ADVANCED FIBER TECHNOLOGY

Cellulose Insulation and Fire Resistance

Introduction

Several million dollars have been spent on studies testing and proving the fire resistance of cellulose insulation in structures. To those familiar with the product the results won't be surprising but to those not familiar, they will be surprising.

Depending upon the manufacturer, by weight cellulose insulation is approximately 85% or more recycled cellulose fibers and the balance is fire retardant chemicals. The US Consumer Product Safety Commission (CPSC) established the fire safety requirements for cellulose insulation in 1978. Cellulose insulation is one of very few building materials that always contain fire retardants. Lumber, sheathing, kraft-faced fiberglass batts, asphalt-based roofing materials, carpet, etc. typically are not treated with fire retardants yet the safety of these common building materials is never questioned.

A common assumption is that a material made from paper must be a fire hazard. This is **not** true. The state of California conducted a study of 2 million fires and concluded concerning fire and insulation materials: 1) There does not appear to be a significant number of attic fires related to any particular manufacturer's product, and 2) Heat-producing devices and electrical short circuits were major factors in insulated-related fires. A study by Oklahoma City Fire Department found that insulation-related fires paralleled market share of respective materials and that the common denominator was recessed lighting fixtures, not insulation materials.

Government Sponsored Research

Extensive fire research associated with various building materials and construction has been conducted by the research arm of the Canadian government (National Research Council, NRC). This testing has been done in conjunction with many major corporate sponsors such as Owens-Corning, Cellulose Insulation Manufacturers Association, Boise Cascade, Gypsum Association, Louisiana-Pacific, Roxul Inc., and others.

In the most recent Canadian National Resource Council (NRC) fire resistance study, published in April 2019, cellulose insulated wall assemblies outperformed all similar and indentical walls with fiberglass and rock fiber insulation. In tests of walls with rock fiber insulation and cellulose insulation, the assembly with non-combustible rock fiber insulation structurally failed at 117 minutes and the otherwise identical wall with cellulose insulation failed at 132 minutes.

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A July 1994 report of 48 small-scale fire resistance tests by Canadian National Research Council (NRC) found that fiberglass had a "neutral effect on the fire resistance performance compared to a non-insulated assembly" when using Type X gypsum board. When lightweight gypsum board is used, it was found the fire resistance performance "was slightly lower than that of a non-insulated assembly". It also found that "the installation of cellulose fibre in the wall cavity provided an increase in the fire resistance performance of 22% to 55% compared to a non-insulated assembly".

Additionally, an April 1998 NRC report of various 32 full-scale floor assemblies concluded very interesting results when varying the insulation material. Assemblies with solid wood joists with a single layer of gypsum board ceiling determined that "glass fibre insulation reduced the fire resistance by 20% while rock and cellulose fibre insulation increased the fire resistance by 33% and 31%, respectively, compared to a non-insulated assembly". For wood I-joists, "cellulose fiber increased the fire resistance by 24% compared to a non-insulated assembly". The following were detailed observations contained in the report. "The glass fibre melted 2 to 3 min after the gypsum board fell off and was unable to compensate for the earlier failure of the gypsum board." "However, the rock and cellulose fibre insulations remained in place after the gypsum board fell off and were able to compensate for the earlier failure of the gypsum board and protected the wood joists and subfloor for a substantial period."

No cellulose insulation tests were done on steel joists however "the installation of glass fibre in the floor cavity reduced the fire resistance by 8% compared to a non-insulated assembly". Based upon the results from the above wood joist configurations, a logical assumption would be that cellulose insulation would increase the fire resistance of steel joists construction.

Furthermore, a 2001 study by NRC of 14 full-scale steel stud walls found wall failure at 56 minutes for fiberglass, 59 minutes for rock fiber insulation, and 71 minutes for cellulose insulation.

