



# Attic Ventilation in Accessory Structures



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## Construction code requirements

for proper attic ventilation should not be overlooked in buildings that don't contain conditioned space.

The **2021 International Residential Code (IRC)** and **International Building Code (IBC)**, published by the International Code Council, include requirements for attic ventilation to help manage temperature and moisture that could accumulate in attic spaces.

Although the code requirements are understood to apply to habitable buildings, not everyone understands how the code addresses accessory structures, such as workshops, storage buildings, detached garages, and other buildings.

### What's the answer?

**The code treats all attic spaces the same, whether the space below the attic is conditioned or not.** (A conditioned space is a space that is heated and/or cooled.)

## The administrative provisions of the IRC that set the scope for the code are found in Chapter 1. Section R101.2 and read:

- The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal, and demolition of detached one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress and their accessory structures not more than three stories above grade plane in height.

### Let's clear up any confusion about the code.

## The ventilated attic requirements in the 2021 IRC include the following language in Section R806.1:

- 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.

## An accessory structure is actually defined in the IRC:

- **ACCESSORY STRUCTURE.** A structure that is accessory to and incidental to that of the dwelling(s) and that is located on the same lot.

## The IBC also includes attic ventilation requirements that are essentially the same as the IRC. Section 101.2 of the 2012 IBC contains this text:

- The provisions of this code shall apply to the construction, alteration, relocation, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

This requirement for ventilated attics in accessory structures in the IBC and IRC is mandatory unless the attic is part of the conditioned space and is sealed within the building envelope. Unvented, or sealed, attics allow any ducts located in the attic to be inside the conditioned space, which can have beneficial effects on energy efficiency. For accessory structures, which are typically unheated, that provision does not apply.

It's important to note the codes do contain detailed requirements for the design and construction of sealed attics to reduce the chance of moisture accumulation in the attic. These requirements have been in the codes for a relatively short time and remain the subject of continued debate at ICC as advocates of sealed attics work to improve the code language in response to concerns about performance issues from the field.

Traditional construction methods for wood-framed buildings include ventilated attics (with insulation at the ceiling level) as a means of isolating the roof assembly from the heated and cooled space inside the building. Attic ventilation makes sense for a variety of reasons. Allowing outside air into the attic helps equalize the temperature of the attic with outdoor space. This equalization has several benefits, including a lower roof deck and roof covering temperatures, which can extend the life of the deck and roof covering. However, it is not just temperature that can be equalized by a properly ventilated attic. Relative humidity differences can also be addressed by vented attics. Moisture from activity in dwelling units including single-family residences and other commercial occupancies can lead to humidity entering the attic space by diffusion or airflow. **It is important to ensure moisture is removed or it can remain in the attic and lead to premature deterioration and decay of the structure and corrosion of metal components, including fasteners and connectors.**

**In northern climate zones, a ventilated attic can isolate heat flow escaping from the conditioned space and reduce the chance of uneven snow melt, ice dams, and icicle formation on the roof and eaves.** Ice damming can lead to all kinds of moisture problems for roof assemblies; it is bad enough that roof assemblies have to deal with moisture coming from inside the attic, but ice damming can allow water to find its way into the roof covering assemblies by interrupting the normal water-shedding process. For buildings with conditioned space, the attic can isolate the roof assembly from the heat source but only if there is sufficient ceiling insulation, properly installed over the top of the wall assemblies to form a continuous envelope. Failure to ensure continuity in the thermal envelope is a recipe for disaster in parts of the country where snow can accumulate on the roof.

For unheated buildings in the north, ice damming is less likely to occur, unless the structure is occasionally heated. Accessory buildings, like workshops, that might be heated from time to time with space heaters or other sources are less likely to have insulation to block heat flow to the roof. In these situations, a little heat can go a long way toward melting snow on the roof.



While the ice damming and related performance problems are a real concern even for accessory structures, it is the removal of humidity via convective airflow in the attic space that is the benefit of ventilated attics in accessory structures. We know that moisture will find its way into buildings. **Providing a way for it to escape is a necessity, especially for enclosed areas like attics.**

There are many types of accessory structures, and some will include conditioned space. **Depending on the use of the structure, moisture accumulation within the building will vary.** For residential dwelling units, building scientists understand the normal moisture drive arising from occupancy. Cooking, laundering, and showering all contribute moisture to the interior environment.

**The IRC and IBC include** requirements for the net-free vent area of intake (lower) and exhaust (upper) vents and also require the vents to be installed in accordance with the vent manufacturer's installation instructions. The amount of required vent area is reduced when a balanced system is installed; most ventilation product manufacturers recommend a balance between intake and exhaust. The IRC requires that balanced systems include exhaust vents with between 40 to 50 percent of the total vent area to reduce the chance of negative pressure in the attic system, which can draw conditioned air and moisture from the conditioned space within the building. **This is less of an issue for non-habitable spaces from an energy-efficiency perspective, but moisture accumulation is a concern in all structures.**

## Real-Life Example of Accessory-Structure Attic Ventilation

When George and Rebecca Fischer completed their country home outside of Chittenango, N.Y., it was not long before they realized they needed more space. With three cars, two lawn tractors, a snowblower, two snowmobiles, a collection of woodworking tools, and a variety of other toys vying for space in a two-car garage, it was apparent their long-term plan to build a detached garage/workshop would soon become a short-term necessity.

George designed a 560-square-foot workshop and storage building and included an attic area to maximize the storage space. When construction and design of the roof assembly came into question, George made two decisions to improve the building. The first decision was to extend the roof assembly at both gable ends to allow the extension of the 12-inch eave overhang along the rake.

The second was to include vented soffits and a continuous ridge vent to ensure the attic space in his workshop would have the necessary ventilation to allow for the normal drying out of moisture vapor that would likely end up inside his prized project. The use of a vented soffit along the upper portion of the continuous rake allows for additional vents in the upper section of the attic space. The rake overhang itself also helps improve the normal shedding of rainwater. It's important to note that vent manufacturers do not recommend their soffit vent products be used along rakes. Typical rake construction does not allow an air path in the attic, but, in this example, the soffit was designed to allow air movement into the attic. Vent manufacturers are also concerned that wind-driven rain and snow can enter an attic through a soffit vent located along a rake edge. **It is important to follow manufacturers' recommendations.**

Calculating the correct balance of intake and exhaust vents was made easier with the simple product information provided by the vent products' manufacturers. Installation instructions for vented soffit and ridge vent products include the open area per linear foot. Using vented soffit helped optimize the balance between vents in the upper and lower sections of the attic space.



By including a properly balanced vented attic design that exceeded the minimum code requirements, George and Rebecca feel more comfortable using their new storage space. **More importantly, their future plans include insulating and heating the workshop so it can be utilized during the long central New York winters.**



## About James R. Kirby, AIA



### James R. Kirby, AIA

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James R. Kirby, AIA, is a Building Enclosure Research + Innovation Architect at GAF. He is a licensed architect in Illinois and has a Master of Architecture—Structures Option and a Bachelor of Science in Architectural Studies from the University of Illinois. Kirby also has a Graduate Certification in Sustainable Building Design and Construction from Boston Architectural College. Kirby has expertise in roof system design and construction, weatherproofing, and energy-efficiency of the building envelope, as well as rooftop PV systems. He also is an accredited Green Roofing Professional. Kirby has a strong combination of association experience, as well as roofing expertise, which helps serve the **Asphalt Roofing Manufacturers Association (ARMA)** and the Roof Coating Manufacturers Association (RCMA), among others.

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