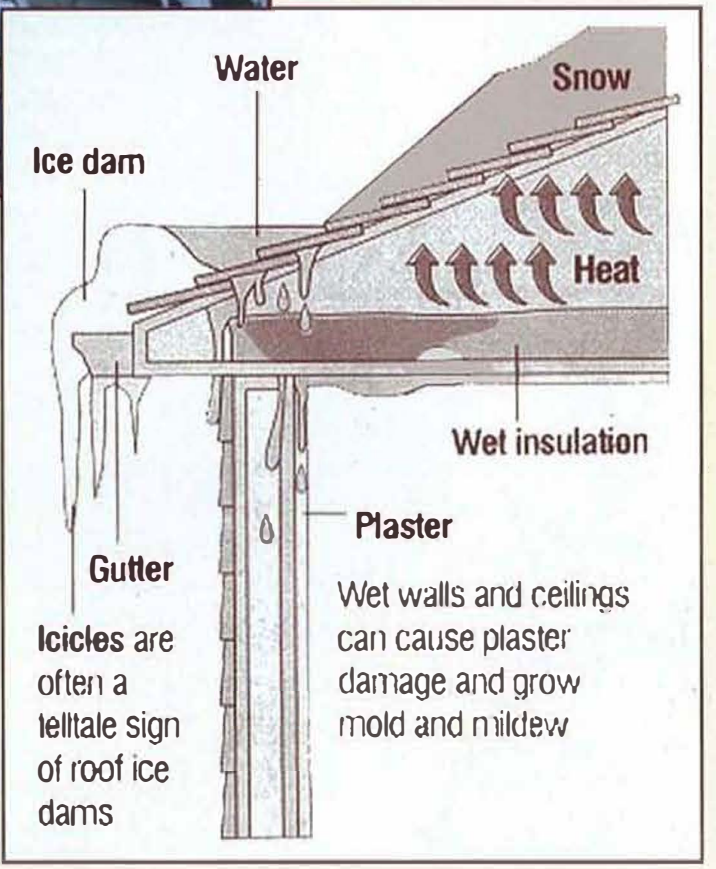
ICE DAM MEMBRANES

By B. Randall Ziegler

Left: A typical ice dam.



This diagram shows the process that causes ice dams.

What is an Ice Dam?

Ice dams are a build-up of ice, typically along the eaves on a building. This is the result of snow farther up on the roof melting, running down the roof, then refreezing at the edge. Ice dams commonly occur when a heavy snowfall is followed by a prolonged cold spell. Eave areas at the base of valleys and sidewall intersections are particularly prone to more severe ice dams due to greater snowmelt areas being concentrated by the valley or greater snow drifting at the intersection of the roof and sidewall.

What causes Ice Dams?

Warm roof decks cause ice dams. Cold roof decks retard the development of ice dams. Building air leaks into the attic or poorly insulated or poorly ventilated attics cause warm roof decks. Air leaks and poorly insulated attics allow heat from the building to enter the attic and warm the roof deck. This, in turn, melts the snow which runs to the cold eaves overhangs where it refreezes, starting the build-up of ice. This build-up blocks further snow melt runoff from leaving the roof, increasing the ice accumulation—now an ice dam. With each snow melt occurrence, the dam gets higher and starts backing the snowmelt up the roof. In severe cases, water backs up under asphalt shingles, slate, wood shingles and shakes, and penetrates the roof deck. In many instances, the water penetration occurs over the living space of the building. The result is water running into the building and damaging ceilings, walls, and flooring.

Alternatively, a well-insulated attic can still allow for the build-up of heat in the attic if the attic is poorly ventilated. The uniform flow of ambient air into the attic keeps the deck cold, lessens snow melt, and retards the development of ice dams.

Designing to Minimize Ice Dams

The best laid plans of house and roof designers can and do go astray. Where the potential for severe ice dams is high, based upon historic climate information, it is best to design for: a) minimum heat loss to the attic, b) sufficient ventilation, and c) ice dam protection for when the two previous precautions fail.

