

# UL Solutions Evaluation Report

**UL ER15890-01**

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DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION

Sub-level 2: 07 20 00 – Thermal Protection

Sub-level 3: 07 21 00 – Thermal Insulation

Sub-level 4: 07 21 23 – Loose Fill Insulation

Sub-level 4: 07 21 26 – Blown Insulation

**Company:**

**APPLEGATE GREENFIBER ACQUISITION, LLC**

5500 77 CENTER DRIVE, SUITE 100

CHARLOTTE, NORTH CAROLINA 28217

(800) 228-0024

[www.greenfiber.com](http://www.greenfiber.com)

[greenfiber.info@greenfiber.com](mailto:greenfiber.info@greenfiber.com)

**1. Subject**

**SANCTUARY® Greenfiber Stabilized or Loose Fill Insulation, FRM Greenfiber Fire Rated Material, and SANCTUARY DEFENSE Greenfiber Loose Fill Insulation**



Throughout this report, the reference to Greenfiber Insulation will apply to all products described above, except where indicated otherwise and except for Greenfiber FRM.

## 2. Scope of evaluation

- 2018 and 2015 *International Building Code*® (IBC)
- 2018 and 2015 *International Residential Code*® (IRC)
- NFPA 70 National Electric Code®, 2017 Edition
- ICC-ES Acceptance Criteria for Quality Documentation (AC10)

The products were evaluated for the following properties:

- Surface Burning Characteristics (UL723)
- Physical Properties (ASTM C739)
- Thermal Resistance (ASTM C739, ASTM C518)
- Sound Transmission (ASTM E90, ASTM E413)
- Fire blocking
- Fire-Resistance Rated Construction (UL263)
- Ignition Barrier - Attics

## 3. Referenced documents

- UL723, Test for Surface Burning Characteristics of Building Materials
- UL263, Fire Tests of Building Construction and Materials
- ASTM C739, Standard Specification for Cellulosic Fiber Loose Fill Thermal Insulation
- ASTM C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- ASTM C1015, Standard Practice for Installation of Cellulosic and Mineral Fiber Loose Fill Thermal Insulation
- ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- ASTM E492, Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
- ASTM E413, Classification for Rating Sound Insulation
- ASTM C840, Standard Specification for Application and Finishing of Gypsum Board
- CPSC 16 CFR Part 1209, Interim Safety Standard for Cellulose Insulation
- CPSC 16 CFR Part 1404, Cellulose Insulation
- Gypsum Standard GA-216, Application and Finishing of Gypsum Panel Products
- ICC-ES Acceptance Criteria for Quality Documentation (AC10)

## 4. Uses

Greenfiber Insulation is used as nonstructural thermal insulating material in buildings of all types of construction. The insulation is for use on or within floors, floor-ceiling or roof-ceiling assemblies, attics, crawl spaces, walls and partitions. See Sections 5 and 6 and product coverage charts for specific applications for each product. The insulation is recognized for use in sound transmission assemblies, as fire blocking material, in both non-fire-resistance rated construction and fire-resistance rated construction in accordance with Section 703 of the IBC, and as an ignition barrier over foam plastic in accordance with R316.5.3 of the IRC.

Greenfiber FRM is for use in specific fire-resistance rated construction in accordance with Section 703 of the IBC and as described in Section 6.13 of this report.

## 5. Product description

Greenfiber Insulation and Greenfiber FRM consist of a uniform low-density mixture of cellulosic fibers and fire-retardant chemicals. Product application methods include stabilized, Wall Spray (spray-applied), loose fill, and Dry Dense-Pack, as described in Section 6. Stabilized and spray-applied applications are applied with water to activate the dry adhesive in the fire retardant treated cellulose fibers. Loose fill and Dry Dense-Pack applications are applied without water. The products used for fire-blocking and in fire-resistance rated applications have not been evaluated for thermal insulation characteristics for use in various structures.

