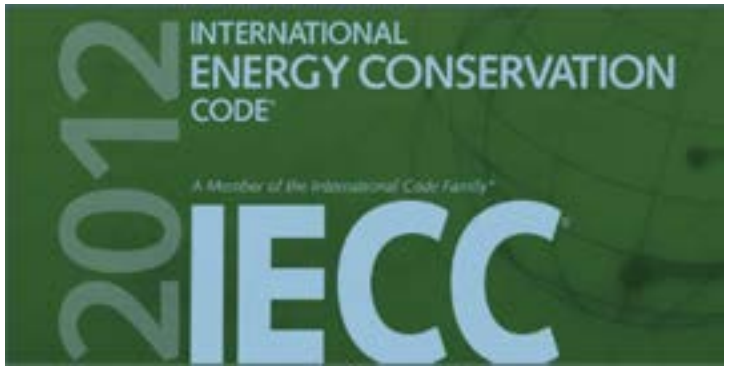
Testing Requirements of the 2012 IECC



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Agenda

- Duct testing
- Blower Door testing
- Blower door tests on multi family buildings
- Training?

Duct Testing

- **2012 IECC says:**
- Duct Sealing Mandatory
- Sealed air handler required
- Building framing cavities shall not be used as ducts or plenums
- Duct tightness shall be verified

Duct Sealing Mandatory

- Ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with either the *IMC* or *IRC*, as applicable.
- IRC says: Joints and seams shall comply with Section M1601.4.1
- Section M1601.4.1 says:
  - All joints, longitudinal and traverse seams and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic plus embedded fabric systems or tapes.
  - 118 B-FX for tape or 181 B-M for mastic
  - Unlisted tape shall not be used on any duct.

Sealed air handler

- Air handler cabinets must have rated leakage ≤ 2% AH flow when tested in accordance with ASHRAE 193

Building framing cavities

- Building framing cavities shall not be used as ducts or plenums
- More flex duct?
- Central returns?

2012 IECC Says:

- **Duct tightness shall be verified by either of the following:**
- 1. Post construction test: Total leakage ≤ 4 cfm @25 Pa. per 100 sq. ft. conditioned floor area
- All registers shall be sealed during the test.
- 2. Rough-in test: Same as post construction except if the air handler is not installed, total leakage ≤ 3 cfm per 100 sq. ft.
- **Exception**: Test is not required for ducts and air handlers located entirely within the building thermal envelope.

Duct Leakage Testing

- **2012 IECC – is anything missing?**
- Is pressurization or depressurization OK
- A protocol for preparing the building and the duct system for a duct leakage test
- The resolution of gauge and fan flow reading
- How do you measure square footage
- Specifics on determining when ducts are inside the envelope

Duct Tightness Test

- It is in everyone's best interest to follow a protocol that allows you to test in an accurate, repeatable way
- What if two people perform a test and get different results
- Builders / building inspectors will have more respect / confidence in you
- *If you do the right thing wrong, does that make it right? -* John Tooley

Duct Tightness Test

- **RESNET Chapter 8**
- RESNET Standard for Performance Testing and Work Scope: Enclosure and Air Distribution Leakage Testing
- RESNET is now an ANSI SDO (1/3/2012)
  - Residential Energy Services Network
  - American National Standards Organization
  - Standards Development Organization
- Path toward recognition in the IECC
  - International Energy Conservation Code

RESNET Chapter 8 Says:

- **803.3 Protocol for Preparing the Building and the Duct System for a Duct Leakage Test**
- **803.3.1** Adjust the HVAC system controls to off
- **803.3.2** Turn off any fans
- **803.3.2** Turn off all vented combustion appliances
- **803.3.3** Remove all filters
- **803.3.4** Any intentional openings left as is. Motorized dampers closed
- **803.3.5** If ducts run through unconditioned spaces, open space to outside
- **803.3.6** Seal supply registers and return grilles
- **803.3.7** Set zone dampers to open position

Total Duct Leakage Test

- **803.4 Installation of the Duct Leakage Testing System**
  - **803.4.1** Attach the duct leakage tester to the largest return grille or to air handler cabinet
  - **803.4.2** Select a location to measure duct pressure.
  - **803.4.3** Insert a pressure probe into the duct system at the chosen measurement location.
  - **803.4.4** Install the pressure gauge and tubing connections
  - Open a door or window to the outside

Total Duct Leakage Test

- **803.5 Procedure for Conducting a Total Duct Leakage Test**
  - **803.5.1** Select the appropriate flow ring
  - **803.5.2** Increase fan speed of duct leakage testing fan and until pressurized to 25 Pa (+/- 0.5 Pa). Measure and record the duct pressure reading (0.1 Pa resolution) and the fan flow reading (1 CFM resolution) using a 5 second averaging period.

