What Your Trainer Should Have Taught You

Courtney Moriarta and Chris Dorsi

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In this session, we discuss a science-based approach to analysis, testing, and decision-making in the world of home performance. We learn how a well-grounded knowledge of building science principles can help you do better work, especially in complicated homes or when you're faced with a new procedure.

The Basis for Measurement

We identify these characteristics for commonly performed tests and inspections.

- **Metric** for the test. We learn what is actually measured in each test, and how we derive it using instruments and observations.
- **Purpose** of the test. We strip the test to its most basic intent, and review WHY we do each test.
- **Proxies** for the test. We identify symptoms in the building that may tell you something about the test results you're apt to get. We identify which proxies are reliable, and which are more difficult to interpret.
- **Trouble** spots for each test. We identify the situations in which you're most likely to get false results, or get distracted into related but different problems. We identify symptoms with synergistic effects, one combining with another, which can confuse your decision-making.

Single Point Blower Door Test

Metric: CFM50 (cubic feet per minute at 50 pascals of pressure), but actually calculated from airspeed at the blower door. Also ACH 50 (air changes per hour at 50 pascals of pressure).
Purpose: Determine air tightness of building shell.
Proxies: Discomfort. Drafts. Hot or cold rooms. High bills. Moisture and mold.
Trouble: The size, shape, and location of the shell openings causing the leakage can affect the reading. The blower door location can affect the reading. You are not measuring CFM directly. Using the manometer to extrapolate at 50 pascals (CFM @50 setting) can obscure incorrect testing procedures.

Zone Pressure Diagnostics

Metric: CFM50, as calculated from blower door test, plus pressure differentials measured across zone boundaries. Zone leakage sometimes also measured as a percentage of total air leakage in the home.
Purpose: Determine the relative leakiness of zones with the building. Identify the potential for migration of pollutants among zones. Determine the most cost effective areas to target for air-sealing.

Proxies: Zones that are uncomfortable, or hard to heat and cool. High levels of pollutants present that could have migrated from a garage or other zones.
Trouble: Some zone tests only measure the *relative* leakiness of zones, not the actual amount of air leakage. Some zone leakage tests are difficult to comprehend, and are often performed incorrectly.

Total Duct Leakage Test

Metric: CFM25, but actually calculated from airspeed at the duct blower.
Purpose: Determine the airtightness of the duct system. Used to determine the likely value of duct-sealing efforts, which can decrease consumption of heating and cooling energy, improve comfort of specific rooms, or decrease the likelihood of capturing and circulating pollutants from zones outside the conditioned space.
Proxies: Discomfort. Drafts. Hot or cold rooms. High bills.
Trouble: Static pressure can vary from one end of the duct system to the other. You are not measuring CFM directly. Sometimes difficult to effectively mask of ducts in order to get an accurate duct test. Cryptic cavity returns can impact the test.

System Airflow Test

Metric: Cubic feet per minute (CFM)
Purpose: Determine whether the forced-air system has sufficient airflow to operate at highest efficiency. Identify possible cause of comfort problems.
Proxies: Comfort problems. Evaporator icing
Trouble: Multiple methods of testing are used. You are not measuring CFM directly. Proper test set-up varies depending on type of equipment. Test principles are complicated and often misunderstood.

Whole House Ventilation Rate

Metric: ACH natural. CFM per person.
Purpose: Protect human health by providing sufficient fresh air.
Proxies: Excess condensation. Indoor air quality complaints. Odors.
Trouble: Source of indoor pollutants can vary widely depending upon weather, home site, connection to soil, occupant behaviors, types of building materials.

Carbon Monoxide Testing

Metric: Parts per million (PPM).
Purpose: Identify high CO levels that can present a danger to human health.
Proxies: Soot in chimney system. In cold climates, excessive window condensation caused by flue gas spillage. The odor of aldehydes in the living space caused by flue gas spillage.
Trouble: CO measuring devices must be calibrated and zeroed correctly. Readings could be skewed by environmental CO concentrations. Technician may confuse “as measured” with “air-free” measurements.

Complete Combustion Safety Testing

Metric: Pascals, for combustion appliance zone (CAZ) with reference to outdoors. Pascals or inches water column (IWC) with reference to combustion zone, for chimney draft. PPM, for carbon monoxide content of flue gas.

Purpose: Identify depressurization in the CAZ that could backdraft combustion appliances. Identify chimney systems that aren't drafting properly.

Identify danger to human health caused by combustion appliances that produce excessive carbon monoxide.

Proxies: Excessive condensation in home. High CO in ambient air. Odd odors near combustion equipment.

Trouble: CAZ depressurization can be created by multiple causes such as exposure to wind, remote exhaust fans, and other combustion equipment. Chimney failure can be caused by defects that are difficult to identify such as incorrect sizing, obstructed flues, and missing chimney caps. High CO can be produced by multiple and synergistic defects in the combustion system.