



# ICE DAMS

Minnesota Department of Commerce Energy Information Center

*Ice dams – or ice buildup on roof eaves – are all too obvious and all too familiar to Minnesota homeowners. The shelf of ice along the eave and the icicles are clearly visible, as are the dislodged roof shingles, sagging gutters, damaged insulation, and water stains on interior ceilings and walls that are the result of ice dams. What isn't clearly visible is what causes ice dams.*

## Causes of Ice Dams

Although there are other causes (see sidebar), in most cases ice dams begin inside the house when heated air leaks up into the unheated attic. In the winter, the roof above the unheated attic is cold. When warm air leaks into the unheated attic, it creates warm areas on the roof which in turn cause the snow on the exterior of the roof to melt. The melting snow moves down the roof slope until it reaches the cold overhang, where it refreezes.

The process continues, causing ice to build up along the eaves and form a dam. Eventually this dam forces the water to back up under the shingles and sometimes into the ceiling or wall inside the home. In addition to the roof and water damage described above, ice dams may cause structural framing members to decay, metal fasteners to corrode, and mold and mildew to form in attics and on wall surfaces.

## The Solution – Sealing Attic Bypasses

The pathways through which heated indoor air moves into the attic are called attic bypasses. To reduce ice dams, attic bypasses must be eliminated. Ideally, attic bypasses are eliminated – or prevented – when the home or building is constructed, since some attic bypasses are not always accessible after construction. The following areas are common sources of attic bypasses that

are required to be sealed by the Minnesota Energy Code:

- penetrations in the building envelope for electrical and telecommunication equipment
- all exterior joints that may be a source of air intrusion
- lighting fixtures, including recessed lights and wire penetrations
- all plumbing and heating penetrations (including chimneys, flue pipes, and ducting)
- attic hatches
- balloon framed walls and walls that span both heated and unheated spaces, such as in split level houses
- dropped ceilings over bathtubs, closets and cabinets, and kitchen soffits
- other areas where walls are not completely sealed at the attic such as stairway walls and interior partition walls

Other common sources of attic bypasses not specifically covered by the code are:

- electrical boxes and fan housings (such as exhaust fans)
- kneewall construction in story-and-a-half houses

*A major solution to ice dams is sealing attic bypasses . . . preferably during construction*

### Related Guides:

- Attic Bypasses
- Combustion Air
- Home Moisture
- Home Insulation
- Home Heating
- House Diagnostics
- New Homes
- Indoor Ventilation

## Combustion Air Caution

Any time a house is tightened to reduce air leaks, care must be taken to ensure that the furnace, water heater, fireplace, and any other fuel-burning appliance has sufficient combustion air to operate safely. For information on providing combustion air, call the Energy Information Center and ask for a free copy of the Combustion Air Home Energy Guide.

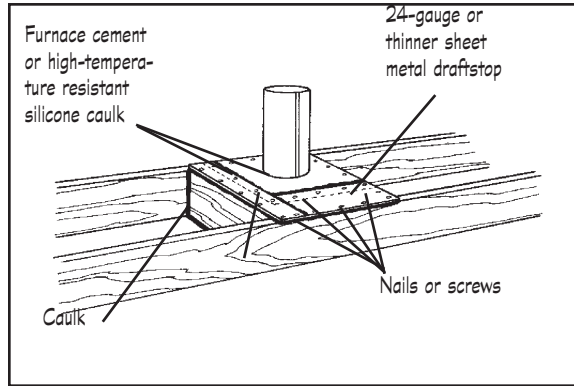


Figure 1  
With a metal chimney, the ceiling penetration can be closed with sheet metal sealed with long-life flexible caulk to the framing. Silicone caulk resistant to 400 degrees F. should be used to seal the sheet metal to the chimney.

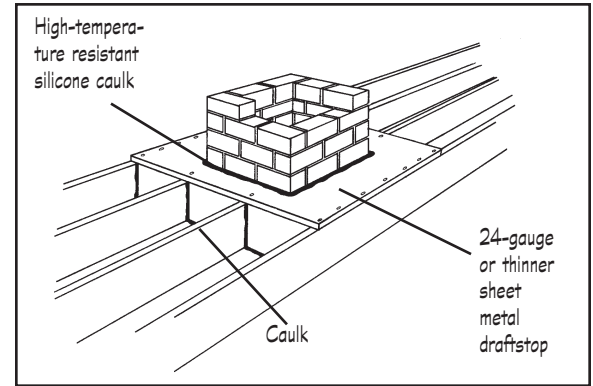


Figure 2  
Gaps between a brick chimney and the joists can be closed with sheet metal cut into halves to fit around the chimney and sealed the same way as with a metal chimney.

