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Agrément Certificate

**08/4531**

Product Sheet 1

## SARNAFIL WATERPROOFING SYSTEMS

### SARNAFIL ADHERED ROOF WATERPROOFING SYSTEMS

#### PRODUCT SCOPE AND SUMMARY OF CERTIFICATE

This Certificate relates to Sarnafil Adhered Roof Waterproofing Systems, comprising single-ply polymeric membranes for use as adhered systems on flat or pitched roofs with limited access.

#### AGRÉMENT 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 membranes will resist the passage of moisture into the building (see section 5).

**Properties in relation to fire** — test results indicate that the membranes will enable a roof to be unrestricted under the Building Regulations (see section 6).

**Resistance to wind uplift** — the systems will resist the effects of any wind suction likely to occur in practice (see section 7).

**Resistance to foot traffic** — the membranes will accept the limited foot traffic and loads associated with installation and maintenance (see section 8).

**Durability** — under normal service conditions the Sarnafil G410 and Sarnafil TG76 membranes will provide a durable roof waterproofing with a service life in excess of 35 and 25 years respectively (see section 10).

The BBA has awarded this Agrément 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 First issue: 11 October 2011

Originally certified on 28 March 2008

Simon Wroe

Head of Approvals — Materials

Greg Cooper

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](http://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, Sarnafil Adhered Roof Waterproofing Systems, if used in accordance with the provisions of this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations:



## The Building Regulations 2010 (England and Wales)

|              |              |  |
|--------------|--------------|--|
| Requirement: | B4(2)        | External fire spread   |
| Comment:     |              | Tests to BS 476-3 : 2004, indicate that on a suitable substructure, the use of systems will enable a roof to be unrestricted under this Requirement. See sections 6.1 and 6.2 of this Certificate. |
| Requirement: | C2(b)        | Resistance to moisture   |
| Comment:     |              | The membranes, including joints, will enable a roof to meet this Requirement. See section 5.1 of this Certificate.   |
| Requirement: | Regulation 7 | Materials and workmanship  |
| Comment:     |              | The membranes are acceptable. See sections 10.1 to 10.4 and the <i>Installation</i> part of this Certificate.  |



## The Building (Scotland) Regulations 2004 (as amended)

|             |         |  |
|-------------|---------|--|
| Regulation: | 8(1)(2) | Fitness and durability of materials and workmanship  |
| Comment:    |         | The use of the membranes satisfies the requirements of this Regulation. See sections 9.1, 10.1 to 10.4 and the <i>Installation</i> part of this Certificate.   |
| Regulation: | 9       | Building standards — construction  |
| Standard:   | 2.8     | Spread from neighbouring buildings   |
| Comment:    |         | The membranes, when applied to a suitable substructure, are classified as having low vulnerability and will enable a roof to be unrestricted under this Standard, with reference to clause 2.8.1 <sup>(1)(2)</sup> . See sections 6.1 and 6.2 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 <sup>(1)(2)</sup> and 3.10.7 <sup>(1)(2)</sup> . See section 5.1 of this Certificate.   |
| Standard:   | 7.1(a)  | Statement of sustainability  |
| Comment:    |         | The membranes 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 — conversions   |
| Comment:    |         | Comments made in relation to the membranes under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1 <sup>(1)(2)</sup> and Schedule 6 <sup>(1)(2)</sup> .<br>(1) Technical Handbook (Domestic).<br>(2) Technical Handbook (Non-Domestic). |



## The Building Regulations (Northern Ireland) 2000 (as amended)

|             |       |   |
|-------------|-------|---|
| Regulation: | B2    | Fitness of materials and workmanship  |
| Comment:    |       | The membranes are acceptable. See sections 10.1 to 10.4 and the <i>Installation</i> part of this Certificate.   |
| Regulation: | B3(2) | Suitability of materials  |
| Comment:    |       | The membranes are acceptable. See section 9.1 of this Certificate.  |
| Regulation: | C4(b) | Resistance to ground moisture and weather   |
| Comment:    |       | The membranes, including joints, will enable a roof to meet the requirements of this Regulation. See section 5.1 of this Certificate.   |
| Regulation: | E5(b) | External fire spread  |
| Comment:    |       | On a suitable substructure, the use of the membranes will enable a roof to be unrestricted under the requirements of this Regulation. See sections 6.1 and 6.2 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 sections: 1 *Description* (1.2) and 2 *Delivery and site handling* (2.3) of this Certificate.

