Louvers 101 - “Basic” Training

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Scott Arnold

Content Manager, AMCA International

Webinar Moderator

- Joined AMCA in 2017
- Leads development and publication of technical articles, white papers and educational materials.
- Editor-in-chief of the award-winning AMCA *inmotion* magazine.

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- Participation Guidelines:
  - Audience will be muted during the webinar.
  - Questions can be submitted anytime via the GoToWebinar platform and will be addressed at the end of the presentation.
  - Reminder: This webinar is being recorded!
  - To earn PDH credit for today, please stay clicked onto the webinar **for the entire hour**.
  - A post-webinar evaluation will be emailed to everyone within one day, and it must be completed to qualify for today's PDH credit.
  - Every person that wants to receive PDH credit must be individually registered. If people are watching in a group and want credit, please contact Lisa Cherney (*lcherney@amca.org*) for a group sign-in sheet.

Q & A

To submit questions:

- From the attendee panel on the side of the screen, select the "Questions" drop down option.
- Type your question in the box, starting with the name of the presenter for whom your question is for.
- Click "Send".

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Jim Smardo

Chair, AMCA Louver Marketing Task Force

- Held positions in engineering, sales, marketing, estimating, and new-product development since1994, all in louver architecture.
- Has expertly covered all phases of louvers, driving specifications and design-build.
- Actively involved in several AMCA committees.

Louvers 101 – "Basic" Training

Purpose and Learning Objectives

The purpose of this presentation is to inform industry professionals about Fiberglass Reinforced Polymer (FRP), comparing properties of corrosion resistance, typical applications Fiberglass Reinforced Polymer (FRP) is currently applied, the advantages of Fiberglass Reinforced Polymer (FRP) vs. Stainless Steel.

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

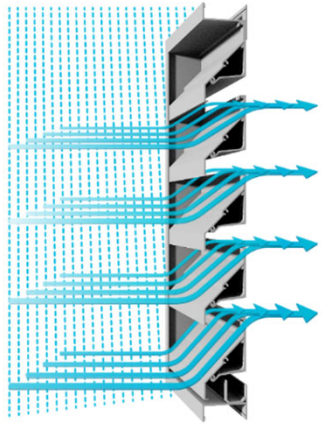
1. Understand the different forms of Fiberglass Reinforced Polymer (FRP).
2. Determine the criteria to specify Fiberglass Reinforced Polymer (FRP).
3. Identify the relevant American Society of Testing and Materials (ASTM) standards applicable to Fiberglass Reinforced Polymer (FRP).
4. Practical examples of the advantages of Fiberglass Reinforced Polymer (FRP), compared to Stainless Steel.

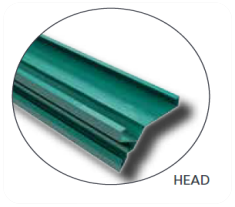
Today's Agenda

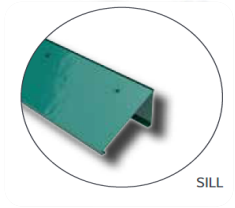
1. Louver: Features and Performance
2. Classic Louver Types
3. Specialty Louver Types
4. Materials
5. Finishes
6. Louver Testing and Certification
7. Summary

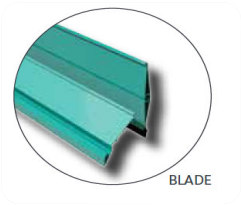
What exactly is a louver?

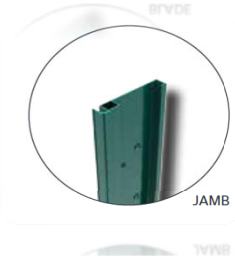
- Per AMCA publication 501…
  - A louver is a device comprised of:
    - a blade or blades…
    - that permit the flow of air…
    - but inhibits the entrance of water or other elements.





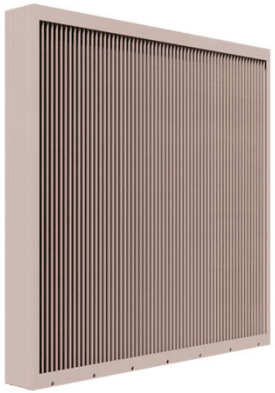


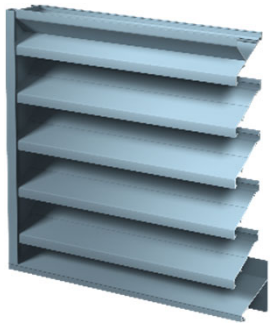




What exactly is a louver?

- Louvers Can:
  - Hide what is behind “sight proof”
  - Repel moisture
  - Can be impact resistant
  - Sound Attenuation
  - Can Repel sand and snow
  - Measure air flow
  - Be Horizontal or Vertical





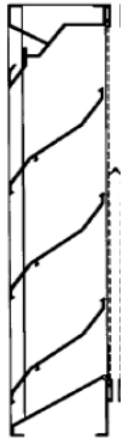
Stationary

Adjustable

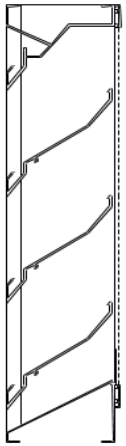
Wind Driven Rain

Louver Types & Blade Styles

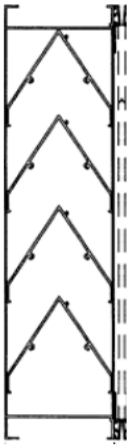
- Louver Types
  - Fixed Blade (Stationary)
  - Adjustable Blade
  - Combination
- Blade Types
  - Architectural (Non-drainable)
    - J or K Blade
  - Drainable Blade
    - Single or Dual Drain



