*Project Number:* **P1010**

**Validation of Gas Protection Measures**

**Residential Housing Development**
**West End Lane, West Hampstead**
**London**
**Block A**

*Client:* **O'Hare and McGovern**

**April 2016**

**MCL Consulting Ltd**
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**Belfast**
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# CONTENTS

# 1.0 INTRODUCTION

MCL Consulting was appointed by O`Hare and McGovern Ltd (OHMG) to undertake the validation of gas protection measures for residential developments constructed on lands at West End Lane, West Hampstead, London.

# 2.0 SUMMARY OF REMEDIAL MEASURES

MCL Consulting previously developed a Remediation Strategy in April 2014 for the proposed development. The gas risk assessment classified the gas regime as a maximum of Characteristic Situation 2 Low Risk (Modified Wilson and Card Classification). In line with the guidance (CIRA C665) the Remediation Strategy proposed the following gas protection measures to be incorporated into the final building design;

- Buildings with commercial ground floor will be constructed of either a reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft) with a 1200g DPM or block and beam or precast concrete slab with a 2000g DPM / gas resistant membrane;
- For buildings which have a residential ground floor, the floor slab design will be similar to that detailed above however in addition there will also be underfloor venting.

Due to the presence of hydrocarbons on-site it is recommended that a DPM / gas resistant membrane which is resistant to hydrocarbons and hydrocarbon vapour should be used in the building construction. A Visqueen GX hydrocarbon resistant gas protection membrane (4000g), or a similar product, was recommended be used in the final building construction

# 3.0 VALIDATION REPORT

## 3.1 Material Installed

### 3.1.1 Gas Barrier

The barrier installed at the site was the Radbar Flexi Hydrocarbon GX Membrane; a specially engineered tri-polymer membrane that is used as a radon, methane, carbon dioxide and hydrocarbon gas barrier. The membrane is black in colour and is supplied in 1.3x20m rolls. This membrane therefore provides resistance to hydrocarbon gases. The specification sheet for this product is presented as Appendix A.

### 3.1.2 Jointing

Radbar double sided tape was used to join to seal any joints between the membranes according to the manufacturer's description at least 100mm from the edge.

### 3.1.3 Pipe Penetrations

Pipe penetrations were sealed using the TEXSELF GS 2 is a Self-Adhesive Gas Membrane. An overlap of at least 8cm was used, and strips of the adhesive were used around the top hat, instead of using a performed top hat unit.

### 3.1.4 Stanchions/ Columns

Stanchions were sealed using the TEXSELF GS 2 is a Self-Adhesive Gas Membrane. Strips of the adhesive were used and jointed around the stanchion.

### 3.1.5 Tears/ Holes & Punctures

Perforations or punctures in the sheet were repaired using patched of TEXSELF GS 2 is a Self-Adhesive Gas Membrane with a minimum of 75mm to cover the tear, puncture or hole.

### 3.1.6 Underfloor Venting

Block A incorporated ground floor residential and therefore underfloor venting was required. The Gas Venting System installed is presented in Appendix B, and was visually inspected by MCL Consulting.

### 3.1.7 Inspection Method

Inspections of the gas protection measures were carried out on the following dates by MCL Consulting:

- 07/10/2015
- 28/10/2015
- 14/03/2016
- 12/04/2016

The inspection engineer carried out a thorough visual inspection of the gas barrier to check for any damage and check if repairs met the required standards. Samples photographs of the membrane joins were taken for the validation report and are presented in Appendix C.

Once the inspection was complete and the inspection engineer had accepted the membrane installation was complete the insulation and other layers were installed.

## 4.0 SUMMARY AND CONCLUSION

Overall, the inspection of the gas membrane confirmed that it has been laid to the correct standard.

