Louvers 101 – Selection & Application

amcainsite

AHR EXPO Atlanta FEB 6-8

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Session Moderator

- Joined AMCA in February 2019
- Responsible for development of AMCA's education programs; staff liaison for the Education & Training Committee
- Projects include webinars, online education modules, presentations at trade shows, AMCA Speakers Network and many other items.

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Business Development Manager, Architectural Louvers Construction Specialties

- Over 22 years in business and sales leadership roles with specialization in industrial, commercial and construction vertical markets
- Provides engineered solutions & specifications to architects, mechanical engineers, façade consultants and the glazing/building envelope vertical markets
- AIA registered provider and RCEP certified presenter
- Degree in electrical engineering and studies in business analytics from Harvard University

Louvers 101– Selection & Application

Purpose and Learning Objectives

The purpose of this presentation is to provide attendees with an introduction to louvers and the different designs and components, as well as outline the parts of the overall system.

At the end of this presentation participants will be able to:

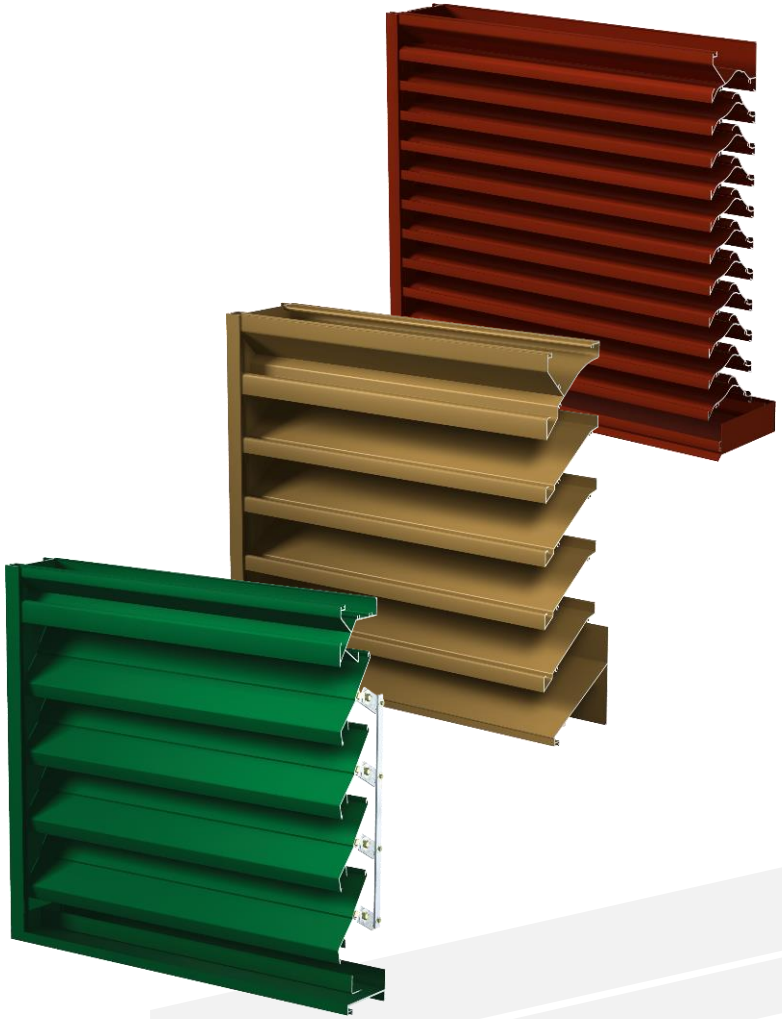
1. Compare the different types of louvers and their functions.
2. Explain louver performance terminology, including free area, pressure drop, water penetration and wind-driven rain rejection.
3. Describe the five types of louver testing as outlined in ANSI/AMCA Standard 500-L and how those tests are performed.
4. Explain how louvers are specified through the AMCA CRP process, and what the equipment seals do and do not represent.

Louver Selection and Application

Louver Design and Construction

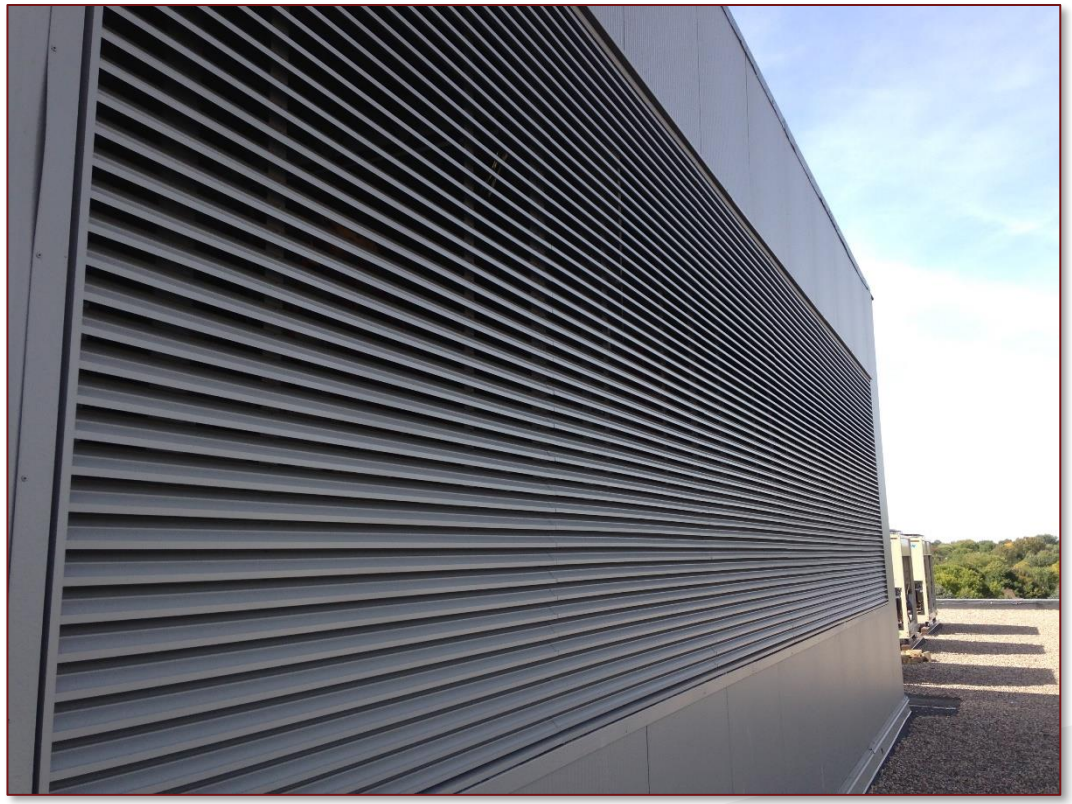
What exactly is a louver?

- Per AMCA publication 501
  - A louver is a device comprising of:
    - A blade or blades…
    - That permit the flow of air…
    - But inhibits the entrance of water or other elements

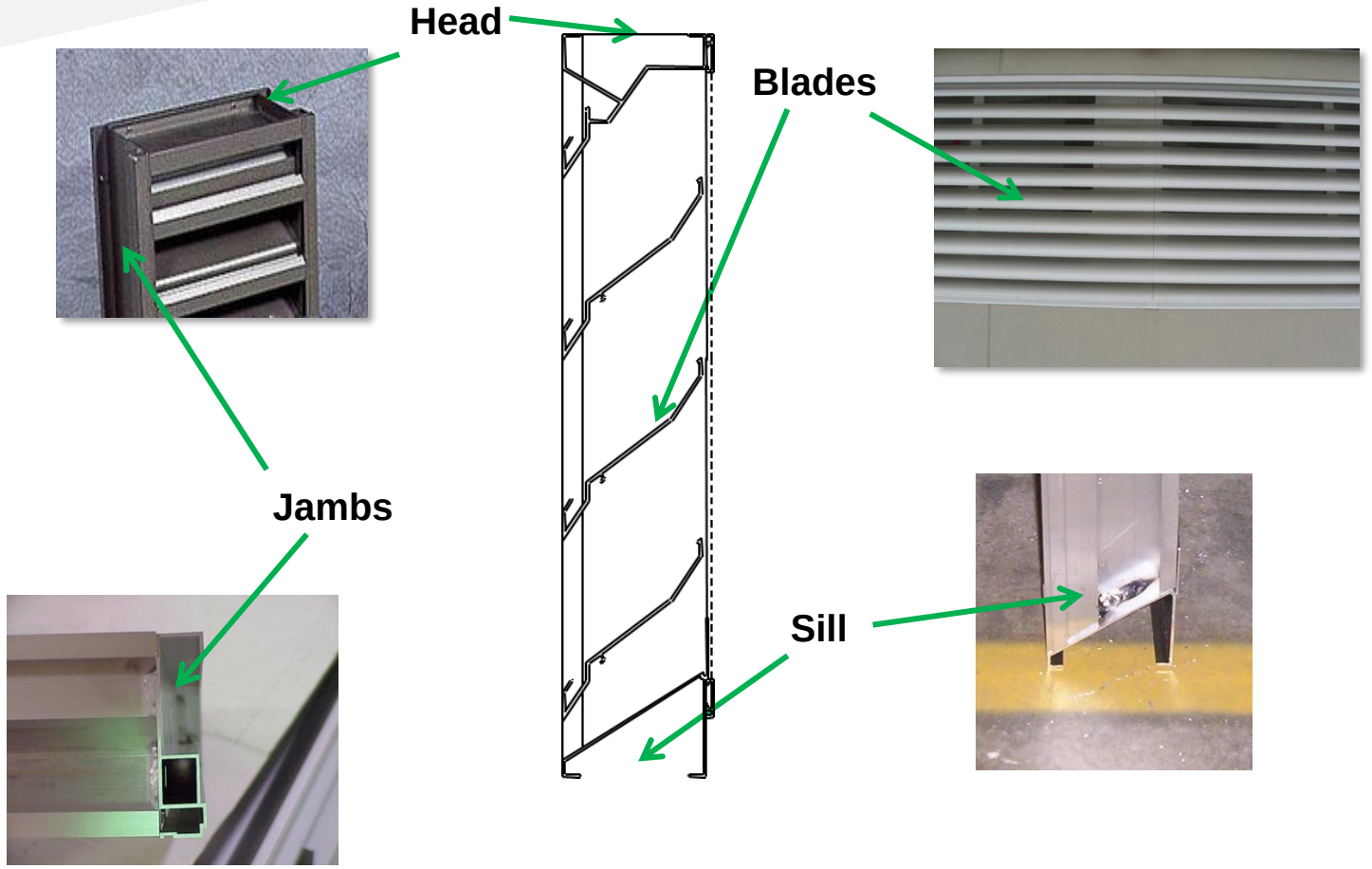


Louver Installations

- Where are louvers typically installed?
  - Exterior Wall
  - Interior Wall
  - Curtain Wall / Storefront
  - Roof (Penthouse)
  - Ductwork



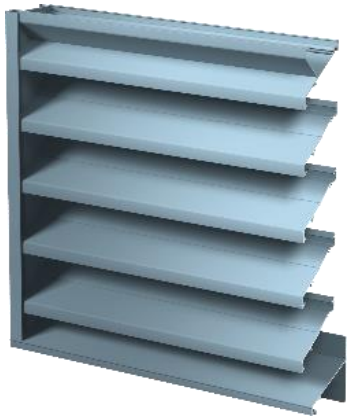
Anatomy of a Louver



Jamb– The vertical frame member on the sides of a louver.

