COMPARISON GUIDE TO NON-FIBROUS LINER PERFORMANCE
Performance Counts
Selection of a duct lining can be a challenging step in the design process of a building’s HVAC system today. Fibrous liners like Johns Manville Permacote® Linacoustic® remain the preferred choice due to their cost/benefit ratio, but non-fibrous alternatives have begun to appear. In particular, manufacturers of foam insulations are actively promoting their products as non-fibrous HVAC duct liners.

Unfortunately, many of the proposed alternatives to traditional fibrous liners do not meet the requirements of a duct lining material, from either a building code or an acoustical absorption standpoint. That’s why Johns Manville embarked on an extensive development program to design a non-fibrous liner with fibrous liner performance.

Polycoustic™ is based on a high-performance polyimide foam core and incorporates Johns Manville’s exclusive Permacote® acrylic polymer airstream coating for long-term durability. An EPA-registered additive in the formula protects the coating against potential microbial or fungal growth. Polycoustic features acoustical performance characteristics similar to market-leading Permacote Linacoustic. It’s the only non-fibrous liner material we’re aware of that’s specifically designed to serve as an acoustical duct liner insulation.

As good as Polycoustic is, it’s important to note that it doesn’t comply with every requirement of national fire and building codes. But as the information in this brochure shows, it outperforms other alternatives in the important areas of temperature resistance, shrinkage, and acoustical absorption. Refer to product information page AHS-183 for detailed information about Polycoustic.

At Johns Manville, we’re confident that our fiber glass Permacote Linacoustic duct liner provides environmentally safe, cost-effective performance. For those who request a non-fibrous liner, Polycoustic is the clear alternative. Remember, in selecting any alternative, it’s important that the specifier and building owner ensure that what they are giving up does not create problems in other areas.

ASTM C 1071
Introduced over a decade ago, ASTM C 1071 is the defining standard for all acoustical duct liners. Liner performance requirements are clearly spelled out in ASTM C 1071 to help make selecting duct liner insulation a more informed decision for specifiers and owners (see back page for more detail and summary checklist). This comprehensive set of tests is based on building code compliance, and contains actual performance range requirements. Check the table for all four tested materials in the ASTM C 1071 summary on the back page.

See the chart on the opposite page for comparison test results of 19 different industry tests. You’ll see clear advantages for both Permacote Linacoustic and Polycoustic in the majority of tests.
## Physical Property Test Summary