Blower Door Testing

- **2012 IECC says:**
- **R402.4.1.2 Testing.** The building shall be tested and verified as having an air leakage rate not exceeding 3 ACH in Climate Zones 3 through 8.
  - ACH50 = (CFM50 x 60) / Volume
  - Example: 3 ACH50 = (1200 CFM50 x 60) / (1500 x 2 x 8)

Blower Door Testing

- **R402.4.1.2 Testing (2012 IECC)**
- Shall be conducted with a blower door at 50 Pa.

- Where required by the *code official*, testing shall be conducted by an *approved* third party.

- A written report of the results shall be signed by the party conducting the test and provided to the *code official*.

- Tested after creation of all penetrations of the *building thermal envelope*

Blower Door Testing

2012 IECC – setting up the building

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; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

Blower Door Testing

- **2012 IECC – is anything missing?**
- **Do you take a baseline reading?**
- **Do you adjust for temperature?**
- **How accurate does the equipment need to be?**
- **Is the garage overhead door open?**
- **When is it too windy to do a test? Accuracy?**
- **How do I measure volume?**
- **Does a tester need training?**
- **How is quality control dealt with?**

Blower Door Testing

- It is in everyone's best interest to follow a protocol that allows you to test in an accurate, repeatable way
- What if two people perform a test and get different results
- Builders / building inspectors will have more respect / confidence in you
- *If you do the right thing wrong, does that make it right? -* John Tooley

Blower Door Testing

- **RESNET Chapter 8:**
  - There are three acceptable airtightness test procedures:
    - Single-point test
    - Multi-point test
    - Repeated single-point test
  - Tests address both accuracy and repeatability

Blower Door Testing

- **RESNET Chapter 8:**
  - Determine Accuracy Levels for Single Point Test:
    - *Record five 10 second averages*
    - *Difference between highest and lowest*
    - *< 5 Pa = standard level of accuracy*
    - *> 5 Pa = reduced level of accuracy*
    - *>10 Pa = 1 point test can't be performed*
    - *Longer time averaging can be used*
  - *Multipoint or repeated single point test*
  - *Adjust reading for temperature*

Blower Door Testing

- **RESNET Chapter 8:**
- Reduced Level of Accuracy adjusted CFM50 value shall be used when:
  - determining whether or not a building meets an airtightness threshold, and
  - conducting a Home Energy Rating for the purpose of compliance with any standard, energy code or program.
  - Single point test add 10%
  - Multi point or repeated single point
    - Software calculates accuracy and precision

Blower Door Testing

- **RESNET Chapter 8:**
  - *Accuracy of gauge:*
    - *0.1 Pa*
    - *1 CFM*
  - Adjust for baseline pressure
  - Adjust results for temperature and elevation
    - *Temperature: when > 30° temperature difference*
      - *use charts or software*
    - *Elevation: when > 5000'*
      - *Use formula*

Blower Door Testing

RESNET Chapter 8– additional items

- **Attached garages:** All exterior garage doors and windows shall be closed
- **Crawlspaces:**
  - conditioned – interior access doors and hatches between the house and the crawlspace shall be opened and exterior crawlspace access doors, vents and hatches shall be closed.
  - unconditioned - interior access doors and hatches shall be closed and crawl-space vents shall be open.
- **Intentional openings**
  - Motorized dampers
  - Non-motorized dampers
  - Fixed dampers
  - Non-dampered openings

Blower Door Testing

RESNET Chapter 8– additional items

- **Whole building fan louvers/shutters:** Shall be closed. If there is a seasonal cover, install it.
- **Evaporative coolers:** The opening to the exterior shall be placed in its off condition. If there is a seasonal cover, install it.
- **Operable window trickle-vents and through-the-wall vents:** Shall be closed.
- **Plumbing drains with p-traps:** Shall be sealed or filled with water, if empty.

