



## Ground Gas Protection System Verification Report

Prepared For: Engie

Issue Date: May 2021

Job No: 12032

**REPORT TITLE** : **Ground Gas Protection System Verification Report, Phase 2A, Herbert Road, Newport**




**JOB NUMBER** : **12032**

**DATE** : **May 2021**

**REPORT REFERENCE** : **140521-12032-01**

**Document Revision Record**

Issue Number	Date	Revision Details
1	14/5/21	Initial Report (plots 1-36)

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## **SECTION 1 Introduction and Proposed Development**

### **1.1 Introduction**

Engie (the Client) has developed 195 residential units in three phases at Herbert Road, Newport.

Terra Firma (Wales) Limited have been commissioned by the Client to prepare a ground gas protection system validation report (Validation Report) for plots 1-36 at the development.

Validation of the ground gas protection system has been undertaken in general accordance with Terra Firma Wales Ltd Ground Gas Protection System Verification Plan, reference TFW\_0219\_12032\_GGVR\_01, dated February 2019.

### **1.2 Objectives**

The objective of the Verification Report is to accurately record the ground gas protection system installation and to confirm its acceptability and compliance with the Verification Plan methodology and remedial objectives at the time of inspection.

### **1.3 Limitations and Exceptions of Investigation**

This report has been prepared for the sole internal reliance of the Client and its design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill. The report represents the findings and opinions of experienced geo-environmental and geotechnical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may be required.

This report does not constitute a validation of membrane installation or any other tradespersons work. Terra Firma Wales Ltd cannot accept any liability relating to any aspect of the ground gas protection system installation or its ultimate performance.

### **1.4 Verification Officer Competency**

The principal Verification Officer at Terra Firma (Wales) Ltd is Mr James Rhys-Williams.

Mr Rhys-Williams is suitably qualified holding a Level 4 NVQ Diploma in Verification of Ground Gas Protection Systems. Furthermore, he is a full member of the British Verification Council (BVC) with instant access to industry peers.

Mr Rhys-Williams has extensive experience in brownfield land investigation, risk assessment and site remediation gained while working for various geotechnical and geoenvironmental contractors and consultants since 2014.

Mr Rhys-Williams holds a bachelor honours degree in Geology obtained from the University of Bristol in 2010 and is a fellow of the Geological Society of London, maintaining regular industry related continuous professional development.

### **1.5 Quality Assurance**

The quality and environmental aspects of the assessment and investigation comply with UKAS Accredited ISO 9001:2015 and ISO 14001:2015 standards.

## SECTION 1 Installed Protection Measures

### 1.1 Structural Barrier

As proposed the structural barrier comprised a beam and block suspended subfloor.

### 1.2 Ventilation

The open void spaces were recorded to have a height more than 150mm. Similarly, adequate ventilation was maintained beneath beams to allow through flow across the whole plot footprint. Photographs demonstrating adequate void height are included in the relevant verification pro forma in **Annex B**.

Telescopic vents and air bricks (Manthorp G930) were typically spaced at 2.0m centres around the full perimeter of the structures and not greater than 4.0m. Photographs provided by the groundworker showing typical ventilation spacing are appended in **Annex A**.

### 1.3 Membrane

The membrane was installed by small groundworker team which remained constant throughout the development. Prior to commencement of the membrane installation on phase 2A, groundworkers and site management attended a toolbox talk presented by Terra Firma Wales Ltd, in which the materials to be used and expected installation quality were discussed.

Daily log sheets of membrane installation were not prepared.

As proposed Solshield Ultra Gas Barrier was used throughout the development.

Membrane joints were taped with 50mm double sided butyl tape and suitably overlapped by at least 150mm. Upon completion of plot verification groundworkers promptly installed Solco Foil Lap Tape along all joints.

Prefabricated top-hats were typically used however duct style service entries were often tapped with SOLCO XL Jointing tape. Duct style service entries were sealed by the groundworkers using expanding foam and capped with mortar. Photographs showing completed sealing details are appended in **Annex A**.

Multiple verification visits were undertaken to acquire all the necessary information to effectively verify the protection system. A thorough visual verification of all plots was undertaken by the author. All joints, pipe penetration etc. were air lanced to ASTM D4437-08:2013. Observations and results are recorded on the verification pro forma, presented in **Annex B**. Photographic evidence of the installation is also presented in **Annex B**.

