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Report on Pre-improvement Air Leakage Testing, in compliance with ATTMA TSL1 (2010)

Result: Unsatisfactory

Site address: 8 Benson Place, Oxford, OX2 6QH

Test Reference No.:		**JALDAS5037/R1**
Test Dates:		**22nd July 2013**
Testing carried out for:	**Client:**	**Tim Nicholson**
Testing carried out by:	**Test Engineer:**	**Paul Jennings**
	Testing Organisation:	**Aldas**
	Contact Tel:	**01452 532878 / 07866 948200**
	Contact E-mail:	**Doorfanman@hotmail.com**
Post-Improvement Design Air Changes, ACH^{-1} @ 50 Pa:		**≤ 1.0 (EnerPHIt)**
Existing Achieved Air Changes, ACH^{-1} @ 50 Pa:		**7.7**
Existing Achieved Air Permeability, $m^3/hr/m^2$ @ 50 Pa:		**7.7**
Data consistency, r^2 (requirement, $r^2 \geq 0.98$):		**1.000**
Slope, n (requirement, $0.5 \leq n \leq 1.0$):		**0.68**

Introduction & Set-Up:

Pre-improvement air leakage testing of the end terrace property at 8 Benson Place in Oxford was carried out on the 22nd July 2013 shortly before the start of works. Testing was carried out using a Retrotec 3000SR high-power fan mounted in an adjustable frame in the front entrance doorway.

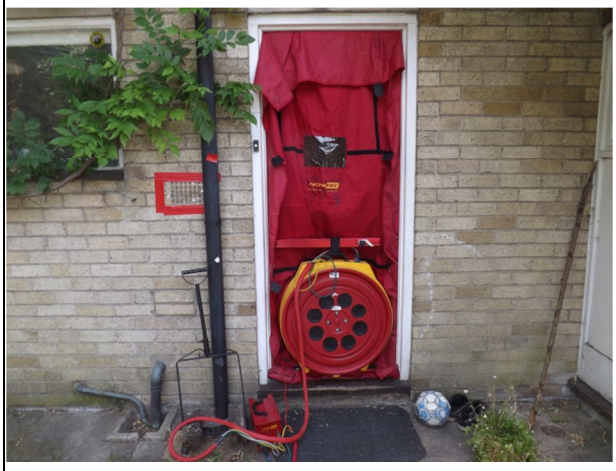
Testing was carried out in accordance with the requirements of BS EN 13829 and the BINDT Quality Procedure, in conformance with the ATTMA TSL1 standard (2010), Method B. Any queries or complaints about this test should be addressed in the first instance to the test engineer and in the second instance 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 shut for the duration of testing, and internal doors (where fitted) were kept open to ensure the dwelling acted as a single volume. The chimney in the Living Room was sealed for the duration of testing, as were two airbricks (already largely sealed by the resident) in the kitchen and an extract fan upstairs. Because there was concern as to the extent of leakage through the party wall to the adjacent mid-terrace house, it had been decided to also undertake co-pressure testing, where two (or more) properties are simultaneously pressurised so that the leakage between them can be estimated.

The pictures below and on the following pages illustrate the equipment and test set-up that was used:

		
Fireplace in Living Room temporarily sealed with polythene and tape to prevent soot escaping into the room if dislodged		Airbrick to larder in kitchen temporarily sealed with polythene and tape externally – satisfactory because sleeved at time of cavity wall insulation, hence not open to cavity

		
Airbrick in kitchen, largely sealed by resident, temporarily sealed for the test		Extract fan upstairs temporarily sealed for duration of testing
		
Test equipment mounted in front entrance doorway to 8 Benson Place		Second fan being installed in entrance doorway of neighbouring property to carry out co-pressure testing
		
Open ridge vent from original heating to next door making co-pressure testing problematic		Temporary sealing of ridge vent to facilitate co-pressure testing

Measurement Procedures:

Test procedures in accordance with the following standards: ATTMA TSL1, 2010, Method B. After the preliminary single-point pressurisation test and leakage check, a full multi-point pressurisation test was carried out.

