System 500

# NEWTON PAC 500 (POSITIVE AIR CURTAIN) SYSTEM

## Waterproofing & Ground Gas Mitigation

NEWTON WATERPROOFING

## System Overview

Rev 2.3 - 18 August 2020

## WHAT IS THE NEWTON PAC-500 SYSTEM?

The Newton PAC-500 System is a combined 'Type C' (BS 8102:2009) cavity drain waterproofing and ground gas mitigation system, developed by Newton Waterproofing Systems and Prestige Air Ltd. The addition of the PAC Positive Air Curtain to the System 500 waterproofing provides protection against water, gasses and hydrocarbon vapours from the ground within a single internally applied system.

This system provides basement waterproofing across all environmental grades (Grade 1-3) in accordance with BS 8102:2009, as well a ground gas mitigation system that is integrity tested with tracer gas to confirm viability.

## HOW DOES IT WORK?

The Newton PAC-500 System consists of an 8mm virgin HDPE void former/in-line studded (cuspated) membrane applied internally to the floor and walls of the retained structure. A drainage conduit, Newton Basedrain, is installed in front of the wall membrane and below the floor membrane at the floor wall junction. A specially designed sump system, the Titan-Pro, is installed within the floor and receives two connections via sealed manifolds from the Basedrain System. All joints in the membrane and between membranes and the drainage and sump, are double sealed with butyl tapes.

A conduit is installed behind the wall membrane at the top of the wall and again the membrane is double sealed to the conduit. A very low pressure, high volume fan introduces air behind the sealed membrane and pressurises the whole system. An outlet pipe from the sump allows the pressured air to be removed to above external ground level.

The continual flow of low pressure air ensures that all ground gasses or hydrocarbon vapours meet a pressure air barrier as they attempt to enter the retained space. Ground gasses and hydrocarbon vapours that pass into the structure are received into the pressurised space created by the Positive Air Curtain and then safely pushed out of the property.

Water entering the sump from the drainage channels is moved out of the structure with conventional pumps.

The membrane system is protected by a screed to the floor and a wall lining system to the walls to provide the habitable space required.

The Newton PAC-500 System has been installed successfully in both new build and refurbishment projects.

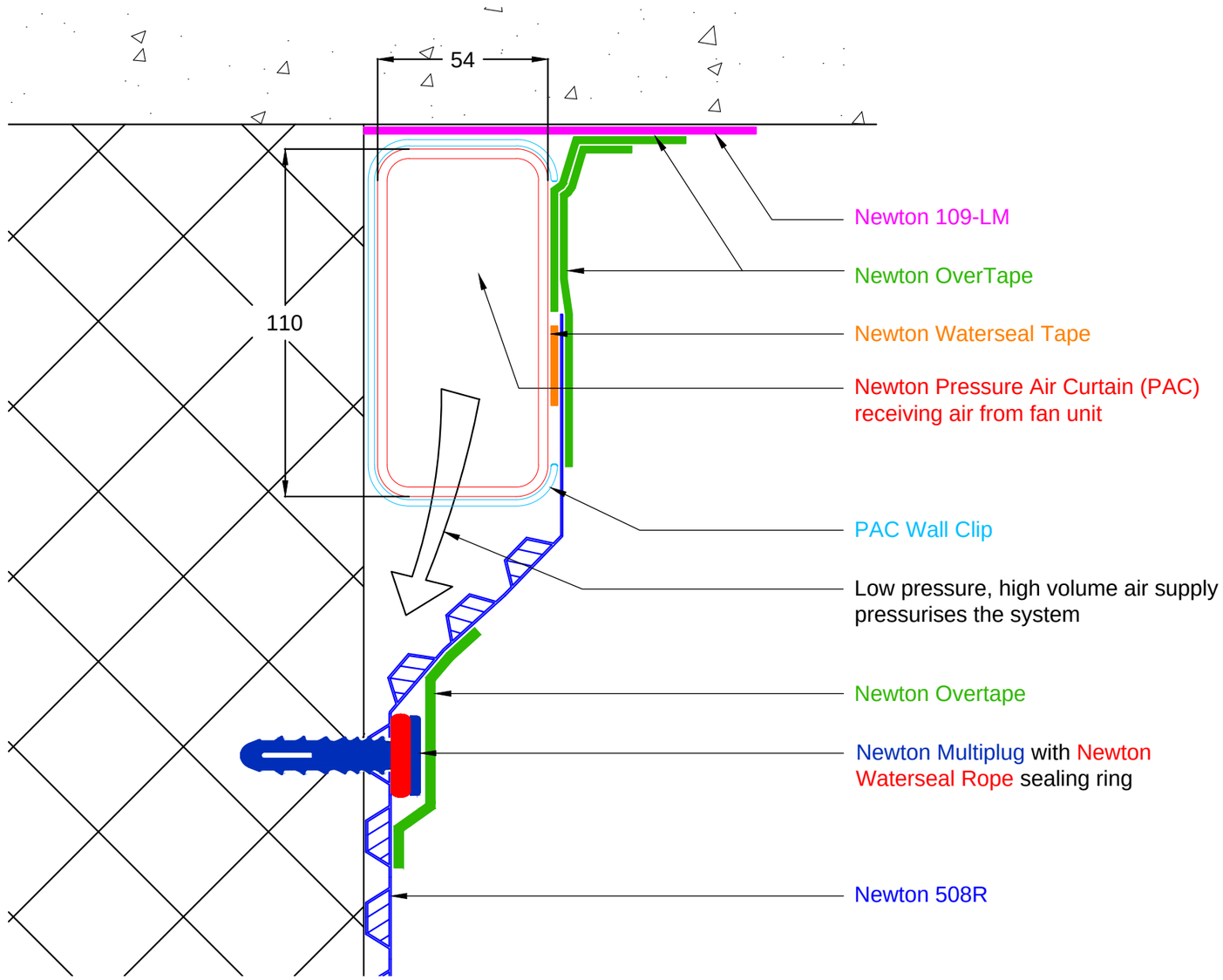
The Newton 508R that forms the air-curtain is neatly fixed to terminate at the soffit

