Advanced Technology Environmental Control SYSTEMS
ATECS L.L.C. 6107 East Grant Road ▲ Tucson, Arizona 85712 ▲ Phone: 520-290-8878 ▲ Fax: 520-722-4992

What to Look for in a Damper System

Low Pressure Drop: The damper must create minimum fixed energy loss when in the fully open position.

Simplicity: The damper should have few moving parts, thus, minimal maintenance requirements.

Adjustment: The damper must be easy to adjust with a calibrated means to determine the damper setting, such that other dampers may be readily set to the same or similar positions.

Noise: The damper must contribute as little acoustical energy to the system as possible.

Cost/Benefit: The damper should be available for a reasonable cost relative to the desired accuracy of adjustment.

Seal: The damper must prevent leakage when in the fully closed position.

Versatile: The ideal damper can be utilized in a variety of applications with a wide range of entering conditions of the fluid such as velocity, pressure, temperature, dewpoint, etc.

Compatible: The damper should be adaptable to construction in a variety of materials as required for different fluid streams.

Operation: The damper design must be such that it can be operated manually or automatically.

Dependable: The damper must be capable of being fixed or locked in any desired position to prevent inadvertent movement which would alter fluid flow.

Quality: The damper design should be such that it can be constructed in a wide range of quality to encourage use in low budget applications such as comfort air conditioning, yet address the needs of highly technical applications where the need for accuracy of control and reliability, justify the added expense of quality enhancements such as sealing materials, actuators, etc.

Predictable: The performance of field installed units must correlate well with the published performance based upon laboratory testing under ideal conditions.

Adaptable: The damper should be adaptable to a variety of sizes and shapes and must be appropriate for use in any direction with respect to the effects of gravity and kinetic energy of the flowing fluid.

Appearance: The damper should be pleasing in appearance in applications where it will be visible and aesthetic considerations are relevant.

New or Replacement: The damper design should be adaptable to new construction applications or replacement/retrofit of existing devices.

Durable: The damper must be able to operate through many cycles over a long period of time without degradation of performance. The damper and its components must not deteriorate with protracted exposure to the fluid medium.

Inert: The assembly shall not cause or support the growth of mildew, bacterial, mold or other undesirable contaminants. The overall assembly and materials of construction shall have flame spread rating less than 25 and smoke developed rating less than 50 as defined by ASTM E84, UL723 and NFPA 255 "Surface Burning Characteristics of Building Materials" test procedures.

Clean: The assembly shall not generate particulate matter when in operation or static. The design shall be such that it is easy to clean of particulate matter deposited by the fluid stream.

Contamination: The materials used in the construction shall not outgas, or otherwise emit odors, or contaminants to the fluid stream.

Repeatable results. i.e. adjustment of one damper to a given position in a given system configuration should yield the same resultant air flow as another damper placed in the same position and configuration.

Promote **energy conservation** by virtue of eliminating excessive leakage of undesired air streams and enhancing the control capability of HVAC Systems.

Performance must be predictable in that the performance of field installed units must correlate well with laboratory testing under ideal conditions.

The damper assembly **shall be suitable for a wide range of thermal and moisture environments**.

Why Not Other Kinds of Dampers

Single Blade Dampers: This generic type is mounted on a shaft or pivot point to allow adjustment of the damper position relative to the air passageway. The blade is generally flat or shaped as an airfoil in cross section. Several arrangement types are commonly utilized as follows:

SLIDING SINGLE BLADE DAMPERS: In this generic type of damper, a single blade of width, length and shape appropriate to block all or a portion of an air passageway is mounted in a track or similar holding device to allow adjustment across the path of the air stream.

RADIAL BLADE DAMPERS: The damper is generally circular in shape when viewed from the perspective of the air flow (as in a plan view). The individual blades are shaped as the slices of a pie and are each bisected by a shaft which radiates from the center to the perimeter of the circle.

This type of damper has very limited application, generally at the inlet of a centrifugal fan.

