Anemostat Door Products

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Door Louvers

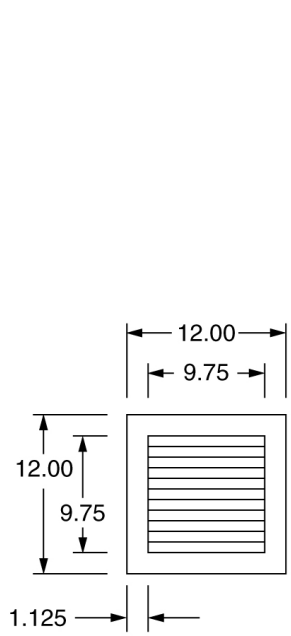
Free Area, Static Pressure, and CFM / Air Flow Velocity

What is Free Area (Opening Size)?

The total minimum area of the openings in an air inlet or outlet (e.g., air diffuser, grille, or register) through which air can pass, usually expressed as a percentage of the total area. Free area is derived by taking the total open area of a grille/louver (after subtracting all obstructions - blades and frame) and dividing by the overall wall opening. This gives a comparison of a grille/louver opening to an unobstructed opening.
Every grille/louver, no matter what size, has a calculated free area. By subtracting any obstructions to airflow (frames and blades) from the overall opening size we get a net result - free area. The typical size for grille/louver comparison is 48" Wide x 48" High - which is an industry standard. Never assume that sizes other than this will have the same percentage free area. Free area varies widely by size, options (deflection, configuration and accessories), and model. Each of these has an impact on the free area and should be considered when selecting the grille/louver for your application.

Free Area Size

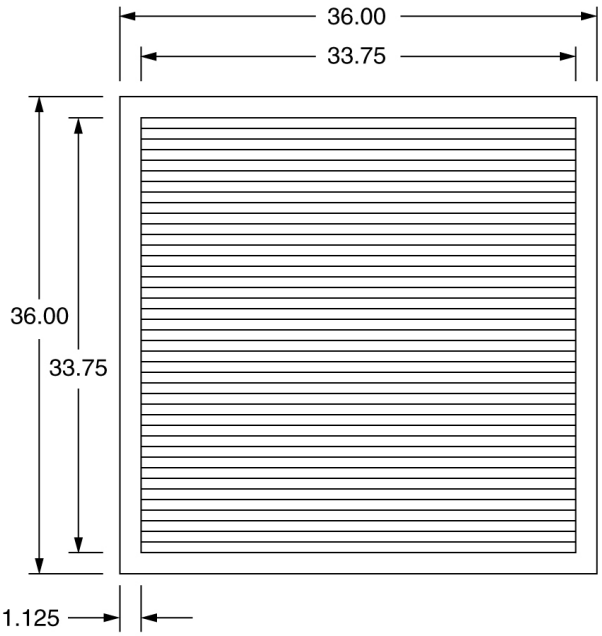
Size plays the most significant role in free area variation. Most people think of percentage free area as a constant, regardless of size. This is far from true, however. For example, the frame of the grille/louver will take up more of the free area (as a percentage) as the grille/louver size reduces (see Figure 1.1 next page)



Door Cutout: 1 sq. ft.

Net Opening (Opening - Frame):
0.66 sq. ft.

Free Area: 66%

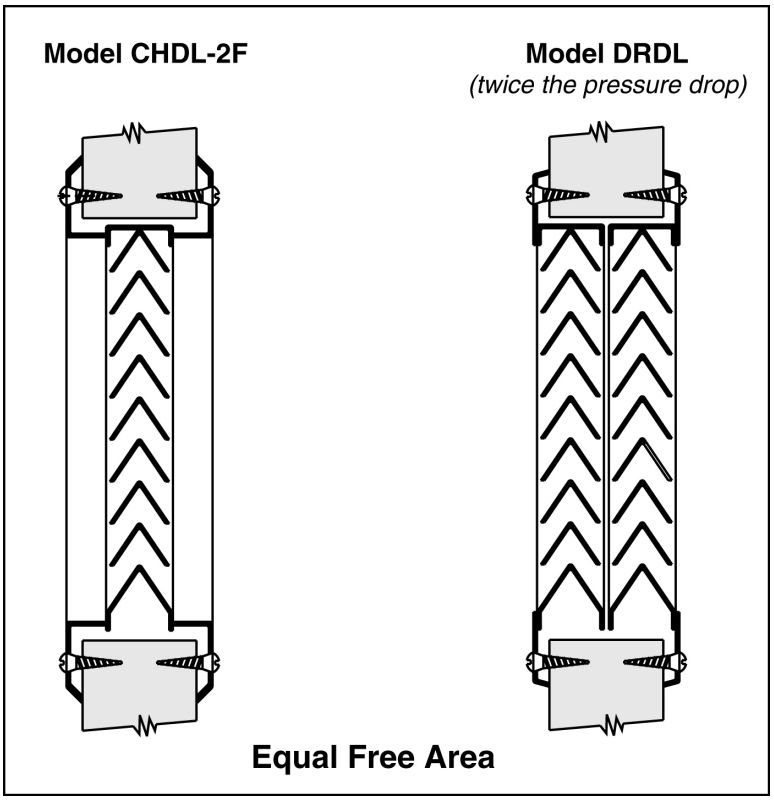


Door Cutout: 9 sq. ft.

Net Opening (Opening - Frame):
7.91 sq. ft.