# Non-regulatory Information

## NHBC Standards 2011

NHBC accepts the use of Sarnafil Adhered Roof Waterproofing Systems, when installed and used in accordance with this Certificate, in relation to *NHBC Standards*, Chapter 7.1, *Flat roofs and balconies* and Chapter 7.2 *Pitched roofs*.

## General

Sarnafil membranes are manufactured in Switzerland by SSC AG and marketed in the UK by Sika Limited.

The Certificate holder operates a Registered Contractors Scheme<sup>(1)</sup> for this product under which the contractors are trained, registered and regularly reviewed by the Certificate holder to demonstrate that they are competent to carry out installation of the product in accordance with this Certificate. Details of Registered Contractors are available from the Certificate holder. Registered Contractors are responsible for each installation of the product they undertake.

(1) The Certificate holder's records relating to their Registered Contractors Scheme will be audited annually by the BBA as part of its programme of surveillance.

## Technical Specification

### 1 Description

1.1 Sarnafil Adhered Roof Waterproofing Systems comprise:

- Sarnafil G410-EL membrane, manufactured by impregnating a glassfibre carrier with plasticised PVC in a multi-stage operation. Sarnafil G410-ELF membrane is also available with a non-woven, polyester felt (300 g·m<sup>-2</sup>) laminated to the underside of the membrane which also acts as an integral separation layer
- Sarnafil TG76 membrane, manufactured from flexible polypropylene alloy (FPO) compound reinforced with a combination of glassfibre and synthetic scrim. A polyester felt (200 g·m<sup>-2</sup>) is laminated to the underside of the membrane.

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

Table 1 Nominal characteristics

| Characteristic (units)                     | Sarnafil G                      |   | Sarnafil TG76    |
|--|---------------------------------|---|------------------|
|  | Standard G410-EL                | Fleece backed G410-ELF  |                  |
| Thickness (mm)                             | 1.2, 1.5, 1.8, 2.0              | 1.2 <sup>(1)</sup> , 1.5 <sup>(1)</sup> , 1.8 <sup>(1)</sup> , 2.0 <sup>(1)</sup> | 1.2, 1.5         |
| Roll length (m)                            | 20, 15                          | 20, 15, 15, 15  | 20, 20           |
| Roll width (m)                             | 2, 3                            | 2   | 2, 3             |
| Weight per unit area (kg·m <sup>-2</sup> ) | 1.6, 2.0, 2.3, 2.6              | 1.9, 2.3, 2.7, 3.1  | 1.5, 1.8         |
| Roll weight (kg)                           | 64, 80, 69, 78                  | 76  | 60, 72           |
| Colours                                    | a range of colours is available |   | grey as standard |

(1) Excluding the thickness of the grey polyester felt (300 g·m<sup>-2</sup>).

1.3 A range of ancillary items for use with the membranes include:

- Sarnacol 2162 — a one-component, polyurethane adhesive for bonding insulation boards
- Sarnacol 2170 — adhesive for bonding G410 membrane to substrate
- Sarnacol 2142S — adhesive for bonding G410-ELF and TG76 membrane to substrate
- Sarnafil G445 — protection sheet for G410
- Sarnafil TG63-13 — protection sheet for TG76
- Sarnafil T Clean — a cleaning agent for TG76
- SarnaPrimer 600 — primer for use with Sarnacol 2162 and SarnaVap 5000E SA subject to substrate requirements
- Sarnafil T Prep — seam preparation for use prior to hot-air welding Sarnafil TG and degreasing metal
- SarnaVap 500E, 1000E and 2000E — polyethylene vapour control layers
- SarnaVap 5000E SA — self-adhered, bituminous vapour control layer
- SarnaTred Walkway pads.

1.4 Quality control checks are carried out on incoming raw materials, during production and on the finished products.

### 2 Delivery and site handling

2.1 The membranes are delivered to site in rolls packaged in polythene bearing a label with product identification, stock number, lot number, bulk roll number, area, date code and the BBA identification mark incorporating the number of this Certificate.

