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13th February 2023

ref: A10967-7/230201/L1

Rafal Chodkowski
Berkeley Homes (Oxford & Chiltern) Ltd
Mill Lane
Taplow
Maidenhead
SL6 0AG
By Email only: Rafal.Chodkowski@berkeleygroup.co.uk

Dear Rafal,

RE: Vastern Road, Reading Gas specification – Gas installation and validation brief

Please find attached Omnia report A10967-7/230201/L1 detailing the gas specification details for the above site.

If you have any questions, please do not hesitate to contact us.

Yours sincerely,
For Omnia

A handwritten signature in black ink that reads "O. Maxwell".

Olivia Maxwell
Senior Geo-Environmental Consultant

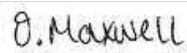
A handwritten signature in black ink, appearing to be "Tim Mitchell".

Tim Mitchell
Director

- Attachment 1 Omnia Figures
- Attachment 2 Symmetry Architects Drawings
- Attachment 3 Proctor Protech VOC Flex Specification Sheets and Installation Guidance

QUALITY ASSURANCE

Project Number: A10967
December 2022

 Geo-Environmental	Gas Specification – February 2023					
	Prepared by:	O. Maxwell	Date:	01/02/23	Signature:	
	Checked by:	T. Mitchell	Date:	13/02/23	Signature:	

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Office 110 Business First
Millennium City Park,
Millennium Road,
Preston, PR2 5BL
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Ecology



Acoustics



Geotechnical



Geo-environmental



Air Quality

Site Address	55 Vastern Road, Reading, Berkshire, RG1 8BU
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1 Background

Omnia were commissioned by Berkeley Homes (Oxford & Chiltern) Ltd to provide a Gas Specification further to a series of investigations at the site comprising 55 Vastern Road, Reading, Berkshire, RG1 8BU.

It is understood that the proposed development consists of the *‘Demolition of existing structures and erection of a series of buildings ranging in height from 1 to 11 storeys, including residential dwellings (C3 use class) and retail floorspace (A3 use class), together with a new north-south pedestrian link, connecting Christchurch Bridge to Vastern Road’*

The outline proposed site layout is presented as Figure 2.0 (Attachment 1).

The site has been subject to numerous phases of investigation and reporting, as detailed below:

- Omnia Report A10967/2.3 – Remediation Method Statement, 55 Vastern Road, Reading, Berkshire, RG1 8BU’ dated January 2023.
- Omnia Report A10967/3.1 – ‘Phase II Supplementary Geo-Environmental Site Assessment, 55 Vastern Road, Reading, Berkshire, RG1 8BU’ dated November 2022.
- Omnia Ground Gas Monitoring Assessment ref: A11220/221115/L1 dated 15th November 2022.
- OEC Report A10967/1.0 Draft – ‘Phase I-II Geo-Environmental Site Assessment and DQRA, 55 Vastern Road, Reading, Berkshire, RG1 8BU’ dated April 2018.
- Peter Brett Associates (PBA) Technical Note Tn002/Rev0 – Preliminary Summary of Ground Investigation – SSE Site, Vastern Road, Reading dated 20th March 2018.
- CC Ground Investigations (CCGI) Report C5925/01 – Draft Factual Report – SSE Site, Vastern Road, Reading dated 12th March 2018.
- Email communication between SSE and their consultant Adler & Allan regarding the findings of the preliminary investigation to identify the location of the leakage – Dated October 2017.

The ground gas assessment presented in Omnia Gas Assessment A11220/221115/L1 classified the site as Characteristic Situation 3 (CS-3) for the proposed Block A, and CS-2 for the remainder of the site in accordance with guidance set out in BS8485:2015 +A1:2019.

The RMS presented in Omnia report A10967/2.3 sets out that measures are required to be selected as appropriate to achieve a protection score level of **4.0** and **3.5** respectively from Block A and the remainder of the site and comprise elements as presented within BS8485:2015+A1:2019, Section 7, Tables 5, 6 & 7.

Ground gas protection measures should be installed in accordance with a standalone Ground Gas Specification document (detailed herein), which should include a design produced by a suitably qualified and experienced engineer, and subsequently installed by a suitably qualified and experienced installation contractor.

Due to elevated concentrations of TPH C₁₂-C₁₆, which are considered to have the potential to present a vapour inhalation risk, beneath the site, the specification for Ground Gas protection membranes should be such that the membrane is dual purpose and also provides sufficient protection against hydrocarbon vapours.

All proposals for remediation must be signed off by the regulator (Local Authority/Warranty Provider/ Environment Agency) ahead of adoption on site. To do otherwise would be progressing at risk with the potential for further costs later in the project.

2 Scope

This letter serves to act as the gas specification for the site which is based on the findings of ground investigation undertaken previously. The document will comprise:

- ☞ Review of schematics for the scheme;
- ☞ Presentation of points build up in line with BS8485;
- ☞ Detail of membrane type including assessment of suitability;
- ☞ Verification process to demonstrate compliance.

3 Parties Involved

Name of Organisation	Function / Interest
Berkeley Homes (Oxford & Chiltern) Ltd	Client
Omnia	Geo-Environmental Consultant
Reading Borough Council (RBC)	Human Health Regulator / Local Planning Authority
The Environment Agency	Controlled Waters Regulator

4 Installation overview

Protection measures have been proposed to consist of the following for each Block, as detailed in Table 4-1 and detailed within drawings 1788-SYM-ZZ-XX-DR-A-0700 P02 and 1788-SYM-ZZ-XX-DR-A-0701 P02.

Table 4-1 Gas Protection Measures Proposed

	Block A		Block B-G	
	Item	Score	Item	Score
Structural Barrier	Cast in-situ reinforced concrete slab	1.5	Cast in-situ reinforced concrete slab	1.5
Ventilation	Proctor Provoid 12 geocomposite void former	0.5	None	None
Gas Membrane	Proctor Protech VOC Flex Membrane	2	Proctor Protech VOC Flex Membrane	2
Total		4.0		3.5

4.1.1 Block A Protection Measures

From a review of the information provided to Omnia, as highlighted above, it is understood that the proposed installation works comprise the installation of a Proctor Provoid 12 geo-composite void former across the entire footprint of the structure, connected to external propriety venting outlets (point score

of 0.5), with a cast in-situ reinforced concrete slab across the entire footprint of the structure (point score of 1.5) overlain by with the Proctor Protech VOC Flex Membrane installed above, again across the entire structure footprint (point score of 2.0).

On the basis of the information provided, Omnia consider that the proposed protection measures achieve a point score of 4.0. This meets the criteria of a CS-3 development under BS8485:2015 +A1:2019 for a Type B building. All measures will need to be successfully validated.

Proctor Protech VOC Flex Membrane is also hydrocarbon resistant, which meets the requirements of the RMS (A10967/2.3).

All aspects of the protection system are to be installed as set out within drawings number 1788-SYM-ZZ-XX-DR-A-0700 P02, in line with current guidance, and to the manufacturers specifications, as set out within the Protech VOC Flex Installation Guide.

