



SATURN
RESOURCE MANAGEMENT

4.2.5 Insulating Closed Roof Cavities

SWS Detail: 4.0103.7 Accessible Pitched/Vaulted/Cathedralized Ceilings - Loose Fill Over; 4.0102.3 Inaccessible Ceilings - Dense Pack

Many existing homes have cathedral ceilings or flat roofs that are partially filled with fibrous insulation. These roofs are often unventilated or ineffectively ventilated. The insulation job may include repair of the roof deck and installation of foam insulation over the roof deck. The IRC building code requires one of these two approaches to insulate a roof cavity.

1. Verify or provide a ventilated space of at least one inch between the roof insulation and the roof sheathing by providing soffit and ridge ventilation.
2. If no roof ventilation, then install foam roof insulation in addition to filling the cavity with insulation. Foam R-value of between R-5 and R-35 depending on climate as specified by the IRC.

Ventilated Closed Roof Cavities

To prepare for roof-cavity insulation, without existing baffles and with a ventilated space above the insulation, use this procedure.

- ✓ Remove either the roofing and sheathing or the interior ceiling to gain full access to the cavity.
- ✓ Remove recessed light fixtures, and replace them with surface-mounted light fixtures. Carefully patch and air seal the openings.
- ✓ Install fiberglass or foam insulation to meet the IECC regional minimum roof-assembly R-value requirements.
- ✓ Install openings into the ventilation channel above the insulation totaling $\frac{1}{150}$ of the roof area. If the ceiling has a Class I or II vapor retarder, the requirement is reduced to $\frac{1}{300}$ of the roof area.
- ✓ In cold climates, install a Class I or II vapor retarder at the ceiling. One option is to paint an oil-based primer over the interior drywall or plaster.

- ✓ Repair roof leaks or install a new water-tight roof. Replace moisture-damaged sheathing as part of the roof replacement.
- ✓ Install an air-barrier ceiling (drywall) if the existing ceiling isn't an adequate air barrier, for example tongue-and-groove paneling.
- ✓ Seal other air leaks with great care, especially at the perimeter and around ridge beams.

Un-Ventilated Closed Roof Cavities: Decisions

Many homes have cathedral ceilings, vaulted ceilings, or flat roofs that are partially or completely filled with insulation and would require major building surgery to install code-compliant roof ventilation or rooftop foam board during retrofit cavity insulation.

Dense-packing the cavities prevents most convection and moist-air infiltration, which are leading causes of moisture problems in roof cavities.

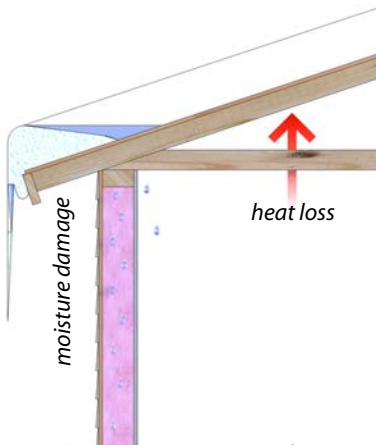
Insulators have dense-packed many cathedral roof cavities with fiberglass insulation without ventilation or foam rooftop insulation. Some experts believe that this method is acceptable. However, this method isn't a code-compliant one and it usually requires special approval by the building department when and if the department issues a building permit.

Important Note: Dense-packing roof cavities with fiberglass insulation and without ventilation is controversial. The colder the climate, the higher the risk of problems, such as ice damming. However, dense-packing the cavities prevents most convection and moist-air infiltration, which are leading causes of moisture problems in roof cavities. Consult a knowledgeable local engineer before deciding to dense-pack a roof cavity with fiberglass. Don't dense-pack roof cavities with cellulose because of its moisture absorption and its susceptibility to moisture damage.

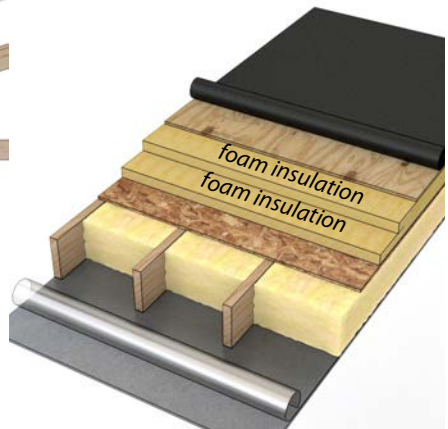
Closed Roof Cavities: Preparation

To prepare for dense-packing the roof-cavity, consider the following steps.

