



INSP 2 - Dealing with Cathedral Ceilings & Conditioned Attics

ACI Solutions For Success
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Conservation Services Group



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Session Objectives

Examine issues; identify risks
Discuss code language and its interpretation
Discuss techniques and products

- Insulating
- Ventilating
- Cathedral ceilings and sloped walls

Identify solutions that meet current NY building code

Learn when to vent and when not to



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What are the risks?

- Wet sheathing
 - Air leaks, vapor diffusion
- Ice dams
 - Air leaks, poor insulation
- Temperature, shingles
- Wind washing
- Vapor permeable insulation w/ non-insulating vapor barrier
 - Inward vapor drive
 - Condensing on sheathing



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Conventional Strategies

- Ventilate roof
 - Ridge, soffit
 - Propa-vents
- Vapor barrier
 - Polyethylene
 - Kraft faced batts



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discussion.autodesk.com



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Moisture control in roof spaces

Vent it when you can—it's a good idea
 Much more important:

- Continuous insulation well installed
- Continuous air barrier

Venting loses effectiveness when there's good insulation and air barrier

Interior humidity control

- Difficult to control

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Cellulose is NOT risk-free:

- 65% moisture content near ridge
- 2 summer months after dry-blown
- vapor permeably netting
- we don't understand this yet







07 NY Code—Roof venting



SECTION R806 ROOF VENTILATION

R806.1 Ventilation required. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilating openings shall be provided with corrosion-resistant wire mesh, with $\frac{1}{8}$ inch (3.2 mm) minimum to $\frac{1}{4}$ inch (6.4 mm) maximum openings.



07 NY Code—Roof venting

R806.2 Minimum area. The total net free ventilating area shall not be less than 1 to 150 of the area of the space ventilated except that the total area is permitted to be reduced to 1 to 300, provided 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 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 to 300 when a vapor barrier having a transmission rate not exceeding 1 perm (57.4 mg/s · m² · Pa) is installed on the **warm side** of the ceiling.

07 NY Code—Roof venting

R806.3 Vent clearance. Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a 1-inch (25.4 mm) space shall be provided between the insulation and the roof sheathing at the location of the vent.



07 NY Code—Vapor Retarder

SECTION R322 MOISTURE VAPOR RETARDERS

R322.1 Moisture control. In all framed walls, floors and roof/ceilings comprising elements of the building thermal envelope, a vapor retarder shall be installed on the warm-in-winter side of the insulation.

Exceptions:

1. In construction where moisture or freezing will not damage the materials.
2. Where the framed cavity or space is ventilated to allow moisture to escape.
3. In counties identified with footnote a in Table N1101.2.






07 NY IECC Code—Vapor Retarder

402.5 Moisture control. The building design shall not create conditions of accelerated deterioration from moisture condensation. Above-grade frame walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder. The vapor retarder shall be installed on the warm-in-winter side of the thermal insulation.

Exceptions:


1. In construction where moisture or its freezing will not damage the materials.
2. Frame walls, floors and ceilings in jurisdictions in Zone 4. (Crawl space floor vapor retarders are not exempted.)
3. Where other approved means to avoid condensation are provided.

2006 IRC

SECTION R806 ROOF VENTILATION

R806.1 Ventilation required. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilating openings shall be provided with corrosion-resistant wire mesh, with $\frac{1}{8}$ inch (3.2 mm) minimum to $\frac{1}{4}$ inch (6 mm) maximum openings.



2006 IRC

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 vapor barrier having a transmission rate not exceeding 1 perm (5.7×10^{-11} kg/s · m² · Pa) is installed on the **warm-in-winter** side of the ceiling.



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R806.4 Conditioned attic assemblies. Unvented conditioned attic assemblies (spaces between the ceiling joists of the top story and the roof rafters) are permitted under the following conditions:

1. No interior vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly.
2. An air-impermeable insulation is applied in direct contact to the underside/interior of the structural roof deck. "Air-impermeable" shall be defined by ASTM E 283.



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Exception: In zones 2B and 3B, insulation is not required to be air impermeable.

3. In the warm humid locations as defined in Section N1101.2.1:
 - a. For asphalt roofing shingles: A 1-perm (57.4 mg/s · m² · Pa) or less vapor retarder (determined using Procedure B of ASTM E 96) is placed to the exterior of the structural roof deck; i.e., just above the roof structural sheathing.
 - b. For wood shingles and shakes: a minimum continuous 1/4-inch (6 mm) vented air space separates the shingles/shakes and the roofing felt placed over the structural sheathing.