Adequate insulation must be provided to keep the attic cool. Pay particular attention to hot spots and air entry points to the attic such as lighting fixtures. In addition, adequate ventilation must be provided to facilitate the escape of warm air.

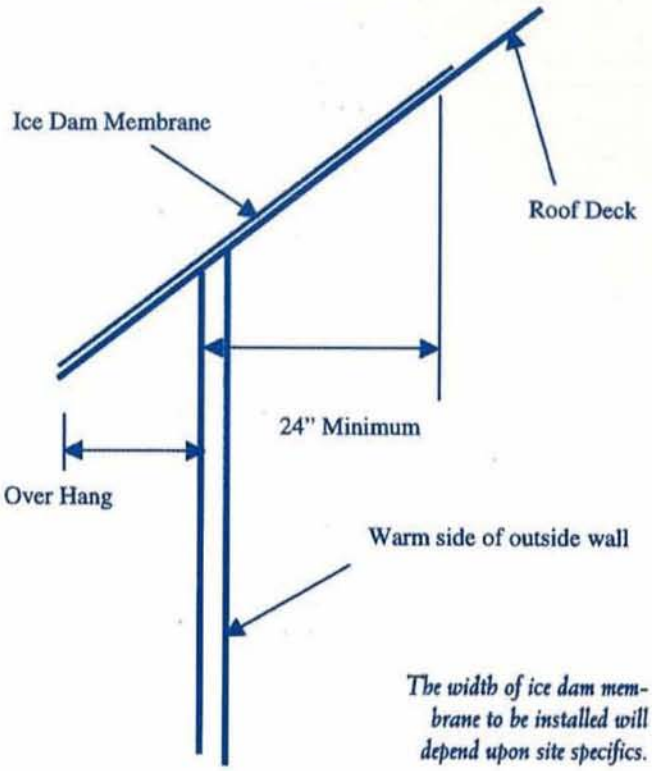
Rooftop Details

Protection against the actual occurrence of an ice dam can be addressed in three basic ways: gravity, heating, and ice dam membranes. A trip to the northern states reveals a number of perimeter details on houses designed to combat ice dams. In some instances, on steeper sloped roofs with significant overhangs, the eaves are covered with a corrosion-resistant metal flashing typically extending 18"-24" up the roof. When an ice dam begins to form on the metal flashing surface, a combination of gravity, solar warming, and the expansion and contraction of the metal breaks the ice's adhesion to the metal, and the ice slides off the roof. Without proper protection, this can create a hazard to persons and property (i.e. shrubbery).

Alone or in combination with metal eaves flashing, electrical heating elements may be installed in a sawtooth pattern at the eaves and in gutters. Pathways melted into the ice dam allow for the drainage of water.

The third means of addressing ice dams is to install an ice dam membrane. Ice dam membranes neither prevent the occurrence of nor do they eliminate ice dams. They mitigate the consequences of ice dams, i.e., water backing up behind the ice dam.

Additionally, in areas where severe ice dams are known to occur, the use of a leak barrier as a backup to other methods is strongly encouraged. Ice dam membranes are installed directly to the deck, under the shingles, slates, shakes, etc. Typically, the ice dam membrane extends up the sloped roof a distance of 24" horizontally past the warm side of the outside wall. In some circumstances, particularly on low roof slopes, the width of the ice dam membrane is extended more than 24". However, covering the entire roof with an ice dam membrane is not recommended. Ice dam membranes are vapor retarders and will prevent moisture vapor transmission. Without proper ventilation, this can lead to moisture vapor condensation and all the problems associated with this condition, i.e., mold, mildew, dry rot, wet insulation,



etc. The distance the membrane runs up the roof to protect 24" of heated building will depend on the slope of the roof. See the figure above.

