

How and Why Ventilation Works

Ventilation: The System Stabilizer

Ventilation is a system of intake and exhaust that creates a flow of air through the attic.

Effective attic ventilation provides year-round benefits, adding comfort, protecting against damage to materials and structure, and helping to reduce energy consumption. The ventilation system must establish a steady flow of air. System components must be sized and positioned correctly to provide a constant air flow. This flow can be created naturally or mechanically through powered systems.

Natural ventilation relies on thermal effects — warm (light) air rising as cooler air falls — and wind. The most efficient system allows the warm air to be removed from the attic through exhaust vents at or near the ridge. Natural circulation is created when a balance of intake vents at the lowest point, typically the soffits, allows cooler air (compared to attic air) to

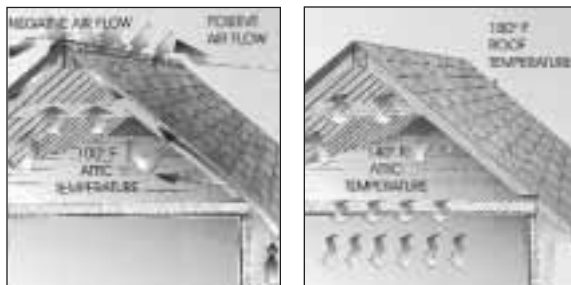
enter, flow through the attic, and exhaust through the higher vents. The wind's speed, as it moves against and over a home's exterior surface, also aids such a ventilation plan. A wind-driven air flow creates areas of positive and negative air pressure. Positive pressure forces air into the attic while negative pressure draws it out. (See Figure 5.1)

In warm weather, ventilation helps cool the attic by minimizing transfer of heat from the roof to the attic. This protects against premature failure of roof materials and high cooling costs. Tests show that proper ventilation can effectively reduce shingle temperatures. Over time, it can help yield a longer life-span for the roof material. However, a well-designed system must provide a uniform flow of cooler air along the underside of roof sheathing. That steady air flow carries heat out of the attic before it radiates to the attic floor.

In cold weather, proper ventilation can reduce the roof temperature differentials and inhibit the freeze-thaw cycle that forms ice dams. Good ventilation in the attic also helps keep attic moisture levels low so that interior materials stay dry and condensation-free. Unchecked moisture otherwise promotes mold, mildew, wood rot and bug infestation. Also, by maintaining consistent air flow through the home, attic ventilation can help reduce indoor air quality related problems.

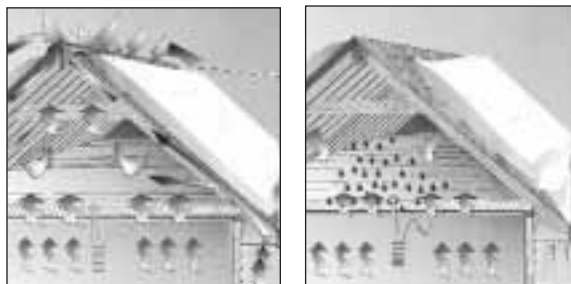
Systematic Implications

Ventilation should be considered and specified as an integrated system with roofing, insulation and ducting all joining forces to provide a trouble-free home. Heat



Summer Vented

Summer Unvented

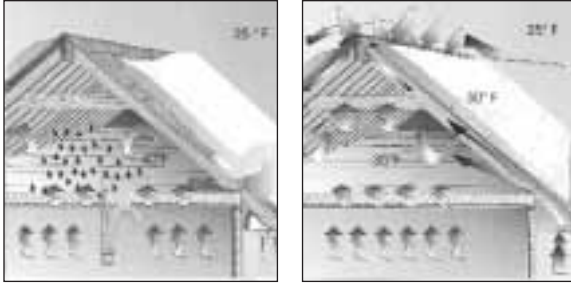


Winter Vented

Winter Unvented

Figure 5.1

Without a continuous flow of air from soffit to ridge, unvented attics in summer can reach temperatures that radiate unwanted heat into living spaces below. In the winter, heat and moisture can become trapped in the attic.



