# Air Pressure Test

to EN13829:2000

## 16 Kilgarron Park
## Enniskerry
## Co. Wicklow

**2014-05-20**

**Retest following renovation works**

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# Introduction

Ms Joan Bolger commissioned an airtightness test using a 'blower door' machine to how well air-sealed the house is following renovation works. The blower door machine allows the level of airtightness to be ascertained and for the results to be compared to the general housing stock already tested.

The current report is structured as follows:

1. Summary Blower door result. This is a quick overview of how this dwelling stands
2. Detailed Blower door result. These details are required if the test is to be used in a BER calculation.

In order to understand the technology and some of the terminology used in compiling the report, your attention is drawn to the appendices:

A. Understanding the Blower door test

It is recommended that if you wish to understand the report on a deeper level, that you read those sections before tackling the main report.

Overall, the result of 4.080 $m^3/(hr.m^2)$ is within what is currently considered “Good Practise for Airtightness” in Ireland, and if the house were a new-build it would be well within the requirements of the Building Regulations Part L (2011) which calls for an airtightness test result of 7.0 $m^3/(hr.m^2)$ or less on new homes.

It also shows a marked improvement on the initial airtightness test rate of 26.04 $m^3/(hr.m^2)$, which was tested immediately prior to renovation works.

# Pressure Test Result Summary

**16 Kilgarron Park**
**Enniskerry**
**Co. Wicklow**

**2014-05-20**

| *Result @50Pa* | **Flow $m^3/h$** | **Air changes (n50)** | **Permeability $m^3/(hr.m^2)$ (q50)** |
|---|---|---|---|
| **Averaged Result** | **1980** | **4.495** | **4.080** |

***Comparison of Air Permeability Result ($m^3/(hr.m^2)$) to 2011 Part L New Home Regulations***

| Industry Standards | Best Practise <3 | Good Practise 3-5 | Acceptable 5-7 | Poor >7 |
|---|---|---|---|---|
| Your Result | | 4.080 | | |

**Notes**:

The flow result is area independent.

The air changes rate (air leakage) and $m^3/(hr.m^2)$ (air permeability) results are both dependent on accurate measurements of the volume and envelope area of the dwelling. The measurements used here were calculated from measurements taken on site.

The Equivalent leakage area is calculated at approximately 770 $cm^{2.}$ (@10Pa)
This is approximately the size a single hole would be through the wall, if all of the leaks now present in the house were concentrated into one hole, measured at 10Pa. That is, about a sheet and a quarter of A4 paper.

The result to be used in a DEAP BER calculation is $1/20^{th}$ of the q50 – 4.080/20 = 0.204.

The test was undertaken in accordance with the provisions of the standard EN13829 Method B, and all variables were within acceptable limits.

# Full Door Fan Test Report

Building Address:
**16 Kilgarron Park**
**Enniskerry**
**Co. Wicklow**

Test technician: **Gavin Ó Sé**
Test company: **Greenbuild Energy**
contact@greenbuild.ie
Tel: **087 2521032**

Elevation: **100 m**
Height above ground : **50 m**
Building Volume, V: **440 m³**
Total envelope area, $A_{T\ BAT}$ **485 m²**
Building exposure to wind: **Partially protected building**
Estimated % error of measurements: **5%**
Date of construction: **1960s, renovated 2014**

**Testing Details**

**Equipment Used:** **Fan** **Retrotec 2000/H01674**
**Gauge** **DM-2/200542**

## Depressurize set

Date: **2014-05-20** from: **09.30** to
Environmental Conditions:
*Barometric Pressure*: **98.6**KPa from **Direct measurement**.
*Wind speed*: **0: Calm**
*Temperature*: Initial: indoors **16 ℃** outdoors **14 ℃**
Final: indoors **16 ℃** outdoors **14 ℃**.
Test Data:
**10** bias pressures taken for **10** sec each.
**10** induced pressures taken for **20** sec each.

