

	<p style="text-align: center;">State of Ohio Weatherization Program Standards</p>	Section	<b>DIAGNOSTIC TESTING METHODS</b>
		Subject	<b>Zone Pressure Measurement Tests</b>

## ZONE PRESSURE MEASUREMENT TEST 1506-3.1

Zone pressures can determine if there are leaks (thermal bypasses) between a house and a zone connected to the house (e.g. attic). The Add-a-Hole and Vent Opening methods can be used to estimate the size of the hole between the zone and the house. Further calculations can turn the hole size into a CFM50 estimate. For example, estimating the amount of bypass leakage may be used to help decide if it is cost-effective to seal the leaks in an attic that is already insulated. It will generally not be cost-effective to address leakage that is less than a 20 sq. in (150 - 200 CFM50) hole.

**purpose**  
1506-3.1a

Zone pressures only determine the relative size of the leaks between that zone and the inside compared to that zone and the outside. To know whether the leakage rate is significant, determine the approximate leakiness of one side of the pressure boundary or use one of the measurement methods (e.g., add a hole).

**limitations**  
1506-3.1b

Zones that are located outside the thermal boundary of the house should have house-to-zone pressure differences of 50 Pa with the house to outside difference at 50 Pa. Readings lower than 50 Pa from house-to-zone indicate that there are air pathways between the house and the zone.

**exterior zones**  
1506-3.1c

Zones located within the thermal boundary should have house-to-zone pressure differences of 0 Pa. A reading greater than zero indicates there are air pathways between the zone and outside.

**interior zones**  
1506-3.1d

Pressure diagnostics is possible in a very leaky house, where a reading of 50 Pa from house-to-outside pressure differential can not be obtained. It requires the use of the computer program in the blower door computer. Refer to the blower door manual for the use of this program.

