

# Louvers



## Selection, Design Considerations and Details

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Louvers are a basic and simple part of many HVAC systems and buildings, but they are often overlooked or not given the proper amount of design time and consideration. The purpose of this paper is to describe the proper way to select louvers, as well as point out application issues and common louver features and accessories. It is written for the beginner to the advanced reader in mind. To prevent the paper from being too long, some topics are only briefly mentioned. Additional conversations, details and supporting documents may be necessary to address specific applications.

### Basic Selection

1. Determine the air flow, direction of air flow and maximum air pressure drop.
2. On the Airflow Resistance chart, start at the selected static pressure and draw a horizontal line across, until it intersects either the intake line or the exhaust line. At the intersection point, draw a line straight down to the free area velocity line.
3. Check the Water Penetration Chart to make sure the recently determined free area velocity is less than the beginning point of water penetration velocity.
4. Calculate the free area required on the louver by taking the air flow amount and divide it by the recently determined free area velocity.
5. Go to the Free Area Chart and select a louver that has a free area equal to or greater than the value found in item # 4.
6. As a minimum, your louver schedule should include: manufacturer's name, louver model number, width, height, depth, free area, air flow amount, direction of air flow, static pressure drop and free area velocity.

- AIRFLOW = 8,500 ft<sup>3</sup>/min, intake  
- MAX PD<sub>s</sub> = 0.15" w.c.  
- THEREFORE, FREE AREA VELOCITY = 1,000 fpm  
- 8,500 cfm / 1,000 fpm = 8.5 ft<sup>2</sup> MIN. REQ'D FREE AREA

① 8500 ft<sup>3</sup>/min, intake, max PDs = 0.15" w.c.

PERFORMANCE DATA

ESD-435

Stationary Louver Drainable Blade  
Extruded Aluminum

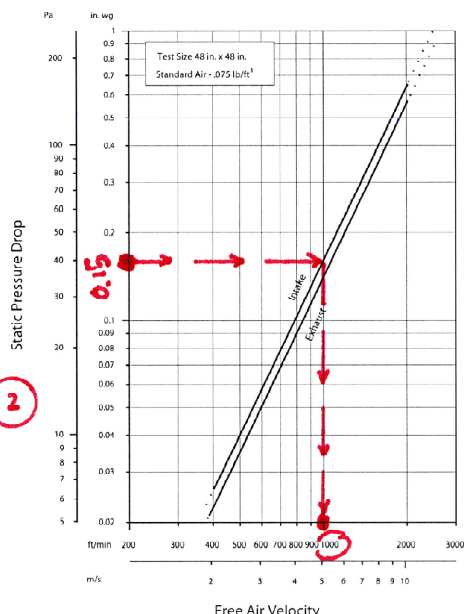
Free Area Chart (Sq. ft.) ⑤

Louver Height Inches	Louver Width in Inches												
	12	16	30	36	48	54	60	72	84	90	102	108	120
12	0.29	0.48	0.85	1.04	1.41	1.56	1.93	2.12	2.49	2.68	3.01	3.20	3.57
18	0.54	0.89	1.59	1.94	2.64	2.91	3.61	3.98	4.66	5.01	5.62	5.97	6.67
24	0.70	1.31	2.33	2.95	3.87	4.28	5.29	5.80	6.83	7.34	8.24	8.76	9.78
30	1.05	1.72	3.06	3.76	5.12	5.63	6.98	7.66	9.02	9.70	10.88	11.56	12.92
36	1.30	2.15	3.84	4.69	6.38	7.01	8.70	9.55	11.24	12.09	13.57	14.41	16.10
42	1.56	2.57	4.59	5.60	7.59	8.38	10.40	11.42	13.44	14.45	16.22	17.23	19.25
48	1.84	3.03	5.41	6.66	8.98	9.87	12.25	13.44	15.82	17.01	19.10	20.29	22.67
54	2.10	3.46	6.19	7.55	10.05	11.30	14.03	15.39	18.12	19.46	21.87	23.23	25.96
60	2.35	3.88	6.93	8.46	11.51	12.85	15.71	17.23	20.28	21.81	24.48	26.01	29.06
66	2.61	4.29	7.67	9.36	12.74	14.01	17.39	19.08	22.46	24.15	27.11	28.80	32.18
72	2.86	4.72	8.43	10.29	14.00	15.39	19.11	20.96	24.67	26.53	29.78	31.64	35.35
78	3.12	5.14	9.10	11.20	15.25	16.76	20.81	22.83	26.87	28.89	32.43	34.45	38.50
84	3.38	5.57	9.86	12.15	16.54	18.19	22.57	24.76	29.15	31.34	35.18	37.38	41.76
90	3.66	6.04	10.79	13.16	17.92	19.70	24.45	26.82	31.57	33.95	38.11	40.48	45.23
96	3.91	6.45	11.53	14.07	19.14	21.05	26.13	28.66	33.74	36.28	40.72	43.26	48.34
102	4.17	6.87	12.27	14.97	20.38	22.40	27.81	30.51	35.91	38.61	43.34	46.04	51.46
108	4.42	7.29	13.02	15.89	21.62	23.77	29.50	32.37	38.10	40.97	45.98	48.85	54.58
114	4.68	7.71	13.78	16.81	22.88	25.15	31.22	34.25	40.32	43.36	48.66	51.70	57.77
120	4.93	8.13	14.53	17.73	24.13	26.53	32.92	36.12	42.52	45.72	51.32	54.92	60.91

