

## DB Group (Holdings) Limited

Wellington Way  
Bourn Airfield  
Cambridgeshire CB23 2TQ

Tel: 01954 780687

e-mail: sales@dbgholdings.com

website: www.dbgholdings.com



**Agrément Certificate**

**19/5620**

Product Sheet 2

## PUDLO WATERPROOFING AND GAS PROTECTION MEMBRANES

### PUDLO GP ULTRA SEAL

This Agrément Certificate Product Sheet<sup>(1)</sup> relates to PUDLO GP Ultra Seal, a self-adhesive membrane comprising PUDLO GP Ultra Tank<sup>(2)</sup> with a self-adhesive polymer-modified bitumen compound. The product is for use as a damp-proof and waterproofing membrane in internally or externally applied tanking and to protect the building from the ingress of water vapour, radon, methane and carbon dioxide, hydrocarbons and volatile organic compounds (VOCs).

(1) Hereinafter referred to as 'Certificate'.

(2) PUDLO GP Ultra Tank is the subject of Product Sheet 1 of this Certificate.

#### CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

#### KEY FACTORS ASSESSED

**Resistance to water and water vapour** — the product, including joints will provide an effective barrier to the passage of water under hydrostatic pressure and water vapour from the ground (see section 6).

**Resistance to underground gases** — the product will restrict the ingress of radon, methane and carbon dioxide into the structure (see section 7).

**Resistance to chemicals** — the product is chemically resistant and will reduce the transmission of VOCs (see section 8).

**Resistance to mechanical damage** — the product has satisfactory resistance to mechanical damage (see section 9).

**Adhesion** — the adhesion of the product to the substrate and to itself is satisfactory (see section 10).

**Durability** — under normal service conditions, the product will remain effective against the ingress of water and water vapour, and will restrict the ingress of radon, methane, carbon dioxide and VOC vapours during the lifetime of the structure in which it is installed (see section 12).



The BBA has awarded this Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

*Claire Curtis-Thomas*

Date of First issue: 18 February 2019

John Albon – Head of Approvals  
Construction Products

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](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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#### British Board of Agrément

Bucknalls Lane  
Watford  
Herts WD25 9BA

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tel: 01923 665300  
[clientservices@bbacerts.co.uk](mailto:clientservices@bbacerts.co.uk)  
[www.bbacerts.co.uk](http://www.bbacerts.co.uk)

## Regulations

In the opinion of the BBA, PUDLO GP Ultra Seal, 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)

|                     |              |   |
|---------------------|--------------|---|
| <b>Requirement:</b> | <b>C1(2)</b> | <b>Site preparation and resistance to contaminants</b>  |
| Comment:            |              | The product will contribute to a construction satisfying this Requirement. See sections 7.1, 7.2 and 8 of this Certificate.       |
| <b>Requirement:</b> | <b>C2(a)</b> | <b>Resistance to moisture</b>   |
| Comment:            |              | The product, including joints, will enable a structure to satisfy this Requirement. See sections 6.1 and 6.2 of this Certificate. |
| <b>Regulation:</b>  | <b>7</b>     | <b>Materials and workmanship (applicable to Wales only)</b>   |
| <b>Regulation:</b>  | <b>7(1)</b>  | <b>Materials and workmanship (applicable to England only)</b>   |
| Comment:            |              | The product is acceptable. See section 12.1 and the <i>Installation</i> part of this Certificate.                                 |



