



# **Introduction to Intake and Exhaust Louvers**

**An AMCA International White Paper**



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# Introduction to Intake and Exhaust Louvers

## ABSTRACT

To better understand the type of louver required for a specific application, it is important to have a good foundational understanding of how they work. This white paper will provide an overview of basic louver function and describe many of the louver designs found on the market today.

In today's era of sustainable buildings, there is a growing need to supply buildings with fresh outdoor air. That means the need to protect outdoor air and building exhaust openings with louvers will continue to flourish. Building envelopes and the components that protect them have and will continue to adapt over time, and louvers have evolved to meet market demands and changing design and code requirements.

## LOUVER TYPES

A louver is a device comprising multiple blades that, when mounted in an opening, permits the flow of air but inhibits the entrance of water or other elements. Traditional louvers with "Z" or "J" type non-drainable blades have been in use in building construction for centuries. They provide a means for large volumes of airflow but offer virtually no rain defense. This insufficiency led to the design of "K" type non-drainable blade louvers. These louvers were originally dubbed "stormproof" and featured a rain hook in the blade design. Unfortunately, they fail to live up to their name, providing only very little rain defense.

Drainable blade louvers were created in an attempt to mitigate the effects of water infiltration. The dual drainable blade louver was developed with hopes of improved performance over single drainable blade louvers. However, these louvers provided minimal rain defense and were insufficient in wind-driven rain conditions.

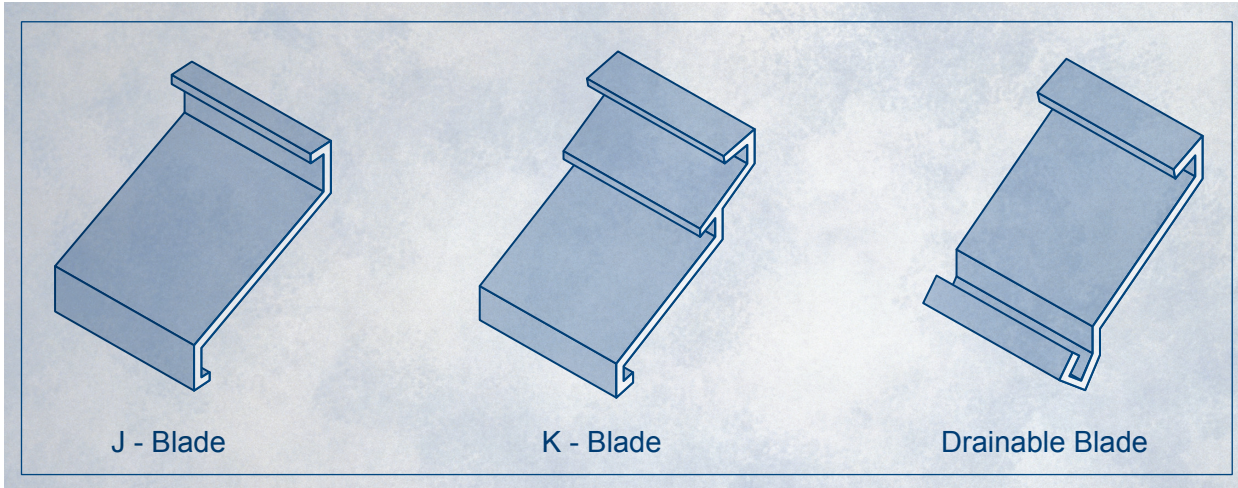


Figure 1. Cross sectional diagrams of different types of louvers. *Image courtesy of AMCA International*

In 1999, in response to a demand for greater levels of envelope protection, AMCA added a new test to its ANSI/AMCA Standard 500-L<sup>1</sup>. The original test for water penetration uses still air, and it continues to be a criterion for evaluation. But the updated test standard addressed concerns of severe weather (wind-driven rain) on louver performance, loosely based on European test standards generated by HEVAC.