- ✓ Reduce or eliminate sources of moisture in the home.
- ✓ Verify that the ceiling has a Class I or II vapor retarder and air barrier on the interior. If not, install a vapor retarder and air barrier.
- ✓ Remove recessed light fixtures and replace them with IC-AT fixtures or surface-mounted fixtures. Carefully patch and air seal the openings if you replace the recessed fixtures with surface-mounted ones.
- ✓ Seal other ceiling air leaks, large and small, with great care.
- ✓ When replacing the roof during roof-cavity insulation, install 1-to-8 inches of rigid high-density foam insulation on top of the roof deck, as required by the IRC. If you replace the roof, dense-pack the existing roof cavity as part of the process.



Ice damming: When a roof is unventilated, the home's heat loss warms the roof deck melting snow. The water re-freezes at the eaves and causes moisture damage.



Rooftop foam insulation: The IRC code requires foam insulation over the structural sheathing when the roof is unventilated.

Blowing Insulation into the Closed Roof Cavity

Always use a fill tube when blowing closed roof cavities. Insert the tube into the cavity to within a foot of the end of the cavity. Access the cavity through the eaves, the roof ridge, the roof deck, or the ceiling. Consider one of these procedures.

- Drill holes in the roof deck after removing shingles or ridge roofing.
- Remove the soffit and blow insulation from the eaves. Drill and blow through a drywall ceiling.
- Carefully remove a tongue-and-groove ceiling plank and blow insulation into cavities through this slot.



Blowing from the eaves: Some vaulted ceilings can be blown from the eaves and/or the ridge.



Blowing from the roof deck: Technicians remove a row of shingles, drill, and blow fiberglass into this vaulted roof cavity.

4.2.6 Exterior Rooftop Foam Insulation

Only install rooftop foam insulation over dense-packed roof cavities. A ventilation space between existing insulation and the new rooftop insulation reduces the roof assembly's R-value.

Roofers install exterior foam roof insulation when re-roofing low-sloping roofs after filling the cavities with fibrous insulation.

- ✓ Use high density foam board: 2 pcf for polystyrene or 3 pcf for polyisocyanurate if the roof is flat or low sloping.
- ✓ Flash all external penetrations according to the roofing manufacturer's specifications.
- ✓ Use a cool roofing material such as white rubber or white metal to limit the foam's temperature during intense summer sun and to minimize cooling costs.
- ✓ Contact a design professional to ensure that the roof drains properly after you install foam installation.
- ✓ Provide an insulation certificate, with insulation type and number of bags installed, installed thickness, coverage area, and insulation R-value at the attic entrance.

Many foam manufacturers can taper expanded polystyrene foam, providing wedge-shaped pieces to create slope for drainage.

4.2.7 Installing Fiberglass Batts in Attics

SWS Detail: 4.0103.3 Accessible Attic - Batt Insulation Over Existing Insulation; 4.0103.1 Accessible Attic - Batt Installation

Follow these specifications when installing fiberglass batts in an attic. Fiberglass batts aren't the best insulation for attics because of all their seams.

- ✓ When layering batts, install new layers at right angles to underlying layers if the top of the existing batts are level with or above the ceiling joist or truss bottom chord.
- ✓ Install un-faced fiberglass insulation whenever possible.

- ✓ If you must install faced batts, install them with the facing toward the heated space. Never install faced insulation over existing insulation.
- ✓ Cut batts carefully to ensure a tight fit against the ceiling joists and other framing.

4.2.8 Roof Deck Underside /Cathedralized Attics

SWS Details: 4.0102.1 SPF Roof Insulation - Unvented Roof Deck; 4.0102.2 SPF Roof Insulation - Vented Roof Deck; 4.0103.6 Accessible Attic - Dense Pack Insulation

A cathedralized attic has insulation attached to the bottom of the roof deck and is also called a hot roof if it isn't ventilated. Choose to insulate the bottom of the roof deck instead of insulating the ceiling when the building owner wants to use the attic or to enclose an attic air handler and leaky ducts within the building's thermal boundary.

