



GeoEnginSeer

FREELANCE DILETTANTE GEOLOGIST

**Oakroyd Hall,
Birkenshaw,
Bradford Road BD11 2DY**

Verification Completion Report for Ground Gas Protection Systems

Date	03.07.23 and 05.07.23
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Project Title	Oakroyd Hall Birkenshaw
Date	03.07.23 and 5.07.23
Client	GRK Civils / Willmott Dixon
Weather	Sunny 17oC light wind 5kmh / Cloudy 15oC light wind 2kmh
Development Type	Commercial
Foundation Type	Sectional concrete slab floors
Plot Numbers	Retro installation to old Fire House building
Visit By	Paul Carter – Jones

Report By**Checked/Approved By**

Name: PAUL CARTER – JONES

Name: Ben Crowther

Company Contact Details

WYFRS
Oakroyd Hall,
Birkenshaw,
Bradford Road
BD11 2DY

1. GAS MEMBRANE

1.1 Condition Of Subgrade and Underside Of Gas Membrane

Check that the subgrade does not contain rough/uneven surfaces, is appropriately clean and that there are no hard/sharp objects. That protective sand blinding or geotextile (if specified) is present and meets the design criteria.

The subgrade was a mixture of sand and gravel in the channels, and smooth pre-poured concrete sections. The first pour could have benefitted from a further clean as there were many bumps underneath, a couple had pierced through and had to be repaired. The second section was much better.

1.2 Gas Membrane Type

Manufacturer and product specification, gauge, colour, brand/name, material batch/roll numbers.

SolSheild Ultra Gas Barrier
Solsheet Self Adhesive Membrane

1.3 Laps, Welds and Joint Seals

Joints lapped and sealed in accordance with manufacturers requirements/specification. Minimum overlap insured? Welds complete? Appropriate joining/double sided tape used?

The laps of the membrane had been taped; a double side tape had been used on the under side and a silver foil tape to be used on the upper side.

1.4 Service Entries Seals

How many pipe penetrations? Top hats seal arrangements fixed around service entries? Use of jubilee clips? Etc.

Service entries had been sealed with top hats, double sided tape, foil tape and clips. Some of them had been sealed in situ with white self-adhesive membrane.

2. VENTILATION SYSTEMS

2.1 Subfloor Void

Is a check possible? Void former? Gravel (type/specification)? Height of void space? Is it clear?

N/A

2.2 External Wall Airbricks

How many? Size? Positioning? Spacing? Etc.

N/A

2.3 Active Venting

Type of air supply: mechanical, natural, combined? Location/condition/number of fans/vents? Location and size of inlets? Provision of air cleaning devices and air heaters? Supply and exhaust duct work? Alarm provision/installation? Gas monitoring system in under-floor void?

N/A

2.4 Testing Of Air Flow

Is the air flowing sufficiently through ventilation? Anemometer reading? Smoke test? Tracer gas?

N/A

3. INSPECTION AND INTEGRITY DETAILS

On the 3rd of July 2023 and a follow up visit on the 5th of July 2023 the installation of the Proprietary Gas Resistant Membrane for the protection of properties from ground gas was inspected at Oakroyd Hall Birkenshaw, in the old Fire House building.

This was a retro installation to the inside of an existing building. The inside perimeter had been primed and the Solsheet Self Adhesive Membrane (S.A.M) had been heat applied. The Solsheet ultra gas barrier had then been joined to the S.A.M with double sided tape.

he subgrade was compacted ground, a mixture of gravel and sand down the channels, and in parts the membrane had been installed on pre-poured slabs. The first area could have benefited from a more thorough sweep as there were many bumps underneath and a few had pierced through and had to be repaired. The second section had been prepped much better.

I noticed a pipe had been missed in the first pour section and had to be rectified during my visit.

