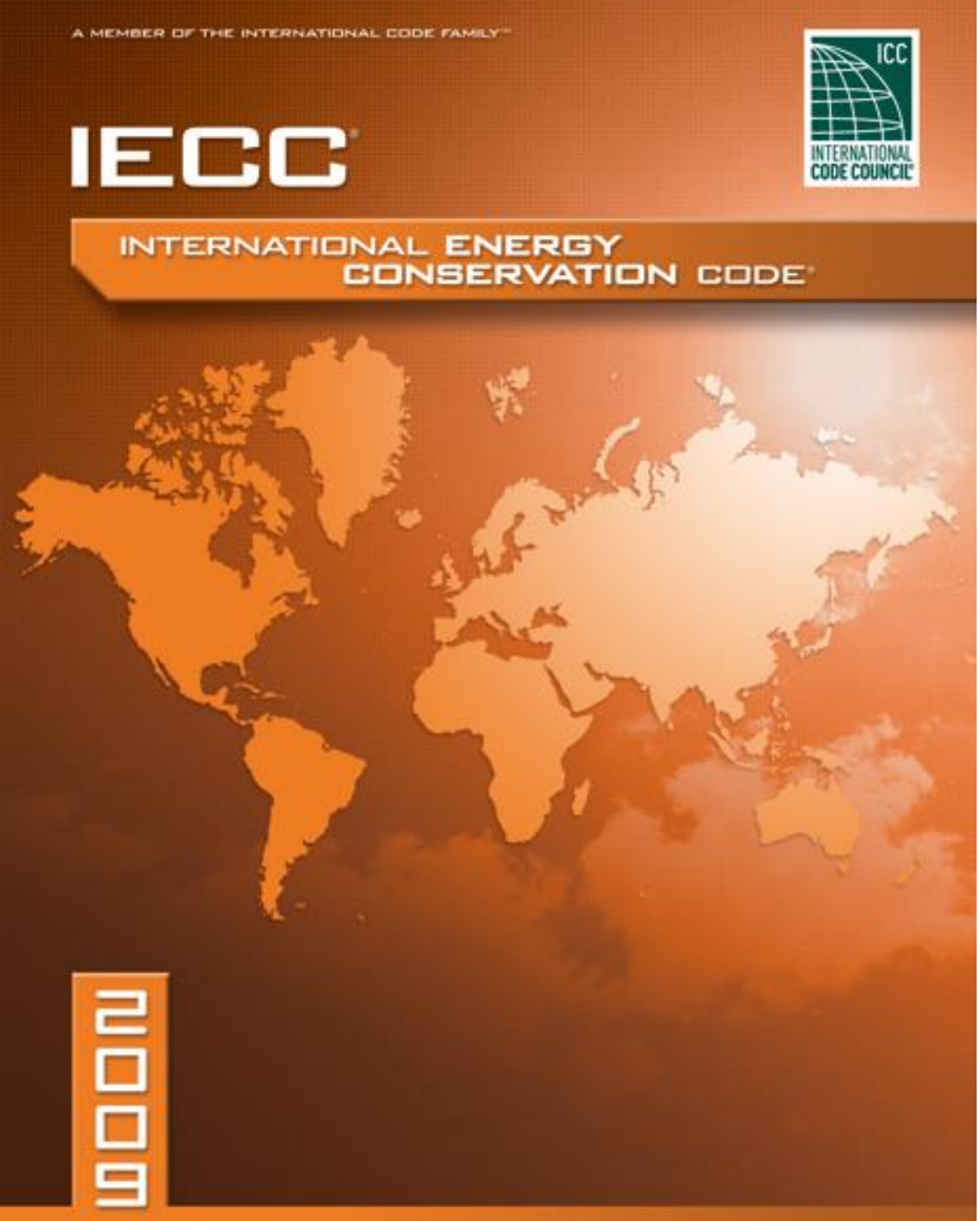
Synergy™
HOME PERFORMANCE

Step 3
Improved Thermal Systems

Spray foam on the right side of the attic vs. traditional blown attic insulation on the left side.