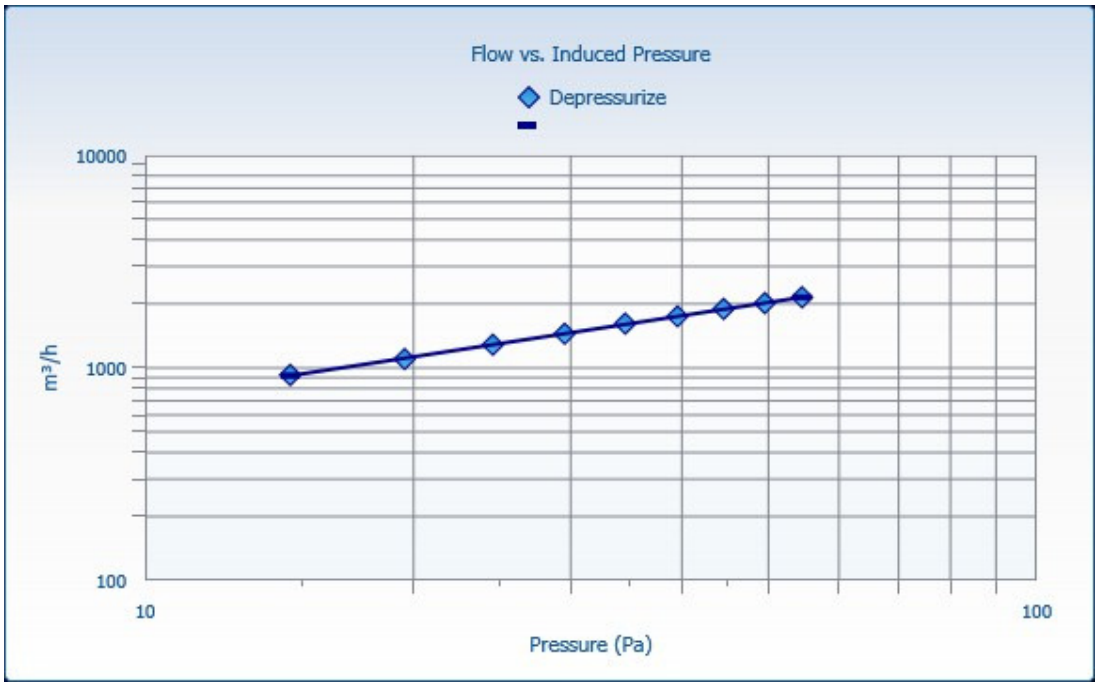
**Bias pressures**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bias, initial [Pa] | **-0.40** | **-0.30** | **-0.30** | **-0.30** | **-0.30** | **-0.30** | **-0.40** | **-0.40** | **-0.40** | **-0.40** | | |
| Bias, final[Pa] | **-0.70** | **-0.60** | **-0.60** | **-0.60** | **-0.60** | **-0.50** | **-0.50** | **-0.50** | **-0.50** | **-0.50** | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Building Test Pressure [Pa] | **-55.0** | **-50.0** | **-45.0** | **-40.0** | **-35.0** | **-30.0** | **-25.0** | **-20.0** | **-15.0** | | | |
| Door Fan Pressure,[Pa] | **235** | **209** | **186** | **160** | **138** | **112** | **89** | **66** | **47** | | | |
| Total flow, $V_r$[$m^3$/h] | **2147.5** | **2015.1** | **1892.5** | **1746.4** | **1614.9** | **1447.6** | **1284.7** | **1101.4** | **926.1** | | | |
| Corrected flow, $V_{env}$[$m^3$/h] | **2145** | **2013** | **1891** | **1745** | **1613** | **1446** | **1283** | **1100** | **925.1** | | | |
| Error [%] | **-0.1%** | **-0.3%** | **0.3%** | **-0.1%** | **0.8%** | **-0.2%** | **-0.2%** | **-1.0%** | **0.7%** | | | |

*Bias pressure Averages*:
initial [Pa] $\Delta P_{01}$ **-0.35**, $\Delta P_{01-}$-0.35, $\Delta P_{01+}$ **0.00**
final [Pa] $\Delta P_{02}$ **-0.56**,$\Delta P_{02-}$**-0.56**, $\Delta P_{02+}$**0.00**

