finished with fine sand. The lower surface has a self-adhesive finish that is protected by a silicone release sheet, for use as a vapour control layer
- Sopravap Stick Alu KSD — an SBS modified bitumen with a composite aluminium reinforcement (polyester and aluminium) also acting as the upper surface protection. The lower surface is protected by a silicone release film, for use as a vapour control layer
- Sopravap Stick A15 — a self-adhesive SBS modified bitumen membrane with a composite aluminium reinforcement (polyester and aluminium). The upper surface is finished with talcum or sand. The lower surface has a self-adhesive finish that is protected by a silicone release sheet, for use as a vapour control layer.

1.4 Ancillary items for use with the systems but outside the scope, include

- Outlets, scuppers, vents and pipe collars
- Flag Geotextile — a 200 $g \cdot m^{-2}$ non-woven polyester, for use as a separation layer
- Flag Bar — perforated fixing bars for use at perimeters of the roof in combination with a PVC retaining cord
- Flag Bar End Protectors — for use in capping the ends of Flag Bar
- Flag Butyl Tape — for use in sealing Vaporflag vapour control layers
- Coltack Evolution CA or Coltack Evolution 750 - a single-component polyurethane spray-applied adhesive, for bonding insulation boards to the substrate
- Soprabond 525 — a single-component polyurethane liquid applied adhesive for bonding insulation boards to the substrate
- Insulation boards — rigid polyisocyanurate (PIR) foam boards.

2 Manufacture

2.1 The membranes are manufactured by fusing the reinforcement between sheets of PVC plastisol and passing 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 the manufacturer has been assessed and registered as meeting the requirements of EN ISO 9001 : 2015 by SGS (Certificate FR 18/81842815).

3 Delivery and site handling

3.1 The membranes are delivered to site in rolls wrapped in polythene on pallets, with labels bearing the Certificate holder's name and address, product identification, batch number and the BBA logo incorporating the number of this Certificate.

3.2 The adhesives are delivered to site in 5 or 20L tins. These must be kept tightly sealed, and stored in a cool, ventilated location away from ignition sources and other chemicals. Storage temperatures of between +5 and +30°C will give the component a shelf-life of six months.

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

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 Flagon SR, SRF, SR SC and SR DE Roof Waterproofing Systems.

Design Considerations

4 General

4.1 The Flagon SR, SR DE and SR SC Roof Waterproofing Systems are satisfactory for use as mechanically fastened waterproofing 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 and 2.0 mm membranes).

4.2 The Flagon SRF Roof Waterproofing System is satisfactory for use as fully bonded waterproofing on flat or pitched roofs with limited access. The bonding medium for Flagon SRF is Flexocol W LV. The membranes are suitable for the following specifications:

- 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).

4.3 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* 2021, Chapter 7.1.

4.4 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.

4.5 Limited access roofs are defined for the purpose of this Certificate as those subjected only to pedestrian traffic for maintenance of the roof covering, cleaning of gutters, etc. Where traffic in excess of this is envisaged, additional protection to the membrane must be provided (see section 9 of this Certificate and the relevant clauses of the Certificate holder's installation instructions).

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, direction of falls, etc.

(1) *NHBC Standards* 2021 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 Structural decks to which the systems are to be applied must be suitable to transmit the dead and imposed loads experienced in service.

4.9 Imposed loads, dead loading and wind loads specifications should 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.

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

4.11 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.*

4.12 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 limitations of, that Certificate.

4.13 Contact with bituminous and oil-based products must be avoided as the membranes are 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. Where doubt arises, the advice of the Certificate holder must be sought.

4.14 The NHBC requires that roof membranes, once installed, be inspected in accordance with *NHBC Standards* 2021, Chapter 7.1, Clause 7.1.12, including the use of 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

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

6 Weathertightness

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

7 Properties in relation to fire

7.1 When tested in accordance with CEN/TS 1187 : 2012, Test 4, the systems as included in Fire Annex 2 of this Certificate, are classified as $B_{ROOF}(t4)$ in accordance with EN 13501-5 : 2016(1).

(1) Individual reports 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:

- when used in 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 or green roofs.

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

7.4 The systems, when used in pitches greater that 70°, should not be used on buildings in England and Wales 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.

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

7.6 If allowed to dry, the plants used 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 membrane into the substrate. 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 membrane
- appropriate calculation of safety factors.

8.2 The wind uplift forces must be calculated by a suitably experienced and competent individual 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 installed systems, mechanically fastened by the lap fixing method and OMG fixing method(1) are given in Table 2.