- **Finally a code that is more than just "life and limb"**

Big Changes in the 2009 International Residential Code

- The Code is finally addressing energy efficiency instead of just health and safety of the occupants.
- Performance based code instead of prescriptive only now allows trade-offs and flexibility if modeling software is used!
- Accurate Manual J / D / S are required.
- Blower door test or an extensive checklist that requires insulation and air barrier to be properly aligned and penetrations to be air sealed.
- Duct Blaster Test and R-8 duct insulation unless ducts are in conditioned areas.
- Fresh air make-up on kitchen exhausts over 400 cubic feet per minute.
- Fresh air makeup on wood burning fireplaces and gasketed doors.
- 50% of lighting fixtures must be high-efficacy.

- Raise your hand if you build an energy efficient, comfortable, durable, and healthy home?
- How do you know?
- Are you code compliant with the 2009 State of Alabama Energy Code or are you still building to the 2003 International Residential Code?

When is the contractor most at risk for construction defects?

- Code compliancy is not achieved. (Regardless of whether or not the code official passed it)
- The contract is not complied with.
- Standard practice is not accomplished.
- The manufacturer's specifications are not followed.
- Reasonable consumer expectation is not met.
- When certifications and qualifications for green building or energy efficient construction methods are advertised but not met. This is called "green washing".
- Negligence.
- Fraud and misrepresentation.

A great resource!

ADECA Field Guide to the 2009 IRC

http://www.adeca.alabama.gov/Divisions/energy/Documents/Codes/

The 7 Steps of Building a Synergy Home

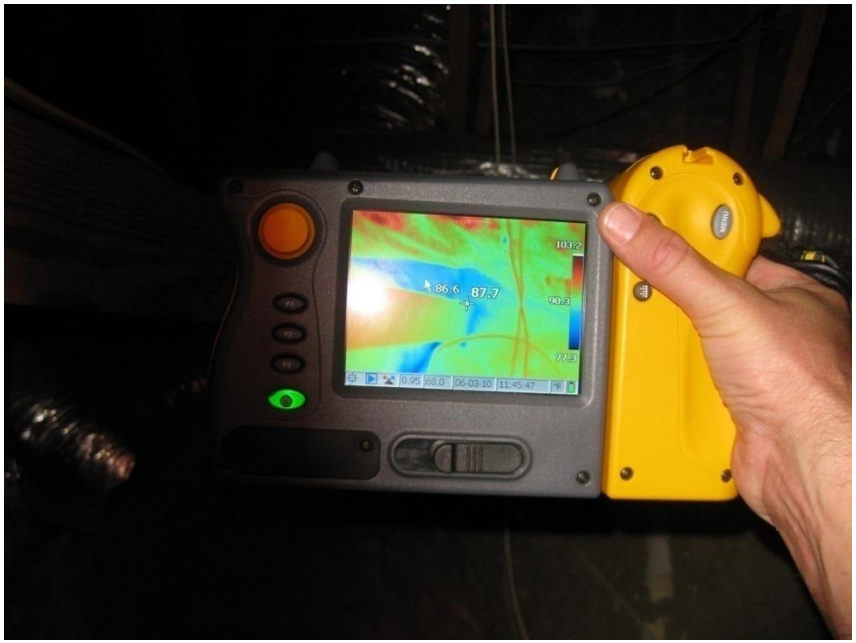
- Airtight Construction
- Fresh Air Ventilation
- **Improved Thermal Systems**
- Properly Sized, Designed, Installed, and Commissioned HVAC System
- Pressure Balanced
- Moisture Managed
- Combustion Safety

