Trend Brief #2: CAS-TB2-2003

Closed Cell Foam — An Acceptable Acoustical Duct Lining?

"2.02 ACOUSTICAL DUCT LINING

*A. Provide 1" thick hospital grade by IMCOA EPFI or equal…. **No fiberglass is allowed.**"*

No fiberglass allowed?

We see this language appearing more and more in specifications for acoustical duct linings. Fiberglass, once the material of choice, is now giving way to products like closed cell foams that don't have the negative health and safety concerns of fiberglass. These materials also have characteristics that provide benefits which, at first glance, outweigh those of fiberglass insulation. But, in the important area of acoustics, can these foam products provide the level of noise control required? And at a reasonable cost?

Designers and specifiers may want to re-evaluate this recent trend and ascertain if closed cell foams are truly an acceptable acoustical duct lining.

So, why specify "no fiberglass is allowed"? For years fiberglass has been considered the "next asbestos". But is such an assessment justified? Fiberglass fibers shed from exposed duct linings have caused health concerns, even after insulation manufacturers developed acrylic coatings to prevent fiber erosion. The International Agency for Research on Cancer (IARC) rated fiberglass as a Group 2B ("potentially carcinogenic to humans") product. Even placing fiberglass in double-wall ductwork, panels and silencers behind perforated sheet metal did not quell concerns. So, over the years acoustical products manufacturers developed fiberglass-free duct system noise control products, such as closed cell foams, specifically for hospitals. Unfortunately, these products do not provide the same level of noise control obtained in products with fiberglass insulation.

In 2002, after years of extensive testing, insulation manufacturers won the effort to have the International Agency for Research on Cancer (IARC) lower the classification of glass wool, rock wool, and slag wool fibers commonly used in building materials from classification Group 2B - "possibly carcinogenic to humans" to Group 3 - "not classifiable as carcinogenic to humans".

Closed cell foams are mostly used as external thermal wrap.

As is evident from the specification language "No fiberglass is allowed", designers fearing use of fiberglass in HVAC ductwork and related products need a comparison between the two products to avoid misapplication of closed cell foams – mostly considered thermal external wrap, not internal acoustical liners. The features/benefits list below, submitted by a manufacturer of closed cell foam, entices designers to specify closed cell foam as a duct liner. We've added an additional column of characteristics that specifiers should consider before finalizing their specifications.

Closed Cell Foam

Features	Benefits
Closed Cell Structure	No need for additional vapor barrier/facing
Non-wicking	Low moisture pick-up
Smooth Integral Skin	Reduces dirt accumulation/bacteria-resistant
Tough Skin Surface	Cleanable surface, resists tearing
Non-fibrous/Non-dusting	No dust mask required, non-itching
Excellent Adhesive Receptivity	Easy installation
Flexible/Easy-to-Cut	Easy to fabricate, no special tools
Uniform Thickness	Consistent R-value/does not compact

Detractors
Extremely poor mid- and high-frequency sound attenuation
Questionable smoke ratings (ASTM E-84 requirements)
Higher costs — up to 20 times more costly than standard OEM fiberglass

The use of closed cell foam sounds great, especially when you review the specifications for schools and hospitals today that incorporate fiberglass-filled ductwork, panels, and silencers requiring an erosion barrier to prevent fiber shedding and a vapor barrier to prevent moisture absorption. Look more closely at each benefit though.

Closed cell structure/No need for additional vapor barrier

Uncontrolled moisture, especially standing water, in a duct system is a problem regardless of the type of insulation. Moisture can collect on any surface, including bare sheet metal. Look at duct cleaning ads that show dust laden duct systems – a number are bare sheet metal in addition to lined duct. Moisture forms on closed cell foam surfaces just as easily. Proper airflow, temperature, and humidity control prevent surface moisture problems. Vapor barriers do not.

Non-wicking/Low moisture pick-up

Closed cell foam does not permit water to wick through it or be trapped against the outer shell of the duct where problems can arise. Some water may get to that area—if the duct joints are not properly sealed. It is impossible to seal a system completely. On the other hand, fiberglass enables water to pass through it easily, but fiberglass does not absorb or hold water. And fiberglass bounces back to its original "fluff" by running heated air through the duct system until moisture is evaporated.

Most humidification problems in duct systems result in little more than a thin moisture film on the duct surface, so wicking is not generally an issue. Most fiberglass insulations now incorporate water-resistant coatings that prevent wicking. These coatings are not closed and benefit from the heated air-drying technique.

Smooth integral skin/Reduces dirt accumulation, resists bacteria

Dirt accumulation in a duct system is not good – consider the many duct cleaning ads and IAQ articles on this subject. Moisture in duct systems easily collects on bare sheet metal, as well as the uneven fiberglass insulation surface. Moisture will collect on the cell foam too. Duct liners today incorporate microbe inhibitors and are bacteria resistant.

Tough cleanable surface/Resists tearing

There are cleaning methods for all types of duct systems. Metal never tears and closed cell foams resist tearing, as do acrylic-coated fiberglass insulations. However, improper cleaning or equipment catching on a tear in foam or fiberglass can result in liner being pulled away from the shell. Acrylic coatings from most insulation manufacturers are as tough as closed cell foam, although improper pinning can cause tears. Vibration and oil canning during operation also can cause applied insulation, foam or fiberglass, to pull loose and inhibit proper cleaning. This is not a problem with double-wall ductwork. Its perforated steel liner protects the insulation against damage from light or aggressive cleaning.

