



Gas Protection Design Document &
Validation Plan
For
Town End Road,
Holmfirth,
HD9 1AH

Prepared By	Michael Corban
Checked By	Michael Corban
Date of Issue	07/02/24

Contents

Copyright Clause

Overview of Required Gas Protection measures

1.0 Introduction

- 1.1 Purpose
- 1.2 Limitations
- 1.3 How to understand and use this report

2.0 Site classification

3.0 Design methodology

- 3.1 Classification of building type
- 3.2 Determine minimum points required

4.0 Selection of protection measures

- 4.1 Structural slab
- 4.2 Ventilation measures
- 4.3 Gas membrane
- 4.4 Solution choice score adherence with Table 4: BS8485: 2015 + A1: 2019
- 4.5 Sectional drawings, detailing and vent layouts

5.0 Verification plan

- 5.1 Installer qualifications
- 5.2 Venting system
- 5.3 Installation schedule (Membrane)
- 5.4 Weather conditions
- 5.5 Damage
- 5.6 Jointing procedure
- 5.7 Risk assessment as per section 3; CIRIA C735: 2014
 - 5.7.1 Risk assessment data
- 5.8 Inspection method and frequency (per visit)
- 5.9 Defects and repair
 - 5.9.1 Evaluation
 - 5.9.2 Repair procedures
- 5.10 Verification of repairs
- 5.11 Verification report

6.0 Verification plan declaration

Table 3: BS8485: 2015 + A1: 2019

Table 4: BS8485: 2015 + A1: 2019

Table A Design methodology points required

Table 5: BS8485: 2015 + A1: 2019

Table 6: BS8485: 2015 + A1: 2019

Table B – Gas membrane risk assessment

Table C – Verification risk assessment

Figure 1 – Risk assessment matrix: CIRIA C735: 2014

Appendix 1 – Toolbox talk

Appendix 2 – Technical data sheets

Copyright Clause

The material contained within these pages is the sole property of MEC Environmental Ltd. All rights to copy the material contained within these pages are reserved.

Any user may receive, store and distribute copies of the material contained within these pages in purely electronic form, including on computer networks, computer bulletin board systems, computer conferencing systems and organisational computers, provided, and only provided, that:

- i. All material contained within these pages, including this notice, are not altered in any manner;
- ii. No profit or payment of any kind is charged for the usage and/or distribution of any material contained within these pages; and
- iii. You may not otherwise copy, reproduce, recompile, decompile, disassemble, reverse engineer, distribute, publish, display, perform, modify, upload to create derivative works from, transmit or in any way exploit any part of this plan. All proprietary rights remain the property of the Company
- iv. The material contained within these pages is not reproduced nor distributed in printed or paper form, nor on CD-ROM, nor in any form other than the electronic forms described above, without prior written permission from MEC Environmental Ltd.

Overview of Gas Protection Measures and Procedures:

MEC Environmental have been employed to carry out a solutions choice, design report and verification strategy for the gas protection requirements at Town End Road, Holmfirth, HD9 1AH. The following table provides a quick glance at the pertinent areas of the design to be aware of, however for a full understanding of the design the report must be read in full.

Site information:	The site consists of 1 no private residential dwelling
Design parameters (Gassing regime, Building type classification etc.)	<p>The site has been classified as a characteristic situation 2 (CS2) risk gassing site by others. The building has been classified as a TYPE A. MEC have had no input into the site characterisation and were provided this information by One17 Design in an email dated 13/11/23, the site is also in area of high risk for Radon, however it is deemed that the protection measures required for a CS2 site will satisfy the Radon requirements also.</p> <p>A solution choice score of 3.5 points is required in line with the design methodology of Table 4; BS8485: 2015 + A1: 2019.</p>
Solution choice:	<p>Using Tables 5, 6 and 7; BS8485: 2015 + A1: 2019 a solution choice score of 3.5 is achieved. This is achieved through;</p> <ul style="list-style-type: none"> • Basement with Grade 2 Waterproofing (waterproof concrete) – 1.5 Points • Gas resistant membrane installation across the footprint of the structure installed by a contractor holding NVQ L2 in gas membrane installation and independently verified by MEC in line with CIRIA C735: 2014 – 2 Points
Important information	
Ventilation system:	N/A
Substrate preparation for membrane:	<p>The membrane will be laid on XPS Insulation that has been laid on a well compacted subbase (horizontal) and on smooth concrete with no sharp edges or undulations (vertical)</p> <p>The installation contractor's supervisor will agree and accept the prepared sub-base prior to installation work beginning.</p>
Gas membrane:	<p>The main contractor must ensure to protect any exposed membrane from damage, in any event the membrane should be permanently covered within 48 hours preceding verification inspections.</p> <p>The gas membrane installation will be visually inspected and integrity tested where required by MEC in line with the verification strategy included which has been prepared in line with CIRIA C735: 2014.</p>

1.0 Introduction

The following report sets out the solutions choice, design report and verification strategy for the gas protection measures required for the aforementioned scheme.

1.1 Purpose

MEC Environmental Ltd (MEC) have been appointed by One17 Design to carry out a solutions choice, detailed design report and verification plan in line with section 8 of BS8485: 2015 + A1: 2019 for the aforementioned site. This reports sets out the solutions and detailing that need to be adopted to achieve compliance with BS8485: 2015 +A1: 2019.

1.2 Limitations

This report is limited to setting out the solutions choice, design and verification requirements based on the site characterisation that has been carried out by others. MEC have not carried out any work in respect of site characterisation or hazard assessment as described in Section 6 of BS8485: 2015 + A1: 2019.

This report and its contents should not be used for any purpose other than that for which it was prepared and provided. Should the client require to pass copies of the report to other parties for information only, the whole of the plan should be so copied. The report should not be relied upon by any third party and no warranty shall be extended or implied to any third party, unless expressly agreed in writing by MEC.