Upon completion of the Verification process site workers typically commenced placement of reinforcement on elevation blocks followed by screeding within one day. This process was observed by the author on plots 1-12 and considerable care was taken in its positioning and placement. Photographic evidence of the reinforcement installation is presented in the relevant verification pro forma in **Annex B** and **Annex A**.

#### 1.3.1 Non-Conformances

Non-conformances were rarely seen but when identified typically comprised minor unbonded seams. Unbonded seams were repaired immediately by applying additional pressure or by incorporating additional tape. The repaired seam was then retested using the air lance for conformity.

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On one occasion the incorrect use of foil lap tape was observed. The installer had used the incorrect tape to detail an internal corner. The issue was rectified by removal of the tape and replacement with SOLCO XL Jointing tape.

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## **SECTION 2 Report Conclusion**

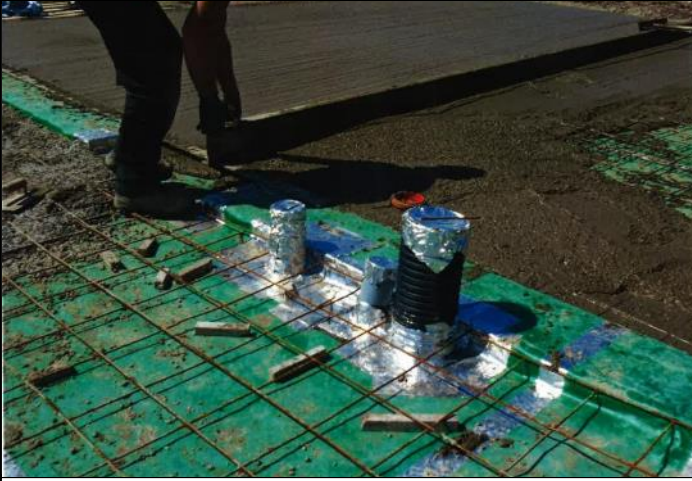
It is considered that lines of evidence gathered during the verification process confirms ground gas protection measures have been install as per the requirements of the Verification Plan and satisfy the remedial objectives, severing the pathway between the source and receptor.

Further in-situ integrity testing was considered unnecessary based on the inspection findings.

Follow on contractors should be made aware of the ground protection system in place. It is essential that the integrity of all gas protection measures is maintained post-verification and not damaged by any subsequent construction works.

Accidental damage to the membrane system post Verification should be reported to the verifier, rectified and re-inspected at a later date.

