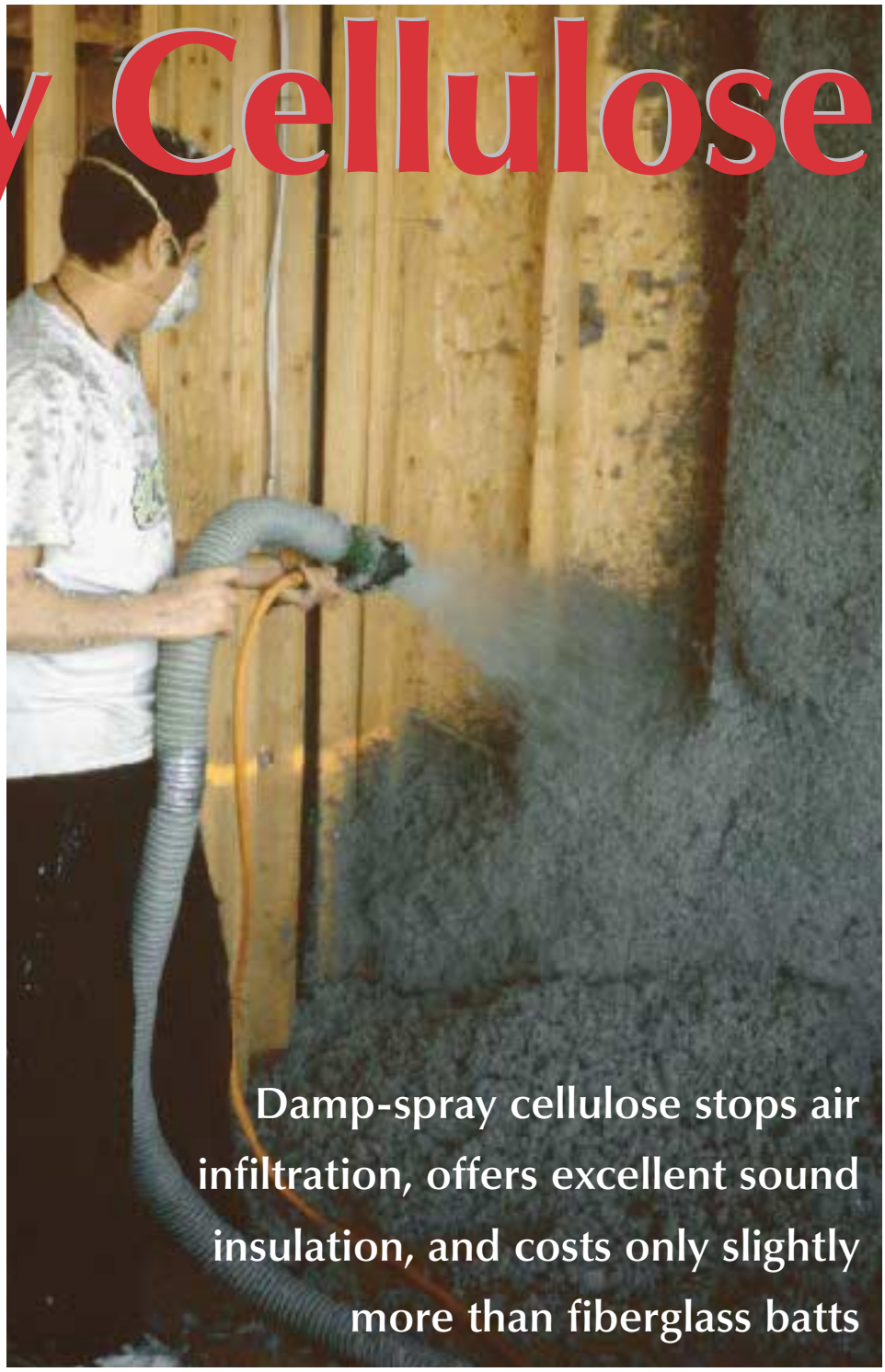
INSULATING WITH Spray Cellulose



Damp-spray cellulose stops air infiltration, offers excellent sound insulation, and costs only slightly more than fiberglass batts

In the hierarchy of the building trades, insulation contractors are often considered about half a step above the porta-john guy. That's because insulation is one of the most taken-for-granted systems in a house. It's installed in exterior walls one day and covered up with sheetrock the next, and few municipalities have substantive insulation inspections. The result is little accountability or quality control on the majority of jobs I inspect.

by Michael Uniacke

In spite of all that, insulation can and should be done right. My company, Advanced Insulation in Prescott, Ariz., works with several types of insulation, but our workhorse product for wall applications is damp-spray cellulose (formerly known as wet-spray cellulose).

