Outdoor Ductwork Tech Brief 15-01

Specifying outdoor ductwork exposed to the weather needs to be given special consideration. The standard of care for the design professional is outlined in the ASHRAE 2012 Handbook (HVAC Systems and Equipment) chapter 21 (page 19.10) as follows:

> ***Exposed ducts and their sealant/joining systems must be evaluated for the following:***
> - ***Waterproofing***
> - ***Resistance to external loads (wind, snow, and ice)***
> - ***Degradation from corrosion, ultraviolet radiation, or thermal cycles***
> - ***Heat transfer, solar reflectance, and thermal emittance***
> - ***Susceptibility to physical damage***
> - ***Hazards at air inlets and discharges***
> - ***Maintenance needs***
>
> ***In addition, supports must be custom-designed for rooftop, wall mounted, and bridge or ground-based applications. Specific requirements must also be met for insulated and uninsulated ducts.***

The first choice is duct geometry. Both rectangular and flat oval duct work have flat surfaces that will tend to pond water and snow and lead to potential water leak paths. It is recommended to use round ductwork when possible or provide adequate duct design to minimize water ponding and/or snow accumulation. In addition, round ductwork is economically available in lengths of up to 20 feet long to minimize rooftop supports and transverse joints.

Most outdoor ductwork will require insulation due to the energy codes. It is recommended to provide factory installed double wall ductwork, with the appropriate R value, in lieu of field installed insulation. The rationale is that under factory controlled conditions the insulation layer will be properly installed and shipped as a complete assembly to the jobsite. In addition, the outer pressure shell provides protection to the underlying insulation. This also minimizes coordination of different trades on the jobsite to complete the duct work installation.

The specified joints between sections of duct and between the duct and the fittings should be EHG G-3 or factory installed full faced sheet metal flanges. The purpose of either system is to insure the “thermal” integrity across the transverse joint. Standard double wall ductwork has both a slip fit on the inner shell as well as the outer shell and requires the installer to temporarily move the insulation away from the joint. From a quality assurance prospective there is no way to insure the insulation is properly placed during the field installation procedure.

The suggested material of construction is G60 (G90 in harsh environments) outer shell using spiral lock seam duct with fittings internally sealed to provide a Leakage Class 3 system. You should require a factory written warranty that the ductwork, when properly installed, will meet a Leakage Class 3 without the use of any external sealants. It is highly recommended that 100% of outside air ductwork is leak tested as required by the latest revision to ASHRAE 90.1 to a Leakage Class 3; the 2012 Handbook in Table 2 recommends air leakage to be limited to 2% of the maximum system design airflow at operating pressure which may be more stringent. This will confirm the system was properly provided by the manufacturer and installed by the contractor.

Ductwork systems sealed to a Leakage Class 3 are “not airtight” nor “water tight”. They will leak very little air when compared to an unsealed system (by definition 3 cfm per 100 square feet of exposed duct work surface area at 1 iwg pressure). If it is deemed appropriate to provide additional waterproofing you may want to consider the following:

1. Ductwork under “positive” pressure will leak air out of the duct work and prevent any water infiltration into the duct work;
2. Ductwork under “negative” pressure tends to tighten the EHG G-3 transverse joints and reduce air leakage;
3. Most air leakage will occur at the transverse joints and around the screws used to connect the duck work. You can apply RTV silicone sealants at these areas to minimize air leakage; or
4. If it is deemed that additional measures need to be taken it is suggested to use a field wrap similar to VentureClad (www.venturetape.com), AlumaGuard (www.polyguardproducts.com), or a similar product. In addition to preventing water infiltration into the ductwork these materials can also offer high thermal emittance from the white or aluminized finishes.

Here are several other considerations:

1. Make sure all holes put into the duct work for Testing and Balancing (TAB) are sealed
2. Make sure that low night time outside air temperature conditions will not cause stagnant air in the duct to drop below the dew point during periods of shutdown.

Design assistance for wind, snow, and ice loads can be found in the SMACNA Round Industrial Duct Construction Standard (1999) 2nd edition or SMACNA Rectangular Industrial Duct Construction Standard (2004).