**Report Prepared By: -**

**David McVeigh BSc**

**Environmental Scientist**

**Reviewed by:-**

**Frank Macfarlane BSc MSc**

**Senior Environmental Scientist**

## Appendix A

## Specification of Gas Membrane

# Radbar® Flexi Hydrocarbon GX Membrane

**Hydrocarbons** are colourless gases formed as a by-product of decomposing organic matter. It is crucial that when gas protection is required, the site conditions, design and application are all taken into consideration to provide an impermeable membrane capable of surviving installation and subsequent traffic, to protect the most valuable asset “the building” against harmful gases that can cause future problems.

Radbar Flexi Hydrocarbon GX Membrane is specially engineered tri-polymer construction that provides a highly effective barrier against Radon, Methane, Carbon Dioxide and Hydrocarbon gases. Hydrocarbon gases are formed as a by-product of decomposing organic matter, a build-up of these colourless gases are explosive which could have devastating consequences. The Membrane is produced from a uniquely formulated blend of polymers to produce outstanding chemical resistance, mechanical properties, dimensional stability and thermal aging characteristics. The membrane is ideally suited for sites formerly used as coalfield, landfill or industrial sites that previously contained volatile liquids, petrol stations for example.

As part of the extensive testing Radbar Flexi Hydrocarbon GX Membrane has undergone, it was subjected to accelerated life immersion tests. These tests, EN 14414 and EN 14415, require the membrane to be subjected to a range of challenge chemicals at 50 degrees C and then retested to establish any affects these chemicals have had on the integrity of the membrane. Full results can be found on the The technical data sheet.

## Physical Properties:

| Physical Description | Value |
|---|---|
| **Thickness** | 1000 Micron |
| **Density** | 0.925 g/cm³ |
| **Colour** | Black |
| **Length** | 20M |
| **Width** | 1.3M |


## Advantages

- **Excellent resistance to chemical and hydrocarbon gases**
- **Suitable for hot welding**
- **Very high puncture and tear resistance**
- **Compatible with vented systems**
- **Part of the Radbar Hydrocarbon System**
- **Full range of accessories available**
- **Outstanding Flexibility properties making it easy to install, especially when compared to HDPE films**
- **Superior mortar adhesion to prominent embossing to prevent slip planes when being used as DPC**
- **Full traceability- Rolls are clearly marked and identifiable with batch numbers and production dates**
- **Onsite training and installation available**
- **RADBAR approved installer certificate once training has been given**

CE Type A EN 13967: 2012

nqa. ISO 9001 Registered — UKAS QUALITY MANAGEMENT 015

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# Flexi Hydrocarbon GX Membrane

## Storage, handling and protection on site

Radbar flexi Hydrocarbon membrane is classified as non-hazardous (code of practice CP101 1973). The membrane is chemically inert and will not react with any acidic or alkaline environment it is laid in. It is not recommended that the membrane is exposed to sunlight for long periods of time. Weathering will not occur when installed with code of practise CP102 1973. If being stored for a lengthy period, the rolls should be stored undercover, out of direct sunlight on a flat level surface.

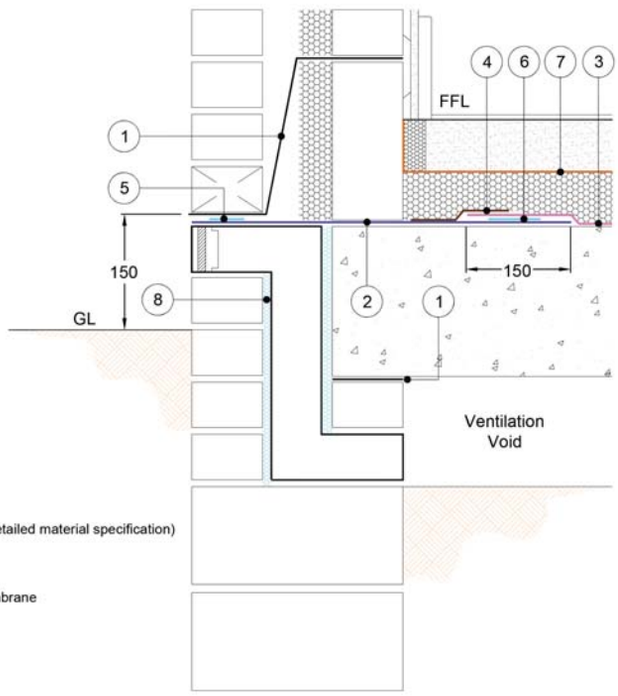
Quality control while laying the membrane is extremely important. The membrane should be protected through the use of temporary boards over the whole area or the immediate laying of the screed. A minimium of 50mm screed is recommended and care should be taken when laying the screed not to stretch, puncture or displace the membrane.

