



# **Pre and Post Retrofit Assessments and Inspections**

**Energy Design  
Conference &  
Expo**

February 21, 2017

Duluth, Minnesota

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

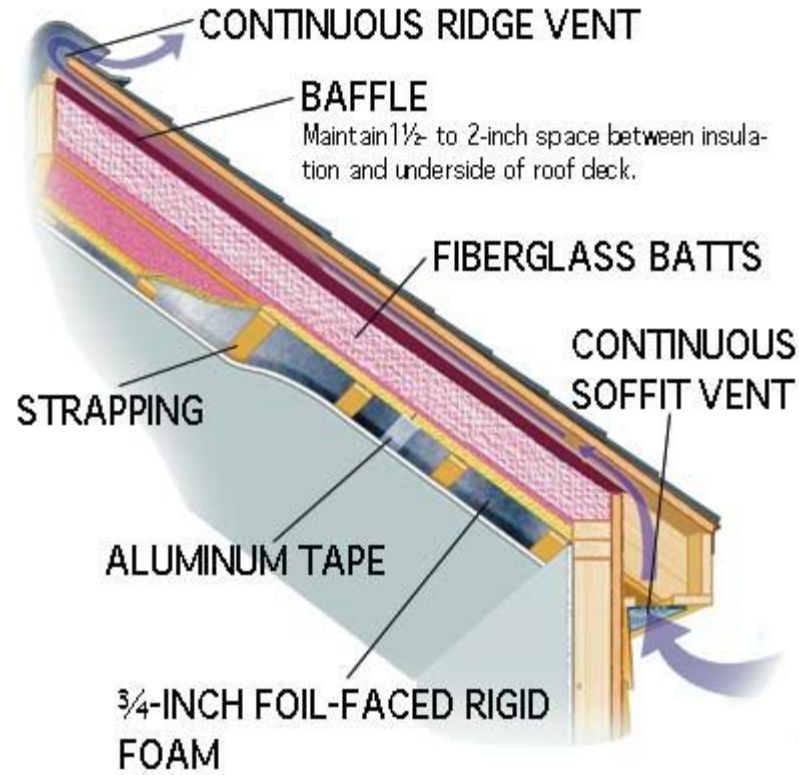
“This educational offering is recognized by the Minnesota Department of Labor and Industry as satisfying **1.5 hours** of credit toward **Building Officials and Residential Contractors code/energy** continuing education requirements.”

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

# Why Are We Here Today?

- Education
- Sources
- Long Term Goals
- Validate Your Skills
- Have Fun!
- Favorite question - “WHY?”

# Who Is Doing Their Research?









# Energy Efficient Retrofits

- Homeowner safety
- Energy saving measures
- Better indoor air quality
- Better comfort
- Combustion safety
- Moisture control
- Maintain structural integrity



# Decisions...Decisions

- Interior
- Exterior
- End value
- System.....new ductwork with the furnace? new electrical?
- Are systems designed for this house
- Hazards.....biological, safety, structural.....
- Ongoing oversight

# It's All In The Details!!!!

- Assessment
- Pre-test
- Research Proper Methods & Materials
- Building Science
- Wholehouse Concept
- **READ THE DIRECTIONS**
- Hire competent Craftsman
- Post-test

The Building Code  
defines the worst  
house allowable by law

-Anonymous Architect

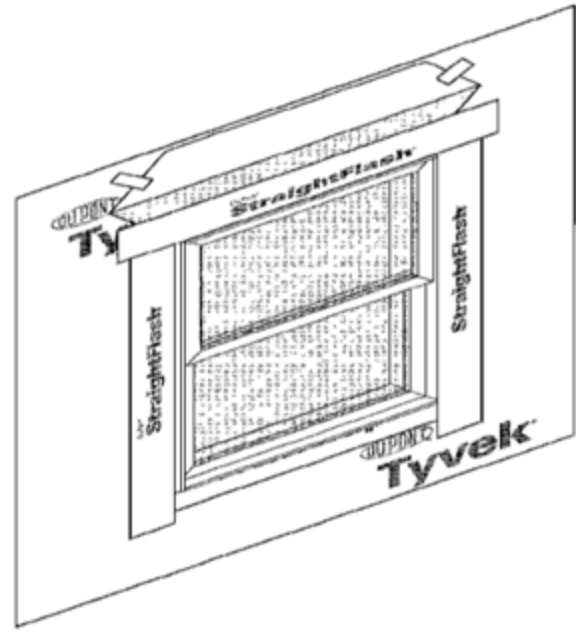
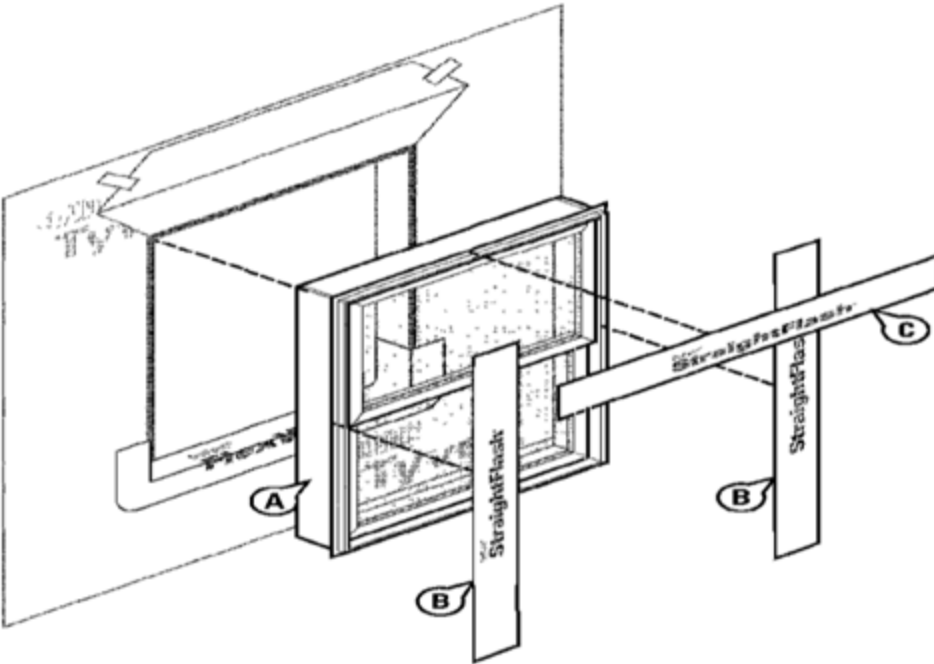
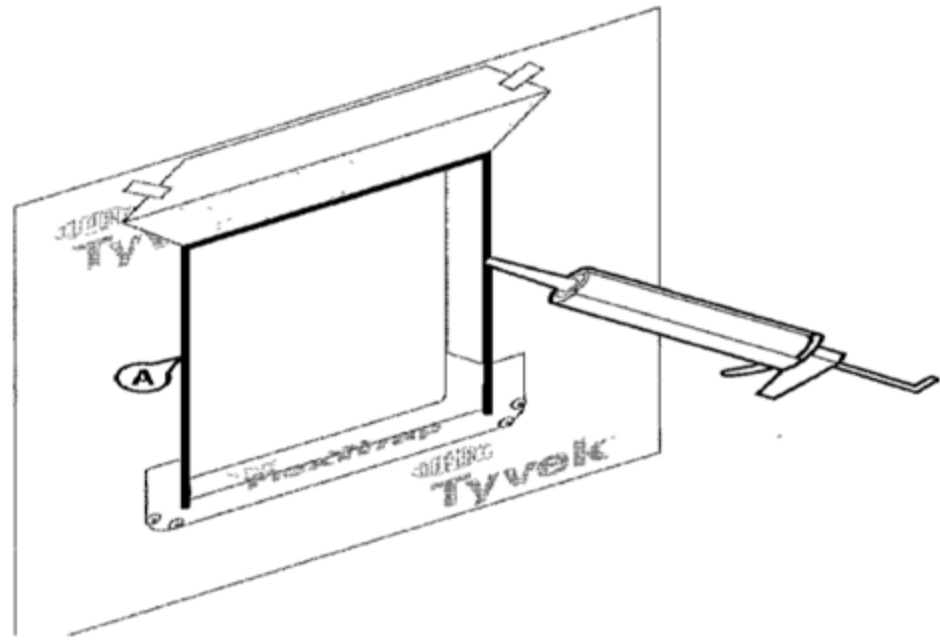
# Licensed Contractors

