ENGINEERING REPORT

TOPIC: Performance of Combined Louvers and Dampers

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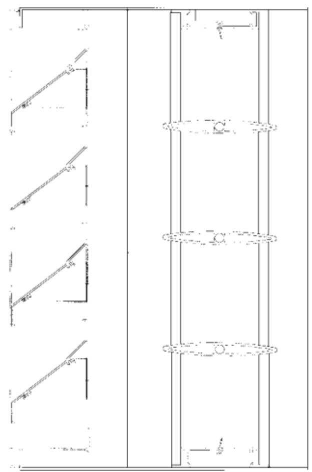
Background

One of the primary challenges for HVAC system designers is to identify and specify components that provide high performance and cost efficiency. In the case of outside air louvers, the development of wind driven rain models has significantly increased the level of water and air performance available. However, the higher price per square foot of these louver models has deterred many designers from utilizing them in their systems. In reality, the ability to reduce the size of the louvers and the increased performance that they provide actually make them more cost effective in many applications. One such application is in the case of individual louvers and dampers that are combined to provide outside air. In this report, we will examine the performance and cost of both standard and wind driven rain design louvers when combined with dampers.

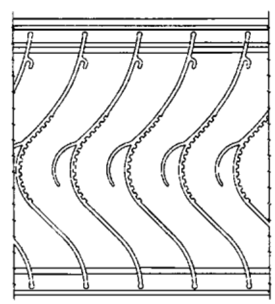
Pressure Drop Calculation

It is difficult to estimate the system effect on pressure drop across a louver/damper combination assembly. A logical assumption would be that the louver blade design greatly affects the airflow interaction between the two products, but to what extent is unpredictable. To determine the actual system effect on a combination assembly, Ruskin conducted pressure drop tests on two louver/damper combinations: an ELF811 standard louver with a CD50 control damper, and an EME6625 wind driven rain louver with a CD50 control damper. The ELF811 louver was selected as the norm because the basic design of the model is widely used in the industry. The EME was selected because the airflow through the vertical blades would create laminar flow through the damper and, in theory, should give substantially less turbulence on the damper blades. This should ultimately lead to less pressure drop through the combination assembly. The CD50 control damper was selected because the airfoil blade will minimize pressure drop through the damper.

To determine the pressure drop of the two different 48" x 48" combination assemblies, we'll use 5,000 cfm as our benchmark for sizing the louvers. The catalog pressure drop through the ELF811/CD50 combination would be .12" + .02" = .14" w.g. at 5,000 cfm air volume. The catalog pressure drop of the EME6625/CD50 combination would be .04" + .02" = .06" w.g. at the same volume.



ELF811/CD50 Combination



EME6625 Plan View

To determine the actual pressure drop of the combinations, both assemblies were tested on an AMCA figure 5.4 chamber and the results were plotted on the chart shown in *Fig. 1* of this report. The results of the ELF811/CD50 test show that the actual pressure drop was .15" w.g. at 5,000 cfm air volume, or 7% above the theoretical catalog pressure drop of the two products combined. The results of the EME6625/CD50 test reveal an actual pressure drop of .044" w.g., 27% less than the theoretical pressure drop of the two products combined. This reduced pressure drop proves that the smooth shape of the EME6625 blade does in fact provide a less turbulent airflow into the damper, which reduces the overall pressure drop through the combination.

A comparison of the combination test data and the cataloged EME6625 data reveals that the damper adds little pressure drop when combined with the louver. Considering the minimal system effect on pressure drop, a combination assembly utilizing the EME6625 louver can be substantially less in overall size than an ELF811/CD50 combination. If the

