A Well-built Roof Doesn't Always Keep the Water Out

BALANCED ATTIC VENTILATION IS KEY

By Marianne Horvat

No matter how well built, a roof can still suffer from improper attic ventilation. What's the purpose of attic ventilation? It seems like a simple question, but all too often the reasons for attic ventilation are misunderstood.

Most homeowners, builders, and contractors believe that the purpose of attic ventilation is to remove heat from the attic. True, ventilation helps remove heat from the attic that can transfer into the living space, making rooms in the home less comfortable and wasting energy as air conditioners and appliances run longer to deal with this added heat. But another and often misunderstood purpose of attic ventilation is to help control moisture build-up in the attic.

Attic and Moisture

There are many ways that moisture gets into an attic. One avenue is upward through the home. Moisture is created in homes every day through normal activities such as showering, washing clothes and dishes, and cooking. An average family produces 2 to 4 gallons of moisture in their homes a day – much of it through perspiration!

As the humidity in the air increases, so does its corresponding vapor pressure. Much as air moves from high pressure to low pressure, so, too, does vapor pressure. High vapor pressure wants to move to lower pressure areas. As the moisture in the air increases, it wants to move into the attic, which is normally a lower pressure area.

Moisture can pass through most building materials. Drywall, insulation, and even vapor retarders can admit moisture through or around them. Once in the attic, moisture can wreak havoc. Too much moisture in wood causes wood rot. Wet insulation can lose its R-value. And moisture contributes to conditions that promote the growth of mold and mildew. In the cold climates, water vapor passing through a structure can freeze and form ice in building cavities, causing costly damage. One of the biggest problems with moisture is that the damage it causes happens slowly and often invisibly at first.

Reviewing this helps one comprehend that a well-built roof covering doesn't guarantee long-lasting performance. To last a long time, moisture driven into an attic needs to be controlled.

Attic Ventilation Extends Roof Life

A well-designed, balanced attic ventilation system can help move air through the attic that in turn helps moisture move through and out of the attic. A balanced system means that the amount of intake ventilation, placed low in the attic at the eaves, is equal to or exceeds the amount of exhaust ventilation placed at the peak of the roof.

Removing heat and moisture from the attic with a proper ridge vent system is fundamental to maintaining a healthy roof structure.

Most experts agree that the most effective attic ventilation system consists of intake vents (soffit openings) placed evenly around the eaves, with an externally baffled ridge vent placed across the peak of the roof for exhaust. Externally baffled ridge vents work well because of the low air pressure they can create. Here's how: as wind passes over the external baffle, it is deflected up and over the vent

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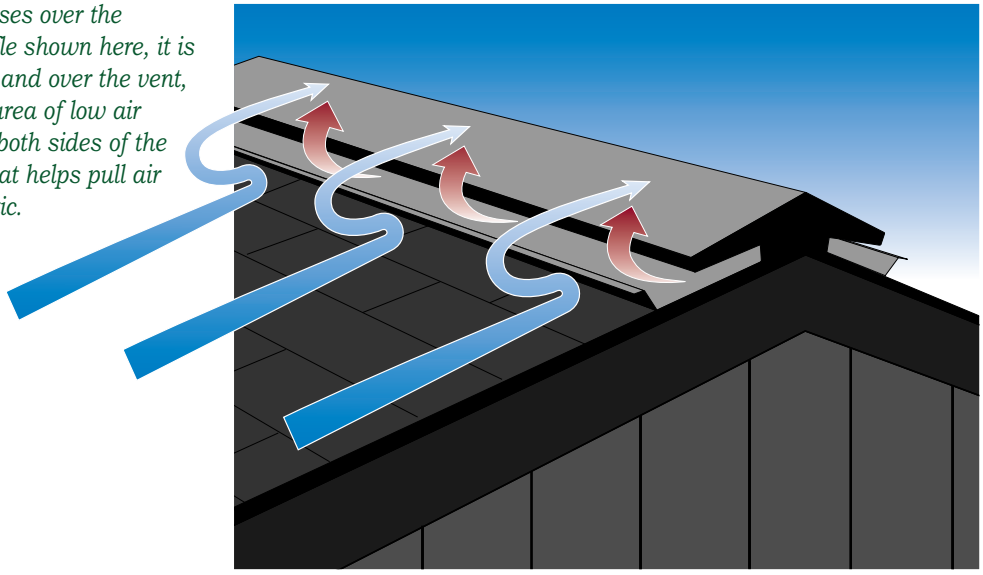
on the leeward side, creating an area of low pressure that helps pull air out of the attic on both sides of the vent. Vents without external baffles can't create this type of low pressure, and consequently don't exhaust the same volume of air.

Learning more about correct ventilation can make one a better informed roofing contractor or consultant. Here are answers to the five most frequently asked questions about attic ventilation from consultants and contractors.



As wind passes over the external baffle shown here, it is deflected up and over the vent, creating an area of low air pressure on both sides of the ridge vent that helps pull air out of the attic.

1. May I use ridge vents without intake vents?

Using a ridge vent without adequate intake venting raises a number of potential problems. First, it's important to understand that ventilation is a system of intake and exhaust. Without intake vents, the ridge vent may act as an intake vent and an exhaust vent. When that happens, the ridge vent can pull air in through one section of the vent in order to feed another section of the vent.

