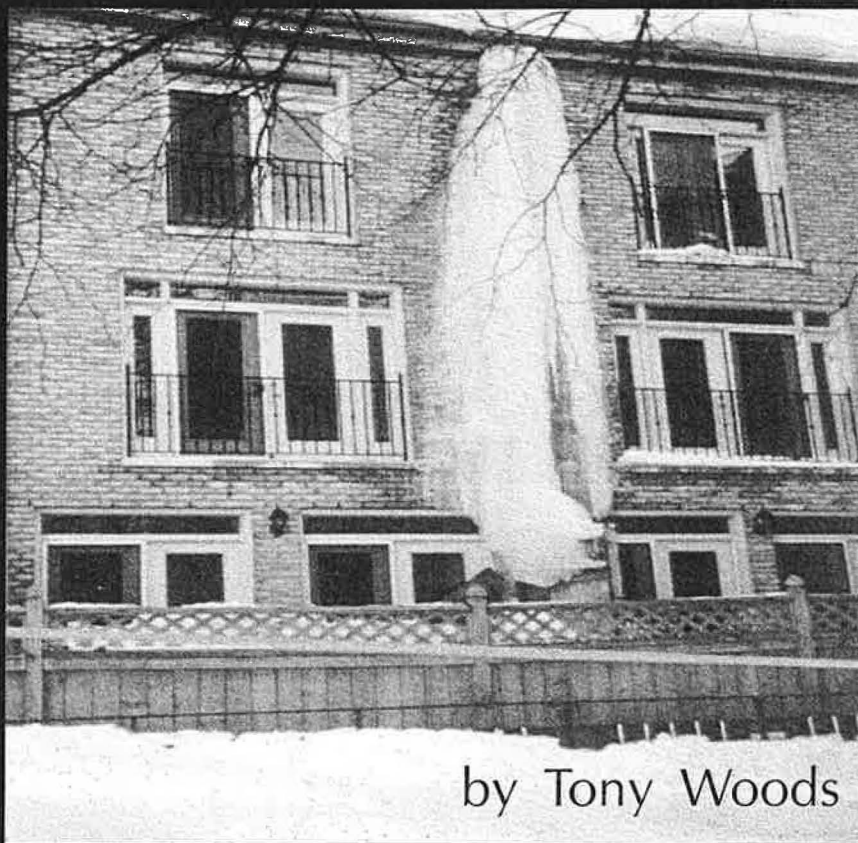


REEXAMINING ROOF VENTILATION

A new business opportunity is being created in cold-climate areas, as roofers work with home performance contractors to address issues of liability, technical rethinking, and customer service.



by Tony Woods

The world of the roofer is changing quickly. Only a year or so ago, customers blamed the roofer for ice damming and wet-attic problems. The solution was simply to add attic ventilation, in many cases beyond building code requirements. Why? Because it was the roofer's only choice. In order to provide the homeowner with a full manufacturer's warranty, ventilation had to be installed according to the requirements of the local building code: typically 1 ft² of ventilation for every 300 ft² of insulated attic space, and twice that amount for low-slope roofs.

Unknowingly, the roofing industry was making the wet-attic situation worse. How? They were following the correct procedure for ventilation, but

solving only part of the problem instead of the whole problem. Ventilating a previously unventilated attic has the effect of making the attic colder. If nothing is done to stop warm, moist air from entering the attic space from the living space, condensation on the now-cooler surfaces is a certainty. Mold, mildew, and eventually leakage into the living space will probably follow. Insulation contractors, armed with the same lack of information about attics as the roofers, have caused similar problems. Insulating the attic floor makes the attic colder in the same way as adding ventilation. But, if contractors don't seal as well as insulate, they don't stop warm, moist air from entering the attic and causing big problems.

Now, thanks to public debate, reeducation, and the publication of *Attic Venting, Moisture and Ice Dams*, a report by Canada Mortgage and Housing Corporation (CMHC), roofers know much more about what's happening, why, and what to do about it.