Penetrations through the membrane are carefully 'double sealed' to ensure gas tightness, ready for the trace-gas testing

TYPICAL DETAILS

DO NOT SCALE

# Section




## Notes

This detail shows one method of sealing the Newton Pressure Air Curtain (PAC) to the underside of a solid soffit and the the top of the wall.

The Newton PAC is installed as part of a measured and planned and patented ground gas mitigation scheme to provide a combined gas and waterproofing system for basements, cellars and other earth retraining structures.

The system allows for the collection and then removal of both water and ground gasses that may enter the structure and utilises components that have been designed and tested for these specific benefits:

Newton 508R, Newton OverTape, Newton Waterseal Tape, Newton Waterseal Rope and Newton 109-LM have been tested independently and carry certification that they are suitable for use in gas mitigation systems.

Double sealing of Newton System 500 reduces the potential for leaks due to less than 100% perfect workmanship.

The system is tested as being gas tight and then further enhanced by the introduction of a low pressure, high volume air supply that reduces gas ingress as well as removing gas from behind the sealed membrane system.

Please use this detail in conjunction with the correct Newton System 500 waterproofing system and with the correct gas mitigation additional measures required to achieve the desired water and gas mitigation requirements.

To access further details and relevant technical information please call our Technical Team on 01732 360095 or refer to our website.

Newton Pressure Air Curtain (PAC)

Termination of Newton PAC system to wall and soffit junction



NEWTON WATERPROOFING

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| Scale | Drawing Reference | Original Reference | Drawing Revision |
|---|---|---|---|
| Not to scale | RW-01 | | c |
| **Date** | **Designed by** | **Drawn by** | **Checked by** |
| 12/04/2018 | DGB | CER | DGB |

## STRUCTURAL WATERPROOFING REQUIREMENTS

When waterproofing a basement in accordance with BS 8102:2009, 'Code of Practice for Protection of Below Ground Structures Against Water From the Ground', the person responsible for the waterproofing design, should ensure that the structure is correctly designed to comply with BS 8102 in regard to the structure itself and that the method of waterproofing is suitable for both the method of construction, and the intended use of the space.

