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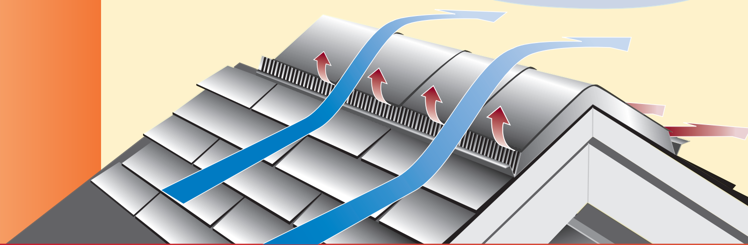

# Balanced Attic Ventilation Reduces Moisture Buildup in Hot, Humid Climates

## TESTING USING RIDGE VENTS AND SOFFIT VENTS

### Conducted at the University of Florida

Data collected at the University of Florida Energy Park, Gainesville, FL, support the benefits of a balanced attic ventilation system. Using Air Vent's shingle-over **ShingleVent® II** ridge vent for exhaust and Air Vent's aluminum **continuous soffit vents** for intake, researchers Dr. Wendell Porter and Barrett Mooney analyzed the impact balanced attic ventilation has on moisture control in hot, humid climates.

"While the current trends in building physics suggest sealing attics and crawlspaces, comprehensive research still supports the benefits of the ventilated microclimate," explained the researchers in their paper *Internal Microclimate Resulting from Ventilated Attics in Hot and Humid Regions.*[1] "This investigation concludes the conditions in a ventilated attic are stable through seasonal changes and promotes cost effective, energy efficient climate control of unconditioned spaces in hot, humid climates."

Both cold, dry climates and hot, humid climates can pose extreme forces inflicted on building components; however, it's the hot, humid climates that present thermal **and** moisture threats in the actual air being circulated through the attic space. The research summarized here demonstrates that attic ventilation works well in the most challenging climates.

Let's examine the test procedure and the findings.

# Test Background and Setup

Researchers Porter and Mooney set out to investigate the effectiveness of ventilated attics in warmer regions where overnight temperatures often remain high and, in general, humidity levels are also high. They realized that "quantifying the benefits of a ventilated attic microclimate requires yearlong investigation exploring each factor of the climate through all seasons, taking into account varying outdoor conditions," they wrote in their paper.

The research took place at the **Building Products Test Facility** on the **University of Florida** campus. The building was wired to provide data related to the internal microclimate of structures, both ventilated and sealed, in hot, humid regions. Data has been collected at that facility since 2001. *The yearlong measurements for the Air Vent study as presented in Porter and Mooney's research paper were taken during 2006.* The building used has 12 bays.

- Bay 9 was chosen for this analysis "due to the construction of a ventilated crawlspace and attic using wood framing members typical of Florida residential construction," wrote Porter and Mooney.
- The bay's conditioned space is 10.5 feet wide and 20 feet long with a ceiling height of 7.9 feet.
- The attic above is 10.5 feet wide and 9.8 feet long with a roof pitch of 5/12.
- R-30 insulation (both blown-in fiber glass and loose fill cellulose) was installed in the ceiling deck.
- Air Vent's **ShingleVent II** ridge vent (18 square inches of net free area per linear foot) and Air Vent's aluminum **continuous soffit vent** (9 square inches of net free area per linear foot) were installed on the structure for a balanced system of attic ventilation.
- Sensors were placed throughout the attic in order to understand the movement of air, temperature and moisture.
- Temperature sensors were attached to various roof joists, at the lower and middle positions on the roof deck, and between the plywood sheathing and the shingles.
- Airflow was measured by anemometers positioned in the soffit vents, in multiple positions of ShingleVent II ridge vent, and three other locations along the roof deck of the attic.
- A weather monitoring station positioned 24.9 feet from the building tracked external conditions such as temperature, relative humidity, barometric pressure, wind speed and wind direction. "Weather conditions were compared to measurements taken inside the building, constructing a relationship between the external conditions and the resulting internal attic climate," Porter and Mooney wrote.
- Data were collected every **15 minutes** for the **entire year.** "The collected data rendered an accurate conclusion of both the average and instantaneous microclimatic conditions of ventilated attics," the researchers wrote.

