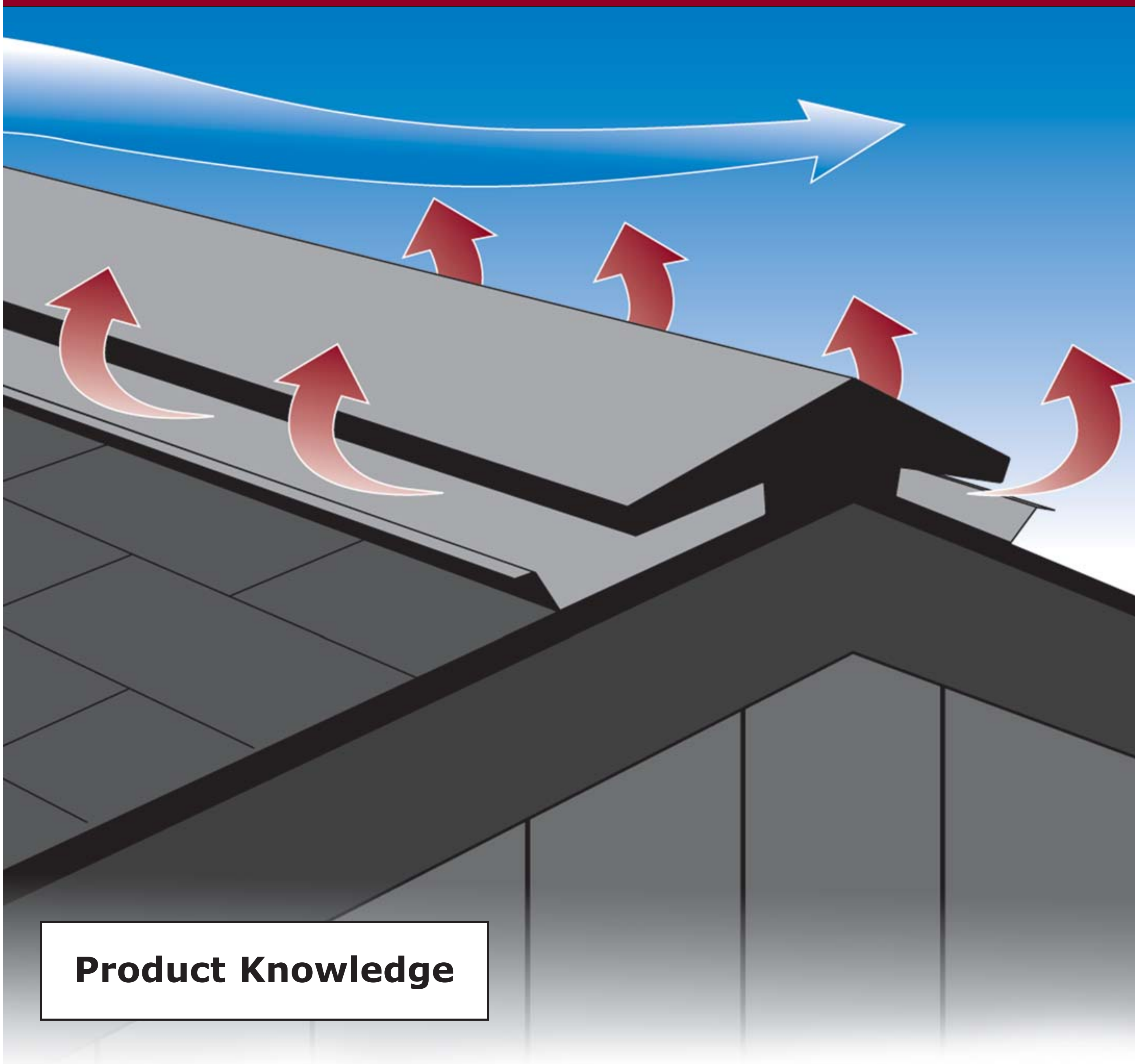
Ventilation Installation Professional™

Education and development program
for attic ventilation systems



Product Knowledge

AIR VENT INC.

Contents:

For questions or comments about this course, please contact Air Vent at *education@gibraltar1.com.*

Introduction:

This Product Knowledge section is one of two key pieces in Air Vent's **Ventilation Installation Professional** (VIP) program. Use it to master the information critical for a thorough understanding of Air Vent's line of ventilation products.

The more you know about ventilation products the better you'll be able to recommend attic ventilation solutions and estimate jobs for your customers. Being able to consult on ventilation, especially if you are a roofing or siding professional, lets you differentiate yourself from the competition as a knowledgeable professional. And this means more options, more high-end products to sell, more accurate estimating, and more profits for you.

At the end of the Product Knowledge section you'll find a 25-question test. If you correctly answer 22 questions (88%), you'll receive a personalized Certificate of Completion ready to be framed or inserted into your presentation portfolio.

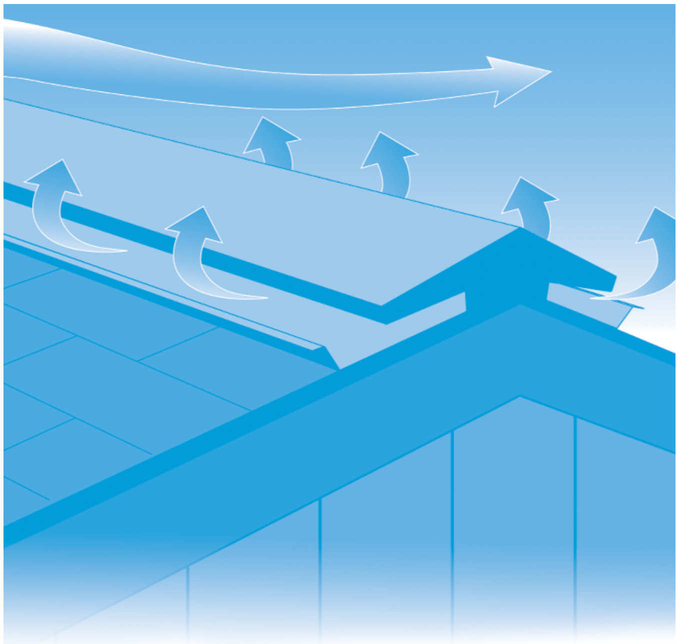
If you do not correctly answer at least 22 questions, you'll receive a letter in the mail with instructions on re-taking the test. You can also take the Installation Guidelines Course in the VIP program and receive the same benefits associated with the Product Knowledge Course. You do not have to pass both courses in order to receive a Certificate of Completion. However, if you successfully complete both the Installation Guidelines and the Product Knowledge courses, you'll receive two personalized Certificates of Completion.

There are two ways to submit your answers for grading:

1. Print out the test pages. Fill in your name and mailing information and complete the test by circling your answers. Then mail the test to: Air Vent, c/o VIP Online Course, 7700 Harker Drive, Suite A, Peoria, IL 61615.
2. Take the test online at http://www.airvent.com/professional/VIPproductscourse.html. Read the question in the VIP Product Knowledge Course PDF, then mark your answer in the interactive column to the right of the appropriate question number.

If you have any questions about attic ventilation or products, call Air Vent, Inc., a Gibraltar Company, at 800-AIR-VENT; www.airvent.com; or email: education@gibraltar1.com.

Section 1: The Benefits of Attic Ventilation



An effective attic ventilation system provides year-round benefits.

- During warmer months, ventilation helps keep attics cool.
- During colder months, ventilation reduces moisture to help keep attics dry. It also helps prevent ice dams.

Several purposes of an attic ventilation system are to provide added comfort, to help protect against damage to materials and structure, and to help reduce energy consumption – during all four seasons of the year.

Your goal should be to provide those benefits whenever you design and install an attic ventilation system.

Dealing with the effects of heat.

On a sunny day, radiant heat from the sun hits the roof. The roof temperature increases and heat travels (technically, it conducts through the roof sheathing) into the attic. As heat builds up in the attic, it radiates to the attic floor, then into adjacent living areas, raising temperatures there.

These are typical temperatures for a home with no attic ventilation, on a sunny day, with an outdoor temperature of 90˚F (32˚C) (see Figure 1).

- Temperature at roof sheath: as high as 170˚F (77˚C).
- Temperature at attic floor: up to 140˚F (60˚C).
- Temperature in rooms directly beneath attic: uncomfortable.

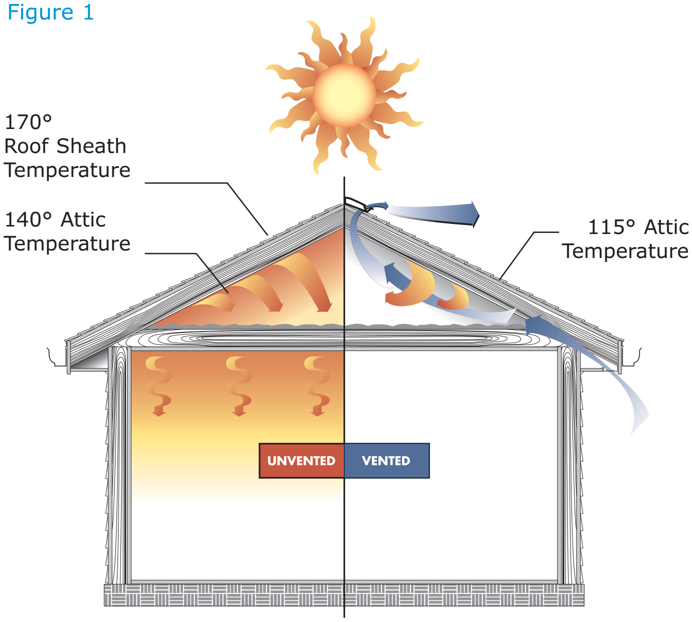
The longer these hot, sunny conditions last, the more uncomfortable it becomes in the home. That's because an unventilated – or inadequately ventilated – attic seldom loses enough heat overnight to compensate for the heat gained during the day. Ironically, the effect is magnified in modern homes with heavier insulation.

Eventually, this accumulation of heat begins to have more practical – and costly – consequences.

To reduce the effect of the heat – not only the daytime heat gain but also the excess heat being stored in the attic – homeowners turn on fans, window air conditioners or central air conditioning systems. As the hot weather continues, these appliances run longer and longer. Homeowners pay for all this added energy consumption in **higher utility bills**.

