Revised June 6, 2006 ©

Performance Tested Comfort Systems® Duct Program Standards and Testing Procedures

1. **Performance Tested Comfort System (PTCS) Duct Program Standards**
2. **Required Testing Procedures**
3. **Other Useful Diagnostic Procedures**
4. **Sample Labels & Reporting Forms**

Duct System Diagnostic Procedures

Testing Protocols

The required procedures for performing the following tests are contained in this manual.

1. **Total Duct Leakage Test**
2. **Duct Leakage to the Exterior Test**
3. **Combustion Appliance Zone Pressure Test**

Certification of a duct system under the PTCS program requires that one or more of these tests are performed on each system. A certified technician to complete the certification process must provide documentation to the sponsoring utility or the Energy Star Program of the test results showing compliance with **Performance Tested Comfort System (PTCS)** Duct Program standards.

The table (below) shows under which circumstances each test is required.

In existing homes, testing is required both before and after sealing. Existing homes that meet program standards without additional sealing may be certified. A home must be occupied for a least one year before it is eligible to be certified under the existing home standards. Check with sponsoring utilities for availability of and eligibility for incentive payments.

Type of Home	**Required Tests**				
	(1) Total Leakage		**(2) Leakage to Exterior**		**(3) Combustion Zone**
New Home	**X**	**or**	**X**		
with combustion	**X**	**or**	**X**	**and**	**X**
Existing Home			**X**		
with combustion			**X**	**and**	**X**

Duct Sealing:
Performance Tested Comfort System (PTCS)
Program Standards

New Construction: Based on the protocol for "Total Leakage Testing", or "Leakage Testing to Exterior" duct leakage in new construction shall not exceed 0.06 CFM50 x floor area served by the system (in square feet), or 75 CFM50 whichever is greater.

> Exception 1: if the air handler is located completely within conditioned space, it is not required to be in place during the test.
>
> Exception 2: If the air handler is located in unconditioned space, it is not required to be in place during the test, the leakage limit shall be decreased to 0.04 x floor area served by the system (in square feet) or 50 CFM50, whichever is greater.)

In addition the following requirements must be met:

1. All *testing* must be done by a PTCS Certified Technician or Inspector;
2. Duct systems must be designed, sized and installed using recognized industry standards so that calculated heating and/or cooling loads are delivered to each zone (documentation may be required);
3. Based on the protocol for "Combustion Appliance Zone Pressure Testing" forced air system operation shall not de-pressurize a combustion appliance zone by more than 3 Pascals.
4. When combustion appliances are located within a conditioned space a UL listed carbon monoxide alarm, or equivalent must be installed.

Sealing Materials: All duct sealing shall be done with mastics that meet the UL-181 AM or BM standard. Where taping is necessary (to provide service access), only UL-181 listed tape shall be used. Cloth duct tape is not acceptable.

Performance Tested Comfort System (PTCS) Program Standards

Existing Home, New Ducts: Based on the protocol for "Total Leakage Testing", or "Leakage Testing to Exterior" duct leakage for new systems in existing homes shall not exceed 0.10 CFM50 x floor area served by the system (in square feet), or 75 CFM50, whichever is greater.

In addition the following requirements must be met:

1. All testing must be done by a PTCS Certified Technician or Inspector;
2. Duct systems must be designed, sized and installed using recognized industry standards so that calculated heating and/or cooling loads are delivered to each zone (documentation may be required);
3. Based on the protocol for "Combustion Appliance Zone Pressure Testing" forced air system operation shall not de-pressurize a combustion appliance zone by more than 3 Pascals.
4. When combustion appliances are located within a conditioned space a UL listed carbon monoxide alarm, or equivalent, must be installed.

Sealing Materials: All duct sealing shall be done with mastics that meet the UL-181 AM or BM standard. Where taping is necessary (to provide service access), only UL-181 listed tape shall be used. Cloth duct tape is not acceptable.

Performance Tested Comfort System (PTCS) Program Standards

Existing Homes, Existing Ducts: Based on the protocol for testing "Duct Leakage to the Exterior", duct leakage in a retrofitted system shall:

A) Not exceed 0.10 CFM50 x floor area (in square feet) served by the system;

Or

B) Document a 50% reduction* in leakage to the outside by comparing duct leakage to the outside before and after sealing;

Or

C) In extreme cases where return ducts are inaccessible, compliance with either A or B may be accomplished by testing the supply side only.

Regardless of qualifying path, all accessible components of the supply plenum and all accessible take offs including the gores on flexible elbows shall be sealed with approved materials. In addition the following requirements must be met:

1. All testing must be done by a PTCS Certified Technician or Inspector:
2. Based on the protocol for "Combustion Appliance Zone Pressure Testing" forced air system operation shall not de-pressurize a combustion appliance zone by more than 3 Pascals.
3. When combustion appliances are located within a conditioned space a UL listed carbon monoxide alarm, or equivalent must be installed.

*****The leakage rate specified in A and B above is required for an existing system to be certified as meeting the PTCS standard. Some utilities may pay an incentive for "test only" (for less than a 50% reduction or greater than 10% of floor area). Contact the sponsoring utility for specific program details.

Sealing Materials: All duct sealing shall be done with mastics that meet the UL-181 AM or BM standard. Where taping is necessary (to

provide service access), only UL-181 listed tape shall be used. Cloth duct tape is not acceptable.

Performance Tested Comfort System (PTCS) Program Standards

For Manufactured homes: Based on the protocol for "Total Leakage Testing", or "Leakage Testing to Exterior" duct leakage in manufactured homes shall document a 50% reduction* in leakage to the outside by comparing duct leakage to the outside before and after sealing.

In addition the following requirements must be met:

1. Be conducted by a PTCS Certified Technician or Inspector

2. Have an existing tested leakage rate of 100 CFM50 for single wide homes or 150 CFM50 leakage for two or more section homes

3. Based on the protocol for "Combustion Appliance Zone Pressure Testing" forced air system operation shall not de-pressurize a combustion appliance zone by more than 3 Pascals.

4. When combustion appliances are located within a conditioned space a UL listed carbon monoxide alarm, or equivalent must be installed.