Free Area: 88%

Even with a thin frame style (3/4") the percentage free area is significantly reduced on smaller size grilles/louvers. Keep in mind that we still need to subtract the blade obstruction from these numbers.



Percentage Free Area has long been used as a convenient means to select louver size, but unfortunately, is NOT an indicator of louver performance (pressure drop and sound created). Louvers with identical free areas can have significantly different pressure differentials based on size, blade spacing or blade angle.

What About Bird and Insect Screens ?

Many assumptions are made regarding rear screens on grilles/louvers. A very limited amount of industry testing has been done and the data is only relevant for new, clean screens. Dirty screens will eventually reduce the free area significantly. In general, the free area of a grille/louver is unaffected by a clean screen.
screen). For small mesh screens (under ½" mesh) used at air intake locations, the buildup of dirt and grime can reduce the free area 10% to 90%. If left without maintenance, the screens will eventually block most of the airflow. If access to the screens is limited or maintenance is questionable, large mesh screen should be used.
Some good practices in screen selection:

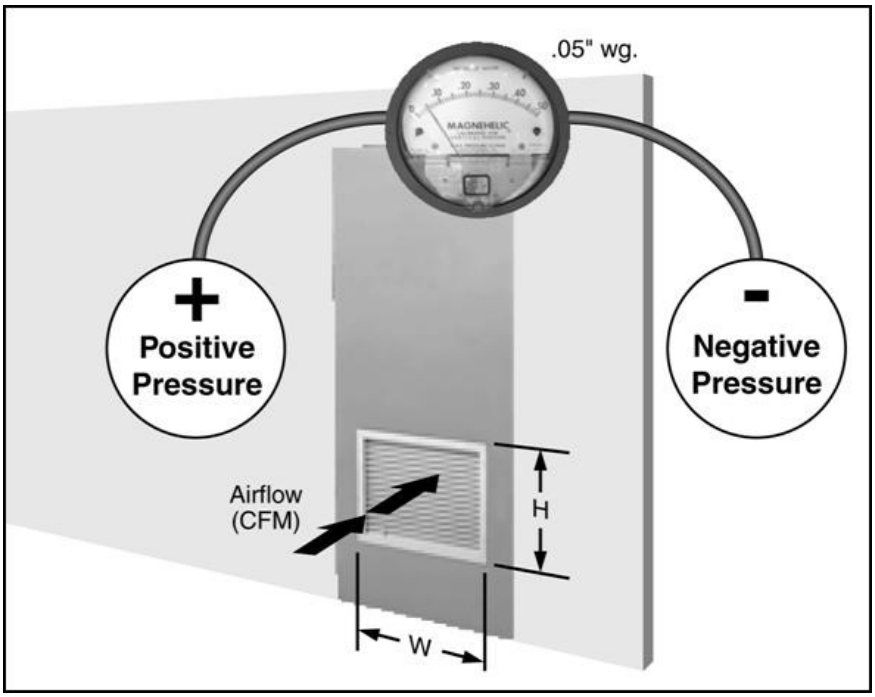
1. Air Ventilation only: any screen selection is acceptable.
2. Air Intake (fan forced): Since the air in not yet filtered, the potential for accumulation of dirt and grime is high. Large opening bird screen (3/4") is the best choice.

If any small mesh screen (½", ¼", or insect screen) is desired for this application, a regular cleaning of the screen is required (once a month is recommended).

Louver Model

Every grille/louver model has a different blade and blade spacing, so the free area will vary based on the characteristics inherent in that design. While free area is not the only consideration in selecting which grille/louver to use, it can have a dramatic impact on performance.

Door Louver Air Flow



What is Static Pressure (Pressure Difference)

Defined as the pressure exerted by still air, not in motion. It is Important because the amount of air measured in velocity and volume. A Fan or source of air movement dictates volume. More volume and movement means a large size to allow for air flow

Why is Static Pressure Important?

It is the DIFFERENCE in static pressure between two spaces (or just "Room Pressure Difference") that causes air to flow from the space with a higher pressure to the space with a lower pressure – thru a door opening / Louver. If you increase the opening size, the volume of air (CFM) will increase. If the air pressure DIFFERENCE increases, the volume of air will also increase due to an increase in speed of air thru the opening/louver. Please note that pressure difference is related only to adjacent spaces, and a building with many rooms will have different pressure relationships between rooms, hopefully planned by the building designer to control the flow of air though out the building. An example might be a commercial kitchen, where the dining room high a higher pressure than the kitchen, such that air flows from the dining room into the kitchen to keep cooking and effluent odors out of the dining space.

What is CFM (Cubic Feet per Minute) or Cubic Meters per Second (Air Flow Rate)

This is the value that will usually be given as the volume of air (cubic feet ft3) per unit of time (minute) of air through the opening or louver.

This is calculated as:

CFM (cubic feet per minute) = Air Velocity (feet/minute) x Area (square feet) or square meters

Summary

Three variables determine the sizing of a Door Louver, and 2 of the 3 variables must be known to determine the 3rd variable.

1. **CFM or Air Flow rate**. This is usually specified or determined by the fan, blower or whatever is generating the air movement through the louver opening, and is generally found in the HVAC/Engineering section of the plans, or the Facilities Manager of the building.
2. **Maximum Pressure Differential (Static Pressure)** This is usually specified as a "not to exceed" value. A low pressure drop is typically preferred over a higher pressure drop.
3. **Louver Size** Is calculated based upon the Louver model and Width x Height (opening)