Blower Door Test Report and ACH Case Study / Inspection Overview

A blower door test is a process that depressurizes a building and then measures the amount of air leaking through the building envelope. The results are usually expressed in air changes per hour (ACH) at a specific pressure. The code stipulates that the test is performed at a pressure level of 50 pascals, then measured on how many times the air will change in a space within an hour at that high depressurized level. The goal is to pump air in or out of a house and measure how much air is leaking through the cracks and the holes in the building's envelope.

☐ BuiltSmart ☐ HERS ☑ Energy Star ☐ IECC
☐ Pre-Drywall ☑ Final ☐ Re-Inspection

Code Edition or State Equivalent

☐ 2009 IECC ☐ 2012 IECC ☐ 2015 IECC ☑ 2018 IECC
☐ 2019 RCO ☐ 6th Edition ☐ 7th Edition ☐ 2020 Indiana IRC

Multi-Point Blower Door Infiltration Test:

Correct CFM50	932.9	x 60 ÷	18639	=	3.00
			Cubic Volume		ACH50

Inspection Results:

Inspection Results	☑ PASS	☐ FAIL	☐ N/A
Blower Door Infiltration Results	☑ PASS	☐ FAIL	☐ N/A

*Airtightness Testing of Building & HVAC Air Distribution System is completed following ANSI/Resnet/ICC 380 as required under the IRC & IECC.

Case Study

Location: Bowie, MD

Date: June 2023

Climate Zone: 4

Maximum allowable leakage rate (IECC 2018): 3.0 ACH50

The Envelope Leakage (blower door) test results in the above graphic were achieved at a townhome community in Maryland, where Greenfiber FRM material and the U370 Party Wall System were used on the interior “shared” walls of the units. The result of the test on this unit was 3.0 ACH50 therefore achieving the Climate Zone requirement of 3.0 ACH50. These results were achieved on the first attempt and no remedial adjustments were needed.

Summary

Installation of the air barrier and then testing of that air barrier are the most challenging parts of the residential energy code and have been since 2012. The 2021 IECC updates are some of the biggest changes to the code in decades and require superior materials than what has been used in the past. Using better sealing insulation will make for a much easier transition to the new requirements and give you peace of mind knowing you will pass this critical step to getting a certificate of occupancy.

Code Edition or State Equivalent

☐ 2009 IECC ☐ 2012 IECC ☐ 2015 IECC ☑ 2018 IECC
☐ 2019 RCO ☐ 6th Edition ☐ 7th Edition ☐ 2020 Indiana IRC

Multi-Point Blower Door Infiltration Test:

Correct CFM50	1820.39	x 60 ÷	22439	=	4.87
			Cubic Volume		ACH50

Inspection Results:

Inspection Results	☐ PASS	☑ FAIL	☐ N/A
Duct Leakage Results	☑ PASS	☐ FAIL	☐ N/A
Blower Door Infiltration Results	☐ PASS	☑ FAIL	☐ N/A

*Airtightness Testing of Building & HVAC Air Distribution System is completed following ANSI/Resnet/ICC 380 as required under the IRC & IECC.

Inspection Results:

1. Range hood not connected
2. Crawl space needs to be sealed including gasket
3. Return and supply existing the mechanical room on fourth floor need to be caulked
4. First floor mechanical room needs work

Case Study

Location: Bowie, MD

Date: June 2023

Climate Zone: 4

Maximum allowable leakage rate (IECC 2018): 3.0 ACH50

The Envelope Leakage (blower door) test results in the above graphic were achieved at a townhome community in Maryland, where Greenfiber FRM material and the U370 Party Wall System were used on the interior “shared” walls of the units. The result of the test on this unit was 4.87 ACH50 therefore exceeding the Climate Zone requirement of 3.0 ACH50. While this was technically a failure of the blower door test, it can be seen in the deficient items listing that the insulation was not involved in the failure. In Climate Zones 1-2 (5.0 ACH50), the unit would have still passed the blower door test despite the deficiencies thanks to the Greenfiber insulation. Upon remedy of the deficiencies, this unit passed the blower door test on the second attempt.

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IMPACTS OF INSULATION ON AIR SEALING HOMES

Overcoming Energy Code Compliance
with SANCTUARY® Cellulose Insulation

The All-in-One Insulation Solution - SANCTUARY® by Greenfiber

AIR SEALING | 1, 2, 3 HOUR FIRE RATING | SOUND ABATEMENT | THERMAL PERFORMANCE

SANCTUARY® cellulose insulation by Greenfiber® is easy to integrate into existing building assemblies, envelopes and plans. It’s engineered to fill the tiny joints, crevices and gaps in attics, walls, floors and ceilings, creating a dense barrier capable of reducing air infiltration, mitigating sound, and achieving better thermal performance. Thanks to its multiple benefits, SANCTUARY® improves quality of life and promotes wellness, helping you build homes that are quieter, safer and more comfortable — homes that are simply more appealing at every level.

