

September 25, 2018 – Sarah Kilnetob Lowe

Blower Doors for Builders

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RESEARCH CENTER



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- 1.0 PDH

- 1.0 AIA LU | HSW (PHRCWEB916)

- 1.0 ICC Contact Hour (0.1 CEU) (8970)

- 1.0 NARI hour/CEU



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AIA Info

Credit(s) earned on completion of this course will be reported to **AIA CES** for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

This course is registered with **AIA**



Description

- Beyond visual inspection, Section R402.4.1.2 of the 2015 IECC now requires testing and verification of the building's air leakage rate to meet the mandatory 5 air changes per hour at 50 Pascals (5 ACH50) or less in Pennsylvania. To meet this requirement builders must have a third party approved by their local code jurisdiction complete a blower door test and submit the air leakage results to the code official. This webinar will provide an overview of the general logistics of completing a blower door test for typical residential construction projects to assist builders in scheduling and planning for this mandatory requirement.



Learning Objectives

- Understand the general process and setup of a blower door test to ensure proper building ventilation and indoor air quality
- Describe how to prepare a construction site before and while a blower door test is being performed for overall site safety
- Analyze appropriate times in the construction schedule for scheduling and completing a blower door test
- Identify resources and next steps if a home does not meet the required 5 ACH50 to ensure building energy efficiency



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Poll Time!

Rate your experience with blower door tests.

Blower WHAT?	Little to no knowledge or experience with blower door tests.
Yeah, I've heard of that.	Know what blower door tests are BUT have <u>not run</u> one on your homes.
We're getting there.	Know what blower door tests are AND have <u>run one or more</u> blower door test on your homes.
We got this.	Know what blower door tests are AND <u>run them semi-regularly</u> on your homes.
Turn the screen over to me, I could teach this webinar.	Know what blower door tests are AND <u>run them on all your homes</u> .

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Webinar Overview



- **Getting You Prepared**
 - What The Code Says
 - Basics of Air Tightness
 - Basics of Blower Door Tests
- **Getting Your Site Prepared**
 - Scheduling
 - Site Preparation
- **Getting Your Company Prepared**
 - Test current homes



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2015 IECC Section R402.4.1.2

2015 IECC Section N1102.4.1.2

- **Topic:** Air leakage testing
- **Code Section Summary:** 2015 IECC mandates air leakage testing and the rate to not exceed 3ACH50 in climate zones 3-8
- **PA Amendment:** Changes the requirement to not exceed 5ACH50 in climate zones 1-8



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Source: International Code Council. (2014). 2015 International Energy Conservation Code. ICC Country Club Hills, IL.



Section R402.4.1.2 Testing

	Old Code Provision (2009 IECC)	New PA Code Provision
AIR LEAKAGE REQUIREMENT	<7 Air Changes Per Hour @ 50 Pascals (ACH50)	<5 ACH50
VERIFICATION REQUIREMENT	Blower door test OR through visual building envelope inspection.	Blower door test ("Test in accordance with ASTM E 779 or ASTM E 1827") that is: 1) performed at any time after creation of all penetrations of the building thermal envelope 2) conducted by an approved third party
REPORTING METHOD	Code official visual inspection	Written report that is signed by the party conducting the test and given to the code official

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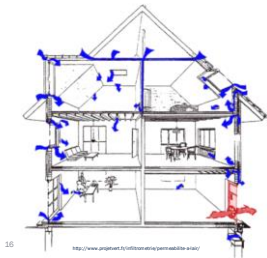
Section R402.4.1.2 Testing

	Old Code Provision (2009 IECC)	New PA Code Provision
TEST CONDITIONS	(Same if doing a blower door test)	1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weathertstripping or other infiltration control measures. 2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures. 3. Interior doors, if installed at the time of the test, shall be open. 4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed. 5. Heating and cooling systems, if installed at the time of the test, shall be turned off. 6. Supply and return registers, if installed at the time of the test, shall be fully open.

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Air Sealing for 5 ACH50 Strategies?