*Some utilities or system benefits administrators may pay an incentive for "test only" or less than a 50% reduction. Contact the sponsoring utility for specific program details.

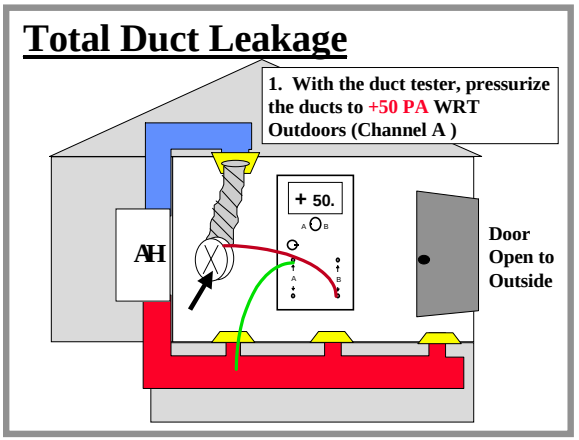
Sealing Materials: All duct sealing shall be done with mastics that meet the UL-181 AM or BM standard. Where taping is necessary (to provide service access), only UL-181 listed tape shall be used. Cloth duct tape is not acceptable.

Total Duct Leakage Test

Testing Procedure

Application: For the PTCS Program perform this test **only on new homes**. This test is most appropriate in new construction when ducts are to be tested at the rough-in stage before the house envelope is intact. The test measures the CFM50 value of the duct system. It is a simpler test, but a more stringent standard than the leakage to exterior test that may be used as an alternative.

Standard: For certification, the measured CFM50 must not exceed 0.06 CFM50 x floor area served by the system (in square feet) or 75 CFM50 whichever is greater.



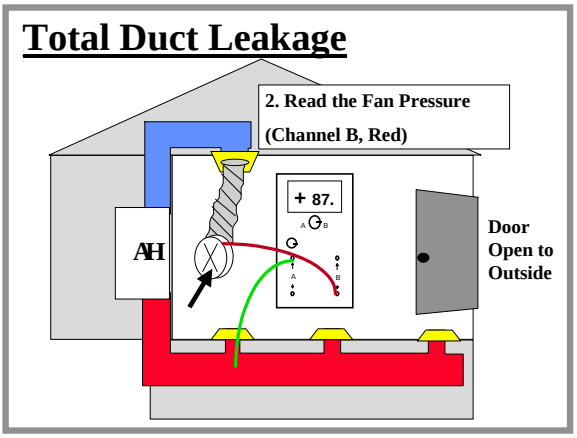
Tools and Equipment:

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

Setup:

- Remove air filters from the air handler.
- Open all duct dampers (Note setting and return after testing).
- Attach the duct tester to the return register closest to the air handler. **or**
- Attach the duct tester to the air handler cabinet (Preferred location).
- Place the duct pressure tube in the supply register closest to the air handler. **or**
- Place the duct pressure tube in the supply plenum.

- Seal all the duct system supply and return registers with tape, paper, or mask.
- Open an exterior door or window so that all spaces exterior to the ducts are at outside pressure.



Test:
1. With the Duct Tester **pressurize** the ducts to **+50 Pa WRT to outside**.
2. Read the fan pressure and follow your Duct Tester instructions to determine the **CFM50** leakage of the system. If you can't reach +50 Pa, perform the test at the highest attainable pressure (rounded to the nearest 5 Pa) and correct the results (see interpreting results below).

Interpreting Results:

The **CFM50** is a measure of the total collected hole size in the system. As an approximation the CFM50 divided by 10 gives the total effective leakage area in square inches.

Example: 400 CFM50/10 = 40 square inches of total leakage area.

Using this approximation during sealing can help estimate how many and how big the holes are that you are looking to seal.

If you could not perform the test at +50 Pa adjust your results using Table 1 (see page 33).

Example: The results of the test show a leakage area of 275 CFM at a duct pressure of 35 Pa. The correction factor from Table 1 for a pressure of 35 Pa is 1.26.

275 CFM35 X 1.26 = 346.5 CFM50

The test doesn't give any indication of where to find the holes, just an estimate of the collected hole size. As CFM50 values get larger, they will tend to be less accurate. In the range of values required for certification, the test should be most accurate.

Limitations: Inaccuracies are introduced because the test assumes a constant pressure difference from inside to outside the ducts throughout the system during testing. This is not always true because of pressure drops caused by large holes and possible induced pressures in buffer zones. Because the assumed constant pressure difference doesn't accurately model the dynamic pressure gradient present during normal system operation, the test measured hole size does not always correlate well with heat loss and potential savings. The assumption, however, is that in new construction, the tighter, the better.

Duct Leakage to the Exterior

Testing Procedure

Application: This test may be used on either **new or existing homes**. In new construction, doors and windows must be installed and the building envelope capable of maintaining +50 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 tester, duct leakage to the interior is eliminated from the measurement. The test attempts to measure the CFM50 value for holes in the duct system outside of conditioned space. In **existing homes**, by performing a pre and post test documenting a 50% reduction in leakage area, it is sometimes possible to certify homes that otherwise would not qualify.

Standard:

New Construction: For certification, the measured CFM50 must not exceed 0.06 CFM50 x floor area served by the system (in square feet) or 75 CFM50 whichever is greater.

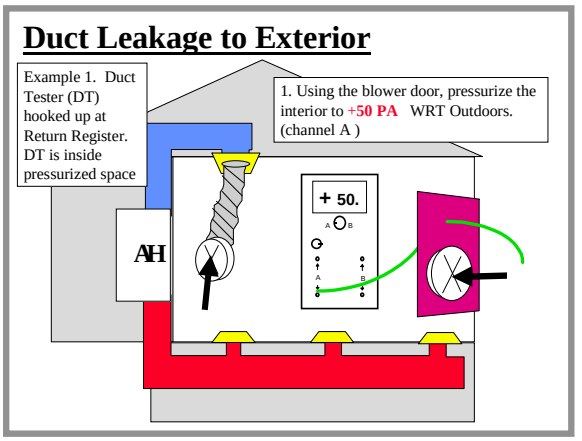
Existing Homes: For certification, the measured CFM50 must not exceed 0.10 CFM50 x floor area (in square feet) served by the system;

Or

Document a **50% *reduction**** in leakage to the outside by comparing duct leakage to the outside before and after sealing.

