11. Unvented Attics and Cathedral Ceilings

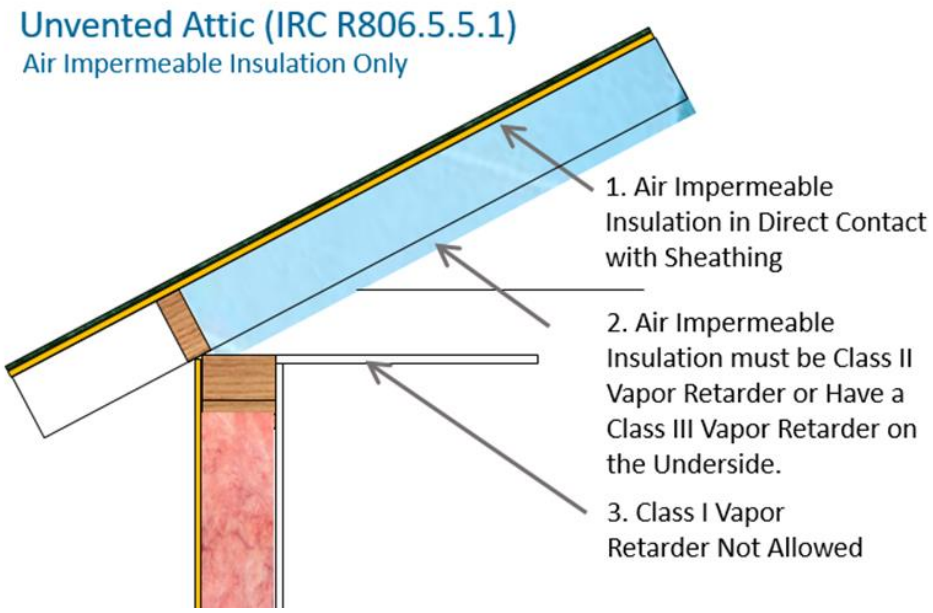
While the vast majority of roof designs are vented, a growing number of homes are being constructed with unvented attics or unvented cathedral ceilings. The building codes have included requirements for ventilating attics for some time. The primary purpose for the ventilation requirements are to remove 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 International Residential Code 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 located in traditional vented attics are now within the thermal envelope which minimizes heat loss to the outside.

The International Residential Code (IRC) addresses the construction of unvented attics and rafter assemblies while the International Energy Conservation Code (IECC) establishes the minimum insulation for the assembly, R-49 in the Montana climate zone. This minimum R-value may be reduced to R-38 if that full R-value is maintained over the wall top plate at the eaves. IECC Section R402.2.2, as amended by Montana, allows R-30 in an area without attic spaces not to exceed 250 Ft^2 or 20% of the total insulated ceiling area, whichever is less.

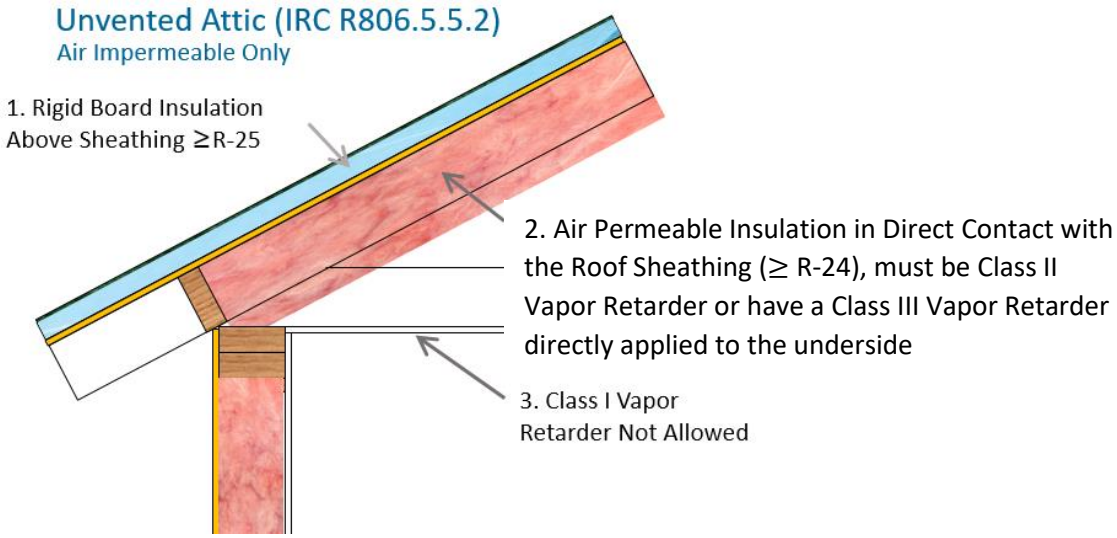
Air-Impermeable Insulation Only (IRC R806.5.5.1) – Attic and Enclosed Rafter Assembly

Air-impermeable insulation is typically high density foam. Installation of a Class I vapor Retarder on the ceiling side of the assembly (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 from the house.



