

# Blower Door Testing and Demonstration

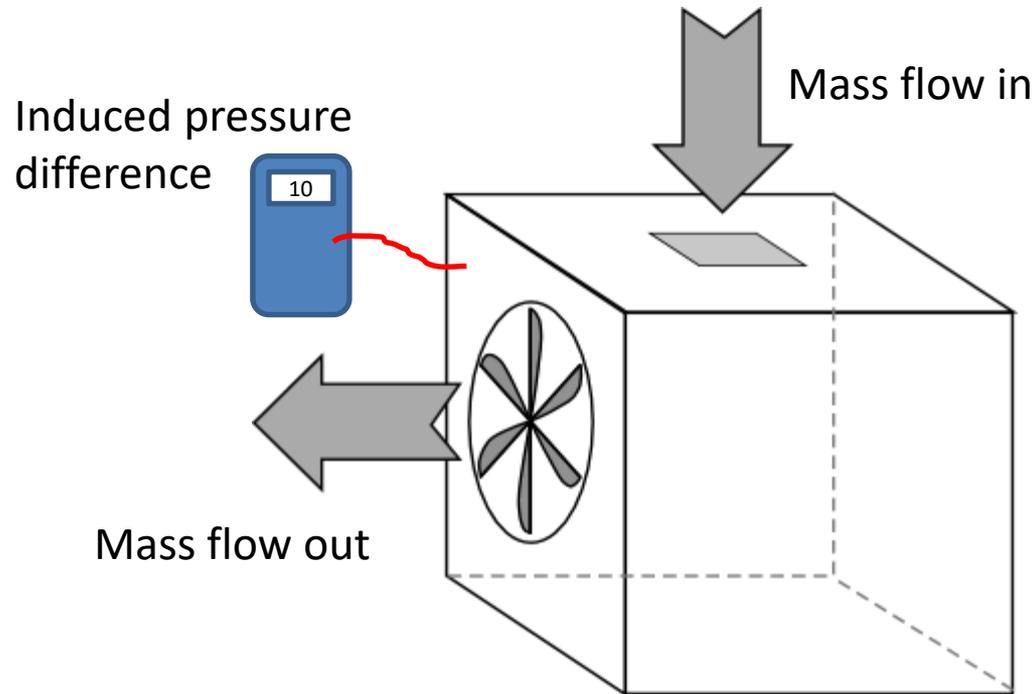


Paul Morin

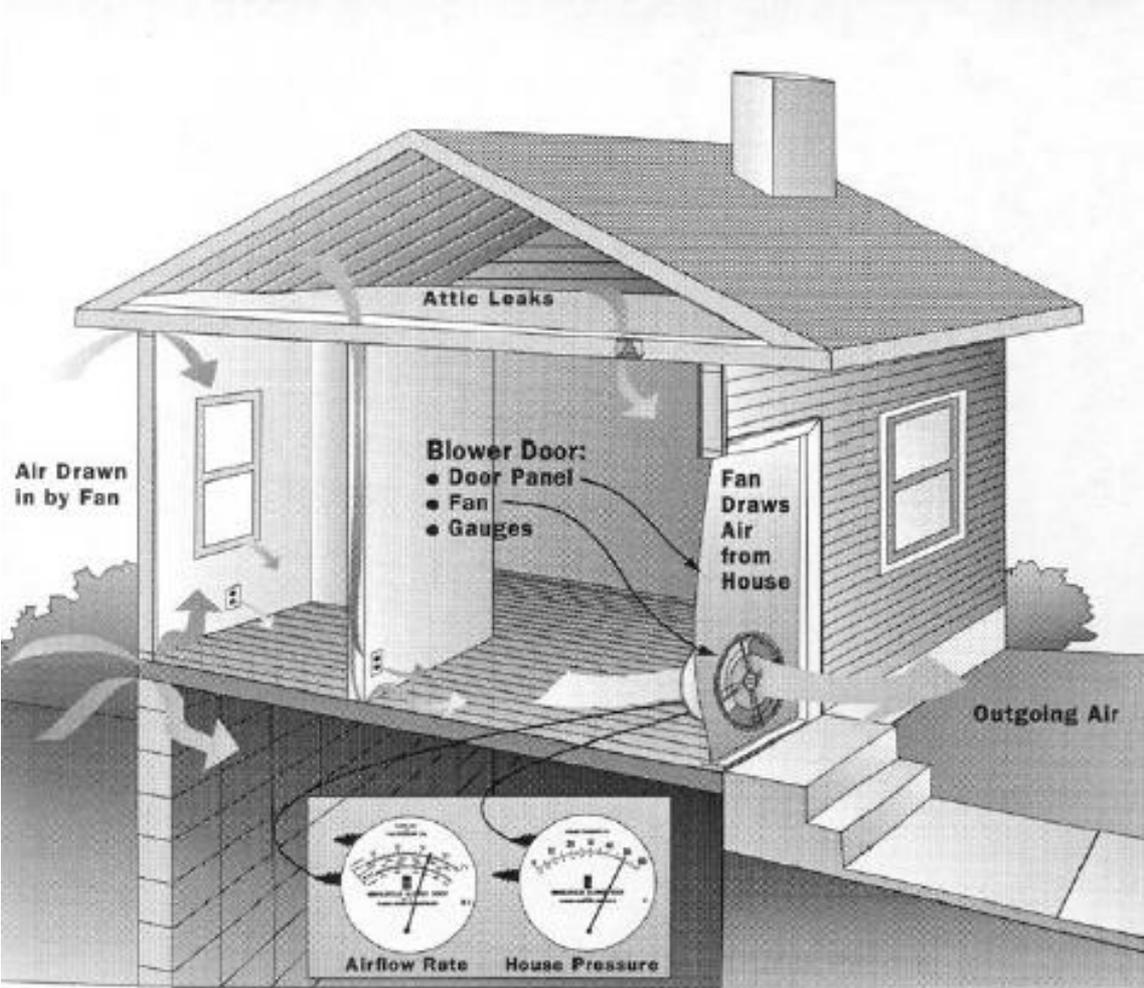
# Intro Questions

- » How many are using blower doors?
- » New or existing homes?
- » Using infrared (IR Cameras)?
- » Blower door guided air sealing?
- » Measuring zonal pressures?
- » What kind of problems are you seeing?

# Fan Pressurization Airtightness Test



# What is a blower door



Calculate Leakage from House Pressure and Airflow Rate

# What is a blower door used for

- » Document how leaky a house is
- » Find the air leaks or duct leaks
- » Document improvement after sealing leaks
- » Determine if a home needs mechanical ventilation
- » Help solve complex problems

# Finding leaks

## » Smoke puffer



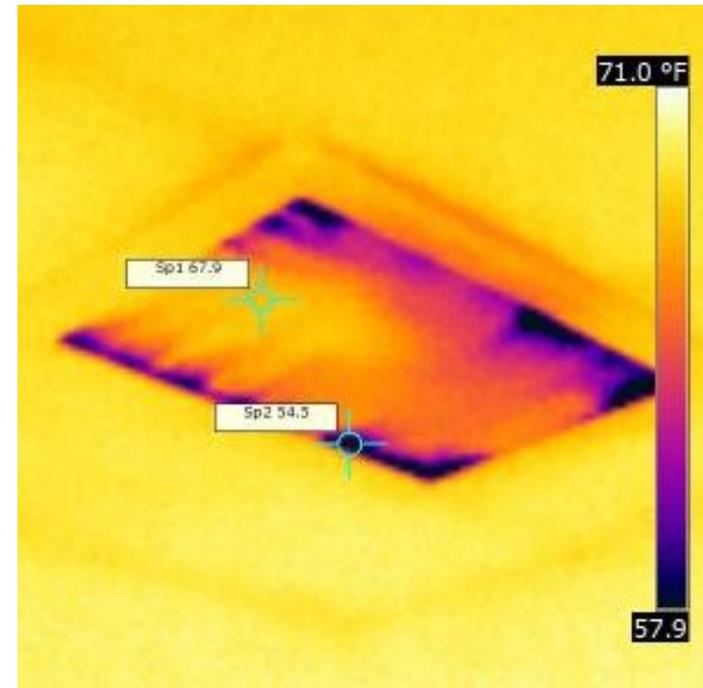
# IR Camera

- » Find missing insulation or air leaks

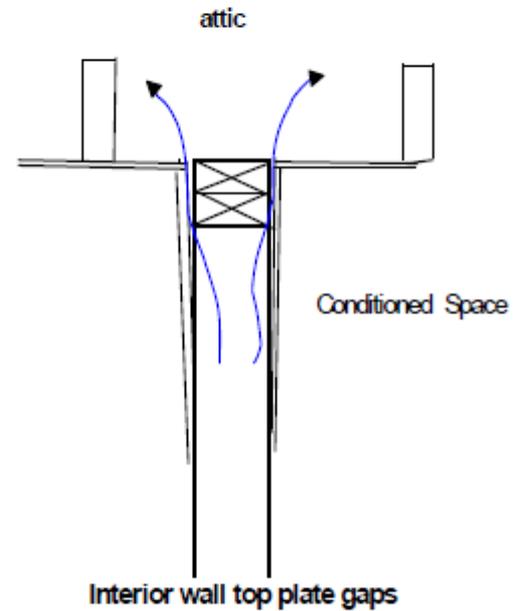
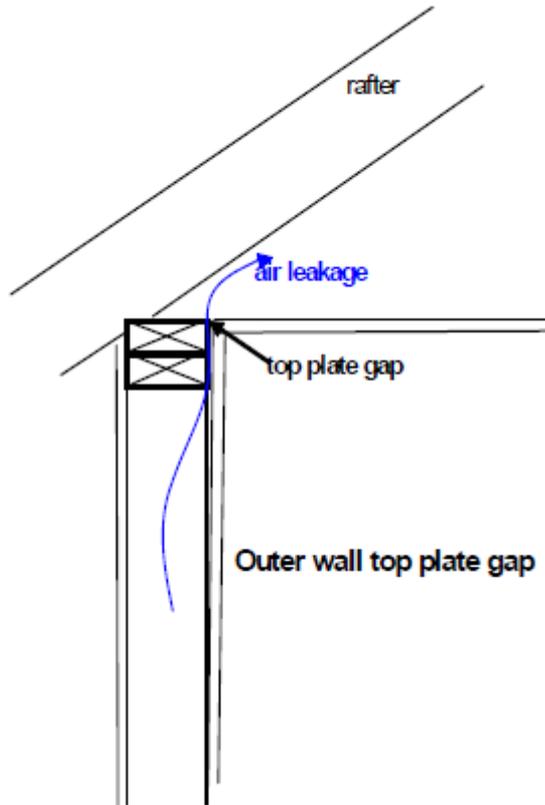