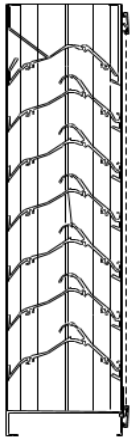
Non-drainable



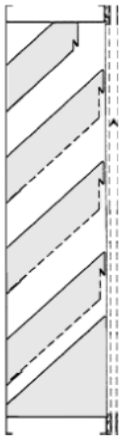
Drainable



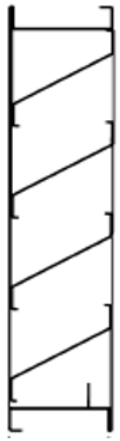
Sight Proof



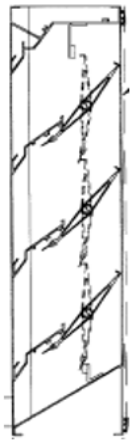
Wind-Driven Rain



Acoustic



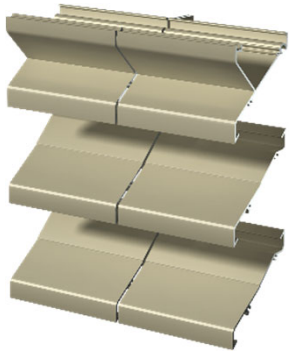
Steel



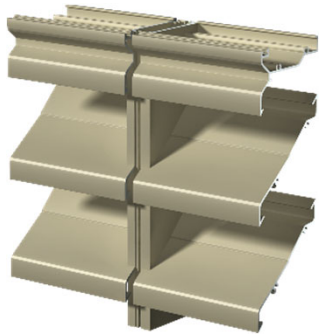
Combination

Louver Mullion Types

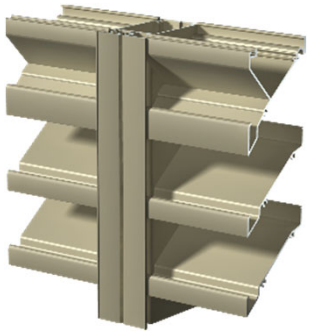
- Mullion Types
  - Architectural
  - Recessed
  - Visible



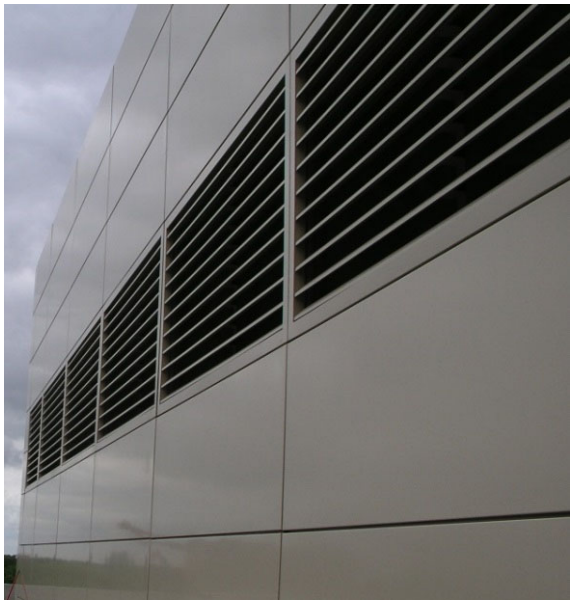
Architectural Mullion



Recessed Mullion



Visible Mullion



Louver Design Considerations

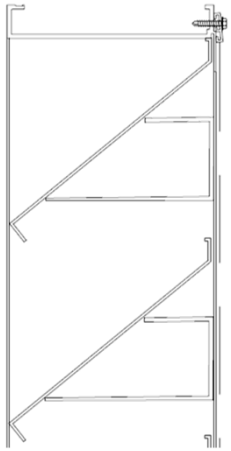
- When designing louvers, consideration should be given to the following criteria:
  - Air Performance (Pressure Drop)
  - Water Penetration (Rain defense)
  - Air flow
  - Application (Type of building)
  - Environmental Conditions
  - Noise reduction
  - Aesthetics
  - Structural Integrity

Features and Performance

- Profile and Size
- Material and Finish
- Blade Style and Shape
- Blade Features, Spacing and angle
- Installation method
- Frame Type

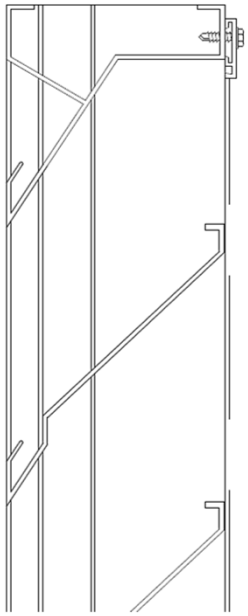
Stationary Louvers Non-Drainable

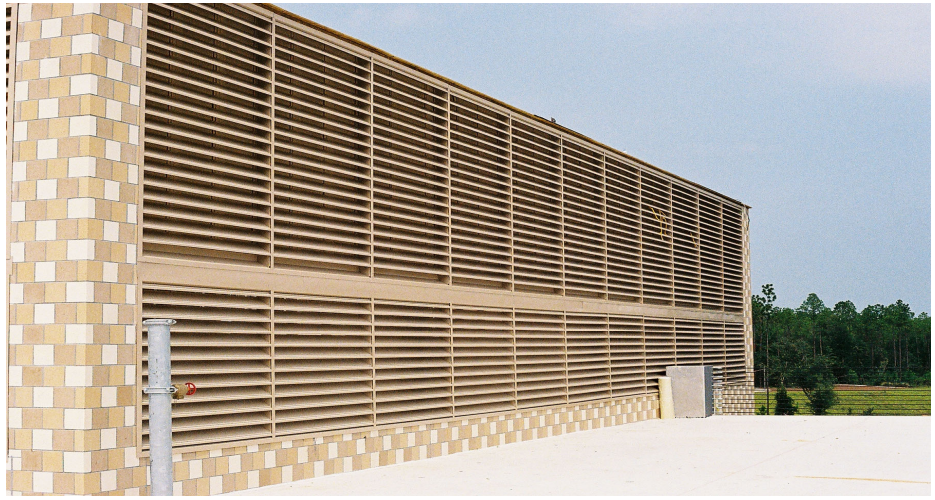
- No Drain/Gutter
- Water Drains in Airstream
- Stationary Blades
- Typically Continuous Blade
- Aluminum or Steel Material
- Provisions for Water Collection Recommended
- Recessed Mullions
- Miter Corners



Stationary Louvers Drainable

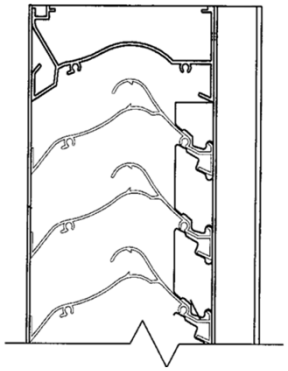
- Drain/Gutter in Blade and Head Frame
- Drain Directs Water out of Air Stream
- Typically Not Continuous Blade
- Typically Vertical Mullions Required
- Tested Water Performance AMCA 500-L
- Aluminum or Steel Material