In addition to SANCTUARY® offering the built-in wellness that homeowners deserve, it can also help builders and contractors meet more stringent energy efficiency codes by reducing unintended airflow. This lowers the air changes per hour, helping them meet ACH 3 to 5 the first time.

	SANCTUARY® Cellulose	FG Blow-In	FG Batts	Spray-Foam (open cell)
Comfort* (air filtration)	++ Resistivity (.038 CFM / ft²) Air Barrier	⊖	⊗ + Resistivity (.062 CFM / ft²)	✓ Air Barrier
Sound** (sound reduction)	✓ 51 STC	⊖ 46 STC	⊖ 46 STC	⊗ 37 STC
Fire (fire resistance)	✓ Class 1 / fire-blocking	⊖ Class 1	⊖ Class 1	⊗ Ratings vary by type
Carbon*** Footprint	✓ 85% Recycled / Carbon - -43 kgCO₂e captured	⊖ 55% Recycled / Carbon + +16 kgCO₂e emitted	⊖ 55% Recycled / Carbon + +11 kgCO₂e emitted	⊗ Petroleum / Carbon +++ +215 kgCO₂e emitted
Ease of Install	⊖ Machine / Bags	⊖ Machine / Bags	✓ No Machine / Rolls	⊖ Handling / Shipping / Toxic

* Based in BCI Thermal Metric Summary Report (2015). Air transfer rates are based on cu ft per minute, per sq ft testing. Cellulose insulation when installed in an enclosed cavity at a density of 3.5 pounds per cubic foot or greater qualifies as an air barrier according to Building Performance Institute’s (BPI) standard, BPI-104 Envelope Professional Standard for Dense-pack Wall Insulation Application.
** Based on standard wall assembly: Single wood studs, 16” OC, resilient channel; single layer ½ ” gypsum drywall each side. Fiberglass insulation = 3.5” thick QuietZone Acoustic Batts / Cellulose insulation = 3.5” Spray-Applied Greenfiber Insulation
*** Based on BEAM Methodology: https://www.buildersforclimateaction.org/beam-estimator.html. Various industry and product specific EPDs utilized. Includes SANCTUARY by Greenfiber EPD, Sustainable Minds, October 2022

✓ Excellent ⊖ Good ⊗ Poor

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Air Transfer Rate Comparison

Source: Thermal Metric Summary Report - Building Science Corporation[1]

R-values do not necessarily give an accurate assessment of the thermal performance of insulation in a complex wall or roof assembly because they do not capture thermal bridging, workmanship, internal convection, and through convection values (i.e., infiltration, exfiltration, windwashing, and reentrant looping).[2]

The "Thermal Metric Summary Report" tested multiple wall assemblies in order to establish a new thermal performance metric that reflected these factors more accurately.

The project compared cellulose insulation when installed as a spray-applied application (wall spray) to kraft-faced stapled fiberglass batts and inset stapled fiberglass batts for resistance to airflow.

Spray-applied cellulose outperformed both inset and face-stapled kraft-faced fiberglass batts for airflow resistance.

The chart below shows that at 0 °F (-18 °C), the inset stapled fiberglass batt tested an air transfer rate of 5.9 CFM for the wall or 0.063/sq. ft., the face stapled fiberglass batt was 5.6 CFM or 0.059/sq. ft., and the sprayed-applied cellulose was 3.6 CFM or 0.0382/sq. ft.

