5a. Ceiling insulation – Is it all there? I paid for it!

Survey results of ceiling insulation

The majority of ceilings were insulated as per specifications. There were a few problems noted: the insulation certification was not present in almost all homes, and 17 percent of ceilings were under-insulated. Also many "complicated" ceilings with vertical and steeply sloped areas were under-insulated. Going above the minimum for ceiling insulation in your climate zone (use Arkansas Energy Code Simplified Zonal Options) is hard to justify on a cost-effective basis; however, it is important to check that the insulation level is measured and is consistent throughout the ceiling.

Steps to a better-performing ceiling

1. Air seal before insulating. Ceiling insulation does not seal air leaks. Seal around all holes made for lights, boots, etc. For recessed lights use AT/IC (**see page 34**).
2. Ask the insulation company for the expected minimum thickness for their product at your requested R-Value. Place markers, such as reflective tape, on strategic locations at that thickness level to assist with installation and inspection.

   About 17 percent of the ceilings in the study were under-insulated – the majority of these measured only R-26. Many attics had an uneven distribution with a decreasing thickness at the extremes. See typical insulation values on **page 93** and "Insulation certification" on **page 41**.
3. Check the work for consistency (same minimum thickness throughout), missing spots, holes, blocked soffit vents, and accidental insulation blown into vent ducts.

Sealed with caulk

An unsealed light wiring box

Uneven distribution

Measuring marker

Hole in ceiling exposes many walls to attic temperature.

Missing knee wall insulation. Check the work.

Batt insulation with exposed joists

Few ceilings are insulated with batts because this is a more expensive option. When batts are used, it is important to pay attention to the exposed joists that transfer heat three to six times as fast as the insulation. Suggestion: Use two sets of R-19 batts. The first R-19 batt goes between the joists; the second R-19 covers the joists by being placed perpendicular to them. In our hot-humid climate, unfaced insulation (not faced with a vapor diffusion retarder) is recommended for the attic.

Attic-framing techniques

There are a variety of energy-efficient ceiling and roof framing techniques that allow for the full thickness of ceiling insulation to go all the way to the walls while allowing for soffit ventilation. **See pages 18-22** for several examples of truss designs for regular ceilings and one example of a cathedral ceiling framing technique.

Soffit-vent baffles

When soffit vents are installed, baffles should be placed around the perimeter to prevent the insulation from blocking the soffit vents and to prevent the wind from blowing on the insulation.

Insulation certification

The Federal Trade Commission (FTC Rule 460) requires that insulation contractors sign and prominently place an insulation certificate in the attic that documents what material was used, the name of the insulation company, and the minimum thickness, R-Value and density of the applied product. This certificate is typically printed on a piece of 8 inch x 11 inch card stock and should be stapled in the attic in such a way that is easily visible from the attic hatch. This certificate was only found in about three out of 100 homes. Do not accept a "bag count," a copy of the bag's specifications or a home-made "certificate." The "bag count" is only a rough "rule of thumb" to help the installer load up the truck for a particular job. This is not any guarantee of adequate and consistent minimum thickness.

Attic ventilation

Attics without a ceiling vapor barrier should be ventilated with 1 square foot of net free vent area for each 150 square feet of ceiling. **See page 46** for estimating net free areas of various screens and louvers.

- **Gable vents** – 1 square foot of gable vent for each 150 square feet of ceiling. Half of the total gable vent area is installed in each gable end. Gable vents rely on cross winds as the driving force, and in the summer, the wind is not always blowing.
- **Continuous ridge vent and soffit vents** – One-half square foot of ridge vent and one-half square foot of soffit vent for each 150 square feet of ceiling. This combination is more effective than gable vents because the naturally rising hot air is the force that draws in cooler air, and it does not rely on the wind. The best ridge vents have external baffles that prevent the wind from interfering with the escape of hot air. When soffit vents are installed, baffles should be placed around the perimeter to prevent the insulation from blocking the soffit vents and to prevent the wind from blowing on the insulation.
- **Turbine vents** – When enough replacement air is provided through soffit vents, turbines can allow hot attic air to escape even though the summer wind is not blowing. Gable vents should not be combined with turbine vents because this combination does not allow enough circulation.
- **Power vents** – These devices are not recommended because because they consume more energy than they save. They can remove conditioned air from the home through ceiling leaks and bypasses, pull pollutants from the crawlspace into a home, and cause exhaust gases from fireplaces and combustion appliances to enter a home. (Source: U. S. Department of Energy)

Use information on ***page 46*** *to estimate the net free area of various soffit vent products.*

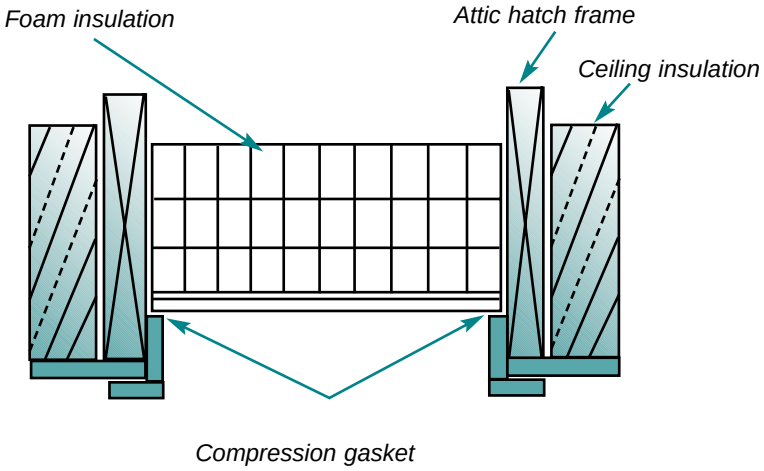
A continuous ridge vent should be matched with continuous soffit vents.

