FIBER GLASS INSULATION vs. CELLULOSE INSULATION

Facts you should know before you insulate

CLAIM: An assertion of something as a fact; a positive statement or declaration, often without support or reason.

FACT: A truth known by actual experience or observation; that which is known to be true.

OWENS CORNING®

INNOVATIONS FOR LIVING.™

SIMPLE GUIDELINES TO HELP YOU MAKE THE RIGHT CHOICE

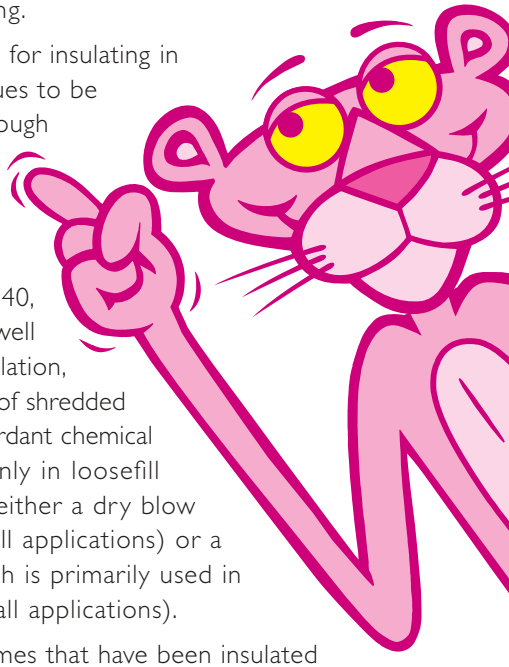
You have only one chance to insulate a home correctly, so it's important to do it right.

Read the facts about:

- Thermal Performance
- R-value per Inch and Weight Limits
- Air Infiltration
- Cathedral Ceiling Ventilation
- Fire Resistance
- Health and Safety
- Environmental Contribution
- Effects of Moisture
- Acoustical Performance

Fiber glass insulation is the residential construction standard for energy-saving excellence.

Builders face numerous choices when deciding on insulation materials and suppliers. Making the right decision can be confusing.

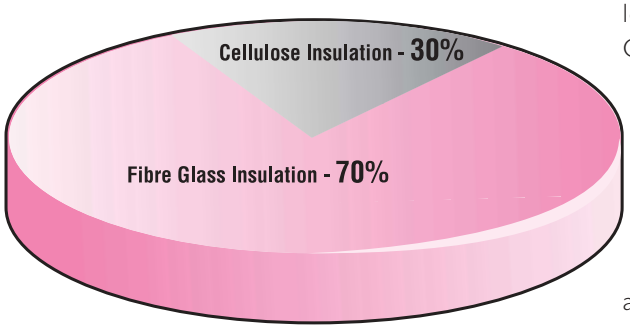


The most popular choice for insulating in new construction continues to be fiber glass insulation, although some builders choose cellulose insulation as an alternative. Fiber glass insulation is produced in R-values from R-12 to R-40, in batts and blankets, as well as loosefill. Cellulose insulation, which is made principally of shredded newspapers with fire-retardant chemical additives, is produced only in loosefill form, and is installed in either a dry blow (in attics and retrofit wall applications) or a wet-spray method (which is primarily used in new construction sidewall applications).

More than 35 million homes that have been insulated with fiber glass insulation offer proof of the product's long-lasting, high-quality performance. And Owens Corning is continuing a 50-year tradition of research and development to bring you even better insulating products.

Owens Corning maintains the most extensive science and technology facility in the industry, with over 600 scientists and engineers and complete labs for thermal performance, air infiltration, fire safety and acoustics testing.

Insulation Type used by Builders
Source: 1997 Builder Practices Survey



Today, there are conflicting performance claims regarding fiber glass insulation. But in head-to-head technical comparison, the facts show that Owens Corning fiber glass insulation is truly superior.

THERMAL PERFORMANCE

CLAIM: Cellulose insulation delivers the R-value stated on its package.

