

Kiwa Ltd.
Unit 5 Prime Park Way
Prime Enterprise Park
Derby
DE1 3QB
T: +44 (0)1332 383333
W: www.kiwa.co.uk/bda

BAF-18-056-P-A-UK
BDA Agrément®
Visqueen Ultimate GeoSeal
ground VOC barrier, ground gas
barrier; waterproof, damp proof
and tanking membrane

Visqueen
Heanor Gate Road
Heanor
Derbyshire
DE75 7RG
T: +44 (0)333 202 6800
E: enquiries@visqueen.com
W: www.visqueen.com

SCOPE OF AGRÉMENT

This Agrément relates to Visqueen Ultimate GeoSeal (hereinafter the 'Product'), a ground volatile organic compound (hereinafter 'VOC') barrier, ground gas barrier; waterproof, damp proof and tanking membrane. The Product is for use in existing and new, domestic and non-domestic buildings when:

- pre-applied below ground-supported concrete ground floors (hereinafter 'concrete ground floor');
- post applied above ground-supported or suspended concrete ground floors (excluding beam and block floors).

Subject to correct detailing, the Product can be used as:

- a chemical-resistant ground VOC vapour and liquid barrier; in this instance, the Product can contribute to protecting a building and its occupants from the ingress of ground VOC vapours and liquids, in accordance with C716D;
- a radon, methane and carbon dioxide ground gas barrier; in this instance, the Product can contribute to protecting a building and its occupants from the ingress of radon, methane and carbon dioxide ground gases, in accordance with BS 8485 and BRE Report 211.

The Product acts as a damp proof membrane (hereinafter 'DPM') in accordance with BS EN 13967; can be used for tanking below-ground structures (with vertical permanent shuttering and temporary formwork) in accordance with BS 8102, and can be used to prevent the ingress of groundwater vapour and liquid groundwater when subject to hydrostatic pressure up to 60 kPa.

PRODUCT DESCRIPTION

The Product is a 1 mm thick flexible, chemical-resistant, coextruded co-polymer thermoplastic membrane sheet, manufactured in accordance with BS EN 13967. The top surface is grey and has a textured finish; the underside is black and has a smooth finish. The Product is supplied in a large, single-wound roll to minimise jointing and for ease of installation.

Where required, Product sheets are overlapped by 150 mm and joints are bonded using Visqueen Ultimate Double Sided Jointing Tape; loose laps are sealed with Visqueen Ultimate Gas Resistant (GR) Lap Tape.

PRODUCT ILLUSTRATION



THIRD-PARTY ACCEPTANCE

NHBC - For detailed information see section 3.3 (Third-Party Acceptance).

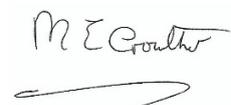
STATEMENT

It is the opinion of Kiwa Ltd. that the Product is fit for its intended use, provided it is specified, installed and used in accordance with this Agrément.

Chris Vurley, CEng
Technical Manager, Building Products



Mark Crowther, M.A. (Oxon)
Kiwa Ltd. Technical Director



SUMMARY OF AGRÉMENT

This document provides independent information to specifiers, building control personnel, contractors, installers and other construction industry professionals considering the fitness for the intended use of the Product. This Agrément covers the following:

- Conditions of use;
- Factory Production Control, Quality Management System and the Annual Verification procedure;
- Points of attention for the Specifier and examples of details;
- Installation;
- Independently assessed Product characteristics and other information;
- Compliance with national Building Regulations, other regulatory requirements and Third-Party Acceptance, as appropriate.
- Sources, including codes of practice, test and calculation reports.

MAJOR POINTS OF ASSESSMENT

Moisture control - subject to correct detailing, the Product provides an effective barrier to (see section 2.1.10):

- the passage of liquid groundwater when subject to hydrostatic pressure up to 60 kPa;
- water vapour transmission.

Strength - the Product has adequate damage resistance to puncture, impact, static loading, tensile strength of lap joints, tensile strength and resistance to tearing (see section 2.1.11).

Fire performance - the Product is European Classification F*, in accordance with BS EN 13501-1 (see section 2.1.12).

Resistance to chemicals and ground gases - the Product can provide resistance to (see section 2.1.13):

- nine challenge VOC chemical vapours;
- eight challenge VOC chemical liquids;
- radon, methane and carbon dioxide ground gases.

Durability - during its service life, the Product will remain effective against the ingress of ground VOC vapours and liquids, radon, methane and carbon dioxide ground gas, liquid groundwater and groundwater vapour. The Product will have a service life equivalent to that of the structure into which it is incorporated (see section 2.1.8).

CE marking - the Agrément holder has taken responsibility for CE marking the Product in accordance with all relevant harmonised European Product Standards. An asterisk (*) appearing in this Agrément indicates that data shown is given in the Product manufacturer's Declaration of Performance (DoP).