Avoiding Moisture Problems

Insulating the underside of the roof deck presents a risk of moisture problems in the structural sheathing from roof leaks or condensation.

To avoid moisture condensation within the insulation or within the structural sheathing during cold weather.

- Install air-impermeable insulation such as closed-cell SPF or install a perfect air barrier and a vapor retarder to the rafters beneath the insulation.
- For additional protection against moisture, install a low-high roof-vent chute to provide ventilating air directly to the roof deck above the insulation.
- If the insulation job requires a permit, see the IRC and the AHJ for guidance on roof insulation, to prevent condensation and optimize the assembly's thermal resistance.

Provide the client an insulation certificate, with insulation type and number of bags installed, installed thickness, coverage area, and insulation R-value. See *“Insulation Receipt or Certificate” on page 104.*

Unvented Spray Foam Roof-Deck Insulation

Use these procedures for spraying high-density, closed-cell foam on the underside of the roof deck.

- ✓ Remove any vapor retarder in the ceiling insulation at the floor of the attic.
- ✓ Create an airtight insulation dam at the eaves to form the roof-wall junction and to prevent spray foam from escaping into the soffit.
- ✓ Spray the foam to cover the entire surface of the cavity.
- ✓ In colder climates, install SPF to a thickness of at least a class II vapor retarder or have at least a class II vapor retarder coating or covering in direct contact with the underside of the SPF.
- ✓ When replacing the roof and adding insulation, install 1-to-8 inches of rigid high-density foam insulation on top of the roof deck, as required by the IRC to prevent moisture problems in a hot roof.
- ✓ Comply with fire safety provisions of the IRC.
- ✓ Post a dated receipt.

Venting a Spray-Foam Roof-Deck

If you spray-foam the bottom of the roof deck, you create a hot roof, which the IRC recognizes as sub-optimal. If you install a vented space between the roof deck and the SPF, you create a cold roof that is more durable.

- ✓ Install continuous ventilation path from soffit to ridge in each truss/rafter bay without any opening that SPF can penetrate or obstruct ventilation airflow.
- ✓ Install continuous damming at the exterior wall plate, without blocking or compromising the ventilation pathway. The damming must allow for highest possible R-value but also prevent any SPF from entering venting path or exterior soffit.

Use **only** high-density closed-cell spray foam and not low-density open-cell spray foam for application to the bottom of a roof deck. Consult the IRC and AHJ for more guidance.



Unventilated attic: The unventilated attic or cathedralized attic is a last resort when an air handler and leaky ducts are in the attic.

Fiberglass Roof-Deck Insulation

Insulating the rafter space with an air-permeable insulation requires an air barrier, vapor retarder, and Class I (or A) fire-rated material at the roof cavity's lower boundary. Consider these two alternatives.

1. Install the rafter's depth of fiberglass batts and then a material or combination of materials that constitutes an air barrier, vapor retarder, and Class I fire barrier.
2. Blow dense-packed fiberglass insulation between the roof deck using a rigid or flexible insulation restraint.

4.2.9 Vaulted Attics

A vaulted attic is framed with a special truss that creates a sloping roof and a sloping ceiling. Access to the cavity varies from difficult to impossible.

Install insulation from either the top of the roof deck or through the ceiling. Insulation, installed at the ceiling, must have some stability to prevent gravity from pulling it downhill or wind from piling it, leaving some areas under-insulated. Damp spray fibrous insulation may serve this purpose.

Consider the following options to insulating uninsulated or partially insulated vaulted attics.

1. Insulate the ceiling with fiberglass batts. Install the batts parallel to the framing if the top of existing insulation is below the framing. Install the batts perpendicular to the framing if the top of the existing insulation is above the framing.
2. Insulate the bottom of the roof deck, as described previously for a cathedralized attic, if you remove the ceiling.
3. Insulate the ceiling with sprayed foam, damp-spray fibrous insulation, or batts from the roof with the roof sheathing removed.
4. Fill the cavity to approximately 100% with loosely blown fiberglass from indoors or through the roof. Maintain the existing vents and hope that settling or under-filling provides room for ventilation.
5. Preserve or install openings into the ventilation space above the insulation totaling $\frac{1}{150}$ of the roof area. If the ceiling has a vapor retarder the requirement is $\frac{1}{300}$ of the roof area.
6. Post a dated receipt.