## Installation

Radbar flexi Hydrocarbon GX membrane system must be installed in accordance with the guidelines laid out in Building Research establishment BRE No.414 “Protective measures for housing on gas contaminated land”, CIRIA C665 “Assessing risks posed by Hazardous ground gases to buildings”, NHBC guidelines and CIRIA C682 the VOC Handbook.

Radbar Flexi Hydrocarbon GX membrane can be used in most common floor constructions and is installed in a similar manor to damp-proof membrane greater but with greater attention to joint sealing and under wall sealing. Where there is risk of hydrostatic pressure Radbar Flexi Hydrocarbon GX can be used so long as the jointing is made using the hot weld process and not taped. The membrane should be laid on smooth surface or sand blinding to prevent puncture.

### Suspended Slab - Raised Floor, Typical Gas Protection Detail




**Key to Materials:**
(Refer to Radbar Technical Data for full detailed material specification)

1. Radbar High Performance DPC
2. Radbar Hydrocarbon DPC
3. Radbar Flexi Hydrocarbon GX Membrane
4. Radbar GX S/S Tape 100mm
5. Radbar D/S Tape 100mm
6. Radbar GX D/S Tape 100mm
7. CVP Vapour Barrier
8. Insulation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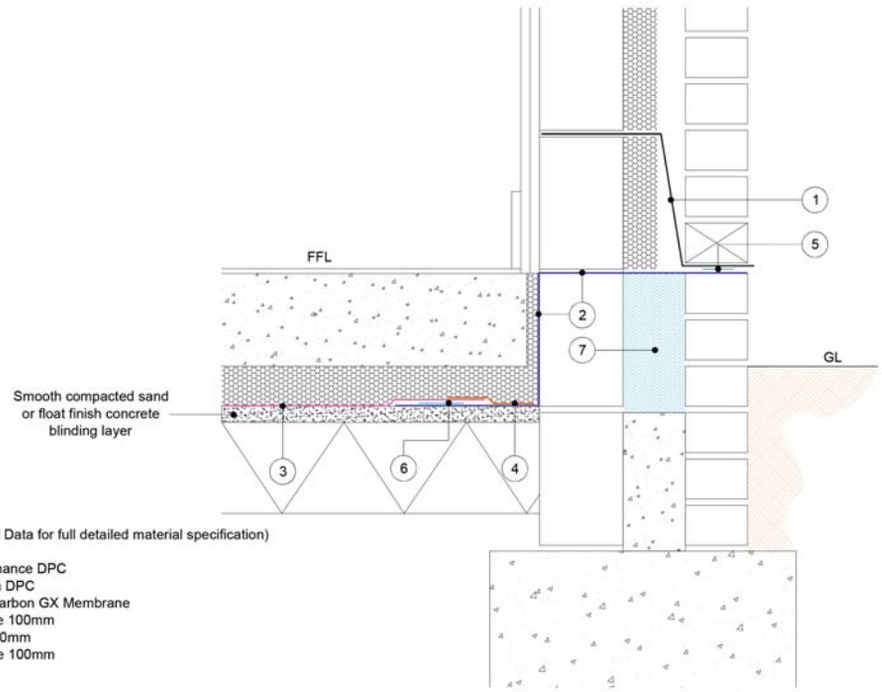
# Flexi Hydrocarbon GX Membrane

