

“**D**am!” That's what many contractors and homeowners alike were thinking during the winter of 2011. The constant snow, freezing rain, and bitter cold wreaked havoc on our homes—especially our roofs. Many of us tired quickly of those cute little icicles as they grew into large ice masses hanging onto the edges of our roofs, punishing the gutters and fascia. When the water began to trickle through the ceilings, we ran for buckets. As many homeowners know now, it was the winter of the ice dam.



What Causes an Ice Dam?

By definition, an ice dam is exactly what it sounds like: a dam or blockage of ice behind which snow or water is held back and prevented from draining off your roof. Ice dams form mainly at the edge of your roof, although they can also form in the roof valleys. The ice forms from snow that melts and refreezes. Even a few inches of snow is enough water to build up a significant ice dam. You might think the snow melts because of the occasional winter sun, but the culprit is really the heat escaping from your attic or the area under your roof. It heats up the sheathing on your roof enough to melt the bottom layer of snow and form water, which can do a number of things as it then flows down—or worse, under—your roofing. It may stop up against a blockage such as an existing ice dam and pool up. Or it might freeze as it hits a cooler part of the roof, such as an overhang, and form a new or larger dam. Sometimes the refreezing results from a reduction in the amount of heat escaping from your home (for example, if you set your thermostat cooler at night). But most of the time the freezing happens as the mercury drops throughout the winter and at night.

If the melted snow doesn't refreeze, it will do what all water on your roof does that doesn't drain off—it will drain down! It will find a nice little hole, crack, weak spot, or space between the gutter and the overhang. It can also force its way between your shingles and “back flow” onto the roof sheathing and down into the exterior walls and attic.

Sometimes the water causes obvious damage, like making your ceilings look like cottage cheese. But the damage can also be hidden from view for quite a while if the water is draining behind your walls. This will cause damage to your insulation and wiring, and could lead to rot, mold and mildew.

The Heat Source

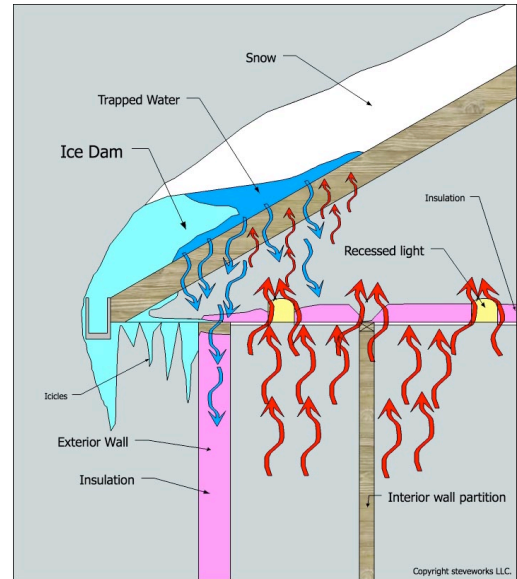
As mentioned above, the primary cause of ice dams is warm snowmelt on warm roof sheathing. The heat that warms the roof comes primarily from the conditioned (i.e. heated) living spaces of your home. There are three major areas for heat leakage, and understanding and identifying those sources is the key to preventing ice dams from forming the next time.

1. The first place I go when I do a “walk through” for a property I'm going to do work on, or if I'm called in to diagnose why there's been an ice dam, is up into the attic and/or knee walls. The first thing I almost always find is poor or inadequate insulation. Today's building codes for Eastern Massachusetts call for a minimum of R-38 insulation. (I like to build to R-40 or better) Fiberglass or cellulose insulation, when properly installed, has a rating of R-3.5 per inch, so your attic should have a

minimum 10-12 inches of insulation. Gaps in the insulation, compressed insulation and wet (or previously wet) insulation will reduce the effectiveness of the entire insulation package.

The corners of your attic might be especially poorly insulated. As the roof meets your ceiling the volume for insulation shrinks. It is also difficult to get insulation into these corners, especially in a retrofit. Capes and homes with short overhangs are especially prone to ice dams because of this. I often find ice dams directly above radiators in the rooms below. There's simply not enough insulation where the exterior walls meet the roof.

Venting, or bringing cold air to the underside of these areas, is another way to handle the problem. Venting, including ridge and soffit vents, can effectively keep the roof sheathing cold, but it must be installed properly. The vents must start in the underside of your overhang (the soffit) and continue up to the ridge via chutes installed between the roof rafters. These vents must be sized large enough to allow for significant air movement. Still, framing for skylights and hips or valleys make continuous airflow impossible. It is also difficult to maintain a good flow and volume of air, so I usually don't recommend this as a total solution.



2. The next common heat source I find in attics is recessed lights, or as the trade calls them, “cans.” Recessed lights offer two great pathways of warming the roof. The first is a bit obvious if you're ever tried grabbing a light bulb that's been on for a while—it's hot! Well, that heat also goes up through the fixture and into the attic. Newer can fixtures are insulated, and older ones can be retrofitted with insulated “hats” up in the attic to keep the heat from flowing up. Putting a can in a cathedral ceiling or in a ceiling where you can't get R-38 between the fixture and the underside of the roof is asking for trouble. If you go outside on a cold day or when there's snow on the roof and see melted circles you'll know where the cans are. On my new construction projects I try to deter my clients from installing recessed lighting on the second floor altogether.