Waterproofing systems are defined within BS 8102 as being: Type A, a pressure resistant barrier; Type B integral protection or Type C, drained cavity protection. The correct system, or combination of systems, should be identified by the designer to gain the degree of watertightness required. Since the rewrite of BS 8102, effective November 2009, in areas where it is considered a high risk of water penetration likely, the deployment of two of the above systems are recommended. In addition, designers are now asked to take into consideration that:

'A risk assessment should be carried out which considers the long term water pressures, the effects of surface water infiltration... the risk assessment should also include... radon... and other ground gases and contaminants'.

With the above in mind, waterproofing designers should install a system which can deal with all aspects of basement waterproofing but also design a system which can deal with potential ground gas contamination within new build and refurbishment basement projects. From a waterproofing perspective, it is vital for the designer to take into consideration not only the type of waterproofing they are using to gain the environmental grade required, they must also consider:

i. The consequences of leaks
ii. The consequences of less than adequate workmanship
iii. The form and feasibility of remedial works. The system needs to be easily accessible and repairable.

Type A pressure resistant systems need to be 100% defect free to work effectively and if problems arise, they are very difficult to identify and repair.

The internal Type C cavity drain membrane conforms to all the above design principles. No other waterproofing system enables it to be as easy to identify and repair a defect.

Where both ground water and ground gases are a potential risk, the Newton PAC-500 System has been developed, tested and proven to work. With any system that utilities a gas barrier, integrity of the barrier is critical, and so the Newton PAC System is tested using a patented trace gas integrity testing method to ensure that the membrane is guaranteed to be fully gas resistant.

The Newton PAC-500 System is suitable for large and complex, multi-level structures







## NEWTON PAC-500 SYSTEM BENEFITS

The Newton PAC-500 System uniquely provides protection against water ingress as well as ground gases such as radon, methane and carbon dioxide, as well as VOC and hydrocarbon vapours. Many of the other commercially available systems provide just a 'gas barrier' with no real understanding of the range of risks and the standard or workmanship for the barrier to work 100% of the time. There is also a misunderstanding that the only gas within the ground is radon and these barriers are in many cases not suitable for the full range of ground gasses and hydrocarbon vapours.

Other systems are available that follow BRE guidelines for the radon aspect by incorporating a means of extraction of radon gas collected within a sump. Some of these have been aligned to cavity drainage systems similar to Newton System 500. Unfortunately, these systems employ the fan to 'suck' out the air/radon from the sump which creates two very real problems:

a) Sucking air out from the system creates negative air pressure which actively helps to bring radon gas up from the ground, into the sump and the structure

b) As these fans remove low air volume, the vent pipe has to be extended upwards to above eye height and the fan is positioned externally within the rise of the vent pipe. This makes the installation unsightly and it is often costly to extend a pipe to such a height with the current 'working at height' health and safety requirements.

The Newton PAC-500 System provides a positive air blanket that actively 'pushes' outwards, preventing gas from entering the structure. The large volume of low pressure air allows for the vent to be terminated at just above external ground level, and of course, the fan is also not in view.

The system is installed by trained and accredited Newton Specialist Basement Contractors (NSBCs). Once installed, the full system is checked using an integrity test, patented by Prestige Air, to identify the exact location of defects, allowing the installing contractor to make repairs to even the smallest leaks in the system. The system cannot be signed off by Prestige Air Ltd until the system is fully gas-tight.

The Newton PAC-500 System controls the air pressure using a divider control valve ensuring that the air enters firstly the manifold and then behind the membrane at an equal pressure and flow rate at all points of the length of the manifold duct, ensuring a constant air pressure throughout the whole system, all the way to the exit vent. It is assumed that a percentage of air loss will occur laterally through the walls into the ground - this pushes migrating gases away from the structure and also creates a positive air blanket as a pressure barrier against gas ingress

The air input divider control valve is also designed to deliver clean air into the basement area for ventilation purposes. Even at the maximum delivery rate of this clean air supply, there will always be a suitable and designed rate of air supplied to the manifold and behind the membrane to maintain the efficacy of the Positive Air Curtain.

Prior to making the Newton PAC-500 System, active by the fitting of the fan, the basement zone can be tested for the presence of gas ingress. If this shows no gas present - this can include post-installation testing of the area to establish the potential risk, allowing the system to remain as a stage one installation, without the PDU being fitted. The system can be upgraded at any time by the fitting of PDU with minimal disruption.