A less obvious – but equally costly – consequence can be found on the roof itself. Homeowners can't see it happening, but over time excess attic heat can cause some shingles to distort and deteriorate. The result is **premature failure of roofing materials** – and perhaps a leaky roof.

Figure 1



Unvented: *Radiant heat penetrating through roof sheath and attic enters living areas of home.* ***Vented:*** *With proper ventilation the heat is vented out of the attic keeping living areas cooler.*

The insulation/ventilation connection.

Efficient insulation increases the need for effective ventilation.

Why? Because heavier insulation absorbs and holds more heat. That means it's less likely overnight cooling can remove heat that builds up in an attic during a prolonged period of hot, sunny weather.

The solution to this dilemma isn't to reduce the insulation in an attic. That would only create problems at other times of the year. Instead, the goal is to design an attic ventilation system that effectively compensates for the additional heat gain produced by the high levels of insulation.

In short, effective attic ventilation also helps cool attic insulation.

Heat: how ventilation can help.

Ventilation can't eliminate the transfer of heat from roof to attic, but it can minimize its effect. To do that, a well-designed system must provide a uniform flow of cool air along the underside of the roof sheathing. That steady flow of air carries heat out of the attic before it can radiate to the attic floor.

It's critical that this airflow is uniform. That means intake and exhaust vents must be **balanced** – for both position and airflow capacities. Otherwise, "hot spots" can develop under roof sheathing, drastically reducing the efficiency and effectiveness of whatever ventilation is installed.

Dealing with the effects of moisture buildup.

When winter arrives and temperatures plunge, heat doesn't travel from an attic into the living quarters. Instead, heated indoor air travels from the home into the attic – along with moisture.

Figure 2 illustrates how this process of moisture transfer takes place. Furnace-warmed air circulates through the house, picking up water vapor generated by activities such as cooking, bathing, and the washing of clothes and dishes – as much as 2 to 4 gallons per family of four. The use of humidifiers, common in many homes, provides an abundant and continual source of moisture. Keep in mind also that the warmer the air is, the greater its capacity to hold moisture.

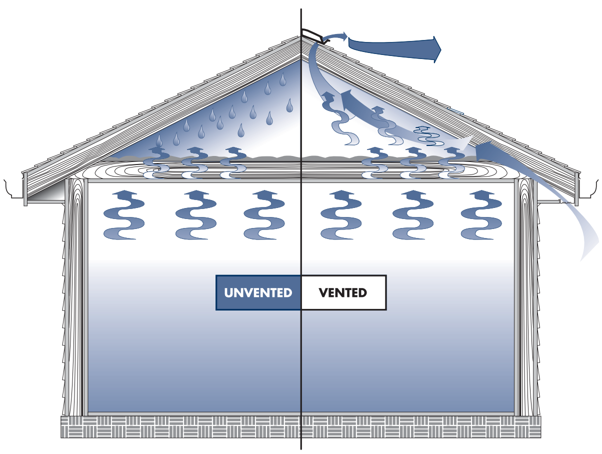
The problem is especially acute in homes with electric heating. Most of these homes were built since the mid-1970s, using advanced insulation materials and methods. As a result, most are "tight," allowing minimal infiltration of outside air. In addition, electric heat sources do not require air for combustion, so another common source of outdoor air has been eliminated.

Section 1: The Benefits of Attic Ventilation

Problems arise when the warm, moist air from the living quarters moves toward the attic, where the air is cooler and drier. That moist air is drawn to the attic in two ways.

The first is through a process called "vapor diffusion." It's a process in which water vapor naturally travels from high-humidity conditions to low-humidity conditions – in our example, from the living quarters into the attic. The force of vapor diffusion is so great that moisture even travels through building materials such as sheet rock. Even vapor barriers cannot totally stop this process.

Figure 2



Unvented: *Moisture rising up through the house condenses in the attic, causing damage to studs, insulation, and other materials.* ***Vented:*** *A vented attic allows moisture to escape.*

The second way moisture travels into an attic is by air moving through openings cut into a vapor barrier. Such openings are commonly found, for example, at recessed ceiling boxes and attic entries.

The problems start when moist air hits cooler rafters, trusses and roof sheathing. The moisture condenses as water droplets or frost. Eventually, the condensation drips on the insulation below. If too much water soaks into the insulation, its volume can be compressed and its effectiveness reduced. The sequence of events that follows: greater heat loss leads to colder rooms, colder rooms lead to a greater need for heat, greater use of the furnace leads to higher energy bills.

As with heat buildup, moisture buildup has long-term effects. That's because not all the condensing moisture drips into insulation. The structural elements of the house absorb some, leading to wood rot and the deterioration of roofing materials. Other moisture is likely to soak into the attic floor and eventually into ceiling materials, causing water stains and paint damage in the rooms below.

Moisture: how ventilation can help.

Although the problems of attic heat and moisture have different causes, they share a common solution: a high-efficiency ventilation system that allows a uniform flow of air to sweep the underside of the roof sheathing. The system exchanges warm, moist air with cooler, drier air.

Section 2: How Attic Ventilation Works

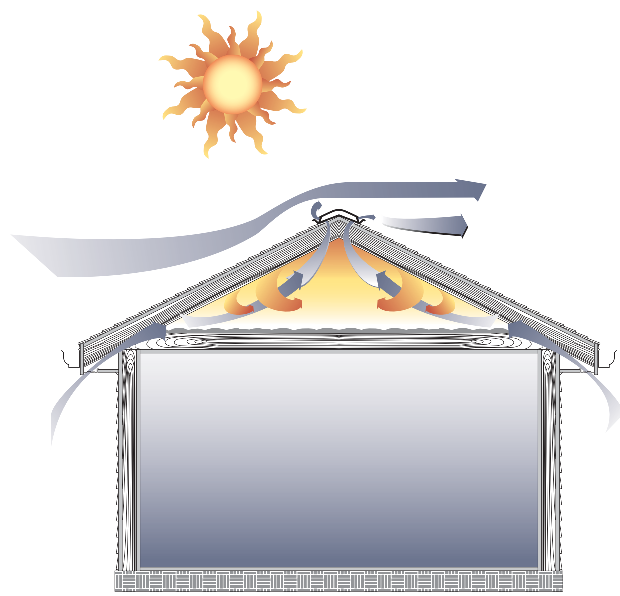
"Ventilate" comes from the Latin word for "to fan," the action of causing air to move.

That's what an efficient ventilation system must do – provide a steady, high volume of air movement. That means the system components must be sized and positioned to provide a constant flow of air, moving in a constant direction.

Air movement can be created in one of two ways – using **natural ventilation** or **mechanical ventilation**.

Natural air movement is created by two key forces: thermal effect and wind (see Figure 3).

Figure 3



Thermal Flow (effect whereby cooler air falls, warmer air rises) and Natural Flow (effect due to wind) come together to ventilate an attic.

Section 2: How Attic Ventilation Works

Thermal Effect

Thermal effect is the inherent property of warm air to rise. A well-designed attic ventilation system takes advantage of that movement in two ways:

1) Since warm air rises, an effective system will include exhaust vents at or near the ridge. That placement allows the hottest air to be removed from the attic most efficiently.

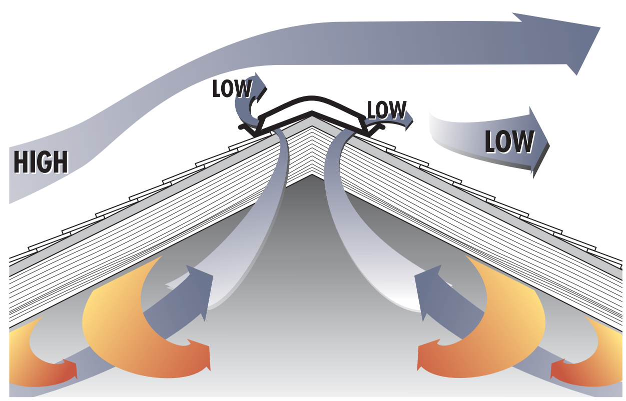
2) The thermal effect creates a natural circulation of air, because as warm air rises, cooler air falls. A well-designed system assists this momentum by placing intake vents at the lowest point in the attic, typically in the soffit. The cooler air entering these vents (cooler as compared to the attic air) speeds this circulation of air.

Wind

By itself, however, thermal effect cannot create the high volume of air movement needed for effective ventilation. **That's why the influence of wind is the key element in the design of a non-powered ventilation system.** Wind, after all, is a natural flow of air. So when designing a ventilation system, you want to make the wind work to your advantage.

To use the power of wind, it's important to understand how wind force affects ventilation. It isn't the velocity of the wind by itself that causes air to move through an attic, but the wind's speed as it moves against and over a home's exterior surfaces. A wind-driven flow of air creates areas of **high** and **low** air pressure (see Figure 4). High pressure forces air into the attic, while low pressure draws air out.

Figure 4



Wind passing over an externally baffled ridge vent creates a low pressure area at the vent's openings which causes air to be lifted or pulled out.

Section 2: How Attic Ventilation Works

Balance the system.

A properly designed attic ventilation system requires balance. That balance is achieved in two ways:

1) Airflow capacity must be balanced between **intake** and **exhaust** vents. In general, the net free area *[Net free area means the total unobstructed area (usually measured in square inches) through which air can enter or exhaust a non-powered ventilation component.]* of intake venting should be equal to or greater than the net free area of exhaust venting. To determine how much net free area a particular attic requires, see Section 4.

2) Intake and exhaust vents must be positioned to create a proper high-low balance. That balance is achieved when two conditions are met:
   a) Half the vent area must be high in the attic, with the other half low in the attic. Without that balance, the area of effective ventilation is limited to the lesser of the two vent areas. For example, if 75 percent of the venting is high and 25 percent low, ventilation is limited to the air moving through the lower vents.
   b) The vents placed high must act as exhaust vents, while the low vents act as intake vents. That placement assures a continuous flow of air, moving in the desired direction.