**Induced Pressure vs. Flow**




**Depressurize Test Results**

| | Results | | |
|---|---|---|---|
| *Correlation, r [%]* | **99.98** | 95% confidence limits | |
| *Intercept, $C_{env}$ [$m^3/h.Pa^n$]* | **165.0** | **159.0** | **171.0** |
| *Intercept, $C_L$ [$m^3/h.Pa^n$]* | **164.53** | **158.5** | **170.5** |
| *Slope, n* | **0.6419** | **0.6314** | **0.6523** |

| | Results | 95% Confidence | | Uncertainty |
|---|---|---|---|---|
| *Air flow at 50 Pa, $V_{50}$ [$m^3/h$]* | **2025** | **2015** | **2040** | **+/-0.6%** |
| *Air changes at 50 Pa, $n_{50}$ [/h]* | **4.605** | **4.375** | **4.840** | **+/-5.0%** |
| *Permeability at 50 Pa, $q_{50}$ [$m^3/h.m^2$]* | **4.178** | **3.968** | **4.389** | **+/-5.0%** |
| *Specific Leakage at 50 Pa, $w_{50}$ [$m^3/h.m^2$]* | **11.014** | **10.459** | **11.569** | **+/-5.0%** |

## Pressurize set

Date: **2014-05-20** Time: to **10.05**
Environmental Conditions:
*Barometric Pressure*: **98.6**KPa from **Direct measurement**.
*Wind speed*: **0: Calm**
*Temperature*: Initial: indoors **16 ℃** outdoors **14 ℃**.
Final: indoors **16 ℃** outdoors **14 ℃**.
Test Data:
**10** bias pressures taken for **10** sec each.
**10**induced pressures taken for **20** sec each.

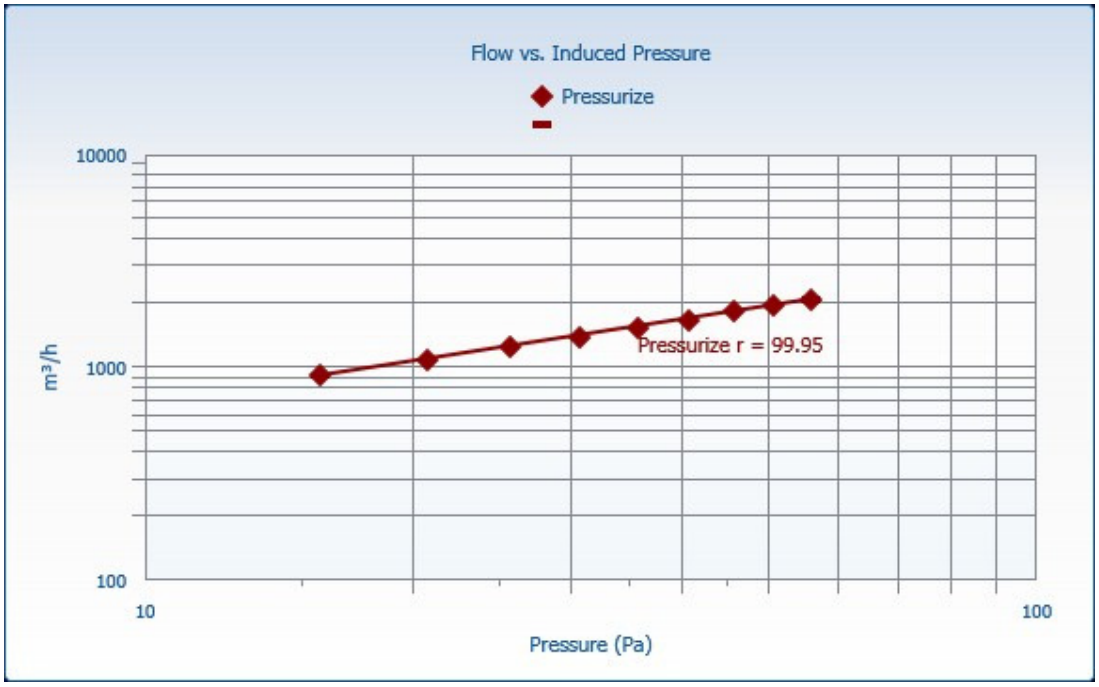
**Bias pressures**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bias, initial [Pa] | **-0.70** | **-0.60** | **-0.60** | **-0.60** | **-0.60** | **-0.50** | **-0.50** | **-0.50** | **-0.50** | **-0.50** | |
| Bias, final[Pa] | **-0.60** | **-0.90** | **-0.90** | **-0.80** | **-0.80** | **-0.70** | **-0.80** | **-0.90** | **-0.90** | **-1.00** | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Building Test Pressure [Pa] | **55.0** | **50.0** | **45.0** | **40.0** | **35.0** | **30.0** | **25.0** | **20.0** | **15.0** | | | |
| Door Fan pressure [Pa] | **273** | **248** | **218** | **187** | **162** | **132** | **108** | **83** | **61** | | | |
| Total flow, $V_r[m^3/h]$ | **2061.9** | **1957.4** | **1820.8** | **1670.0** | **1546.2** | **1379.0** | **1239.4** | **1075.6** | **916.0** | | | |
| Corrected flow, $V_{env}[m^3/h]$ | **2081** | **1976** | **1838** | **1686** | **1561** | **1392** | **1251** | **1086** | **924.7** | | | |
| Error [%] | **0.1%** | **1.0%** | **0.5%** | **-0.6%** | **0.2%** | **-1.4%** | **-0.5%** | **-0.6%** | **1.4%** | | | |

