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Green Thumb
Paper Chase (Part 2)

By J.M. Syken

Last month, in Part 1, we took a look at some of the pros and cons of cellulose insulation. This month, we'll conclude the discussion with an in-depth look at the manufacturing and installation processes, the various types of cellulose insulation and its energy efficiency. Also, we'll examine the contributions of industry pioneer Nu-Wool Inc.

Manufacture

Essentially, for standard cellulose insulation production, there are two stages of production. The first stage requires the recycled newspaper to be chopped into pieces varying in size from 1 inch to several inches in diameter. Depending upon the manufacturer, the second or finish mill stage requires the chopped newspaper to be beaten or shredded to a much smaller size, whereby it can be filtered through a screen. The oldest method, known as "hammer-mill," beats the chopped newspaper in a chamber via a rotating shaft. Another method is the disk refiner. Here, the chopped newspaper from stage one is shredded as it falls between two rotating plates. In general, cellulose insulation made from either process is generically known as "hammer-mill cellulose." A more modern and desirable method of manufacturing cellulose insulation is known as fiberization. High-pressure air blows apart the paper particles into individual fibers, creating a fluffy, low-density cellulose that has many advantages over hammer-mill cellulose. The process "disaggregates" the newspaper back into its original cellulose fiber state.

Upon the completion of the shredding process, chemicals such as boric acid, sodium borate (borax) and ammonium sulfate, are added to the cellulose to provide a fire-retarder and mold, insect and rodent resistance to the cellulose. Nowadays, a mixture of borates and ammonium sulfate with small quantities of phosphate is most common as a chemical admixture. The worldwide supply of boron is limited to just two mines: one in California's Mojave Desert and the other in Turkey (the U.S. mine accounts for 50 percent of the supply and will only last another 30 years, more or less, at the current rate of extraction). Once the chemicals and dry-binders are added to the cellulose, it is packaged and transported to suppliers and distributors. It

is recommended that cellulose manufactured with borax and boric acid, by themselves or in combination with ammonium sulfate, not ammonium sulfate alone, be used. If using cellulose with ammonium sulfate, be sure it is of a commercial—not agricultural—grade.

Installation/types

Cellulose insulation is used in exterior walls and ceilings as a thermal insulation. For attic spaces, a loose-fill installation is used whereby the cellulose insulation is blown or poured into the attic space providing about 3.7 R per inch. To reduce the possibility of settling, whereby the installed thickness of loose-fill cellulose can be reduced by up to 25 percent thus reducing the R-value, a binder is used. Inclusion of a binder with loose-fill cellulose creates what is termed as stabilized cellulose. Since stabilized cellulose insulation also reduces shifting in the attic space, it is the best choice for attic installations. Care should be taken to avoid causing a gypsum board ceiling secured to the underside of ceiling joists/trusses to sag. Cellulose loose-fill insulation greater than 12 inches thick can cause the gypsum board panels to sag from the weight of the cellulose. Extra layers of gypsum board applied to the ceiling and/or a reduction in ceiling joist/truss spacing may be required.

As a retrofit measure, cellulose insulation can be dry-blown into exterior walls via holes drilled through the exterior sheathing. One drawback to this process is the likely existence of “cats” between the studs (which act as bracing) thus preventing the cellulose to fill the cavity between studs completely. This undermines the integrity of the installation. Most common for wall installations is the wet-spray application. On a dry-weight basis (weight of water divided by the weight of dry cellulose), about 4 gallons of water is to be added to each 30-pound bag of cellulose for a dry-weight moisture content of about 100 percent (binders may be included).

As discussed in Part 1, dry-out for cellulose insulation is a major concern for its use, therefore it is recommended that cellulose, with 50 percent maximum moisture content (dry-weight basis), be used and proper dry-out procedures followed. Fiberized cellulose insulation can achieve a dry-weight moisture content as low as 28 percent, produces less dust during installation, attains higher R-values and provides more coverage than hammer-mill cellulose. For these reasons, fiberized cellulose is preferred for all wet-spray applications.

Another installation for walls that requires no water (and therefore none of the problems encountered with wet-spray applications) is known as the dense-pack process. Installed at high densities (3 to 3 1⁄2 pounds per CF), it is blown into closed wall cavities. For open wall cavities, forms are used to blow in the dry cellulose.

Energy efficiency

As compared to fiberglass, cellulose insulation has some important advantages. Nu-Wool has been offering a three-year energy savings guarantee since 1987 for attic and wall applications in residential and commercial structures. Savings of up to 40 percent on heating and cooling bills can be realized by use of their products. One of the ways cellulose insulation achieves these savings is by blocking the voids and air pockets that can occur in other types of insulation, effectively eliminating air convection within the insulation itself. Though settling is less of a problem with fiberglass batt insulation, and high-density

fiberglass can achieve higher R-values than cellulose, loose-fill fiberglass can lose R-value in very cold climates (up to 50 percent R-value) by air convection through it. Fiberglass insulation's R-value increases with density (plus or minus R-4 per inch), cellulose does not. As compared to standard fiberglass insulation, cellulose insulation achieves higher R-values. The company likes to point out the resistance to mold growth and the significant reduction in wall and floor noise transmission inherent in its line of cellulose insulation products:

• Wallseal: spray-in-place for wall cavity insulation

• Energy Care DIY: spray-in-place for attic spaces

• Incide Pest Control: odorless, lasts for the life-cycle of building, EPA certified

Another benefit inherent in wet-spray applied cellulose is its ability to seal around wires and pipes and its ability to act as an air-barrier, often eliminating the need for a polyethylene vapor-barrier. University tests for an insulation's ability to increase a building's air-tightness showed that cellulose insulation increased air-tightness by 74 percent, fiberglass increased it by 41 percent, that makes cellulose 33 percent more effective. Though these were short-term tests, the cellulose-insulated building realized a 26 percent favorable differential in energy use for heating, as compared to the fiberglass-insulated building.

Nu-Wool and Cellulose Insulation Manufacturers Association have conducted tests in accordance with ASTM standards to show how effective cellulose insulation is as a fire-blocking material. Dry- and moist-applied cellulose insulation was tested against standard wood blocking—the cellulose outperformed the lumber by generating lower temperatures. Formal recognition of the results of these tests are pending. Nu-Wool products have the EPA's Five Star Energy Program label and the products are made from 100-percent recycled fibers. Since the company began operations in 1949, 515 million pounds of paper has been recycled. In 2002 alone, 18,000 homes in 14 states had Nu-Wool's cellulose products installed. Each business day 150 tons of recycled paper is used in the company's manufacturing process. This is the equivalent of saving 2,550 trees each and every day. Not only are our forest resources being preserved in this process, so too are our landfills saved from being overburdened with used newspapers—a major environmental benefit.

The company is proud of the very real environmental benefits of cellulose insulation. Global warming is reduced since atmospheric emissions are considerably less as compared to the fiberglass insulation manufacturing process. On a Btus-per-R basis, fiberglass requires 40 times more energy to produce. Somewhere between 150 to 750 Btus per pound are required to produce cellulose insulation. The gas-fired furnaces needed to melt sand and glass result in an energy usage of about 8,500 Btus-per-pound. This is a significant difference in embodied energy for both insulation products (EE being one of the most important yardsticks by which a product is environmentally rated).

Based in Michigan, Nu-Wool has been family owned and operated since its inception. It offers technical support in the form of load calculations and AIA training (for CEU credits) to their customer base of architects, owners and contractors. Recently, the company licensed National Fiber to manufacture Nu-Wool for the east coast market.

Currently, the company has direct distribution to 15 Midwestern states.

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