Unvented

Vented

Figure 5.2

In cold weather, ventilation reduces temperature differentials that can lead to ice dams.

and moisture removal requirements are present regardless of design, insulation or roofing materials.

In fact, more efficient insulation increases attic temperatures in hot weather. That means it's less likely that overnight cooling can remove built-up attic heat. Reducing attic insulation isn't the answer because it would only create problems by allowing conditioned air to escape the living areas. Instead, the goal is to design an attic ventilation system that compensates for the additional attic heat resulting from the high levels of insulation.

Ventilation also protects the insulation. Without continuous venting along the underside of the roof sheathing, indoor water vapor can collect and condense on trusses, beams, rafters and sheathing. Moisture then drips onto the insulation creating a predictable cycle: greater heat loss, colder rooms, greater need for heat, greater use of the heating system, higher fuel bills. Secondary effects of moisture also emerge: wood rot, stained ceilings and peeling paint.

Ventilation directly affects roof performance and shingle life. First, it helps by protecting against ice dams. The continuous flow of cold air under the roof sheathing inhibits the freeze-thaw cycle that backs up ice and water under roof shingles where it can damage, if not destroy, the shingles and leak into the home.

Particularly in low-slope roofs, this water back-flow presents a problem that can be alleviated by using a waterproof shingle underlayment such as CertainTeed's WinterGuard (see the Roofing section in this guide) and further emphasizes the need for ventilation.

Types of Vents

Good vent system design depends on placing the right vent in the right areas. Generally, vents fall into two categories, intake and exhaust. Among those you'll find passive or fixed vents that rely on natural forces, such as thermal buoyancy and wind, to move air, and mechanical vents, which are powered.

Intake Vents

Intake vents are best installed in or near the roof eaves wherever they occur on a home. This helps protect against rain and snow infiltration and provides a more equal distribution of positive and negative pressure areas.

Intake vents are available in many designs. Your choice depends on the home's structure, site and the capacity of each unit. The most common types of intake vents are:

Undereave Vents. Varying in size and capacity, these are mounted on the underside of the eaves and should be installed between each rafter for continuous air flow.

Continuous Soffit Vents. These intake vents are located on the underside of the eaves or soffit area. They are usually about 96" long and can be installed along the entire soffit to create a continuous air flow pattern.

Drip edge and roof edge. These vents are an option for homes without an eaves area and combine the drip edge with intake vents.

Mini-louvers. Mini-louvers are typically used with other types of intake venting because they are too small to provide sufficient net free area of intake on their own. They are typically installed in an exterior wall to help eliminate moisture that collects in the wall cavity. To be effective, they must be installed below the source of humidity (a bathroom or laundry area, for example).



Figure 5.3
Undereave Soffit Vents



Figure 5.4
Continuous Soffit Vent

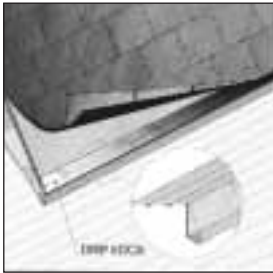


Figure 5.5
Drip Edge Vent



Figure 5.6
Gable Louvers

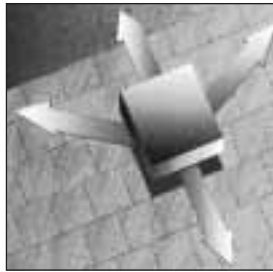


Figure 5.7
Roof Vents or Louvers



Figure 5.8
Turbine Vents

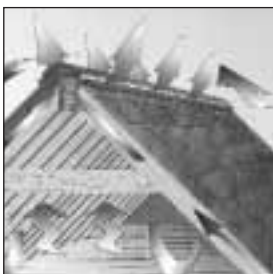


Figure 5.9
Ridge Vents

Exhaust Vents

These should permit an efficient, unobstructed outflow of attic air. Typically installed high in the attic, they must be designed to prevent or at least minimize rain and snow infiltration. Exhaust vents must be used with intake vents to provide proper high/low balance and adequate air flow. For maximum efficiency, the net free area of the exhaust units should be equal to that of the intake.

