

Air-Sealing Beyond the Attic

Energy Design Conference

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February 26, 27, 2013

About WECC

- Proving the value of energy efficiency and renewable energy since 1980
- National leader in administering, implementing, and designing energy programs
- Anticipate and understand trends that affect the marketplace
- Exceed client goals and maximize program budgets



Agenda

- Building Science: nature of air-leaks
- Garages: Attached and Tuck-under
- Basements, Crawl-spaces: interior
- Foundations: Interior and Exterior
- Windows, Doors
- Walls: Interior and Exterior
- Interstitial spaces
- Chimneys

Objectives

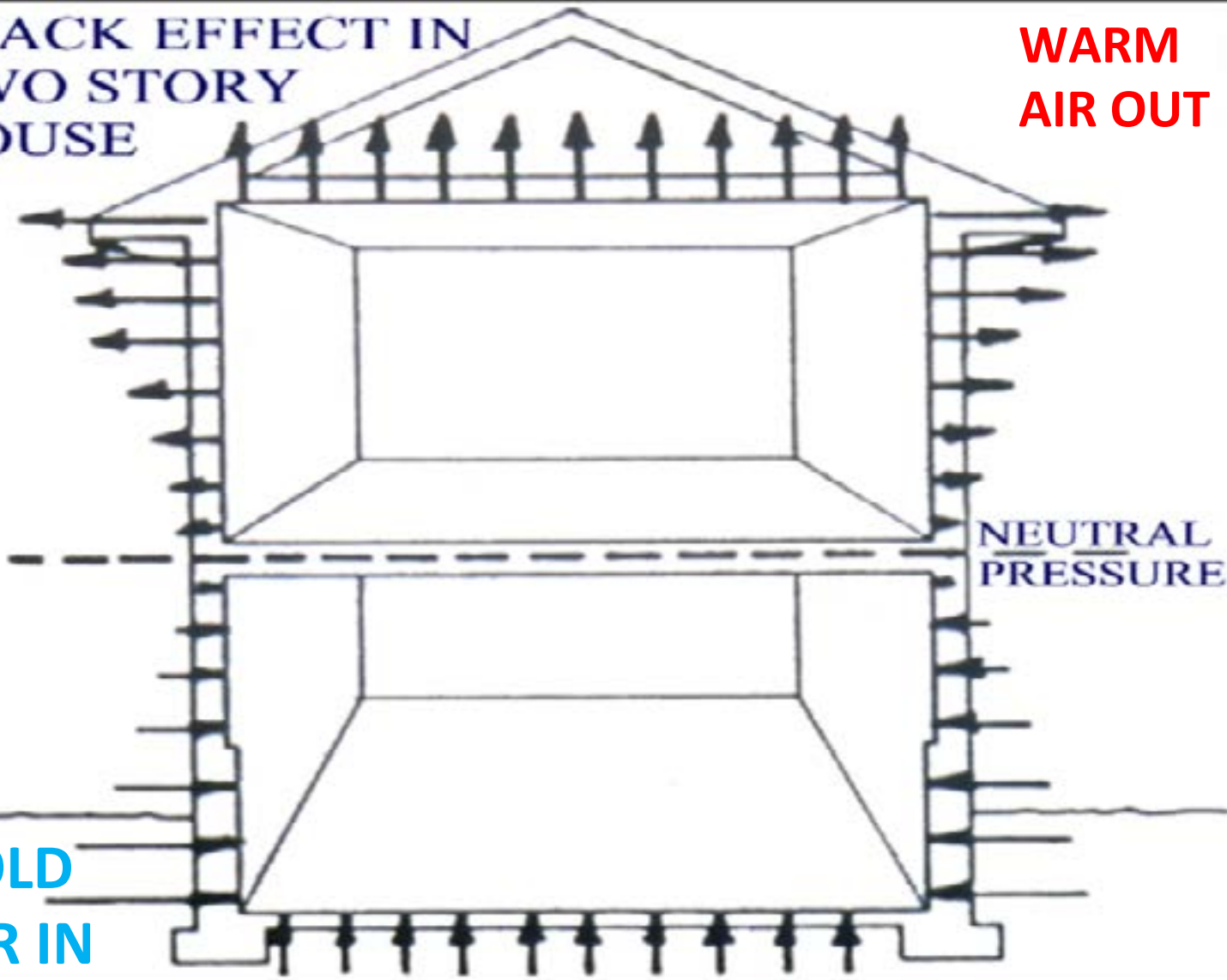
- List reasons why air-sealing efforts can expand to entire shell
- Identify missed opportunities
- Conduct inspections to locate and quantify air-leakage sites
- List proper material applications
- Measure effect of air-sealing efforts

STACK EFFECT IN TWO STORY HOUSE

**WARM
AIR OUT**

**COLD
AIR IN**

**NEUTRAL
PRESSURE**



Air in = Air out

- Primary air leaks (4 types)
- Secondary or “symptomatic” leaks
- Connected pathways
 - Compartmentalizing helps a bit- slows convective loop heat loss
 - May not be affected by pressure differential testing- (floor line cavities)

Air Leakage Not “Seen”

Neutral Pressure Plane

- Does it mean we don't seal certain places?
- Is it stable?
- Locate it!

- Like everything else in this business-
It's Complicated!!

Four Types of Air-Leaks



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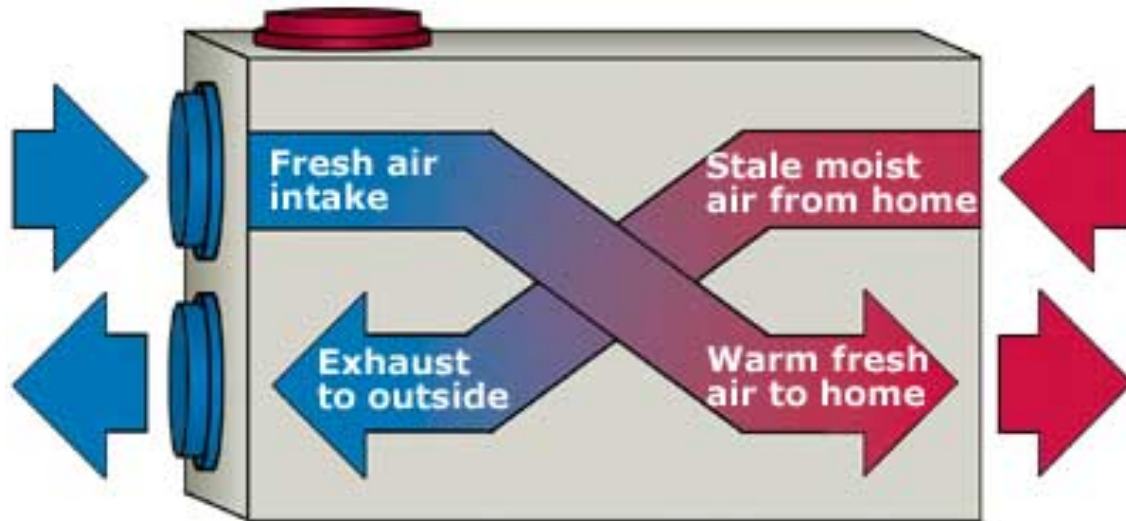