- Electricians
- Plumbers
- HVAC
- Foundation
- Framers
- Roofing
- Siding/Windows/WRB installers



# Consistent Issues

- Moisture control
- Indoor air quality
- Techniques and products
- Upper Midwest specific issues
- Industry direction







# Repeats By Contractors.... Not You Guys!!!

- Didn't read the directions – which pretty much explains everything, doesn't it?
- Untrained crews
- “Don't give a rip”
- Reverted back to their old ways – 1970 Stoners
- It's not in the contractor's “toolbox”
- Owner won't pay for it

**Liability.** A lack of building science knowledge can place contractors at risk when retrofits produce unintentional results that endanger a house or its occupants. The potential risks in whole-house retrofits are serious, with implications that involve fatality, quality of life degradation, building durability, and occupant comfort. The work of any single crew may unintentionally affect the performance of the whole house. To minimize liability, QC procedures and performance metrics are needed at the “wholehouse” level, not just the system level

# Time To Stress Air Sealing To The Parties Involved

- Saves on heating and cooling
- Controls moisture vapor movement by slowing or stopping air
- Stops uncomfortable drafts
- Helps to prevent frozen water lines
- Keeps the tub floor warmer
- What about controlled “designed” ventilation?

# Past - Seal It Up –Caulk, Caulk, and More Caulk Or Just Add Insulation

- Air leakage -Where
- Moisture vapor-Open a window
- Water leakage-More caulk
- Moldy basements-It's "Earthy"
- Wet windows-Need new Super Duper windows
- Building failures-"We've always done it that way!"
- Frosty attics – All purpose excuse for anything wrong in the attic is
- "You need more vents" Checked one on Saturday



