COCOON™ CELLULOSE INSULATION
AND THE SYSTEMS APPROACH TO BUILDING DESIGN
Cocoon insulation is designed to conserve energy and improve insulation performance in a wide range of climatic conditions. Cocoon insulation may be used in walls and attics of residential or commercial structures, as well as cathedral or flat ceilings, crawl spaces, basements, and as insulation under floors. There are no slope restrictions with Cocoon stabilized insulation.

**HIGH R-VALUE AND SEAMLESS PROTECTION**
Cocoon insulation's density gives it a high R-value per inch, and it maintains that R-value even under extreme conditions. Cocoon insulation completely fills most voids, forming a tight, seamless insulation seal around irregular objects such as chimneys, etc., which are not rated for zero clearance from combustibles. Proper venting and moisture control will deter moisture infiltration. The need, selection and installation of insulation cannot be overemphasized. The space between walls and ceilings must be adequately insulated to provide a frame for the installation of exterior and interior wall coverings. This space is also a potential source of air infiltration, which will increase the heat loss in the winter and the heat gain in the summer, and reduce the performance of any thermal insulation. Questions about appropriate installation of Cocoon insulation may be directed to a representative at 888-592-7684.

**LIMITATIONS**
Engineered for Life recommends installation according to ASTM C-1015. Cocoon insulation should not be installed in areas where temperatures exceed 194°F, or in areas of excessive or continuous moisture. Spaces to be insulated must be prepared so as to keep insulation material from coming in direct contact with heat sources such as light fixtures, stone pipes, chimneys, etc., which are not rated for zero clearance from combustibles. Proper venting and moisture control will improve the effectiveness of any thermal insulation. Questions about appropriate installation of Cocoon insulation may be directed to a representative at 888-592-7684.

**SAFE FOR THE BUILDING AND THE ENVIRONMENT**
Cocoon insulation does not irritate normal skin. Although Cocoon insulation is only classified as a nuisance dust, wearing a dust mask during installation is recommended. Cocoon insulation is highly effective at reducing airborne sound transmission as well as inside noise from plumbing and other sources.

**FIRE, MOLD, INSECTS AND SOUND CONTROL**
Cocoon insulation meets flame resistance specifications set by all federal, state and local building authorities. The same boron-based chemicals that are so effective as fire retardants in Cocoon insulation are also natural fungicides that protect against mold, mildew and other microbes. Cocoon Pest Control Formula insulation contains higher concentrations of the boron chemicals which repel pests such as termites, cockroaches, ants and silverfish. In addition, Cocoon insulation is highly effective at reducing airborne sound transmission and as well as inside noise from plumbing and other sources.

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**ADVANCED WALL SPRAY SYSTEM**
The unique Cocoon Wall Spray system uses minimal moisture, which permits installation of drywall within 24 hours of application. The product is self-supporting and does not need veneer to hold it in place. And it adheres to any typical wood, metal, gypsum board or concrete sheathing surface.

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INSTALL COCOON™ CELLULOSE INSULATION FOR EFFECTIVE INSULATION THROUGHOUT YOUR STRUCTURE.

The building envelope plays many roles in the proper function of the entire structure. It serves as the thermal barrier and the air pressure barrier of the building. The systems approach to design and construction ensures that Cocoon™ cellulose insulation will perform to meet a wide range of structural demands.

Construction and workmanship are critical to building envelope performance. The examples below illustrate effective installation techniques for addressing varying conditions, from foundation to attic.

1. **BAFFLE INSULATION**

2. **FLOOR OVER GARAGE**

3. **SET-BACK ROOF**

4. **CANTILEVERED FLOOR AND DUCTS**

5. **INTERNALLY INSULATED CRAWL SPACE**

6. **TUB FRAMING**

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SOUND

What is STC?

Sound Transmission Class (STC) is a numerical rating in decibels (dB) of an assembly’s ability to reduce airborne sound transmission over a limited frequency range. ASTM Test Method E90 is used to generate transmission loss data on an assembly, and ASTM E413 uses this data to calculate an STC rating. The single-number ratings correlate with sound transmission for speech, radio, television, and similar sources of noise. For other sources such as machinery, many music systems, and transportation noises, accurate STC assessment requires a detailed frequency band analysis.

Materials

Metal framing reduces sound transmission significantly better than equally dimensioned wood, as does wider spacing between framing members, regardless of material. Likewise, a break or separation between materials in the path of sound (the vibration path) can significantly reduce sound transmission. The mass or weight of an assembly’s membrane also contributes to sound control. For example, added sheets of gypsum board absorb more sound, and a cement block wall absorbs more sound than an empty 2 x 8 frame wall. Likewise materials with higher density and airflow resistance are better at reducing sound transmission. Table 1 lists typical airflow resistivity values for the most common absorptive materials. Airflow resistance was measured according to ASTM C522.

Airflow Resistivity of Common Absorptive Materials

<table>
<thead>
<tr>
<th>Absorptive Material</th>
<th>Density (lb/ft³)</th>
<th>Resistivity (Rayls/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass Fiber</td>
<td>3.5</td>
<td>0.76</td>
</tr>
<tr>
<td>Rockwool</td>
<td>3.5</td>
<td>2.04</td>
</tr>
<tr>
<td>Celotex</td>
<td>3.5</td>
<td>3.08</td>
</tr>
</tbody>
</table>

Table 2 may be used as a guide in estimating the STC of an insulated wall from the contribution of various elements. If an empty 2 x 4 wood stud wall had an STC rating of 35, for example, adding 3 1/2" Cocoon™ cellulose insulation would raise the STC to 40.