This change in market requirements led manufacturers to develop a new product: the wind-driven rain louver. Typical wind-driven rain louvers can be characterized by their close blade centerlines, sophisticated, aerodynamic blade shapes, and front and sometimes rear rain gutters. These louvers effectively mitigate water infiltration inside buildings and in many cases have significantly higher airflow capacities than traditional louvers.

Additional louver types for various applications are have also been developed to meet design conditions and market demands: adjustable blade, combination louver/dampers, vertical blade, Y-Blade, acoustical louvers and various architectural configurations for aesthetic purposes. Another type of louver has been designed to reject wind-driven sand, meeting regional requirements for dry, desert areas. This type of louver is covered in a separate white paper, “Introducing the AMCA Sand Louver Test Standard.”<sup>2</sup>

## PERFORMANCE CRITERIA

The three most common performance criteria evaluated for selection of louvers in a given application are as follows:

### 1. PRESSURE DROP

Pressure drop is the difference in pressure between two points in a flow system. It is also referred to as air performance.

### 2. FREE AREA

Free area is the minimum area through which air can pass, usually expressed as a percentage. It is not to be confused with face area, which is the total cross-sectional area of a louver.

### 3. WATER PENETRATION RESISTANCE

Water penetration resistance is a calculation of the amount of water that passes through a louver while subjected to specific airflow conditions. It is expressed as the weight of water passing through the louver divided by the free area at a specified free area velocity. The maximum rating for water penetration velocity is 6.35 m/s 1250 fpm.

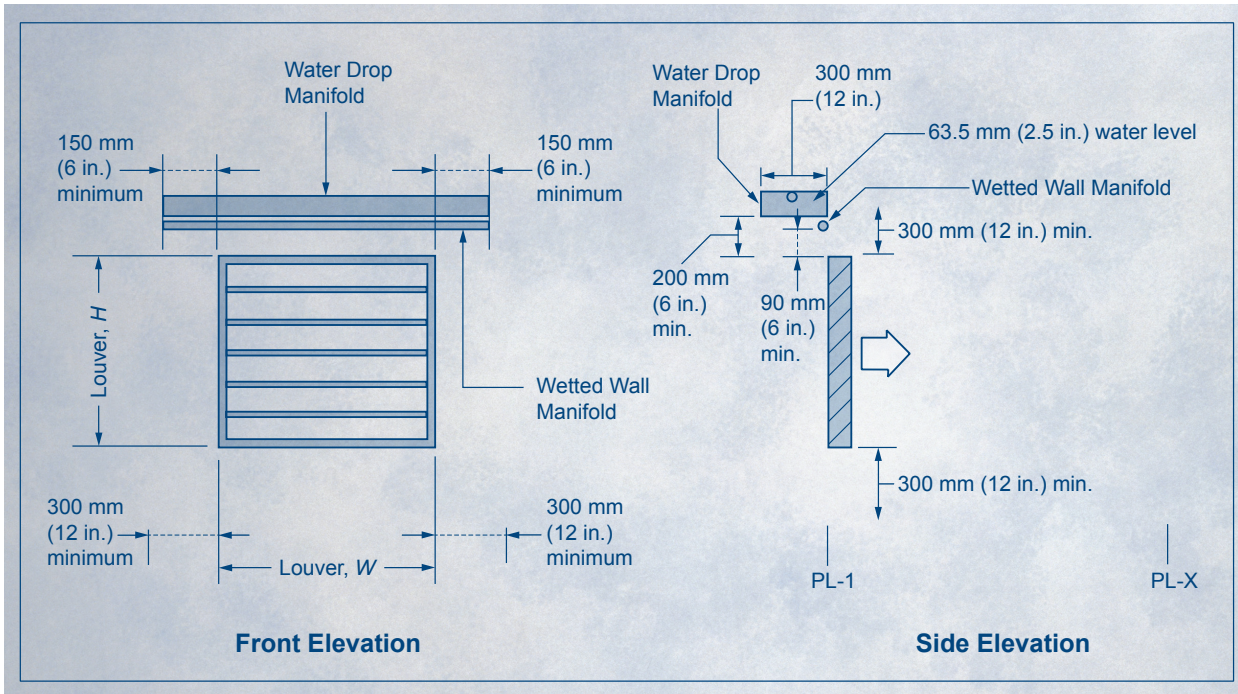


Figure 2. Figure 5.6 from ANSI/AMCA Standard 500-L. Image courtesy of AMCA International

