Energy Program
WASHINGTON STATE UNIVERSITY

Duct Testing Standard (RS-33)

For New & Existing Construction - 2018 WSEC-R

New Construction

Based on the protocol for "Total Leakage Testing" or "Leakage Testing to Outdoors," duct leakage in new construction shall not exceed 0.04 CFM_{25} x floor area (in square feet, sf) served by the system for leakage to outdoors or for total leakage when tested post construction. When testing at rough-in, targets should not exceed 0.04 CFM_{25} x floor area (in sf) for total leakage or 0.03 CFM_{25} x floor area (in sf) if the air handler is not installed.

Exception:

1. The total leakage or leakage to outdoors test is not required for ducts and air handlers located within the building thermal envelope. Ducts located in vented or conditioned crawl spaces do not qualify for this exception.
2. **A maximum of 10 feet of return ducts and 5 feet of supply ducts are allowed to be located outside of the building thermal envelope.**

Existing Construction

When a space-conditioning system is altered by the installation or replacement of space-conditioning equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger), the duct system that is connected to the new or replacement space-conditioning equipment shall be tested. The test results shall be provided to the building official and the homeowner.

Exception 1: Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in RS-33.

Exception 2: Ducts with less than 40 linear feet in unconditioned spaces.

Exception 3: Existing duct systems constructed, insulated or sealed with asbestos.

Exception 4: Additions of less than 750 sf of conditioned floor area.

In addition, the following requirements must be met:

1. All testing must be done by a qualified technician. The minimum qualification requirement is documented attendance at a duct testing training course approved by the building official. The following training programs are recognized as equivalent to this requirement:
   - Northwest Energy Star Homes Program, Performance Testing training for new construction.
   - Performance Tested Comfort Systems (PTCS) training for existing homes and new construction.
2. **Where required by the code official, testing shall be conducted by an approved third party.**
3. Duct systems must be designed, sized, and installed using recognized industry standards and International Residential Code (IRC) requirements so calculated heating and/or cooling loads are delivered to each zone.

Useful Links: List of Duct Testers
Database of PTCS Technicians

Total Duct Leakage Test

Testing Procedure Application:
This test is appropriate in new construction when ducts are to be tested at the rough-in stage before the house envelope is intact and can also be done post construction. The test measures the total collected leaks in the system at an induced pressure of 25 Pascals (PA). Compared to the leakage to exterior test, the total leakage test is simpler, but does not discriminate between leakage to inside and outside the heated space; as such, this test is not recommended for homes with complete house envelopes and HVAC systems. In such cases, the leakage to outside test is recommended.

Standard:

1. For certification, the measured duct leakage must not exceed ***0.04 CFM_{25} x floor area*** (in sf) served by the system at rough-in **when the air handler is installed.**
2. The measured duct leakage at rough-in must not exceed ***0.03 CFM_{25} x floor area*** (in sf) served by the system **when the air handler is <u>not</u> installed.**
3. If testing post construction, the total leakage must not exceed ***0.04 CFM_{25} x floor area*** (in sf) served by the system.

   Note: If the 0.5 buried duct energy credit is taken for code compliance (Table 406 option 4.2, a duct leakage test is required, where duct leakage shall not exceed 0.03 CFM/sf x floor area (in sf).

HVAC System Duct Leakage Testing (R403.3)		*Circle one*
All ductwork and air handler in conditioned space? (See Option 4.2)		Y or N
All ductwork in unconditioned spaces buried and tested at 3% total leakage, and air handler in conditioned space? (See Option 4.1.)		Y or N
All ductwork & air handler outside conditioned space insulated to minimum R-8?		Y or N
Air handler present at duct leakage test? (Total leakage 4% if yes, 3% if no)		Y or N
HVAC leakage to outside test conducted at final?		Y or N
Do HVAC duct leakage tests include GPS and time stamp verification?		Y or N
HVAC system leakage test calculated design target:	_____ CFM @ 25 Pa	
HVAC system leakage test measured results:	_____ CFM @ 25 Pa	
Building Leakage Testing (R402.4.1.2)		
Dwelling unit leakage test calculated design target:	_____ ACH @ 50 Pa	
Dwelling unit leakage test, measured results:	_____ ACH @ 50 Pa	
Whole Building Leakage test (R2 corridor only) design target:	_____ CFM/sf @ 50 Pa	
Whole Building Leakage test (R2 corridor only) measured:	_____ CFM/sf @ 50 Pa	
Do building leakage tests include GPS and time stamp verification?		Y or N

