

IES GREEN REVIEW

INTELLIGENT ENERGY SOLUTIONS LLC

MOISTURE AND FROST IN MY ATTIC

A building science review of safety, indoor air quality, and energy efficiency

The frost in your attic is excess moisture. Unless there is an unknown structural issue, that is the only explanation. The important question we can answer for you is, "Where is the moisture coming from?"

Answer:
Inside your home.

We all know that warm air rises -- not heat, just warm air -- which is commonly known as the "stack effect." During the heating months, the stack effect is taking place in our homes; warm air is rising and finding its way into the attic. Warm air also has the capacity to carry more moisture than cold air. So, when the heated air escapes from your home and into your attic where it comes in contact with a cold surface, the moisture is deposited as condensation or even frost. Typically, this is the underside of the roof deck, or the sloped roof rafters.

The relationship between air temperature and moisture is part of the scientific area of study

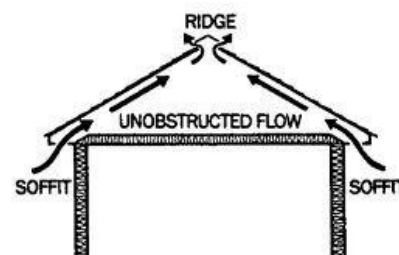
known as Psychrometry. The relationship between common terms like humidity, dew point, temperature, etc. can all be seen in the Psychrometric chart provided below. An example of what the chart can reveal is the intersecting point of temperature and humidity (let's use 70°F and 30% RH). Follow the line leading to "Dew point," and that is the temperature at which water vapor will begin to condense on surfaces. Knowing this, we believe it to be incredibly important to stop the flow of warm air into cold attics.

Sources of air leakage are plentiful. Every penetration has the potential to allow air to move through it. Small openings, such as electrical or plumbing pipes, can have gaps around their penetrations through the ceiling. Can lights, HVAC duct work, open wall cavities, and improperly vented exhaust fans can all leak massive amounts of warm air. The list of sources goes on and on.

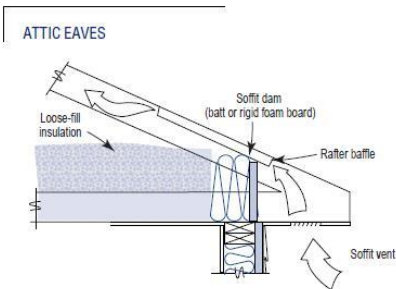
The **first step** in addressing excess moisture is *air sealing* the attic

floor, which will turn off the open spigot of warm, moist air flowing upward from your house. Keep in mind that insulation is not an air barrier, solid material such as foam or caulk must be used to stop air leakage.

Unfortunately, air sealing everything is not always possible. The majority of air leakage can be prevented after the fact, but not all. The **second step** in addressing the issue is proper attic ventilation.



Typical residential attics require at least 1 square foot of net free ventilation area (NFA) for every 300 square feet of ceiling area. This is only the minimum, and certain attics require even more. Put frankly, our professional opinion is that there is no such thing as too much BALANCED ventilation.



Balanced is the operative word in that last thought. Attics should ventilate passively with both air intakes installed somewhere low (e.g. soffit vents) and exhaust vents somewhere high (e.g. ridge vent). We strongly caution against active ventilation from an attic fan. Please see our related article titled "Attic Fans" for details.