*****The leakage rate specified above or a minimum 50% reduction in duct leakage is required for an existing system to be **certified** as meeting the PTCS standard. Some utilities may pay an incentive for "test only" or less than a 50% reduction. Contact Climate Crafters or the sponsoring utilities for specific program details.

Tools and Equipment:

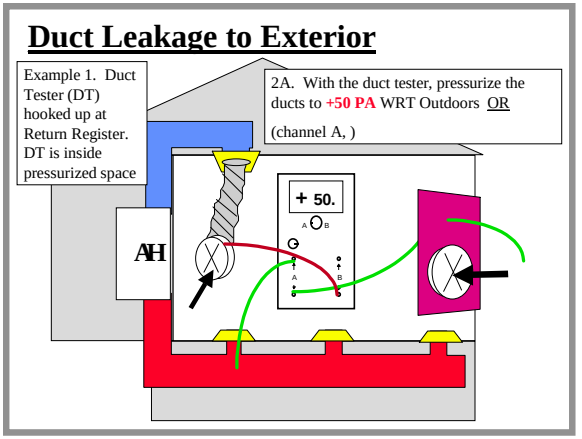


- Blower Door
- Duct Tester
- Manometer
- Tape and paper or duct mask to seal registers

Setup:

Example 1. Duct Tester is hooked up at largest return register. The duct tester 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.



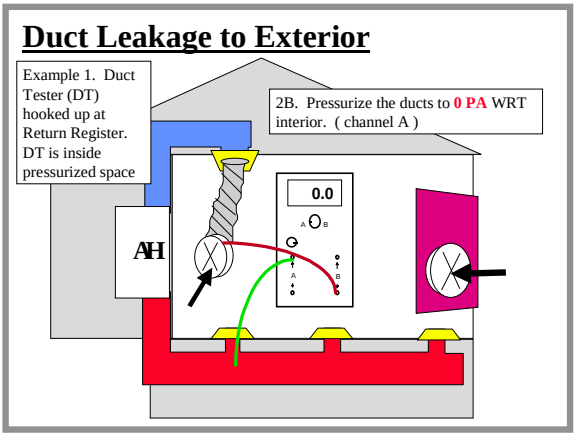
- Set up the **Duct Tester** as in a total leakage test except all exterior doors and windows must be closed.

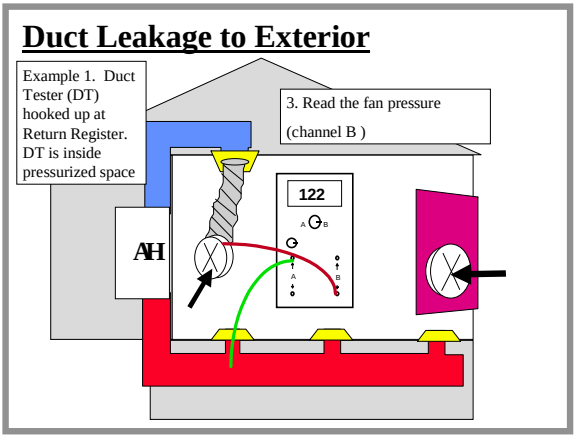
Test:

1. Using the **blower door** pressurize the interior to **+50 PA WRT outdoors**.

2A. With the **Duct Tester**, pressurize the ducts to + **50PA WRT outdoors**.

Or

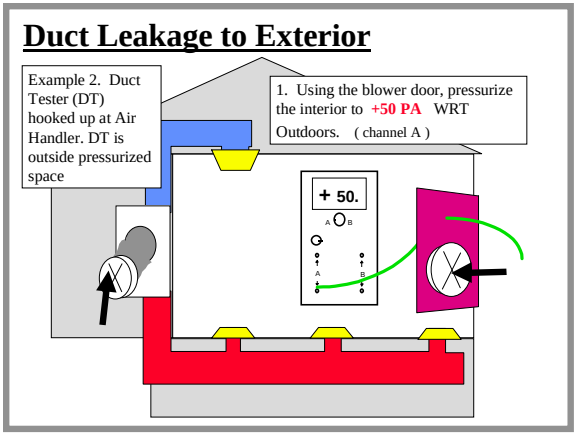




2B. With the **Duct Tester**, pressurize the ducts to **0 PA WRT interior**

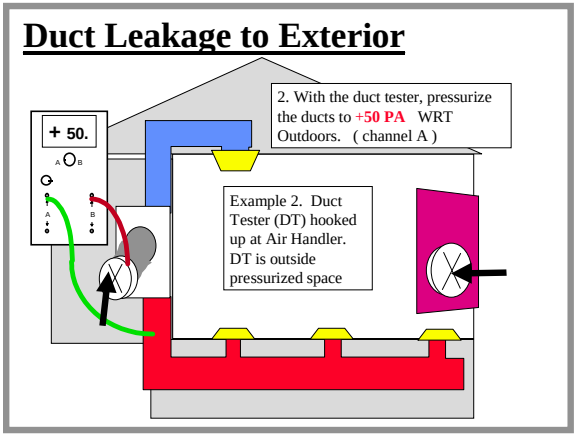
Check the blower door reading to assure it is still at +50PA.

3. Measure Fan Pressure of the Duct Tester.
Note: You may need to adjust the ring size of the duct tester (see duct tester manual).
4. Convert Fan Pressure to CFM50 measurement by consulting the duct tester manual.