4.1.2 Block B – G Protection Measures

From a review of the information provided to Omnia, as highlighted above, it is understood that the proposed installation works comprise the installation of a cast in-situ reinforced concrete slab across the entire footprint of the structure (point score of 1.5) overlain by with the Proctor Protech VOC Flex Membrane installed above, again across the entire structure footprint (point score of 2.0).

On the basis of the information provided, Omnia consider that the proposed protection measures achieve a point score of 3.5. This meets the criteria of a CS-2 development under BS8485:2015 +A1:2019 for a Type B building. All measures will need to be successfully validated.

Proctor Protech VOC Flex Membrane is also hydrocarbon resistant, which meets the requirements of the RMS (A10967/2.3).

All aspects of the protection system are to be installed as set out within drawings number 1788-SYM-ZZ-XX-DR-A-0701 P02, in line with current guidance, and to the manufacturers specifications, as set out within the Protech VOC Flex Installation Guide.

5 Site Overview

Drawing reference O.448.ENG.028 – Gas Protection Measures dated September 2022, produced by Berkeley Homes, sets out the gas classification for each block.

6 Installation Guidance

All installations are to be undertaken and installed as set out within Symmetry Architecture's drawings 1788-SYM-ZZ-XX-DR-A-0700 P02 and 1788-SYM-ZZ-XX-DR-A-0701 P02, following the methodology as set out in Protech VOC Flex Installation Guide. Drawings are provided in Attachment 2.

All installations are to be undertaken in line with the product manufacturers guidance documentation, to allow for conformity with CIRIA C735, Good Practice on the Testing and Verification of Protection Systems. This will allow for a smooth and efficient installation process to minimise damage and non-conformities.

6.1 Geo-composite Void Former – Block A Only

A geo-composite void former has been adopted as part of the gas protection measures on site for Block A only and consists of the Proctor Provoid 12 geocomposite void former which will be laid on top of the sub-base comprising 100/150mm of Type 1 to give full coverage of the building footprint and connected to external vents, understood to comprise two (2no.) vents per wall run. It is understood there will be one (1no.) row of void former beneath any habitat space.

6.2 Gas Protection Membrane

A ground gas membrane has been adopted for the protection measures on site and consists of the Proctor Protech VOC Flex Membrane, which protects against Methane, Carbon Dioxide, hydrocarbons and Radon gases.

The membrane is to be installed by a suitably experienced NVQ Level 2 trained installers in line with Symmetry Architecture's drawings 1788-SYM-ZZ-XX-DR-A-0700 P02 and 1788-SYM-ZZ-XX-DR-A-0701 P02, following the methodology as set out in Protech VOC Flex Installation Guide included as Attachment 3.

A full line out approach across the floor area is to be adopted to minimise damage and non-conformities to the installed membrane, with protection boards laid directly on top of the membrane. Once the membrane has a passed verification inspection, the remainder of the floor construction can continue.

The gas membrane should not be trafficked by follow-on trades until protection has been applied, with this information communicated to all site personnel during site induction, as to comply with CIRIA C735.

6.3 Membrane Jointing

It is understood that jointing and sealing will be undertaken using Heat Welding with membranes overlapped by at least 50mm as set out in Protech VOC Flex Gas Protection Installation Guide included as Attachment 3.

If membranes are to be tape jointed membranes are to be overlapped by at least 150mm, with Protech GM double sided tape 50mm from the front edge of the membrane as set out in Protech VOC Flex Gas Protection Installation Guide included as Attachment 3.

6.4 Corner Detailing

All corner detailing will utilise a manufacturer specified Gas Resistant Self-Adhesive Membrane (GRSAM) with all corner details being formed to create an airtight seal as set out in Protech VOC Flex Gas Protection Installation Guide included as Attachment 3.

6.5 **Service Penetration Points**

It is understood that all service penetration points will comprise bespoke 'Top Hats' formed from the manufacturer specified GRSAM specifically for each service penetration point. All aspects of the detailing should create an airtight seal as set out in Protech VOC Flex Gas Protection Installation Guide included as Attachment 3.

7 **Validation**

In accordance with CIRIA C735 a risk-based approach to verification has been adopted. Given that the site is classified as CS-3 (with ventilation measures proposed) and CS-2 (with no ventilation measures proposed), it is considered the gas regime poses an intermediate risk. Consideration has been given to the VOC risk on site, however it is not considered suitable to raise the risk level to high as hydrocarbons that present a vapour risk have not been identified at a high density across the site, or at significantly elevated concentrations. Therefore, an intermediate risk is considered suitable.

The following table summarises the risk based approach to verification of the installation of gas protection measures, in accordance with CIRIA C735 Annex 1.

Table 7-1 Summary of Risk Based Approach to Verification

Gas Regime / Risk	Intermediate Risk
Slab Type	Reinforced Slab
Installer Experience	Qualified and Experienced Installer (NVQ Level 2)

Based on the risk based approach summarised above, the following verification procedure will be required on-site:

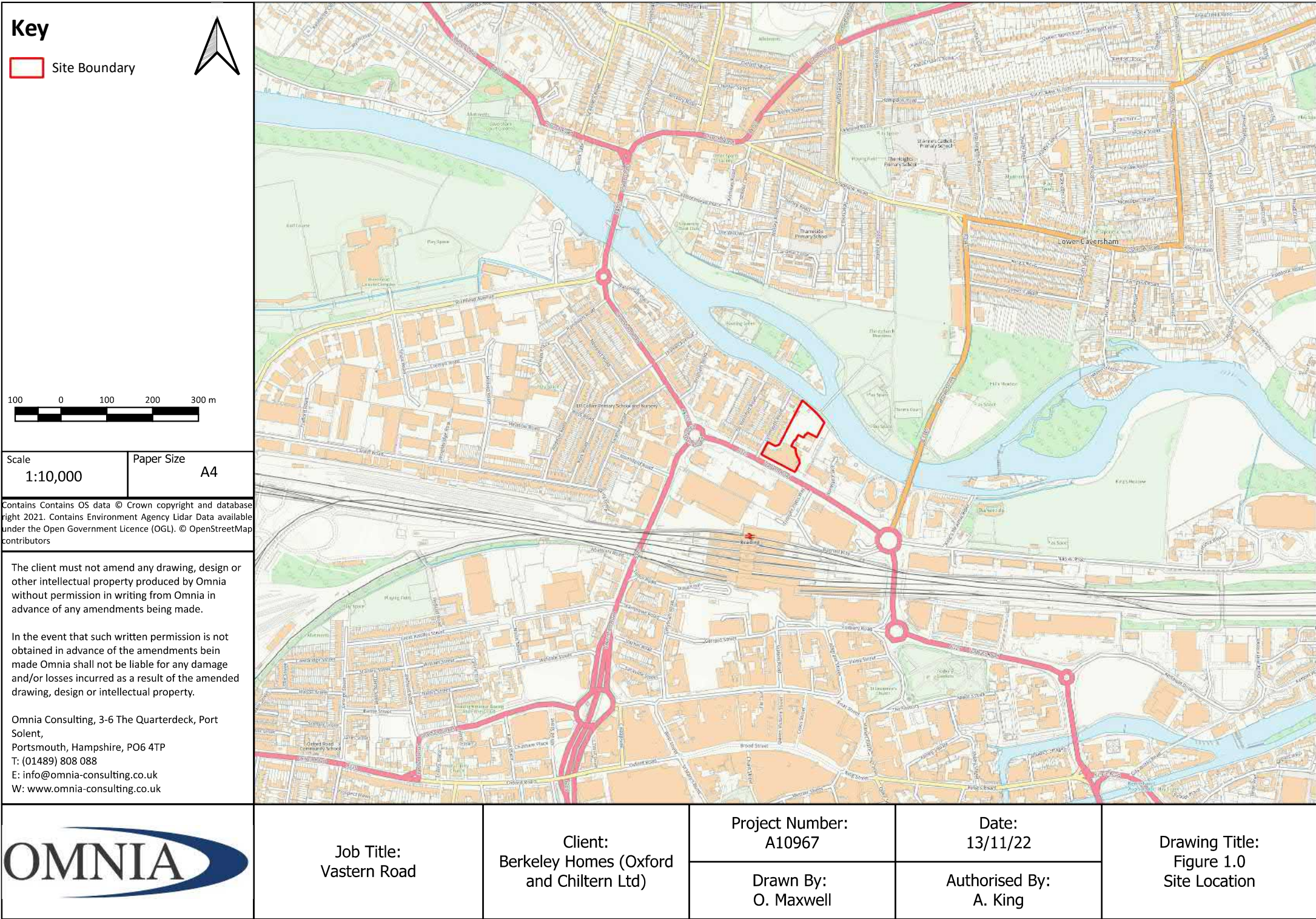
-  Verifier to conduct thorough visual verification of void former, number of ventilation ducts and subgrade inspection prior to 50% of concrete pours;
-  Independent Third Party to undertake Air Lance Testing in accordance with ASTM D4437 on 25% of joints, pipe penetrations, corners and seals of the installed membrane;
-  Installer to test remaining joints, pipe penetrations, corners and seals of the installed membrane to a recognised standard as detailed in their method statement and CQA Plan;
-  Installer to provide sign off sheets including sub grade acceptance forms, photographs of installed membranes and inspections to independent verifier;

A verification report will be required once all sign off sheets have been provided, to provide confirmation that all measures have been undertaken.

Upon completion, this document should be submitted to the Local Authority for approval, to allow subsequent discharge of the associated Planning Condition.

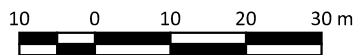
END OF REPORT

Attachment 1
Omnia Figures



Key

 Site Boundary



Scale
1:1,000

Paper Size
A4

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Project Number:
A10967

Job Title:
Vastern Road

Client:
Berkeley Homes (Oxford
and Chiltern) Ltd

Date:
13/11/2022

Drawn By:
O. Maxwell

Authorised By:
A. King

Drawing Title:

Figure 2.0
Proposed Development

Key

Site Boundary

Gas Classification

CS-2

CS-3



Scale
1:1,000

Paper Size
A4

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Job Title:
Vastern Road

Client:
Berkeley Homes (Oxford and Chiltern) Ltd

Project Number:
A10967

Drawn By:
O. Maxwell

Date:
08/12/2022

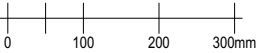
Authorised By:
A. King

Figure 3.0
Drawing Title:

Gas Classification

Attachment 2

Symmetry Architects and Berkeley Homes Drawings

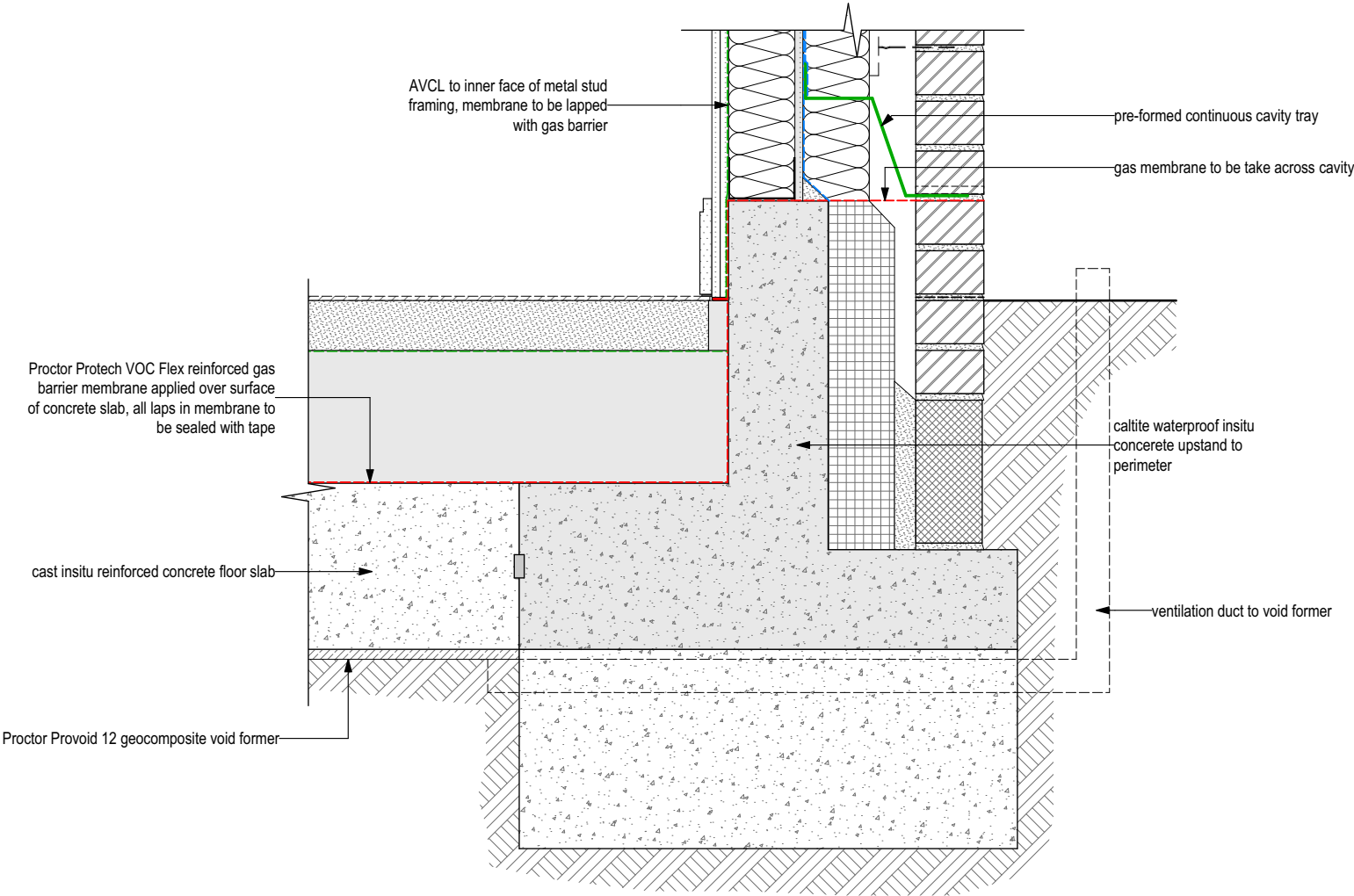


Floor construction to achieve CS-3 Classification

Building Type B
Minimum score 4

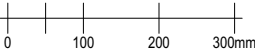
Structural barrier:	Cast insitu reinforced slab concrete slab	Score: 1.5
Ventilation:	Proctor Provoid 12 pressure relief	Score: 0.5
Gas Membrane:	Proctor Protech VOC Flex membrane	Score: 2