U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

# Air Leakage GUIDE





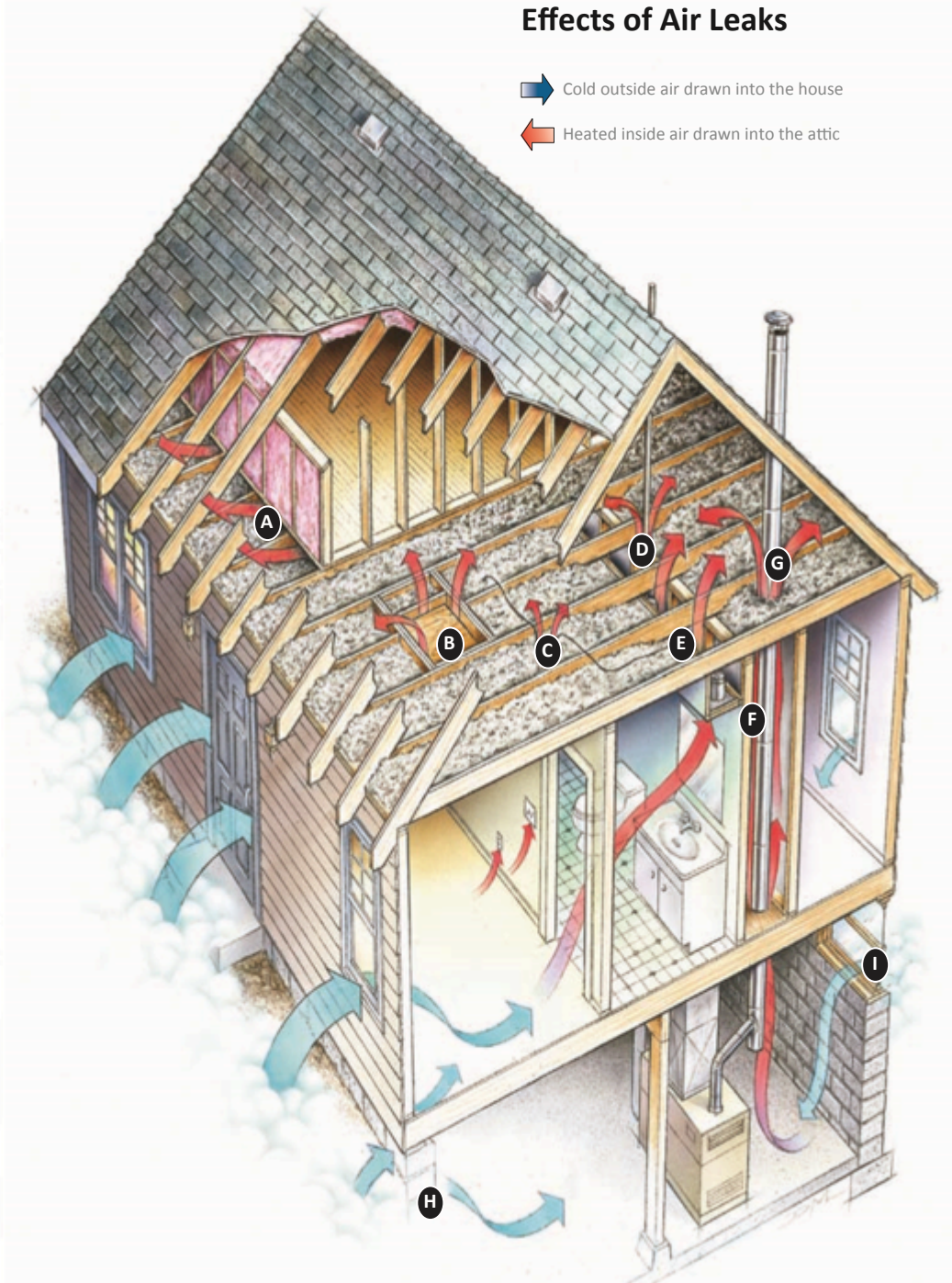


A DO-IT-YOURSELF GUIDE TO  
**SEALING AND INSULATING WITH ENERGY STAR**  
SEALING AIR LEAKS AND ADDING ATTIC  
INSULATION




## Effects of Air Leaks

-  Cold outside air drawn into the house
-  Heated inside air drawn into the attic



## COMMON AIR LEAKS

 Air Leaking into the house

 Air Leaking out of the house



Source: U.S. EPA



# How Do We Get Fresh Air?

Bath fans

Range hood fans

HRV

ERV

Windows

Fresh air intake

Fireplaces????

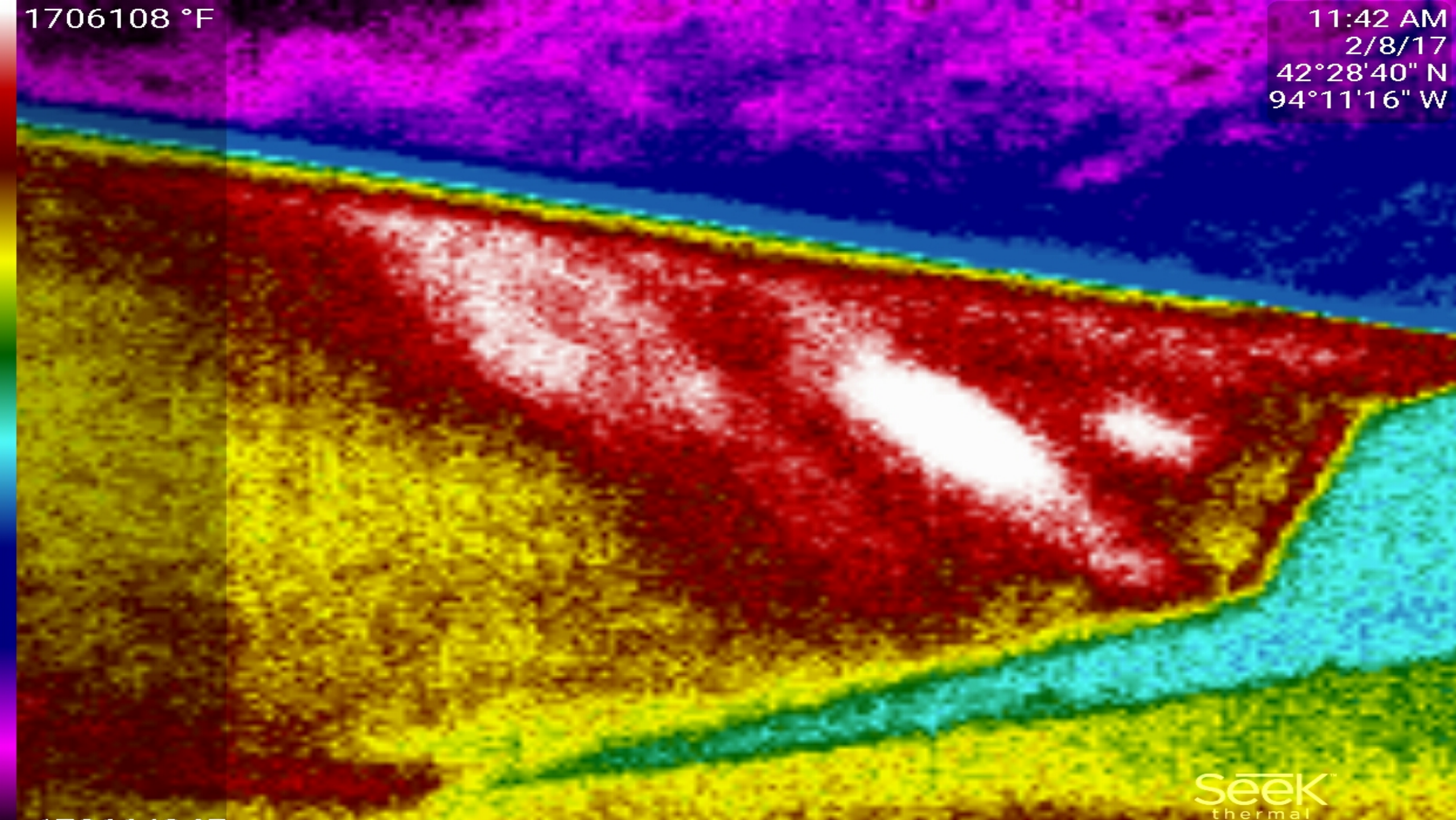


# Initial Walk Assessment and Scope of Work

- Exterior
- Interior
- Basement
- Attic
- HVAC/Electrical/Plumbing
- Other items not listed on a Google search
- Check contractor's work history