CONTENTS

Chapter 1 - General considerations

- 1.1 - Conditions of use
- 1.2 - Factory Production Control (FPC) and Quality Management System (QMS)
- 1.3 - Annual verification procedure - continuous surveillance

Chapter 2 - Technical assessment

- 2.1 - Points of attention to the Specifier
- 2.2 - Examples of details
- 2.3 - Installation
- 2.4 - Independently assessed Product characteristics
- 2.5 - Product components and ancillary items

Chapter 3 - CDM, national Building Regulations and Third-Party Acceptance

- 3.1 - The Construction (Design and Management) Regulations 2015 and The Construction (Design and Management) Regulations (Northern Ireland) 2016
- 3.2 - National Building Regulations
- 3.3 - Third-Party Acceptance

Chapter 4 - Sources

Chapter 5 - Amendment history

CHAPTER 1 - GENERAL CONSIDERATIONS

1.1 - CONDITIONS OF USE

1.1.1 Design considerations

See section 2.1.

1.1.2 Application

The assessment of the Product relates to its use in accordance with this Agrément and the Agrément holder's requirements.

1.1.3 Assessment

Kiwa Ltd. has assessed the Product in combination with its relevant DoPs, test reports, technical literature and factory and site visits. Also, the NHBC Standards have been taken into consideration. Factory Production Control has been assessed.

1.1.4 Installation supervision

The quality of installation and workmanship shall be controlled by a competent person who shall be an employee of the installation company.

The Product shall be installed strictly in accordance with the instructions of the Agrément holder and the requirements of this Agrément.

1.1.5 Geographical scope

The validity of this document is limited to England, Wales, Scotland and Northern Ireland, with due regard to chapter 3 of this Agrément (CDM, national Building Regulations and Third-Party Acceptance).

1.1.6 Validity

The purpose of this BDA Agrément® is to provide for well-founded confidence to apply the Product within the Scope described. The validity of this Agrément is three years after the issue date, and as published on www.kiwa.co.uk/bda.

1.2 - FACTORY PRODUCTION CONTROL (FPC) AND QUALITY MANAGEMENT SYSTEM (QMS)

Kiwa Ltd. has determined that the Agrément holder fulfils all obligations in relation to this Agrément in respect of the Product.

The initial FPC audit demonstrated that the Agrément holder has a satisfactory Quality Management System (QMS) and is committed to continuously improving their FPC operations.

Document control and record keeping procedures were deemed satisfactory.

A detailed Production Quality Specification (PQS) has been compiled to ensure traceability and compliance under the terms of this Agrément.

1.3 - ANNUAL VERIFICATION PROCEDURE - CONTINUOUS SURVEILLANCE

To demonstrate that the FPC is in conformity with the requirements of the technical specification described in this Agrément, the continuous surveillance, assessment and approval of the FPC will be done at a frequency of not less than once per year by Kiwa Ltd.

This Agrément does not constitute a design guide for the Product. It is intended as an assessment of fitness for purpose only.

2.1 - POINTS OF ATTENTION TO THE SPECIFIER

2.1.1 Design responsibility

A Specifier may undertake a project specific design in which case it is recommended that the Specifier co-operates closely with the Agrément holder. The Specifier or installing contractor is responsible for the final as-built design.

2.1.2 Applied building physics (heat, air, moisture)

The physical behaviour of the building incorporating the Product shall be verified as suitable by a competent specialist, who can be either a qualified employee of the Agrément holder or a qualified consultant. The Specialist will check the physical behaviour of the building design and if necessary can offer advice in respect of improvements to achieve the final specification. It is recommended that the Specialist co-operates closely with the Agrément holder.

2.1.3 General design considerations

The project specific design shall achieve complete integrity across the entire building footprint.

The application of the Product shall take account of possible differential movement in the floor due to ground settlement.

Ground VOC and ground gases

Design of ground VOC vapour and ground gas protective measures for buildings on contaminated land or in areas of risk shall be in accordance with the following minimum recommendations:

- BS 8485 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings;
- BRE Report 211 Radon: Guidance on protective measures for new buildings;
- BRE Report 212 Construction of new building on gas-contaminated land;
- BRE Report 414 Protective measures for housing on ground gas-contaminated land;
- CIRIA C665 Assessing risks posed by hazardous ground gases to buildings;
- CIRIA C716D Remediating and mitigating risks from ground VOC vapours from land affected by contamination;
- CIRIA C735 Good practice on the testing and verification of protection systems for buildings against hazardous ground gases;
- CIRIA C748 Guidance on the use of plastic membranes as VOC vapour barriers;
- CIRIA R149 Protecting development from methane;
- CIEH The Local Authority Guide to Ground Gas.

The Specifier shall consider the site-specific ground gas regime and purpose criteria in BS 8485 such as the number of buildings, construction period, the complexity of the design and the experience of the workforce.

When medium to high levels of ground VOCs and ground gases are present or when the generation of gases still occurs, use a suspended pre-cast concrete ground floor or construct an open void beneath the ground-supported concrete ground floor, as ventilation beneath the ground floor will dilute and disperse ground gases to atmosphere. Sub-floor ventilation should be at least 150 mm deep and achieve at least one air exchange per 24 hours. An option for providing ventilation to a ground supported concrete ground floor is to install a Visqueen Gas Vent Mat.

Service ducts should be vented to prevent the possibility of ground gas accumulating in confined spaces.

The Product laps shall:

- be jointed and sealed by taping;
- form a continuous barrier with the gas-resistant damp-proof course (hereinafter 'DPC') in a wall.