The SANCTUARY® product meets the requirements of CPSC 16 CFR Part 1209 and has a flame spread index of not more than 25, and a smoke developed index of not more than 50 when tested in accordance with UL 723 as prescribed by the requirements set forth in Section 720 of the IBC and Section R302.10 of the IRC. Density and thermal characteristics are provided in Table 1 of this report.

**Table 1 – Density and Thermal Resistance**

SKU Number	Product Info	Thermal Applications				Nominal Density (pcf)	Installed Density Range (pcf)	Thermal Conductivity k-VALUE (Btu-in./hr-sq ft °F)	R-VALUE <sup>1</sup>
		All Loose Fill Attics / Manufactured Housing Floors	Stabilized Attics	All Dry Dense-Pack (In Floors)	Wall Spray				
SANCTUARY®	S, LF	YES	YES	YES	YES	1.5	1.25-1.75	0.27	3.70
FRM	FRM	NO	NO	NO	NO	1.6	Varies with assembly type	N/A	N/A
SANCTUARY DEFENSE	LF	YES	NO	YES	NO	1.6	1.25-1.75	0.27	3.76

<sup>1</sup>Per inch of thickness at 4 inches representative thickness

Greenfiber Stabilized Insulation = S

Greenfiber Loose Fill Insulation = LF

Greenfiber Fire Rated Material = FRM

## 6. Installation

### 6.1 General:

Installation of Greenfiber Insulation and Greenfiber FRM must comply with ASTM C1015, as applicable, this report, and the manufacturer’s published installation instructions.

Installation must be in accordance with CPSC 16 CFR 1404, Section E4003.2 of the IRC, and NFPA 70 (NEC) 410.116.9 when installation is above or adjacent to recessed luminaires (lighting fixtures) or other heat-producing elements. A permanent barrier is necessary to maintain a 3-inch wide (76 mm) clearance between the item and the insulation, unless the recessed luminaire is identified as Type IC and is listed in accordance with the applicable code for direct contact with insulation, or the heat-producing element is listed for zero clearance to combustibles. The insulation is limited to areas where the temperature will not exceed 194°F (90°C).

The code official may require an approved vapor retarder to be installed in accordance with Section 1404.3 of the 2018 IBC and Section 1405.3 of the 2015 IBC or Section R702.7 of the IRC, as applicable. Protection against condensation in exterior wall assemblies must be provided in accordance with IBC Section 1404.4 or IRC Section R703, as applicable.

Attic ventilation, when required by the code, must not be blocked by the application of the insulation when installed in accordance with Section R806.3 of the IRC.

## 6.2 Fire Resistive Material:

Greenfiber FRM is a spray-applied, uniform, low density mixture of cellulosic fibers and fire retardant chemicals used for concealed applications within walls and partitions of wood and metal construction. The product is spray-applied with water to activate the dry adhesive in the fire retardant treated cellulose fibers at a density of between 3.4 and 6.0 lbs./ft<sup>3</sup> (54.4 and 96.1 kg/m<sup>3</sup>), is assembly specific, and qualifies as a fire blocking material as defined in the IBC and IRC.

Before enclosing Greenfiber FRM in walls, the insulation must be left uncovered for a minimum of 24 hours and the moisture reading must be 25 percent or lower when measured at least 24 hours after installation.

Greenfiber FRM must be installed in accordance with the manufacturer's detailed instructions, published by Applegate Greenfiber Acquisition, LLC.

For installation guides and technical information, please visit [www.greenfiber.com/support](http://www.greenfiber.com/support).

## 6.3 Stabilized:

Greenfiber Stabilized Insulation is used for exposed, stabilized applications on horizontal or sloped attic floors at a density of between 1.5 and 3.0 lbs./ft<sup>3</sup> (24 and 48 kg/m<sup>3</sup>).