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

|                    |             |  |
|--------------------|-------------|--|
| <b>Regulation:</b> | <b>8(1)</b> | <b>Durability, workmanship and fitness of materials</b>  |
| Comment:           |             | The use of the product satisfies the requirements of this Regulation. See section 12.1 and the <i>Installation</i> part of this Certificate.   |
| <b>Regulation:</b> | <b>9</b>    | <b>Building standards applicable to construction</b>   |
| Standard:          | 3.1         | Site preparation – harmful and dangerous substances  |
| Standard:          | 3.2         | Site preparation – protection from radon gas   |
| Comment:           |             | When properly installed in a correctly designed structure, the product will form an effective barrier to the movement of radon, methane, carbon dioxide and VOC vapours enabling compliance with these Standards, with reference to clauses 3.1.2 <sup>(1)(2)</sup> , 3.1.6 <sup>(1)(2)</sup> , 3.1.7 <sup>(1)(2)</sup> and 3.2.2 <sup>(1)(2)</sup> . See sections 7.1, 7.2 and 8 of this Certificate. |
| Standard:          | 3.4         | Moisture from the ground   |
| Comment:           |             | The product, including joints, will enable a structure to satisfy the requirements of this Standard, with reference to clauses 3.4.2 <sup>(1)(2)</sup> , 3.4.4 <sup>(1)(2)</sup> 3.4.6 <sup>(1)(2)</sup> . See sections 6.1 and 6.2 of this Certificate.   |
| Standard:          | 7.1(a)      | Statement of sustainability  |
| Comment:           |             | The product 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.  |
| <b>Regulation:</b> | <b>12</b>   | <b>Building standards applicable to conversions</b>  |
| Comment:           |             | Comments in relation to the product 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> .   |

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).



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

|                    |                    |   |
|--------------------|--------------------|---|
| <b>Regulation:</b> | <b>23(a)(i)</b>    | <b>Fitness of materials and workmanship</b>   |
| Comment:           | <b>(iii)(b)(i)</b> | The product is acceptable. See section 12.1 and the <i>Installation</i> part of this Certificate. |

|                    |                  |  |
|--------------------|------------------|--|
| <b>Regulation:</b> | <b>26(1)(b),</b> | <b>Site preparation and resistance to contaminants</b>   |
| <b>Comment:</b>    | <b>26(2)</b>     | The product will contribute to a construction satisfying the requirements of this Regulation. See sections 7.1, 7.2 and 8 of this Certificate. |
| <b>Regulation:</b> | <b>28(a)</b>     | <b>Resistance to moisture and weather</b>  |
| <b>Comment:</b>    |                  | The product, including joints, will enable a structure to satisfy this Regulation. See sections 6.1 and 6.2 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 section: 3 *Delivery and site handling* (3.1, 3.2 and 3.4 to 3.6) of this Certificate.

### Additional Information

#### NHBC Standards 2019

In the opinion of the BBA, PUDLO GP ULTRA SEAL, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements in relation to *NHBC Standards*, Chapters 4.1 *Land quality — managing ground conditions*, 5.1 *Substructure and ground bearing floors*, Clause 5.1.20 *Damp-proofing concrete floors* and 5.4 *Waterproofing of basements and other below ground structures*, for use externally as a post applied membrane.

Where Grade 2 or 3 protection is required and the below ground wall retains more than 600 mm measured from the top of the retained ground to the lowest finished floor level, the product must be used in combination with either Type B or C waterproofing protection, as defined in BS 8102 : 2009.

The Certificate holder should be consulted for approved Type B and C solutions.

#### CE marking

The Certificate holder has taken the responsibility of CE marking the product, in accordance with harmonised European Standard EN 13967 : 2012. An asterisk (\*) appearing in this Certificate indicates that data shown are given in the manufacturer's Declaration of Performance.

### Technical Specification

#### 1 Description

1.1 PUDLO GP Ultra Seal is a nominal 1.5 mm thick membrane comprising PUDLO GP Ultra Tank with a self-adhesive polymer-modified bitumen compound applied to one face, leaving a 50 mm wide selvedge to allow taping or hot air welding of side laps. The self-adhesive layer is protected with a siliconized polypropylene release film. The product has the nominal characteristics given in Table 1.