If an attic has proper, balanced vents, a regular exchange of attic

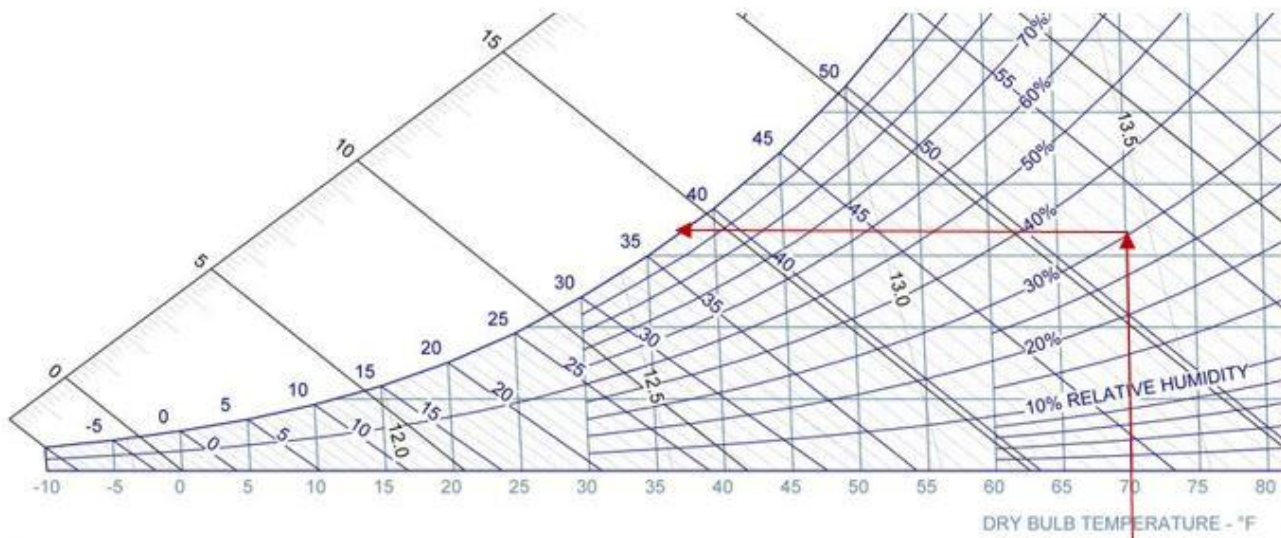
air occurs. This exchange draws exterior air into the attic through the soffits and exhausts attic air out through the high vents. This regular exchange stops the attic environment from becoming stagnant and helps prevent condensation and frost from forming, even if small leaks or exchanges exist between the house and attic.

Together, air sealing and properly ventilating your attic are two steps necessary in preventing the condensation that becomes frost. Moisture management is the single most important aspect in maintaining the structural integrity and healthy environment of your

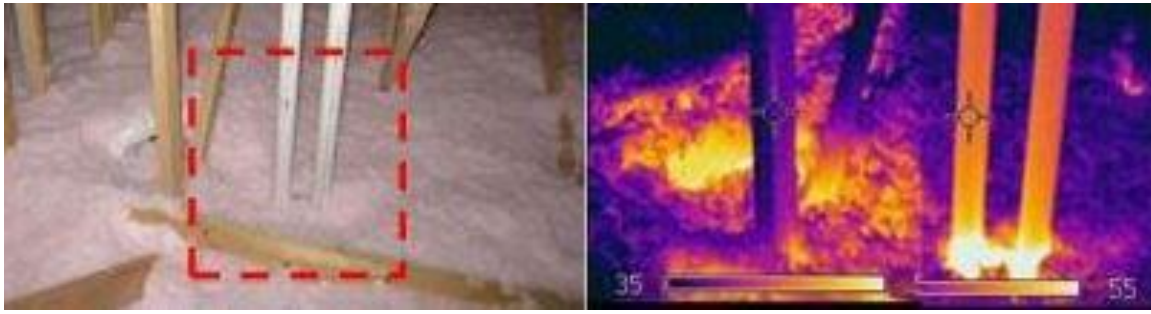
home. Preventing condensation from ever forming is a way we can help you achieve this.

Remember: don't just do things right. Listen to building scientist John Tooley, and be sure to do the right things right.

Bonus! Through May 31st 2017 Rebates are available from Nicor and ComED Through the [energySMART](#) Program for air sealing and insulation in your attic. IES is an approved contractor for the program and can provide the rebates to you as an instant discount!



Indoor air at 70 degrees and 30% Relative Humidity when cooled to 37 degrees or lower will reach its dew point and form condensation.



Additional Recourses:

<http://www.ecohome.net/guide/frost-attic>

<http://www.human.cornell.edu/dea/outreach/upload/attic-condensation-2.pdf>

https://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/ENERGY_STAR_V3_Building_Science.pdf?d387-4a5e

<http://www.greenbuildingadvisor.com/articles/dept/building-science/fundamentals-psychrometrics-part-2>

<https://www.nicorgasrebates.com/your-home/rebates-for-home>