That preference is based on years of experience in our marketplace, which is at 5,000 feet elevation and has a climate similar to that of Denver. We've found that walls insulated with spray cellulose are more thermally efficient than those with fiberglass batts. In our 5,000 heating-degree-day climate, we are seeing 1,600-square-foot homes that don't require conventional forced-air heating systems. In some cases, the actual heating load is so small that it can be handled by a heater-rated gas log fireplace. Equally important, our customers tell us that spray cellulose provides a much more comfortable house.

Spray cellulose does cost a little more than batts — in our market, it's about $.60 per square foot of wall area, compared to $.42 for fiberglass, or an additional $250 or so for

Figure 1. The same cellulose material is used for both wall-spray and loose-fill applications. A typical whole-house wall-spray application requires 60-120 bags.

Figure 2. A high-pressure water nozzle moistens both the surface to be sprayed and the insulation as it is blown from the hose. The water flow is adjustable by the operator, who must supply enough moisture to get the insulation to adhere properly but not so much that excess moisture leads to nail pops and other problems. Freshly applied spray cellulose should contain between 30% and 40% moisture by weight.

a typical 2,000-square-foot house — but the gain in energy efficiency and overall comfort makes the investment well worth it.

Cellulose Basics

Cellulose fiber is produced from paper, which in turn is derived from wood. However the insulation is installed — blown into the attic or damp-sprayed into wall cavities — the material is the same. It comes packed in bags that weigh from 25 to 35 pounds apiece (see Figure 1). By weight, about 82% to 85% of the material is cellulose fiber — most of which is reprocessed from old newspaper — with the remainder consisting of chemical fire retardant. The fire retardants are added in the form of a dry powder. The borate chemicals used — often in combination with ammonium sulfate — also add mold, insect, and rodent resistance. We often use an all-borate insulation called Incide (Hamilton Manufacturing, 901 Russet St., Twin Falls, ID 83301; 208/733-9689; www.hmi-mfg.com) that is designed to prevent infestation by termites and other insects throughout the life of the structure.

Cellulose and fire. Although pure cellulose is flammable, the added fire retardants make cellulose insulation a safe material. The cellulose manufacturing industry adheres to strict standards set by the ASTM and Consumer Products Safety Commission, and at least three of the ten material attributes considered by the ASTM (thermal resistance, surface burning characteristics, adhesive and cohesive strength, smoldering combustion, fungi resistance, corrosiveness, moisture vapor absorption, odor, and flame resistance permanency) relate directly to fire safety.

Test data consistently show that the fire resistance of cellulose is as good as or better than that of most insulating materials. According to Canada's National Research Council, for example, cellulose-insulated walls are from 22% to 55% more fire resistant than uninsulated walls. Walls insulated with fiberglass were found to be slightly less fire resistant than uninsulated walls.

My own experience has led me to the conclusion that cellulose insulation simply does not burn, partly because of the added fire retardants but also because cellulose contains few voids, excluding the air necessary for combustion. Not long ago a plumber working in a house that we had recently insulated got careless with a torch and set fire to a stud. The stud and adjacent insulation smoldered all night and filled the crawlspace with smoke, but the fire never spread. I've also inspected hundreds of attics insulated by others in which cellulose was carelessly blown against B-vent chimneys, on top of metal fireplaces, and against recessed cans and other hot

Figure 3. A 24-foot box truck holds up to 200 bags of insulation, as well as the blower, water supply, and other equipment. We try to get as close to the job as possible, but our equipment is powerful enough to push material up to 250 feet if necessary.

points, and although I've occasionally seen slight charring, I've never seen evidence of fire. (I've also seen charring of the kraft facing of improperly placed fiberglass batts.) It goes without saying that such practices should be avoided, but it's reassuring to know that even under such worst-case conditions, the material won't burn.

Why Damp Spray?

In a blown cellulose installation, the material is simply blown into place in a loose, unconsolidated state. This is commonly done in attics, where the cellulose is supported by the ceiling beneath. Loose-fill cellulose can also be blown into enclosed walls in remodeling applications — an application known as dense-pack cellulose — although it can be tricky to do that without leaving hidden voids.

Damp spray, on the other hand, is self-sticking, so it can be placed in open wall cavities that are backed by sheathing or spray mesh.

Blown and damp-spray cellulose use the same basic equipment — typically, a truck-mounted insulation-blowing machine that delivers the material through a 2 1/2-inch hose — but with one important difference: The nozzle of a damp-spray hose contains a separate water nozzle that mixes the cellulose with a fine water spray as it emerges (Figure 2). The water, which is delivered at 200-300 psi, comes from a truck-mounted tank through a hose like that used on pressure washers. The 200-gallon tanks on our trucks contain enough water to complete a typical house.