**Table 1 Nominal characteristics**

| Characteristic (unit)  | Value         |
|--|---------------|
| Thickness (mm)   | 1.5           |
| Roll Length (m)  | 20            |
| Roll Width (m)   | 0.3, 0.9, 1.0 |
| Mass per unit area ( $\text{g}\cdot\text{m}^{-2}$ )                            | 1000          |
| Impact resistance (mm)   | $\geq 900$    |
| Tensile strength* ( $\text{N}\cdot 50\text{ mm}^{-1}$ )                        |               |
| MD   | $\geq 550$    |
| CD   | $\geq 400$    |
| Elongation (%)   | $\geq 550$    |
| Water vapour transmission ( $\text{g}\cdot\text{m}^{-2}\cdot\text{day}^{-1}$ ) | 0.11 – 0.18   |
| Watertightness* (60 kPa)   | Pass          |
| Nail tear* (N)   |               |
| MD and CD  | $\geq 300$    |
| Resistance to static loading* (kg)   | $\geq 20$     |

1.2 Ancillary items for use with the product and included in this assessment are:

- PUDLO Self Seal Primer — a bituminous solvent-based primer used to prime masonry substrates prior to the application of PUDLO GP Ultra Seal
- PUDLO Ultra Tape — an extruded double-sided butyl rubber based tape for sealing overlap joints where hot air welding is not required.

1.3 Other ancillary items for use with the product, but outside the scope of this Certificate, include:

- protection fleece and/or protection boards for use over the membrane to protect it from damage by trafficking during the installation
- fleece-backed butyl sealing tape for use over joints to provide additional protection and a smooth finish
- proprietary pre-fabricated corner units and top hats
- specialised sealants and liquid-applied membranes for sealing around penetrations and pile caps
- void-vent geocomposite membranes for use as part of a gas/VOC restrictive system
- angle fillets.

The Certificate holder should be consulted for suitable products.

## 2 Manufacture

2.1 The product is manufactured by extrusion and laminating processes.

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.

## 3 Delivery and site handling

3.1 PUDLO GP Ultra Seal is available in rolls of 0.3 x 20 m, 0.9 x 20 m and 1 x 20 m, packed in cardboard cartons.

3.2 Each carton contains one 0.9 or 1 m wide roll or three 0.3 m wide rolls weighing approximately 25, 28 and 25 kg respectively. The Certificate holder should be consulted for confirmation of available roll sizes prior to specification.

3.3 The product should be stored in an upright position under clean and dry conditions, at a temperature above 5°C, protected from freezing conditions and high temperatures.

3.4 PUDLO Ultra Tape is available in rolls of 50 mm x 1.5 mm x 10 m, in black. The product is packed into cardboard boxes. Each box contains 12 rolls and has a nominal weight of 1 kg.

3.5 PUDLO Self Seal Primer is supplied in 5 and 25 litre tins.

3.6 The Certificate holder has taken the responsibility of classifying and labelling the product 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 PUDLO GP Ultra Seal.

### Design Considerations

## 4 Use

4.1 PUDLO GP Ultra Seal is satisfactory for use as a Type A waterproofing protection, as defined in BS 8102 : 2009 for the waterproofing on new-build underground structures, and as a damp-proofing membrane for solid floors in accordance with the relevant clauses of CP 102 : 1973 Section 3, BS 8000-0 : 2014 and BS 8000-4 : 1989.

4.2 The product can be internally and externally applied to provide an effective barrier to the transmission of liquid water where Grades 1 to 3 waterproofing protection is required, as defined in Table 2 of BS 8102 : 2009.

4.3 Where Grade 3 waterproofing protection is required, the environment must be controlled by use of ventilation, dehumidification and/or air conditioning, as appropriate, to ensure dampness does not occur. See also the *Additional information* part of this Certificate relating to *NHBC Standards 2019*.

4.4 The product is compatible with concrete, smooth brick and blockwork or screeded substrates, and is resistant to those chemicals likely to be present in normal service conditions.

4.5 The product is satisfactory for use as a gas-resistant membrane to restrict the ingress of methane, carbon dioxide and radon. Installations must be verified in accordance with BS 8485 : 2015.

4.6 The PUDLO GP Ultra Tank film component of the membrane is chemically resistant when in contact with hydrocarbons and PUDLO GP Ultra Seal can be used externally applied to restrict the ingress of VOC vapours into the building. When used in buildings in areas at risk from VOCs, the guidance given in CIRIA Report C748 : 2014 should be followed.