1706108 °F

11:42 AM  
2/8/17  
42°28'40" N  
94°11'16" W



SEEK  
thermal

# Poor Man's Infra Red















SHEATHING

R VALUE 1.32

WARNING

COMBUSTIBLE

DO NOT EXPOSE TO OPEN  
FLAME. MAY SMOLDER IF  
IGNITED. EXTINGUISH  
COMPLETELY.

MANUFACTURED TO MEET  
ASTM  D-209

11/79

75

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III

SHE









































**ON PACKAGE**

Do not install or remove this product without first reading warning & fire hazard statement located on package. If package is not available, contact your local supplier, or write: Freeze-Drying, Inc., Headquarters, Toledo, Ohio 43601 or call 1-419-248-8221 for a copy of the statement.

The facing on Fiberglas' insulation will burn. Do not leave exposed. The facing must be protected by substantial contact with an approved ceiling, wall or floor construction material. Protect facing from any open flame or heat source.

All direct applications, lay this side toward the space. See package for installation instructions.

Remove excess insulation only and they not be squeezed or compressed to less than stated thickness.

**3M Fiberglas' Insulation**

AL-248162

**R-11**

**WARNING**  
**STATEMENT**

Do not install or remove this product without first reading warning & fire hazard statement located on package. If package is not available, contact your local supplier, or write: Freeze-Drying, Inc., Headquarters, Toledo, Ohio 43601 or call 1-419-248-8221 for a copy of the statement.

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**3M Fiberglas' Insulation**









25.7°F

 FLIR



15°F



26°F













# Results

## Blower Door Test Results

Blower Door Pre Air Sealing Results 2015	CFM50: 2800	ACH@50: 12.15
Blower Door Post Air Sealing Results 2016	CFM50: 2105	ACH@50: 9.13

**Reduction of air leakage: 24.8 %**

**Estimated annual heating energy savings: 102 LP Gallons**

**Estimated annual carbon reduction: 0.67 metric tons**

**Estimated annual savings: \$153.44**

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## Other Issues!!!!

CO Levels	
Water heater	24 ppm
Furnace	15 ppm

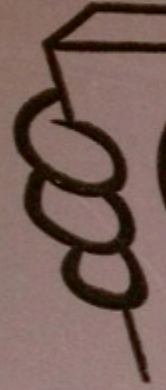








energía



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CERO**

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NO DA  
CAPA  
OZON**

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...instructions carefully. If manufacturer's  
...disposal, request this and return it correctly.  
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Interior Air Quality Certified

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Listed  
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...Minimum 20%  
Recycled Content

**Aislamiento de Poliestireno extruido (XPS) FOAMULAR® 150**

**PRECAUCIÓN:** Este producto es combustible. Requiere una buena protección a una buena distancia según se especifica en el código de construcción correspondiente. Para obtener más información, consulte el MDS o póngase en contacto con Owens Corning World Headquarters llamando al 1-800-CET-PINK.

Valor R o rango temperatura promedio de 75°F (23°C). La letra R representa la resistencia al flujo de calor; cuanto mayor es el valor R, mayor es el poder de aislamiento. Para obtener el valor R que corresponde, el aislamiento debe estar instalado correctamente. Si se las instrucciones del fabricante. Si se proporciona una hoja de datos del fabricante junto con el envío del material, póngala a un lado y llámela.

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R1602050



**FOAMULAR® 150**

Energy-Saving, Moisture-Resistant XPS Insulation  
Aislamiento XPS resistente a la humedad y reduce el consumo de energía

R-50



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CERO**

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**FOAMULAR 150**



# What To Use

- Caulk – types, where to use – read directions
- Canned spray foam – types, where to use – read the directions
- Spray applied sealers by professionals – “Did they read the .....?”
- Fiberglass batts – Yes, this air filter is many times used to stop air. Really!
- Sheet goods – plywood, OSB, foil faced panels
- Vapor barriers and retarders
- Mastic
- Combinations of the above

# Remember

- Surfaces usually need to be **CLEAN**
- Surfaces usually need to be **DRY**
- Caulks have different expansion capabilities
- Caulk and foam need something to grip or adhere to
- Some foams shrink after being applied
- Other issues?

