SLAB ON GRADE CONSTRUCTION
Meeting the MN Energy Code
(air tightness)
for
2017
Energy Design Conference

By

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Dakota Supply Group

- In accordance with the Department of Labor and Industry's statute 326.0981, Subd. 11,

  "This educational offering is recognized by the Minnesota Department of Labor and Industry as satisfying **1.5 hours** of credit toward **Building Officials and Residential Contractors code/energy** continuing education requirements."

  For additional continuing education approvals, please see your credit tracking card.

Learning objectives

1. Overview of the 2015 MN Energy Code regarding building tightness and ducting/ testing requirements
2. Learn about common areas that are overlooked when it comes to air sealing
3. Gain an understand where to seal and what to use when air sealing that will help you achieve a tighter house.
4. Find out what is the best time during construction to do a blower door test and a duct blaster test
5. Learn about the different HVAC design option for slab on grade construction
6. Gain information on when you need to do a duct leakage test and how to pass that test.
7. Learn about balanced ventilation designs

Slab on grade twin home

Large slab on grade

Energy codes

- Overview of the 2015 MN Energy Code regarding building tightness and ducting/ testing requirements
- Code
- Slab on grade half the house small metric
- Work with all trades, insulator and energy auditer/blower door guy on air sealing
- Do walk thru at framing
- Do a blower door with infrared camera
- Training learning curve
- Air sealing is different then insulating
- Get more training, on site

Code language R402.4.1.2 Testing

- The building shall be tested and verified to 3 Air Changes per Hour or less
- Conducted with calibrated blower door to 50 Pascals
- Code Official may require approved third party to do the test
- A signed written report of result be needs to be supplied

This is for all new homes, we know how to meet these standards, some builders have been meeting these level for 25 plus years

Comfort ,energy savings, durability , good IAQ, resale and more are why this is a code

Who can do a blower door test, duct leakage?

DUCT LEAKAGE TEST

Date of Test: 11/25/2014
Test File:

Technician: Chris

Customer:

Building Address:

C
Phone:
Fax:

Test Results

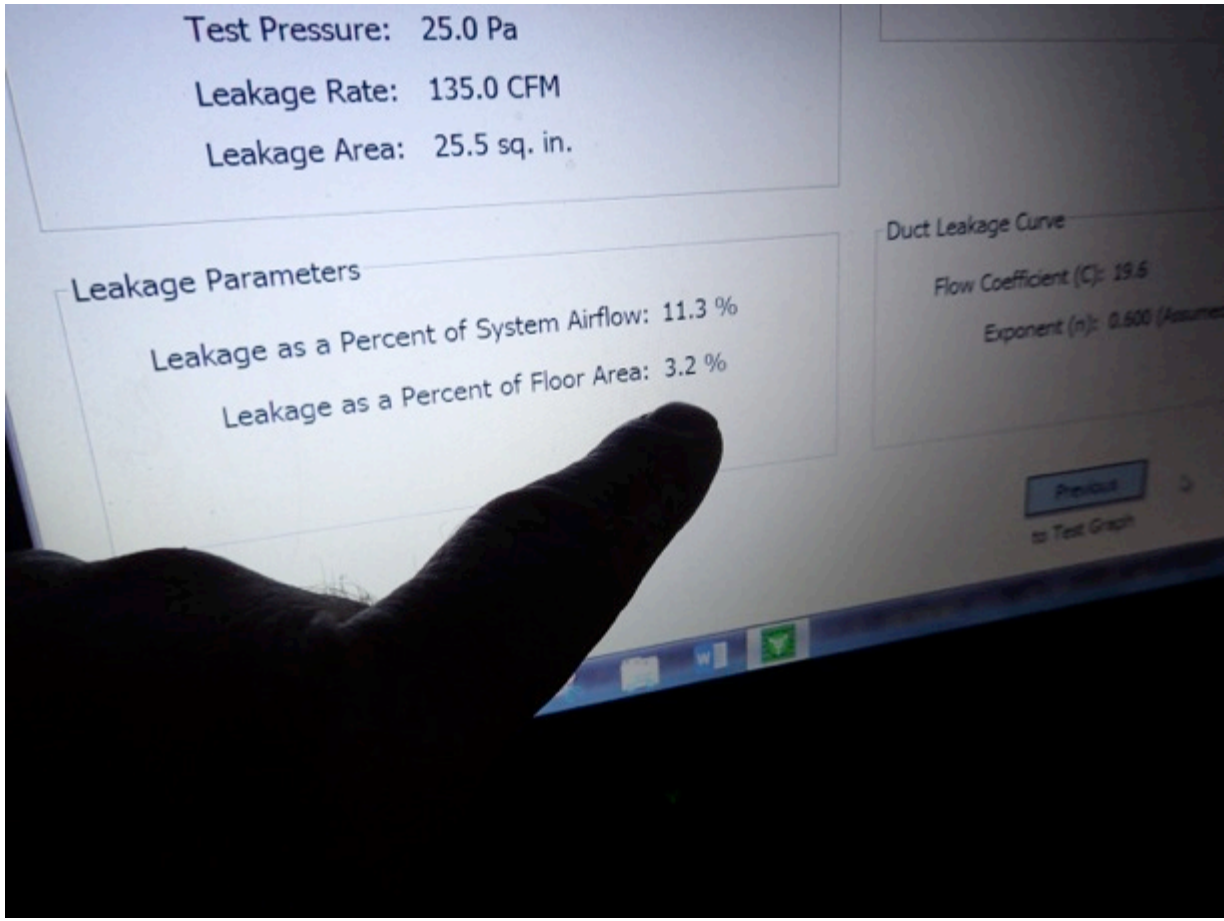
1. Measured Duct Leakage: **135.0 CFM / 25.5 sq. in. (+/- 0.0 %)**
2. Duct Leakage as a Percent of System Airflow: **11.3 %**
3. Duct Leakage as a Percent of Building Floor Area: **3.2 %**
4. Leakage Split:
   Supply Side:
   Return Side:
5. Duct Leakage Curve:
   Flow Coefficient (C): **19.6**
   Exponent (n): **0.600 (Assumed)**
6. Test Settings:
   Test Mode: **Pressurization**
   Test Pressure: **25.0 Pa**
   Equipment: **Series B Minneapolis Duct Blaster**
   Test Type: **Total Leakage (Duct Blaster Only)**

Building and System Parameters:

Floor Area:	**4164 sq. ft.**	Average Supply Operating Pressure:	**Pa**
System Airflow:	**1200 CFM**	Average Return Operating Pressure:	**Pa**
Supply Leakage Split:	**%**	Supply Leakage Penalty:	
Return Leakage Split:	**%**	Return Leakage Penalty:	

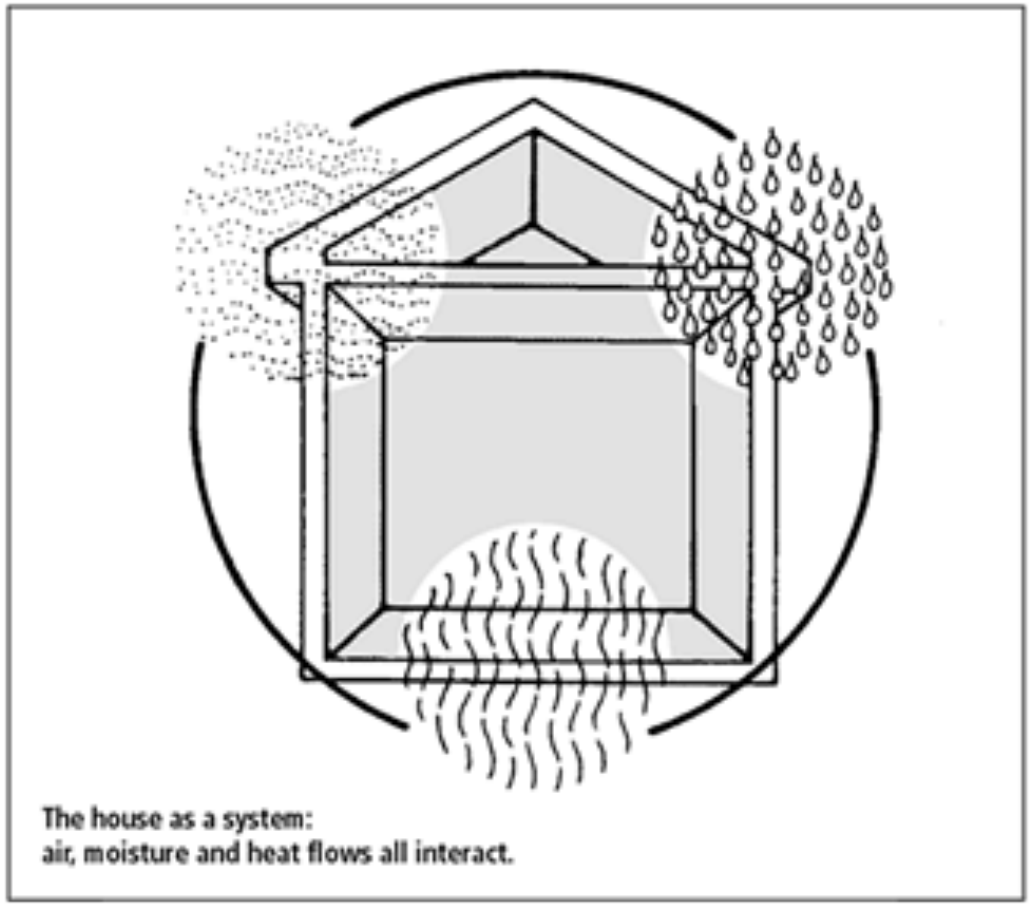
Percentage of Measured Leakage Connected to Outside: **100% (135.0 CFM)**