4.7 The product should be fully protected immediately after it is installed, in accordance with the Certificate holder's instructions.

## 5 Practicability of installation

The product should only be installed by installers who have been trained and approved by the Certificate holder. The Certificate holder must be consulted for suitable installers.

## 6 Resistance to water and water vapour



6.1 The product, including joints when completely sealed and consolidated, will resist the passage of water under hydrostatic pressure and moisture from the ground and so satisfy the relevant requirements of the national Building Regulations.

6.2 When installed in accordance with the following documents, the membrane will comply with the minimum sheet thickness detailed in the national Building Regulations:

**England and Wales** — Approved document C, Requirements C2(a), Section 4.8

**Scotland** — Mandatory Standard 3.4, Technical Handbook<sup>(1)(2)</sup> (clauses 3.4.2, 3.4.4 and 3.4.6)

**Northern Ireland** — Technical Booklet C, Regulation 28(a), section 5.5.

(1) Technical Handbook – Domestic.

(2) Technical Handbook – Non-domestic.

6.3 The product is impervious to water and will give a waterproof layer capable of accepting minor structural movement without damage.

## 7 Resistance to underground gases



7.1 The product, including hot air welded joints, will restrict the ingress of radon, methane and carbon dioxide into buildings from landfill and naturally occurring sources, and satisfy the performance for a gas-resistant membrane as defined in BS 8485 : 2015.

7.2 Measured gas permeability/diffusion values on unjointed PUDLO GP Ultra Tank component of the membrane are given in Table 2.

*Table 2 Measured gas transmission rates and radon diffusion coefficient of PUDLO GP Ultra Tank component of the membrane*

| Gas  | Method                                  | Result  |
|--|---|---|
| Methane  | ISO 15105-1                             |   |
| membrane without joint <sup>(1)</sup>                  |   | 0.13 ml·m <sup>-2</sup> ·day <sup>-1</sup> ·atm <sup>-1</sup> |
| membrane with joint <sup>(2)</sup>                     |   | ≤ 1 ml·m <sup>-2</sup> ·day <sup>-1</sup> ·atm <sup>-1</sup>  |
| Carbon dioxide (membrane without joint) <sup>(1)</sup> | ISO 15105-1                             | 3.01 ml·m <sup>-2</sup> ·day <sup>-1</sup> ·atm <sup>-1</sup> |
| Radon  | Czech University<br>(method K124/02/95) | 1.0 x 10 <sup>-12</sup> m <sup>2</sup> ·s <sup>-1</sup>       |

(1) 0.50 mm thick PUDLO GP Ultra Tank tested.

(2) Hot air welded joint tested.

7.3 BRE Report BR 211 : 2015 recommends a 300 µm thick polyethylene sheet as a minimum required thickness for a radon gas-resistant membrane. It is generally accepted that other materials with comparable or higher gas-resistance are suitable, provided they can withstand the construction process. In the opinion of the BBA, the product satisfies these criteria.

## 8 Resistance to chemicals



8.1 The PUDLO GP Ultra Tank component of the membrane is resistant to the chemicals commonly found on construction sites. The results of immersion tests on PUDLO GP Ultra Tank for a range of chemicals, including hydrocarbons, are given in Table 3. Site-specific examination and assessment should be carried out on a case by case basis to establish the suitability for any specific application and the need for additional testing.