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Permacote&lt;sup&gt;®&lt;/sup&gt; Linacoustic&lt;sup&gt;®&lt;/sup&gt;</th>
<th>Polycoustic™ Foam</th>
<th>Elastomeric Foam</th>
<th>Polyolefin Foam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosiveness on steel</td>
<td>ASTM C 665</td>
<td>Pass</td>
<td>Fail</td>
<td>Fail</td>
<td>Pass</td>
</tr>
<tr>
<td>Water Retention WRs / WRs (g/ft²)</td>
<td>ASTM C 1134</td>
<td>88.9 / 246.5</td>
<td>11.6 / 91.6</td>
<td>2.4 / 9.3</td>
<td>7.5 / 5.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.40 / 12.20</td>
<td>0.54 / 4.31</td>
<td>0.11 / 0.41</td>
<td>0.36 / 0.28</td>
</tr>
<tr>
<td>Moisture Vapor Sorption (%)</td>
<td>ASTM C 1104</td>
<td>2.86</td>
<td>0.56</td>
<td>5.55</td>
<td>-0.12</td>
</tr>
<tr>
<td>Odor Emission</td>
<td>ASTM C 665</td>
<td>Otherwise / Weak</td>
<td>Otherwise / Weak</td>
<td>Objectionable / Strong</td>
<td>Otherwise / Weak</td>
</tr>
<tr>
<td>Fungus Resistance</td>
<td>ASTM C 1338</td>
<td>0, No fungal growth</td>
<td>0, No fungal growth</td>
<td>0, No fungal growth</td>
<td>0, No fungal growth</td>
</tr>
<tr>
<td>Fungus Resistance</td>
<td>UL 181</td>
<td>0, No mold growth</td>
<td>0, No mold growth</td>
<td>0, No mold growth</td>
<td>0, No mold growth</td>
</tr>
<tr>
<td>Fungus Resistance (rating)</td>
<td>ASTM G 21</td>
<td>0, No fungal growth</td>
<td>0, No fungal growth</td>
<td>0, No fungal growth</td>
<td>0, No fungal growth</td>
</tr>
<tr>
<td>Bacterial Resistance</td>
<td>ASTM G 22</td>
<td>0, No bacterial growth</td>
<td>0, No bacterial growth</td>
<td>0, No bacterial growth</td>
<td>0, No bacterial growth</td>
</tr>
<tr>
<td>Hot Surface Performance @ 250°F</td>
<td>ASTM C 411</td>
<td>No effects</td>
<td>No effects</td>
<td>Surface became rigid</td>
<td>Sample melted – Unable to test</td>
</tr>
<tr>
<td>Hot Shrinkage (%)</td>
<td>ASTM C 356</td>
<td>0.55</td>
<td>-0.10</td>
<td>1.25</td>
<td>0.16</td>
</tr>
<tr>
<td>Heat Aging @ 250°F for 60 days</td>
<td>JM TM-436-548</td>
<td>Passed / 20+</td>
<td>Passed / 20+</td>
<td>Failed / 6</td>
<td>Unable to test – Samples melted in 15 minutes</td>
</tr>
<tr>
<td>Puncture Resistance</td>
<td>JM TM-436-558</td>
<td>20+ / 20+ / 20+</td>
<td>20+ / 20+ / 20+</td>
<td>20+ / 20+ / 20+</td>
<td>20+ / 20+ / 20+</td>
</tr>
<tr>
<td>Surface Burning Characteristics</td>
<td>ASTM E 84</td>
<td>15 / 15 / 20 / 20</td>
<td>15 / 15 / 20 / 20</td>
<td>30 / 115 / 20 / 20 / 25</td>
<td>5 / 80 / 195 / 315 / 5 / 65</td>
</tr>
<tr>
<td>Limited Combustibility (Btu/lb)</td>
<td>NFPA 259 per NFPA 90A</td>
<td>2,300</td>
<td>8,800</td>
<td>7,533</td>
<td>18,333</td>
</tr>
<tr>
<td>k-Factor @ 75°F mean</td>
<td>ASTM C 518</td>
<td>0.24</td>
<td>0.36</td>
<td>0.26</td>
<td>0.32</td>
</tr>
<tr>
<td>Ultraviolet Resistance for 60 days</td>
<td>UV-C</td>
<td>No effect</td>
<td>No effect</td>
<td>Dry surface, Visible shrinkage</td>
<td>No effect</td>
</tr>
<tr>
<td>Ph/Alkalinity (%Na₂O)</td>
<td>ASTM E 70</td>
<td>8.4 / 0.22</td>
<td>3.7 / 0</td>
<td>7.3 / 0</td>
<td>3.0 / 0</td>
</tr>
<tr>
<td>Cracking Resistance</td>
<td>JM TM-436-548</td>
<td>Passed</td>
<td>Passed</td>
<td>Passed</td>
<td>Passed</td>
</tr>
</tbody>
</table>

### Acoustical and Thermal Performance Summary

#### Sound Absorption – Sabins / Ft.<sup>2</sup>

<table>
<thead>
<tr>
<th>Material (1” thick)</th>
<th>Frequency (Hz) 125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>NRC</th>
<th>R-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permacote&lt;sup&gt;®&lt;/sup&gt; Linacoustic&lt;sup&gt;®&lt;/sup&gt;</td>
<td>0.05</td>
<td>0.23</td>
<td>0.57</td>
<td>0.84</td>
<td>0.97</td>
<td>0.98</td>
<td>0.65</td>
<td>4.2</td>
</tr>
<tr>
<td>Polycoustic™ Foam</td>
<td>0.03</td>
<td>0.31</td>
<td>0.63</td>
<td>0.99</td>
<td>0.93</td>
<td>0.90</td>
<td>0.70</td>
<td>2.8</td>
</tr>
<tr>
<td>Elastomeric Foam</td>
<td>0.01</td>
<td>0.02</td>
<td>0.12</td>
<td>0.34</td>
<td>0.23</td>
<td>0.19</td>
<td>0.25</td>
<td>3.8</td>
</tr>
<tr>
<td>Polyolefin Foam</td>
<td>0.00</td>
<td>0.04</td>
<td>0.17</td>
<td>0.44</td>
<td>0.14</td>
<td>0.43</td>
<td>0.20</td>
<td>3.1</td>
</tr>
</tbody>
</table>

*ASTM C-423 Type “A” Mounting*
Comparison Photos

Application Testing
Air duct liner insulations are required to perform to 250° F, and they should maintain their performance over the life of the HVAC air distribution system. The following photo series illustrate real world performance differences that impact the durability of the installed insulation.

Johns Manville test samples were taken at random from plant inventory. Alternative insulation samples were each purchased from three separate sources, located in different geographic regions of the USA.

Heat Aging
Photo Series One (pp. 3, 4, 5) illustrates accelerated aging testing per Johns Manville TM-436-548. Samples are exposed to 250° F for 60 days. Control samples are placed on left, test samples on right in all photos.