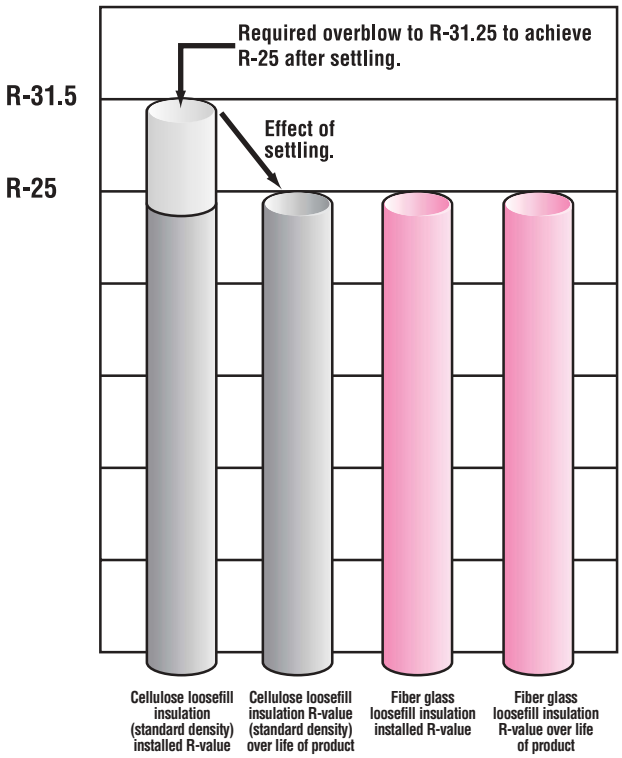
Cellulose Insulation Fact

In some cases, the R-value and thickness listed on cellulose insulation packages reflect settled density only (as minimum requirement of CAN/CGSB-51.60-M90 cellulose standard) – the density the product achieves over some length of time. In attics, if the contractor installs cellulose insulation at the labelled settled thickness, the homeowner will not receive the stated R-value, due to settlement after installation. If extra cellulose insulation is not installed, the insulation may never achieve its claimed insulating power because it will lose approximately 15 to 25 percent of its R-value over time from settling.

Note: All cellulose insulation packaging should feature a statement concerning the installed and settled thickness R-value of the product.

R-value Retention Over Time

Source: Oak Ridge National Laboratories report



Fiber Glass Insulation Fact

Owens Corning fiber glass insulation products are clearly labelled by R-value. Those values are based on tests made by accredited laboratories using current American Society for Testing and Materials (ASTM) methods. Furthermore, fiber glass batt and loosefill insulations are factory-engineered to retain their thermal performance for the lifetime of the product. Properly installed, they will not significantly sag or settle, thereby assuring that the installed R-value is maintained. (Tests done on fiber glass insulation from a 40-year-old building in Ohio confirmed that, despite the age of the material, the fiber glass insulation had retained its original thermal performance.)

Fiber glass batts and properly installed loosefill insulations are not significantly affected by convection (the upward movement of warm air). The Canadian insulation standard has incorporated minimum thermal resistivity requirements for batts and loosefill insulation which restricts the design of loosefill insulations and ensure suitable performance even in extremely cold weather environments.

Laboratory attic tests have shown that fiber glass loosefill products actually experience better thermal performance as the temperature in an attic drops. Some low density fiber glass loosefill products (not permitted by Canadian standard CAN/ULC-S702-97) may experience a reduction in thermal performance as the temperature further decreases. However, the impact on annual utility bills would normally be insignificant.

R-VALUE PER INCH AND WEIGHT LIMITS

CLAIM: Cellulose insulation has a higher "R-value per inch" than fiber glass insulation.

Cellulose Insulation Fact

Cellulose insulation only has a higher R-value per inch than fiber glass insulation where it doesn't matter – in attic applications, where installation depth is not usually an issue. However, installing an R-value above RSI 4.07 (R-23) for standard density cellulose insulation (RSI 6.55 (R-37) for low density cellulose) exceeds the weight limitations given by certain drywall manufacturers in constructions with 24-inch-on-center framing and 1/2-inch drywall.

