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AIR DISTRIBUTION
TECHNICAL BULLETIN
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SIZING WALL & DOOR LOUVERS

Louvers allow the transfer of air across a boundary such as a wall or door. There are three variables that relate air transfer: pressure difference, opening size, and flow rate (see fig. 1):

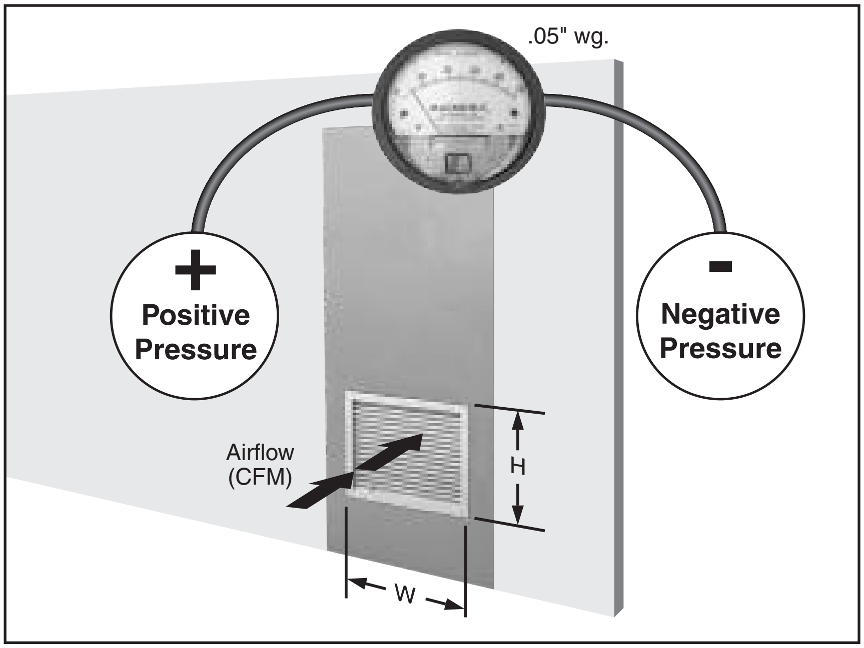

Figure 1. Louver Airflow

1. ***Pressure difference (ΔP)*** – air moves through a wall/door opening due to the *differential* pressure, or difference in pressure on opposing sides of the boundary. The air pressure differences are small in comparison to, say, the air pressure in the tire of a car. For example, you might maintain 30 psi (lbs/square inch) of pressure in your car tires, yet a pressure differential of .03 psi on opposite sides of a door would be considered extremely high. When considering air flow and air pressure in buildings and HVAC systems, a smaller means of measuring pressure is appropriate, and often, inches of water (inches w.g.) is used (similar to inches of mercury, inches Hg, used for barometric pressure measurements). For comparative purposes, 1 inch of water = .0375 psi.

   Pressure differences in building spaces must occur for air to move. Designers consider space pressurization and pressure relationships of one space to another. In restaurants, for example, the dining room is positively pressurized as compared to the kitchen, or in other words, the kitchen is negatively pressurized as compared to the dining room. That means that air will flow from the dining room INTO the kitchen to keep smoke, odors, and cooking effluent contained in the kitchen, and from escaping into the dining room.

   The pressure difference dictates how fast the air moves through the opening in the boundary. The larger the pressure difference, the faster the air moves through the opening (faster means speed or velocity, usually measured in feet per minute, fpm).

   Note that a high pressure difference across a door will result in a high force on the door. Depending on the direction that the door swings, it may be difficult to open or close the door due to the force on the door caused by the pressure differential.

2. ***Opening size (area)*** – the size of the opening in the boundary (wall/door) also determines "how much" air will flow across the boundary. For example, if the pressure differential across the boundary is .05" w.g., and the opening size is doubled, then the amount of airflow through the opening will also double. Because a louver occupies the hole in the boundary and louvers vary in design and construction, the louver must be tested in a laboratory with actual airflow at controlled conditions to determine the relationship between size, airflow, and pressure. % 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 (see Fig. 2), so testing must be performed to accurately report performance.