## Ground Bearing Slab Typical Edge Detail




**Key to Materials:**
(Refer to Radbar Technical Data for full detailed material specification)

1. Radbar High Performance DPC
2. Radbar Hydrocarbon DPC
3. Radbar Flexi Hydrocarbon GX Membrane
4. Radbar GX S/S Tape 100mm
5. Radbar D/S Tape 100mm
6. Radbar GX D/S Tape 100mm
7. Insulation

## JOINTING of MEMBRANE

**1**
Unroll the first membrane, ensure the surface is dry and free from dust or grease. Inspect the membrane to ensure that there are no indentations or protrusions. If there are remove and apply sand blinding.

**2**
Apply Radbar Double Sided Tape to the membrane, 100mm from the edge. It is very important that the membrane is dry and free from dust and dirt.

**3**
The second membrane must be unrolled overlapping the first membrane by 150mm. Remove the protective paper from the Radbar Double Sided Tape; apply pressure to the membrane while joining the two membranes together.

**4**
Seal the two membranes by installing Radbar Single Sided Tape to the edge. (ensure that the membrane is completely dry, free from dust and dirt.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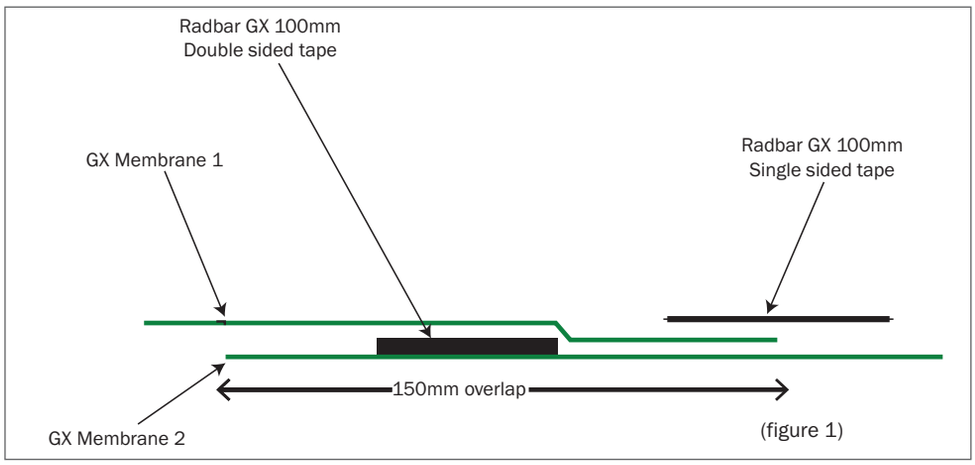
# Flexi Hydrocarbon GX Membrane

## Jointing of Radbar Flexi Hydrocarbon GX Membrane

Sheets must be clean and free from dirt and grease before application of Radbar double sided gas tape, and in view of the difficulty of achieving gas tight seals under wet or dirty conditions it is recommended that special care is taken with this aspect of the installation. Unroll one width of the membrane after determining the most effective method of covering the area. Apply the Radbar double sided gas tape about 50mm from the edge, leaving the backing paper on. Lay the next width of membrane overlapping the first by 150mm. Remove the backing paper from the Radbar double sided gas tape and join the top sheet to the bottom sheet by applying pressure with a hand roller. Where the membranes overlap apply the 100mm single sided tape, equidistant on both membranes. See figure 1.

All service entry points must have airtight seals. Top hats and corner pre-forms must be sealed using Radbar Double sided gas tape. (As in figure 1)



(figure 1)

## Hydrocarbon System Components and Accessories

When used in conjuncture with other products in the range Radbar Hydrocarbon DPC is part of a highly effective complete system to prevent the ingress of hydrocarbon gases.