# IR camera

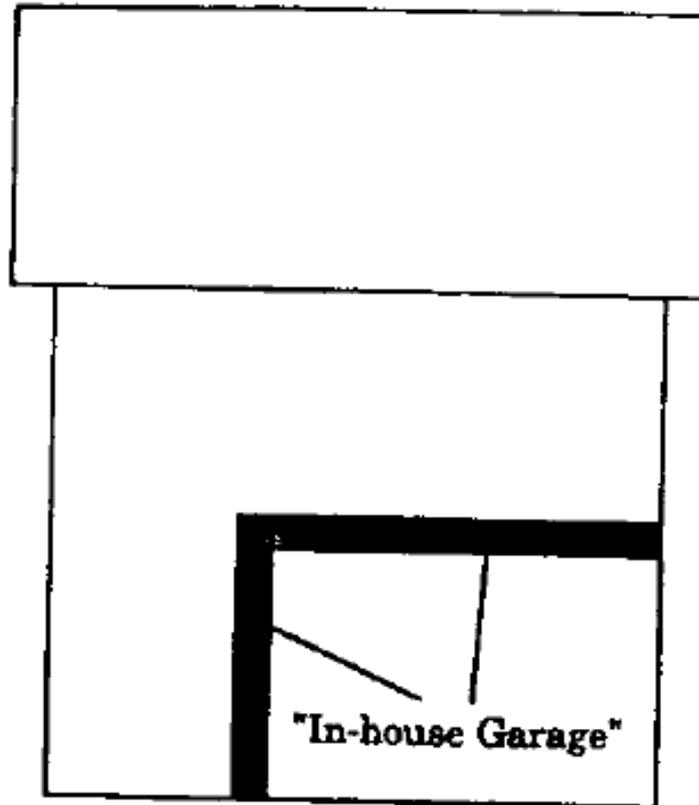
- » From inside the house,  $10^{\circ}\text{F}$  ( $5.5^{\circ}\text{C}$ )  $\Delta\text{T}$
- » From attic while house is pressurized