Duct blaster print report , leakage %



Building Science Basics

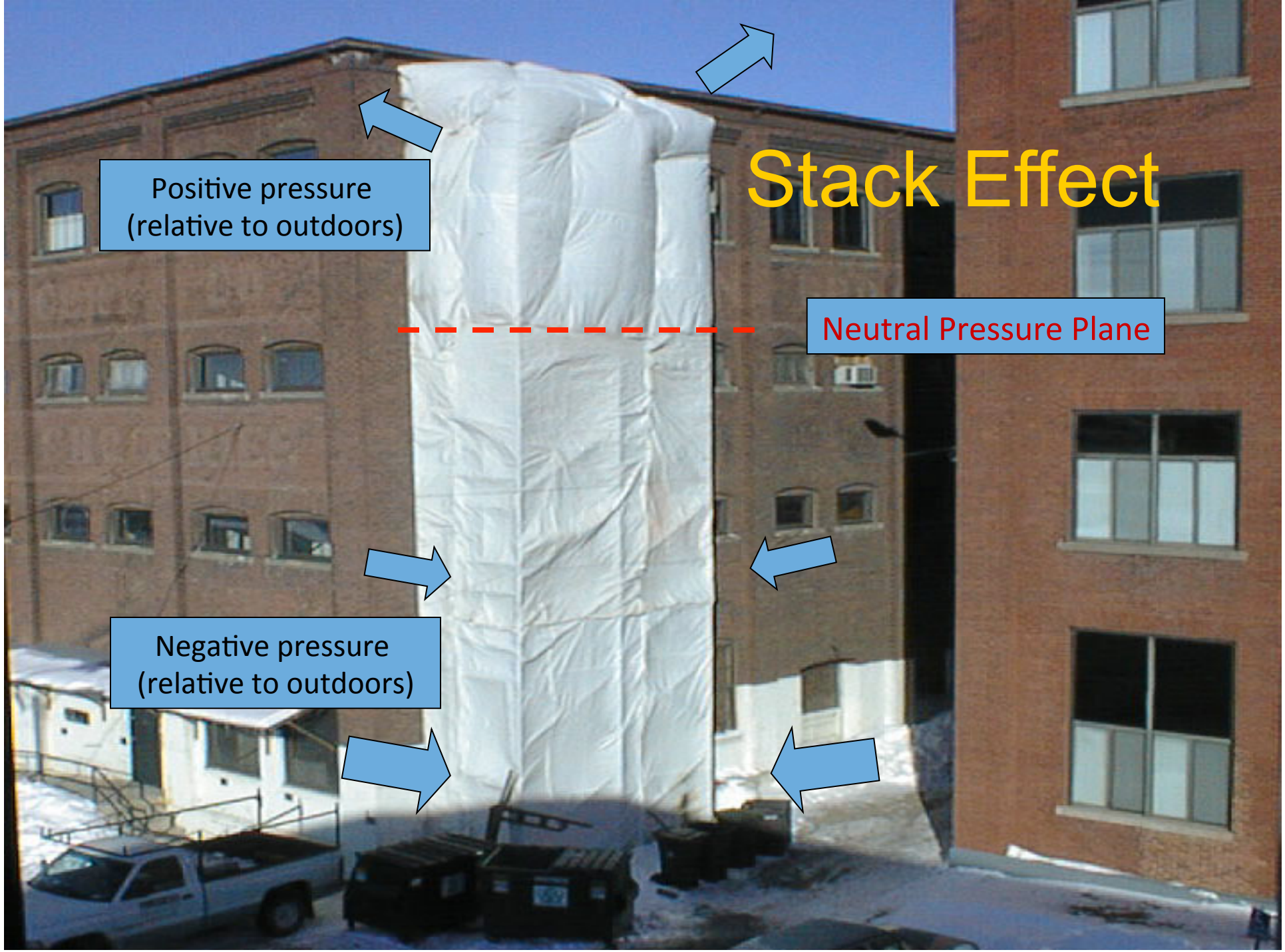
- Heat
- Air
- Moisture



The house as a system:
air, moisture and heat flows all interact.

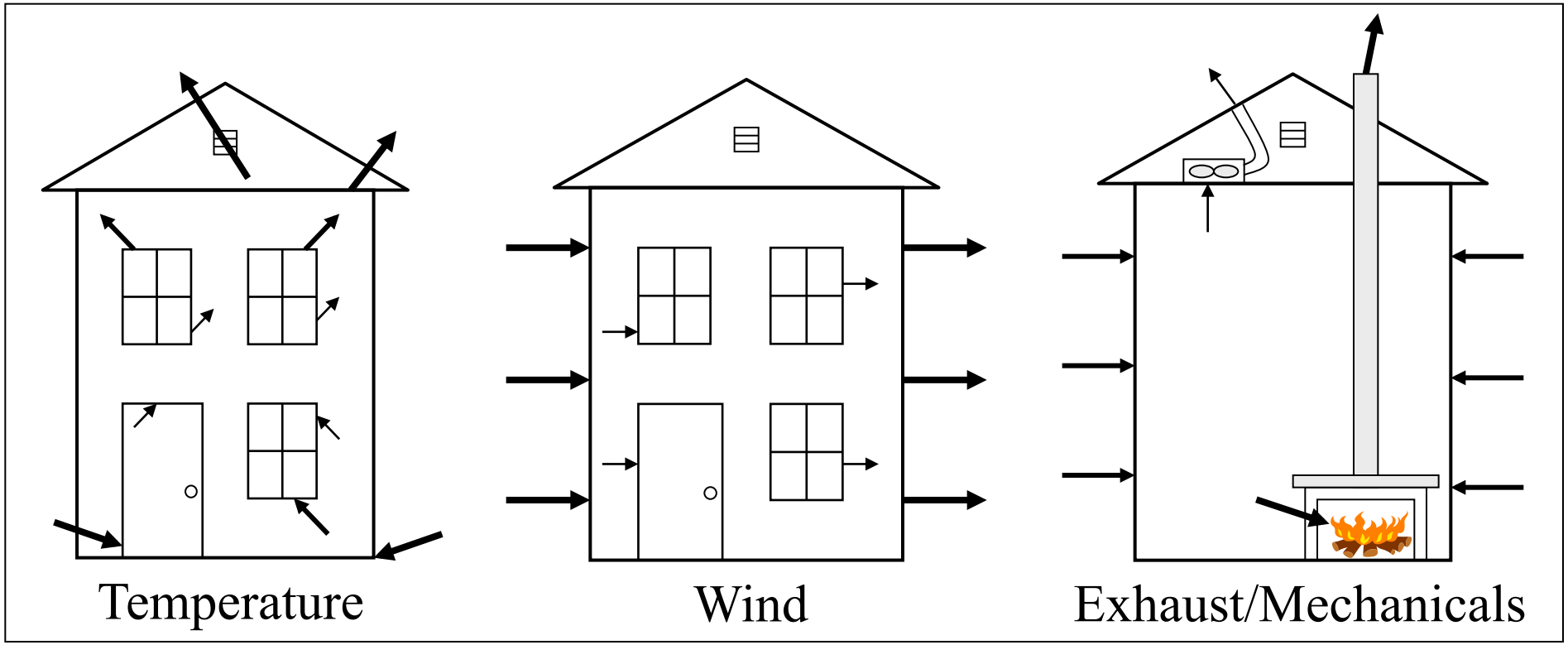
Air movement

- Air is pushed by higher air pressure to areas of lower air pressure
- Air pressures usually result from:
  - Wind
  - Stack effect
  - Mechanical fans


Stack Effect
Positive pressure
(relative to outdoors)
Neutral Pressure Plane
Negative pressure
(relative to outdoors)

Air Moves Under Pressure

- *Convection*



Building Science Example

- Mold on underside of roof decking
- What's going on?

Air sealing details

1. Learn about common areas that are overlooked when it comes to air sealing
2. Gain an understand where to seal and what to use when air sealing that will help you achieve a tighter house

PROJECT REENERGIZE

Saving Energy Through Home Improvements

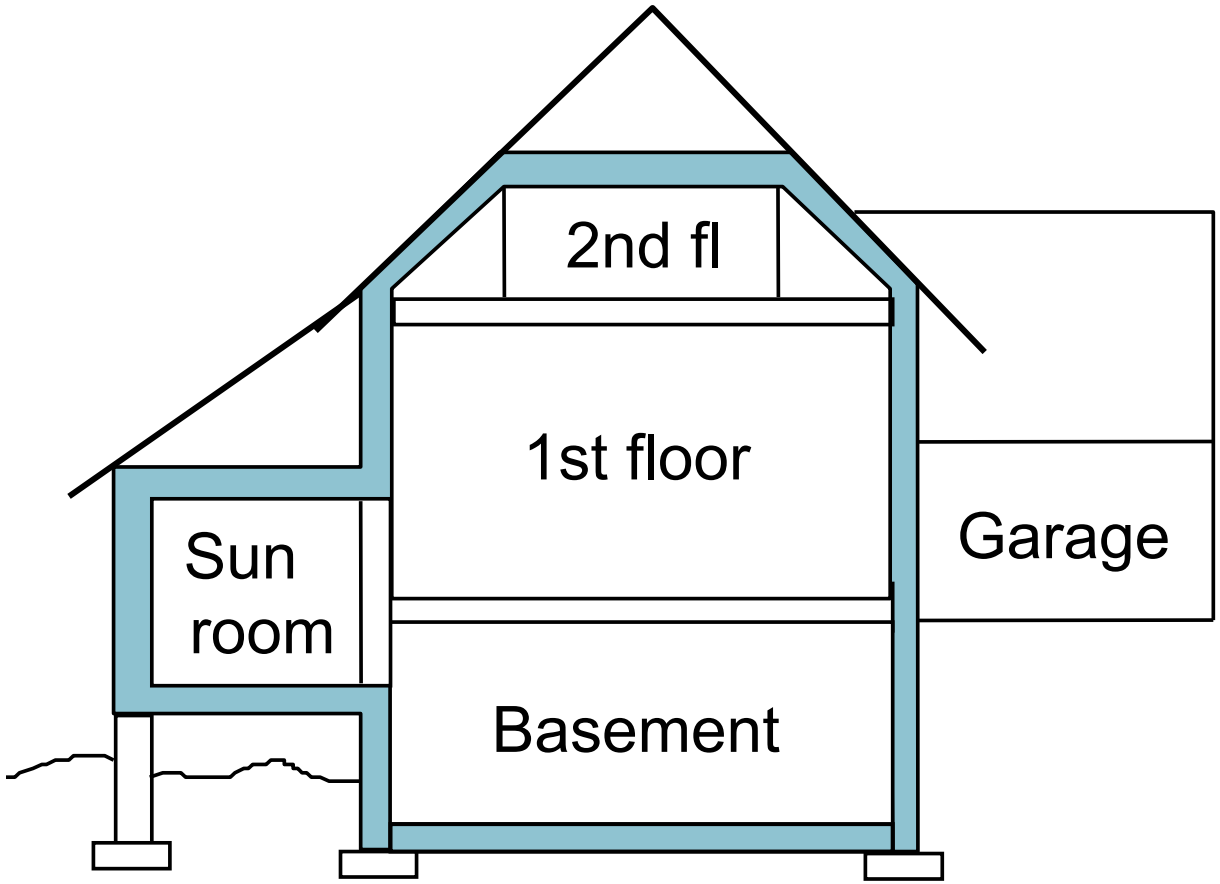
Air Sealing Training

The Five Important Steps of Air-Sealing

1. Identify type of opening
2. Choose air sealing materials
3. Cut and/or fit materials
4. Seal the leaks
5. Test to air tightness standard

- If you could sink your house in the lake, would it hold water ?