**Table 3 Resistance to chemicals of PUDLO GP Ultra Tank**

| Test method            | Exposure chemical(s)   | Retained Tensile strength/elongation (%) | Result |
|------------------------|--|--|--------|
| BS EN 14414 : Method A | Sulphuric acid (10% solution)  | MD 108/117<br>CD 118/123                 | Pass   |
| BS EN 14414 : Method B | Calcium hydroxide solution (saturated)   | MD 108/118<br>CD 107/122                 | Pass   |
| BS EN 14414 : Method C | Diesel, paraffin, lubricating oil mixture  | MD 86/97<br>CD 80/92                     | Pass   |
| BS EN 14414 : Method D | Synthetic leachate comprising a mixture of organic acids, glucose, chlorides, sulfates and phosphate | MD 101/103<br>CD 96/101                  | Pass   |
| BS EN 14414            | Benzene<br>(saturated solution in water)   | MD 95/101<br>CD 102/104                  | Pass   |
|                        | Toluene<br>(saturated solution in water)   | MD 94/103<br>CD 91/96                    | Pass   |
|                        | Ethyl benzene<br>(saturated solution in water)   | MD 99/100<br>CD 97/95                    | Pass   |
|                        | m,p,o-Xylenes<br>(saturated solution in water)   | MD 91/93<br>CD 106/103                   | Pass   |
|                        | Tetrachloroethene (PCE)<br>(saturated solution in water)   | MD 93/97<br>CD 102/104                   | Pass   |
|                        | Trichloroethene (TCE)<br>(saturated solution in water)   | MD 99/102<br>CD 93/100                   | Pass   |
|                        | Hexane<br>(saturated solution in water)  | MD 99/100<br>CD 104/99                   | Pass   |
|                        | Napthalene<br>(saturated solution in water)  | MD 101/101<br>CD 93/99                   | Pass   |

8.2 Measured vapour transmission rates for a range of VOCs are given in Table 3. A site-specific risk assessment should be carried out to establish the product's suitability for any specific application.

**Table 3 Measured vapour transmission rates of volatile organic compounds for PUDLO GP Ultra Tank <sup>(1)</sup>**

| Volatile liquid                           | Method                | Result                                   |  |
|---|-----------------------|--|--|
|   |                       | (mg·m <sup>-2</sup> ·day <sup>-1</sup> ) | (ml·m <sup>-2</sup> ·day <sup>-1</sup> ) |
| Benzene <sup>(2)</sup>                    | ISO 15105-2 (Annex B) | 3.6                                      | 1.04                                     |
| Toluene <sup>(2)</sup>                    | ISO 15105-2 (Annex B) | 13.8                                     | 3.36                                     |
| Ethyl benzene <sup>(2)</sup>              | ISO 15105-2 (annex B) | 2.7                                      | 0.56                                     |
| m,p,o-Xylenes <sup>(2)</sup>              | ISO 15105-2 (Annex B) | 7.7                                      | 1.62                                     |
| Tetrachloroethene (PCE) <sup>(2)</sup>    | ISO 15105-2 (Annex B) | 26.2                                     | 3.54                                     |
| Trichloroethene (TCE) <sup>(2)</sup>      | ISO 15105-2 (Annex B) | 54.7                                     | 9.32                                     |
| Napthalene                                | ISO 15105-2 (Annex B) | < 0.0006                                 | <0.0001                                  |
| Hexane <sup>(2)</sup>                     | ISO 15105-2 (Annex B) | 0.6                                      | 0.15                                     |
| Vinyl chloride                            | ISO 15105-2 (Annex B) | < 0.04                                   | 0.05 <sup>(3)</sup>                      |
| Cis-1,2,-dichloroethene <sup>(2)</sup>    | ISO 15105-2 (Annex B) | < 1.1                                    | ≤ 0.3                                    |
| 1,1,2,2,-tetrachloroethane <sup>(2)</sup> | ISO 15105-2 (Annex B) | < 0.008                                  | ≤ 0.001                                  |
| 1,1,2-trichloroethane <sup>(2)</sup>      | ISO 15105-2 (Annex B) | < 0.006                                  | ≤ 0.001                                  |

(1) Membrane in contact with test gases at saturated vapour pressure unless otherwise noted.

(2) Membrane in contact with the liquid.

(3) 0.05 cm<sup>3</sup>·m<sup>-2</sup>·day<sup>-1</sup>·bar<sup>-1</sup>.

## 9 Resistance to mechanical damage

9.1 The membranes can be punctured by sharp objects; care should be taken when handling building materials and tools over the exposed surface.