SolSheild Ultra gas membrane (green) had been laid throughout the main floor area, which had ample of overlap of over 150mm. The membrane had been taped together with double sided tape [REDACTED] underside, all was tested [REDACTED] at 50 [REDACTED] and.

Solsheet Self Adhesive Membrane had been heat applied to all 11 columns.

Service entries were sealed with prefabricated top hats, clips and sealed with gas resistant tapes. Some of the larger pipes had been sealed in situ with S.A.M.

Once completed, the areas were covered in a protective fleece

Site to provide photographic evidence to the last part of detailing.

Overall the membrane had been installed to a good standard.

Please see photographs.

4. PHOTOGRAPHIC RECORDS









PRODUCT DATA SHEETS:

SOLCO Technical Datasheet
Last Issued: November 2012

Solsheet GR Self-Adhesive Membrane

Description:

Solsheet GR Self-Adhesive Membrane is a 1.5mm thick preformed, cold applied, waterproofing system, compatible with concrete, smooth brickwork, and blockwork or screeded substrates and is resistant to Rose chemicals likely to be present in normal service conditions.

Solsheet GR Self-Adhesive Membrane is manufactured from an aluminium and cross-oriented HDPE film laminated to a layer of rubber modified bitumen adhesive. The advanced backing film suppresses Methane, Carbon Dioxide, and Radon gases. The membrane also offers good conformability for site application.

Solsheet Gas Resistant Self-Adhesive Membrane conforms to the requirements of BS 8485 and BS 8102. Substrates should be primed with Solsheet HP Primer prior to application. Solsheet Gas Resistant Self-Adhesive Membrane can be used with Solcourse GR DPC and other Solshield Gas Membranes.

After installation, the membrane should be covered as soon as possible with a cementitious screed or similar protective layer.



- Roll Dimensions: 1m x 20m (20m²/roll)
- Roll Weight: 34kg.

Features:

- Resistant to Rn, CH₄, CO₂, and Hydrocarbon Vapours.
- Cross-laminated film – provides dimensional stability, high tear strength, puncture, and impact resistance.
- Polymer modified bitumen coating.
- Cold applied – no heating via flames or hot bitumen on site.
- Flexible – will accommodate minor settlement and shrinkage.
- Comprehensive range of accessories and ancillary products.
- Full design and on-site technical support.
- Specification compliant with BS 8102:2009, BS 8485:2015+A1:2019, and EN ISO 15105-1.
- CE Marked.
- Non-hazardous and resistant to dilute acids and alkalis.
- Compliant with NHBC Standards.
- Easy Application.
- Provides high-performance protection against the surface and groundwater and soluble salts such as chlorides, sulfates, urates, and acids.

Typical Uses:

For general waterproofing where gas protection is required:

- Internal and external tanking of underground structures.
- Land-fill sites and specific geographical locations.
- Car parks and retaining walls.
- Subways and lift shafts.

Substrate Compatibility:

- Wood.
- Brick.
- Concrete.
- Metal.
- Other construction materials.

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SOLCO Technical Datasheet
Last Issued: November 2012

Technical Data:

Property	Test Method	Value
Thickness (Total Thickness)	EN 1849-1	1.5mm
Thickness (Backing Thickness)	EN 1849-1	0.1mm
Thickness (Adhesive)	EN 1849-1	1.4mm
Mass per Unit Area	EN 1849-1	1.3 kg/m ²
Resistance to Static Load	EN 12730	< 5 kg
Tensile Properties	EN 12311-1	Transverse - 230 N/50mm, 200% Longitudinal - 230 N/50mm, 180%
Watertightness to Liquid Water	EN 1528	Watertight at 2 kPa
Durability of Watertightness (Against Artificial Aging)	EN 1528	Watertight at 2 kPa
Durability of Watertightness (Against Chemicals)	EN 1528	Watertight at 2 kPa
Resistance to Tear (Hot Brands/Trans./Long.)	EN 12310-1	140 N / 150 N
Impact Resistance	EN 12691	200mm
Low Temperature Flexibility	EN 1109	-25°C
Joint Strength	EN 12317-1	Transverse - 180 N Longitudinal - 170 N
Water Vapour Transmission	EN 1931	0.22 g/m ² /24hrs
Reaction to Fire	EN 13501-1	Pass
Ignitability	BS EN ISO 11952-2	Pass
Fire Rating	EN 13501-1	E/EFL
Storage Temperature Range		+5°C to 35°C
Application Temperature Range		+5°C to +35°C
Service Temperature Range		-20°C to +80°C
Gas Transmission Rate	ISO 15105-1	CH ₄ (single layer and joint): <10 mcm ³ /day CO ₂ (single layer and joint): <10 mcm ³ /day