(1) Further details of these methods are given in section 15.7 of this Certificate.

Table 2 Wind uplift results from testing

	Lap fixing method	OMG fixing method
Load per fixing (N)	1000	1500
Admissible load per fixing (N)	461	900

8.4 When Flagon SRF is bonded to a decking or to a reinforced bituminous membrane, it will have sufficient adhesion to resist the effect of wind suction, elevated temperature and thermal shock conditions likely to occur in practice.

8.5 When Flagon SRF is fully adhered 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 must be taken into account when the insulation material is selected.

8.6 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.

8.7 The ballast requirements for inverted roof systems must 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. When using gravel ballast, the systems must 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

9.1 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.

9.2 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 or Flagon Walkway).

9.3 The systems are capable of accepting minor structural movement while remaining weathertight.

10 Resistance to root penetration

The 1.5 mm membranes are resistant to root penetration. The 1.5 and 2.0 mm membranes can be used in a roof waterproofing system for roof gardens and green roofs.

11 Maintenance

11.1 The roof systems should be the subject of six-monthly inspections and maintenance in accordance with BS 6229 : 2018, Chapter 7, to ensure continued satisfactory performance.

11.2 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 17 and the Certificate holder's instructions.

12 Durability

12.1 Under normal conditions, the systems will have a service life in excess of 35 years.

12.2 In environments where the systems are in contact with organic solvents, the life expectancy may be reduced. In cases of doubt, the advice of the Certificate holder should be sought.

13 Reuse and recyclability

The systems components comprise PVC and polyester or glass, which can be recycled.

Installation

14 General

14.1 Installation of Flagon SR, SR DE, SR SC and SRF Roof Waterproofing Systems must be carried out by installers trained and approved by the Certificate holder 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 this Certificate.

14.2 Substrates to which the systems are to be applied must be sound, dry, clean and free from sharp projections such as nail heads and concrete nibs. When used over a rough substrate, a suitable protection layer must be placed over the substrate.

14.3 Installation must not be carried out during inclement weather (eg rain, fog or snow). The systems can be installed below 0°C; however, at temperatures below 5°C, suitable precautions against surface condensation must be taken.

14.4 In all cases, a VCL is used directly over the deck. When internal temperatures and humidity conditions will exceed 22°C/50% relative humidity, special precautions should be taken and the Certificate holder consulted.

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

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

14.7 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 Procedure

Fully bonded (adhered)

15.1 The bonding agent (Flexocol W LV) is applied to the substrate at the prescribed rate using the appropriate method.

15.2 The Flagon SRF membrane is unrolled into the bonding agent, taking care not to stretch the material and ensuring adequate overlaps for jointing (see section 16).

15.3 When bonding Flagon SR (in vertical applications), Flexocol C must be used.

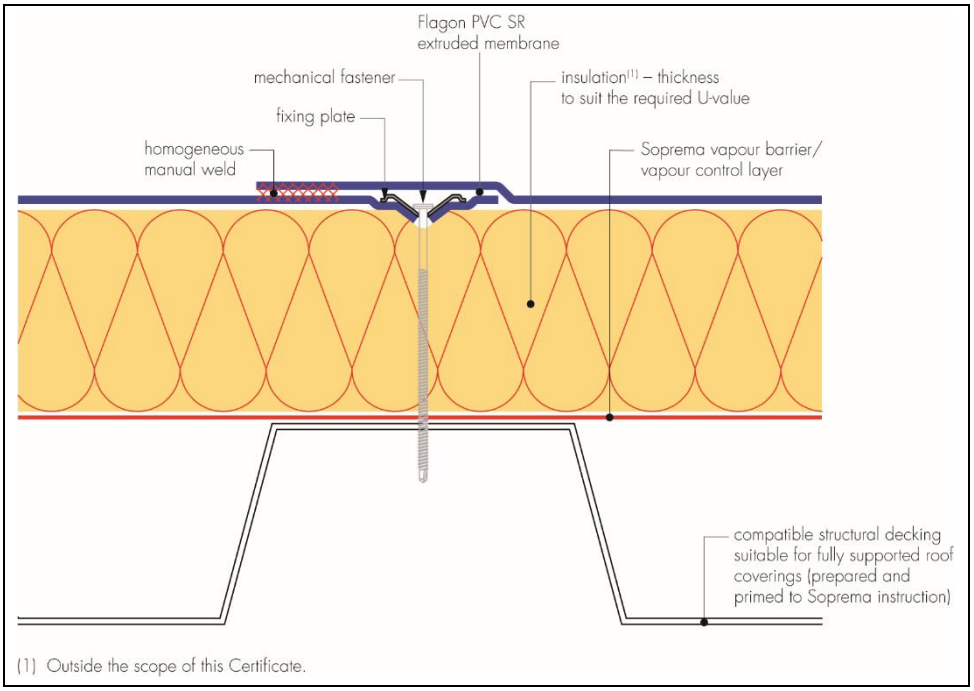
15.4 Details at perimeter upstands must be either fully adhered or mechanically fixed (see Figure 3).

