



COLD CLIMATE HOUSING RESEARCH CENTER

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## ENERGY FOCUS

# Roofs: a top problem in keeping your home warm

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In severe cold climates, roofs face two important challenges; retaining heat effectively, and controlling moisture trying to escape from the living space. The colder the weather and the longer the winter, the more pronounced the issues can become. Deficiencies and poor building practices that are overlooked in a more forgiving climate become very apparent here in Fairbanks. A basic understanding of your roof system and the challenges it faces can help to identify the sources of problems.

Roofs fall into two categories: “cold” and “hot.” They can suffer from the same ailments.

A properly constructed “cold” roof maintains a continuous air space between the underside of the roof and the insulation. This air space is designed to do two things. To some degree, it allows an exit path, through vents, for moist air that has leaked from defects in the ceiling vapor barrier into the insulation cavity. The space also creates a thermal break that helps prevent escaping interior heat from conducting directly to the roof’s underside, where it can cause the snow above to melt.

A “hot” or unvented roof relies on high levels of insulation to slow down heat transfer to the exterior. The other critical component in a hot roof system is a near-perfect vapor barrier that keeps moisture-laden air from being able to enter the roof cavity where it can become trapped.

Ice damming is a relatively common sight on Fairbanks roofs. The classic symptoms are large icicles hanging off of the eaves in the middle of winter, and exposed spots on the roof where the snow has melted away. Ice damming can occur for any of three reasons, or a combination: air leaking from the living space into the roof; insufficient insulation; or insufficient ventilation.

Roof problems become more pronounced in colder temperatures due to increased “stack effect” which creates a pressure imbalance in the building. Rising warm interior air will try to exit the building through any leaks at the ceiling level. This in turn draws dense, cold, outside air in through the cracks at the bottom of the house, causing the house to act like a chimney. The greater the temperature difference between inside and outside, the stronger the stack effect. This leads to more heat loss. There are similar effects that move vapor.

During winter there is a huge imbalance between moist heated indoor air and the extremely dry and cold outdoor air. Consequently, the forces trying to balance these different humidity levels are great. Water vapor molecules will naturally try to reach equilibrium. The greater the temperature difference, the more vigorously they will try to do so. Moisture will try to exit the building through any vulnerable

areas (including solid wood) and try to reach a balance. When a house has high indoor humidity levels, the combination of stack effect and vapor drive can cause severe moisture problems inside the roof when it is poorly sealed. Gone unnoticed, this can lead to structural damage as well as health related issues due to mold growth.

In addition to ice damming, other manifestations of roof problems are excessive exterior frost build up around vents and gable ends, or patches of roof where the snow cover is receding due to heat losses from below.

Regardless of the roof system, good indoor moisture control, adequate insulation, and good sealing are three key elements to keep potential problems at bay.