Techniques for sealing various attic bypasses are illustrated above and on the next page.

### Sealing Bypasses after Construction

**Homeowners guide.** For the homeowner faced with an ice dam problem, not all of the techniques illustrated may be practical. The Home Energy Guide “Attic Bypasses” describes common sources of air leaks and methods the homeowner can use to seal them. For a free copy, call the Energy Information Center.

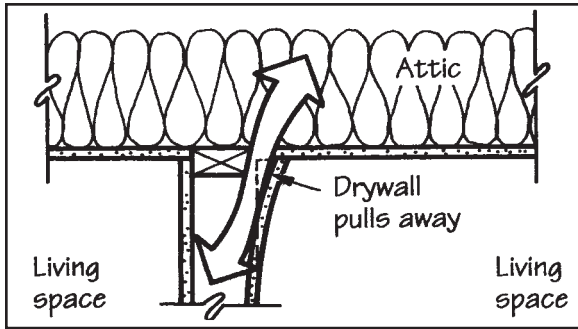
**Diagnostic services.** Both builders and homeowners may seek the help of technicians trained in using diagnostic equipment to identify sources of air leaks. A blower door test and an infrared scan can locate major leaks in houses and help determine whether they have been sealed effectively. Attic bypasses often follow long paths through building cavities before they enter the attic. For more information on pressure diagnostic testing equipment and a list of house doctors who provide these testing services, call the Energy Information Center.

### Some Non-Solutions to Ice Dams

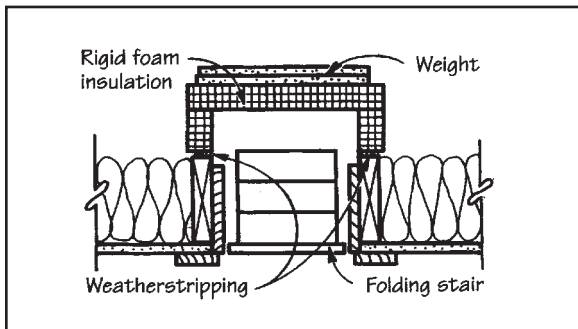
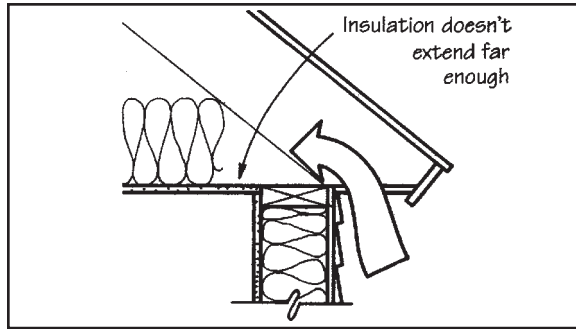
#### Increasing insulation and/or roof ventilation.

Adding insulation helps reduce ice dams, but once you have reached an R-44 level, there may be little value in adding more insulation. Adding insulation without sealing attic bypasses could actually increase the amount of air leakage, diminishing the performance of the insulation.

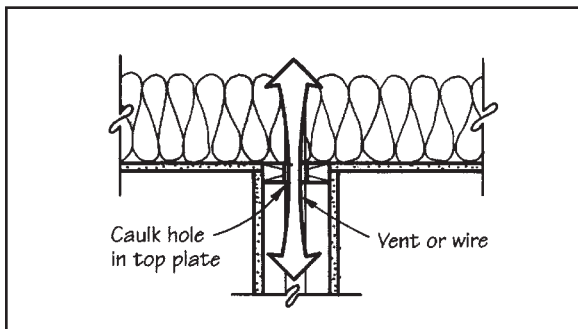
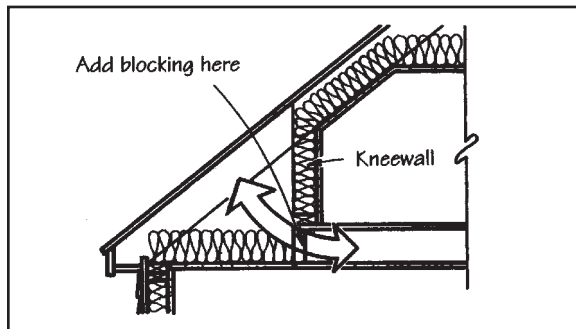
Roof vents are required by all building codes and should be installed according to building code standards. They are, however, only a partial solution to reducing ice dam formation. One caution: using power ventilators such as attic fans or other motorized devices can depressurize the attic, drawing warm moist air out of the house and into the attic.



