Attic and Roof Ventilation

Facts and Fiction

PHRC

1:00 PM
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Presented by Bryan Heitzmann
Training & Education
Development Specialist , PHRC

Agenda

Background

- Reduces moisture
- Keeps area temperatures cool
- Types of vents
- Net Free Venting Area

Benefits

- In Warm weather
- In Cold weather

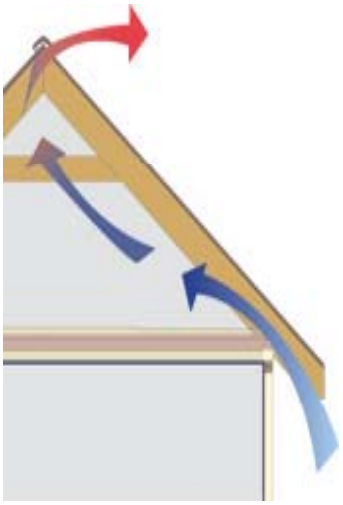
Best Practices

- Rules of attic ventilation
- Vs. Code
- Venting area calculations

Venting Strategies

- Attic vs. roof vs. unvented

❖*What's the Purpose of Attic Ventilation?*



Why Ventilate?

Purposes of an attic ventilation system

- Provide added comfort
  - In all seasons
- Protect against damage to materials and the structure
  - Mold & wood rot
- Help reduce energy consumption
  - Save $$

Why Ventilate?

Purposes of an attic ventilation system

- Keeps attic/roof temperatures cool
  - Expel solar-heated hot air
  - Prevents ice damming
- Reduces moisture and keeps attic dry
  - Prevents condensation
  - Reduces potential for mold

Why Ventilate?

❖Types of Vents

Types of Vents

- A vent's effectiveness is measured by its Net Free Vent Area (NFVA)

- **Net Free Vent Area**
  - the portion of the opening in the vent that actually ventilates
    - Screens
    - Insect barriers

restricts the movement of air through the ventilation product

Types of Vents

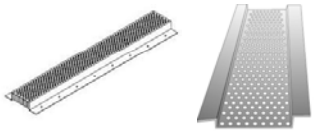
Intake Vents

Under-eave vents

- Mounted in soffit
- Vary in size
- NFVA depends on vent size

Continuous soffit vents

- Located in soffit
- Vary in length but 96" is typical



Vented drip edge

- Used on home without an eave

Types of Vents

Exhaust vents

- Designed to permit efficient outflow of attic air
- Installed in the upper portion of the attic
- Designed to prevent rain and snow infiltration
- Used with intake vents to provide air movement through the attic

Common fixed exhaust vents include:

Gable Louvers

- Installed in the gables
- Rectangular, round, or triangular

Types of Vents

Roof Louvers

- Installed as close to ridge as possible
- Release moisture and overheated air
- Provide continuous airflow along most of the underside of the sheathing

But….

- The airflow pattern is **not** uniform
- Vents should be space equally along the roof to provide maximum venting effectivness

Types of Vents

Ridge Vents

Provide **maximum** efficiency in 3 ways:

- Maximize air movement
  - Thermal effect
  - Low pressure air
- Provide uniform air movement
  - Venting area spans the entire length of the roof
  - Eliminates warm areas left by other types of vents
- Maximize visual appeal
  - Low profile
  - Shingles installed over vent provides uniform roof look

Types of Vents

Wind Turbines

- Require consistent wind speeds of at least 5mph
- Must be equally spaces along ridge
- Spinning creates an area of low pressure that pulls air from attic

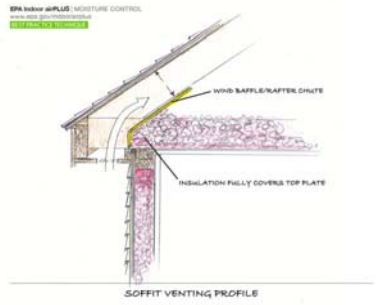
Power Vents

- Motor driven wind turbine
- Turned on/off automatically or with t-stat or humidistat
- Does not provide uniform air movement