The Product should not be taken through any masonry wall. A gas-resistant DPC should be taken through the inner blockwork leaf by a minimum of 150 mm and be incorporated below the Visqueen Preformed Cavity Tray Unit in the outer brick leaf. The gas-resistant DPC should be extended beyond the blockwork wall by a minimum of 225 mm where it can be jointed to the Product.

Where the Product is used in conjunction with a cavity wall, a clear cavity of at least 225 mm below the gas-resistant DPC should be maintained. This depth may be reduced to 150 mm where weep holes are provided and other necessary measures are taken to ensure that the cavity can drain freely. Where buildings are stepped down a sloping site, the gas-resistant DPCs and the Product should be linked so that all parts of each building are protected.

Long periods of outdoor weathering and exposure to ultraviolet (UV) light will reduce the effectiveness of the Product.

Waterproofing protection

A waterproofing design shall be in accordance with BS 8102.

The Product can act as a fully bonded Type A membrane in accordance with BS 8102, providing waterproofing protection Grades 1 and 2; it can provide Grade 3 protection when part of a combined waterproofing solution.

A project specific design shall be undertaken by a Certificated Surveyor in Structural Waterproofing (CSSW), in accordance with BS 8102.

On NHBC sites additional waterproofing measures may be required as detailed in their individual technical requirements.

2.1.4 Project specific design considerations

For ground VOC and ground gas barrier applications, a pre-installation walkover site survey and subsequent desktop study is required to allow determination of the project specific design. This shall include:

- an assessment of the ground conditions;
- a site investigation to determine the nature and extent of the conditions, including geotechnical and contamination investigations, in accordance with BS EN 1997-2 (ground investigation and testing), BS EN ISO 14688-1 (classification of soil) and BS EN ISO 22476-1 (electrical field testing); this on-site testing should be supplemented by subsequent laboratory testing where necessary;
- investigating, assessing and managing risks from inhalation of ground VOCs in land affected by contamination, in accordance with CIRIA C665 and CIRIA C682;
- investigation for ground VOC and ground gas contamination, in accordance with BS 8576 and BS 10175.

The desktop study of the site shall include:

- review of the results of the pre-installation walkover site survey;
- assessment of the soils, geology, surface water, groundwater, current and historical land uses;
- a ground gas risk assessment and site characterisation, in accordance with CL:AIRE research bulletin RB 17 and CIRIA R152.

For waterproof, damp proof and tanking membrane applications, a desktop study is required to allow determination of the project specific design. This shall include an assessment of ground conditions and the groundwater table, in accordance with BS 8102.

2.1.5 Permitted applications

Only applications designed according to the specifications as given in this Agrément are allowed under this Agrément; in each case the Specifier will have to co-operate closely with the Agrément holder/installer.

2.1.6 Installer competence level

The Product shall be installed strictly in accordance with the instructions of the Agrément holder and the requirements of this Agrément.

Installation can be undertaken by competent persons experienced in this sort of work.

2.1.7 Delivery, storage and site handling

The Product is delivered to site in large, single-wound rolls wrapped in polythene film, bearing the Product name, the Agrément holder's name and the BDA Agrément® logo incorporating the number of this Agrément. Each roll has a leaflet enclosed describing the Product and installation instructions.

Store the Product in accordance with the Agrément holder's requirements. Care shall be taken to:

- avoid exposure to direct sunlight and high or low temperatures for long periods of time;
- store in a well-ventilated covered area to protect from rain, frost and humidity;
- store away from possible ignition sources;
- store rolls of the Product horizontally on a flat surface and not stacked.

Care should be taken to avoid accidental damage to the Product when handling on-site.

2.1.8 Durability

The Product has adequate durability in respect of:

- watertightness after immersion in liquid alkali, in accordance with BS EN 1847 and BS EN 1928;
- watertightness after long term heat ageing, in accordance with BS EN 1928 and BS EN 1296;
- retention of physical properties after immersion in ground VOC liquid organic solvent blends, in accordance with CIRIA C748, BS EN 14414 and BS EN 14415.

The Product:

- is chemically inert and is not affected by acids and alkalis under normal service conditions;
- is not compatible with products containing pitch;
- will restrict the ingress of ground gases and remain effective against the ingress of water vapour and liquid water from the ground, during the lifetime of the building;
- will have a service life durability equivalent to that of the structure into which it is incorporated;
- has adequate resistance to liquid chemicals, including water.

When underfloor heating is installed, the Product shall be positioned between the concrete ground floor and insulation layer, and as such there will be no adverse effect on the Product from overheating under normal service conditions.

2.1.9 Maintenance and repair

Once installed, and depending on the application, the Product shall be covered by concrete, backfill, an insulation layer and/or screed layer and does not require maintenance.

Punctures shall be repaired prior to application of the insulation layer and/or screed layer, concrete ground floor or backfill. Simple punctures are repaired using a patch of the Product, lapped and taped at least 150 mm beyond the puncture. Other repairs/patching of the Product can be done using Visqueen Pro Detailing Strip. For advice in respect of repair, consult the Agrément holder.