Mechanically fastened

Lap fixing method

15.5 The Flagon SR membranes are laid flat onto the substrate without folds or ripples, and fixed to the deck by fasteners and plates through the overlap of the membrane (see Figure 1).

Figure 1 Application to steel decks - lap fixing method



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

OMG fixing method

15.7 The appropriate number of Rhinobond fasteners are installed in the position required in accordance with the fixing specifications provided by the Certificate holder.

15.8 The membrane is laid flat onto the substrate without folds or ripples, and fixed to the deck by using the Rhinobond tool, to induction-weld the membrane to all of the Rhinobond plates (see Figure 2).

Figure 2 Application to steel decks - OMG fixing method

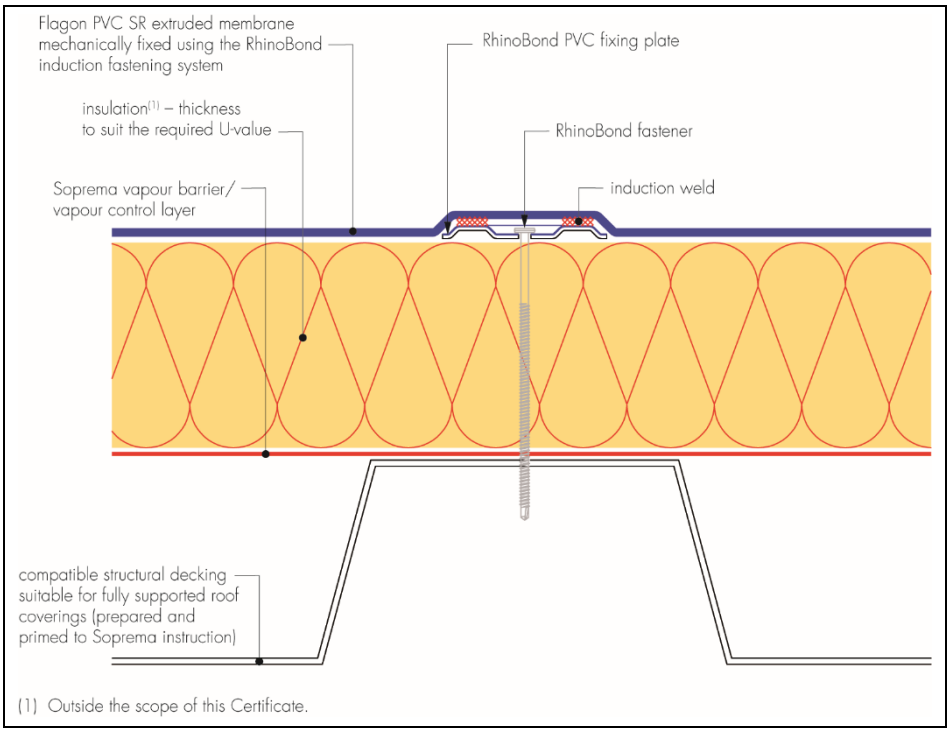
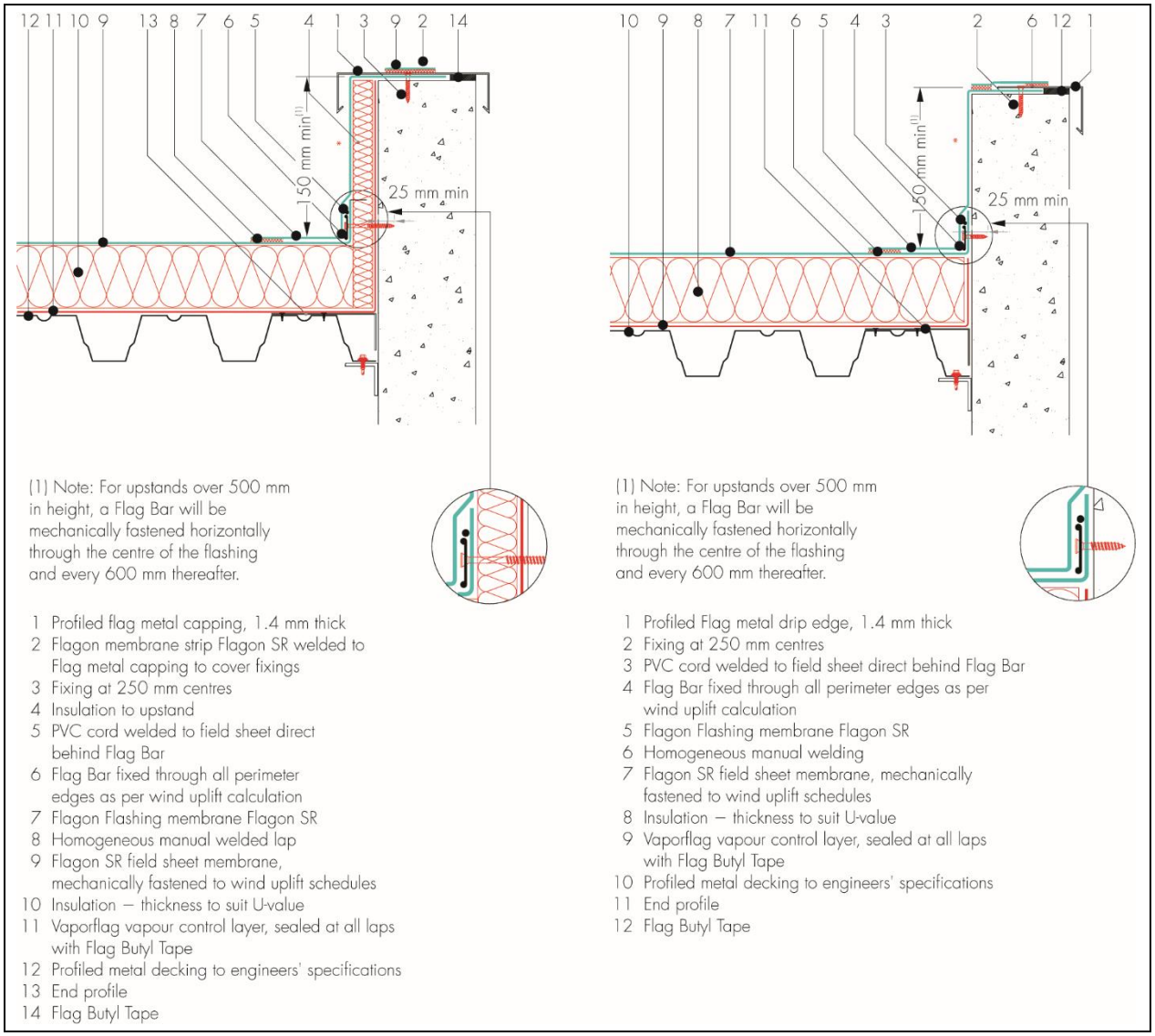