In planning the location of intake and exhaust vents, two other factors must be considered:

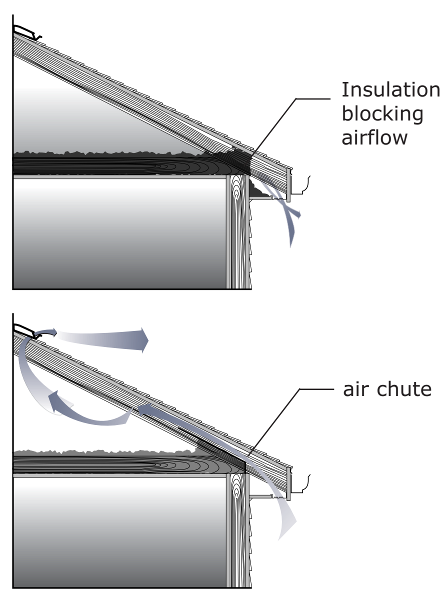
1) **Intake and exhaust vents must be positioned so they assure continuous airflow along the underside of the roof sheathing.** This is where ventilation is most effective. During summer, airflow along the sheathing removes heat before it can radiate to the attic floor. During winter, airflow along the sheathing removes moisture before it can condense into water droplets or frost.

2) **Intake vents must be located so there is little possibility of rain or snow infiltration.** Intake vents should be placed in protected areas, the most convenient being in the soffit (the area underneath the eave of the house).

   Placing intake vents in the soffit doesn't assure that a strong wind won't drive moisture into the openings. But should that happen, the area around the soffit is less likely to suffer major damage. For one thing, insulation isn't installed in the soffit, so the problem of wet insulation is avoided. In addition, rain or snow entering a soffit vent is more likely to drain back through that opening. At worst, the moisture would be confined to the soffit area, where it can evaporate quickly without causing permanent damage.

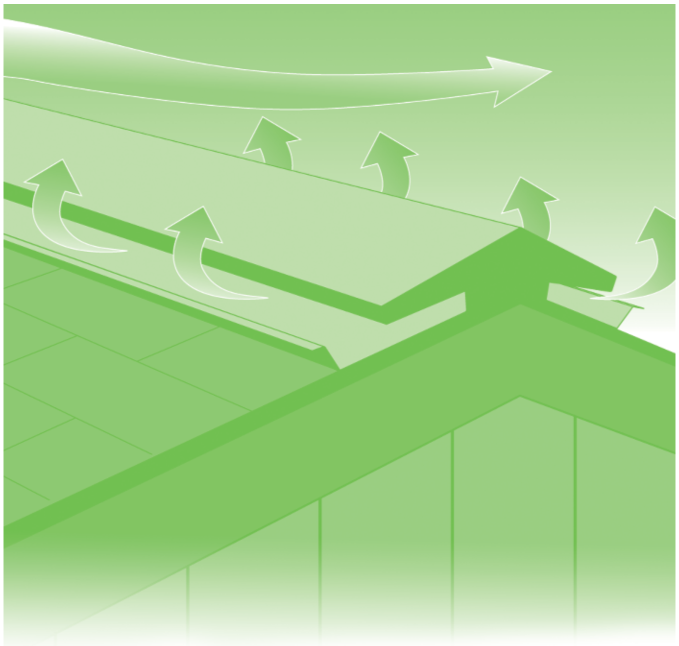
Note: To assure optimum performance of intake vents, you must make certain the area above the intake opening isn't blocked by dirt, building debris or attic insulation (see Figure 5).

Figure 5



***(Top)** Insulation blocks undereave intake vents preventing proper airflow into the attic. **(Bottom)** An unblocked undereave vent allows a passage for air to move through attic.*

Section 3: An Overview of Attic Ventilation Products



In general, ventilation components can be divided into two broad categories: **intake vents** and **exhaust vents**. Within each category there are various styles. Furthermore, ventilation components are either fixed (also called static) or powered. Let's look at intake vents.

The best place to install intake vents is in or near the roof eave. That location provides two key advantages:

1) The vents are better protected from rain and snow infiltration. Vents mounted in the eave provide almost total protection. (We qualify that statement only to acknowledge the possibility that winds at or near hurricane force could drive moisture into an undereave vent. In normal conditions, however, undereave vents don't allow moisture infiltration.)

2) Usually, **when undereave vents are placed on both sides of a roof (as they should be), there's always an equal distribution of high and low pressure areas.**

Note: This doesn't mean there's an adequate distribution of high and low pressure areas. A ventilation system that uses only undereave vents violates the principle of a balanced system (intake vents and exhaust vents). What this means, in practical terms, is that the system will provide a continuous flow of air along the attic floor, but not along the underside of the roof sheathing, where it does the most good.

Intake Vents

Intake vents are available in many designs. In choosing the right unit for a particular job, you have to consider the structure of the home, the area where the units will be located and the net free area provided by each unit.

The most common types of intake vents are:

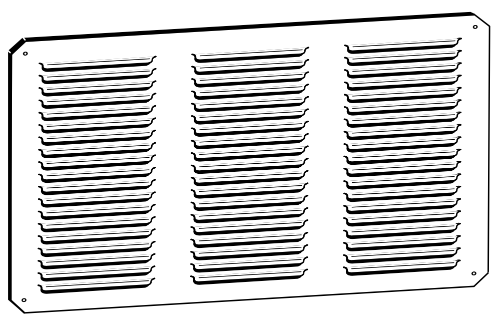
Undereave vents are mounted in the soffit. Units vary in size from 16" x 8" to 16" x 4". Naturally, net free area varies according to unit size (see Figure 6).

Continuous soffit vents are also mounted in the soffit. These units vary in length, with the typical length being 96" (see Figure 7).

Vented drip edge is used on homes without an eave area. It combines a drip edge with intake louvers.

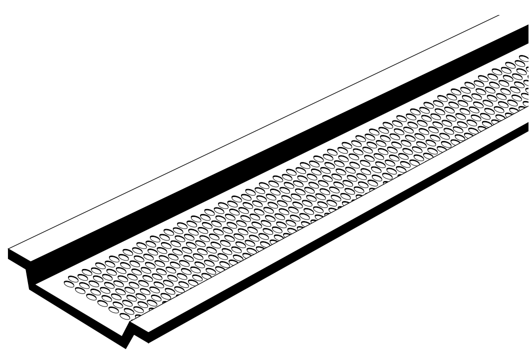
Mini-louvers are typically used with other types of intake vents; they're too small by themselves to provide sufficient net free area of intake. In most applications, they're installed in an exterior wall to help eliminate moisture that collects in the wall cavity. To be effective, mini-louvers must be installed below the source of humidity (such as a bathroom or laundry area). That placement allows a flow of air to collect the humidity and carry it into the attic.

Figure 6



The undereave vent, an intake vent, allows needed air to enter the attic. It is located on the underside of the eave of the house.

Figure 7



Continuous soffit vent takes in outside air and is located on the underside of the eave.

Vented soffit panels are vinyl or aluminum soffit with vent openings already cut into the panels. Be sure to check the net free area of the panels to assure that they provide enough intake ventilation area to balance with the exhaust ventilation.

Exhaust Vents

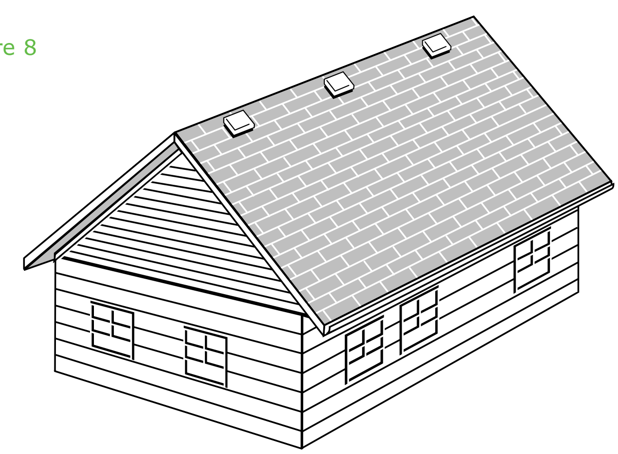
Exhaust vents are designed to permit an efficient, unobstructed outflow of attic air. In addition, because they're installed high in the attic where there's greater exposure to the weather, these units must be designed to prevent (or at least minimize) rain and snow infiltration.

Exhaust vents must be used with intake vents to provide a balanced system and thus an adequate flow of air through an attic. It's also worth repeating another point made previously: **for maximum efficiency, the net free area of intake vents should be equal to or greater than the net free area of exhaust vents.**

As with intake vents, exhaust vents are available in different designs. Two commonly used fixed exhaust vents are roof louvers and gable louvers.

Roof louvers which are installed as close to the roof ridge as possible to allow maximum release of moisture and overheated air. Because they're installed near the ridge, they provide a continuous airflow along most of the underside of the roof sheathing. **The airflow pattern isn't uniform, however, so for maximum effectiveness, vents should be spaced equally along the roof** (see Figure 8).

Figure 8



A roof louver is an exhaust vent located near the ridge.

Section 3: An Overview of Attic Ventilation Products

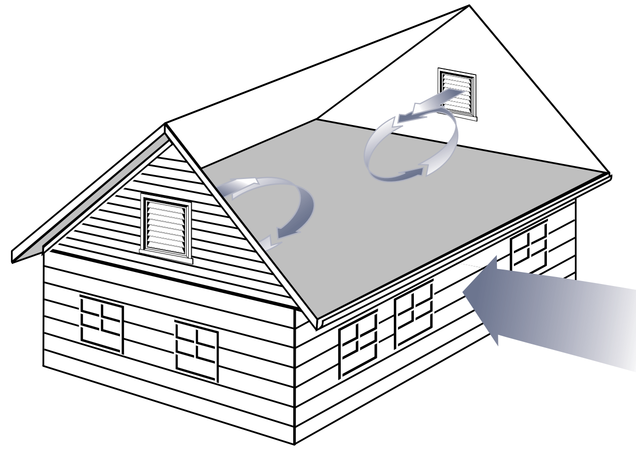
Gable louvers are typically installed in the gables. Two types are generally available: rectangular and triangular. In most installations, a unit is placed at each gable end (see Figure 9).

Figure 9

A gable louver, an exhaust vent, allows unwanted air to flow out of the attic. These are located at the ends of the attic.