Performance factors in relation to the Major Points of Assessment

2.1.10 Moisture control

Including when under hydrostatic pressure up to 60 kPa, the Product (subject to correct detailing) has adequate watertightness to provide a barrier to the passage of water vapour from the ground into the internal environment, in accordance with BS EN 1928.

The Product has adequate water vapour resistance to prevent water vapour transmission from the ground into a building in accordance with BS EN 1931.

2.1.11 Strength

The grey textured top surface aids adhesion to concrete.

On a smooth or blinded surface, the Product will not be damaged by normal on-site foot traffic or activities associated with the placement of concrete or an insulation layer and/or screed layer. No protection of the Product is required in this situation.

In a vertical permanent shuttering and temporary formwork application, the Product may need protection with TreadGUARD 1500 against backfilling depending on the backfill material to be used.

The Product has adequate:

- resistance to static loading, in accordance with BS EN 12730;
- static puncture resistance, in accordance with BS EN ISO 12236;
- impact resistance in accordance with BS EN 12691;
- tensile strength of lap joints in accordance with BS EN 12317-2.

The Product has adequate tensile strength and elongation properties in accordance with BS EN 12311-2. The Product can stretch sufficiently underneath a pre-cast concrete ground floor or an insulation layer and/or screed layer to accommodate typical settlement movement of a building.

The Product has adequate resistance to tearing (nail shank), in accordance with BS ISO 34-1 and BS EN 12310-1. The Product has adequate tear resistance and abrasion resistance which are beneficial during installation.

2.1.12 Fire performance

The Product has a reaction to fire classification of European Classification F* (combustible), in accordance with BS EN 13501-1.

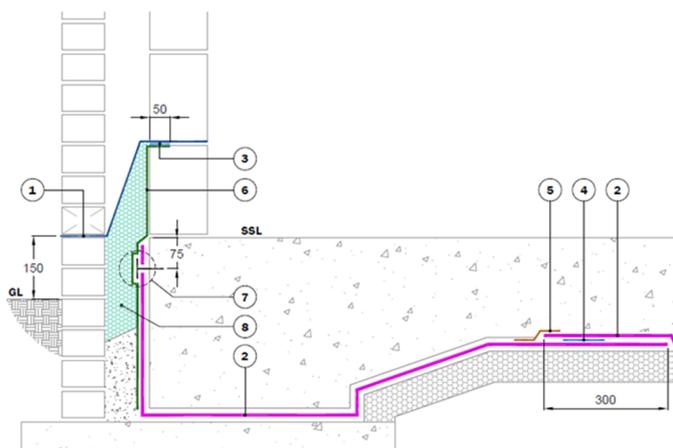
Once incorporated into a concrete ground floor, the Product is fully protected.

2.1.13 Resistance to chemicals and ground gases

The Product without joints will restrict ground VOC vapours and liquids, and radon, methane and carbon dioxide ground gas ingress into buildings; and meet the performance criteria for a ground gas resistant membrane as defined in BS 8485.

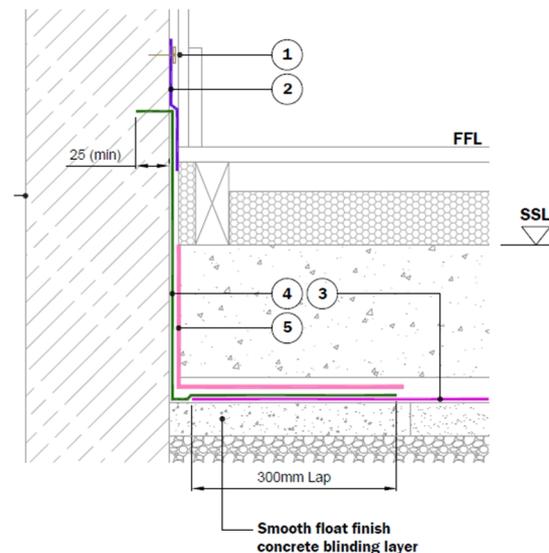
2.2 - EXAMPLES OF DETAILS

Diagram 1 - Typical suspended pre-cast concrete ground floor edge detail



- 1 Gas-resistant DPC
- 2 Visqueen Ultimate GeoSeal
- 3 Visqueen Double Sided Tape
- 4 Visqueen Ultimate Double Sided Tape
- 5 Visqueen Ultimate Gas Resistant (GR) Lap Tape
- 6 Visqueen GR SAM and Visqueen High Performance (HP) Tanking Primer
- 7 Visqueen Ultimate Retaining Discs at 400mm centres
- 8 Rigid insulation by others to support the DPC

Diagram 2 - Typical existing wall abutment detail



- 1 Visqueen Fixing Strip System with suitable fixings
- 2 Visqueen Pro Detailing Strip and Visqueen High Performance (HP) Tanking Primer
- 3 Visqueen Ultimate GeoSeal
- 4 Visqueen GR SAM and Visqueen High Performance (HP) Tanking Primer
- 5 Visqueen TreadGUARD 1500

The Product shall be installed strictly in accordance with the instructions of the Agrément holder and the requirements of this Agrément.

2.3.1 Installer competence level

See section 2.1.6.

2.3.2 Delivery, storage and site handling

See section 2.1.7.