**ANNEX A**  
**Groundworker Photographic Evidence**



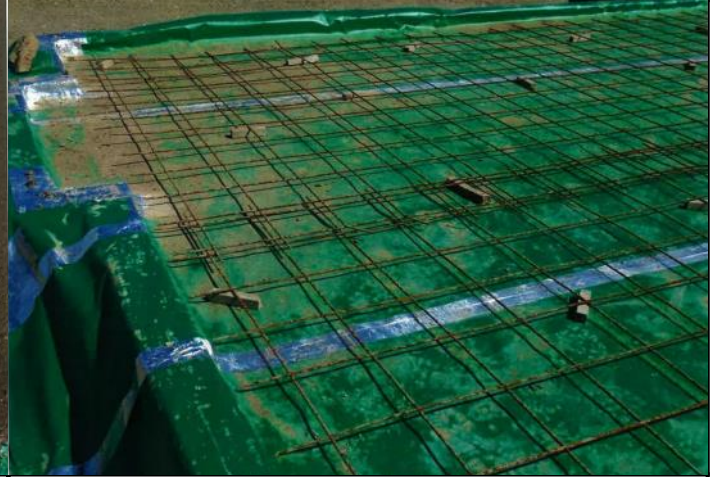
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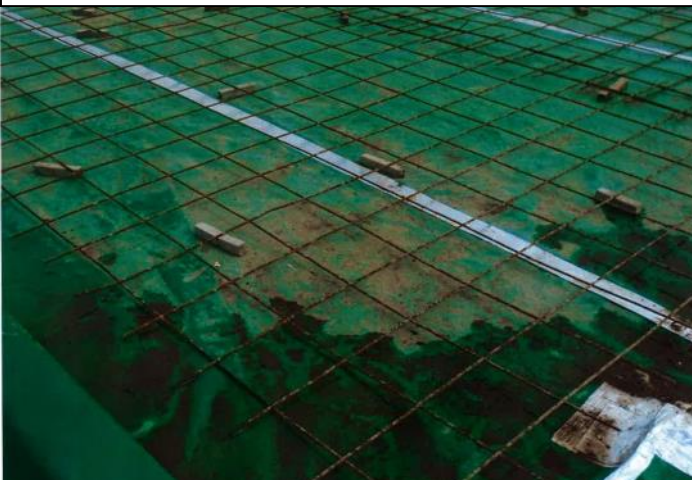
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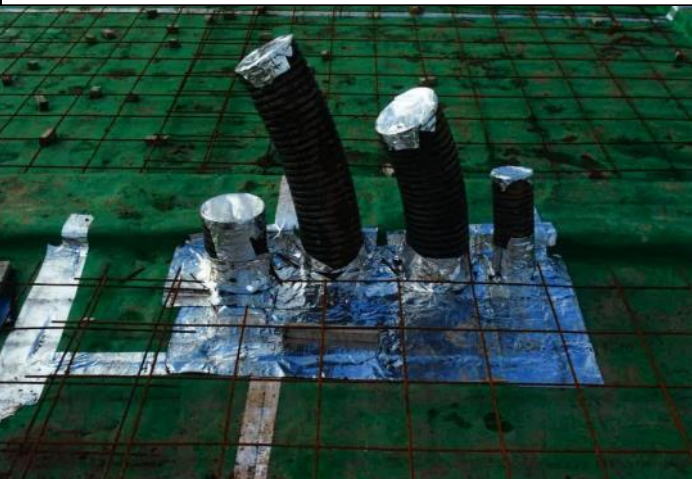
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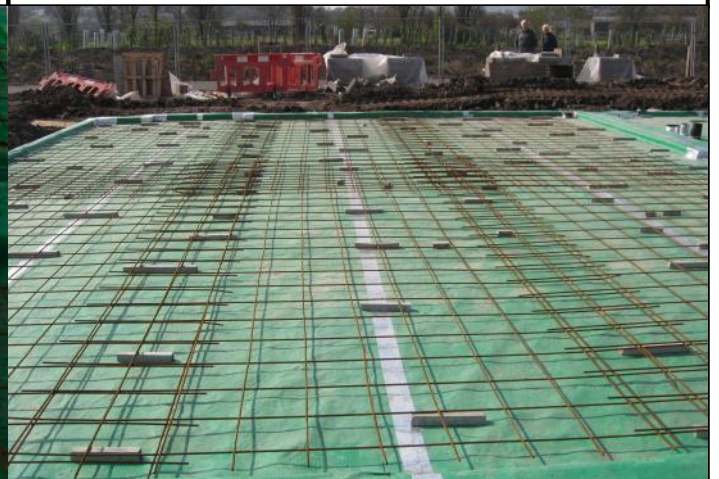
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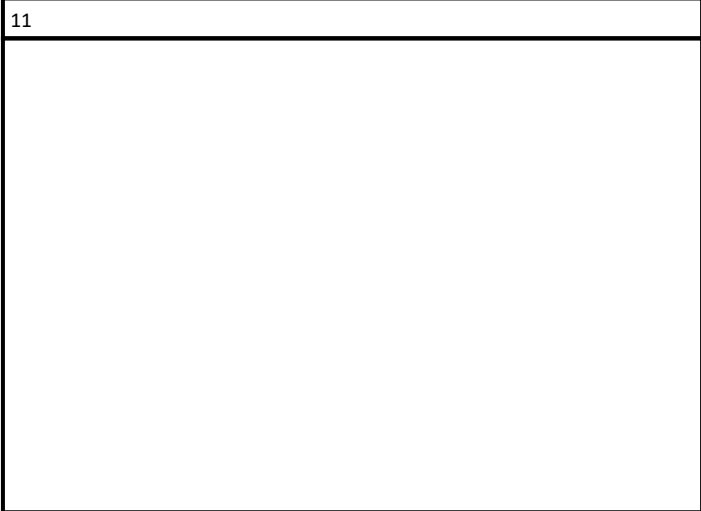