Storage:

- The membrane rolls must be stacked on end and stored in dry, well-ventilated buildings, out of direct sunlight, or other major sources of heat.
- Storage conditions should be adjusted before application to bring the temperature of the rolls to within the relevant specified application range.
- The stock should be rotated on a first in/first out basis.
- Solsheet GR Self-Adhesive Membrane is classified as non-hazardous (code of practice CP102 1973). The product is chemically inert and any acids or alkalis present in the substrate will not affect the membrane.
- It is not recommended for use when exposed to sunlight and general outdoor weather conditions for long periods of time. Weathering will not occur when installed.
- Rolls should be stored undercover.
- Quality control during the laying of the membrane is extremely important.
- The membrane should be protected either through the use of temporary boarding over its whole area or the immediate laying of the concrete slab.

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Installation:

Surface Preparation:

- All surfaces should be smooth, clean, and dry. Loosely adhering material and sharp protrusions should be removed by mechanical means.
- Concrete or renders should be allowed to dry before applying Solsheet membranes.

Priming:

All vertical surfaces should be primed using Solsheet HP Emulsion/Primer. Horizontal surfaces do not require priming where the membrane is covered with a screed, floor slab, etc. Priming should be carried out as follows:

1. Roll can well before use.
2. Apply at the rate of approximately 2m²/L. Only prime the area which is to be covered with Solsheet within the next 4 hours. Allow to dry for at least 1 hour until touch dry. Keep free from dust.
3. On very porous surfaces, use two coats of primer.

Application:

- Internal angles must always be provided with an adequate sand/cement fillet.
- After priming as previously described a 300mm wide reinforcing strip of Solsheet must be applied with 150mm on either side of the centre of the fillet.
- External angles or corners must be provided with a 25mm x 25mm splay and this covered with a 300mm wide strip of Solsheet, applied equidistant from the centre of the splay.

Horizontal Membrane:

- This should preferably be laid prior to the application of the vertical membrane, adequately protected from damage by a minimum 25mm screed or protection board, with the membrane bonded to the vertical surface at least 200mm above the top of the screed so that the vertical Solsheet can be overlaid.
- If it is not possible to apply the screed over the membrane before the application of the vertical membrane, full and adequate protection must be given to the horizontal membrane to prevent damage.

Vertical Membrane:

- Cut off the appropriate length of membrane, then starting at the top of the area to be waterproofed, peel off at least 200mm of release sheet and bond the Solsheet firmly to the surface, locking the end of the material into the appropriate DPC or chase.
- Gradually peel off the remainder of the release sheet downwards, at the same time rolling the material against the surface until the bottom of the wall is reached. At the base, the vertical membrane must overlap the horizontal membrane by at least 100mm.
- All subsequent sheets must overlap the preceding sheet by 50mm at the edges and by 100mm at ends. Overlaps must be thoroughly rolled to ensure adequate bonding.

Backfilling:

On vertical applications where an abrasive backfill is to be used the Solsheet membrane should be protected by a concrete outer skin, brick skin or Solco HD Protection Board, the latter being held in place by Solco 50mm Butyl Tape.