Louver Types

- Basic Louver Types
  - Fixed Blade (Stationary)
  - Adjustable Blade
  - Combination



Stationary

Adjustable

Combination

Blade Styles

- Blade Types
  - Architectural (Non-drainable)
    - J or K Blade
  - Drainable Blade
    - Single or Dual Drain

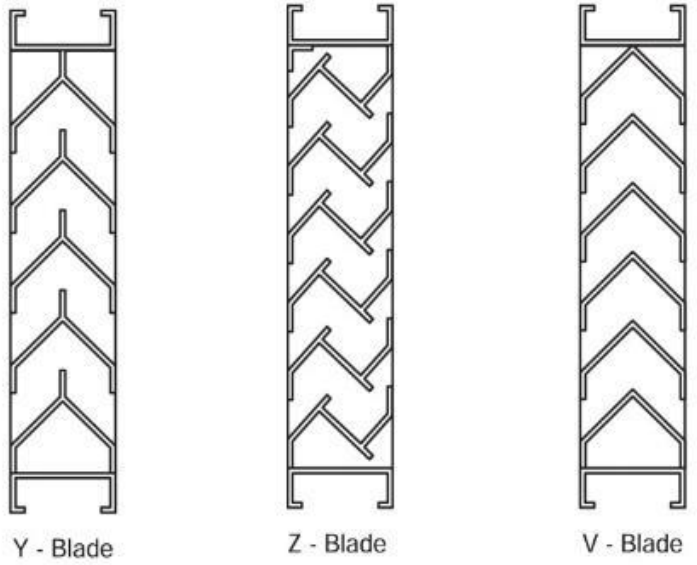
J Blade

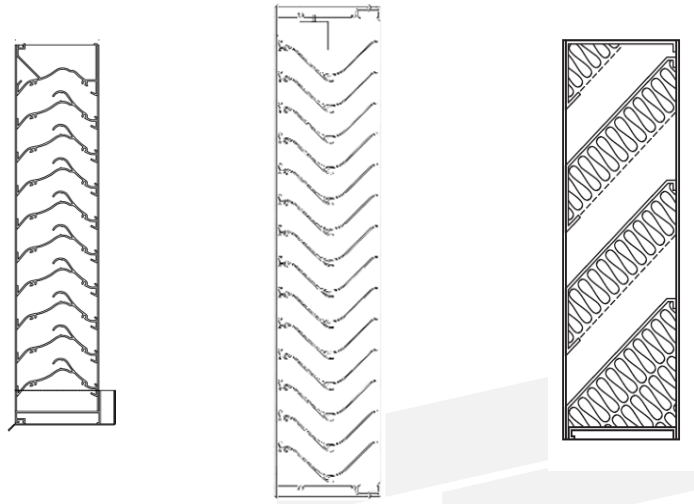
K Blade

Drainable Blade

Specialty Louver Types

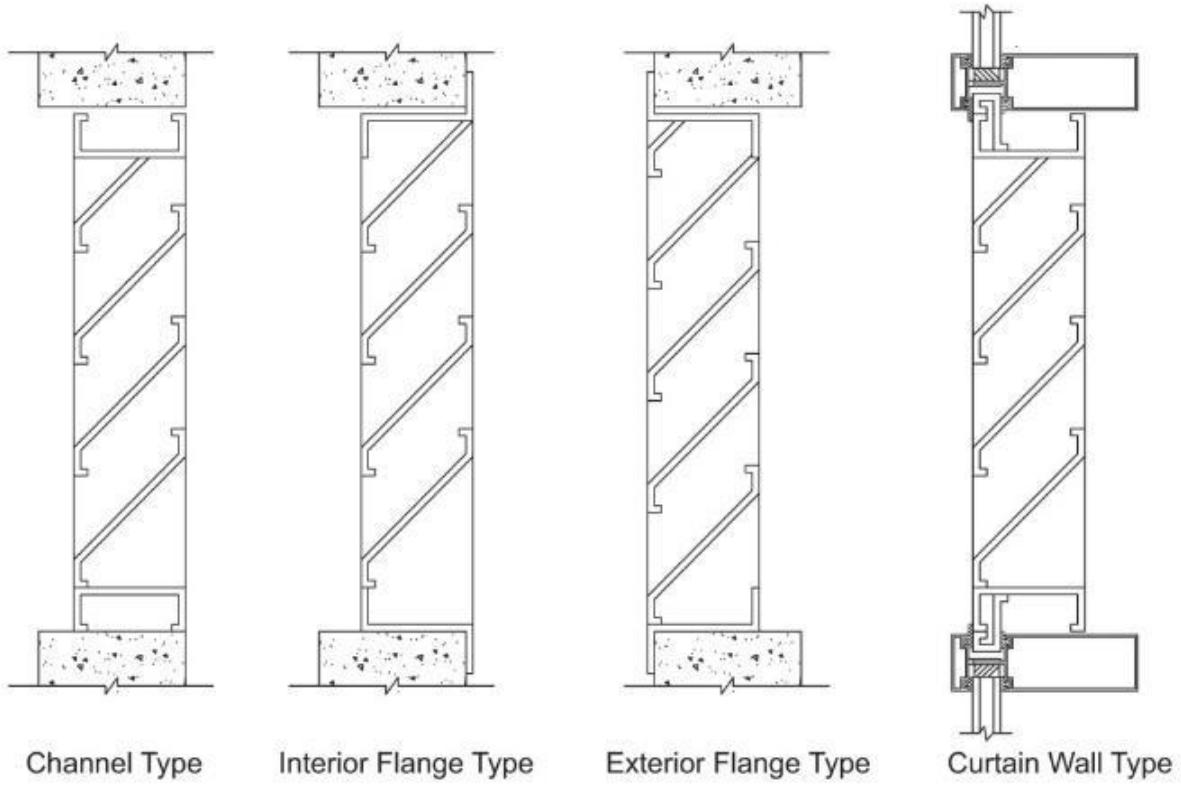
- Sightproof Louvers
  - Y Blade
  - Z Blade
  - V Blade
- Wind-Driven Rain Louvers
  - Horizontal Blade
  - Vertical Blade
- Hurricane Resistant Louvers
- Sand Louvers
- Acoustical Louvers
  - J Blade
  - Airfoil Blade





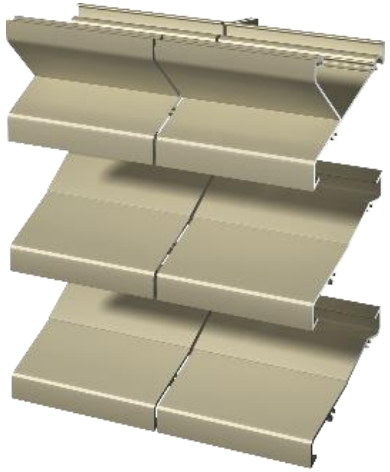
Louver Frame Styles

- Frame Types
  - Channel
  - Flange
    - Interior Flange
    - Exterior Flange
  - Glazing Adapter

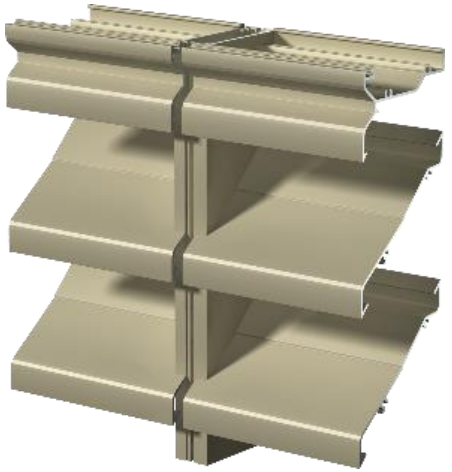


Louver Design Features

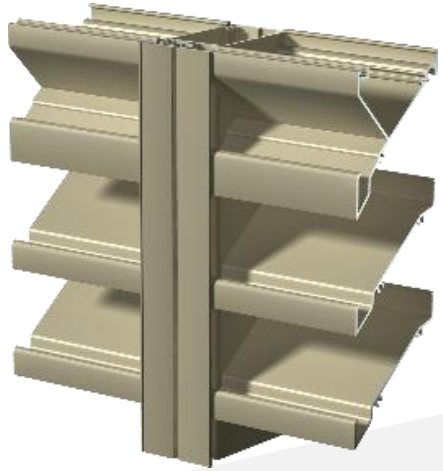
- Mullion Types
  - Architectural
  - Recessed
  - Visible



Architectural Mullion



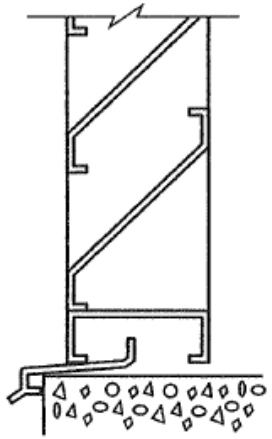
Recessed Mullion



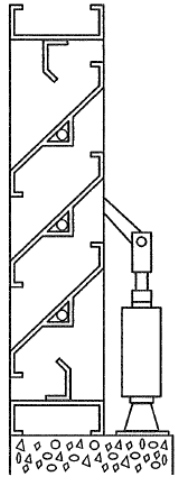
Visible Mullion

Louver Accessories

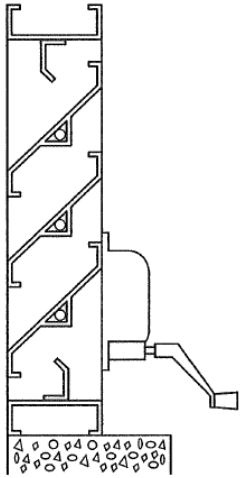
- Screens
  - Bird or Insect
- Blank off panels
  - Non-insulated
  - Insulated
- Sill flashing/extensions
- Actuators