Historically, the ice dam membrane is constructed by cementing two plies of roofing felts together with asphalt roofing cement. These field-fabricated membranes appear to perform satisfactorily. However, they have been almost universally replaced with labor-saving, peel and stick, modified bitumen sheet membranes. The newer, self-adhering membranes are generally easier to install, and their elastomeric compounds maintain a seal around the nails fastening the shingles to the deck.

Ice Dams and the Codes

Ice damming is a common phenomenon and is recognized by the experienced builder, roofing contractor, roof consultant, and the code bodies. U.S. code bodies address the potential for ice damming by requiring the installation of an ice dam leak barrier at the eaves of buildings in areas where the average January temperature is 25°F or less or where ice dams are known to occur. The codes require that the ice dam membrane extend up the

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roof to a point 24" horizontally past the warm side of the exterior walls of the building. The codes recognize the cementing of two piles of roofing felts or the application of a self-adhering modified bitumen sheet meeting the requirements of ASTM D-1970. This standard is being revised to reflect a broader group of products.

The average January trigger temperature of 25°F may be somewhat arbitrary. Since water freezes at 32°F, the potential for ice dam formation during a below normal January is significant. The prudent designer needs to seriously consider the installation of ice dam prevention designs and the use of ice dam membranes where it can reasonably be expected for ice dams to occur based upon prior history. For example, during the snowy and cold winter of 1996, the state of New Jersey experienced extensive ice damming on residences resulting in significant property damage. However, the majority of New Jersey has a mean January temperature of between 28° and 32°F.

In severe ice damming situations, the ice dam membrane should be installed to prevent dammed water from getting beneath the membrane. This can be accomplished by running the membrane down the fascia where present. This also protects the edge of the roof deck. The ice dam membrane should be installed beneath any drip edge that may be used. Where gutters are to be used, and depending upon the gutter design, the ice dam membrane should be installed in such a manner to avoid water and ice from getting beneath the membrane. In general, running the membrane down behind the gutter accomplishes this.

Roof slope (in./ft.)	Width of leak barrier (inches)	Slope factor
2"	24-1/2	1.02
3"	24-3/4	1.03
4"	25-1/2	1.06
5"	26	1.08
6"	26-3/4	1.11
7"	27-3/4	1.16
8"	28-3/4	1.20
9"	30	1.25
10"	31-1/4	1.30
11"	32-1/2	1.35
12"	34	1.42
13"	35-1/2	1.48
14"	37	1.54
15"	38-1/2	1.60
16"	40	1.67

To ensure that the membrane extends at least 24" horizontally into the heated portion of the building, follow this table.

The slope factor converts the 24" horizontal requirement into the distance up the sloped roof and past the outside wall surface that needs to be covered with leak barrier.

Example:

With a 6" in 12" sloped roof, multiply 24" by the slope factor 1.11 and get 26.64"—a little bit more than 26-1/2". (The table is rounded up to 26-3/4".) In this case, run the leak barrier 26-3/4" up the roof from the point directly above the outside wall.

The slope factor may also be used to address the roof overhang. If the house has an 18" overhang with a 6" roof slope, the additional amount of leak barrier required is 18" x 1.11 = 20.0".

The total width of ice dam membrane is 26-3/4" + 20" = 46-3/4".

Summary

Ice dam membranes provide an inexpensive, aesthetic solution to potentially damaging ice dams. They should be installed directly to the deck, up the roof to protect at least 24" past the outside walls and should be installed to prevent water from getting beneath the membrane.

When in doubt, install an ice dam membrane at the eaves. ■

About the Author

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B. Randall Ziegler has worked at GAF Materials Corporation for thirty-five years, starting originally with the Ruberoid Corporation. Ziegler's career has included work in Research, Commercial Development, Technical Services and Contractor Services. His most current responsibilities include obtaining and maintaining agency and code approvals and listings. He has a bachelor's degree in Chemical Engineering and is an active member of the American Society for Testing and Mateirals (ASTM).

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