1.3 How to understand and use this report

The report follows the step by step procedures set out in BS8485: 2015 +A1: 2019 to determine the protection measures required based on:

A. The classification of the site – The British Standard explains three ways of characterising a site which are;

- An empirical, semi-quantitative approach using gas monitoring data;
- An empirical approach using TOC (Total organic carbon) content;
- A detailed quantitative assessment approach (DQRA).

This report is based on the results of the classification for the site that has been supplied to MEC by our client. MEC have had no input into the risk assessment or characterisation of the site and is outside the scope of this report.

B. The classification of the building type – The building type has been classified using Table 3; BS8485: 2015 + A1: 2019.

C. Determine protection points required – Utilising the classification of the site and building type, the required number of points can be determined following Table 4; BS8485: 2015 + A1: 2019

D. Determine the protection measures – Once the required number of points have been ascertained then at least two different forms of protection are selected from Tables 5, 6 & 7; BS8485: 2015 + A1: 2019.

E. Justification of protection measures – Once the protection measures have been determined the performance requirements of each element are justified against the requirements in BS8485: 2015 + A1: 2015 and any site specific considerations. This includes but is not limited to any assumptions made, venting calculations, specific performance characteristics of the membrane etc.

F. Detailed design of the elements – All of the elements are detailed to ensure that they are:

- **Effective:** in that they do what they are intended to do; Effectiveness should be assessed in terms of the theoretical effectiveness assuming perfect installation; practical effectiveness (i.e. what it is reasonable to expect to achieve under normal conditions); and likely long-term effectiveness given the likely durability of materials, etc
- **Robust:** in that they are not easily compromised, particularly during construction;
- **Durable:** in that they remain effective for the required design life. Protective measures should include the use of materials that have a defined design life or no known critical time deterioration properties. These should be placed where they might reasonably be expected to continue to perform for the life of a building that might be in excess of 60 years.
- **Buildable:** in that they can be built to an appropriate standard of workmanship, supervision and verification.

G. Verification plan – A plan detailing the frequency of independent inspection, any integrity testing requirements and CQA responsibilities that will be required to comply with CIRIA C735: 2014. This is a crucial requirement of any gas protection system as a verification report is usually required by the warranty provider alongside the regulatory authority to discharge any planning conditions.

H. Submission for regulatory approval – On receipt of this report it should be submitted to the regulatory authority and or warranty provider for approval, it is strongly recommended that the contents of this report are not acted on until approval has been granted.

2.0 Site classification

The site is a characteristic situation 2 (CS2), in an area at high risk from Radon:

3.0 Design methodology

3.1 Classification of building type:

Adopting the methodology contained in BS8485: 2015 + A1: 2019 the construction and use of the building, together with the control of future structural changes to the building and its maintenance (the building's management) should be assessed. The building as a whole or each different part of the building can be characterised into one of four building types: Type A, Type B, Type C or Type D.

- **Type A building:** private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises.
- **Type B building:** private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancy. Small to medium size rooms with passive ventilation of rooms and other internal spaces throughout ground floor and basement areas. May be conventional building or civil engineering construction. Examples include managed apartments, multiple occupancy offices, some retail premises and parts of some public buildings (such as schools, hospitals, leisure centres) and parts of hotels.
- **Type C building:** commercial building with central building management control of any alterations to the building or its uses and central building management control of the maintenance of the building, including the gas protection measures. Single occupancy of ground floor and basement areas. Small to large size rooms with active ventilation or good passive ventilation of all rooms and other internal spaces throughout ground floor and basement areas. Probably civil engineering

- construction. Examples include offices, some retail premises and parts of some public buildings (such as schools, hospitals, leisure centres and parts of hotels).
- **Type D building:** industrial style building having large volume internal space(s) that are well ventilated. Corporate ownership with building management controls on alterations to the ground floor and basement areas of the building and on maintenance of ground gas protective measures. Probably civil engineering construction. Examples are retail park sales buildings, factory shop floor areas, warehouses. (Small rooms within these style buildings should be separately categorized as Type B or Type C).”

The development; consists of a single residential dwellings and has been classified as a type A building using Table 3: BS8485: 2015 + A1: 2019.

Building Type	Ownership	Control of Changes	Room Sizes	Area of Building if Zoned
Type A	Private	None	Small	
Type B	Private or commercial/public, possible multiple	Some but not all	Small/Medium	Not applicable
Type C	Commercial/public	Full	Small to Large	
Type D	Commercial/industrial	Full	Large industrial/large retail park	

Table 3: BS8485: 2015 + A1: 2019

3.2 Determine minimum points required:

To determine the minimum gas protection score for the building as a whole, or for each part of the building then the guidance in BS8485: 2015 + A1: 2019 should be followed using Table 4.

	Type A	Type B	Type C	Type D
CS1	0	0	0	0
CS2	3.5	3.5	2.5	1.5
CS3	4.5	4	3	2.5
CS4	6.5	5.5	4.5	3.5
	N/A	6	5.5	4.5

CS5				
CS6	N/A	N/A	N/A	6

Table 4: BS8485: 2015 + A1: 2019

AREA: Full Footprint of Building	CS	Building Type	Points Required
Result of Tables 1 and 2	2	A	3.5

Table A: Design methodology points required

To achieve the required points a combination of two or more of the following three types of protection measures should be used to achieve the minimum score required:

- A. the structural barrier of the floor slab, or the basement slab and walls if a basement is present;
- B. ventilation measures;
- C. gas resistant membrane.

The gas protection system needs to consist of at least two different elements; e.g. a structural barrier with either a membrane or a ventilation or dilution system (or both). The elements work independently and collaboratively, and a single element cannot be used because there would be no redundancy to allow for defects in any of the elements.

4.0 Selection of protection measures

The following measures have been selected to provide the gas protection system for the site and the required point scoring methodology required.

4.1 Structural slab (BS8485: 2015 +A1: 2019); Table 5

Concrete structural slabs on their own will offer some restriction to the passage of gas, however this will be dependent on the type of slab, its likelihood of small cracks and number of penetrations through the slab like pipes, stanchions and joints.