The Envelope Area and Volume were calculated by the test engineer, Paul Jennings, directly from measurements made on site. These measurements will need to be checked and the calculations revised in the case of any variations (and to generate the volume according to PassivHaus conventions) at the time of the final acceptance test.

Based upon: BS EN 13829:2001

Dwelling	**Envelope area m^2 (ATTMA conventions)**	**Volume m^3 (ATTMA conventions)**
8 Benson Place, Oxford, OX2 6QH	**286.2**	**286.1**

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 3000SR Blower Unit	Serial No: PH001057	Expires 15th April 2014
Retrotec DM2A Digital Gauge	Serial No: 102036	Expires 15th April 2014
Testo 511 Digital Barometer	Serial No: 39107531/301	Expires 6th June 2014
Testo 110 Digital Thermometer	Serial No: 33949361/208	Expires 9th June 2014
Testo 525 Digital Anemometer	Serial No: 01712338	Expires 16th June 2014

Pressurisation Test

After leakage checking externally whilst the dwelling was initially pressurised, a full multi-point pressurisation test was undertaken.

Date: **22nd July 2013** Time: **2.32 pm** to **3.48 pm**

Environmental Conditions:

Barometric Pressure:		**101.0**	KPa	Wind speed:		**0.8 m/s**
Temperature:	Initial:	indoors	**28°C**	outdoors	**30°C**	
	Final:	indoors	**29°C**	outdoors	**31°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]	0.0	+0.7	+0.3	+0.6	+0.8	+0.7
Baseline, final[Pa]	+0.7	+0.6	+0.9	+0.8	+0.6	+0.5

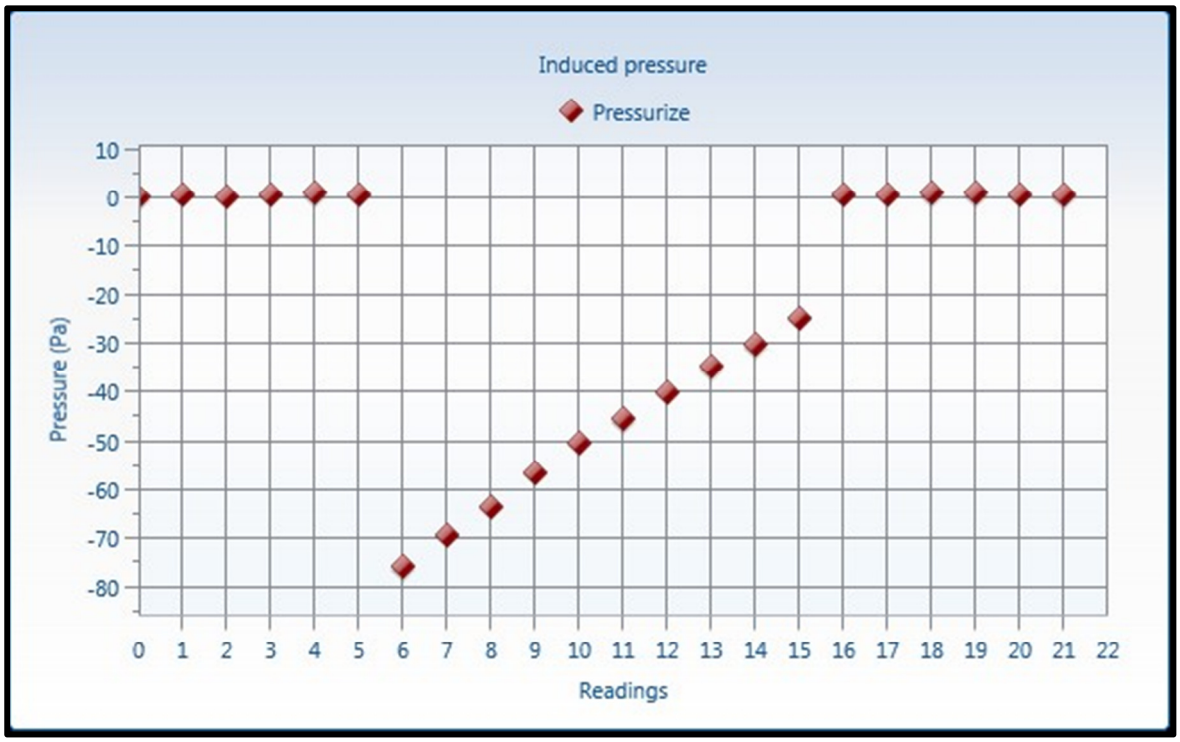
Static Pressure Averages:	initial [Pa]	ΔP_{01}	**+0.52**	ΔP_{01-}	**-0.00**	ΔP_{01+}	**+0.52**
	final [Pa]	ΔP_{02}	**+0.68**	ΔP_{02-}	**-0.00**	ΔP_{02+}	**+0.68**