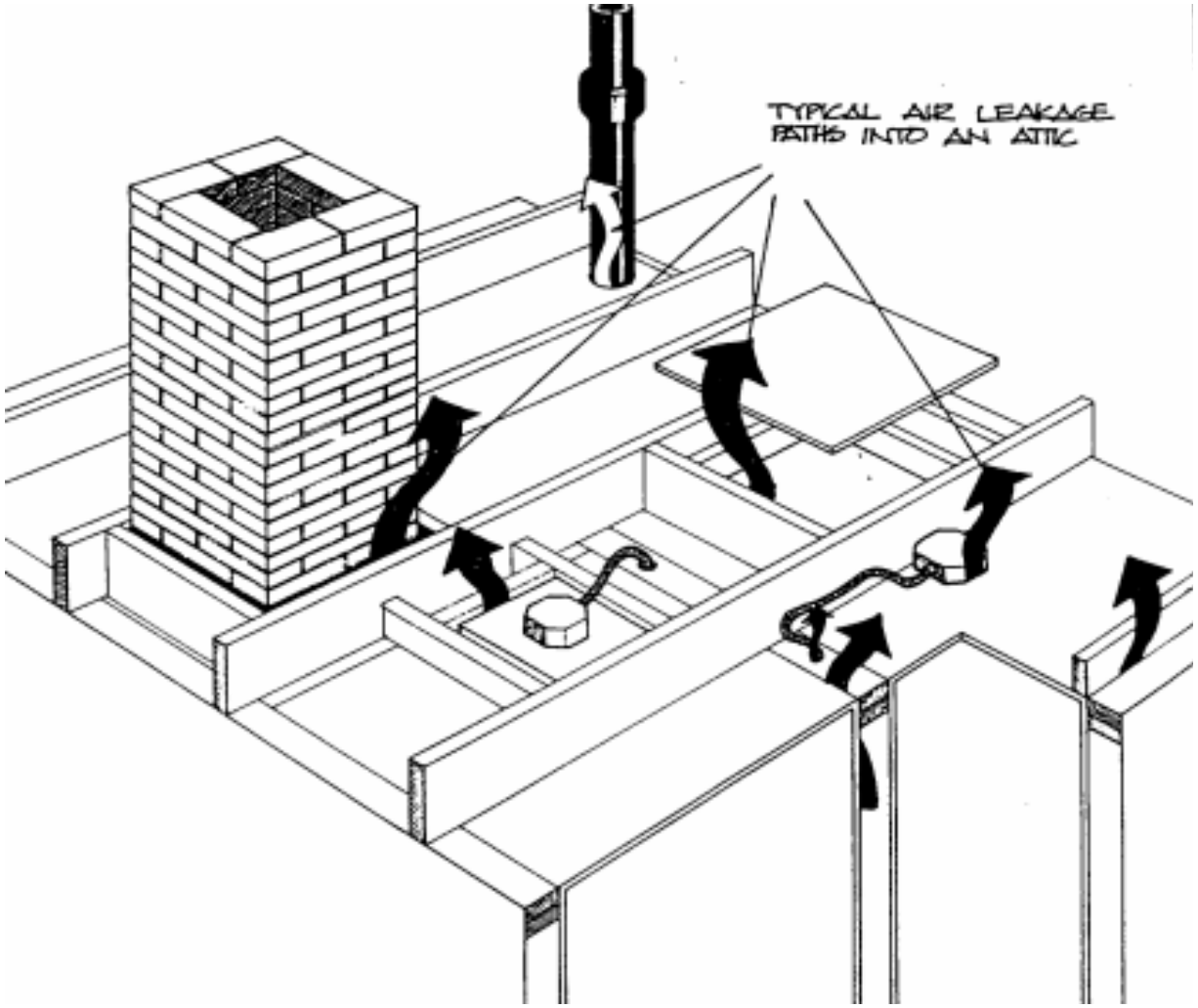
Thermal Boundary



Thermal Bypass Examples

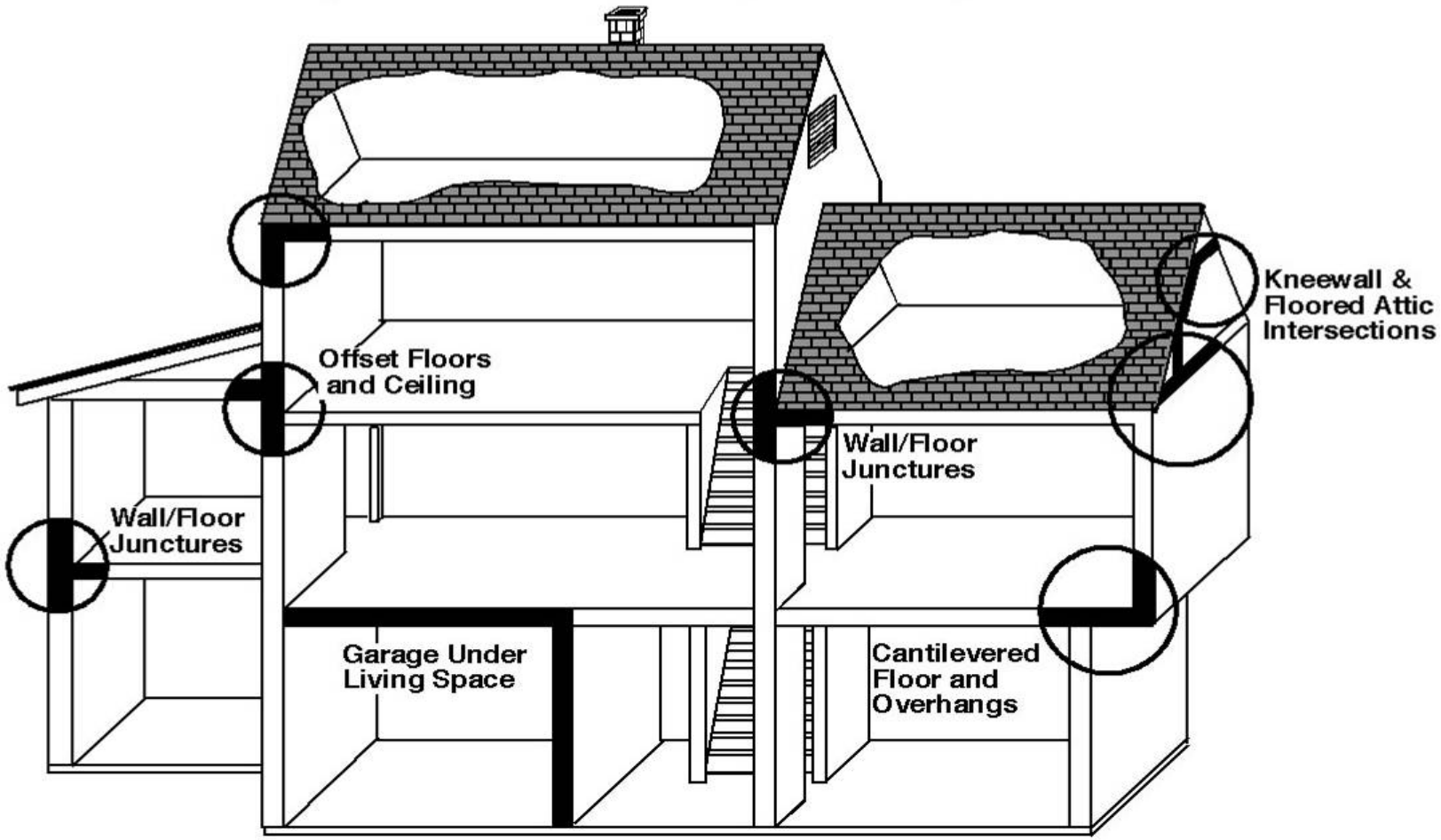
1. Vaulted ceiling
2. Porch overhang
3. Knee wall rafter insulation
4. Chimney chase
5. Can light