These products include but are not limited too:

- Radbar GX Double sided joint tape
- Radbar GX Single sided joint tape
- Radbar GX flexi top hats (110&160mm)
- Radbar Hydrocarbon DPC
- Radbar GX Internal/External corners

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## Appendix B

## Gas Floor Ventilation System

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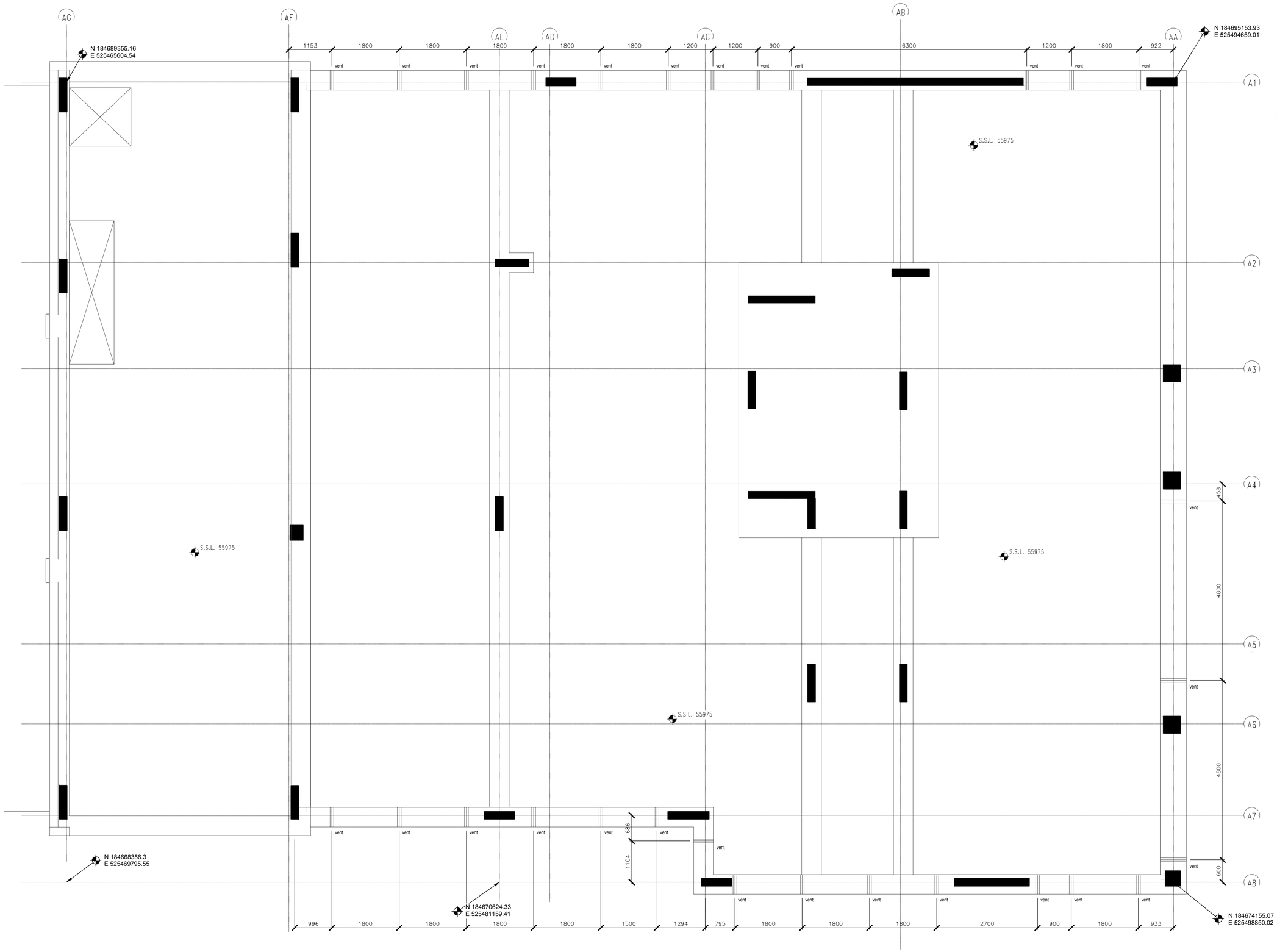
XREF'S IN THIS DRAWING




Note
Ventilated airspace to be minimum 150mm from the ground to underside of the floor (or insulation if provided).