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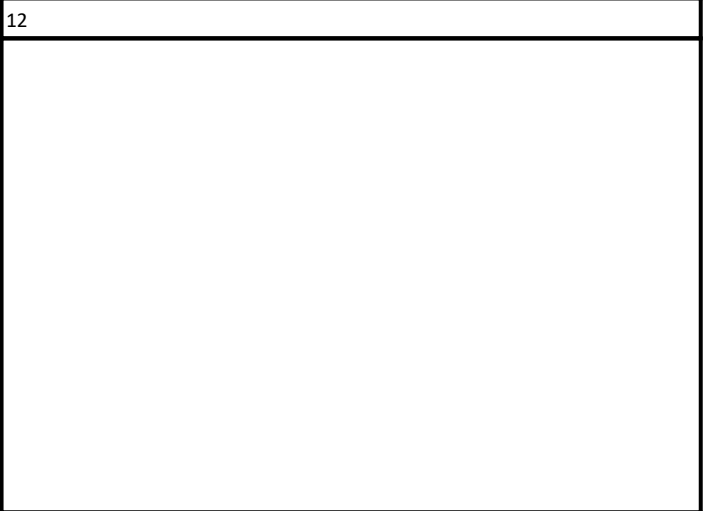
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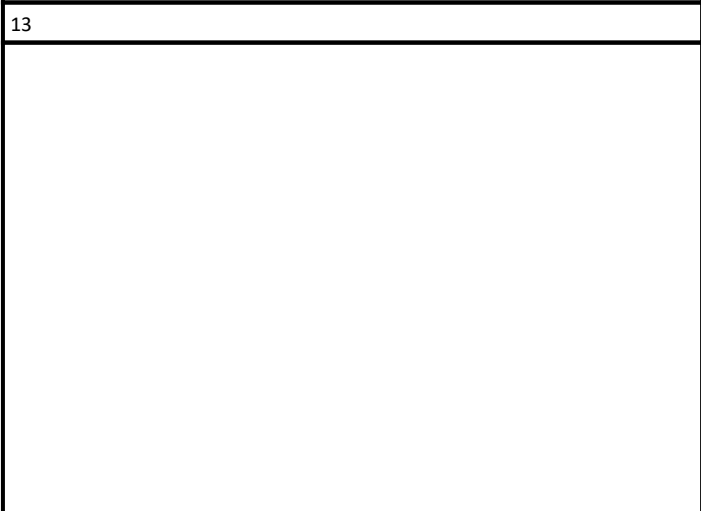
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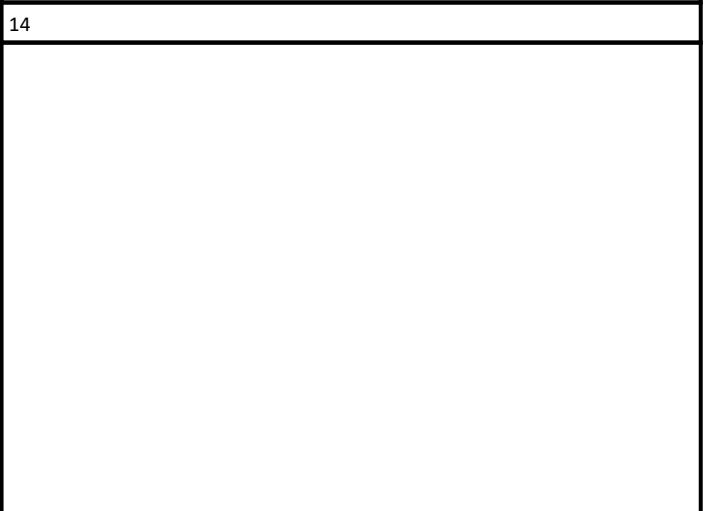
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**ANNEX B**  
**Verification Pro Forma & Photographic Evidence**