Types of Vents

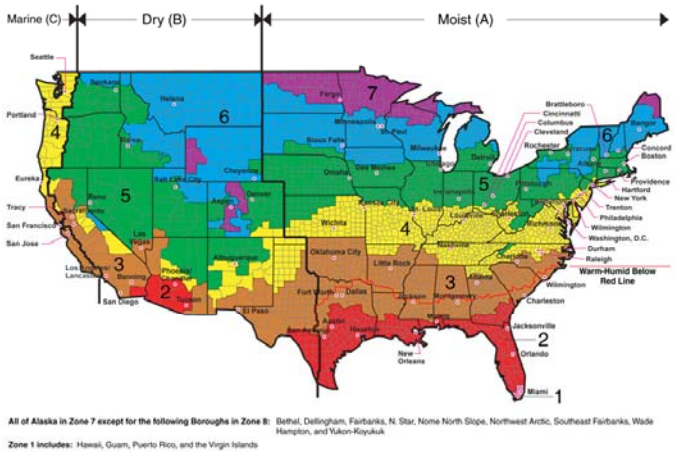
Baffles

- Cardboard or foam
- Allow air to freely enter the attic & travel upward & out through exhaust vents
- Prevent wind from blowing insulation away from the walls
- Allow loose-fill insulation to completely cover the top plates in attic walls

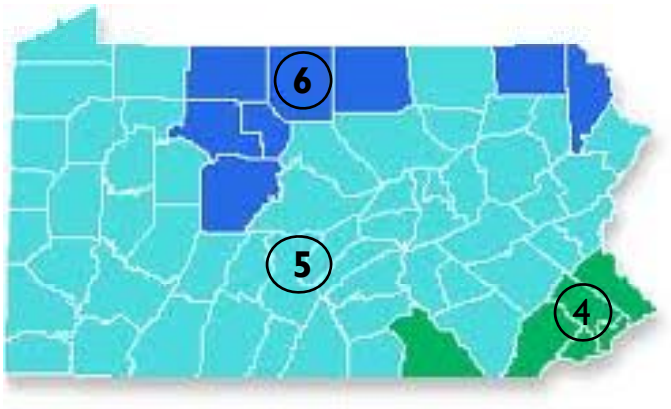


❖Benefits of Proper Attic Ventilation

Climate Zones



Pennsylvania Climate Zones



Benefits of Proper Attic Ventilation

Ventilation In Warm Weather

- Ventilation helps to keep the attic cool
  - Removes solar- heated air from the attic/roof

How?

- Ventilation can **minimize** heat transfer from the roof to the attic
- Must provide a uniform air flow along the underside of the roof sheathing
- Airflow helps to carry heat out of attic before it radiates to floor

Results

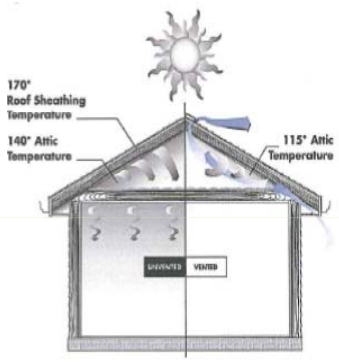
- Reduces cooling load
- Relieves strain on air-conditioning system
- Saves energy/saves homeowner money

Benefits of Proper Attic Ventilation

Ventilation In Warm Weather

Unvented – Radiant heat conducts through the roof sheathing and into the attic. Then, the heat radiates to the attic floor and into living areas, making house more difficult to cool

Vented – Proper ventilation allows for the heat to be vented out of the attic, thus keeping living space cooler



Benefits of Proper Attic Ventilation

Ventilation In Warm Weather

Shingle Damage

- Hot & moist air in the attic can warp roof sheathing and cause shingles to deteriorate
- Does shingle color have an effect on attic temperature?

Benefits of Proper Attic Ventilation

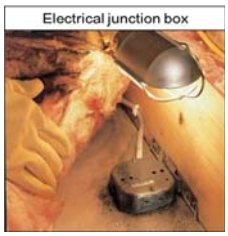
Ventilation In Cold Weather

Primary purpose

- To maintain a cold roof temperature
- Vent moisture

Reason for attic ventilation

- Conductive heat losses
  - Supply ductwork/equip. located in attic above insulation
  - Through insulation or where insulation is missing/compacted
- Air leakage
  - Leaky supply ducts
  - Ceiling penetrations
- Vapor diffusion



