

ARTICLES



Side Attics and Kneewalls- The Problems



In many buildings there are areas and details that, by themselves, represent a substantial percentage of the buildings total heat loss. These same "key junctures" often have both thermal insulation failings and large air leakage areas that dominate whole house air exchange rates. Side attics are typical of these key juncture problem areas.

Side attics and other associated configurations include roof lines over side ells, bonus room attics, a mixed bag of kneewall shapes, bay roofs, shed roofs , flat roofs, plus the whole range of differing eaves assemblies.



These various details all have the following common characteristics and potential flaws that make them a prime suspect for a wide range of building performance issues.

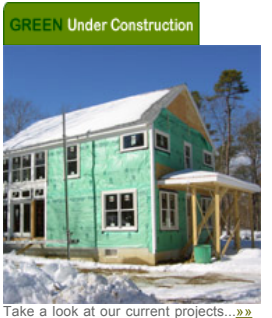
- The interface between the heated space and these side attics is often poorly defined
- The framing details are not conducive to combining the thermal and air barrier details in one continuous working surface
- These areas are difficult to insulate with conventional methods, due to the complexity of numerous intersecting surfaces
- The framing details between the main structure and the side attic includes compound transitions, cantilevers, or offsets that results in "interstitial" openings that allow air leakage between the two spaces. This large scale air leakage results in diminished insulation performance due to air moving around and through the insulation.
- The side attic space is open to both the heated space and the outside world resulting in not only excessive heat loss but moisture complications when warm heated air condenses on cold exterior sheathing.
- The enclosed and concealed nature of these spaces makes them
 - a. A convenient location for duct work and heating pipes
 - b. An opportune location for built in shelving, drawers, and storage
 - c. An accommodating location for adjacent whirlpool tubs and prefab fireplaces units.
 - d. Easy to miss or ignore when considering or detailing the thermal shell



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Side Attics and Kneewalls -The Diagnostics

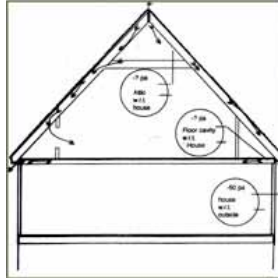
Infrared thermography is well suited to help unravel the assortment of side attic problems. Compounding air and thermal flaws can sometimes make it difficult to see the "trees in the forest" when using less insightful diagnostics. Qualitative infrared images can cut through the confusion with a very visual and revealing version of the building dynamics.

The infrared camera when used alone however can have limitations. In side attics located at the top of the building, it is not uncommon to have heat leaving the building (during the winter). The infrared image may not pick up this dynamic during the winter months. Therefore it is important to depressurize the building with a blower door fan to move cold outside and attic air into the heated space. This procedure will better reveal and sort out the various thermal flaws, by-passes and air leakage areas with greater accuracy.

Another approach to help determine the effectiveness and location of the air barrier involves pressure testing with a blower door and portable gauge. Is the air barrier on the correct side of the thermal barrier? Does it work in conjunction with the thermal barrier? Is it continuous?

Using a standard blower door depressurization creates a 50pascal pressure difference between the inside and the outside of the building. Pressure gauge readings across the building shell would indicate that any space outside the building would be 50 Pascal greater than inside. If both pressure taps on the gauge were inside the building the pressure difference would be zero.

When the building is depressurized to -50 pa to the outside what is the pressure difference between the house and side attic? It depends. Is the side attic inside the house or outside the space. Using this pressure mapping technique can help determine the location of the air barrier. In many side attics and kneewalls the air barrier is poorly defined so the difference is neither zero or fifty. In either case there's a problem, since a well defined air barrier is required to work with the insulation envelope.



Side Attics and Kneewalls -The Solutions



The strategies for side attics are built on the same good practices that apply to other areas of the building shell:

- Insulation works best when it is enclosed in an air tight configuration
- The air barrier has to be continuous
- The air barrier and thermal insulation barrier should be aligned and work as one
- Duct work and heating pipes should be on the conditioned side of the air/thermal envelope
- In heating climates the air barrier should be effective at stopping warm moisture laden air from touching the cold outside sheathing.
- Exposed materials must be durable and meet fire code

The above broad guidelines allow flexibility to adapt the appropriate treatment for each individual scenario. The best strategy should be determined on a case by case basis using the diagnostic tools as a guide. What are the framing details that can complicate the air barrier construction? Are there built-in shelves or poorly constructed kneewall doors that prevent the kneewall from being air tight? If the insulation is placed on the slope can an air tight barrier be installed using rigid board on the back of the kneewall and in the joist opening below the kneewall? If there are ducts in the kneewall space can the insulation and rigid board be placed on the sloped roof line to create an air tight conditioned space Does it make sense to use a spray foam insulation as a combination thermal and air barrier? If the kneewall is made of two by four studs why not use an R-19 batt.? Or blown/ netted cellulose?



Often a hybrid approach using a combination of materials is the best strategy, especially in difficult retrofit applications where access is limited. This includes a range of products such as two part expanding polyurethane foam, Thermax fire rated insulation board (or duct board) and blown in cellulose.

Since there are so many various configurations for side attics do not rely on "boiler plate," one size fits all, solutions. The only correct strategy for any given situation should be based on the results of follow up blower door and infrared testing.



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