# Site Verification Pro Forma



Site Name: Herbert Road	Installer: Groundworker
Job Number: 12032	Phase: 2A
Start Date: 27/3/19	Plot Number: 1-12
End Date: 1/4/19	Housing Style: L
Verifier: JRW	Foundation Type: Suspended Floor
Weather Conditions: Sunny, warm	Gas Protection Type: Passive

Site Visit Dates & Comments
26/3/19 Toolbox talk undertaken with site management and groundworker installer team
27/3/19 Initial inspection - plots not complete, re-arranged verification visit for the 1st April
1/4/19 verification visit undertaken

No.	Item	Comments
<b>1. Membrane</b>		
1.1	Condition of sub-grade and underside of gas membrane	Insulation board over suspended floor.
1.2	Gas membrane type	Solshiel ultra gas barrier - green
1.3	Gas membrane condition	Good without visible defect. Some debris noted but told groundworkers to keep surfaces clean to avoid accidental penetration.
1.4	Joining tape product	50mm double sided butyl tape
1.5	Lapping design	At least 150mm overlap of membrane
1.6	Laps, welds, and joints seals	All air lanced to ASTM D4437. Serval minor non-compliances noted (joint not sealed needed to be rolled more). Immediately repaired and re-tested. <b>Passed</b> . Generally easy to repair due to the temp. Lap tape installed post verification.
1.7	Service entries seals	Self adhesive membrane detailing tape and preformed top hats with jubilee clips used.
<b>2. Ventilation</b>		
2.1	Sub-floor void	Clear void observed previously.

2.2	External wall airbricks	Approx. 2m spacings between air brick voids
2.3	Internal sleeper walls/Beams	At least 150mm gap beneath sleeper wall beams
2.4	External vents trenches/ducts	NA

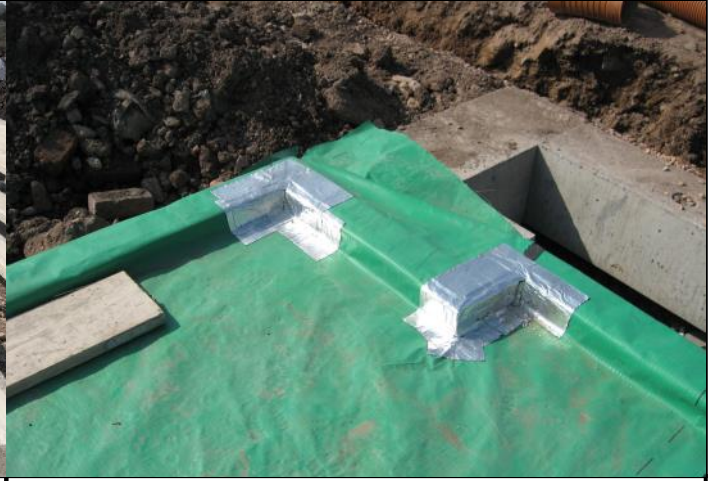
**Additional Information:** Steel reinforcements laid during inspection visit. Care was taken, no damage recorded.

Photographs	
No.	Description
1	Sub-floor void
2, 3	Corner details
4, 5	Full plot
6, 7	Service entry sealing
8	Reinforcement placement

Conclusions
<p>The gas protection measures inspected: A - are acceptable and comply with the specification; B - Are Acceptable but attention is drawn to issues related to item no. XX; C - Are not acceptable due to the issues related to item no. XX. <b>B - service entry ducts to be sealed at later date, photos to be provided by PM</b></p>



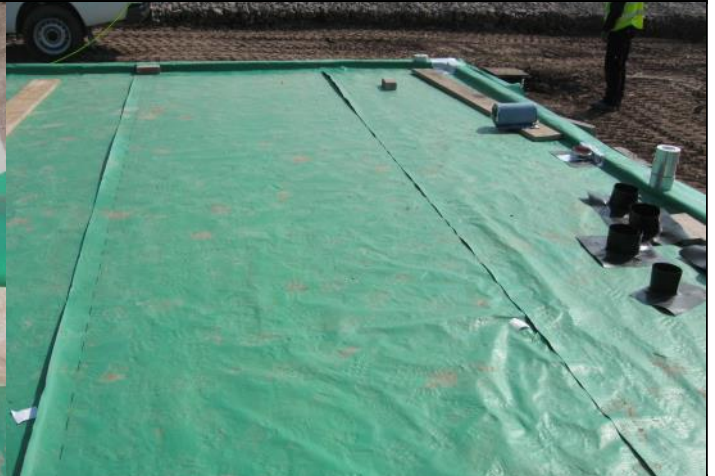
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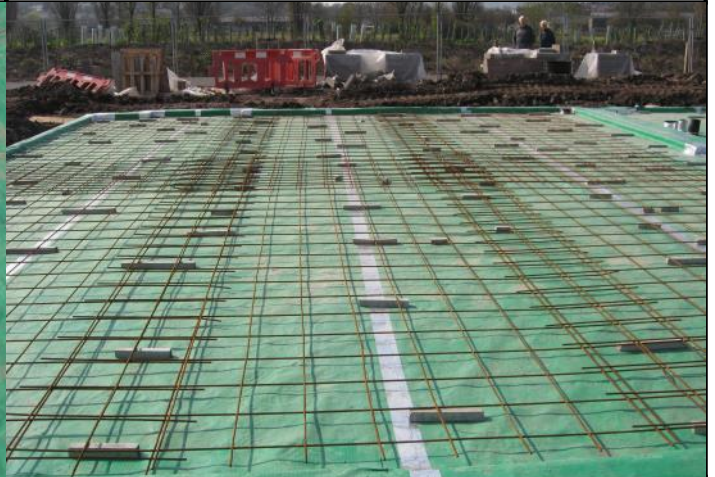
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# Site Verification Pro Forma