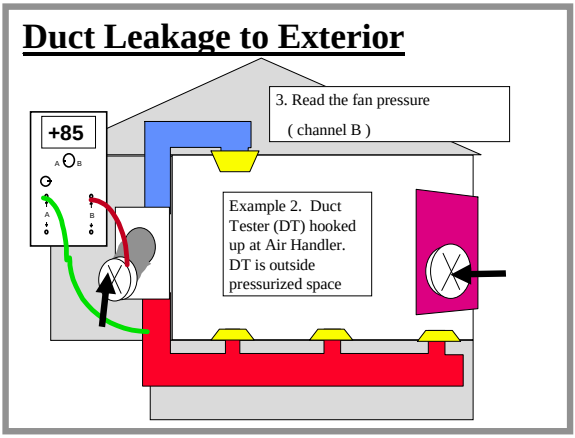
Example 2. Duct Tester is hooked up at Air Handler. Depending on the location of the Air Handler, the Duct Tester may be either inside or outside the pressurized zone of the house. (Outside in pictured example)

Follow the same steps as in Example 1.



Note:
In this example because the Duct Tester is outside of the pressurized zone of the house, it is no longer necessary to run a pressure hose 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.

In any case, if either the house or the ducts can't be pressurized to 50 Pa WRT to outside, pressurize them both to highest same value possible (rounded to the nearest 5 Pa) and then convert to CFM50 using Table 1 (see page 33).



Interpreting Results:

By pressurizing the house to the same pressure as the ducts, holes between the ducts and the house are assumed to have no pressure difference and therefore make no contribution to the measured CFM50. All the measured leakage is to the exterior. Generally this will be a more reliable indicator of potential energy savings than a *Total Leakage* test.

The test doesn't give any indication of where to find the holes, just an estimate of the collected hole size to the outside. As CFM50 values get larger, they will tend to be less accurate. In the range of values required for certification, the test should be most accurate. Documenting a 50% reduction of a very leaky system for certification may not provide the desired benefits. Always try to get the systems as tight as possible.

Limitations: The test assumes that the pressures inside the ducts and outside the ducts within the house are always equal during the test. This is not always true and may skew the results. Two story houses with ducts in the second story floor cavity and houses with ducts in other buffer zones that are partially pressurized by the blower door may produce unreliable results.

WASHINGTON STATE UNIVERSITY
EXTENSION ENERGY PROGRAM

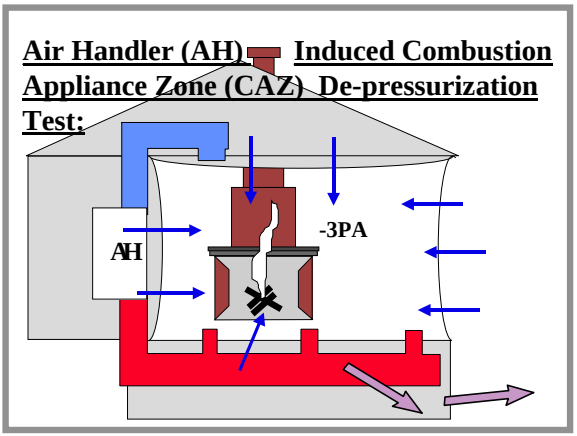
Combustion Appliance Zone Pressure Test

Testing Procedure

Application: This test is required for PTCS Certification whenever a combustion appliance is present within a building. A **Combustion Appliance Zone (CAZ)** is any zone in the house that contains a combustion appliance. CAZs need not be heated. An attached garage or unheated basement with a combustion-fired furnace or water heater **is** a CAZ. A zone with a **sealed combustion appliance** that has an isolated combustion path preventing mixing of room air and combustion air **is not** considered a CAZ. The test measures the magnitude of any air handler induced pressure effects within the combustion appliance zone. Supply leaks to the exterior and return leaks within a zone create negative pressures that may cause dangerous back drafting of combustion appliances. Door closer that isolates supply and return sides of the system may also induce negative pressure within a combustion appliance zone. In **retrofit** situations, the test should be done both before and after sealing. **Note:** This test only measures air handler induced effects and is not a worst-case test.

Standard: Forced air system operation shall not de-pressurize a combustion appliance zone by more than 3 Pascals with reference to outside. As a further safety precaution, the Climate Crafters Standard also requires the installation of a UL listed Carbon Monoxide whenever combustion appliances are within the conditioned space of the home.

Air Handler (AH) Induced Combustion Appliance Zone (CAZ) De-pressurization Test:



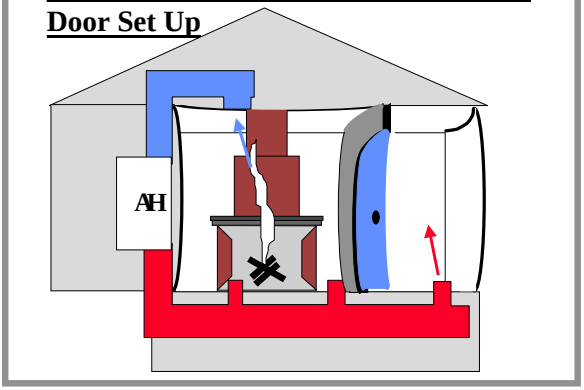
Tools:

- Micro-manometer

Set Up:

- The house should be set up for normal heating season operation with all **exterior doors and windows closed**.
- **Turn off all exhaust devices** including clothes dryer, bathroom fans, kitchen fan, central vacuum, and whole house ventilation systems.
- **Open** all return and supply **registers**.
- **Turn off combustion devices** so that they will not operate during the test (except furnace if air handler will not operate at high speed without firing).
- **Remove** furnace **filters.**
- **Shut** off any **outside ventilation air** to the duct system if it can normally be shut off during air handler operation.
- **Close manual flue dampers**

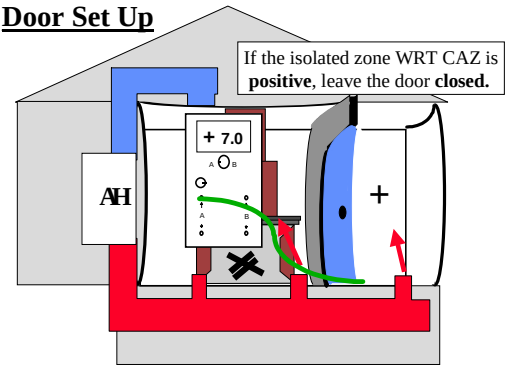
CAZ Test-Air Handler Effect: Interior Door Set Up