Beam and block floors have gaps between the concrete or polystyrene blocks and therefore this type of slab has many ingress routes for gas across the whole slab and on that basis this type of floor construction achieves (0 points).

A ground bearing slab has a joint that runs the full length of the perimeter of the slab parallel to the internal leaf of the blockwork and therefore the score for this type of slab is low (0.5 points) as there is potential route for ingress of gas in this location.

Well reinforced raft and suspended slabs have less ingress routes for gas and where these have minimal penetrations they can achieve a score of (1 or 1.5 points).

Structural Slab	Points Scored
Beam & Block	0
Cast Insitu Ground Bearing (Nominal mesh)	0.5
Monolithic Ground Bearing Suspended or Raft with reinforcement and minimal penetrations	1.5
Basement Floor & Walls (Grade 2 Waterproofing)	2
Basement Floor & Walls (Raft)	2.5
Points Claimed from this Table (Reinforced Raft)	1.5

Table 5: BS8485: 2015 + A1: 2019

4.2 Ventilation measures (BS8485: 2015 + A1: 2019); Table 6

Ventilation protection measures should be one of the following five types, points are only scored for one of these measures:

- A. pressure relief pathway only (no effective dispersal layer);
- B. passive dispersal layer;
- C. active dispersal layer (fan suction);
- D. active positive pressurisation (air blanket); and
- E. ventilated basement substructure present.

The applicability and design of ventilation protection measures and selection of an appropriate score need to be carried out in accordance with Annex B of BS8485: 2015 + A1: 2019.

Ventilation protection measures need to be designed with a defined level of performance and supporting dilution calculations.

Venting Performance	Performance (P.I.T. 1997)	Design Concentration	Points
Pressure relief system	N/A	N/A	0.5
Passive Dispersal Layer	Very Good	1%	2.5
	Good	2.5%	1.5

Passive Dispersal Layer			
Active Dispersal Layer (extraction)	At least Good	1 - 2.5%	1.5 - 2.5
Positive Pressure	At least Good	1 - 2.5%	1.5 - 2.5
Ventilated Car Park	Designed to Approved Document F		4
Points Claimed From This Table			0

Table 6: BS8485: 2015 + A1: 2019

4.3 Gas membrane (BS8485: 2015 + A1: 2019); Table 7

Gas resistant membranes should be:

- sufficiently impervious to methane and/or carbon dioxide;
- capable after installation of providing a complete barrier to the entry of the relevant gas;
- sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;
- sufficiently strong to withstand in service stresses (e.g. due to ground settlement if placed below a floor slab);
- sufficiently strong to withstand the installation process and following construction activities until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, and dropping tools); and
- chemically resistant to degradation by other contaminants that might be present.

A methane gas transmission rate of <math><40.0 \text{ ml/day/m}^2/\text{atm}</math> (average) for sheet and joints (tested in accordance with the manometric method in BS ISO 15105-1:2007) is usually considered sufficient in regards to gas resistance performance. The onus is on the gas membrane manufacturer to provide adequate test data for the designers risk assessment to gas/vapours. There are many gas resistant membrane types available on the market. Membrane specification should be made according to the resistance of the material to the passage of the challenge gas and the resistance to site damage during and after installation in the designed position. The designer specifying the membrane should consider the combination of a particular membrane's properties to assess whether it is suitable in any given situation. The specified membrane and the reasons for its selection are described below.

Membrane: Juta GP1	Justification For Selection of Membrane
GTR 0.13ml/day/m ² /atm	<math><0.09 \text{ ml/day/m}^2/\text{atm}</math> (CH ₄ & CO ₂)
Durability of membrane	Anticipated Life of Building source: BBA certificate.

Will the membrane be subject to settlement	We have not been made aware that there is significant risk of settlement, however the base sheet is fully bonded to the underside of the slab
How will damage from follow on trades be avoided	As part of the site induction all personnel should receive the toolbox talk on the importance of the gas membrane (See Appendix 1)
Chemically resistant to contaminants	Yes, the remediation strategy has not identified any chemicals that will degrade the barrier.
Type of joint	The membrane should be jointed by hot air welding;
Installer experience	The membrane should be installed by a suitably qualified installation specialist who are registered on or hold an NVQ level 2 in gas membrane installations
Sealing of pipes/ducts	Pipes shall be sealed with Juta Self-adhesive gas membrane.
Sealing of stanchions	Not applicable
Verification to CIRIA C735	See Verification Plan
Points Claimed For Gas Membrane	2