Note: Consider using automated duct and envelope air leakage testing equipment, to help provide greater accuracy, repeatability and precision. The automated software will help document GPS location and time stamp as required to be completed per R401.3.

R401.3 Certificate. A permanent certificate shall be completed by the builder or other approved party and posted on a wall in the space where the furnace is located, a utility room, or an approved location inside the building. When located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *below-grade wall*, and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration; the results from any required duct system and building envelope air leakage testing done on the building; and the results from the whole-house mechanical ventilation system flow rate test. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiencies of heating, cooling, whole-house mechanical ventilation, and service water heating appliances. Where a gas-fired unvented room heater, electric furnace, or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be *listed* for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters.

The *code official* may require that documentation for any required test results include an electronic record of the time, date and location of the test. A date-stamped smart phone photo or air leakage testing software may be used to satisfy this requirement.

***Example*:** For a 2,240 sf home:

- Total leakage target 2,240 X .04 = 90 CFM
- Leakage to exterior target 2,240 X .04 = 90 CFM

Tools and Equipment:

- Duct testing device
- Manometer
- Tape and paper or duct mask to seal registers

Setup:

- Ensure air handler does not operate during test.
- Remove air filters from the air handler.
- Open all duct dampers (Note setting and return after testing).
- Attach the duct testing device to the air handler cabinet (preferred location) **or**
  - Attach the duct testing device to the return register closest to the air handler.
- Place the duct pressure tap in the supply register closest to the air handler **or**
  - Place the duct tape in the supply plenum.
- Seal all the duct system supply and return registers with tape, paper, or mask.
- If the duct testing equipment is not located outside of conditioned space, open an exterior door or window to insure all spaces exterior to the ducts are at outside pressure.
- Install a flow ring which you think best matches the needed capacity of the fan and will provide a duct system pressure of over 25 Pa (see duct testing equipment manual).

Test:

1. With the duct testing device, pressurize the ducts to **+25 Pa with respect to (WRT) outside** (Figure 1).

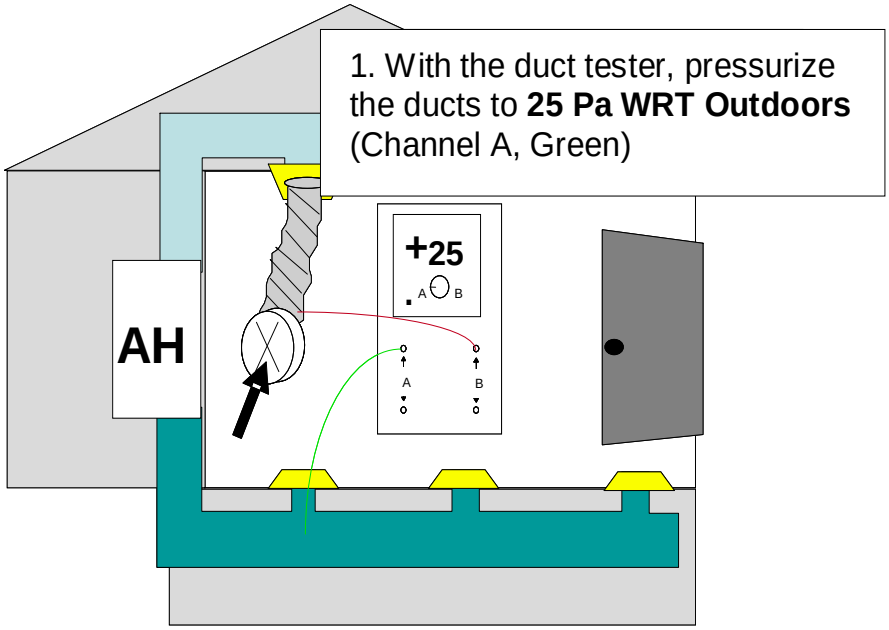

Figure 1: Pressurizing the duct system

2. Determine the duct leakage (with simple manometers, the fan pressure (Pa) is converted to CFM_{25} using a flow table. Many digital manometers sold with duct testing equipment can automatically perform this conversion, and display CFM_{25} directly. Consult your duct testing equipment manual (Figure 2).
   - You may need to adjust the ring size of the duct testing device (see duct testing equipment manual).

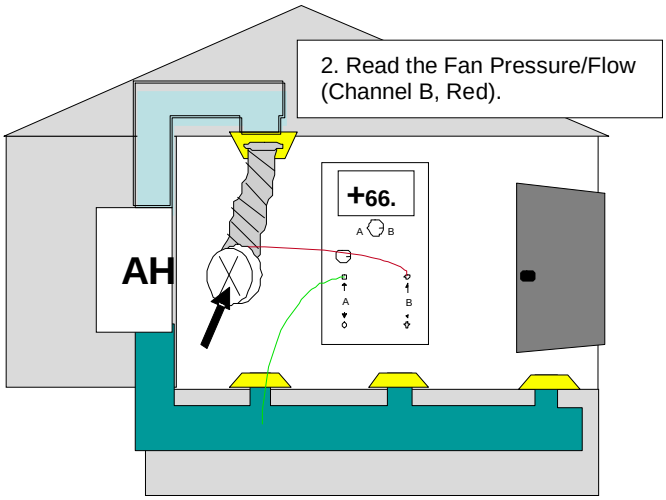

Figure 2: Determining duct leakage

Duct Leakage Testing to Outdoors

Testing Procedure Application

In new construction, doors and windows must be installed and the building envelope capable of maintaining +25 Pa WRT outside pressure with the operation of a blower door. By pressurizing the interior of the home with a blower door while using a duct testing device, duct leakage to the interior is eliminated from the measurement. The test is designed to measure the CFM_{25} value for leakage in the duct system to outside of the conditioned space.

Standard

The measured duct leakage must not exceed ***0.04 CFM_{25} x floor area*** (in sf) served by the system.

Tools and Equipment

- Blower door
- Duct testing device
- Manometer (a second manometer is helpful but not required)
- Tape and paper or duct mask to seal registers

Setup

Example 1. Duct testing device is hooked up at largest return register. The duct testing equipment is inside the pressurized zone of the house when the blower door is turned on.

- Prepare house for a standard blower door test
- Set up blower door and set to pressurize the house
- Set up the duct testing device as in a total leakage test except all exterior doors and windows must be closed

