

Selecting a Pressure Drop Through a Modulating Damper (AFC-1)

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Selecting a Pressure Drop

Many types of VAV air distribution systems are offered for air flow control serving interior and exterior zones – each with different loads and flow rates. Estimating the pressure drop of a modulating damper (and the resultant selection of a damper size) is not difficult but the designer must consider all of the needs of the system.

Control (Actuator) Range

Probably the most important design consideration is to select the damper with enough control range so that the system has stable, predictable performance. The damper should be able to modulate toward both an open and closed position when installed in series with the changing system resistance. The minimum and maximum system resistance should be estimated and the initial damper position selected to operate between the two resistances. An example is the clean and change-out pressures of a HEPA filter. An alternative method on low resistance systems is to select a damper to operate initially with 2 or 3 psi control air or as an alternate 1200 ft/min or 1400 ft/min face velocity.

Damper design

Dampers are sometimes oversized to operate with low face velocities and low noise levels. The Waddell damper blade is an air foil shape which does not shed vortices and operates at a predictable noise level at all operating points. Oversizing the airfoil type damper serves no useful purpose and will likely reduce the control range. Acoustical estimates are easy and should be used to assure a quiet installation. A rule of thumb suggests that for normally quiet applications the pressure upstream of the damper should not exceed more than 0.5 in where the damper is located with a few duct turns between the damper and the air distribution devices.

Energy consumption should also be a part of the damper selection process. The damper should not have complex internal pathways that result in a high initial pressure drop and additional fan energy. The internal design of the damper should be smooth with a low initial (at a wide open position) pressure drop and minimum fan energy requirements.

A performance curve of the Waddell damper with airfoil blades indicating the low initial pressure drop of the damper at various face velocities is shown below.

WPD Pressure Drop Curve