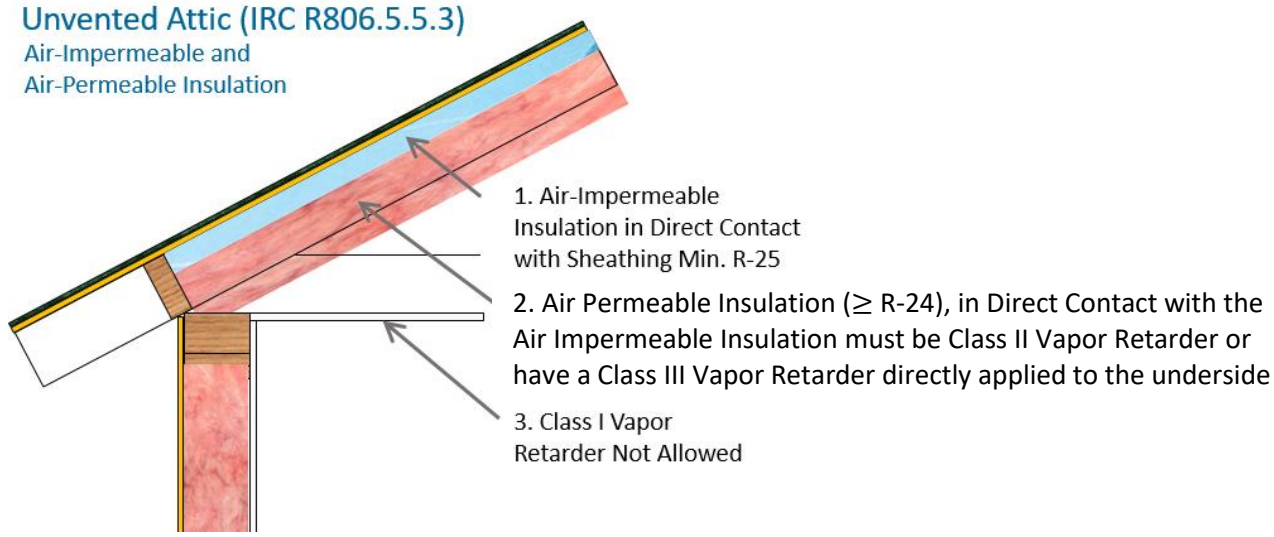
Air-Permeable Insulation Only (IRC R806.5.5.2) – Attic

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 (≥ R-25) above the roof sheathing will keep the temperature at the underside of roof sheathing warm to minimize the possibility of condensation.



Air-Impermeable and Air-Permeable Insulation (IRC R806.5.5.3) – Attic

Air-permeable insulation is typically fiberglass, cellulose, or low density foam. Air-impermeable insulation is typically high density foam. The addition of the air-impermeable (rigid board) insulation (≥R-25) below the roof sheathing will keep the temperature at underside of the air-impermeable insulation warm to reduce the possibility of condensation. Installation of a Class I vapor Retarder on the ceiling side (attic floor) is prohibited.



Plan Review

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 as well as section R402.2.1 and R402.2.2.

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

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*. Very 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).

Code References

2012 IRC Section 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 ¼ 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.

2012 IRC Table 806.5 - Insulation for Condensation Control
Climate Zone 6 – Minimum Rigid Board On Air-impermeable Insulation ***R-25*** Required

2012 IECC Table R402.1.1 - Insulation and Fenestration Requirements By Component
Climate Zone 6 – Minimum Ceiling R-Value is R-49. *(**R402.2.2** allows R-38 if that full R-value is maintained over the wall top plate at the eaves.)*

2012 IECC Section R402.2.2 – Ceilings without Attic Spaces. Where Section R402.1.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section R402.1.1 shall be limited to 250* square feet or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section R402.1.3 and the total UA alternative in Section R402.1.4.

* - Montana amended this value from 500 square feet in the IECC to 250 square feet.

Resources

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