## WHAT TO CONSIDER WHEN SELECTING A LOUVER

If specifiers understand three things — the parameters for louver selection criteria, the design intent of the application and the local building codes — it will ensure they are best equipped to select the appropriate louver model for the application. Most traditional louvers are evaluated based on the performance criteria described above: pressure drop, free area, and water penetration resistance.

Rain infiltration especially can cause a variety of problems inside a building, ranging from ruined ceiling tiles and drywall to mold growth to equipment damage to personal injury due to wet floors. It is important to note that the ANSI/AMCA Standard 500-L water penetration test (Figure 2) is a still air test, replicating calm rain conditions without the effect of wind. In this test, water is applied to the louver in two methods. In the first method, simulated raindrops fall from above the louver. In the second, water is sprayed at the test chamber bulkhead above the louver to simulate rain running down the face of a wall. Airflow is pulled through the louver from behind, and no wind effect is applied during the test. The purpose of the test is to determine the free area velocity through the louver when 3 mL (0.01 oz) (mass) water penetration per square foot of free area occurs. The maximum airflow tested and maximum AMCA rating for water penetration is 6.35 m/s (1250 fpm) free area velocity.

While traditional louvers can prevent some rain penetration in calm rain conditions, they are much less effective in storm conditions where wind-driven rain is present.

A specifier should remember that, when selecting a louver, percentage free area is not an indicator of overall louver performance. It is simply an indicator that the particular model of louver may be suited to handle larger volumes of air. Blade design has a direct impact on pressure drop. Generally speaking, the more steps, rain hooks and drainage provisions there are in a blade configuration, the more that air performance will be affected negatively. Blade spacing and geometry, direction of airflow, drain pans and rear structural supports can also have an effect on water penetration performance.

## LOUVERS FOR EXTREME CONDITIONS

With all of the design flexibility of a louver, testing to real-world conditions becomes a pivotal task. Louvers must not only look good, but they must also perform in various elements of nature. Different geographic regions require different considerations for building construction and component design.