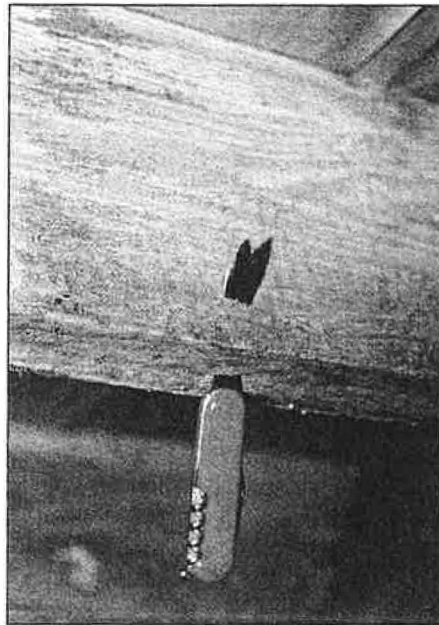
Wet attics are a continentwide problem. This problem has been identified and verified by the Institute for Home and Building Safety in Boston, an insurance-funded group that investigates, advises, and demonstrates curative and preventive measures for any potentially catastrophic loss. Of \$50 million worth of claims received by insurers in south-west Ontario during a January 1999 storm, much of the property damage involved ice damming and seepage, according to the Insurance Bureau of

Canada. A recent article in *Canadian Roofing Contractor & Design* asked the question: "Who's responsible for snow or ice falling from the roof?" (and injuring or killing innocent passersby). Insurers, like roofers, were unaware, until recently, that ventilation was not the solution to the problem.

CMHC's new report is the strongest official document to date that puts attic ventilation in proper perspective. Ventilation is needed to keep attics dry in spring, but in a growing number of cases it cannot cope with the moisture load coming from inside the house. This load can be reduced by preventive measures. According to CMHC and William B. Rose of the Building Research Council, University of Illinois, the number one priority in coping with attic moisture problems—including ice damming and condensation—is to stop the air in the attic from becoming warm and moist from internal sources.

Spores of mold and mildew are showing up far too often in too many homes, sometimes in houses not yet two years old. Small children, elderly people, and people with allergies or respiratory problems are especially at risk. Asthma levels in Canada have increased three-

fold in the last 20 years; this is blamed largely on the increase in bacteria, mold, and chemicals in the attic atmos-



Rotting wood is fragile and dangerous, as this pocket knife test shows.

phere. Health, comfort, structural durability, asset value, and energy costs are all affected by wet-attic problems.

The new understanding of why these problems happen, and of the real role of attic ventilation, is good news for roofers. By bringing in experts help to prevent recurrence, the roofer can provide better service, reduce callbacks, and better protect the product warranty. It also means extra business for the home performance specialist, since roofers, in general, do not want their workers performing weatherization services in attics.

Cause and Effect

Ice damming and attic condensation, or wet attics, are symptoms of similar problem conditions in the home. They can be blamed on a whole range of usual suspects—inappropriate design, poor construction techniques and workmanship, poor communication between trades, location of heating and air conditioning ducts, and botched renovations. In addition, many people crowded into one living space—all of them taking showers, cooking, and drying clothes indoors—can send indoor moisture levels soaring. There may be no single cause. An indoor relative humidity of 50% can cause problems in an attic with

Table 1. Where and How to Seal Attic Leaks

Leakage Path	Single-Component Foam	Two Component Foam (Zerodraft Attic-Sealing Kit)	Other
Attic hatch	Yes		Weatherstrip, caulk, latch, and insulate.
Ducting		Yes	Insulate to R-25 minimum in Canada, seal boot to ceiling, and seal plenum shaft.
Plumbing stacks	Yes	Yes	
Chimney stacks			Drywall and high-temperature caulk.
Electrical penetrations	Yes	Yes	
Top plates	Yes		
Recessed ceilings	Yes		First stuff with batt insulation.
Light fixtures			Caulk from below.
Kneewalls		Below wall, between joists	Mineral fiber batts on vertical walls.
Plumbing penetrations	Yes	Yes	
Recessed lights		Yes	Plus drywall box (or replace with sealed units).
Perimeter and party walls	Yes		Drill or punch block cores in lowest course above ceiling, then fill. Won't work if blocks are already filled with concrete, as in earthquake country.
Split level junctions		Yes	Stuff first with batt insulation.