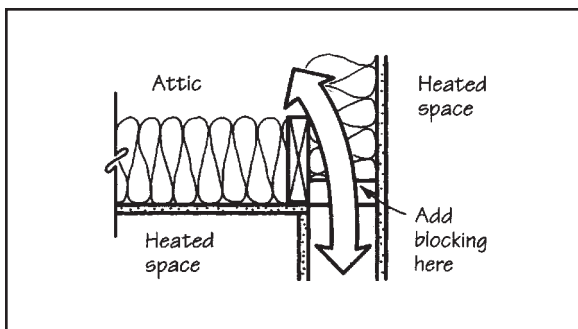
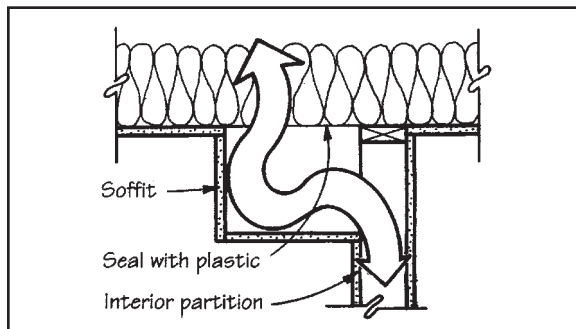
Above left: Leaks at wall-ceiling intersection. If the top plate shrinks and pulls away from the drywall, cold air will enter the partition and then the living space through openings such as electrical boxes. Prevent this by caulking the top plate or laying poly beneath the insulation batts in the ceiling. The same problem can also occur where a partition wall joins an exterior wall. Right: Cold wall-ceiling intersection at eaves may have mildew from condensation when insulation doesn't extend deeply enough into the eaves. Fix by extending batt far enough to completely cover the living space, but make sure to leave ventilation space below the roof sheathing.



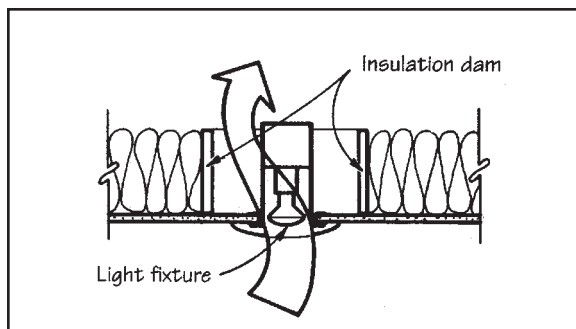
Above left: Attic bypasses occur when no seal or insulation is placed over the folding attic stair. The best solution is a box made of rigid foam with a little weight on top (wallboard works well), with weatherstripping to seal it. Right: A gap below the kneewall in the second story is a common area of air leaks. Unless the joist space is blocked below the kneewall, cold air enters the joist space. Block with rigid foam sealed with caulk.



Above left: Leaks around plumbing vents and wiring is a frequent problem. Fix by caulking or foaming around openings in the top plate or using rubber boots that slip around pipes or chases. Right: Unsealed kitchen or bath soffits are all too common. A soffit is hung from the framing with no wallboard at ceiling level to seal the insulation. Seal with plastic under the ceiling insulation. This may be hard to retrofit, but it's a major problem.



Above left: Unblocked stud bay to attic in split levels, similar to a problem in balloon framing, where stud bays continue past ceiling joists to the attic. Block with rigid foam. Right: Recessed ceiling lights are tough to deal with, though some models offer good air sealing. Reduce use of recessed cans as much as possible; look for fixtures designed and tested for low leakage.



## Other Possible Causes of Ice Dams

The root cause of ice dams is a warm roof: a warm roof melts snow which trickles down to the roof edge where it refreezes and begins to form a ridge of ice. In most cases a warm roof is the result of attic bypasses (indoor warm air leaks up into the unheated attic).

Other factors can create a warm roof, however, including roof design. Roofs with large surface areas exposed to the sun and having small run-off areas are prone to ice buildup. A classic example is a roof with several gables or dormers. Very heavy snowfalls also can create problems: a foot or more of snow on a roof combined with warm winter temperatures can warm the roof and result in snow melt and ice on eaves. Leaking or disconnected heating ducts that pass through the attic also can result in a warm roof.

If you have ice buildup for any of these reasons, do not remove the ice by chopping since this could seriously damage the roof. Instead, use a side-walk snow melt product or have a roofer steam the snow off. If you replace a roof, install an ice and water membrane along the roof valleys and perimeter.

Illustrations on this page are reprinted with permission from the *Journal of Light Construction*. For subscription information call 800-375-5981