For wall applications with cellulose fiber BIBS having moisture applied at 15% of dry mass and adhesive, the Canadian Construction Materials Centre has deemed that to compensate for the temporary reduction of thermal resistance due to moisture as well as to estimate the performance under field conditions, the design resistivity of the BIBS applied cellulose product is reduced 5% to 23.8m.K/W (R-3.43 per inch). This gives RSI 2.1 (R-12) for an 89 mm (3.5") 2x4 wall and RSI 3.3 (R-19) for a 140 mm (5.5") 2x6 wall. CCMC has reported a dried wet spray cellulose performance of 24.4 m.K/W (R-3.52 per inch) or RSI 2.17 (R-12.3) for an 89 mm (3.5") 2x4 wall and RSI 3.41 (R-19.4) for a 140 mm (5.5") 2x6 wall.

CCMC has also deemed that for dry applied cellulose at densities up to 48 kg/m³ the worst case thermal resistivity is 25 m.K/W (R-3.6 per inch) which gives RSI 2.22 (R-12.6) for 89 mm walls and RSI 3.49 (R-19.8) for 140 mm (5.5") 2x6 walls and typical thermal resistivity is 25.4 m.K/W (R-3.67 per inch) which gives RSI 2.26 (R-12.8) for 2x4 walls and RSI 3.56 (R-20.2) for 2x6 walls according to CCMC reports.

Variations in product and installation technique may affect the overall R-value of wet-spray cellulose in wall applications. Installers may add differing percentages of water and/or adhesive to the shredded newspaper insulation, thus altering the material's installed density and actual R-value.

The density of blown-in insulation can be verified by sampling the installed material. To do this, a measured core sample of material should be cut from the wall, weighed and compared to the package's installation label for proper installed density. This process should be repeated several times in the house to get a representative sampling.

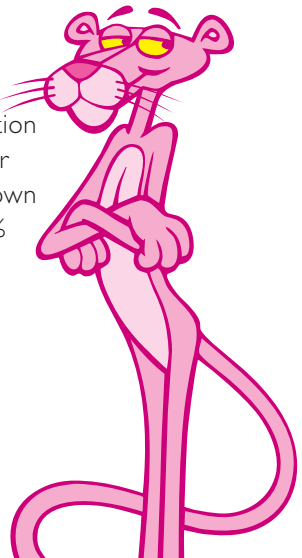
Fiber Glass Insulation Fact

In attics, fiber glass loosefill insulation can match cellulose insulation R-value for R-value, since there is usually no height limit. Thus builders should consider performance, not thickness or R-value per inch when making insulation decisions.

There is essentially no weight limit for fiber glass batt or loosefill insulation in attic installations. In fact, a maximum RSI 8.63 (R-49) (SUPER-PINK R® Blowing Wool) or RSI 12 (R-68) (PROPINK™) Loosefill Fiber Glass Insulation can be installed over 1/2-inch drywall ceilings with framing 24-inches on centre.

For 2x4 wall cavity applications, Owens Corning offers RSI 2.1 (R-12) and RSI 2.4 (R-14) high-density fiber glass batts, as well as fiber glass loosefill with installed R-values ranging from RSI 1.9 (R-11) (at 1.07 kg/m² [0.219 lb/ft²]) to RSI 2.6 (R-15) (at 3.28 kg/m² [0.671 lb/ft²]) for PROPINK™ Loosefill Fiber Glass Insulation for 2x4 walls. For 2x6 wall cavity applications, compressible RSI 3.5 (R-20) batts giving in place RSI 3.34 (R-19) and high-density RSI 3.87 (R-22) (in place) batts are available, as well as, PROPINK™ Loosefill Fiber Glass Insulation with installed R-values ranging from RSI 3.0 (R-17) (at 1.68 kg/m² (0.344 lb/ft²) to RSI 4.2 (R-24) (at 6.17 kg/m² [1.260 lb/ft²]).

In other words, assuming proper installation techniques are used, 89 mm (3.5") thick, RSI 2.4 (R-14) fiber glass batts or RSI 2.6 (R-15) PROPINK™ Loosefill Fiber Glass Insulation installed in a 2x4 cavity achieves 8.5% or 17% higher performance than dry blown cellulose at RSI 2.26 (R-12.8) and 16.7% or 25% higher performance than BIBS cellulose at RSI 2.1 (R-12). Also 140 mm (5.5") thick, RSI 3.87 (R-22) fiber glass batts or RSI 4.2 (R-24) PROPINK™ Loosefill Fiber Glass Insulation installed in 2x6 cavity achieves 8.9% or 18.8% higher performance than dry blown cellulose at RSI 3.56 (R-20.2) or 15.8% or 26% higher performance than BIBS cellulose at RSI 3.3 (R-19).



