



# Thermal Performance

## Product Specifications

*R-value means resistance to heat flow. The higher an insulation's R-value, the greater its resistance to heat loss or gain. GreenFiber's insulation products are tested per 16 CFR 460, the Federal Trade Commission (FTC) R-value Rule. The representative thickness is 4", which is the thickness used for testing the material thermal resistance. R-value for all insulations is dependent on the material's density. In the case of compressible thermal insulations, the density is further dependent on depth, since the upper layers will tend to compress the lower layers. Depending on the specific application type, product thickness and other parameters, the R-value (thermal resistance per inch of material) of GreenFiber's products will vary. Being a loose fill insulation type, GreenFiber's products fill voids and gaps, surrounding cavity obstructions to create a consistent and complete insulation mass in wall cavities, and thoroughly filled attic floor insulation application.*

GreenFiber Insulation may be used in walls and attics, and between floors of residential or commercial structures, as well as in cathedral or flat ceilings and framed basement walls above grade. It provides effective resistance to heat flow for thermal applications, noise control for acoustical treatments, plus fire resistance and fire blocking (under the Family of International Codes as published by the ICC, International Code Council. Refer to UL-ER 15890.) Non-standard or unusual wall configurations (i.e., other than 2x4 and 2x6 walls) can affect thermal and sound properties and require special installation considerations. These types of designs should be reviewed and, if necessary, tested prior to plan review. For non-standard walls, contact a GreenFiber technical service representative for assistance.

All GreenFiber Insulation sold in the United States must conform to CPSC standard 16 CFR Parts 460. In addition, GreenFiber Insulation meets all of the test requirements of ASTM C739 (US) and CAN/ULC-S703-09 in Canada. Per the R-value Rule, settling for compressible insulations must be taken into account in published coverage charts. The R-value of the settled thickness and density is used as the final R-value claimed in all GreenFiber coverage charts on every bag of insulation.

## Installation Benefits

GreenFiber Insulation completely fills gaps and voids around irregular objects such as wiring, plumbing and framing materials in attics and walls.

Our insulation plays a crucial role in the building enclosure system. It is critical that all thermal insulation be in full continuous contact with the pressure barrier so as to prevent thermal bypass. The air barrier is the pressure plane commonly made of drywall that separates the conditioned areas of the building from the unconditioned areas. GreenFiber Insulation adheres to these guidelines to produce an effective thermal boundary.

GreenFiber Insulation provides:

- No gaps from insulation covering too short or too narrow an area in a stud cavity.
- No voids in thermal boundary to allow unwanted heat gain during the summer and heat loss during the winter. Typical problem areas are knee walls, stairs on exterior walls, vaulted ceilings, tubs or tub and shower enclosures, and utility shafts.
- No compression due to insulation not being allowed to remain at its full thickness.

To check the quality of your installed thermal value in an attic application, verify the calculation of the amount of insulation that should be installed in the attic. Secondly, verify that the correct amount of insulation has been installed. There should be no obvious mounds of insulation or uninsulated areas above conditioned space. Many times, old attic insulation has been disturbed or even removed over time and this compressed or missing insulation needs to be accounted for in adding more insulation. The International Energy Conservation Code (IECC) requires insulation depth markers (attic rulers) be placed every 300 sq. ft. The insulation must be at a specified level indicated by the attic ruler and the surrounding material must be reasonably close to the same level. The Federal Trade Commission requires that installed insulation must have an R-value that is at least 90% of the manufacturer's claimed value.

The simplest way to meet the desired R-value is to fasten attic rulers to truss webs or other framing members every eight feet. Assuming trusses are used, a ruler should be fastened to every fourth 24" on center truss or every sixth 16" on center truss. The rulers should always face the attic access and be visible to code officials to verify the claimed insulation level. Keep in mind that it can be difficult in older attics to calculate how much insulation is needed when the



previous insulation has been disturbed. Install blown cellulose to the level of the installed thickness as measured by the rulers, and it will settle to the claimed thickness on the individual product's coverage chart.

## Reduced Air Leakage

GreenFiber Insulation demonstrates its ability to reduce air infiltration more effectively than light density (<1.0pcf) blown fiber glass when used in building components due to two product attributes:

- The high density provided by GreenFiber Insulation effectively blocks air infiltration.
- Completely fills cavities, eliminating voids and gaps, which are common with batt installations that can lead to convective heat loss.

Numerous university studies have favorably compared the performance of cellulose insulation to fiber glass. In 1990, the University of Colorado-Denver compared cellulose and fiber glass batt insulation in identical structures during the winter heating season. They found that the house insulated with cellulose insulation was 38% tighter and required 26% less energy.

Likewise, a Princeton University study at the Center for Energy and Environmental Studies measured the air leakage of common residential insulation in older uninsulated homes and in a laboratory setting. In their field tests, walls retrofitted with cellulose insulation, showed a reduction in air leakage of over 40%. The study further states, "Cellulose wall insulation retrofits may have a major potential impact on house ventilation and indoor air quality." In the lab tests on typical attic retrofit configurations, 6" of cellulose was blown over fiber glass batts and dropped air leakage by 33%. Leakage dropped 27% when cellulose was applied over fiber glass blowing wool.

## Decreased Convective Heat Loss

Convection is the transfer of heat by means of air current. Natural convection results as air warms, becomes less dense and rises. Cooler air replaces this air. Then this air warms and the process continues, thereby forming a convection current.

Studies by the U.S. Department of Energy's Office of Building Technologies at the Oak Ridge National Laboratory confirmed that natural convection occurs within loose-fill fiber glass. The fiber glass specimens tested "revealed that as the temperature differential increased, apparent conductive resistance (R-value) of the insulation decreased by as much as half the estimated nominal thermal resistance of the insulation. Loose-fill cellulose, initial testing indicates, allows no such convective patterns to develop. R-values increased as the temperature difference across the cellulose increased – the opposite effect that the fiber glass exhibited. The researchers concluded that the cellulose tested did not allow convective losses as the fiber glass had."

An article dated October 1991 in *Energy Design Update* included information on tests performed at the University of Illinois and Oak Ridge National Laboratory (ORNL). These showed that loose-fill fiber glass R-value decreased when temperatures dropped below 30°F. "Below that point, the heat loss increased geometrically with temperature difference, indicating a loss of effective R-value. At a temperature of 10°F, the effective R-value dropped over 50%." The loss of R-value was due to convection (air movement) in and through the insulation.

## Our Lifetime Warranty

GreenFiber warrants that the product will, at the initial date of purchase, meet the requirements of the FTC R-value Rule (16 CFR 1209), the Amended CPSC Standard (16CFR Part 1209), ASTM C739-08 and has building code acceptance by the Family of International Codes as published by ICC. GreenFiber Insulation has a Class 1 rating for flame spread when tested in accordance with ASTM E84. GreenFiber further warrants that the product will, for the lifetime of the structure (a) be free from defects; (b) will not deteriorate under normal and proper use including the chemical fire retardant treatment if the insulation is installed according to GreenFiber's instructions. See the complete terms and conditions of this warranty in GreenFiber's written Limited Lifetime Warranty.



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