Table B: Gas membrane risk assessment

4.4 Solution choice score adherence with Table 4: BS8485: 2015 + A1: 2019

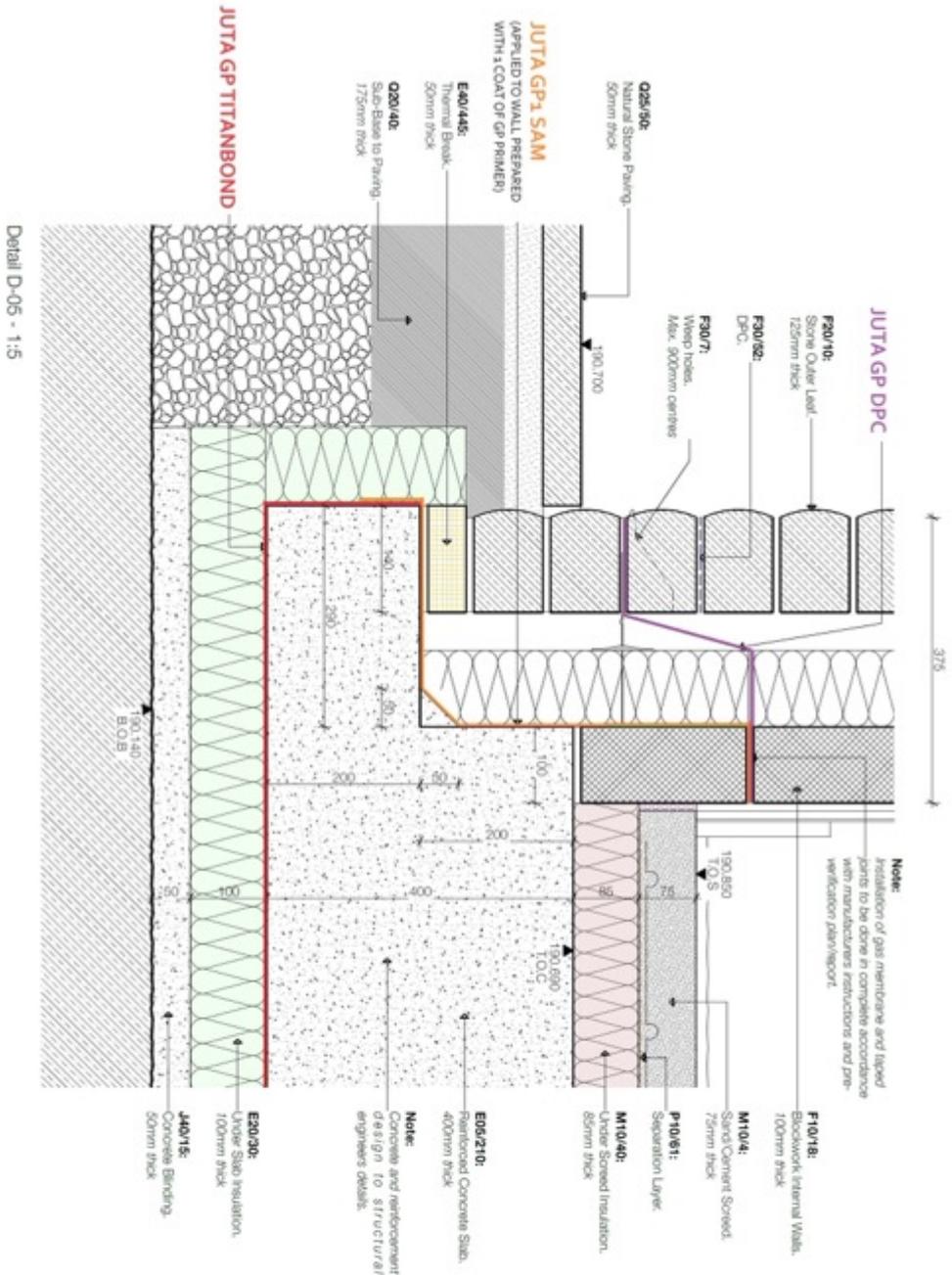
The proposed protection measures consist of:

- a) Full Cover of Gas resistant membrane, verified in accordance with CIRIA C735. **(2 points)**
- b) Basement Slab and Walls in waterproof concrete with waterbars **(2. points)**

Total Score Achieved **(4 points)**

This exceeds the **3.5 points** required to comply with a CS2 risk and Type A building as per Table 4: BS8485: 2015 + A1: 2019

4.5 Sectional drawings and detailing



Detail D-05 - 1:5

Notes

1. All dimensions are in millimeters unless otherwise stated.

2. All materials shall be checked and certified as per spec in accordance with the contract documents and approved by the architect.

3. The drawing is intended to provide a guide only and is not to be used for construction without the approval of the architect.

4. The drawing is not to be used for any other purpose without the written consent of the architect.

Item	Quantity	Unit	Remarks
Drawing created	1	Sheet	

Note: Concrete and reinforcement design to structural engineers details.

