Reference: **441-17-446.1943Rev3**

Date: **16th February 2018**

Keytec Geomembranes Ltd
Unit 6 Plover Close
Interchange Park
Newport Pagnell
Buckinghamshire
MK16 9PS

For the attention of**: Mr Geoff Williams**

INSTALLATION AND VALIDATION OF GAS PROTECTION MEASURES
AREA 2 – AZTEK LOGISTICS, LETCHWORTH

Dear Geoff,

Further to your email dated 14th December 2017, we are pleased to present the validation report for the installation of gas protection measures within Area 2 of the above named site.

1.0 INTRODUCTION

The site is located approximately 1.5km to the north-east of Letchworth city centre to the north of Works Road at approximate National Grid Reference TL 231 332. The site comprises a development site for a new single-storey, steel framed, commercial warehouse building.

The development comprises the construction of a steel framed building with concrete ground bearing floor slab. A gas membrane is placed beneath the slab.

ASL were requested to undertake independent validation of the gas membrane, which comprised a Keytec 400Hp installed by Keytec Geomembranes Ltd in the warehouse area.

In accordance with the Keytec Method Statement, the following gas membrane has been incorporated into the construction scheme.

- Placement of a Keytec 400 HP Gas Membrane;
- CQA of installation works with independent validation.

2.0 VERIFICATION WORKS

The site has been visited on the 20th December 2017 to view the installation of the gas protection measures in Area 2. The area of inspected membrane is shown on Figure 1. It was noted that the concrete had already been poured within Area 1.

The works observed included the placement of the gas impermeable membrane, the welding of joints and sealing of penetrations through the membrane and the general standard of the installation works completed.

3.0 INSPECTION FINDINGS

The findings of the inspections are as follows:

The membrane installed was a Keytec 400 HP Gas Membrane, the technical data sheets for which is included in Appendix I, in accordance with the Keytec method statement, included in Appendix III. The membrane has been installed to an appropriate standard with all joints and penetrations sealed.

The general standard of the installation works was good and care was being taken to protect the membrane during the installation works. Minor repairs were required during the works due to the method of concrete floor construction and these were carried out by Keytec operatives. Selected photographs showing the membrane and sealed penetrations are included in Appendix II.

Further to these inspections we can confirm that the gas protection measures installed within the development meet the requirements.

We trust this meets with your requirements and please contact us with any queries.

Yours sincerely
for **ASL**



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Principal Engineer

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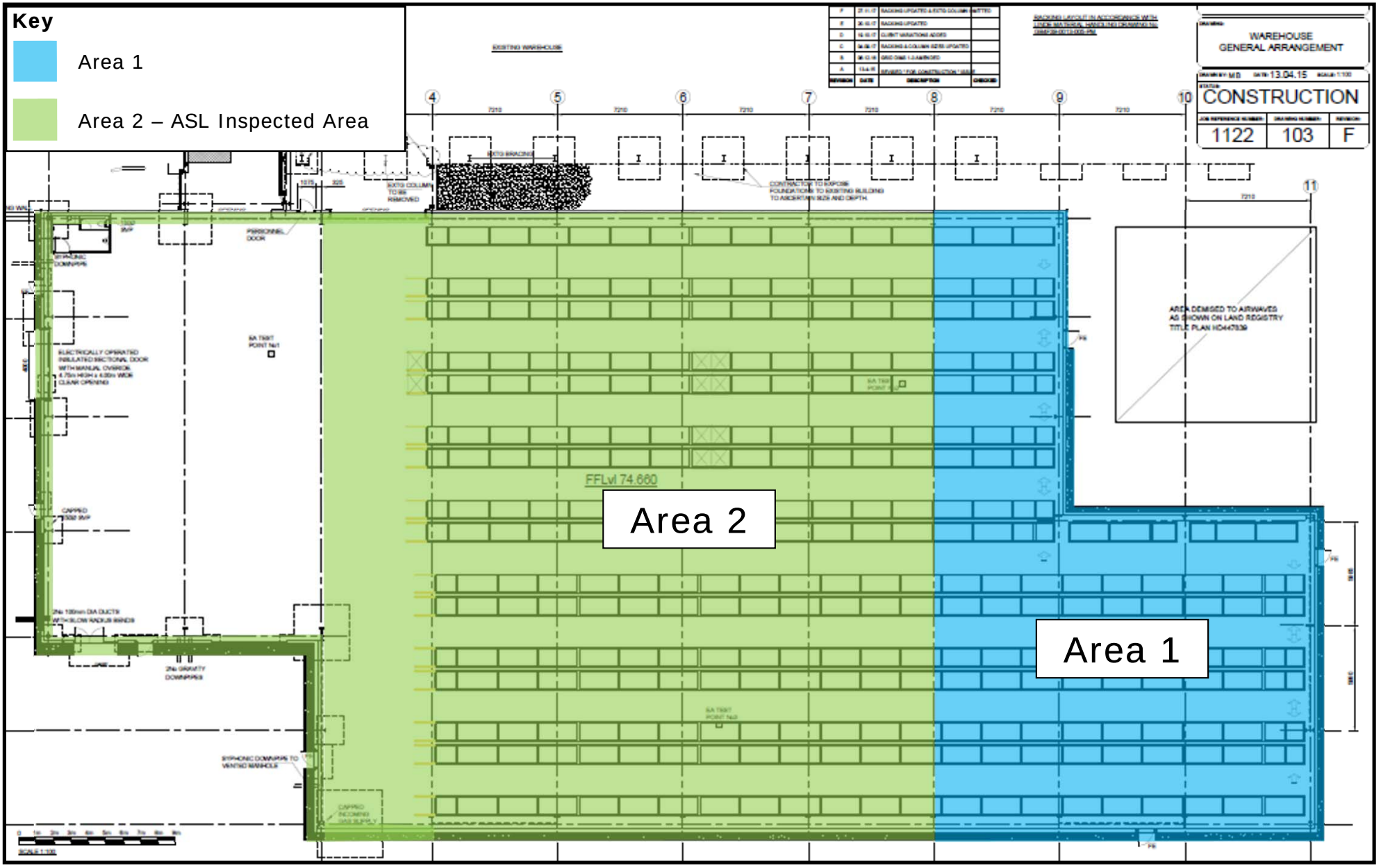
FIGURES



