The Benefits of Attic Ventilation

WHAT VENTILATION DOES

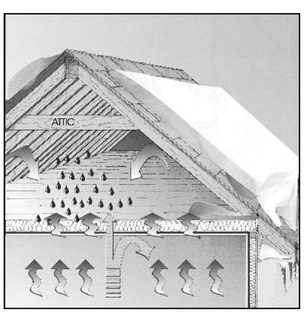
Ventilation is a system of intake and exhaust that creates a flow of air. Effective attic ventilation provides year-round benefits, creating cooler attics in the summer and drier attics in the winter, protecting against damage to materials and structure, and helping to reduce energy consumption. Effective ventilation creates a cooler attic in the summer, a drier attic in the winter, and helps prevent ice dams.

With poor ventilation, summer sunshine can cause a terrific build-up of heat in attic space. In a home with poor ventilation, the heat in the attic may eventually reach 140°F on a 90° day. If the unventilated attic is heavily insulated, that heat will stay there much of the night, perhaps slowly migrating to the home's interior. An overheated attic, combined with moisture, can also be damaging to roof decking and roofing shingles, causing them to distort and deteriorate prematurely.

In the winter, again in a house with poor ventilation, moist, warm air from the lower portions of the home will tend to rise through the ceiling area into the attic, especially through bypasses where electrical and plumbing fixtures are installed. In a cold attic, the warm, moist air condenses on the cold surfaces of the rafters, the nails and other metal, and the attic side of the deck. This water can create several problems.

First, the condensation can swell the deck, causing waviness and buckling of both the deck and the shingles. Second, the water can rot the roof deck, destroying its ability to carry loads (like a roofing crew) and its nail-holding capability. Third, severe condensation can drip onto the insulation, reducing its effectiveness and possibly seeping through to the ceiling below.

Another winter problem caused by poor ventilation is the formation of ice dams. Ice dams form in cooler climates in winter when heat collects in a poorly ventilated and/or inadequately insulated attic. Built-up attic heat combines with the sun's warmth to melt snow on the roof, even though outside temperatures may be below freezing. Then the flow of melting snow refreezes at the eaves and gutters. This freeze – thaw cycle can result in a pool of water that can back up under roof shingles and behind fascia boards, soaking roof decking and wall sheathing, damaging exterior and interior walls, peeling paint and ruining ceilings. Soaked lumber and building materials lead to secondary problems: wood rot, bug infestation, mold and degradation of structural integrity.



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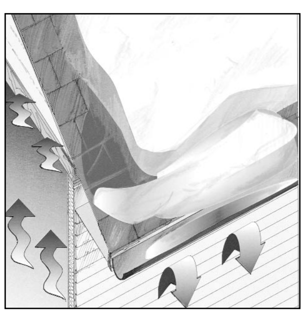

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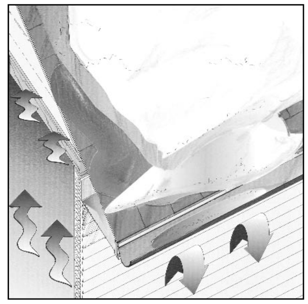

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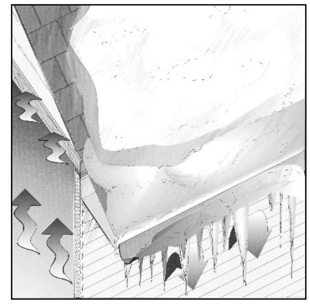

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Figure 7-1 a - d:

In a four-phase cycle of freeze and thaw, snow begins to melt when heat in the attic warms the underside of the roof deck and causes snow to melt and run down the roof. The melting snow refreezes at gutters and soffits. Pools of water and ice back up and soak decking and wall sheathing, then refreeze again to further damage all building materials *(Figure 7-1 a-d)*.

Good ventilation will move the hot air next to the roof deck out of the attic in the summer, and it will dilute and remove the moist air in the winter, before it can cause damage. Also, proper ventilation, in combination with sufficient insulation, helps keep a more uniform temperature on the underside of the deck in the winter, and that can eliminate one of the principal causes of ice dam formation.

VAPOR RETARDERS CAN HELP KEEP WARM, MOIST AIR FROM ENTERING THE ATTIC

The typical family of four generates an estimated 2.5 gallons of water vapor every day from activities such as cooking, cleaning, bathing and laundering. During the heating season, that water vapor tends to move from the warm interior to the home's cooler exterior. If passage into attics and exterior walls isn't slowed by a vapor retarder, and assuming the attic ventilation system is inadequate, condensation can occur on the cold surface, and can eventually cause mold, mildew and wood rot. It can also damage insulation, causing it to become damp and reduce its performance.