Building Codes

Based upon tests conducted per ASTM E119 "Standard Test Methods for Fire Tests of Building Construction and Materials", the International Building Code (IBC) acknowledged the fire resistance properties of cellulose insulation. The codes allow cellulose insulation to contribute an additive 15 minutes to the fire resistance of an uninsulated wall while no additional minutes are allowed for low density fiberglass batts and foam insulation. These provisions are contained in IBC "Section 703: Fire Resistance Rating and Fire Tests" and IBC "Section 722 Calculated Fire Resistance". Cellulose insulation is also recognized in the codes as an ignition barrier over foam insulation

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The IBC further establishes fire resistance criteria for a product to be considered as a fire stop in IBC "Section 714 Penetrations" and a fire block in IBC "Section 718.2 Fireblocking Materials". This is the result of ASTM E119 tests in 1999 and 2002 that exposed cellulose insulation to temperatures exceeding 1600°F to ensure the fire endurance ratings of the walls were met or exceeded when insulated with cellulose insulation.

IBC "Section 714.4 Penetrations - Fire Resistant Rated Walls" permits electrical boxes as close as 3-1/2 inches to each other on opposite sides in 2x4 fire-rated walls when using cellulose insulation or rockwool. This was supported by CIMA sponsored tests conducted by Omega Point Laboratories in 1999.

The building codes establish a maximum flame spread (FS) of 25 and smoke developed index (SDI) of 450 as tested under ASTM E84. AFT Carbon Smart™ cellulose insulation is below 25 FS and below 50 SDI and is considered a Class 1/A building material. Paper faced fiberglass batts are permitted to have the paper facing containing the asphalt-based adhesive removed to meet the same fire performance criteria.

Paper-faced batts are not treated for fire resistance and are not covered by the same stringent flammability standards that apply to cellulose insulation. For this reason, paper-faced batts, which are among the most commonly used forms of insulation in the U.S., are no longer sold in Canada.

Consumer Product Safety Commission

The CPSC initially established the fire safety criteria of cellulose insulation. What wasn't understood at the time was the criteria resulted in an insulation material with superior fire resistance properties compared to fiberglass and foam insulation. These fire resistance properties are contained in 16 CFR Part 1209 (1) of the Code of Federal Regulations.

Two Hour Fire Walls

Several cellulose insulation manufacturers have successfully met the requirements of a 2-hour fire wall using ASTM E119 with a single sheet of type X drywall on each side. These designs are proprietary to the respective manufacturers. Advanced Fiber Technology's AFT Fire Shield has a 2-hour fire wall rating.

Cellulose Insulation and Fire Resistance (Continued)

Full-Scale Fire Tests

In 1978 the so-called "Big Burn" demonstration set fire to three structures; one insulated with fiberglass, one with cellulose insulation, and one with no insulation. The ceiling of the fiberglass insulated structure collapsed after 21 minutes while the ceiling of the cellulose insulated structure collapsed after 70 minutes. Demonstration burns conducted by the Cellulose Industry Standards Enforcement Program (CISEP) in 1987 and by GreenStone Industries in June 1998 at the Maryland Fire Training Academy produced similar results. Cellulose-insulated structures remained standing while identical structures with fiber glass insulation burned to the ground.

Summary

It is very easy to mislead by stating, "our product is noncombustible (because it melts), but their stuff is combustible so our insulation is "safe" but theirs is a fire hazard." As you should have just learned, this is a misleading. According to *Building Construction for Fire Suppression Forces*, a publication of the National Fire Services Training Academy: "It is critical to recall that noncombustible does not mean 'safe'. And it certainly does not mean 'fireproof'. The concept of fire-resistance goes beyond that of non-combustibility. It refers to the capacity of a material or construction to withstand fire or give protection from it, characterized by its ability to confine a fire."

Be smart and evaluate the role you want building materials to play in giving your family members the appropriate home environment. If you would like copies of the referenced studies, we would be pleased to provide them. Should you like for us to meet with any local building or fire officials, we'd be pleased to do so.

AFT Carbon SMART

Cellulose Insulation