# Critical junction points



# Critical junction points



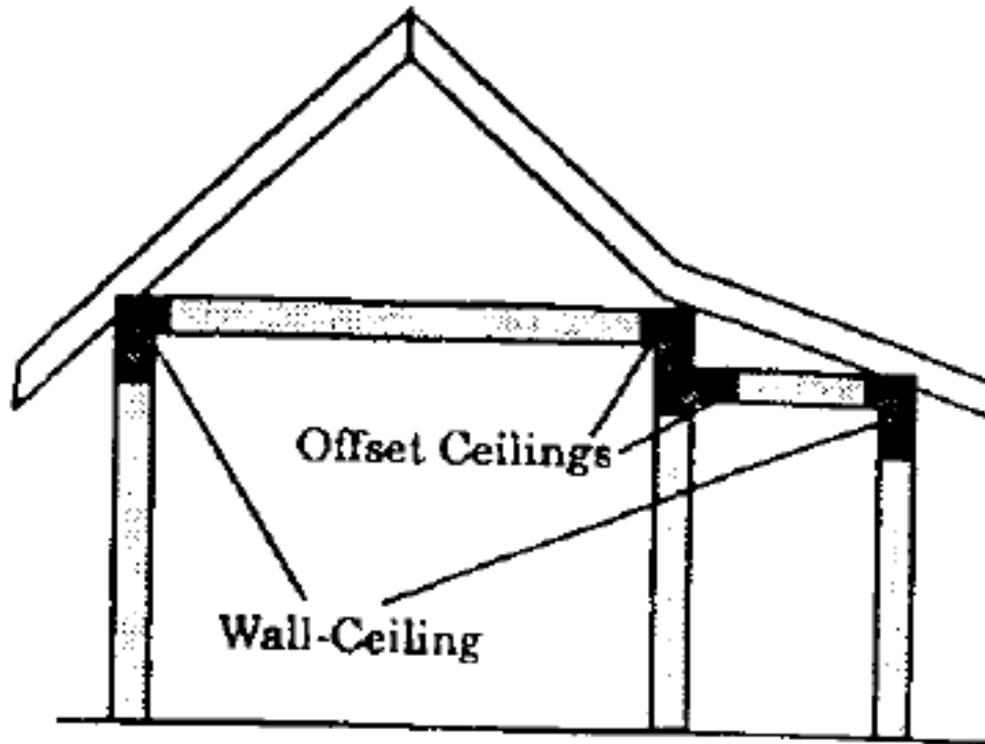
# Seal between house and garage



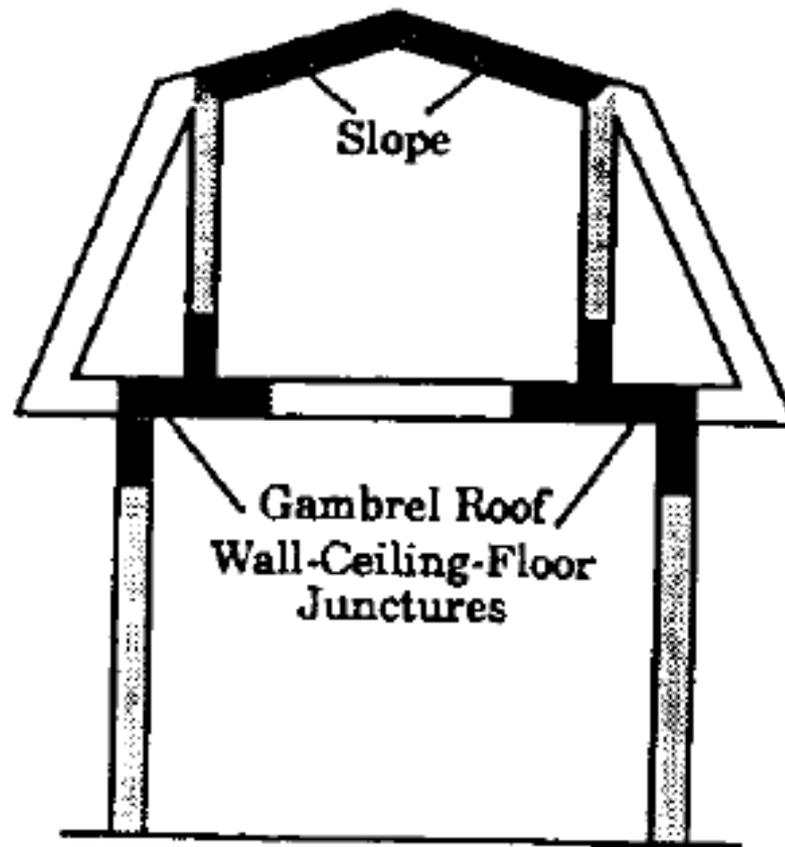
# Ductwork or plumbing through a garage



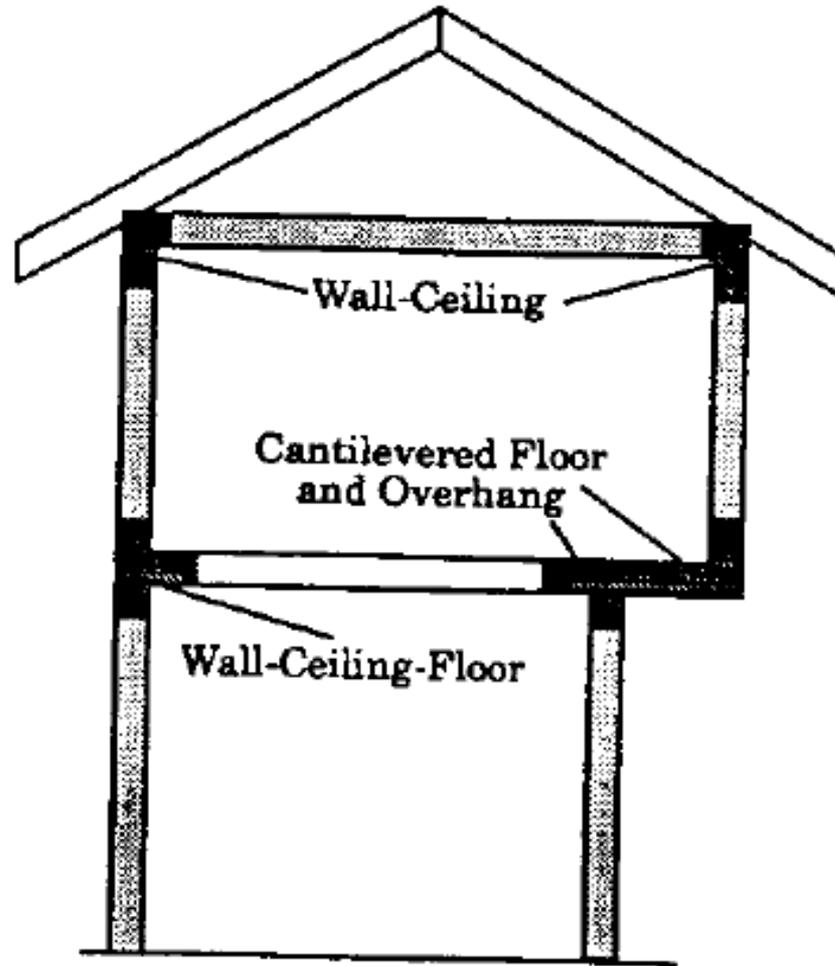
# Critical junction points



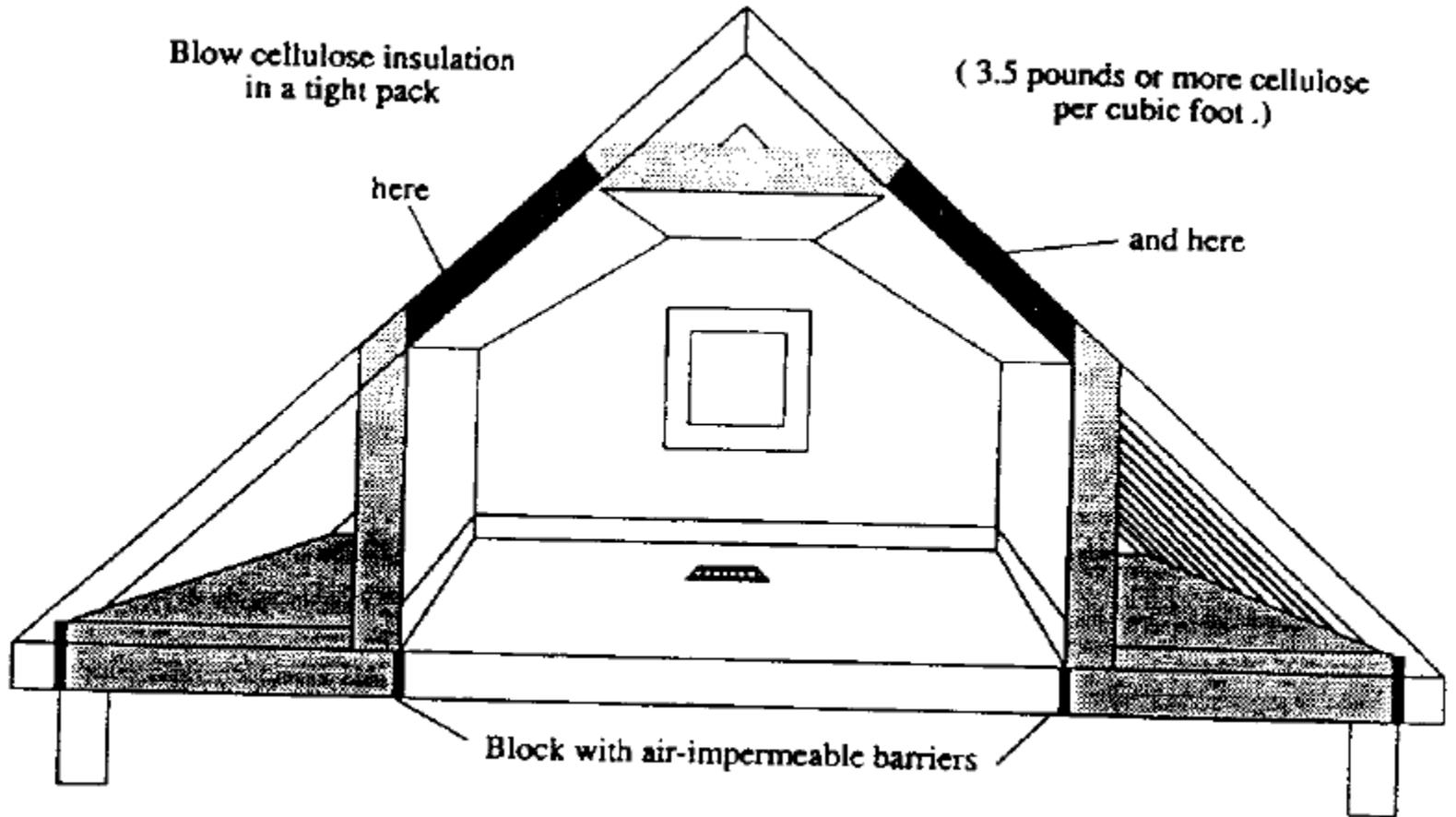
# Critical junction points



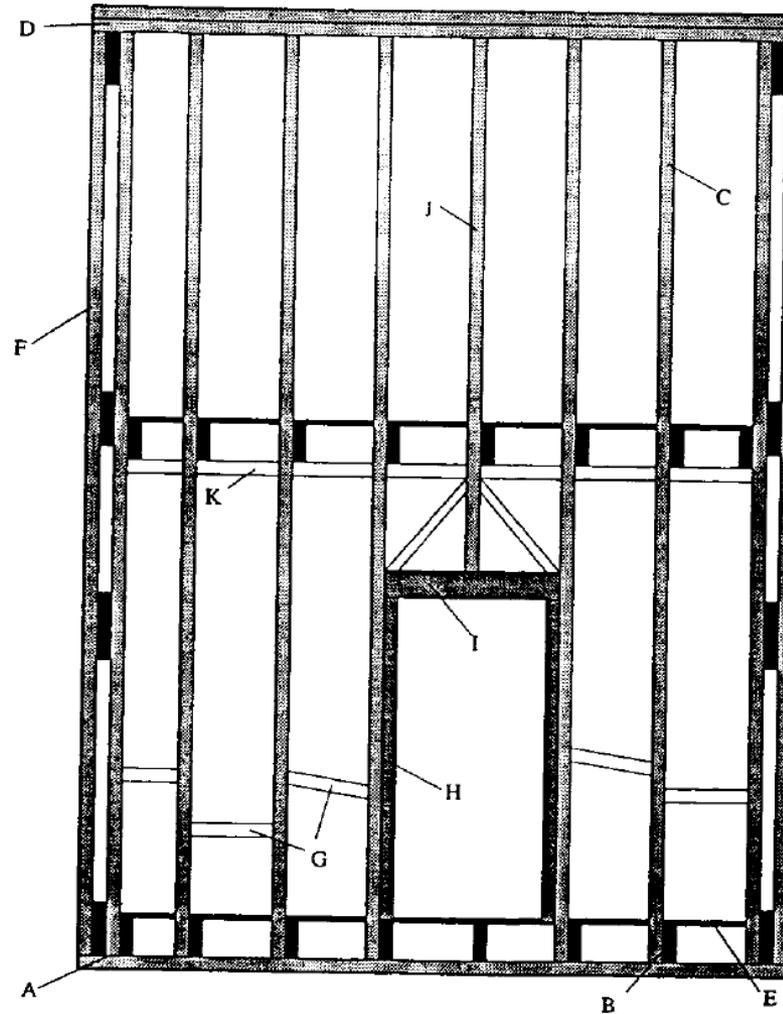
# Critical junction points



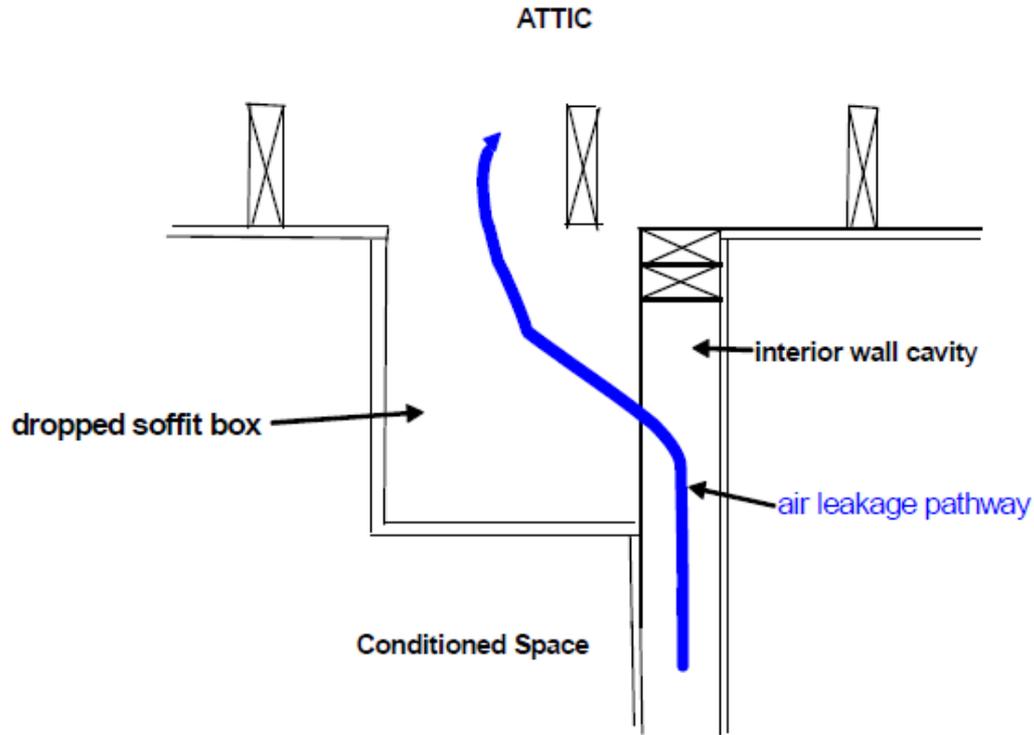