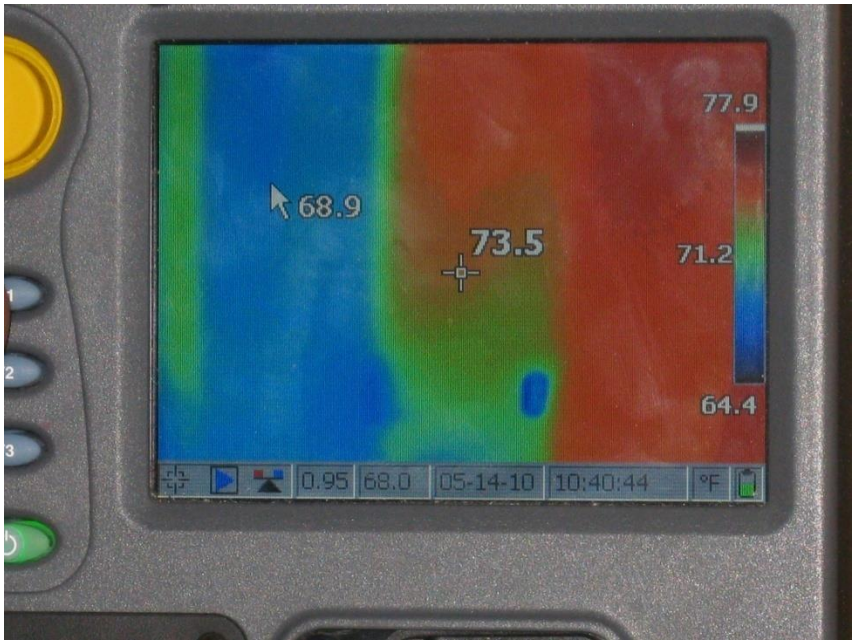
Bring your HVAC system into the building envelope.

Conditioned Crawlspace

Encapsulated Attic

The infrared camera allows us to identify bad insulation jobs that are covered up.





Insulation, other than foam, is not an air barrier. It is mandatory that the insulation must be touching the air barrier for it to work correctly!

- Identify the thermal envelope on the blueprints!
- Frame correctly!
- Air-seal correctly!
- Insulate correctly!
- Inspect!
- Blower door test and infrared scan!

Radiant barriers do not help well insulated wall systems.

We recommend radiant barrier Tech-Shield roof decking in specific instances.

- If your ducts are located in the attic it helps to knock off heat gains.
- Remember that radiant barrier has to have an air space for it to work.
- Installing foam onto radiant barrier eliminates any benefit due to the lack of airspace.

Radiant barriers only provide marginal energy savings and are often sold by companies making unrealistic energy savings claims.

See

http://www.greenbuildingadvisor.com/blogs/dept/musings/stay-away-foil-faced-bubble-wrap

&

http://www.greenbuildingadvisor.com/blogs/dept/qa-spotlight/bubble-wrap-duct-insulation

Foam is a Great Product

- It is an insulator and an air barrier. It eliminates the need to add an air barrier over traditional insulation such as behind tubs, fireplaces, etc
- It eliminates the need for a radiant barrier in the attic.
- It eliminates the need for attic venting and vented soffits.
- It makes up for not framing correctly.
- It has the potential to reduce your HVAC unit by up to 50%.
- It eliminates the need to perform a duct tightness test, R-8 duct insulation, insulated attic access doors and pulldowns, extensive air-sealing, etc.

The problem with foam is….

- It is expensive initially….it starts at around $1.50 per square foot.
- It requires a well thought out ventilation strategy.
- It requires a properly sized, designed, and installed HVAC system.
- Many of the companies installing foam do not know what they are doing.
- You must understand the difference between “open cell” and “closed cell”.

See our article “Things To Consider When Purchasing Spray Foam Insulation.”

Fourier's Law of Thermodynamics tell us there is a diminishing return in R-value. 6" of spray foam reduces the conductive heat flow by 96%. 8" of spray foam reduces conductive heat flow by 97%.

Q = Area x Delta T x U Value

Band Joists/Rim Joists are notorious for being improperly air sealed and insulated.

Only spray foam insulation works as both an insulator and air barrier. F/G batts and cellulose allow unconditioned air to flow through it and this leads to energy losses, nail pops, and trim cracks.