④  
8500 cfm  
= 1000 fpm  
= 8.5 ft<sup>2</sup>  
min free  
area

Greenheck Fan Corporation certifies that the ESD-435 louvers shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

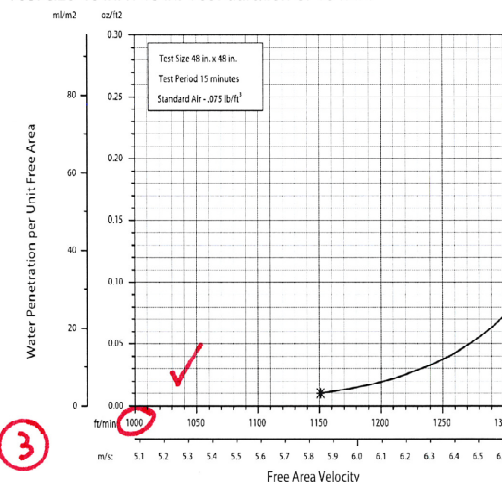
Airflow Resistance (Standard Air - .075 lb/ft<sup>3</sup>)



Model ESD-435 resistance to airflow (pressure drop) varies depending on louver application (air intake or air exhaust). Free area velocities (shown) are higher than average velocity through the overall louver size. See louver selection information.

Water Penetration (Standard Air - .075 lb/ft<sup>3</sup>)

Test size 48 in. x 48 in. Test duration of 15 min.



The AMCA Water Penetration Test provides a method for comparing various louver models and designs as to their efficiency in resisting the penetration of rainfall under specific laboratory test conditions. The beginning point of water penetration is defined as that velocity where the water penetration curve projects through .01 oz. of water (penetration) per sq. ft. of louver free area. **\*The beginning point of water penetration for Model ESD-435 is 1151 fpm free area velocity.** These performance ratings do not guarantee a louver to be weatherproof or stormproof and should be used in combination with other factors including good engineering judgement in selecting louvers.



## More Advanced Selection Concerns

1. The data calculated and reported in the Airflow Resistance Chart is based on a louver *without* a bird or insect screen. Most bird screens have a nominal pressure drop, but there are circumstances when their effects should not be overlooked. Insect screens have very high pressure drops, clog with dirt quickly and are rarely cleaned. We recommend insect screens *only be used* when required by the FDA or for other special applications.
2. The data calculated and reported in the Free Area chart is based on a 48" x 48" louver. As the louver height decreases, *the percentage* of free area to total outside dimension area decreases. That is because the shorter the overall louver, the more the louver blades get in the way.
3. For louvers greater than 48" high, performance data in the columns can be taken as linear in between the reported points. Therefore, using interpolation is an accurate way to obtain a free area for a louver height other than one listed. For louvers between 24" and 48" high, the data is somewhat linear in between the reported data points. For louvers less than 24" high, the data *is not* linear in between the reported data points because of blade spacing issues. Interpolation *is not accurate* for small sizes. We strongly recommend either using the lower published data point shown in the chart or contact us for the exact free area. Interpolation is accurate for all louver width data points.
4. The data shown in the Water Penetration table is based on an AMCA test standard. The standard requires a 48" x 48" louver and a certain amount of simulated rain drops which fall straight down. Several real world factors are not included in this laboratory test. They are: wind driven rain, the effects of a louver installed low on a high wall, wind pressure against a large wall and rates of rain greater than the AMCA dripping test.