Non-fibrous, non-dusting/No dust mask required. Non-itchy

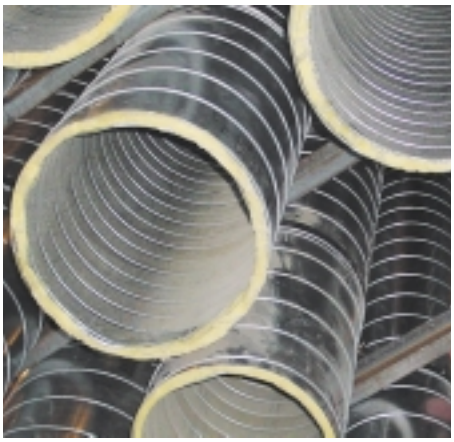
Many of us have handled fiberglass insulation and experienced fiber itching, especially after cutting fiberglass. The fibers do break loose with handling. However, insulated ductwork is a finished product when it arrives at the site to be installed by trained contractors. Insulation fiber-shed, along with other site dust, should be cleaned from the duct system prior to start-up and building occupancy. Minimal fiber-shed at this point is no more detrimental to respiratory health than drywall dust. On the other hand, closed cell foam does not contribute to dustiness, but it gets as dirty as other duct material during installation and must be cleaned.

Excellent adhesion/Easy to install

Closed cell foam and fiberglass liners require 100 percent adhesive coverage on flat surfaces, such as rectangular duct and panels, before they are pinned. Closed cell foam manufacturers have peel and stick versions of their products. Peel and stick application is recommended for round duct and does not require fasteners. Some high-density fiberglass insulations are available for round ductwork. They do not require adhesives or fasteners – they simply slip or snap into place. Double-wall construction does not require adhesives or fasteners by convention – the insulation is wrapped around the inner perforated liner and inserted into the outer shell.

Flexible, easy to cut/Easy to fabricate, no special tools required

Like fiberglass, closed cell foam can be easily cut, trimmed, and shaped with a utility knife. Its flexibility allows it to be quickly inserted, fitted and glued to the inside of duct and fittings.



Double-wall duct construction protects the fiberglass insulation during cleaning and inhibits entrainment.

Insertion Loss Value Comparison *(1-inch-thick insulation used as a liner in 26-inch by 26-inch duct)*

	Insertion Loss (dB/ft)							
	63	125	250	500	1K	2K	4K	8K
Fiberglass	2	2	4	13	32	17	13	14
Closed Cell Foam	2	2	3	5	13	7	9	7

Uniform thickness/Consistent R-value, does not compact

Closed cell foam and fiberglass insulations have similar k-factors and prevent mold growth. Closed cell foam offers a constant R-value. It does not compress, as does most standard fiberglass insulation used for commercial HVAC ductwork, especially double-wall construction. Commercial connection systems are available and should be specified when the concentricity of double-wall ductwork is desired. Otherwise, specify higher density fiberglass insulation used for round, lined ductwork noted above. Closed cell foam and acrylic-coated fiberglass insulation surfaces are easily cleaned.

Acoustical properties/Poor mid- and high-frequency attenuation

Notably lacking in the Features/ Benefits is language addressing the acoustical features of closed cell foam, particularly insertion loss values. McGill AirFlow conducted comparison testing of closed cell and acrylic-coated fiberglass insulations in accordance with ASTM E477 test standards in its NVLAP-accredited laboratory to determine insertion loss characteristics of each type of insulation. Included here is a comparison of 1-inch-thick insulation used as liner in 26-inch by 26-inch duct.

Closed cell foams are shown to have equal low-frequency sound attenuation compared with fiberglass but extremely poor mid- and high-frequency attenuation. So know your application needs before specifying duct liners, especially for acoustically sensitive designs. Independent lab testing should be requested to qualify insertion loss performance characteristics of insulation material used to solve noise problems in a duct system.

Flame and smoke and emissions/ Questionable ASTM results

Closed cell foam manufacturers claim their product meets the necessary ASTM E-84 flame spread 25 and smoke developed 50 ratings. Yet testing by other sources note they do not meet smoke developed ratings. Visit www.jm.com to review AHS-199 6-00 literature. If you intend to specify closed cell foams, you may want to request a lab report verifying ASTM E-84 Flame Spread and Smoke Developed performance requirements.

Closed cell foams give off odors that may be offensive. Perform a 'smell test'.

Cost/Expensive

Closed cell foam material costs up to 20 times more than standard OEM insulation used in most double-wall ductwork, panels, and silencers. Closed cell foam material costs up to six times more than acrylic-coated fiberglass insulation. Most closed cell foams require 100 percent adhesive coverage. Ask installing contractors about the labor cost to properly clean the duct to ensure proper adhesion.

Conclusion

Under low-frequency noise reduction applications closed cell foams appear to be a viable acoustical duct lining. Outside of that range the specifier should carefully weigh closed cell foam's poor acoustical performance and higher cost before declaring "No fiberglass is allowed."