2.2 Rolls should be stored in a cool, dry area on a clean, level surface, and kept under cover. Rolls should only be unwrapped from packaging at time of installation and unused membrane returned to its packaging until required.

2.3 The properties of the adhesives in relation to *The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009* (CHIP4)/*Classification, Labelling and Packaging of Substances and Mixtures (CLP Regulations) 2009* are given in Table 2. These products should be stored in accordance with *The Dangerous Substances and Explosive Atmospheres Regulations 2002*.

Table 2 Adhesive characteristics

| Product         | Flashpoint (°C) | Classification            |
|-----------------|-----------------|---------------------------|
| Sarnacol 2142S  | -18             | Highly flammable/Harmful  |
| Sarnafil T Prep | -4              | Highly flammable/Irritant |
| Sarnacol 2170   | -4              | Highly flammable/Irritant |
| Sarnacol 2162   | <3              | Highly flammable/Harmful  |

## Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Sarnafil Adhered Roof Waterproofing Systems.

## Design Considerations

### 3 General

3.1 Sarnafil Adhered Roof Waterproofing Systems are satisfactory for use as adhered waterproofing installations on flat and pitched roofs with limited access.

3.2 Limited access roofs are defined for the purpose of this Certificate as those roofs subjected only to pedestrian traffic for maintenance of the roof covering and cleaning of gutters, etc. Where traffic in excess of this is envisaged, additional protection to the membrane must be provided (see section 8).

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

3.4 Decks to which the membranes are to be applied must comply with the relevant requirements of BS 6229 : 2003 or BS 8217 : 2005 and, where appropriate, *NHBC Standards 2011*, Chapter 7.1.

3.5 Insulation materials to be used in conjunction with the membrane 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, and within the scope of, that Certificate
- be included in the Certificate holder's list of *Adhered Systems Insulation List*. The insulation must be attached independently to the substrate.

3.6 The Sarnafil G410 membrane must not be laid directly onto expanded polystyrene or on timber substrates impregnated with substances containing solvents or oil (eg oil-based preservatives) and can be adversely affected by contact with bituminous or coal tar products or polystyrene insulation boards. In these situations the felt-backed membrane or a suitable separation layer must be used. Where doubt arises, the advice of the Certificate holder should be sought.

### 4 Practicability of installation

The system should only be installed by installers who have been trained and approved by the Certificate holder. The records relating to this will be audited by the BBA as part of its programme of surveillance on the Certificate.

### 5 Weathertightness



5.1 Results of tests confirm that the membranes, including joints, 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 (see section 15 for *Physical properties — general*):

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

**Scotland** — Mandatory Standard 3.10, clauses 3.10.1 and 3.10.7

**Northern Ireland** — Regulation C4(b).

5.2 The membranes are impervious to water and will achieve a weathertight roof covering capable of accepting minor structural movement (see section 15, Table for *Physical properties — directional*).

### 6 Properties in relation to fire



6.1 When tested in accordance with BS 476-3 : 2004, a system comprising:

- 18 mm thick OSB deck, one layer of SarnaVap 5000E SA vapour control layer, 100 mm thick PIR insulation and one layer of Sarnafil G410-12EL fully bonded using Sarnacol 2170 achieved an EXT.F.AB rating