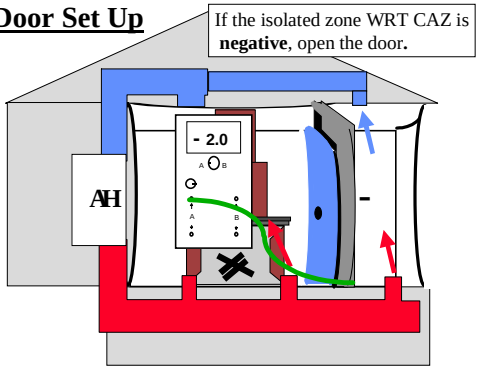
Door Set Up:

- With air handler operating (high speed if more than one speed);

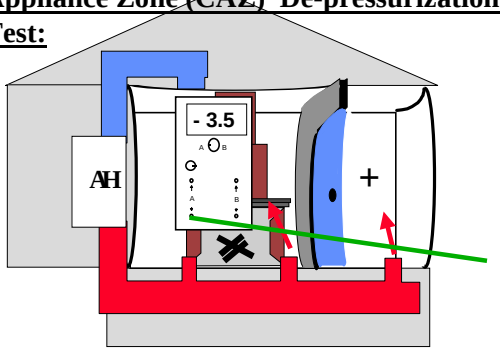
CAZ Test-Air Handler Effect: Interior Door Set Up



CAZ Test-Air Handler Effect: Interior Door Set Up



Air Handler (AH) Induced Combustion Appliance Zone (CAZ) De-pressurization Test:



4. Record pressure of CAZ WRT outside.

- Using the manometer, check the pressure in each zone isolated behind a closed door WRT to the CAZ.

1. If the zone behind the closed door is **positive** WRT to the CAZ, leave the door **closed** for the test

2. .If the zone behind the closed door is **negative** WRT to the CAZ, **open** the door for the test.

Test:

- Establish a baseline. With the air handler off measure the pressure in the CAZ WRT outside.

3. Turn on air handler to high speed.

Example:
Baseline pressure = **-1.0 PA**
CAZ test = **-3.5 PA**

NET air handler effect **equals** CAZ test pressure **minus** baseline pressure.

NET air handler effect = -3.5 - (-1.0) = **-2.5 PA**

Interpreting Results:

If the net **Air Handler Effect** de-pressurizes the system by less than **3.0 PA** the system meets the PTCS Program Standard.

If the depressurization is more than 3.0 PA, modifications must be made to reduce the de-pressurization. If the supply ducts have been well sealed, the induced depressurization is most probably a result of door closer effects and may be mitigated by undercutting doors; installing transfer grilles or new returns into rooms without returns; or possibly providing supplemental make-up combustion air to the CAZ.

Warning!!: The test procedure described only measures air handler induced effects. The added effects of other exhaust appliances such as: bath fans, range hood exhausts, dryers, central vacuums, etc. may still induce back drafting. To ensure safety a worst-case test including these other appliances is recommended.

Pressure Pan Test

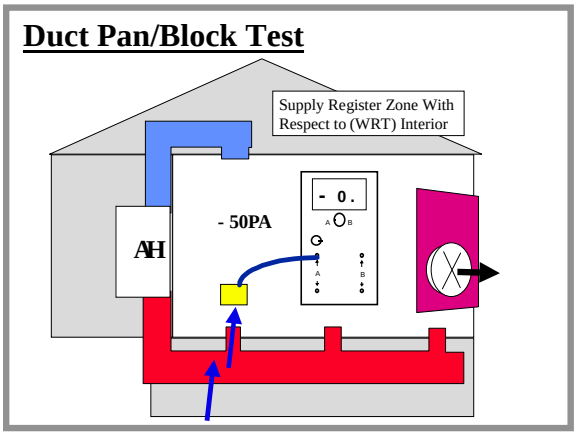
(This is a useful procedure **Not a required test)**

Testing Procedure

Application: Pan testing provides a quick, qualitative assessment of the leakiness of a duct system and helps to identify leak location.

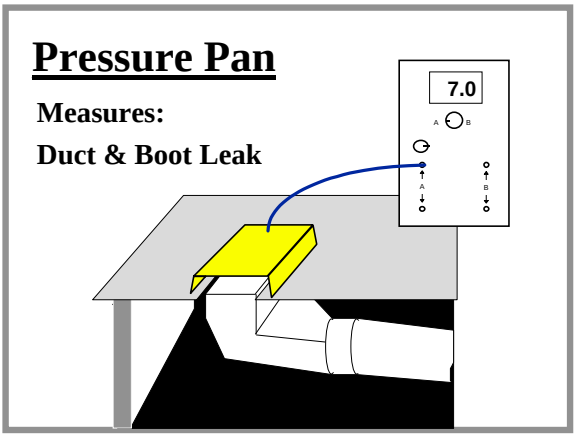
Tools and Equipment:

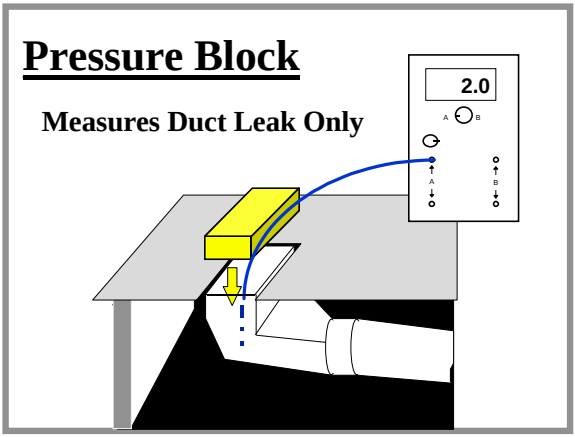
- Blower Door
- Digital Micro- Manometer (Accurate to **0.1** Pascal)
- Tape or Duct Mask
- Pressure Pan or Foam Block