Air Vent's **ShingleVent II** ridge vent

Air Vent's aluminum continuous soffit vent

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## Results

The researchers found many advantages to ventilating the attic in hot, humid climates:

- Relative humidity remains well below that of the external environment.
- Condensation on roofing members is rare.
- Moisture is removed quickly.
- Moisture levels remain below those that foster mold growth.

**Figure 1** shows that the monthly average relative humidity for the attic is consistently lower than the exterior. "This relationship holds true for the daily instantaneous data recorded at 15-minute intervals," Porter and Mooney wrote.

**Figure 2** and **Figure 3** show the temporally averaged daily conditions for February and July. "The moist air entering the attic through the soffits gains heat, and rises a vertical distance of 5.2 feet exiting the ridge vent (ShingleVent II). …As the temperature rises (inside the attic), the air can hold more moisture lowering the relative humidity, decreasing the chance of condensation, and reabsorbing any moisture that precipitated out onto the insulation or attic members," Porter and Mooney reported. "This moist air is maintained at high temperatures well above the dew point limiting the instances where condensation can occur."

## Conclusions

"It is the position of this paper," explained Porter and Mooney, "that the ventilation of an attic space in hot, humid regions serves to purge hot, moist air providing an air mass with a lower humidity ratio to sit directly above the indoor conditioned space. This is a necessary cycle that directly controls unwanted condensation and inhibits the growth of mold and mildew within attic insulation and on roof truss members.

"Looking closely at the data it is clear that the air flow consistently enters the attic through the soffits. The ridge vent, with a higher volumetric flow rate than the soffit vents, consistently provides the bulk air flow out of the attic creating the only successful pathway to remove moisture. Therefore moisture flow is governed by the ridge vent (ShingleVent II)." Installing a balanced attic ventilation system (equal intake and equal exhaust) helps ensure that the ridge vent allows proper airflow.

