

COTTON FIBER DUCT LINERS

As more mechanical engineers and building owners seek alternatives to fiberglass duct liners, many have found that the performance characteristics of closed-cell elastomeric liners make it an ideal choice.

Another product that has been introduced to the market in the past 3 years is a cotton fiber liner material which is available from several sources. Cotton fiber liner has been viewed as a viable product in some markets and has been used as a non-fibrous liner in VAV boxes (Titus and ASC). It does have several advantages over fiberglass:

1. Contains no man-made mineral fibers (mmmf's), not a dermatologic irritant.
2. Contains no CFC's, HCFC's or formaldehyde or other ozone depleting chemicals.
3. Noise reduction coefficient (NRC) value comparable to fiberglass.
4. Cotton is a renewable resource and cotton liners may have a high recycle content – preferred on LEED projects.
5. Dimensionally stable.
6. Can be installed using water based adhesives.
7. Excellent flexibility – handling characteristics similar to fiberglass.
8. Available in rolls up to 60 inches, can be installed on coil lines.
9. Has International Code Council Evaluation Services (ICC ES) compliance report #ESR-1589 and meets ASTM E84 25/50 rating for up to 2" thickness.

While all of the above may sound attractive, this product has several serious flaws:

1. It is organic (cotton) and must rely on a facer, additives and edge protection to prevent moisture penetration and mold growth and to provide ASTM E84 rating compliance.
2. Sodium borate is used in large quantities (up to 10% by wt.) to provide fire resistance. In the presence of moisture, boric acid is formed. Boric acid is highly corrosive to galvanized steel, and cotton fiber liners fail when tested in accordance with ASTM C665 (reference Insulation Facts #73 published by NAIMA). This same mechanism became a significant corrosion problem with similarly treated cellulosic insulation products in the 1970's. In humid attics, electrical wiring, outlet boxes and light fixtures became corroded, creating potential fire hazards.
3. The ASTM C1104 water vapor sorption rate averaged almost 50% by weight when tested by NAIMA versus a 3% total allowed by C1104. This test is a humidity cabinet test only. By comparison elastomeric duct liner only absorbed 0.02% by weight in an immersion test, ASTM C209.
4. Sodium borate could leach out of the product under continuous moisture conditions, resulting in a loss of mold / bacteria growth resistance and ASTM E84 performance.
5. All edges of the cotton liner must be coated to prevent moisture intrusion. Any damage to the facer or edge protection could result in moisture intrusion. Facers and edge protection are easily damaged during fabrication, transport / storage and installation.
6. Cotton fiber liner will lose significant thermal performance and suffer physical damage if subjected to moisture or mold attack. Cotton fiber is an ideal food source for many types of mold.

7. Cotton liner is difficult to cut when compared to fiberglass and elastomeric liner materials.
8. Based on a published R-value of 3.8 per inch, a 1" liner thickness will not meet many specification and energy code requirements. R-values vary by manufacturer.
9. Sodium borate and boric acid both have significant potential health effects as a result of ingestion, inhalation or dermal contact. Boric acid is used for roach and termite control.
10. Cotton fiber liner is comparable in cost to elastomeric liner, but has limited distribution and little history of successful use as a liner material.
11. The product is fibrous. Long term exposure to large quantities of plant fiber (cotton) dust through inhalation has potential adverse health effects (weaver's cough or byssiniosis).
12. These "natural" products may be subjected to a bleaching process to provide a white appearance. Chlorine is highly toxic, and is an ozone depleting chemical. This calls into question whether these products are truly environmentally friendly.

Once all of the advantages and disadvantages are carefully considered, it becomes apparent that cotton fiber is not a good choice for a duct lining material, especially where an inorganic material like fiberglass has a documented history of moisture related problems.

Closed-cell elastomeric insulation materials have been used successfully for over 15 years as an indoor air quality friendly alternative to fiberglass duct liner. Closed-cell elastomeric liners combine inherent moisture resistance (no loss of R-value in the presence of moisture, no physical degradation or mold growth) and excellent handling / installation characteristics.