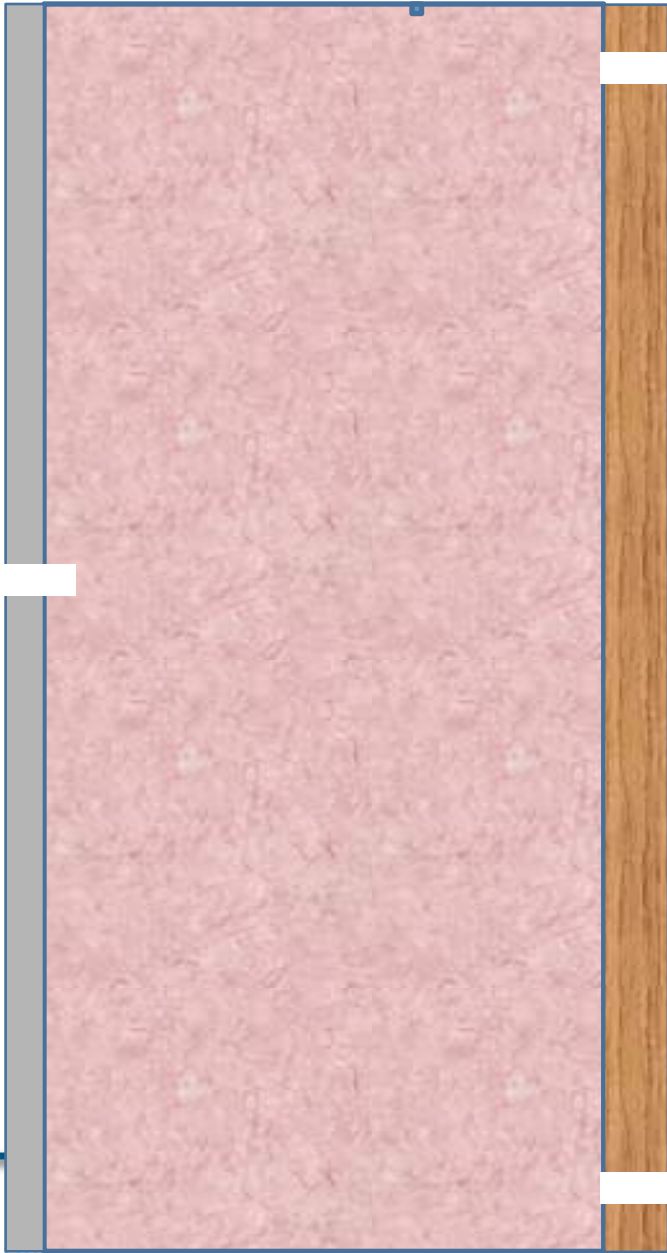


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Infiltration Heat Recovery

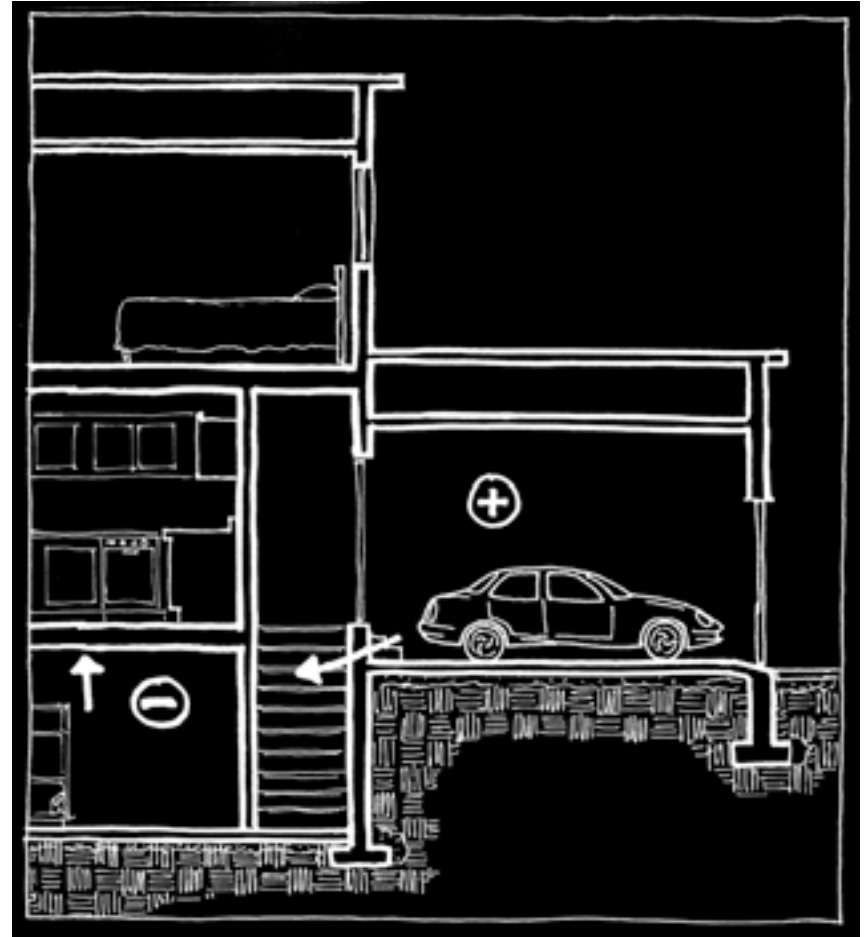




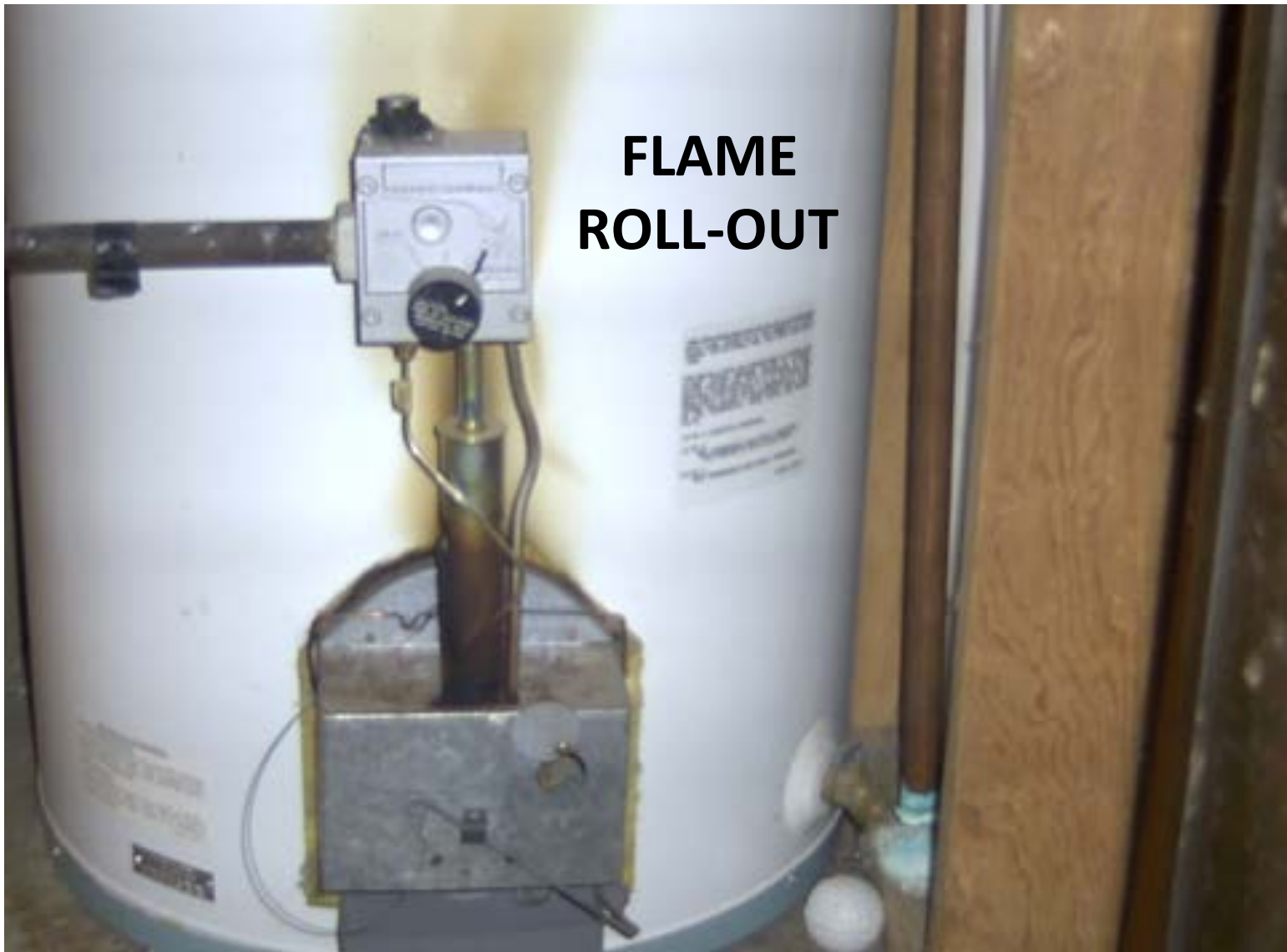
What's At Stake?

Air Leaks can cause...