Client: Mrs Ann Mcgarry

Site Address: Linnahill, 27 Pear End Road, Haverhill, Wick, IRE

Project Description: Proposed Slabbing

Date: January 2024

Scale: 1:5

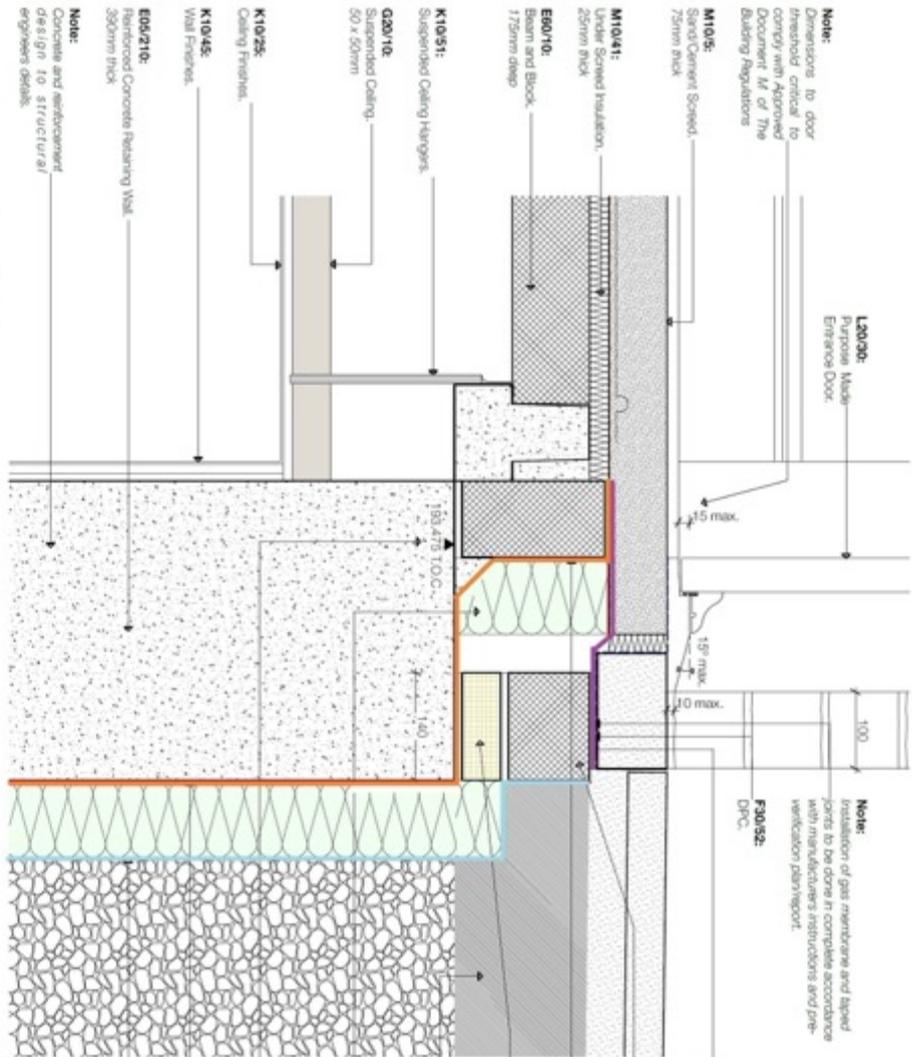
Sheet: 8 of 8

Detail: D-05

Drawing No.: 2024/01/15

Author: [Name]

ONE17 DESIGN.COM



Detail D-12 - 1:5

Notes

1. To be used with JUTA GP DPC and JUTA GP SAM.

2. All dimensions are in millimetres unless otherwise stated.

3. All materials and finishes to be checked and approved by the Architect.

4. All materials and finishes to be checked and approved by the Engineer.

5. All materials and finishes to be checked and approved by the Structural Engineer.

6. All materials and finishes to be checked and approved by the Fire Engineer.

7. All materials and finishes to be checked and approved by the Acoustic Engineer.

8. All materials and finishes to be checked and approved by the Environmental Engineer.

9. All materials and finishes to be checked and approved by the Health and Safety Engineer.

10. All materials and finishes to be checked and approved by the Sustainability Engineer.

11. All materials and finishes to be checked and approved by the Quality Engineer.

12. All materials and finishes to be checked and approved by the Project Manager.

13. All materials and finishes to be checked and approved by the Client.

F10/18: Brickwork External Walls, 140mm thick

JUTA GP SAM
(APPLIED TO WALL PREPARED WITH 1 COAT OF GP PRIMER)

E60/45: Thermal Break, 50mm thick

G20/40: Sub-Bases to Paving, 175mm thick

Note: JUTA GP SAM insulation to be used in cavity where door thresholds occur to support scribed.

Note: Top of concrete retaining wall level varies, refer to setting out.

JUTA GP SAM
(APPLIED TO WALL PREPARED WITH 1 COAT OF GP PRIMER)

JUTA PD3700

ONE17 DESIGN
THE ORIGINAL ARCHITECTURAL BRIDGE
ARCHITECTURAL VISUALISATION
17 ONE17 LANE | 17 ONE17 LANE | 17 ONE17 LANE
ONE17DESIGN.COM

5.0 Verification plan

This section sets out the strategy of verification required for the site aligned to the site risks, design and installation methods employed in line with CIRIA C735: 2014. MEC are not related in any way to the installation contractor or manufacturer and are independent as per the requirements set out in CIRIA C735: 2014 and BS8485: 2015 + A1: 2019.

5.1 Installer qualifications

Qualifications/Trade Associations

Installer: TBA
Supervisor to hold NVQ Level 2 Gas Membranes Installations –

5.2 Venting system

N/A

5.3 Installation schedule (Membrane)

If installation of the membrane will proceed in stages rather than a full lineout then sufficient membrane shall be left for jointing purposes of the next section of membrane. Care must be taken to ensure that the previously installed membrane is not damaged during the interim period.

5.4 Weather conditions

Gas membrane placement shall not take place in an area of ponded water, or during excessive winds.

The recommended maximum and minimum installation temperatures quoted on material manufacturers data sheets should be adhered to at all times. Special attention should be given to bitumen and butyl type self-adhesive products (tape jointing or detailing work) as in most cases these will have the lowest installation temperature range.

Placement of the gas membrane should not take place in any event when the temperature is below zero degrees, as this will present a health and safety risk to site personnel. In these conditions the gas membrane surface will become too dangerous to walk on.

When laying the gas membrane it is beneficial to proceed in the direction of (with) the prevailing winds. This decision must be made during installation, in accordance with varying environmental conditions. In any event, the Installer will be fully responsible for the decisions made regarding placement procedures.

5.5 Damage

During the installation inspections by the installation contractors supervisor will take place to visually examine the gas membrane and details (pipe penetrations, stanchions etc), after placement and jointing, for damage. Damaged areas will be repaired in accordance with the procedures described in 5.9 *Defects and repair*. The Installers Supervisor **MUST** be in attendance for the full duration of the installation works and shall present a CQA sheet to the main contractor at the end of each shift. These sheets should then be forwarded to MEC along with annotated photos for inclusion in the final report.

As a minimum, the installer will ensure that:

- The membrane is placed in such a manner that it has not been, or is unlikely to be, damaged; and
- Any tears, punctures, holes, thin spots, gouges, and protuberances etc. repaired according to best practise and manufacturer's recommendations;
- Supply dated CQA sign off sheets for 100% of all areas including photographs and records of any repairs.

5.6 Jointing procedure

Unless detailed elsewhere, the jointing procedure used by the Installer will be as follows:

- A roll of gas membrane will be rolled or pulled out onto the pre-approved subgrade and trimmed to size, ensuring that contact with the subgrade is achieved. The membrane should be fully supported by the subgrade with no areas bridging changes in grade;
- The next roll of membrane should be placed, ensuring that a minimum **100mm overlap** is achieved;
- The two sheets shall then be heat welded to form the joint between the two sheets;
- Fishmouths or wrinkles at the joint overlaps will be patched with an oval or round patch of the same gas membrane material extending a minimum of 150mm beyond the cut in all directions. The end of the cut should be rounded;

