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Precise Control Over Plenum Spaces

(A-4)

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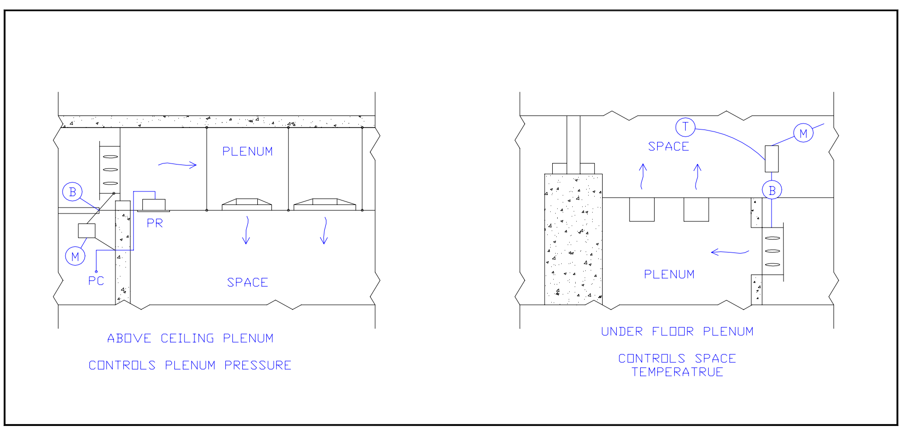
Precise control over plenum spaces
A typical challenge for the designer is close temperature or pressure control over plenum spaces serving critical building areas. Examples are the pressure control in plenums above **clean spaces** or the volume control in **under floor plenums** serving displacement floor diffusers. In general the pressure or volume control is provided by a suitable damper directed by a sensor /controller. In the case of under floor diffusers the space temperature should direct the damper activity and in the case of ceiling filtration units the need for a constant pressures between adjacent spaces should drive the damper activity.



The choice of damper or throttling device should be determined by the application as well as the accuracy and repeatability required.

Application
An example of a non-critical application is a high ceiling room served by aspirating or mixing diffusers where mixing throughout the space is needed. An example of critical

application is a clean room where minimum and positive pressures have to be maintained between adjacent spaces. Another critical application is a conference room requiring low noise levels and immediate mixing above the floor diffusers. In each case pressures of .02” to .05” are common

Damper Accuracy and Repeatability

For non-critical applications a damper with uneven accuracy (large hystersis or non linearity) will often give satisfactory results. These dampers can be OBD, parallel or flapper dampers where the net area between blades is not proportional to the input signal and the resultant air flow (or pressure) also is not proportional to the input signal. The ASHRAE Guide discusses hystersis and graphs the hystersis of OBD dampers.

For critical applications the damper should be directed to a position proportional to the input signal and performance should not have hystersis. No hystersis means that the damper will see the same point when returning to a set point from either an open or closed position i.e. a linear performance curve.

Our Model WPD pneumatic damper not only meets these critical project needs but is also a time proven product. The linearity of our WPD damper design is assured by presenting an airfoil shape to the air stream at all times during modulation. The areas between the vanes (and the resultant flow rate) will change in proportion to the input signal. To confirm our thoughts one installation for a large pharmaceutical company maintained room flow rates within +/- 2% of design --- well within the alarmed +/- 5%. In contrast the OBD and “flapper” damper design does not present an equal reduction or increase in areas between damper blades as the WPD damper does. With the non-proportional area change the resultant airflow will not increase or decrease in proportion to the input signal.

Damper Selection Guidelines

The WPD damper should be selected with attention paid to acoustical and throttling requirements. The system that the damper serves should drive the damper selection. Example: dampers serving **under floor plenums** should be sized with low velocities and duct pressures i.e. operating toward an open position. For ceiling plenums serving **clean spaces** the damper can be sized for normal velocities and higher duct pressures and therefore operate in a mid range position. In any event the maximum and minimum operating conditions should be selected and the resulting control pressure range established. Care should be taken when estimating a pressure drop to the furthest point in the plenum. Often structural beams within the plenum will impede airflow and result in pressure and noise increases. A vertical shaft or chase is easily analyzed as a long narrow plenum with uneven internal pressures. Often internal pressures can be averaged by a pressure sensor located 2/3 down the shaft. However for the velocity ranges normally encountered in this application pressures and noise levels at the first exit and the last should be analyzed and properly treated. Local supplementary airfoil dampers are often used to compensate for higher pressure and noise levels at the first exit from the plenum. Our selection software also can often help the designer match the damper performance to the desired system performance.

Damper Illustration Guidelines
A large range of damper sizes offers space and flow rate solutions for even the most restrictive spaces. Typical installation details are noted below