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Air Components, Inc.

M & P Air Components, Inc. provides Components, Technologies, Guidelines, Sales and Technical Services for Industrial Air and Dry Solids Processes.

Our Goal is to provide Clients with the correct components selection and system design to achieve the best Utilization, Reliability, Safety and Economy for their plant processes.

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Technical Bulletin

Fan Selection – Volume Control **TB.20.2.04**

Fan & System Curves. Just as fan curves are used to graphically represent the operating capability of the fan, system curves are used to graphically represent the operating capability of the system.

The *Point of Operation* will always be at the intersection of the Fan and System Curves.

Fan Dampers are used to change the Point of Operation in order to operate at alternate condition(s).

Fan Outlet Dampers increase resistance on the fan, resulting in a new Point of Operation to the left of the original. Parallel Blade Dampers are reliable for up to a 25 % turndown, while Opposed Blade Dampers are reliable up to a 75 % turndown. Both dampers typically have a 10 to 15 % leakage rate when fully closed, unless specially constructed for tighter sealing. Operation is always on the fan curve, with the slope of the system curve increasing to meet the new Point of Operation created by the damper resistance.

Fan Inlet Dampers reduce the fan output by spinning the air into the wheel and lowering its capacity and hp. Each new damper setting produces new Fan SP and HP curves which move the Point of Operation to a new point on the system curve. Inlet dampers can be internal, external, or inlet box type, and are normally reliable for a turndown up to 30 degrees. Beyond this, the inlet damper typically begins to perform like an outlet damper. Fully closed, the inlet damper leakage rate is 10 to15 %.

Comparison of Outlet & Inlet Dampers

Parallel blade outlet dampers are the least costly, with opposed blade outlet dampers about 1.2 times and inlet dampers about 2.5 to 4 times the cost of the parallel blade outlet damper.

Parallel blade outlet damper performance is reliable up to a 25 % turndown, while opposed blade and inlet dampers are both reliable up to a 75 % turndown.

Parallel blade damper throw the exiting airstream to one side, while the opposed blade outlet damper tends to help straighten the exiting airstream.

The inlet damper operates at significantly lower power consumption than the outlet damper.

Outlet dampers change the system curve to a new Point of Operation on the fan curve, while inlet dampers change the fan curve to a new Point of Operation on the system curve.

Comparison of Inlet Dampers & VFD Controllers

Fan inlet dampers create a partially new fan curve with each blade angle setting. The pitch of each new curve normally begins at the peak of the original fan curve, resulting in a new fan curve almost identical to the original curve from peak to left, but substantially new from peak to right. Additionally, inlet vane damper curves are limited in turndown up to 30 degrees, at which point they begin to perform as an outlet damper.

VFD controllers create an infinite number of new fan curves by changing the fan speed, with each curve identical in shape to the original fan curve. As long as the VFD controller and the motor are compatible to the turndown, turndown ratios can be achieved with greater reliability and precision than with inlet vane dampers.

Fan Laws Applied To System Curves

The Fan Laws are useful in predicting new system curves when turbulent flow conditions exist (ducting, fans, dampers). But they cannot be applied to laminar flow conditions, which have losses that are directly proportional or constant with flow (air filters, dust collectors, packed tower scrubbers).

As such, the Fan Laws can be applied to the portions of the system in turbulent flow, but separate calculations must be made for laminar flow sections. Then, a new overall system curve is calculated for the combined sections.

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