# Critical junction points



# Critical junction points

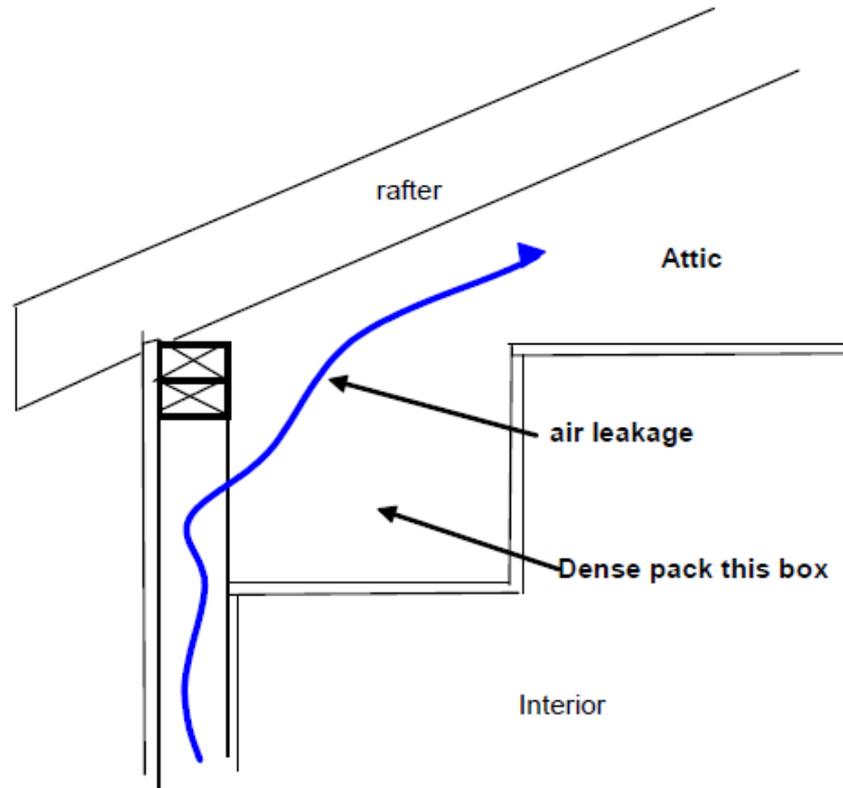


# Critical junction points



Interior wall dropped soffit

# Critical junction points



Exterior wall dropped soffit

# Critical junction points



# Critical junction points



# Critical junction points



# Critical junction points



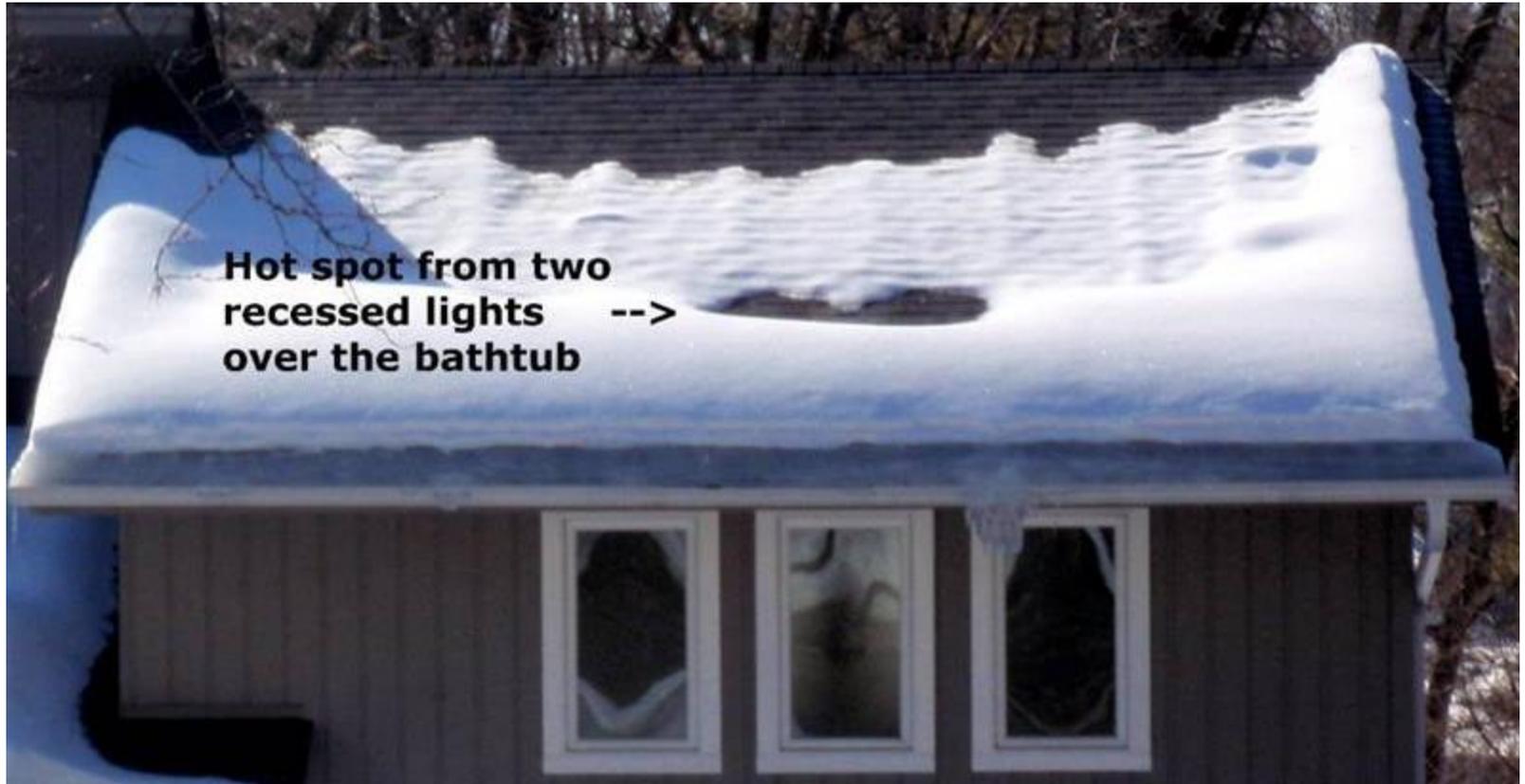
# Snow melt patterns



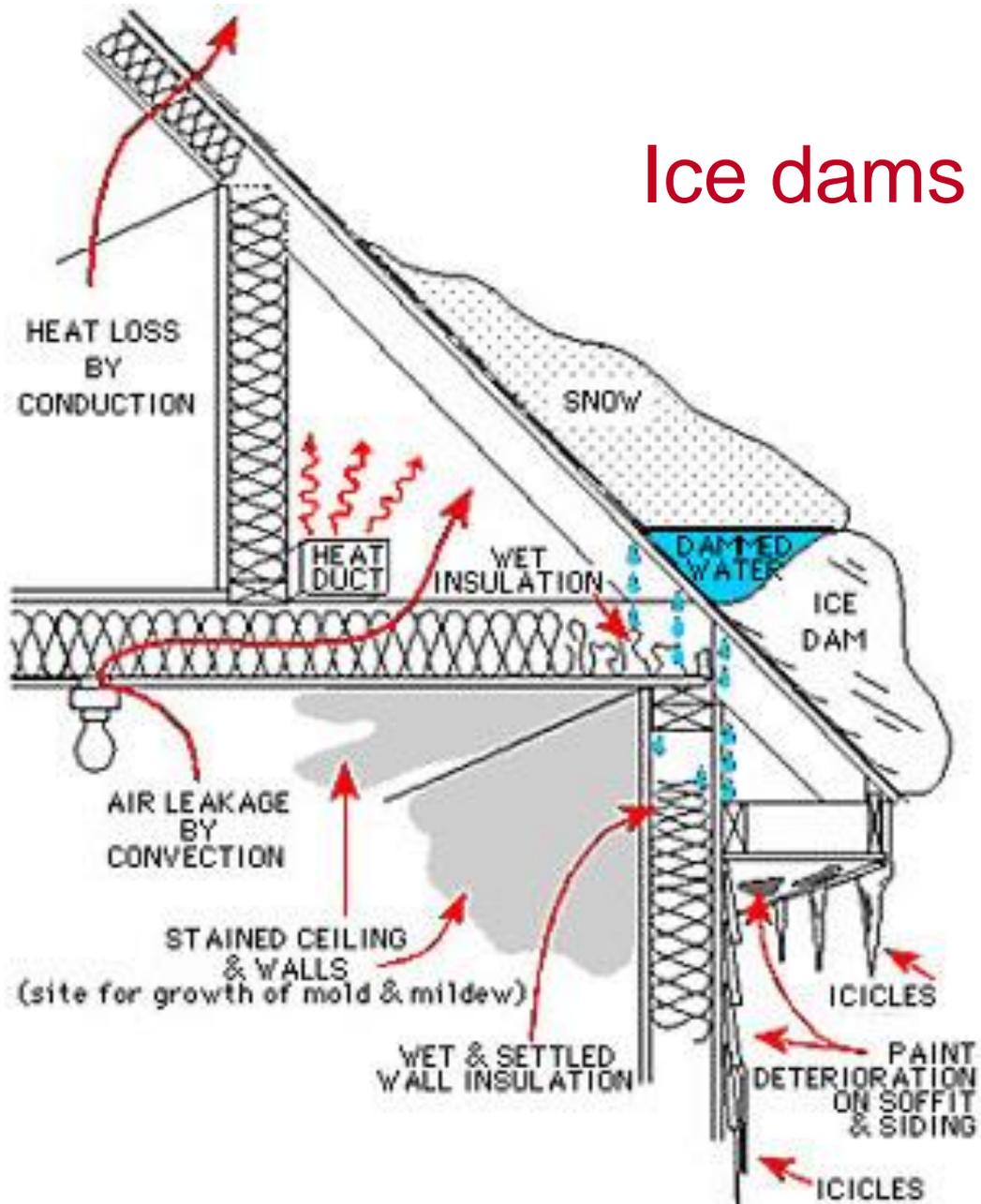