*Bias pressure Averages*:
initial [Pa] $\Delta P_{01}$ **-0.56**, $\Delta P_{01-}$ -0.56, $\Delta P_{01+}$ **0.00**
final [Pa] $\Delta P_{02}$ **-0.83**, $\Delta P_{02-}$ **-0.83**, $\Delta P_{02+}$ **0.00**

**Induced Pressure vs. Flow**




**Pressurize Test Results**

| | Results | | |
|---|---|---|---|
| *Correlation, r [%]* | **99.95** | 95% confidence limits | |
| *Intercept, $C_{env}$ [$m^3/h.Pa^n$]* | **152.0** | **142.5** | **162.1** |
| *Intercept, $C_L$ [$m^3/h.Pa^n$]* | **151.40** | **142.0** | **161.5** |
| *Slope, n* | **0.6508** | **0.6327** | **0.6690** |

| | Results | 95% Confidence | | Uncertainty |
|---|---|---|---|---|
| *Air flow at 50 Pa, $V_{50}$ [$m^3/h$]* | **1930** | **1910** | **1950** | **+/-1.0%** |
| *Air changes at 50 Pa, $n_{50}$ [/h]* | **4.390** | **4.165** | **4.615** | **+/-5.1%** |
| *Permeability at 50 Pa, $q_{50}$ [$m^3/h.m^2$]* | **3.982** | **3.779** | **4.185** | **+/-5.1%** |
| *Specific Leakage at 50 Pa, $w_{50}$ [$m^3/h.m^2$]* | **10.496** | **9.960** | **11.032** | **+/-5.1%** |

**Combined Test Data**

| | Results | 95% Confidence Interval | | Uncertainty |
|---|---|---|---|---|
| *Air flow at 50 Pa, $V_{50}$ [$m^3/h$]* | **1980** | **1960** | **1995** | **+/-0.8%** |
| *Air changes at 50Pa, $n_{50}$ [/h]* | **4.495** | **4.270** | **4.725** | **+/-5.1%** |
| *Permeability at 50 Pa, $q_{50}$ [$m^3/h.m^2$]* | **4.080** | **3.873** | **4.287** | **+/-5.0%** |
| *Specific leakage at 50 Pa, $w_{50}$ [$m^3/h.m^2$]* | **10.755** | **10.209** | **11.300** | **+/-5.0%** |

**Test Notes:**
Door fan was in front door.

Temporary seals:

- HRV system
- Chimney

All external windows and doors were closed, except for the opening holding the fan equipment.
All internal room doors were open, including the hot press door.

**Ventilation Type –** Centralised Heat recovery ventilation
**Heating Type –**boiler with radiators

# Appendix A - Understanding The Blower Door Test

The blower door test is performed using a calibrated fan machine to move a measured amount of air through a dwelling. The air can be sucked from the house (depressurized) or pushed into the house (pressurize), or both.