# Proper Materials And Methods





*STUDENT CENTER*









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# Mid Project









R-5.0  
1 inch Thickness  
pulg. de espesor

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FOAMULAR 150

R-5.0  
1 inch Thickness  
pulg. de espesor

OWENS  
CORNING®

FOAMULAR 150

R-5.0  
1 inch Thickness  
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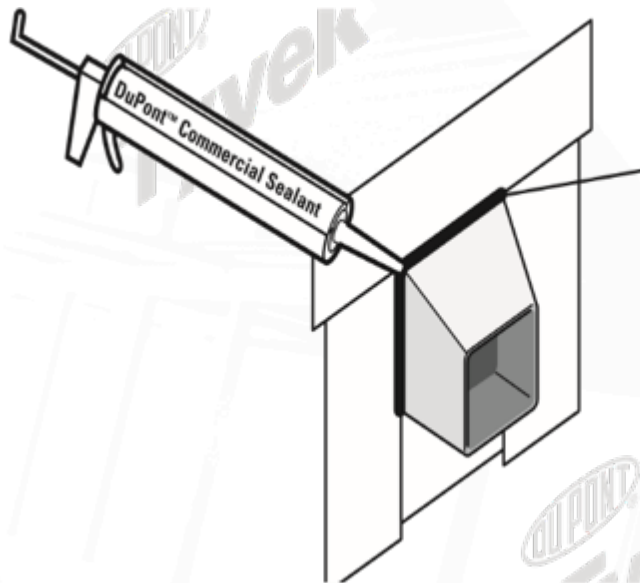
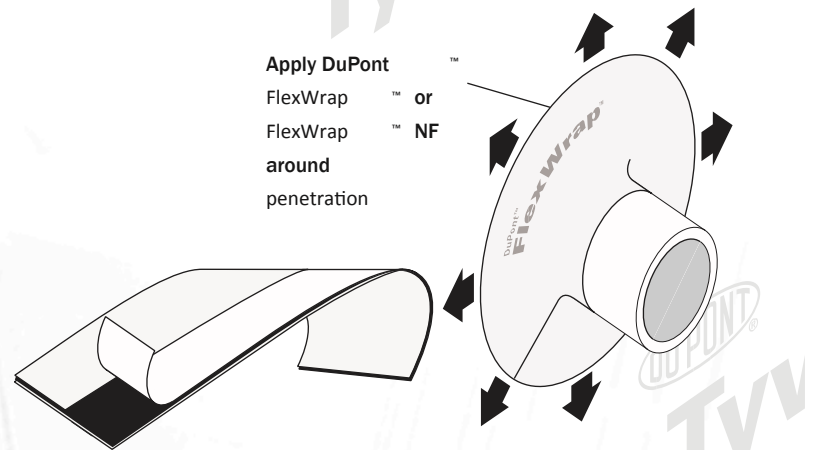
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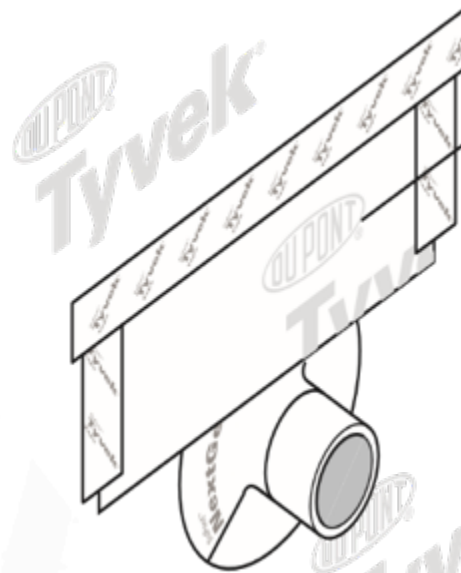
R-5.0  
1 inch Thickness  
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Apply DuPont  
FlexWrap™ or  
FlexWrap™ NF  
around  
penetration



Seal around  
penetration  
using DuPont  
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Sealant or  
DuPont  
approved  
sealant



Tape a piece of  
DuPont™ Tyvek®  
over the top of the  
DuPont™ FlexWrap™







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**FOAMULAR® 250 Extruded Polystyrene (XPS)**

Meets ASTM C 578 Type IV; California Quality Standards (HQD UMI 471a)  
See ICC Legacy Report 9727A

**CAUTION:** This product is combustible. A protective barrier or thermal barrier is required as specified in the appropriate building code. For additional information, consult MSDS or contact Owens Corning World Headquarters at 1-800-GET-PINK®

R @ 25 F mean temperature. R means the resistance to heat flow; the higher the value, the greater the insulation power. This insulation must be installed properly to get the marked R-value. Follow the manufacturer's instructions carefully. If a manufacturer's fact sheet is not provided with the material, please visit [www.owenscorning.com](http://www.owenscorning.com) and review it carefully.