Test

1. Using the blower door, pressurize the interior to +25 PA WRT outdoors (Figure 3).

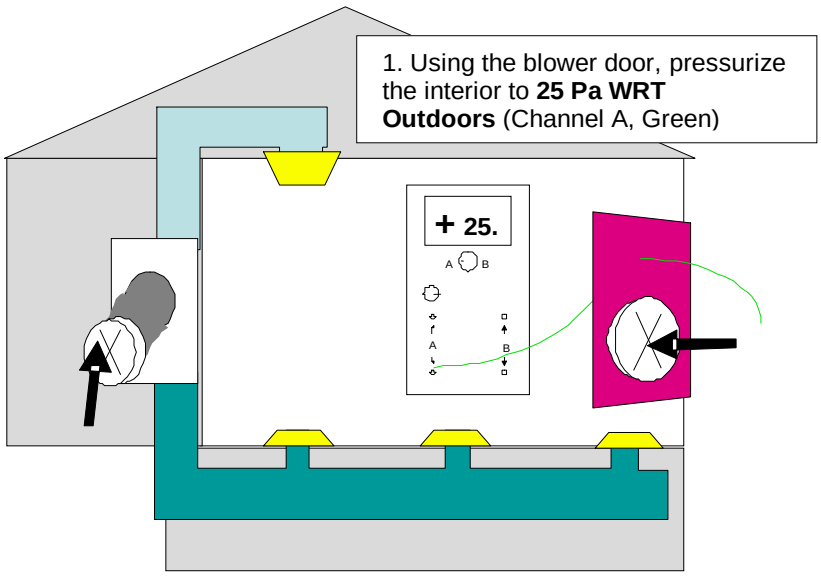

Figure 3: Pressurizing interior to +25 PA WRT outdoors

2. With the duct testing device, pressurize the ducts to + 25 PA WRT outdoors, or
   - With the duct testing device, pressurize the ducts to 0 PA WRT interior (Figure 4).