2.3.3 Project specific installation considerations

For ground VOC and ground gas barrier applications, a pre-installation site survey and desktop study have been undertaken to allow determination of the project specific design. For waterproof, damp proof and tanking membrane applications, a desktop study has been undertaken to allow determination of the project specific design.

The Product shall be installed in accordance with the Agrément holder's recommendations and BS 8000-0; and BS 8102 and BS 8485 as appropriate.

In vertical permanent shuttering or temporary formwork applications, the Product may need protection with Visqueen TreadGUARD 1500 against backfilling (depending on the backfill material to be used).

When the Product is loose-laid, and the lap joints are taped, the air temperature should not be below 5°C or falling to prevent the risk of surface condensation affecting the tape adhesion.

Rolls of Visqueen Ultimate Double Sided Jointing Tape and Visqueen Ultimate Gas Resistant (GR) Lap Tape should be kept in a warm, dry place, to ensure the tape is workable and can be more easily applied.

The surface of the Product to be taped shall be dry and free from dirt.

The Product installation shall achieve complete continuity and integrity across the entire building footprint.

The Product shall be sealed at the perimeter and around service pipe penetrations using Visqueen Pro Detailing Strip.

In ground VOC and ground gas barrier applications, the Product installation shall be subject to third-party independent verification and testing to provide validation in accordance with CIRIA C735 and BS 8485.

2.3.4 Preparation

The following works may be required prior to installation of the Product:

- in horizontal pre-applied applications, blind the surface over which the Product is to be applied with compacted soft sand or similar material to fill voids in the hardcore base;
- in waterproofing protection, repair any cracks and joints in the substrate and install an external drainage system as appropriate.

2.3.5 Outline installation procedure

The key sequence for installation is:

- all applications:
 - the Product shall be rolled out with the grey, textured surface laid to receive the concrete when placed, ensuring that the sheet edges are aligned allowing adequate overlap for jointing;
 - all lap joints should be a minimum of 150 mm and bonded using Visqueen Ultimate Double Sided Jointing Tape; the lap joints shall be firmly compressed using a hand roller during taping to ensure an adequate bond is achieved for complete adhesion and continuity; secure and seal taped lap joints using Visqueen Ultimate Gas Resistant (GR) Lap Tape.
- tanking and waterproofing applications:
 - when using the Product in an external waterproofing application, hydrostatic pressure can be relieved by using Visqueen Protect & Drain;
 - a suitable drainage system should be incorporated, in accordance with the requirements of BS 8102.
- vertical permanent shuttering and temporary formwork applications:
 - the Product should be applied with the black, smooth surface facing the permanent shuttering, temporary formwork or an adjoining structure, with Visqueen Ultimate Retaining Discs to secure the leading edge of the Product;
 - a suitable power tool and 6 mm drill bit should be used to create a pilot hole in the Product;
 - Visqueen Ultimate Retaining Discs should be mechanically fixed using oval nails at maximum 400 mm centres;
 - the top edge of the Product should be kept to approximately 20 mm below the top edge of the planned concrete level;
 - once the concrete has set, the oval nails should be removed from the exposed face if temporary formwork is used;
 - when temporary formwork is removed, the Visqueen Ultimate Retaining Discs should be visible on the black, smooth surface of the Product, prior to sealing over with Visqueen Pro Detailing Strip;
 - ensure continuity of the Product with Visqueen Gas Resistant Self Adhesive Membrane (GR SAM).
- horizontal application below or above a concrete ground floor:
 - when underfloor heating is being installed, the Product shall be positioned between the concrete ground floor and insulation layer.
- penetrations, corners and perimeter details:
 - all service pipe penetrations shall be properly detailed in accordance with the Agrément holder's instructions; in ground VOC and ground gas barrier applications, airtight seals shall be formed around all service pipe penetrations using taped Product or preformed Visqueen Ultimate Top Hat Units;
 - external and internal corners should be bonded using Visqueen Ultimate Double Sided Jointing Tape, reinforced using Visqueen Pro Detailing Strip, and sealed using Visqueen Ultimate Gas Resistant (GR) Lap Tape; where this is not possible, and the three-dimensional shape corners required are complex, it is recommended that Visqueen Pre-formed Corner Units are bonded to the Product using Visqueen Ultimate Double Sided Jointing Tape and are sealed using Visqueen Ultimate Gas Resistant (GR) Lap Tape.

2.3.6 Finishing

The following finishing is required upon completion of the installation:

- for pre-applied horizontal applications, concrete is placed over the Product.

The Product shall be incorporated into a finished floor as soon as possible after installation. Care shall be taken to ensure that the Product is not punctured, stretched or displaced when applying a screed layer.

When ambient temperatures are above 25 °C or rising, the Product should be covered immediately after installation.

In vertical shuttering/formwork applications, the Product may require protection with Visqueen TreadGUARD 1500 before backfilling operations commence.