Benefits of Proper Attic Ventilation

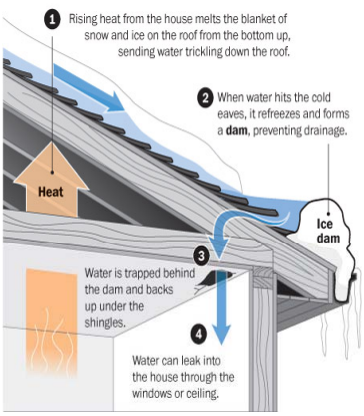
Ventilation In Cold Weather

Results

- Warm air hits cooler rafters and roof sheathing & condenses
  - Frost or water droplets
- Condensation can drip onto insulation
- Cause mold or wood rot
- Deteriorate roofing materials

Benefits of Proper Attic Ventilation

Ice Dams



Roof Ventilation in the IRC

- 2009 IRC Code Section R806.2

R806.2 Minimum area. The total net free ventilating area shall not be less than $^{1}/_{150}$ of the area of the space ventilated except that reduction of the total area to $^{1}/_{300}$ is permitted provided that at least 50 percent and not more than 80 percent of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above the eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. As an alternative, the net free cross-ventilation area may be reduced to $^{1}/_{300}$ when a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling

*Creates a slightly ***depressurized*** attic

Roof Ventilation in the IRC

Calculate how much NFVA is required –

1200 sq ft
/ 150 sq ft
= 8 sq ft of NFVA

Convert to Inches

8 sq ft of NFVA
X 144 (in per sq ft)
1152 sq in of NFVA

Roof Ventilation in the IRC

However….

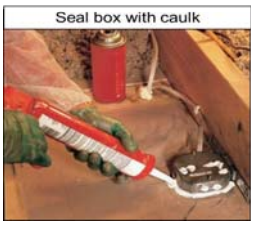
- IRC requirements actually create a slightly depressurized attic
- A depressurized attic can pull conditioned air from the living space
  - Adds stress to HVAC equipment
  - Wastes energy
  - Increases costs to homeowner

❖Best Practices for Attic Venting

Best Practices for Attic Venting

Seal the Attic Floor Completely

- Attic floor should be airtight prior to installation of insulation
  - Recessed lights, light boxes, ect.
- Air leaks can lead to moisture problems & contribute to ice dams

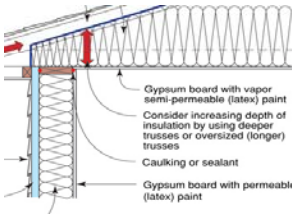

Seal box with caulk


Foam around plumbing stack

Best Practices for Attic Venting

Insulate Above the Top Plate

- The insulation level above the top plate should be equal to the R-value in the wall
  - R-20 in the wall, the at least R-20 over the top plate
  - More is better
  - Never Less!!



Best Practices for Attic Venting

Vent the Soffit Completely

- The vent should be placed as far to the outside edge of the soffit as possible
  - Allows the complete underside of the roof deck to be "washed" with air

Provide Plenty of Airspace

- The IRC calls for 1 inch of airspace but allow for more if possible
  - Allows for sufficient airflow through assembly

Best Practices for Attic Venting

Pressurize the Attic

- More ventilation at the **soffits** than at the ridge will allow the attic to be slightly pressurized
  - IRC 2012 requirements reflect this approach
- For best results provide 50% to 75% of ventilation space at the **soffits**
  - 60/40 is the optimal split

Best Practices for Attic Venting

Pressurize the Attic

- Example – House with 1200 sq ft of attic

Step #1
Calculate how much NFVA is required –

1200 sq ft
/ 300 sq ft
= 4 sq ft of NFVA

Step #2
Convert to Inches

4 sq ft of NFVA
X 144 (in per sq ft)
576 sq in of NFVA

Step #3
Divide between soffit and ridge

60% of 576 sq in = 345.6 sq in (soffit)

40% of 576 sq in = 230.4 sq in (ridge)

....Continued

Best Practices for Attic Venting

Pressurize the Attic

- Example – House with 1200 sq ft of attic

Step #4

Apply it to the particular soffit and ridge vents that are being used

Soffit – 345.6 sq in / 9(product rating)

=38.4 lin. ft of intake, OR

=19.2 ft of intake per side

Ridge vents –

230.4 sq in / 9 (rating)