Blower Door Testing

- Method of calculating square footage and volume
  - IECC does not address
  - RESNET refers to an ANSI standard for floor area and has a definition for volume.

Blower Door Protocol – multifamily

- Set up unit / building
  - IECC does not give guidance specific to multifamily.
  - The biggest issue is whether to test individual units with a single blower door, which counts leakage between a unit and other conditioned spaces the same as if it were leakage to outside.

Blower Door Protocol – multifamily

- **Possible options :**
  - Test whole building as one zone
  - Test individual units with a single blower door counting interior leakage the same as leakage to outside.
  - Do guarded tests so all adjoining units are at the same pressure as the test unit, which measures only leakage to outside.
  - Use RESNET Sampling Protocol for larger buildings so testing of every unit is not required

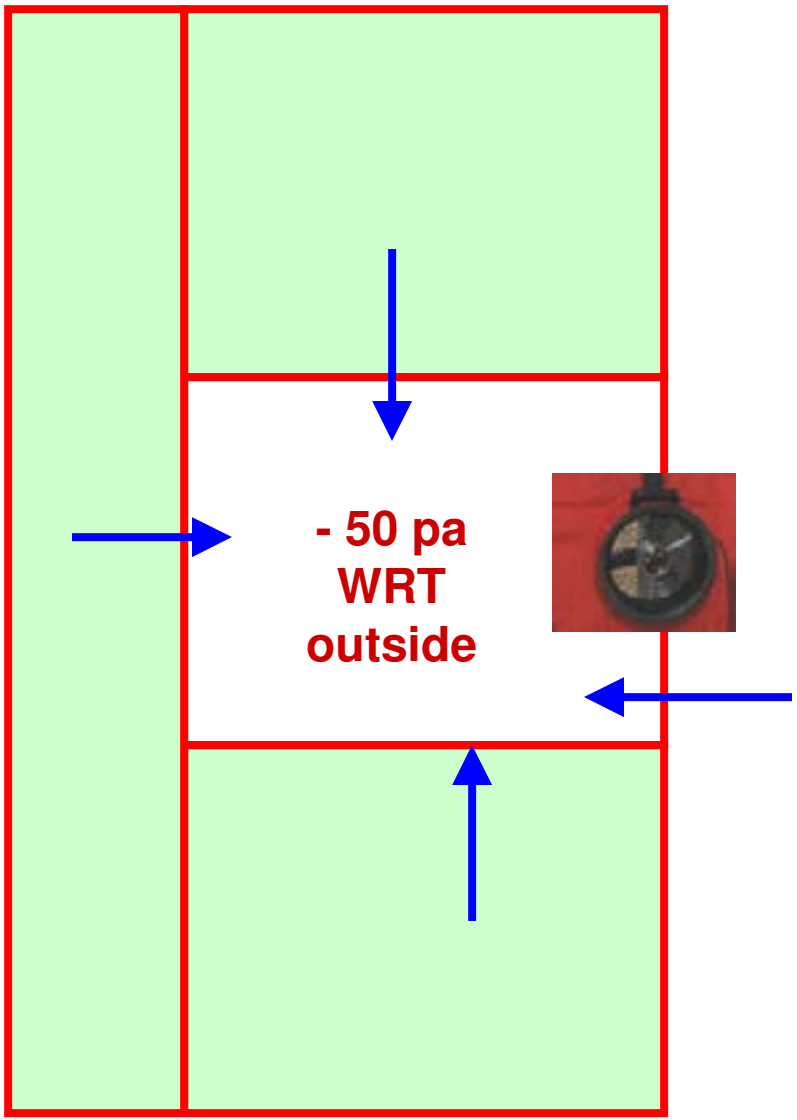
Equipment and software options

Single unit testing

- Equipment options
  - Blower Door
  - Duct Blaster fan in Blower Door frame
  - Duct Blaster fan in a window