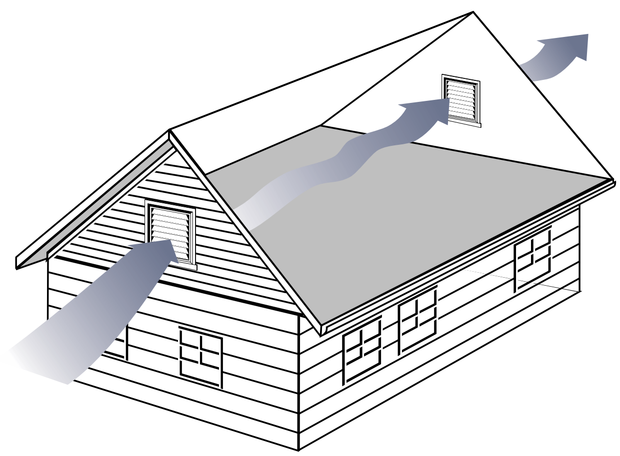
Note: Sometimes louvers are installed in opposite gable ends, without intake venting, in the mistaken assumption that a good "cross flow" of air can provide adequate ventilation. What typically happens, however, is illustrated in Figures 10 and 11. If wind direction is perpendicular to the ridge, the louvers act as both intake and exhaust vents, providing ventilation only in the areas near the vents. If the wind direction is parallel to the ridge, a cross flow of air is established, although the flow tends to dip toward the attic floor, leaving the hottest air still at the underside of the roof sheathing. Of course, if absolutely no intake venting can be installed at low points in the attic, a louver-only installation is preferable to no ventilation at all.

Figure 10



With wind blowing perpendicular to the ridge, the louvers act as both intake and exhaust vents.

Figure 11



With wind blowing parallel to the ridge, airflow dips towards the attic floor leaving the hottest air still on the underside of the roof sheathing.

Ridge vents are a special type of fixed exhaust vent. Ridge vents offer unique advantages when compared to other fixed venting units.

– **Maximum efficiency.** The best ridge vents use an external baffle designed to draw heated air from the attic regardless of wind direction or force. Figure 12 shows how that happens.

Figure 12

A baffled ridge vent creates an area of low pressure on both sides of the ridge vent. It literally pulls air out of the attic.

– **Maximum air movement.** Externally baffled ridge vents work better because they take advantage of two natural forces: thermal effect or the fact that warm air rises and low air pressure that is created at the vent openings as wind is deflected by the baffle. (see Figure 4 on page 8).

Weather protection

An added benefit of the external baffle is that any weather that hits it is deflected up and over the vent away from the attic.

When wind direction is perpendicular to the ridge, it strikes the external baffle and jumps over the ridge. That movement creates a Bernoulli Effect, causing low pressure to develop on both sides of the vent. When that happens, air from the attic is "lifted" out, in much the same way low pressure created above an airplane wing gives "lift" to the plane (refer also to Figure 4 on page 8).

The same thing happens when the wind direction is parallel to the ridge. It moves across the louvers, creating a low pressure area on both sides of the ridge vent.

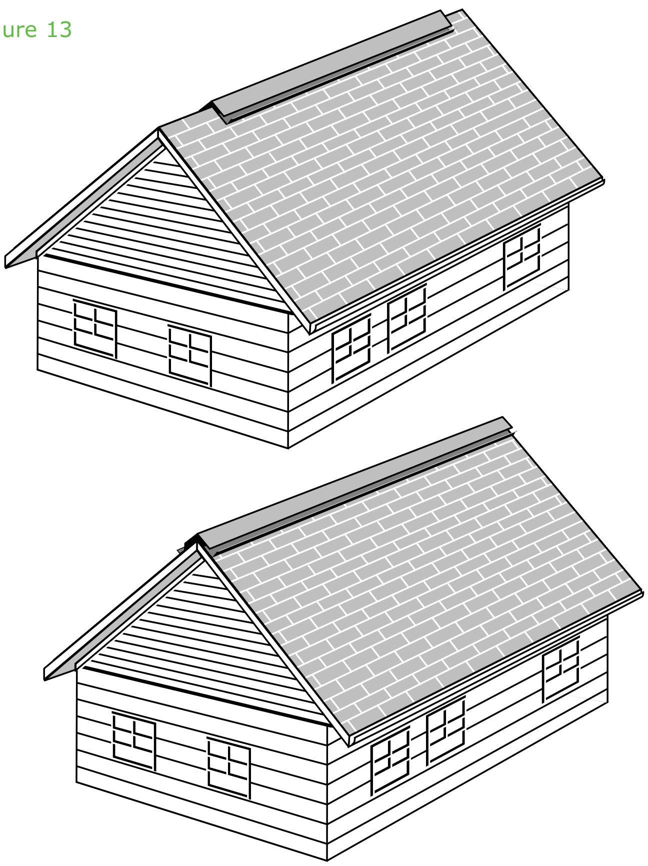
In addition, when little wind force exists, ridge vents take full advantage of the thermal effect to maintain air circulation across the underside of the roof sheathing. Warm air rises to the ridge and exhausts through the vent. That allows a continuous flow of cooler air to enter through the intake vents. Only ridge vents use thermal effect efficiently and effectively, because only ridge vents provide continuous and uniform air movement along the full length of a roof.

Note: To provide this efficient air movement, ridge vents should be balanced with equal net free area of intake vents. For best results, intake vents should be divided equally along both sides of a structure.

– Uniform air movement. Because ridge vents run the entire length of a roof, they provide a uniform flow of air along the underside of the roof sheathing. That air movement helps eliminate "hot spots" that can develop with other types of exhaust vents – even powered vents. No other exhaust vent provides this type of airflow pattern.

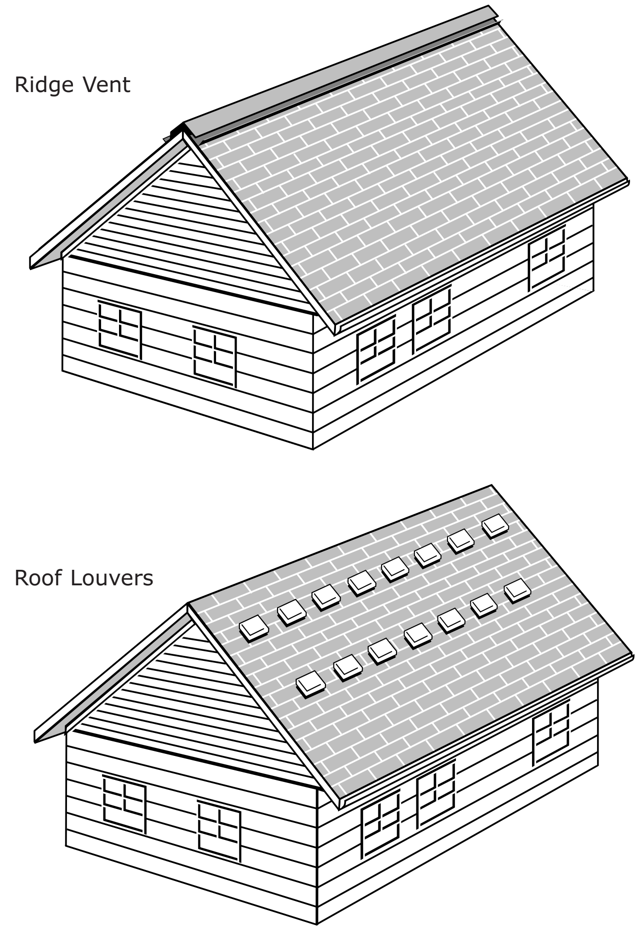
– Maximum visual appeal. Most ridge vents offer a low-profile design that minimizes its appearance on a roof. Shingle-over designs allow optimum blending with other roof materials (see Figure 13 and Figure 14).

Figure 13



(Top) *Ridge vent installed shorter than the ridge length presents an awkward "broken" appearance.* ***(Bottom)*** *A ridge vent should extend all the way along the roof for a smooth "unbroken" roof line.*

Figure 14

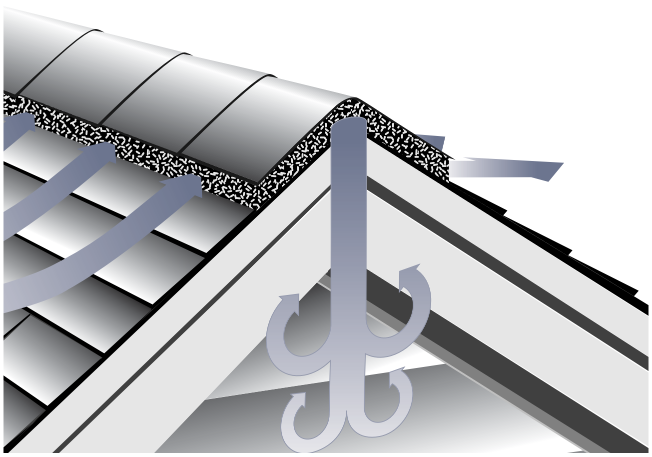


Fifteen roof louvers are required to equal the exhaust venting of 42 linear feet of ridge vent. This clearly demonstrates the performance and aesthetic advantages of ridge vents.

Section 3: An Overview of Attic Ventilation Products

It's important to emphasize that the advantages listed above apply only to ridge vents that use an external baffle design. A series of independent tests has concluded that only an external baffle can direct the wind up and over the vent. That's significant, because it's that controlled flow of air that creates the area of low pressure that causes air to be pulled from an attic (see Figure 15 and Figure 16).

Figure 15



A roll vent with an internal baffle, or without any baffle at all, does not "pull" air from the attic.

Figure 16

An externally baffled vent "pulls" air from the attic from both sides of the ridge vent.

Wind turbines

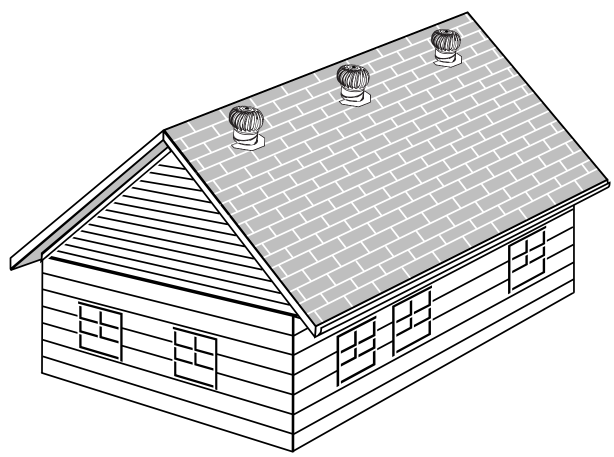
Although not as effective as ridge vents, wind turbines provide a low-cost alternative in areas where consistent wind speeds of at least 5 mph are typical. Without that minimal wind speed, wind turbines act essentially as roof louvers.

When the wind is blowing, however, wind turbines can be effective air movers.

Wind turbines consist of a series of specially shaped vanes that turns wind force into a rotary motion. As the spinning vanes gain velocity, they create an area of low air pressure. That low pressure, in turn, pulls air from the attic.

