# Blower Door Basics

# Weatherization Energy Auditor Single Family

Learning Objectives

By attending this session, participants will be able to:

* Explain natural driving forces that cause pressure differences.
* Describe units of pressure and measurement of air leakage.
* Set up and operate a blower door.
* Measure air leakage and conduct zonal pressure diagnostics.
* Discuss the meaning and importance of minimum ventilation requirements (MVR).
* Calculate total size of opening in square inches and cubic feet per minute (CFM) of air leakage under natural conditions.
* Describe the relationship between CFM50,CFMnatural, and air change per hour (ACH).

Key Terminology

Air changes per hour (ACH)

Building tightness limit (BTL)

Can’t reach fifty (CRF)

Cubic feet per minute (CFM)

CFM50

CFMnatural

Low-flow rings

Manometer

Minimum ventilation requirement (MVR)

N-factor

Pascals (Pa)

Stack effect

Wind effect

Winter mode

With reference to (WRT)

Worst-case draft combustion appliance zone (CAZ) testing

Supplemental Materials

Handouts & Resources

Air Sealing Target Table for State or Region.

Anderson, Abba. “The History of the Blower Door.” *Home Energy* Nov./Dec. 1995. <www.homeenergy.org>.

Area and Volume Calculation.

“Blower Door Basics: Part 1 - Prep and Setup.” *WxTV*. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Blower Door Basics: Part 2 - The Test Process.” *WxTV*. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Blower Door Basics: Part 3 - The Breakdown.” *WxTV*. Montana Weatherization Training Center. <www.wxtvonline.org>.

Bohac, David. “Zone Pressure Diagnostics.” *Home Energy* May/June 2002: 32-37. <www.homeenergy.org>.

Building Tightness Limits “Quick Sheet.”

Cox, Anthony. “Manometer Setup Sheet.”

Cutchin, Kelly and Anthony Gill. “ASHRAE 62.2 Checklist.”

“DM-2 Mark II Digital Gauge - QuickGuide.” *Retrotec*. 4 April 2011. <www.retrotec.com>.

Fitzgerald, Jim, Robert Nevitt, and Michael Blasnick. “User-Friendly Pressure Diagnostics.” *Home Energy* Sept./Oct. 1994. <www.homeenergy.org>.

U.S. Department of Energy. Weatherization Assistance Program Standardized Curriculum. “DG-700 Manometer Set-Up” Oct. 2011. PowerPoint presentation.

Van der Meer, Bill. “Blower Door Testing.” Builder Brief (BB0201). Pennsylvania Housing Research Center, Pennsylvania State University. 2001. <www.engr.psu.edu>.

Weatherization Assistance Program Standardized Curriculum. “Blower Door Basics.” Oct. 2011. PowerPoint presentation.

Online Platform Lessons

Use these online interactive training modules as prerequisites before students attend the course or as in-class computer lab sessions. Users must first create an account at [www.nterlearning.org](http://www.nterlearning.org) to access.

a- 7.1 Target Air Leakage Reductions <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 7.2 Room Pressure Tests, Thermal Boundary and Add-a-Hole Case Study
<https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 8.1 Building Tightness Limits <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 9.1 Measuring Duct Leakage with a Blower Door
<https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 9.2 Pressure Pan Testing <https://www.nterlearning.org/web/guest/course-details?cid=248>

i- 3.3 Driving Forces, Airflow & Stack Effect
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.0 Blower Door Basics <https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.1.1 Setting Up a Blower Door, Part 1
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.1.2 Setting Up a Blower Door, Part 2
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.1.3 Setting Up a Blower Door, Part 3
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.2 Preparing for a Blower Door Test
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.3 Blower Door Test Procedures <https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.4 Interpreting CFM50 Readings <https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.5 Blower Door Guided Air Sealing <https://www.nterlearning.org/web/guest/course-details?cid=249>

**Classroom Props & Activities**

**House of Pressure or Tell-Tale House**
Use the house with the blower door running to illustrate how pressure varies from room to room within the house, based on leaks and forced air systems.

**ASHRAE 62.2 Determination**

Give students a test case in class and have them determine whether mechanical ventilation is required. Use the ASHRAE 62.2 Checklist as a handout.

**ACH Demonstration**

Materials – Two 2-liter bottles full of tap water, two different sizes of cups, disposal container or sink in which to dump water.

Explain ACH and how it takes house size into account. Use the 2-liter bottles of water to represent how much air leaks through a house in one day. The different sized cups represent different sized houses. Pour water into the smaller cup, and then dump it out. Continue until one bottle is empty. Have students keep track of how many “air changes” the “small house” experiences, and then compare with the “large house” in the same way.

 **Hands-on Props**

**Blower door** – Break students into teams of two to set up a blower door and conduct zonal pressure diagnostics. Use any available space, including wall cavities, as applicable.

Class Overview

* Find out what level of experience students have with blower doors and teach to their level. Use the presentation as a framework for building an understanding in students of what is being measured with the blower door diagnostics and how that drives weatherization measures.
* Introduce air-sealing targets and minimum ventilation requirements. Begin by working through simple area calculations to refresh students’ basic math skills. Use examples and worksheets to teach how ACH relates to building size and MVR.
* Demonstrate blower door setup.
* Break up into groups of two and have students set up blower door and conduct zonal pressure diagnostics. Repeat key concepts like ACH, MVR, and air-sealing targets during this exercise, building on the concepts introduced during the presentation.