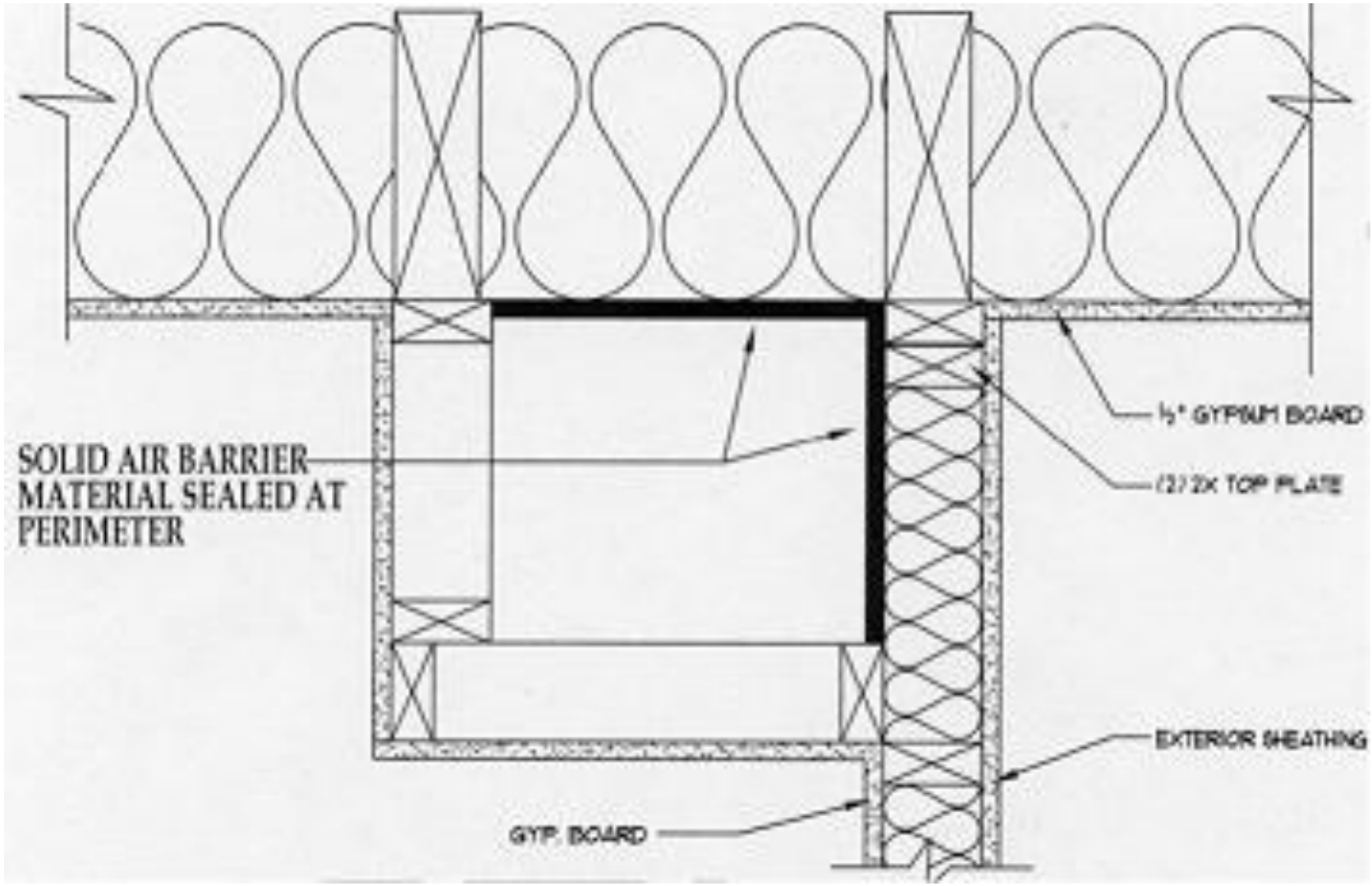
1st Priority- attic air leaks



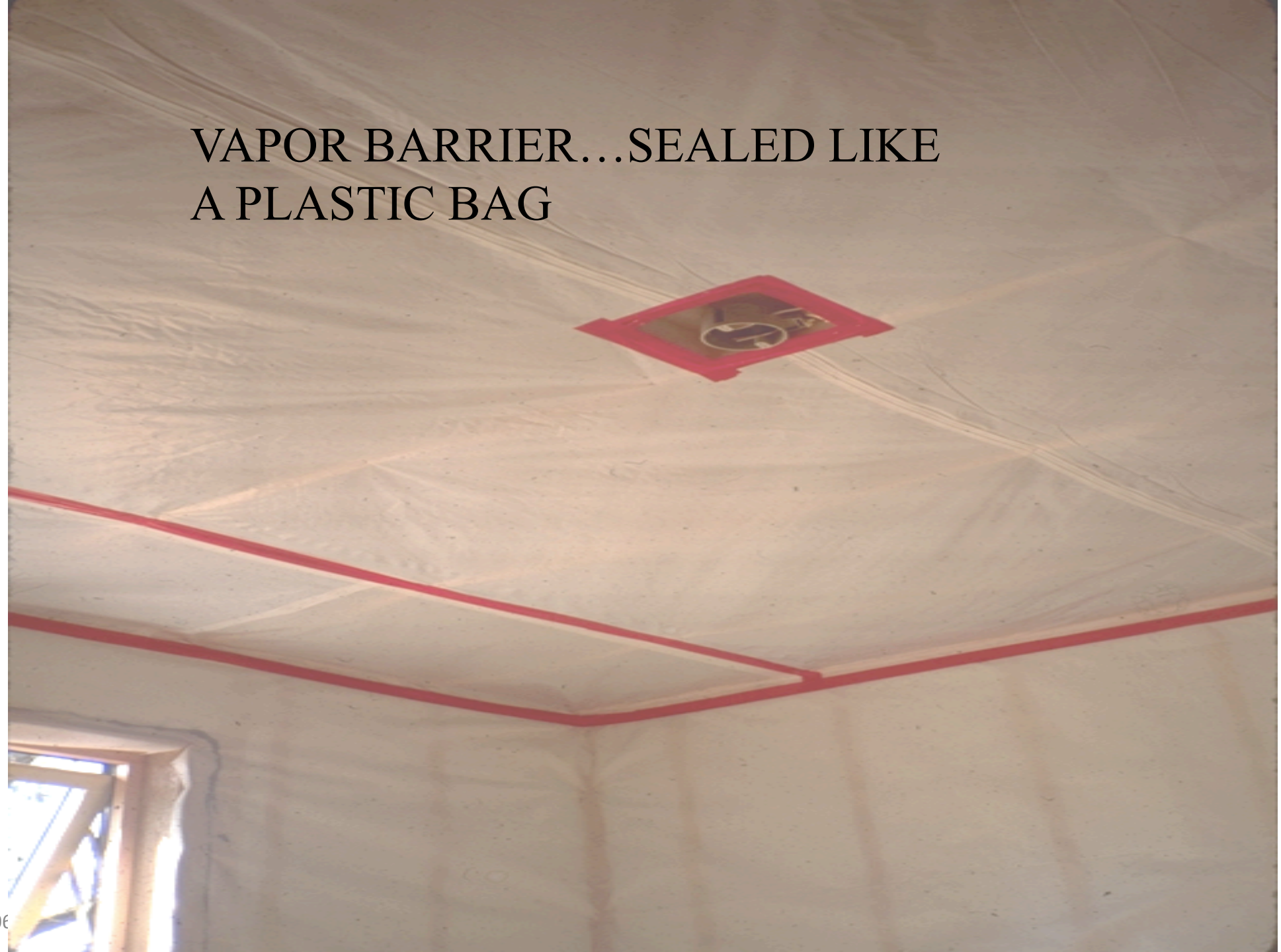
What type of Construction details to look for

Key details

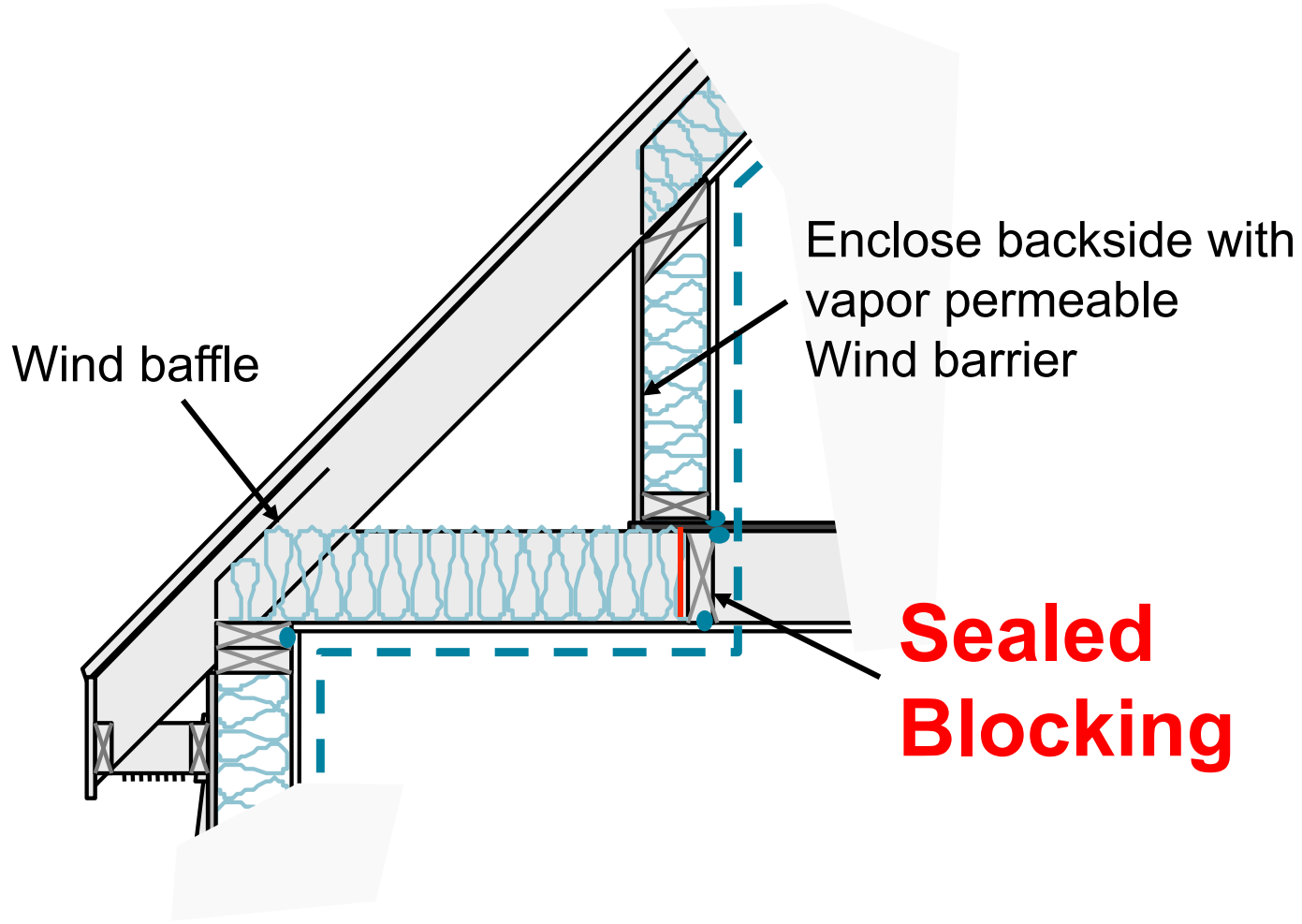

Kneewall &
Floored Attic
Intersections
Offset Floors
and Ceiling
Wall/Floor
Junctures
Wall/Floor
Junctures
Garage Under
Living Space
Cantilevered
Floor and
Overhangs