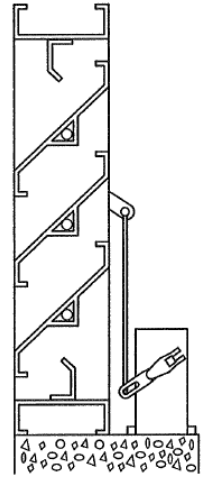
Sill Flashing



Pneumatic Operator



Hand Crank Operator

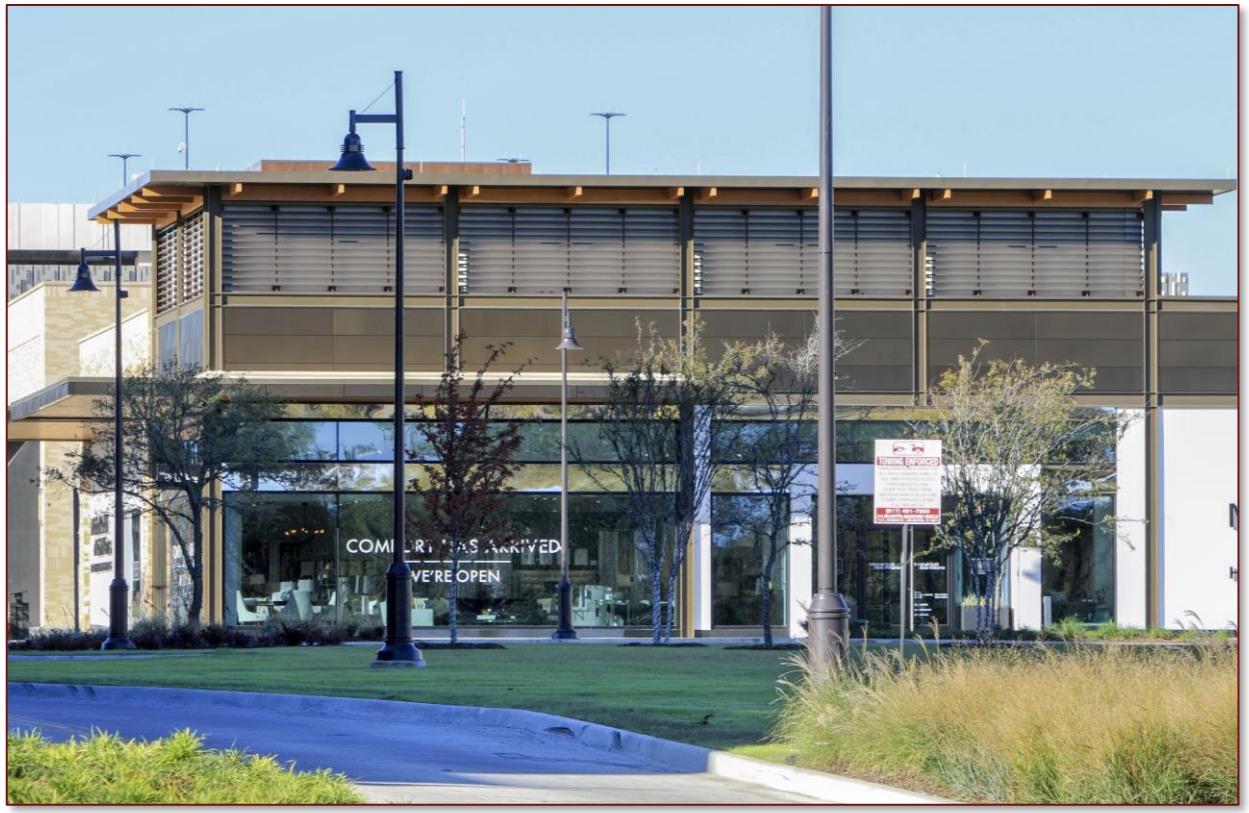


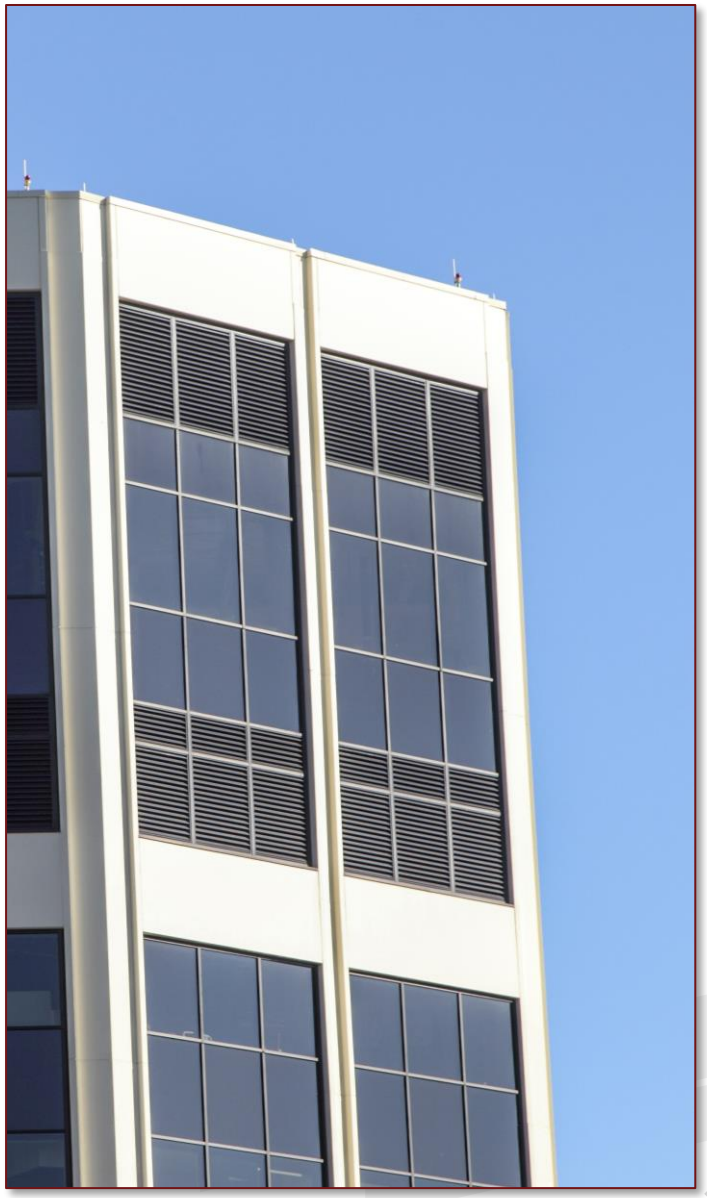
Motorized Operator

Aesthetics

- **Specialty Shape** – Round, triangular, etc.
  - Performance - AMCA performance not valid unless specific shapes tested
- **Finish Types**
  - To match building construction elements
  - Primer, Baked Enamel, Powder Coat, Fluoropolymer and Anodize finishes most common

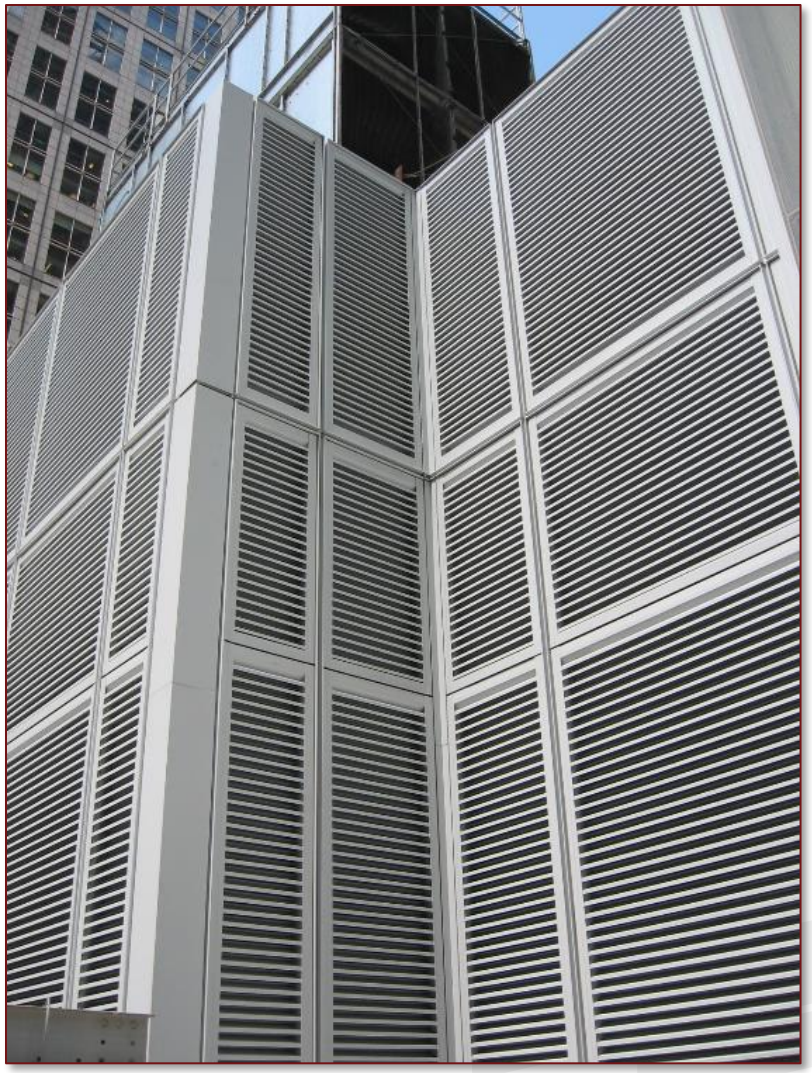
Job Examples





Job Examples

Aesthetic Examples



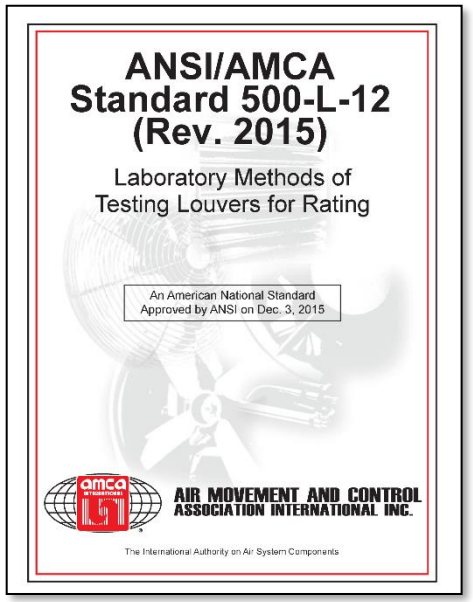
Louver Performance and Test Standards

Louver Performance Considerations

- When designing louvers, consideration should be given to the following performance criteria:
    - Free Area
    - Air Performance (Pressure Drop)
    - Water Penetration
        - Still Air
        - Wind Driven Rain
    - Sand Rejection
    - Structural Integrity
    - Noise

Test Standards & Publications

- **AMCA Publication 501**: Application Manual for Air Louvers
- **ANSI/AMCA 500-L**: Laboratory Methods of Testing Louvers for Ratings
  - Tests the following:
    - Air Performance (Pressure Drop)
    - Water Penetration (still air)
    - Wind Driven Rain
    - Sand
    - Leakage (adjustable louvers)
- **AMCA 511**: Certified Ratings Program Product Rating Manual for Air Control Devices
- **ANSI/AMCA 540**: Test Method for Louvers Impacted by Wind Borne Debris
- **ANSI/AMCA 550**: Test Method for High Velocity Wind Driven Rain Resistant Louvers



AMCA 500-L

- AMCA 500-L consists of five different testing protocols for testing louvers:
  1. Pressure Drop
  2. Airflow Leakage
  3. Water Penetration
  4. Wind-Driven Rain
  5. Wind-Driven Sand

- AMCA 500-L: Gives you the testing parameters for testing louvers and confirms performance.
- AMCA 511: Was written to give guidance on how to certify the louvers that are tested.