The Geo-Environmental Service Provider

Figure 1
Site Layout Plan
Aztek Logistics, Letchworth
Project No. 441-17-446.1943
Prepared for: Keytec Geomembranes Ltd

APPENDIX I

GAS MEMBRANE TECHNICAL DATA SHEET

Keytec Geomembranes Ltd
Unit 6, Plover Close
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Milton Keynes MK16 9PS

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BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

Agrément Certificate
16/5375
Product Sheet 1

KEYTEC GAS-RESISTANT MEMBRANE

KEYTEC 400 HP GAS BARRIER

This Agrément Certificate Product Sheet(1) relates to Keytec 400 HP Gas Barrier, for use as a low-density polyethylene gas barrier and damp-proof membrane in concrete ground floors, above and below the slab not subject to hydrostatic pressure, to protect the building against moisture, radon, methane and carbon dioxide from the ground.

(1) Hereinafter referred to as 'Certificate'.



CERTIFICATION INCLUDES:

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

KEY FACTORS ASSESSED

Resistance to water and water vapour — the membrane provides an effective barrier to the passage of liquid water and water vapour from the ground (see section 6).

Resistance to underground gases — the membrane is capable of restricting the ingress of radon, methane and carbon dioxide gases into the building (see section 7).

Resistance to puncture — the membrane has a high resistance to puncture and on a smooth or blinded surface will not be damaged by foot or site traffic (see section 8).

Durability — under normal service conditions the membrane will remain effective against the ingress of water and water vapour, and will restrict the ingress of radon, methane and carbon dioxide during the lifetime of the flooring construction in which it is installed (see section 13).

The BBA has awarded this Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 16 November 2016

John Albon – Head of Approvals Construction Products

Claire Curtis-Thomas
Chief Executive

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

The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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Regulations

In the opinion of the BBA, Keytec 400 HP Gas Barrier, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



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

Requirement:	**C1(2)**	**Site preparation and resistance to contaminants**
Comment:		The product can contribute to a structure satisfying this Requirement. See section 7.1 of this Certificate.
Requirement:	**C2(a)**	**Resistance to moisture**
Comment:		When properly installed in a correctly-designed structure, the product forms an effective barrier to the movement of water within the ground floor slab, enabling compliance with this Requirement. See sections 6.1 and 6.2 of this Certificate.
Regulation:	**7**	**Materials and workmanship**
Comment:		The product is of an acceptable material. See section 13.1 and the *Installation* part of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)**	**Durability, workmanship and fitness of materials**
Comment:		The product can contribute to a construction satisfying this Regulation. See section 13.1 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	3.1	Site preparation — harmful and dangerous substances
Standard:	3.2	Site preparation — protection from radon gas
Comment:		The product will enable a floor to satisfy the requirements of these Standards, with reference to clauses 3.1.2[(1)(2)], 3.1.6[(1)(2)], 3.1.7[(1)(2)], 3.1.8[(1)(2)], 3.2.1[(2)] and 3.2.2[(1)(2)]. See section 7.1 of this Certificate.
Standard:	3.4	Moisture from the ground
Comment:		When properly installed in a correctly-designed structure, the product forms an effective barrier to the movement of water within the ground floor slab, enabling compliance with this Standard, with reference to clauses 3.4.2[(1)(2)], 3.4.4[(1)(2)] and 3.4.6[(1)(2)]. See sections 6.1 and 6.2 of this Certificate.
Standard:	7.1(a)	Statement of sustainability
Comment:		The product can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6 and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard.
Regulation:	**12**	**Building standards applicable to conversions**
Comment:		Comments in relation to the product under Regulation 9, Standards 1 to 6 also apply to this Regulation, with reference to clause 0.12.1[(1)(2)] and Schedule 6[(1)(2)].