- 18 mm thick OSB deck, one layer of bitumen vapour control layer, one layer of 100 mm PIR insulation and one layer of Sarnafil G410-12EL fully bonded using Sarnacol 2170 achieved an EXT.F.AC rating
- 18 mm thick OSB deck, one layer of SarnaVap 500E vapour control layer, one layer of 150 mm thick EPS insulation and one layer of Sarnafil G410-12EL felt fully bonded using Sarnacol 2142S achieved an EXT.F.AB rating
- 18 mm thick OSB deck, one layer of SarnaVap 5000E SA vapour control layer, one layer of 100 mm thick PIR insulation and one layer of Sarnafil G410-12EL felt fully bonded using Sarnacol 2170 achieved an EXT.S.AB rating
- 18 mm thick plywood deck and one layer of Sarnafil G410-12EL fully bonded using Sarnacol 2170 achieved an EXT.F.AB rating
- 18 mm thick OSB deck, one layer of SarnaVap 5000E SA vapour control layer, 100mm PIR insulation and one layer of Sarnafil G410-12ELF fully bonded using Sarnacol 2142S achieved an EXT.F.AB rating
- 18 mm thick OSB deck and one layer of SarnaVap 5000E SA vapour control layer, 100 mm thick PIR insulation and one layer of Sarnafil G410-EL membrane fully bonded using Sarnacol 2170 achieved an EXT.F.AB rating
- 18 mm thick plywood deck, one layer of bitumen vapour control layer, 75 mm thick mineral wool insulation and polyester fleece-backed Sarnafil TG76 fully bonded using Sarnacol 2142S achieved an EXT.F.AC rating
- 18 mm thick plywood, one layer of bitumen vapour control layer, 100 mm thick PIR insulation and polyester fleece-backed Sarnafil TG76 fully bonded using Sarnacol 2142S achieved an EXT.F.AC rating.

6.2 The designation of other specifications should be confirmed by:

**England and Wales** — Test or assessment in accordance with Approved Document B, Appendix A, Clause A1

**Scotland** — Test to conform to Mandatory Standard 2.8, clause 2.8.1, Annex 2C

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

## 7 Resistance to wind uplift

The adhesion of the membranes will be limited by the cohesive strength of the substrate. On substances with high cohesive strength, the adhesion of the membrane or of a fleece-backed version of the membrane is sufficient to resist the effect of wind suction, thermal cycling or minor structural movements likely to occur in service. The Certificate holder takes the liability for the calculations for the adhered system and provides a project specific design service which takes into account all the relevant information supplied.

## 8 Resistance to foot traffic

Results of tests indicate that the membranes can accept the limited foot traffic and light concentrated loads associated with the installation and maintenance operations. Reasonable care should be taken to avoid puncture by sharp objects or concentrated loads. Where traffic in excess of this is envisaged, such as maintenance of lift equipment, a walkway should be provided using SarnaTred walkway pads or concrete slabs on paving support pads.

## 9 Maintenance



9.1 Systems must be the subject of annual inspections to ensure continued performance.

9.2 A planned maintenance cycle, and inspections by the Certificate holder at minimum intervals of every five years, should be introduced if an extended service life is required. The Certificate holder can advise on methods of extending the service life. This could include the use of thicker membrane, and/or specific maintenance requirements.

## 10 Durability



10.1 The durability of all roofing materials is dependent on the roof design, installation, immediate environment, maintenance and use. Other specific factors assessed by the BBA relating to the durability of individual products include formulation, thickness, and life to first maintenance of any coating.

### Sarnafil G410

10.2 Accelerated weathering tests and performance in use confirm that satisfactory retention of physical properties is achieved. Available evidence indicates that the membrane will have a service life in excess of 35 years.

10.3 Sarnafil G has been in use in Switzerland and the UK since 1968 and 1980 respectively. The BBA has examined the oldest available sites where the material has been installed. Tests conducted on the naturally aged material taken from existing sites and naturally aged material which has been subjected to further ageing conditions confirm satisfactory retention of properties indicating that a service life in excess of 40 years can be achieved with periodic maintenance as stated in section 9.