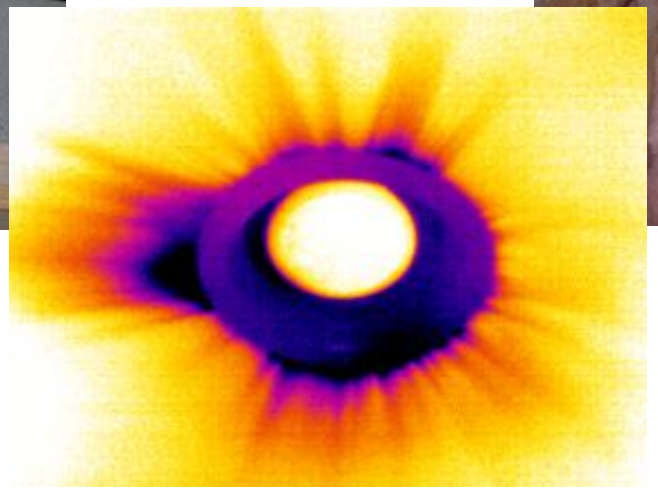
EPA: Thermal Bypass Guide


VAPOR BARRIER…SEALED LIKE
A PLASTIC BAG

Treatments


Wind baffle
Enclose backside with
vapor permeable
Wind barrier
Sealed
Blocking

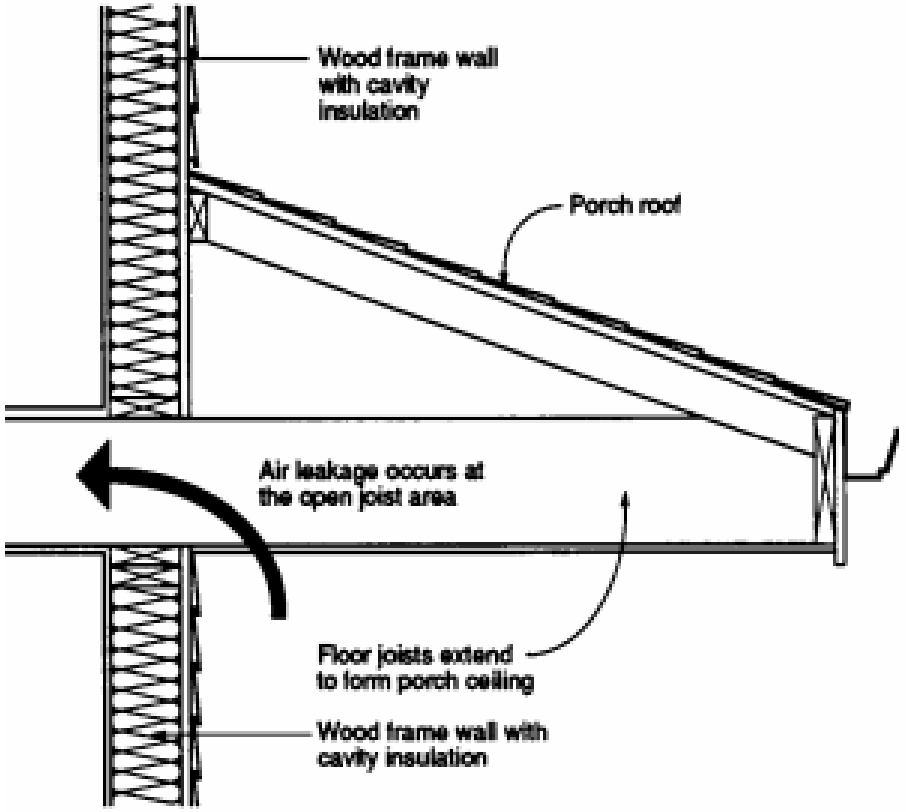
Build airtight, recessed light enclosures



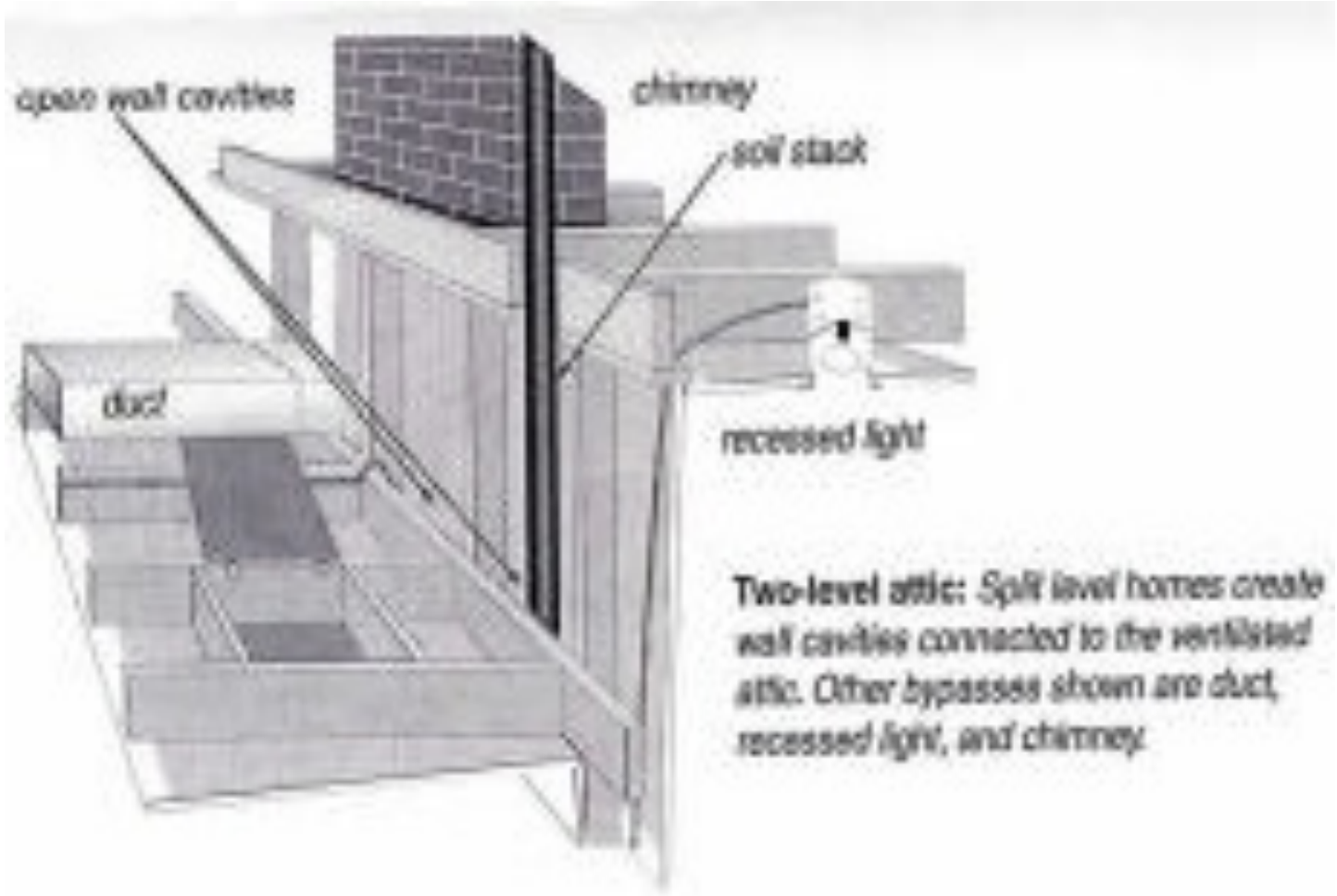
AIR FLOW LEAKAGE(speakers and lights) and DUCT PENETRATION FROM ATTIC