AMCA 500-L

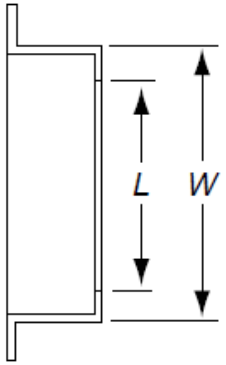
- Upon testing, manufacturers can show that their louver has been part of AMCA's certified ratings program (CRP).

*** Very important because not all manufacturers choose to certify their product!*

- Manufacturers can identify which tests have been independently conducted by AMCA with a CRP marking on their submittal page.

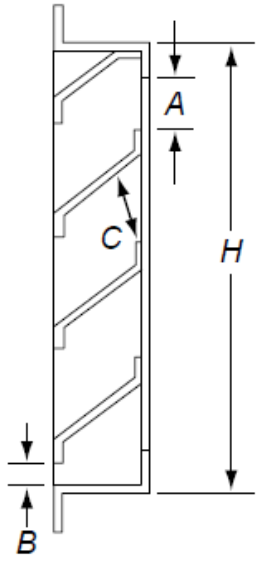
Free Area

- The minimum area through which air can pass
  - Free Area = $L[A + B + (NXC)]$
  - Percent Free Area = $\frac{L[A+B+(N*C)]100}{W*H}$



Horizontal Blade Louvers:

- A = Minimum distance between the head and top blade
- B = Minimum distance between the sill and bottom blade
- C = Minimum distance between adjacent blades
- N = Number of “C” openings in the louver
- L = Minimum distance between louver jambs
- W = Actual louver width
- H = Actual louver height



Horizontal Blade

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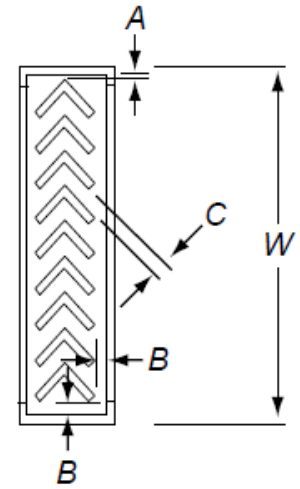
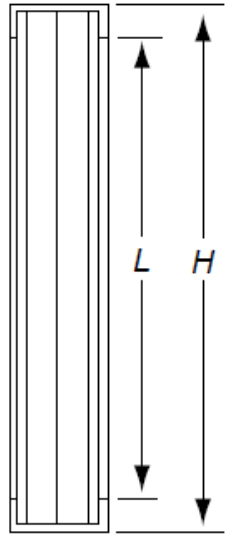


Vertical Blade Louvers:

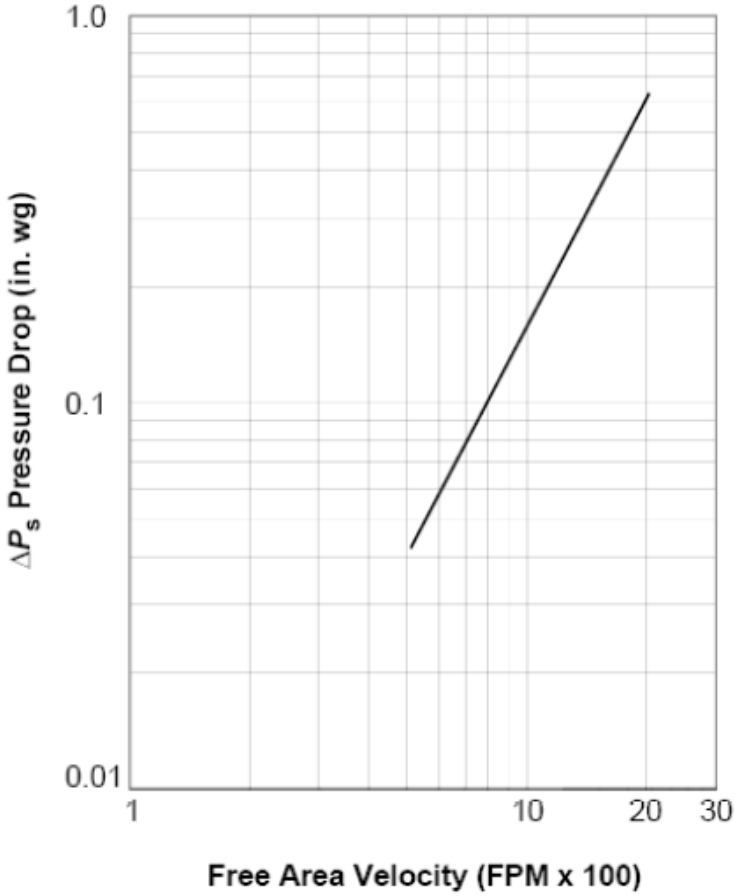
- A = Minimum distance between the left jamb and left blade
- B = Minimum distance between the right jamb and right blade
- C = Minimum distance between adjacent blades
- N = Number of “C” openings in the louver
- L = Minimum distance between head and sill
- W = Actual louver width
- H = Actual louver height



Vertical Blade

Air Performance

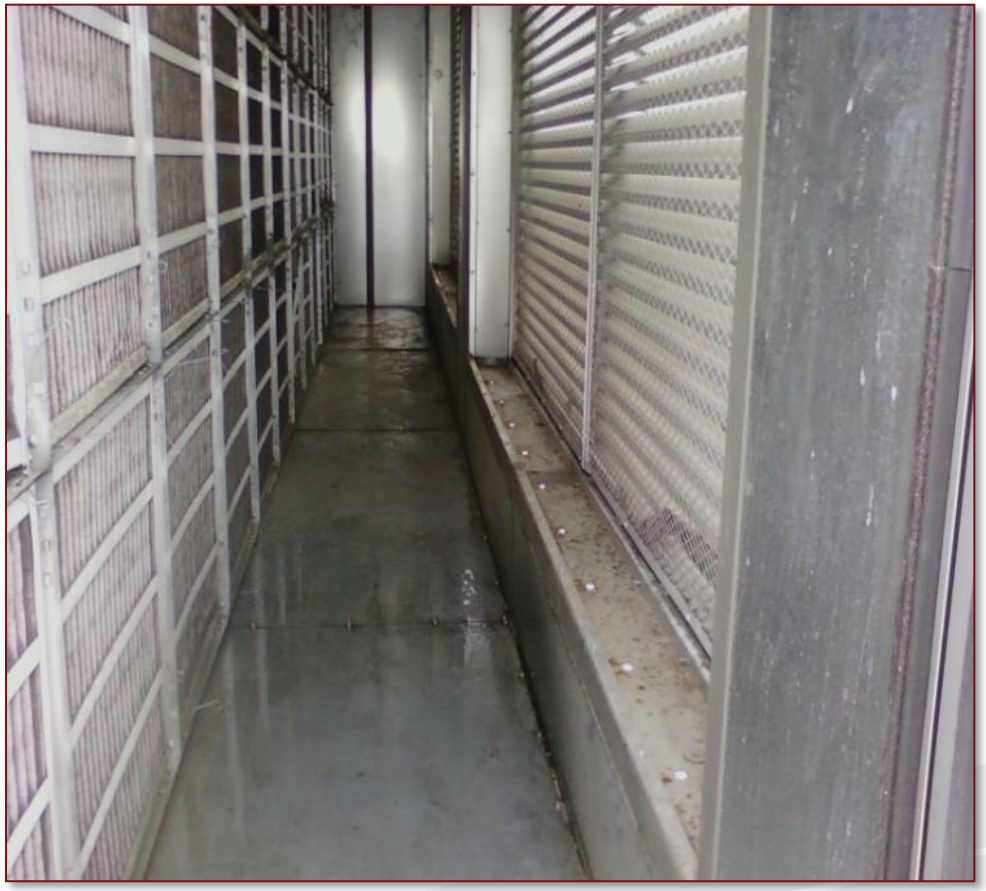
- **Airflow/Volume**
  - The measurement of the rate of airflow that passes through a louver (measured in cfm/m^3s)
- **Pressure Drop**
  - The resistance to airflow across an open louver (stated in inches of water/kpa)
- **Free Area Velocity**
  - Rate of airflow that passes through the free area of a louver (expressed in fpm/ms)



Water Infiltration

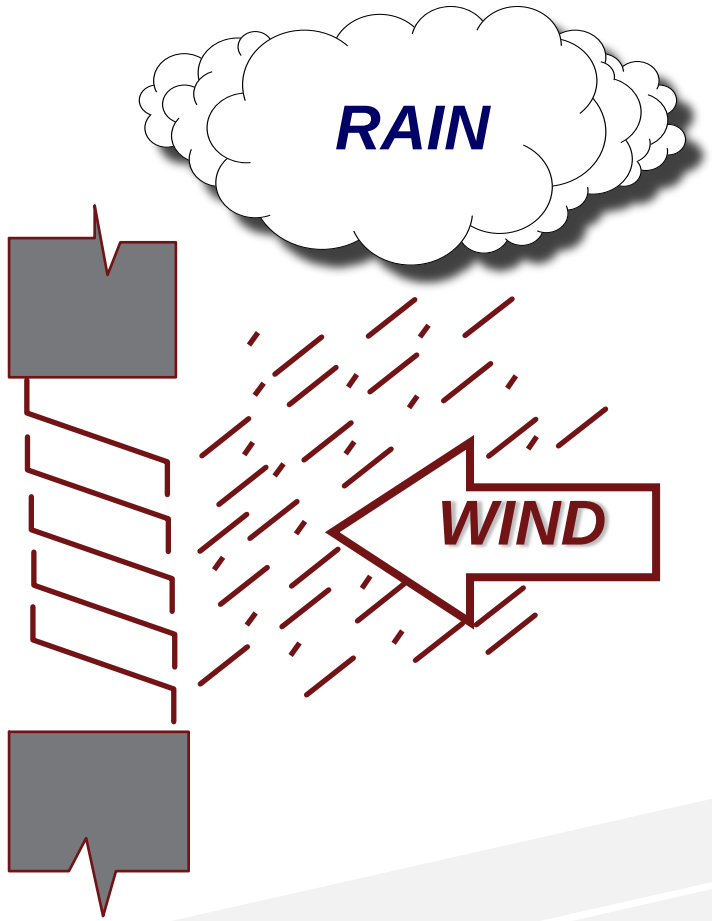
Traditional Louvers

- Typically sized at 600 to 800 fpm intake velocity
- Drainable blades for intake applications
- Some very high performing traditional models
- How much water is allowed?
  - Adequate drainage
  - Equipment that needs to be kept dry