Precautions:

- Solsheet and Solsheet HP Primer must not be applied when the surface temperature of the substrate falls below 5°C.
- When a brick-skin is applied to the face of the vertical Solsheet, care must be taken not to damage the membrane and a gap of 40mm should be left, which is filled with sand/cement mortar as work proceeds.
- Only sufficient Solsheet should be laid which can be protected as work proceeds.
- When areas of Solsheet are left exposed for any length of time ensure that all edges are held in place by battens.

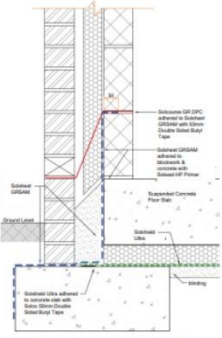
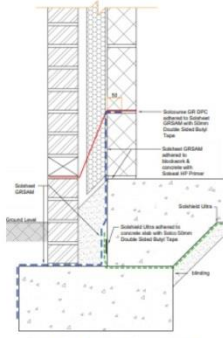
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SOLCO Technical Datasheet
Last Issued: November 2012

Solsheet GRSM System Accessories

Accessory	Description	Units
Solsheet HP Primer	A quick drying primer that provides the adhesion of self-adhesive membranes. Used prior to the application of Solsheet Membranes.	Tubs
Solco HD Protection Board	A tough, reinforced flexible board, used to protect waterproofing membranes against damage by abrasive backfill materials and poured concrete.	Sheets
Solco Protection Fleece	Protects Solco membranes against mechanical or chemical damage. Can be used as a separating layer between membranes and overlying components.	Rolls
Solco XL Jointing Tape	A self-adhesive tape used for securing waterproofing membranes at overlaps edge and corner details.	Rolls
Solco Foil Tape	A single-sided tape for securing tape & joints.	Rolls
Solco Double Sided Butyl Tape	A double-sided synthetic butyl mastic tape, used for bonding waterproofing membranes. Also used for bonding SA membranes to DPCs and fixing other accessories.	Rolls
Solco Top Hats	Form an effective seal where a pipe, duct, or service penetrates Solsheet membranes.	Units

Please contact the Technical department for project specific application details.

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Technical Datasheet

Last issued: February 2022

Solshield Ultra Gas Barrier

Description:
 Solshield Ultra Gas Barrier is a multi-layer low density polyethylene (LDPE) gas barrier and damp-proof membrane reinforced with a polypropylene grid with an integral aluminium foil. The membrane is designed for use in concrete ground floors, above and below slab not subject to hydrostatic pressure.
 Solshield Ultra protects buildings against Moisture, Radon, Carbon Dioxide, and Methane from the ground.
Air & Moisture protection system.
Resistance to puncture - the membrane has a strong resistance to puncture and on smooth surfaces will not be damaged by foot/site traffic.
Durability - the membrane remains effective against the ingress of water and water vapour, will restrict the ingress of radon, methane, and carbon dioxide during the lifetime of the flooring construction in which it is installed.

Compliance:

- NHBC Standards 2019, Chapters 4.1/5.1.
- CE Marking Standard EN13967:2012
- BS 8485:2015+A1:2019.
- CP 102:1973, Section 2.
- BS8000-4:1989.
- BBA Certificate No. 20/5737.

General:

- Solshield Ultra Gas Membrane should not be installed at temperatures below 5°C, to prevent the risk of surface condensation.
- The membrane must be installed and fixed in accordance with the relevant clauses in BRE Report BR 211:2015, and guidance given in BS 8485:2015+A1:2019.
- The membrane should be installed on a sand blinding layer, Solshield P30 protection fleece, or a smooth concrete float finish. In order to provide a continuous barrier across the cavity, Solshield Ultra Gas Barrier should be taken through the blockwork and incorporated below the damp proof course cavity tray in the outer leaf.
- Solshield Ultra Gas Membrane is suitable for installation with:
 - Beam and block floor application with 150mm clear void in an Amber 2 category projects.
 - Reinforced raft foundation and in situ suspended slab, providing the membrane is laid above the ground and not in direct contact with any source of hydrocarbon/VOC vapour.
- Long periods of exposure to ultraviolet light will reduce the effectiveness of the membrane.

