Lined versus Double Wall Ductwork
Tech Brief 07-01

Johns Manville markets their Spiracoustic Plus System with the following advantages:

1. Double-wall performance with single-wall simplicity
   a. Exceeds the acoustical and thermal performance of double-wall insulated round ducts
   b. The self-supporting insulation eliminates the need to connect both an internal core and external duct shell
2. Superior temperature control
   a. Due to the high density and material thickness
3. Quieter operation
   a. Gives dramatic acoustical results
   b. Virtually eliminates air rush noises, fan noise, and crosstalk
4. Airstream surface protected against microbial growth
   a. Both the airstream surface and transverse edges are coated with an acrylic polymer
   b. Contains an immobilized protective agent
   c. Registered with the EPA for HVAC duct applications
5. Tough airstream surface
   a. Black Permacote acrylic polymer surface offers minimal resistance to airflow
   b. Use of available SuperSeal coating products allows the system to retain all engineered performance characteristics when fabrication cuts or repairs are needed
6. Uncomplicated Installation

>>>

1. **Double-wall performance with single-wall simplicity**
   a. Exceeds the acoustical and thermal performance of double wall insulated round ducts

      Converting the published spectral acoustical performance Insertion Loss in dB/ft to dBA/ft (an adaptation to how the human ear responds to sound) results in a 0.4 dBA/ft advantage for Spiracoustic as compared to 1 inch fiberglass double wall (25% open area, perforated inner liner, 24 inch diameter); 0.2 dBA/ft for 36 inch diameter. After approximately 10 feet there is almost no appreciable additional sound attenuation, therefore, there is a maximum of 4 or 2 dBA respectively total Insertion Loss difference. A 3 dB change in sound pressure is just perceptible to the human ear.

   b. The self-supporting insulation eliminates the need to connect both an internal core and external duct shell

      Johns Manville is very quick to point out the ease of installation for their product into round spiral duct, however, their installation guide includes 54 pages of detailed instructions. In the writer's opinion, if this guide is strictly followed a successful double wall system will result. I would strong suggest the reader to review this guide located by the following internet link (https://www.jm.com/content/dam/jm/global/en/hvac-insulation/HVACdocuments/Duct%20Liner/Spiracoustic%20Plus/Spiracoustic%20Plus%20Install%20Guide%20LR%20HVAC-306.pdf).

      I will only point out a few salient points that pertain to lining round duct. The requirements for fittings are too involved for discussion in the document:

      a) "Due to limited air transmission of the backing, Spiracoustic Plus duct liner is subject to collapse in negative pressure applications if airflow occurs between the metal duct and the FSK backing."
      b) Spiracoustic Plus round liner board has limits to the design size range:
         a. 8 - 32 inch inside diameter for 1-inch duct liner
         b. 12 – 40 inch inside diameter for 1.5-inch duct liner
         c. 14 – 54 inch inside diameter for 2-inch duct liner
      c) Estimated scrap differs for shop versus field applied as follows:
         a. Straight duct – 4% - 20%
         b. Fittings – 8% - 25%

d) SuperSeal coating is required for the fabrication or repair of the surface coating. Johns Manville estimates one gallon per 2,000 square feet of round liner board, however, this requirement could double if certain procedures are not followed.
e) Duct board liner is only available in 4-foot x 10-foot sheets and therefore, for minimizing material waste and labor, duct sections should be in increments of 4 feet. For example, 8 feet long in lieu of 10 feet.
f) Flange type connectors are preferred as any connecting device (or accessory) that reduces the duct I.D. or is secured with fasteners that penetrate the duct wall will impact the liner installation.
g) Flanges installed with screws and rivets, depending on length, can complicate installation….screws must be backed out or rivets flattened to install the liner.
h) Estimated tape usage for sealing the FSK facing ranges from 6.5 feet for each 4 foot section to 12 feet for each foot of reducer length, plus 5%-15% waste depending on if pressure sensitive or thermal tape is used.
i) There may be situations when pins, adhesives, or other types of mechanical securement in straight sections may be required:
    a. …where the insulation slides easily in the duct (loose fit), as with VSD sizes (8-32" I.D. and 1" insulation)
    b. Very large (>60" I.D.) duct sections…in other sections of the Johns Manville manual limits the maximum I.D. to 54 inches.
    c. Vertical runs, or other risers greater than 45 degrees from horizontal.
j) When negative pressure is greater than 0.5 iwg exist, or in supply air duct that may be used for emergency smoke exhaust, mechanical fasteners must be used, in addition to:
    a. Must be completely sealed against air leakage to prevent airflow between the duct shell and FSK backing.
    b. Any leading edge of the insulation exposed to airflow must have metal nosing
    c. Must be secured with mechanical fasteners, 3 inch in from the ends and one row centered between the ends; spaced evenly around the circumference with spacing not to exceed 16 inches.