OWENS CORNING, LLC

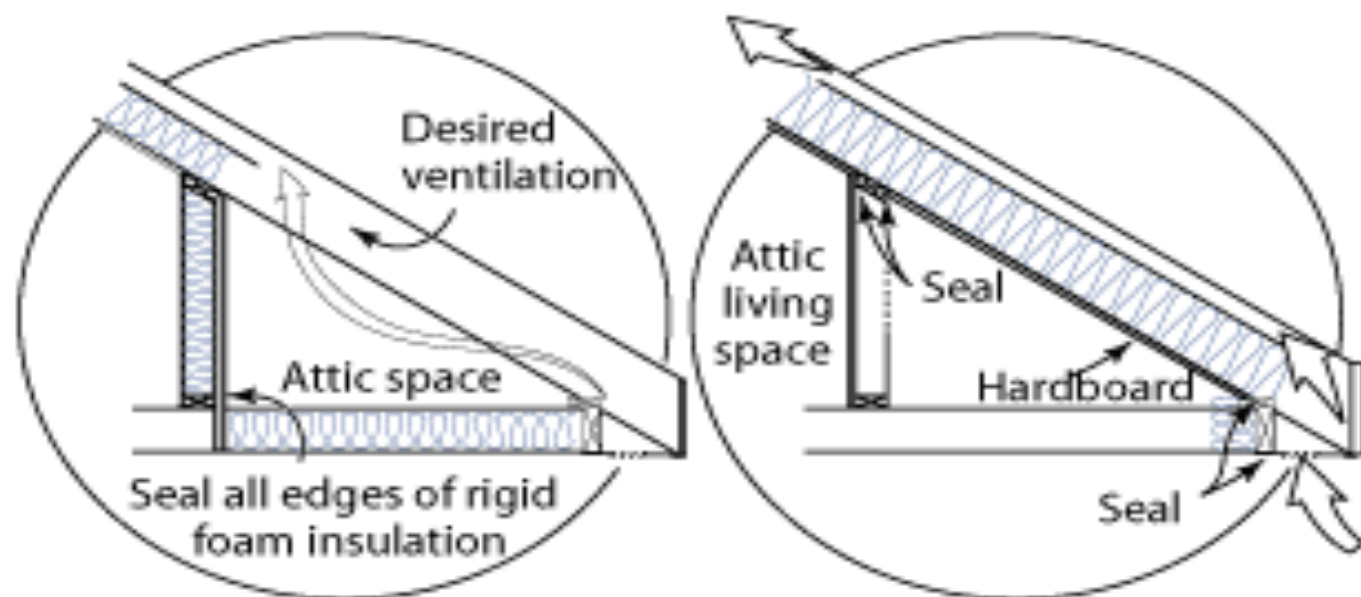
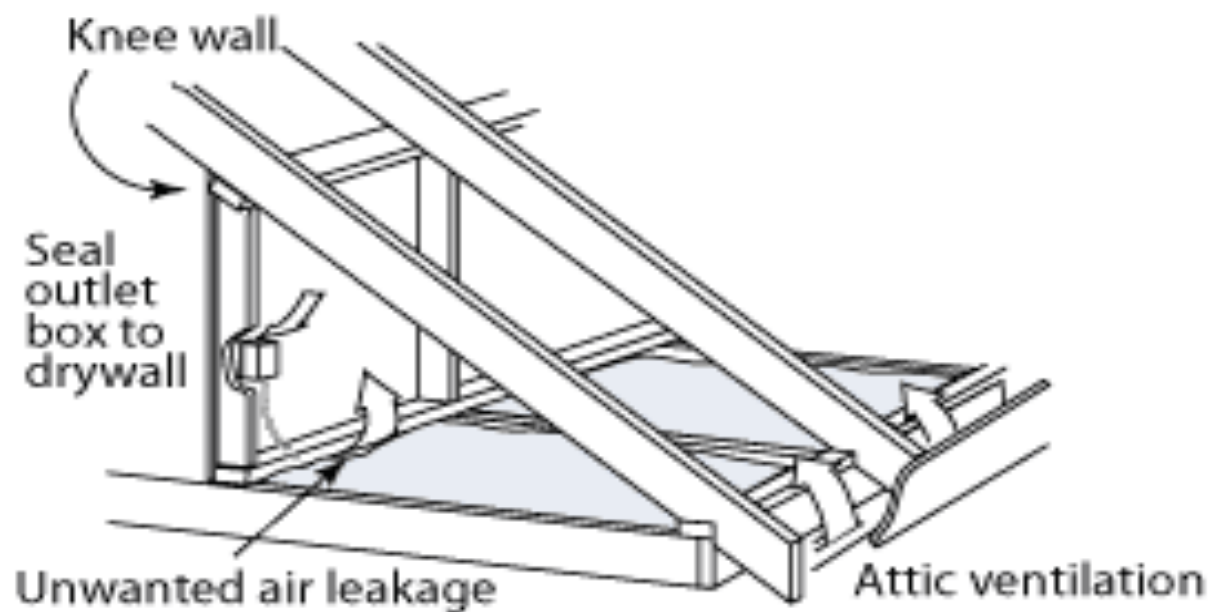








## ATTIC KNEE WALL





# Often Overlooked

- **Brick chimney to ceiling connection**
- **Access door to attic stairs**
- **Attic stairway walls**
- **Garage attic to house attic**
- **Remodeled wall connections**
- **Attic “combustion air”**
- **HUGE vents to unsealed attic**