AIR INFILTRATION

CLAIM: Standard density and wet-spray cellulose wall insulation systems make a house more airtight vs. fiber glass insulation.

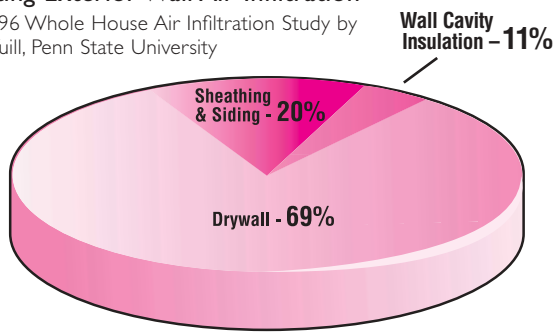
Cellulose Insulation Fact

Some cellulose manufacturers claim that their wet-spray cavity insulation improves air infiltration performance in cavity walls, compared to fiber glass batt insulation. But air infiltration occurs mostly through attics and floors, as well as through doors, windows and vents – not wall cavities, according to a recent Whole House Air Infiltration Study.

And when it comes to walls, that same study and a field study by Union Electric documented that insulation type has no significant impact on air infiltration.* Some cellulose manufacturers have used unrealistic, small-scale demonstrations to make their claims about air infiltration. Typical small-scale demonstrations feature wall sections without drywall, exterior sheathing, caulk or sealant.

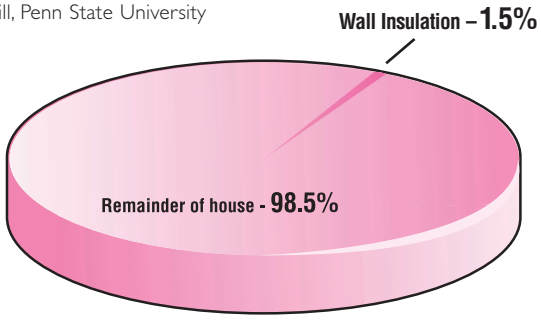
Effect of Construction Materials in Resisting Exterior Wall Air Infiltration

Source: 1996 Whole House Air Infiltration Study by Dr. Gren Yuill, Penn State University



Impact of Cavity Insulation on Whole House Air Infiltration

Source: 1996 Whole House Air Infiltration Study by Dr. Gren Yuill, Penn State University



*Energy Design Update, Vol. 17, No. 2 article reprint "Union Electric Field Test Pits Cellulose Against Fiberglass… and the Winner is…"

Fiber Glass Insulation Fact

According to a 1996 Whole House Air Infiltration Study, conducted by Dr. Gren Yuill of Penn State University, drywall alone accounted for 69 percent of a wall's airflow resistance, with the exterior siding and sheathing providing an additional 20 percent airflow resistance. *(See top chart.)*

Wall cavity insulation as an air infiltration barrier is insignificant when compared to the other components of a wall, and the air leakage through the walls is small compared to the overall leakage through the other components of a house. *(See bottom chart.)*

No significant amount of air will flow through a wall cavity, regardless of the material with which the wall has been insulated. Openings for wiring runs, light switches and electrical outlets, where air infiltration can occur, can and should be sealed by the builder with foam sealants and caulk. In other words, wall cavity insulation plays an important role in a house, but its job is to provide resistance to heat loss or heat gain, not to reduce air infiltration.

It should be noted that the Canadian Model National Energy Code for Houses – 1997 (MNECH), Section 3.2.4 calls for caulking, gasketing or otherwise sealing of the envelope to prevent air infiltration. The MNECH recommended good practices basic system options for sealing described in referenced "Air Barrier Systems for Houses" (first published by Ontario New Home Warranty Plan) includes sealed sheets or membranes, or sealed structural materials such as air tight drywall systems and does not mention cavity insulation as any part of the air barrier system solution.