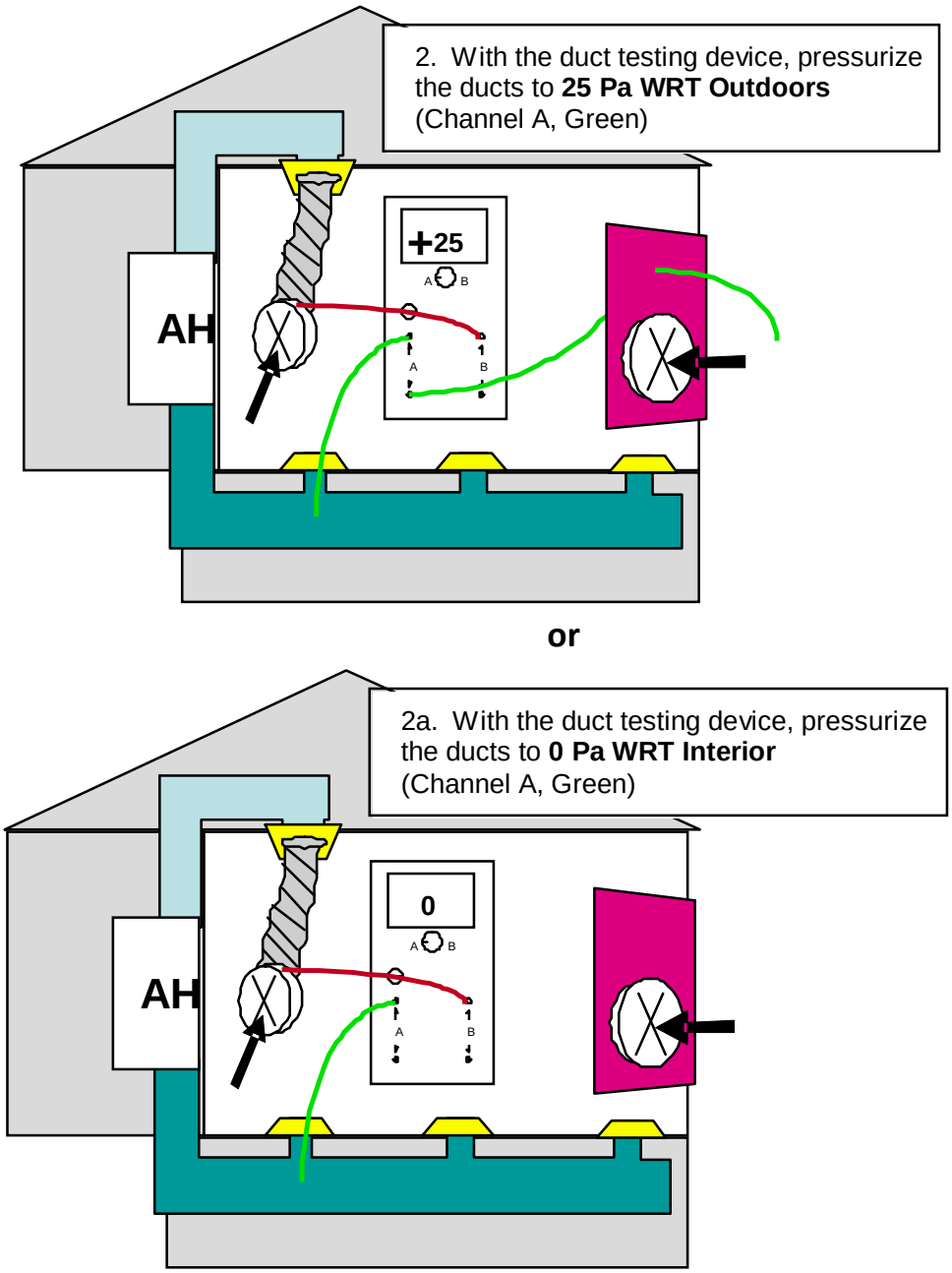

Figure 4: Pressurizing ducts to +25 PA WRT outdoors, or 0 PA WRT indoors (duct testing device hooked up to largest return duct, inside the pressurized zone of the house)

3. Check the blower door reading to assure it is still at +25PA.

4. Determine the duct leakage (with simple manometers, the fan pressure (Pa) is converted to CFM25 using a flow table. Many digital manometers sold with duct testing equipment can automatically perform this conversion, and display CFM25 directly.) Consult your duct testing equipment manual (Figure 5).
   - You may need to adjust the ring size of the duct testing device (see your equipment manual)

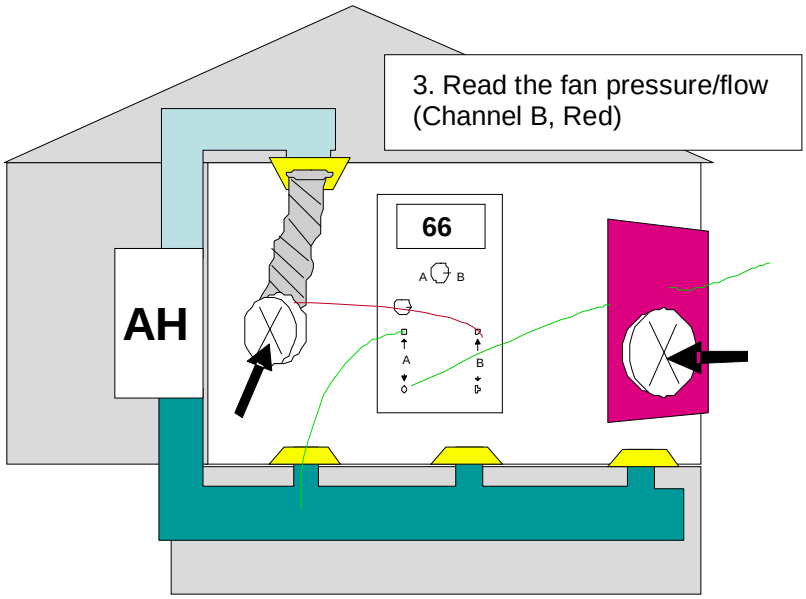

Figure 5: Determining duct leakage

Example 2. Duct testing device is hooked up at air handler. Depending on the location of the air handler, the duct testing device may be either inside or outside the pressurized zone of the house (air handler is "Outside" in Figures 6, 7, 8). Follow the same steps as in Example 1.