Venting:

- Solshield Ultra can be used on site where passive or active ventilation is required.
- Solshield Geocomposite Drainage & Venting Mat should be used in conjunction with the relative vent connectors where required. These types of systems are designed on a bespoke site specific nature.
- Please contact us for our design advice.

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Technical Datasheet

Technical Data:

Property	Test Method	Value
Thickness	EN 1849-2	0.60mm
Thickness - Between Scrim	BS EN ISO 9863-1:2016	0.40mm
Width	EN 1849-2	2.0m
Length	EN 1849-2	50m
Weight	EN 1849-2	370 g/m ²
Hydraulic Properties		
Water Column Test	EN 20811	> 300
Resistance to Water Penetration	EN 13967 / EN 1928	Pass
Watertightness	EN 1296 / EN 1367 / EN 1928	Pass
Mechanical Properties		
Resistance to Static Load	EN 12730-B	20 kg
Tensile Strength (MD)	EN 12311 - 1	600 N/50mm
Tensile Strength (CMD)	EN 12311 - 1	480 N/50mm
Tensile Elongation (MD)	EN 12310 - 1	20%
Tensile Elongation (CMD)	EN 12310 - 1	20%
Puncture Resistance	EN 12236	1.25 kN
Resistance to Tearing (Nail Shank) (MD)	EN 12310 - 1	330 N
Resistance to Tearing (Nail Shank) (CMD)	EN 12310 - 1	400 N
Durability and Chemical Resistance		
Transmission Rate of Volatile Liquids (Diesel)	ISO 6179:2010 (B)	0.246 g/m ² /hr
Transmission Rate of Volatile Liquids (Xylene)	ISO 6179:2010 (B)	0.571 g/m ² /hr
Transmission Rate of Volatile Liquids (Toluene)	ISO 6179:2010 (B)	0.583 g/m ² /hr
Transmission Rate of Volatile Liquids (Petrol)	ISO 6179:2010 (B)	0.135 g/m ² /hr
Gas Permeability		
Methane Permeability	BS EN ISO 15105-1	< 0.09 ml/m ² /day/atm
Carbon Dioxide Permeability	BS EN ISO 15105-1	< 0.09 ml/m ² /day/atm
Radon Permeability	K124/02/95	8.0x10 ⁻¹⁵ m ² /s

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Data sheet

SOLSHIELD GP TITANBOND Hydrocarbon Barrier

GP TITANBOND is a pre-applied waterproofing membrane comprised of GP TITAN and a specialist bonded geotextile to provide a bonding layer for poured concrete specifically for waterproofing applications, offering a safe solution for the protection of buildings and occupiers against all levels of hydrocarbons, methane, carbon dioxide and radon ingress.




- Complies with BS 8485:2015+A1:2019 & CIRIA C748.
- Quick and easy installation.
- Suitable for Ground Gas/Hydrocarbon protection to NHBC Green, Amber 1,2 & Red site characteristics.
- Suitable against most aggressive chemicals.
- Also acts as a high performance DPM.
- Long term Durability (Guaranteed for the lifetime of a building).



SOLSHIELD - Gas Protection System

Last Issue Date 06.05.21
Rev 4

Product Description

SOLSHIELD GP TITANBOND is a pre-applied fully bonded waterproofing membrane, incorporating the GP TITANFLEX membrane and a heavy duty virgin polypropylene geotextile. The geotextile is laminated to the membrane to provide a dual function; protecting the membrane from damage and providing an integrated 'bond' to poured concrete, ensuring a fully bonded waterproofing barrier which has exceptionally high resistance to ground gas and VOCs/Hydrocarbons.