Total Score: 4.0 (PASS)



Floor Construction Detail
Block A

Rev	Date	By	Description
P02	02/02/2023	JF	Gas membrane amended
P01	26/01/2023	SA	Initial Issue

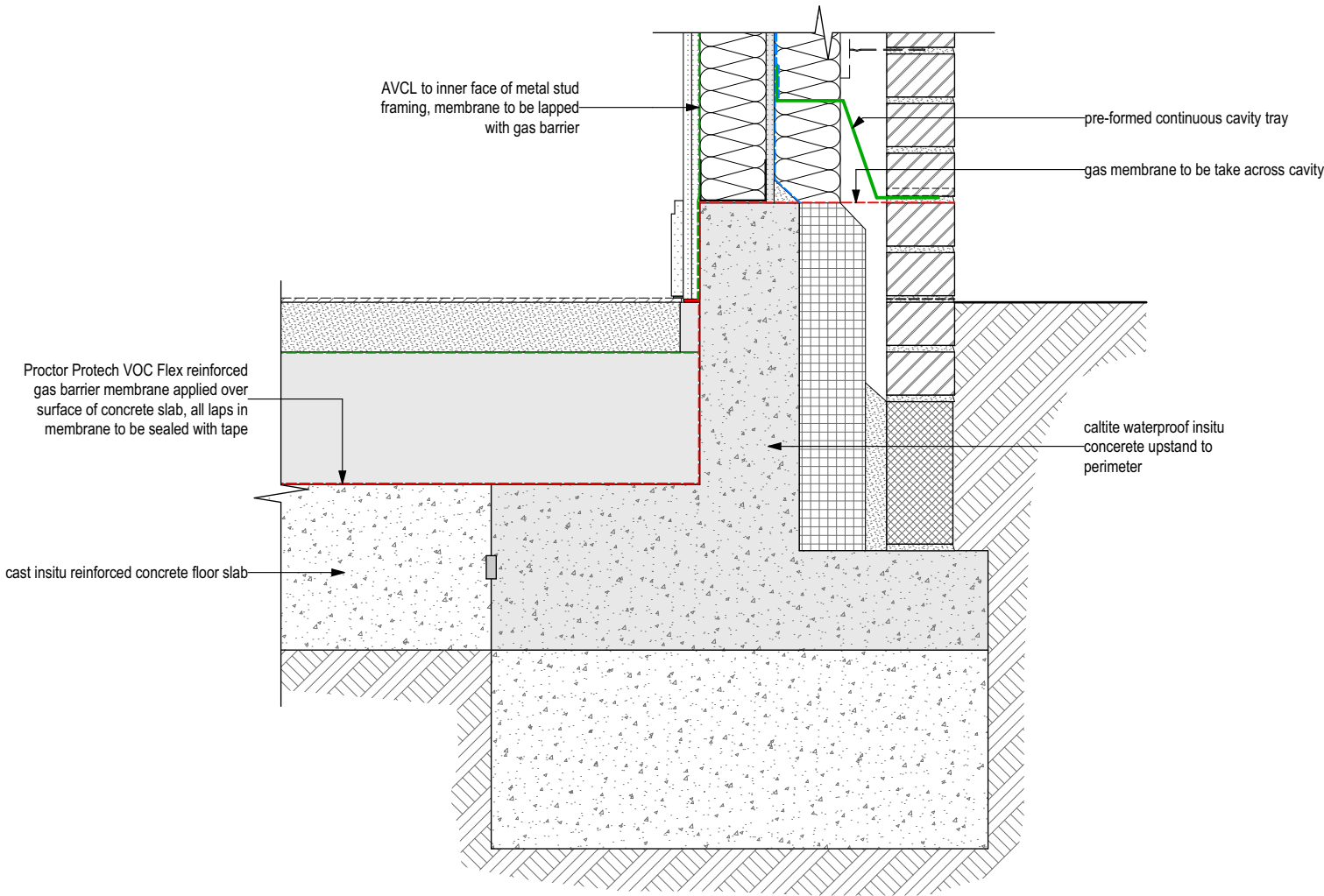


Floor construction to achieve CS-2 Classification

Building Type B
Minimum score 3.5

Structural barrier:	Cast insitu reinfirced slab concrete slab	Score: 1.5
Ventilation:	No ventilation measures	Score: 0
Gas Membrane:	Proctor Protech VOC Flex membrane	Score: 2

Total Score: 3.5 (PASS)



Floor Construction Detail
Blocks B-G

Rev	Date	By	Description
P02	02/02/2023	JF	Gas membrane amended
P01	26/01/2023	SA	Initial Issue



Block A requires further investigation post demo - classification to be confirmed.

key plan

notes

Key -

CS3 Gas Protection

CS2 Gas Protection

PRELIMINARY

A 13/12/19 NAC Foundation Type and Block reference amended

revision	date	prepared	description

Berkeley
Designed for life

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SL2 3RQ

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project
Vastern Road
Reading

drawing
Gas Protection Measures

date	scale @ a1 (a3)	drawn
Sep 2022	1:500	RGM
drawing number	revision	
O.448.ENG.028	-	

0 1 5 10 20 50m

Attachment 3

Proctor Protech VOC Flex Specification Sheets and Installation Guidance

A Proctor Group Ltd

The Haugh
Blairgowrie
Perthshire PH10 7ER

Tel: 01250 872261 Fax: 01250 872727

e-mail: contact@proctorgroup.com

website: www.proctorgroup.com



Agrément Certificate

20/5723

Product Sheet 1

PROTECH GAS RESISTANT MEMBRANES

PROTECH VOC FLEX

This Agrément Certificate Product Sheet⁽¹⁾ relates to Protech VOC Flex, a multilayer thermoplastic membrane that is resistant to ground gases, hydrocarbons and volatile organic compounds (VOCs). The product is for use as a damp-proof membrane and to protect the building from the ingress of water vapour, radon, methane, carbon dioxide, hydrocarbons and VOCs.

(1) Hereinafter referred to as 'Certificate'.

