

Tech Talk - Aesthetically Pleasing Air Door Installations For Entrances - Recessed Air Doors

When some engineers and architects think of an air door they think “industrial” or “big metal (ugly) box”. Although there are some architects who use the open architectural industrial look in current retail and restaurant designs, this is not generally the case in most buildings for higher aesthetic value architectural concepts. In most cases the entry areas of building have vestibules with finished lay-in or gypsum board ceilings. In these cases the architectural designer typically wishes to minimize the exposure of the mechanical equipment that heats the vestibule.

Many times recessed cabinet heaters or fan coil units are used; however, these are a “reactive” type product that tend to waste energy. These products either over heat the vestibule or reactively try to recover the heating set point temperature after the doors close and the gust of cold air has already entered the vestibule. In a pre-heating mode the heat is set at a high temperature so that when the doors open and a gust of air blows in through the doors there is a mixture of the hot air in the vestibule with the cold air from the outside. The hope is to have a resultant mixed air temperature that does not cause too much discomfort when the mass of air blows into the main building where occupants and employees are located.

THERE IS A BETTER WAY to deal with both the aesthetics of the vestibule and the energy/comfort objectives. Stop the cold air gust before it enters the building with a nozzle type diffuser from a recessed air curtain unit. Many engineers have either not been educated on the benefits of an air curtain or have not lost sight of the value of air curtains. Just as the best way to save electrical energy is to turn off a light when a room is not occupied, the best way to save energy wasted in heating outside air that blows into open door entrances is to stop the air from blowing in at all. This is simply smart engineering.

The calculation for analyzing the heat of infiltration air can quickly prove that it is a waste heat the outside air after it enters a building unrestricted: $BTU_h = CFM \times 1.08 \times (T_{\text{inside}} - T_{\text{outside}})$. To offset the cold blast of outside air it is necessary to provide an equal and opposite force. Total building pressurization is generally insufficient to stop a gust of cold air from entering through an open door. An air curtain provides a stream of air (heated or unheated) to minimize the effect of the outside air force blowing in through an open door. However, keep in mind that the first law of thermodynamics (the conservation of mass) always applies. An air door won't stop air rushing through a door if there is a negative pressure in a building with no other source of air to account for the air that is being exhausted in another location.

Air door have been lost in the building industry for a variety of reasons. One is simply the fact that many engineers have never studied the benefits of air curtains and simply follow the lead of other engineers who take the approach of putting a cabinet heater in the vestibule because it is the easy thing to do. This is not engineering. Engineering involves combining multiple objectives of accomplishing energy savings and comfort. Air doors are an engineering solution that need to be considered more. Air doors can be concealed and provide good benefits to the owners and occupants of a building.

Application Consideration

When using a concealed air curtain unit as shown in the picture at right it is important to specify a nozzle extension and to only use a ceiling slot border. A “diffuser” that is designed for low airflow and low velocity (relative to an air door nozzle outlet velocity) should not be used because the diffuser will result in high noise and high pressure loss.

The return air inlet to the air curtain unit inlet can be used as the access panel to get to the air curtain unit for service of the filter or coil if a coil is used to add heating to the vestibule with the air door unit. The air door unit with heat is then the replacement for any other heating source (cabinet heater or diffuser from a central system).

Bottom line _____ recessed conceal air door units are the better engineering solution to providing an energy efficient installation in a vestibule. Call your local Powered Aire representative for assistance in your application.