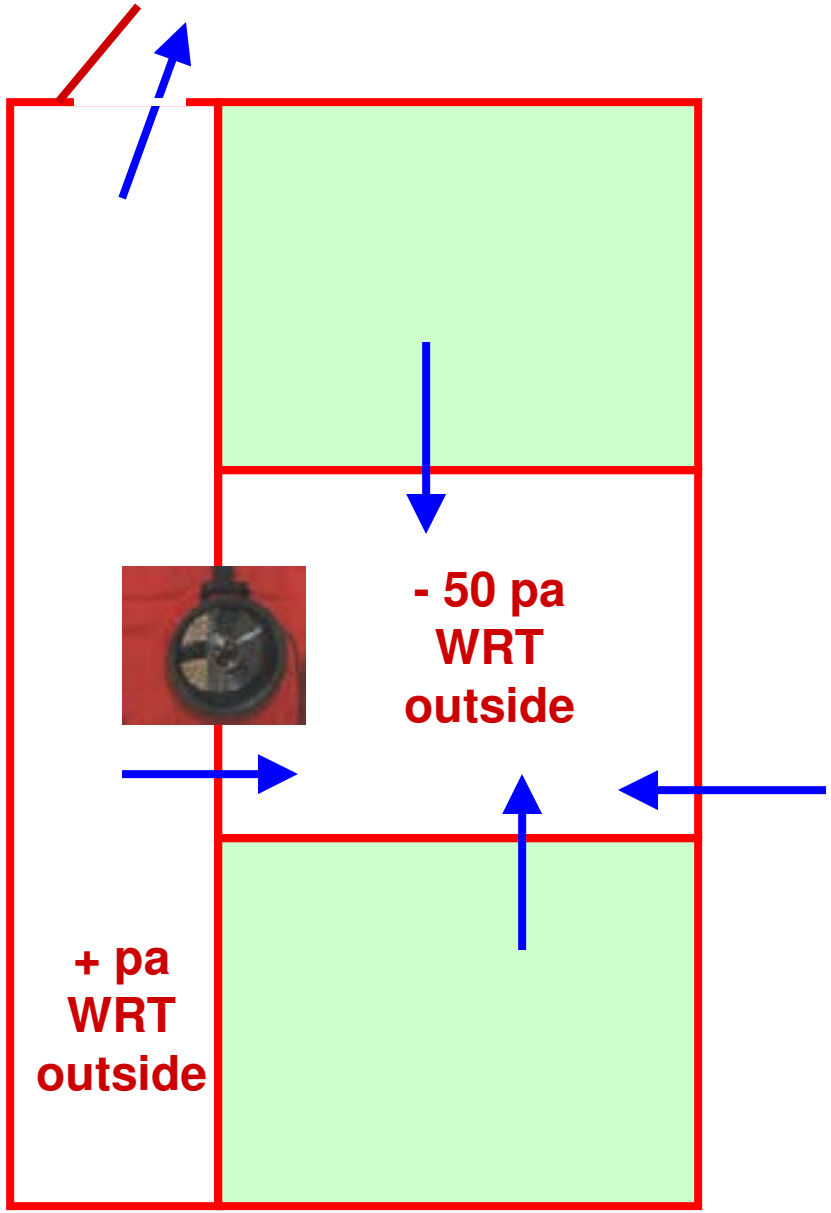
Setup Location

- Duct Blaster installed in a window
- Small surface area to outside
- Adjoining zones depressurized slightly