How many air leakage details in this picture

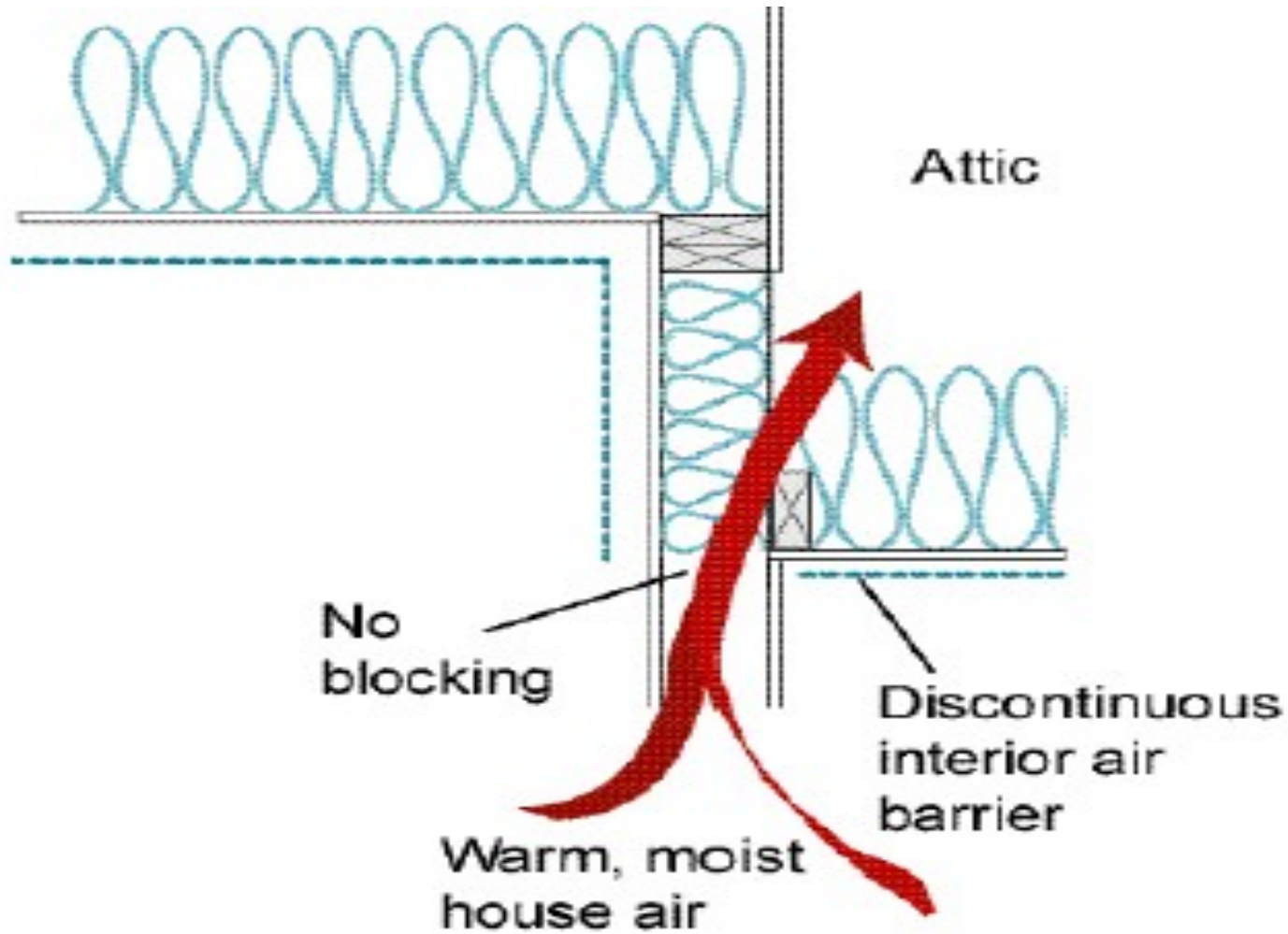
Key Detail:
Porch framing on two-story



Key Detail: Level changes

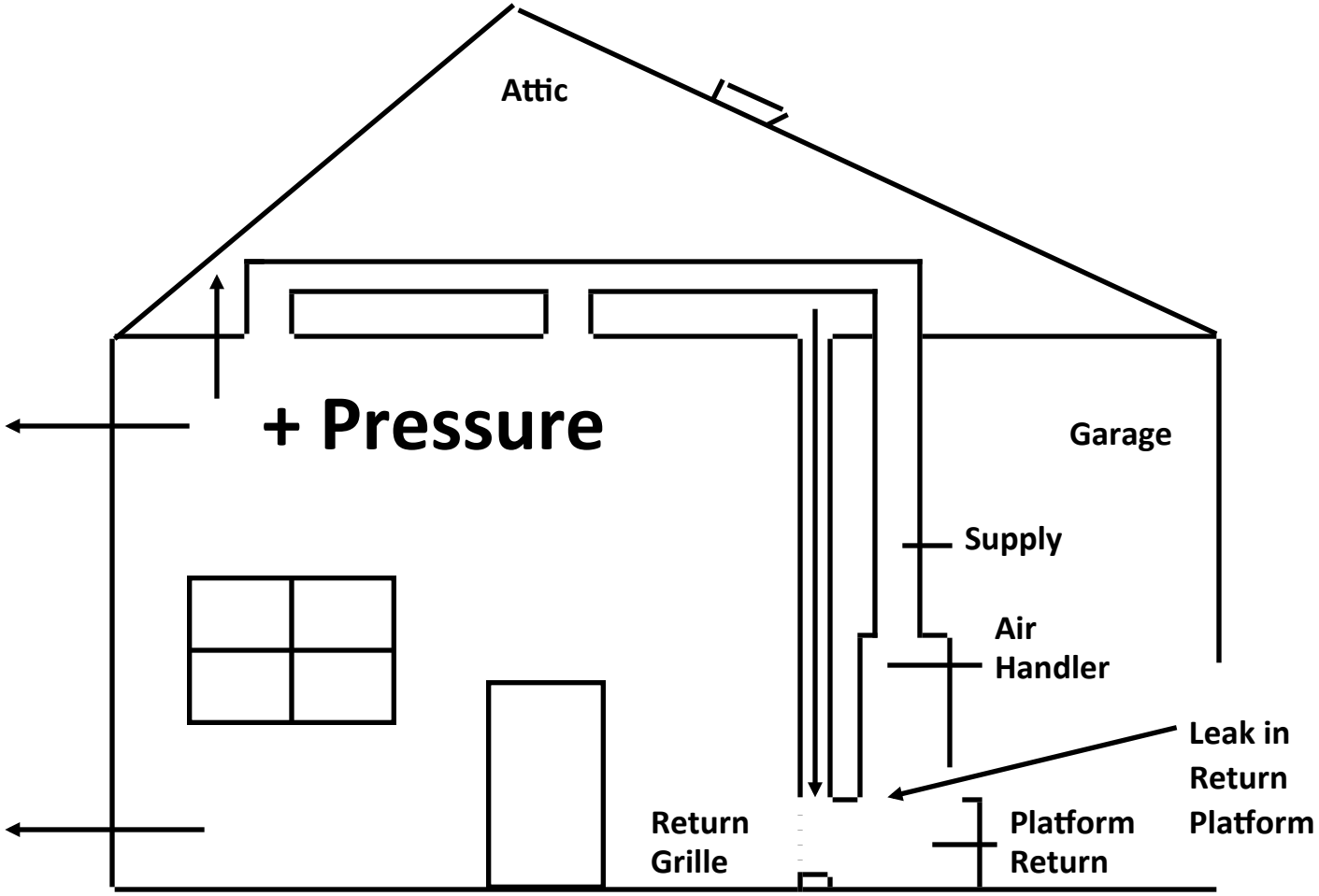


Two-level attic: *Split level homes create wall cavities connected to the ventilated attic. Other bypasses shown are duct, recessed light, and chimney.*

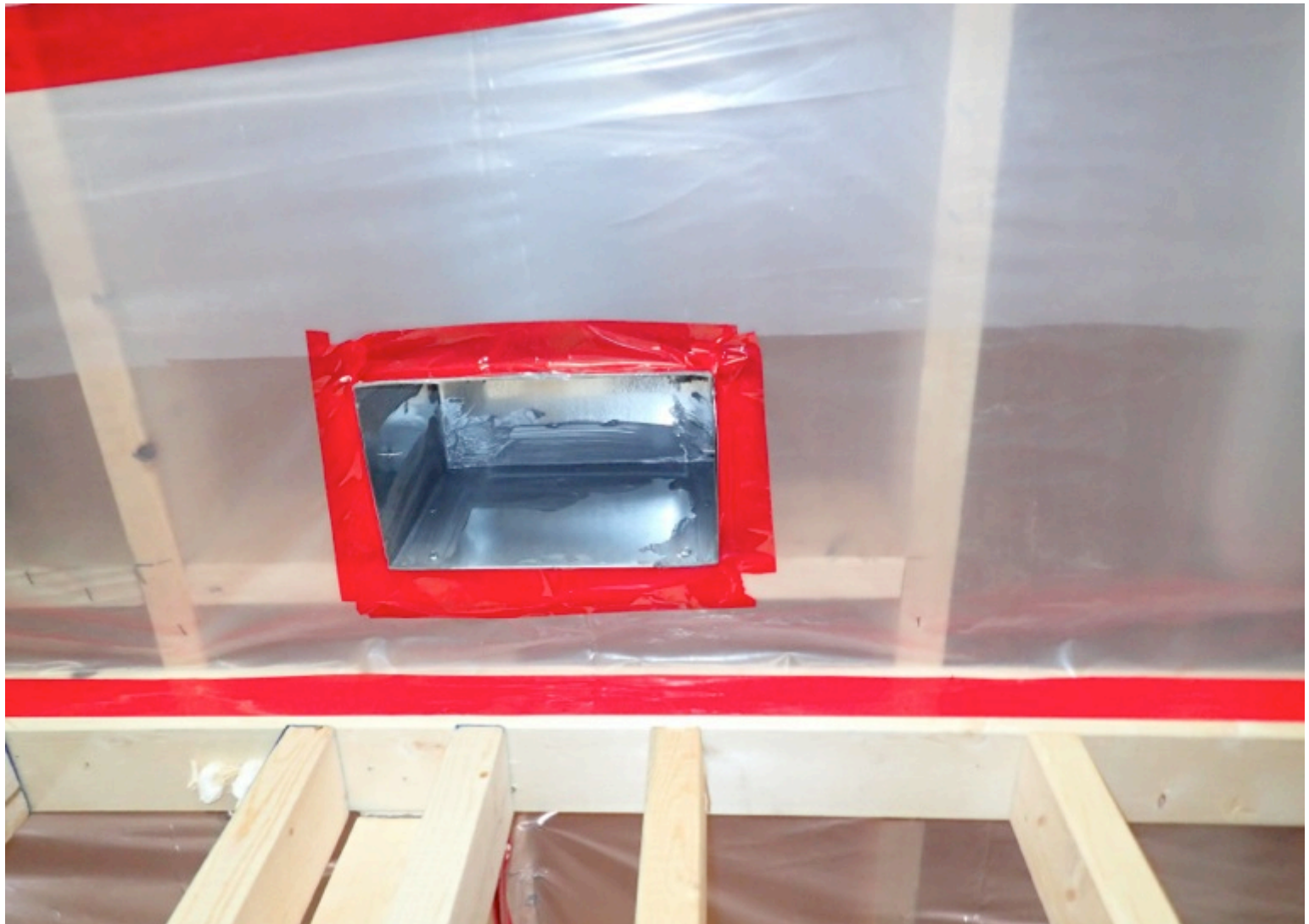

Attic
No
blocking
Discontinuous
interior air
barrier
Warm, moist
house air

House to garage connection

Return Leaks From Outside Pressurize Houses



Duct penetration



Wiring air bypass

Window and Door jambs

Seal joint floor to plate, wall, pipe, holes in floor

Air inlet system ?

Insulation and air sealing types

- A lot of stuff on the market- discussion

Talk to people that do the blower door test, insulators, and others builders that pass the test

Testing and Site Verification

Blower door test when ?

- After sheet rock is up ?
- When house is at final ?
- When trades are all done with there work (holes)

Duct sealing (mandatory)

- All joints need to be sealed
- Building cavities can’t be used as ducts

Mastic vs tape

- It has been proven in many programs thought out the country and performance testing over many years that mastic is better sealing the duct work when doing the air tightness testing on the duct system
- Spread the mastic on nickel thick.. With brush is generally the best
- To my understanding no tape meets the UL 181 (A or B ?) listing
- Talk to your inspector

Mastic and Tape , Ducting sealing

- Some cities will be allowing tape, ask your inspector
- Closure systems used to seal ductwork listed and labeled in accordance with UL 181A shall be marked “ 181A-P” for pressure-sensitive tape, “181A-M for mastic…. This will be allowed

- FROM NATIONAL EXPERIECE IF YOU HAVE TO DO THE DUCT LEAKAGE TEST YOU BETTER USE DUCT MASTIC !!!