=25.6 lin. Ft of exhaust

❖Ventilation Strategies

*Venting the attic

Venting the Attic

- Make sure that the ceiling is absolutely air tight
  - Limit ceiling penetrations if possible
- Avoid ductwork in attic
  - Leaky ductwork can lead to moisture issues
- Keep attic free of storage items
  - Only if built on an elevated platform above the insulation
  - This will prevent compaction of insulation

❖Ventilation Strategies

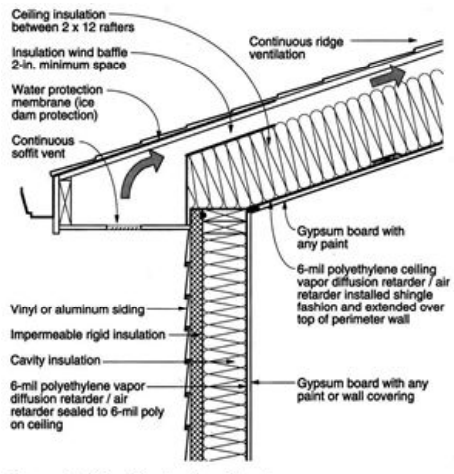
*Venting the Roof Deck

Venting the Roof Deck

Vaulted/cathedral ceilings

- IRC section R806.3
  - calls for minimum of 1-inch airspace
- For best performance, the airspace should be at least 2 inches
  - will likely require furring out the rafters if using fiberglass batts, OR…
  - use closed-cell spray foam

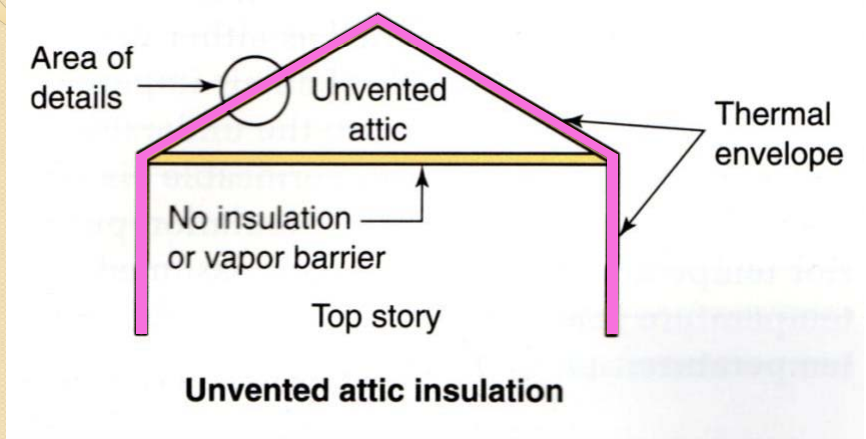
Venting the Roof Deck



❖Ventilation Strategies

*Unvented Attics

Unvented Attic Assemblies



Unvented attic insulation

Unvented Attic Assemblies

IRC: R806.4 Unvented attic assemblies shall be permitted if all of the following conditions are met:

1. The unvented attic space is contained completely **within the building thermal envelope**.
2. **No interior vapor retarders** are installed on the ceiling side **(attic floor)** of the unvented attic assembly.
3. Where **wood shingles or shakes** are used, a minimum 1/4 inch vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing.

Continued…

Unvented Attic Assemblies

4. In climate zones 5, 6, 7 and 8, any air-impermeable insulation **shall be a vapor retarder, or shall have a vapor retarder** coating or covering in direct contact with the underside of the insulation

5. Either **Items 5.1, 5.2 or 5.3** shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing…

Continued…

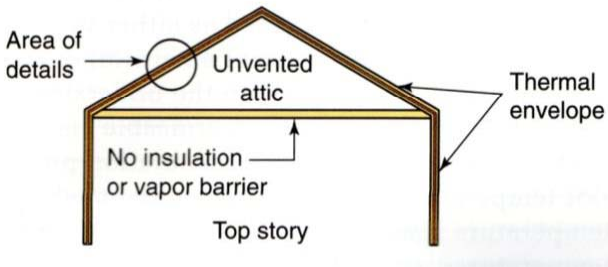
Unvented Attic Assemblies

5.1. **Air-*im*permeable insulation only.** Insulation shall be applied in direct contact with the **underside of the structural roof sheathing**

5.2. **Air-permeable insulation only.** In addition to the air-permeable insulation installed directly below the structural sheathing, **rigid board or sheet insulation shall be installed directly above the structural roof sheathing** as specified in Table R806.4 for condensation control

5.3. **Air-*im*permeable and air-permeable insulation.** The air-impermeable insulation shall be applied in direct contact with the underside of the structural roof sheathing as specified in Table R806.4 for condensation control. The **air-permeable insulation shall be installed directly under the air-impermeable insulation**.