Penetration of the vapor retarder by recessed lights, attic openings and vents defeats its purpose, providing paths for conditioned air and moisture to escape into the attic.

HOW VENTILATION WORKS

There are many types of attic ventilation systems in use today. Some systems use all natural forces to move the air, such as the wind and "thermal convection" (rising warm air). Other systems use mechanical fans to move the air. And still other systems use some combination of natural and mechanical forces.

NATURAL FORCES

THE WIND: As the wind moves against and around the building, it creates areas of higher and lower air pressure. Higher pressures push air away. Lower pressures pull, or suck air toward them (*Figure 7-2*). A well-designed ventilation system will have intake vents where the high pressure is created on the outside of the roof system at the eaves, and have exhaust vents where there is low pressure on the outside, high on the roof. This kind of system depends on wind flow to operate.

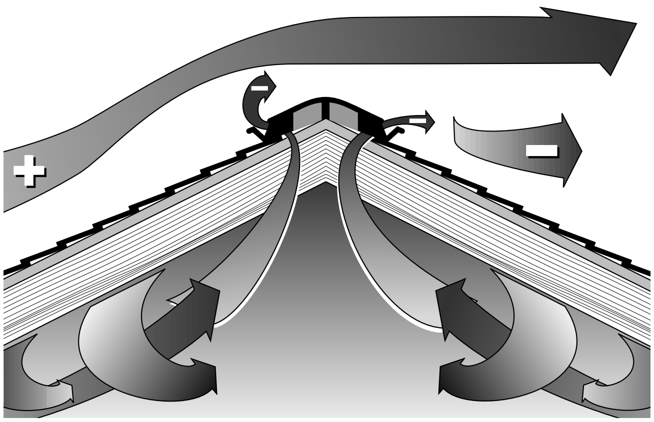

Figure 7-2: Positive air pressure moving over the baffled ShingleVent II creates negative air pressure inside the vent, causing the attic air to be "lifted" out.

Some systems will only work properly when wind blows from the right direction. In such a system, when wind comes from the wrong direction, airflow could go into, rather than out of, the high levels of the attic. This airflow can also bring rain or snow into the attic.

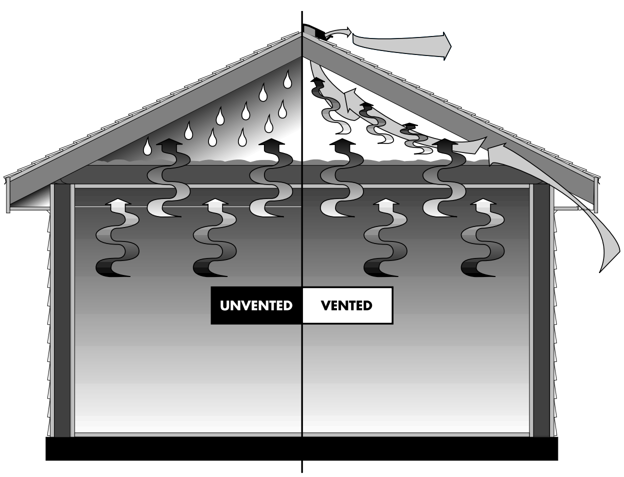

Figure 7-3: Attic ventilated by thermal effect.

THE "THERMAL EFFECT": Warm air rises. In the home, hot air from the living area is always trying to get into the attic and naturally work its way up to the roof ridge. If the home has ridge ventilation (which should always operate as an exhaust vent) with adequate intake vents at the soffit, the hot air will go up and out of the house. *(See Figure 7-3.)* Cooler air is allowed into the attic through the intake vent at the soffit in the eaves.

CATHEDRAL OR VAULTED CEILINGS: Warm air which moves from the inside of the house to the roof might be moist because of a furnace humidifier, a wet basement, a wet crawl space, or some other moisture source. This can be the cause of serious sheathing deterioration in cathedral ceilings if they are not protected by an effective vapor barrier. When a vapor barrier is not in place, the best remedy seems to be balanced ridge and soffit ventilation, with air spaces (e.g., air chutes) of at least ¾" (more on roofs with lower slopes) positioned beneath the sheathing, above the insulation. However, if ridge ventilation is used on a cathedral ceiling roof without balanced soffit air intakes, the problem can be made worse by pulling moist air from the living area upward, where it then saturates the wood and promotes mold growth on the sheathing. If deteriorated decking is found above a cathedral ceiling, do not replace the decking without addressing the root of the problem by installing proper ventilation and air sources, and by installing an effective vapor barrier. You should be aware that the best clearance for air spaces has not been determined. Some literature recommends 1½", but clearances of ¾" and as much as 3" have also been recommended. Greater clearance will be the safer choice.