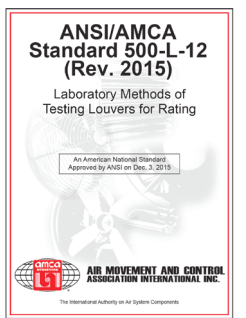
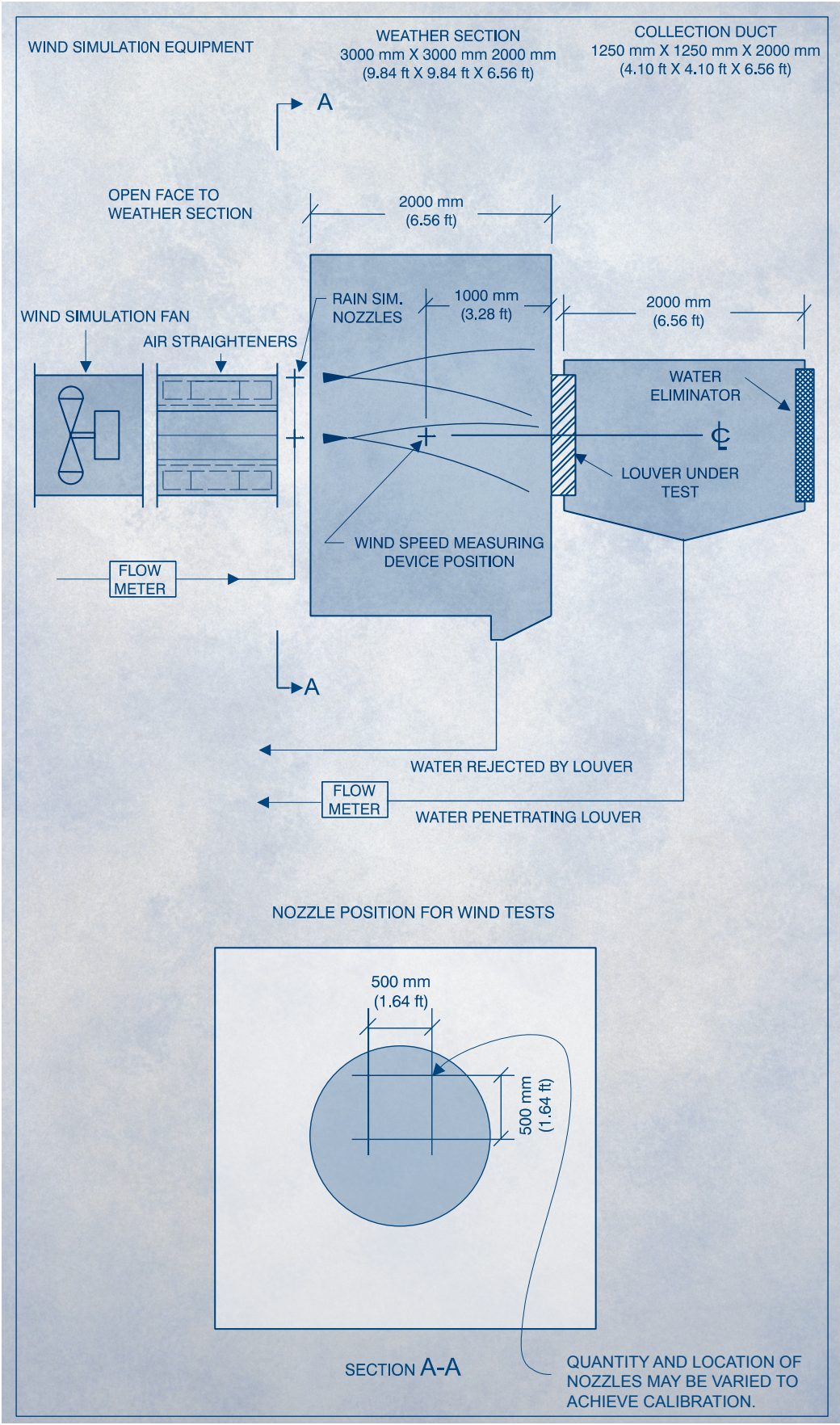


Figure 4. ANSI/AMCA Standard 500-L and AMCA Publication 511 are used by manufacturers for testing and certifying louvers. Images courtesy of AMCA International.

Figure 3. Figure 5.11 from ANSI/AMCA Standard 500-L. Image courtesy of AMCA International

Wind-driven-rain-resistant louvers are tested to ANSI/AMCA Standard 500-L's wind-driven rain test parameters (Figure 2), which simulates storm conditions. The test compares how much water the louver rejects to how much water would penetrate an identically-sized opening without the louver to block the rain.

In this test, airflow is pulled through the louver while wind is simultaneously blown at its face. Then, water is introduced in the airstream and subsequently driven at the louver by the wind. There are two different levels of storm conditions that may be used in the test. The basic condition applies 13 m/s (29 mph) winds and 75 mm/hr (3 in./hr) of rain, and the optional extended rating condition applies 22.4 m/s (50 mph) winds and 200 mm/h (8 in./hr) of rain. Airflow is pulled through the louver at various rates and water penetration is measured in grams or ounces (volume) based on a one-hour duration. This result is an effectiveness ratio and coefficient of performance, and the highest performance rating possible is identified as Class A, which represents 99% or greater rain rejection.

### THE EFFECTIVENESS OF WIND-DRIVEN RAIN LOUVERS

In a comparison test<sup>3</sup>, a traditional drainable blade louver that has achieved the highest rating possible in the ANSI/AMCA Standard 500-L water penetration test (a beginning point of water penetration at 6.35 m/s (1250 fpm) free area velocity) was tested to the basic condition of 13 m/s (29 mph) winds and 75 mm/hr (3 in./hr) of rain, as per the wind-driven rain test. At the highest system airflow available, many wind-driven rain louvers can provide 99% or better rain rejection. In contrast, the traditional louver only rejected approximately 65% of the water applied, allowing over 25 times as much water during the comparison testing.