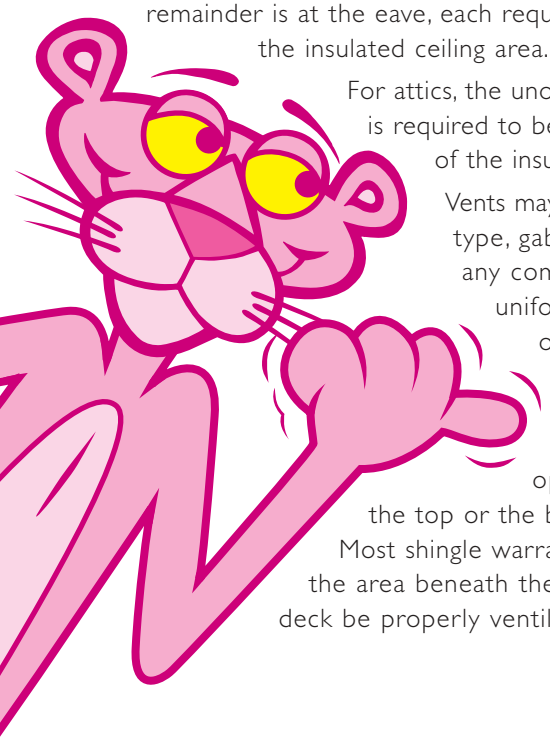
CATHEDRAL CEILING VENTILATION

CLAIM: Some cellulose insulation manufacturers and promoters have stated that it is unnecessary to provide venting between the insulation and the roof deck in cathedral ceiling applications.

Cellulose Insulation Fact

Cellulose insulation is no different than fiber glass insulation when it comes to following building codes and common construction practices regarding ventilation of cathedral ceilings. To meet building code requirements in all areas of the country – and to simply follow good construction techniques – the rafter cavity between the roof deck and the insulation must be ventilated. These codes require unrestricted vent area of not less than 1/150 of the insulated ceiling area for cathedral ceilings or where the roof slope is less than 1 in 6 for any type of insulation.

If 50 percent of the vent area is near the ridge and the remainder is at the eave, each require areas 1/300 of the insulated ceiling area.



For attics, the unobstructed vent area is required to be not less than 1/300 of the insulated ceiling area.

Vents may be roof type, eave type, gable end type or any combination thereof, uniformly distributed on opposite sides of the building and with not less than 25% of the required openings located at the top or the bottom of the space. Most shingle warranties require that the area beneath the roof sheathing or deck be properly ventilated.

Fiber Glass Insulation Fact

To provide effective ventilation through the rafter cavities between the roof deck and the insulation in cathedral ceiling applications, a minimum 64 mm (2 1/2") passage-way between the insulation and the roof sheathing is required by building codes. Since roof rafters are typically notched at the wall top plate, baffles are commonly used to provide passageway clearance at the eave.

If the cathedral ceiling insulation is too thick to provide an adequate passageway, then 38 mm (1-1 1/2") thick purlins shall be installed to the top of the joists and the design insulation thickness may then come to 25 mm (1") from the top of the joist.

If the required thermal performance cannot be achieved by the addition of purlins to the joists, Owens Corning Celfort® CodeBord™ or Celfort® 200 Extruded Polystyrene Insulation boards may be fastened through a continuous 6 mil polyethylene vapour barrier on the bottom of the roof joists and an interior drywall finish fastened to strapping which is fastened through the foam insulation to the roof joists as well as the maximum thickness of PINK® Fiber Glass batts being installed between the joists.

FIRE RESISTANCE

CLAIM: Cellulose insulation will not burn.

Cellulose Insulation Fact

Cellulose insulation is made principally of shredded newspapers – a combustible material. It must be treated with fire-retardant chemicals to meet minimum fire safety standards. However, according to a study conducted by the California Bureau of Home Furnishings, fire-retardant chemicals can disappear from the insulation over time – as much as 28 percent in the first two-year period following installation.

The city of Palo Alto, California, tested cellulose insulation in 133 attics for fire safety. Only eight of the attics passed the requirements of the Consumer Product Safety Commission fire tests.