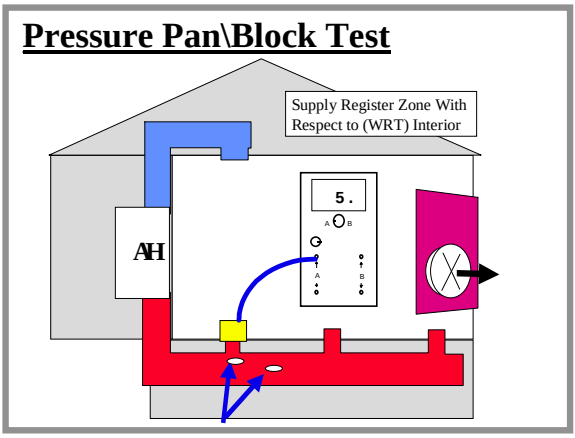


Setup:

- Setup and operate a blower door to maintain the house at **-50 Pascals** WRT outside according to the instructions for **Basic Blower Door Setup.**
- Set the air hanadler so that it cannot go on during the test.
- Make sure all exhaust fans and vented appliances are turned off.
- If using a Pressure Pan, seal all floor or ceiling to boot leaks before testing.
- Remove all system filters.
- Measure and record depressurization in buffer zones containing ducts (see procedure for **Zone Pressure** testing).







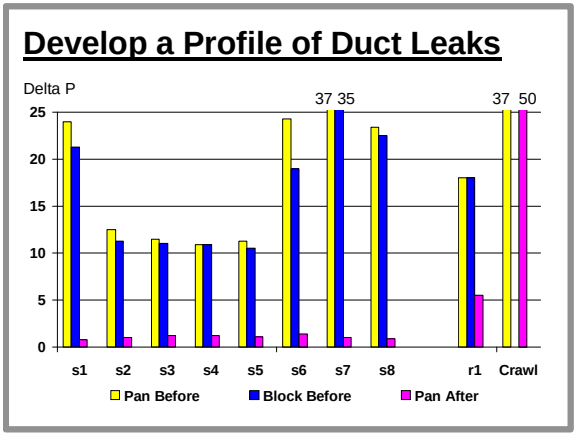
Test:

- With all the registers open, place the pan or block at each register to create a pressure boundary between the inside of the duct and the house.
- Using the manometer record the pressure in the duct WRT the house.

Repeat this procedure for each supply and return register in the house. Registers that are too large for the pan or which can't otherwise be covered such as toe kick registers should be taped with duct mask or masking tape and the pan pressure taken by inserting a pressure probe into the duct at the register being tested.

Note:
For each measurement, only the register tested is covered or blocked. All the other registers remain fully open to the house.

Interpreting Results:

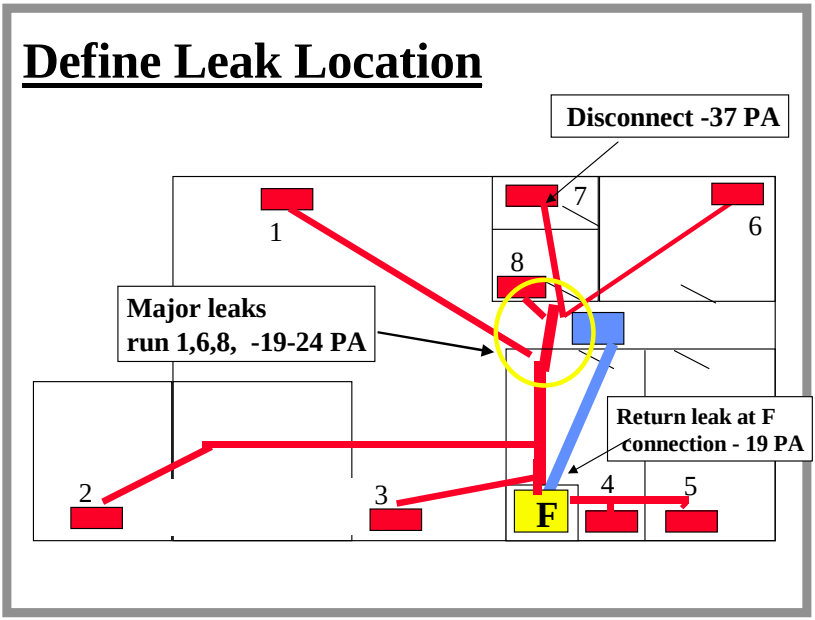


Generally higher pan numbers are associated with proximity to larger leaks in the system. If there is little leakage to the outdoors, all the pan numbers will approach zero. If there is a total disconnect at a register to a duct outside of conditioned space, the pan number at that register will equal the pressure in the zone containing the duct WRT to the house. When the duct zone is a well-ventilated attic or crawlspace the pan pressure for the disconnected duct will approach the pressure outside WRT to the house (in most cases 50 Pascals). All pan numbers in tightly sealed system would normally be less than 1 Pa.

The **pan number** represents the **ratio** of the size of the hole in the ducts connected to the outside compared to the size of the hole in the ducts connected to the interior of the house.

Example:
The pan numbers recorded above average about 17.5 on the supply side well above the program standard for a leaky system.
Supply register 7 with a pan number of 37 compared to the crawlspace (duct zone) pressure of 37 suggests a disconnect.
Registers S2 through S5 are all above 10 but consistent. In a system with a disconnect, these may represent a tight part of the system with little leakage that “sees” the disconnect from a distance.

Example:
Mapping the numbers from the previous page onto the schematic of the system helps to find potential leakage sites. Pan numbers are the only diagnostic test that point toward the location of the leak.



Limitations: Pressure Pan testing is at best a qualitative assessment of duct tightness. Systems with many registers will tend to have lower pan numbers while small systems with only a few registers will tend to have higher pan numbers even if they have similar leakage areas. Adding registers to a system, enlarging a return or even removing a clogged filter can significantly lower the numbers even when no sealing is done.