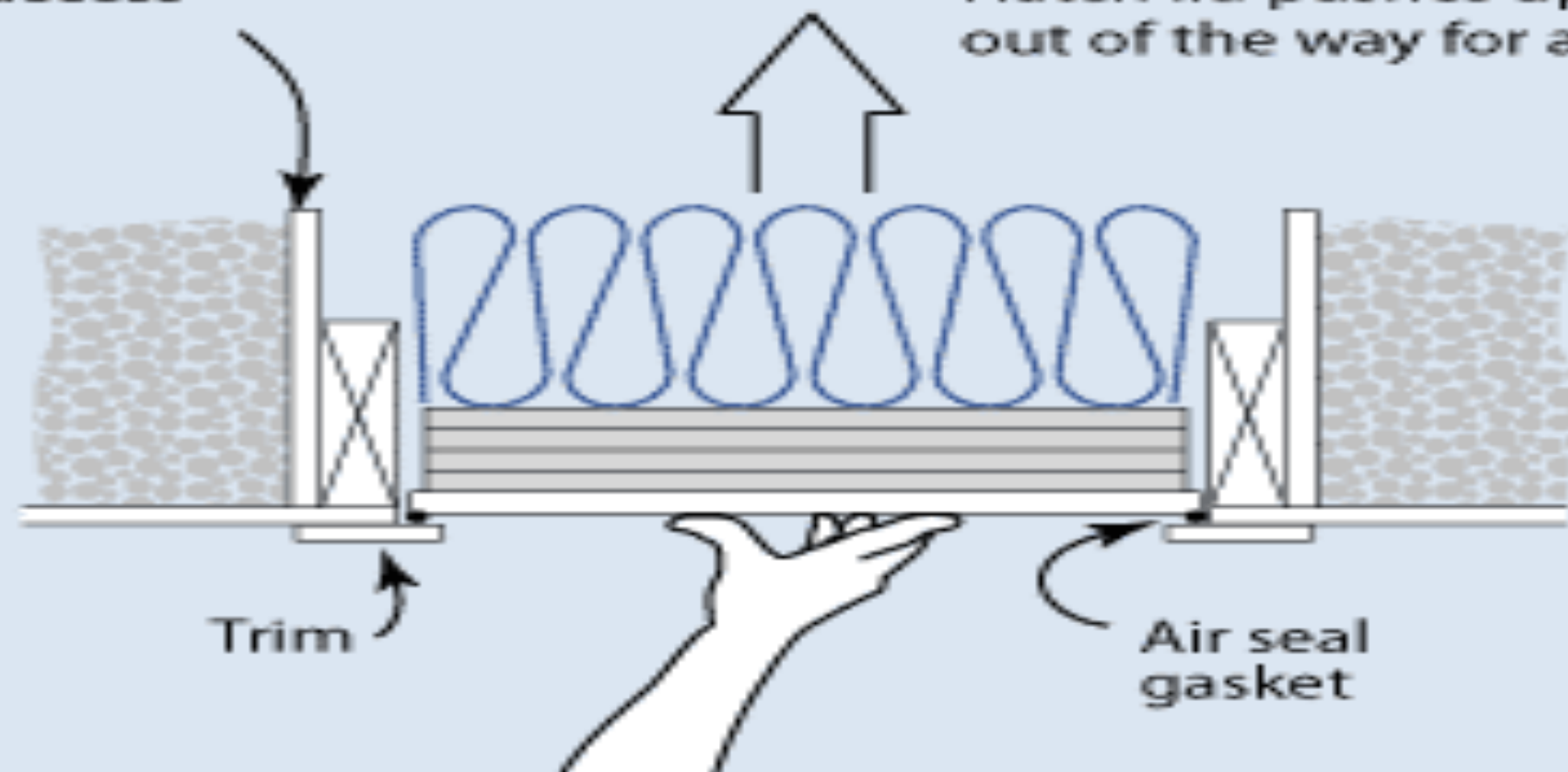




# SCUTTLE HOLE COVER

Insulation dams prevent loose-fill insulation from falling through access

Hatch lid pushes up and out of the way for access



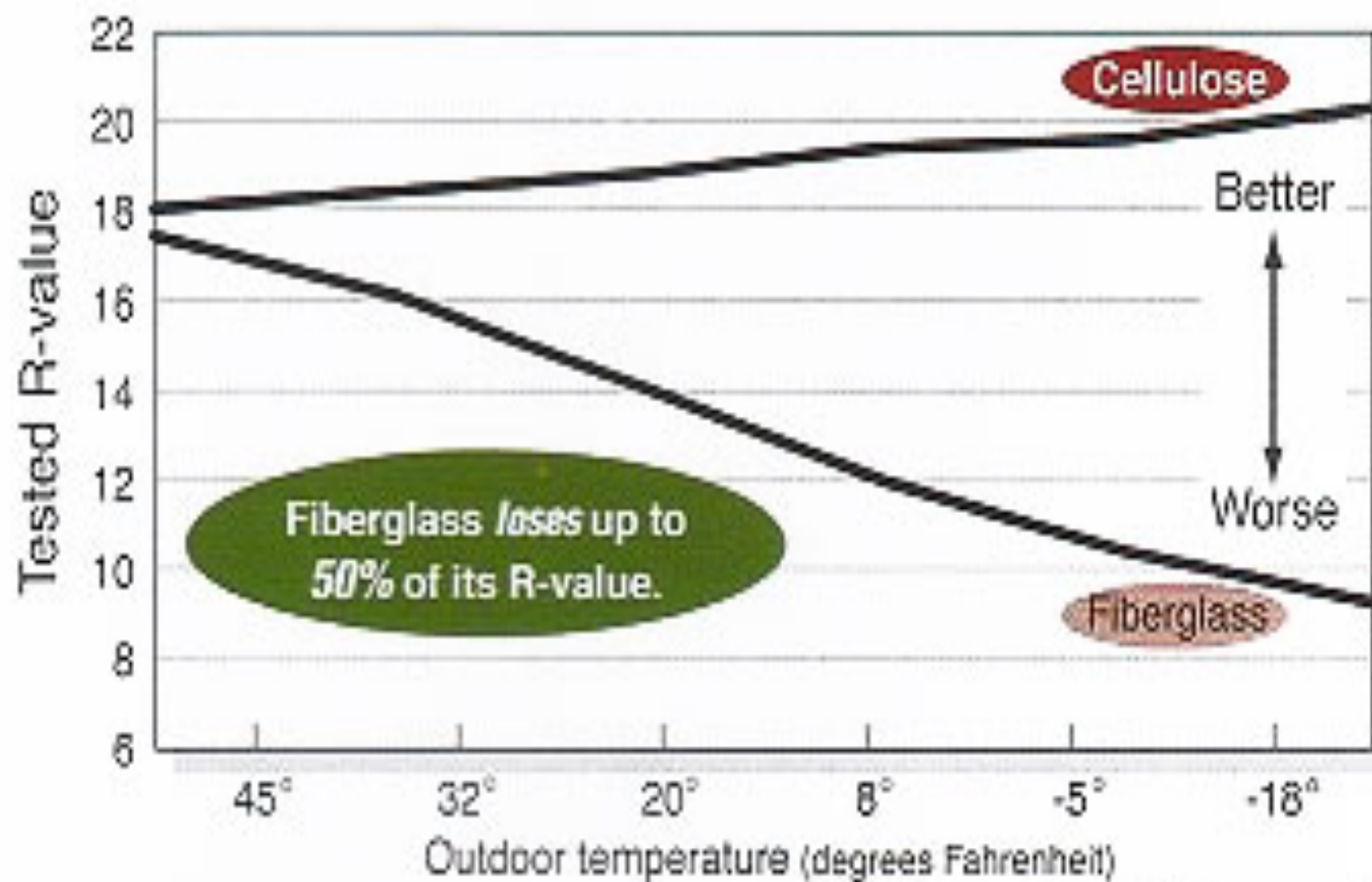
Trim

Air seal gasket



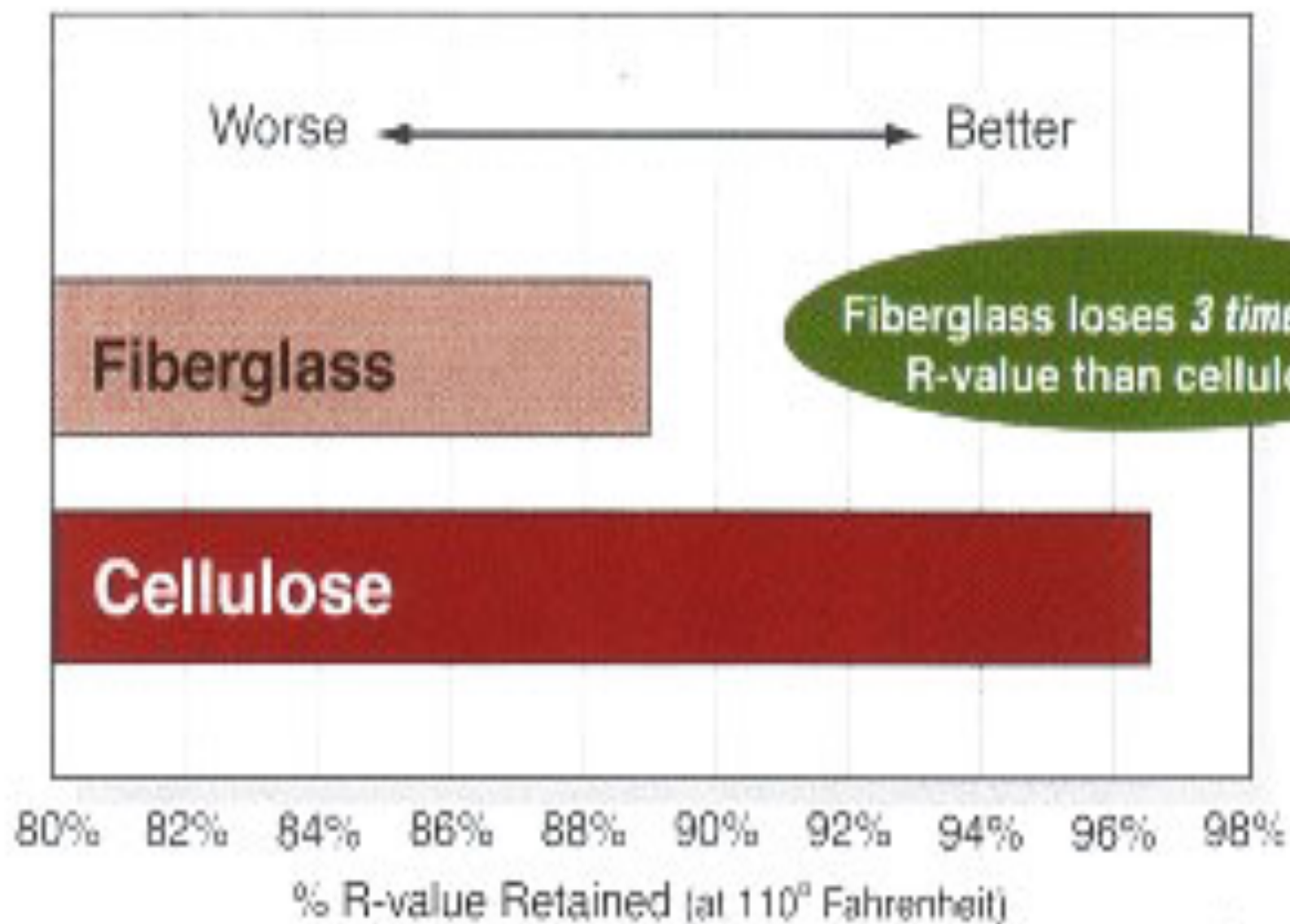


## Winter Performance



Source: Oak Ridge National Laboratory<sup>1</sup>

# Summer Performance



Source: Brookhaven National Laboratory<sup>2</sup>













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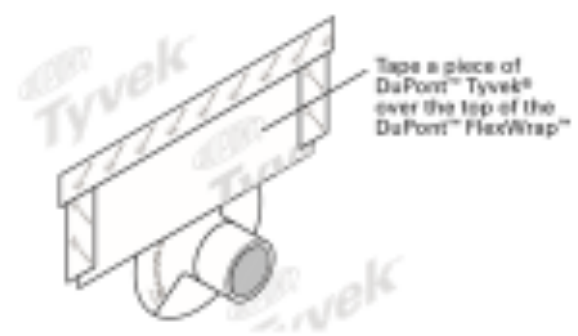