Among the most common fixed exhaust vents:

Gable Louvers. Usually either rectangular or triangular in shape, these units are usually installed high in the attic at the gable end. Louvers work independently to provide limited air flow across the underside of the roof deck and should be installed with intake ventilation.

Roof Louvers or Roof Pots. These surface-raised units in the roof deck allow only a small, confined area of air movement. Air flow does not move along the entire underside of the roof deck. Multiple vents must be installed to provide adequate ventilation.

Turbine Vents. These vents protrude from the roof surface and use a moving series of specially shaped vanes that rotate with wind force. These spinning vanes gain velocity and create an area of negative air pressure that in turn, pulls air from the attic. They provide limited air movement at most wind speeds and are best applied in climates where consistent wind speeds of at least 5 miles per hour are typical.

Ridge Vents. Located at the roof peak, these provide an air outlet, and some designs are virtually invisible from the ground. Ridge vents tend to have a large amount of net free vent area and vary greatly in design, which affects performance.

Non-Baffled Continuous Ridge Vents. Available in various styles such as rolled and corrugated, these may provide the same net free area per linear foot as a baffled ridge vent, but studies show they don't create negative air pressure and therefore don't produce significant air flow out of the attic. Instead, in windy conditions, they can actually cause air to be ingested into the attic.

Externally Baffled Ridge Vents. In tests, these vents provide greatest air flow in all wind conditions, deflecting wind over the vent to create an area of negative air pressure that effectively "pulls" air from the attic. A number of choices are available, including Air Vent's

ShingleVent® II, a shingle-over ridge vent, and FilterVent®, a metal ridge vent. Both include external baffles and a patented internal weather filter.

Powered or Mechanical Vent Systems. Powered electric vents use fans for air movement. The major advantage is that heat removal is assured because the fan is thermostatically controlled. Some power vents also have humidistats to start the fan when moisture removal is needed. Powered fans also can be installed where some fixed vent systems don't work as well, such as ridge vents on hip roofs.

When evaluating the feasibility of power fans for ventilation, also consider the key factors of energy and moisture. Power fans consume energy and don't vent moisture during winter unless they are equipped with humidistat controls.

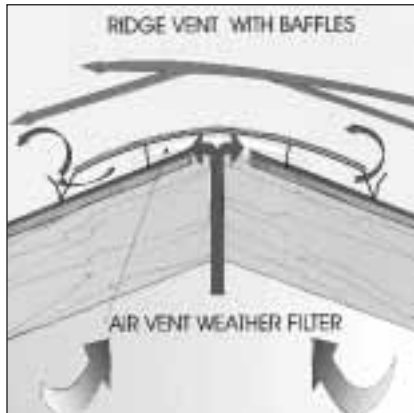


Figure 5.10a Ridge Vent With Baffles

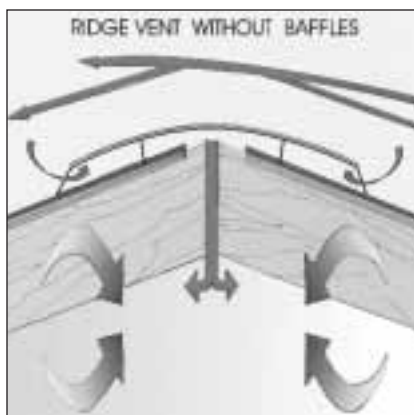


Figure 5.10b Ridge Vent Without Baffles

EXTERNAL BAFFLES OFFER OPTIMAL PERFORMANCE

An advanced ridge vent design uses “warm air rising” and “negative air pressure” — two natural forces — to provide air flow along the underside of the roof. A ridge vent must have an external baffle to create negative air pressure. Independent tests that compared different ridge vent designs — internal baffles, external baffles or no baffles at all — yielded these findings:

- All of the vents tested with external baffles created the desired negative air pressure. Those with internal baffles or no baffles did not.
- Vents without external baffles can allow rain or snow to pass through.
- Vents with external baffles deflect wind over the ridge, creating an area of negative pressure over the vent to pump air from the attic, and deflect snow over the vent rather than through it. (See Figure 5.10)