### AMCA LOUVER CERTIFICATIONS

Designers should understand how a louver performs before specifying, and there are many test methods and certifications designed to help them make a decision. But louver manufacturers may arrive at their self-reported performance data by employing different test methods and laboratory setups. To ensure that cataloged performance data is accurate and up-to-date, the use of a third party certification body is recommended.

AMCA is one of these third party certification bodies, and it also creates peer-vetted American national standards for testing louvers. The most common AMCA standard used to test and rate the performance of louvers is ANSI/AMCA Standard 500-L. The association also administers and maintains the AMCA Certified Ratings Program (CRP) for air control products. Guidelines for certifying performance ratings can be found in AMCA Publication 511<sup>4</sup>.

When product has been licensed by the CRP, a specifier can be sure its performance test data was collected following the prescribed methods in a nationally-accredited standard. Additionally, AMCA staff hand-checks the product line catalog, ensuring that the ratings and information are correct. The product line is then subjected to a check test at specified intervals to ensure the continued integrity of that information.

AMCA seals may not be on the products themselves. However, they should appear in the manufacturers catalogs, datasheets and electronic software. Louvers can be certified for

- Air performance
- Sound performance



Figure 5. Some of the louver seal types available through the AMCA Certified Ratings Program. Images courtesy of AMCA International.

- Water penetration
- Wind driven rain
- Wind driven sand
- Air leakage

Manufacturers can opt to have one seal per license type or combined seals (Figure 5).

## HOW TO SPECIFY AMCA-CERTIFIED LOUVERS

Architects and engineers need to properly specify louvers if they are to get the performance characteristics required for a given application. Aside from the general construction details of a louver, it is recommended to specify percent free area, maximum allowable pressure drop, beginning point of water penetration and, if applicable, wind-driven rain penetration class (typically Class A) at a specified free area ventilation rate.

To ensure louvers are AMCA certified and meet the criteria selected by the specifier, this language should accompany the specifications.

*Louvers shall be licensed to bear the AMCA Certified Ratings Program seal for air performance, wind-driven rain and water penetration [as applicable] in accordance with AMCA Publication 511.*

More information about the CRP and how to specify can be found in AMCA’s CRP-related white papers (see “Resources”).

## CONCLUSION

There will always be challenges for building owners and designers to overcome. With the growing need for fresh outdoor air and an emphasis on total systems efficiency, louver construction technology and testing standards have been steadily improving, helping to meet the evolving demands of the building construction market. Understanding the design requirements of a project location and the kinds of louvers available will help you choose the louver that is best suited to defend against the elements, allowing for proper ventilation and optimal system efficiencies. And specifying AMCA-certified louvers will help ensure your design performs as intended.

## REFERENCES

1 AMCA Standard 500-L. *Laboratory Methods of Testing Louvers for Rating*. Arlington Heights, IL: AMCA International, 2015.

2 “Introducing the AMCA Sand Louver Test Standard.” Arlington Heights, IL: AMCA International, 2016. <http://www.amca.org/whitepapers>

3 Livingston, James. “The Value of Wind Driven Rain Resistant Louvers.” *AMCA inmotion* (Spring 2007). 18–20.

4 AMCA Publication 511. Certified Ratings Program — Product Rating Manual for Air Control. Arlington Heights, IL: AMCA International, 2016.

## RESOURCES

AMCA International headquarters and laboratory

[www.amca.org](http://www.amca.org)

Other AMCA white papers provide an overview of the AMCA Certified Ratings Program, guideline specifications for AMCA-certified products and a checklist for ensuring that intended to be AMCA-certified are actually installed. These white papers can be downloaded at no cost.

[www.amca.org/whitepapers](http://www.amca.org/whitepapers)

CRP publications (no cost) and standards (cost)

[www.amca.org/store](http://www.amca.org/store)



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