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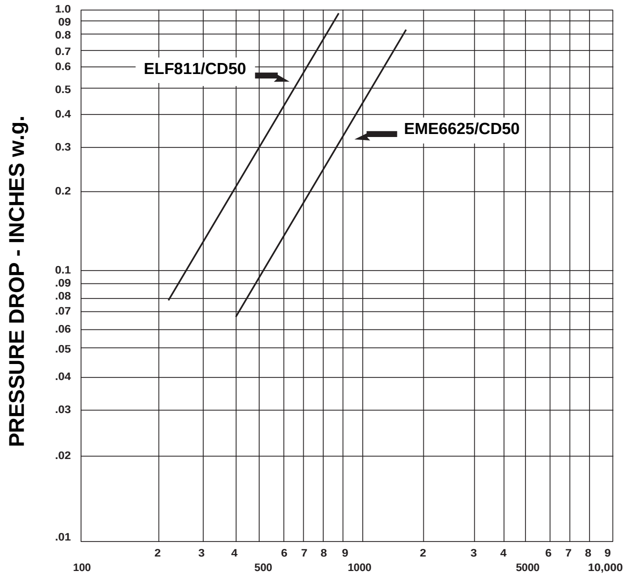

FACE VELOCITY - FEET/MINUTE

Fig. 1

designer's goal is .15" as the target pressure drop and using catalog pressure drop data, the EME/CD50 combination can be sized to handle 570 fpm face velocity, over 80% higher than the velocity of the ELF/CD combination. This would allow the EME/CD50 combination to be almost half of the overall size of the ELF/CD50 arrangement. Water penetration through the EME6625 would not be a concern as the free area velocity through the louver would be 1,341 fpm, which is less than its 2,062 fpm maximum wind-driven rain rating.

Reducing the overall size of the combination assembly means the control dampers and sleeves will be smaller as well. The reduction in damper size could also reduce the number of actuators required. In addition, utilizing an EME in the combination provides other benefits not possible with the ELF. First, the higher velocity of the air through the assembly will make the damper more controllable as the velocity through it will be closer to the velocity of the return air damper. Secondly, the EME6625 louver will provide protection from wind driven rain penetration that is not possible with a standard wall louver.

A comparison table showing price and performance information of both combination arrangements is shown below using air volume as a benchmark. The first columns identify the air volumes and present the ELF 811/CD50 combination information. The sizes are based on the ELF 811's maximum free area velocity of 707 fpm. The next three columns present EME6625/CD50 combination information with the sizes based on 1,341 fpm free area velocity through the EME. This velocity was selected to achieve the same pressure drop as the ELF/CD combination at the same air volumes. The last three columns present EME 6625/CD50 information with the sizes based on the 2,062 fpm maximum free area velocity of the EME6625. A list price comparison ratio is given for each unit that considers the price of the louver, damper, 120V electric actuators, aluminum sleeve and combination charge. To establish a point of reference, we have selected the 96" x 54" ELF811/CD50 combination as the basis of the price ratio values.

As shown in the table, the high airflow capacity of the EME6625 makes it more cost effective to use in combination units than the ELF811 in many applications.

Summary

When designing the air intake components for HVAC systems, evaluate performance as well as cost when selecting louvers. As we have identified here, the EME6625 wind driven rain louver, which has a higher cost per square foot than an ELF811 standard louver, is actually more cost effective in many situations when used in combination with a damper. In addition, using the EME provides air characteristics and wind driven rain protection that would not be possible with a standard wall louver.

COMPARISON TABLE

(*96" x 54" ELF811/CD50 used as base price)

CFM	ELF811/ CD50	▲p	LIST PRICE RATIO	EME6625/ CD50	▲p	LIST PRICE RATIO	EME6625/ CD50	▲p	LIST PRICE RATIO
6,000	54" x 52" 1 actuator	.15"	.60	36" x 44" 1 actuator	.15"	.72	32" x 36" 1 actuator	.24"	.56
12,000	96" x 54" 2 actuators	.15"	1.00*	54" x 54" 1 actuator	.15"	1.08	48" x 48" 1 actuator	.24"	.85
24,000	106" x 96" 3 actuators	.15"	2.22	84" x 70" 2 actuators	.15"	1.90	64" x 72" 2 actuators	.24"	1.60