



Report on the Acceptance Air Leakage Testing of 8 Benson Place in Oxford, in compliance with ATTMA TSL1 (2010)



Result: **Satisfactory**

Site address: 8 Benson Place, Oxford OX2 6QH

Test Reference No.:

Test Dates:

Testing carried out for:

Testing carried out by:

Client:

Test Engineer:

Company:

Contact Tel:

Contact E-mail:

Target Air Changes, ACH^{-1} @ 50 Pa:

Achieved Air Changes, ACH^{-1} @ 50 Pa:

Achieved Air Permeability, $m^3/hr/m^2$ @ 50 Pa:

Data consistency, r^2 (requirement, $r^2 \geq 0.98$):

Slope, n (requirement, $0.5 \leq n \leq 1.0$):

JALDAS5037/R3
15 th November 2014
Tim Nicholson
Paul Jennings
Aldas
01452 532878 / 07866 948200
Doorfanman@hotmail.com
≤ 1.0 (EnerPHit)
0.97
0.90
0.997
0.70



ALDAS, 54 Melville Road, Churchdown, Gloucester GL3 2RG

Aldas is a trading name of Jennings Aldas Limited, Co. Reg 8409614

Director: Clare Corley

Air Leakage Specialist: Paul Jennings, BSc, MSc doorfanman@hotmail.com 07866 948200



Introduction & Set-Up:

Acceptance air leakage testing of the end-terrace house at 8 Benson Place in Oxford was carried out on the 15th of November 2014. Testing was carried out using a Retrotec 300 DucTester fan mounted in the front door of the house.

Testing was carried out in accordance with the requirements of BS EN 13829 and the BINDT Quality Procedure, in conformance with the ATTMA TSL1 standard (2010), Method B. Because the house had been refurbished to the EnerPHit standard, the additional requirements of the Passivhaus Institute for acceptance tests of Passivhaus projects were also followed. Any queries or complaints about this test should be addressed in the first instance to the test engineer and in the second instance to BINDT.

BINDT contact details: Newton Building, St. George's Avenue, Northampton NN2 6JB

Tel: 01604 893860

www.bindt.org

All external doors and windows, other than that where the test equipment was mounted, were closed for the duration of testing, whilst internal doors were kept open to ensure the building acted as a single volume. Temporary sealing of ventilation systems to facilitate the fabric-first air leakage test was undertaken as described below.

The pictures below illustrate key parts of the equipment and test set-up used:



P2) External view of test equipment mounted in front entrance doorway



P3) Internal view of test equipment mounted in front entrance doorway

	
P4) Balloon used to temporarily seal flue from wood burning stove in the Living Room	P5) Temporary seal over end of incoming subfloor air duct for wood burning stove
	
P6) Temporary seal over end of second incoming subfloor air duct for wood burning stove	P7) Temporary seal to inlet and outlet filters in Paul MVHR unit in loft to exclude leakage through the ventilation system

Measurement Procedures:

Test procedures in accordance with the following standards: ATTMA TSL1, 2010, Method B. After a preliminary single-point depressurisation test and a short leakage check, a number of remedial sealing works were undertaken before a full multi-point depressurisation test was carried out. The most significant of these was adjusting the dormer window at the top of the stairwell to ensure it closed fully and sealed properly. The leakage sites identified are detailed later in this report. As required by the PassivHaus Institute, a full multi-point pressurisation test was also then undertaken, after turning the fan around.

The Envelope Area and Volume were calculated by the test engineer directly from measurements made on site on the 11th December 2013. **Based upon:** BS EN 13829:2001.



Dwelling	Envelope area m ² (ATTMA conventions)	Volume m ³ (PHI conventions)
8 Benson Place, Oxford, OX2 6QH	343	316.5

Measurements Recorded:

Averages of zero flow pressure differentials were recorded before and after the test, as were internal and external temperatures, windspeed and barometric pressure.

Equipment Calibration:

All test equipment and accessories are calibrated. The table below provides details of the equipment and the calibration validity for each:

Retrotec 300 DucTester	Serial No: 3LFT00000130	Expires 1 st August 2015
Retrotec DM2A Digital Gauge	Serial No: 102036	Expires 15 th April 2015
Testo 511 Digital Barometer	Serial No: 39107531/301	Expires 9 th April 2015
Testo 110 Digital Thermometer	Serial No: 33949361/208	Expires 10 th April 2015

Depressurisation Test

During the extensive leakage check, a number of major and minor leakage sites were identified, which are discussed later in this report. The most significant of these was adjusting the dormer window at the top of the stairwell to ensure it closed fully and sealed properly. A full multi-point depressurisation test was then carried out.