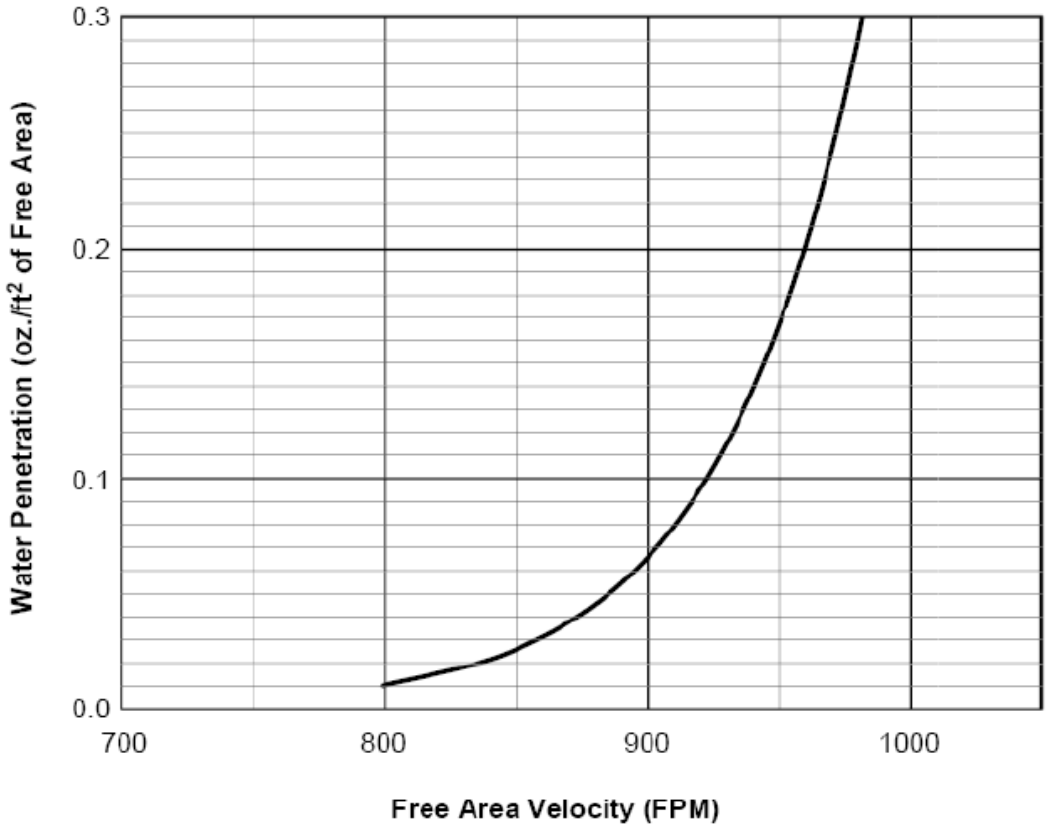
Rain Defense

- Prevents Damage
  - Mechanical Rooms, Generators, Production Plants, Electrical switchgear areas
- Protects interior finishes & contents
  - Exhibition Halls, Warehousing, Museums



AMCA 500-L Water Penetration Test
Water Penetration (still air)

- Defines the point of beginning water penetration at a specific intake air velocity
- The beginning point of water penetration is $0.01 oz/ft^2$ of free area

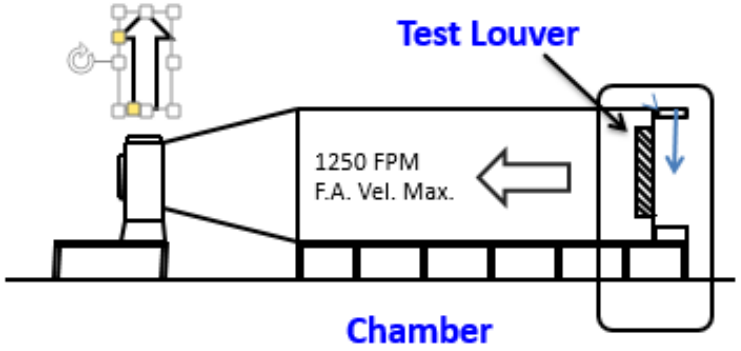


Still Air Test

Test Conditions:

- 4” per hour rain - light vertical rain
- 1,250 fpm max free area velocity
- Approx. 14 mph
- Tested for beginning point of water penetration based on free area velocity
- 48” x 48” sample size
- No screen

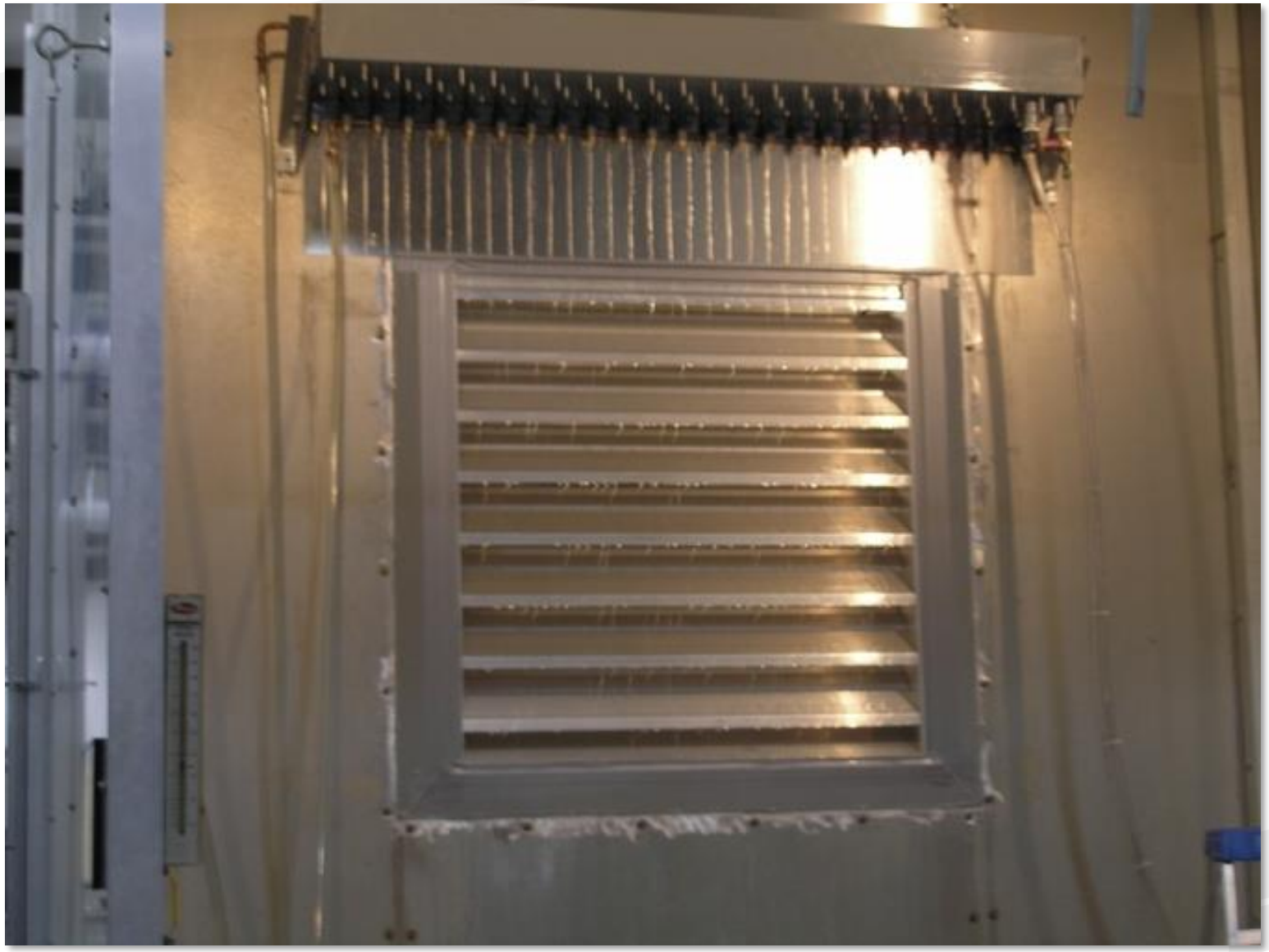
Still Air Test



Still Air

Beginning Point of Water penetration- .01 oz. of water per sq./ft. at X FPM F.A. Vel.