Basic Blower Door Setup

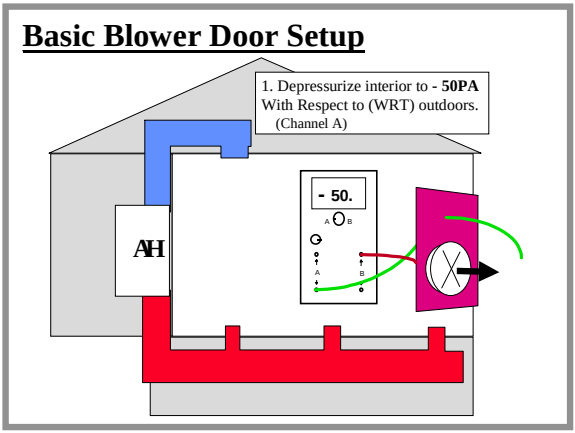
Application: The basic setup and operation of a Blower Door is an integral part of the ***Duct Leakage to the Exterior*** and ***Pressure Pan*** tests. The Blower door can also be used to verify the **Minimum Ventilation Level** (MVL) required for a house when there is no whole house mechanical ventilation system present.

Tools:

- Blower Door
- Manometer

Set Up:

- Open all register dampers.
- Close all exterior doors and windows.
- Open all interior doors
- Close fireplace or wood stove dampers and doors. Cover ash with wet newspaper (In some cases it may be necessary to tape opening).
- Turn down combustion water heater so it will not fire during the test (i.e. set to pilot and check to confirm pilot is still lit after testing. Re-light if necessary.).
- Turn off all exhaust devices including: clothes dryer, bath fans, kitchen fans, and central vacuum cleaner.
- Set thermostat to Off so HVAC system will not come on during testing.
- Turn all ventilation controls to Off position.
- Set up blower door. Channel A, pressure tap, house WRT out doors. Channel B, fan pressure WRT house.



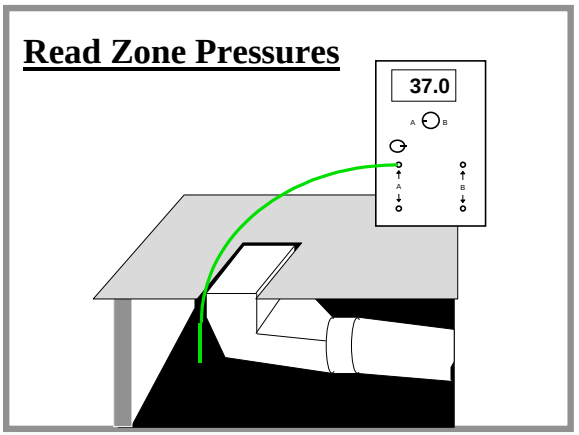
When testing is complete reset all thermostats and controls to original settings.

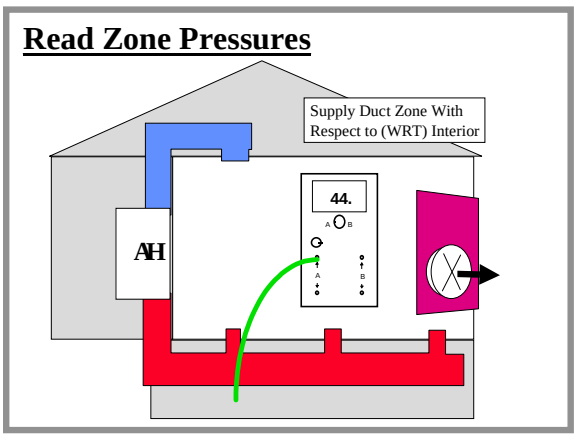
Test:
Adjust hole size and/or fan speed to pressurize or depressurize the house as needed.

Danger! Never perform test if any combustion appliance is operating; fires in fireplaces or wood stoves, gas ovens or range tops, etc.

Zone Pressure Testing

Application: Determination of pressure in one Zone with reference to (WRT) another. This test is especially useful for determining the pressure boundary of a building. When ducts appear to be outside of conditioned space in attics, crawlspaces, etc., or in other intermediate zones like floor cavities, this test determines to what extent these zones are connected to the outside. The information helps interpret Pan Numbers and other test results.



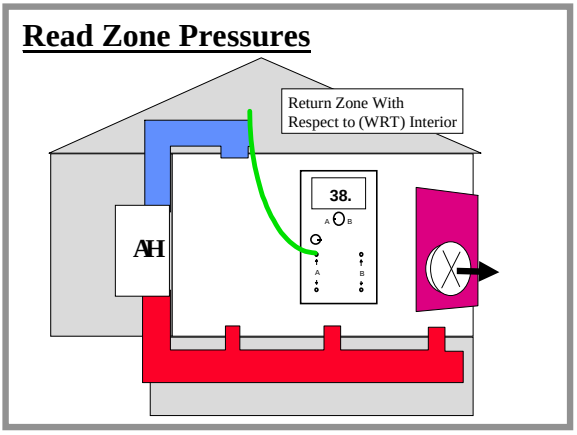


Tools:

- Blower Door
- Manometer
- Metal Probe
- Awl

Set Up:
Set up house for basic blower door test. Determine access points between zones for pressure probe.

Test:
De-pressurize the house to - 50 PA using the blower door.
Insert pressure probe into zone to be tested.
Zones of interest: Attic, Crawlspace, Basement, Attached Garage, Wall Cavities, Floor Cavities between floors, Any Zone containing Ducts or the Air Handler.

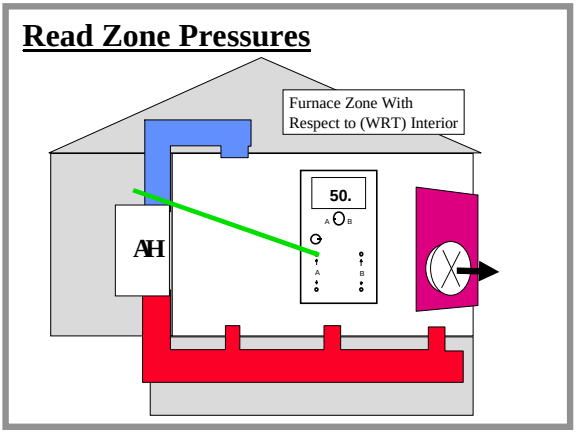


Interpreting the results:

1. Any zone totally outside the house and totally connected to the outside should show the same pressure as the outside WRT the house i.e.. 50 PA or 0 PA if the pressure is measured as the zone WRT outside.