3. Another source of heat up under the roof is air leakage from the conditioned (heated) space. A great source for this is the fore-mentioned cans. Improper seals around the cans will allow air to flow right past the lights. Air will also leak up through the wall top plates (where the wall meets the ceiling), around chimneys, and wire and pipe penetrations. Bathroom exhaust fans are also to blame. I don't know how many times I see fans either leaking air from the ducting or directly venting that warm, moist, “perfumed,” mold-breeding air right into the attic.

Those evil but necessary attic access doors and stairways are often the largest sources of heat penetration into the attic. I very often find poor or nonexistent air seals around the doors, which allow air to whistle past. Not having insulation on top of the door, again R-38 or better, is akin to just cutting a hole in your ceiling and blasting the heat up through.

Prevention, The first Step

The easiest way to prevent ice dams, and reduce your heating bill, is to properly insulate your attic. Each home will call for it's own treatment or remedy, but the first



place to start is to seal up all those air leaks. Which can be easily achieved by sealing up leaks with foam and caulk. Testing, using an infrared (IR) camera and a blower door to draw air through the cracks, is an easy way to find those leaks so they can be properly blocked.

As mentioned above, it is important to properly seal and insulate any attic accesses, including stairs. I've made removable insulated covers that sit up in the attic space, which work well. They also help keep cooled air from escaping to the attic in the summer. On occasion, I've also found non-insulated knee walls leaking heat into the attic that need attention.

And those bathroom fans—take care of those soon. Let's make sure the ducts don't leak air into the attic. Of course ensuring the air is dumped outside the house and not into the attic is next. And—wait for it—insulate the pipe! Insulating the heck out of your attic and then dropping a warm air pipe in the space is, not surprisingly, a bad idea.

Adding more insulation, either with fiberglass batts or additional cellulose, is a good next step. In some cases, spraying insulated foam to the underside of the roof or into those corners is another way of achieving more R-value and sealing up air leaks at the same time. High-density foam installed in these areas works well as it has a rating of R-6 or better per inch, so less insulation provides more protection.

Prevention, The second Step

Providing a cold underside to your roof is a wonderful way to prevent the snow from melting. If done properly, it can be very effective. But, if done wrong, it can be counterproductive. This is a subject that is constantly and hotly (pun intended) debated. I will not get into the methodology here as that's an entire essay on it's own, but a good volume of free-flowing air from the eaves to the ridge is a must. The seal between the vent chutes and the insulated area below must be tight, otherwise you'll be dumping cold air below your insulation and into the conditioned space. The cold air moving through this space will cause the air pressure in the attic to drop (just trust me here), and if you have not sealed the entire ceiling, wire, and pipe penetrations properly, the warm air from the floors below will be sucked into the attic actually be making your problem worse! The bottom line is, if someone just wants to cut a slot in your ridge and not do the rest of the venting properly, just simply walk away from that contractor!

The Next Step

This next technique is to install a self-stick and self-sealing rubber membrane between the roof shingles and the sheathing. It's definitely more invasive, as you have to remove the shingles to do it, so it's less



practical on a good roof. But for a newly installed or repaired roof, this is a no-brainer. The idea here is to prevent water from penetrating below the shingles. Commonly, a roofer will install a 3-foot wide strip from the gutter up the roof and along the perimeter, which is what the building code requires. I have my roofer extend the rubber into the gutter to prevent water from running behind the gutter and down the fascia. I also encourage a 6-foot wide strip to be installed when possible. It's a little bit more labor and material, but very helpful when the snow really piles up. If you take a look at the photograph of my house, the only thing that saved me from leaks from the ice dams was the 6 feet of rubber.

Other Prevention Measures

I'm not a big believer in heater cables on the roof. I find that they do more harm than good by drying out at cracking the roof. I also find that when the cables are off or when the water runs far enough away, it will refreeze and form more "mini" dams. Also, water can flow past the fasteners used to secure the cable to the roof.

Although icicles hanging from your gutters are a telltale sign that you might have an ice dam, having ice in your gutters alone does not constitute an ice dam. That being said, it is still very important to keep your gutters clean so that water will drain from your roof properly and not exacerbate the problem. Also, when the gutters fill with snow, ice, and debris, they get quite heavy and tend to pull off the house, often taking the fascia and drip-edge with them. Although I've never tried it, I've often wondered about running heat tapes down my gutters and downspouts as an extra measure to keep ice from forming. (Maybe this winter I'll try it and let you know how it goes.) Still, the most important thing you can do for your gutters (and roof) is to keep them clean. The cost of cleaning the gutters regularly in the short term is far less than the cost of fixing any potential damage in the long term.

Believe it or not, snow is actually a great insulator and has an R-value of about 0.5 to 1 per 5 inches. So a 10-inch layer of snow on your roof can have the effect of R-5 to R-10. So what's the big deal? If you have a nice insulated area of snow keeping the cold from the sheathing, all that escaping heat will just sit there and melt the underside of the snow mass. Reducing the snow load by using a snow rake is not a bad idea. Please stay on the ground and use an extension for the rake! Also be very careful to not scrape the granules from the shingles, as this will greatly reduce the longevity of your roof.



What To Do Next

Call us out to take a look at your roof and the attic and knee wall spaces. Let's come up with a plan to effectively insulate and seal up those air leaks, and get your home ready for the winter. A little prevention and maintenance will go a long way towards preventing expensive damage down the road.