# Snow melt patterns



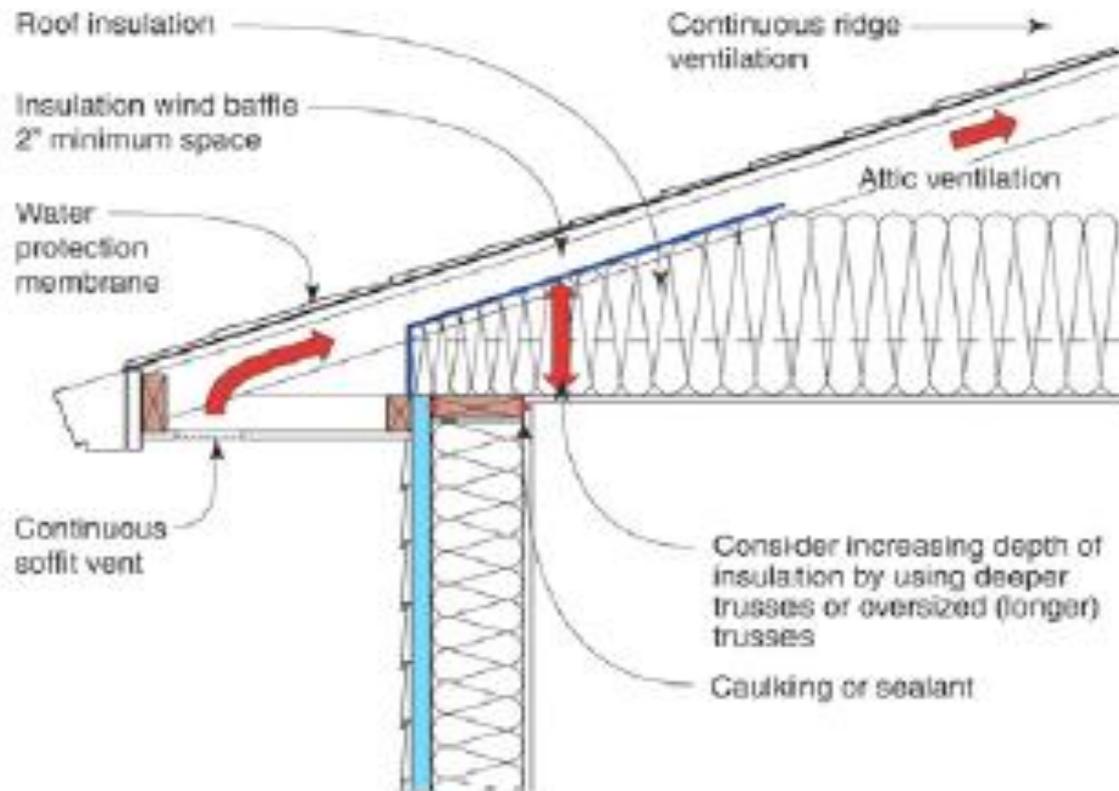
# Snow melt patterns



# Ice dams



# Attic venting



# Attic condensation



# Attic condensation



# Attic condensation

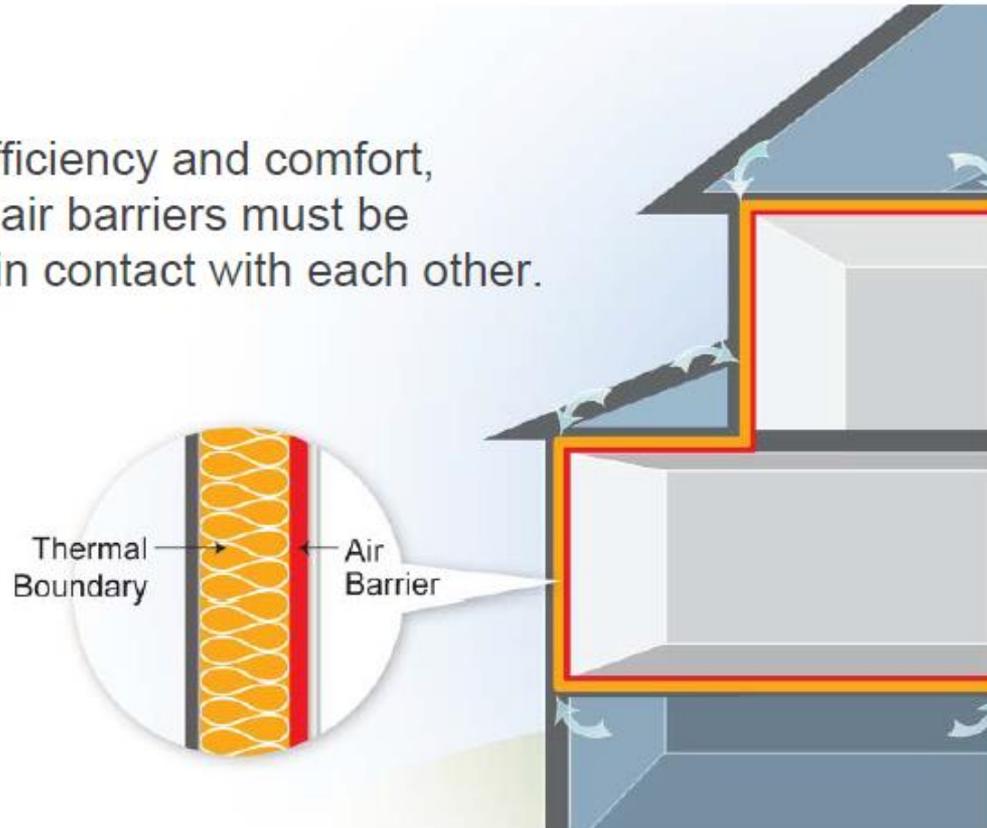


# Attic condensation

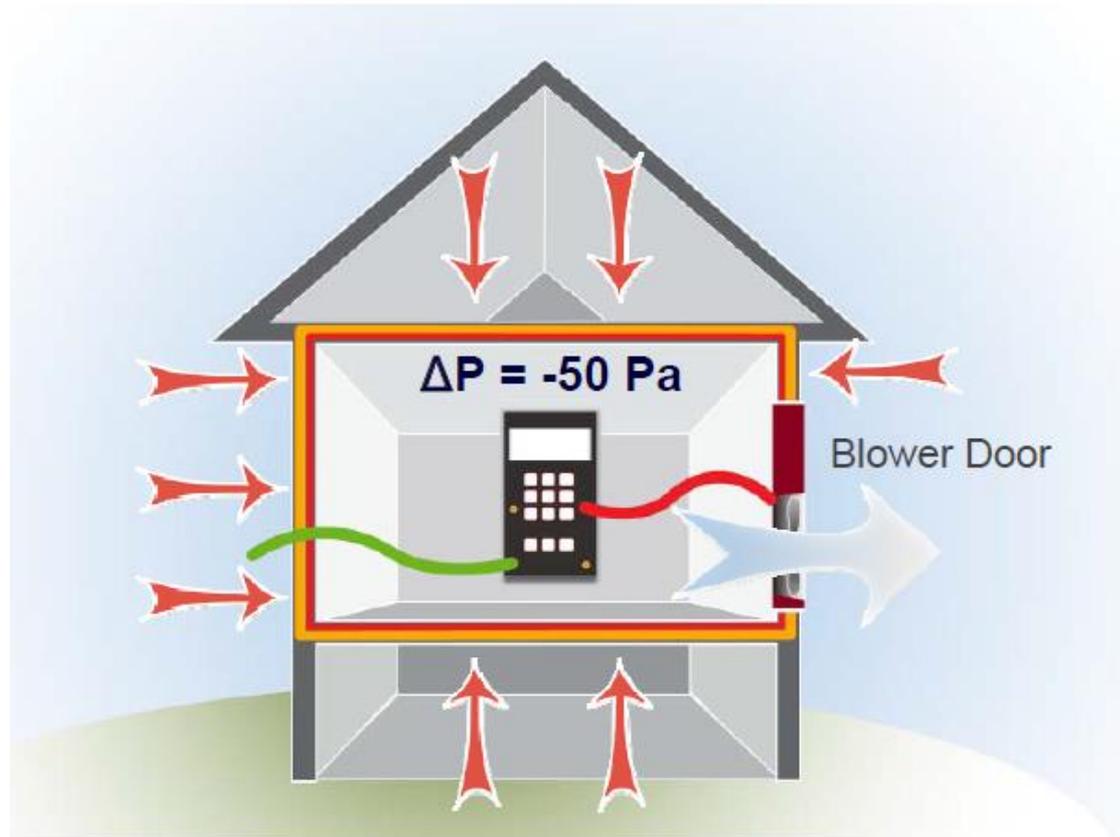


# Thermal and Air Barriers

For maximum efficiency and comfort, the thermal and air barriers must be continuous and in contact with each other.