Site Name: Herbert Road	Installer: Groundworker
Job Number: 12032	Phase: 2A
Start Date: 10/4/19	Plot Number: 13-24
End Date: 10/4/19	Housing Style: L
Verifier: JRW	Foundation Type: Suspended Floor
Weather Conditions: Sunny	Gas Protection Type: Passive

Site Visit Dates & Comments
10/4/19 initial verification inspection

No.	Item	Comments
<b>1. Membrane</b>		
1.1	Condition of sub-grade and underside of gas membrane	Insulation board over suspended floor.
1.2	Gas membrane type	Solshiel ultra gas barrier - green
1.3	Gas membrane condition	Very good condition - some footprints noted but no damage
1.4	Joining tape product	50mm double sided butyl tape
1.5	Lapping design	At least 150mm overlap of membrane
1.6	Laps, welds, and joints seals	All air lanced to ASTM D4437. <b>Passed</b> . Lap tape installed post verification. Inappropriate use of lap tape used in one section. Groundworker told to remove and use correct self adhesive membrane instead.
1.7	Service entries seals	Self adhesive membrane detailing tape and preformed top hats with jubilee clips used.
<b>2. Ventilation</b>		
2.1	Sub-floor void	Clear void observed previously.

2.2	External wall airbricks	Air brick voids noted around development
2.3	Internal sleeper walls/Beams	At least 150mm gap, seen previously
2.4	External vents trenches/ducts	NA

**Additional Information:** Steel reinforcements laid post inspection visit. No damage reported. Groundworker to provide photos.

#### Photographs

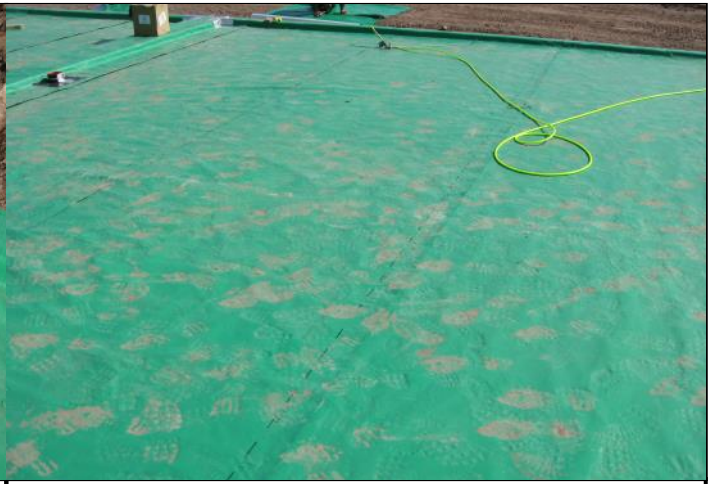
No.	Description
1	Top-hat and corner details
2	Full plot
3,	Corner details
4	Threshold corner details
5	Inappropriate use of lap tape

#### Conclusions

The gas protection measures inspected: A - are acceptable and comply with the specification; B - Are Acceptable but attention is drawn to issues related to item no. XX; C - Are not acceptable due to the issues related to item no. XX. **B - service entry ducts to be sealed at later date, photos to be provided by PM**



