

The shelter of excuses has a leaky roof.

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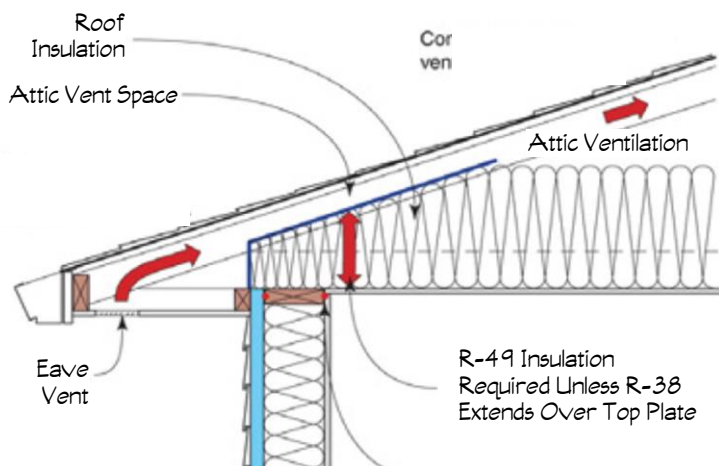
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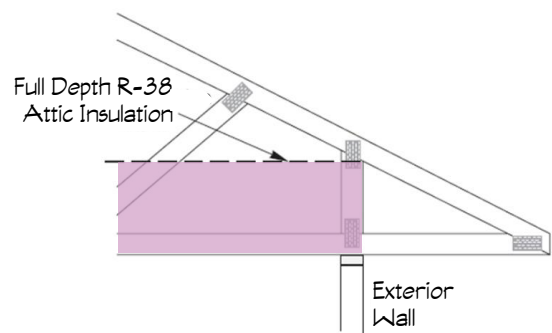
Unvented Attics and Cathedral Ceilings

Background. Vented attics and cathedral ceilings have been around for a long time but unvented attics and cathedral ceilings were much less common. Today we are seeing these unvented approaches more often for several reasons which include efforts to tighten the building envelope, to better take advantage of the space under the roof, and because there are new foam insulation products on the market. Before discussing how the energy code addresses unvented roof construction let's review the basic code requirement for roofs.

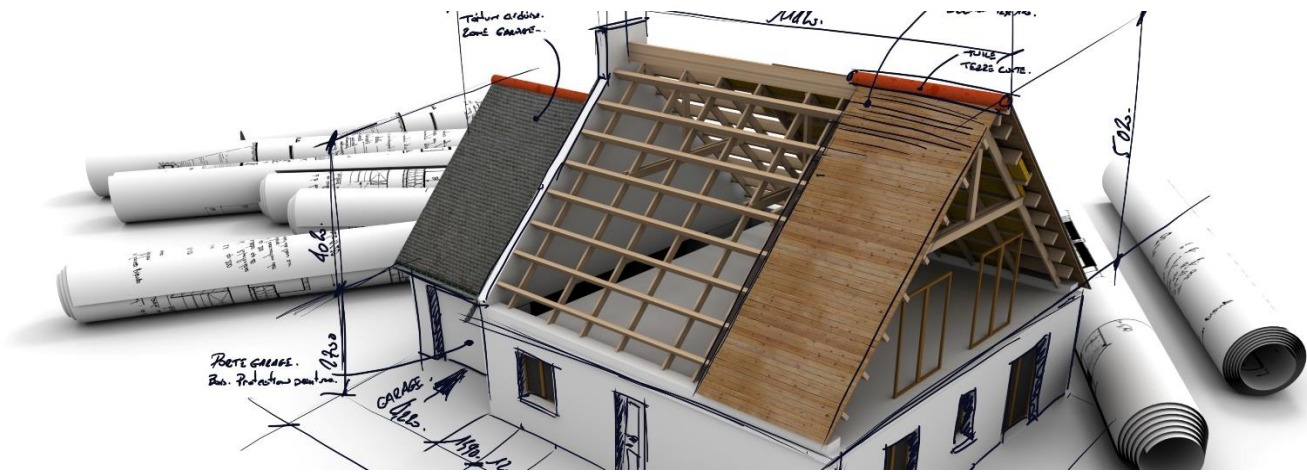
The 2012 International Energy Conservation Code (IECC) requires R-49 for ceilings. In ceiling assemblies with attic spaces, R-402.2.1 states that R-38 is satisfactory wherever the full height of uncompressed R-38 insulation extends over the top plate at the eaves. Where the roof/ceiling is without an attic space and the assembly does not allow sufficient space for the required insulation R-30 is allowed for up to 250 square feet. This area is a Montana amendment as the 2012 IECC would have allowed 500 square feet. Eave baffles are required for air permeable insulation.