Correct

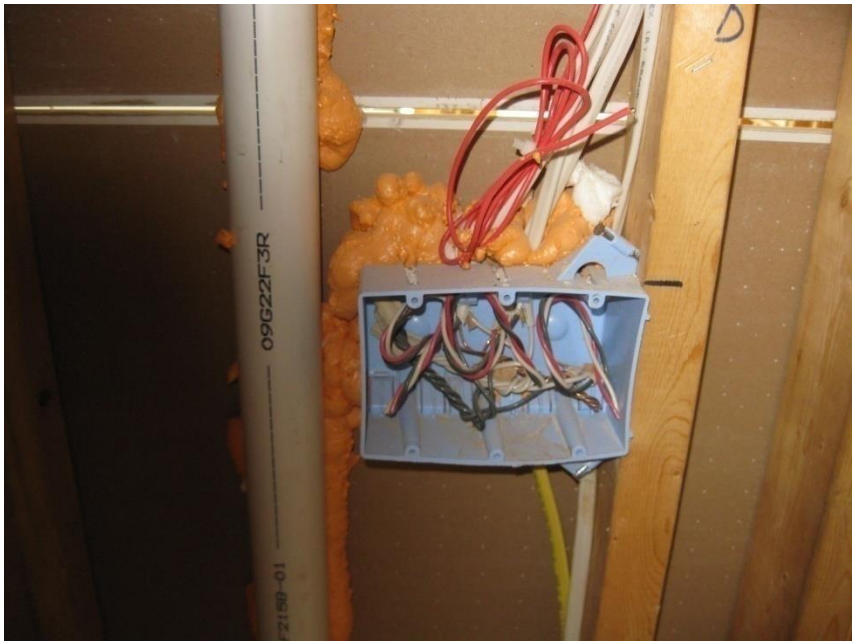
Incorrect

Bonus room floors, cantilevers, and floor insulation have no chance of performing since the insulation is not installed in permanent contact with the subflooring.

Spray foam is the only product that can perform properly in a bonus room floor system or cantilever.

Notice that this home has some spray foam but fiberglass batts were installed in the difficult areas. Why bother?

Air-sealing details are almost impossible unless spray foam is used.



Notice how spray foam seals around the electrical work.

Fiberglass batts are…..

- Rarely installed correctly and as a result they rarely perform.
- Most often installed by the contractor with the lowest bid. There is a major price war going on in our area and quality is suffering!
- Cheap upfront costs usually means the homeowner pays extra for the life of the home.
- Essentially air filters.

Fiberglass batts must be installed per Level 1 Grading per manufacturer's installation guidelines.

See
http://www.owenscorning.com/literature/pdfs/GradeOneWithFiberglassBatts.pdf
& video
https://www.youtube.com/watch?v=sEWSmJz7w0M#t=20

See

http://www.energyvanguard.com/blog-building-science-HERS-BPI/bid/47219/

&

www.homeenergy.org Insulations Inspections for Home Energy Ratings

http://www.greenbuildingadvisor.com/blogs/dept/musings/installing-fiberglass-right?utm_source=email&utm_medium=eletter&utm_content=gba_eletter&utm_campaign=green-building-advisor-eletter