Greenfiber Stabilized Insulation must be installed in accordance with the manufacturer's detailed instructions, published by Applegate Greenfiber Acquisition, LLC, available at:

For installation guides and technical information, please visit [www.greenfiber.com/support](http://www.greenfiber.com/support).

## 6.4 Wall Spray (Spray-Applied):

Greenfiber Stabilized Insulation may be used in spray-applied, exposed applications as an interior finish and in concealed applications within walls and partitions at a density between 2.75 and 4.0 lbs./ft<sup>3</sup> (44.1 and 64.1 kg/m<sup>3</sup>).

Before enclosing Wall Spray insulation in walls, the insulation must be left uncovered for a minimum of 24 hours and the moisture reading must be 25 percent or lower when measured at least 24 hours after installation.

Greenfiber spray-applied insulations must be installed in accordance with the manufacturer's detailed instructions, published by Applegate Greenfiber Acquisition, LLC, available at:

For installation guides and technical information, please visit [www.greenfiber.com/support](http://www.greenfiber.com/support).

## 6.5 Loose Fill:

Greenfiber Loose Fill Insulations are used for exposed loose fill applications on horizontal or sloped attic floors at a density of between 1.5 and 3.0 lbs./ft<sup>3</sup> (24.0 and 48.0 kg/m<sup>3</sup>) when installed in accordance with Section R806.3 of the IRC.

Greenfiber Loose Fill Insulation is installed into its final position using a pneumatic device. The insulation may be applied to sloped attic floors having a maximum slope of 5:12 (41.7 percent slope).

Greenfiber Loose Fill Insulation must be installed in accordance with the manufacturer's detailed instructions, published by Applegate Greenfiber Acquisition, LLC, available at:

For installation guides and technical information, please visit [www.greenfiber.com/support](http://www.greenfiber.com/support).

## 6.6 Dry Dense-Pack:

Greenfiber Insulation is used in Dry Dense-Pack applications for concealed spaces of walls, partitions, and roof-ceiling or floor-ceiling assemblies. Dry Dense Pack products are installed at a density of between 3.5 and 5.0 lbs/ft<sup>3</sup> (56.1 and 80.0 kg/m<sup>3</sup>) when installed in accordance with Section R806.5 of the IRC, as applicable.

Dry Dense-Pack installation requires pneumatic application of the product in closed or netted cavities. There are several techniques for verifying the installed density of the product, as noted in the instructions. Greenfiber Insulation installed in Dry Dense-Pack applications must be installed in accordance with the manufacturer's detailed instructions, published by US Greenfiber, LLC.

For installation guides and technical information, please visit [www.greenfiber.com/support](http://www.greenfiber.com/support)

## 6.7 Installation Directly Beneath the Roof:

Greenfiber Insulation may be installed beneath the roof deck when installed in accordance with Section R806.5 of the IRC for the following applications using the Dry Dense-Pack methodology:

- **Exposed Roof Decks and Roof Framing Members:**

May be installed beneath exposed roof decks when Dry Dense-Packed behind netting at a density of 3.3 – 5.0 lbs/ft<sup>3</sup>. Climate Zones 2B and 3B do not require an air impermeable insulation layer to the roof deck in accordance with Section R806.5 of the IRC. All other climate zones must comply with the conditions set forth in 5.1 or 5.2 Section R806.5. Climate zones 1A, 2A and 3A can comply without the use of continuous insulation by meeting the requirements for vapor diffusion and supply distribution as set forth in condition 5.2 of Section R806.5. The use of Greenfiber products in cathedralized attics outside of Zones 2B and 3B needs to be reviewed by a registered design professional to determine the need for air barriers on the exposed side of the insulation.

For detailed instructions, refer to the Cathedralized Attic Applications document published by Applegate Greenfiber Acquisition, LLC, available at [www.greenfiber.com/support](http://www.greenfiber.com/support).

