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BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

Agrément Certificate
**14/5118**
**Product Sheet 1**

# DANOSA SINGLE-PLY ROOF WATERPROOFING MEMBRANES

# DANOPOL HS PVC ROOF WATERPROOFING MEMBRANES

This Agrément Certificate Product Sheet(1) relates to Danopol HS PVC Roof Waterproofing Membranes, for use in mechanically-fastened systems on flat and pitched roofs with limited access, and loose-laid and ballasted on flat roofs with limited access.

(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 products will resist the passage of moisture into the building (see section 6).

**Properties in relation to fire** — the products will enable a roof to be unrestricted under the Building Regulations (see section 7).

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

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

**Durability** — under normal service conditions the products will provide a durable roof waterproofing with a service life in excess of 25 years (see section 11).

The BBA has awarded this Certificate to the company named above for the products described herein. These products 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 First issue: 14 April 2014

Simon Wroe
Head of Approvals — Materials

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.*

# Regulations

In the opinion of the BBA, Danopol HS PVC Roof Waterproofing Membranes, if installed, used and maintained in accordance with this Certificate, will meet or contribute to meeting 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 membranes will enable a roof to be unrestricted under the requirements of this Regulation. See section 7 of this Certificate. |
| Requirement: | C2(b) | Resistance to moisture |
| Comment: | | The membranes, including joints, will enable a roof to meet this Requirement. See section 6.1 of this Certificate. |
| Regulation: | 7 | Materials and workmanship |
| Comment: | | The products are acceptable. See section 11 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 membranes satisfies the requirements of this Regulation. See sections 10 and 11 and the *Installation* part of this Certificate. |
| Regulation: | 9 | Building standards applicable to construction |
| Standard: | 2.8 | Spread from neighbouring buildings |
| Comment: | | The membranes, when applied to a suitable substructure, are regarded as having low vulnerability under clause 2.8.1[(1)(2)] of this Standard. See section 7 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 products can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6 and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. |
| Regulation: | 12 | Building standards applicable to conversions |
| Comment: | | All comments given for these products 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

| | | |
|---|---|---|
| Regulation: | 23(a)(i)(iii)(b)(i) | Fitness of materials and workmanship |
| Comment: | | The membranes are acceptable. See section 11 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 6.1 of this Certificate. |
| Regulation: | 36(b) | External fire spread |
| Comment: | | On suitable substructures, the use of the membranes will be unrestricted by the requirements of this Regulation. See section 7 of this Certificate. |

### Construction (Design and Management) Regulations 2007

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

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

See section: 1 *Description* (1.2) of this Certificate.

# Additional Information

## NHBC Standards 2014

NHBC accepts the use of Danopol HS PVC Roof Waterproofing Membranes, provided they are installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Chapter 7.1 *Flat roofs and balconies*.

## CE marking

The Certificate holder has taken the responsibility of CE marking the products in accordance with harmonised European Standard EN 13956 : 2005 and ETAG 006. 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 Danopol HS PVC Roof Waterproofing Membranes are a range of polyester reinforced PVC membranes. The membranes are available in light grey, dark grey and white.

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

*Table 1 Nominal characteristics*

| Characteristic (unit) | Danopol HS 1.2 | Danopol HS 1.5 | Danopol HS 1.8 | Danopol HS 2.0 |
|---|---|---|---|---|
| Thickness (mm) | 1.2 | 1.5 | 1.8 | 2.0 |
| Width (m) | 1.06, 1.80 | 1.06, 1.08 | 1.06, 1.80 | 1.06, 1.80 |
| Length (m) | 25, 20 | 20, 15 | 17, 13 | 15, 11 |
| Mass per unit area ($kg \cdot m^{-2}$) | 1.6 | 2.0 | 2.4 | 2.7 |
| Watertightness* | pass | pass | pass | pass |
| Tensile strength* ($N \cdot 50\ mm^{-1}$) | | | | |
| longitudinal | ≥ 1000 | ≥ 1100 | ≥ 1200 | ≥ 1200 |
| transverse | ≥ 1000 | ≥ 1100 | ≥ 1200 | ≥ 1200 |
| Elongation at maximum force* (%) | | | | |
| longitudinal | ≥ 25 | ≥ 25 | ≥ 25 | ≥ 25 |
| transverse | ≥ 25 | ≥ 25 | ≥ 25 | ≥ 25 |
| Tear resistance* (N) | ≥ 200 | ≥ 250 | ≥ 300 | ≥ 350 |
| Peel strength of joints* ($N \cdot 50\ mm^{-1}$) | ≥ 250 | ≥ 250 | ≥ 250 | ≥ 250 |
| Shear strength of joints* ($N \cdot 50\ mm^{-1}$) | ≥ 800 | ≥ 950 | ≥ 1100 | ≥ 1150 |
| Low temperature foldability (°C) | ≥ –30 | ≥ –30 | ≥ –30 | ≥ –30 |
| Static load* (kg) | | | | |
| method A | 50 | 55 | 60 | 60 |
| method B | 50 | 55 | 60 | 60 |
| Impact resistance* (mm) | | | | |
| method A | ≥ 500 | ≥ 700 | ≥ 900 | ≥ 900 |
| method B | ≥ 500 | ≥ 700 | ≥ 900 | ≥ 900 |
| Root resistance* | pass | pass | pass | pass |
| Reaction to fire* | E | E | E | E |