A December, 1993 survey by the Indiana State Fire Marshal's Office of 900 fire departments found that 72 percent of them fight cellulose insulation fires in an average year.

Fiber Glass Insulation Fact

Fiber glass insulation is made primarily from sand, an inherently non-combustible material. Therefore, glass fibers will not burn and require no fire-retardant chemicals.

Unfaced PINK® Home Insulation (except RSI 2.4 and RSI 3.87 batts) and Owens Corning PROPINK™ Loosefill Fiber Glass Insulations are rated non-combustible by building codes by passing CAN/ULC-S114. And they remain non-combustible for the life of the product.

Some cellulose samples have failed the ASTM E970 fire safety test only six months after installation.

Fiber glass loosefill and batt insulation routinely pass the ASTM E970 fire safety test.

HEALTH & SAFETY

CLAIM: Cellulose insulation is safer to install than fiber glass insulation.

Cellulose Insulation Fact

Not enough is known about the safety of cellulose. No health testing by cellulose manufacturers or the cellulose industry exists and no hazard testing or risk assessment evaluations have been done on cellulose insulation. While many cellulose insulation manufacturers claim that their product is made from natural, safe, recycled materials, typically 20 percent of cellulose insulation is chemicals by weight. Some ingredients in shredded newspaper insulation are known to adversely affect health: paper dust causes chronic pulmonary obstructive disease, and boric acid and borax fire-retardants have been shown to cause reproductive disorders in laboratory rats.

Some labour organizations have called for testing the health effects of cellulose insulation and have urged manufacturers to act responsibly and test their products. They have argued that simply because a product is untested does not mean it is safe. Those unions have also asked the federal government to test cellulose insulation. The National Institute of Environmental Health Sciences, through the National Toxicology Program, has agreed to conduct such testing.

Fiber Glass Insulation Fact

Fiber glass insulation is safe to use when the simple directions printed on the package are followed. In terms of health and safety testing, fiber glass insulation is one of the most tested building materials ever. Studies conducted over the past 50 years involving 40,000 workers have not established a causal relationship between exposure to glass fibers and cancer or any other disease in plant workers or installers. In fact, during the last 50 years, more than 600 reports and scientific articles have been published on the subject.

Following the simple work practices described on the label permits installer comfort and lowers exposure to airborne fibers. The potential health effects of glass fibers have been reviewed by various national and international bodies for over 20 years. Although the International Agency Research on Cancer (IARC) in October 2001 reclassified glass wool insulation and it is considered "not classifiable as to carcinogenicity to humans" (Group 3), Owens Corning's packages of fiber glass insulation continue to carry toxic "T" WHMIS warning labels. This is primarily for regulatory reasons that require warning labels on many commonly used products, including paint, cleaners, artificial sweeteners and gasoline. The origin of the statement is based on the results of studies using extremely high doses injected into laboratory animals, not on the results from studies of humans or in laboratory animals breathing in the fibers, which is the way humans are exposed.

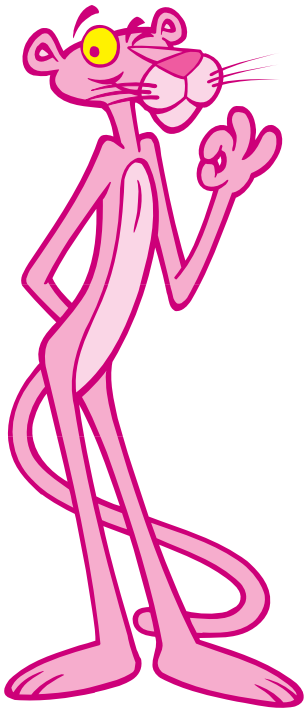
In 1997, the American Conference of Governmental Industrial Hygienists evaluated glass fibers and fully considered the uniqueness of the positive animal tests. Their test resulted in an "A3" designation and concluded that the "available evidence suggests that [fiber glass] is not likely to cause to cause cancer in humans except under uncommon and unlikely routes or levels of exposure." An "A3" designation indicates that the substance to which it applies may cause cancer in experimental animals at relatively high doses and by routes of exposure that "are not considered relevant" to workers.