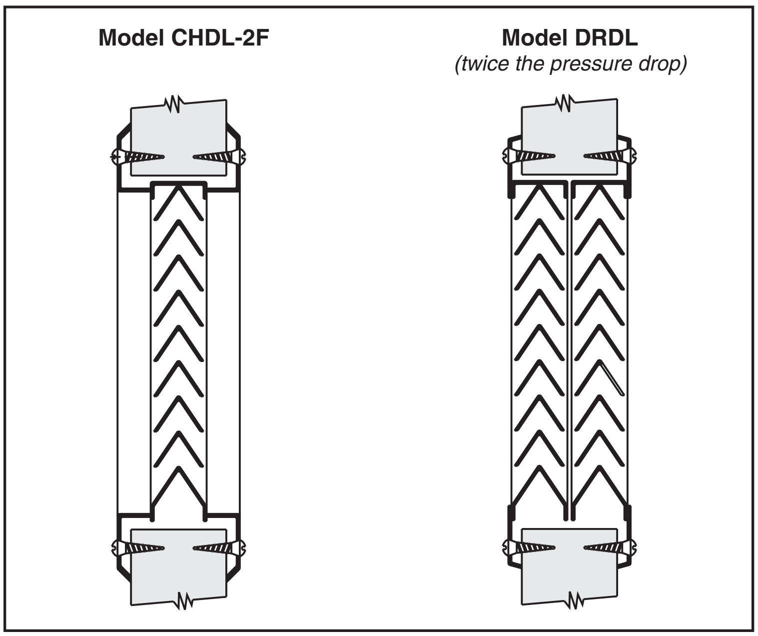

Figure 2. Equal Free Area

3. ***Flow rate (CFM)*** – this is the value that will usually be given in specifications as the volume of air (cubic feet, ft^3) per unit time (minute) or CFM (cubic feet per minute) of air through the opening or louver. This is calculated as:

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

Summary

Three variables determine the sizing of a wall or door louver, and 2 of the 3 variables most be known to determine the 3rd variable:

1. Airflow rate, CFM. This is usually specified.
2. Maximum pressure differential (ΔP), inches w.g. 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, Width x Height (opening).

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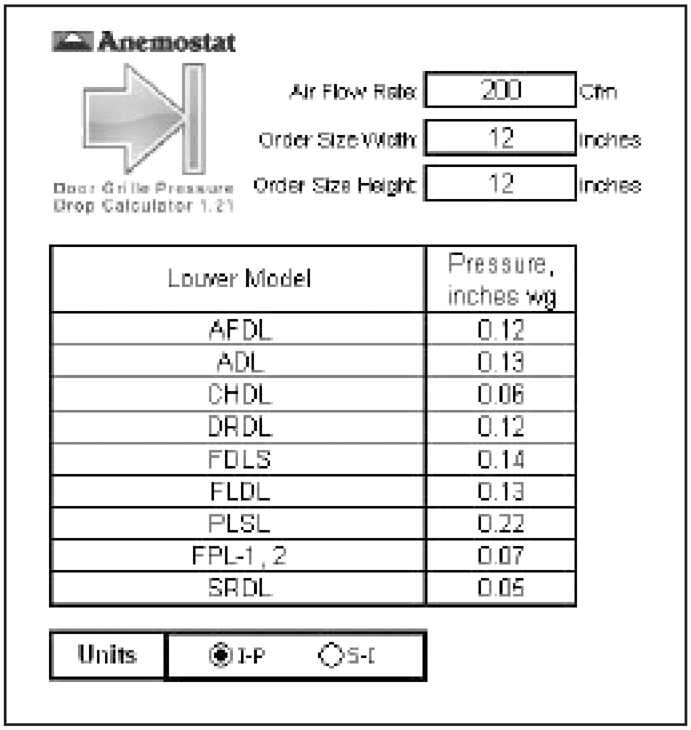
Anemostat Pressure Drop Calculator

All Anemostat louvers have been performance tested in our Air Distribution Research & Development Center, and data can be determined using our Pressure Drop Calculator (see Fig. 3).



Louver Model	Pressure, inches wg
AFDL	0.12
ADL	0.13
CHDL	0.06
DRDL	0.12
FDLS	0.14
FLDL	0.13
PLSL	0.22
FPL-1 , 2	0.07
SRDL	0.05

Fig. 3 – Louver Pressure Drop Calculator

Units may be selected for I-P (inch-pounds) or S-I (Systems International) measurements. The pressure differential is calculated for the airflow and sizes entered. When asked “what size louver should I use?”, then more information must be obtained and the 2 other variables (CFM and pressure differential) must be considered to provide a correctly sized louver. Without this information, then some assumptions must be made which may not be appropriate for the installation. For door louvers, the air pressure differential will equate to a load on the door (lbs) and can be calculated as:

Force on Door (lbs.) = Door size, ft^2 x Differential Pressure(ΔP) x 5.41lb/ft2

As an example, consider a 36” x 80”’ hinged door with a .05” pressure differential. Using the formula above, the door will have 5.4 lbs of force acting on it. The amount of force needed to open the door (assuming we are opening the door AGAINST the high pressure side) will be about half this force or 2.7 lbs.

Sizing Louvers for Mechanical Equipment

The airflow rate (CFM) through the louver is more difficult to determine without information about the building design and requirement for transfer of air from space to space. Fans or boilers in mechanical rooms have specific airflow and pressure requirements that allow appropriate wall or door louver sizing. Many codes are written based on “Square Inches of Free Area or opening” per BTU/hr for fuel combustion processes. Again, this does not guarantee the required airflow rate will be met. Typically, a maximum pressure drop of .05” wg. may be used for combustion air requirements, but should be confirmed by the design engineer.