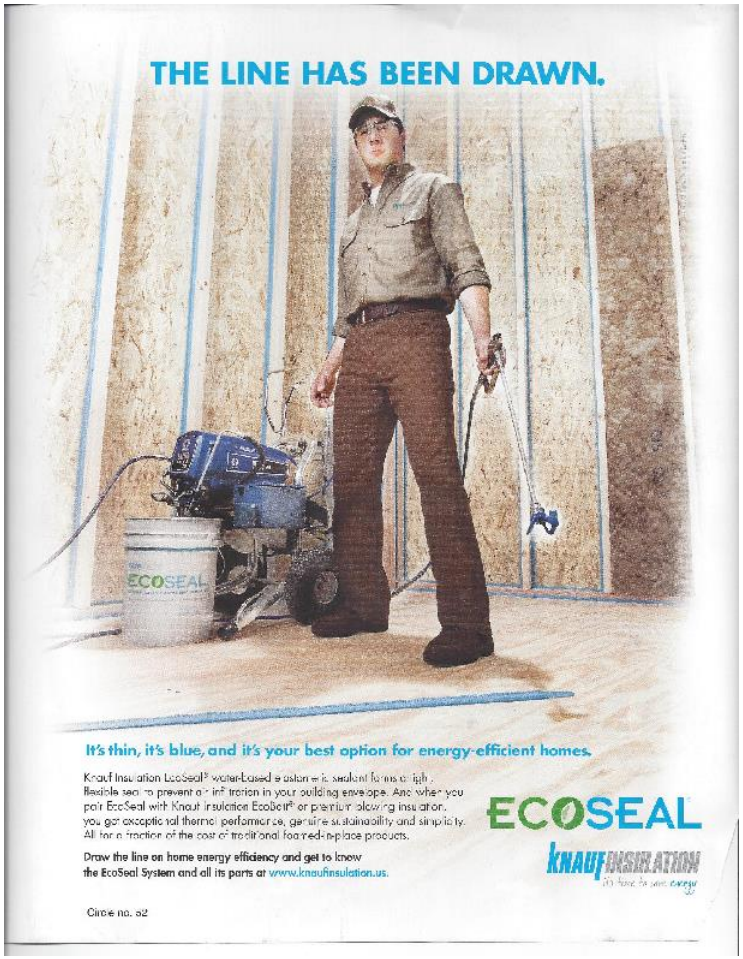
&

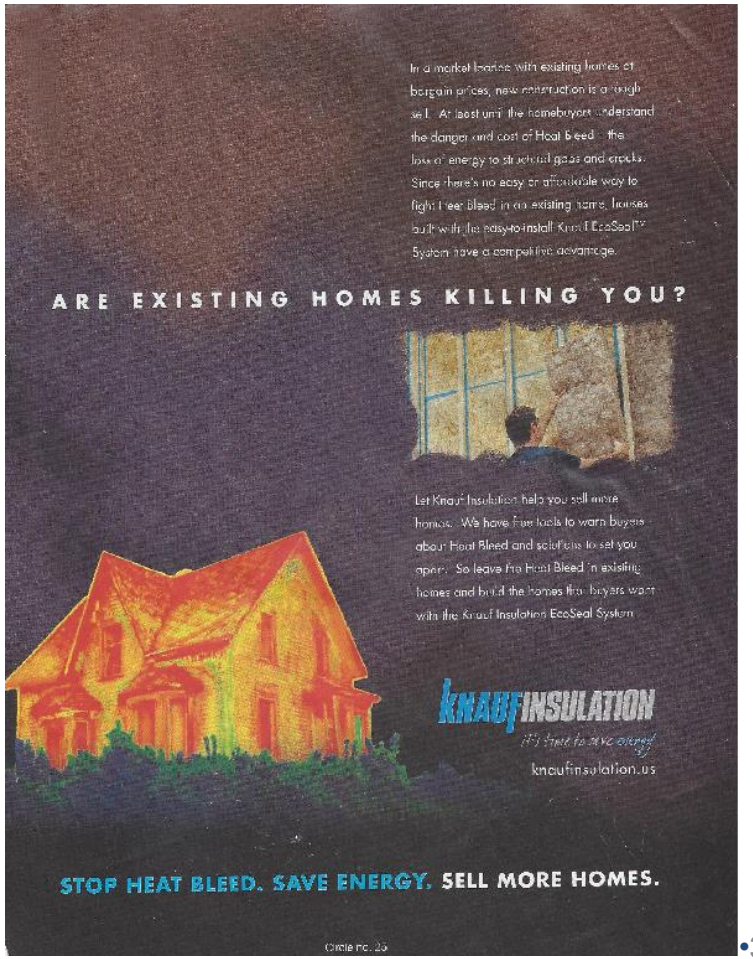
www.ADECA.org Insulation Pix

In the past, when insulating you had to choose between 2 of the 3

- Quality
- Price
- Speed

Fiberglass manufacturer's are selling Ecoseal sealant and similar products because batts do not air-seal. What about the houses without it?