Depressurization in the home, drawing in carbon monoxide



FLAME ROLL-OUT



Moisture Movement by Diffusion & Air Transport

Moisture moves high to low

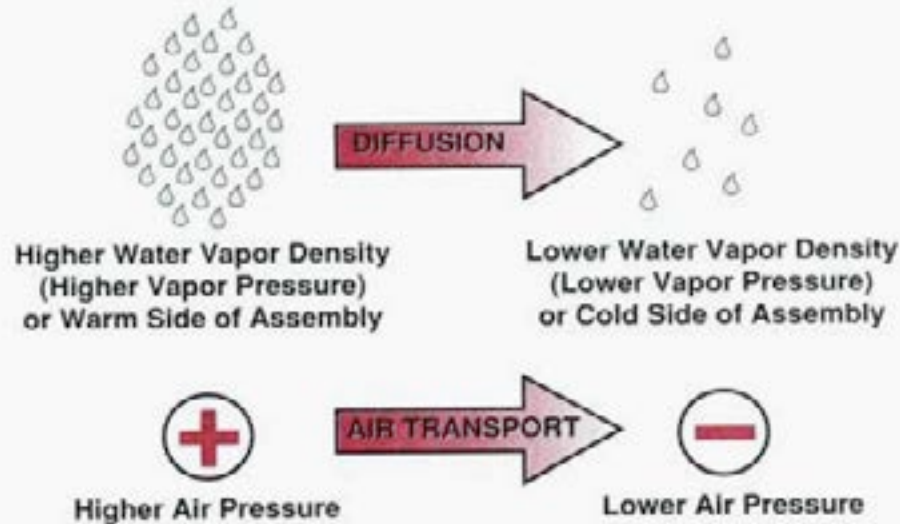
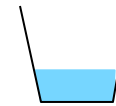
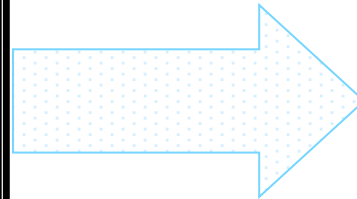
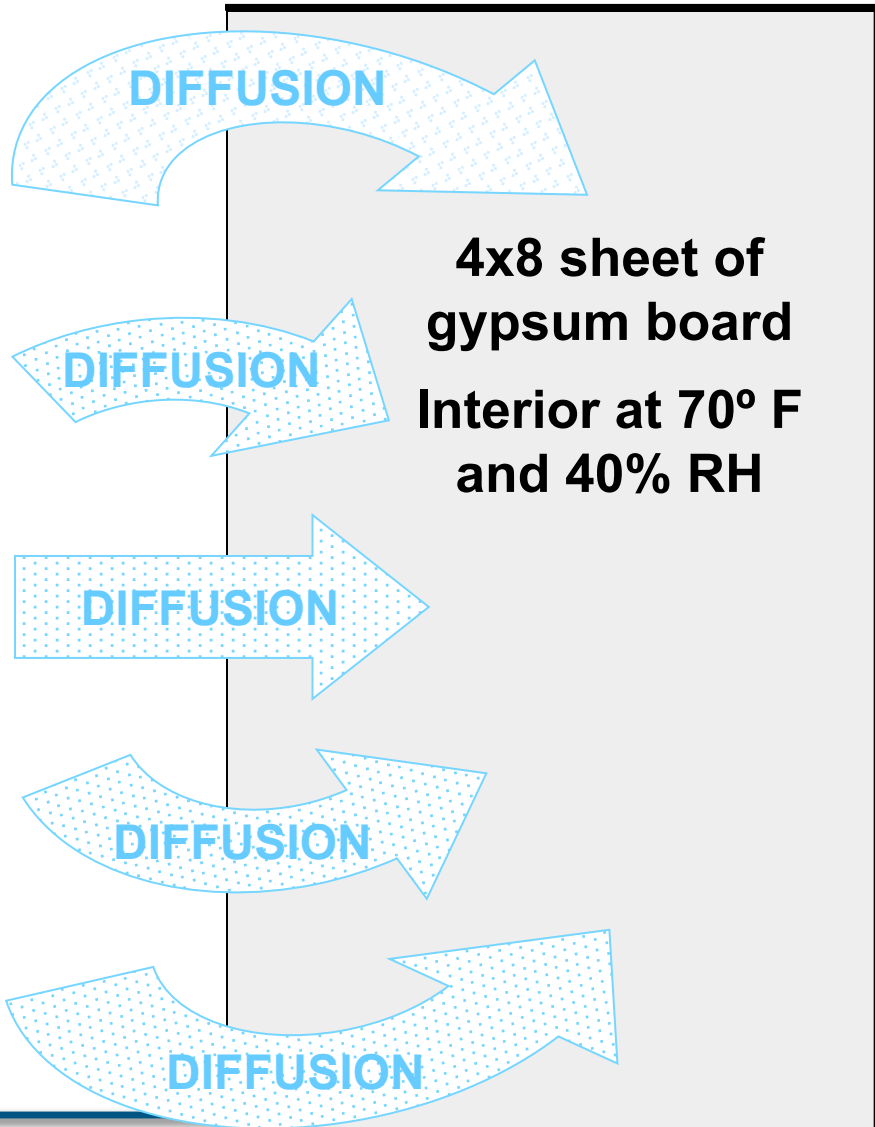


Figure III.1
Water Vapor Movement

- Vapor diffusion is the movement of moisture in the vapor state as a result of a vapor pressure difference (concentration gradient) or a temperature difference (thermal gradient)
- Air transport is the movement of moisture in the vapor state as a result of an air pressure difference

Diffusion

Test Period
Was One
Cold Climate
Heating Season



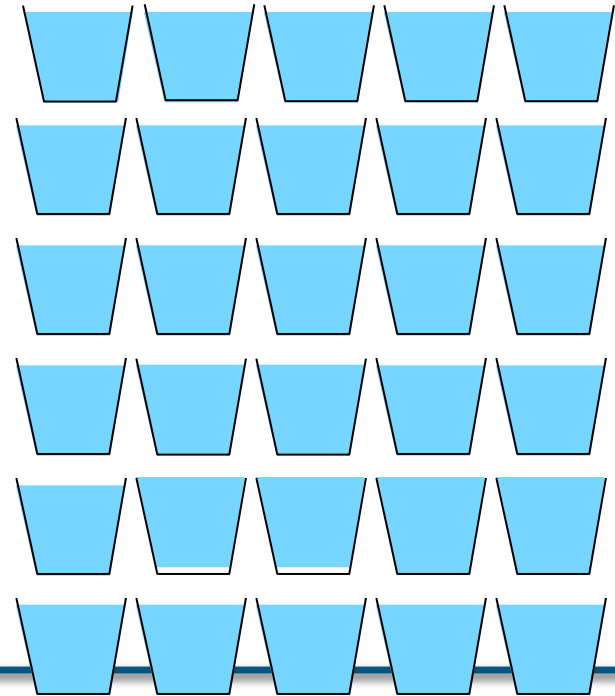
1/3 quart
of water

Air Transported Moisture

test period:

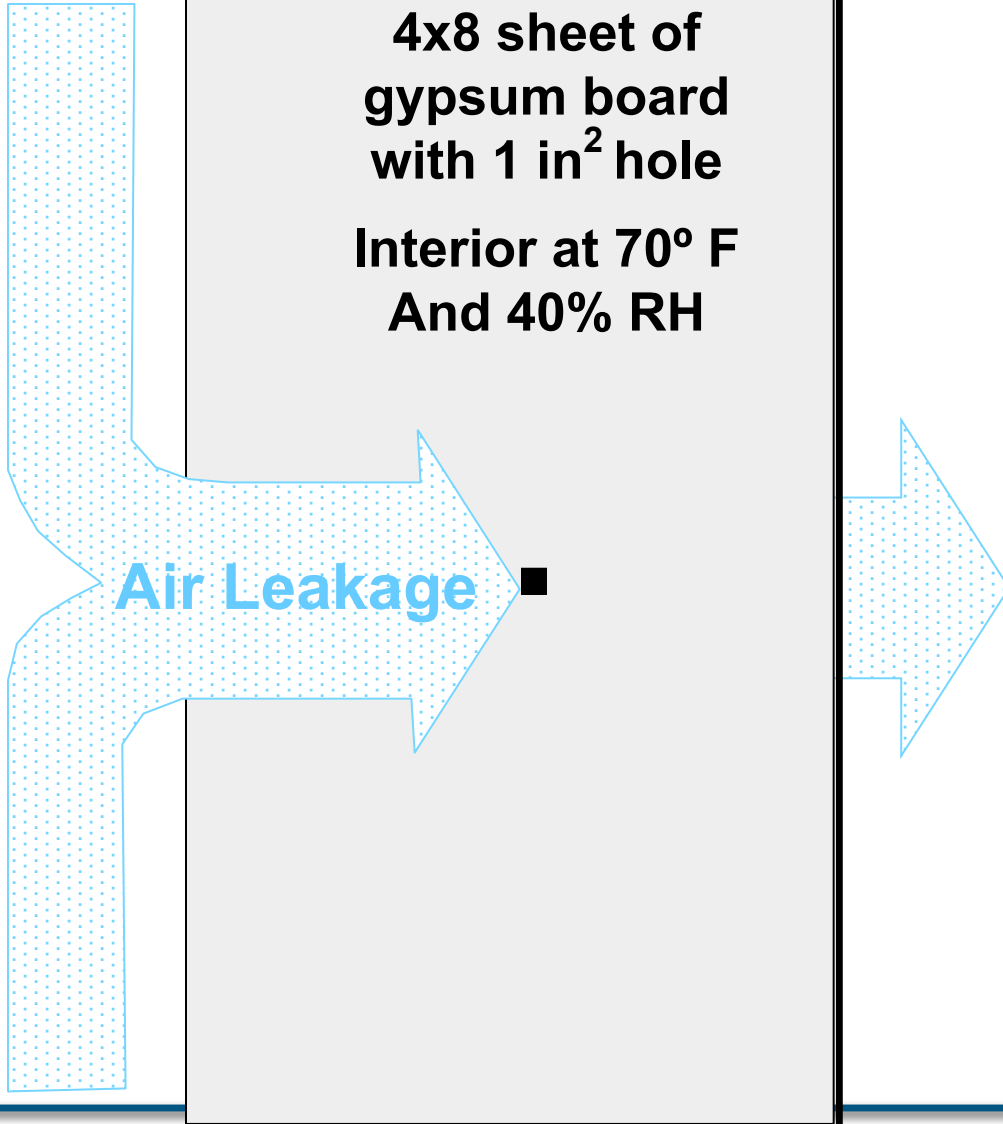
One Cold Climate Heating Season

30 quarts of water



**4x8 sheet of
gypsum board
with 1 in² hole**
**Interior at 70° F
And 40% RH**

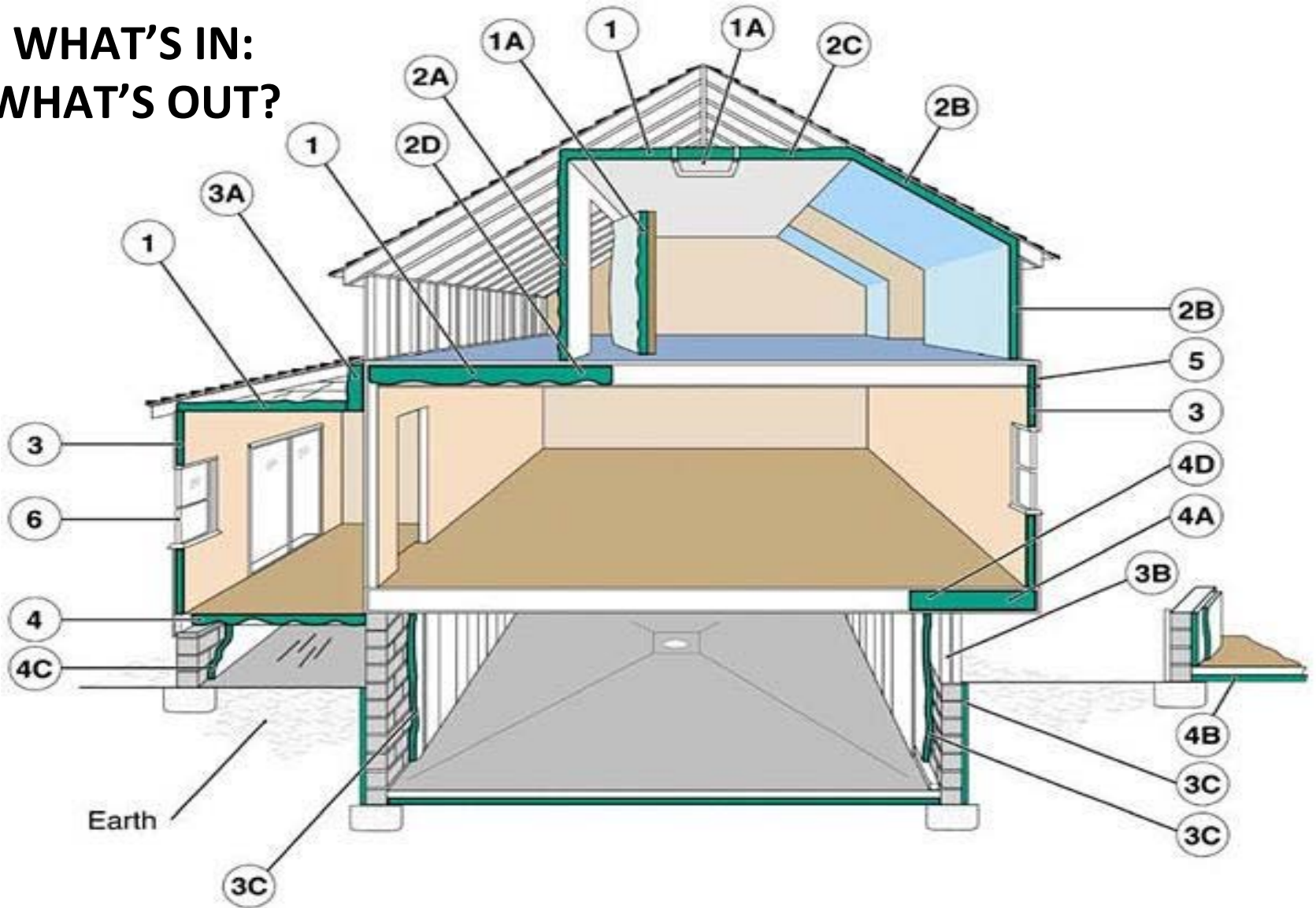
Air Leakage



What's In, What's Out?

- Define the heat envelope before starting
- Understand what is important
- Find the opportunities
- Put someone in charge once agreement is reached

WHAT'S IN: WHAT'S OUT?



Low-Cost Air-Sealingg



Joe Nagan



Joe Nagan

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Joe Nagan

Garages

- Greatest source of:
 - Carbon Monoxide
- VOC's
- Moisture
- Second most important leak sites to seal according to BPI





In or out?



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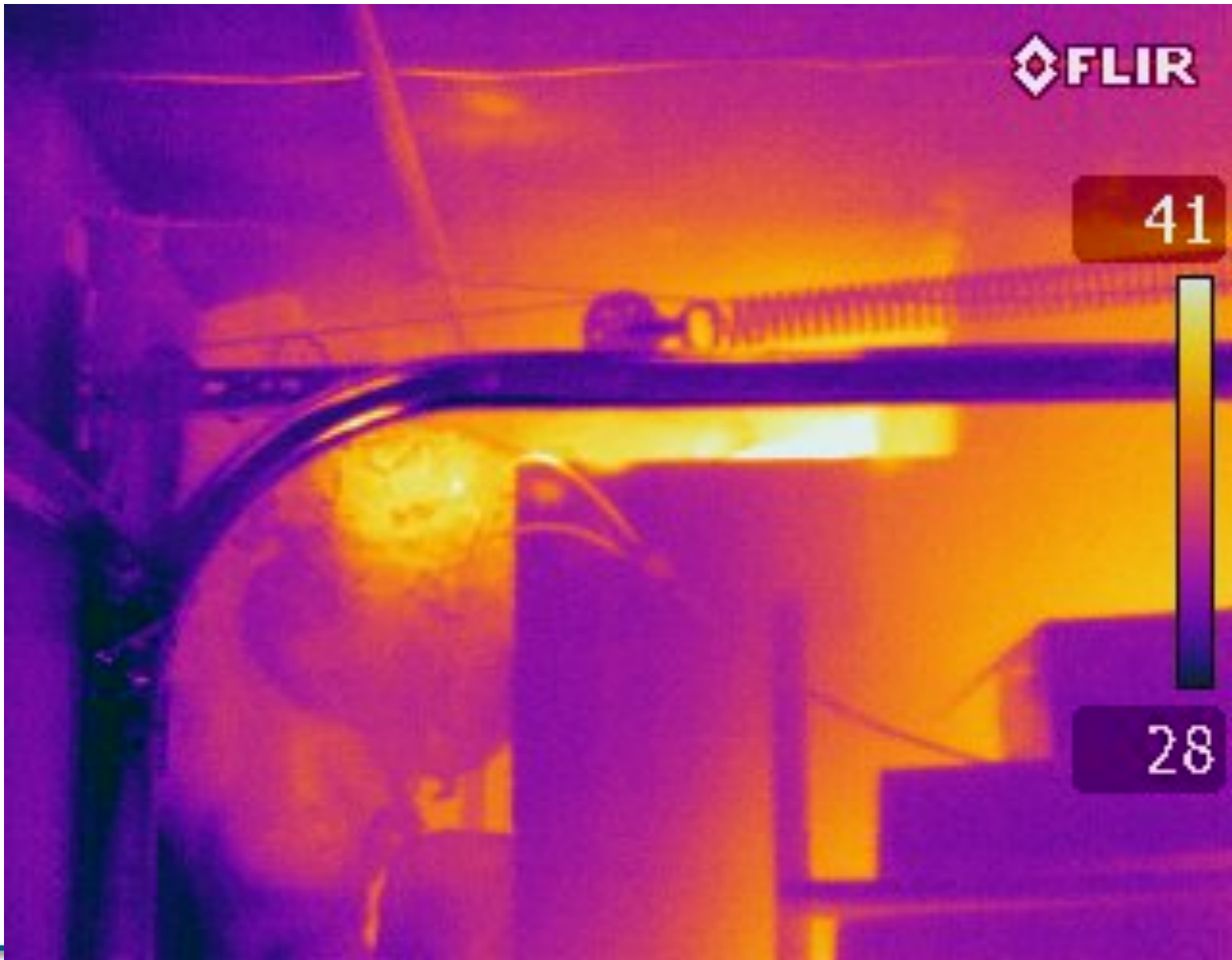
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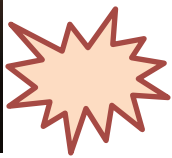
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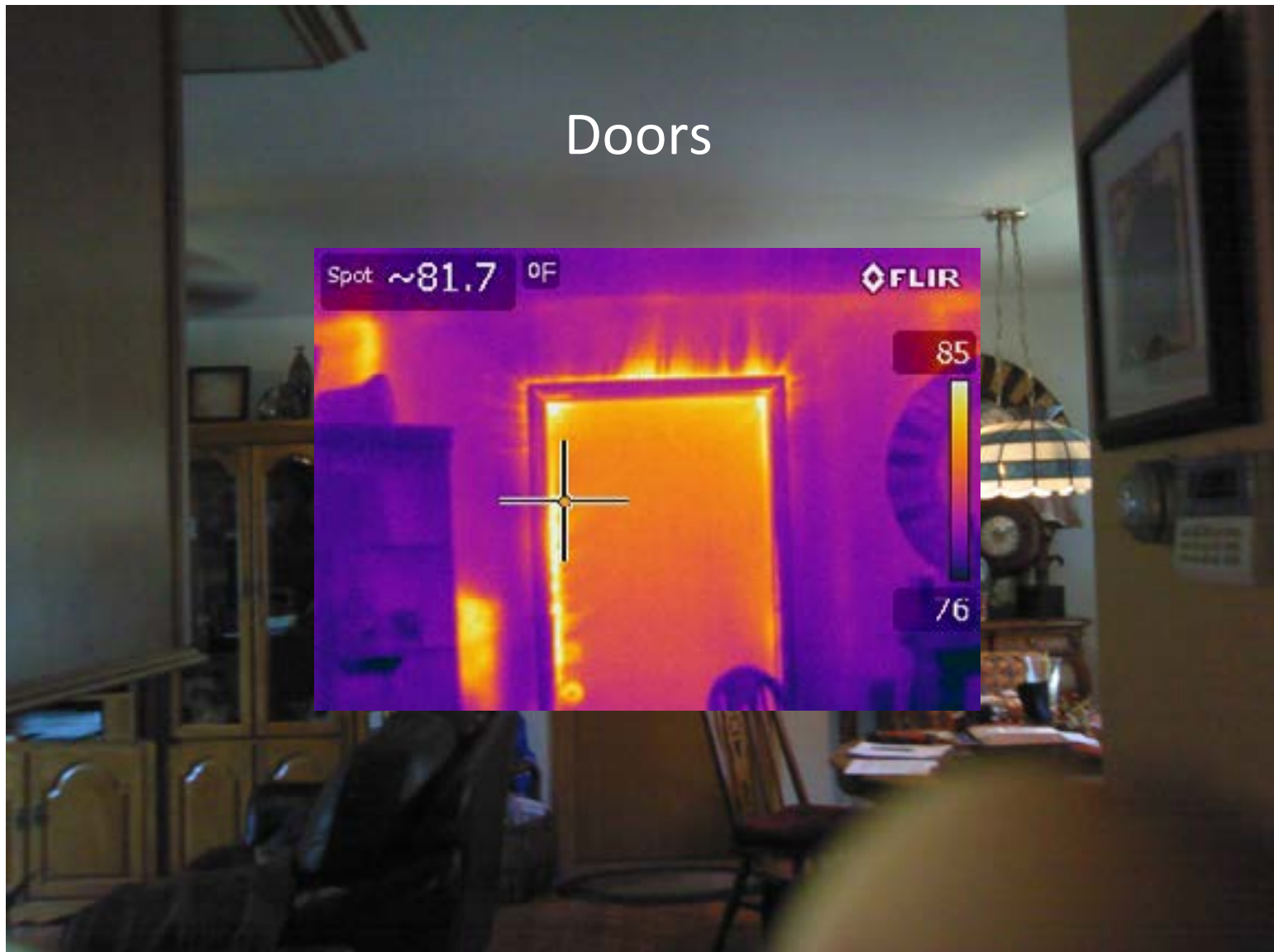




