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Some Design Guidelines

(A1)

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.

> As a general guideline we suggest modeling the performance of the system as well as the products – toward a project with no surprises.

A.
Design Goal
Constant volume supply variable volume exhaust

Many pharmaceutical and other clean space applications require a constant volume supply system regardless of the varying up stream pressures (supply fan speed controlled by a VFD) and VAV exhaust, which compensates for filter resistance changes in the exhaust system

Design Suggestion
Use the 861 differential pressure probe and the WPD damper on the supply selecting duct velocities in the range of 1000ft/mi to 1600 ft/min for differential pressure flow sensing. On the exhaust side use a WPD damper (same characteristics as the supply side damper) and drive the exhaust damper with a room pressure sensor.

B.
Design Goal
Variable volume supply and variable volume exhaust

Many Research laboratories (both industrial and Instructional) require very close tracking of the fume hood exhaust, the room exhaust, as well as the room supply. The offset should be constant at all flow rates

Design Suggestion
Estimate accurately the maximum and minimum supply and exhaust flow rates so the influence on room pressures can be maintained within design guidelines. Feedback provides a direct confirmation of each flow rate.

Use a side wall controller (sensor) in the hood and a duct mounted air flow station (for feedback) to maintain a constant face velocity into the fume hood. Use the 861 differential probe with an auto-zeroing transmitter to directly read flow rates for feedback to the Hood controller. Room exhaust and supply dampers will have to operate linearly to track the fume hood exhaust.

C.
Design Goal
Control the room pressure independently of the supply- exhaust offset

Where a constant offset is to be maintained and the room pressure must be controlled separately from the supply and exhaust volumes. These requirements arise in laboratories processing lethal pathogens and pilot plants where a high positive pressure is to be maintained in spite of light loads.

Design Suggestion
Use the normal supply and exhaust linear volume control dampers for close tracking and add a linear WPD independently controlled by room pressure. The effect of the independent room pressure on the pressure developed by the offset should be modeled. The space envelope should be as impervious as possible

D.
Design Goal
Accurate tracking of supply and exhaust flow rates

Accurate tracking of supply and exhaust is important where loads vary and the offset determines the pressure differential between the space and neutral area. For accurate tracking both supply and exhaust dampers should have linear performance without hystersis. The damper performance should be linear to flow.

Design Suggestion
Use the WPD damper (output is linear to instrument air input) but model the performance with software to insure that the input control pressure remains within a linear part of the transducer output pressure. The entire flow range (max and min flows) for both supply and exhaust dampers should be examined to insure that the offset remains constant.

We discuss tracking in more detail in our white paper.

E.
Design Goal
Space pressurization

Many specialized rooms (example isolation rooms) require a stable pressure relationship between the space and a neutral space possibly a corridor

Design Suggestion
A space pressure can be referenced to a pressure in an adjacent area and the differential pressure outputted to a controller. The controller will adjust the WPD damper to maintain a pressure set-point. Normally these differential pressures are low so a sensor/transmitter combination with good low pressure accuracy should be used. The supply air flow rate should be accurately coordinated with the pressure driven exhaust flow rate.

F.
Design Goal
To maintain a constant volume point on the performance curve of a fan or a constant total exhaust for several points of varying exhaust within in a space

Sometimes an exhaust fan serves a plenum, which handles two air streams each with varying flow rates. The exhaust fan should see a constant flow rate in order to maintain fixed point on the PV curve

Design Suggestion
Two WPD dampers can be used-- each controlling an air stream to maintain the total constant air flow through the fan and a constant point on the PV curve. The linearity of the air flow shaped blades permit very accurate air flow control as one damper is opening and the other is closing

A variation of the above can be to use two WPD dampers to control exhaust flow rate from a fume hood and another to modulate the room exhaust to maintain a constant exhaust stack velocity.

G.
Design Goal
Constant pressure or volume control over larger flow rates

Quite often larger spaces are treated as one zone with their own loads. This happens often in spaces similar to sterile packaging areas and other larger clean spaces.

Design Suggestion
One very successful solution is to use several normal sized dampers factory spliced together. These are installed and controlled as one damper. An alternative solution is to install several individual smaller dampers in parallel and provide controls for each device.

H.
Design Goal
Pressure or volume control using a local control loops

For dedicated spaces where instrument air is available and a wired connection to a Building computer is impractical

Design Suggestion
A choice of Pneumatic control loops or Analog Control Loops

The Pneumatic control loop includes a pneumatic controller and a booster relay factory mounted and piped. These loops use 20 psi control air and are factory piped and field adjusted, a choice of constant volume (CP 20) or constant duct pressure (CP10) These control loops are intrinsically safe.

The Analog control loop includes a local loop controller normally including “fuzzy“ logic. These controllers can be configured for constant pressure or constant velocity applications.