Fiber and water. When the spray nozzle is properly adjusted, it delivers a fine spray that simultaneously moistens the studs and sheathing as well as the insulation itself. The moistened fibers then adhere strongly to both the substrate and one another.

This bond gets even stronger as it dries, which makes correctly installed spray cellulose very resistant to settling. At the recommended density of 3 pounds per cubic foot, it's reliably self-supporting. (For comparison, loose-fill attic insulation is typically installed at about 1.6 pounds per cubic foot.) Some cellulose manufacturers regularly test their products in a machine that vibrates an 8-foot-tall wall cavity for 24 hours to simulate 20 years of normal vibration. For a product to meet the standard, no more than a quarter-inch gap can appear at the top of the cavity.

Some damp-spray cellulose used in commercial construction — for coating gym ceilings, for example, where the insulation will be left exposed — contains adhesives that provide an even stronger bond. A similar technique

Figure 4. As protection from overspray, windows are covered with poly (left), and electrical boxes are taped over (above).

Figure 5. "Smiles" are horizontal gaps that result from poor technique when spraying below window sills, plates, or blocking. To correct the problem, the worker is compressing the insulation by hand before re-spraying the affected area.

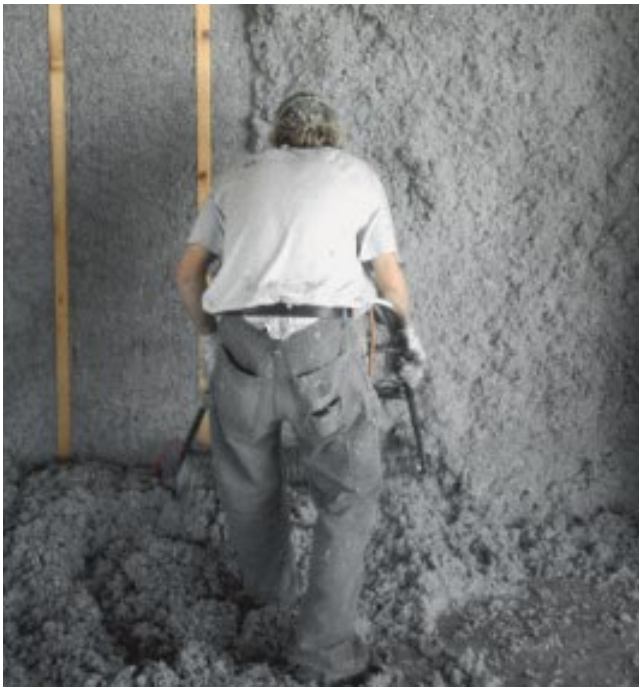


Figure 6. The area at left in this photo has already been scrubbed, leaving the faces of the studs flush with the surface of the cellulose. The scrubbed-off material accumulating on the floor will later be collected, combined with fresh material, and reapplied elsewhere.

is used for blowing insulation against the masonry walls of unvented crawlspaces. But this is overkill in residential wall cavities and complicates cleanup, so we don't use added adhesives there.

Spraying and Cleanup

When we arrive on a job site, we park our 24-foot box truck in a convenient spot and run a power cord, water hose, cellulose hose, and vacuum hose into the house (Figure 3, previous page). The truck has its own generator and water tank, so we're not dependent on the job for power or water.

A wall-spray job begins by prepping the house. The combination of moisture and cellulose can leave quite a mess, so all windows and electrical outlets are covered with polyethylene and electrical boxes are protected with tape (Figure 4, previous page).

Add water. The key to a good spray job is achieving a proper blend of air, fiber, and water. We've seen and heard about installations in which the product was sprayed so wet that the water literally started to seep out of the bottom of the cavity just as it would from a saturated sponge. That is unacceptable. Normally, the liquid-to-fiber ratio should be .3 to .4 pounds of water per pound of fiber, or about a gallon of water per bag of insulation. In simple terms, this means that the applied material should be damp but not wet. A basic test we often use is to grab a handful of wall-spray cellulose right after it is sprayed and squeeze it. If any water can be squeezed out, the mix is too wet.

Scrubbing and scraping. The spraying itself goes pretty quickly. It takes about 30 to 45 seconds to fill an 8-foot wall cavity, and a three- or four-person crew can spray a 3,000- to 4,000-square-foot house in a day. Spraying well takes some experience. If you spray at too oblique an angle or don't get close enough, gaps may appear between the cellulose and the framing. This happens most often in the last three to five inches below a plate or sill, resulting in a horizontal defect we call a "smile" (Figure 5).

When a cavity is sprayed, it is filled past the face of the studs. This fills the cavity completely but also creates another step. We use a tool called a scrubber — a rotating brush that rides on the face of the studs — to cut or shave the cellulose flush with the face of the studs (Figure 6). Our usual crew consists of one worker to spray, one or two to move material and keep the hopper filled, and one to run the scrubber and keep the job clean.