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Doors





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Verification of Sealing

- Visual
- Blower door and smoke
- Blower door CFM50
- Blower door and Thermography
- Zone pressure diagnostics [Open_Door_House_to_Garage.pdf](#)
- Pressure pan ducts- duct blaster

Basements, Sills, Crawlspace

- To seal or not to seal?
 - Costs (2-part foam)
 - Reduced air supply for natural draft appliances
- Absence of natural draft appliances
- Insulated foundation
- High-performance housing
- Radon considerations
- Third priority for air-sealing: BPI



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**Was the installer
a lefty or righty?**





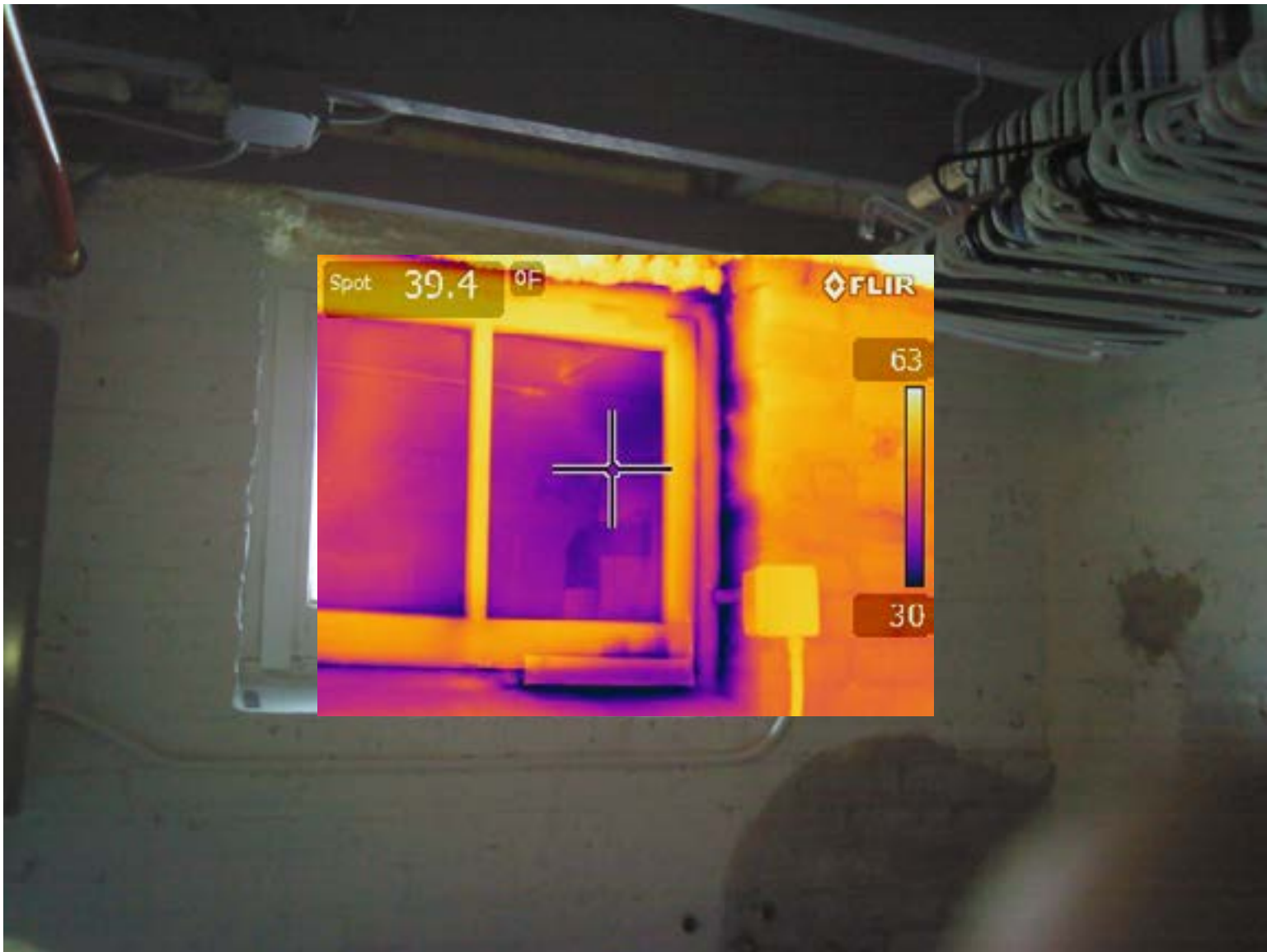
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Foundations - Exterior





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Exterior Walls



Bob Pfeiffer



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Interior Walls





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10:10:15 AM



10 10:15AM



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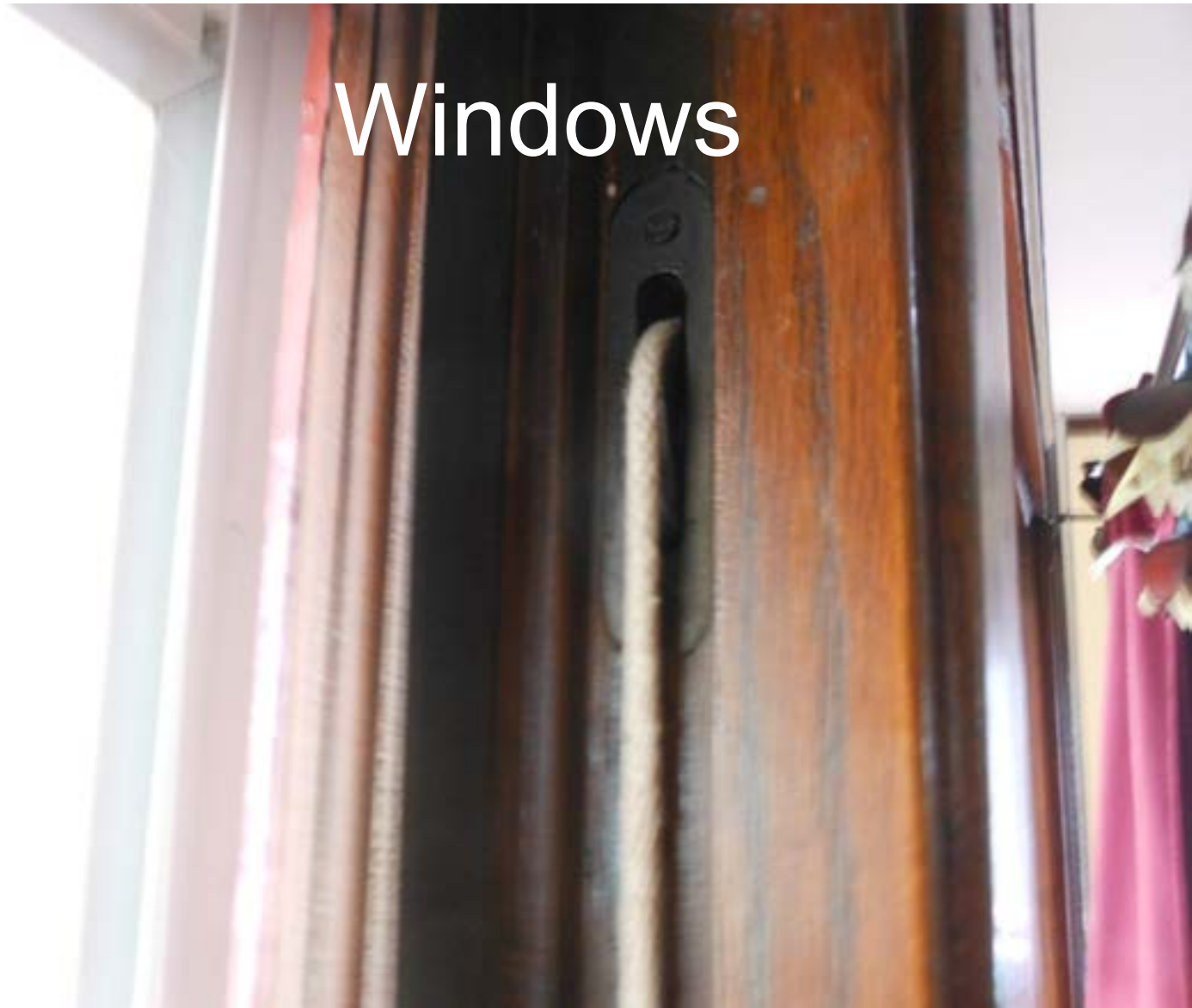




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Windows



Is This Cost-Effective?