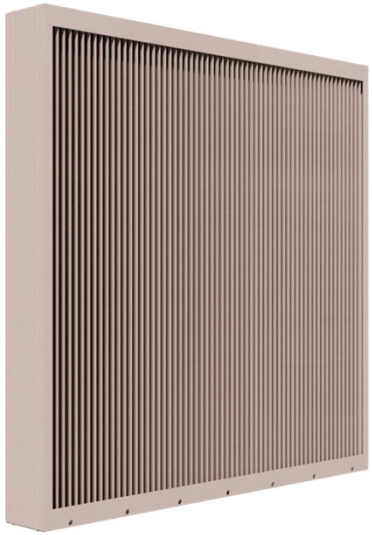




Wind Driven Rain Louvers

- Applications with Storm Conditions
- Vertical or Horizontal Blade Orientation
- Typically Not Continuous Blade
- AMCA 500-L Wind Driven Rain Tested
- Tested Water Performance AMCA 500-L
- Free Area/Pressure Drop Considerations





Still Air Louvers VS. Wind Driven Rain

- Still Air
  - Wide Blade Spacing
  - High Free Area
  - Lower Cost
  - Low Pressure Drop
  - Not Effective I Storms

- Wind Driven Rain
  - Close Blade Spacing
  - Lower Free area
  - Greater Velocities
  - Higher Pressure Drop
  - Effective Rejection in Storm Conditions

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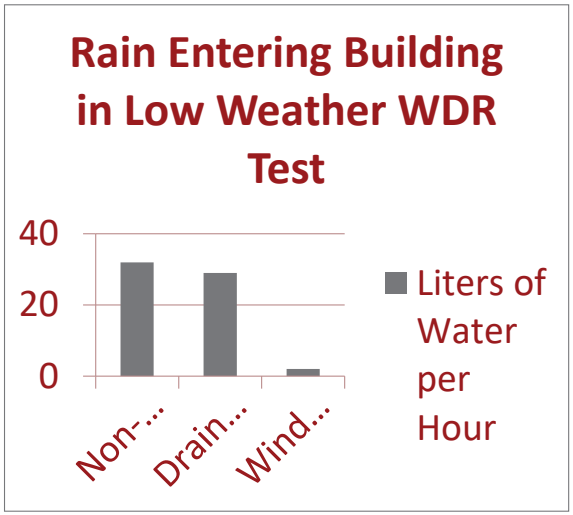
WATER PENETRATION
AIR PERFORMANCE
AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

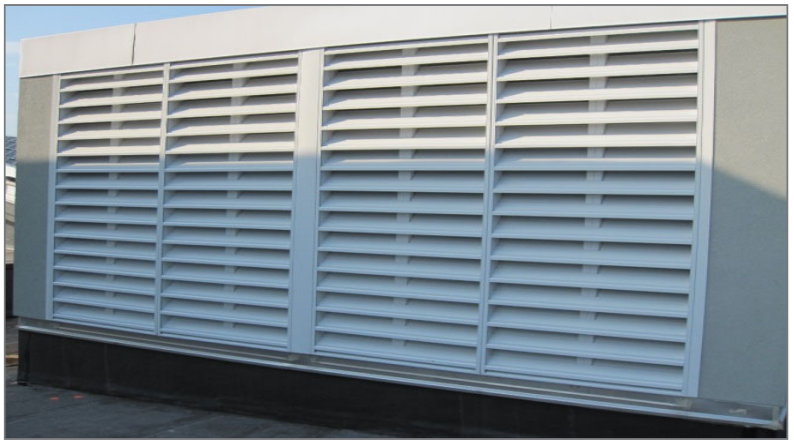


Operable Louvers

- Single Blade Rotates within Frame
- Sometimes called “Adjustable”
- Tested for Air Leakage in Closed Position
- Multiple Actuated Options
  - Electric
  - Pneumatic
  - Chain Pull
  - Hand Crank
  - Worm Gear
  - Hand Quad

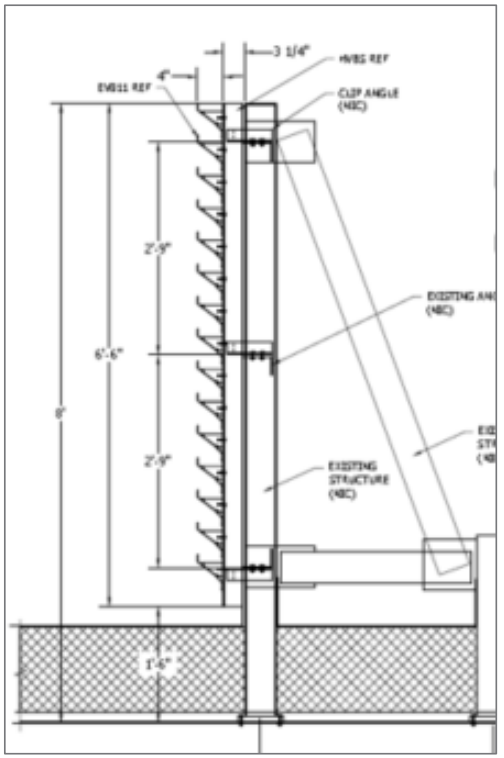
Combination Louvers

- Fixed Louver Blade and Damper in a Single Frame
- Tested for Air Leakage in Closed Position
- Multiple Actuated Options
  - Electric
  - Pneumatic
  - Chain Pull
  - Hand Crank
  - Worm Gear
  - Hand Quad



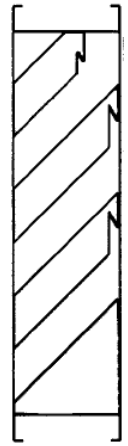
Equipment Screens

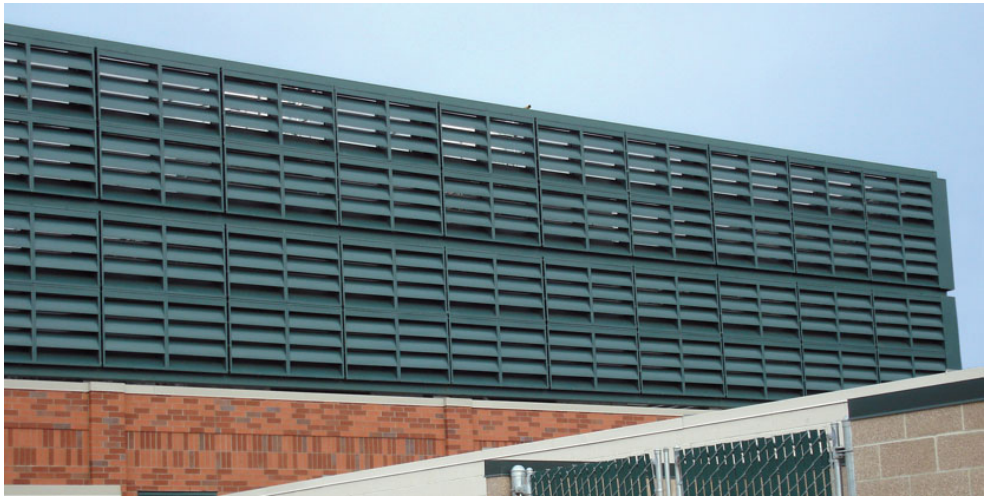
- Used to hide equipment, cooling towers, vision barriers and for decorative purposes.
- Can serve as a protective barrier that is less costly than a concrete wall.
- Both horizontal and vertical blade configurations with multiple depths.