Louver Still Air Test



Traditional Louver Technology

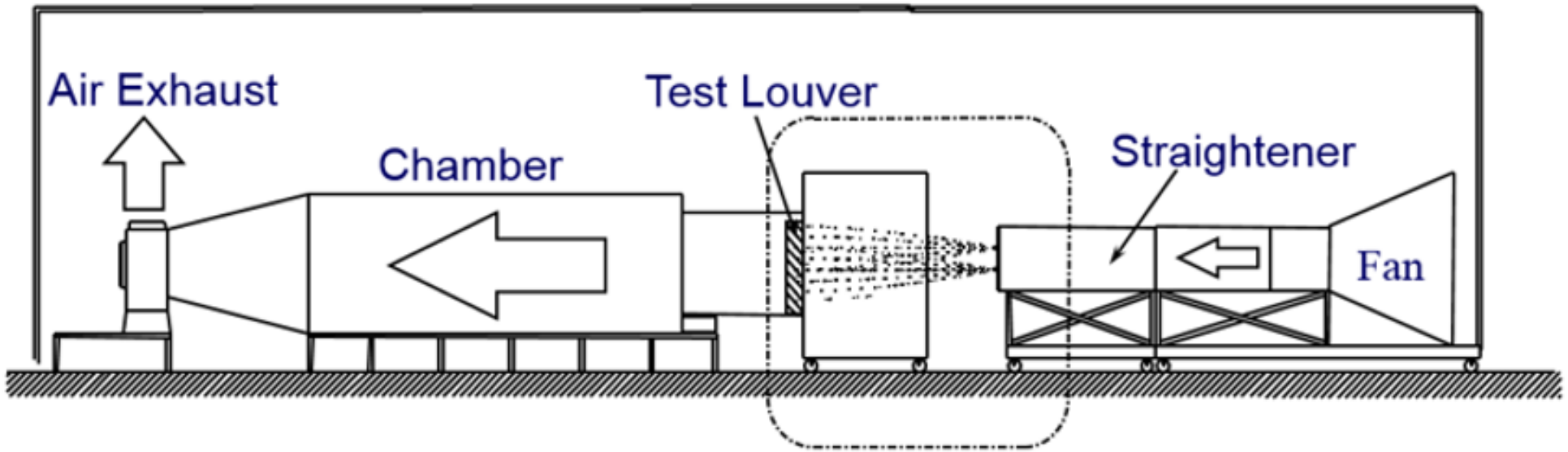
- Design Characteristics
  - Wide Blade Spacing
  - High Free Area
  - Low Cost
  - Low Pressure Drop
  - Not Effective In Storms

Wind Driven Rain Louver Technology

- Design Characteristics
  - Close Blade Spacing
  - Lower Free Area
  - Greater Velocities
  - Higher Pressure Drop
  - Effective water rejection in storm conditions

AMCA 500-L Wind-Driven Rain Test for Louvers

- The chamber behind the louver is fully pressurized with an exhaust fan trying to draw water through the louver's blades during the testing procedure (30-minute testing period).
  - Test values are noted at regular intervals and are not more than 10 minutes apart.
  - The test procedure is completed when a minimum of 4 consecutive readings within the steady state of tolerance have been noted.



WDR Test

Wind Driven Rain

Measures the performance by establishing an effectiveness rating of louvers subjected to both rain and wind pressure, both with and without airflow through the louver.

- **Two conditions**
  - 3 in. of rain/hour @ 29 mph wind vel.
  - 8 in. of rain/hour @ 50 mph wind vel.
- **Effectiveness Ratings**
  - A = 99.9% to 99%
  - B = 98.9% to 95%
  - C = 94.9% to 80%
  - D = Below 80%

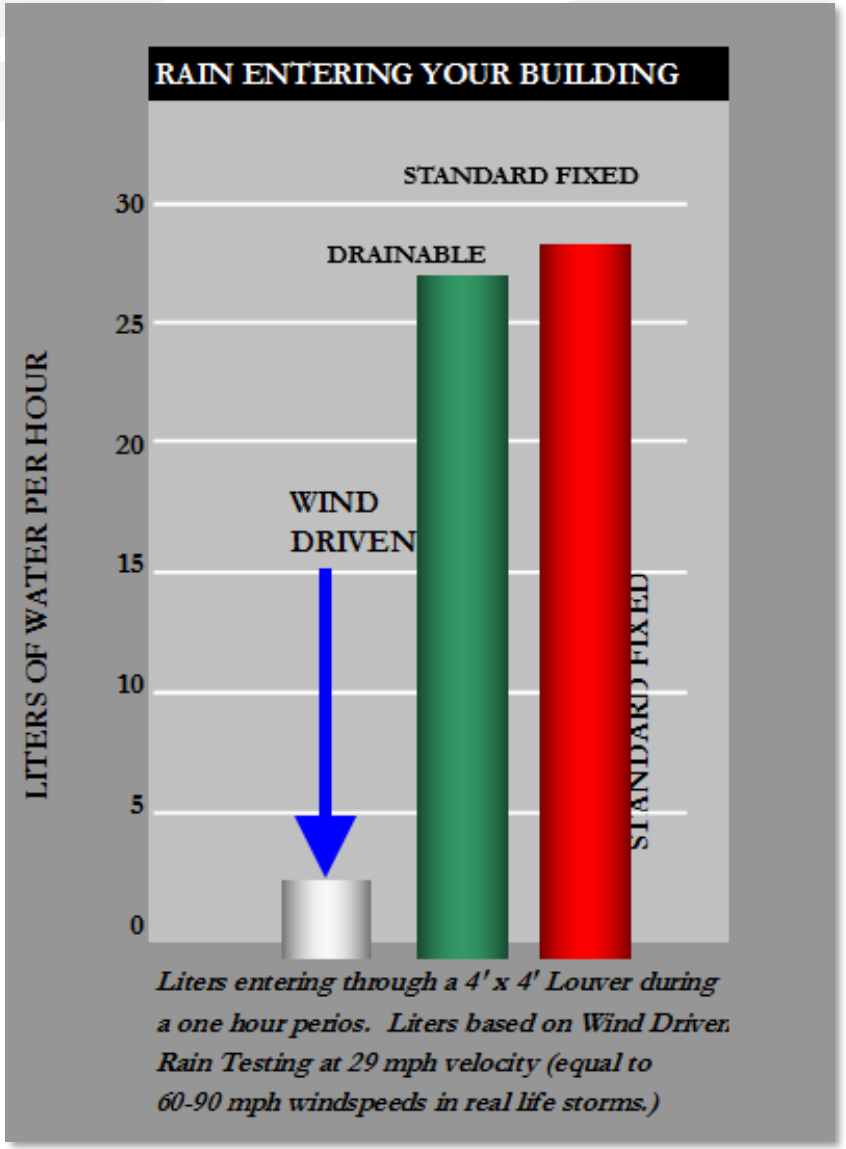
Rainfall Rate: 3 in./hr
Wind Velocity: 29 mph

Core Velocity (fpm)	0	106	218	286	386	499	586	686	761	853	987
Effectiveness (%)	99.7	99.4	99.1	98.3	96.9	93.9	91.6	86.2	84.4	81.5	75.2
Penetration Class	A	A	A	B	B	C	C	C	C	C	D

Rainfall Rate: 8 in./hr
Wind Velocity: 50 mph

Core Velocity (fpm)	0	128	214	300	401	498	586	667	772	861	973
Effectiveness (%)	98.5	98.4	98.3	98.7	96.9	96.4	95.5	93.6	93.3	88.2	80.1
Penetration Class	B	B	B	B	B	B	B	C	C	C	C

Still Air vs. WDR



AMCA Wind Driven Rain test

Based on Wind Driven Rain test-- 3" per hour at 29 mph wind velocity, wind tunnel pulling 1300 FPM.

29 liters

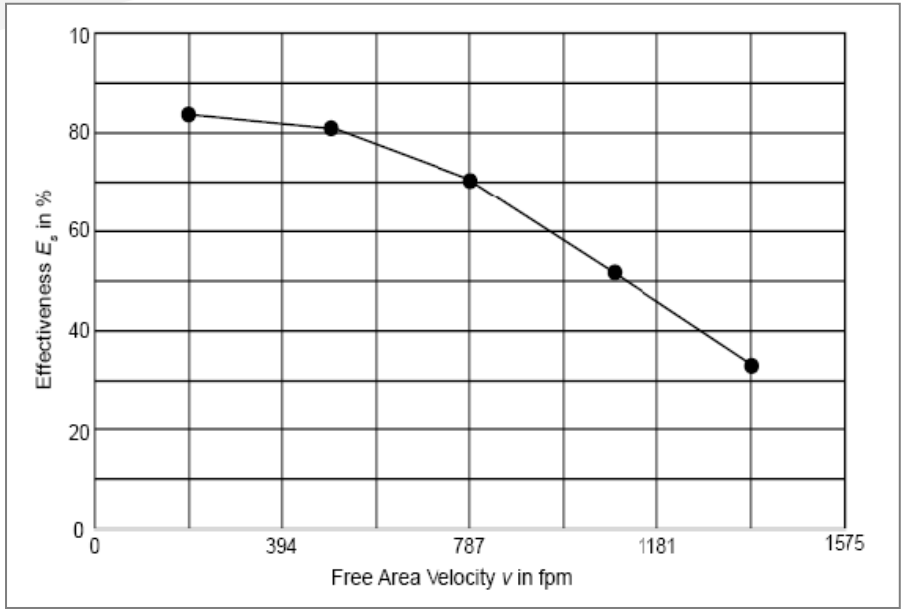
Sizing Tips

- Free area not necessarily the most important characteristic
- Pressure drop generally becomes the limiting factor.
  - Low free area can be offset by low pressure drop
  - Still area louvers require a **(15% to 25%)** safety factor – WDR louvers do not.
  - At **10,000 CFM** a 6” still air louver with 860 fpm fav requires a **48” x 60”** louver – A 6” vertical WDR with 2019 fpm fav requires a **42” x 42”** louver.
  - A difference if 7.75 sq. ft. face area

Sand Louver Application

Wind Driven Sand

- Measures the sand rejection performance subject to airborne dry sand particles at different airflow rates through the louver
- Test procedure and certification launched January 13, 2016
- Primarily a concern for Middle East region
  - Could be applicable in construction near beaches and other sandy regions worldwide
- Effectiveness Ratings
  - A = 100% to 90%
  - B = 89.9% to 80%
  - C = 79.9% to 70%
  - D = Below 70%



Free area velocity (fpm)	197	492	787	1083	1378
Weight of sand (lbm)	2.204	2.204	4.41	4.41	4.41
Discharge duration (s)	200	75	100	70	60
Sand feed rate (lbm/s)	0.011	0.029	0.044	0.064	0.073
Effectiveness (%)	98	91	83	75	69
Penetration class	A	A	B	C	D

Sound Performance

- **ASTM E90-99**: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

Octave Band (Hz)	2 (125)	3 (250)	4 (500)	5 (1000)	6 (2000)	7 (4000)
Free Field Noise Reduction	10	10	13	16	18	16

Extreme Weather

- **ANSI/AMCA 540**: Test Method for Louvers Impacted by Wind Borne Debris
  - Intended to demonstrate the structural capabilities of the louver in the event the louver were to be impacted by wind borne debris.
  - Large missile impact test as described in **ASTM E 1996-04** and **E 1886-05**
- **ANSI/AMCA 550**: Test Method for High Velocity Wind Driven Rain Resistant Louvers
  - Intended to demonstrate the acceptability of the louver in which water infiltration must be kept to manageable amounts during a high velocity wind driven rain event.
  - Pass / Fail Criteria
  - Equivalent to **FBC TAS 100A**

ANSI/AMCA 540-
Test Method of Louvers Impacted by Wind Borne Debris

- Test procedure measures a products capacity to withstand impact from wind borne debris in hurricane wind velocities.
  - Test Missile: 9 lb. 2 x 4
  - Distance: 12-feet (9 ft. long missile)
  - Impact Velocity:
    - 3 units tested
    - Shortest blade span
    - Longest unsupported span
    - Mullion location