The scrubber works well on open expanses of wall, but it can't get all the way into inside corners, so there's always some hand work as well. To clean out corners and other obstructed areas, we use a wide-bladed paint scraper with a threaded socket on the handle. This accepts an extension handle like those used with paint rollers, making it possible to reach the angle between

wall and ceiling (Figure 7). To allow the blade to slide easily over the framing rather than digging in, we often cover the metal edge with a strip of duct tape.

The excess cellulose comes off readily while it's still damp, but if it's left for the drywallers to deal with, it dries to something like paper-mâché. That makes their job much more difficult, so we make a point of cleaning up thoroughly as we go.

Drying time. Unless the cellulose is installed too wet, there's no need to worry about nail pops or other drywall problems. In our climate, we find that insulated walls can be closed in within 24 hours of spraying. This seems to hold true for us even during the occasional spell of damp rainy weather. The residual moisture will migrate out through the wall through vapor diffusion, and the cavity will dry completely over the next month or two. The borate content of the cellulose prevents any mold growth during that time.

Figure 7. Damp, freshly sprayed cellulose comes off easily, but the material sticks firmly when dry. Corners and other areas too tight for the scrubber to handle are cleaned with a paint scraper fitted with a pole extension.

Filling in With Fiberglass

Cellulose is difficult to use in some areas. Kneewall framing, for example, is often left open on the back side, leaving nothing to spray against. In such cases, we resort to carefully fitted kraft-faced fiberglass. We also make limited use of batts around rim joists, blocking, and some difficult-to-spray corners.

This approach might upset cellulose purists, but it's a necessary compromise in our competitive marketplace. In our market, many customers are unwilling to bear the cost of installing the mesh or rigid-foam backing needed to make spraying possible in that situation. Even though sprayed kneewalls are thermally superior, we'd rather see a customer invest in airtight ductwork and a duct blaster test instead if there's no room in the budget for both.

Air and vapor barriers. Except in kneewall areas, where the batt facing provides a localized vapor barrier, we don't use a vapor retarder or additional air barrier. We feel that spray cellulose contains so few voids that there's little convective movement to allow moisture-laden air into the wall. The combination of an outer layer of housewrap and sheathing and an inner layer of drywall is enough to control air penetration.

Interior Partitions

Where interior soundproofing is called for, we often spray interior partitions as well. Many of the general contractors we work with tell us that cellulose performs much better than fiberglass batts in this application. In addition to being three times as dense as the batts, spray cellulose leaves fewer voids, which helps resist sound transmission at electric boxes and other small openings (Figure 8).

Figure 8. Spray cellulose is ideal for sound insulation in partition walls containing plumbing and wiring, because it contains few voids and seals small openings that allow sound to pass from room to room.

Figure 9. The low-tech method of dealing with excess cellulose is to collect it in clean garbage cans (top) and hand carry it to the hopper (center), where it's mixed with virgin material for reuse (bottom). Newer equipment includes a vacuum system that eliminates most hand work. Either way, it's important to start with a clean, well-swept floor to keep sawdust and other debris from contaminating the insulation.

Mesh and drywall. Many of our customers install drywall on one side of interior walls to provide backing for us to spray against, and we've never had any problems with excess moisture soaking the drywall. That approach does require the drywall sub to make an extra trip to the job site, though. If that's too much trouble, we can staple spray mesh to the studs instead. The key to using spray mesh — which is actually not a mesh but a porous, nonwoven material something like the filter fabric used in footing drains — is to get the material taut, so it won't belly out beyond the studs and complicate life for the drywall crew.

Recycling

The excess material that the scrubber shaves off the wall is referred to as "recycle." The traditional method of dealing with it is to shovel it into clean garbage cans and dump it back into the hopper on the truck (Figure 9). This works well, although it can be a lot of work if the truck is some distance from the house; if that's the case, we'll often assign a fourth member to the crew.

The easy way — which we're able to use with the newer of our two truck-mounted spray rigs — is to suck up the recycle with a powerful vacuum hose that sends it back to a dedicated recycle hopper. This predampened cellulose is automatically blended with the virgin material in a separate dry hopper. In addition to saving a lot of labor, this makes it easier to maintain a consistent moisture content, which improves quality control and keeps dust down. The only disadvantage is higher cost: Not counting the trucks, our older rig, without the vacuum system, cost us about $18,000, while the newer one set us back $40,000. That's a big investment, but we — and our customers — are convinced that the results are worth it.

Michael Uniacke *is principal owner of Advanced Insulation Incorporated in Prescott, Ariz.*