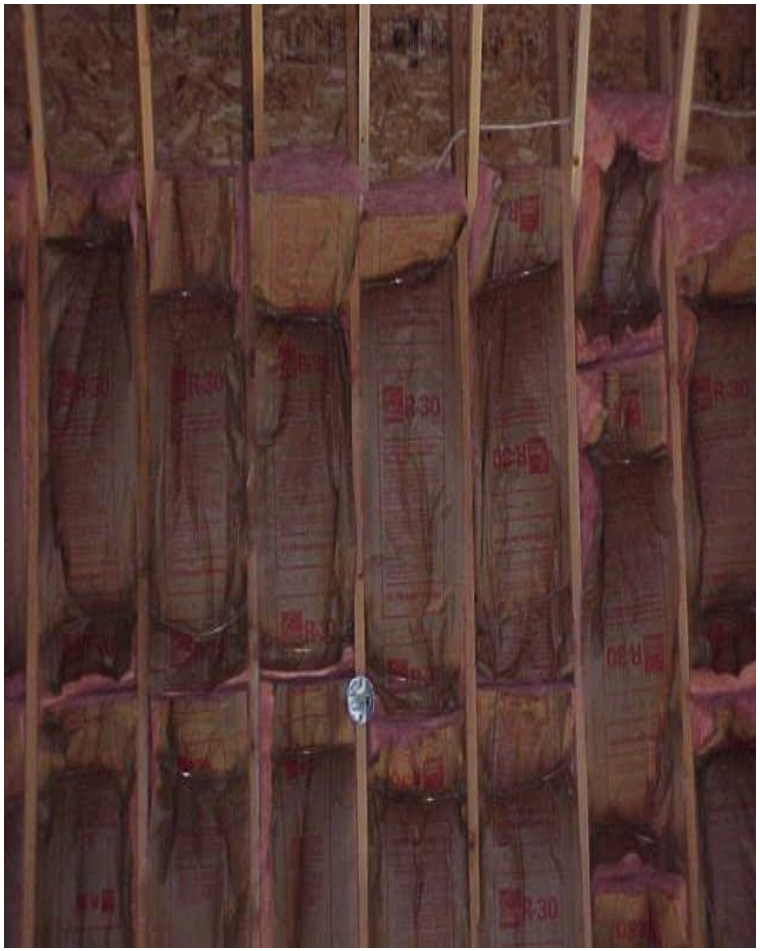
The six most common mistakes made installing fiberglass batt insulation

- Gaps – dramatic R-Value losses result from as much as 1/8” gaps. The blower door and infrared camera help identify these areas.

Voids – when insulation is missing entirely. The blower door and infrared camera help identify these areas.

Compression – the degree of compression is roughly equal to the degree of R-Value loss.

Why cut to fit when you can cram to fit?



Neatness rarely makes a difference in insulation performance. These batts are not performing.

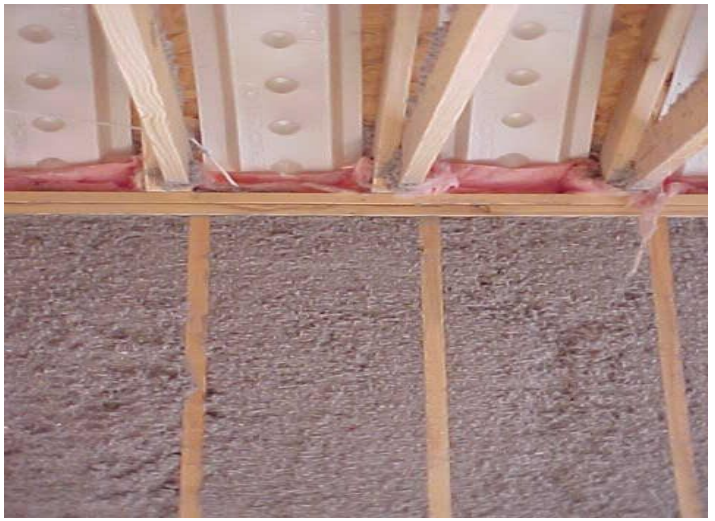
Misalignment – insulation must be touching the air barrier to work correctly. For example, skin is our air barrier. A blanket 12” away will not keep us warm, either.

