ENGINEERING BULLETIN

AIR BALANCE • Bulletin 2

FULL OPEN PRESSURE DROP THROUGH OVERSIZED DAMPERS

On occasion, Engineering has been asked to oversize multi-bladed dampers such that the damper's free area equals the duct size. An example would be to provide a 27-1/2" x 31" Model AC-1 damper (576 sq. in. of free area) to transition to a 24" x 24" duct (576 sq. in. face area), see **figures 1 & 2**. Our customer is attempting to negate any damper blockage that will cause pressure drop.

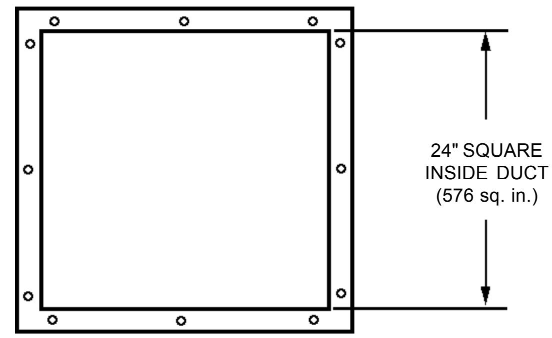


Figure 1

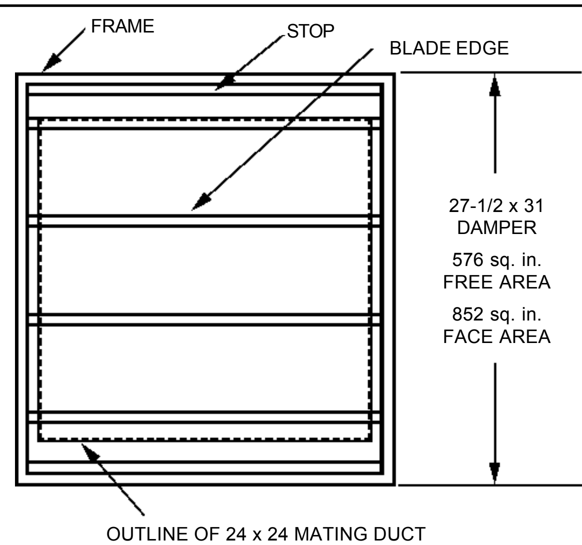
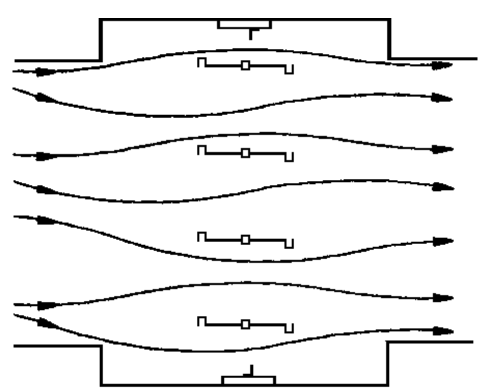


Figure 2

In reality, this oversized damper still has blade edges, mullions, and other obstructions in the airstream that the air must flow around (**figure 3**). The purpose of this bulletin is to illustrate typical tested pressure drop performance of an oversized damper that has the same free area as the mating duct face area. In addition, testing was performed to determine if the cap-collar duct transition distance from the face of the damper was a factor (**figures 4 and 5**).



AIRFLOW PATTERN THROUGH OVERSIZED DAMPER

Figure 3

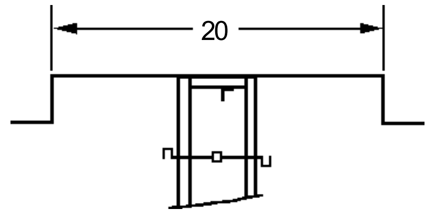
At our AMCA Registered Laboratory in Bradner, Ohio, pressure drop testing was performed on a Model AC-1 Volume Control damper 27-1/2" wide by 31" high. This damper had a full open free area of 576 sq. in. Other particulars on the testing performed:

A. The damper was tested in a run of ductwork that complied with AMCA's figure 5.3 test setup which requires seven equivalent duct diameters upstream and ten equivalent duct diameters downstream.

B. For comparison purposes, a 24" x 24" model AC-1 damper was also tested. This damper had a full open free area of 378 sq. in. (66%).

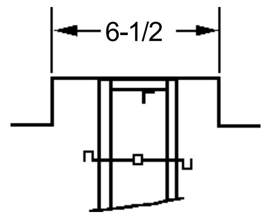
C. For comparison purposes, the 27-1/2" x 31" damper was centered between blunt edge transition plates 20" apart (**figure 4**).

D. For comparison purposes, the 27-1/2" x 31" damper was centered between blunt edge transition plates 6-1/2" apart (**figure 5**).



FURTHER SPACED
BLUNT EDGE TRANSITIONS

Figure 4



CLOSELY SPACED
BLUNT EDGE TRANSITIONS

Figure 5

TEST RESULTS

A. Pressure drop through "empty" length of 24" x 24" figure 5.3 ductwork:
    @ 1000 fpm velocity = .017 in. wg.
    @ 2000 fpm velocity = .067 in. wg.

B. Pressure drop through 24" x 24" AC-1 damper and duct:
    @ 1000 fpm velocity = .073 in. wg.
    @ 2000 fpm velocity = .300 in. wg.

C. Pressure drop through 27-1/2" x 31" AC-1 damper with transition plates 20" apart (**figure 4**) and duct:
    @ 1000 fpm velocity - .041 in. wg.
    @ 2000 fpm velocity - .160 in. wg.

D. Pressure drop through 27-1/2" x 31" AC-1 damper with transition plates 6-1/2" apart (**figure 5**) and duct:
    @ 1000 fpm velocity - .041 in. wg.

NOTE: VELOCITIES LISTED FOR TESTS A THROUGH D ARE DUCT FACE VELOCITIES (1000 fpm = 4000 cfm, 2000 fpm = 8000 cfm).

SUMMARY/CONCLUSIONS

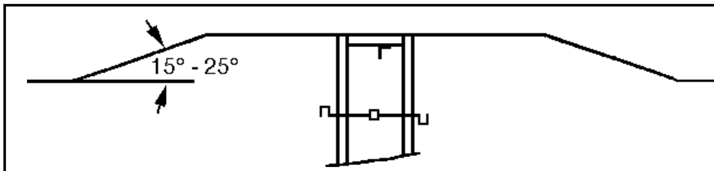
A. Putting any size damper into the "empty" duct system increases the pressure drop. The more blockage from damper frame, stops, blade edges, etc., the higher the pressure drop.

B. The space between transitions (20" versus 6-1/2") appeared to make very little difference.

C. It would be safe to speculate that the oversized 100% free area damper would have been even more beneficial if it were compared against an inserted damper with 40% to 50% free area versus 66% free area.

*D. It would be safe to speculate that the oversized 100% free area damper would have been even more beneficial if the entering and leaving ductwork were flared to the oversized damper versus a blunt edge transition. ASHRAE recommends that ductwork flare-out/flare-in at duct size changes be at a gradual 15° to 25° angle (**figure 6**).*

E. This testing supports the popular belief that when there is a concern regarding pressure drop through a full-open damper, oversizing the damper can be a solution.



FLARED/TAPERED TRANSITIONS

Figure 6