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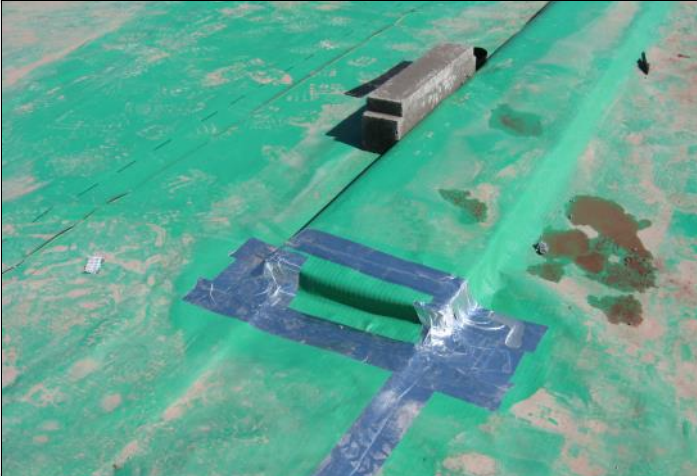
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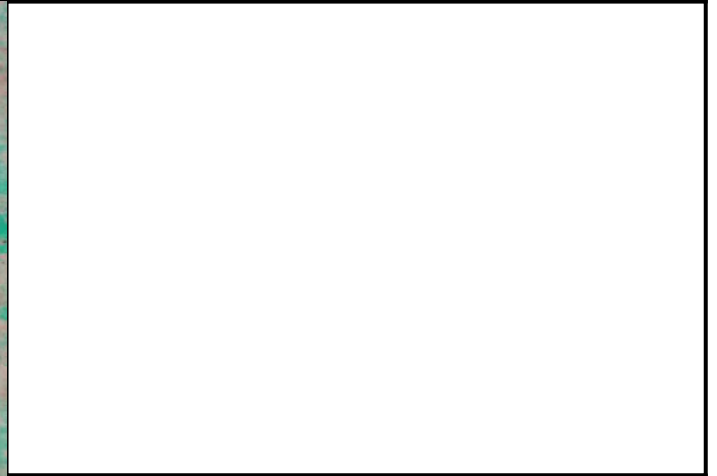
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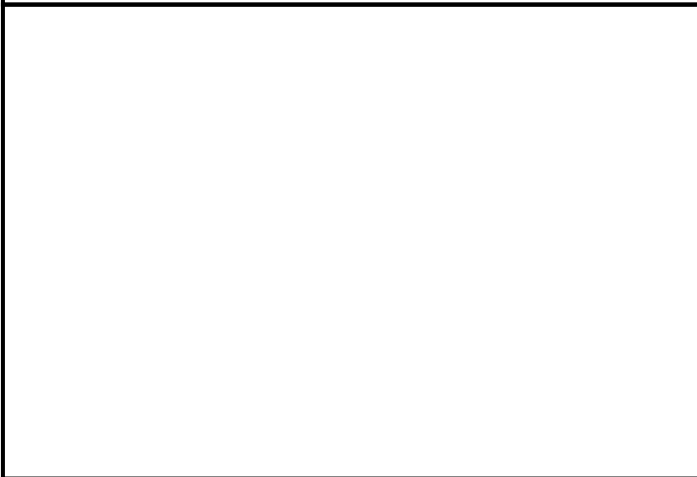
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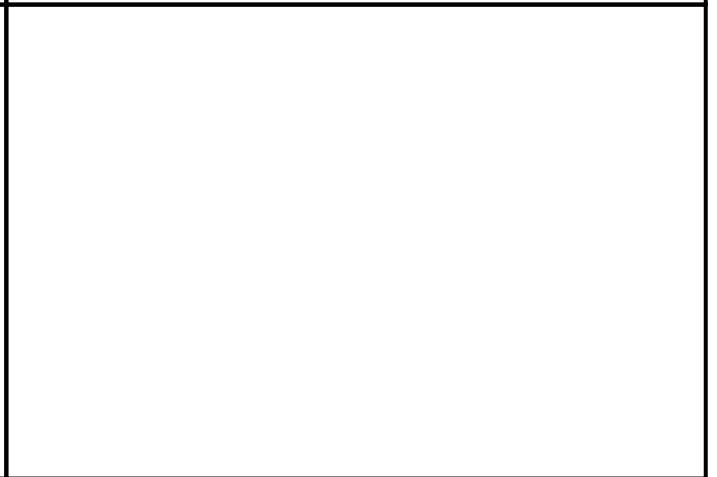
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# Site Verification Pro Forma