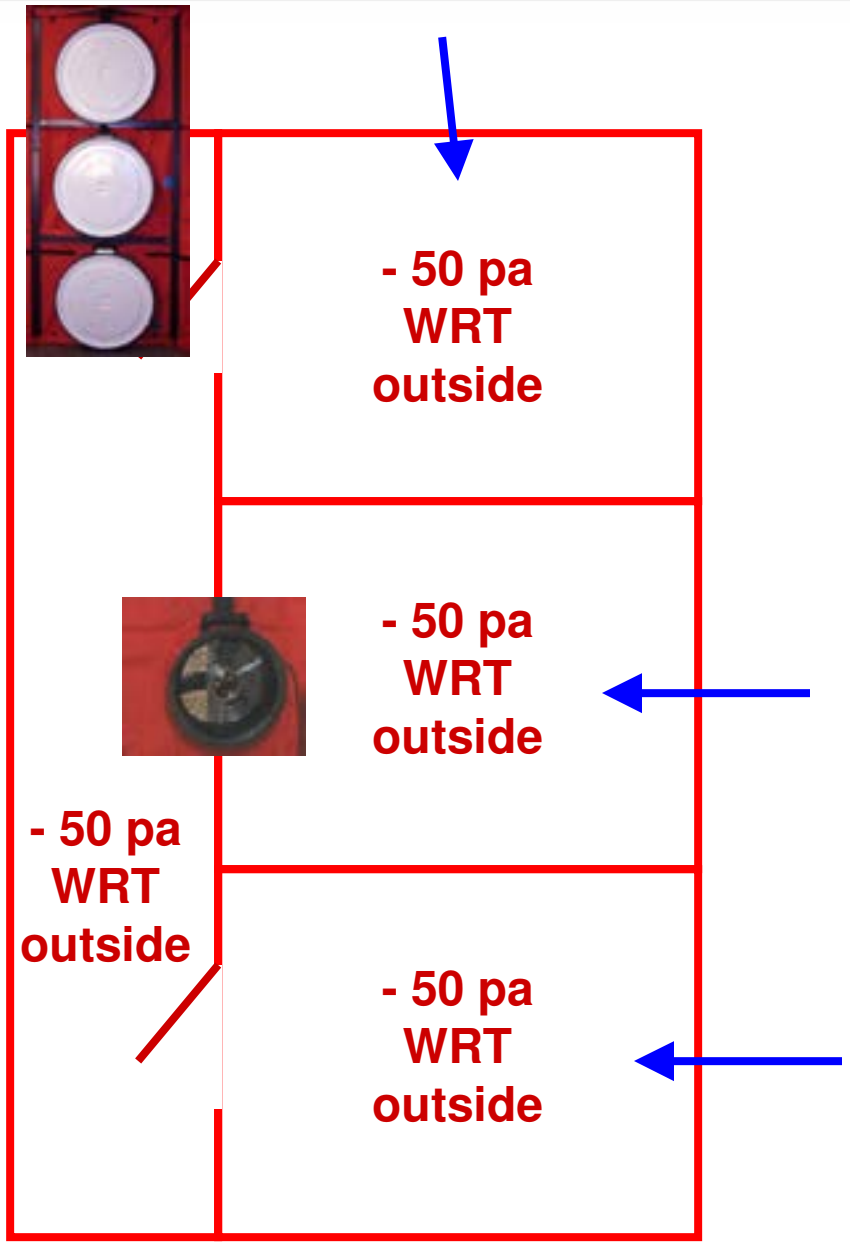
Setup Location

- Duct Blaster installed in a hallway door
- Larger surface area to outside
- Adjoining zones depressurized slightly



Setup Location

- Duct Blaster installed in a hallway door or window
- Whole building depressurized with blower doors
- Whole building at same pressure
- Only leakage to outside in unit



Compartmentalizing

- **Advantages**
- Reduce odor / pollutant transfer
- Reduce stack effect
- Reduce infiltration / exfiltration
- Ventilate each unit separately
  - Exhaust fans
  - Trickle vents
- Use much smaller hallway ventilation systems