- Home Energy Article-
- Depends!
- Quick treatment



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Treatments

- Pulley Seals
- Sash lock
- V-Seal
- Caulk/glaze window lites
- Interior clear caulk

- Window film –temporary but very effective

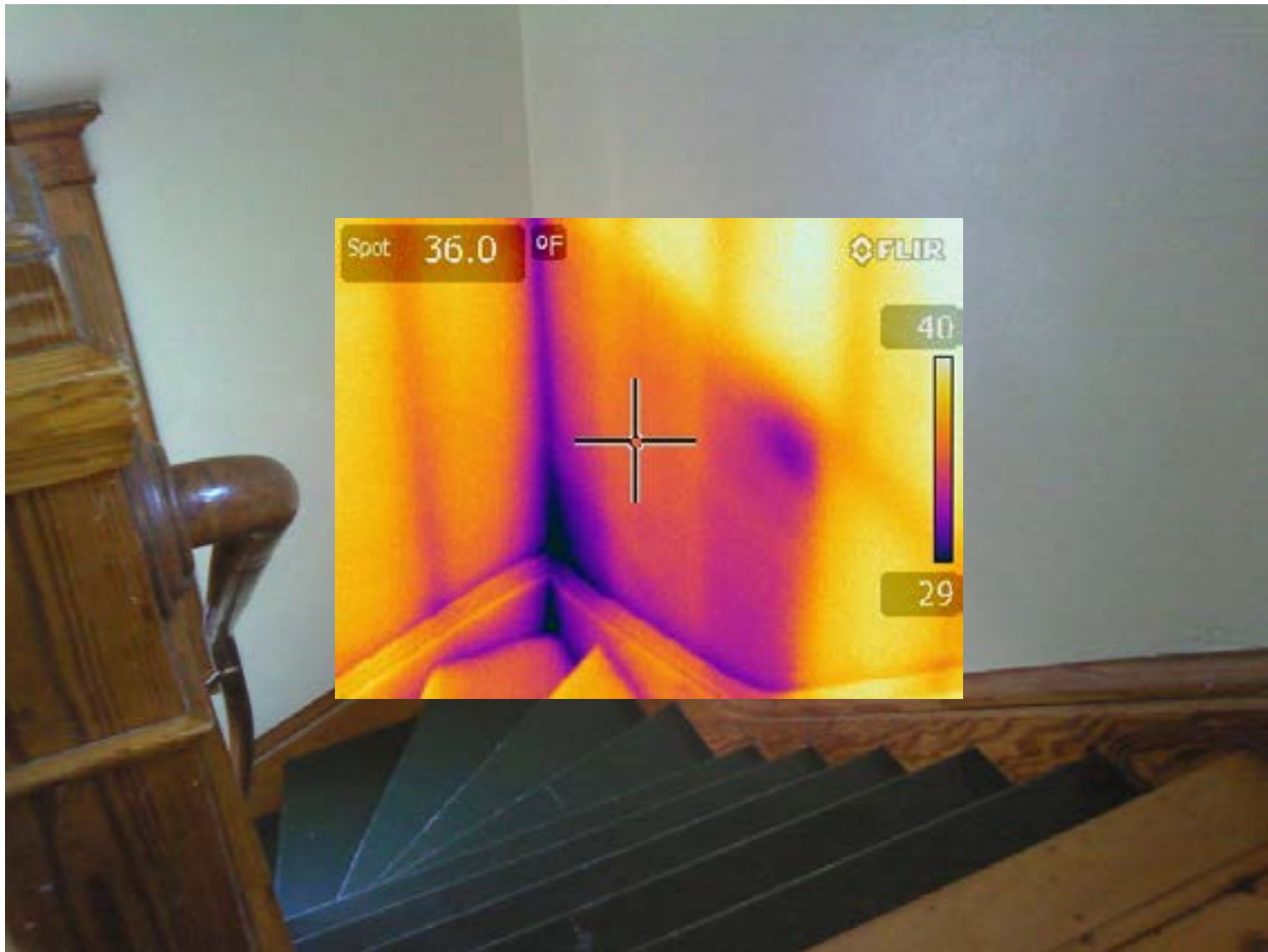
Doors



Installation Tips

- Bulb style least effective
- Remove all extra junk
- Caulk or seal behind weather stripping
- Watch clearance to knob
 - Silicone flap works well- low profile
 - Might need compression style
- Notch corners
- Caulk or foam behind jambs when needed