The Newton PAC-500 System is designed as a modular system, depending upon the size of the basement. The PDU fan is extremely quiet and housed within an attractive enclosure. As a variation, the PDU can be installed in a services room or externally to suit the customer's requirement. The Newton PAC-500 System can be fitted with a variety of monitoring functions to suit the customer's requirements. Installed as a retrofit system, or for a new build project, the Newton PAC-500 System can be designed for all scenarios and client preferences.

Each modular system includes the installation of two probe/samplers behind the void membrane. This enables sampling to take place post-installation, prior to activating the fan, allowing for concentrations of gas levels to be monitored to ascertain both the gas reduction achieved, and the established optimum pressure for the best level of gas control.

## A SPECIALIST, NATIONWIDE NETWORK

Newton Waterproofing have a nationwide network of Newton Specialist Basement Contractors (NSBCs) who are skilled and trained to design, install and guarantee the Newton System 500 cavity drain system. The NSBC network can offer full PI on design and installation and will be fully responsible in all aspects of the structural waterproofing components of the Newton PAC-500 System.

Working in partnership UK-wide are our patent partners in the Newton PAC-500 System; Prestige Air Ltd. Prestige Air will provide all design and installation elements for the gas mitigation side of the combined system. Once the ground gas system elements of the project have been installed, the testing process will then be initiated.

The test is carried out on the membrane immediately after its installation and prior to it being covered up by the internal finishes. The area below the membrane is temporarily pressurised with a mixture of clean air and a specialist tracer gas which seeks out and identifies any leaks within the membrane. The tracer gas used is both non-toxic and inert and has been selected for its extreme sensitivity to detection. Specialist equipment sensitive to the tracer gas is used to trace all leaks within the installation, with particular attention being paid to the critical points and junctions formed between the membrane material and other structural elements, prior to conducting a detailed sweep of the complete area. The process is ongoing with the leaks being traced, sealed and re-tested before the membrane is passed and the certificate issued.

The degree of gas protection designed into each individual project will be the responsibility of Prestige Air and this will be based on industry standards and guidelines, in particular CIRIA C659 The Ground Gas Assessment Process Table. Please see the table on page 7 to see how the specification of the Newton PAC-500 System by Prestige Air Ltd for Gas/Vapour protection relates to the current standards.

Each modular system includes the installation of two probe/samplers behind the void membrane - this enables sampling to take place post-installation prior to activating the fan. Concentrations of gas levels can then be monitored to establish both the gas reduction achieved, as well as to establish the optimum pressure for the best level of gas control.


Case Study:
Ground Gas Protection and Waterproofing: New-Build Mansion

The Newton PAC-500 was the perfect solution for this large-scale new build basement project which included multiple swimming pools.



WHO INSTALLS THE NEWTON PAC-500 SYSTEM?

| CIRIA C659 GROUND RISK ASSESSMENT PROCESS | | | | |
|---|---|---|---|---|
| Characteristic Situation (CIRIA Report 149) | Risk Classification | GSV (CH4 or CO2) (1hr)1 | Additional factors | Typical source of generation |
| 1 | Very low risk | <0.07 | Typically methane <1%v/v And /or carbon dioxide <5%v/v. Otherwise consider increase to Situation 2 | Natural soils with low organic Content. "Typical" Made Ground |
| 2 | Low risk | <0.7 | Borehole flow rate not to Exceed 701/hr Otherwise consider increase to Situation 3 | Natural soil, high Peat/organic content. "Typical" Made Ground |
| 3 | Moderate risk | <3.5 | | Old landfill, inert waste, Mineworking flooded |
| 4 | Moderate to high risk | <15 | Quantitative risk assessment required to evaluate scope of protective measures | Mineworking susceptible to flooding, completed Landfill (WMP 26B criteria) |
| 5 | High risk | <70 | | Mineworking unflooded Inactive with shallow Workings near surface |

Notes:

1. Gas screening value: litres of gas/hour is calculated by multiplying the gas concentration (%) by the measured borehole flow rate (1/hr)
2. Site Characterisation should be based on gas monitoring of concentrations and borehole flow rates for the minimum periods as defined within CIRIA Report 659
3. Source of gas and generation potential/performance must be identified
4. Soil gas investigation to be in accordance with guidance contained with CIRIA Report 659
5. If there is no detectable flow, use the limit of detection of the instrument

## RISK ASSESSMENT & SPECIFICATION

When specifying the different levels of protection required by the CIRIA guidance document, Prestige Air are able to use the modular qualities of the Newton PAC-500 System to provide a tailor-made ground gas mitigation system which gives the ability to upgrade the system should it be required in the future.