Test date: **15th November 2014** Time: **14.49 to 15.07**

Environmental Conditions:

Barometric Pressure:	99.3 KPa	Wind speed:	1 m/s
Temperature: Initial: indoors	17.2°C	outdoors	11.6°C
Final: indoors	18.4°C	outdoors	11.6°C

Test Data:

At least **3** static pressures taken for **10** sec each.

A minimum of **10** induced pressures taken for **≥20** sec each.

Existing Pressure Differentials (Static pressure):

Baseline, initial [Pa]	-1.0	-1.1	-1.1	-1.0	-1.0	-1.1
Baseline, final [Pa]	-1.1	-1.2	-1.4	-1.3	-1.4	-1.5

Static Pressure Averages:	initial [Pa]	ΔP_{01}	-1.05	ΔP_{01-ve}	-1.05	ΔP_{01+ve}	0.00
	final [Pa]	ΔP_{02}	-1.32	ΔP_{02-ve}	-1.32	ΔP_{02+ve}	0.00

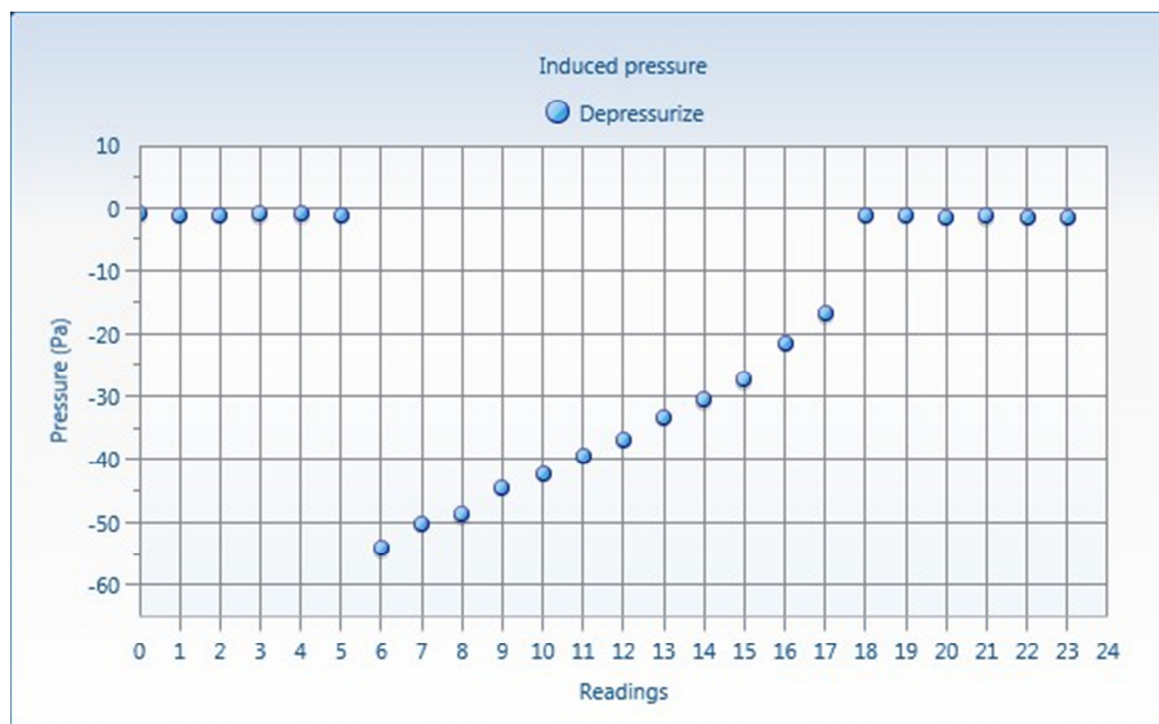


Results:

All results are compared to the standards set in Building Regulations 'Approved Document L1A – Conservation of fuel and power in new dwellings (2010)'. Results are calculated using the formulae set out in ATTMA TSL1 (Section 3.2). Readings collected are detailed below:

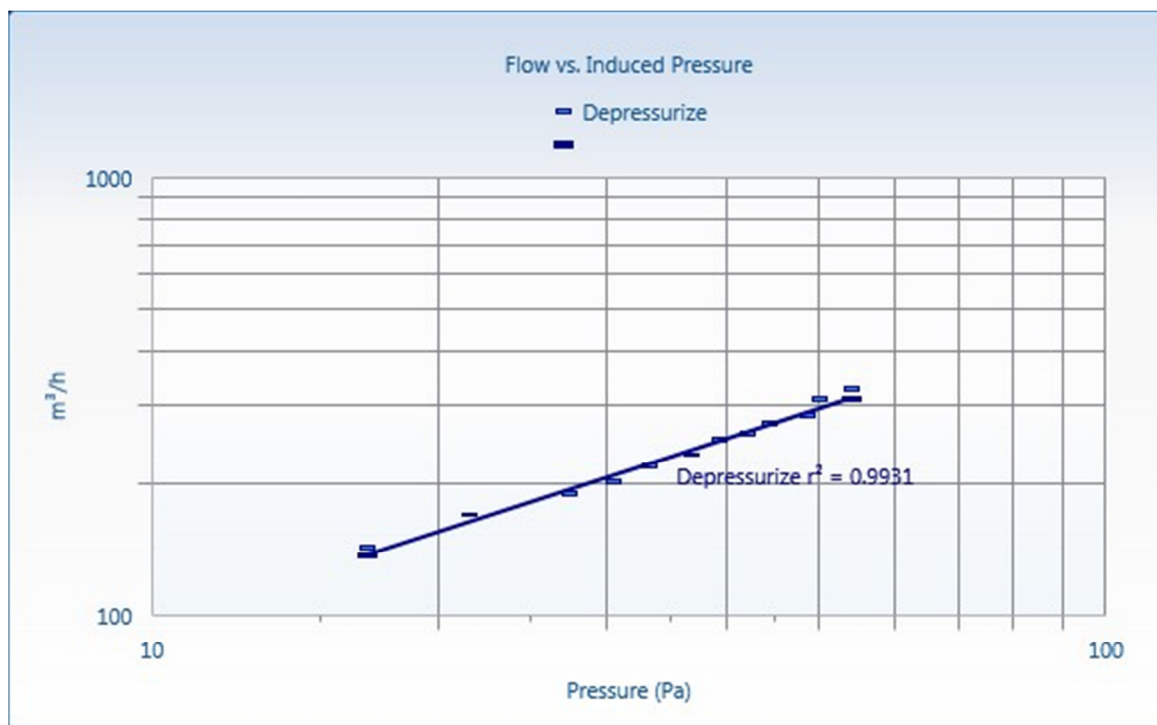
Reading	1	2	3	4	5	6	7	8	9	10	11	12
Induced Pressure [Pa]	-55.3	-51.3	-49.9	-45.5	-43.3	-40.5	-38.0	-34.4	-31.7	-28.6	-22.7	-18.0
Total flow, Q_r [m^3/h]	328	311	286	275	261	252	233	221	202	190	170	143
Corrected flow, Q_{env} [m^3/h]	325	308	283	272	258	249	231	218	200	188	168	141
Error [%]	4.2%	4.4%	-2.3%	0.3%	-1.1%	0.2%	-2.9%	-1.3%	-4.1%	-2.7%	3.0%	2.9%

G1: Graph of imposed pressure differentials, Depressurize:





G2: Graph of imposed pressure differential against airflow, Depressurize:



Depressurize Test Results					
	Results			Results	Uncertainty
Correlation, r^2	0.993	95% confidence limits		Air flow at 50 Pa, Q_{50} [m³/h]	295 +/-2.8%
Intercept, C_{env} [m³/h.Pa ⁿ]	18.9	15.4	23.3	Permeability at 50 Pa, AP_{50} [m³/h.m²]	0.86 +/-2.9%
Slope, n	0.70	0.64	0.76	Equivalent leakage area at 50 Pa [cm²]	148 +/-2.8%
				Air changes, n_{50}	0.93 +/-2.9%



Pressurize Data Set

After the depressurisation test a full multi-point pressurisation test was also carried out, as required by the Passivhaus Institute.

