INSULATION FACTS #35

NAIMA
North American Insulation Manufacturers Association

Comparing Fiber Glass and Cellulose Insulation

Compare Today Insulate and Save Tomorrow

Introduction

Whether your pocketbook or the planet is your chief concern, energy efficiency can add up to a lot of savings.

Reducing energy demand reduces the amount of fossil fuel combustion needed to heat and cool homes, which in turn decreases the amount of carbon dioxide emitted into the atmosphere. In terms of your pocketbook, reducing your energy consumption means lower utility bills.

While there are many things you can do to increase your home's energy efficiency, one of the most inexpensive and effective ways is to install additional insulation.

Before Choosing Your Insulation

Things to consider when choosing an insulation product include ease of application, thermal performance, and value.

Importantly, you should also consider the overall lifetime performance of an insulation product as well as its related safety aspects prior to purchase and installation.

A Side-by-Side Comparison

One way to compare insulation products is to do a side-by-side comparison. Here we compare the two most common types of insulation: fiber glass and cellulose. The following comparison reveals important differences between the two products which you should consider before making a final decision.

	Thermal Resistance		Air Infiltration
	Water Vapor Sorption		Resistance to Corrosion
	Convection		Use of Recycled Materials
	Impact of Weight		Sound Control
	Fire Safety		Safety
	Settling & Loss of R-Value		

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THERMAL RESISTANCE R-VALUE

The thermal resistance of insulation is designated by R-value. R-value is resistance to heat flow - the higher the R-value, the greater the insulating power. Thickness of insulation is only one factor that determines its R-value. To ensure that consumers are provided with accurate information regarding R-values, the Federal Trade Commission (FTC) has established a rule which mandates that specific R-value information for home insulation products be disclosed in ads and at the point of sale.[1] The purpose of the FTC R-value disclosure requirement for advertising is to prevent consumers from being misled by certain claims which have a bearing on insulating value. When insulating a home, it is important that the homeowner gets the R-value specified and that the thermal performance lasts over time. In comparing the insulating properties of fiber glass versus cellulose insulation, the important thing for consumers to compare is not the R-value per inch of the products but the R-value provided by the products for the space to be insulated.

Fiber Glass Insulation

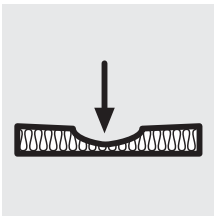
The ability of fiber glass insulation to provide the desired R-value for a given space equals or exceeds the ability of cellulose insulation. Fiber glass insulation is offered in different densities, which allows you to achieve different R-values for a given space.

Cellulose Insulation

Cellulose insulation manufacturers promote their products as having "higher R-value per inch." This is simply not true given the range of fiber glass products available. Moreover, the R-value Rule specifically states "do not give the R-value for one inch or the 'R-value per inch' of your product"[2] because representing a product's R-value per inch is "clearly leading consumers to believe that insulation R-values are linear."[3]

SETTLING AND LOSS OF R-VALUE

Settling is important in insulation product selection because it directly relates to the installed thermal performance over time.



Fiber Glass Insulation

Properly installed fiber glass batts and rolls do not settle. Fiber glass loose-fill insulation will experience negligible settling (less than 2%)[4] over time. When manufacturers' installation procedures are employed, fiber glass insulation maintains its thermal performance for the life of the building.

Cellulose Insulation

Cellulose manufacturers agree that their products settle over time.[5] Most set the settling rate at about 20%.[6] Therefore, always consult the "minimum settled thickness" and the "initial installed thickness" listed on the cellulose manufacturer's coverage chart, which is required by the FTC, to ensure future settling is accounted for. [7]

WATER VAPOR SORPTION

In general, insulation will lose R-value when wet. However, there are important differences in the water vapor sorption properties of the two insulations which can impact their installed performance.

Fiber Glass Insulation

Insulation made of fiber glass is not absorbent. Under normal conditions, all insulation is exposed to humidity in the air. Fiber glass will not wick up and hold water, thus it resists permanent loss of R-value. Because it is inorganic, it is naturally fire resistant. If fiber glass insulation becomes saturated as the result of flooding or other catastrophic events, the manufacturer of the product should be consulted to determine whether the product should be replaced.

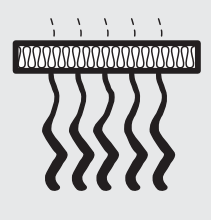
Cellulose Insulation

Cellulose insulation is made of shredded newspaper with an added fire retardant. Two relevant properties of shredded newspaper are as follows: (1) without special treatment it will burn; and (2) it naturally absorbs moisture from the air. This can result in the cellulose insulation losing its added fire retardancy as it ages.[8] Cellulose insulation that is saturated because of a flood or other catastrophic event can lose its fire retardants, and even if it can be dried, it should not be reused without consulting the product's manufacturer.