The table below shows the protection level required with the appropriate PAC installation solution.

| METHANE AND CARBON DIOXIDE | | |
|---|---|---|
| Characteristic Situation | Number of levels of protection | Solution |
| 1 | None | No special precautions<br>a. Tested voidformer optional |
| 2 | 1 to 2 | Newton PAC-500 System Stage 1 or Stage 2<br>a. Tested voidformer/redundant manifold<br>b. Active manifold |
| 3<br>Amber 1 (New build) | 2 | Newton PAC-500 System Stage 2<br>a. Tested voidformer<br>b. Active manifold |
| 4<br>Amber 2 (New build) | 3 | Newton PAC-500 System Stage 2<br>a. Tested voidformer<br>b. Active manifold<br>c. Monitoring system |
| 5 | 4 | Newton PAC-500 System Stage 2<br>a. Tested voidformer<br>b. Active manifold<br>c. Monitoring system<br>d. Uninterrupted power supply, multiple units min. 2no. |

Notes:

1. With Characteristic Situation no. 1 where no special precautions are required, a tested voidformer can still be considered
2. With Characteristic Situation no. 2, the decision on whether to deploy Stage 1 or Stage 2 is dependent upon the use of the finished structure i.e. a warehouse may be at Stage 1 and a school at Stage 2. The redundant manifold in Stage 1 allows for the future use of the building to change

| RADON | | |
|---|---|---|
| New Build | Existing Structures | Protection Level |
| Radon map shows no protection required | Measured Radon levels<br>Commercial <400Bq/$m^3$<br>Domestic <200Bq/$m^3$ | None |
| Radon map shows basic protection required | | Newton PAC-500 System<br>Stage 1<br>Tested voidformer/manifold |
| Radon map shows full protection required | Measured Radon levels<br>Commercial >400Bq/$m^3$<br>Domestic >200Bq/$m^3$ | Newton PAC-500 System<br>Stage 2<br>Tested voidformer/activated manifold |

Notes:

1. With radon protection, a different approach is taken as it is considered that the risk posed by the ground gas cannot be properly assessed until the structure and protection measures are in place. For this reason, Stage 1 always includes a manifold
2. With Radon protection, a tested voidformer is still an option where there is no identified risk







## THIRD-PARTY VERIFICATION

The Appendix of this report outlines the full data testing that has been carried out on the Newton 508 cavity drain membrane and ancillary components from a number of independent testing houses.

## BBA CERTIFICATION – NEWTON WATERPROOFING SYSTEMS

The Newton 508 cavity drain membrane has full BBA certification in its own right as a stand-alone structural waterproofing system and is approved by NHBC and Heritage bodies for use in new build and refurbishment properties, on a domestic and commercial platform. Internal tests were carried out by the BBA table 18.1 and external testing certificates and results were examined and verified in table 18.2 in relation to:

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE 94/3010

18.1 - BBA tests for:

- Resistance of the sealed membranes' joints to water penetration
- Resistance to loading and impact
- Water vapour permeability
- Weight per unit area
- Thickness
- Resistance to nail tear
- Resistance to long-term loading

18.2 - Independent test reports were examined relating to:

- Thickness
- Rensile strength
- Elongation at break
- Resistance to compression
- Water vapour resistance
- Resistance to alkali
- Resistance to UV radiation
- Radon permeability and transmission

## TESTING & CERTIFICATION

Newton 508 cavity drain membrane and the joints have been independently tested by the two most recognised testing houses in Europe for radon permeability and transmission

1. SP Laboratories of Sweden - 2007
2. University of Prague - 2008

Newton 508R and Newton 508 eco Floor cavity drain membranes performed extremely well in independent tests, and it has been utilised in its own right for radon protection of structures throughout the UK.