1.3 VRF Eurofast EDS-BZT/BGT metal fasteners and VRF Eurofast DVP-EF/DF 8240D metal fastening plates are used for mechanically fastening the membranes. The VRF Eurofast EDS-BZT/BGT fasteners are available in lengths of 60, 70, 80, 90, 100, 120, 140, 160 and 180 mm.

1.4 Ancillary items outside the scope of the Certificate include:

- Danopol laminated metal — metal coated with Danopol compound for use in forming details
- Danopol H 1.5 — non-reinforced PVC membrane for use in detailing
- preformed corners — prefabricated internal and external corners manufactured from the Danopol compound
- Danofelt PY — a range of polyester geotextiles for use as separation and filter layers
- Danofelt PP 125 — a polypropylene geotextile separation layer
- Glue-dan PVC — a contact adhesive for use in detailing, for example at upstands
- Elastydan PU 40 Gris — a grey polyurethane sealant
- PVC liquido — a solution of PVC in THF for use in sealing seal joints
- vertical and horizontal outlets — a range of drainage outlets incorporating a Danopol membrane to allow sealing to the waterproofing
- Soporte Regulable Danosa — a pavement support system
- Danolosa — a paving slab incorporating an extruded polystyrene insulation.

## 2 Manufacture

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

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

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

2.3 The management system of Danosa (Derivados Normalizados Asfálticos S.A) has been assessed and registered as meeting the requirements of EN ISO 9001 : 2008 by Bureau Veritas Certification (Certificate ES044036-1).

### 3 Delivery and site handling

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

3.2 Rolls should be stored on end on a clean, level surface, and kept under cover.

## Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Danopol HS PVC Roof Waterproofing Membranes.

## Design Considerations

### 4 General

4.1 Danopol HS PVC Roof Waterproofing Membranes are satisfactory for use as a roof waterproofing system either:

- mechanically fastened on exposed flat and pitched roofs with limited access, or
- loose-laid and ballasted on flat roofs with limited access.

4.2 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).

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

4.4 Decks to which the products are to be applied must comply with the relevant requirements of BS 6229 : 2003, BS 8217 : 2005 and, where appropriate, *NHBC Standards* 2014, Chapter 7.1.

4.5 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 8217 : 2005, or
- the subject of a current BBA Certificate and be used in accordance with that Certificate.

4.6 Contact with bituminous, coal tar 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. Where doubt arises, the advice of the Certificate holder must be sought.

### 5 Practicability of installation

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

### 6 Weathertightness

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

*England and Wales* — Approved Document C, Requirement C2(b), section 6

*Scotland* — Mandatory Standard 3.10, clauses 3.10.1[1][2] and 3.10.7[1][2]

(1) Technical Handbook (Domestic)

(2) Technical Handbook (Non-Domestic)

*Northern Ireland* — Regulation 28(b).

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

## 7 Properties in relation to fire

7.1 When tested in accordance with DD CEN/TS 1187 : 2012 (Test 4) and classified to BS EN 13501-5 : 2005, the following systems achieved a $B_{ROOF}$(t4) classification:

- a 0.75 mm thick profiled steel deck, Danopol 250 Vapor Barrier, a 100 mm polyisocyanurate insulation board and a layer of Danopol HS 1.2, mechanically-fixed
- a 0.75 mm thick profiled steel deck, Danopol 250 Vapor Barrier, a 100 mm polyisocyanurate insulation board and a layer of Danopol HS 2.0, mechanically-fixed
- a 0.75 mm thick profiled steel deck, Danopol 250 Vapor Barrier, a 100 mm mineral wool insulation and a layer of Danopol HS 1.2, mechanically-fixed
- a 0.75 mm thick profiled steel deck, Danopol 250 Vapor Barrier, a 100 mm mineral wool insulation, and a layer of Danopol HS 2.0, mechanically-fixed.