The test is performed in accordance with the Irish & European Standard IS EN13829:2000, so that the results should be able to be replicated and also compared across dwellings.

Greenbuild is one of only a small number of companies in the country audited by the National Standards Authority of Ireland (NSAI), so you can be assured of the quality of our service.

As part of the NSAI scheme, we also take account of the UK ATTMA standard. This is not required in Ireland generally, but may be specified in some cases.

Whilst the fan is running, the air pressure inside will be different to the air pressure outside. Readings are recorded and the results are plotted on a graph. The reading on the graph at 50 Pascal pressure difference between the inside and the outside is then taken as the final result for the building. If the building has been both pressurised and depressurised then the 50 Pascal result for each is added and the final result is the average of the two readings.

In Europe generally, the result is expressed in terms of the volume of air being moved through the fan relative to the volume of the building. This is called the Air Change rate, or Air Leakage rate, or the n50.

In Ireland and Britain, the result is usually expressed in terms of the volume of air being moved through the fan relative to the area of the building envelope (ground floor, external walls and upper ceilings), measured in square metres. This is called the Air Permeability rate, or the q50.

People often speak of these two results as equivalent, but it is important to note that they depend on the shape of the building and can be quite different.

Greenbuild provides both the Air Permeability and Air Leakage rate results for tests undertaken.

## Example

Take a bungalow of 100 square metres, with 8ft ceilings (2.4m).

The volume of the house is thus 100*2.4 = 240 cubic meters.

The envelope of the house depends on whether is it long and narrow, or square etc., but let's say it has an envelope area of:

| | |
|---|---|
| Floor | $100m^2$ |
| Ceilings | $100m^2$ |
| Walls | 20m Long, 5m wide = $120m^2$ |

Thus the envelope of the sample house is $320m^2$.

If the volume of air going through the fan at 50 Pa is 1600m3, then:

Air Leakage is 1600/240 = 7 Air changes per hour
Air Permeability is 1600/320 = 5 m3/(hr.m2)

# Appendix B - Equipment used

## PRESSURE TESTING

Retrotec 2000 fan – **Retrotec 2000/H01674**

Calibrated to 16th January 2015 (Manufacturer's Calibration- Valid 3 Years)

DM2 Mark II Gauge. - **DM-2/200542**

Calibrated to 3rd Sept 2014 (Manufacturer's Calibration- Valid 1 Year)

AIR TIGHTNESS TESTING
I.S. EN 13829:2000
NSAI Certified

## THERMAL IMAGING

Impac 770H 320x240

## OTHER DEVICES

Kestrel 4000 – Windspeed, Humidity, Atmospheric Pressure.

SN: 540810 - Calibrated to 29th July 2014, INAB Accredited Laboratory

Dwyer 471-3 – Hot wire anemometer

Fluke 51 – Thermometer

## Fan Calibration Details

| Retrotec 2000 H01674 | | | | | | |
|---|---|---|---|---|---|---|
| Range | N | K | K1 | K2 | K3 | K4 |
| **Open(22)** | **0.5214** | **519.618** | **-0.07** | **0.8** | **-0.115** | **1** |
| **A** | **0.503** | **264.996** | **-0.075** | **1** | **0** | **1** |
| **B** | **0.5** | **174.8824** | **0** | **0.3** | **0** | **1** |
| **C8** | **0.5** | **78.5** | **-0.02** | **0.5** | **0.016** | **1** |
| **C6** | **0.505** | **61.3** | **0.054** | **0.5** | **0.004** | **1** |
| **C4** | **0.5077** | **42** | **0.009** | **0.5** | **0.0009** | **1** |
| **C2** | **0.52** | **22** | **0.11** | **0.5** | **-0.001** | **1** |
| **C1** | **0.541** | **11.9239** | **0.13** | **0.4** | **-0.0014** | **1** |
| **L4** | **0.48** | **4.0995** | **0.003** | **1** | **0.0004** | **1** |
| **L2** | **0.502** | **2.0678** | **0** | **0.5** | **0.0001** | **1** |
| **L1** | **0.4925** | **1.1614** | **0.1** | **0.5** | **0.0001** | **1** |