

BY LEROY ANTHONY

Insulating any building can be a challenge, but the nonprofit energy-efficiency and weatherization company I work for, Community Environmental Center, frequently insulates old houses being rebuilt for residential group homes and elderly housing in New York City. These skilled-care buildings, like the one shown in these photos, are crammed with pipes, ducts, and wires, so they're tough to insulate. They're also located in dense urban neighborhoods that can be busy and loud.

For all these reasons, we use damp-spray cellulose insulation in the majority of our open-wall insulating projects. Damp-spray cellulose fills cavities without voids, and it covers pipes and wires without gaps, creating a house that according to the Cellulose Insulation Manufacturers Association is 30% to 40% more effective at stopping air infiltration than a similar house insulated with fiberglass batts installed in the typical manner. The density and air-sealing qualities of damp-spray cellulose also create an effective sound barrier (STC44) that makes these buildings far quieter inside than their surroundings would lead you to expect.

Treated with borates, cellulose is fire resistant and unattractive to vermin. We often demonstrate its fire resistance to skeptical clients by using a propane torch to heat a penny on a small pile of cellulose insulation. Ultimately, the penny melts, but the cellulose fibers turn black without burning. Cellulose also has low embodied energy and installs quickly. We can spray a 3000- to 4000-sq.-ft. house in one day with a three-person crew. Depending on the building's complexity, that can cost from \$2.50 to \$3.50 per sq. ft. of living space.

Given its attributes, the Natural Resources Defense Council has called cellulose insulation made from recycled paper "the least polluting and most energy efficient" insulation in use today. Unfortunately, damp spray can't be



Insulating With Damp-Spray Cellulose

It's cheaper than spray foam, air-seals better than fiberglass, and has more recycled content than both of them

Insulation comparison

Damp-spray cellulose

- R-value: 3.8 per in.
- Cost per sq. ft. of wall (filling a 2x4 cavity to R-13): 58¢ to \$1.80



Fiberglass batts

- R-value: 3.2 to 3.8 per in.
- Cost per sq. ft. of wall (filling a 2x4 cavity to R-13): 49¢ to \$1



Open-cell spray foam

- R-value: 2.6 to 3.5 per in.
- Cost per sq. ft. of wall (filling a 2x4 cavity to R-13): \$1 to \$1.20

Closed-cell spray foam

- R-value: 6.5 per in.
- Cost per sq. ft. of wall (filling a 2x4 cavity to R-13): \$1.75 to \$3



Penny wane.
A propane torch will melt a penny but won't burn cellulose insulation.

Installing damp spray



Cover outlets and windows. Damp cellulose sticks to everything it touches, so electrical outlets, ducts, and windows should be covered with plastic sheeting and painter's tape. Because of the particles, workers wear booted coveralls and N90 particle masks. The spray crew wears HEPA respirators and air monitors.

A crew of three is best. The installer is responsible for mixing in the right amount of water and filling the cavities so that there are no voids or gaps. A second worker runs the scrubber to level the slightly overfilled cavities so that the dampened cellulose doesn't project beyond the framing. A third worker vacuums the excess insulation for reuse.

Scrub it flat. The scrubber's rotating brush quickly cleans away the excess cellulose. This specialty tool is available in lengths from 18 in. to 27 in., in battery-powered and electric versions. The author prefers a 2-ft.-long electric model.

Suck it up. Spraying and scrubbing leave piles of insulation on the floor, but the dampened cellulose isn't wasted. Instead, it's vacuumed up, mixed with dry cellulose at the blowing machine, and then resprayed.

10 THINGS YOU NEED TO KNOW ABOUT CELLULOSE INSULATION

1. A 4000-sq.-ft. house requires about 260 bags of cellulose.
2. The space to be insulated must be broom clean before spraying to prevent damaging the recovery equipment.
3. A ratio of 25% water to 75% dry cellulose by weight is best.
4. Test moisture content by squeezing a handful of damp insulation. If water squeezes out, the cellulose is too wet.
5. The nozzle should be held about 1 ft. away and at a 15° angle for spraying.
6. The cellulose should be sprayed over the studs so that it slightly overfills the cavity.
7. The installer may use his hand to keep the insulation in place while he fills the stud cavity.
8. The scrubber is most effective when it's moved from the top down.
9. A whisk broom can level the insulation in places where a scrubber can't reach.
10. Wait 24 hours for the cellulose to dry, then close up the walls.

installed overhead (in cathedral ceilings, for example), so for these areas, we use a different approach.