Testing of Duct System… Air Tightness of Complete Duct System… Duct Blaster Test

- Both return and supply shall be tested if duct work is out side thermal building envelope
- Two options for testing
  1. Rough in test , when duct work is complete but furnace cabinet has not been installed
  2. Post construction , this is when furnace cabinet has be installed

Option one at rough in

- Find air leaks early
- Who is going to do the test?
- Test one side at a time
- 0.03 x sq. ft. of condition area
- Example 3000 ft. = 90 cfm leakage
- Very few people are talking about this method
- This is now the norm

Option two when ducting and furnace installation is complete

- Hard to find and seal air leaks
- Who is going to do the test ?
- 0.04 x sq. ft. of condition area
- Example 3000 ft. would = 120 cfm of leakage
- System we are doing today 700 to 2000 cfm leakage
- System now have to be between 15 and maybe 200

Cover supply and return covered with card board

Foam plugs

Mechanical options

- Learn about the different HVAC design option for slab on grade construction

Type Heating and Cooling

- Forced air
  - Furnace
  - Mini split Ducted and Ductless
  - Geo
- Radiant
  - Boiler…. Gas-LP-Electric
  - Electric cable

Mechanical options

Type Ventilation balanced

- Ducted to furnace
- Fully ducted

Duct design

- Attic
- Drop ceiling soffit
- Tran site (under ground duct work)

Hot water (DHW)

