# Building Science Basics

# Weatherization Energy Auditor Single Family

Learning Objectives

By attending this session, participants will be able to:

* Explain the difference between thermal and air boundaries.
* Locate thermal and air boundaries.
* Name the driving forces of air leakage.
* Describe the connection between air leakage, energy waste, and moisture problems.
* Describe how air ducts affect pressure balances within the home.
* Explain the principle behind the blower door as a tool for measuring air leakage.

Key Terminology

Air barrier

Backdraft

Carbon monoxide (CO)

Combustion air

Cubic feet per minute (CFM)

Delta T

Direct leakage

Direct-vented appliances

Exfiltration

Heat recovery ventilation (HRV)

Indirect leakage

Indoor air quality (IAQ)

Infiltration

Manual J

R-value

Stack effect

Thermal boundary

Thermal envelope

Ventilation

Supplemental Materials

Handouts & Resources

Prowler, Don. “Mold and Moisture Dynamics.” Rev. Heinz Trechsel. *WBDG.org*. National Institute of Building Sciences. <www.wbdg.org>.

Stack Effect Prop Guide

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 the lesson.

i- 3.1 Basics & Modes of Heat Transfer <https://www.nterlearning.org/web/guest/course-details?cid=249>

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

i- 3.4 Building Envelope, Thermal Envelope, Pressure Boundary & Conditioned Space <https://www.nterlearning.org/web/guest/course-details?cid=249>

Relevant Standard Work Specifications

5.000 – Heating and Cooling
6.000 – Ventilation

Classroom Props & Activities

Various types of insulation with R-value indicated:

* Loose-fill fiberglass
* Cellulose
* Rigid foam
* Fiberglass batt (faced and unfaced)

Blower door and manometer − Point out sections of the blower door during the classroom presentation.

**Pressure difference + hole = Air leakage lesson**Materials – Balloons, pin, transparent tape.

Before class, blow up a balloon and crisscross two pieces of transparent tape on one section. Illustrate the need for both a hole and pressure difference for air leakage to occur. During class, raise a deflated balloon and the pin, and ask students what may happen if a hole is made in the balloon: nothing will occur because there is no pressure difference. Hold the inflated balloon and ask the same thing; students will probably think it will pop. Make a hole where the tape crisscrosses and let the balloon slowly deflate.

**Moisture dynamics demo**

Materials – Cold can of soda or glass of water.

Let water condense on the glass, and use it to illustrate moisture dynamics and the way air leakage can

cause moisture issues when warm, relatively moist air leaks into colder areas of the building.

Hands-on Props

**PVC stack effect prop** – Illustrate stack effect with students. Have students cover and uncover various holes to change the location of the neutral pressure plane and measure change in draft with manometer.

Class Overview

* Deliver the presentation to students, and ask them leading questions. Have them fill in the blanks on slides before progressing.
* Use in-room, hands-on props to maintain interest.
* Illustrate moisture dynamics with a cold can or glass of soda.
* Illustrate the relationship between pressure and air leakage with full and deflated balloons.
* Break from classroom teaching and allow students to use the stack effect props and manometers to illustrate the stack effect to make sense of the neutral pressure plane.