- **Enclosed Rafter Spaces (Insulated Cathedral Ceilings):**

Insulated cathedral ceilings are rafter spaces, formed where ceilings are applied directly to the underside of the roof framing members, which fully encapsulate the thermal insulation on all sides. In applications with vented rafter spaces, Greenfiber insulation is Dry Dense Packed to a density of 3.5 to 5.0 lbs/ft<sup>3</sup> (56.1 to 80.0 kg/m<sup>3</sup>) and installed in accordance with Section 1202.2 of the 2018 IBC, Section 1203.2 of the 2015 IBC, and Section R806.1 of the IRC, as applicable.

In applications with unvented rafter spaces, Greenfiber Insulation may be Dry Dense Packed over an air impermeable insulation in accordance with Section R806.5 of the IRC, as applicable. The air impermeable insulation must be of a thickness necessary to comply with the R-Value specified in Table R806.5 of the IRC, as applicable.

For detailed instructions, refer to the Cathedral Ceiling Applications document published by US Greenfiber, LLC, available at [www.greenfiber.com/support](http://www.greenfiber.com/support).

### **6.8 Metal Construction:**

Only Greenfiber Stabilized and Greenfiber Loose-Fill insulation may be used in construction using metal studs, metal buildings or any construction in which Greenfiber Insulation will be in contact with metal structural or sheathing members.

### **6.9 Crawl Space Floors:**

Greenfiber Insulation or Greenfiber FRM should not be applied to foundation walls in either vented or unvented crawl spaces. Greenfiber Stabilized Insulation and Greenfiber Loose-Fill Insulation may be used as floor insulation over a crawl space when a vapor retarder is attached to the bottom of the floor joists.

### **6.10 Fire blocking:**

Only Greenfiber SANCTUARY and Greenfiber FRM may be used as fire blocking materials in accordance with Section 718.2.1 of the IBC, Section R302.11.1 and Section R602.8 of the IRC.

The insulation may be placed in concealed spaces of wood or steel stud walls and partitions of combustible construction with stud spacing up to 24 inches (610 mm) on center. When the walls and partitions have existing insulation in the spaces between the studs, access holes measuring from 1-inch (25.4 mm) in diameter to 6 inches (152 mm) square are cut in the wall covering at each space between studs, and the plugs are removed. The existing insulation is cut and pushed away to form a space with a minimum height of 16-inches (406 mm) above the floor level. Greenfiber Insulation is then installed into the open space, filling from the floor a full 16-inch (406 mm) (or greater) height and contacting all surfaces. After installation has been completed, the plugs are replaced, and the wall covering is repaired with tape and joint compound in accordance with ASTM C840 or GA 216.

When there is no insulation in the wall or partition, insulation must completely fill the stud cavity to a minimum depth of 16 inches (406 mm).

### **6.11 Installation in Attics when used as a Prescribed Ignition Barrier:**

Greenfiber Insulation may be used as an ignition barrier over foam plastics in accordance with Section R316.5.3 of the IRC when applied at a minimum thickness of 1-½ inches (38.1 mm) and a minimum installed density of 2.6 lbs/ft<sup>3</sup> (43.0 kg.m<sup>3</sup>).

### **6.12 Sound Transmission:**

Sound testing data can be found in the Superior Sound Control with Greenfiber Insulation published by Applegate Greenfiber Acquisition, LLC at [www.greenfiber.com/support](http://www.greenfiber.com/support).

### **6.13 Fire-Resistance:**

#### **6.13.1 Calculated Fire-Resistance**

The fire-resistance rating of wood-stud walls is increased by 15 minutes when calculating fire-resistance in accordance with Table 722.6.2(1) of the IBC, when the spaces between wood studs are completely filled with cellulose insulation having a nominal density not less than 2.6 pcf.