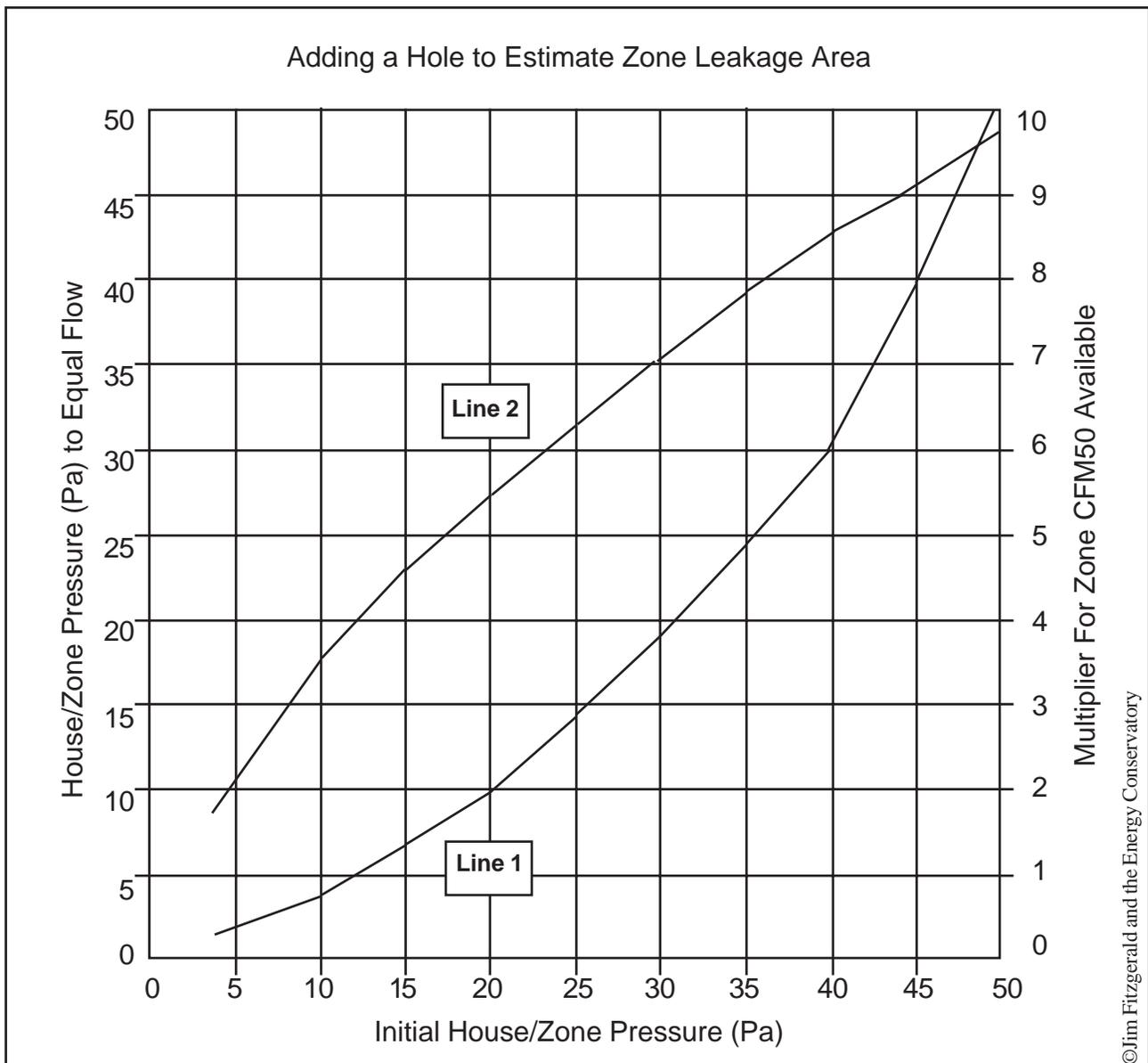
**leaky houses**  
1506-3.1e

Overall building tightness should not be overlooked while air sealing based on pressure differential readings. Potential reductions available from effective air sealing can be predicted using the advanced testing procedures and the blower door diagnostic computer program.

**building tightness  
considerations**  
1506-3.1f

*BASIC ZONE TESTING 1506-3.2*

<b>set up blower door</b> 1506-3.2a	Set up the blower door using established procedures and precautions. Run a hose to the exterior of the house making sure it will not be affected by the blower door exhaust air flow.
<b>run hoses</b> 1506-3.2a.i	Run hoses to the zones to be tested making sure the end of the hose is beyond any existing insulation, flooring or false ceilings, and will not be subjected to air flow through surrounding leakage areas when the blower door is operating.
<b>depressurize house</b> 1506-3.2a.ii	Using a separate pressure gauge set up to record house WRT outside, depressurize the house to -50 Pa. It is important to check throughout the testing procedure to assure the house to outside pressure differential remains at -50 Pa.
<b>take reading</b> 1506-3.2a.iii	Take a pressure reading from the house to the zone and record the reading.
<b>seal leakage sites</b> 1506-3.2b	Seal leaks between the zone and the house. If a large intentional penetration exists, temporarily block it while performing the testing and sealing of the zone. The goal is to achieve a pressure difference of 50 Pa. If the pressure difference of 50 Pa is not achieved, reenter the attic and find the leaks by using a smoke bottle with a blower door running. Seal the remaining leaks.
<b>take reading</b> 1506-3.2c	If an opening exists between the zone and the house, a quick test can be performed to give a visual indication of the remaining hole size. Measure the house to zone pressure with the house-to-outside pressure set to -50 Pa.
<b>determine target pressure</b> 1506-3.2d	Using figure 1506-3.2d, locate the measured pressure on the bottom line of the graph (Initial House/Zone Pressure). Read up vertically to the intersection of Line 1. Read horizontally to the left side of the graph (House/Zone Pressure to Equal Flow). The number indicated will be the new target house to zone pressure.



**It will not be cost effective to address leakage that is less than 20 in<sup>2</sup>.** Open the hole a small amount and adjust the blower door until the house-to-outside pressure is at -50 Pa. Measure the house to zone pressure. If the house-to-zone pressure is not at the target difference, repeat changing the hole size and readjusting the blower door until the target house-to-zone differential is achieved. Once the target differential is obtained, look at the size of the hole that was created. This hole approximately equals the size of the existing hole between the house and the zone.