R-49 IS REQUIRED UNLESS FULL INSULATION VALUE EXTENDS OVER TOP PLATE OF EXTERIOR WALL



R-38 IS ALLOWED IF FULL INSULATION VALUE EXTENDS OVER TOP OF EXTERIOR WALL



A growing number of homes are being constructed with unvented attics or unvented cathedral ceilings. The building codes have included requirements for venting attics for some time. The primary purpose for the ventilation requirements are to remove moisture that can accumulate in the attic and potentially result in condensation. The primary source of water vapor that enters an attic is from air leaks in the ceiling. Proper attic ventilation also reduces the chance of ice damming at the eaves.

The 2012 International Residential Code (IRC) allows the construction of unvented attics and cathedral ceilings but includes specific design requirements. Unvented attics are constructed with insulation installed above or below the roof sheathing. The insulation must be in direct contact with the sheathing. One major benefit of an unvented attic is that mechanical equipment and ducts are within the thermal envelope which eliminates heat losses to the outside.

Code Citation: 2012 IRC, R806.5 Unvented Attic and Unvented Enclosed Rafter Assemblies

Unvented attic and unvented enclosed rafter assemblies are permitted if all of the following conditions are met.

1. The unvented attic space is completely contained within the building thermal envelope.
2. No interior Class I vapor retarders are installed on the ceiling side of the unvented attic assembly or enclosed rafter assembly.
3. Where wood shingles or shakes are used, a minimum $\frac{1}{4}$ inch vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing
4. Any air-impermeable insulation shall be a Class II vapor retarder, or shall have a Class III 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.
 - 5.1 Air-impermeable 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 806.5 for condensation control.
 - 5.3 Air-impermeable 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 806.5 for condensation control. The air-permeable insulation shall be installed directly under the air-impermeable insulation.
 - 5.4 Where performed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

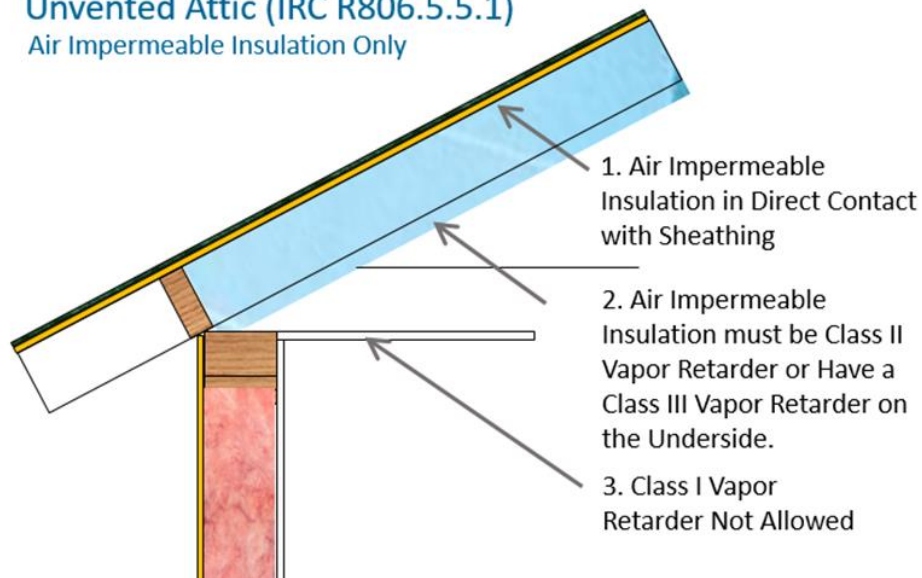
Table 806.5 Insulation for Condensation Control

Climate Zone 6 – Minimum Rigid Board On Air-impermeable Insulation **R-25** Required

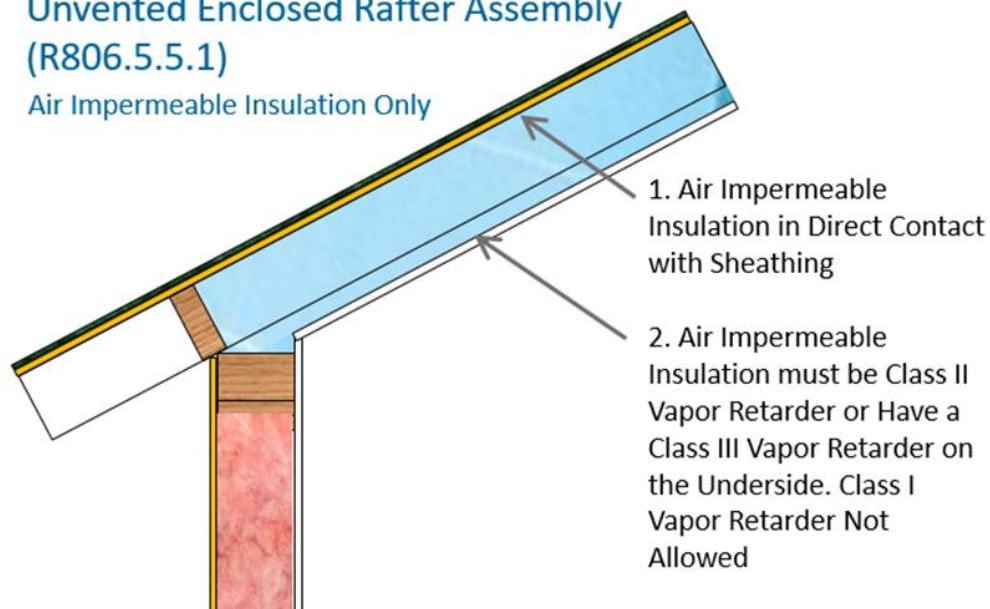
Air-Impermeable Insulation Only (IRC R806.5.5.1) – Attic and Enclosed Rafter Assembly