The Newton PAC-500 System gives a measurable and guaranteed solution which can be tested and certified by Prestige Air in relation to the workmanship of installation, which is unique with a cavity drain membrane used for ground gas mitigation systems.

## THIRD PARTY ACCREDITATION AND TESTING (CONTINUED)

In addition to Radon Permeability and Transmission testing, Newton 508 cavity drain membrane has also been tested by the UK Testing House, VINCI Construction UK Ltd Technology Centre for the following gas/vapour criteria.

Test 1 - Determination of High Density Hydrocarbon (Engine Oil) Vapour Transmission rate through Newton 508

Date of Test - August 2011

Test 2 - Determination of Low Density Hydrocarbon (Petrol) Vapour Transmission rate through Newton 508

Date of Test - August 2011

Test 3 - Determination of Methane Permeability of the Newton 508 cavity drain membrane

Date of Test – August 2011

Test 4 - Determination of Sensitivity to Changes in Appearance of Newton 508 cavity drain membrane produced by contact with liquid hydrocarbons

Date of Test - August 2011







## NEWTON PAC-500 SYSTEM GUARANTEES AND WARRANTY

The guarantee and warranties provided for the Newton PAC-500 System are offered by all installer partners with the Newton materials having a 30-year product warranty.

The structural waterproofing component of the system must be installed by a Newton Specialist Basement Contractor who can take full design liability and installation guarantees for the waterproofing component of the PAC system. All NSBC contractors can offer insured backed guarantees upon request.

Newton Pumps, if required on the project, will need to be maintained by a Newton approved pump maintenance company.

The gas mitigation element of the system is the responsibility of Prestige Air who, upon testing of the installed system, can offer a gas integrity test certificate.

## TESTIMONIALS

### "Drum and Monkey" Public House, Worcester – Hydrocarbon Contamination Project

"The Newton PAC-500 System employed was an ingenious clean and effective way of providing an internally applied vapour and waterproofing barrier solution. Prestige Air communicated well with the consultants at the design stages offering their advice based on years of experience. This was followed by an excellent close partnership with Newton as the main building contractor. The system was fully commissioned upon completion and backed up with full and thorough tests that included final air monitoring. This difficult and confined project was successfully delivered to the client on time and on budget."

Garry Whitall
Contract Supervisor
Carter Construction (Gloucester)

Newton PAC-500 System installed to a house in Derbyshire with very high levels of radon gas

### Listed Building, Derbyshire – Treating Extremely High Radon Levels

"Having carried out a series of Radon monitoring it was established that we had levels up to 5000bqm within the basement of our home. In addition to this our basement was also damp. After failing to get levels down to acceptable levels by using a standard type retrospective sump, Prestige Air and Protectahome jointly installed the Newton PAC-500 System for both radon and waterproofing. We now enjoy a dry basement with levels of radon less than 100bqm."

Mr Read, Derbyshire

"The Newton PAC-500 System takes our proven air technology and combines it with Newton's approved products to provide complete protection from ground gas and ground vapour."

Andy Collins
Project Director
Prestige Air Technology Ltd

# PRESTIGE AIR-TECHNOLOGY LIMITED

# CERTIFICATE

## FOR GAS RESISTANT MEMBRANE INTEGRITY TEST

This is to certify that the membrane installed at

The Drum and Monkey Public House, Worcester

has been tested for its integrity and has been demonstrated to represent a complete gas resistant barrier within the limits of the test conditions.

Issuing Authority Prestige Air Technology Limited

Signed: ..... .....

Date: 10th October, 2011

Certificate No: .....1.....

Prestige Air-Technology Limited, Prestige House, Landews Meadow, Green Lane
Challock, Ashford, Kent. TN25 4BL

Tel: 01-233-740844 Fax: 01-233-740834

John Newton have been established as a leading specialist in damp control for many years, for over 15 years. Prestige Air Technology have been the leading specialists in the use of positive pressurization for gas control systems with over a thousand systems across the country and abroad the Newton PAC-500 System is the most advanced method available today.

Newton PAC-500 is a patented system by Prestige Air Technology Ltd and J. Newton Ltd.

NOTES

NEWTON WATERPROOFING


Newton Waterproofing Systems Is A Trading Name Of

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