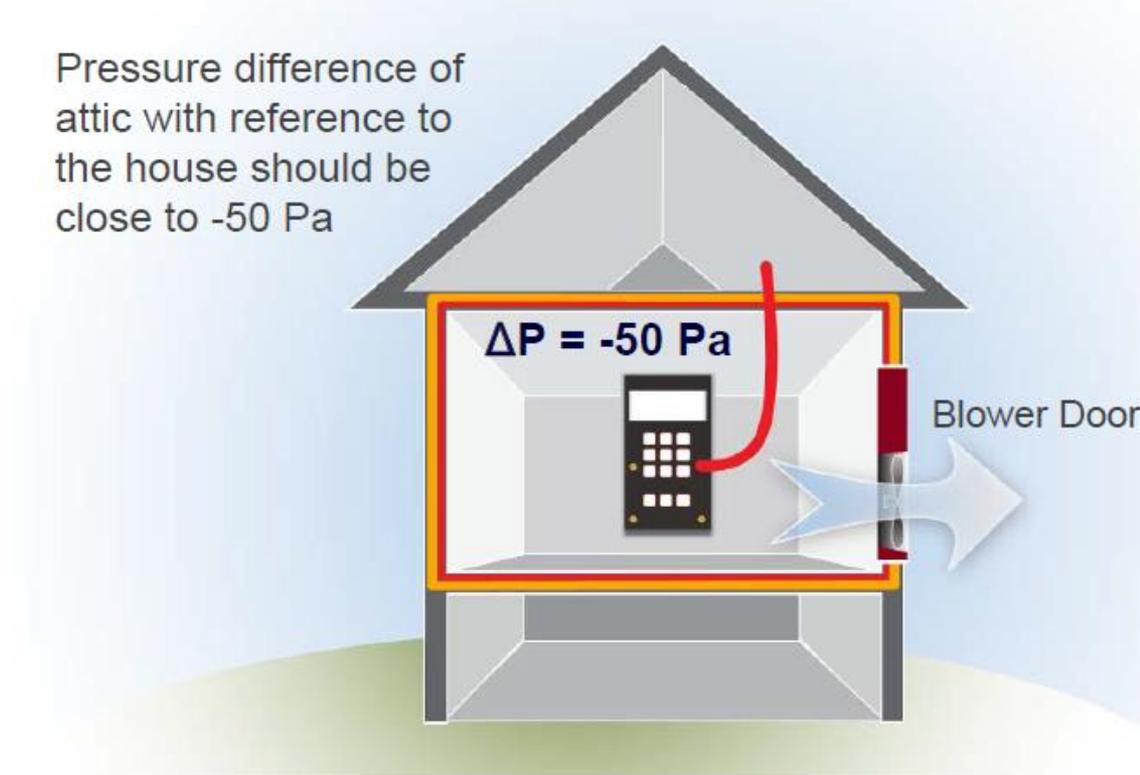


# Blower door test



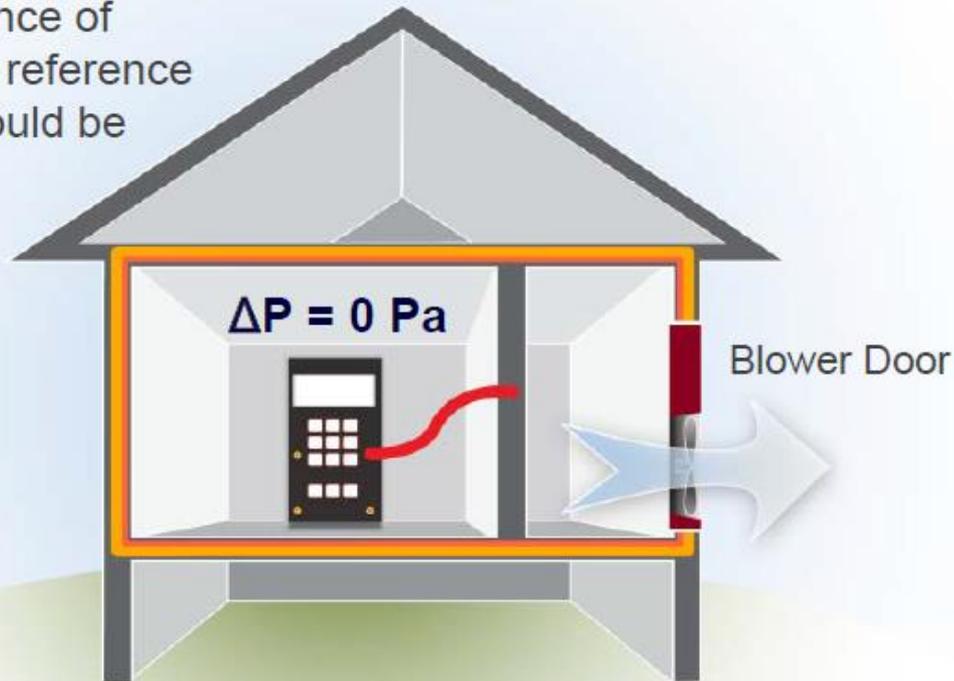
# Zone Pressure Diagnostics

Pressure difference of attic with reference to the house should be close to -50 Pa

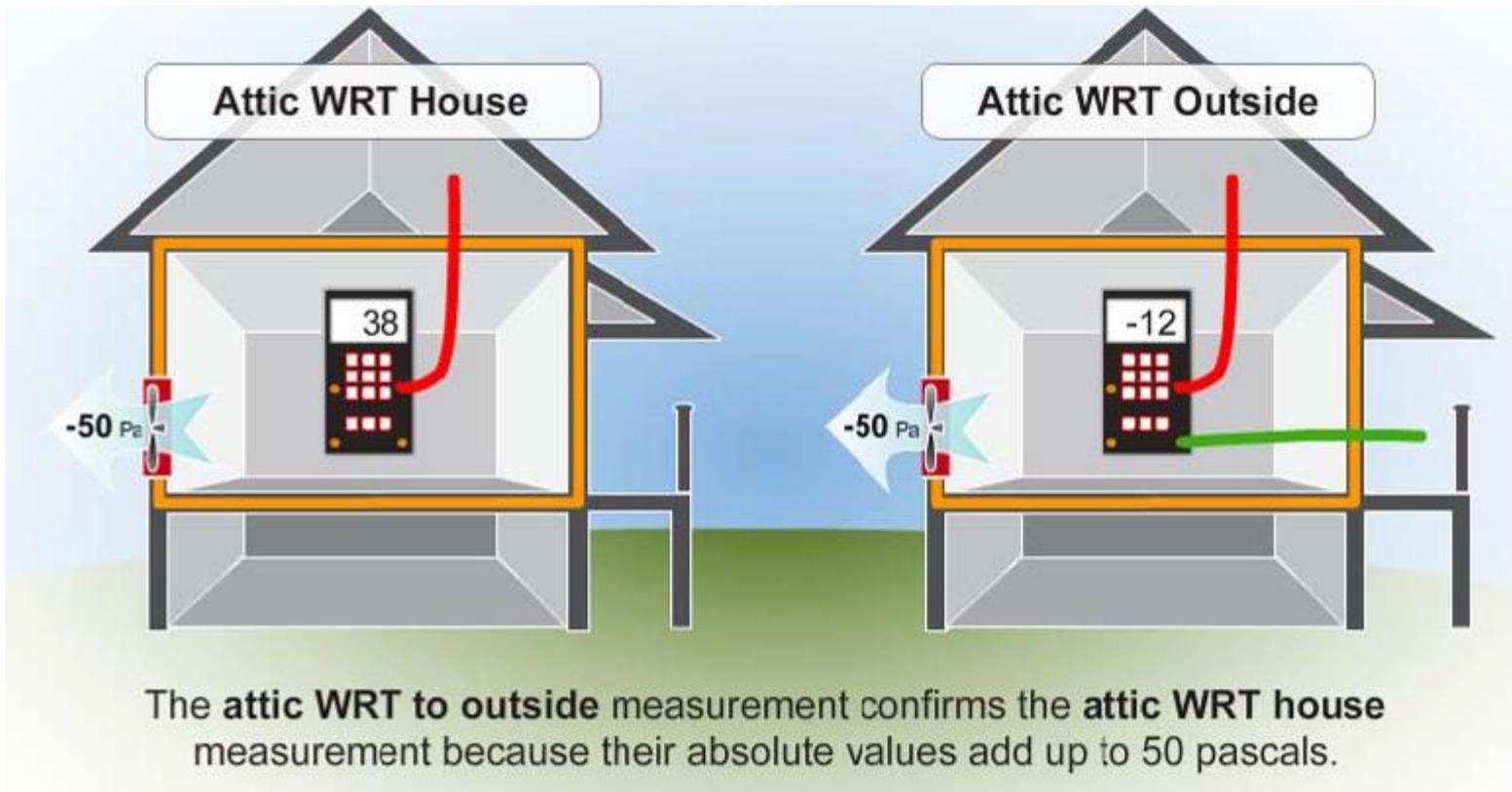


# Zone Pressure Diagnostics

Pressure difference of interior wall with reference to the house should be close to 0 Pa



# Verifying Zonals



# Outside zones and inside zones

Unheated zones **OUTSIDE** the house should be closer to **50 pascals**.

