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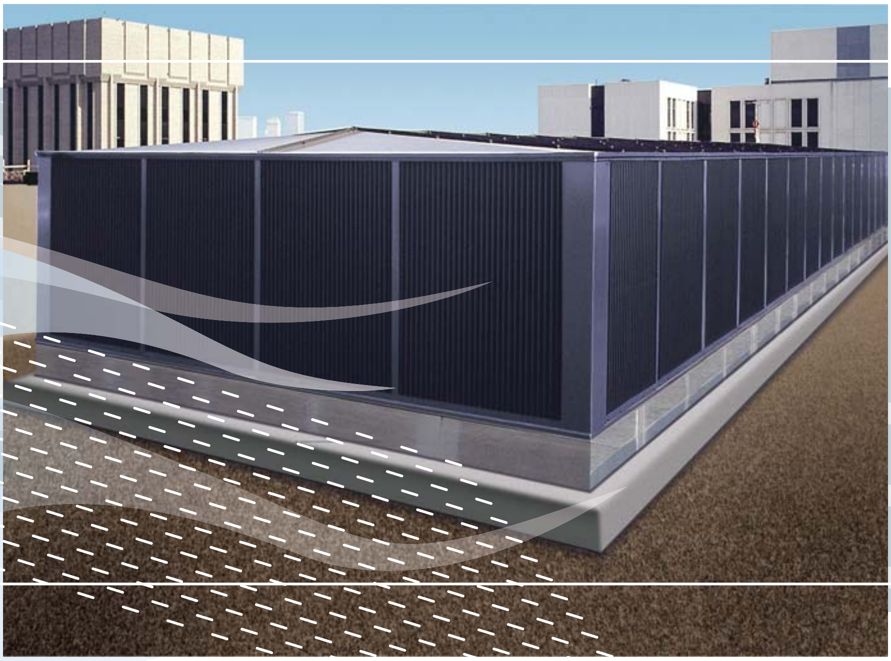

Numerous benefits help justify and offset the additional costs.

In the last decade, there have been design innovations that enable louvers to provide greater airflow capacity and increased resistance to weather infiltration. One of the most significant improvements in this regard has been the development of wind driven rain resistant louvers. These louvers are highly effective at keeping rain out of buildings, and in many cases have significantly higher airflow capacities than traditional louvers.

Typically, wind driven rain resistant louvers cost more to produce in terms of material and labor, which makes them more expensive than traditional louvers. However, the value benefits of these louvers make them well worth the price.

Blade Considerations

Traditional louvers are typically 2 to 6-in. deep with horizontal blades positioned at fairly wide spacing. A common design that is widely used incorporates 6-in. deep blades spaced at roughly 6-in. center to center spacing.

Wind driven rain resistant louvers are typically 4 to 8-in. deep with horizontal or vertical blades. Blade spacing ranges from 1½ to 2½-in., depending on the model. The additional louver depth and tighter blade spacing are key factors in resisting rain penetration, but it's not as easy as just adding more traditional-style blades. Wind driven rain resistant blade profiles are specially engineered to not only stop rain penetration, but to also create the least amount of pressure drop possible. Otherwise, the high number of blades in these models would create such high pressure drop that they would essentially be unusable in any forced-air application.

Rain Penetration Resistance

The first value benefit to consider is rain penetration resistance. It's no secret that rain infiltration can cause a variety of problems inside a building. Ruined ceiling tiles and drywall, mold growth, damage to water-sensitive items, and personal injury due to wet floors are all potential results of louver rain penetration. While traditional louvers can prevent some rain penetration in calm rain conditions, they are much less effective in storm conditions where the rain is wind driven.

The customary water penetration test for standard louvers is AMCA's *Figure 5.6* Water Penetration Test, which simulates "still air" conditions without the effect of wind. In this test, water is applied to the louver in two methods: by dropping simulated raindrops from above and by spraying the test chamber bulkhead above the louver to simulate rain flowing down a wall. System airflow is pulled through the

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louver from behind. No wind effect is applied in the test. The purpose of the test is to determine the free area velocity through the louver when .01 ounce (mass) water penetration per square foot of free area occurs. The maximum airflow tested is 1,250 fpm free area velocity. Since wind effect is not a consideration in this test, it is recommended that system designers size standard louvers so that their free area velocity is less than their beginning point of water penetration to allow for some wind.