ROOF VENTILATION

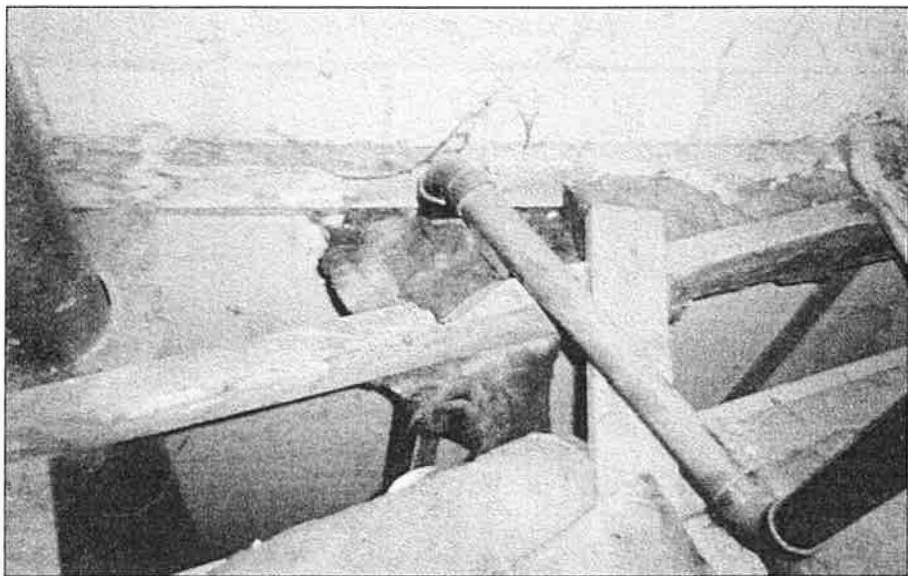
major bypasses, while a humidity level greater than 65% can move through small cracks and create damage.

Solutions center on isolating the attic in cold and moderate climates, making it completely separate from the rest of the house. This will ensure that warm, moist air in the living space cannot get into the non-conditioned space in the attic. Keeping the attic sealed off from the living area (using air leakage control measures to seal holes, cracks, gaps) is key. It is important to add insulation as appropriate to keep the attic cold, but insulation without sealing can make matters worse.

Southern climates—particularly those with high outdoor humidity—may be approached differently, of course. And isolating attics with ductwork and mechanical equipment is more complicated, because it is harder to define the thermal boundary of the living space. Nevertheless, the rule remains: Prevent warm, moist air from finding its way to condensing surfaces.

One-Step Cure and Prevention

CanAm Building Envelope Specialists Incorporated, a private firm near



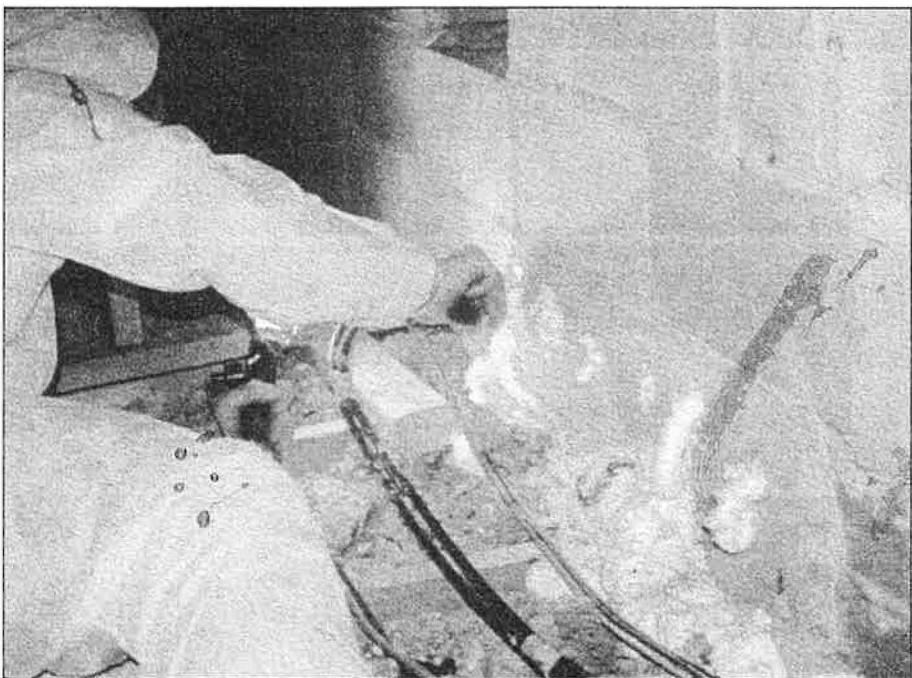
This hole between the attic and the party wall needs to be stuffed with mineral wool and then foamed.

Toronto, Canada, has created a residential comfort-contracting division to work with its local roofing, insurance, and home inspection communities to solve wet-attic problems. As a referred or consulted contractor, the division, known as Zerodraft, usually arrives on the scene once the “educated” roofer has discovered the problem. If rotting, moldy, or mildewed wood has been found, cleanup and possibly replace-

ment may be required before the comfort contractor can start work.