### Sarnafil TG76

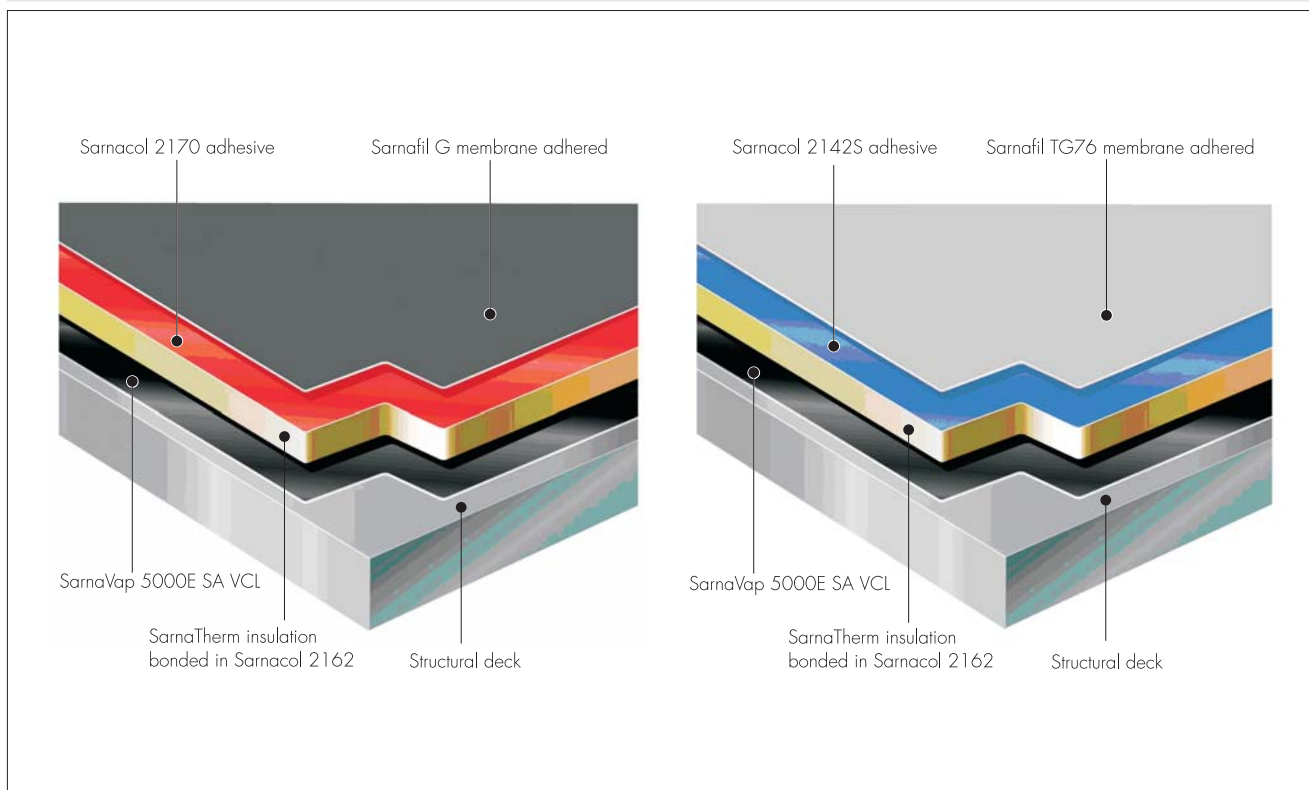
10.4 Sarnafil TG76 has been used in Switzerland and the UK since 1989 and 1992 respectively. Accelerated weathering tests and performance in use confirm satisfactory retention of physical properties is achieved. Available evidence indicates that the membrane will have a service life in excess of 25 years.



## 11 General

11.1 Installation of Sarnafil Adhered Roof Waterproofing Systems (see Figure 1) must be carried out by trained and approved installers working in accordance with the relevant clauses of the manufacturer's instructions and BS 8217 : 2005 and BS 8000-4 : 1989.

Figure 1 Typical installations



11.2 Substrates to which the membranes are applied must be sound, dry, clean and free from sharp projections such as nail heads and concrete nibs.

11.3 Installation should not be carried out during inclement weather (eg rain, fog, snow or when the temperature is below 5°C).

## 12 Procedure

### Sarnafil G410

12.1 Sarnacol 2170 should be applied to the substrate and allowed to dry. Sarnafil G410-12EL should be unrolled onto the surface and approximately one-third of its length folded back to expose the underside. Sarnacol 2170 should be applied to the membrane (200 g·m<sup>-2</sup>), and substrate (300 g·m<sup>-2</sup> to 800 g·m<sup>-2</sup>) depending on texture. When the adhesive has dried to the point that strings are formed on touching with a finger, the two adhesive-coated surfaces should be brought into contact and the surface of the membrane rolled with a water filled roller. This should then be repeated over the rest of the sheet.

12.2 When the adhered system is used over insulation products, the resistance to wind uplift will be limited by the cohesive strength of the insulation, and the method of attachment. These factors should be taken into account when selecting the insulation material. Insulation boards can be either fully adhered, using Sarnacol 2162 or hot bitumen, or be mechanically fastened. Sarnacol 2170 must not be used directly on polystyrene products.