**Table 2**

<table>
<thead>
<tr>
<th>Approximate Contribution of Wall Elements</th>
<th>Approximate Change in STC</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1/2 inch Absorptive Material, Wood Studs</td>
<td>5</td>
</tr>
<tr>
<td>5-1/2 inch Absorptive Material, Wood Studs</td>
<td>7</td>
</tr>
<tr>
<td>5-1/2 inch Absorptive Material, Metal Studs</td>
<td>8</td>
</tr>
<tr>
<td>5-1/2 inch Absorptive Material, Wood Studs</td>
<td>10</td>
</tr>
<tr>
<td>1/2 x 5/8 inch Gypsum Board, per sheet</td>
<td>4</td>
</tr>
<tr>
<td>Joint Spacing, 16 vs. 16 inch</td>
<td>4</td>
</tr>
<tr>
<td>Resilient Channel on 16 inch Centers, Wood Studs</td>
<td>10</td>
</tr>
<tr>
<td>Resilient Channel on 24 inch Centers, Wood Studs</td>
<td>12</td>
</tr>
<tr>
<td>Wood Studs on 16 inch centers</td>
<td>27</td>
</tr>
<tr>
<td>Metal Studs on 16 inch Centers</td>
<td>30</td>
</tr>
<tr>
<td>Staggered 2 x 4 Wood Studs on 6 inch Plate</td>
<td>37</td>
</tr>
<tr>
<td>Double Rope of Wood Studs on Separate Plates</td>
<td>40</td>
</tr>
</tbody>
</table>

**This only applies when wood studs are on 10 inch centers.**

Detailing and Workmanship

Detailing and workmanship significantly affect sound control. For instance, flanking paths, inter-connecting ductwork, non-airtight edge joints, and inadequate door and window construction all degrade sound control performance. Performance is also compromised when sounds bypass absorptive material through gaps and voids; therefore, intimate contact between absorptive material, framing, and gypsum board should be maintained.

FIRE SAFETY

Cocoon Insulation Enhances Fire Resistance

Cocoon insulation can add significant fire resistance. Cocoon insulation will burn at a controlled rate of about one inch per five minutes, based on one- and two-hour ASTM E119 fire endurance tests on wood and steel-framed walls. Cocoon insulation can be added to any non-load bearing or load bearing wood or steel-framed wall assembly without reducing fire resistance. It can also be used as an alternative to traditional building code fireblocking measures. Fire rated walls filled with Cocoon insulation will meet building code provisions for adequate protection against non-combustible through penetrations. Normally, membrane penetrations for such things as wall receptacles require a separation of at least 24" on opposite sides of a fire rated wall. However, if the wall is filled with Cocoon insulation, the horizontal separation need be only equal to the wall’s thickness. GreenFiber has obtained approval from Underwriters Laboratories for the use of Cocoon insulation for many designs listed in their Fire Resistance Directory.

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Special Considerations

For rated fire-resisting systems require special consideration if sound absorptive material such as Cocoon™ cellulose insulation is added to the plenum area. The weakest link in a fire system is the joint. The fiber must be held in place by means of a fire-resisting joint compound, and rated fire resistive material must be used at all exposed end points. Combined with appropriate seals, fire-rated wood and metal framing may be used as fire barriers.

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SCOPE
This specification provides data pertinent to the pneumatic application of Cocoon™ cellulose insulation in attics and walls. Cocoon insulation provides outstanding resistance to heat flow for thermal applications, noise control for acoustical treatments, and fire control in walls and attics of residential and commercial construction.

MATERIALS
More than 80% of the content of Cocoon insulation is processed from recycled cellulose fibers which have been chemically treated for flame resistance. The additives will not irritate normal skin and will not adversely affect other building materials.

FUNCTIONS
Thermal performance
Cocoon insulation resists the flow of heat by trapping air within the cell wall of each fiber and between fibers, creating significant resistance to air movement. This natural ability to trap air provides Cocoon cellulose insulation with 22% more insulation effectiveness than the same R-Value of other low-density loose-fill fibrous insulating materials.

Sound Control
These same isolated air pockets and density also provide effective noise reduction in walls and between floors by effectively creating a customized batt at the job site.

MATERIAL CHARACTERISTICS
All cellulose insulation sold in the U.S. must conform to the CPC standard16 CFR Parts 1209 and 1404. In addition, Cocoon meets all of the test requirements of ASTM C-739, the maximum density anticipated after long-term settling of dry attic applications was determined by the following specifications:

ASTM C-739 1.6lb/ft³
CAN/ULC-S703 25.6kg/m³

Thermal Resistance
The average thermal resistance per inch was determined by test method ASTM C-518 (4 in. thick):

ASTM C-379 3.70 (R-Value)
CAN/ULC-S703 25.65 (RSI – Value/M)

Surface Burning Characteristics
Two surface burning characteristics are evaluated. They are Critical Radiant Flux using test method ASTM E-970, and Flame Spread using ASTM E-84 or CAN/ULC-S102.2. Cocoon insulation meets or exceeds the specified requirements for each test as follows:

ASTM E-970 greater than 0.12 watts/cm²
ASTM E-84 Flame spread less than 25 Smoke developed less than 50
CAN/ULC-S102.2 less than 150

Moisture Vapor Sorption
This requirement assures that normal variations in relative humidity will not adversely affect thermal performance. Cocoon insulation meets the requirements of less than 1.5% for maximum weight gain under the specified test conditions.

Corrosiveness
When in contact with steel, copper, aluminum, or galvanized materials, Cocoon insulation was determined to be non-corrosive.

Other Properties Tested
Cocoon cellulose insulation passed these additional tests:
- Odor Emission
- Separation of Chemicals
- Flame Spread Permanency
- Fungi Resistance
- Smolder Resistance

BUILDING CODES

ACKNOWLEDGEMENT
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