**Building Science Education Solution Center – Duct Leakage Testing**

Proficiency Level 1: Remember

**Learning Objective 1.1:**

* What is duct leakage testing, who performs the test, and why is it useful?

**Lecture Notes 1.1:**

Reference: Building America Solution Center - Total Duct Leakage Tests: <https://basc.pnnl.gov/resource-guides/total-duct-leakage-tests>

Central forced air heating and cooling systems use ducts to distribute the hot and cold air. If these ducts have loose connections, air can leak through the cracks. Leaks can occur where sections of duct connect to the air handler, the trunk, a duct boot, or to each other. Leaky ducts can be a major source of energy loss and comfort problems, and can contribute to moisture problems, especially when the ducts run through unconditioned spaces such as vented attics or crawlspaces.

Building codes such as the International Residential Code (IRC) (link: <https://codes.iccsafe.org/content/IRC2021P2>) and the International Energy Conservation Code (IECC) (link: <https://codes.iccsafe.org/content/IECC2021P2>), and energy-efficiency programs like ENERGY STAR Certified Homes require that if a home’s heating, ventilation, and air conditioning (HVAC) system includes a duct distribution system, the ducts must be tested for air leakage. While any properly trained HVAC technician can perform a duct leakage test, energy efficiency programs such as ENERGY STAR Certified Homes have a building’s duct leakage be measured and documented by a certified home energy rater using a testing protocol approved by an organization such as the Residential Energy Services Network, Inc. (RESNET). RESNET’s accepted testing protocols are American National Standards Institute (ANSI)/RESNET/ICC 380-2019: Standard for Testing Airtightness of Building, Dwelling Unit, and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems; and Airflow of Mechanical Ventilation Systems (link: <https://www.resnet.us/wp-content/uploads/ANSIRESNETICC_380-2019_vf1.24.19_cover%5E0TOC-2.pdf>) and ASTM E1554: Standard Testing Methods for Determining Air Leakage of Air Distribution Systems by Fan Pressurization (link: <https://www.astm.org/e1554_e1554m-13r18.html>).

While most duct leakage testing occurs during construction/installation of a new ductwork system or when modifying an already installed system, duct leakage tests can be performed at any time. Additionally, for duct systems that have combustion appliances in their systems, duct leakage testing is useful for detecting spillage of combustion exhaust products. See the “[HVAC – Combustion Safety](https://bsesc.energy.gov/training-modules/hvac-combustion-safety)” module for more information.

**Problem Set 1.1:**

1. When conducting duct leakage tests to comply with energy efficiency programs, who typically performs duct leakage measurement and documentation?
	1. A certified home energy rater.
	2. The resident/owner of the building.
	3. The contractor who installed the building’s ductwork.
	4. Anyone can measure and document duct leakage.

**Learning Objective 1.2:**

* Understand key terms used with duct leakage testing.

**Lecture Notes 1.2:**

Air Handler: A device used to regulate and circulate air as part of a heating, ventilating, and air-conditioning (HVAC) system.

Air Sealing: The process of sealing gaps and holes in the overall building envelope that cause drafts and air leaks.

Blower door: A device used to measure the airtightness of buildings that consists of three components: a calibrated fan that can be used to pressurize or depressurize the building, a device to measure fan flow and building pressure, and a mounting system used to mount the fan in a building opening, such as a door or a window.

CFM25: The airflow rate in cubic feet per minute through a duct system that has been pressurized to 25 pascals.

Duct Blaster: A device used to measure airflow and help detect leaks that consists of three components: a calibrated fan that is used to either pressurize or depressurize the duct, a device to measure fan flow and building pressure, and supplies such as cardboard and tape or adhesive plastic sheeting to seal off the supply and return registers during the test.

Duct Sealing: The process of sealing gaps and holes specifically in the ductwork that cause drafts and air leaks.

Duct Boot: A type of fitting used in HVAC systems to connect ductwork to a vent or register. A duct boot has a circular end that connects to the ductwork and rectangular end that connects to the vent that faces out into the living space.

Manometer: An instrument used to measure the pressure of gases and vapors.

Trunk: The main supply duct coming off the air handler. Smaller ducts branch off the trunk to supply various rooms in the house, usually running through the ceiling or the basement of the home.

**Problem Set 1.2:**

1. Match the following terms with the correct definition.

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| 1) \_\_\_\_ The airflow rate in cubic feet per minute through a duct system that has been pressurized to 25 pascals. | a) Air Sealing |
| 2) \_\_\_\_ The process of sealing gaps and holes in the overall building envelope that cause drafts and air leaks. | b) Manometer |
| 3) \_\_\_\_ A type of fitting used in HVAC systems to connect ductwork to a vent or register. One end is circular and connects to the ductwork and the other end is rectangular and connects to the vent that faces out into the living space. | c) Air Handler |
| 4) \_\_\_\_ A device used to measure the airtightness of buildings that consists of three components: a calibrated fan that can be used to pressurize or depressurize the building, a device to measure fan flow and building pressure, and a mounting system used to mount the fan in a building opening, such as a door or a window. | d) Trunk |
| 5) \_\_\_\_ A device used to regulate and circulate air as part of a heating, ventilating, and air-conditioning (HVAC) system. | e) Duct Blaster |
| 6) \_\_\_\_ The process of sealing gaps and holes specifically in the ductwork that cause drafts and air leaks. | f) Duct Boot |
| 7) \_\_\_\_ An instrument used to measure the pressure of gases and vapors. | g) CFM25 |
| 8) \_\_\_\_ The main supply duct coming off the air handler. Smaller ducts branch off from it to supply various rooms in the house, usually running through the ceiling or the basement of the home. | h) Duct Sealing |
| 9) \_\_\_\_ A device used to measure airflow and help detect leaks that consists of three components: a calibrated fan that is used to either pressurize or depressurize the duct, a device to measure fan flow and building pressure, and supplies such as cardboard and tape or adhesive plastic sheeting to seal off the supply and return registers during the test. | i) Blower Door |