Installed Hot Shrinkage
Photo Series Two (p. 6) illustrates hot shrinkage conducted in accordance with ASTM C 356, with insulation material installed on galvanized metal in accordance with NAIMA Duct Liner Installation guidelines or manufacturer’s recommendations. Test samples were adhered to metal with 100% adhesive coverage, butted firmly, and pinned with mechanical fasteners selected to provide compression of less than 1/8” at installed height. No control samples were used.

Photo Series One – Heat Aging

Control samples on left, test samples on right.

Permacote® Linacoustic®
250° F at 60 days
Test sample exhibited no change.

Polycoustic™
250° F at 60 days
Test sample exhibited no change.
Elastomeric Sample #1
250˚ F at 60 days
Test sample exhibited shrinkage, curling.

Elastomeric Sample #2
250˚ F at 60 days
Test sample exhibited cracking, shrinkage, curling.

Elastomeric Sample #3
250˚ F at 60 days
Test sample exhibited cracking, shrinkage, curling.

Control samples on left, test samples on right.
Comparison Photos

Polyolefin Sample #1
250˚ F at 10 minutes
Test sample photo taken at 10 minutes; sample exhibited extreme shrinkage and deformation. Test concluded at 15 minutes – sample failure due to melting.

Polyolefin Sample #2
250˚ F at 10 minutes
Test sample photo taken at 10 minutes; sample exhibited bubbling, shrinkage, and curling. Test concluded at 15 minutes – sample failure due to melting.

Polyolefin Sample #3
250˚ F at 10 minutes
Test sample photo taken at 10 minutes; sample exhibited extreme shrinkage and deformation. Test concluded at 15 minutes – sample failure due to melting.

Control samples on left, test samples on right.
Polyolefin
180˚ F at 96 hours
Test sample exhibited shrinkage resulting in gap at panel seam, shear load on fasteners; sample panels deformed away from metal in squares defined by fasteners.

Elastomeric
180˚ F at 96 hours
Test sample exhibited shrinkage resulting in gap at panel seam, shear load on fasteners.

Polycoustic™
180˚ F at 96 hours
Test sample exhibited no change.

Permacote® Linacoustic®
180˚ F at 96 hours
Test sample exhibited no change.

Control samples on left, test samples on right.
ASTM C 1071 Performance-Based Duct Liner Selection

The performance-based ASTM C 1071 duct liner standard has removed the guesswork from the selection of duct system liner insulations. Historically, only insulation thickness and density were primary selection criteria for duct liners. Today it is recognized that performance is dependent upon the base liner material composition and airstream surface treatment.

That’s why the insulation industry collaborated with ASTM to produce the C 1071-89 specification. C 1071 provides a comprehensive series of tests to document actual insulation performance.

ASTM C 1071 Benefits

As the test results in this brochure show, insulation materials of similar thickness can have widely diverse acoustical and thermal performance levels. Using ASTM C 1071 as selection criteria gives engineers and owners the ability to:

- Specify acoustical performance requirements
- Specify thermal performance requirements
- Specify other key duct liner parameters, as indicated below

ASTM C 1071 - Not Just Acoustics and Thermal Performance

There’s much more to ASTM C 1071 than acoustical and thermal performance. The checklist below summarizes the results of other important duct liner tests. For more information about ASTM C 1071, refer to JM Fact Sheet #AHS-193.

<table>
<thead>
<tr>
<th>Test</th>
<th>Permacote® Linacoustic®</th>
<th>Polycoustic® Foam</th>
<th>Elastomeric Foam</th>
<th>Polyolefin Foam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity (ASTM C 518)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Temperature resistance (ASTM C 411)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Corrosiveness (ASTM C 665)</td>
<td>✓</td>
<td>X*</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Surface burning characteristics (ASTM E 84)</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fungi resistance (ASTM C 1338)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Acoustical absorption (minimum NRC)</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Odor emissions (ASTM C 1304)</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Moisture vapor sorption (ASTM C 1104)</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Erosion resistance (ASTM C 1071)</td>
<td>✓</td>
<td>✓</td>
<td>Not Tested</td>
<td>Not Tested</td>
</tr>
</tbody>
</table>

*Test sample failed. JM has taken corrective action.

North American Sales Offices, Commercial/Industrial Division

Eastern Region
P.O. Box 158
Defiance, OH 43512
(419) 784-7000
(800) 334-2399
Fax: (419) 784-7866

Western Region
P.O. Box 5108
Denver, CO 80217
(303) 978-2284
(800) 368-4431
Fax: (303) 978-4661

International
(303) 978-3763
Fax: (303) 978-2627

Johns Manville Insulations
Commercial/Industrial Division
P.O. Box 5108
Denver, CO 80217-5108
www.jm.com

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