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Mr. Ed Reeves, P.eng., Engineering Manager
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Dear Mr. Reeves:

In our architectural, engineering, and building science consulting practice, we have relied on the unvented-cathedralized attic approach, using non-shrinking spray foam insulation under the roof sheathing, to correct problems with buildings in Florida for more than 5 years. The problems corrected have been: high humidity conditions, condensation, mold, metal corrosion, occupant discomfort, and high cooling bills.

By applying non-shrinking spray foam insulation under the roof sheathing, and to gabled end walls if applicable, the humid outdoor environment is sealed from the cool air distribution system and other cool interior surfaces. This creates a more durable, healthy, safe, and comfortable indoor environment. Any space conditioning system heat gain or loss is within the air and thermal boundary of the building envelope reducing energy consumption.

The historical perspective on attic venting comes from the late 1930's when houses began to be insulated. Before insulation, moisture easily moved from crawl spaces, basements, and the primary living area to attics, but the attics were warm due to heat loss from the living space. After insulation, the moisture movement was still there, but the attics were colder, resulting in condensation on roof sheathing. By the late 1940's, attic ventilation became a code requirement.

The 2001 ASHRAE Handbook of Fundamentals states that, "The commonly stated rules for attic and cathedral ceiling construction—[that is] ventilation and vapor retarder toward the inside—pertain to cold climates and not to warm, humid climates with indoor air conditioning."

Because of the warm, humid climate, the primary moisture source is always from the outside in Florida. If non-shrinking spray foam insulation is applied under roof sheathing, roof sheathing condensation will not be a problem anywhere in Florida, in our opinion. This is because the foam insulation blocks air transported moisture from getting to the roof sheathing, and the temperature at the bottom surface of the foam is always above the attic dewpoint temperature, which is close to that of the living space.

In Florida, sealing the attic and applying non-shrinking spray foam insulation under the roof sheathing can conservatively decrease annual space conditioning energy consumption by 15% if duct leakage is 10%, and by 25% if duct leakage is 15%.

As to any question about roof sheathing degradation, plywood and OSB sheathing are good for service to at least 180 degrees which is above the maximum roof sheathing temperatures under dark shingles in Florida, whether the attic is vented or unvented. Our measurements on Florida homes show the maximum roof sheathing temperature to be 165 F under dark shingles, and 135 F under dark clay or concrete tile. Light colored roofs run cooler. Our company has gone back to inspect and take moisture content measurements of roof sheathing in houses that were constructed with non-shrinking spray foam insulation under the roof sheathing. We found the sheathing to be in perfect condition and the moisture content ranged between 6 and 12 percent, well below the 16% level of concern stated by APA. This type of inspection has also been conducted by personnel from the Florida Solar Energy Center (FSEC) and no problems were observed. From our experience, if this construction method was going to create a problem with roof sheathing integrity, it would have been detected within 2 to 3 years.

As to any question about roof shingle degradation, shingle degradation is primarily a function of temperature and exposure to ultra violet radiation. Our measurements on Florida homes show peak shingle temperatures to be 175 degrees for dark shingles over an unvented attic. This is within 5 degrees of the peak shingle temperature over a vented attic. The choice of shingle color from black to white has a larger impact on shingle temperature than vented versus unvented attic. Most importantly, asphalt shingles can reach 190 degrees in Las Vegas over a vented attic which is 15 degrees hotter than in Florida over an unvented attic. This shows that geographical location has a larger impact on shingle temperature than vented versus unvented attics. Shingle manufacturers have not adjusted warranties for shingle application in Nevada or Arizona versus Florida, so why should there be a concern between vented and unvented attics in Florida?

In a 1988 Roofing Manual, the Asphalt Roofing Manufacturers Association (ARMA) states that "ventilation of attic areas is a little understood but very helpful method of controlling heating and cooling costs..." When in fact, venting an attic always increases heating costs because it reduces the heating benefit of solar heat gain to the roof. Of course, cooling costs are the important matter in Florida, and sealing the attic by applying non-shrinking spray foam under the roof sheathing, which encloses the air distribution system within conditioned space, reduces cooling costs more than venting the attic. A recent article in the June 2003 issue of *The Journal of Light Construction*, by Danny Parker of FSEC, corroborates this. In addition, smaller cooling systems can be used with more predictable performance, saving electrical energy demand as well.

Sincerely yours,



Armin Rudd