The AMCA test is similar to a nice and gentle springtime rain that lulls a person to sleep. Unfortunately, many rainstorms are more aggressive than the conditions found in the test laboratory. For example, an average beginning point of water penetration for an average louver might be 1,000 fpm. Although 1,000 seems like a big number, when converted to the more recognizable measurement of 11.3 mph, it becomes plausible that rain will enter the louver even though it was selected properly.

5. Rain and snow will pass through most, if not all, standard louvers. We recommend some means of trapping, holding, containing or draining the water be incorporated into the design of every louver installation. Depending on the application, it can be as simple as sloping the duct back to the louver, sealing joints water tight, including weep holes in the louver frames, etc. Larger installations may require drain pans or mist eliminators.
6. For critical water penetration applications, we recommend using louvers which are AMCA Certified for Wind Driven rains. These louvers are tested at 29 mph - 3"/hr rain fall rate and 50 mph - 8"/hr rain fall rate. They are usually 99 to 100% effective. Their drawback is because they have a lower free area percentage, a larger louver is required to prevent excessive intake velocity and pressure drop.

7. For critical structural integrity and water penetration applications, we recommend using louvers which are Miami-Dade Enhanced Hurricane Qualified. With the amount of high winds, tornados and heavy rains we experience in Kentucky and Southern Indiana, this type of louver has become a valuable problem solving option.
8. When adding a motorized damper or gravity damper to the back side of the louver, take the extra time to specify the damper by model number and detail it accurately. This will prevent guessing and field problems later. Some louvers are provided with factory installed dampers, or with a louver blade which rotates like a damper blade. There are many options and variations.
9. When a louver is used with a fan, size the louver for air performance, not as required to match the physical size of the fan. This usually results in the louver being about twice the size of the fan and the need for a plenum box on the back side of the louver. Also, a certain distance must be maintained between the fan discharge and the louver (or damper) for proper fan performance. For a typical wall prop fan, the distance should be about one fan diameter. Contact us for a separate technical paper we have prepared which addresses this topic.

## Getting Down to the Details

1. The majority of louvers are fabricated from extruded aluminum. For special applications, sometimes galvanized steel or stainless steel construction is required. The industry standard thickness of the aluminum is 0.081” (approx 14 gauge) for the blades and 0.081” for the frame. This is satisfactory for medium and small louvers which will not endure any physical abuse or high air velocities. As an option, the blades, the frame or both blades and frame can be provided as 0.125” thickness (about 11 gauge).

The industry standard for assembly is “mechanical fastened”, which means screwed together. This is acceptable for medium and small louvers which will not endure any physical abuse or high air velocities. For stronger construction, the louvers can be welded together.

Obviously, the heavier gauge materials and welding will add some cost. If these upgrades are desired, please clearly specify them. Also, check submittals and actual products shipped to the jobsite to ensure the end user gets the louver they need and the one you specified.

2. The most common louver is 4” deep. Louvers are also made 6” deep, 2” deep and 1.5” deep. Sometimes, the 6” deep louver will have better water resistance and pressure drop properties than a 4” deep louver. Louvers with 2” or 1.5” depth are normally used when a 4” will not fit or for other aesthetic reasons.
3. The industry standard practice is to specify “nominal” dimensions with width first and height second. To allow for proper fit in the wall opening, the “actual” dimension of the louver is normally ¼” less. For example, a 36” x 24” louver will be fabricated as 35.75” wide x 23.75”high. If the words nominal or actual are not used next to the specified louver size, it is understood the louver is described in nominal dimensions.

4. The manufacturer can make most louver sizes, with a few exceptions and comments. First of all, the louver sizes shown in the Free Area Chart are only performance points for area data. Any size, from the smallest number to the largest number on this chart, is available.

Louvers that are 4” deep are generally not available smaller than 12” high. Louvers that are 6” deep can have a minimum size of 12” to 16” high.

Louvers over a certain size must be made in sections because of handling and shipping constraints. The sections are field assembled by the contractor with visible or non-visible mullions. Refer to the model specific submittals for exact minimum and maximum sizes. Also, ask the architect if they want visible or non-visible mullions on the large louvers.

5. Louvers can be provided with a flanged frame or a channel (sometimes called box) frame. A channel framed louver is intended to slide into a finished wall opening. Flange framed louvers can be used in finished opening or where a rough hole was cut in the wall because the flange hides the edges. Louvers can also be provided with special frames to fit into architectural framing and window elements.