2.4 - INDEPENDENTLY ASSESSED PRODUCT CHARACTERISTICS

2.4.1 Moisture control

Test	Result
Watertightness, in accordance with BS EN 1928 method B at 60 kPa for 24 hours - membrane without joints	Pass, dry
Watertightness, in accordance with BS EN 1928 method A at 60 kPa for 24 hours - membrane with taped joints	Pass, dry
Water vapour transmission of membrane without joints, in accordance with BS EN 1931 method B, desiccant and 75 % RH, density of moisture flow rate	7.31 x 10 ⁻¹⁰ kg/(m ² s)
Moisture resistance factor (μ) of membrane without joints, in accordance with BS EN 1931 method B	4.33 x 10 ⁵
Water vapour permeability of membrane without joints, in accordance with BS EN 1931 method B	0.063 g/m ² day
Water vapour resistance of membrane without joints, in accordance with BS EN 1931 method B	2142 MNs/g

2.4.2 Strength

Test	Result		
Tensile strength of membrane lap joints, in accordance with BS EN 12317-2, at grip separation speed of 100 mm per minute	598 N		
Tensile strength and elongation, in accordance with BS EN 12311-2 method B	Longitudinal direction	Tensile stress	23.6 N/mm ²
		Elongation at max. force	701 %
	Transverse direction	Elongation at break	701 %
		Tensile stress	22.4 N/mm ²
		Elongation at max. force	705 %
		Elongation at break	706 %
Tear strength resistance (trouser tear), in accordance with BS ISO 34-1 method A	Machine direction	79.6 kN/m	
	Cross direction	75.8 kN/m	
Tear strength resistance (angle tear, no nick), in accordance with BS ISO 34-1 method B	Machine direction	128.3 N	
	Cross direction	126.9 N	
Resistance to tearing (nail shank), in accordance with BS EN 12310-1	Longitudinal direction	720 N	
	Transverse direction	750 N	
Static puncture resistance, in accordance with BS EN ISO 12236	Puncture strength	2850 N	
	Puncture displacement	112.8 mm	
Impact resistance hard support, in accordance with BS EN 12691 method A	No punctures at mean drop height 700 mm		
Impact resistance soft support, in accordance with BS EN 12691 method B	No punctures at mean drop height > 2000 mm		
Resistance to static loading, in accordance with BS EN 12730 method B on hard concrete support	Pass at 20 kg applied load		

2.4.3 Fire Performance

Test	Result
Reaction to fire classification, in accordance with BS EN 13501-1	European Classification F* (combustible)

2.4.4 Resistance to chemicals and ground gases

Test	Result		
Gas transmission rate of unjointed membrane to C748 ground VOC vapours - 100 % concentration nine challenge chemicals, in accordance with BS ISO 15105-2 by equal pressure method, 2 days at 23 °C	benzene	0.08 ml/m ² /day	67.7 mg/m ² /day
	toluene	0.09 ml/m ² /day	75.9 mg/m ² /day
	ethyl benzene	0.11 ml/m ² /day	90.7 mg/m ² /day
	xylene	0.01 ml/m ² /day	6.5 mg/m ² /day
	hexane	0.03 ml/m ² /day	19.1 mg/m ² /day
	vinyl chloride	Gas	2.5 mg/m ² /day
	tetrachloroethene	0.00 ml/m ² /day	6.2 mg/m ² /day
	trichloroethylene	0.00 ml/m ² /day	3.1 mg/m ² /day
	naphthalene	Solid	0.3 mg/m ² /day
Radon permeability k, in accordance with SP Method no. 3873	< 3.0 x 10 ¹² m ² /s		
Ground gas transmission rate of methane of unjointed membrane by differential-pressure methods, in accordance with BS ISO 15105-1 at 23 °C, 0 % RH for 24 hours	< 4.94 ml/m ² /day/atm		
Ground gas transmission rate of carbon dioxide of unjointed membrane by differential-pressure methods, in accordance with BS ISO 15105-1 at 23 °C, 0 % RH for 2 days	17 ml/m ² /day/atm		

2.4.5 Durability

Test	Result	
Watertightness - water penetration resistance after artificial heat ageing by 12 weeks at 70 °C, in accordance with BS EN 1296, then exposure to 60 kPa water pressure for 24 hours, in accordance with BS EN 1928 method B	Pass, dry	
Watertightness - after alkali immersion in a saturated solution of Ca(OH) ₂ for 28 days, in accordance with BS EN 1847, then exposure to 60 kPa water pressure for 24 hours, in accordance with BS EN 1928 method B	Pass, dry	
Property changes of membrane without joints after immersion in ground VOC liquid organic solvent blends VOC Blend 1, 25 % each at 50 °C for 56 days, in accordance with CIRIA C748, BS EN ISO 527-1 and BS EN ISO 527-3: <ul style="list-style-type: none"> - benzene - toluene - ethyl benzene - o,m,p xylene isomer blend 	Thickness change	-3.06 %
	Weight change	-1.88 %
	Tensile strength change	-20.1 %
	Elongation change	0.9 %
Property changes of membrane without joints after immersion in ground VOC liquid organic solvent blends VOC Blend 2, 12.5 % each at 50 °C for 56 days, in accordance with CIRIA C748, BS EN ISO 527-1 and BS EN ISO 527-3: <ul style="list-style-type: none"> - benzene - toluene - ethyl benzene - o,m,p xylene isomer blend - xylene - hexane - tetrachloroethene - trichloroethylene 	Thickness change	2.04 %
	Weight change	2.82 %
	Tensile strength change	-20.2 %
	Elongation change	-20.5 %

2.5 - PRODUCT COMPONENTS AND ANCILLARY ITEMS

2.5.1 Components included within the scope of this Agrément

The following components are integral to use of the Product:

- Visqueen Ultimate GeoSeal - membrane - 41 m long by 2.44 m wide roll, 1.0 mm thick, roll coverage 100 m²;
- Visqueen Ultimate Double Sided Jointing Tape - 100 mm by 15 m double-sided self-adhesive blue butyl strip tape for bonding the membrane laps;
- Visqueen Ultimate Gas Resistant (GR) Lap Tape - 150 mm by 10 m single-sided self-adhesive with an integral foil for sealing the membrane laps.