ENVIRONMENTAL CONTRIBUTION

CLAIM: Cellulose is manufactured using 100 percent natural materials.

Cellulose Insulation Fact

Cellulose insulation is composed of approximately 20 percent chemicals by weight – in addition to the impurities, inks and dyes present in shredded newspaper, cardboard and waste paper.



Fiber Glass Insulation Fact

Owens Corning PINK® Fiber Glass insulation is made primarily from sand – one of the most plentiful materials on earth – and recycled glass. It averages 30 percent recycled content, including both pre-and post-consumer materials. Owens Corning has used over 1.9 billion kilograms of recycled glass in the past 10 years – and the product itself is recyclable.

Incidentally, the "embodied" energy consumed in manufacturing fiber glass insulation is very small compared to the amount of energy that the insulation can save over its installed life.* (For every joule of energy consumed in the manufacture of the product, 12 joules of energy per year are saved for the life of the house. For every kilogram of carbon dioxide emitted in the production of insulation, 330 kilograms of such emissions are prevented by the use of insulation over the life of an average home.)

Owens Corning is a partner in promoting energy conservation and environmentally friendly home construction through its associations with:

- Natural Resources Canada
- Natural Resources Canada R-2000 Home Program
- Canadian Energy Efficiency Alliance
- Energy Efficient Builders Association
- The Environmental Choice Program
- Habitat for Humanity

By participating in these alliances, Owens Corning hopes to bring about more environmentally friendly building practices. The primary goal of our commitment to these organizations – and to our global neighbourhood – is to help conserve energy, which, in turn, reduces the carbon dioxide gases that contribute to global warming, as well as the acid rain that is thought to be created by the burning of fossil fuels in the generation of electricity.

*Insulating residential structures to well above building code levels should result in net energy savings, over time, above the cost of the insulation. Savings vary with application and the amount of existing insulation. Higher R-values mean greater insulating power.

EFFECTS OF MOISTURE

CLAIM: Cellulose insulation can be installed without a vapour retarder.

Cellulose & Fiber Glass Insulation Fact

Vapour retarders or vapour retarding paint are required in new construction by building codes. The building codes state: "Thermally insulated wall, ceiling and floor assemblies shall be constructed with a vapour barrier so as to provide a barrier to diffusion of water vapour from the interior into wall spaces, floor spaces, attic or roof spaces."

"Vapour barriers shall have an initial permeance not greater than 45 ng/Pa.s.m^2 except for walls that incorporate low water vapour permeance exterior cladding or sheathing shall have a permeance not greater than 15 ng/Pa.s.m^2."

CLAIM: Dry-blown and wet-spray cellulose insulations are not corrosive to wiring, nails or metal pipes.

Cellulose Insulation Fact

Several problems are presented by the installation of dry-blown or wet-spray cellulose insulation, with or without vapour retarders:

- Cellulose insulation loses R-value when wet, and the rated R-value of the material will not be achieved until it is completely dry.
- If cellulose insulation collects moisture, it may lead to rotting of framing members. Moisture combined with certain combinations of fire-retardant chemicals may also lead to corrosion of wiring, nails, pipes and other metals in the structure.

Standard formulations of fire retardant chemicals and cellulose fiber are tested for fungi resistance and corrosiveness at least once every three years. Cellulose with alternate blends of chemicals or depleted chemicals due to separation of the powders or moisture cycling migration may not be fungi resistant or may be corrosive.

A study by the Oak Ridge National Laboratory (ORNL), a unit of the U.S. Department of Energy, demonstrated that cellulose insulation in the presence of moisture from condensation can corrode nails, gang nail plates, bolts, wiring, electrical boxes, pipes and steel studs, metal components in a building's structure, while fiber glass insulation will not. A specific conclusion of the report was that "all of the cellulosic insulation materials tested produced corrosion of steel and copper."

Fiber Glass Insulation Fact

Insulation made of Fiber Glass is not absorbent; any moisture lies on the surface of the fibers, not inside them. If exposed to moisture vapour, the moisture passes through the fiber glass insulation and condenses on the next interface below the dew point temperature. Deposited droplets may evaporate over time or simply drain off. In this way the insulation resists any permanent loss of R-value.