In addition, studies conducted in Canada, New England, and Ohio demonstrated that wet-spray applications of cellulose insulation do not achieve their advertised R-value until dry and may take as long as two months to dry.[9] In many cases, wet-spray applications may need to remain uncovered until completely dry.

NATURAL CONVECTION

Natural convection is a form of heat flow in which thermal gradients cause bulk air flow. When air is heated, it expands, becomes less dense, and moves in an upward direction. Generally, natural convection has no effect on insulation performance.



Fiber Glass Insulation

Properly installed fiber glass batts and rolls are not affected by natural convection. In addition, in cold climate conditions, all fiber glass insulations experience improved thermal performance as the temperature in an attic drops. However, some lighter density loose-fill fiber glass products are affected in limited applications such as those found in extremely cold weather environments. In those climates, denser loose-fill insulation designed for extreme temperatures should be installed.

Cellulose Insulation

Natural convection will not affect the thermal performance of properly installed cellulose insulation due to the way the fibers nest together.

THE IMPACT OF WEIGHT

When installing insulation above ceilings, homeowners should consider the weight of the insulation on the ceiling structure of the home. This is primarily an issue in cold climates where R-values of 38 and higher are commonplace.

Fiber Glass Insulation

Fiber glass insulation is extremely efficient and gives a higher insulating value per pound of insulation installed. Homeowners can install fiber glass insulation up to R-70 over ½ inch ceiling drywall with framing spaced 24 inches on centers without causing drywall to sag.

Cellulose Insulation

Based on U.S. Gypsum weight limit recommendations for back loaded standard drywall[10] and the installed density of shredded newspaper insulations, cellulose insulation may cause ceiling drywall to sag at high R-values when installed over ½ inch ceiling drywall with framing spaced 24 inches on centers.

FIRE SAFETY

Fire resistance is an important attribute of any insulation material. It is in a homeowner's best interest to consider the flame-resistance properties of the insulation in his or her home. In terms of fire safety, fiber glass and cellulose perform quite differently.

Fiber Glass Insulation

Fiber glass insulation is made from sand and other inorganic materials which are melted and then spun into glass fibers. Fiber glass is naturally noncombustible and remains so for the life of the product. It requires no additional fire-retardant chemical treatments. Unfaced fiber glass insulation is recognized by building code groups as an acceptable fire stop in residential wood frame walls.

Kraft and some foil facings available on fiber glass insulation are themselves combustible. Products with combustible facings should not be left exposed. When properly installed, in substantial contact with a code approved thermal barrier, these products do not pose a fire hazard.

Cellulose Insulation

Cellulose insulation is made of ground-up or shredded newspaper which is naturally combustible. In fact, cellulose insulation is regulated as a recognized fire hazard by the Consumer Product Safety Commission (CPSC).[11]

To protect against fire hazards, cellulose insulation is heavily treated with fire-retardant chemicals prior to installation. These fire-retardant chemicals can leach out of the cellulose insulation over time.[12] Tests conducted by the California Bureau of Home Furnishings and Thermal Insulation have demonstrated that some cellulose samples failed the standard fire safety test only six months after installation.[13] Additionally, smoldering combustion and re-ignition problems are concerns with cellulose insulation should a fire start.[14] Even properly treated cellulose insulations will burn at about 450°F, the surface temperature of a 75 watt light bulb.[15]

RESISTANCE TO CORROSION

Products that may cause corrosion problems in a home should be avoided.

Fiber Glass Insulation

Fiber glass insulation is not corrosive and contains no chemicals that can corrode pipes and wires.[16]

Cellulose Insulation

Certain chemicals routinely applied as a fire retardant to most cellulose insulation (particularly the sulfates) can cause the corrosion of pipes, wires, and fasteners under some conditions.[17]

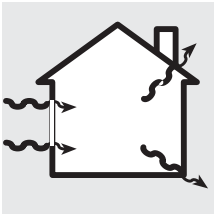
AIR LEAKAGE

Air infiltration and exfiltration are the uncontrolled leakage of air into and out of a home. It is driven by wind, temperature differences, or HVAC equipment-induced pressures.