Date: **15th November 2014**

Time: **15:12 to 15:26**

Environmental Conditions:

Barometric Pressure:	99.2 KPa	Wind speed:	1 m/s
Temperature: Initial: indoors	18.4°C	outdoors	11.6°C
Final: indoors	18.5°C	outdoors	11.4°C

Test Data:

At least **3** static pressures taken for **10** sec each.

A minimum of **10** induced pressures taken for **≥20** sec each.

Existing Pressure Differentials (Static pressure):

Baseline, initial [Pa]	-1.1	-1.2	-1.4	-1.3	-1.4	-1.5
Baseline, final [Pa]	-0.8	-1.0	-1.2	-1.2	-1.1	-1.1

Static Pressure Averages:	initial [Pa]	ΔP_{01}	-1.32	ΔP_{01-ve}	-1.32	ΔP_{01+ve}	0.00
	final [Pa]	ΔP_{02}	-1.07	ΔP_{02-ve}	-1.07	ΔP_{02+ve}	0.00

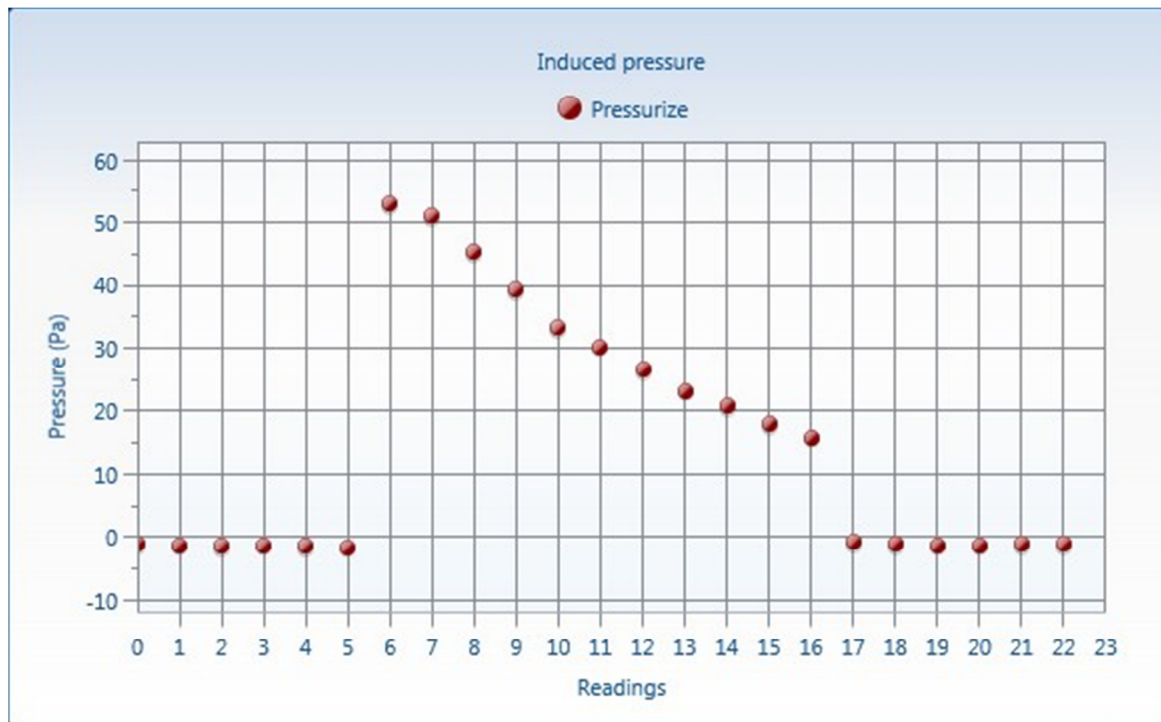
Results:

All results are compared to the standards set in Building Regulations 'Approved Document L1A – Conservation of fuel and power in new dwellings (2010)'. Results are calculated using the formulae set out in ATTMA TSL1 (Section 3.2). Readings collected are detailed below:

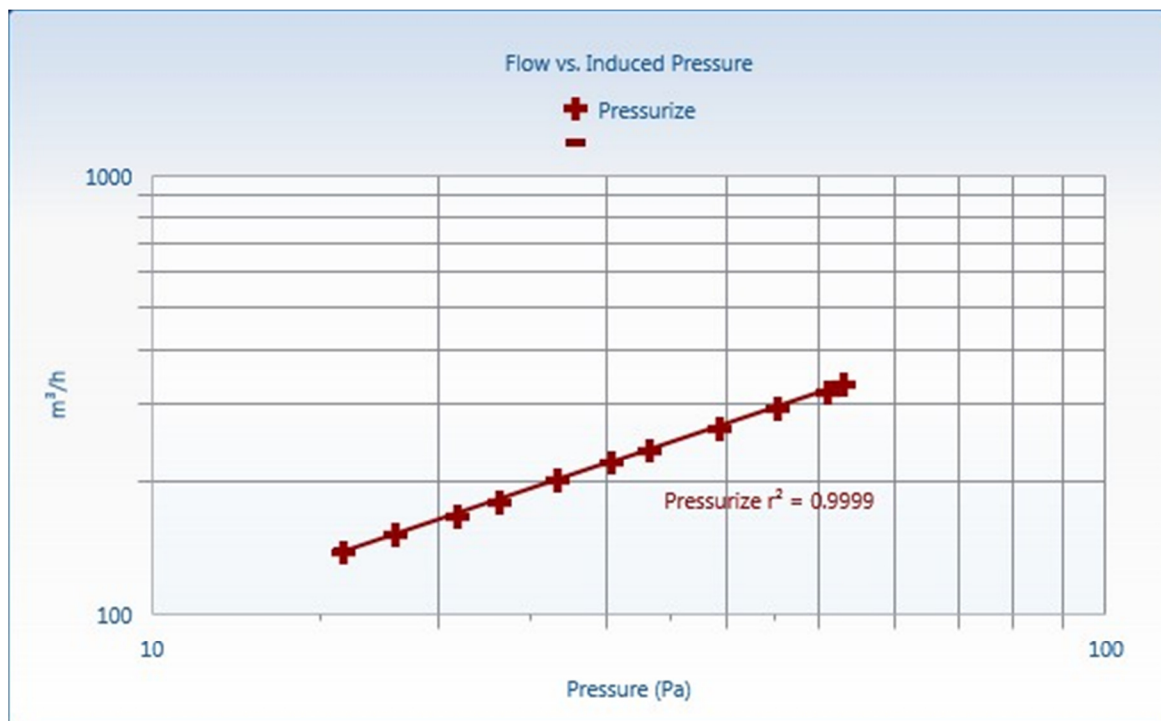
Reading	1	2	3	4	5	6	7	8	9	10	11
Induced Pressure [Pa]	51.8	49.8	44.2	38.1	32.0	29.1	25.4	22.0	19.7	16.8	14.7
Total flow, Q_r [m ³ /h]	332	318	294	265	236	221	200	180	167	151	137
Corrected flow, Q_{env} [m ³ /h]	337	323	299	269	240	224	204	183	170	153	140
Error [%]	0.7%	-0.9%	-0.2%	-0.2%	0.5%	0.5%	0.3%	-0.5%	-0.5%	0.3%	-0.1%



G3: Graph of imposed pressure differentials, Pressurize:



G4: Graph of imposed pressure differential against airflow, Pressurize:





Pressurize Test Results						
	Results				Results	Uncertainty
Correlation, r^2	1.000	95% confidence limits		Air flow at 50 Pa, Q_{50} [m ³ /h]	320	+/-0.6%
Intercept, C_{env} [m ³ /h.Pa ⁿ]	18.7	18.1	19.3	Permeability at 50 Pa, AP_{50} [m ³ /h.m ²]	0.93	+/-0.8%
Slope, n	0.73	0.72	0.74	Equivalent leakage area at 50 Pa [cm ²]	160	+/-0.6%
				Air changes, n_{50}	1.01	+/-0.8%

Combined Results

Combined Test Results		
	Results	Uncertainty
Air flow at 50 Pa, Q_{50} [m^3/h]	308	+/-1.7%
Permeability at 50 Pa, AP_{50} [$m^3/h.m^2$]	0.90	+/-1.8%
Equivalent leakage area at 50 Pa [cm^2]	154	+/-1.7%
Air changes, n_{50}	0.97	+/-1.8%
Average correlation, r^2	0.997	n/a
Average intercept, C_{env} [$m^3/h.Pa^n$]	18.8	n/a
Average slope, n	0.71	n/a