9.2 Provided there are no sharp objects present either below the membrane or on the membrane's surface during installation of the membrane and protective layer, the product will not be damaged by normal foot traffic.

## 10 Adhesion

The adhesion of the product to the substrate and to itself, with joints as described in this Certificate, is satisfactory.

## 11 Maintenance

As the product is confined within the structure and has suitable durability (see section 12), maintenance is not required. However, any damage occurring before enclosure must be repaired (see section 16).

## 12 Durability



12.1 The product, when fully protected in normal circumstances, will remain effective against the ingress of water and water vapour, and will restrict the ingress of radon, methane, carbon dioxide and VOC vapours during the lifetime of the building.

12.2 The product will not be affected by short term exposure to ultraviolet light to allow for installation. Long periods of exposure may however reduce the effectiveness of the membrane and it should be protected from UV as soon as practicable after it is installed.

## 13 Reuse and recyclability

The product contains polyethylene, which can be recycled.

## Installation

## 14 General

14.1 PUDLO GP Ultra Seal must be installed in accordance with the Certificate holder's instructions and this Certificate and follow the relevant guidance given in BRE Report BR 211 : 2015, BS 8485 : 2015 and CIRIA Report C748 : 2014.

14.2 The product can be installed in dry conditions at temperatures between 5 and 35°C. Care must be taken to ensure that there is no surface condensation when installing at low temperatures that could affect jointing.

14.3 The surface onto which the product is to be applied must be smooth, dry and free from sharp protrusions and debris that could damage the membrane. Brickwork or blockwork must be flush pointed or rendered to provide a smooth surface.

14.4 For waterproofing applications, PUDLO GP Ultra Seal must be installed in accordance with the relevant requirements of BS 8102 : 2009, CP 102 : 1973 Section 3, and the Certificate holder's instructions. Additional guidance on the use of damp-proof membrane materials is given in BS 8000-0 : 2014 and BS 8000-4 : 1989.

14.5 For internal tanking applications the membrane must be fully loaded.

14.6 For chemical and gas resistance applications it is recommended that the membrane is installed with hot air welded joints in accordance with the Certificate holder's instructions.

14.7 For VOC resistance applications, the membrane must be installed with hot air welded joints.

14.8 For waterproofing applications, joints in the membrane can be finished by hot air welding or using PUDLO Ultra Tape.

14.9 The membrane must be protected as soon as possible after it is installed to minimise the risk of damage from direct foot trafficking. Direct trafficking by vehicles must be avoided.

## 15 Procedure

15.1 Prepared surfaces must be primed with PUDLO Self Seal Primer, typically at a coverage rate of between 6 and



10 m<sup>2</sup> per litre, and allowed to dry before application of the membrane. Only areas that can be covered with the membrane on the same day should be primed.

15.2 Sharp angles at changes of direction should be avoided by using suitable angle fillets. The Certificate holder should be consulted for suitable products.

15.3 The membrane is cut to length allowing 150 mm for end laps and positioned by partially peeling back the release film and applying the self-adhesive face to the prepared surface.

#### **Self-adhesive lap jointing**

15.4 The release film is progressively removed and the membrane pressed firmly onto the wall, using firm hand pressure so that it is fully bonded to the surface.

15.5 The next sheet is laid over the existing edge of the previously applied sheet ensuring a minimum 100 mm edge lap and fixed to the substrate in the same way as the first sheet. Subsequent sheets are applied in the same way.

15.6 Where vertical drops require more than one length of membrane, a minimum overlap of 150 mm should be ensured, with the lower end of the upper length overlapping the upper end of the lower length, ensuring good weathering of the joints. End laps should be staggered.

15.7 Joints can be finished with PUDLO Ultra Tape and with a suitable sealing tape applied over the joint to provide a smooth finish or hot air welded.

15.8 In vertical applications, in cold or very warm weather, the top of the membrane may be temporarily supported with battens.

#### **Hot air welded joints**

15.9 Side laps and end laps must be a minimum of 100 mm and end laps should be staggered to avoid thickness build-up that could make sealing joints difficult.