5.7 Risk assessments as per section 3 (CIRIA C735)

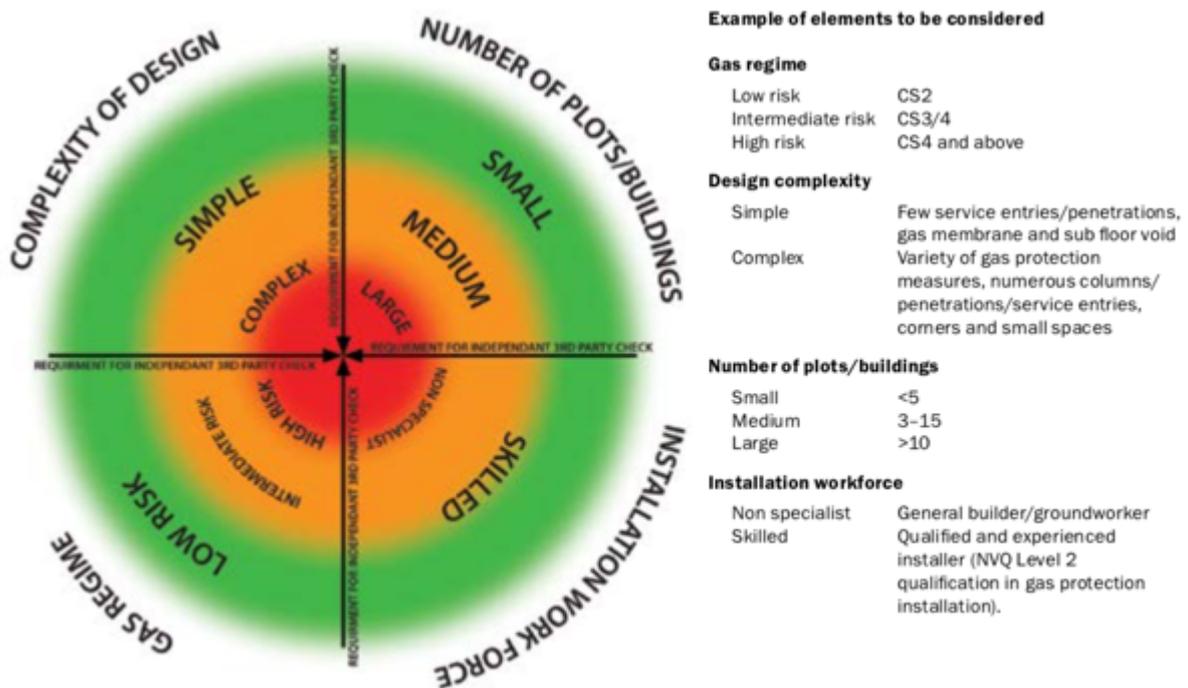


Figure 3.1 Illustration of factors to be taken into account in determining the scope and level of independence in the verification of gas protection systems in buildings

Figure 2: Risk assessment matrix; CIRIA C735

5.7.1 Risk assessment data

Gas regime: CS2

Installer: Skilled Non-specialist

Complexity: Simple Complex

Number of buildings: Small < 5 Medium 3-15

Large >10

Overall rating: Medium Risk

Risk to receptor	Risk	Control Measures	Risk after control measure
Gas regime – CS2 (Figure 3.1 rating – Green)	Low Risk	A gas protection system has been designed by MEC in line with BS8485: 2015 + A1: 2019	Low
Design complexity – Complex– (Figure 3.1 rating – Green)	Medium	The design will incorporate a slab that contains waterproofing additives and waterbars along with a gas membrane with detailing to seal all penetrations. Toolbox talk to be carried out with all site operatives on importance of gas membrane.	Low
Number of buildings – Small (Figure 3.1 rating – Orange)	Medium	It is anticipated that the works will be carried over a period of less than 12 months, all personnel to receive toolbox talk prior to commencement of work	Low
Installation workforce – Skilled (Figure 3.1 rating – Green)	Low	The sub-contractor appointed must have 1 operative who holds CSkills NVQ L2 in gas membrane installation. Independent verification work will be carried out by MEC in line with CIRIA C735: 2104 and BS8485: 2015 + A1: 2019.	Low

Table C: Verification risk assessment table

5.8 Inspection Method & frequency (per visit)

The Validation Consultant WILL visually inspect 100% of the installation of the gas barrier, furthermore a minimum of 25% of all detailing work, including joints which shall be subject to air lance or probe testing to ASTM D4437.

Any defects will be repaired and recorded. The purpose of this method of inspection and testing is to identify any holes, areas of bridging, poorly adhered seals or defects in the gas membrane and ancillary products.

The Validation Consultant on each visit will:

- Perform all Independent Visual Inspections and/or testing;
- Record all defects and take photographs for inclusion in the final validation report
- Inform the Installation Contractor of any required repairs.
- The Installer will complete any required repairs. (See repair procedures)
- Observe the repair and re-inspect/re-test the repair;

Record that the repair has been successfully made and tested, photograph and include a selection in the final validation report

5.9 Defects and Repair

The gas membrane will be inspected by the Validation Consultant for identification of defects, protruding and penetrating objects, lack of subgrade support, overheating, holes, blisters, undispersed raw materials, scratches and gouges, and any sign of contamination by foreign matter. To facilitate the examination the gas membrane surface will be kept clean by the Installer (or as agreed at the Preconstruction Meeting).

5.9.1 Evaluation

In areas that fail the inspection, the Validation Consultant will inform the Installer who will then repair this. Work will not proceed with any materials which will cover locations that have been repaired until the Validation Consultant has passed the subsequent repair, the number of repairs will be recorded and presented in the validation report.

5.9.2 Repair Procedures

Any portion of the gas membrane exhibiting a flaw, or failing a visual inspection or non-destructive test, will be repaired. The final decision as to the appropriate repair procedure will be agreed upon between the Validation Consultant and the Installer.

The procedures available include:

- Self-adhesive patching, used to repair all penetrating holes, tears, undispersed raw materials, and contamination by foreign matter;

In addition, the following provisions will be satisfied:

- All surfaces must be clean, free of all particulate matter, and dry at the time of the repair;
- The repair procedures, materials, and techniques will be approved in advance of the specific repair by the Validation Consultant;

- Patches and will extend at least 100 mm beyond the edge of the defects.

