



Attic Space Ventilation is Key to Cooling a Roof



BY ASPHALT ROOFING MANUFACTURERS ASSOCIATION (ARMA)

Solar radiation delivers energy

to the surface of the roof. Some of this energy is reflected away from the surface, but much is absorbed as heat.

Excessive heat on a residential roof accelerates the rate of aging of roofing materials, raises the attic temperature, and may drive heat into the home's living space.

The best thing to do is remove this heat as cheaply and effectively as possible.

Heat is moved by three mechanisms: radiation, conduction, and convection.

- Radiation occurs when the roof temperature is higher than its surroundings. The rate of heat release depends upon the temperature difference and the emissivity (ability to radiate absorbed heat) of the roof material.
- Conduction is the transfer of heat from a hotter material to a cooler material through physical contact. Insulation acts to restrict conduction.
- Convection is the movement of heat through air movement.

Ventilation uses the mechanism of convection to move heat out of the attic space in an effective, economical, and efficient manner. Some convection occurs naturally on the upper roof surface, but convection can also be enhanced by flowing air underneath the roof deck. This airflow reduces the accumulation of heat in the space between the roof system and the insulation.

Ventilation is a highly effective method for reducing roof temperatures, particularly in hot climates.

It should be noted that roof reflectivity reduces the heat going into the roof system but does nothing to remove accumulated heat. Ventilation is the best method to keep the temperature of the air against the insulation closer to the outdoor air temperature. Adequate insulation combined with proper attic ventilation is a key principle of building design for energy efficiency.

Hence, it is not surprising that the chapter in the *Asphalt Roofing Residential Manual, Design and Application Methods* has much to say about ventilation, ventilation effects on heating and cooling costs, and ventilation design considerations.^[1]

Moreover, ARMA has published a couple of Technical Bulletins to provide additional information regarding using ventilation to remove heat titled **“Considerations in Attic Ventilation System Selection”**^[2] and **“Why Ventilation is Important.”**^[3] The “Considerations” bulletin includes an overview of ventilation requirements, including how calculations depend on three primary factors: the size of the attic, the placement of the vents, and the rating of the vents.

The standard recommended ventilation practice works on the principle of the **“Chimney Effect.”** The hot air rises (like smoke up a chimney) and passes out the exhaust vents located at or near the ridge of the roof. As the air exits, it is replaced with airflow coming into the attic space through the intake vents, generally located in the eave or soffit area. It is the combination of balanced intake and exhaust that provides the airflow that ventilates this space, removing the excessive heat.

The **“Considerations”** bulletin covers several topics, for example, how much ventilation is needed (net free area). In most cases, the recommended minimum free flow ventilation area is equal to one square foot per 150 square feet of attic floor area. This should be built into the roof system design and properly installed to provide proper ventilation.

In certain circumstances, in combination with specific building construction features, a minimum free flow ventilation area equal to one square foot per 300 square feet of attic floor area may be sufficient and allowed. The most effectiveness of a system will vary depending on factors such as climate and home design, including roof type and slope, roofing materials, ventilation, insulation, vapor barriers, and other relevant aspects.



It's essential to understand best practices developed through the knowledge of building science and ventilation technology, which are constantly evolving. As the building and roof become more complex, material selection and calculations can become challenging. In these cases, it may be suitable to seek the help of an experienced contractor or building designer for optimal results.

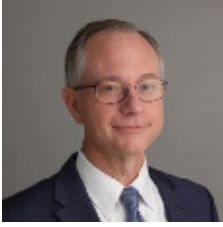
Ventilation should be considered a **“green”** building practice. Airflow provided by the **“chimney effect”** is passive ventilation that consumes no energy. It saves energy by removing excess heat from the attic space. Without ventilation, this heat might otherwise pass into the living space of the house, driving increased air conditioning and energy consumption.

More information on roof ventilation can be found on the ARMA website: www.asphaltroofing.org.

References

1. (2022). *Residential Asphalt Roofing Manual – Design and Application Methods* (pp 15-27). Asphalt Roofing Manufacturers Association (ARMA). <https://www.asphaltroofing.org/product/residential-asphalt-roofing-manual/>
2. (2023). Considerations in Attic Ventilation System Selection. *ARMA Technical Bulletins*. <https://www.asphaltroofing.org/considerations-in-attic-ventilation-system-selection/>
3. (2023). Why Ventilation is Important. *ARMA Technical Bulletins*. <https://www.asphaltroofing.org/why-ventilation-is-important/>

About Aaron R. Phillips



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My goal is to advocate and advance the technical interests of the asphalt roofing industry.

Aaron R. Phillips, ARMA Vice President of Technical Services, has worked in the asphalt roofing industry since 1988. Phillips serves as ARMA's primary technical voice, assuring that asphalt roofing is accurately, equitably, and appropriately represented in all scientific and technical discussions regarding residential and commercial roofing applications. He manages all of ARMA's technical-related activities and also serves as the association's technical liaison to organizations involved in the development of building standards. Phillips has been active in various industry organizations throughout his career, including more than 25 years of service as an ARMA volunteer.

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About ARMA

The Asphalt Roofing Manufacturers Association (ARMA) is a trade association representing North America's asphalt roofing manufacturing companies and their raw material suppliers. The association includes the majority of North American manufacturers of asphalt shingles and asphalt low slope roof membrane systems. Committed to advances in the asphalt roofing industry, ARMA is proud of the role it plays in promoting asphalt roofing to those in the building industry and the public.

For more information about ARMA, visit asphaltroofing.org.

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