Results:

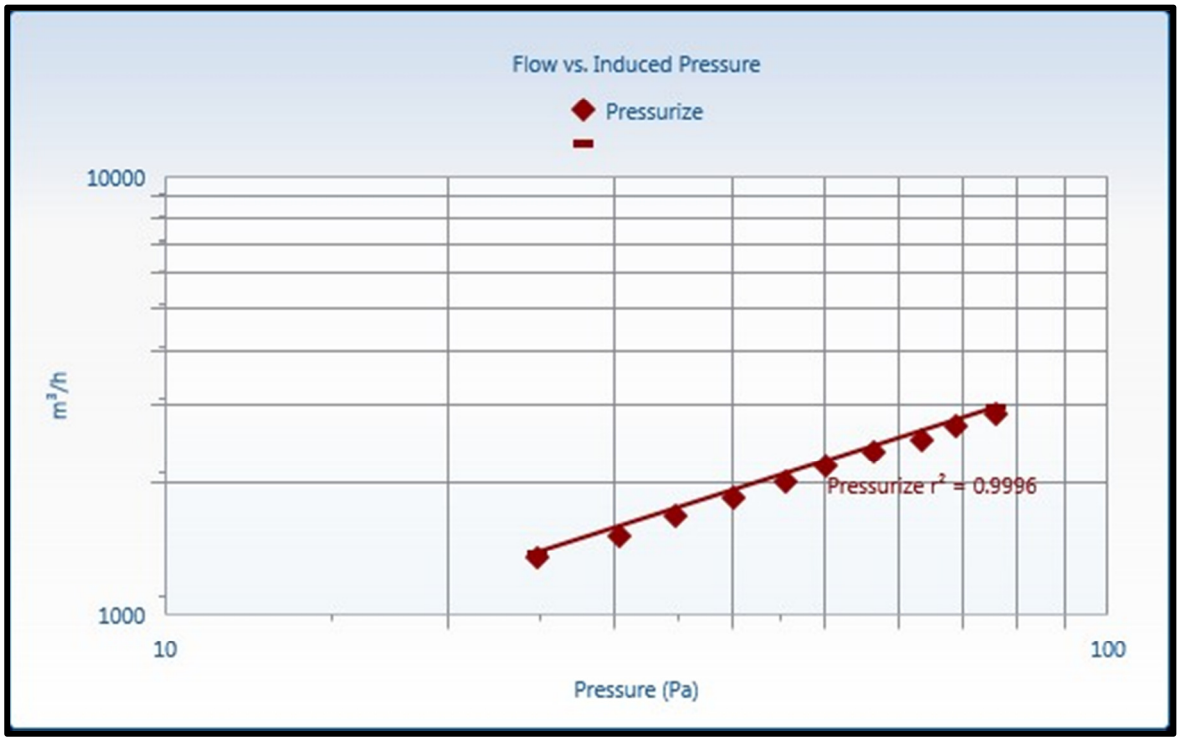
All results are compared to the standards set in Building Regulations 'Approved Document L1A – Conservation of fuel and power in new dwellings (2010)'. Results are calculated using the formula set out in ATTMA TSL1 (Section 3.2). Readings collected are detailed below:

Reading:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Induced Pressure [Pa]	75.3	68.5	62.8	55.8	49.7	44.9	39.5	34.2	29.7	24.2
Total flow, Q_r [m^3/h]	2879	2705	2522	2356	2186	2019	1858	1692	1518	1357
Corrected flow, Q_{env} [m^3/h]	2981	2801	2611	2439	2263	2090	1924	1752	1571	1405
Error [%]	+0.2%	+0.4%	-0.8%	+0.3%	+0.6%	-0.5%	-0.2%	+0.1%	-1.3%	+1.1%