A turbine vent waits for the wind to blow during the hot summer

Attic hatch

The survey found that when an attic hatch was located inside the home, it was not insulated or sealed. It doesn't take much to reduce the overall ceiling R-Value. For instance, if a 2,000 square foot R-30 ceiling has an uninsulated 6 square foot attic hatch, then the overall R-Value is reduced about 8 percent to R-27.6 for that 0.3 percent uninsulated hatch area.

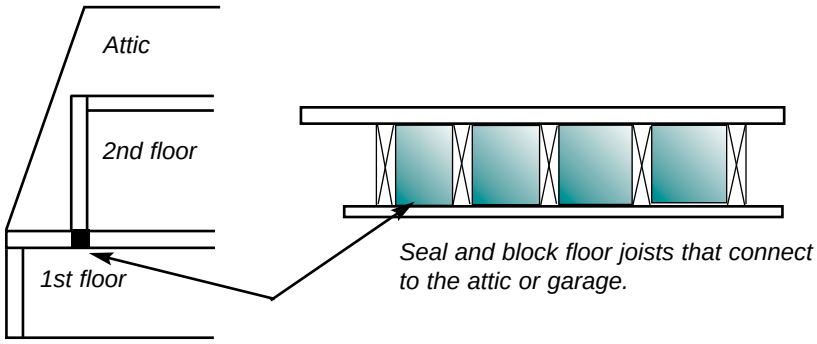
The attic hatch should also be carefully weather-stripped to reduce air leakage and to prevent dust and ceiling insulation from entering the conditioned space. An insulated and air-sealed attic hatch can be built in about 15 minutes using scrap plywood, weather-stripping, a 6-inch thick block of Styrofoam, and some wood veneer. Build a channel for the attic hatch with some wood framing that will prevent the ceiling insulation from falling into the living space. Glue the Styrofoam to the hatch cover, and then attach a good compression gasket (weather-stripped to the wood veneer. (Source: *Energy Design Update*, June 2001)



Block exposed floor joists

When the ceiling of the first floor of a 1 1/2 story home is also the floor of the room above it, the ceiling's joists are typically connected to the attic area. Keep the attic air from this floor/ceiling area by blocking off and air-sealing these joists with some insulated sheathing. Then the attic insulation can be installed against the blocking.

A similar problem occurs when a room is directly above a garage. The ceiling of the garage is the floor of the room above it; however, the joists between these two rooms are typically connected to the attic, and the insulation is typically found resting on the garage's ceiling. These joists also need to be blocked, air-sealed and insulated.



Joist cavity is blocked and sealed to prevent attic or outside air from entering between floors.

Calculating net free area

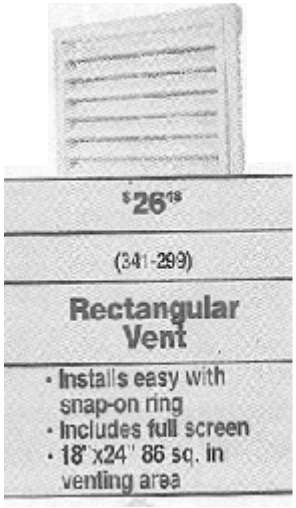
Ventilation area is defined as a "net free area." This is the unobstructed area through which air can freely pass. Here is how to determine if enough net free area is being considered for adequate ventilation:

> Example: Say a roof area is 1,000 square feet, and louvered and screened attic vents are being used to ventilate the attic. One square foot of net free vent area is needed for each 150 square feet of roof. Therefore, 1,000 ÷ 150 = 6.67 square feet of net free vent area is needed. Using the formula below for louvered and screened attic vents, 6.67 ÷ 0.44 = 15 square feet of this vent type is needed to deliver 6.67 square feet of net free area.

Louvered & screened attic vents: NFA ÷ 0.44 = Area
Roof ventilators: NFA ÷ 0.66 = diameter
Soffit louvers: NFA ÷ 0.37 = Area
Continuous soffit strips:

- Parallel slots: NFA ÷ 0.25 = Area
- Closely punched holes: NFA ÷ 0.3 = Area
- 1/4" hardware cloth & louvers: NFA ÷ 0.5 = Area
- 1/8" mesh screen: NFA ÷ 0.8 = Area
- 1/8" mesh plus louvers: NFA ÷ 0.44 = Area
- 1/16" mesh screen: NFA ÷ 0.5 = Area
- 1/16" mesh screen plus louvers: NFA ÷ 0.33 = Area

Two gable vents are probably not enough



Example: An advertisement for gable vents indicates that one particular model has 86 square inches of venting area for each vent (the size of the vent itself is 18 inches by 24 inches). In that same 1,000 square foot attic example, 6.67 square feet of venting area is needed, which is 6.67 x 144 = 960 square inches of venting area. 960 square inches ÷ 86 square inches per vent = 11 vents. Therefore, a total of 10 to 12 of these vents (5 or 6 on each side) would be needed to adequately ventilate the attic with only gable vents.

If, however, gable vents are used in combination with continuous soffit vents, half of that area (six gable vents) could work if an equal net free area is installed for the soffit vents. Attic ventilation works by taking advantage of the hot air that is rising in the attic. An inadequate ventilation area easily restricts this low-pressure force.