

Accurate VAV Control of Large Modulating Dampers

(AFC-4)

We offer these white papers as a contribution to the growth of our industry. These ideas may or may not apply to a specific project. Please contact us for detailed recommendations.

The use of a small number of large dampers rather than quite a few small boxes can offer a lot of advantages. Our pneumatic damper will save space and with our air foil blades lades will control large volumes of air accurately and repeatably . One excellent application used a series of large dampers each serving a series of large zones in place of a large number of smaller VAV boxes.

Other component options include either Opposed Blade dampers (which offer a lot of hysteresis with attendant control inaccuracies) or a large quantity of smaller 'boxes" all suggest higher installation, control and startup costs.

But special requirements attendant to the management of any large volumes of air should be considered during the design process.

We will look at these considerations in some detail

Entry conditions

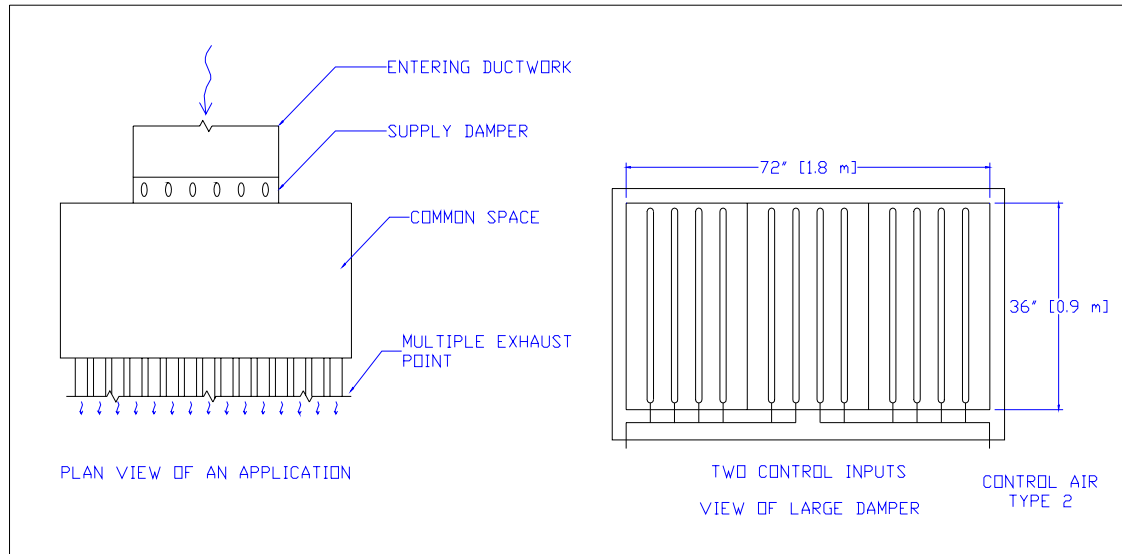
Large dampers are an excellent space saving solution but are often located in spaces which can easily distort entry velocity contours. These distorted velocities do not duplicate laboratory test conditions. The result can be flow rates which are difficult to measure and control. Normal straight runs of duct (2 or 3 times the short damper dimension) as well as turning vanes are advisable.

Volume control

Large dampers can be easily controlled but the instrument air capacities should be considered if the of response is important . The internal volumes of the dampers should be known and the required response time between min and max flows should also be known . We offer software to help determine these response times. For high efficiency filters response times are normally not important.

Some Typical Applications

1. A large supply damper to serve a large room in which a multiple number of smaller exhaust points are located examples a series of hoods and snorkels
2. A large exhaust or return air damper serving a series of individually conditioned cubic les



Design Analysis

The common denominator within these applications is that the common space between the supply and exhaust systems must be maintained at a set point regardless of the varying flow rates

Design Example

Lets use an example of say 40 on-off exhaust ports located in one room. The supply flow tare should be a bit less (offset) than the exhaust flow rates to keep the room under a small negative pressure. This offset ideally should be a constant value when operating with either max or min flow rates. Let us guess that each exhaust point is 0 cfm when closed and 500 cfm when open. Max flow rate should be 20,000 cfm +/- the offset. Let us assume that the room should be 0.05 " [13Pa] negative to an adjacent corridor with a maximum pressure variation of +/- .02"[6 Pa] during changing flow rates.

This application is easily handled by the bladder damper design but does need some design considerations

Our suggestions

1. Sense the room pressures in several locations and average the signal through a large diameter manifold (1" [25mm]) to minimize any signal loss.
2. The transmitter should auto zero to prevent any drift in output signal to the controller
3. The input signal to the transducer and the control pressure to the damper should be as close to mid-span as possible
4. The pneumatic output signal to a very large bladder damper should be at two or three locations to assure equal inflation times across the face of the damper
5. Where possible the rate flow rate should be measured to provide feedback which will help to maintain the set point for the damper.