CERTIFICATION INCLUDES:

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



KEY FACTORS ASSESSED

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

Resistance to underground gases — the product is capable of restricting 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 damage — the product has satisfactory resistance to damage (see section 9).

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's for the lifetime of the structure in which it is installed (see section 11).



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

Date of First issue: 13 February 2020

Hardy Giesler
Chief Executive Officer

The BBA is a UKAS accredited certification body – Number 113.

The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk
Readers MUST check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA directly.

Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.

British Board of Agrément

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Watford
Herts WD25 9BA

©2019

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clientservices@bbacerts.co.uk
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Regulations

In the opinion of the BBA, Protech VOC Flex, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	C1(2)	Site preparation and resistance to contaminants
Comment:	The product will contribute to a construction satisfying this Requirement. See sections 7.1, 7.2 and 8 of this Certificate.	
Requirement:	C2(a)	Resistance to moisture
Comment:	The product, including joints, will enable a structure to satisfy this Requirement. See section 6 of this Certificate.	
Regulation:	7(1)	Materials and workmanship
Comment:	The product is acceptable. See section 11.1 and the <i>Installation</i> part of this Certificate.	



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:	The use of the product satisfies the requirements of this Regulation. See section 11.1 and the <i>Installation</i> part of this Certificate.	
Regulation:	9	Building standards applicable to construction
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's enabling compliance with these Standards, with reference to clauses 3.1.2 ⁽¹⁾⁽²⁾ , 3.1.6 ⁽¹⁾⁽²⁾ , 3.1.7 ⁽¹⁾⁽²⁾ and 3.2.2 ⁽¹⁾⁽²⁾ . 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 ⁽¹⁾⁽²⁾ , 3.4.4 ⁽¹⁾⁽²⁾ 3.4.6 ⁽¹⁾⁽²⁾ . See section 6 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.	
Regulation:	12	Building standards applicable to conversions
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 ⁽¹⁾⁽²⁾ and Schedule 6 ⁽¹⁾⁽²⁾ .	

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).



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

Regulation:	23(a)(i)	Fitness of materials and workmanship
Comment:	(iii)(b)(i)	The product is acceptable. See section 11.1 and the <i>Installation</i> part of this Certificate.

Regulation:	26(1)(b)	Site preparation and resistance to contaminants
Comment:	26(2)	The product will contribute to a construction satisfying the requirements of this Regulation. See sections 7.1, 7.2 and 8 of this Certificate.
Regulation:	28(a)	Resistance to moisture and weather
Comment:		The product, including joints, will enable a structure to satisfy this Regulation. See section 6 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* (3.2 and 3.3) of this Certificate.

Additional Information

NHBC Standards 2020

In the opinion of the BBA, Protech VOC Flex, 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*, for use below the slab and in sandwich constructions, and 5.2 *Suspended ground floors*, Clauses 5.2.3 *Contaminants* and 5.2.10 *Damp proofing and ventilation*.

CE marking

The Certificate holder has taken the responsibility of CE Marking the product in accordance with harmonised European Standard EN 13967 : 2012.

Technical Specification

1 Description

1.1 Protech VOC Flex is a multilayer membrane consisting of layers of polyethylene, low density polyethylene (LDPE) and Ethylene vinyl alcohol (EVOH), with a polypropylene reinforcing core.

1.2 The product is available in an orange colour and has the nominal characteristics given in Table 1.

Table 1 Nominal characteristics

Characteristic (unit)	Protech VOC Flex
Thickness (mm)	0.55
Roll length (m)	50
Roll width (m)	2.0
Mass per unit area (g·m ⁻²)	564
Impact resistance (mm)	300
Tensile strength* (N per 50 mm)	
MD	700
CD	640
Elongation (%)	
MD	30
CD	20
Water vapour transmission (g·m ⁻² ·day ⁻¹)	0.0627
Watertightness (60 kPa)	Pass
Nail tear (N)	
MD	500
CD	540
Resistance to static loading (kg)	25

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

- Protech VOC Starter Band — for use to continue gas/VOC protection through the cavity
- Protech Protection Boards — for use above and below the membrane to protect it from damage during installation
- Protech GM Protection Fleece — for use above and below the membrane to protect it from damage during installation pre-fabricated corner units and top hats
- tapes for sealing around penetrations and pile caps
- gas-resistant damp-proof course (dpc) — used through junctions with cavities or masonry to protect against the ingress of gas and damp.

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.

2.3 The management system of the manufacturer have been assessed and registered as meeting the requirements of EN ISO 9001 : 2015 by Bureau Veritas, Belgium (Certificate BE011118).

3 Delivery and site handling

3.1 The product is delivered to site in 50 x 2 m rolls wrapped with cardboard protection on pallets. Pallets include a maximum of 12 rolls.

3.2 The rolls have a nominal weight of 56 kg.

3.3 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 Protech VOC Flex.

Design Considerations

4 Use

4.1 Protech VOC Flex is satisfactory for use as a gas-resistant barrier to restrict the ingress of radon, methane, carbon dioxide and VOCs into buildings from landfill and naturally occurring sources. The product is chemically-resistant when in contact with hydrocarbons, see section 8.

4.2 Buildings in areas at risk from radon, methane or carbon dioxide should be constructed in accordance with the recommendations of BRE Report BR 211 : 2015, and following the guidance set out in BS 8485 : 2015.

4.3 When used in buildings in areas at risk from VOCs, the guidance given in CIRIA Report C748 : 2014 should be followed.

4.4 The product is also satisfactory for use as a damp-proofing membrane for solid and suspended ground floors in accordance with the relevant clauses of CP 102 : 1973 Section 3, BS 8000-0 : 2014 and BS 8000-4 : 1989.

4.5 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 are experienced with this type of product. In gas/chemical applications, hot air welding specifications must be obtained from the Certificate holder.

6 Resistance to water and water vapour



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

6.2 The membrane complies with the minimum thickness detailed in the documents supporting the national Building Regulations.

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 Protech VOC Flex are given in Table 2.

Table 2 Measured gas transmission rates of Protech VOC Flex

Gas	Method	Result
Methane	ISO 15105-1	<0.1 ml·m ⁻² ·day ⁻¹ ·atm ⁻¹

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 product, including hot air welded joints, is resistant to the chemicals commonly found on construction sites. The results of immersion tests on a range of chemicals, including hydrocarbons, are given in Table 3. Site-specific examination and assessment should be carried out to CIRIA C682 and CIRIA C716 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 Protech VOC Flex

