Dan Int-Hout

The Deal About Duct Lining

BY DAN INT-HOUT, FELLOW ASHRAE

The ASHRAE MTG-EAS (Energy Efficient Air Distribution Systems Committee) in their circulated draft (see my March column, "High Performance Air Distribution Systems" March 2014) questioned the inclusion of lined duct sound attenuation in room noise calculations. Presently, room sound levels in manufacturer's catalog typically include 5 ft (1.5 m) of lined duct, which could lead to overestimated sound levels.

All VAV terminal unit manufacturers rate performance of their products with exposed fiberglass insulation; some may rate them with other types of linings, such as foil-faced, polymer, perforated wall, or solid wall liners. While the units may not be rated by every supplier, the acoustical adjustments for the different linings are available within most manufacturers' selection software. In fact, AHRI will likely make these acoustical adjustment values "publicly available" in the near future.

Except in a few locations in the U.S. or where prohibited, such as hospitals, using duct lining is common practice. Some individuals (well-intentioned, of course) have banned exposed fiberglass, citing it as a health concern. Making a reasonable deduction, one would assume that if lining is prohibited in the ductwork that it would be prohibited in the VAV terminal units as well. This is not always the case.

For those occasions where liners are prohibited, acoustical calculations for the space need to include proper sound data for VAV terminal units. Only a few manufacturers provide values in printed catalogs for unlined duct and unlined (or non-exposed) VAV terminal units. Their selection programs, however, can facilitate this determination.

So what is the big deal about duct lining?

Facts About Fiberglass Insulation

While there are some widely known facts about fiberglass liner and its applications, you may be surprised to learn just how much misinformation there is in the market today. Here, we break down the facts.

■ While fiberglass insulation on the skin does tend to itch, by itself, it is actually *not* a health hazard. The fibers are in fact too large to be ingested into the alveoli of the lungs and do not have the jagged edges of asbestos, which causes mesothelioma.

■ Duct insulation is required to pass rigid duct erosion test standards. ASHRAE Standard 62.1-2013 states:

5.4 Airstream Surfaces. *All airstream surfaces in equipment and ducts in the heating, ventilating, and air-conditioning system shall be designed and constructed in accordance with the requirements of the following subsections.*

5.4.1 Resistance to Mold Growth. *Material surfaces shall be determined to be resistant to mold growth in accordance with a standardized test method, such as the "Mold Growth and Humidity Test" in UL 1813, ASTM C 1338 4, or comparable test methods.*

Exception: Sheet metal surfaces and metal fasteners.

Note: Even with this resistance, any airstream surface that is continuously wetted is still subject to microbial growth.

5.4.2 Resistance to Erosion. *Airstream surface materials shall be evaluated in accordance with the "Erosion Test" in UL 1813 and shall not break away, crack, peel, flake off, or show evidence of delamination or continued erosion under test conditions.*

Exception: Sheet metal surfaces and metal fasteners.

■ Take note of the listed exceptions in the above excerpt: "Sheet metal surfaces and metal fasteners." These exceptions are listed because the oils left on sheet metal duct during fabrication have been shown to *support mold growth*. That's right, bare sheet metal can support mold growth; fiberglass insulation on its own, however, cannot.

■ Extensive studies by insulation manufacturers and the Thermal Insulation Manufacturer's Association (TIMA) show that when glass fibers become detached, they do so almost immediately (at initial system startup) and pose no risk of detachment over time.

Mold Growth and Fiberglass

■ Fiberglass has the ability to trap dirt, which left at the right conditions, may support mold growth. Sheet metal

Dan Int-Hout is a chief engineer at Krueger in Richardson, Texas. He is a member of SSPC 55, SPC 129 and consultant to SSPC 62.1.

also can collect dirt and support mold growth, especially if it has been treated with the previously mentioned oils. In practice, most lined ductwork is best left untouched, as duct cleaning has been shown to create more issues than it solves.

■ Three things are required for mold growth: dirt, a dark location, and humidity/dampness. As mentioned previously, dirt can get trapped in the liner, especially if filters are not changed often. Ductwork should be dark (which goes without saying that if that is not the case, there are other issues at hand). Dampness is most likely to occur if ductwork remains unlined.

Insulation and Acoustics

■ Finally, insulation is very effective at deadening sound, which is to say that if there is no insulation downstream of a VAV terminal unit, the risk of a noisy project is high. Of course, if one chooses to eliminate insulated flexible duct, a noisy project is almost guaranteed. I know of one project in particular that measured 51 NC in patient rooms for this very reason. Later, after having installed insulated flex duct (which has no exposed insulation), the sound was reduced to 38 NC, but it ended up costing three times the original VAV terminal unit purchase price.

Manufacturers are required to use Appendix E of AHRI 885, which includes a set of default acoustical deductions (including 5 ft [1.5 m] of lined duct), when presenting NC in a catalog. The input to AHRI 885 calculations is octave band sound power. The AHRI 885 committee has been requested to remove lined duct from Appendix E. While the difference in sound power between lined and unlined or covered insulation is negligible for single duct units, the variance is far greater when discussing fan powered and dual duct units (+12 dB in critical frequencies). It is unlikely that one would provide sound estimates for a system with unlined duct and a unit that is lined. Modifying Appendix E to eliminate lined duct would mean that it could only be used with unlined unit sound power.

Using the tables in AHRI 885, one can estimate the room sound levels only if one has octave band sound power data as an entering argument. Many manufacturers' selection software will perform this calculation for units with and without lining. When presenting results, it is important that all the assumptions used be fully identified so that it is understood what has been used in the estimate.

In lieu of providing sound power data and subsequently using AHRI 885 to predict room sound levels, there have been instances where only mock-up sound pressure data has been available. Using only mock-up sound data for a double wall unit is a tactic that is open to interpretation, as in some cases, the location of a unit above a mock-up space can result in radiated sound being directed away from the measurement position. It may be quiet in the observation room, but not in the adjacent space (where there are no measurements are taken). For this reason, it is recommended that one use AHRI 885 with properly adjusted sound power data to predict room sound pressure levels.

Conclusion

In summary, fiberglass duct liners have been and will continue to be a popular method of providing effective thermal insulation and sound reduction in buildings. For those special applications where duct liners are not used or prohibited, it is crucial that one calculates the resultant room sound levels using all the proper inputs, especially the sound power generated by VAV terminal units (taking into account the proper unit lining for the given application). Failure to do so will not only leave you with a noisy building, but expensive corrections as well. ■