### 6.13.2 Fire-Resistance Ratings

The assemblies described in Table 2 are fire-resistance rated assemblies complying with Section 703.2 of the IBC. Refer to the UL Fire Resistance Certification information for File R15890 ([CCAZ](#)) for applicable design coverage and details of the fire-resistance rated Floor-Ceiling and Wall assemblies covered by this report. Fire-resistance ratings are only applicable when the assemblies are constructed in accordance with the published designs. Stud and joist spacing are a maximum. Lesser spacing is permitted without affecting the fire resistance rating of any assembly.

**Table 2 – Fire-Resistance Designs**

Product Designation	Applicable Fire-Resistive Design(s)
FRM (Fire Rated Material)	U370, U377, W305
SANCTUARY	G524, L521, L528, L546, L574, L576, L582, L587, M509, M512, M562, P522, P531, P533, P545, P552, P556, P579, P580, U023, U032, U036, U053, U305, U309, U311, U317, U321, U326, U330, U331, U333, U338, U339, U340, U341, U342, U344, U347, U348, U349, U350, U354, U355, U356, U375, U376, U398, U403, U411, U412, U420, U425, U426, U428, U429, U434, U438, U440, U460, U462, U463, U465, U466, U467, U469, U470, U471, U477, U478, U495, U498, U499, U528, U622, U646, U647, U648, U651, V302, V303, V310, V321, V323, V324, V341, V344, V345, V346, V351, V401, V410, V414, V416, V421, V455, V472, V481, V493, V495, W307, W405, W419, W451, W456, W461, W469

