

M&P

Air Components, Inc.

M & P Air Components, Inc. provides Components, Technologies, Guidelines, Sales and Technical Services for Industrial Air and Dry Solids Processes.

Our Goal is to provide Clients with the correct components selection and system design to achieve the best Utilization, Reliability, Safety and Economy for their plant processes.

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Technical Bulletin

Fan Fundamentals

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There are many different types of fans, including Residential, Commercial, HVAC, and Industrial. This discussion is for Industrial Fans.

Radial Fans are the most durable and least efficient of all fans, with mechanical efficiencies from 50 to 75 %. Its curve is stable from full open to full shut off, its housing is a tight scroll to maintain high velocities through the fan, and its horsepower curve constantly increases with increased flowrate. Its static pressure capacities can extend beyond 100 in wg. It is commonly used for material handling and contaminated or dirty airstreams. See nyb Bulletin 251.

Backward Inclined Fans achieve the highest efficiency of all fans (to 90 %) due to the backward positioned blades allowing the air to exit the wheel at velocities lower than the wheel tip speed while achieving efficient expansion of air from the blades. Its curve may be unstable left of peak, depending on blade design. Its housing has a critical fit between the wheel and inlet cone, and its horsepower curve is non-overloading and bell shaped, which allows the horsepower to decrease with flowrates on either side of the bell peak. The highest efficiencies and peak horsepower typically occur between 50 to 60 % of free delivery. Its static pressure capacities are normally up to 20 in wg, but can be extended to about 50 inches. It is commonly used for relatively clean airstreams. See nyb Bulletin 051.

Axial Fans are characterized by the axial flow of air across the wheel and requires a close fit between the wheel tip and the housing. Its curve can have regions that change from stable to unstable, depending on the point of operation. The wheel hub can be greater than 50 % of the wheel diameter, and as the hub to wheel diameter increases the static pressure capacity increases. High flowrates are typical with medium to high efficiencies against static pressures from 0.125 to 6 in wg. For higher capacities, straightening vanes are sometimes used downstream of the wheel. In some cases, this fan will be rated by Total Pressure instead of Static Pressure. This fan is normally used for air distribution systems requiring an in-line design at normal temperatures and clean air. See nyb Bulletin 671.

Forward Curved fans are referred to as a "Squirrel Cage" design due to the many short, cupped, shallow blades. Lightweight and low cost, it operates at low speeds as the air exits the blades at velocities higher than its tip speed. It is unstable left of peak, and has a constantly increasing horsepower curve. It is most efficient at about 45 % of free delivery and operates at the lowest speed of all fans, giving it good high temperature operating characteristics. Its pressure capacity is up to about 6 in wg, and it can achieve high flowrates at moderate efficiencies. This fan is commonly used in air distribution systems handling clean, and sometimes hot, air. See nyb Bulletin 111.

AMCA (Air Movement and Control Association) has established Fan Ratings Standards for Air, Sound, Balance and Vibration and Fan and System Performance. AMCA's tolerance for Fan Ratings is +/- 2.5 % by capacity and +/- 5 % by pressure.

Fan ratings for capacity, pressure and power are provided by Fan Manufacturers in the form of published capacity tables and curves.

Capacity is the fan volumetric capacity in cubic feet per minute (cfm). For rating purposes it is referenced as standard cubic feet per minute (scfm).

Pressure is the Fan Static Pressure in inches of water (in wg) and is calculated as $FSP = SP_{out} - SP_{in} - VP_{in}$.

Power is the power required to drive the fan shaft, including fan bearing drag, but not including drive losses. The driver selected for the fan must be capable of satisfying both the published fan power rating and the additional drive power requirement. Fan power is referred to as Brake Horsepower (BHP) or Chart Horsepower (CHP), and is provided by the Fan Manufacturer.

Selecting the correct fan type requires an understanding of fan types and the capacity, pressure, airstream conditions and application for which the fan is intended.

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