15.10 All surfaces must be dry before welding.

15.11 Before welding work is carried out, trials must be completed to determine the 'operating window' for the welding equipment, materials and ambient conditions. Typically, the operating window will be between 180 to 240°C at a rate of 1.5 m/min. In case of doubt, the Certificate holder should be consulted for advice.

15.12 Side laps are welded using the 50 mm wide selvedge ensuring a minimum of 50 mm wide weld and must be checked for integrity after being formed.

15.13 End laps are sealed using a 100 mm wide strip of PUDLO GP Ultra Tank laid centrally over the joint and fully welded.

15.14 All service penetrations and direction changes should be properly detailed in accordance with the Certificate holder's instructions. Service ducts should be vented to prevent the possibility of gas accumulating in confined spaces.

15.15 The continuity of the gas protection must extend over the footprint of the building, and the gas membrane must be sealed to a compatible gas-resistant damp-proof course.

15.16 The membrane must be protected as soon as possible after installation.

15.17 For gas and VOC resistance applications the membrane installation should be subject to third-party independent validation, in accordance with BS 8485 : 2015 and/or CIRIA Report C748 : 2014.

## **16 Repair**

Any damage to the membrane must be repaired using a patch of the membrane. All patched areas must extend a minimum of 100 mm from the damaged area. For gas and VOC resistant applications a patch of PUDLO GP Ultra Tank

must be used and hot air welded. If required, repair work should be confirmed by an independent validation report, as all gas membrane installations should be subject to third-party validation in accordance with BS 8485 : 2015 and/or CIRIA Report C748 : 2014.

## Technical Investigations

### 17 Tests

17.1 Tests were carried out on PUDLO GP Ultra Seal and the results assessed to determine:

- width, straightness and flatness
- mass per unit area
- thickness
- flexibility at low temperature
- airtightness of lap joint (100 mm self-adhesive)
- unrolling at low temperature
- peel adhesion
- resistance to fatigue.

17.2 In addition, tests were carried out on the PUDLO GP Ultra Tank component and the results assessed to determine:

- visible defects
- characterisation by thermogravimetric analysis
- width, straightness and flatness
- mass per unit area
- thickness
- foldability at low temperature
- tensile strength and elongation
- airtightness of joints (hot air welded)
- shear strength of joints (hot air welded)
- dimensional stability
- resistance to static loading
- effect of heat ageing
- effect of water exposure
- effect of exposure to UV.

### 18 Investigations

18.1 An evaluation was made of the results of independent test data to establish:

- methane gas transmission (on unjointed and jointed membrane)
- carbon dioxide gas transmission
- radon gas diffusion coefficient
- transmission of vapours from VOC compounds
- tensile strength and elongation
- chemical resistance
- leaching resistance
- resistance to tearing (nail shank)
- resistance to impact
- watertightness at 196.2 kPa hydrostatic pressure (including 100 mm overlap self-adhesive joint).

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

## Bibliography

BRE Report BR 211 : 2015 *Radon — Guidance on protective measures for new buildings*

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 8102 : 2009 *Code of practice for protection of below ground structures against water from the ground*

BS 8485 : 2015+ A1 : 2019 *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*

BS EN 14414 : 2004 *Geosynthetics — Screening test method for determining chemical resistance for landfill applications*

BS ISO 15105-1 : 2007 *Plastics — Film and sheeting — Determination of gas-transmission rate — Differential-pressure methods*

BS ISO 15105-2 : 2003 *Plastics — Film and sheeting — Determination of gas-transmission rate — Equal-pressure method*

CIRIA C748 : 2014 *Guidance on the use of plastic membranes as VOC vapour barriers*

CP 102 : 1973 *Code of practice for protection of buildings against water from the ground*

EN 13967 : 2012 + A1 : 2017 *Flexible sheets for waterproofing — Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet — Definitions and characteristics*

### 19 Conditions

#### 19.1 This Certificate:

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

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

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

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

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

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

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

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