2. Superior temperature control

a. The thermal performance for the Spiracoustic Plus is stated at 0.23 BTU-in/(hr-ft^2-^{0}F) and the Linx standard fiberglass insulation is 0.26 (13% less thermal performance).
b. Most specifications call for R=4 insulation and is provided with 1 inch of either product.
c. There is a slight benefit using Spiracoustic when R=6 is required; 1.5-inch Spiracoustic can be used.
d. This "assumes" that the manufacturer's installation instruction has been followed and there are no gaps in the insulation due to poorly cut joints and seams.

3. Quieter operation – refer to 1.a above

4. Airstream surface protected against microbial growth

The following testing standards are referenced:

1. UL-181 Mold Growth and Humidity Test
2. ASTM C1338 Fungi Resistance Test
3. ASTM G21 Determining Resistance of Synthetic Polymeric Materials to Fungi
4. ASTM G22 Determining Resistance of Synthetic Polymeric Material to Bacteria

Microbiological Resistance Test Summary - The test results referenced above confirm that Permacote® acrylic coating and all mat-faced airstream surfaces are protected from microbial growth. This level of effectiveness is achieved by incorporating an **EPA-registered antimicrobial agent** into the airstream surface, ensuring performance that is not diminished over time or by exposure to high humidity or incidental exposure to water.

Posted on the EPA website (September 30, 2010): "The Agency believes that certain types of antimicrobial products not registered for use in HVAC&R systems are being used in a manner not authorized by the label and not assessed by the Agency as part of the pesticide registration or amendment process. Although the directions for use of most registered sanitizer and disinfectant products permit use on hard non-porous surfaces, because of the uniqueness of HVAC&R systems, such directions for use do not include use on or in HVAC&R components or surfaces unless such HVAC&R use is specifically included on the label."

A request to Johns Manville for their EPA registered anti-microbial agent as published in their literature was responded by the following statement: ***"The EPA-registered anti-microbial is based on thiabendazole chemistry. It is similar to the anti-microbial agents used in acrylic latex paints to prohibit microbial growth".***

A search of the EPA database could not identify the reported agent as approved for HVAC duct applications. The EPA reports: "Thiabendazole is used to control a variety of fruit and vegetable diseases such as mold, blight, rot and stains caused by various fungi…..A ready-to-use formulation is added to paints, carpets, textiles and adhesives."

5. **Tough airstream surface**
    a. Johns Manville publishes a "Friction of Air in Straight Ducts to 6,000 fpm" in accordance with NAIMA AHS-152 standard (NAIMA - North American Insulation Manufacturers Association – association of manufacturers of fiberglass rock wool, and slag wool insulation products).
        i. The recognized testing standard for ductwork is ASHRAE Standard 120-2017 Method of Testing to Determine Flow Resistance of HVAC Ducts and Fittings.
        ii. NAIMA does not advertise this standard on their website. Efforts to contact NAIMA for a copy of this standard have met without a response. Johns Manville responded that they are "checking", however, have not found a copy yet.
        iii. Evaluating the chart provided by Johns Manville against a recognized duct size calculator from ASHRAE results in an **INCREASE** pressure drop per 100 feet ranging from 28% to 100% when compared to regular sheet metal (18" – 60" diameter and 2,000 fpm).
        iv. The friction chart is rather useless without the determination of the absolute roughness of the installed material which includes the fabrication and joining methods between sections of duct. This information is required to determine the pressure drop for the various fittings in the system.
        v. The test method referenced explicitly states that the data does not apply to fittings (TIMA 152 / AHS-182)
    b. It is the writers belief that the proper use of SuperSeal coating products and strictly adhering to the installation instructions, allows the system to retain all engineered performance characteristics when fabrication cuts or repairs are needed, however, almost impossible to successfully achieve in the field due to physical accessibility to the areas to be sealed.