To provide maximum ventilation benefits, wind turbines, like roof louvers, must be equally spaced along a roof. Otherwise, ventilation will be focused in the area surrounding the wind turbines, allowing hot spots to develop in other areas of the attic (see Figure 17).

Figure 17



Wind turbines are located near the ridge and are used to exhaust air from the attic.

Power fans

For the most part, a power fan is a motor-driven version of a wind turbine.

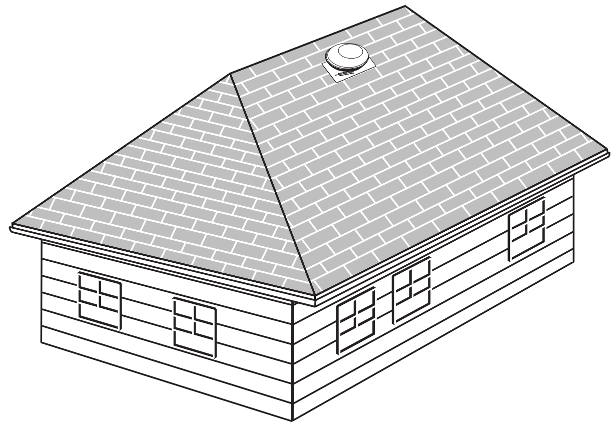
A power fan uses the rotary motion of blades to pull air into the attic through the intake vents at the soffit and exhausts it out of the attic near the ridge. Instead of using wind power to drive the blades, power fans use electricity to drive high-efficiency motors **or sunlight if they are solar powered**.

Unlike a wind turbine, however, the effectiveness of a power fan isn't dependent on wind force. Instead, a power fan is automatically turned on and off as needed, with thermostat and humidistat controls. (In some models, an integral humidistat control is standard; in most models, however, a humidistat is an add-on option. **Generally, solar powered fans do not have thermostat or humidistat controls.**)

Depending on the size of the motor and the efficiency of the blade design, power fans can move more than 1,500 cubic feet of air per minute (CFM). That high volume of air movement is critical. To ensure adequate ventilation, power fans must provide at least 10 changes of attic air every hour. (Some models offer a two-speed option that allows fan speed – and air movement – to be determined by the "demand" for increased ventilation).

Although a power fan can move a large volume of air, a single unit generally cannot "vacuum" all hot air from an attic. Usually, to provide uniform air movement along the underside of the roof sheathing, a series of power fans must be spaced equally along a roof.

Figure 18



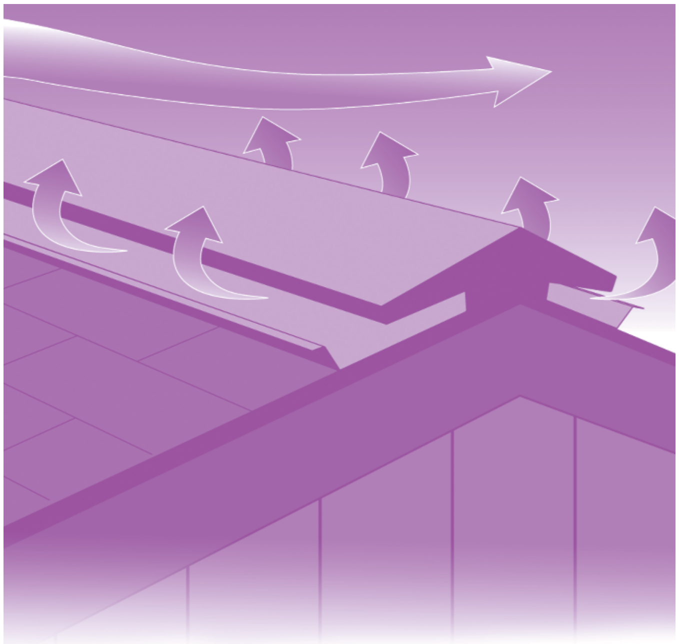
Power fans are used to move large volumes of air. Roof-mount models are a good option for hard-to-vent hip roofs that have limited horizontal ridge length available for ridge venting.

When evaluating the feasibility of using power fans, it's important to evaluate one factor which is considered to be a major disadvantage: namely, that **power fans cannot vent away moisture during the winter unless they are equipped with humidistat controls**.

This problem can be solved by using a power fan that has a humidistat control. When that's done, power fans do offer key benefits. For one, they ensure a high volume of airflow, even on days when outside air is virtually still (a common occurrence in inland areas on hot summer days).

In addition, power fans provide ventilation in some circumstances where fixed systems would prove inadequate. For example, most static exhaust vents in a hip roof application fail to meet ventilation code requirements for high (exhaust) vents, while power fans can provide the air needed to ventilate the attic properly (see Figure 18).

Section 4: Determining Ventilation Requirements



An example of current **minimum** requirements for ventilation comes from the 2003 International Residential Code (IRC) Section R806:

R806.1 Ventilation required. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow...
R806.2 Minimum area. The total net free ventilating area shall not be less than 1 to 150 of the area of the space ventilated except that the total area is permitted to be reduced to 1 to 300, provided at least 50 percent and not more than 80 percent of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. As an alternative, the net free cross-ventilation area may be reduced to 1 to 300 when a vapor barrier having a transmission rate not exceeding 1 perm (57.4 mg/s · m2 · Pa) is installed on the warm side of the ceiling.
R806.3 Vent clearance. Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a 1-inch (25.4 mm) space shall be provided between the insulation and the roof sheathing at the location of the vent.

Is adequate attic ventilation now assured by following the code requirement?

The intent of the requirement, after all, is to establish minimum standards. For example, the IRC permits the net free area requirement to be reduced to the 1/300 ratio in certain situations. That amounts to less than $^{1}/_{2}$ inch of vent area for each square foot of attic floor area, barely enough to create a flow of air. In addition, this standard assumes a proper balance of exhaust and intake vents. Unfortunately, it's probably safer to assume that assumption rarely holds true.

Exceeding code.

If you want to install an effective, year-round ventilation system, follow the steps below which are based on the 1/150 ratio. This ratio takes into account that today's homes are built with – or remodeled with – materials (doors, insulation, windows, etc.) that are more energy efficient. Consequently, **these homes are more airtight and need more attic ventilation.**

Calculating requirements for an efficient static vent system.

The math involved in calculating ventilation requirements is simple. A pad and pencil are all you need.

Note: The following process is used to calculate requirements for non-powered ventilation systems. If you plan to install a power fan, see calculation instructions on page 19.

1. Determine the square footage of attic area to be ventilated.

   To do that, just multiply the length of the attic (in feet) by its width.

   Example: For this and the following calculations, we'll assume the home has a 40' by 25' attic area.

   Calculation:

   40' x 25' = 1,000 square feet of attic area

2. Determine the total net free area required.

   Once attic square footage is known, divide by 150 (for the 1/150 ratio). That determines the total amount of net free area needed to properly ventilate the attic.

   Calculation:

   1,000 sq. ft. ÷ 150 = 6.6 square feet of total net free area

3. Determine the amount of intake and exhaust (low and high) net free area required.

   For optimum performance, the attic ventilation system must be balanced with intake and exhaust vents.

   This is a simple calculation: just divide the answer from Step 2 by 2.

   Calculation:

   6.6 ÷ 2 = 3.3 sq. ft. of intake net free area and 3.3 sq. ft. of exhaust net free area

4. Convert to square inches.

   The net free area specifications for attic ventilation products are listed in square inches. Therefore, let's convert our calculation in Step 3 from square feet to square inches. To do this simply multiply by 144.

   Calculation:

   3.3 sq. ft. x 144 = 475 sq. in. of intake net free area and 475 sq. in. of exhaust net free area

5. Determine the number of units of intake and exhaust vents you'll require.

   To make these calculations, first refer to the Net Free Area Table on page 19. The table lists the approximate net free area, in square inches, for common intake and exhaust ventilation units.

   To perform the calculations, divide the net free area requirement from Step 4 by the appropriate figure from the Net Free Area Table[1]. For our example, we will use the figures for 4 ft. length of ridge vent as well as 16" x 8" undereave vents.

   Calculation:

   (for 4-foot length of ridge vent)
   475 sq. in. ÷ 72 = 6.6 pieces of vent
   (or seven 4-foot lengths of ridge vent)

   (for 16" x 8" undereave vent)
   475 sq. in. ÷ 56 = 8.5 pieces of vent
   (or nine 16" x 8" vents)

---

1 You can also use the calculation table in the Appendix to determine the number of feet of ridge vent and soffit vent required for an installation.

Section 4: Determining Ventilation Requirements

Calculations for power fan installations.

If you plan on installing a power fan, you can calculate intake and exhaust requirements using the following formulas:

1. Determine the fan capacity needed to provide about 10 to 12 air exchanges per hour.

   The formula is:

   Attic square feet x 0.7 = CFM capacity
   For example, using the same dimensions as the previous example:

   Calculation:

   1,000 sq. ft. x 0.7 = 700 CFM

   Note: For roofs with a 7/12 to 10/12 roof pitch, you may want to add 20 percent more CFM; and for roofs 11/12 pitch and higher, add 30% more CFM to handle the larger volume of attic space.

2. Determine the amount of intake ventilation required. The formula is:

   CFM rating of fan ÷ 300 = square feet of intake ventilation needed.

   Calculation:

   700 ÷ 300 = 2.3 square feet

   To turn that figure into square inches, multiply by 144.

   Calculation:

   2.3 x 144 = 331 square inches of net free intake area

   To find the number of intake vents required, use the Net Free Area Table (see “Low Vents – Intake”).

Net Free Area Table

Type of Vent	Net Free Area (sq. in. – approximate)†
High Vents – Exhaust	
Ridge vent (8' length)	144
Ridge vent (4' length)	72
Roof louver	50
Wind turbine (12")	112
Rectangular gable louvers	
12" x 12"	56
12" x 18"	82
14" x 24"	145
18" x 24"	150
Low Vents – Intake	
16" x 8" undereave	56
16" x 6" undereave	42
16" x 4" undereave	28
Continuous Soffit Vent (1' length)	9
Vented Drip Edge (1' length)	9
Perforated aluminum soffit† One square foot	14
Lanced aluminum soffit† One square foot	4-7

†Be sure to check specifications for individual products to determine actual net free vent area.

Appendix: Ridge vent/soffit vent calculator for standard gable attic.