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

7.3 The designation of other specifications should be confirmed by:

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

*Scotland* — test to conform to Mandatory Standard 2.8, clause 2.8.1[1][2]

(1) Technical Handbook (Domestic)

(2) Technical Handbook (Non-Domestic)

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

## 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 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 of Danopol HS 1.2 in an installed system are:

- load per fixing (N) 1100
- corrected load per fixing (N) 645
- admissible load per fixing (N) 436.

8.4 The ballast requirements for loose-laid and ballasted roof systems must be calculated in accordance with the relevant parts of BS EN 1991-1-4 : 2005 and its UK National Annex. When using gravel ballast, the system 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.

## 9 Resistance to foot traffic

Results of tests indicate that the products can accept the limited foot traffic and light concentrated loads associated with installation and maintenance. Where traffic in excess of this is envisaged, such as for maintenance of lift equipment, a walkway such as Danolosa or concrete slabs on bearing pads should be used. In all circumstances, reasonable care should be taken to avoid puncture by sharp objects or concentrated loads.

## 10 Maintenance

10.1 Systems must be the subject of annual inspections and maintenance to ensure continued performance.

10.2 Any damage must be repaired in accordance with section 15 and the Certificate holder's instructions.

## 11 Durability

11.1 Accelerated weathering tests confirm that satisfactory retention of physical properties is achieved. Under normal conditions, the membranes will have a service life in excess of 25 years.

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

## 12 Reuse and recyclability

The products contain PVC and polyester, which can be recycled.

# Installation

## 13 General

13.1 Installation of Danopol HS PVC Roof Waterproofing Membranes must be carried out by installers trained and approved by the Certificate holder in accordance with the relevant clauses of BS 8000-4 : 1989, BS 8217 : 2005, the Certificate holder's instructions and this Certificate.

13.2 Substrates to which the membranes are to be applied must be sound, dry, clean and free from sharp projections such as nail heads and concrete nibs. Rough substrates must first be overlaid with a suitable protection layer.

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

13.4 The need for a vapour control layer should be judged on a case by case basis, taking into account the internal hygrothermal values and the external vapour resistance of the different elements of the system. A vapour control layer must be used when the water absorption by diffusion of the insulation is greater than 3% by volume.

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

## 14 Procedure

### Mechanically fastened

14.1 The membrane is laid flat onto the substrate without folds or ripples, with 100 mm minimum side laps and 50 mm minimum end laps.

14.2 The membrane is fastened to the deck by fasteners and plates in the overlap of the membrane. The fastener plates are set 10 mm from the edge of the lower membrane.

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

14.4 Joints are produced either by hot-air welding or by solvent welding using Tetrahydrofuran (THF) in accordance with the Certificate holder's instructions. The weld must be a minimum width of 40 mm.

### Loose-laid and ballasted

14.5 The membrane is laid flat onto the substrate without folds or ripples, with 50 mm minimum side laps and 50 mm minimum end laps. The joints are welded as described in section 14.4.

14.6 The membrane must 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.

## 15 Repair

Any damage must be repaired by cleaning around the affected area and welding a patch of the membrane over it, as described in section 14.4.

# Technical Investigations

## 16 Tests

16.1 Tests were carried out on Danopol HS PVC Roof Waterproofing Membranes and the results assessed to determine:

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

- peel of joints
- heat ageing
- UV ageing.

16.2 Tests were carried out on VRF Eurofast EDS-BZT/BGT metal fasteners and the results assessed to determine axial load resistance.

## 17 Investigations

17.1 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.

17.2 Existing data on fire performance of the membrane were evaluated.

17.3 A site in progress visit was carried out to assess the practicability of installation.

# Bibliography


BS 6229 : 2003 *Flat roofs with continuously supported coverings — Code of practice*

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

BS EN 13501-5 :2005 *Fire classification of construction products and building elements Classification using data from external fire exposure to roofs tests*

DD CEN/TS 1187 : 2012 *Test methods for external fire exposure to roofs*

EN 13956 : 2005 *Flexible sheet for waterproofing — Plastic and rubber sheets for roof waterproofing — Definitions and characteristics*

EN ISO 9001 : 2008 *Quality management systems — Requirements*

ETAG 006 : 2000 *Guideline for European Technical Approval of Systems of Mechanical Fastened Flexible Roof Waterproofing Membranes*

## 18 Conditions

18.1 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.

18.2 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.

18.3 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.

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

18.5 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.

18.6 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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