All pipes needed to carry ventilation air to incorporate suitable grilles to prevent the entry of vermin to the subfloor but do not resist the air flow unduly.

Perimeter = 88m = 17no pipes required.
Area = 458m² = 30no pipes required.

1no 100mm dia pipe = 7850mm²

| No. | Date | Description | Drwn/Chkd By |
|---|---|---|---|
| A | 05/05/15 | Ventilation notes added for NHBC/Building Control confirmation. | DRJ/AM |

CLIENT
Ballymore & Network Rail

PROJECT
West Hampstead Square

TITLE
Block A
Subfloor Vent Setting Out

DRAWING STATUS
For Construction

| DRAWN | CHECKED |
|---|---|
| DRJ | AM |

SCALE 1:50 @ A1

DATE August 2014

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| JOB NO. | DRAWING NO. | REV |
|---|---|---|
| 12-316 | A00-A098 | A |

## Appendix C

## Verification of Gas Protection Measures Checklist

## Verification of gas protection measures

| | |
|---|---|
| **Site Name:** West Hampstead Square | **Plots Checked:** Block A |
| **Job Number:** P1010 | **Building Type:** Residential Apartments |
| **Inspection Completed by:** David McVeigh | **Gas Protection Measure:** Proprietary Gas Barrier & Underfloor venting |
| **Date:** 12/04/2016 | **Weather at time of inspection:** Cold/Rain |

| Item No. | Item | Comments |
|---|---|---|
| 1 | Membrane | The membrane inspection was conducted in the perimeter areas of the walls, and around any fittings and top hats, and across the floor area (sees photo 1). |
| 2 | Sub-Floor Void | N/A |
| 3 | Membrane Type | The membrane used on site was the Radbar Flexi Hydrocarbon GX Membrane is a specially engineered tri-polymer membrane that is used as a radon, methane, carbon dioxide and hydrocarbon gas barrier. The visual inspection of the site confirmed the presence of this membrane.<br><br>Another membrane used on site was the TEXSELF GS 2 is a Self-Adhesive Gas Membrane was confirmed as being present via the visual; inspection of the site. |
| 4 | Membrane Condition | The Radbar Flexi Hydocarbon GX Membrane has been installed throughout the floor surface of the building (see photo 2) by a specialist gas membrane installer. The visual inspection confirmed that the condition of the membrane was of an acceptable standard. |
| 5 | Joining tape product | Radbar double sided tape was used to join to seal any joints between the membranes according to the manufacturer's description at least 100mm from the edge. |
| 6 | Lapping Design | The membrane was overlapped at least 150mm as per the manufacturer's instructions in all areas. |
| 7 | Laps, welds and joints seals | The joints and seals were found to be acceptable to the inspections engineer. (see photo 3) |
| 8 | Service entries seals | Pipe penetrations were sealed using the TEXSELF GS 2 is a Self-Adhesive Gas Membrane. An overlap of at least 8cm was used as per the manufacturer's instructions in all areas. The service entries seals were found to be acceptable to the inspection engineer. |
| 9 | Underfloor Venting | The underfloor venting system was installed as according to Appendix B. |

| No. | Description |
|---|---|
| 1. | Membrane across floor |
| 2. | Membrane across floor (Radbar labelling can be seen) |
| 3. | Membrane around stanchion |

**1.**

**2.**

**3.**

The installation has PASSED inspection and a further inspection is not required to this area.

Signed:

Environmental Scientist

15/04/2016