**open hole**  
1506-3.2e

*FINDING LEAKAGE BY TESTING INTERIOR WALLS*  
*1506-3.3***zone testing**  
1506-3.3

Set up the blower door using established procedures and precautions. Run a hose to the exterior of the house making sure it will not be affected by the blower door exhaust air flow.

**set up blower door**  
1506-3.3a

Depressurize the house to -50Pa. Obtain permission to drill small holes into the interior partition walls if the wall surface is repairable with a latex spackling compound or paintable caulk. Avoid wall papered and wood panelled walls.

**set up and access walls** 1506-3.3a.i

Run a hose to the attic making sure the end of the hose is beyond any existing insulation, flooring, false ceilings, and will not be subjected to air flow through surrounding leakage areas when the blower door is running.

**run hoses**  
1506-3.3a.ii

Using a separate pressure gauge set up to record house WRT outside, depressurize the house to -50 Pa. It is important to check throughout the testing procedure to assure the house to outside pressure difference remains at -50 Pa.

**depressurize house**  
1506-3.3a.iii

If a wall/attic zone connection is being investigated, ensure that doors to conditioned or unintentionally conditioned basements remain open during the testing.

**open basement door**  
1506-3.3a.iv

Take a pressure reading from the house to the attic and record the reading.

**take reading**  
1506-3.3a.v

If the reading is less than 50 Pa, proceed with primary attic bypass sealing looking for chimney and plumbing chases, open-top partitions, dropped ceilings, and other visible openings. It can be helpful to use a smoke bottle to look for leaks with the blower door running.

**seal leakage sites**  
1506-3.3b**retest**  
1506-3.3c

Retest the attic. If the attic is still not at 50 Pa WRT the house, further air sealing is needed.

**check interior walls**  
1506-3.3d

Obtain permission to drill small holes into the interior partition walls if the wall surface is repairable with a latex spackling compound or paintable caulk. Avoid wall papered or wood panelled walls. Depressurize the house to -50 Pa. Drill small holes into the interior partition walls and take pressure readings.

A reading greater than zero indicates that a wall is connected to the outside. However, readings greater than 15Pa indicate that the wall has significant leaks to the zone (i.e. attic) or the outside (i.e. exterior wall cavities). **It is not cost-effective to address leakage for any wall with a reading of less than 15 Pa WRT the attic.**

**check interior walls (con't)**  
1506-3.3d

With the blower door running, reenter the attic and use a smoke bottle to find the remaining leaks connected to the tested walls. Seal the leaks. This may require dense packing interior wall cavities. Retest the interior walls as necessary.

**seal leakage sites**  
1506-3.3e

Retest the attic. If the attic is still not at 50 Pa and all interior walls are less than 15 Pa house to wall cavity, then further testing will be required to determine the size of the holes.

**retest**  
1506-3.3f

*DETERMINING THE AMOUNT OF LEAKAGE - ADD-A-HOLE METHOD* 1506-3.4

**"add-a-hole" method**  
1506-3.4

If there is an opening between the zone and the living area, the size of the leak can be estimated by opening the hatch/door gradually to achieve the pressure difference indicated in 1506-3.2d.

**purpose**  
1506-3.4a

Identify the unheated zones that could contain the most significant air leakage pathways. This may include attics, crawlspaces, cellars, attached garages, etc.

**identify zones**  
1506-3.4b

Access the zone and insert a vinyl tube or a probe connected to that tube.

**run hoses**  
1506-3.4c

Provide a means for checking the house-to-outside pressure difference in the same location that you will be measuring the house-to-zone pressure difference. It will be necessary to be able to control the blower door fan speed from that same area.

**provide reference check**  
1506-3.4d

Depressurize the house to -50 Pascal pressure difference and record the house-to-zone pressure difference (see Figure 1506-3.2d). Find the House/Zone Pressure reading along the bottom line of the graph, follow the vertical line to where it intersects LINE 1 and locate where that horizontal line intersects the left hand column (House/Zone Pressure to Equal Flow).