After a blower door test, visual inspection, or both have been completed, the remedial work begins. All the typical sites for potential leaks must be checked and corrected, if needed (see Table 1). Zerodraft crews have learned to watch out for unusual air bypasses to the attic that have been created by the enterprising contractor or homeowner, including laundry chutes, retractable projection equipment, huge wall cavities, bulkheads, skylights, furnaces, and air conditioning equipment.

The Zerodraft-trained two-operator crew use a specially formulated two-component polyurethane foam attic sealing spray as their primary air sealing system. The spray is pressurized and blows away dirt as it is applied. The crew wear complete safety gear whenever they are working in an attic. This includes a disposable Tyvek suit with a hood, gloves, safety glasses, and a respirator designed to cope with organic vapors. The two cylinders of foam are placed near the center of the attic, usually across two beams for extra support. With a 30-ft hose assembly, it is often possible to reach almost every corner in the attic without moving the cylinders. If the existing insulation smells bad or makes it impossible to perform the remedial measures, it may need to be removed and replaced with new insulation.



The crew always wear complete safety gear, including a disposable Tyvek suit. Here, one crew member is foaming into block cores to stop stack effect within the party wall.

Individual crews have their own preferences about how to divide the work, depending on accessibility and the type of roof. Common sense suggests that the attic be divided into manageable sections. In each section, the first operator exposes top plates at the perimeter and interior walls by clearing any blown insulation and lifting batt or other insulation away from the area to be sealed. The second operator follows behind and lays one or more continuous beads of foam from the attic-sealing kit to seal the leaks. As soon as the foam cures—a 30-second process—the second operator lays the existing insulation back on top of the seal. Soffit vents are added or improved, taking into account homeowner preferences for exterior aesthetics.

For kneewalls, the top plates and joist cavities under the half-story are sealed with foam, and the vertical wall is insulated using mineral fiber batts. Ventilation requirements are frequently coordinated with the roofer.

As the operators move along the top plates, they deal with any electrical or plumbing penetrations. For recessed light fixtures, a drywall box can be built and foamed to seal the edges.

Heating ducts in attic spaces cause many roof problems (see Figure 1). In

homes that have recently been converted from electric to gas heating and have suddenly started experiencing roof problems, ducts should be the first suspect. In general, ducts are frequently damaged, have leaky joints, and are poorly insulated. They are nearly always guilty of bringing warm, humid air into the attic. All ducts need to be sealed and insulated to at least R-25. The Zerodraft crew encapsulate the ducts completely and seal everything to the air barrier plane.

Once all cracks, gaps, holes, and leaks have been satisfactorily sealed according to the experienced judgment of the crew, it is time to insulate. If the space is sealed thoroughly, blown cellulose is the recommended insulation,

because of its superior air-tightening capabilities.

Before the operators leave the attic, they weatherstrip the entry hatch, using Zerodraft C-fold polyethylene-clad foam compression seal. Then they insulate to R-30 with three 2-inch slabs of extruded polystyrene foam cut to the exact size of the hatch. The hatch door is latched with a hook and eye to hold it down firmly. Prefabri-

cated airtight insulated metal assemblies can also be used for hatches or kneewall entryways.

The last, but very important, step is to address the source of the moisture. This is generally associated with lifestyle—a lot of teenagers taking showers, for example—but it could be a below-grade problem such as a crawlspace with an earth floor. Mechanical ventilation is essential in both cases. For the crawlspace, one should lay a moisture barrier consisting of a layer of 6-mil polyethylene on top of the earth and hold it in position at the perimeter walls with two-component foam. Also, one should spray the walls with 2 inches of foam or use extruded polystyrene foam board and seal the joints with sprayed foam. Sprayed foam will also effectively seal the rim joist.

It is important to check the existing exhaust fans. Most of these are improperly installed; sometimes they are found to be exhausting directly



The crew lays continuous beads of foam to seal all leaks.