- Integrated
- Independent
- Gas –Electric

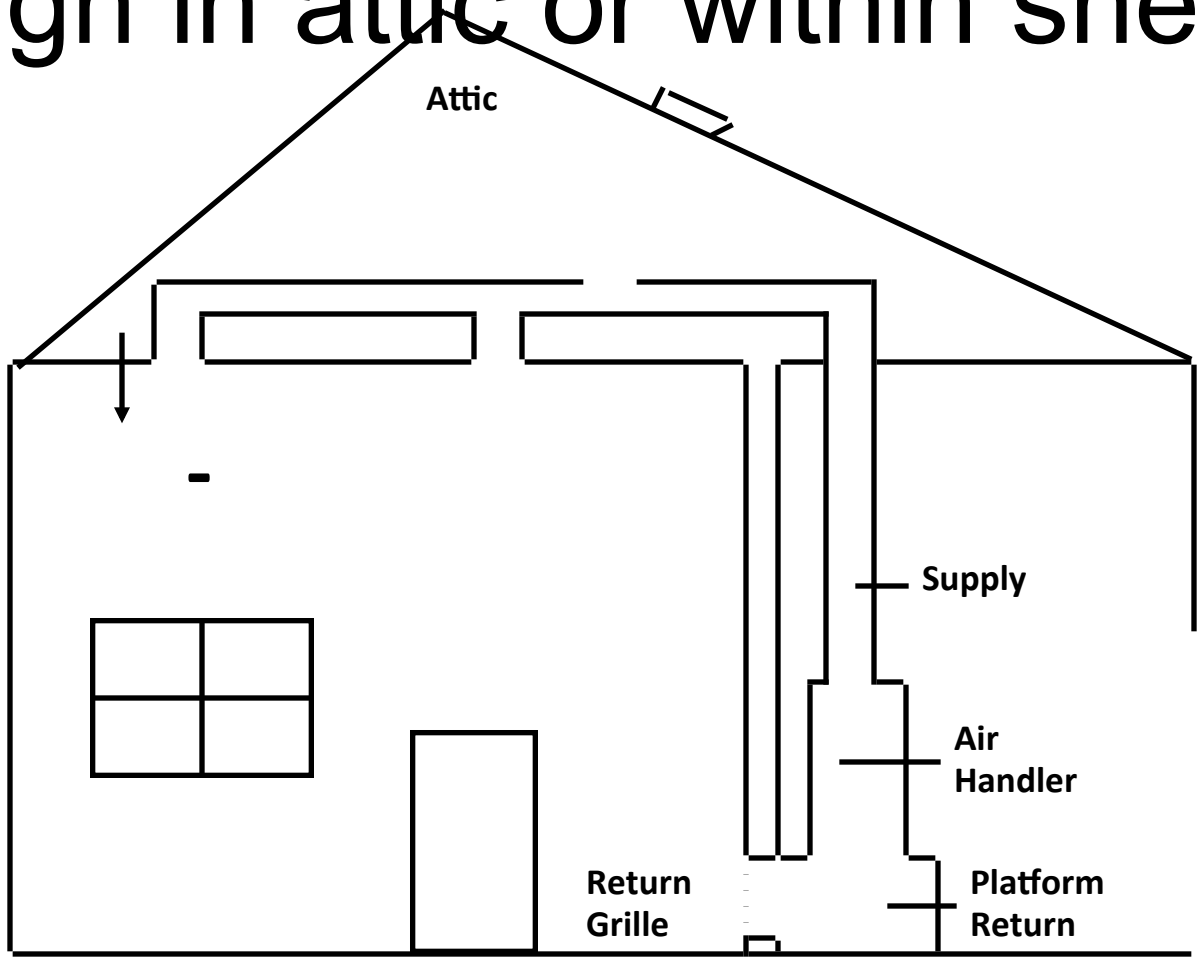
Humidity

Summer and Winter

Small mech. Rooms are tough to get equipment in …. Work with HVAC trade

90 % two pipe furnace

Duct design in attic or within shell

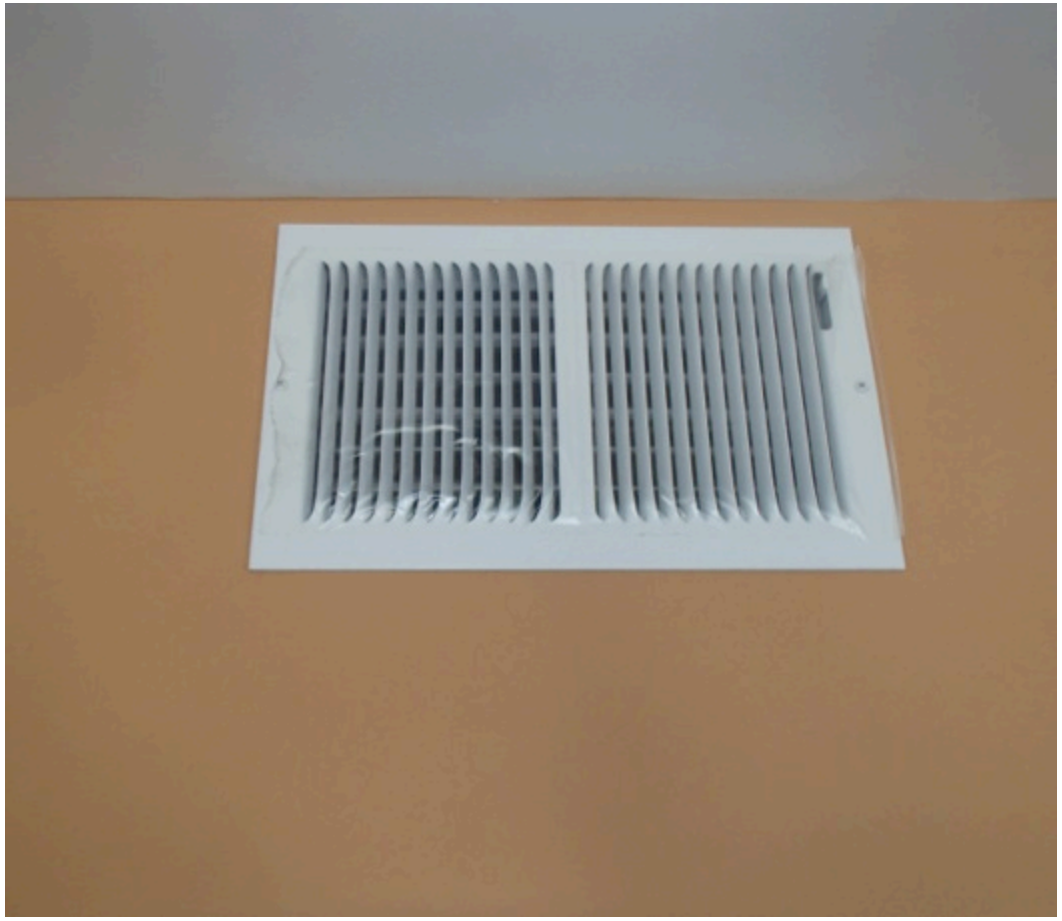


Forced air duct work in the attic

Drop ceiling for duct work

High V

Central supply grills that are on interior walls



Single return filter grills


Water in the ductwork below slab

Quiet one sone bath fan

Small Hrv , general duct design

RADIANT HEAT WITH A BOILER OR ELECTRIC CABLE

Ductless Cooling & Heating

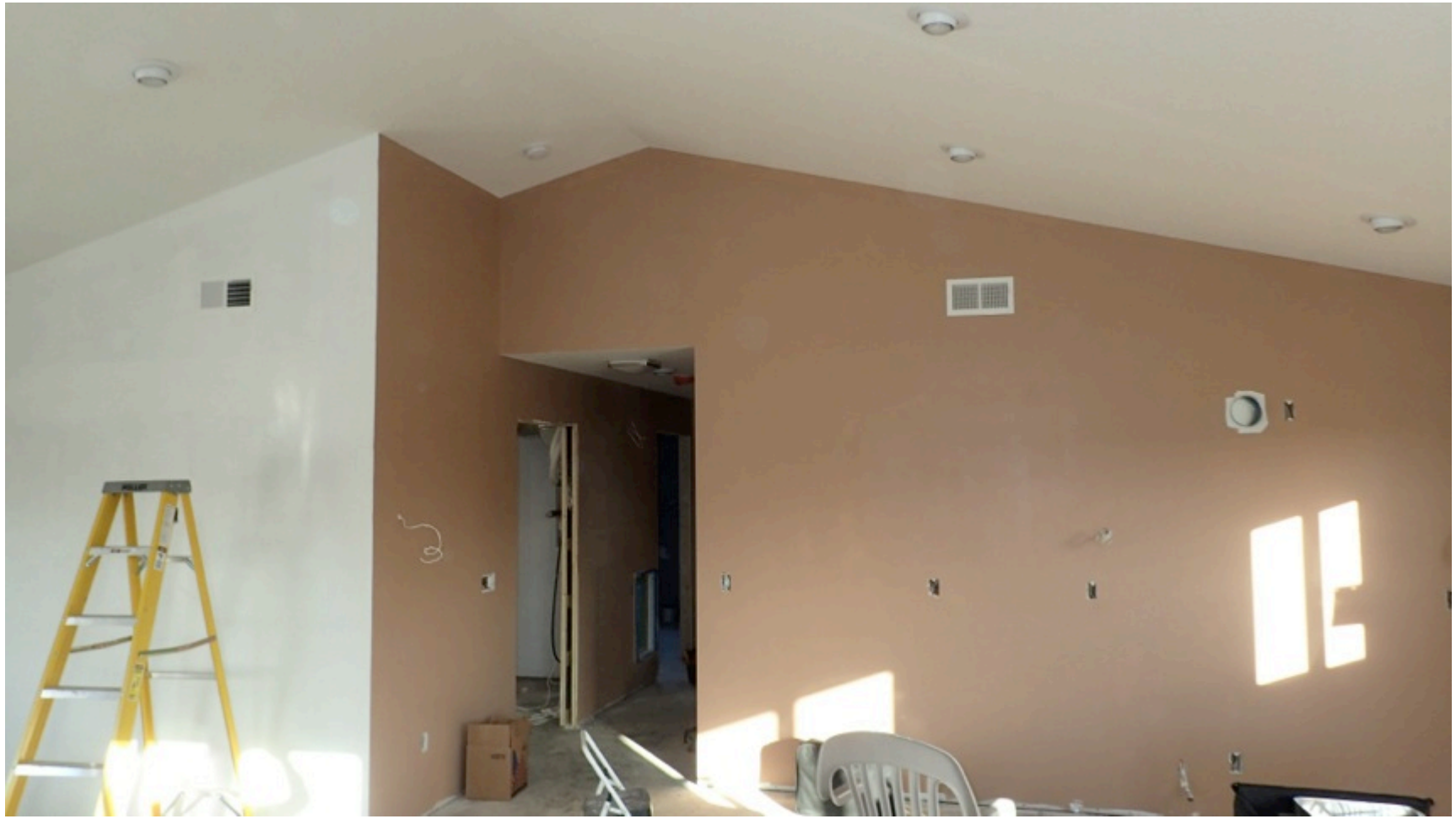
- Very cost-effective method of adding cooling to existing home without forced air or addition
- Up to three-zone capability
- With new Inverter Heat Pump technology, heating can be added to an addition with electric baseboard backup where other methods will not work

DUCTLESS AC AND HEAT

HIGH SIDE WALL MINI SPLIT WITH FULLY DUCTED VENTILATION

DUCTED MINI SPLIT, IN MECH. ROOM

DUCTED MINI SPLIT WITH BALANCED VENTILATION



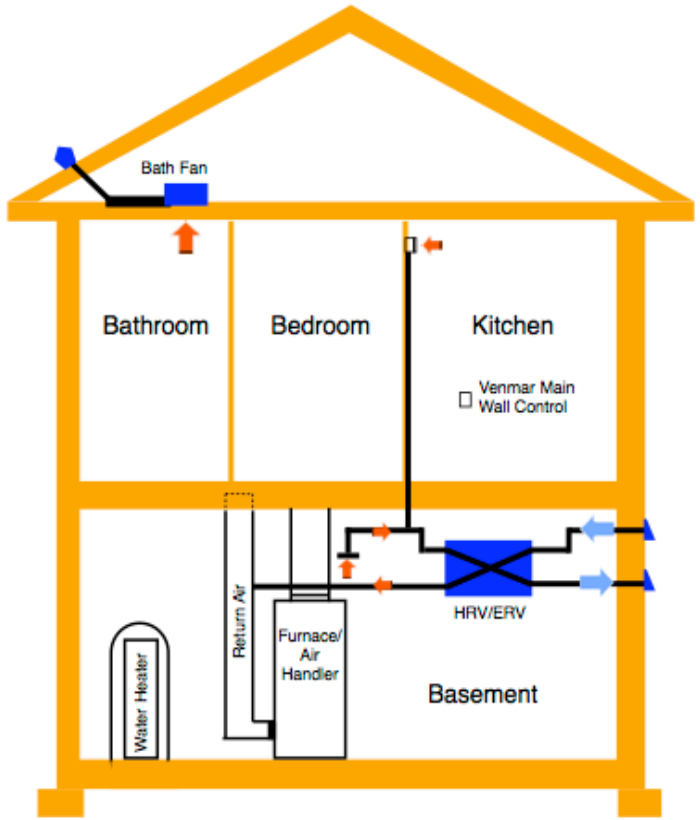
Direct vent fireplace

New 65 pint dehumidifier

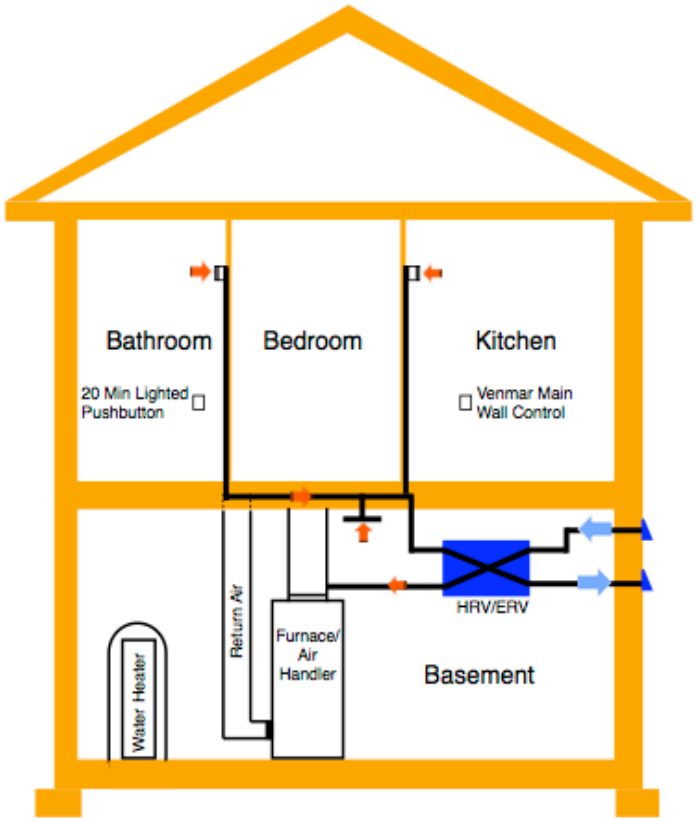
VENTILATION DUCT DESIGN HRV/ERV

- Source point
- General ventilation
- Return- return
- Return- supply
- Fully ducted

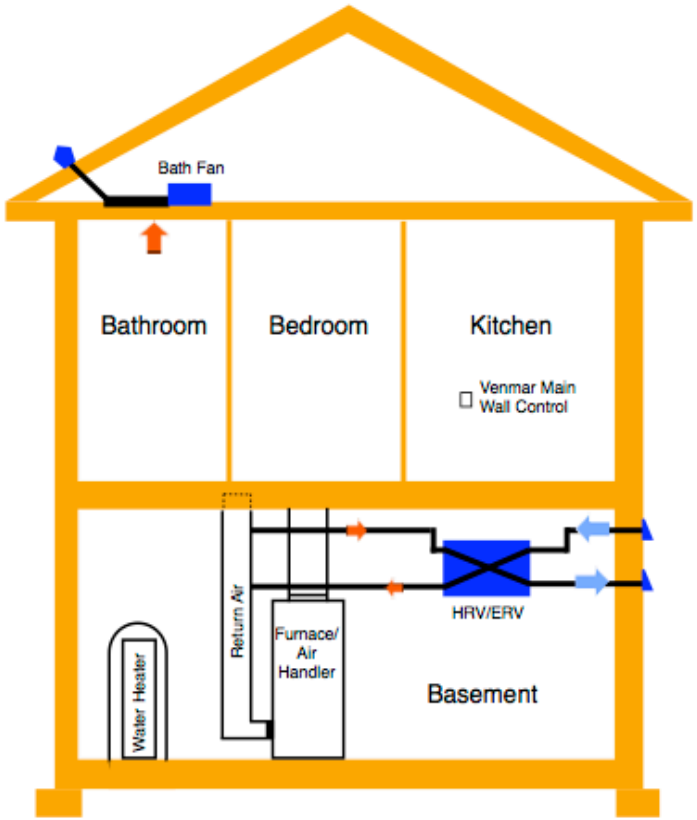
Installation Options



General Ventilation
(one exhaust per level)



Source Point Ventilation



Volume Ventilation
(return/return or return supply)

General Ventilation

- Air is exhausted from the basement (musty smells, moisture) and the kitchen area (moisture, cooking odors, gas stove by-products)
- Tempered fresh Air is ducted to furnace return or supply

Source Point Ventilation

- Air is exhausted from the kitchen area and can replace bathroom fans-- in applications where duct lengths are not excessive.
- Tempered air is ducted to furnace return or supply.

Volume Ventilation

- The existing furnace ductwork is used to exhaust and supply fresh air to the building.
- Tempered air is ducted to furnace return or supply.

Furnace fan needs to run on a return/return strategy

FULLY DUCTED

- For non-forced air heating systems
- Exhaust from bathrooms & kitchen
- Supply to bedrooms & main living areas
- Optimum air quality control

SOURCE POINT DESIGN AND BATH FANS

- DEPENDING ON DUCT LENGTH , TYPE AND SIZE OF THE BATH ROOM

ONE MAY USE HRV/ERV AS BATHROOM EXHAUST SYSTEM… 5 TO 6 ACH. NO BATH FAN NEEDED

- ZONING OF HRV/ERV IS AN OPTION
- AN EXHAUST POINT FROM HRV/ERV AND BATH FAN IN THE SAME BATHROOM IS AN OPTION

DESIGN DETAILS

- THERE IS A LOT OF EXPERIECE AND HISTORY ON HOW SYSTEM ARE INSTALLED ….LOWEST COST IS NOT ALL WAYS THE BEST OPTION , THE INDUSTY IS 30 PLUS YEARS OLD, REVIEW THESE DESIGNS WITH SOME ONE THAT HAS DIRECT EXPERIECE WITH ALL THESE VENTILATION DESIGNS, SIT DOWN WITH AN HVAC PROFESSIONAL AND REVIEW YOUR OPTION FOR THE HOMES THAT YOU ARE BUILDING

Thank you for your time

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