Acoustical Louvers

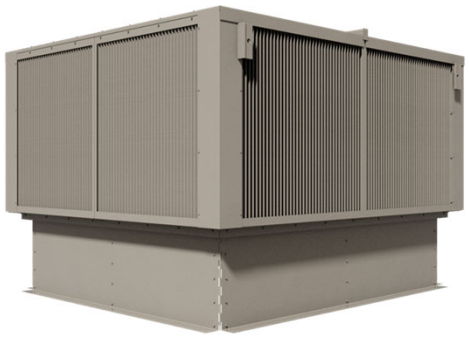
- Blades packed with sound attenuating material
- Typically deeper frame and blades
- Box or airfoil blades instead of single blade thickness
- Lower free area due to blade designs
- Fiberglass or mineral wool materials





Penthouses

- Typ. 4 louvers (box) joined together with a roof
- Just about any louver can be made into a penthouse.
- Miter or box corner options
- Typ. mounter onto a roof curb



Specialty Louvers and Options

- FEMA Louvers
- Hurricane Louvers
- Sand Louvers
- Blast Louvers
- Fiberglass Louvers
- Snow Louver

Sand Louver

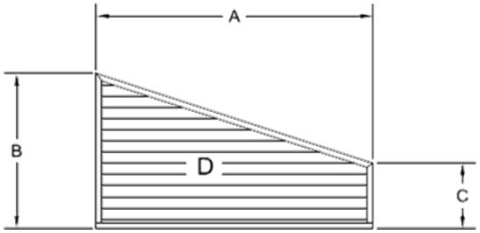
Blast Louver

FEMA Louver

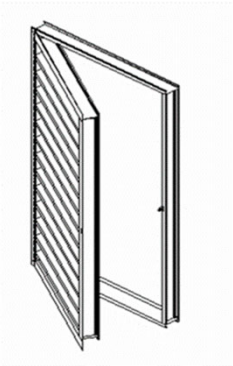
Snow Louver

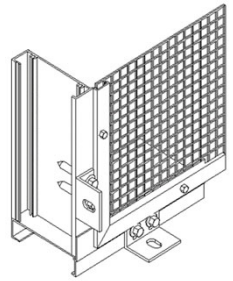
Specialty Louvers and Options

- Glazing Frames
- Hinged Doors
- Grilles
- Triangular and Round Shapes
- Filter Racks
- Security Bars
- Drip Caps and Extended Sills
- False Mullions
- Blank-Off Panels



Right Triangle Top (D)

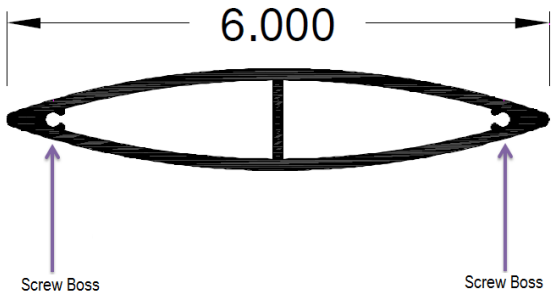


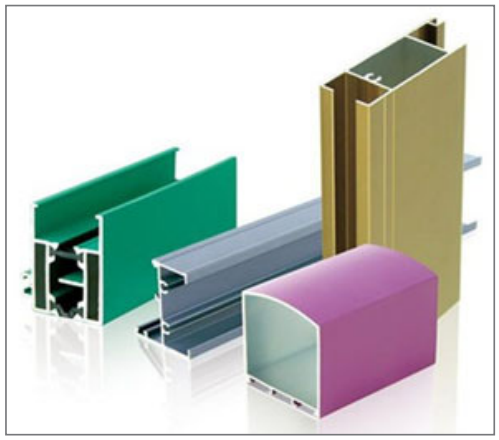


Materials

- Typically Aluminum or Steel
- Aluminum and Steel not Interchangeable
- Aluminum Extrusions offer Precise Lines and Complex Profiles
- Steel will be:
  - Die-Formed
  - Roll Formed
  - Stainless Steel Options
- Aluminum
  - Lightweight
  - More Receptive to Finishes
  - Less Corrosive than Steel
  - Can Help Earn LEED Credits

Roll-Formed Steel





Aluminum Extrusions

Construction–Welded Or Mechanically Fastened

- Benefits to Mechanically Fastened
  - Easy Component Replacement
  - Clean Connections at Jambs
- Benefits to Welding
  - Strong Connections
  - Faster Assembly on Larger Sizes

Finishes

- Finish Types Include
  - Polyvinylidene Fluoride (PVDF) Liquid Finishes
  - Powder Coating
  - Epoxy Coating
  - Anodize Finishing

PVDF Finishes

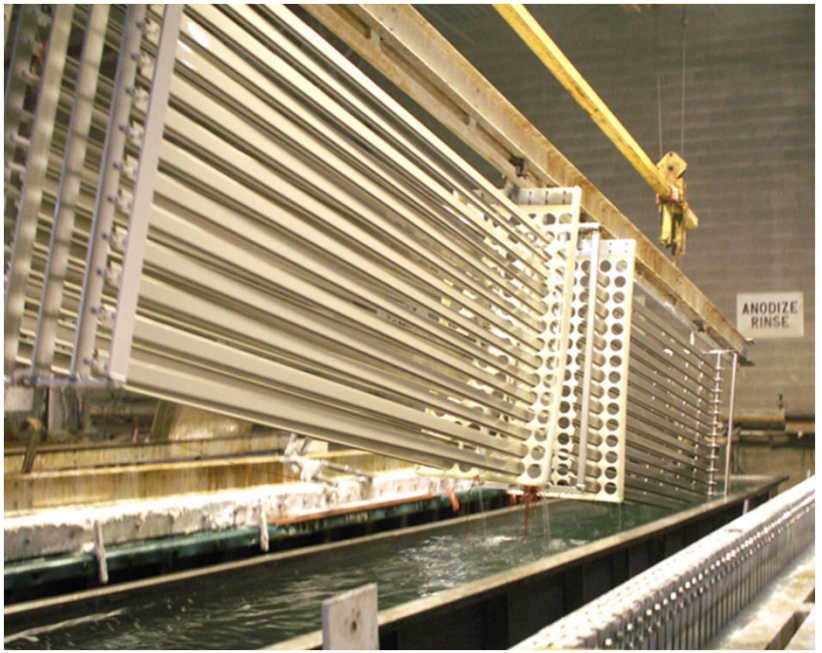
- Fluoropolymer Resin Typically 50% and 70%
- 2 Coat Standard with Options for additional Coats
- Easily Match with Liquid Pigments
- Mica “Flake” Added to give Metallic Coating Appearance
- Specifications Include
  - AAMA 2604
    - 50% PVDF
    - Requires 5 Year Min. South Florida Exposure
  - AAMA 2605
    - 70%
    - Requires 10 Year Min. South Florida Exposure
    - Carries up to 20 Year Warranty