Equipment and software options

Multi fan testing

- Two fan system
- Three fan system
- Multi fan protocol

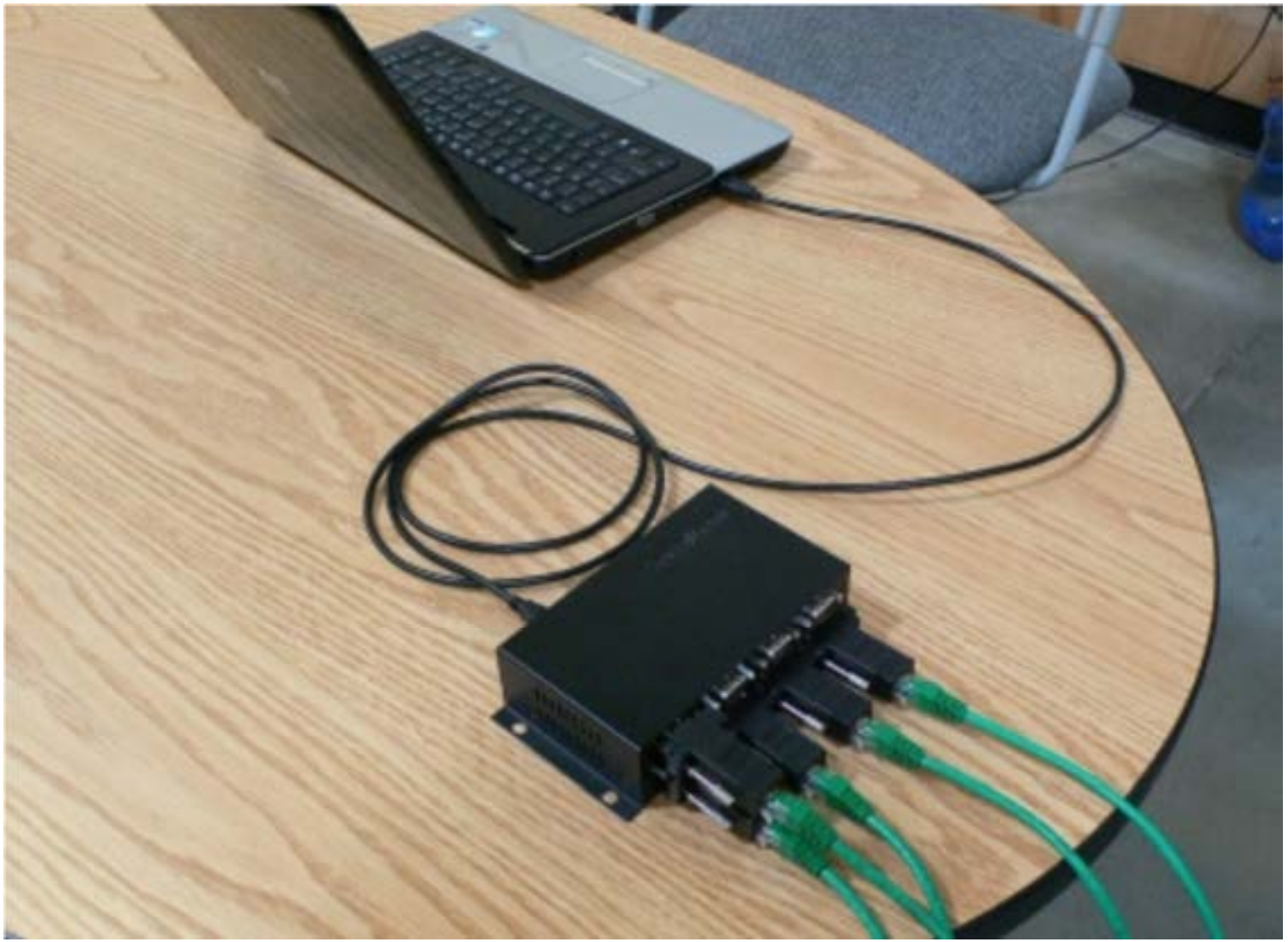
Equipment and software options

TECLOG2

- Will control up to 24 fans with one slide bar
- Will average multiple outdoor references
- Can monitor interior pressures during test
- Set channel to measure
  - Flow, BD or DB
  - Envelope pressure of pressure
- Can be used for long term pressure monitoring

Multi fan testing

Data Acquisition Hardware



At the Other End…

Fan Control Splitter

Master control slide bar controls all fans

Two Gauges and Three Fans

Gauge 1

A: Envelope Press.

B: Bottom Fan

Gauge 2

A: Middle Fan

B: Top Fan

No open taps on gauges

3 Controllers

Combine two CAAT5 cables into one

Fans plugged into separate circuits

TECLOG2 software

Training?

Duct and Envelope Tightness (DET) Verifier

Southface

Certified DET Verifier can either:

- Be previously certified
  - HERS Rater
  - BPI Analyst
  - Home Performance with ENERGY STAR contractor
- Pass a DET Verifier Course
  - Explain calculations for ACH50 and % duct leakage
  - Discuss testing protocol (setup, safety, and accuracy)
  - Field exam on tools (use blower door and duct tester)
  - Pass Written Exam – 25 Questions (1 hour)

CERTIFIED DUCT AND ENVELOPE TIGHTNESS (DET) VERIFIER. A certified DET verifier shall be a certified Home Energy Rating Systems (HERS) rater, or be a certified Home Performance with ENERGY STAR contractor, or be a Building Performance Institute (BPI) Analyst, or successfully complete a certified DET verifier course that is approved by the Georgia Department of Community Affairs.
(Effective January 1, 2011)

Training?

- Duct and Envelope Testing (DET) Training
- Who
  - Building officials
  - Builders / mechanical contractors / insulators
  - Testers
- What
  - Pretest online, basic math
  - Classroom
  - Hands on use of the equipment
  - Written and field testing exam

Testing Requirements of the 2012 IECC

Thank You!

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