5.10 Verification of Repairs

Each repair will be re-inspected using the methods previously described or another approved method. Repairs passing re-inspection will be considered acceptable. Failed repairs will require the repair to be redone and re-inspected until a passing test result is obtained. The Validation Consultant shall carry out all re-inspection of repairs; a statement confirming that all repairs have been successfully carried out will be included in the final validation report.

5.11 Verification Report

A separate validation reports will be produced by MEC on completion of the installation and submitted to the client, the report will take the format of MEC standard gas membrane validation report and will contain the following information as a minimum.

- Reference/Name of Job
- Scope of Work Undertaken (as per this document)
- Inspection Survey Sheets for all site visits
- Records of any repairs and apparent failures
- Sample Photographic Evidence of the Installation

This report and plan should be agreed with the regulator, the main contractor's client and/or other insurance providers prior to work commencing on site, The implementation of this report and plan is entirely at the clients risk if said agreements have not been agreed at the time of installations and/or inspections with the regulator and nsurance providers prior to any installations taking place.

Signed: Date: 07/02/24

On behalf of MEC Environmental Ltd

Appendix 1: Toolbox Talk



MEC Environmental Ltd

Importance of Gas & Vapour Membrane.

This toolbox talk should be incorporated into the site induction of this project

A correctly installed gas membrane is important in order to protect the future occupants health from harmful ground gases and vapours.

Importance.

Gas and vapour membranes are installed at ground level to ensure that harmful gases and vapours do not enter buildings and cause harm to future occupants. The decision to install a gas barrier is not taken lightly and is often a condition of planning permission.

MOST GAS MEMBRANES THAT FAIL CERTIFICATION HAVE BEEN ACCIDENTALLY DAMAGED BY FOLLOW ON TRADES!!!

Regulations.

The design and installation of a gas membrane is detailed in British Standard (BS)8485:2015 (A1:2019). BS8485 states that ALL gas membranes installations must be signed off by an independent third party who has followed the guidelines in CIRIA 735. If the above certification does not take place then the building may not achieve planning discharge which can in some cases lead to building be demolished. A gas barrier that fails and causes harm can lead to prosecution under The Environmental Protection Act and is punishable by an unlimited fine and/or prison.

Guidance.

- Do not walk on the gas membrane without permission.
- If you damage the membrane report it **IMMEDIATELY** to a member of the site team.

- If you see damage to the membrane report it **IMMEDIATELY** to a member of the site team
- Holes and tears can usually be easily repaired prior to covering, however these need to be reported to the company responsible for certifying the membrane (Verifier).
- Never move or tamper with the gas membrane seal around a pipe, if a pipe needs to be moved after the membrane has been installed, ensure that the membrane is repaired and re-inspected.
- Never store materials or equipment directly on a gas membrane, use a plywood board or similar to protect the membrane.
- Never drive on a gas membrane with any plant e.g fork lifts etc.
- Prior to permanently covering the gas membrane check that it has been inspected by the verifier and has been signed off.
- In 2016, 64no new houses were demolished in Gorebridge, Scotland when occupants fell ill due to gas ingress.
- The two main landfill or mine gases Methane and Carbon Dioxide are colourless and do not give off any smells. Methane is explosive and long term exposure to both Methane and Carbon Dioxide can lead to death by asphyxiation on heavily contaminated sites.
- According to the NHS there are an estimated 1,100 deaths from lung cancer



MEC Environmental Ltd

per year that can be attributed to Radon gas entering both residential properties and places of work.

- Under normal site conditions the gases are not harmful to site based operatives, however if working for long periods in poorly ventilated confined spaces then the prevention of the build up of hazardous gases should be assessed in the risk assessment.

Questions.

1. If you see a hole in a gas membrane what should you do?
2. Can a damaged gas membrane cause death?

Summary.

A well installed functioning gas membrane will adequately protect the future occupants for the lifetime of the building. Please treat it with the respect it deserves .

Appendix 2: Membrane and Accessories Specification Sheets

Feature	Characteristics	Test Method	GP® TITANBOND®
Physical Properties	Thickness	EN 1849-2	2.0 mm
	Width	EN 1849-2	1.9 m
	Length	EN 1849-2	25 m
	Weight	EN 1849-2	650 g/m ²
Hydraulic Press	Water Vapour Transmission Rate	EN 1931	0.11 - 0.18 g/m ² /day
	Water Tightness (60 kPa)	EN 1928	Pass
	Water Tightness (196 kPa - 20 m Water Head) (Basement Application)	EN 1928	Pass
Mechanical Properties	Resistance to Static Load	EN 12730-B	≥ 20 kg
	Puncture Resistance	EN 12236	≥ 2.0 kN
	Tensile Strength (MD)	EN 12311-1	> 550 N/50mm
	Tensile Strength (CMD)	EN 12311-1	> 400 N/50mm
	Tensile Elongation (MD/CMD)	EN 12310-1	> 550 %
	Tear Resistance (MD/CMD)	EN 12310-1	> 300 N
	Resistance to Impact	EN 12691-B	> 1650 mm
	Reaction to Fire	EN 13501-1	E Class
	Concrete Peel Adhesion	ASTM D903 (MOD)	> 3.0 kN/m
	Resistance to Artificial Ageing	EN 1296/EN 1928	Pass
Resistance to Chemicals	EN 1296/EN 1928	Pass	
Compliance and Certification	CE Mark - EN13967:2012		
	NHBC Standards Compliant		
	BS 8485:2015 Compliant (Methane and Carbon Dioxide barrier)		
	CIRIA C748 Compliant (VOC Barrier)		
Vapour Permeability 100% Concentration	Transmission Rate of Benzene	EN ISO 15105-2	< 3.6 mg/m ² /day
	Transmission Rate of Toluene	EN ISO 15105-2	< 13.8 mg/m ² /day
	Transmission Rate of Ethyl Benzene	EN ISO 15105-2	< 2.7 mg/m ² /day
	Transmission Rate of Xylenes (M,P,O)	EN ISO 15105-2	< 7.7 mg/m ² /day
	Transmission Rate of Hexane	EN ISO 15105-2	< 0.6 mg/m ² /day
	Transmission Rate of Vinyl Chloride	EN ISO 15105-2	< 0.05 mg/m ² /day
	Transmission Rate of Trichloroethene (TCE)	EN ISO 15105-2	< 54.7 mg/m ² /day
	Transmission Rate of Tetrachloroethene (PCE)	EN ISO 15105-2	< 26.2 mg/m ² /day
	Transmission Rate of Naphthalene	EN ISO 15105-2	< 0.0006 mg/m ² /day
	Transmission Rate of CIS-1,2-Dichloroethylene	EN ISO 15105-2	< 1.1 mg/m ² /day
Gas Permeability	Methane Permeability	EN ISO 15105-1	0.13 ml/m ² /day/atm
	Methane Permeability (Jointed)	EN ISO 15105-1	1.00 ml/m ² /day/atm
	Carbon Dioxide Permeability	EN ISO 15105-1	3.01 ml/m ² /day/atm
	Vinyl Chloride Gas Permeability	EN ISO 15105-1	0.04 ml/m ² /day/atm
	Radon Permeability	K124/02/195	1.0 x 10 ⁻¹² m ² /S