Wind driven rain resistant louvers are tested in AMCA's *Figure 5.11* Wind Driven Rain test, which simulates storm conditions. Airflow is pulled through the louver, but wind is also blown at the face of the louver at the same time. Water is introduced in the airstream and is driven to the louver by the wind. The purpose of the test is to determine how much water is rejected by the louver compared to what penetrates an opening identical in size and shape to the core of the louver. The core of the louver is the effective area of the louver or the louver face area, less the frame flange widths. Two different levels of storm conditions may be used in the test; the basic condition applies 3-in./hr. rain and 29 mph wind, and the extended condition applies 8-in./hr. rain and 50 mph wind. System airflow is pulled through the louver at various airflow rates. Water penetration is measured in ounces (volume) based on a one hour duration. The highest performance possible in the test is identified as Class A, which represents 99% or better rain rejection.

How much water penetration are we talking about in the wind driven rain test? In the basic condition test (3-in./hr., 29 mph), 21 gallons of water will penetrate a square meter opening. To have Class A performance (99% or more rain rejection), louvers must allow no more than 27 fluid oz. (less than one quart) to penetrate during the same duration.

In the extended condition (8-in./hr., 50 mph), 54 gallons will penetrate the square meter opening. A Class A louver allows no more than 69 fluid oz. (a little over ½ gallon) to penetrate. While the amount of penetration allowed may seem high at first glance, standard louvers allow much more water penetration in the same conditions.

A popular drainable blade louver that achieves a beginning point of water penetration at 1,250 fpm free area velocity, the highest rating possible in the "still air" test, was tested in the basic condition of the wind driven rain test. At the highest system airflow available, where many wind driven rain resistant louvers provide 99% or better rain rejection, the standard louver rejected only 65% of the water applied. It allowed over 30 times as much water penetration (roughly seven gallons) during the test. This performance was measured at roughly 950 fpm free area velocity, far less than its "beginning point of water penetration" as defined in the standard water penetration test.

Figure 1: A drainable standard louver.

Figure 2: A vertical blade wind driven rain resistant louver.

The Value of Wind Driven Rain Resistant Louvers, continued

Table 1. A typical drainable blade standard louver versus a wind driven rain resistant louver.

LOUVER STYLE	FREE AREA/SQ.FT. (note 1)	MAX. FREE AREA VELOCITY fpm	VOLUME cfm	PRESSURE DROP in. w.g.	WIND DRIVEN RAIN PENETRATION gals./hr. (note 2)
6-in. Drainable Standard	9.0	1,000	9,000	.15 in.	7
6-in. Vertical Blade Wind Driven Rain Resistant	6.8	2,100	14,400	.20 in.	0

1. All information based on 4-ft. square size.
2. 3-in./hr. rain and 29 mph wind conditions.

Increased Airflow Capacity

Another value benefit of wind driven rain resistant louvers is their increased airflow capacity. Water penetration performance is one of the most important limiting factors in sizing standard louvers. System designers should size the louvers so that their operational free area velocity is below their beginning point of water penetration. Many wind driven rain resistant louvers have a higher maximum recommended free area velocity, which enables them to handle more volume than a similar sized standard louver.

As an example, we'll compare the airflow capacities of typical standard and wind driven rain models. Let's consider a drainable blade standard louver that provides 57% free area in a 4-ft. square size and has a beginning point of water penetration over 1,000 fpm free area velocity *(see Figure 1)*. The 4-ft. square size will handle approximately 9,000 cfm while generating roughly .15 in. w.g. pressure drop.

Now let's look at a common vertical blade wind driven rain design that provides 43% free area in a 4-ft. square size and provides 100% rain resistance at 2,100 fpm *(see Figure 2)*. This 4-ft. square unit will handle approximately 14,400 cfm while generating roughly .20 in. w.g. pressure drop. This results in 60% more volume through the same size *(see Table 1)*.

The pressure drop increases 33%, but is still acceptable for most systems. To handle as much cfm, the standard louver would have to be 5-ft. square – a 56% increase in louver area.

To look at it another way, consider the cfm/sq.ft. of louver face area. The standard louver handles roughly 560 cfm/sq.ft., whereas the wind driven rain model handles 900 cfm/sq.ft. This means that wind driven rain resistant louvers can be sized significantly smaller than standard louvers in new systems. And, for retrofit projects, they can handle much more airflow in the same size.

A Sensible Solution

Wind driven rain resistant louvers provide outstanding rain penetration protection and airflow capacities. While they are higher in cost, they can be sized smaller than standard louvers which helps offset the cost differential. Additionally, they provide solutions for applications with limited size. And perhaps most importantly, they help eliminate water infiltration issues which can result in costly remedial work after installation.

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