Test method	Exposure chemical(s)	Retained Tensile strength/elongation (%)	Result
BS EN 14414 : Method A	Sulphuric acid (10% solution)	MD 105/91 CD 96/94	Pass
BS EN 14414 : Method B	Calcium hydroxide solution (saturated)	MD 100/89 CD 100/93	Pass
BS EN 14414 : Method C	Diesel, paraffin, lubricating oil mixture	MD 99/91 CD 88/95	Pass
BS EN 14414 : Method D	Synthetic leachate comprising a mixture of organic acids, glucose, chlorides, sulfates and phosphate	MD 906/94 CD 93/99	Pass
BS EN 14415 : Method A	Leaching by hot water (distilled water)	MD 105/93 CD 103/99	Pass
BS EN 14415 : Method B	Leaching by aqueous alkaline liquids (saturated Ca(OH)_2)	MD 105/99 CD 102/97	Pass
BS EN 14415 : Method C	Leaching by organic alcohols (30% methanol, 30% 2-propanol, 40% 1,2 ethandiol)	MD 106/91 CD 107/113	Pass
BS EN 14414	Benzene (saturated solution in water)	MD 100/89 CD 100/93	Pass
	Toluene (saturated solution in water)	MD 99/91 CD 88/95	Pass
	Ethyl benzene (saturated solution in water)	MD 906/94 CD 93/99	Pass
	m,p,o-Xylenes (saturated solution in water)	MD 95/100 CD 88/98	Pass
	Tetrachloroethene (PCE) (saturated solution in water)	MD 98/100 CD 89/111	Pass
	Trichloroethene (TCE) (saturated solution in water)	MD 97/103 CD 91/65	Pass
	Hexane (saturated solution in water)	MD 97/92 CD 95/112	Pass
	Napthalene (saturated solution in water)	MD 98/93 CD 96/102	Pass

8.2 Measured vapour transmission rates for a range of VOCs are given in Table 4. Site-specific examination and assessment should be carried out to CIRIA C682 and CIRIA C716 on a case by case basis, to establish the suitability for any specific application and the need for additional testing.

Table 4 Measured vapour transmission rates of volatile organic compounds for Protech VOC Flex (to ISO 15105-2 (Annex B))

Volatile liquid	Result	
	(mg·m ⁻² ·day ⁻¹)	(ml·m ⁻² ·day ⁻¹)
Benzene	48.9	14.0
Toluene	181	43.9
Ethyl benzene	445	94.0
Xylene	518	109.3
Tetrachloroethene (PCE)	8.56	1.2
Trichloroethene (TCE)	163	27.8
Napthalene	61.6	10.8
Hexane	40.4	10.5
Vinyl chloride	33.2	11.9
Bromoform	1,670	148.1
Carbon Tetrachloride	1,400	20.4
Chloroform	118	22.1
Ethylene Dichloride	280	63.4
Methyl Teriary Butyl Ether	46.2	11.7



8.3 The results of additional tests carried out on a selection of VOC's in accordance with ISO 6179 : 2010 are given in Table 5.

Table 5 Transmission rates of volatile liquids of Protech VOC Flex to ISO 6179: 2010 (Method B)

Volatile liquid	Result
	(g·m ⁻² ·h ⁻¹)
Xylene	1.855
Toluene	3.283
Petrol	2.341
Diesel	0.099

9 Resistance to damage

9.1 The membrane 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 Maintenance

As the product is confined within the structure and have suitable durability (see section 11), maintenance is not required. However, any damage occurring before enclosure must be repaired (see section 15).

11 Durability



11.1 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's for the lifetime of the building in which it is incorporated.

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

12 Reuse and recyclability

The product contains polyethylene, which can be recycled.

Installation

13 General

13.1 Protech VOC Flex must be installed in accordance with the Certificate holder's instructions and this Certificate, and following the relevant guidance given in BRE Report BR 211 : 2015, BS 8485 : 2015 and CIRIA Report C748 : 2014.

13.2 The membranes can be installed in all normal site conditions, provided that the air temperature is not below -15°C and the membrane is free from condensation and ice that could affect jointing.

13.3 The surface onto which the membranes are to be laid must be smooth, dry and free from sharp protrusions and debris that could damage the membranes. Brickwork or blockwork must be flush pointed or rendered to provide a smooth surface.

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

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

13.6 The membrane must be protected as soon as possible after it is installed to minimise direct foot trafficking. Direct trafficking by vehicles must be avoided.

14 Procedure

Hot air welded joints

14.1 The membrane is rolled out and properly aligned to the structure.

14.2 Each joint should consist of two 15 mm weld tracks, with a 20 mm gap between.

14.3 All surfaces must be dry before welding.

14.4 Before welding work is carried out, trials must be completed to determine the 'operating window' for the welding equipment, materials and ambient conditions. In case of doubt, the Certificate holder should be consulted for advice.

14.5 Weld widths must be a minimum of 50 mm and must be checked for integrity after being formed.

14.6 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.

14.7 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 dpc. The use of the membrane as dpc is outside the scope of this Certificate and the Certificate holder must be consulted in these instances.

14.8 The membrane must be protected from UV light and mechanical damage as soon as possible after installation.

14.9 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.

15 Repair

15.1 Any damage to the membrane must be repaired using a patch of the membrane, and laps welded or sealed with tape (see section 13.5) and secured over the edges with a suitable generic sealing tape. All patched areas must extend a minimum of 100 mm from the damaged area.

15.2 If required, the adequacy of repair work should be confirmed by an independent validation report, as all gas or VOC membrane installations should be subject to third-party validation in accordance with BS 8485 : 2015 and/or CIRIA Report C748 : 2014.

Technical Investigations

16 Tests

Tests were carried out 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
- shear strength of joints
- dimensional stability
- trouser tear
- impact
- water vapour transmission
- resistance to static loading
- watertightness.

17 Investigations

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

- methane gas transmission (unjointed)
- transmission of vapours from VOCs
- tensile strength and elongation
- chemical resistance
- leaching resistance.

17.2 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 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 EN 14415 : 2004 *Geosynthetic barriers — Test method for determining the resistance to leaching*

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

CIRIA C682 : 2009 *The VOCs Handbook. Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination*

CIRIA C716 : 2012 *Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination*

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*

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

ISO 6179 : 2010 *Rubber, vulcanized or thermoplastic — Rubber sheets and rubber-coated fabrics — Determination of transmission rate or volatile liquids (gravimetric technique)*

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

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

18 Conditions

18.1 This Certificate:

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

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

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

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

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

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

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

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

Protech VOC Flex

GAS PROTECTION

DESCRIPTION

Protech VOC Flex complies with CIRIA C748 and BS8485:2015 +A1 2019. It is a high performance 6 layer flexible proprietary reinforced VOC gas barrier and is suitable for use on brownfield sites that require protection from dangerous contaminants such as hydrocarbons. Protech VOC Flex has been developed to ease installation on site due to the flexibility of the membrane. It is also suitable as a high performance damp proof membrane.



INSTALLATION

Protech VOC Flex can be sealed by welding. In areas where the membrane crosses cavity walls or internal single skin walls, Protech VOC Flex Starter Band should be used in conjunction with Protech VOC Flex Internal and External preformed corner units. Pipe penetrations should be sealed with Protech VOC Top Hats or Protech GM Flashing Strips. Stanchions and columns should be sealing with Protech GM Primer and Protech GM Flashing strips (Photos, isometric and standard details are available on our website).

