It's a Breeze

Understanding Proper Attic Ventilation of Sloped Roofs

By Anthony J. Katona

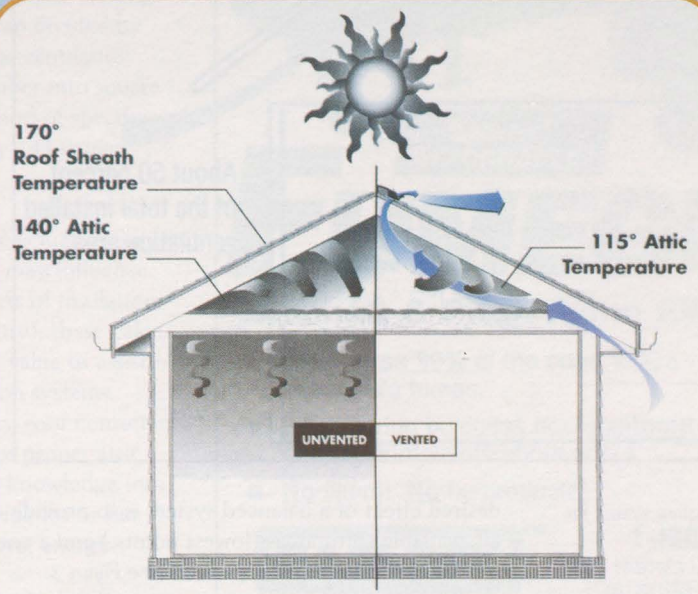

Figure 1: **Unvented:** *Radiant heat penetrating through roof sheath and attic enters living areas of home.* **Vented:** *With proper ventilation the heat is vented out of the attic keeping living areas cooler.*

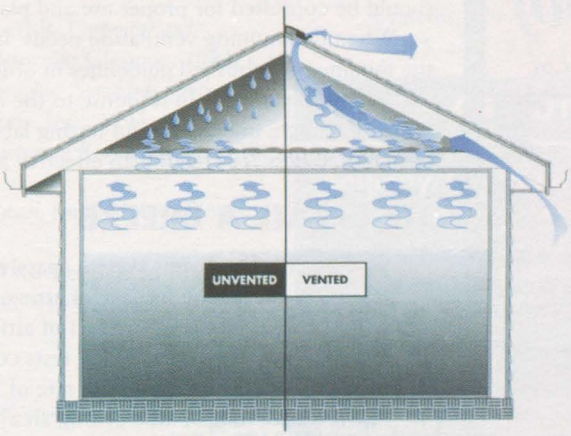

Figure 2: **Unvented:** *Moisture rising up through the house condenses in the attic, causing damage to studs, insulation, and other material.* **Vented:** *A vented attic allows moisture to escape.*

Understanding and implementing proper attic ventilation design measures can provide year-round benefits to owners of sloped roof assemblies. These benefits include: getting the maximum service life out of the building materials used in the roof assembly, added protection against damage to wood roof sheathing and structural materials, minimizing ice damming, a reduction in energy consumption during all four seasons of the year, and added comfort for occupants.

A number of factors play a role in the need for better ventilation design measures. One such issue is a result of the 1970s energy crisis. Since that time, there has been an increased focus on energy efficiency, with buildings being designed and constructed using more insulation and less air infiltration.

Another reason is that while the national code bodies BOCA, ICBO, and SBCCI have their place in assuring that minimum standards are met when buildings are constructed, there seems to be some debate as to when it is necessary to follow these codes (i.e., when determined to be necessary by a building official[1]).

Adding to the problem are perhaps the outdated codes themselves, many of which refer to the guidelines set forth in the Federal Housing Administration statutes of the Minimum Property Standards, which appeared in the November 1958 edition.

As testing continues and further research is performed (such as studies by The Small Homes Council at the University of Illinois), some of these requirements may be changed. A higher minimum standard and greater uniformity would perhaps be more suitable for today's energy-efficient designs and materials.

Let's start by establishing what is considered proper ventilation. Ventilation comes from the Latin word *"findere,"* "to fan," the action word for causing air to move. It is this concept of air movement or refreshing the air by constantly replacing the chambered air in the attic with new fresh air on which we want to focus. For this article we shall assume that the structure has properly installed insulation, that the attic space is independent from the conditioned air space, and that all the bathroom, laundry room, and kitchen exhausts are vented to the outside of the structure and not into the attic space.

Our goal is to establish a specific amount of air movement to provide year-round ventilation benefits. In order to do this, system components must be carefully sized and placed so they provide a constant, balanced flow of air moving in a uniform direction.

To begin, let's take a closer look at the physical properties inherent in attic spaces that create the need to ventilate. These