2.5.2 Ancillary items falling outside the scope of this Agrément

Ancillary items detailed in this section may be used in conjunction with the Product but fall outside the scope of this Agrément:

- High Performance Vapour Barrier - a vapour control layer;
- Visqueen Adjustable Z vent & Air Brick - plastic venting solution;
- Visqueen Fixing Strip System - plastic strip and nails for securing a DPC to the inner blockwork leaf of a masonry wall;
- Visqueen Double Sided Tape - 10 m long by 50 mm wide double-sided adhesive tape;
- Visqueen TreadGUARD 1500 - a heavy-duty protection board used to prevent damage to the Product;
- Visqueen Gas Vent Mat - a 25 mm thick vent mat that forms a void to collect and exhaust VOCs and ground gases;
- Visqueen Zedex CPT DPC - a high-performance, flexible DPC and cavity tray;
- Visqueen Preformed Cavity Tray Unit - built-in and surface fixed design options; standard sizes available for a range of cavity widths, reduces the installation time of DPC cavity tray at complex/awkward junctions, simplify detailing at corners, changes of level, etc.;
- Visqueen Vapour Barrier - single wound polyethylene sheeting with vapour resistance > 530 MN/g which reduces the risk of cracks in screed, to omit the risk of interstitial condensation within a structure, as well as improving the general airtightness of the building;
- Visqueen DPC Surface Fixing System - a semi-flexible black plastic strip, 2 m long, 25 mm to 30 mm wide. The strip is pre-drilled at approximate 150 mm centres (13 to 14 holes per strip) - secures DPC to cavity wall constructions. The insulation pins are available in two options:
 - masonry (including blockwork, cast concrete etc) - A grey plastic fixing pin with a central nail. Hammering the central nail into the body of the fixing expands the fixing securing it in the drilled hole. Supplied in a box of 50;
 - insulation - a black plastic, fir-tree, push-fit fixing pin. Supplied in a bag of 500 pins;
- Visqueen Ultimate Retaining Discs - a plastic disc head 35 mm diameter with a 50 mm long shaft supplied in boxes of 500; secures Visqueen Ultimate GeoSeal to vertical applications such as permanent shuttering, temporary formwork or adjoining structures;
- Visqueen Protect & Drain - available in 12 mm and 25 mm thicknesses; used to protect the Product during back-filling operations and to promote the drainage of water away from a structure;
- Visqueen Cavity Drain Membrane System - V20 Cavity Drain Membrane, V8 Wall Membrane and Cavity Drain Components (range of drainage channels, pumps, sumps and alarms); the components provide mechanical drainage solutions for all below-ground structures where a cavity drain system is being installed and is designed to be fully maintainable, in accordance with BS 8102;
- Visqueen Gas Resistant Self Adhesive Membrane (Visqueen GR SAM) - self-adhesive membrane with integral aluminium foil for resistance to methane;
- Visqueen High Performance (HP) Tanking Primer - a black elastomeric bituminous priming solution; suitable for green concrete and damp surfaces;
- Visqueen Ultimate Top Hat Unit - preformed top hat unit for ground gas-tight sealing around service entry pipe penetrations;
- Visqueen Pro Detailing Strip - self-adhesive strip used for sealing at complex junctions, terminations and stanchions, around column penetrations and for repairs/patching of Product damaged during installation;
- Visqueen Pre-formed Corner Unit - black HDPE internal and external corner units;
- Visqueen Pre-formed Unit - used at doorways and thresholds;
- gas-resistant DPC - a flexible polyethylene DPC with an aluminium foil designed to prevent the transmission of methane ground gas;
- rigid polystyrene insulation - floor insulation.

CHAPTER 3 - CDM, NATIONAL BUILDING REGULATIONS AND THIRD-PARTY ACCEPTANCE

3.1 - THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2015 AND THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS (NORTHERN IRELAND) 2016

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

3.2 - NATIONAL BUILDING REGULATIONS

In the opinion of Kiwa Ltd., the Product, if installed and used in accordance with Chapter 2 of this Agrément, can satisfy or contribute to satisfying the relevant requirements of the following national Building Regulations.