Figure 3 Perimeter upstands



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

Steel decks

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

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

Reinforced concrete decks

15.12 Concrete decks will require pre-drilling. The diameter of the holes should be at least 6 mm, and nylon dowels or self-drilling anchors are recommended.

15.13 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

15.14 Fixing bars should be positioned above beams or joists and secured in place. 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.

15.15 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.

16 Jointing and flashing procedure

Hot-air welding (automatic welding machine)

16.1 The welding 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.

16.2 The overlap width of the membranes must be a minimum of 120 mm and the overlap must be spot welded with a welding machine, every 150 to 200 mm along the length of the joint.

16.3 The temperature for the automatic welding machine must be set in accordance with the Certificate holder's instructions, depending on the thickness of the membrane and the ambient temperature.

16.4 The joint is welded using the machine. Care must be taken to ensure that overheating of the membrane does not occur, as possible impairment of the membrane may result.

16.5 The seam must be tested with a suitable metal probe and any weakness repaired immediately.

Hot-air welding (hand-held welder)

16.6 The welding 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.

16.7 The overlap width of the membranes must be a minimum of 120 mm and the overlap must be spot welded approximately every 400 mm along the length of the joint.

16.8 The temperature for the hand-held welder must be set in accordance with the Certificate holder's instructions, depending on the thickness of the membrane and the ambient temperature.