• Tuesday, November 13 @ 1pm: PHRC Webinar!

Air Sealing for 5 ACH50

Description

Pennsylvania's prescriptive air leakage requirements have recently been changed from 7 ACH₅₀ to 5 ACH₅₀. With this change, builders may have to modify their air sealing package to comply with the prescriptive air infiltration requirements. In this webinar we will look at areas of concern for air leakage and review several techniques to potential seal those areas.

Learning Objectives

1. Review the 2015 IRC and IECC requirements on air leakage.
2. Understand the physical transition of a home with a higher leakage rate to a home with a lower leakage rate and how that change can affect the sustainability of building components
3. Learn why air sealing is important to the occupant comfort and health by not allowing air infiltration from potentially contaminated areas
4. Review air sealing techniques that can help achieve this lower prescriptive standard.



Webinar Overview



• Getting You Prepared

- ✓ What The Code Says
- ✓ Basics of Air Tightness
- Basics of Blower Door Tests

• Getting Your Site Prepared

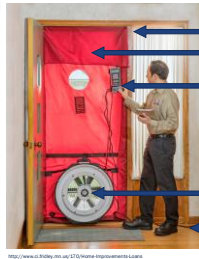
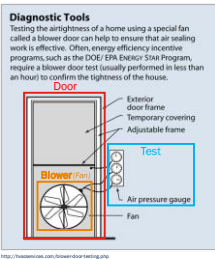
- Scheduling
- Site Preparation

• Getting Your Company Prepared

- Test current homes



Blower Door Setup



- Set up on an exterior door
- Adjustable frame & cover for any size single exterior door
- Air pressure gauge
- Fan with adjustable rings for nearly all SF buildings
- Fan power cord (standard outlet)



Blower Door: Fan Sizes (Single Family)



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<http://www.energy.com/supply-cases/products/products/150blowdoor/>

<http://www.ashraeblowerdoor.com/30cfm-blower-door-system-with-kg-3000/>

Blower Door: Fan Sizes (Multifamily)



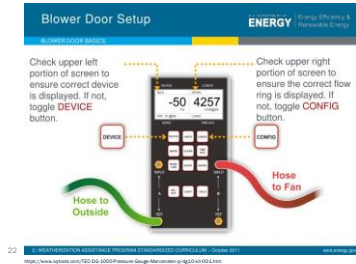
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Blower Door: Fan Sizes (Multifamily)

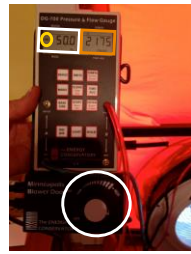
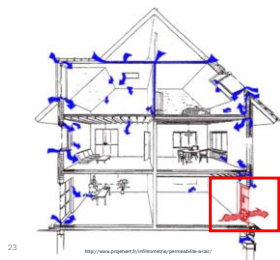


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Blower Door: Test Setup



Blower Door Test: Measurements



Blower Door Test: Measurements



$$ACH_{50} = \frac{CFM_{50} \times 60}{V}$$

Example #1:
2,500 ft² house with 8' ceilings

$$ACH_{50} = \frac{CFM_{50} \times 60}{V}$$

$$ACH_{50} = \frac{2175 \frac{ft^3}{min} \times 60 \frac{min}{hour}}{(2500 ft^2 \times 8 ft)}$$

$$ACH_{50} = 6.5$$

$$Approx. Hole Size \approx \frac{CFM_{50}}{1,000} \approx \frac{2175}{1,000} \approx 2.175 ft^2$$

Example #2:
3,500 ft² house with 9' ceilings

$$ACH_{50} = \frac{CFM_{50} \times 60}{V}$$

$$ACH_{50} = \frac{2175 \frac{ft^3}{min} \times 60 \frac{min}{hour}}{(3500 ft^2 \times 9 ft)}$$

$$ACH_{50} = 4.1$$



Webinar Overview



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- **Getting You Prepared**

- ✓ *What The Code Says*
- ✓ *Basics of Air Tightness*
- ✓ *Basics of Blower Door Tests*