Interstitial Spaces





Jpcraighomebuilders.com

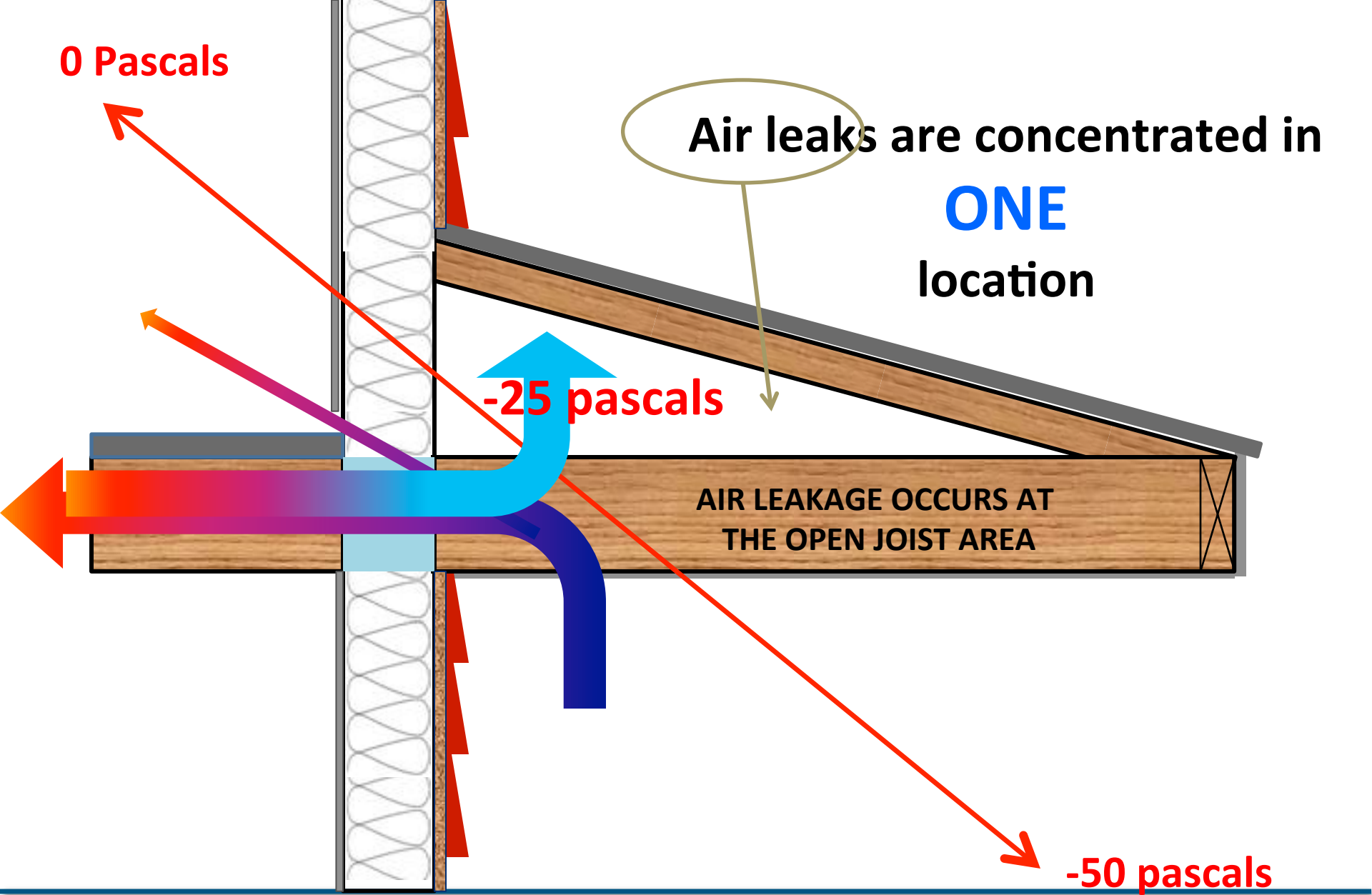


Myoldhouse.com











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Dense-Pack Cellulose

Air-Seal While Insulating

-50 Pascals

PORCH
ROOF

0 Pascals

AIR NO LONGER LEAKS AT
THE OPEN JOIST AREA

WOOD
FRAMED WALL
WITH
CAVITY
INSULATION

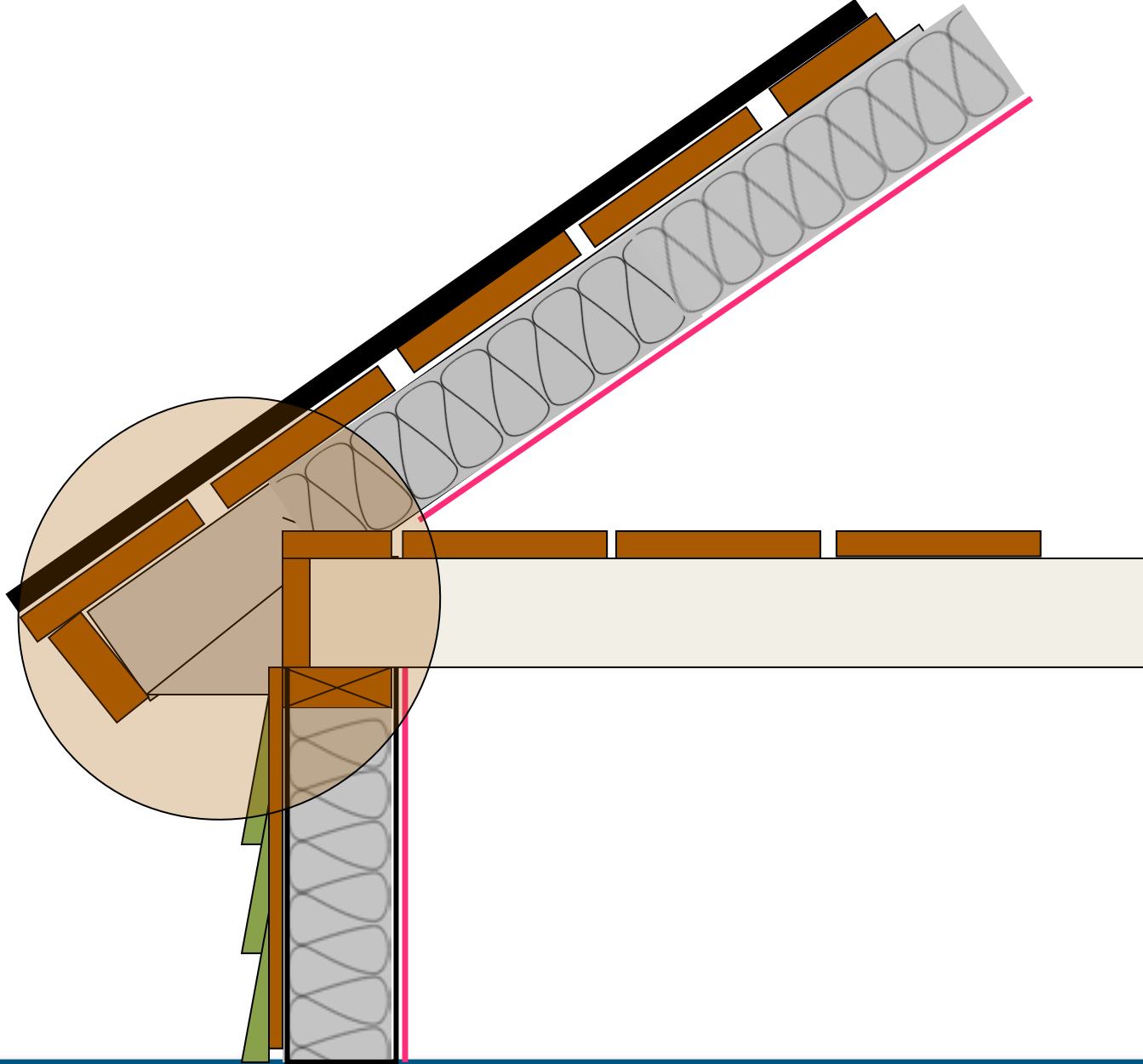
FLOOR JOISTS EXTEND
PAST WALL TO FORM
PORCH CEILING

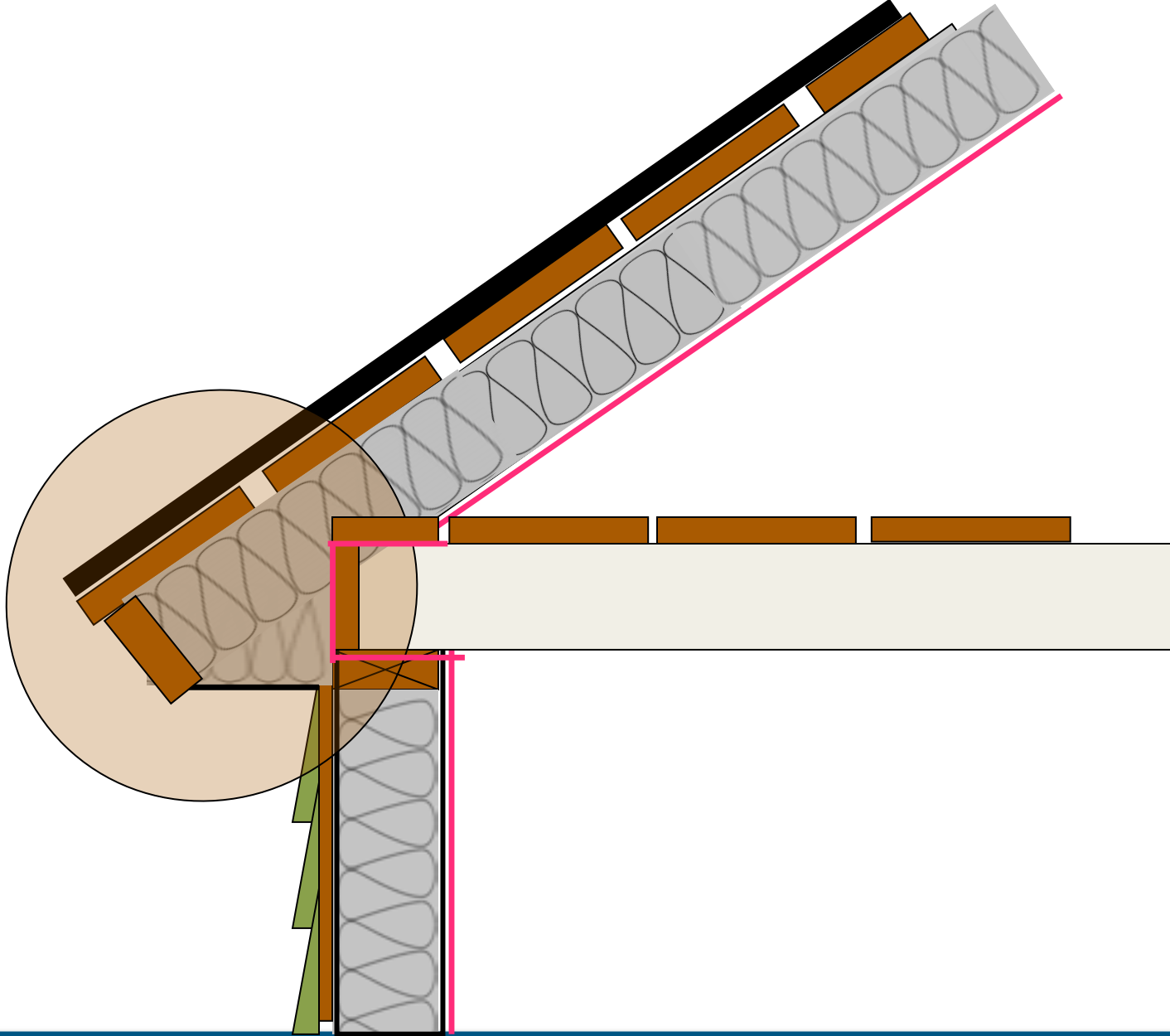
0 pascals



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Dropped Ceilings





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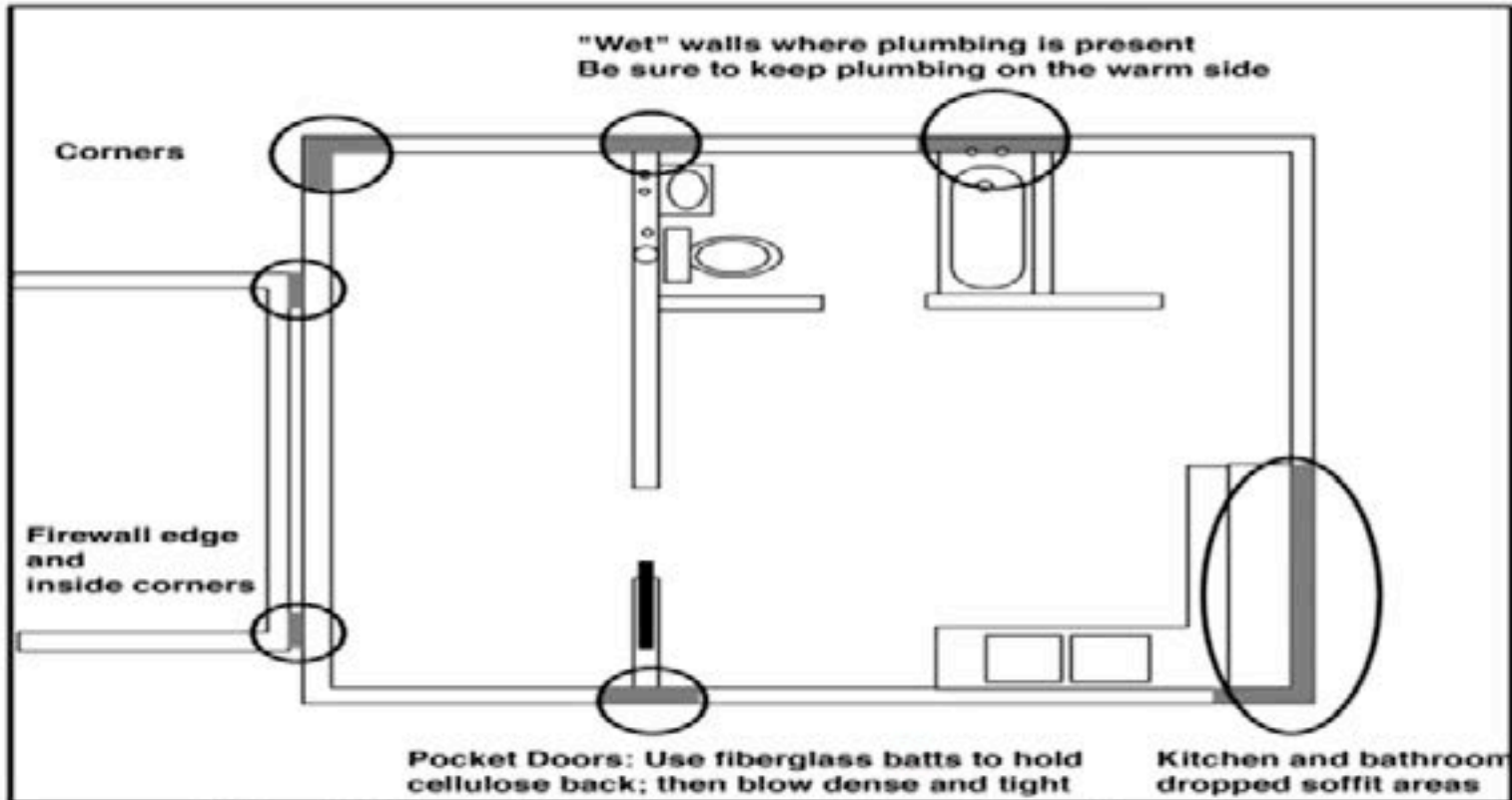
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Partition Walls