If a wall cavity has been properly closed off using drywall, sheathing, and caulking, very little air will flow through it regardless of the type of insulation used. Openings for wiring runs, light switches, and electrical outlets where air infiltration can occur can be sealed with foam sealants, caulking, or foam gaskets. To control air leakage in a home, a house-wrap or other air infiltration control strategies should be considered to limit air infiltration through cracks and joints.

While some debate which insulation products are better at reducing air infiltration, research shows that air infiltration is dependent on the sealant package, and not the insulation type installed in the wall cavity.

A 1997 study conducted by the National Association of Home Builders (NAHB) Research Center for the U.S. Environmental Protection Agency's Energy Star Homes Program[18] could find no relationship between the type of insulation used and the amount of air infiltration. The study determined that the individual air sealing practices of the insulators had a larger impact on air leakage than the insulation products themselves. These findings were confirmed by a 1997 study conducted by a researcher at Penn State University[19] and a 1996 study by a St. Louis, Missouri utility company.[20]



Fiber Glass Insulation

Minimizing air leakage is dependent on the sealant package and has very little to do with the insulation.[18, 19, 20] The purpose of insulation is to provide thermal performance.

Cellulose Insulation

Despite claims that wet-spray cellulose eliminates air leakage, the research shows that what is in the cavity of the wall or attic – fiber glass or cellulose – has little, if any, effect on air infiltration.[18, 19, 20]

SOUND CONTROL

In general, the density of the insulation material in a sidewall assembly has little, if any, effect on the Sound Transmission Class (STC) rating of the assembly. STC ratings are a measure of the effectiveness of a given partition construction in reducing airborne sound transmission.

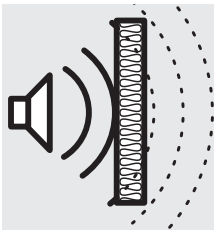
Insulation thickness, however, has a more significant effect on STC ratings than does density. In comparison testing, representative 2 x 4 and 2 x 6 wood stud and metal stud walls demonstrated equivalent or slightly better performance for fiber glass over cellulose when the cavities were completely filled.[21]

Fiber Glass Insulation

Fiber glass insulation significantly reduces sound transmission in wall, ceiling, and floor assemblies. The first inch of fiber glass insulation can increase the STC value by 3 or 4 points in some constructions. Each additional inch of fiber glass insulation increases the STC value from 1 to 2 points.

Cellulose Insulation

Cellulose insulation is also considered a good insulator against unwanted sound in wall and ceiling assemblies.



USE OF RECYCLED MATERIALS

Increased attention has been given to recycling and recycled products as concerns about our environment have heightened. Both fiber glass and cellulose manufacturers use significant amounts of recycled materials in the manufacture of their products.

Fiber Glass Insulation

Between 1992 and 2008, the fiber glass insulation industry recycled over 18 billion pounds of pre- and post-consumer glass containers, eliminating the need for millions of cubic feet of landfill space.

Many fiber glass insulation manufacturers have plants that use up to 40% or more recycled materials in their products. The current industry average is 30% recycled content. Manufacturers are currently exploring ways in which their use of recycled materials can be increased without compromising the performance of their insulation products.

Cellulose Insulation

Cellulose insulation is generally made up of about 80% recycled newspaper and 20% fire-retardant chemicals. Three times more cellulose material by weight than fiber glass is needed to insulate a typical home. An average 1,200 square foot attic insulated to R-38 with cellulose insulation would introduce 300 pounds of fire-retardant chemicals into the home.

SAFETY

The value of scientific research regarding the health aspects of insulation materials cannot be overstated in relation to the safety of workers and the public.

Fiber Glass Insulation

Fiber glass insulation is the most thoroughly tested insulation material in use today. The great amount of medical scientific evidence compiled over more than 70 years by industry, government, and independent research organizations supports the conclusion that fiber glass insulation is safe to use when manufacturers' recommended work practices are followed.

Cellulose Insulation

Questions about the health and safety aspects of cellulose insulation persist in the building industry because very little medical scientific testing of the products has been conducted. Repeated requests by union and contractor groups that such testing be undertaken have been ignored.[22] Full toxicological testing of dust from cellulose building insulation and indeed dust from pure cellulose fibers as well is needed.[23] Given the high levels of exposure to fibers and dust measured during cellulose installation, only after long-term experiments are available will the safety of cellulose insulation be known.

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ABOUT NAIMA

NAIMA is the association for North American manufacturers of fiber glass, rock wool, and slag wool insulation products. Its role is to promote energy efficiency and environmental preservation through the use of fiber glass, rock wool, and slag wool insulation, and to encourage the safe production and use of these materials.

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