Site Name: Herbert Road	Installer: Groundworker
Job Number: 12032	Phase: 2A
Start Date: 10/4/19	Plot Number: 25-36
End Date: 18/4/19	Housing Style: L
Verifier: JRW	Foundation Type: Suspended Floor
Weather Conditions: Sunny, Partly cloudy	Gas Protection Type: Passive

Site Visit Dates & Comments
10/4/19 initial verification inspection - plot incomplete
18/4/19 main verification visit

No.	Item	Comments
<b>1. Membrane</b>		
1.1	Condition of sub-grade and underside of gas membrane	Insulation board over suspended floor.
1.2	Gas membrane type	Solshiel ultra gas barrier - green
1.3	Gas membrane condition	Very good condition - no damage noted
1.4	Joining tape product	50mm double sided butyl tape
1.5	Lapping design	At least 150mm overlap of membrane
1.6	Laps, welds, and joints seals	All air lanced to ASTM D4437. <b>Passed</b> . Lap tape installed post verification.
1.7	Service entries seals	Self adhesive membrane detailing tape and preformed top hats with jubilee clips used.
<b>2. Ventilation</b>		
2.1	Sub-floor void	Clear void observed previously.

2.2	External wall airbricks	Air brick voids noted around development
2.3	Internal sleeper walls/Beams	At least 150mm gap, seen previously
2.4	External vents trenches/ducts	NA

**Additional Information:** Steel reinforcements laid post inspection visit. No damage reported. Groundworker to provide photos.

#### Photographs

No.	Description
1	Sub-floor void
2,	Corner details
3,	Top-hats
4	Full plot
5	Threshold detailing and service entry sealing
6	Corner details

#### Conclusions

The gas protection measures inspected: A - are acceptable and comply with the specification; B - Are Acceptable but attention is drawn to issues related to item no. XX; C - Are not acceptable due to the issues related to item no. XX. **B - service entry ducts to be sealed at later date, photos to be provided by PM**



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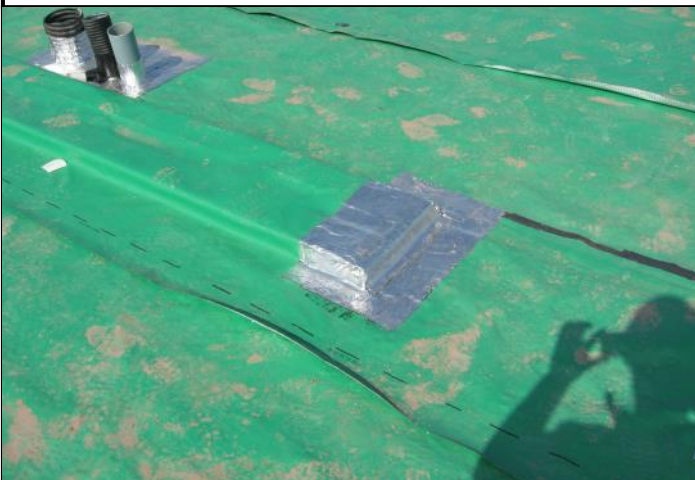
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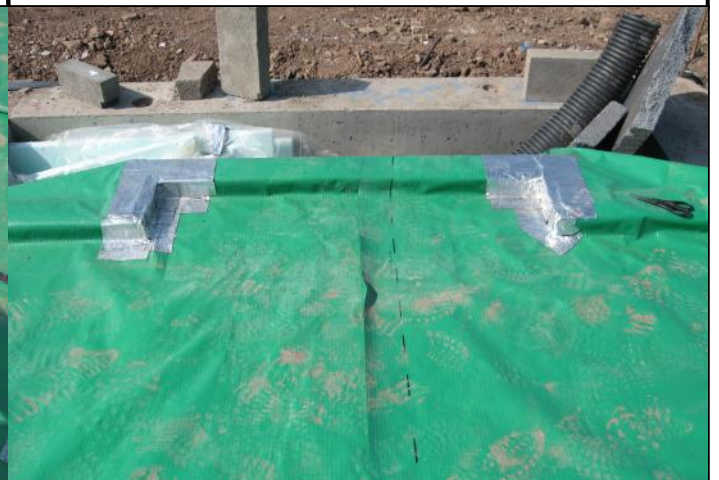
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