**determine target pressure**  
1506-3.4e

<b>open hole</b> 1506-3.4f	Open the hatch or door into the zone until you have dropped the house-to-zone pressure to the level indicated on the left hand column of Figure 1506-3.2d. The house-to-outside pressure will need to be maintained at 50 Pa. When the pressure drop is stable, measure the amount of opening around the hatch/door. Close the hatch/door and turn off the blower door.
<b>estimate leakage rate</b> 1506-3.4g	<p>Convert the hatch/door measurements to square inches. Consult Figure 1506-3.2d to determine the CFM50 per sq.in. conversion factor for the initial house-to-zone pressure difference by following the initial house/zone pressure reading up the vertical line to where it intersects LINE 2.</p> <p>The horizontal line that intersects the right hand column (Multiplier for Zone CFM50 Available) is the number of CFMs per square inch of opening. Multiply the square inch opening by that conversion factor to find the CFM50 leakage estimate from that zone.</p>
<b>test other zones</b> 1506-3.4h	Proceed to the other zones and repeat this procedure. As the zone pressures are measured, inspect the areas for indications of the primary air leakage pathways.
<i>DETERMINING THE AMOUNT OF LEAKAGE - ESTIMATE VENT OPENING METHOD 1506-3.5</i>	
<b>NFVA method</b> 1506-3.5	If there is no interior attic access or it cannot be opened while a blower door is operating, the following method can be used to roughly estimate the size of the leaks across the house-to-zone boundary.
<b>take reading</b> 1506-3.5a	Note the pressure drop across the attic ceiling. Using Figure 1506-3.5a (Zone pressures and Leakage Rate), find the most appropriate house-to-zone pressure level.
<b>estimate attic ventilation</b> 1506-3.5b	Estimate the amount of ventilation opening (in NFVA) between the attic and the outside. It may be necessary to estimate the openings, especially when there is a continuous perforated soffit. Be very conservative with estimates.
<b>estimate leakage rate</b> 1506-3.5c	Calculate the amount of leakage across the house-to-zone boundary by multiplying the ventilation area by the appropriate house-to-zone multiplier (fraction). This will provide an estimate of how large a hole, in square inches, there is between the house and zone.

**Zone Pressure and Leakage Rates**

Attic to Outside

House to Attic

Zone Pressures		Relative Size of Leaks	
House-Zone	Zone-Outside	House-Zone	Zone-Outside
12	38	2	1
25	25	1	1
37	13	.5	1
41	9	.33	1
45	5	.25	1
48	2	.13	1
49	1	.08	1

Note: Zone pressures only tell us the relative size of the leaks between that zone and the inside compared to that zone and the outside. To know whether the leakage rate is significant, determine how leaky one side is, or else use one of the measurement methods (e.g. open a door).

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**USING PRESSURE TO DETERMINE ZONE INTERCONNECTIONS 1506-3.6**

This test is used to determine if two separate zones are connected. The two zones may be an attic and basement, or a kneewall attic and upper attic.

**zone interconnection test**  
1506-3.6

Set up the blower door using established procedures and precautions. Run a hose to the exterior of the house making sure it will not be affected by the blower door exhaust air flow.

**set up blower door**  
1506-3.6a

Run hoses to the zones to be tested making sure the end of the hose is beyond any existing insulation, flooring, false ceilings, and will not be subjected to air flow through surrounding leakage areas when the blower door is running.

**run hoses**  
1506-3.6a.i

Close access doors to the two zones being checked.

**close access doors**  
1506-3.6a.ii

Using a separate pressure gauge set up to record house WRT outside, depressurize the house to -50 Pa. It is important to check throughout the testing procedure to assure the house to outside pressure differential remains at -50 Pa.

**depressurize house**  
1506-3.6a.iii

**take reading**  
1506-3.6a.iv

Record the pressure differential between the house and one of the zones.

**open one access door**  
1506-3.6a.v

Open the door to the other zone and adjust the blower door so the house-to-outside pressure is back to -50 Pa if needed.

**take reading**  
1506-3.6a.vi

Recheck the pressure differential between the house and the first zone. If the pressure differential dropped more than 2 Pa, there is a direct connection between the two zones.