- **Getting Your Site Prepared**

- Scheduling
- Site Preparation

- **Getting Your Company Prepared**

- Test current homes



Code Requirements

New PA Code Provision	
AIR LEAKAGE REQUIREMENT	<5 ACH50
VERIFICATION REQUIREMENT	Blower door test ("Test in accordance with ASTM E 779 or ASTM E 1827") that is: 1) performed at any time after creation of all penetrations of the building thermal envelope 2) conducted by an approved third party
TEST CONDITIONS	1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures. 2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures. 3. Interior doors, if installed at the time of the test, shall be open. 4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed. 5. Heating and cooling systems, if installed at the time of the test, shall be turned off. 6. Supply and return registers, if installed at the time of the test, shall be fully open.

Approved Third Party

- Will depend on your code enforcement office
- No specific "blower door certification"
- Certifications that include blower door operation include:
 - Building Performance Institute (BPI)
 - RESNET HERS Rater
 - Passive House Verifiers



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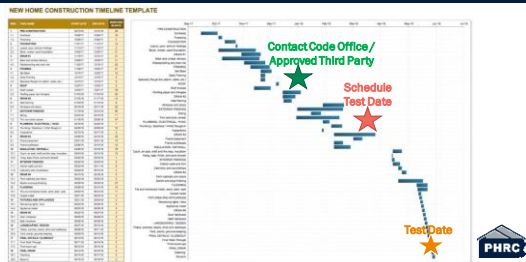
Scheduling!

- 1) Call your code office for Approved Third Parties
 - Get on their list
 - Get their prices
- 2) Call an Approved Third Party
 - Get on their list
 - Get their prices
- 3) Schedule the Test Date
 - After all exterior penetrations are completed
 - At a time with no other interior sub work



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Scheduling!



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Talk Overview



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1) Do A Blower Door Test After Rough-In / As Early as You Can



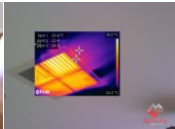
1a) Use a smoke pen during the test



1b) Infrared During a Blower Door Test

BOTTOM PLATES

<https://www.phrc.org/sites/default/files/2016-05-15-1000x700.jpg>

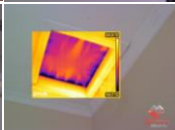
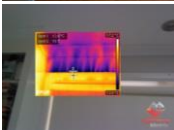


REGISTERS

<https://www.phrc.org/sites/default/files/2016-05-15-1000x700.jpg>

WINDOWS

<https://www.phrc.org/sites/default/files/2016-05-15-1000x700.jpg>



ATTIC HATCH

<https://www.phrc.org/sites/default/files/2016-05-15-1000x700.jpg>

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Blower Door Test Video



<https://www.youtube.com/watch?v=icZG05XU9pM>



2) Test Multiple Home Sizes



$$ACH_{50} = \frac{CFM_{50} \times 60}{V}$$

Example #1:
2,500 ft² house with 8' ceilings

$$ACH_{50} = \frac{CFM_{50} \times 60}{V}$$

$$ACH_{50} = \frac{2175 \frac{ft^3}{min} \times 60 \frac{min}{hour}}{(2500 ft^2 \times 8 ft)}$$

$$ACH_{50} = 6.5$$

Example #2:
3,500 ft² house with 9' ceilings

$$ACH_{50} = \frac{CFM_{50} \times 60}{V}$$

$$ACH_{50} = \frac{2175 \frac{ft^3}{min} \times 60 \frac{min}{hour}}{(3500 ft^2 \times 9 ft)}$$

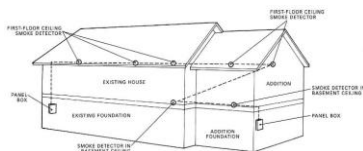
$$ACH_{50} = 4.1$$

$$Approx. Hole Size \approx \frac{CFM_{50}}{1,000} \approx \frac{2175}{1,000} \approx 2.175 ft^2$$



Unknowns

- Who will be considered an “approved” third party
- Testing additions for air leakage



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Questions?

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