12.3 The membrane is mechanically fixed at the perimeter. The membrane should then be lap jointed.

12.4 Sarnafil G410-ELF can be fully adhered using Sarnacol 2170 or Sarnacol 2142S adhesives, depending upon the substrate.

12.5 When using Sarnacol 2170 adhesive, a primer coat of the adhesive is applied to the substrate and allowed to dry. The membrane is unrolled onto the surface and approximately half of its length folded back to expose the underside. Sarnacol 2170 is applied to the previously primed area. The membrane should be immediately unrolled directly onto the wet adhesive. The surface of the membrane should be rolled with a water-filled roller. The other half of the membrane is folded back and the procedure is repeated.

12.6 When using Sarnacol 2142S, the membrane is unrolled onto the substrate and approximately half of its length rolled back to expose the underside. A coat of Sarnacol 2142S is applied to the substrate, covering only the area where the membrane is to be laid. The membrane should be immediately rolled onto the wet adhesive, ensuring that the weld area is kept adhesive free. The surface of the membrane should be rolled with a water-filled roller. The other half of the membrane is folded back and the procedure repeated.

#### **Sarnafil TG76**

12.7 Sarnafil TG76 should be unrolled onto the substrate and approximately half its length rolled back to expose the underside.

12.8 A coat of Sarnacol 2142S should be applied to the substrate covering only one area where the membrane is to be laid.

12.9 The membrane should be immediately rolled onto the wet adhesive, ensuring that the weld area is kept adhesive-free. The surface of the membrane should be rolled with a water-filled roller. The other half of the membrane is folded back and the procedure repeated.

### **13 Jointing and flashing**

13.1 Jointing is achieved by hot-air welding with the temperature set in accordance with the Certificate holder's instructions.

13.2 The welding area should be dry and clean. If the membrane in the welding area is oxidised due to prolonged outdoor exposure, or contaminated, it should be cleaned in the prescribed manner. Sarnafil T Prep should be allowed to totally flash off prior to welding.

13.3 The welded width of the joint must be a minimum of 25 mm. Care should be taken that overheating of the membrane does not occur, as scorching and carbonisation of the membrane will result.

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

13.5 Flashing and detailing should be formed in accordance with the Certificate holder's instructions.

### **14 Repair**

In the event of accidental damage, repair should be carried out in accordance with the Certificate holder's instructions. The damaged area should be cleared back to unweathered material and a new piece of membrane hot-air welded to the original membrane. Repair should be carried out with a piece of the membrane, sized to extend at least 50 mm beyond the defect in all directions.

## **Technical Investigations**

### **15 Tests**

Tests were carried out on samples of the membranes obtained from the manufacturer, and the results assessed. These are summarised in Tables 3 to 7.