Powder Coating

- Requires No Solvent
- Applied Electrostatically then Heat Cured
- Typically Warrantied up to 10 Years
- Custom Colors can be More Difficult to Match than Liquid PVDF

Anodize Finishes

- Electrochemical Process
- Adds Natural Oxide Layer to Louver Surface
- Color Selections are Limited
- Color Variations Can Occur with Large Runs
- Specifications:
  - 204 R1 AAMA AA-C22A31 .04 Mills Min. Depth
  - 215 R1 AAMA AA-C22A41 .07 Mils Min. Depth
  - Color Anodize AAMA AA-C22A44
  - Standard Warranty 1 to 7 Years



Epoxy Finishes

- Air Dried
- For Use In Caustic Environments
- Fades and Chalks faster than PVDF Finishes

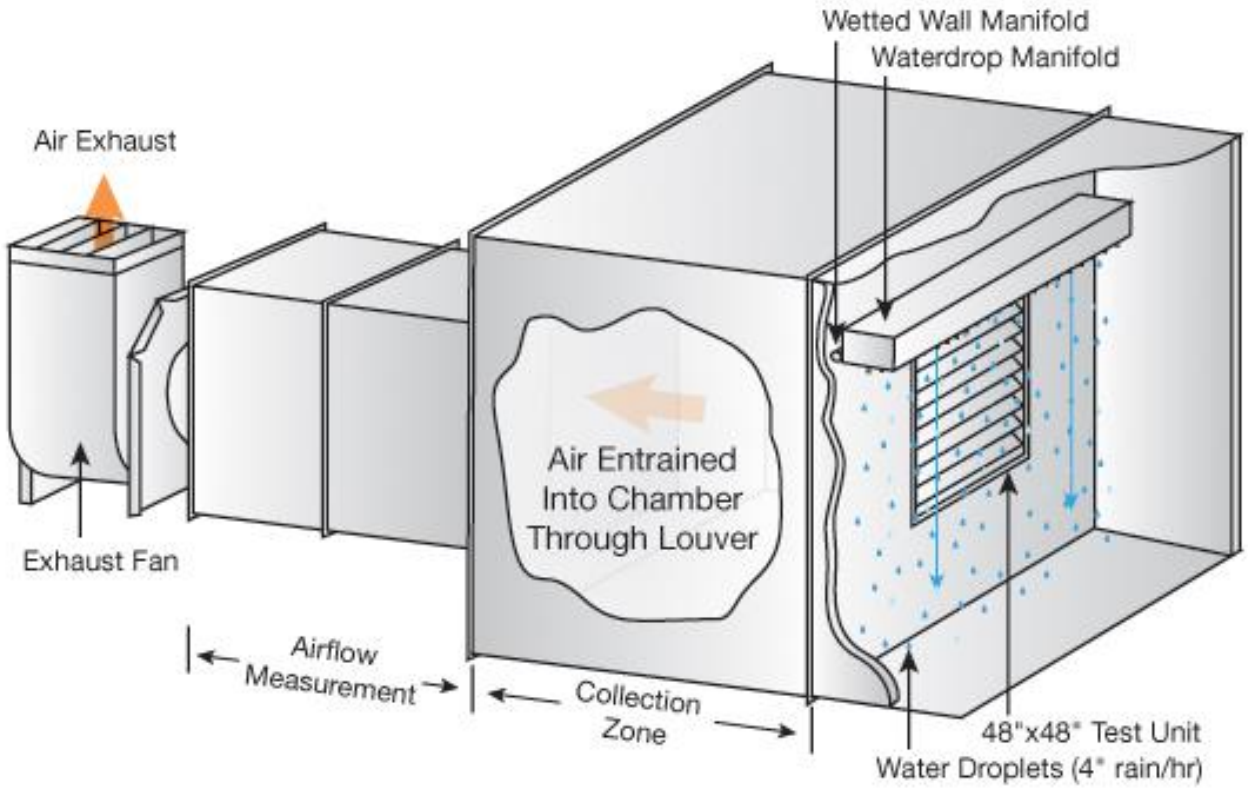
AMCA – Air Movement and Control Association

- www.amca.org
- Not-for-profit manufacturers association incepted in 1917.
- Member companies worldwide
- Administers AMCA Certified Ratings Program (CRP)
- Has a worldwide network of testing laboratories.
- Publishes rating test standards, handbooks and application guides.

AMCA 500-L & 511

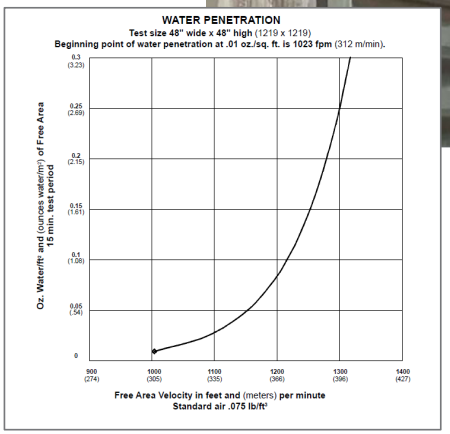
- Tests and Certifies Louvers
  - Awards a CRP – Certified Ratings Program
  - 500-L Consists of Different Test Protocols For Testing Louvers
    - Water Penetration (Still Air)
    - Wind driven Rain
    - Pressure Drop
    - Free Area
    - Sound Performance
    - Wind Driven Sand
    - Airflow Leakage
  - AMCA 500-L gives you The Test Parameters for Testing and Confirms Performance.
  - AMCA 511 gives Guidance on How to Certify Those Tested Louvers