GP TITANBOND is used for the Gas/Waterproofing/Tanking on underground structures, where harmful ground gases are anticipated.

The membrane can be used externally to provide an effective barrier to the transmission of liquid water where Grades 1 to 3 waterproofing protection is required, as defined BS 8102 : 2009. GP TITANBOND must not be used for negative side pressure waterproofing applications.

SOLSHIELD GP TITANBOND offers a safe solution for the protection of buildings and occupiers against all levels of hydrocarbons, methane, carbon dioxide and radon ingress. Typically, these are sites previously used as petrol stations, coalfields, landfill sites, contaminated industrial sites, fracking sites and heavily contaminated sites.

SOLSHIELD GP TITANBOND provides exceptional resistance to a wide range of pollutants, including hydrocarbons, industrial chemicals, toxic waste, natural and radioactive gases. The membrane can also act as a high performance DPM.

Due to its flexible nature, SOLSHIELD GP TITANBOND also provides a flexible membrane suitable for various applications unlike rigid HDPE rich membranes. SOLSHIELD GP Titan is designed to withstand the most aggressive environments. Testing has been completed in accordance with BS8485:2015 +A1:2019 and Ciria C748 to determine the permeation rates for Methane, Carbon Dioxide, and a range of VOC's. Immersion testing has also been completed for Chemical Resistance to EN 14414 and EN 14415.

NOTE: Solshield Titanbond should only be used in vertical applications when it is pre-applied to shuttering, to allow adhesion to concrete when concrete is poured against Titanbond. For post-application to RC walls, use GP Titanank. A protection board or drainage medium should be placed against the membrane prior to backfill.

ISO 15105-2 Rate of Permeation (ml/m ² /day)				
	Benzene	Toluene	Ethyl Benzene	Xylenes (M,P,O)
GP-TITANBOND	<3.6	<13.8	<2.7	<2.7
PURAFLEX	3846	3763	494	767
HDPE (1.0mm)	146626	151725	117912	114672

Tel: 0845 450 9766 enquiries@solco.co.uk www.solco.co.uk

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5. CONCLUSION OF SITE VISIT

5.1 Details Of Installers

Are the installers suitably qualified / trained? Names of installers / company details?

GRK Civils Ltd

5.2 Pass / Fail?

Are the measures inspected acceptable / NOT acceptable? Do they comply with the specifications? Is attention required to specific issues?

PASS

5.3 Additional notes

Remedial actions to be taken? Re-visit to be arranged?

Work is continuous.

If you have any questions regarding the above, please do not hesitate to contact me.

Yours sincerely



Ben Crowther B.Sc, M.Sc, PGCE, FGS, CIEH, PCA-QT, SGPV
For and on behalf of GeoEnginSeer Ltd.

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6.0 Limitations and Challenges of Verification Reporting

This report is based on the information that has been made available to us from the client, contractor and architect regarding the site. The conclusions drawn in the report are considered correct although any subsequent additional information or actions may allow refinement of the conclusions. It should be noted that: The report has been prepared under the express instructions and solely for the use of the Client.

The findings of this report represent the professional opinion of experienced Ground Gas System Surveyors. GeoEnginSeerLtd does not provide legal advice and the advice of lawyers may also be required.

All work carried out in preparing this report has utilised and is based upon understanding of current relevant UK standards and codes, technology, and legislation. (BS8485:2015+A1:2019 & CIRIA 735).

Changes in this legislation and guidance may occur at any time in the future and cause any conclusions to become inappropriate or incorrect.

The report is limited to the boundaries identified by the Client. on this site and confirmed within this document.

Should additional services be introduced, or service conduits are not sealed or have services provided through them at a later date that are not sealed to the conduit and or gas protection system, a retrospective fit may be required. If a site is left open for prolonged periods following verification or works are conducted that may damage the integrity of the installation by follow on trades repairs may be needed, the standards observed in a positive verification report may be compromised. Intellectual rights to this document may be rescinded.