## 7. Wall - Floor Joist Penetration

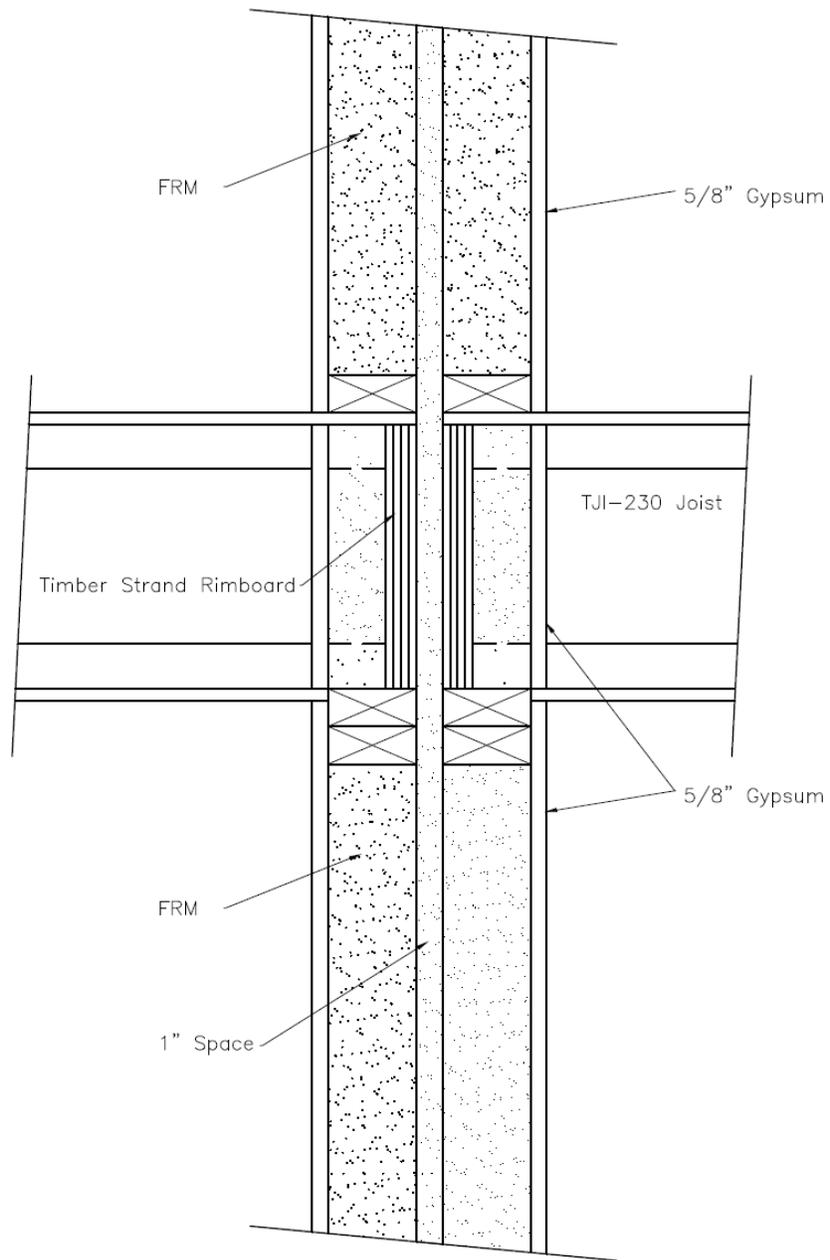
### 7.1 General

Testing was conducted with a modified ANSI/UL 263, Standard for Fire Tests of Building Construction and Materials, Thirteenth Edition, dated April 4, 2003 system consisting of a load bearing wall assembly and perpendicular wood floor joists penetrating each side of the assembly. The relationship between a wall assembly and wood floor joists is not addressed in UL 263. The test set-up was constructed in accordance with specifications determined by Applegate Greenfiber Acquisition and tested under controlled conditions as described in UL 263. The test was conducted on June 9, 2006.

### 7.2 Description of Test Assembly

The wall portion of the test assembly was constructed in accordance with U370, System A, for a 2-hr Rating (See UL Product iQ for full details). This consisted of a load bearing double wall assembly with a minimum 1-inch gap constructed of two rows of nominal 2 by 4 in. wood studs spaced 16 in. on center with their outer surfaces faced with one layer of nominal 5/8 in. gypsum board with the cavities of each row of studs filled with Greenfiber FRM spray applied cellulose material having a minimum dry density of 3.89 lb/ft<sup>3</sup>. The test assembly additionally contained a wood floor joist that penetrated the wall. The wood floor joist utilized TJI-230 joists, Timber Strand rim board (1-1/4-inch thick) and Georgia Pacific Quick Fit sub-flooring. Rim board and top plate were cut to fit inside the outer studs of the wall assembly. The joists were cut to 9-inch lengths and were spaced 16-inch on center. The 1-inch gap was maintained through the joist and sub-flooring assembly. The FRM insulation when sprayed into the internal cavity filled the 1-inch gap. The floor joist protruded from both sides of the wall and had a superimposed load applied vertically to the unexposed row of studs and separately to the exposed row of studs by hydraulic equipment to simulate 75% of the maximum working stress.

The picture below details the tested assembly.