AMCA 500-L Water Penetration Test

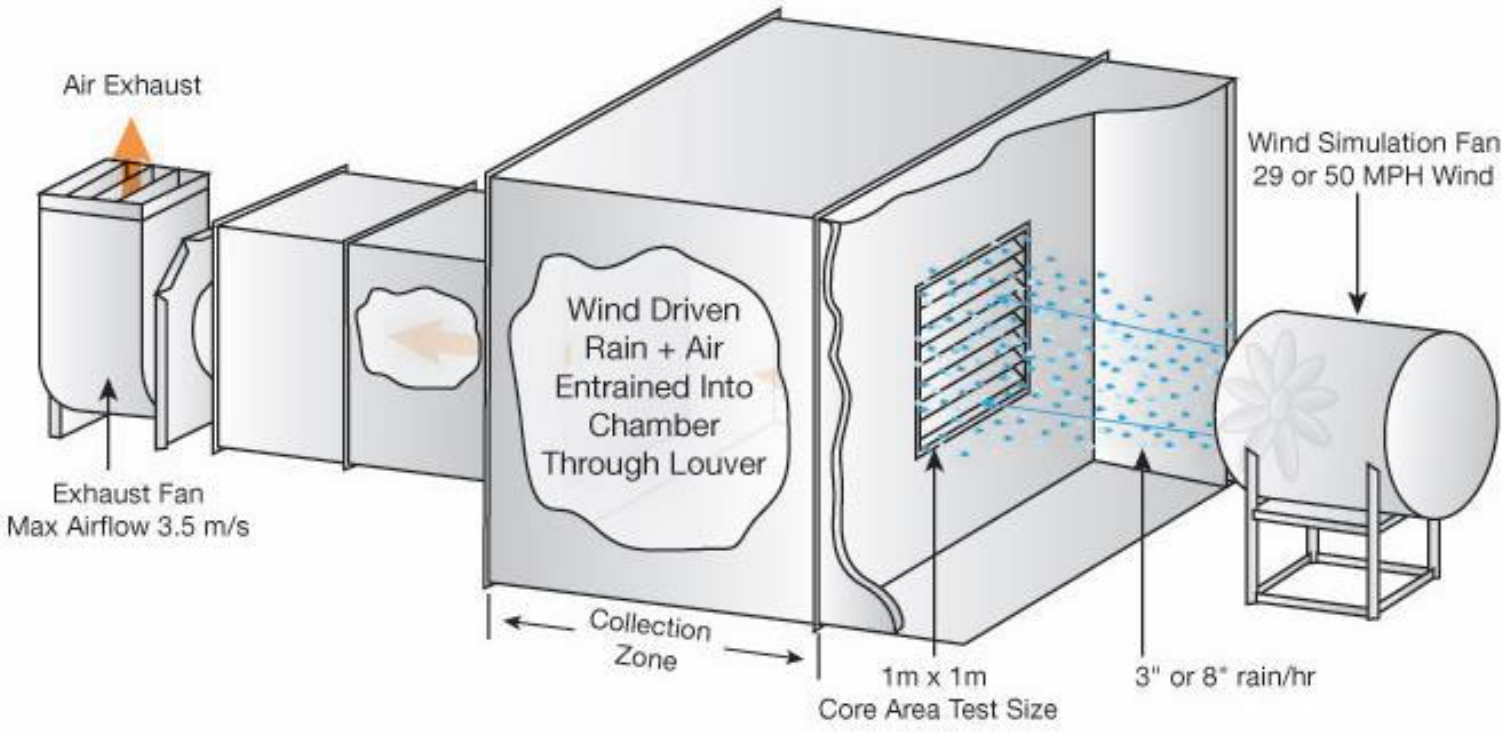


Louver Still Air Water Test

- Defies the Beginning Point of Water Penetration by Intake Velocity Where Water Begins To Penetrate the Louver
- 4” Rainfall Rate Per Hour
- 48” x 48” Louver Size
- Still Air - No Simulated Wind
- 1250 fpm max. Free Area Velocity Pulled Through Louver from Intake Fan
- .01 oz @ 871 fpm fav



AMCA 500-L Wind-Driven Rain Test



Louver Wind Driven Rain Test

- Measures The Louvers Ability to Reject Water introduced to the Louver with Simulated wind-Driven Rain
- Measured With High Powered Fan at 29 MPH and 50 MPH
- Results in Class A, B, C, or D Showing Rain Rejection
  - Class A rejects 99% to 100%
  - Class B rejects 95% to 98.9%
  - Class C rejects 80% to 94.9%
  - Class D rejects 0% to 79.9%

WIND-DRIVEN RAIN PERFORMANCE

Test size is 1m x 1m (39" x 39") core area, 1.04m x 1.12m (41" x 44") nominal. Free Area of test louver is 5.45 ft² (.51m²).

29 mph (47 kph) wind & 3" (76) per hour rain conditions

Core Velocity$_1$ fpm (m/s)	Airflow cfm (m³/min)	Free Area Velocity$_2$ fpm (m/sec.)	Effectiveness Ratio	Class$_3$
0 (0)	0 (0)	0 (0)	99.9%	A
98 (.5)	1060 (30)	226 (1.1)	99.9%	A
197 (1.0)	2119 (60)	389 (2.0)	99.9%	A
287 (1.5)	3179 (90)	583 (3.0)	99.9%	A
381 (1.9)	4239 (120)	778 (4.0)	99.9%	A
476 (2.4)	5299 (150)	972 (4.9)	99.9%	A
586 (3.0)	6358 (180)	1167 (5.9)	99.8%	A
673 (3.4)	7418 (210)	1361 (6.9)	99.7%	A
763 (3.9)	8478 (240)	1556 (7.9)	98.9%	B
882 (4.5)	9537 (270)	1750 (8.9)	97.3%	B
987 (5.0)	10597 (300)	1944 (9.9)	95.3%	B

50 mph (80 kph) wind & 8" (203) per hour rain conditions

Core Velocity$_1$ fpm (m/s)	Airflow cfm (m³/min)	Free Area Velocity$_2$ fpm (m/sec.)	Effectiveness Ratio	Class$_3$
0 (0)	0 (0)	0 (0)	99.4%	A
106 (.5)	1060 (30)	226 (1.1)	99.3%	A
184 (.9)	2119 (60)	389 (2.0)	99.2%	A
282 (1.4)	3179 (90)	583 (3.0)	99.0%	A
408 (1.9)	4239 (120)	778 (4.0)	99.0%	A
495 (2.5)	5299 (150)	972 (4.9)	98.9%	B
567 (2.9)	6358 (180)	1167 (5.9)	98.9%	B
680 (3.5)	7418 (210)	1361 (6.9)	98.3%	B
791 (4.0)	8478 (240)	1556 (7.9)	97.2%	B
882 (4.5)	9537 (270)	1750 (8.9)	95.1%	B
982 (5.0)	10597 (300)	1944 (9.9)	23.9%	D

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).