BUTTERFLY DAMPER: In this configuration the blade is supported by a shaft which is mounted in the center of the blade along the long axis of the blade such that the blade may rotate about the shaft, generally through a range of 90 angular degrees to allow the damper to be positioned at any point in the range of rotation from fully open (to allow the least restriction to air flow with the blade parallel to the air stream) to fully closed with the blade perpendicular to the air stream.

SPLITTER DAMPER: In this configuration the damper blade is supported by a shaft or hinge devices at one edge and rotates about this edge to regulate the passage of air. The damper blade may be used in a number of physical arrangements to either fully or partially restrict air flow or divert air from one path to another. Actuator mechanisms may include a simple rod attached to the free end of blade or any other linkage or device.

In conclusion: As the case for single blade dampers, the performance of this type of damper is highly non-linear.

Multiple Parallel Blade Dampers: In this generic type of device a number of blades are placed in an arrangement such that the blades touch or overlap one another when in the closed position. The blades rotate about a shaft mounted parallel to the length of the blades and in the center of the width of the blade. The blades are linked together such that they rotate in <u>unison</u> about their individual shafts such that the centerline of each blade remains in parallel to the adjacent blades. The blades typically rotate through approximately 90 angular degrees as the device is adjusted from the fully open to the fully closed position. In this type of damper, a small angular rotation of the blades from the closed position results in a substantial percentage of the full open flow rate, thus the device exhibits non-linear flow/position relationship.

Multiple Opposed Blade Dampers: In this generic type of device a number of blades form a damper plane with a general arrangement much like that of the parallel blade damper. The blades may be flat, air foil cross section, or otherwise formed to serve a variety of specific applications. The individual blades are mounted on shafts which are secured in a perimeter frame. The longitudinal axes of the blades and shafts are parallel to one another. The edges of the blades touch or slightly overlap the blades on either side, to effect a seal when in the closed position. The blades are linked together and provided with suitable mechanisms such that when operated the blades move simultaneously, however each blade rotates about its shaft in a direction opposite that of the adjacent blades. The action of the blades is such that when viewed from the end of the shaft about which the blades rotate, alternate blades rotate clockwise, counterclockwise, clockwise, counterclockwise and so forth. As in the case of the parallel blade damper, the blades typically rotate through 90 angular degrees and may be adjusted and caused to remain in any position from fully closed to fully open. This damper exhibits flow vs. position characteristics which are better than the parallel blade damper, however, the performance is still rather non-linear.

The data provided in the 1987 ASHRAE "Handbook" suggests the performance of typical parallel blade and opposed blade dampers in air handling systems as follows (pg. 51.7 for "alpha parameter equal to 50):

Flow Percent vs. Damper Percent Open

Damper Type/ % Open	10%	20%	30%	40%	50%	60%	70%
Parallel Blade							
Flow	22%	52%	74%	85%	92%	95%	100%
Deviation	12%	32%	44%	45%	42%	35%	30%
Opposed Blade							
Flow	13%	27%	45%	62%	77%	87%	92%
Deviation	3%	7%	15%	22%	27%	27%	22%

NOTE: "Deviation represents the difference in the actual flow performance of the damper from ideal linear performance.

ATECS Dampers

Lower cost: The ATECS dampers improve performance at less total investment that OBD or parallel damper types.

No Maintenance: Because the ATECS damper has few moving parts, there is virtually no maintenance required to ensure the performance does not degrade with time, or cycles of operation.

The OBD type of damper, as a result of the need for complex linkage and the high length of aperture "crack" (between blades) for a given damper face area suffers marked degradation in reliability of performance with time and the number of cycles of operation.

Linear Flow: the orifice configuration will provide linear flow control. Production and lab tests have shown that a specific percent opening, such as 10, 25, 50, 75 percent, will yield a similar percent air flow; that is 10, 25. 50, and 75 percent, respectively. This is the only damper orifice configuration that can provide this characteristic.