Structural Integrity

- Wind loads
  - American Society of Civil Engineers (ASCE) formula
  - Hidden or Visible supports
  - Effective Wind Speed (mph)
  - Louver panel size
    - Blade Span (Span tables)
    - Intermediate bracing
- Impact Testing
  - AMCA Standard 540

AMCA Testing Standards - 540

- AMCA 540
  - Minimum of three specimens impacted
    - Requires the minimum and maximum sections to be tested
    - Can be one single-section and one multi-section

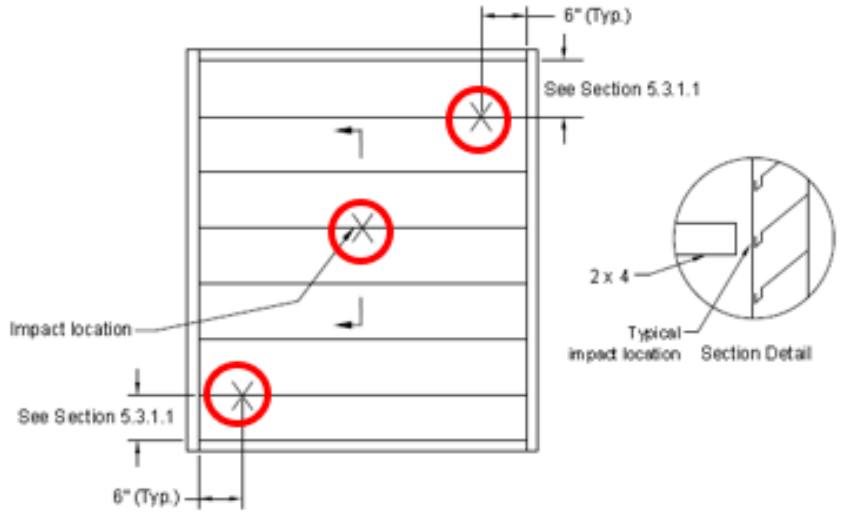


Figure 1
Impact Locations for Testing Single Section, Horizontal Blade Louver

Horizontal

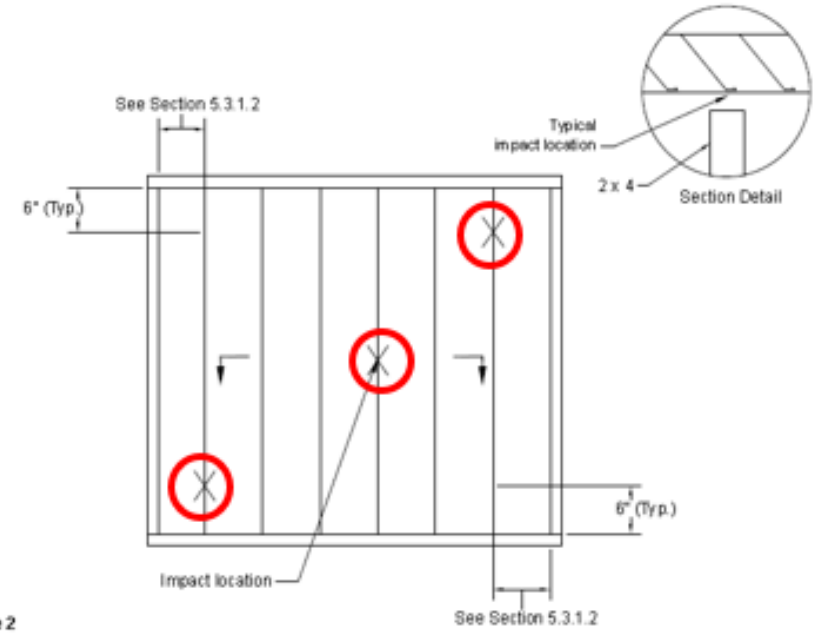
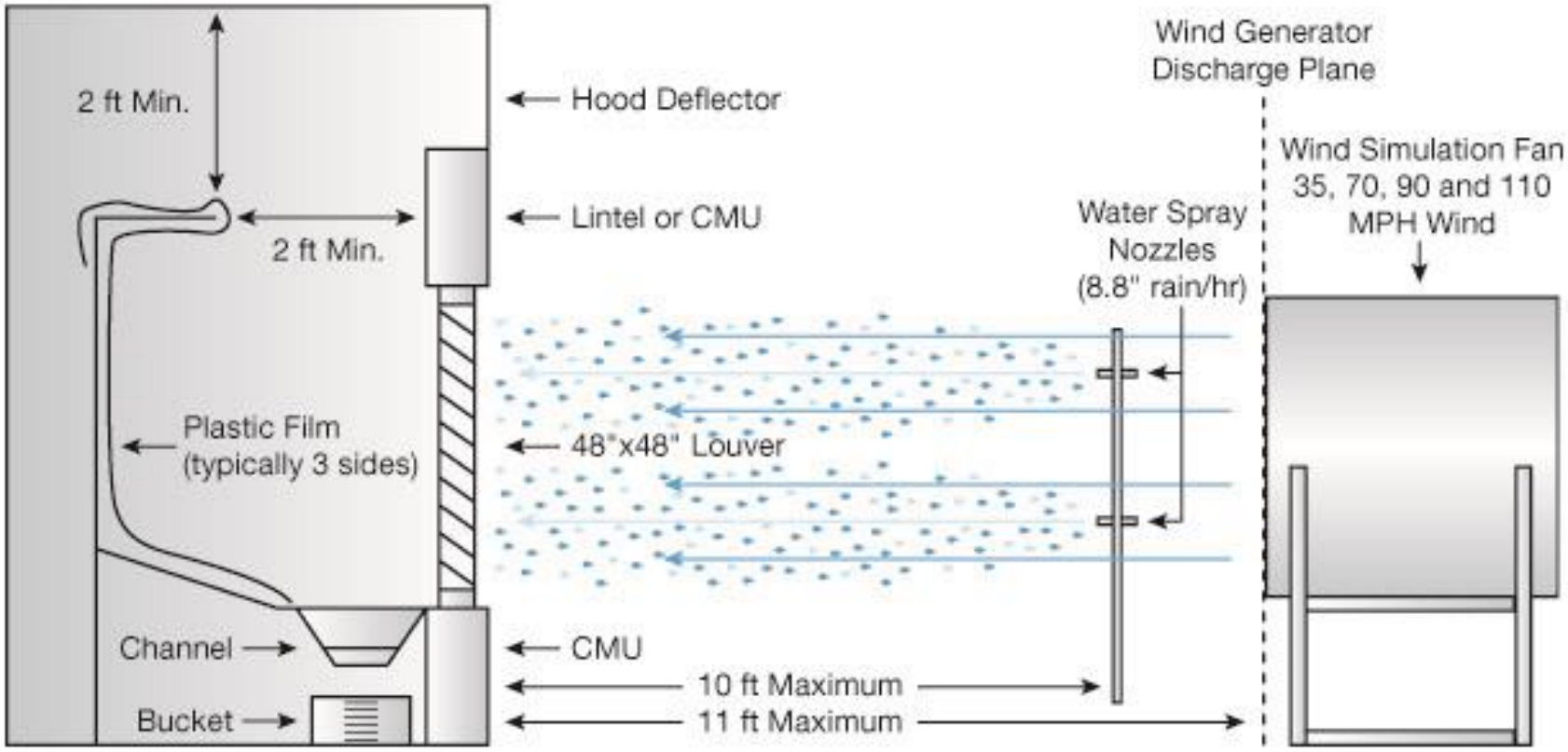


Figure 2
Impact Locations for Testing Single Section, Vertical Blade Louver

Vertical

ANSI/AMCA 550-
Test Method for High Velocity Wind Driven Rain Resistant Louvers

AMCA 550 / Miami-Dade TAS100A - High Velocity Wind-Driven Rain



amca INTERNATIONAL LISTED
HIGH VELOCITY
RAIN RESISTANT
WITH BLADES FULLY OPEN
See www.AMCA.org for all certified or listed products
This label does not signify AMCA airflow performance certification.

amca INTERNATIONAL LISTED
HIGH VELOCITY
RAIN RESISTANT
WITH BLADES FULLY CLOSED
See www.AMCA.org for all certified or listed products
This label does not signify AMCA airflow performance certification.

AMCA Listing Standards - 550

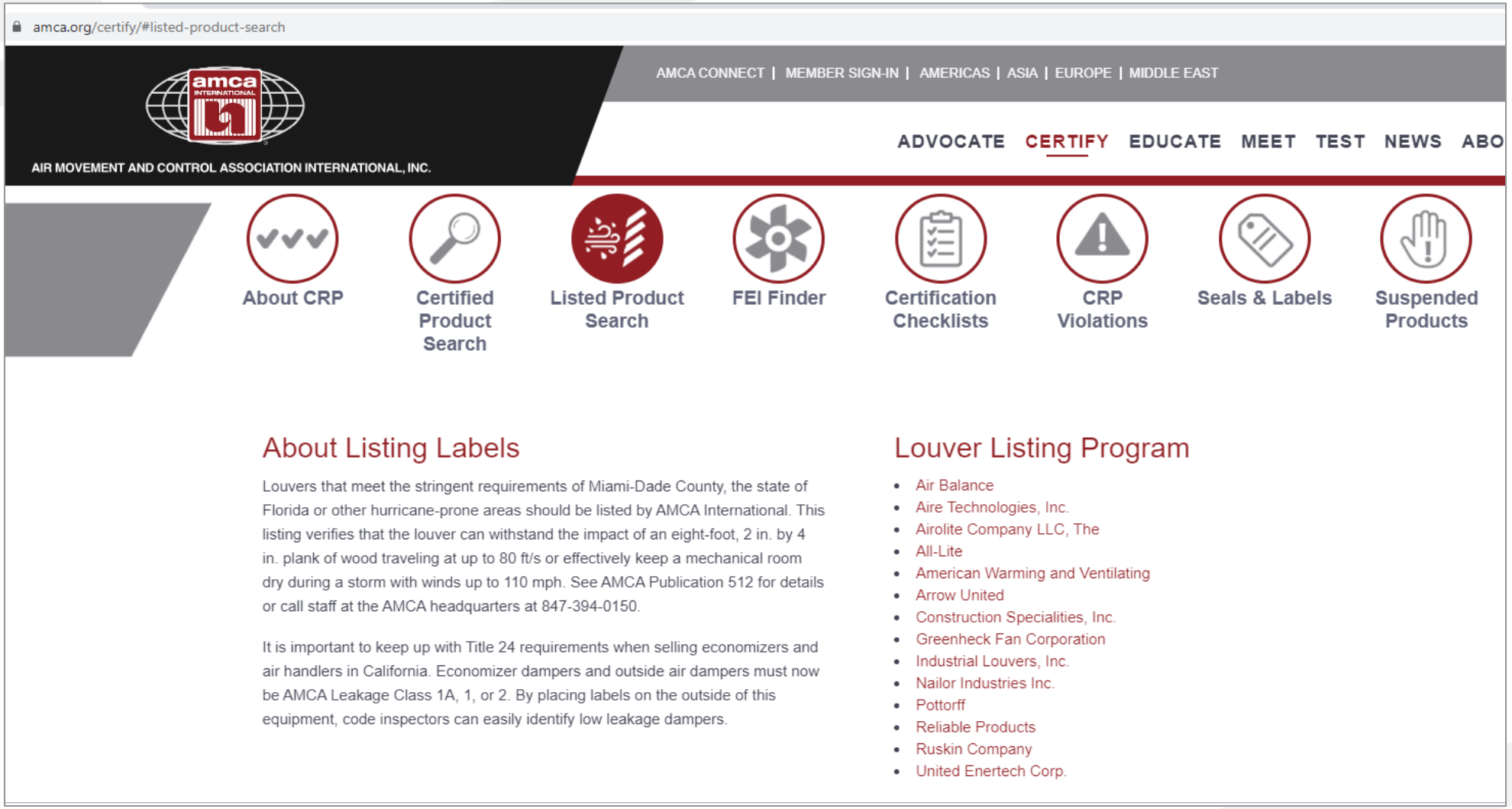
- **AMCA 550**
  - Water shall be supplied to the wind stream using a sprinkle pipe system simulating a uniform 8.8 inches/hour (223.5 mm/hour) over the test specimen.
  - Eight intervals of testing
    - Five to fifteen minutes
    - Wind Speeds from 0 mph to 110 mph
  - Pass/Fail is determined by whether or not the louver exhibits water infiltration in excess of 1% of the total water sprayed.