Flanges are generally offered as 1.5” wide, but are available in other widths upon request. An extended sill is available (but must be specified or it will not be provided) for channel louvers to help redirect water from the face of the louver to the outside surface of the adjacent wall. Manufacturers have standard mounting details which are available to the architect and engineer. Including details and specifying the type of frame required will prevent inevitable field coordination problems.

6. Blade shape drives the performance. They are many (too many) available louver models and blade shapes. The most common, best performing is usually a 4” deep, mounted between 35° and 45°, with a drainable blade. “J” and “K” blades are terms which describe the kicks and hooks in a blade, they have similar performance. “Storm-proof” is an old term that should no longer be used. If rain and storms are an issue, specify AMCA Certified Wind Driven Rain louvers.

The drain in a drainable blade louver catches water and moves it to the edges of the louver. This prevents a cascade, or waterfall effect, which can happen as water drops from blade to blade on a standard louver. For intake louvers, cascading water is a sure bet for water penetration problems.

If the louver is mounted on a wall, and there is a lot of wall above it (for example louver is mounted 12 ft AFF, but the building is two or three stories high), include a drainable head. This will catch the water running down the wall and stop it from running across the face of the louver and decrease the chance of water penetration issues.

Sometimes louver models are picked for their appearance on the face and how they blend in with adjacent surfaces. That’s okay, but if air is moving through them, performance should take precedence over looks.

7. Bird screens are a common accessory. A typical screen is an expanded & flattened aluminum diamond pattern. Depending on the pattern size and wire size, their free area can range from 58% to 77%. They can be made from aluminum, stainless steel or galvanized steel. They can be attached to the back of the louver in a shoddy fashion or be attached via a stout removable frame.

Other screen types are wire mesh and wire cloth. Because of the need for constant cleaning and excessive pressure drop, we recommend insect screens only for FDA or other critical applications.

Not all “standard” bird screens meet the opening size requirements described in the International Mechanical Code, section 401. There are building code inspectors who know this and will check screens.

Remember to include the pressure drop across the screens when determining the static pressure required for your duct system.

8. Standard construction for louvers is mill finish, which means not cleaned, not prepped and not painted. This is acceptable for some applications, but not for others. If something other than mill finish is required, please clearly describe what is needed. There can be large price differences and for competitively bid projects; we are driven to quote the least expensive option allowed.

**Mill Finish:** This is a natural aluminum or galvanized surface. Some scratches and / or inconsistencies caused during manufacturing or assembly may be visible.

**Clear Anodized:** The aluminum is dipped in an acid bath which removes imperfections, gives the surface a uniform appearance and leaves an oxidized protective layer. This offers a modest resistance to scratching and fading over time.

**Clear Anodize 204 R-1** (AA-M10C22A31) is dipped in the tank for an amount of time to result in a 0.4-0.7 mil thick oxidized layer and it has a 1 year warranty. Color is a flat aluminum.

**Clear Anodize 215 R-1** (AA-M10C22A41) is in the tank for a longer amount of time to result in an oxidized layer of 0.7 mil or greater and it has a warranty of 5 years. Color is flat aluminum.

**Color Anodize** (AA-M10C22A42) is dipped in an acid tank with dye. Colors and shades of colors are somewhat limited and can be expensive. Thickness is 0.7 mil or greater and it has a warranty of 5 years.

**Paint:** Factory applied paint finishes are the most common coating. They are durable, uniform and can be touched up in the field if scratched during handling. Louver manufacturers offer a standard paint color chart, but can provide any nationally recognized paint company’s color if provided the color code. Also, color matching is available, but an

original sample must be provided and the match sample must be approved in writing before the order is processed.

**Baked Enamel** (AAMA 2603) provides good adhesion and resistance to weathering, corrosion and chemical stains. Warranty of 1 year.

**Two Coat 50% KYNAR 500 / HYLAR 5000** (AAMA 2604) provides a tough, long lasting coating with excellent color retention and abrasive properties. It resists chalking, fading, chemical abrasion and weathering. Warranty of 5 years.

**Two Coat 70% KYNAR 500 / HYLAR 5000** (AAMA 2604) is the premier finish for extruded aluminum. It provides a tough, long lasting coating with superior color retention and abrasive properties. It resists chalking, fading, chemical abrasion and weathering. Standard warranty of 10 years, but an extended warranty is available for additional cost.