Free Area

- Free Area is any Space That Is Not Obstructed Within The Frames and Blades Of a Louver.
- Free Area Varies From Louver to Louver.

FREE AREA GUIDE

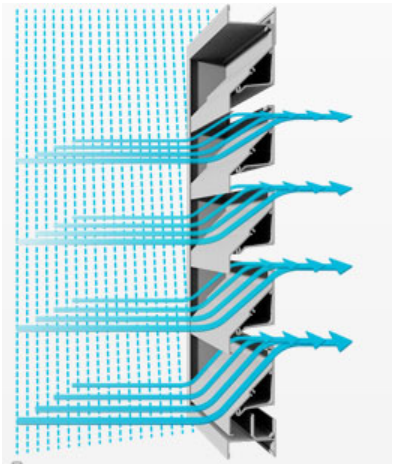
Free Area Guide shows free area in ft² and m² for various sizes of ELF375DX

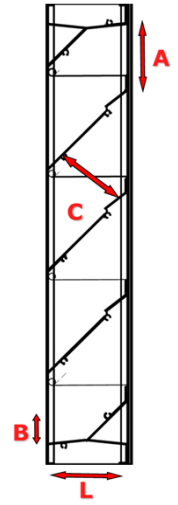
Width – Inches and Meters

Height – Inches and Meters	12 0.30	18 0.46	24 0.61	30 0.76	36 0.91	42 1.07	48 1.22	54 1.37	60 1.52	66 1.68	72 1.83	78 1.98	84 2.13	90 2.29	96 2.44	102 2.59	108 2.74	114 2.90	120 3.05
12 0.30	0.26 0.02	0.41 0.04	0.56 0.05	0.71 0.07	0.87 0.08	1.02 0.09	1.17 0.11	1.33 0.12	1.48 0.14	1.63 0.15	1.79 0.17	1.94 0.18	2.09 0.19	2.24 0.21	2.40 0.22	2.55 0.24	2.70 0.25	2.86 0.27	3.01 0.28
18 0.46	0.61 0.06	0.97 0.09	1.33 0.12	1.70 0.16	2.06 0.19	2.43 0.23	2.79 0.26	3.15 0.29	3.52 0.33	3.88 0.36	4.25 0.39	4.61 0.43	4.97 0.46	5.34 0.50	5.70 0.53	6.06 0.56	6.43 0.60	6.79 0.63	7.16 0.67
24 0.61	0.87 0.08	1.40 0.13	1.92 0.18	2.45 0.23	2.97 0.28	3.50 0.33	4.02 0.37	4.55 0.42	5.07 0.47	5.60 0.52	6.12 0.57	6.65 0.62	7.17 0.67	7.70 0.72	8.22 0.76	8.75 0.81	9.27 0.86	9.80 0.91	10.32 0.96
30 0.76	1.14 0.11	1.83 0.17	2.51 0.23	3.20 0.30	3.89 0.36	4.57 0.42	5.26 0.49	5.94 0.55	6.63 0.62	7.32 0.68	8.00 0.74	8.69 0.81	9.37 0.87	10.06 0.93	10.74 1.00	11.43 1.06	12.12 1.13	12.80 1.19	13.49 1.25
36 0.91	1.33 0.12	2.13 0.20	2.92 0.27	3.72 0.35	4.52 0.42	5.31 0.49	6.11 0.57	6.91 0.64	7.70 0.72	8.50 0.79	9.30 0.86	10.09 0.94	10.89 1.01	11.69 1.09	12.49 1.16	13.28 1.23	14.08 1.31	14.88 1.38	15.67 1.46
42 1.07	1.60 0.15	2.55 0.24	3.51 0.33	4.47 0.42	5.43 0.50	6.39 0.59	7.34 0.68	8.30 0.77	9.26 0.86	10.22 0.95	11.18 1.04	12.13 1.13	13.09 1.22	14.05 1.31	15.01 1.39	15.96 1.48	16.92 1.57	17.88 1.66	18.84 1.75
48 1.22	1.86 0.17	2.98 0.28	4.10 0.38	5.22 0.49	6.34 0.59	7.46 0.69	8.58 0.80	9.70 0.90	10.82 1.01	11.93 1.11	13.05 1.21	14.17 1.32	15.29 1.42	16.41 1.52	17.53 1.63	18.65 1.73	19.77 1.84	20.89 1.94	22.00 2.04
54 1.37	2.13 0.20	3.41 0.32	4.69 0.44	5.97 0.55	7.25 0.67	8.53 0.79	9.81 0.91	11.09 1.03	12.37 1.15	13.65 1.27	14.93 1.39	16.21 1.51	17.49 1.62	18.77 1.74	20.05 1.86	21.33 1.98	22.61 2.10	23.89 2.22	25.17 2.34
60 1.52	2.40 0.22	3.84 0.36	5.28 0.49	6.72 0.62	8.16 0.76	9.61 0.89	11.05 1.03	12.49 1.16	13.93 1.29	15.37 1.43	16.81 1.56	18.25 1.70	19.69 1.83	21.13 1.96	22.57 2.10	24.01 2.23	25.45 2.37	26.90 2.50	28.34 2.63
66 1.68	2.59 0.24	4.14 0.38	5.69 0.53	7.24 0.67	8.79 0.82	10.35 0.96	11.90 1.11	13.45 1.25	15.00 1.39	16.56 1.54	18.11 1.68	19.66 1.83	21.21 1.97	22.76 2.12	24.31 2.26	25.86 2.40	27.42 2.55	28.97 2.69	30.52 2.84
72 1.83	2.85 0.26	4.57 0.42	6.28 0.58	7.99 0.74	9.71 0.90	11.42 1.06	13.13 1.22	14.84 1.38	16.56 1.54	18.27 1.70	19.98 1.86	21.70 2.02	23.41 2.18	25.12 2.33	26.83 2.49	28.55 2.65	30.26 2.81	31.97 2.97	33.69 3.13
78 1.98	3.12 0.29	5.00 0.46	6.87 0.64	8.74 0.81	10.62 0.99	12.49 1.16	14.37 1.34	16.24 1.51	18.11 1.68	19.99 1.86	21.86 2.03	23.74 2.21	25.61 2.38	27.48 2.55	29.36 2.73	31.23 2.90	33.10 3.08	34.98 3.25	36.85 3.42
84 2.13	3.39 0.32	5.43 0.50	7.46 0.69	9.50 0.88	11.53 1.07	13.57 1.26	15.60 1.45	17.63 1.64	19.67 1.83	21.70 2.02	23.74 2.21	25.77 2.39	27.81 2.58	29.84 2.77	31.88 2.96	33.91 3.15	35.95 3.34	37.98 3.53	40.02 3.72
90 2.29	3.66 0.34	5.86 0.54	8.05 0.75	10.25 0.95	12.44 1.16	14.64 1.36	16.83 1.56	19.03 1.77	21.23 1.97	23.42 2.18	25.62 2.38	27.81 2.58	30.01 2.79	32.20 2.99	34.40 3.20	36.60 3.40	38.79 3.60	40.99 3.81	43.18 4.01