Typhoon Conditions – AMCA 550

- Louver test specimen size must exhibit a 1m x 1m “core” area.
- No more than **1%** of the total sprayed water volume may penetrate the louver to pass.

Interval	Wind Speed	Duration	Water Spray
1	35 mph	15 min	On
2	0 mph	5 min	Off
3	70 mph	15 min	On
4	0 mph	5 min	Off
5	90 mph	15 min	On
6	0 mph	5 min	Off
7	110 mph	5 min	On
8	0 mph	5 min	Off

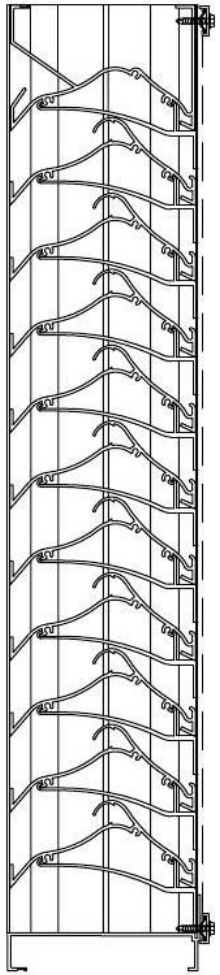
Searching for AMCA 540/550 Louvers



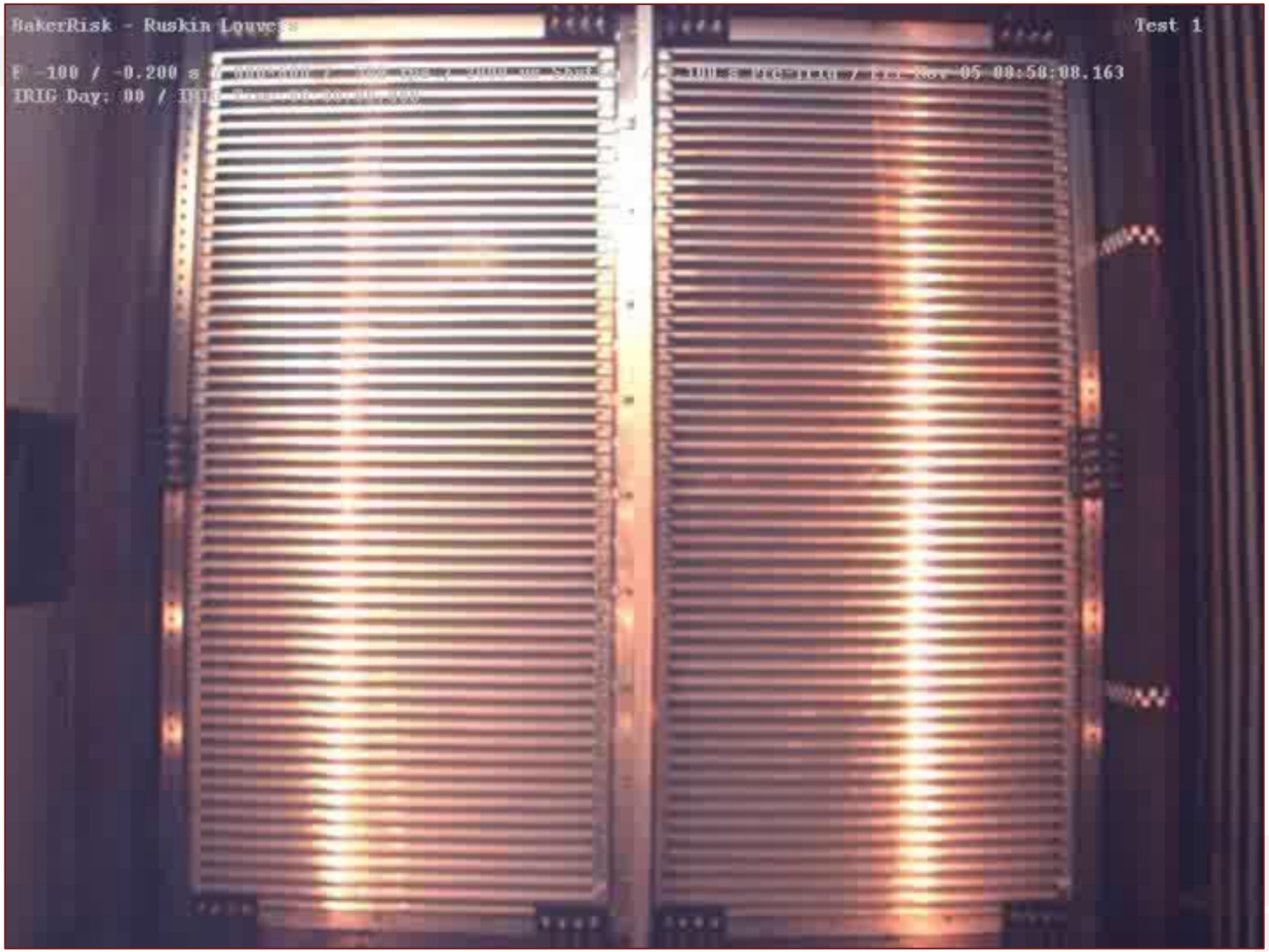
Source: www.amca.org/certify/#listed-product-search

Blast Resistant Louvers

- Blast Resistance – GSA Solutions
- Government installations
- 10 psi tested performance
- Proven installed design



Blast Resistant Louvers



How to Specify AMCA-Certified Louvers

AMCA International- Equipment Validation

How do you know if the product you want to specify is certified or listed by AMCA International?

- Visit AMCA's website (www.amca.org); click on "Certify"
  - Select "Certified Product Search" to research products by company name, product type, country or license type
  - Select "Listed Product Search" to research the louvers that are verified as meeting the severe-duty requirements
- Check the manufacturer's catalogs
- Look for AMCA International's Certified Ratings Seal or Listing Label on the product (Note: displaying physical seals and labels is optional.)
- Contact AMCA International's Certified Ratings Program Department — certified@amca.org.

AMCA Publication 511-10

- **Publication 511**: Certified Ratings Program Product Rating Manual for Air Control Devices
  - Dictates proper presentation of data and other required technical procedures for certification of air control devices under the AMCA Certified Ratings Program
- AMCA CRP seals for one or more licenses; licenses can be combined into one seal:
  - Water Penetration, Air Performance
  - Air Leakage
  - Air Performance, Wind Driven Rain
  - Wind Driven Rain
  - Water Penetration, Air Performance, Wind Driv
  - Sound
  - Wind Driven Sand

What is the AMCA Seal?

- The AMCA International Certified Ratings Program is a globally recognized third-party program that gives buyers, specifiers and users assurance that manufacturers' published data for air movement and control products are accurate.

- AMCA-tested and certified products ONLY are eligible to bear the CRP seal.

What is the AMCA Seal?

- What **DOESN'T** this seal mean?

≠

≠ "Tested in accordance with AMCA Standard 500-L."

Louver Presentation Summary

- Topics covered:
  - Louver types, definitions and terms
  - Louver performance, test standards/methods and performance data
  - Traditional louvers offer high FA and low pressure drop but do not provide WDR performance
  - WDR louvers stop water penetration and allow greater FA velocities
  - WDR allows for smaller footprint of louver sizes
  - WDR louvers do not require a safety factor
  - How to specify louvers and AMCA-certified louvers

Resources – Louvers 101

- **AMCA International**: *www.amca.org*
- **AMCA White Paper:** *www.amca.org/educate/#articles-and-technical-papers*

  > Understanding the AMCA Standard 500-L Tests

- **ANSI/AMCA Standard 500-L-12**: *www.amca.org/store*

  > Laboratory Methods of Testing Louvers for Rating *(Available for purchase)*

- **AMCA Publications**: *www.amca.org/store*

  > **501-17**: Louver Application Manual and Design Guide *(Available for purchase)*

  > **502-06 (R2009)**: Damper Application Manual for Heating, Ventilating, and Air Conditioning *(Available for purchase)*

  > **511-21**: Certified Ratings Program — Product Rating Manual for Air Control Devices *(Free PDF download)*

- **AMCA Online Education**: *www.amca.org/educate*

Q & A

Survey QR Code:

Thank you for your time!

To receive PDH credit for today's educational session, you must complete the online evaluation, either via the QR code or a link, which will be emailed to you 2 weeks of this program.

PDH credits and participation certificates will be issued electronically within 30 days, once all attendance records are checked and the completed online evaluations are received.

Attendees will receive an email at the address provided on your 2023 AHR Expo registration, listing the total credit hours awarded and a link to a printable certificate of completion.

If you have any questions, please contact Lisa Cherney, Education Manager, at AMCA International *(lcherney@amca.org)*.

NEXT SESSION @ 1:00PM:

How Women Are Impacting the Industry and What You Can Do To Help