Leakage Inspection

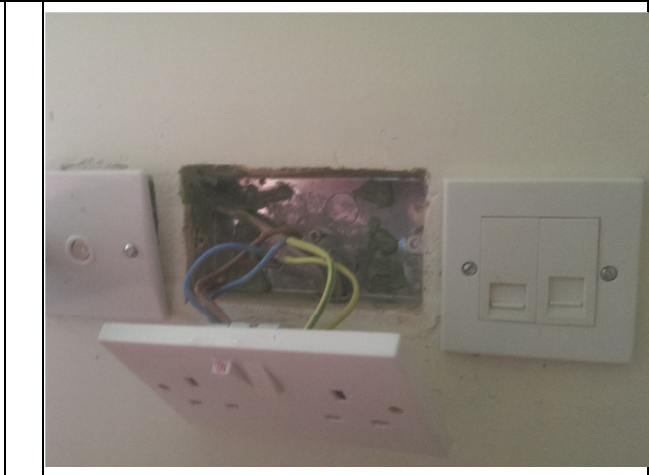
After an unsatisfactory initial single-point test, an extensive inspection for leakage was carried out. Permanent remedial sealing works were undertaken prior to the full multi-point testing being carried out. Various leakage sites were identified, which are illustrated in the pictures below and on the following pages:



P8) Adjustments being made to dormer window and electric closer to achieve an effective seal. By far the most significant leak identified



P9) Mastic seal around cable through wall to unheated outbuildings

	
P10) Redone tape seal around pipe connection to solar thermal panel on roof	P11) Orcon-F mastic (green) having been used to seal leakage around cables and fixings through back of switch box – ideally would have been fully parged

Comments & Conclusions:

After the remedial sealing works undertaken, the air leakage results achieved in the acceptance air leakage testing of the refurbished dwelling at 8 Benson Place in Oxford were an average Air Change Rate of $0.97 \text{ ACH}^{-1} @ 50 \text{ Pa}$ and an average Air Permeability of $0.90 \text{ m}^3/\text{hr}/\text{m}^2 @ 50 \text{ Pa}$. These are excellent results, and meet the EnerPHit target of $\leq 1.0 \text{ ACH}^{-1} @ 50 \text{ Pa}$. Hence we have issued an Air Leakage Certificate for the property, a copy of which is attached.



Air Leakage Certificate

Building tested:	8 Benson Place, Oxford, OX2 6QH
Client contact:	Tim Nicholson
Test Date:	15 th November 2014
Test Engineer:	Paul Jennings, Aldas
Certificate No:	JALDAS5037/T4C

This is to certify that the above named structure has been tested for air leakage in accordance with the BS EN 13829:2001 methodology and the requirements of BINDT and the Passivhaus Institute. The average Leakage Characteristics of the building were recorded as follows:

Airflow @ 50 Pa:		307.5 m ³ /hr	
Air Permeability @ 50 Pa:		0.90 m ³ / (hr.m ²)	
Air Change Rate @ 50 Pa:		0.97 ACH ⁻¹	
Correlation of Results, r ² :		0.997	
Slope, n:		0.70	
Intercept, C _{env} :		18.82 m ³ / (hr.Pa ⁿ)	
Test Parameters			
Envelope, A _E :		343.0 m ²	
Volume, V:		316.5 m ³	
Env. Calc. prepared by:		Paul Jennings	
Initial Offset Pressure	-1.05	Final Offset Pressure:	-1.07 Pa
Initial Inside Temperature:	17.2°C	Final Inside Temperature:	18.5°C
Average Outside Temperature:	11.5°C	Barometric Pressure:	98.2 kPa

This certificate should be read in conjunction with the report JALDAS5037 R3 and associated test method statement.

Paul Jennings

Signed: _____ Name: Paul Jennings Date Issued: 24/11/14
Position: Air Leakage Specialist



ALDAS, 54 Melville Road, Churchdown, Gloucester GL3 2RG
Aldas is a trading name of Jennings Aldas Limited, Co. Reg 8409614

Director: Clare Corley

Air Leakage Specialist: Paul Jennings, BSc, MSc doorfanman@hotmail.com 07866 948200