2. Any zone totally inside the house will be at the same pressure as the house and will show no pressure difference i.e.. 0 PA WRT to the house.

3. Zones with readings between 0 Pa and 50 PA WRT house are part of a series leakage path. Pressures closer to 50 PA WRT house will be in zones more closely connected to the outside. Pressures closer to 0 PA WRT house are more closely connected to the interior. A Zone at 25 PA is equally connected to the interior and exterior. An attic or crawlspace is considered well vented with a zonal pressure 47 to 50 PA WRT house.



Example

This Air handler (AH) is totally outside the conditioned area of the house.

Minimum Ventilation Level

Application: Whenever air sealing (including duct sealing) is performed, the overall tightness of the house envelope should be measured in order to estimate the potential for moisture and/or indoor air quality (IAQ) problems. The measured CFM50 of the house as determined from a blower door test may be used to estimate house ventilation as compared to suggested Minimum Ventilation Level (MVL) guidelines. Sealing a house below the MVL should only be undertaken if some provision is made or already exists to provide whole house mechanical ventilation adequate for the expected occupancy.

Standard: The ASHRAE standard for residential ventilation is based on providing **15 CFM** per occupant. In homes of typical size and occupancy, this is equivalent to approximately **0.35 air changes per hour (ACH)**.

Calculations: The MVL for a house may be calculated based on: **(1)** the known number of occupants; **(2)** an estimate of the possible number of occupants based on the number of bedrooms; or **(3)** the air change rate and volume of the house. Generally the most restrictive of these methods should be applied to provide an additional margin of safety.

1. **MVL based on known occupancy:**

   MVL = (# of Occupants) x (15 cfm/occupant)

2. **MVL based on bedrooms:**

   MVL = (# of bedrooms + 1) x (15 cfm/bedroom)

3. **MVL based on ACH and volume**

$$\text{MVL} = \frac{0.35\ \text{ACH} \times \text{Volume of House (ft}^3\text{)}}{60\ \text{minutes}}$$

Each of these calculations yields an estimate of the required ventilation (in cfm) to maintain good indoor air quality.

The following formula **(4)** is used to convert the measured CFM50 from the blower door test to an estimate of the average ventilation potential (in cfm)

4. **Ventilation Potential = CFM50/N**

Where N is a correlation factor: N = C x H x S

C = climate factor, a function of annual temperature and wind. C = 20 is an appropriate approximation for most areas in the Northwest
H = height correction factor (see Table 2)
S = wind shielding correction (see Table 3)

As long as the measured **Ventilation Potential** is greater than the **MVL** additional air sealing should be possible without creating moisture and IAQ problems.

Table 2. Height Correction Factor

Number of Stories	1	1.5	2	3
Correction Factor "H"	1.0	0.9	0.8	0.7

Table 3. Wind Shielding Correction Factor

Wind Exposure	Well Shielded	Normal	Exposed
Correction Factor "S"	1.2	1.0	0.9

Example Calculation:

Given a 1200 ft^2 house with 8 ft ceilings, 3 bedrooms, single story, in an exposed windy site and 6 occupants with a tested CFM50 = 1800. Volume = 1200 x 8 = 9600 ft^3.

1. MVL based on known occupancy:

MVL = 6 x 15 = 90 cfm

2. MVL based on bedrooms:

MVL = (3 + 1) x 15 = 60 cfm

3. MVL based on ACH and volume:

MVL = (0.35 x 9600) / 60 = 56 cfm

The MVL based on occupancy of **90 cfm** is the most restrictive and should be used as the target value.

Using the values of **C = 20** and **H = 1** and **S = 0.9** taken from **Tables 1 & 2**.

N = 20 x 1 x 0.9 = 18

Calculating the **Ventilation Potential = 1800/18 = 100 cfm** is greater than the MVL.

Limitations: The CFM50 of a house is a measure of the effective leakage area. Estimating the amount of ventilation that a given leakage area will provide is affected by many factors and is at best an approximation averaged over a wide range of conditions for the entire year. Periods of over and under ventilation will certainly occur. A properly sized and controlled mechanical ventilation system installed in a tight house envelop is the preferred alternative to assure adequate ventilation rates at all times.

Energy Star New Home Duct leakage Label

ENERGY STAR® Homes
Northwest Certified
Residential Air Duct

Company Information

Company Name _____

Technician _____ Date _____

Duct Leakage

Cond. Floor Area (ft^2) _____

☐ yes ☐ no Air Handler in conditioned space?

☐ yes ☐ no Air Handler present during test?

If "yes" for either, then floor area x 0.06 = _____CFM@50 Pa

Target CFM is the above or 75 CFM@50 Pa, whichever is greater.

If "no" for both, then floor area x 0.04 = _____CFM@50 Pa

Target CFM is the above or 50 CFM@50 Pa, whichever is greater.

Circle Test Method: Leakage to Outside ***or*** Total Leakage

Test Result _____ CFM@50Pa

Fan Pressure _____ Pa

Ring (circle one) Open 1 2 3

Duct Blaster Location _____

Pressure Tap Location _____

Combustion Appliance Zone (CAZ) Test

	Main Zone	**Zone 2, if applies**
CAZ WRT Outside	_____ Pa	_____ Pa
Baseline, House WRT Outside (fans off)	_____ Pa	_____ Pa
NET CAZ Pressure (***subtract*** baseline from CAZ WRT outside)	_____ Pa	_____ Pa

Notes

Notes

Terminology

ACH – Air Changes per Hour.
CAZ – Combustion Appliance Zone.
CFM50 – airflow at an induced pressure of 50 Pascals. Hole Size.
MVL – Minimum Ventilation Level. Based on ASHRAE Standard of 15 CFM per occupant.
Pascal – metric unit of pressure. 1 inch of water column = 249 Pascals.
WRT – With Reference To. The pressure in the house was 25 Pascals WRT outside.

Table 1
Can't Reach Pressure (CRP) Correction Factors

Reference Pressure	CRP Factor 50 PA
10	2.85
15	2.19
20	1.81
25	1.57
30	1.39
35	1.26
40	1.16
45	1.07

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