In the previous picture, can anyone tell me what temperature the bonus room floor will be if the attic is 130 degrees? How about when the outside temperature is 20 degrees?

Foam and encapsulated crawlspaces are the only way to go in crawlspaces.

Foam is the only way to go with Bonus Rooms.

Wind Intrusion – wind blows through the insulation and reduces its R-Value. Hard-decking, “wind tunnels”, or foam prevents this.



We see cracked trim, nail pops, and “ghost marks” around the exterior of the attic where insulation is blown back.

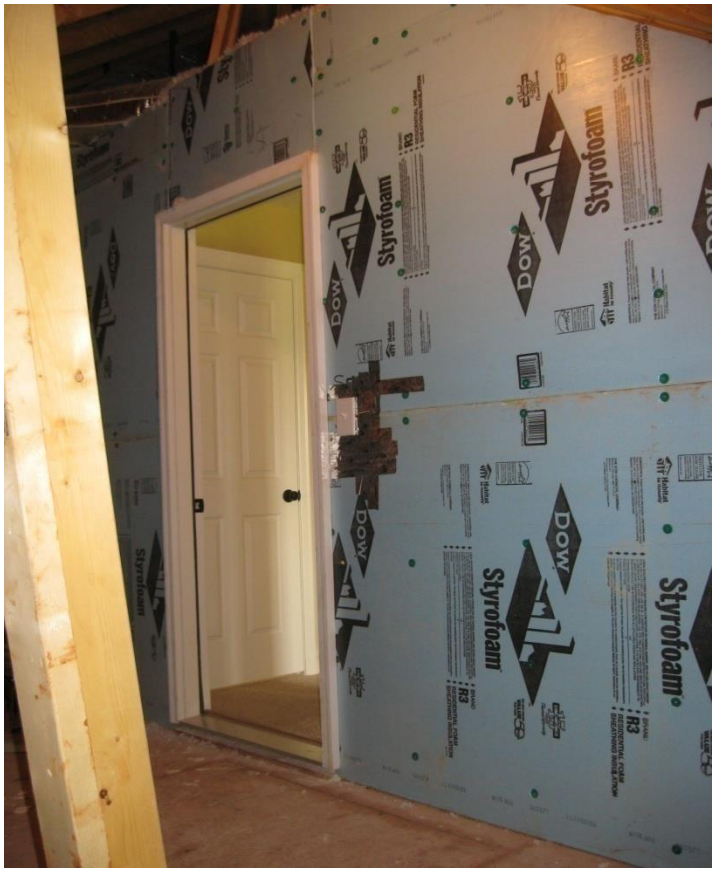
Inadequate Levels of Insulation

- The practice of “shorting” attic insulation has long been a major issue.
- Attic Cards should be signed and dated with the number of bags installed and the R-value.
- Attic Rulers are required.
- Demand proper depth and density.
- The Federal Trade Commission makes it a $10,000 fine per offense.
- Commissioning of the home with a BPI certified energy auditor prevents this.