3.2.1 - ENGLAND THE BUILDING REGULATIONS 2010 AND SUBSEQUENT AMENDMENTS

- C1(2) Preparation of site and resistance to contaminants - the Product can contribute to separating the occupants from contaminants in the ground
- C2(a) Resistance to moisture - floors/basements incorporating the Product can contribute to protecting a building from ground moisture
- Regulation 7(1) Materials and workmanship - the Product is manufactured from suitably safe and durable materials for the application and can be installed to give a satisfactory performance

3.2.2 - WALES THE BUILDING REGULATIONS 2010 AND SUBSEQUENT AMENDMENTS

- C1(2) Preparation of site and resistance to contaminants - the Product can contribute to separating the occupants from contaminants in the ground
- C2(a) Resistance to moisture - floors/basements incorporating the Product can contribute to protecting a building from ground moisture
- Regulation 7(1) Materials and workmanship - the Product is manufactured from suitably safe and durable materials for the application and can be installed to give a satisfactory performance

3.2.3 - SCOTLAND THE BUILDING (SCOTLAND) REGULATIONS 2004 AND SUBSEQUENT AMENDMENTS

3.2.3.1 Regulations 8(1) Durability, workmanship and fitness of materials

- The Product is durable and fit for its intended purpose

3.2.3.2 Regulation 9 Building standards - construction

- 3.1 Site preparation - harmful and dangerous substances - the Product can contribute to separating a building and occupants from harmful or dangerous substances
- 3.4 Moisture from the ground - floors/basements incorporating the Product can contribute to protecting a building from moisture penetration from the ground
- 7.1(a)(b) Statement of sustainability - the Product can contribute to satisfying the relevant Requirements of Regulation 9, Standards 1 to 6 and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard

3.2.3.3 Regulation 12 Building standards - conversions

- All comments given under Regulation 9 also apply to this Regulation, with reference to Schedule 6

3.2.4 - NORTHERN IRELAND THE BUILDING REGULATIONS (NORTHERN IRELAND) 2012 AND SUBSEQUENT AMENDMENTS

- 23(a)(b) Fitness of materials and workmanship - floors/basements incorporating the Product are suitable and can be adequately prepared and applied
- Regulation 26(1)(b) Site preparation and resistance to contaminants - the Product can contribute to separating a building and occupants from harmful contaminants
- Regulation 28(a)(b) Resistance to moisture and weather - floors/basements incorporating the Product can contribute to protecting a building from the passage of moisture from the ground and the weather

3.3 - THIRD-PARTY ACCEPTANCE

NHBC - In the opinion of Kiwa Ltd., the Product, if installed, used and maintained in accordance with this Agrément, 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, 5.2 Suspended ground floors and 5.4 Waterproofing of basements and other below-ground structures.

CHAPTER 4 - SOURCES

- BS EN ISO 527-1:2019 Plastics. Determination of tensile properties. General principles
- BS EN ISO 527-3:2018 Plastics. Determination of tensile properties. Test conditions for films and sheets
- BS EN ISO 9001:2015 Quality management systems - Requirements
- BS EN ISO 12236:2006 Geosynthetics. Static puncture test (CBR test)
- BS EN ISO 14688-1:2018 Geotechnical investigation and testing. Identification and classification of soil. Identification and description
- BS EN ISO 22476-1:2012 Geotechnical investigation and testing. Field testing. Electrical cone and piezocone penetration test
- BS EN 1997-2:2007 Eurocode 7. Geotechnical design. Ground investigation and testing
- BS EN 13501-1:2018 Fire classification of construction products and building elements. Classification using data from reaction to fire tests
- BS 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
- BS EN 14414:2004 Geosynthetics. Screening test method for determining chemical resistance for landfill applications
- BS EN 14415:2004 Geosynthetic barriers. Test method for determining the resistance to leaching
- BS ISO 34-1:2015 Rubber, vulcanized or thermoplastic. Determination of tear strength. Trouser, angle and crescent test pieces
- 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
- BS 8000-0:2014 Workmanship on construction sites. Introduction and general principles
- 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 8576:2013 Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs)
- BS 10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of practice. Code of practice
- BRE Report 211:2015 Radon: Guidance on protective measures for new buildings;
- BRE Report 212:1991 Construction of new building on gas-contaminated land;
- BRE Report 414:2001 Protective measures for housing on ground gas-contaminated land
- CIEH - The Local Authority Guide to Ground Gas:2008
- CIRIA C665:2007 Assessing risks posed by hazardous ground gases to buildings
- CIRIA C682:2009 VOCs handbook: investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination
- CIRIA C716D:2012 Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination
- CIRIA C735:2014 Good practice on the testing and verification of protection systems for buildings against hazardous ground gases
- CIRIA C748:2014 Guidance on the use of plastic membranes as VOC vapour barriers
- CIRIA R149:1995 Protecting development from methane
- CIRIA R152:1995 Risk assessment for methane and other gases from the ground
- CL:AIRE research bulletin RB 17:2012 A Pragmatic Approach to Ground Gas Risk Assessment
- NHBC Standards 2020

Remark: apart from these sources, technical information and confidential reports have been assessed; any relevant documents are in the possession of Kiwa Ltd. and kept in the Technical Assessment File of this Agrément. The Installation Manual for the Product may be subject to change, the Agrément holder should be contacted for clarification of revision.

CHAPTER 5 - AMENDMENT HISTORY

Revision	Amendment Description	Amended By	Approved By	Date
-	First Issue	C Devine	C Vurley	February 2021