(1) Technical Handbook (Domestic)
(2) Technical Handbook (Non-Domestic).

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

Regulation:	**23(a)(i) (iii)(b)(i)**	**Fitness of materials and workmanship**
Comment:		The product is acceptable. See section 13.1 and the *Installation* part of this Certificate.
Regulation:	**26**	**Site preparation and resistance to contaminants**
Comment:		The product can contribute to a structure satisfying the requirements of this Regulation. See section 7.1 of this Certificate.
Regulation:	**28**	**Resistance to moisture and weather**
Comment:		When properly installed in a correctly-designed structure, the product forms an effective barrier to the movement of water within the ground floor slab, enabling compliance with this Regulation. See sections 6.1 and 6.2 of this Certificate.

Construction (Design and Management) Regulations 2015
Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See section: 1 *Description* (1.2) of this Certificate.

Additional Information

NHBC Standards 2016

NHBC accepts the use of Keytec 400 HP Gas Barrier, provided it is installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Chapters 4.1 *Land quality — managing ground conditions* and 5.1 *Substructure and ground bearing floors.*

CE marking

The Certificate holder has taken the responsibility of CE marking the product in accordance with harmonised European Standard EN 13967 : 2012. An asterisk (*) appearing in this Certificate indicates that data shown are given in the manufacturer's Declaration of Performance.

Technical Specification

1 Description

1.1 Keytec 400 HP Gas Barrier is a multilayer, low-density polyethylene membrane, reinforced with a polypropylene reinforcing grid with an integral aluminium foil.

1.2 The membrane has the following nominal characteristics:

Thickness* (mm)	0.6 (overall)
Roll length* (m)	various
Roll width* (m)	various
Mass per unit area* ($g \cdot m^{-2}$)	350
Tensile strength* ($N \cdot 50\ mm^{-1}$)	
MD	600
CD	480
Elongation*	
MD	20
CD	20

Nail tear resistance*	
MD	330
CD	400
Watertightness*	pass
Colour	
upper surface	various
lower surface	various.

1.3 Ancillary products for use with the membrane include:

- Keytec butyl or Keytec bitumen tape —for joints and laps
- Keytec jointing tape — for securing laps and joints.

1.4 Ancillary products for use with the membrane, but outside the scope of the Certificate, include:

- Keytec 400 HP Top Hats — to seal around entry points to the membrane
- Keytec Internal Corner Cloaks — prefabricated corner details
- Keytec External Corner Cloaks — prefabricated corner details
- Keytec Primer — used to provide adhesion for application of bitumen enhanced geomembranes
- Keytec Void Vent 25 — cuspated HDPE drainage core with a non-woven polypropylene geotextile separator/filter bonded to one side
- Keytec Void Vent 40 — cuspated HDPE drainage core with a non-woven polypropylene geotextile separator/filter bonded to one side
- Keytec Protection Fleece — to form a protective layer to prevent damage to the membrane
- Keytec SAM — gas-resistant self-adhesive membrane.

2 Manufacture

2.1 The product is manufactured by an extrusion/coating process

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control being operated by the manufacturer are being maintained.

3 Delivery and site handling

3.1 Rolls are wrapped in polythene film. Each roll has a leaflet enclosed describing the product and installation details. The BBA logo and Certificate number are printed on the leaflet and pallet label.

3.2 The rolls must be stacked on a flat surface, kept under cover and protected from sunlight and mechanical damage.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Keytec 400 HP Gas Barrier.

Design Considerations

4 Use

4.1 Keytec 400 HP Gas Barrier is satisfactory for use as a gas-resistant barrier to restrict the ingress of radon, methane and carbon dioxide gases into buildings from landfill and naturally-occurring sources.