**Table 3 Physical properties — general — Sarnafil G410**

| Test (units)   | Mean result | Method                |
|--|-------------|-----------------------|
| Apparent density ( $\text{kg}\cdot\text{m}^{-3}$ )                             | 1250        | direct measurement    |
| Water vapour permeability ( $\text{g}\cdot\text{m}^{-2}\cdot\text{day}^{-1}$ ) | 2.1         | BS 3177 (25°C/75% RH) |
| Water vapour resistance ( $\text{MN}\cdot\text{s}\cdot\text{g}^{-1}$ )         | 97          | BS 3177 (25°C/75% RH) |
| Ash content (%)  | 5.7         | MOAT 29 : 4.5         |
| Resistance to water pressure (6 metre head)                                    | pass        | MOAT 27 : 5.1.4       |
| Dynamic indentation  |             | MOAT 27 : 5.1.10      |
| chipboard  | $I_3$       |                       |
| expanded polystyrene   | $I_3$       |                       |
| perlite board  | $I_2$       |                       |
| Static indentation   |             | MOAT 27 : 5.1.9       |
| concrete   | $L_4$       |                       |
| fibre board  | $L_4$       |                       |
| expanded polystyrene   | $L_4$       |                       |
| Resistance to wind uplift (kPa)  |             | MOAT 27 : 5.1.2       |
| Sarnacol 2170 (chipboard)  | >8          |                       |
| Thermal shock  |             | MOAT 27 : 5.1.5       |
| Sarnacol 2170 (chipboard)  | pass        |                       |
| Resistance to cyclic movement  |             | MOAT 27 : 5.1.8       |
| unaged (500 cycles)  | pass        |                       |
| heat aged (500 cycles) <sup>(1)</sup>  | pass        |                       |
| Low temperature flexibility (°C)   | ≤-30        | MOAT 27 : 5.4.2       |
| Resistance to sliding (at angle of 90°)  | pass        | MOAT 27 : 5.1.7       |
| Resistance to peel (N per 50 mm)   |             | MOAT 27 : 5.1.3       |
| Sarnacol 2170 (Sarnafil G410-12EL)   |             |                       |
| chipboard  | 82          |                       |
| concrete   | 56          |                       |
| perlite board  | 7.7         |                       |
| polyisocyanurate (asbestos faced)  | 10.4        |                       |
| Sarnacol 2170 (Sarnafil G410-ELF)  |             |                       |
| concrete   |             |                       |
| unaged   | 40          |                       |
| heat aged <sup>(2)</sup>   | 69          |                       |
| water soak <sup>(3)</sup>  | 67          |                       |
| Sarnacol 2142S (Sarnafil G410-ELF)   |             |                       |
| unaged   | 146         |                       |
| heat aged <sup>(2)</sup>   | 125         |                       |
| water soak <sup>(3)</sup>  | 96          |                       |

(1) Heat aged 28 days at 80°C.

(2) Heat aged 56 days at 80°C.

(3) Water soak 28 days at 20°C.

**Table 4 Physical properties — directional — Sarnafil G410**

| Test (units)                                       | Mean results |            | Method  |
|--|--------------|------------|---|
|  | Longitudinal | Transverse |   |
| Tensile strength ( $\text{N}\cdot\text{mm}^{-2}$ ) |              |            | BS 2782-3.320A (speed: 200 mm·min <sup>-1</sup> ) |
| unaged   | 11.99        | 11.18      |   |
| heat aged <sup>(1)</sup>                           | 12.42        | 12.39      |   |
| UV aged <sup>(2)</sup>                             | 12.11        | 11.69      |   |
| Elongation (%)                                     |              |            | BS 2782-3.320A (speed: 200 mm·min <sup>-1</sup> ) |
| unaged   | 210          | 200        |   |
| heat aged <sup>(1)</sup>                           | 200          | 190        |   |
| UV aged <sup>(2)</sup>                             | 200          | 190        |   |
| Tear strength ( $\text{N}\cdot\text{mm}^{-1}$ )    | 57.6         | 61.9       | BS 2782-3.308A (speed: 300 mm·min <sup>-1</sup> ) |
| Dimensional free stability (%)                     | -0.06        | -0.02      | MOAT 27 : 5.1.6.1                                 |

(1) Heat aged 56 days in an oven at 80°C.

(2) UV aged 500 light hours using UVB 313 lamps cycling 4 hours UV/45°C and followed by 4 hours condensation at 40°C.



**Table 5 Tests on joints — Sarnafil G410**

| Test (units)                                      | Mean result | Method   |
|---|-------------|--|
| Peel strength of weld joint (N)                   | 301         | MOAT 29 : 4.17.2 (speed: 200 mm·min <sup>-1</sup> )  |
| Tensile strength of weld joint <sup>(1)</sup> (N) |             | MOAT 27 : 5.2.2/4 (speed: 200 mm·min <sup>-1</sup> ) |
| unaged  |             |  |
| longitudinal                                      | 562         |  |
| transverse  | 552         |  |
| heat aged <sup>(2)</sup>                          |             |  |
| longitudinal                                      | 563         |  |
| transverse  | 563         |  |
| water soak <sup>(3)</sup>                         |             |  |
| longitudinal                                      | 621         |  |
| transverse  | 580         |  |
| Air pressure (10 kPa)                             | pass        | MOAT 27 : 5.2.1                                      |

(1) Overlaps of 50 mm hot-air welded.

(2) Heat aged 28 days at 80°C.