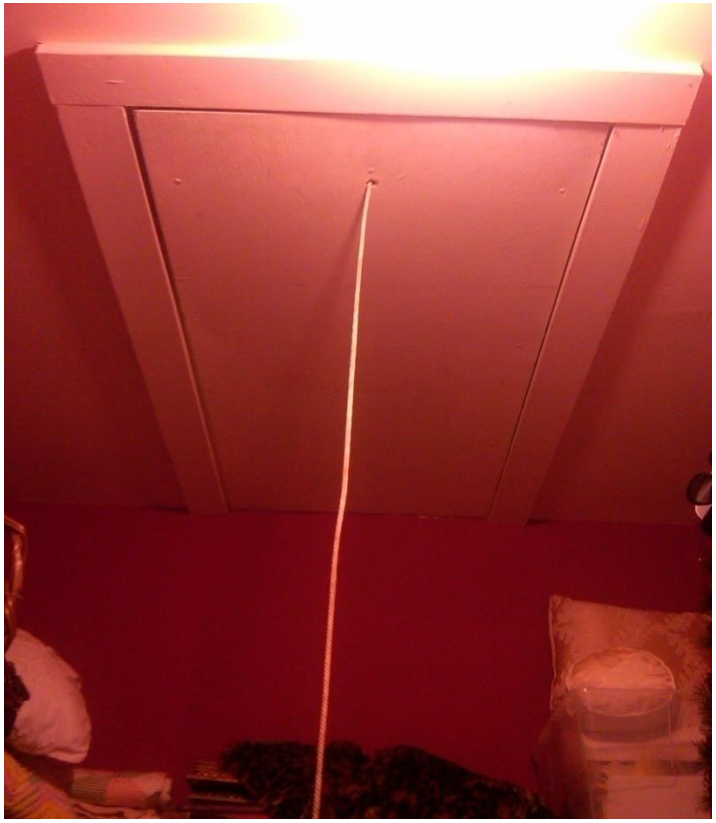
Homes with multiple knee walls will not work without backing or foam.

This is what the backside of the wall typically looks like.

Blueboard stops conduction through the studs, helps align the insulation with the air barrier, and it stops air infiltration.



If 990sf of an attic has perfect R30 insulation but the 10sf of attic access is uninsulated and unsealed with an R1 the total R Value is R23.



When the rafters rest directly on top of the top-plate, there is not enough room for adequate insulation. Notice that a plastic interior vapor barrier that will trap moisture is installed in this "Energy Star" rated home.

Commercial buildings with metal framed studs are almost impossible to insulate with traditional fiberglass batts due to the C-channels and conduction.

Oftentimes commercial buildings are insulated by the sheetrockers and the walls are covered up immediately. Awarding work to the lowest bidder oftentimes saves money up front but adds additional energy costs for the life of the structure.

Drop ceilings in commercial buildings are almost impossible to insulate and airseal without the use of foam.

Low E Windows are Mandatory!

Homes facing east and west will
never cool properly without them!!

This east facing single pane window with metal blinds was 110 degrees at 10:30am

Demand low U-value, low solar heat gain coefficient (SHGC) windows.
Consider your interior window shading.

Window Performance Ratings

A = Measures how well a product prevents the escape of heat

B = Measures how well a product blocks heat from the sun

C = Measures how much light comes through a product

D = Measures how outside air comes into a home

E = Measures how well a product resists the formation of condensation

ASHRAE defines comfort as a state of mind in which satisfaction is expressed with the thermal environment. In other words, human comfort is in our minds!

Six Factors Affect Comfort

- Activity
- Clothing
- Relative Humidity
- Air Velocity
- Air Temperature
- **Radiant Surface Temperature**

Radiant Surface Temperature is the most dominant in our perception of comfort.

This is why…

- Bonus Rooms with slanted ceilings have so many comfort complaints.
- Rooms with windows facing east and west are oftentimes hot.
- Rooms facing north are oftentimes cold.
- HVAC vents are still being installed on exterior walls.
- Hardwood floors in vented crawlspaces are cold in the wintertime.

The envelope of the building is the foundation of comfort!

- Frame properly.
- Air-seal properly.
- Insulate properly.
- Use Low E windows.

Seal the ducts and perform a blower door test and you essentially have an “EnergyRight” rated home all without the slightest consideration of the HVAC system!

Step #4

Proper HVAC Sizing, Design, Installation, and Commissioning is what sets Synergy Airflow and Ventilation LLC apart!