16.9 The joint is pre-welded parallel to, and behind, the main welding line. The pre-weld is tested for delamination prior to the main welding being carried out.

16.10 The main weld is carried out. Care must be taken to ensure that overheating of the membrane does not occur, as possible impairment of the membrane may result.

16.11 The seam must be tested with a suitable metal probe and any weakness repaired immediately.

Flashing

16.12 Flashing and detailing must be formed in accordance with the Certificate holder's instructions.

17 Repair

In the event of damage occurring, repairs are 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 Flagon SR and SRF membranes to determine:

tests on the reinforcement

- mass per unit area

- tensile strength and elongation
- mesh number

tests on the membrane

- mass per unit area
- tensile strength and elongation at break
- nail tear resistance at 23, 40 and –10°C
- dimensional stability
- low temperature foldability
- static indentation
- weight loss at elevated temperatures at 14, 28, 84 and 168 days
- water absorption after 180 days water immersion
- wind uplift load per fixing
- water soak at 180 days immersion followed by dimensional stability
- 168 days heat ageing at 80°C followed by dimensional stability and low temperature foldability
- plasticiser content
- dehydrochlorination
- ash content
- colour change after UV exposure equal to 4500 $MJ \cdot m^{-2}$ of radiation energy

tests on joints

- joint shear strength for hot-air welded joints and THF welded joints
- T-peel for hot-air welded joints and THF welded joints.

18.2 Samples were taken from an existing site over 20 years old. Comparison testing was carried out on new products from the factory, site samples and site samples following additional UV ageing, and the results assessed:

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

18.3 Results of root resistance tests were assessed.

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 Existing data on fire performance of the membranes were evaluated.

19.3 Wind uplift data on mechanically fixed systems from an independent accredited laboratory were evaluated.

19.4 Corrosion resistance test data from an independent accredited laboratory on the fixing screws and plates were evaluated.

19.5 Fatigue resistance and creep stress data of the fixing screw's polyamide sleeve were examined.

19.6 An inspection visit was conducted to an existing site over 20 years old.

19.7 Existing data on performance were evaluated for the assessment of membranes Flagon SR DE and Flagon SR SC.

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

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

20 Conditions

20.1 This Certificate:

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

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

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

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

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

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

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

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

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Fire Annex 2 – Fire Data for FLAGON SR, SR SC and SR DE

Systems A							
SUBSTRATE	**PRIMER**	**VAPOUR BARRIER**	**INSULATION(1) LAYER 1**	**INSULATION(1) LAYER 2 (Optional)**	**TOP LAYER**	**SYSTEMS**	**FIRE REPORTS ASSESSED**
Trapezoidal profiled Steel deck 106/750 (Thickness ≥ 0.75 mm) or Fibre cement board (Density: 1850 kg/m³; thickness ≥ 8 mm)	–	• No vapour control layer or • VAPOR FLAG LOOSE LAID	• Sopratherm G or Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED	–	• FLAGON SR (thickness 1.5 mm) MECHANICALLY FASTENED	Systems A1 and A2	20029C
	–	• No vapour control layer or • VAPOR FLAG LOOSE LAID	• Sopratherm G or Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED	• Sopratherm G or Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED		Systems A1 and A2	
	• Sopradere Quick or • Aquadere	All bituminous VCL with RTF E or better • SOPRAVAP EVA 35 • SOPRABASE SLP300 SF • SOPRABASE SLV 200 SF • SBS EASYTORCH 2000 • SOPRAVAP GLOBAL PB A30 TF TORCHED	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED(2)	–		Systems A3	
	• Sopradere Quick or • Aquadere	All bituminous VCL with RTF E or better • SOPRAVAP EVA 35 • SOPRABASE SLP300 SF • SOPRABASE SLV 200 SF • SBS EASYTORCH 2000 • SOPRAVAP GLOBAL PB A30 TF TORCHED	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED(2)	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED(2)		Systems A3	
	• Elastocol 600	All bituminous VCL with RTF E or better • SOPRAVAP ALU ACTIVA 2 • SOPRAVAP STICK ALU S16 • SOPRAVAP STICK S16 • SOPRAVAP STICK ALU KSD • SOPRAVAP STICK A15 PARTIALLY/FULLY SELF ADHERED	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED(2)	–		Systems A4	
	• Elastocol 600	All bituminous VCL with RTF E or better • SOPRAVAP ALU ACTIVA 2 • SOPRAVAP STICK ALU S16 • SOPRAVAP STICK S16 • SOPRAVAP STICK ALU KSD • SOPRAVAP STICK A15 PARTIALLY/FULLY SELF ADHERED	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/GLUED(2)	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED(2)		Systems A4	

(1) Insulation is outside the scope.
(2) Glued with Soprabond 525 or Coltack CA or Coltack Evolution 750.