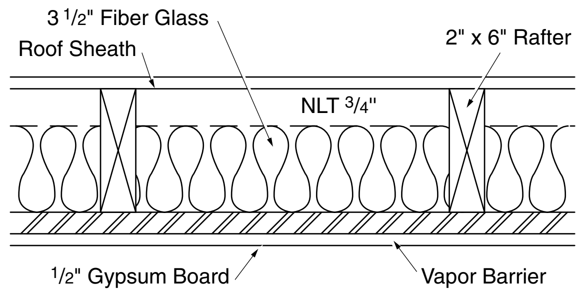

Figure 7-4: Ventilated cathedral ceilings (illustration is drawn horizontally for convenience).

HIP ROOFS: The two best venting options for hip roofs are:

- Venting with a short ridge vent (like the baffled ShingleVent II) and four sides of soffit vents. To satisfy code requirements, measure the length of both the ridge and soffit vents. You'll probably achieve sufficient ventilation if 25 to 30 percent of the vent area is at the ridge and you maximize venting in the soffit.
- Power vents located at the upper portion of the roof with adequate intake venting at the eaves.

ROOFS WITH UNUSUAL SHAPES: Roof shapes such as "L," "T," cone and octagonal, have an impact on the type of venting required for proper performance. Continuous ridge vents in combination with soffit vents can be used effectively with "L" or "T" shaped roofs, if installed properly. Vents should run across both the long and short ridges as long as all attic areas are open to each other. If ridge heights vary and the attics are connected, vents should be placed only along the highest ridge. This design prevents snow infiltration and eliminates a potential "short circuiting" problem where vented ridges at various heights limit the air flow to that level and compromise the "whole house" effectiveness of the ridge-soffit vent arrangement.

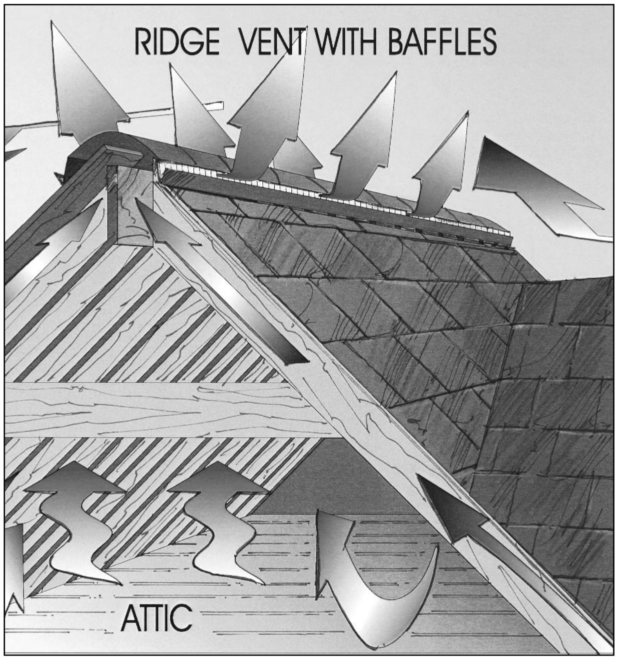

Figure 7-5:
In L- or T-shaped roofs, vents should run across both the long and short ridges as long as areas are open to each other. If roof heights vary, vents should be placed only along the highest ridge.

METAL CONSTRUCTION MATERIALS CAN AFFECT ATTIC VENTILATION

As a better conductor than wood, metal framing and metal duct work in the attic can speed condensation, which in turn breeds problems of mold, rot and poor indoor air quality, to name a few. Metal framing, therefore, may increase the need for ventilation, insulation, vapor retarders and other materials.

VENTILATION STANDARDS AND SHINGLE WARRANTIES

STANDARDS FOR VENTILATION: The Housing and Urban Development agency, model building codes and ASHRAE have set standards for attic ventilation. Most shingle manufacturers have adopted these standards as minimum acceptable ventilation requirements in their shingle warranties. The standards require a minimum of 1 square foot of net free ventilation area for every 150 square feet of attic floor space. However, if approximately half of the open ventilation area is in the upper portion of the roof, such as at the ridge, and half is in the lower area, such as at the soffits or eaves, the standard reduces to 1 square foot of net free ventilation for every 300 square feet of attic floor space. A balanced system allows a less restricted, even flow of air through the attic space. When in-and-out ventilation cannot be equally balanced, research indicates that it is better to have somewhat more ventilation area at the lower part of the roof.

WARRANTIES: Shingle manufacturers require that roof systems in which its shingles are installed meet HUD or local building code standards for ventilation. If not, the shingle warranty terms may be void in whole or in part.