**GROUND GAS
PROTECTION
GP[®] TITANBOND[®]
TECHNICAL DATA
SHEET**



**GP[®]
TITANBOND[®]**

Feature	Characteristics	Test Method	GP [®] TITANBOND [®]
Durability and Chemical Resistance	Chemical Resistance - Sulfuric ACID (10% Solution of Sulfuric Acid (H ₂ SO ₄)) 50° For 56 Days	EN 14414-A	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Chemical Resistance - BASIC (Calcium Hydroxide Saturated Suspension) 50° For 56 Days	EN 14414-B	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Chemical Resistance - SOLVENTS (35% Diesel, 35% Paraffin, 30% Oil Hd3O (Vol)) 50° For 56 Days	EN 14414-C	TENSILE STRENGTH RETAINED >80% RESULT - PASS
	Chemical Resistance - SYNTHETIC LEACHATE (Mixture of 14 Acids, Chlorides, Sulphates & Phosphates) 50° For 56 Days	EN 14414-D	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Resistance to Leaching - HOT WATER (Deionised Water) 50° For 56 Days	EN 14415-A	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Resistance to leaching - AQUEOUS ALKALINE (Saturated Calcium Hydroxide) 50° For 56 Days	EN 14415-B	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Resistance to Leaching - ORGANIC ALCOHOL (30% Methanol, 30% Isopropanol, 40% Glycol) 50° For 56 Days	EN 14415-C	TENSILE STRENGTH RETAINED 100% RESULT - PASS
	Chemical Resistance - BENZENE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 95% (MD), 102% (CMD) RESULT - PASS
	Chemical Resistance - TOLUENE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 94% (MD), 91% (CMD) RESULT - PASS
	Chemical Resistance - ETHYL BENZENE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 99% (MD), 97% (CMD) RESULT - PASS
	Chemical Resistance - XYLENES - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 91% (MD), 106% (CMD) RESULT - PASS
	Chemical Resistance - TCE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 99% (MD), 93% (CMD) RESULT - PASS
	Chemical Resistance - PCE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 93% (MD), 93% (CMD) RESULT - PASS
	Chemical Resistance - NAPHTHALENE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 101% (MD), 93% (CMD) RESULT - PASS
	Chemical Resistance - HEXANE - 100% Saturated Concentration	EN 14414-D (MOD)	TENSILE STRENGTH RETAINED 99% (MD), 104% (CMD) RESULT - PASS

GP[®] SAM

Rev: June 2019



Ground Gas
Protection

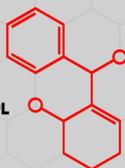
JUTA GP[®] SAM - Gas Protection - Self Adhesive Membrane, is a bituminous gas proof and water proof sheet, composed of self-adhesive SBS polymer modified bitumen incorporating an aluminium foil with an upper surface finish of white cross laminated HDPE, and a lower surface finish of siliconized paper release film. JUTA GP[®] SAM is used for the gas/waterproofing of underground structures where harmful ground gasses are anticipated.



JUTA GP [®] SAM			
Characteristic	Test Method	Unit	GP [®] SAM
Physical Properties			
Thickness	EN 1849-2	mm	1.00
Width	EN 1849-2	M	0.3 or 1
Length	EN 1849-2	M	20
Weight	EN 1849-2	g/m ²	1100
Hydraulic Properties			
Watertightness	EN 1928	-	PA55
Water Vapour Transmission	EN 1931	g/m ² /day	0.013
Mechanical Properties			
Tensile Strength (MD/CMD)	EN12311-2	N/mm ²	3
Elongation (MD/CMD)	EN 12311-2	%	>120
Resistance to Static Load	EN 12370	kg	20kg
Joint Strength	EN 12317-2	N	>30
Durability and Water tightness (ageing and chemicals)	EN 1847	-	PA55
Resistance to Nail Tear (MD/CMD)	EN 12310-1	N	>100
Reaction to Fire	EN 13501	Euro Class	F
Gas Permeability			
Methane Permeability	B5 EN ISO 15105 - 1	ml/m ² /day/atm	< 0.53
Carbon Dioxide Permeability	B5 EN ISO 15105 - 1	ml/m ² /day/atm	< 0.53
Radon Permeability	K124/02/95	m ² /s	5.0 x 10 ⁻¹⁴

JUTA GP[®] SAM complies with the latest codes of practice as published by BRE, CIRIA and BSI (BS 8485:2015).

Contact us to find out more information.
info@juta.co.uk | 01772 754177 | JUTA.CO.UK
 Melton Grove Works, Church Road, Lytham, FY8 5PL



riba
product
selector

JUTA