To use this calculator, first find the total square footage of the attic floor area. Round your calculations up to the next highest number (see Appendix A).

Then look across to the number under the Minimum Length of Ridge column. That tells you the total linear feet of ridge vent needed using the 1/300 minimum code requirements. *Note: Because today's tighter homes require more airflow, the 1/150 ratio is also included in Appendix A.*

To balance your ridge vent system, find the length of the ridge and follow the column to the right for required soffit or undereave vents (see Appendix B).

Appendix A

Ventilation Requirements

Attic Square Footage	Minimum Length of Ridge at 1/300 ratio	at 1/150 ratio
1200	16	32
1500	20	40
1800	24	48
2100	28	56
2400	32	64
2600	36	72
3000	40	80
3300	44	88

Note: Calculations are based on ridge vents that provide 18 square inches of net free area per linear foot.

Appendix B

Balancing Your Ridge Vent System

Length of Ridge	Linear Feet of Continuous Soffit Vent	Number of Undereave Vents 16" x 8"	16" x 6"	16" x 4"
15'	30	5	6	10
20'	40	6	9	13
30'	60	10	13	19
40'	80	13	17	26
50'	100	16	21	32
60'	120	19	26	39
70'	140	23	30	45
80'	160	26	34	51
90'	180	29	39	58

Note: FHA requirements and most building codes state the minimum required net free area. This minimum ventilation area may not be enough to effectively ventilate the attic to help prevent moisture damage and cool the attic enough in the winter to help prevent ice dams.

Air Vent products meet the highest standards for product quality and function. That's because we invest years of research and rigorous product testing to ensure our products deliver proven performance.

We offer professionals the most complete line of attic ventilation products available: ridge vents from shingle-over, to tile, to copper and zinc. And a full line of additional ventilation products for the attic: powered and non-powered exhaust vents as well as louvered vents and intake vents.

Attic Intake Vents

As the hot air leaves or diminishes, cool air moves in to replace it, creating a balance. That's ideal ventilation. Intake ventilation is an essential component of a balanced system. Air Vent offers a variety of intake vents to fill this need.

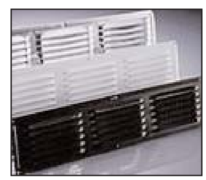
Continuous Soffit Vents

For intake venting, these vents install in the soffit or eave areas.

Available in aluminum or PVC, these vents are 2" by 96" long and provide 9 square inches of net free area per linear foot. Continuous soffit vents are very effective because they allow air to enter the attic along the entire undereave where they are installed.

Air Vent's continuous soffit vents are designed for retrofit (double leg return) and new construction (single leg return) applications.

Undereave Vents



These screened aluminum vents are available in three sizes:

- 16" x 4" (provides 28 sq. in. of net free area per piece)
- 16" x 6" (provides 42 sq. in. of net free area per piece)
- 16" x 8" (provides 56 sq. in. of net free area per piece)

Available colors are white, brown or mill finish.

Vented Drip Edge

Air Vent's Pro Flow™ Vented Drip Edge combines venting with a drip edge and is used to provide intake ventilation on homes with little or no soffit area. The vent provides 9 square inches of net free area per linear foot. These aluminum vents are available in 10-ft. lengths in white, mill, brown and black.

Section 5: Air Vent's Full Line of Products

Attic Exhaust Vents

The first stage in effective ventilation is getting the hot air out. That's what exhaust vents do. Air Vent makes a complete line of exhaust vents.

Ridge Vents

ShingleVent® II and **FILTERVENT®** feature an *external baffle* for enhanced airflow performance and an *internal weather filter* for more complete protection against weather, insects and debris. Both provide 18 square inches of net free area per linear foot.

ShingleVent® II

ShingleVent II features:

- Built-in end plug eliminates need for separate part and flexes for different roof pitches.
- Made of durable, molded high-impact copolymers that are flexible at below-zero temperatures and stable at high temperatures.
- Colorfast pigments prevent fading.
- Lifetime limited warranty and 5-year Replacement Plus™ protection.

Three sizes:

ShingleVent II is 12" wide for conventional shingle-over applications. Fits roof pitches from 3/12 to 16/12.

ShingleVent II-9 is 9" wide for enhanced ridge cap shingles, cedar shake or cedar shingle applications. Fits roof pitches from 3/12 to 12/12.

ShingleVent II-7 is 7" wide for narrow enhanced ridge cap shingles. Fits roof pitches from 3/12 to 12/12.

Multi-Pitch FilterVent®

FilterVent features:

- No job site assembly required with one-piece integrated baffle design.
- Connector plugs and hold-down straps designed to assure tight, secure joints.
- Available for tile, cedar shakes, and contemporary architectural designs.
- Copper and Zinc available. Zinc prevents the growth of fungus, mold and mildew on the roof.
- Fits roof pitches from 3/12 to 12/12.
- 30-year limited warranty and 5-year Replacement Plus protection

VenturiVent Plus™

VenturiVent Plus™ is a shingle-over ridge vent that features an *external* baffle, which creates low pressure on both sides of the vent to enhance airflow. It provides 18 sq. in. of net free area per linear foot and is ideal for areas of the country where there are limited snowstorms.

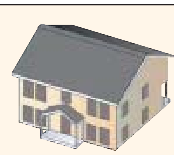
VenturiVent Plus features:

- Built-in end plug eliminates need for separate part and easily adjusts for roof pitch.
- Molded from a copolymer formulation to remain flexible and easy to nail.
- Colorfast pigments prevent fading.
- Fits roof pitches from 3/12 to 12/12.
- 30-year limited warranty and 5-year Replacement Plus protection.

The Ideal Solution

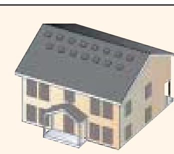
A balanced ventilation system.

Years of research have proven that Air Vent ridge vents, combined with undereave venting, are the most efficient and effective system you can install. This balanced system of intake and exhaust through the attic provides greater airflow than any other fixed vent — and it's the most attractive system.



Ridge vents

Located precisely where they do the most good, at the peak of the roof, ridge vents are virtually invisible from ground level. And they provide greater airflow than other vents.



Roof louvers

In order to provide the same ventilation, 11 conventional roof vents would be necessary — creating quite an eyesore.

Wind turbines

To ventilate the same area, five turbine vents would be necessary — resulting in an unattractive roof line.

For questions or comments about this course, please contact Air Vent at *education@gibraltar1.com.*

Air Vent Ventilation System:

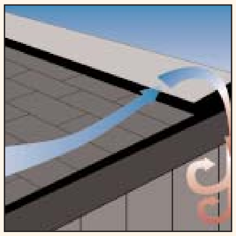
Proven performance based on research.

In independent tests against competitive ridge vents, Air Vent products produced the greatest amount of low pressure above the vent, which resulted in a greater ability to exhaust air from the attic. Two unique features contribute to the superior performance of Air Vent ridge vents:

1) **External Wind Baffle** creates low pressure to "pull" air out of the attic, and help prevent windblown rain and snow infiltration.

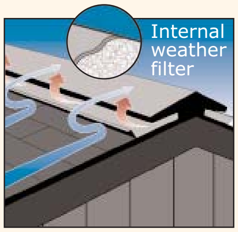
2) **Internal Weather Filter** deflects rain, snow, dust and insects to provide a more complete weather barrier.

Unbaffled Ridge Vents



- Wind and elements can blow directly in through the ridge vent. Air entering the vent can create pressure in the attic which prevents air and moisture from being pulled out.
- Strong winds can actually pass through one side of the vent and out the other, also preventing air and moisture from escaping the attic.

Air Vent's Externally Baffled, Filtered Ridge Vents



- Ventilation occurs through the thermal effect of warm air rising in the attic and expelling air at the highest point in the roof.
- External baffle directs airflow up and over the vent, creating an area of low pressure which pulls or draws air out of the attic through the vent.
- Internal weather filter provides a more complete barrier against wind-driven rain, snow, dust and insects.

Specialty Ridge Vents

Some jobs call for special ridge vents, such as where a roof meets a vertical wall or when the ridge slot needs to be cut extra wide. For such applications, Air Vent manufactures Specialty Ridge Vents. Each of the vents described below features Air Vent's unique combination of an external baffle and an internal weather filter.

Flash FilterVent provides ventilation where a roof meets a vertical wall. It delivers 9 square inches of net free area per linear foot. Flash FilterVent comes with an extra reverse flashing which helps prevent water backup in areas where snow can drift over the vent or in heavy run-off areas against high vertical walls.
Available in black, brown, gray, bronze and copper.

Peak FilterVent is designed for contemporary roofs formed by a pitched roof and a vertical wall that drops off from the pitched roof. It provides 9 square inches of net free area per linear foot.
Available in black, brown, gray and bronze.

Utility FilterVent can be used when you need to build your own ridge vent. For example, an oversized ridge board that calls for an extra wide slot. The general application is to cut the slot where needed to provide the airflow opening, place the vent on wood blocks to maintain its shape, and continue shingling above it similar to a shingle-over ridge vent. Utility FilterVent has 9 square inches of net free area per linear foot.
Available in black, brown, gray and bronze.

Tile FilterVent has special adapters that cover the ends of tile, shakes or metal roofs. It provides 18 square inches of net free area per linear foot.
Available in black, brown, white, gray and mill.

Power Vents

Air Vent power attic ventilators are controlled by a factory pre-wired humidistat and/or a thermostat to ensure effective ventilation as needed. They deliver cooling results faster than wind turbines and roof louvers. Power vents are available for both roof- and gable-mount applications. Roof-mount power vents are ideal for hard-to-vent hip roof applications.

Roof-Mount Power Vents

Power Cool Plus™
Model PC15 with Automatic Thermostat/Humidistat

- 1500 CFM for attics up to 2100 square feet
- Heavy-duty, rust-resistant steel dome
- Ten-year limited warranty includes 5-year Replacement Plus™ protection
- Requires 5.0 square feet of intake vents

Dome colors available: gray, brown, black and weatherwood.

Power Cool Plus™
Model PC12 with Automatic Thermostat/Humidistat

- 1170 CFM for attics up to 1650 square feet
- Heavy-duty, rust-resistant steel dome
- Ten-year limited warranty includes 5-year Replacement Plus protection
- Requires 3.9 square feet of intake vents

Dome colors available: gray, brown, black and weatherwood.