## Outside Zones (Unheated)

- Attics
- Garage
- Porches (sometimes)
- Crawlspace (sometimes)

Heated zones **INSIDE** the house should be closer to **0 pascals**.

## Inside Zones (Heated)

- Interior walls
- Floors between stories
- Porches (sometimes)
- Crawlspace (sometimes)
- Basement

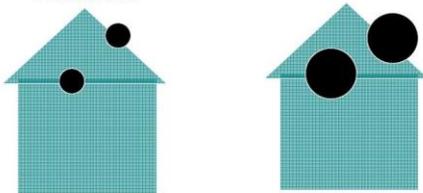
# Zone Pressure Diagnostics

- » Measure attic or attached garage pressure with house at 50 Pa
- » This tells you a relative hole size
- » Need to open a hatch or door and retest to learn CFM between house and attic

## Pressures and Leakage

Attic Zonal Reading of 25pa

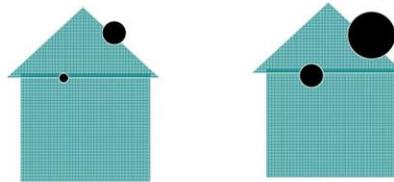
Means hole between Attic and House is Same size as Hole Between Attic and Outdoors



## Pressures and Leakage

Attic Zonal Reading of 48pa

Means hole between Attic and House is 1/8<sup>th</sup> size of Hole Between Attic and Outdoor



## Ratios of Pressures to Leakage

Zone Pressures		Relative Size of Leaks	
Zone-House	Zone-Out	Zone-House	Zone-Out
12	38	2	1
25	25	1	1
37	13	1/2	1
41	9	1/3	1
45	5	1/4	1
48	2	1/8	1
49	1	1/13	1

# Types of zone testing

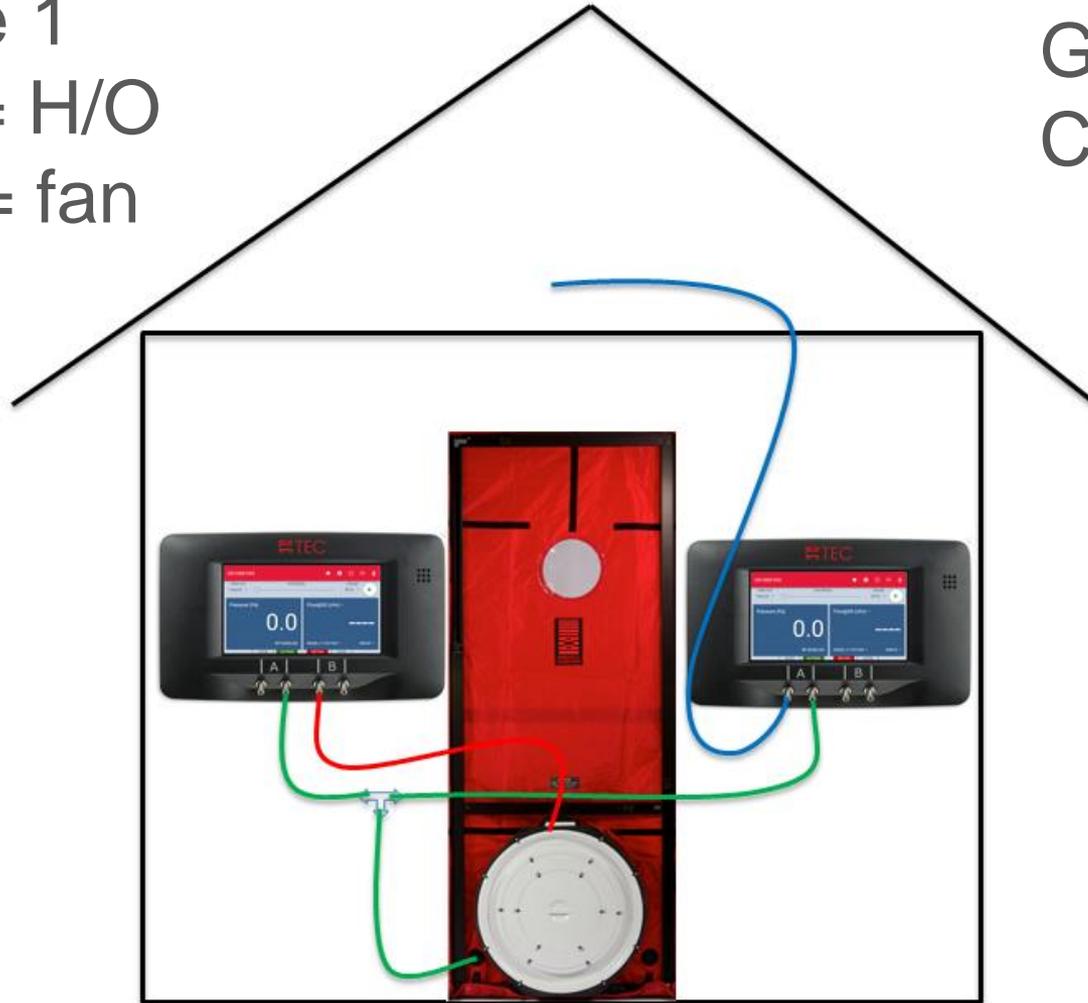
- » Direct pressure measurement
  - Is zone more inside of more outside
  - Do pressure and thermal boundaries line up
- » Advanced zone measurements
  - Record CFM50 and zonal reading
  - Open a hatch or door to that zone
  - Record the new CFM50 and zonal reading
  - Enter results into software