KEY FEATURES

- BBA Certified 20/5723
- Exceptional chemical resistance
- Gas resistant
- Additional damp proofing protection
- Flexible membrane to ease installation on site
- Robust & durable multi-layer membrane
- High resistance to puncturing

ACCESSORIES

- Protech VOC Flex Starter Band
- Protech VOC Tophats
- Protech GM Flashing
- Protech VOC Corner Units
- Protech GM Primer
- Protech GM 3mm Protection Board
- Protech GM Protection Fleece
- Protech GM Tape
- Protech Liquid Applied Gas Membrane (LAGM)

PROPERTIES

PROPERTY	UNIT	MEAN	METHOD
Roll size	m	2 x 50	
Thickness	mm	0.55	
Weight	g/m ²	564	DIN EN ISO 536
Tensile strength MD CD	N/50mm	700 640	EN 12311-1 +Mods EN 13859-1
Elongation MD CD	%	30 25	EN 12311-1 +Mods EN 13859-1
Nail tear resistance MD CD	N	500 540	EN 12311-1

Protech VOC Flex

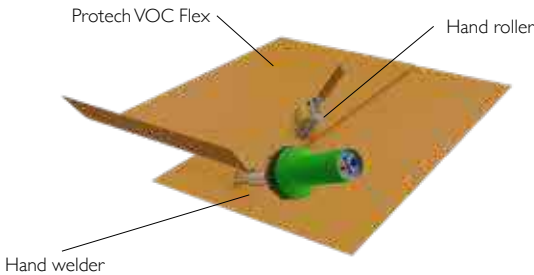
CHARACTERISTICS	TEST METHOD		
Methane Permeability	ISO 15105-1	✓	
Diesel Permeability	ISO 6179:2010	✓	
Petrol Permeability	ISO 6179:2010	✓	
Xylene Permeability	ISO 6179:2010	✓	
Toulene Permeability	ISO 6179:2010	✓	
Vinyl Chloride	ISO 15105-2	✓	
Ethyl Benzene	ISO 15105-2 EN 14414 Method C	✓	
Trichlorethene	ISO 15105-2	✓	
Xylene (O, M, P)	ISO 15105-2 EN 14414 Method C	✓	
Naphthalene	ISO 15105-2 EN 14414 Method C	✓	
Benzene	ISO 15105-2 EN 14414 Method C	✓	
Toluene	ISO 15105-2 EN 14414 Method C	✓	
Hexane	ISO 15105-2 EN 14414 Method C	✓	
Tetrachlorethene	ISO 15105-2	✓	
Bromoform	ISO 15105-2	✓	
Carbon Tetrachloride	ISO 15105-2	✓	
Chloroform	ISO 15105-2	✓	
Ethylene Dichloride	ISO 15105-2	✓	
Methyl Teriary Butyl Ether	ISO 15105-2	✓	
Trichloroethylene (TCE)	EN 14414 Method C	✓	
Perchloroethylene (PCE)	EN 14414 Method C	✓	
Determination of Chemical Resistance	Test Method	Properties	
Hydrolysis under Acid Conditions	BS EN 14414 Method A	Tensile Strength Mpa MD	Pass
		Tensile Strength Mpa CD	Pass
		Tensile Elongation % MD	Pass
		Tensile Elongation % CD	Pass
	NO VISUAL DEGRADATION		
Hydrolysis under Basic Conditions	BS EN 14414 Method B	Tensile Strength Mpa MD	Pass
		Tensile Strength Mpa CD	Pass
		Tensile Elongation % MD	Pass
		Tensile Elongation % CD	Pass
	NO VISUAL DEGRADATION		
Solvation & Swelling (Diesel/Parafin/Lubrication Oil)	BS EN 14414 Method C	Tensile Strength Mpa MD	Pass
		Tensile Strength Mpa CD	Pass
		Tensile Elongation % MD	Pass
		Tensile Elongation % CD	Pass
	NO VISUAL DEGRADATION		
Synthetic Leachate	BS EN 14414 Method D	Tensile Strength Mpa MD	Pass
		Tensile Strength Mpa CD	Pass
		Tensile Elongation % MD	Pass
		Tensile Elongation % CD	Pass
	NO VISUAL DEGRADATION		



Protech VOC Flex

GAS PROTECTION

WELDING DETAIL



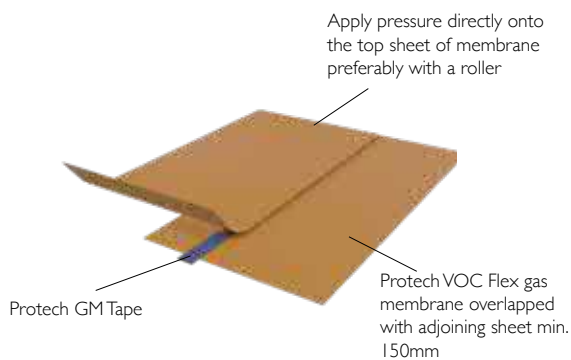
It is advised that VOC membranes that are installed below the slab should be welded, taped joints can be compromised by direct contact with some challenge chemicals found on VOC contaminated sites.

METHOD

1. Lay roll of Protech VOC Flex gas membrane on a prepared sub base or Provoid venting mat ensuring all creases are removed and sheet is laid flat.
2. Roll out next sheet of Protech VOC Flex ensuring a minimum overlap of 50mm.
3. Insert the hand welder between the two sheets and fuse together using a hand roller whilst moving along the joint.
4. A weld width of between 30mm and 40mm is recommended.

Prior to welding the membrane, it is advised to test welds on membrane offcuts to determine correct heat setting and welding speed. Weld sample tickets (small test welds approx. 200mm to 300mm long) should be kept for independent verification.

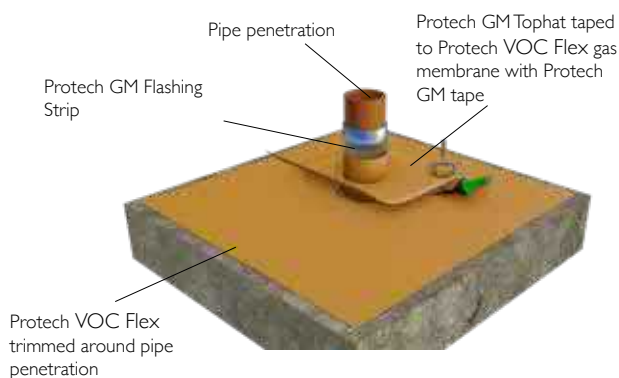
TAPE JOINT DETAIL



METHOD

1. Lay roll of Protech VOC Flex Gas Membrane on prepared sub base or Provoid Venting Mat ensuring that all creases are removed and sheet is laid flat.
2. Roll Protech GM double sided tape 50mm in from edge of Protech VOC Flex Gas Membrane.
3. Roll out next sheet of Protech VOC Flex Gas Membrane ensuring a minimum 150mm overlap with adjoining sheet.
4. Remove the release paper from the Protech GM Tape and apply pressure to the top sheet of Protech VOC Flex Gas Membrane (This can be done with a long handled roller).
5. Ensure that the two sheets of Protech VOC Flex Gas Membrane are securely sealed.
6. Apply Protech Foil Lap Tape over membrane laps to prevent trip hazard/accidental uplift due to foot traffic.