Power Cool™
Model BR28 with Automatic Thermostat

- 1320 CFM for attics up to 1900 square feet
- Heavy-duty, rust resistant steel dome
- Five-year limited warranty includes 2-year Replacement Plus protection
- Requires 4.4 square feet of intake vents

Dome colors available: gray and weatherwood.

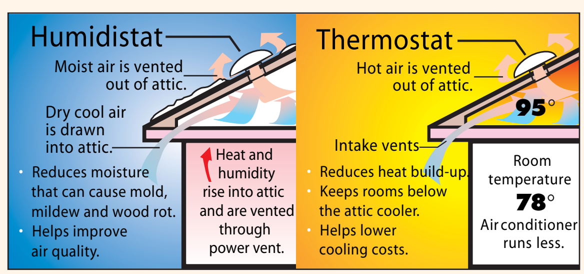
Power Cool™
Model BR26 with Automatic Thermostat

- 1170 CFM for attics up to 1650 square feet
- Plastic or heavy-duty, rust-resistant steel dome
- Five-year limited warranty includes 2-year Replacement Plus protection
- Requires 3.9 square feet of intake vents

Steel dome colors available: gray, brown, black and weatherwood
Plastic dome colors available: gray, brown and black.

Why a humidistat?

A typical family of four produces an average of 2 to 4 gallons of water vapor per day in a home.
In the winter this vapor is attracted to the cooler air in the attic, where it quickly condenses. Condensation can drip onto attic insulation, reducing its effectiveness. This moisture can cause wood rot to the attic structure and promote the growth of mold and mildew, affecting the quality of the air in the home. So, for added protection, install a power vent equipped with a humidistat.



Section 5: Air Vent's Full Line of Products

Gable-Mount Power Vents

Air Vent's gable-mount power vents operate 30% **quieter** and 35% **more efficiently** than comparable units. The fan blade is encased in a patented series of rings – not a cylinder like standard units. This open ring configuration allows the fan motor to move air more efficiently and with fewer restrictions. A decorative shutter, sold separately, can be painted to match the home's exterior.

Attic Aire All Season™
Model APGH with Automatic Thermostat/Humidistat

- 1620 CFM for attics up to 2300 square feet
- Ten-year limited warranty includes 5-year Replacement Plus™ protection
- Requires 5.4 square feet of intake vents

Attic Aire™
Model WCGB with Automatic Thermostat

- 1320 CFM for attics up to 1900 square feet
- Five-year limited warranty includes 2-year Replacement Plus protection
- Requires 4.4 square feet of intake vents

Solar-Powered Vents

Air Vent's roof-mount and gable-mount solar power vents are an exciting alternative to traditional attic ventilation. That's because they're powered by a solar panel that collects energy directly from the sun and converts it, naturally, to operate a durable, high efficiency 24-volt DC motor.

There's no electrical hook-up or electrical cost. They're easy to install and easy on the wallet. And that means environmentally friendly, budget-conscious operation for year-round comfort.

Roof-Mount Solar Power Vent

Solar Cool™ Solar Power Vent
Model SC8BL

- Up to 800 CFM for attics up to 1200 square feet (for larger attics, multiple units can be installed)
- Galvanized black steel dome; powder coated for extra weather protection
- Solar panel can be tilted and rotated for maximum sun exposure and energy collection
- Solar panel is wind, hail and impact resistant
- Five-year limited warranty includes 2-year Replacement Plus protection
- Requires 2.6 square feet of intake vents

Gable-Mount Solar Power Vent

Attic Aire Solar Power Vent
Model SG8

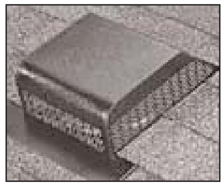
- Up to 800 CFM for attics up to 1200 square feet
- Solar panel is on a bracket and can be mounted on the roof or exterior wall
- Solar panel can be tilted toward the sun to maximize exposure
- Wind, hail and impact resistant solar panel
- Five-year limited warranty includes 2-year Replacement Plus protection
- Requires 2.6 square feet of intake vents

Section 5: Air Vent's Full Line of Products

Airhawk® Roof Louvers

From metal to plastic, Air Vent makes a variety of roof louvers ranging from round, square and slant-back designs.

SLA Slant Aluminum



- 1-piece base and throat is weather tight and adds strength
- Large flange for easy installation
- NFA (square inches): 50/pc.
- 3/12 to 12/12 roof pitch

RVG 53 High Collar

- High Collar aluminum vent for use with tile roofs or wood shake shingles
- NFA (square inches): 51/pc.
- 3/12 to 8/12 roof pitch

RVA 40 / RVG 40 Slant Back

- Aluminum or galvanized
- Low profile, compact vent
- NFA (square inches): 40/pc.
- 3/12 to 12/12 roof pitch

RVG 55 Slant Galvanized

- Heavy-duty galvanized construction
- NFA (square inches): 50/pc.
- 3/12 to 12/12 roof pitch

RVA 51 / RVG 51 Square

- Aluminum or galvanized
- Hood and throat designed to maximize airflow
- Heavy, rust-free integral screen
- NFA (square inches): 50/pc.
- 3/12 to 8/12 roof pitch

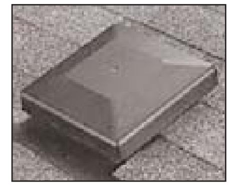
B-144 Metal Dome

- Galvanized steel
- 24" x 24" flashing
- NFA (square inches): 144/pc.
- 3/12 to 8/12 roof pitch

SLP Slant Back Plastic

- 17" x 18" flashing
- NFA (square inches): 61/pc.
- $12\frac{1}{2}$" x 10" opening
- 3/12 to 12/12 roof pitch

SQP Square Plastic



- 17" x 18" flashing
- NFA (square inches): 61/pc.
- Rain diverter throat
- 9" x 10" opening
- 3/12 to 8/12 roof pitch

B-144 Plastic Dome

- Round plastic
- 24" x 24" flashing
- NFA (square inches): 144/pc.
- 3/12 to 8/12 roof pitch

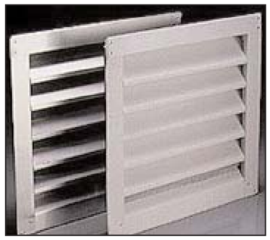
Airhawk® Wind Turbines

- Air Vent's Airhawk wind turbines are available in both internally and externally braced styles
- Dual ball bearing system assures long-lasting, quiet operation
- Two-piece base fits roof pitches from 3/12 up to 12/12
- Large flashing allows for easy installation
- Aluminum construction in 12- and 14-inch sizes

Size	Type	Description	Color
12″	Aluminum	Internal brace with base	Mill, Black, Brown, White and Weatherwood
12″	Aluminum	External brace with base	Mill, Black, Brown, White and Weatherwood
14″	Aluminum	Internal brace with base	Mill, Black, Brown, White and Weatherwood

Section 5: Air Vent's Full Line of Products

Wall Lovers



Air Vent's rectangular louvers add a decorative touch while providing exhaust ventilation.

- Aluminum construction
- Fully screened
- Flush flange
- Mill finish or baked white enamel

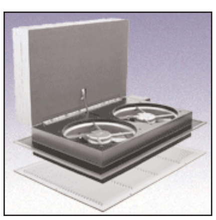
Size	Net Free Area (Square Inches)
12″ x 12″	56/pc.
12″ x 18″	82/pc.
14″ x 24″	145/pc.
18″ x 24″	150/pc.

Whole-House Fans

Whole-house fans are installed in a central hallway inside the house and pull fresh outdoor air through open windows. They are often used to augment air conditioning or instead of air conditioning in mild summertime climates.

Whisper Aire™ Dual Drive Whole-House Fan

The Whisper Aire Whole-House Fan is designed to move up to 2200 CFM – pulling warm, stale air up and out of the home while drawing fresh air in.



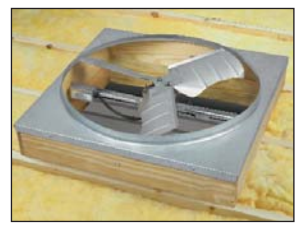
It features twin fans mounted side by side in a compact, 16 x 24-inch housing. It's designed to fit between 16- or 24-inch on-center joists. You can install Whisper Aire without having to cut and reinforce joists. The Whisper Aire fan has a remote control, making it easy to operate and eliminating the need to feed wires down an interior wall to a switch.

The remote control has 5 speed settings and a timer that can be set to circulate for 30 minutes, one, two or four hours. Plus, to minimize heat and cold transfer between the attic and living space, the fan has an insulated, motorized cover with an R-value of 25. When the fan turns on, the cover motor automatically opens the cover, then closes it when the fan stops.

A simple, white metal louver that blends in with the ceiling is included.

CFM (from lowest speed to highest speed control): 1300; 1450; 1600; 1750; and 2200

Direct-Drive Whole-House Fans



- Feature two-speed operation, with a convenient pull-chain switch
- A heavy steel housing with a powder-coated finish makes them extremely durable
- Can be mounted without cutting an attic joist
- Sizes: 24" (4500 CFM) and 30" (5700 CFM)
- Shipped in an assembled wood frame to simplify installation

Belt-Drive Whole-House Fans

- Fan motor is attached to blade with a pulley for quieter operation than direct-drive models
- Made with a rubber-mounted, self-aligning, precision ball bearing drive assembly to reduce friction
- Feature two-speed operation, with a convenient wall-mounted switch
- An enamel steel housing with a powder-coated finish makes them extremely durable
- Sizes: 30" (5700 CFM) and 36"(6900 CFM)
- Shipped in an assembled wood frame to simplify installation

Glossary

Balanced System
Equal amounts of intake net free area ventilation at the eaves and exhaust net free area ventilation at or near the ridge.

Bernoulli Effect
A phenomenon whereby low pressure resulting from wind passing over a structure or object creates a pulling or lifting action.

CFM
Cubic feet of air moved per minute. All motorized vents have a CFM rating that defines the vent's capacity to move air. The higher the CFM number, the greater the vent's capacity.

Cold Roof
The condition in which the roof temperature is equalized from top to bottom. An equalized roof temperature can help eliminate the conditions that can lead to the formation of ice dams.

Condensation
The change of water from vapor to liquid when warm, moisture-laden air comes in contact with a cold surface.

Conduction
Flow of heat directly through a solid material; responsible for most heat loss or gain in a residence.

Convection
Transfer of heat by air currents, i.e., gravity, hot air furnace.

Deck
The surface, installed over the supporting framing members, to which the roofing is applied.