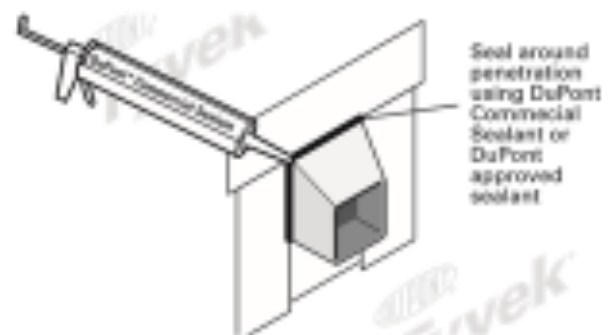
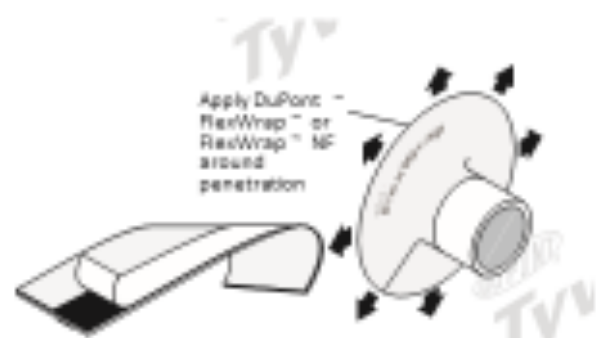








5/20-6/25/10 3/5 PAPA 10/20/2010 3/5











# What Have We Learned?

- ▶ The importance of energy audits
- ▶ The importance of “System” thinking
- ▶ Why didn’t we ask “What if” more often?
- ▶ HVAC design and installation
- ▶ The importance of moisture and moisture vapor control
- ▶ Quality installation of products
- ▶ The true impact of air sealing
- ▶ Impacts on indoor air quality and structural integrity



# •QUESTIONS?