# 'Add a Hole' Procedure

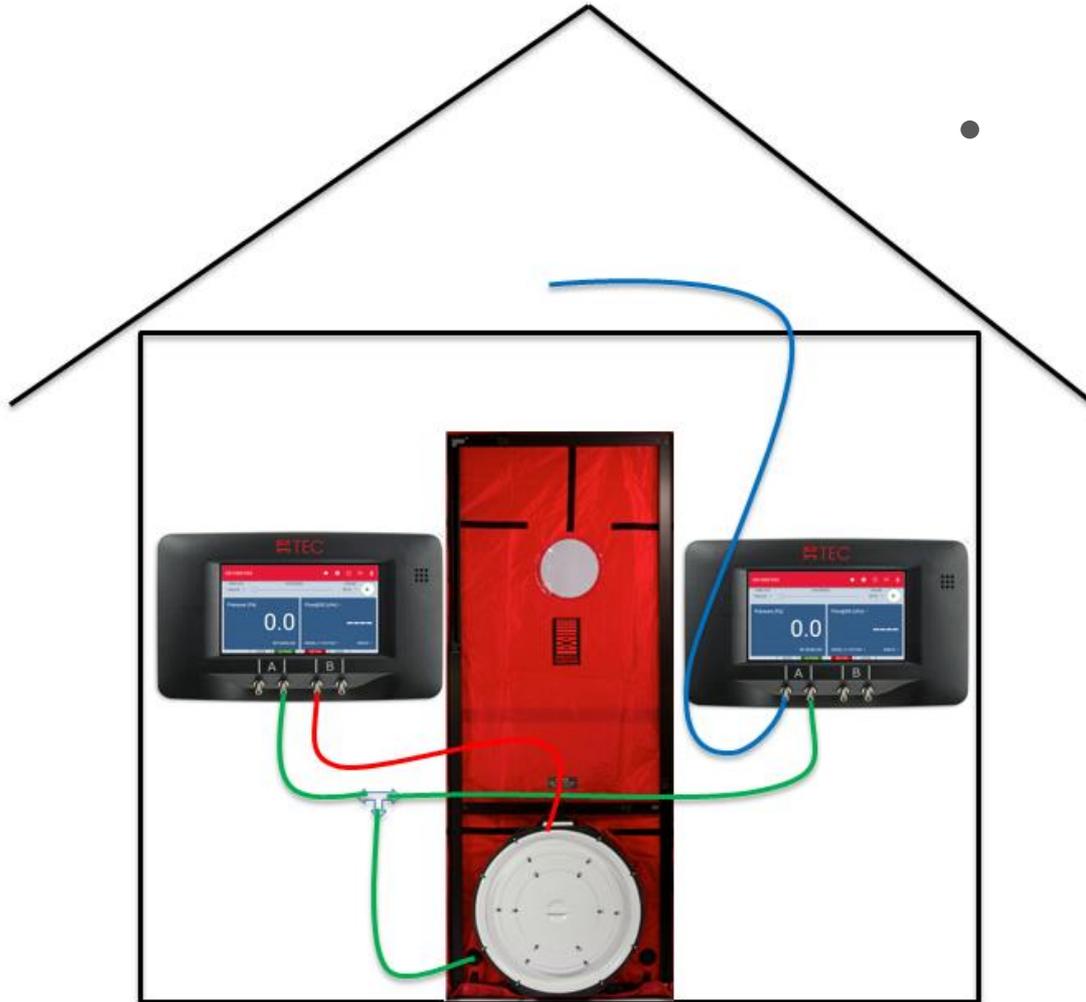
## Baseline both gauges

Gauge 1  
Ch A = H/O  
Ch B = fan

Gauge 2  
Ch A = Z/O



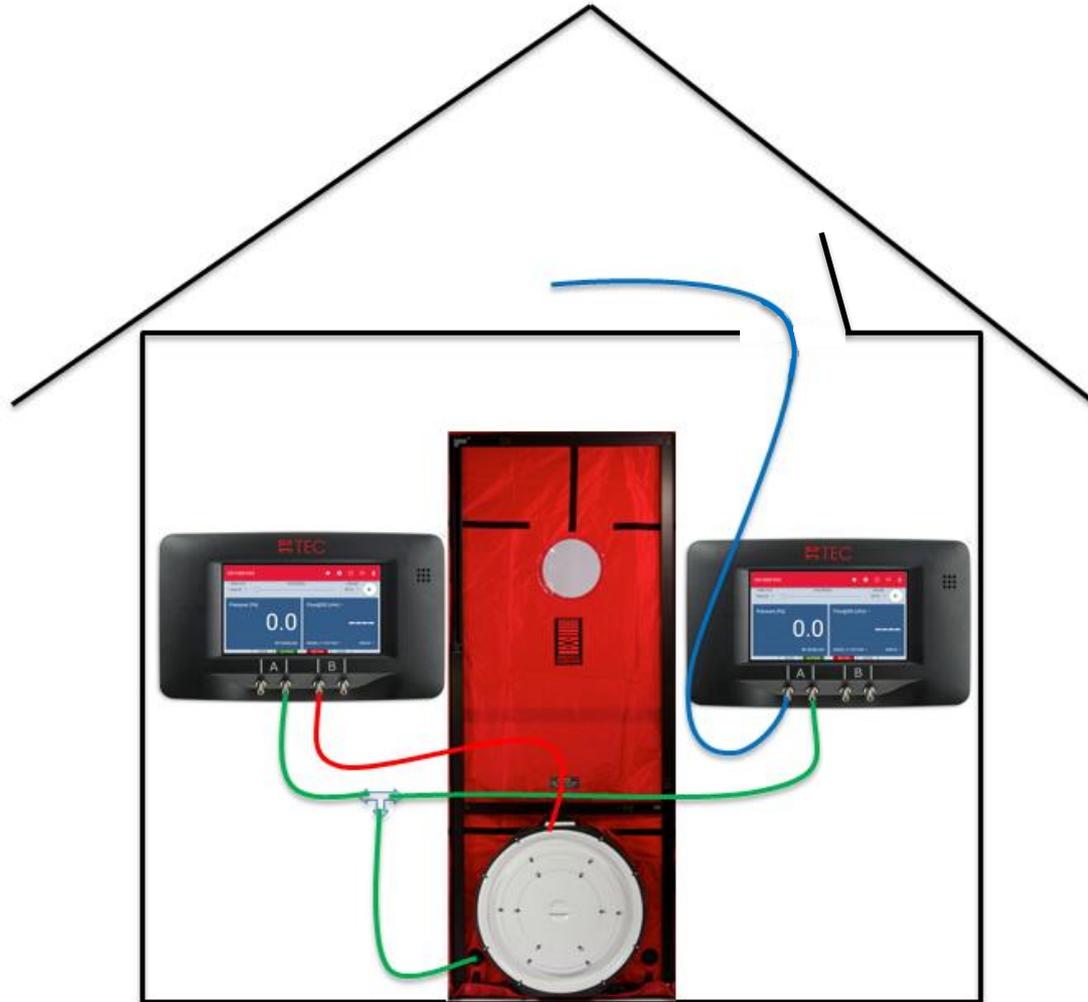
# Bring house to 50 Pa



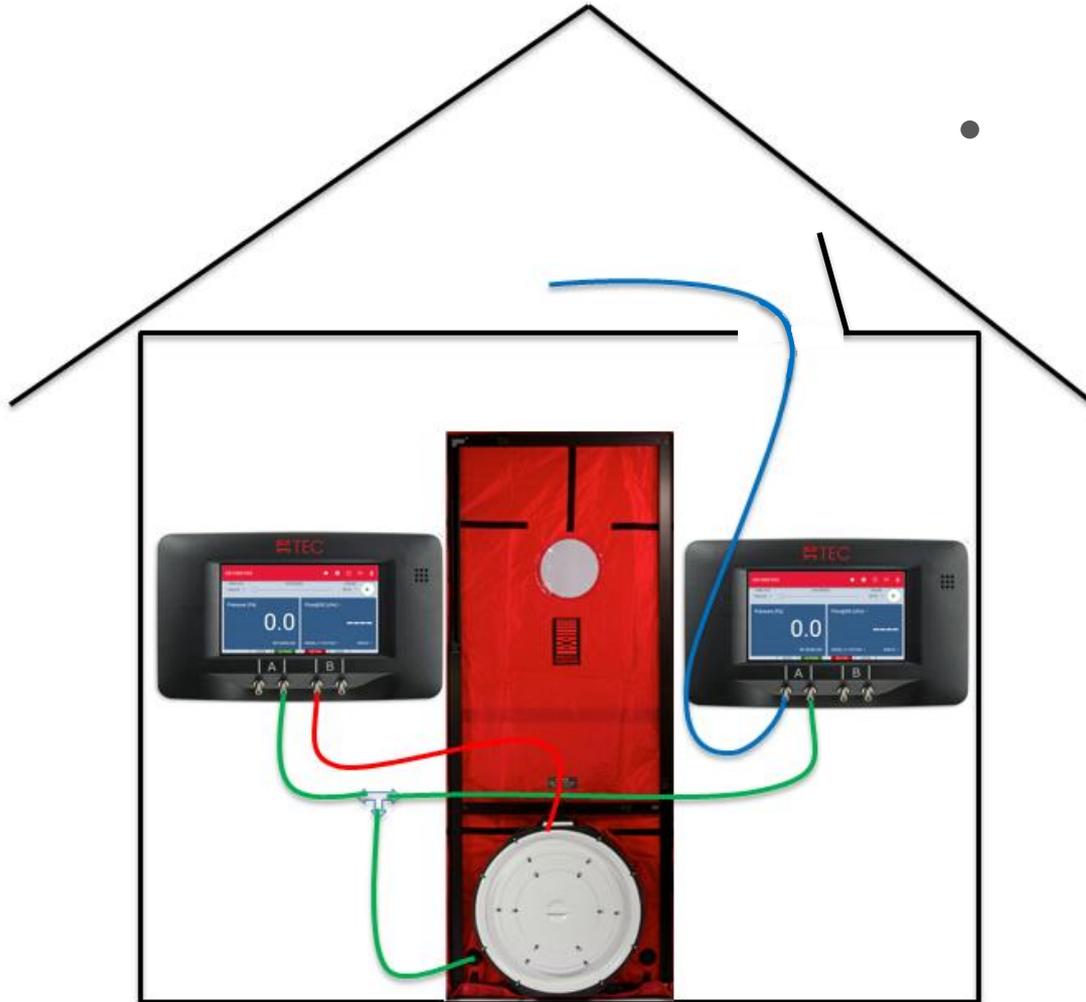
- Record results
  - CFM50
  - Zonal pressure



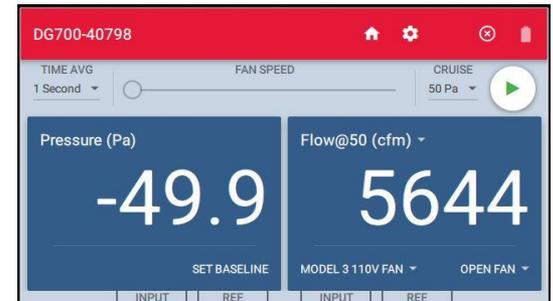
# Open hatch and redo the baseline



# Bring house to 50 with hatch open



- Record results
  - CFM50
  - Zonal pressure



# Enter Results into Software

» Rick Karg's website – web based software  
<http://www.residentialenergydynamics.com>

RED  
RESIDENTIAL ENERGY DYNAMICS  
INNOVATIVE SOFTWARE SOLUTIONS

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RED Calc Pro Tools Development

Cost to Operate Ventilation

Weather Station Data tool

ZPD



Reset Print

### Zone Pressure Diagnostics

Zone tested

Blower door test type

Use Advanced Inputs

#### Initial Zone Configuration

Pressures [Pa]	BD off	BD on	$\Delta P$
House wrt outdoor	<input type="text" value="0"/>	<input type="text" value="-50"/>	-50
Zone wrt outdoor <input type="text" value=""/>	<input type="text" value="0"/>	<input type="text" value="-9"/>	-9

Blower door flow adjusted to 50 Pa [] 3644

Zone leakage ratio (zone-to-house : zone-to-outdoor) = 1 : 2.7

Both baseline adjusted

Set to 'Zone WRT Outside'

#### Modified Zone Configuration

Hole/door located between zone and

Type of modification

Pressures [Pa]	BD off	BD on	$\Delta P$
House wrt outdoor	<input type="text" value="0"/>	<input type="text" value="-49.9"/>	-49.9
Zone wrt outdoor <input type="text" value=""/>	<input type="text" value="0"/>	<input type="text" value="-40.4"/>	-40.4

Blower door flow adjusted to 50 Pa [] 5644

Reset base w/ hatch open  
Both baseline adjusted

CFM reduction possible

#### Results for Initial Zone Configuration

	Leakage @ 50Pa [ <input type="text" value="CFM"/> ]	Leakage area [ <input type="text" value="in2"/> ]	$\pm$
Zone-to-house	1370 $\pm$ 390	146 $\pm$ 42	29%
Zone-to-outdoor	3700 $\pm$ 440	390 $\pm$ 57	15%
Through zone	1210 $\pm$ 310		26%

Percent of whole-house leakage passing through the zone = 33%

in<sup>2</sup> of venting  
  
The Energy Conservatory

# Crawlspace or basement insulation



# Blower door test demo

- » Single point test at 50 Pascals
- » Multipoint test following a test standard
- » Use software or apps to do an automated test and generate a report



# Questions?

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