### 7.3 Pictures of Surfaces Pre- and Post- Test



Unexposed Surface – Pre-Test Photo



Unexposed Surface – Post-Test Photo



Exposed Surface – Pre-Test Photo

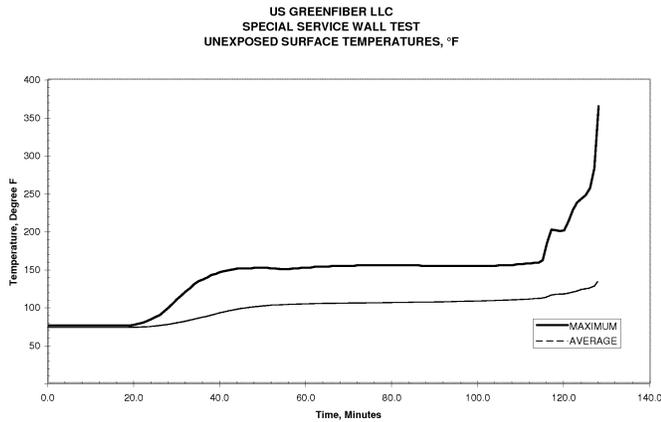


Exposed Surface – Post-Test Photo

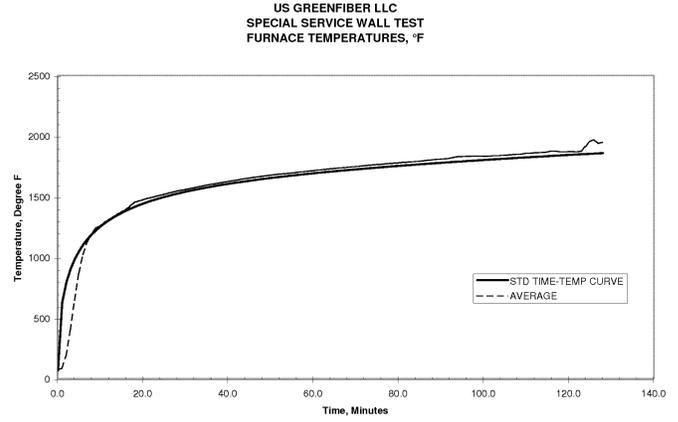
### 7.4 Results

At the completion of 2 hours, it was observed that the assembly sheetrock face exposed to the furnace fire was cracked but remained in place containing the Fire Rated Material. The assembly sustained the test duration without passage of flame or passage of gases hot enough to ignite cotton waste. The transmission of heat through the assembly did not raise the average temperature of the unexposed surface to more than 250°F above its initial temperature. The transmission of heat through the assembly did not raise the maximum individual temperature of the unexposed surface to more than 325°F above its initial temperature. The assembly's unexposed studs continued to maintain load.

Unexposed Surface Temperatures Chart



Furnace Temperatures Chart



7.5 Codes Discussion

The test assembly investigated utilizing the U370 wall design penetrated by wood floor joists may be applied to the following code areas.

- Structural Independence (R302.2.2 and R302.2.6 IRC) – Exception 5 of R302.2.6 advises that “townhouses separated by a common wall” are exempt from the structural independence requirement when that common wall is provided in accordance with Section R302.2.2, Item 1 or 2. The U370 wall design without floor penetration meets the requirements of R302.2.2, Item 1 in that it is a 2-hr Rated design. In the test data presented above, the U370 wall design with floor penetration has shown to perform to the temperature requirements detailed in Section 6.4 of UL 263, Thirteenth Edition.
- Structural Stability (706.2 IBC) – Section 706.2 of the IBC requires that fire walls meet the requirements of NFPA 221 to comply with the structural stability requirements. As stated in NFPA 221, double fire walls “shall be independent of the fire wall and framing on the opposite side”. The U370 wall design meets the requirements of a double fire wall when not penetrated by the floor joist. When floor joists are used, if the 1-inch gap is maintained between the double fire wall and floor, the results as shown above describe the temperatures maintained.

IBC 706.2, Exception: In Seismic Design Categories D through F, where double fire walls are used in accordance with NFPA 221, floor and roof sheathing not exceeding 3/4-inch (19.05mm) thickness shall be permitted to be continuous through the wall assemblies of light frame construction.

- Continuity (R302.2.3 IRC) – Section R302.2.3 of the IRC requires that the fire-resistance rating shall extend the full length of the wall or assembly continuously from the foundation to the underside of the roof sheathing, deck or slab. The test data presented above indicates that the specific tested wall section with floor penetration (modified U370 design) demonstrates continuity through the length of the tested assembly.