Unvented Attic Assemblies



Unvented attic insulation

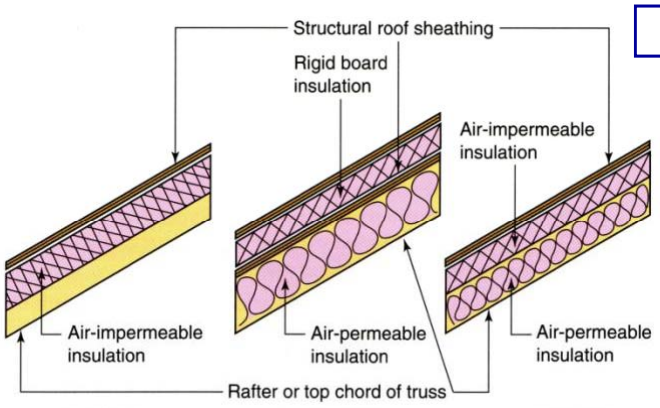
IRC: R806.4

PA Values from Table R806.4
Insulation for Condensation Control

Zone	Minimum R for air impermeable insulation
4	R-15
5	R-20
6	R-25

157

R806.4



Option 1

R806.2 item 5.1
Spray Foam

Many mfg have limits on how thick materials can be applied

Option 2

R806.2 item 5.2
Rigid foam sheathing per Table R806.2 above roof sheathing

Option 3

R806.2 item 5.3
Spray foam per Table R806.4 covered with fiberglass

Common practice

158

Insulation Properties

Material	Type	R per Inch	Inches for R-20	Inches for R-38
Spray Foam	Low Density	3.5-3.8	5.0-6.0	10-11
	High Density	6.0-7.0	2.9-3.3	5.4-6.3
Foam Board	Expanded Polystyrene	3.6-4.2	3.5-5.0	
	Extruded Polystyrene	5.0	4.0	
	Polyisocyanurate	5.6-7.6	2.6-3.6	

For Items 5.1, 5.2, and 5.3 in Climate Zone 5

50

Air-permeable insulation to meet energy code in CZ 5

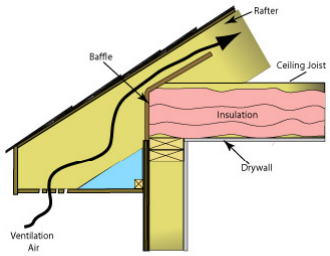
Energy code	Air-*im*permeable insulation	Air-permeable insulation
R-38	R-20	R-18

Material	Type	R per Inch	Air-permeable insulation options
Fiberglass	Std density	3.2	R-19 batt
	High density	3.8	R-21 batt
	Blown-in-batt	4.0	4.5"
Cellulose	Loose fill	3.2-3.8	4.7-5.6"
	Dense pack	3.0-3.4	5.3-6.0"
	Spray on	2.9-3.4	5.3-6.2"

For Item 5.3

51 51

❖Summary & Conclusions



Summary and Conclusions

Benefits

- Keeps attic/roof temperatures cool
- Reduces moisture and keeps attic dry
- Protects against damage to materials and the structure
- Help reduce energy consumption
- Provide added comfort

Types of vents

- Intake & exhaust
- A vent's effectiveness is measured by its Net Free Vent Area (NFVA)

Summary and Conclusions

Roof Ventilation is required by 2009 IRC

- **Section R806**
  - Shall not be less than 1/150 of area being ventilated

Best Practices

- Seal the Attic Floor Completely
- Insulate Above the Top Plate
- Vent the Soffit Completely
- Provide Plenty of Airspace
- Pressurize the Attic

❖Questions & Evaluations

Next month's webinar:
Tuesday, April 9th@ 1PM
*HVAC Quality Installation – Code Requirements, Best Practices, and Contractor Selection