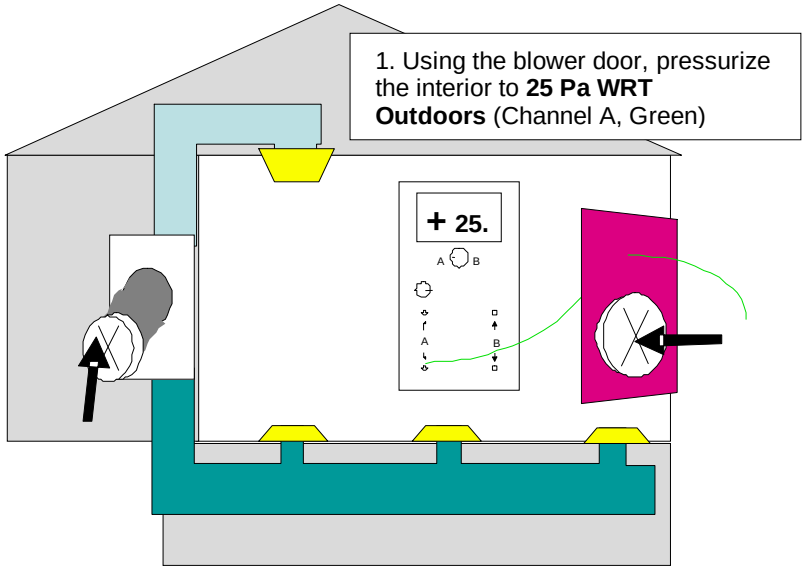

Figure 6: Pressurizing interior to +25 PA WRT outdoors

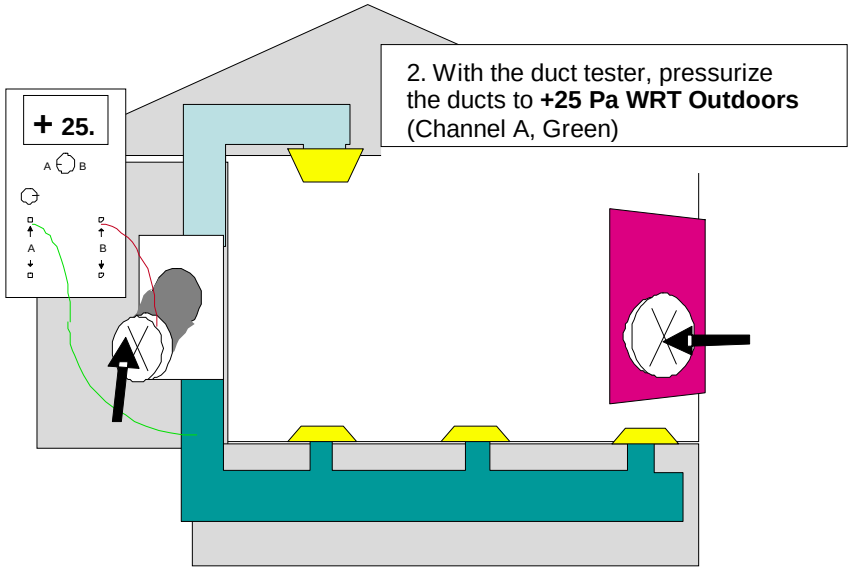

Figure 7: Pressurizing ducts to +25 PA WRT outdoors (duct testing device located outside the pressurized zone of the house)

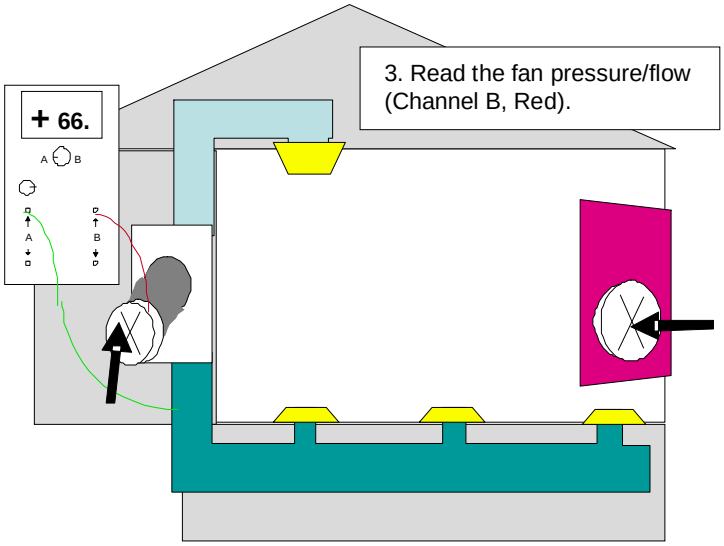

Figure 8: Determining duct leakage

Note: When the duct testing device is outside the pressurized zone of the house, it is no longer necessary to run a pressure tube from the reference pressure tap on channel A to the outside when determining the duct pressure WRT to outside as it was in Example 1.

Note: If the buried duct energy credit is taken for WSEC-R code compliance, a duct leakage test is required, where duct leakage shall not exceed 0.03 CFM/sf x floor area (in sf).

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