Imagine a large tree that is blocking one side of the house. The side open to the wind will have a lower static pressure than the side blocked from the wind. Low pressure pulls air out of the vent. The question is: where is it going to get the air it's trying to pull? Air flows from the nearest path of least resistance. If there is no soffit venting, the ridge vent has no option but to pull air from the other side of the ridge vent. Now there is a potential weather infiltration problem.

Assuming that there is no infiltration issue, another possible consequence of a ridge vent without intake is a negatively pressurized attic. The effect here is the same as with a power fan without intake – air is going to be pulled from somewhere, so now the only place to pull air from is out of the living space. That inside air is very expensive to condition. The bottom line: if the air is not coming from the soffit to feed an exhaust vent, it is probably coming from the wrong place.

Shown is a filtered shingle-over-ridge vent (ShingleVent ® II) that provides 18 square inches of net free ventilation area per linear foot. This product's external baffle system deflects wind up and over the ridge, creating low pressure above the vent openings on both sides of the vent that literally lifts or pulls air evenly out of the attic.

2. How do I ventilate a roof with multiple ridge heights?

This question is asked more than any other at Air Vent's seminars. The answer is that for multiple ridgelines, ridge vents are best because they are independent of wind direction. The basic rule for ridge heights states that all ridges can be vented, whether they run parallel or at angles to one another. If, however, the ridges are more than three feet apart in height, only ventilate the higher one.

Here's why. Recall how an externally baffled ridge vents works: as the wind passes over the baffle, it creates low static pressure, drawing air from the attic. The faster the wind moves over the baffle, the greater the pressure it creates, drawing more air from the attic. Typically, wind moves faster at higher elevations; therefore, the higher ridge will be exposed to higher wind speeds. If the wind speed difference is adequate, the pressure at the higher ridge may be enough to pull air through the lower ridge vent.

If the ridge lines are more than three feet apart in height, it is recommend to separate the attics with a piece of plywood or polyethylene sheeting to create two distinct attics. Once this is done, ventilate both ridgelines with exhaust vents and balance them with intake vents.

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To work effectively, exhaust vents need proper intake ventilation at the soffit or undereave, like the rectangular undereave vent pictured here. Intake and exhaust vents work together to form a balanced attic ventilation system.

3. Is it possible to have too much intake ventilation?

It's nearly impossible. For example, if there is more intake net free area installed than exhaust net free area, the excess intake venting will become exhaust on the leeward side of the house. This is because the intake vents on the windward side will have pressurized the attic. As a result, the intake vents on the leeward side will work with the exhaust vents to release the air. In general, it's more likely that houses will have too little intake than too much.

4. How do I ventilate cathedral ceilings?

For starters, the ventilation system must be balanced with high vents for exhaust and low vents for intake. For intake, it is recommended that every rafter bay be ventilated. In addition to this, a major concern is the air space between the insulation and the roof deck. A minimum 1.5" air space is recommended in all cathedral or vaulted or compact roof systems. These values come from calculation, design, and experience. The calculation is fluid dynamics, and the design is based on rafter depths and insulation requirements. Experience shows that anything less can cause problems.

One thing to watch for in cathedral ceilings is insulation "slumping down" and blocking off the air space that was originally designed for ventilation. Air Vent always recommends using insulation baffles for the entire length, even with fiberglass batt insulation. Thirty to 35 feet is the maximum length of rafter that should be used with the 1.5" air space. When rafter runs get longer than this, looking at 2" or 3" air spaces is recommended.

Recent investigations of the Cold Regions Research and Engineering Laboratory in New Hampshire support this idea. Research found that various roof slopes, roof systems' R-value, inlet area, and rafter lengths define what the requirements should be for most attic air spaces. The research shows that in some cases (high roof R-value and steep slope), even for long rafter runs, the 1" to 1.5" rule applies; however, for longer rafter runs, it recommends providing air spaces of 2" - 3".

5. Can I place roof louvers low on the roof for intake ventilation when getting intake at the soffit is not possible or practical or to simply add additional intake venting?

This is potentially a problem that could lead to weather infiltration and could short-circuit the proper airflow of the ventilation system. Here's why:

Weather Infiltration — An exhaust vent placed low on the roof could lead to weather infiltration because the vent is not designed to be an intake vent. If the exhaust vent is pulling in air, it can eventually pull in rain, snow, dust, and dirt. Furthermore, an exhaust vent low on the roof will receive an increased amount of watershed from higher points on the roof that it's not designed to handle.

Short-circuiting — Proper airflow travels from low at the soffit to high near the peak of the roof. Placing an exhaust vent low on the roof interrupts this airflow because air will always follow the path of least resistance. If intake vents are in place in the soffit, the path of least resistance may be between the exhaust vents low on the roof to the exhaust vents high on the roof; or between the soffit vents and the exhaust vents low on the roof. Either way, part of the roof deck is not being properly ventilated.

Conclusion

With construction codes, practices and products changing so frequently, it really helps to "go back to school." With windows and doors more airtight, insulation levels increasing dramatically over the past twenty years, and the use of house wraps and vapor retarders now commonplace, it's never been more important for contractors and consultants to be "up to speed" on all the aspects of correct attic ventilation. ■

About the Author

Marianne Horvat is the vice president of marketing for Air Vent, Inc., headquartered in Dallas, TX. She has over 20 years of marketing and building product development experience. Air Vent, chartered in 1976, manufactures metal and shingle-over-ridge vents and power and solar attic ventilators. The company presents ventilation seminars nationwide.

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