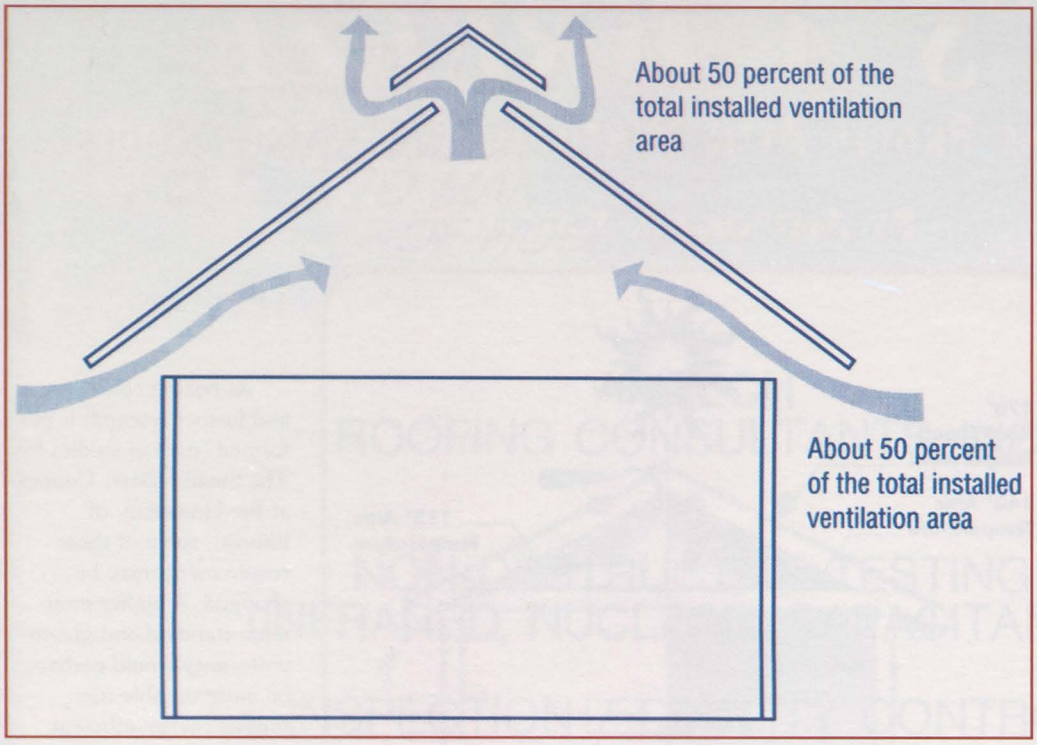

Figure 3: Diagram of a balanced ventilation system for attic spaces. Soffit and ridge vents are shown.

physical properties during the warmer temperatures are much different than during the colder temperatures.

Figure 1 depicts the effect of heat transfer and build-up that occurs during warmer temperatures. *Figure 2* represents the effects of moisture transfer and build-up that occurs during colder temperatures.

Interestingly, while the problem of attic heat and moisture transfer and build up involve distinctly different causative properties, they share a common solution.

The goal for designing this common solution should be an efficient, balanced, uniform flow of air along the underside of the roof sheathing. Hence, "It's a breeze." The most efficient way to achieve the desired effect of a balanced system is to provide a continuous intake of air along all available soffit areas (lowest points) and a continuous exhaust vent along the roof ridge areas (highest point).[2] See *Figure 3*.

While this design is adequate for taking advantage of the thermal effect to maintain circulation, the design would be greatly enhanced by the inclusion of an electrically-powered, motorized fan. This should be connected to a thermostat as well as a humidistat control. These fans are available in different sizes and should be spaced to accommodate each different project. Specific manufacturers should be consulted for proper use and placement of their products.

When determining ventilation needs, it is almost always best to design above the minimum established guidelines in order to provide year-round benefits of the ventilation system. In response to the need for greater energy conservation, private research, university, and testing labs have developed an easy-to-follow, five-step process for creating an effective and efficient ventilation system.

TO CREATE A BREEZE

For an efficient, fixed-vent system (passive)

1. Determine the square footage of attic ceiling area to be ventilated (length in feet x width in feet = square feet of attic area).
2. Establish an airflow rate. [Note: tests conducted at the University of Illinois established a suggested air flow rate of 1.5 cubic feet per minute (CFM)/square foot of attic ceiling area].
3. Determine the net-free area required to establish the desired airflow (net-free area is the total unobstructed area through which air can enter or exhaust a non-powered ventilation component). This factor is usually measured in square inches. (Square feet of attic ceiling x 1.5 square inches/square foot - total net-free area required.)
4. Determine the amount of intake and exhaust net-free area required (divide answer from step #3 in half).
5. Determine the number of intake and exhaust ventilation units to be used. Check specifications for individual products to determine the actual net-free vent area. (Note: the use of louvers and screens affects the actual net-free vent area realized.)

For an efficient power fan vent system (active)

1. Determine the fan capacity needed to provide approximately 10 to 15 air exchanges per hour (attic ceiling square feet x 0.7 = CFM capacity).[3] *Note: for roofs with an 8/12 pitch or higher, add approximately 20% more CFM to accommodate the larger volume of attic space.*
2. Determine the amount of intake venting required (CFM rating of fan divided by 300 = square feet of intake ventilation needed). To turn this number into square inches (the common method of specifying net-free area), multiply by 144 (square inches in a square foot).

While certain elements of the actual construction methods and materials used may influence the results achieved (i.e., thickness of insulation, vapor barrier, climate and humidity), these calculations can provide a benchmark value to assist in developing proper attic ventilation systems.

In conclusion, the professional roof consultant who understands the principles of proper attic ventilation and incorporates this knowledge into sloped roofing projects will provide his or her clients with valuable, cost-effective, energy-efficient ventilation systems. ■

References

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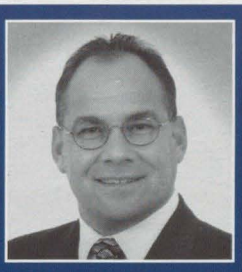
Footnotes

[1]Lile, Frank. "Let the Air Flow." *Professional Roofing,* June 1998: R6-R16.

[2]Feirer, John L. & Hutchins, Gilbert R. *Carpentry and Building Construction, third edition.* California: Glencoe, 1986.

[3]"A Comprehensive Guide to Planning Attic Ventilation Systems." *Principles of Attic Ventilation: Sixth Edition.* 1997: 1-2, 5, and 14-16.

About the Author



Anthony J. Katona has over 20 years experience in the roofing industry. His knowledge and experience include mentoring under the generation before him. He is president of Alliance Roof Consultants, Inc., Norristown, PA. Mr. Katona attended Villanova University and is a professional member of RCI.

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