A low-tech operation

Compared to spray foam, installing damp-spray cellulose is a comparatively low-tech operation. Basically, cellulose (recycled newspaper) runs through a flexible hose under air pressure and mixes with high-pressure water added at the blowing nozzle. The water dampens the insulation as it is blown and moistens the sides of the cavity for good adhesion. Through hundreds of jobs, we've found that 25% moisture to 75% dry cellulose (by weight) is the ideal ratio. Remember: This is damp spray, not wet spray.

We use Green Seal All-Borate Loose Fill cellulose that we buy from FiberAmerica (FiberAmerica.us). This product has 85% recycled content—considerably more than fiberglass (0% to 35%) or foam (0%). We move the insulation and damp-spray equipment to the job in a 16-ft. box truck. When we get there, we connect to a water supply for the sprayer at the blowing nozzle.

We use two portable Krendl insulation machines (KrendlMachine.com) to apply insulation: Model 2300 handles the dry cellulose, and Model VH550, which we call the recovery machine, handles the dampened cellulose. The machines combine dry and reclaimed damp cellulose to maintain the proper moisture level. We attach a flexible hose at least 150 ft. long to each machine. One hose brings the cellulose into the building, and the other vacuums up the excess and sends it to the recovery machine for reuse.

The work makes a mess and sends a lot of dust into the air, so even though cellulose has no toxic properties and the EPA defines cellulose particles as “nuisance dust,” our crew members wear particle respirators and Tyvek suits. With the windows open, the dust usually clears within 30 minutes.

Prep starts the installation

After the equipment is ready to go, the first thing my crew and I do is make sure surfaces and corners are broom clean so that our recovery machine doesn't suck up nails or debris that could damage the impeller. Then we tape over electric outlets and any other openings we don't want cellulose to get into. I have found that it's good to start by blowing some insulation in a clean corner, then vacuuming it up with the recovery machine.

Do I really want wet newspaper in my walls?



BY BILL HULSTRUNK

Many contractors are skeptical about damp-spray cellulose insulation because it can conjure thoughts of moldy newspapers in an unattended recycling bin. The damp-spray cellulose used in walls, though, is protected from mold as it dries by borate-based fire retardants. Our company recommends hanging drywall 24 hours after cellulose application. The longer you wait before covering the cellulose, the more ambient moisture ends up in the cellulose due to its hygroscopic properties. The only moisture issues our company has seen have occurred when cellulose was left uncov-

ered for about a month in projects with high indoor humidity, resulting in cellulose moisture levels much higher than when it was sprayed.

Gauging the moisture levels of spray-applied cellulose in the field is straightforward. If the cellulose has a mottled appearance after scrubbing, with some dark areas and some light areas, the material has the proper moisture content. If the material is consistently dark after scrubbing, it is wetter than it should be, and this additional water weight will likely cause the material to sag, leaving gaps at the top of the stud bays.

These gaps not only affect insulation performance, but also can create cold spots where moisture can condense. If one or more stud bays show signs of sagging, you should have your insulation contractor remove the cellulose and respray it with less water.

You might be tempted to check cellulose with a moisture meter, but most moisture meters measure high-density materials such as lumber or drywall. They're generally not accurate for insulation, which is a low-density material.

Bill Hulstrunk is technical manager at National Fiber in Belchertown, Mass.

This primes the equipment so that we start with an appropriately damp mixture.

Once the preparations are made, we begin the installation. One crew member handles the insulation hose. Another follows behind, using a “scrubber” outfitted with a row of fast-turning brushes that scrape away excess cellulose; that crew member also makes sure that the stud profile is even. A third worker vacuums up the excess cellulose that ends up on the floor. Although we usually work in three-person crews, a fourth person can tend the machines, add cellulose as needed, and make adjustments to the mix.

I have found that the best technique is to hold the hose nozzle about a foot or less away from the wall, facing down at about a 15° angle. I start at the bottom of the cavity and then move up. If the spraying angle is too severe, voids develop that diminish the wall's energy efficiency.

I fill the cavities past the studs, and another crew member follows with the scrubber.

This tool is available in electric and battery-powered models in several lengths for different wall heights. I like the electric 2-ft. version. The person operating the scrubber generally starts at the top of the wall and works down, creating a flat surface that is flush with the studs.

After the scrubber has evened out the cellulose, it's a good idea to pat the cellulose with your hands gently to make sure that it is packed firmly within the wall cavity. After spraying, wait 24 hours for the cellulose to dry before installing drywall. If the cellulose was installed correctly, any electrician, plumber, or HVAC tech at any point in the life of the building should be able to remove the cellulose and then put it back after dampening it with a little water. □

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