Fire Annex 2 – Fire Data for FLAGON SR, SR SC and SR DE

Systems A

SUBSTRATE	PRIMER	VAPOUR BARRIER	INSULATION[1] LAYER 1	INSULATION[1] LAYER 2 (Optional)	TOP LAYER	SYSTEMS	FIRE REPORTS ASSESSED
Wood Particle Board (Density: 680 kg/m³; thickness ≥ 16 mm) or Trapezoidal profiled Steeldeck 106/750 (Thickness ≥ 0.75 mm) or Fibre cement board (Density: 1850 kg/m³; thickness ≥ 8 mm)	–	• No vapour control layer or • VAPOR FLAG LOOSE LAID	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED	–	• FLAGON SR DE (thicknesses 1.5, 1.8 and 2.0 mm) • FLAGON SR SC (thicknesses 1.5 and 1.8 mm) MECHANICALLY FASTENED	Systems A1 and A2	20029C
	–	• No vapour control layer or • VAPOR FLAG LOOSE LAID	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED		Systems A1 and A2	
	• Sopradere Quick or • Aquadere	All bituminous VCL with RTF E or better • SOPRAVAP EVA 35 • SOPRABASE SLP300 SF • SOPRABASE SLV 200 SF • SBS EASYTORCH 2000 • SOPRAVAP GLOBAL PB A30 TF TORCHED	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED[2]	–		Systems A3	
	• Sopradere Quick or • Aquadere	All bituminous VCL with RTF E or better • SOPRAVAP EVA 35 • SOPRABASE SLP300 SF • SOPRABASE SLV 200 SF • SBS EASYTORCH 2000 • SOPRAVAP GLOBAL PB A30 TF TORCHED	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED[2]	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED[2]		Systems A3	
	• Elastocol 600	All bituminous VCL with RTF E or better • SOPRAVAP ALU ACTIVA 2 • SOPRAVAP STICK ALU S16 • SOPRAVAP STICK S16 • SOPRAVAP STICK ALU KSD • SOPRAVAP STICK A15 PARTIALLY/FULLY SELF ADHERED	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED[2]	–		Systems A4	
	• Elastocol 600	All bituminous VCL with RTF E or better • SOPRAVAP ALU ACTIVA 2 • SOPRAVAP STICK ALU S16 • SOPRAVAP STICK S16 • SOPRAVAP STICK ALU KSD • SOPRAVAP STICK A15 PARTIALLY/FULLY SELF ADHERED	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED[2]	• Sopratherm G or • Sopratherm F 40-140 mm thickness MECHANICALLY FASTENED/ GLUED[2]		Systems A4	

(1) Insulation is outside the scope of this Certificate.

(2) Glued with Soprabond 525 or Coltack CA or Coltack Evolution 750.

Fire Annex 2 – Fire Data for FLAGON SR, SR SC and SR DE

REPORT REFERENCE	NATURE OF REPORT	TEST CENTRE	DATE OF REPORT
20029C	Extended Application Report to CEN/TS 16459 : 2013	Exova Warrington Fire	08/12/2020

Note: Systems A are determined by the different vapour barriers used or not used and their fixing method. Further details of the system definitions can be obtained from the Certificate holder.

System A1	NO VAPOUR CONTROL LAYER
System A2	PE VAPOUR CONTROL LAYER - fixing method 1
System A3	BITUMINOUS VCL - fixing method 2
System A4	BITUMINOUS VCL - fixing method 3

Other Systems assessed:

SUBSTRATE	PRIMER	VAPOUR BARRIER	INSULATION	TOP LAYER	FIRE REPORTS ASSESSED
Exterior grade WBP plywood (thickness 19 mm)	–	High-density polythene vapour barrier	Polyurethane insulation board (thickness 50 mm) MECHANICALLY FASTENED	• FLAGON SR (thickness 1.2 mm) MECHANICALLY FASTENED	62436

REPORT REFERENCE	NATURE OF REPORT	TEST CENTRE	DATE OF REPORT
62436	External Fire Exposure Roof Test to BS 476: Part 3: 1958	Warrington Fire research	11/07/1994