Fiber glass insulation does not cause corrosion of metal objects or damage to wood or steel framing elements. In order to make proper glass fibers, the composition of molten glass has to be maintained within a very narrow range. Representative insulation materials are tested for fungi resistance and corrosiveness, and long term storage thickness recovery on a routine basis. The Fiber Glass insulation materials thereby maintain their resistance to moisture damage and do not support biological and bacterial growth.

ACOUSTICAL PERFORMANCE

CLAIM: Cellulose insulation offers superior acoustical properties compared to fiber glass insulation.

Cellulose Insulation Fact

Both cellulose insulation and fiber glass insulation provide sound control acoustical absorption. On the basis of extensive testing of partition walls and joist ceiling systems at NRC Canada, equivalent thicknesses of dry blown or sprayed cellulose fiber and Fiber Glass insulation have equivalent acoustical performance within testing errors and the ability of the human ear to determine differences (perception requires 3 or more STC units difference). On average Fiber Glass batts had equivalent to 1 to 2 higher STC performance in walls than cellulose fiber and on average cellulose fiber had equivalent to 1 to 2 higher STC performance in joist floor/ceilings.

The National Research Council Canada internal summary report documenting the performance of Fiber Glass, mineral wool fiber and cellulose fiber in walls is: *Summary Report for Consortium on Gypsum Board Walls: Sound Transmission Results*, IRC-IR-693, October 1995 and for floor/ceilings is: *Summary report for Consortium on Fire Resistance and Sound Insulation of Floors: Sound Transmission Class and Impact Insulation Class Results*, IRC-IR-766, dated April 1998.

A series of ASTM E90 sound transmission loss and ASTM C423 sound absorption tests were performed for the North American Insulation Manufacturers Association (NAIMA) at an accredited acoustical testing facility in Littleton, Colorado, in 1993. The purpose of the test program was to investigate the relative sound performance of fiber glass and cellulose insulations in typical residential wall constructions.

While both cavity insulations improved wall performance, the results indicated no significant difference between the measured sound transmission loss or sound absorption characteristics of similarly constructed walls insulated with either fiber glass or cellulose insulation. (See chart.)

Fiber Glass Insulation Fact

The NRC walls STC Summary Report stated: "The amount of absorption in the cavity has a significant effect on the sound transmission – the greater the faction of the cavity filled with absorption, the higher the sound transmission loss." and "Increasing the fraction of the cavity filled with absorptive material improved the sound transmission loss steadily, in a partition with negligible structural connection between the surfaces. With a half-filled cavity the STC was 6 dB lower than with a full cavity."

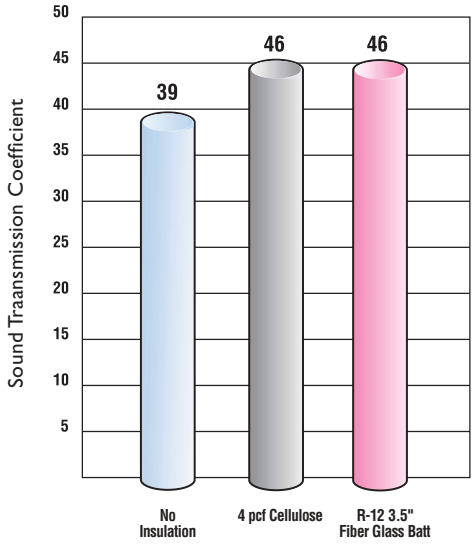
Absorptive material density increases did not contribute to the performance of walls as on average Fiber Glass batts had equivalent to slightly better performance than nominal equivalent thickness approximately 400% to 459% higher density cellulose dry and spray products and approximately 265% higher density mineral wool batts.

Absorptive material density increases gave equivalent to a slightly better performance for approximately 450% higher density sprayed cellulose fiber and about 205% higher density blown-in cellulose fiber than equivalent thickness Fiber Glass batts in the NRC floor/ceiling STC Summary Report.

Sound Transmission Results for 2x4 Interior Walls

Wall assembly was 2x4 wood framing on 16" centers, 1/2" regular gypsum wallboard, with resilient channels applied on one side.

Source: 1993 NAIMA Study



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