**Two Coat Mica** is similar to the above KYNAR 500 / HYLAR 5000, but it includes crushed pearlescent powder. This combines the appearance of a color anodized surface with the protective property of KYNAR.

**Industrial Coatings** such as epoxy, polyester, heresite, phenolic, polyurethane and others are available to meet specific requirements. The coating should be matched according to the chemicals and fumes moving through the louver. Color options are very limited.

9. Louvered penthouses are efficient rain catchers. We encourage engineers and contractors to instead utilize hoods for bringing in or exhausting air on the roof. If a louvered penthouse must be used for aesthetic reasons, we recommend the associated ductwork be sealed watertight and a drain be provided. If this is not possible, AMCA Certified Wind Driven Rain louvers should be used to build the penthouse.
10. Brick vents are in the louver family and are normally used when small amounts of air are being exhausted. Performance data on brick vents is not AMCA certified and sometimes not available. They are available in standard brick or block sizes and are made from aluminum.

Hopefully, this has been a good introduction and overview of louvers and their application. There are many topics and applications barely addressed in this paper and many others which have not even been mentioned in an effort to keep it somewhat brief. Please feel free to contact us to discuss your specific questions and selections.

For information on Greenheck louvers, go to... <http://www.greenheck.com/products/category/5>

Thank you for the opportunity to be involved with your projects,



## Products and Applications

### Air Distribution

- *Grilles, Registers, Diffusers*
- *Laminar Flow Supply Outlets*
- *VAV & Fan Powered Terminals*
- *Control Dampers*
- *Displacement Ventilation*
- *Underfloor Air Distribution*
- *Bubble-Tight Isolation Dampers*
- *Fire & Smoke Dampers*
- *Heavy Duty Industrial Dampers*
- *Louvers - Standard & Hurricane Proof*
- *Flexible Duct & Spin-In Fittings*
- *Round/Oval/Fiberglass/PVC Ductwork*
- *Fiberglass & PVC Duct*
- *Air Mixing/Blending Devices*

### Dust & Filtration Control

- *Custom Design Filtration Equipment*
- *Cyclone & Cabinet Collectors*
- *Oil Mist Collectors*
- *Shaker/Pulse Clean Baghouses*
- *Side Access Filter Housings*
- *HEPA, Standard, Charcoal Filters*
- *Welding Smoke & Fume Exhausters*

### Fans

- *Ceiling Fans*
- *Centrifugal Fans*
- *PVC & Fiberglass Fans*
- *Inline Fans & Tube Axial Fans*
- *Kitchen Ventilation Systems*
- *Pressure Blowers*
- *Propeller Fans*
- *Roof Exhauster Fans*
- *Utility Set Fans*
- *Vane Axial & Mixed Flow Fans*
- *Wall Exhauster Fans*
- *High Temperature & Process Fans*
- *Material Handling Fans*
- *Fume Exhaust Fans - High Discharge/Dilution*
- *Stainless Steel Fans*

### Heating & Cooling Equipment

- *Air Rotation Units*
- *Energy Recovery Units*
  - *Standard Applications*
  - *With Supplemental Heating/Cooling*
  - *Custom Applications*
- *Chilled Beams*
- *Radiant Cooling/Heating*
- *Electric Heating Products*
  - *Baseboard Heaters*
  - *Duct Heaters*
  - *Cabinet Unit Heaters*
  - *Wall Heaters*
- *Hazardous Location Heaters*
- *Industrial Steam Heaters*
- *Infrared Gas & Electric Heaters*
- *Make-Up Air Units*
  - *Direct & Indirect Fired*
  - *Gas, Electric & Steam Units*
  - *100% Supply or 80/20 Fresh Air*

### Vibration & Noise Control

- *Acoustical Panels & Enclosures*
- *Duct Silencers - Commercial/Industrial*
- *Floating Floor Systems*
- *Noise Control Products*
- *Sound Measurements & Reports*
- *Seismic Restraints & Protection*
- *Vibration Isolation Systems*

### Other Equipment

- *Air Curtains with Heating/Cooling*
- *Automotive Garage Exhaust*
- *Laboratory Air Flow Controls*
- *Roof Curbs & Equipment Supports*
- *Spark Detection and Extinguishing Systems*
- *Humidification Systems*
- *Motor Starters/Control Panels*
- *Air Quality Monitor/Alarm Systems*

5 August 2009