Dormer
A framed window unit projecting through the sloping plane of a roof.

Drip Edge
A corrosion-resistant, non-staining material used along the eaves and rakes to allow water run-off to drip clear of underlying construction.

Eaves
The horizontal, lower edge of a sloped roof which typically overhangs the walls.

Exhaust Vent
An outlet or opening installed high on the roof near the ridge or in the gable for the purpose of ventilating the underside of the roof deck.

External Wind Baffle
The built-in wing or lip on a ridge vent that deflects wind up and over the vent creating the Bernoulli Effect that enhances airflow performance by pulling or lifting the air out of the attic. It also deflects weather elements over the vent away from the attic.

Flashing
Pieces of metal or roll roofing used to prevent seepage of water into a building around any intersection or projection in a roof, such as vent pipes, chimneys, adjoining walls, dormers and valleys. Galvanized metal flashing should be minimum 26-gauge.

Gable
The upper portion of a sidewall that comes to a triangular point at the ridge of a sloping roof.

Gable Roof
A type of roof containing sloping planes of the same pitch on each side of the ridge. Contains a gable at each end.

Gambrel Roof
A type of roof containing two sloping planes of different pitch on each side of the ridge. The lower plane has a steeper slope than the upper. Contains a gable at each end.

Gutter
A shallow channel or conduit of metal or wood set below and along the eaves of a house to catch and carry off rainwater from the roof.

Hip
The inclined external angle formed by the intersection of two sloping roof planes. Runs from the ridge to the eaves.

Hip Roof
A type of roof containing sloping planes of the same pitch on each of four sides. Contains no gables.

Ice Dam
A collection of melted snow that refreezes, typically at the projecting eave of a sloping roof. The ice dam causes the water from melting snow to back up under roof shingles.

Intake Vent
An inlet or opening installed in the soffit or undereave area for the purpose of ventilating the underside of the roof deck.

Glossary

Internal Weather Filter
An untreated, unwoven fiberglass material inside certain ridge vents that provides extra weather protection from wind-driven rain, snow and dust.

Louver
An opening with a series of horizontal slats so arranged as to permit ventilation but to exclude rain, sunlight, or vision.

Mansard Roof
A type of roof containing two sloping planes of different pitch on each of four sides. The lower plane has a much steeper pitch than the upper, often approaching vertical. Contains no gables.

Net Free Area
The total unobstructed area through which air can enter or exhaust a non-powered vent; generally measured in square inches. All nonpowered vents have a Net Free Area rating.

O.C.
On center. The measurement of spacing for studs, rafters, joists, and the like from the center of one member to the center of the next.

Overhang
The portion of the roof structure that extends beyond the exterior walls of a building.

Perm
A measure of water vapor movement through material.

Pitch
The degree of roof incline expressed as the ratio of the rise, in feet, to the span, in feet.

R-Value
Thermal resistance, a measure of a material's or a construction's ability to retard heat flow. R-Values in a series of materials can be added to determine a construction's total thermal resistance.

Radiant Heat
Heat transferred from one body to another which are not in contact (i.e., from the sun to a roof).

Rafter
One of a series of structural members of a roof, designed to support roof loads. The rafters of a flat roof are sometimes called roof joists.

Rake
The inclined overhang of a gable roof.

Ridge
The horizontal line at the junction of the top edges of two sloping roof surfaces. The rafters of both slopes are nailed to a board at the ridge.

Sheathing
Exterior grade boards used as a roof deck material.

Shed Roof
A roof containing only one sloping plane. Has no hips, ridges, valleys or gables.

Slope
The degree of roof incline expressed as the ratio of the rise, in inches, to the run, in feet.

Soffit
The finished underside of the eaves.

Square
A unit of roof measurement covering a 10 ft. by 10 ft. roof area, or 100 square feet of roof area.

Thermal Effect
The inherent property of warm air to rise, also known as thermal buoyancy.

Vapor Diffusion
The process in which water vapor naturally travels from high-humidity conditions to low-humidity conditions; for example, from the living space into the attic.

Vapor Retarder
Any material used to prevent the passage of water vapor. Applied to insulation or other surfaces, it retards vapor travel to regions of low temperature where it may condense. A material is considered a vapor retarder if it has a perm rating of 1 or less (the lower perm, the better the vapor retarder). Examples: Kraft facing on insulation, foil facing on insulation.

Vent
Any device installed in a roof, gable or soffit for the purpose of ventilating the underside of the roof deck. Any outlet for air that protrudes through the roof deck such as a pipe or stack.

Waterproofing Shingle Underlayment (WSU)
A special self-adhering waterproofing shingle underlayment designed to protect against water infiltration due to ice dams or wind-driven rain.

Taking the VIP Product Knowledge Test

After reviewing the course material on the previous pages, you're ready to take the VIP Product Knowledge test that follows. To successfully complete this course and qualify for your VIP rewards, you must correctly answer 22 of the 25 questions on the test. If you do not correctly answer at least 22 questions, you'll be notified in writing with instructions on re-taking the test. Be sure to fill out your name and mailing information so that we can mail your test results and Certificate of Completion.

There are two ways to submit your answers for grading:

1. Print out the test pages. Fill in your name and mailing information and complete the test by circling your answers. Then mail the test to: Air Vent, c/o VIP Online Course, 7700 Harker Drive, Suite A, Peoria, IL 61615.
2. Take the test online at http://www.airvent.com/professional/VIPproductscourse.html. Read the question in the PDF, then mark your answer in the interactive column to the right of the appropriate question number.

Please allow 2 to 3 weeks for processing.

VIP Product Knowledge Test

Name ____

Company ____

Address ____

City, State, ZIP ____

E-mail ______________________ Phone ______________________

1) A properly designed attic ventilation system can:
   a. provide added comfort inside the living space and help reduce energy consumption inside the house
   b. help protect against damage to the roof structure and materials
   c. both a and b

2) On a sunny day with outdoor temperatures of 90° F, the attic temperature in a home without attic ventilation:
   a. could be as high as up to 140°
   b. would be at about the same temperature as the outdoor air
   c. would be 10° cooler than the outdoor air

3) In the winter:
   a. daily activities such as cooking, cleaning and bathing can generate up to 2 to 4 gallons of moisture inside the house, some of which rises into the attic
   b. moisture is not a concern
   c. both a and b

4) "Ventilate" comes from the Latin word for:
   a. "to move"
   b. "to fan"
   c. "to dry"

5) The goal of an efficient attic ventilation system is to:
   a. provide a steady, high volume of air movement
   b. keep only the upper part of the attic cool
   c. keep only the lower part of the attic cool

6) A properly designed attic ventilation system requires balance, which means:
   a. an equal amount of intake venting and exhaust venting
   b. all of the ventilation positioned high on the roof
   c. all of the ventilation positioned low on the roof at the eave

7) Continuous soffit vents, rectangular undereave vents and vented drip edge are:
   a. types of foundation vents
   b. types of bathroom vents
   c. types of intake vents

For questions or comments about this course, please contact Air Vent at *education@gibraltar1.com.*

VIP Product Knowledge Test

8) With a roof louver exhaust system:
   a. the airflow pattern is uniform
   b. the airflow pattern is not uniform
   c. intake ventilation is not necessary

9) The following statement best describes which type of exhaust vent: "They provide maximum efficiency and aesthetics because they are installed along the entire peak of the roof end-to-end."
   a. roof louvers
   b. ridge vents
   c. wind turbines

10) Ideally, a power vent should provide:
   a. at least 5 changes of attic air every hour
   b. at least 7 changes of attic air every hour
   c. at least 10 changes of attic air every hour

11) In order to properly calculate the amount of intake venting needed for a power vent:
   a. you must first know the fan's CFM capacity
   b. divide the living space square footage by 300
   c. multiply the overhang size by 0.7

12) Air Vent's Continuous Soffit Vents are designed for both:
   a. new construction (no leg return) and retrofit (single leg return) applications
   b. new construction (double leg return) and retrofit (no leg return) applications
   c. new construction (single leg return) and retrofit (double leg return) applications

13) Air Vent's Pro Flow™ Vented Drip Edge:
   a. is available in 8 ft. lengths
   b. is available in 12 ft. lengths
   c. is designed for homes with little or no overhang

14) Air Vent's ShingleVent® II ridge vents:
   a. feature an external baffle to enhance airflow and provide weather protection
   b. can be used on a 2/12 roof pitch
   c. both a and b

15) For enhanced ridge cap shingles, cedar shake and cedar shingle applications Air Vent:
   a. offers ShingleVent II-9 inch wide ridge vent
   b. does not offer a ridge vent
   c. only recommends a power vent

16) Without an external baffle on a ridge vent:
   a. wind and elements can blow directly into the ridge vent
   b. air entering the ridge vent can create a pressure situation in the attic which prevents air and moisture from being pulled out
   c. both a and b

VIP Product Knowledge Test

17) Air Vent's Flash FilterVent:
   a. is a specialty intake vent
   b. is an exhaust vent designed for applications where a roof meets a vertical wall
   c. does not have an internal weather filter

18) To help fight moisture buildup inside the attic, Air Vent offers electric power vents:
   a. equipped with a water meter
   b. equipped with a humidistat
   c. equipped with solar panels

19) Air Vent's SolarCool™ power vent:
   a. features a fixed solar panel that cannot be repositioned
   b. features a solar panel that tilts and can be rotated for maximum exposure to the sun
   c. features a solar panel that can be rotated but cannot be tilted

20) Airhawk® roof louvers:
   a. are only available in metal
   b. are available in round, square and slant-back designs
   c. both a and b

21) Airhawk wind turbines:
   a. are available in mill, black, brown, white and weatherwood
   b. are not available with an external brace
   c. can be used on roof pitches up to 16/12

22) Air Vent's 12" x 12" rectangular wall louver:
   a. provides 46 square inches of net free area
   b. provides 56 square inches of net free area
   c. provides 66 square inches of net free area

23) The following description best describes which type of Air Vent product: Installed in a central hallway inside the house pulling fresh outdoor air through open windows.
   a. an undereave vent
   b. a whole house fan
   c. a power vent

24) Air Vent's Whisper Aire™ dual drive whole house fan:
   a. can be installed without having to cut and reinforce joists
   b. includes a remote control with 5 speed settings
   c. both a and b

25) The test you are taking is part of the VIP program which stands for:
   a. Very Important Person
   b. Ventilation Installation Professional
   c. Ventilation Is Promising