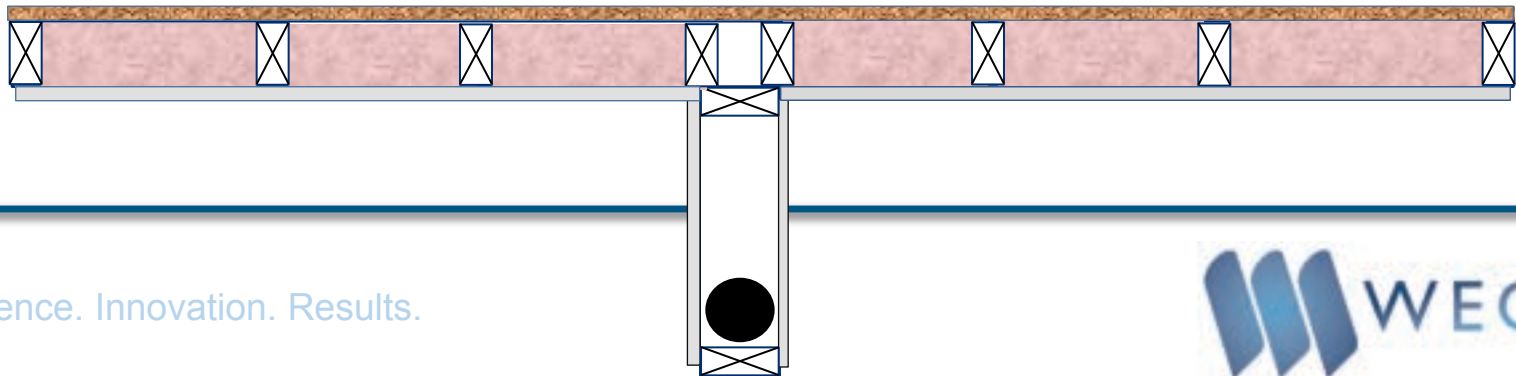
Key Junctures* High Density Insulation

Plan View of Trouble Spots



* Where to Blow Cellulose dense and tight in outside wall cavities

Always look for (and seal) attic bypasses above wet walls, pocket doors, and soffit areas



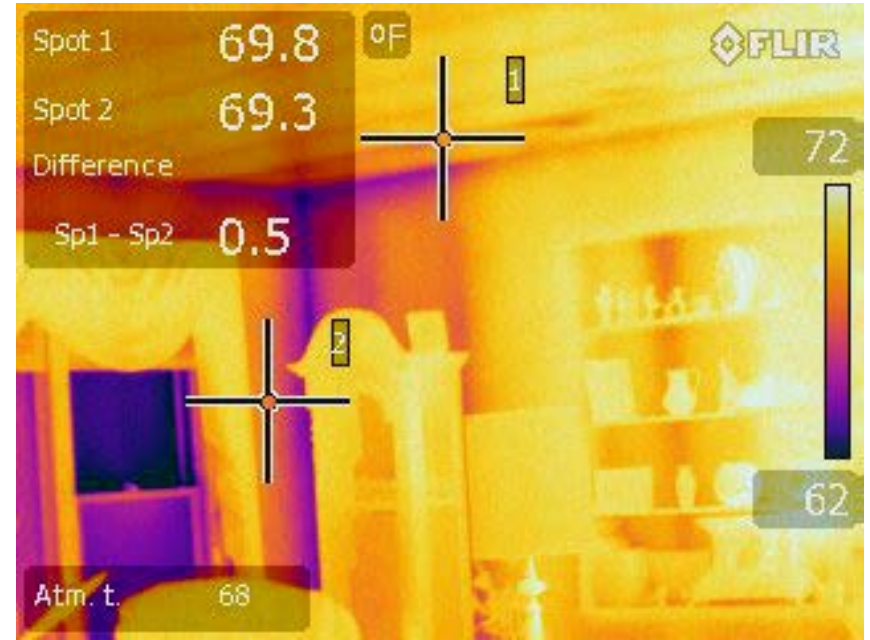
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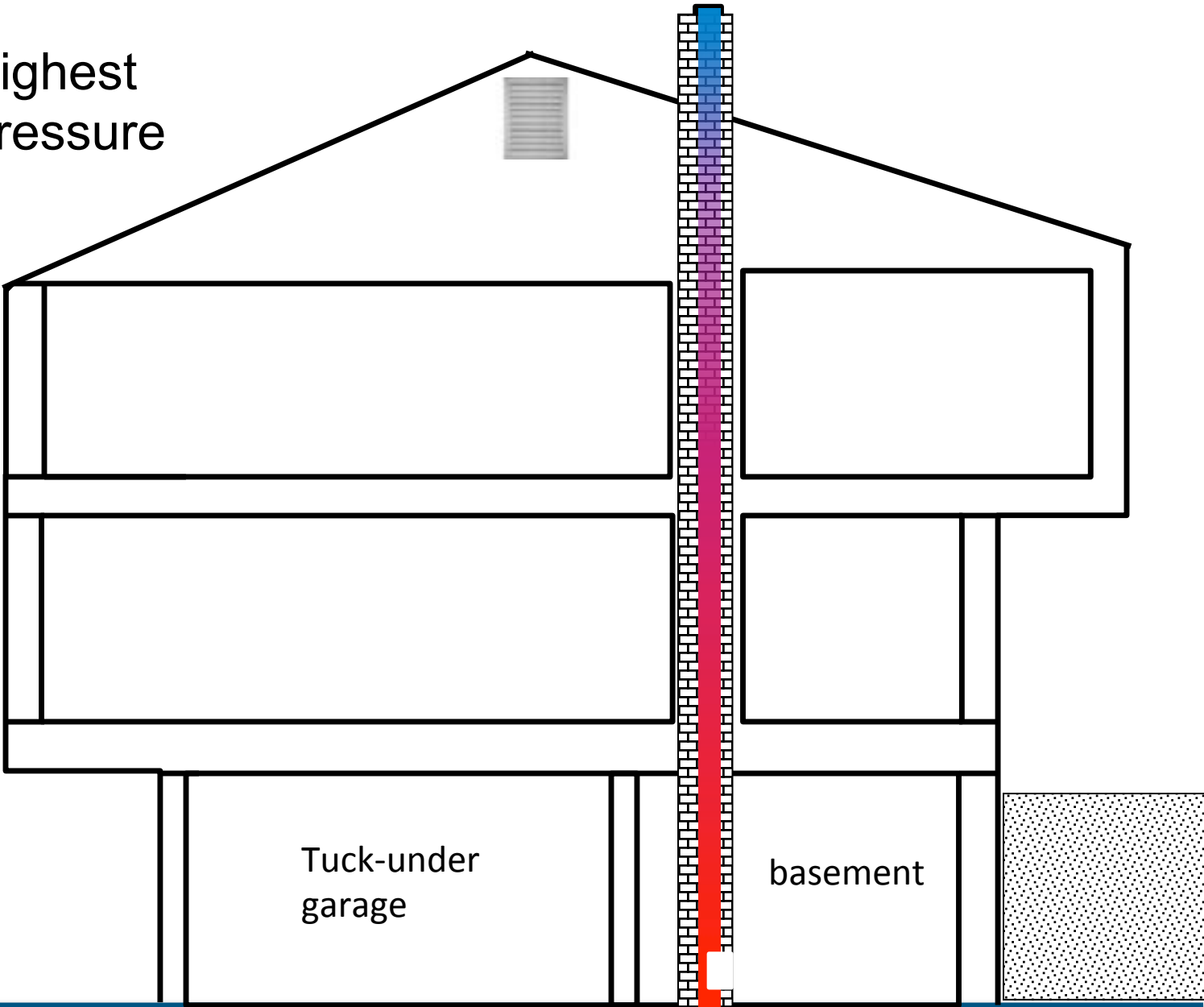




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What is the highest point in the pressure boundary?





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Treatments

- Cap top of Chimney
- Roofer takes chimney below roof line
- Bring chimney to attic floor-line
- Punch out a brick at floor-line and seal

- Post notice at base!

Questions?

For more information, please contact:

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Needed –will be added to final document

- Kitchen cabinet/dropped ceilings
- 5 methods to verify garage sealing
- Videos of air-leaks-
- More garage pics