G1: Graph of imposed pressure differentials, pressurisation:



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



Pressurisation Test Results

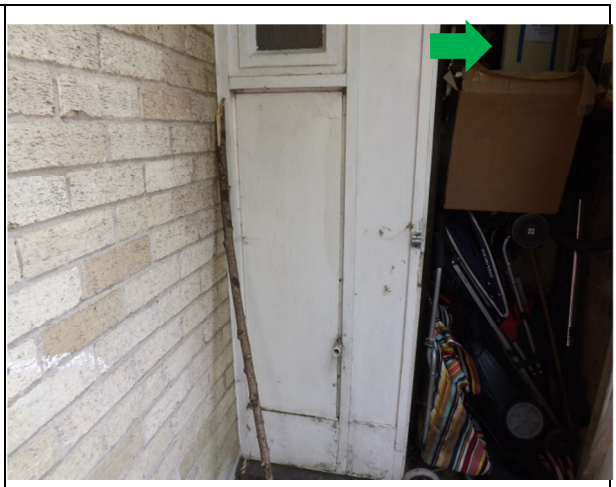
	Results		
Correlation, r^2	**1.000**	95% confidence limits	
Intercept, C_{env} [$m^3/h.Pa^n$]	**156.5**	**147.0**	**166.5**
Slope, n	**0.68**	**0.66**	**0.70**

	Results	Uncertainty
Air flow at 50 Pa, Q_{50} [m^3/h]	**2215**	**±0.6%**
Permeability at 50 Pa, AP_{50} [$m^3/h.m^2$]	**7.7**	**±0.8%**
Equivalent leakage area at 50 Pa [m^2]	**0.11**	**±0.6%**
Air changes, n_{50}	**7.7**	**±0.8%**

Leakage Inspection

A leakage check was carried out externally whilst the dwelling was first pressurised. The pictures below and on the following pages detail the most significant leakage sites that were identified during the test:

Leakage through gaps around access hatch at base of front wall



Substantial leakage at top of wall to external storage cupboard from downstairs WC

		
Using smoke to check for leakage through cracks in external wall beneath kitchen window. Also leakage found beneath edge of window sill		Checking for leakage at corner of window frame and beneath lintel above window

Comments & Conclusions:

The results achieved in the pre-improvement test at 10 Benson Place were an Air Permeability of 7.7 $m^3/hr/m^2$ @ 50 Pa and an Air Change Rate of 7.7 ACH^{-1} @ 50 Pa. These clearly indicate the substantial improvement that is required to achieve the EnerPHIt target of $\leq$ 1.0 ACH^{-1} @ 50 Pa.

Extensive sealing included in the package of improvement works, but the works will need to be both effective designed and properly implemented to achieve such a large improvement. Because there was concern about leakage through the party wall to the adjacent mid-terrace house, it had been agreed prior to attending site to carry out a co-pressure test, where two (or more) dwellings are pressurised (usually) at the same time so that the leakage between them can be determined by subtraction.

This was carried out at Benson Place, but hit a major snag in that the next door house was found to be so leaky that it was not initially possible to achieve the required pressure differential. After sealing off some airbricks with little impact, this was ultimately traced to an old heating system, which included a ridge vent that was still open to atmosphere. This was then temporarily sealed at which point the co-pressure testing could proceed.

Whilst being aware of the reduced accuracy that co-pressure testing is subject to, the difference between the effective areas of the two sets of leakage measurements was 0.022 m^2, The larger value was measured when testing 8 Benson Place individually, then in the co-pressure test the leakage through the party wall was effectively neutralized, giving the smaller value. This means that the effective leakage through the party wall at 50 Pa is approximately one-fifth (20%) of the existing leakage in 8 Benson Place. Hence it is essential to tackle leakage through the party wall to achieve the target air change rate of $\leq$ 1.0 ACH^{-1} @ 50 Pa and thereby meet the EnerPHIt refurbishment standard.