$$Percent\ Free\ Area = \frac{L[A + B + (N \times C)]100}{W \times H}$$

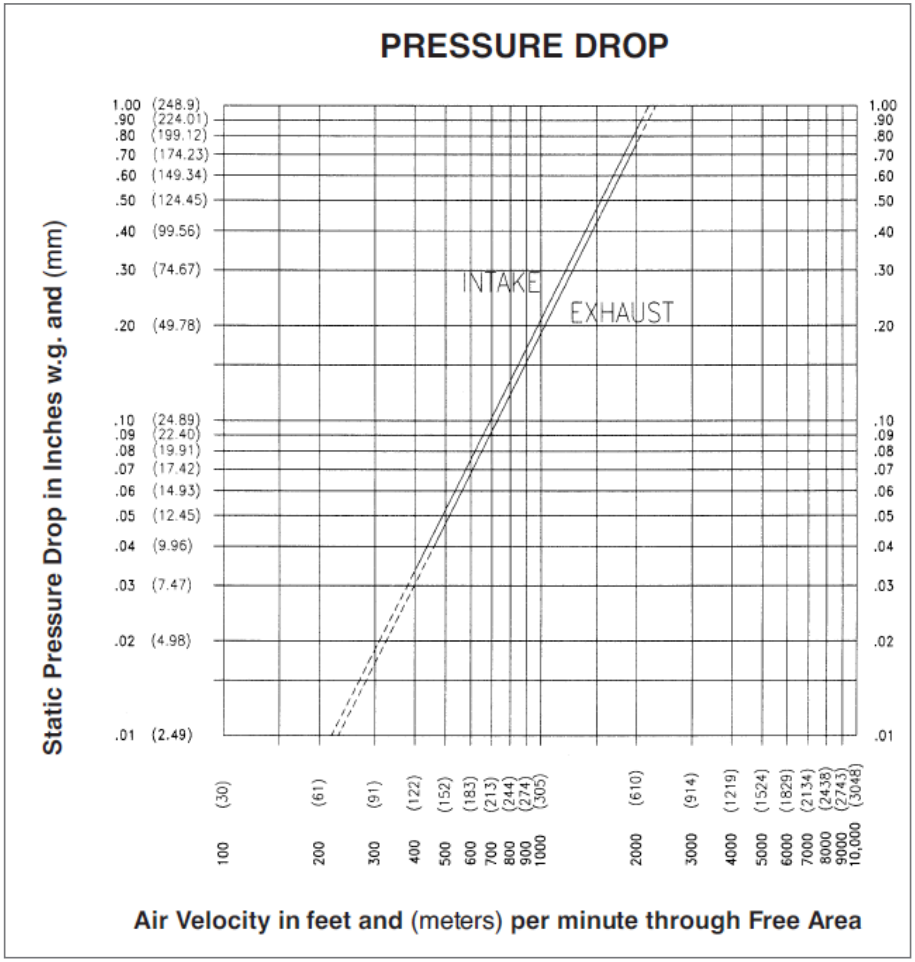
L - Minimum distance between louver jambs
A - Minimum distance between the head and top blade
B - Minimum distance between the sill and bottom blade
C - Number of *C* openings in the louver
W - Actual Louver Width
H - Actual Louver Height





Pressure Drop

- Measures The Resistance Louver Blades Create In The Air Stream
- Measured In Inches in Water Gauge
- Lower Pressure Drop = Less Resistance In Air Stream
- Measured For Both Intake and Exhaust
  - Free Area Velocity on X-Axis
  - Pressure Drop on Y-Axis



Airflow Leakage

- Determine the Relationship Between Airflow Leakage Rate and the Static Pressure for the Louver Tested
- Tested on Adjustable and Combination Louvers that can be Closed

Structural Integrity

- Windloads:
  - American Society of Civil Engineers (ASCE) formula
  - Hidden or Visible supports
  - Effective Wind Speed (mph)
  - Louver panel size
    - Blade Span (Span tables)
    - Intermediate bracing

What is the AMCA Certified Ratings Program?

- How AMCA's third-party verification works:
  - Companies send products to AMCA for testing
  - AMCA tests products for parameters specified
  - AMCA checks its data against manufacturer literature

What is the AMCA Certified Ratings Program?

- After certification, the product:
  - Is licensed to bear AMCA's seal
  - Is listed in AMCA's online database
  - Promotes Fair Competition
  - Ensures Product Performance
  - Provides a Way For Manufactures to Promote Their Product and Performance

AMCA International

- Free white papers on AMCA Certified Ratings Program:
  - *Introducing the AMCA Certified Ratings Program*
  - *Guideline Specifications for AMCA-Certified Products*
  - *How to Assure AMCA-Certified Products are Installed*
  - *Introduction to Intake and Exhaust Louvers*
  - *All free at www.amca.org/whitepapers*

Summary

- There are Many different Louver types Blade Styles and Options
- The Most Common Specifications Requirements are Water Performance, Free Area, Pressure Drop
- The most Common Finishes are:
  - Liquid PVDF
  - Powder Coat
  - Anodize
- Most Louvers Manufactures Offer Certified Louvers for Guaranteed Performance

Resources– Lisa to edit

- **AMCA International**: *www.amca.org*
- **ANSI/AMCA Standard:** *www.amca.org/store*

  > 230-15: Laboratory Methods of Testing Air Circulating Fans for Rating and Certification (Available for purchase)
- **AMCA Publication:** *www.amca.org/store*

  > 211-13: Certified Ratings Program — Product Rating Manual for Fan Air Performance (Free PDF download)
- **AMCA Certified Products:** *www.amca.org/certify*

  > Certified and listed large diameter ceiling fan products by company name

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Join us for our next AMCA *insite* Pop-Up Webinar:

- Thursday, June 18
- 11:00am-12:00pm CDT
- ***TOPIC: Factory Process & Equipment Noise – Engineered Controls***
- Presenter: John Sofra, Market Manager – North America, Commercial “Airside”| Industrial |Environmental Markets, AMCA Member Company

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