TOPHAT DETAIL

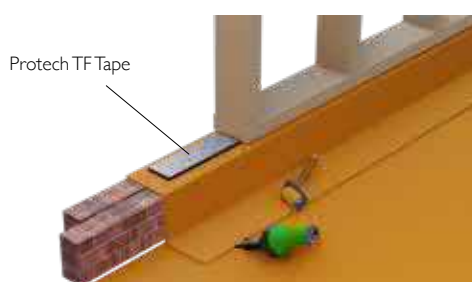


METHOD

1. Trim Protech VOC Flex Gas Membrane around pipe penetration.
2. Fix Protech GM Tape to underside of tophat flange 20mm from edge, ensuring that there are no gaps between the strips of tape at each corner.
3. Remove the release paper from the Protech GM Tape and slide the Protech GM Tophat over the pipe and push down onto Protech VOC Flex Gas Membrane.
4. Ensure that the Protech GM Tophat is adhered to the Protech VOC Flex Gas Membrane.
5. Cut a strip of Protech GM Flashing Strip and stick to top of pipe penetration and Protech GM Tophat ensuring an overlap onto Pipe and Protech GM Tophat.

Protech GM Tophats are available in all popular pipe sizes including our standard 110mm, 130mm and 160mm and also bespoke sizes when required.

TIMBER FRAME DETAIL

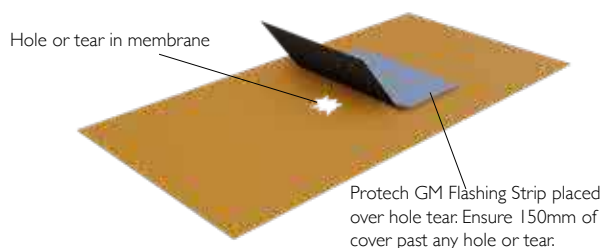


METHOD

1. Apply Protech TF Tape centrally on the gas membrane / DPC where the sole plate will be located.
2. Apply pressure to ensure a good seal using a roller or similar.
3. Any mechanical fixings that penetrate the TF tape and Membrane/ DPC will be sealed.

Protech VOC Flex

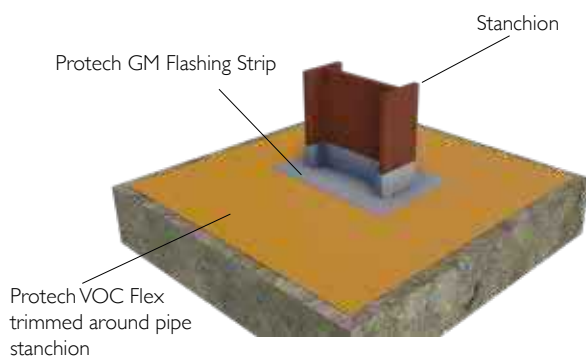
PATCH DETAIL



METHOD

1. Clean membrane with a damp cloth and wipe dry.
2. Cut a strip of Protech GM Flashing Strip, minimum of 300mm x 300mm, remove release paper and place over the hole or tear.
3. On larger holes, use several pieces of 300mm x 300mm Protech Flashing Strip, ensuring that strips are overlapped a minimum of 25mm with adjoining strip.

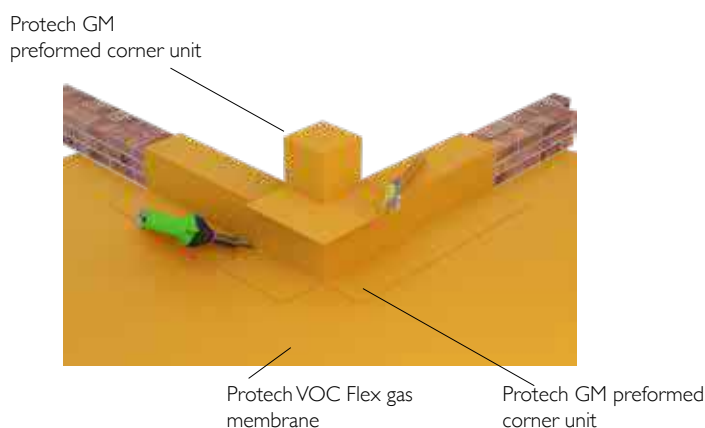
STANCHION DETAIL



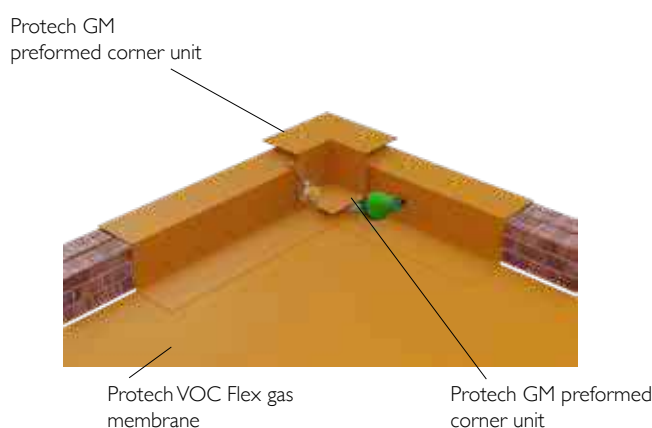
METHOD

1. Trim Protech VOC Flex Gas Membrane around stanchion.
2. Apply two coats of Protech Bitumen Primer to area of stanchion to be covered by Protech GM Flashing Strip.
3. Cut 300mm lengths of Flashing Strips and fold in half and apply to Protech VOC Flex Gas Membrane and stanchion.
4. Repeat the process around the entire stanchion until a gas tight seal is achieved.

EXTERNAL CORNER DETAIL



INTERNAL CORNER DETAIL



METHOD

1. Fix Protech GMTape to underside of Protech GM Corner 20mm from edge, ensuring that there are no gaps between the strips of tape at each corner.
2. Remove the release paper from the Protech GMTape and slide the Protech GM Corner over the edge and push down onto Protech VOC Flex Gas Membrane.
3. Ensure that the Protech GM Corner is adhered to the Protech VOC Flex Gas Membrane.
4. Cut a strip of Protech GM Flashing Strip and stick the the edges of Protech GM Corner ensuring an overlap onto Protech VOC Flex and Protech GM Corner.
5. Please note that an architectural cavity tray, in most instances, will need to be placed above the corner detail.

BS 8215, Design and Installation of DPCs, recommends that '3-dimensional shapes in DPC should be pre-fabricated' avoiding site fabrication.

The A. Proctor Group Ltd recommends the use of preformed corner units to achieve a gas tight seal.

Preformed corner units are a technically better solution for gas proofing and are also cost effective, due to the added time it takes to create similar details in situ.



Download a full Gas Protection brochure from our website...

www.proctorgroup.com



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