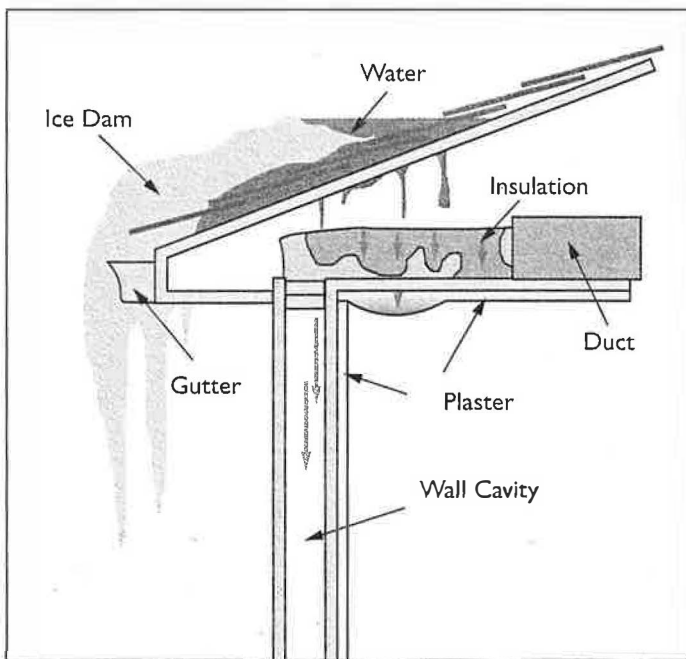


Figure 1. Ducts are nearly always guilty of bringing warm, humid air into the attic, which can lead to ice damming.

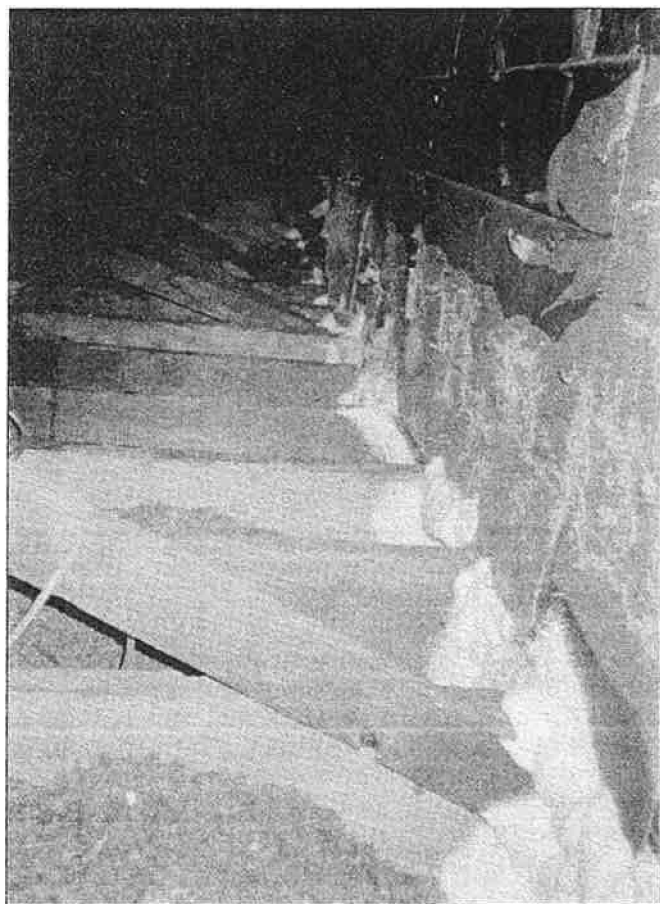
into the attic. In 20 years of home contracting, Zerodraft has rarely seen an exhaust fan box that was properly sealed. This must be done as part of the remedial measures.

Comfort Problem Solving

In the home performance contracting industry, what homeowners want, what they need, and what they will buy is foremost in the mind of the business owner and the marketing people. For the policymakers, energy and environmental performance ranks number one. Fortunately, there are participants in this fledgling market who believe that both issues are critical.

Wet attics, ice damming and other moisture-related problems are extending the business opportunity for the comfort contractor. Why? Because other trades and interests are becoming aware of the risks and benefits that these problems entail for their business.

Roofers, of course, do not want to be blamed for problems they did not cause. They also see the added value of providing a service that meets a customer's need. Home inspectors have been caught unawares, and now realize that they need to know more about potential moisture problems. For instance, in Toronto last winter a home inspector was sued for issuing a certificate without even going up into the attic. The same is true for insurance companies, who face claims from homeowners for expensive repairs.



For kneewalls, the top plates and the joist cavities under the half-story are sealed with foam.

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For more information:

Attic Venting, Moisture and Ice Dams. Canada Mortgage and Housing Corporation (CMHC), 700 Montreal Road, Ottawa, Ontario K1A 0P7. Tel: (613) 748-2367; Fax: (613) 748-2098. Report CE-13 in the "About Your House" series is available on the Internet at www.cmhc-schl.gc.ca/publications/aboutyourhouse/ce13.html.

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