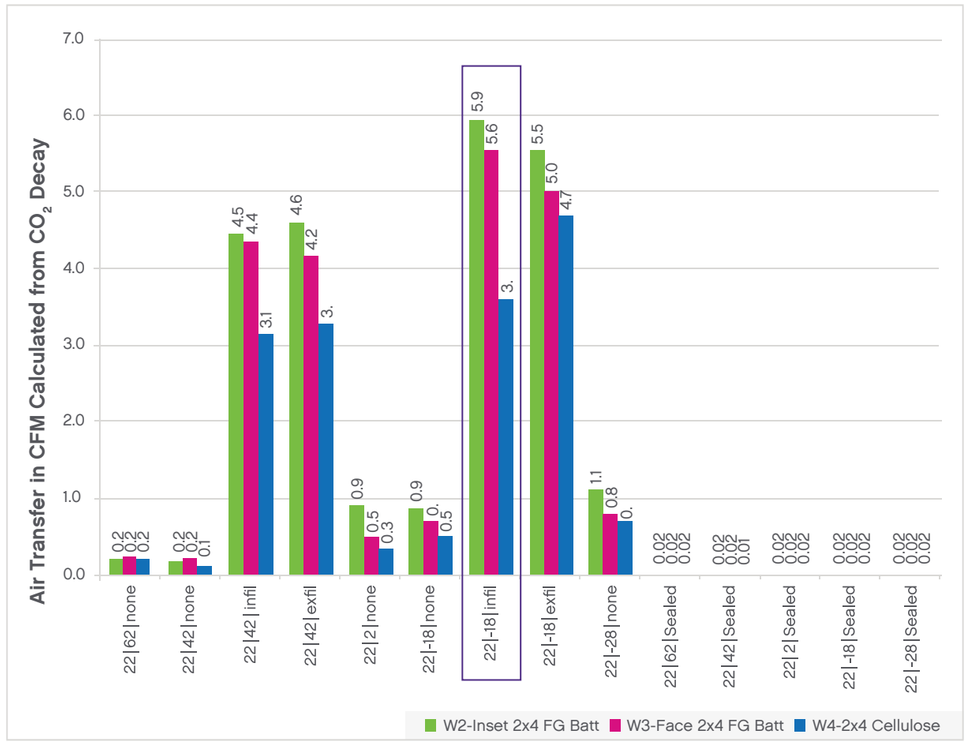


Figure 31 - Wall 2, Wall 3, and Wall 4 Air Transfer Rates in CFM

Figure 31 shows air transfer in cubic feet per minute (CFM) for the test wall. The test wall was 7.9 ft. x 11.9 ft. or 94 sq. ft. The middle numbers (62, 42, 2, -18, -28) are the temperatures that the sample wall was subjected to in Centigrade. Converted to Fahrenheit these temperatures are (143, 108, 36, 0, -18). The fiberglass batts were installed to conform with HERS Grade 1.

Dense-Pack and Spray-Applied Cellulose as an Air Barrier

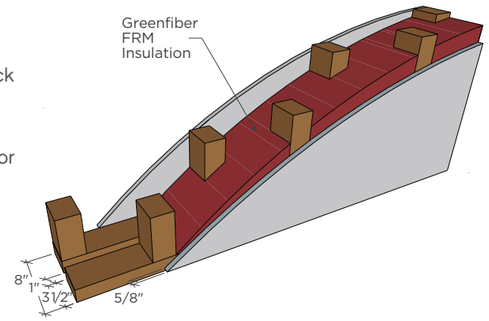
According to Building Performance Institute's (BPI) standard, BPI-104 Envelope Professional Standard for Dense-pack Wall Insulation Application,[3] dense-packed cellulose at 3.5 pcf does qualify as an air barrier. The same study requires blown fiberglass, mineral wool or spray foam to be installed in an enclosed cavity with a BPI-102 approved ASTM test that validates an air permeance value of < 3.5 cfm/sq. ft. at 50 Pascals.

The US Department of Energy also noted in their report "11.4.2 High Impact Project: Support of Standards Development: Dense-Pack Airflow Resistance."[4]

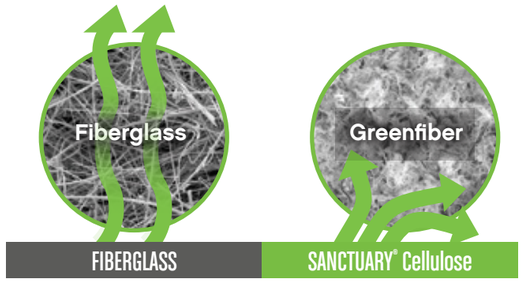
SANCTUARY® TWO-HOUR FIREWALL by GREENFIBER®

Overcoming the Challenge of Newly Adopted IECC ACH Requirements for Common Walls Between Townhouses

In addition, spray-applied cellulose installed in an 8" thick wall cavity at 3.5 to 4 pcf qualifies as an air barrier. This is why the SANCTUARY® Two-Hour Firewall by Greenfiber serves as a best-in-barrier for sound and odor transfer between townhome units, while blocking fire.



Where Air Flows, Heat, Sound & Pollutants Follow



[1] "Thermal Metric Summary Report." Building Science Corporation, 2015 update: **https://buildingscience.com/sites/default/files/project/20150618_thermal_metric_summary_report_-_june_2015_update.pdf**

[2] Savings vary. Find out why in the seller's fact sheet on r-values. Higher r-values mean greater insulating power.

[3] BPI-104 Envelope Professional Standard for Dense-Pack Wall Insulation Applications" and by testing for the US Department of Energy as noted in their report "11.4.2 High Impact Project: Support of Standards Development: Dense-Pack Airflow Resistance. Report available upon request.

[4] Schumacher, Christopher. "High Impact Project: Support of Standards Development: Dense-Pack Airflow Resistance, Final Research Report" US Dept. of Energy, 30 Nov. 2011, **https://buildingscience.com/sites/default/files/migrate/pdf/BA-1109_High%20Impact%20Dense%20Pack%20Air%20Permeance%20Standards.pdf** Accessed June 2023.