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4. In Zones 3 through 8 as defined in Section N1101.2, sufficient insulation is installed to maintain the monthly average temperature of the condensing surface above 45°F (7°C). The condensing surface is defined as either the structural roof deck or the interior surface of an air-impermeable insulation applied in direct contact with the underside/interior of the structural roof deck. "Air-impermeable" is quantitatively defined by ASTM E 283. For calculation purposes, an interior temperature of 68°F (20°C) is assumed. The exterior temperature is assumed to be the **monthly average** outside temperature.



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Best Strategies

Seal air leaks


- Manually or w/ spray foam insulation

Reduce vapor drive from interior

- Mechanical ventilation in building
- Class III vapor retarder (CZ4-5) = latex paint
- Class II VR (CZ 6-7) = kraft facing, VR paint, 1" XPS



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More Strategies

Keep sheathing warm with rigid foam

- Expensive on roof

Limit vapor drive and air flow by spraying foam

- Low density foam needs vapor control

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Roof Design (Building Science Corp)

Roofs can be designed and constructed to be either vented or unvented in any hygro-thermal zone.

In cold climates, the primary purpose of attic ventilation is to maintain a cold roof temperature to avoid ice dams created by melting snow, and to vent moisture that moves from the conditioned space to the attic. Melted snow, in this case, is caused by heat loss from the conditioned space.

In hot climates, the primary purpose of attic ventilation is to expel solar heated hot air from the attic to lessen the building cooling load.

The amount of roof cavity ventilation is specified by numerous ratios of free vent area to insulated ceiling area ranging from 1:150 to 1:600 depending on which building code is consulted, the 1:300 ratio being the most common.

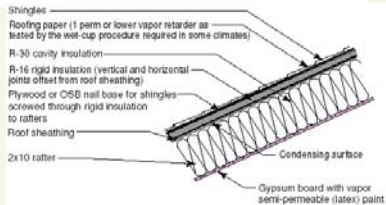
Control of ice dams, moisture accumulation and heat gain can also be facilitated by unvented roof design.

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The following detail drawings are from:

<http://www.buildingscienceconsulting.com>

→ "Technical Resources"
→ "Building Science Information Resources"
→ "Roofs"



R-46 Unvented Roof Assembly

- Two layers of R-6.5/inch rigid insulation yielding a total combined thickness of 2.5 inches
- Layers of rigid insulation have staggered joints to facilitate air tightness; two layers are preferable to one layer due to increase in air flow resistance

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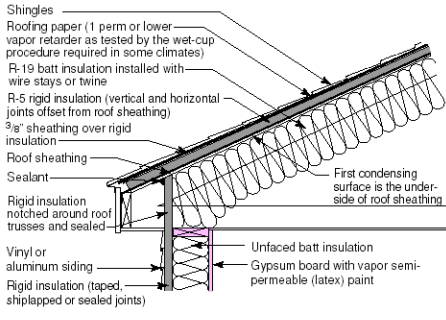


Figure 2
Rigid Insulation Used to Control Condensing Surface Temperatures

- Rigid insulation installed above roof deck
- Ratio of R-value between rigid insulation and batt insulation is climate-dependent

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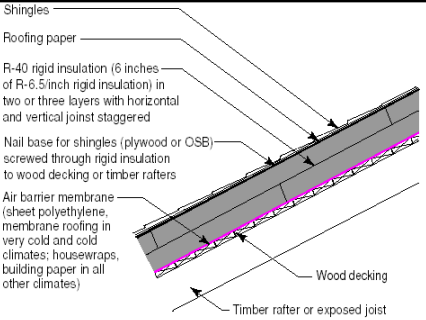


Figure 7
Compact Unvented Roof Assembly

- R-value increased to R-50 in very cold climate zones to control ice-damming
- Optimum roof assembly design to enclose pool areas and spas

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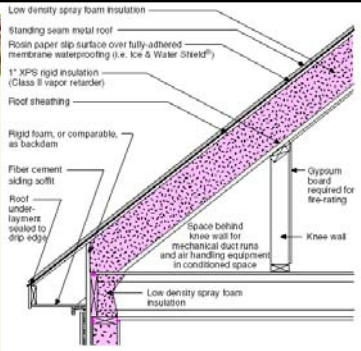


Figure 9
Air Impermeable Spray Foam Insulation

- Spray foam protected with thermal barrier in occupied attic space
- Interior vapor retarder (Class II) required with low density spray foam in Climate Zones 6 and 7

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