Air-impermeable insulation is typically high density foam. Installation of a Class I vapor Retarder on the ceiling side (attic floor) is prohibited. A Class I Vapor Retarder would prevent the assembly from drying to the inside. A Class 2 or 3 vapor retarder will allow the assembly to dry to the inside while minimizing the movement of water vapor into the assembly.

Unvented Attic (IRC R806.5.5.1) Air Impermeable Insulation Only

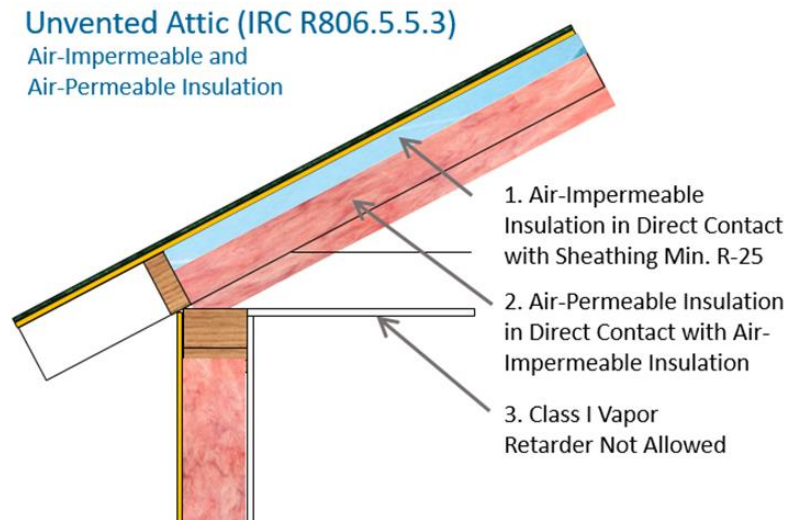


Unvented Enclosed Rafter Assembly (R806.5.5.1) Air Impermeable Insulation Only



Air-Permeable Insulation Only (IRC R806.5.5.2) – Attic

While the IRC refers to this assembly as *Air-Permeable Insulation Only*, it also involves installation of rigid board insulation above the roof sheathing. Air-permeable insulation is typically fiberglass, cellulose, or low density foam. The addition of the rigid board insulation ($\geq R-25$) above the roof sheathing will keep the temperature at the underside of roof sheathing warm to minimize the possibility of condensation.



Plan Review Guidelines

1. Verify that the total insulation R-value proposed for the roof assembly meets or exceeds the energy code, refer to Table R402.1.1 in the IECC.
2. Verify that the insulation is specified to be installed in direct contact with the roof sheathing.
3. Verify that there is no Class I vapor retarder to be installed on the warm side of the insulation, including at the attic floor.
4. Where air-impermeable insulation is to be installed underneath the roof sheathing, verify that the air-impermeable insulation is to be a Class II vapor retarder or will have a Class III vapor retarder on the underside.
5. Where air-permeable and air-impermeable insulation will be installed, verify that at least R-25 of rigid board insulation is specified to be placed on top of the roof deck.
6. Verify that a ¼-inch air gap is called out for wood-shingle roof systems.

Field Inspection Guidelines

1. *Insulation beneath Sheathing.* Verify that roof insulation installed under the roof sheathing is well supported and in substantial contact with the sheathing. For air-impermeable insulation, verify that the installed insulation is the correct thickness to meet the R-value requirement called out on the plans.
2. *Insulation above Sheathing.* Verify that the correct R-value of insulation is installed on top of the roof sheathing, if required by code.
3. *Vapor Retarder.* Verify that a vapor retarder is installed under the air permeable insulation where air-impermeable insulation is used.
4. *Insulation Type.* Verify that the type of insulation installed is the same as approved during plan review. It is particularly important to determine if foam insulation is air-permeable (low-density foam) or air-impermeable (high-density foam).



Energize Montana Energy Code Website:
<http://deq.mt.gov/Energy/EnergizeMT/EnergyCode>