(3) Water soak 7 days at 60°C.

**Table 6 Physical properties — directional — Sarnafil TG76**

| Test (units)                              | Mean results |            | Method  |
|---|--------------|------------|---|
|   | Longitudinal | Transverse |   |
| Tensile strength (N·50 mm <sup>-1</sup> ) |              |            | BS 2782-3.320A (speed: 100 mm·min <sup>-1</sup> ) |
| unaged                                    | 948          | 728        |   |
| Elongation (%)                            |              |            | BS 2782-3.320A (speed: 100 m·min <sup>-1</sup> )  |
| unaged                                    | 52           | 67         |   |
| Tear strength (N·mm <sup>-1</sup> )       | 748          | 698        | MOAT 27 : 5.4.1                                   |
| Dimensional free stability (%)            | -0.11        | -0.07      | MOAT 27 : 5.1.6.1.                                |

**Table 7 Physical properties — general — Sarnafil TG76**

| Test (units)  | Mean result    | Method                |
|---|----------------|-----------------------|
| Water vapour permeability (g·m <sup>-2</sup> ·day <sup>-1</sup> ) | 0.24           | BS 3177 (25°C/75% RH) |
| Water vapour resistance (MN·s·g <sup>-1</sup> )                   | 848            | BS 3177 (25°C/75% RH) |
| Dynamic indentation   |                | MOAT 27 : 5.1.10      |
| expanded polystyrene  | I <sub>3</sub> |                       |
| perlite board   | I <sub>3</sub> |                       |
| Static indentation  |                | MOAT 27 : 5.1.9       |
| concrete  | L <sub>4</sub> |                       |
| expanded polystyrene  | L <sub>4</sub> |                       |
| Resistance to cyclic movement                                     |                | MOAT 27 : 5.1.8       |
| unaged (500 cycles)   | pass           |                       |
| heat aged (200 cycles) <sup>(1)</sup>                             | pass           |                       |
| Resistance to peel (N per 50 mm)                                  |                | MOAT 27 : 5.1.3       |
| concrete  |                |                       |
| unaged  | 110            |                       |
| heat aged <sup>(1)</sup>  | 120            |                       |
| water soak <sup>(2)</sup>   | 41             |                       |

(1) Heat aged 28 days at 80°C

(2) Water soak 28 days at 20°C.

## 16 Investigations

16.1 Results of tests conducted on a material of similar formulation to Sarnafil TG76 were assessed for:

- tensile strength and elongation
- resistance to water pressure
- resistance to nail tear
- resistance to folding at low temperatures
- resistance to leakage at joints
- tensile strength of joint
- peel strength of joints.

16.2 The manufacturing processes were evaluated, including methods of quality control. Details were also obtained of the quality and composition of the material used.

16.3 An examination was made of existing data on fire performance to BS 476-3 : 2004.

16.4 A survey of known users was carried out to assess the performance in use of the systems.

16.5 A reassessment of the Durability statement for Sarnafil G410 was based on the finding of visits to existing sites in Switzerland and in the UK and the results of tests conducted on unaged, naturally-aged and accelerated aged material.

16.6 A reassessment of the Durability statement for Sarnafil TG76 was based on the findings of visits to existing sites in Europe and on the results of tests conducted on a material of similar formulation in both unaged and naturally-aged conditions.

## Bibliography

BS 476-3 : 2004 *Fire tests on building materials and structures — Classification and method of test for external fire exposure to roofs*

BS 2782-3.308A : 1970 *Methods of testing plastics — Mechanical properties — Tear strength of flexible unsupported polyvinyl chloride sheet*

BS 2782-3.320A to 320F : 1976 *Methods of testing plastics — Mechanical properties — Tensile strength, elongation and elastic modulus*

BS 3177 : 1959 *Method for determining the permeability to water vapour of flexible sheet materials used for packaging*

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*

MOAT No 27 : 1983 *General Directive for the Assessment of Roof Waterproofing Systems*

MOAT No 29 : 1984 *Directives for the Assessment of Roofing Systems using PVC sheets without reinforcement, loose laid under heavy protection and not compatible with bitumen*

## 17 Conditions

17.1 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
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- 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.

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- individual 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.

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