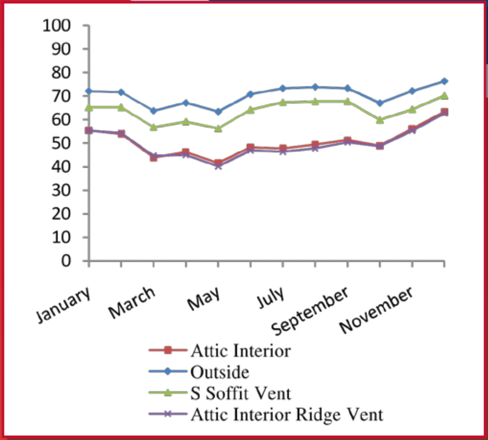



**Figure 1**
Monthly averages of relative humidity at various points.

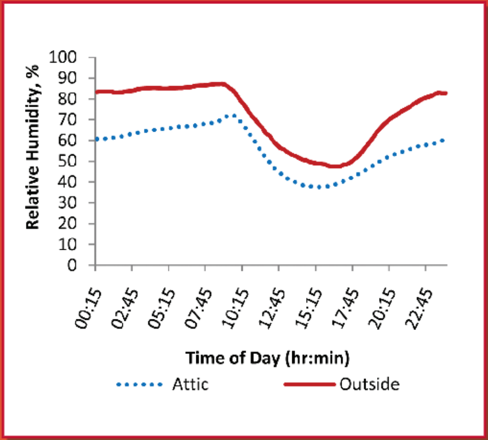



**Figure 2**
Time averaged daily relative humidity conditions for the average day in January.

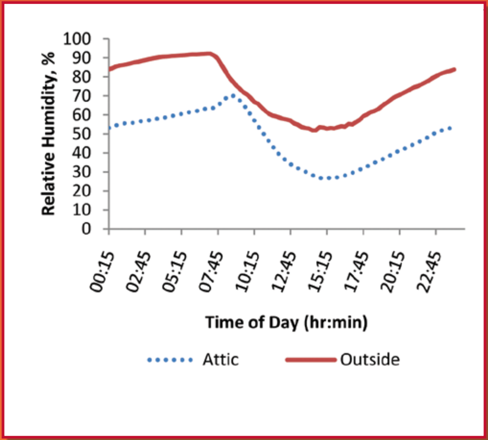


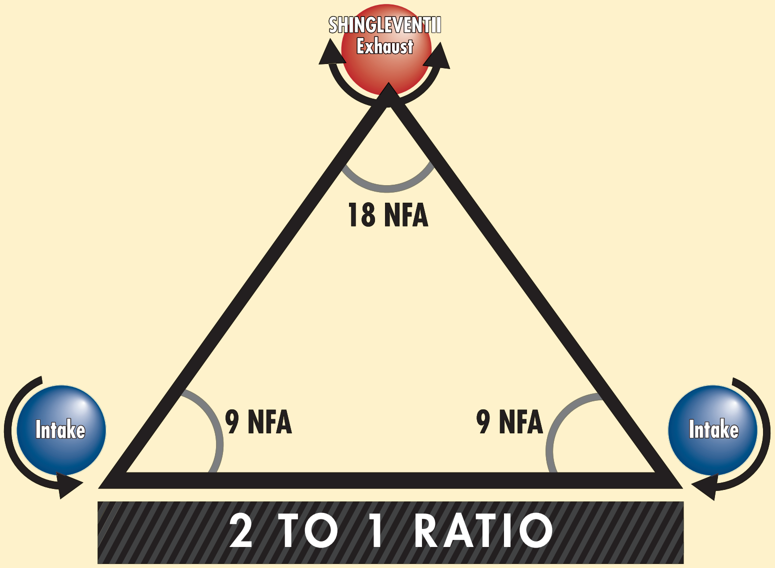

**Figure 3**
Time averaged daily relative humidity conditions for the average day in July.

## What About Sealed Attics?

"It is possible that sealing the attic spaces entirely and insulating the structure would reduce the thermal heat transfer from an attic, but this would provide no outlet for moisture transported through porous roofing materials or past the ceiling plane," Porter and Mooney explained in their research paper. "Passively cooling the attic spaces in a hot, humid climate must be achieved in conjunction with ventilation rates that sustain moisture removal. The air movement in the attic serves to maintain a microclimate that is consistently drier than the outdoor environment. Bulk air movement out of the ridge vent, contingent on radiated heat to the roof, is the result of natural thermal buoyancy and illustrates the necessity of ridge venting for proper microclimate development.

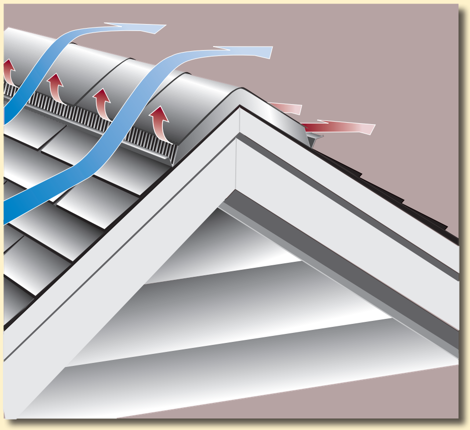
"Designing for a hot, humid climate must balance undesirable heat storage while maintaining a moving air mass that can carry moisture through the ridge."

[1] Visit www.airvent.com to read the complete University of Florida research paper.

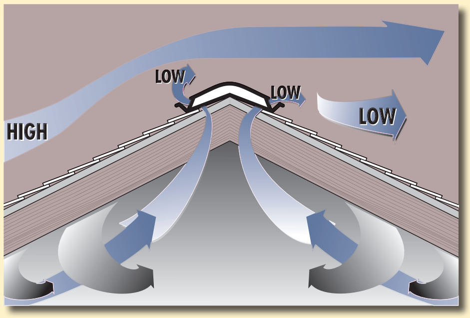



## How a Ridge Vent Works

Ridge vents, like Air Vent's ShingleVent II used in this study, are installed over a slot cut into the deck at the ridge of the roof. Proper ventilation occurs through two kinds of air movement:



**1.** Warm air rises in the attic and expels at the highest point in the roof.




**2.** Wind passes over the ridge vent and creates low pressure above the vent openings **on both sides of the vent** to pull air and moisture out of the attic — if the ridge vent is designed with an external baffle like ShingleVent II has. The external baffle not only enhances airflow performance but also provides protection against weather and debris infiltration.

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