## 8. Conditions of Use

### 8.1 General:

The loose fill insulation described in this report comply with or are suitable alternatives to what is specified in those codes listed in Section 2 of this report, subject to the following conditions:

- 8.2** Installation must comply with this report, the manufacturer’s published installation instructions, and the applicable code. If there is a conflict between this report and the manufacturer’s published installation instructions, this report governs.
- 8.3** Greenfiber Insulation and Greenfiber FRM may be installed in noncombustible construction without affecting the noncombustible classification as described in Section 603.1 of the 2018 IBC.
- 8.4** The installer must provide the code official a signed and dated statement describing the type of insulation installed, including thickness, coverage area, *R*-value and number of bags or pounds of insulation installed.
- 8.5** When the fire-resistance rated wall or floor-ceiling assemblies described in Section 6 are used in multi-family applications, design and details to verify compliance with all of the applicable requirements of any code must be prepared by a registered design professional where required by state or local jurisdictions in which the project is constructed and submitted to the local code official for approval.
- 8.6** See Product iQ® for products evaluated for Surface Burning Characteristics in accordance with UL 723, Test for Surface Burning Characteristics of Building Materials, ([BPHX](#)).
- 8.7** Greenfiber Stabilized Insulation, Greenfiber Loose Fill Insulation, and Greenfiber FRM are manufactured by Applegate Greenfiber Acquisition LLC located at the manufacturing locations named below, under the UL LLC Classification and Follow-Up Service Program, which includes inspections in accordance with the quality elements of ICC-ES Acceptance Criteria for Quality Documentation, AC 10.

City, State	Plant Identification
Chandler, AZ	CHANDLER
Chambersburg, PA	CHAMBERSBURG-R15890
Decatur, AL	DECATUR-R15890
Eastonollee, GA	EASTAGGF
Hickory, KY	HICKORY-R15890
Lester Prairie, MN	LESTERPRAIRE-R15890
Norfolk, NE	NE
Salt Lake City, UT	UT
Tampa, FL	310
Waco, TX	TX
Webberville, MI	WEBBERVILLE-R15890
Wilkes-Barre, PA	PA-WB

## 9. Supporting Evidence

- 9.1 Manufacturer's published installation instructions.
- 9.2 UL test reports and Classification in accordance with the following:
- Surface Burning Characteristics in accordance with UL 723. See UL Product Certification Category for Loose Fill Materials (BPHX).
  - Physical properties testing in accordance with ASTM C739. See UL Product Certification Category for Loose Fill Materials (BPHX).
  - Fire Resistance in accordance with UL 263. See UL Product Certification Category for Sprayed Fiber (CCAZ).
- 9.3 Reports of physical property testing in accordance with CPSC 16CFR Part 1209.
- 9.4 Reports of sound transmission testing in accordance with ASTM E90 and ASTM E413.
- 9.5 Report of testing conducted on the U370 wall design penetrated by the floor joist.
- 9.6 Documentation of quality system elements described in AC10.

## 10. Identification

The loose fill insulations described in this evaluation report are identified by a marking bearing the report holder's name, Applegate Greenfiber Acquisition LLC; the plant identification; the UL Solutions Classification Mark; and the evaluation report number UL Solutions ER15890-01. The validity of the evaluation report is contingent upon this identification appearing on the product or UL Solutions Classification Mark certificate. Additionally, each package must bear a label with information required by FTC 16 CFR Part 460, and CPSC 16 CFR, Parts 1209 and 1404.

## 11. Use of UL Solutions Evaluation Report

- 11.1 The approval of building products, materials or systems is under the responsibility of the applicable code authorities.
- 11.2 UL Solutions Evaluation Reports shall not be used in any manner that implies an endorsement of the product, material or system by UL Solutions.
- 11.3 The current status of this report, as well as a complete directory of UL Solutions Evaluation Reports, may be found at [UL.com/Solutions](http://UL.com/Solutions) via Product iQ®.
- 11.4 As stated in UL 263, Section 1.6 (d) "These requirements do not cover [the] simulation of the fire behavior of joints between building elements, such as floor-wall or wall-wall, and like connections."

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UL Solutions Headquarters  
333 Pfingsten Road  
Northbrook, IL 60062-2096 USA  
T: 847.272.8800  
[UL.com/Solutions](http://UL.com/Solutions)