

1. Volume of air in cubic feet per minute, (68 F, 50 per cent relative humidity, 0.07488 lb per cubic foot).
2. Outlet velocity.
3. Revolutions per minute.
4. Brake horsepower.
5. Tip or peripheral speed.
6. Static pressure.

The most efficient operating point of the fan is usually shown by either bold or italicized figures in the capacity tables.

Fans for Ventilation

Two important factors in selecting fans for ventilating systems are efficiency (which affects the cost of operation) and noise. First cost and space available are secondary. The fans should be selected to operate at maximum efficiency without noise. Noise in a ventilating system is irritating and a cause for complaint. Fans must be selected of proper size in order to reduce it to a minimum. Noise may be caused by other factors than the fan, namely, high velocity in the duct work, unsatisfactory location of the fan room, improper construction of floors and walls and poor installation. Where noise is chargeable directly to the fan, it is caused either by excessive peripheral speeds, or the fan is of insufficient size. It should be remembered, however, that the tip speed required for a specified capacity and pressure varies with the type of blade, and a tip speed that is excessive for the forward curved type is not necessarily so for the backward or slightly backward type. A noisy fan usually is one which is operated at a point considerably beyond maximum efficiency.

For a given static pressure there is a corresponding outlet velocity and peripheral speed wherein maximum efficiency is obtained. If a fan be selected to operate at this point, the cost of operation and the noise can be held within control.

To aid in selecting fans as near as possible to the point of maximum efficiency, there are listed for each static pressure corresponding outlet velocities and tip speeds which will give satisfactory results. The proper tip speed for a given static pressure varies with design of wheel and number of blades or vanes in wheel.

Lower outlet velocities than listed in Table 1 may be used, but care must be exercised when fans of the forward curved type are used to avoid selecting a fan for operation below its useful range.

In exhaust ventilating systems where the air column moves toward the fan, noise due to the higher tip speeds and outlet velocities will not be so readily transmitted back through the air column to the building. Therefore higher outlet velocities may be used, but this will be at the expense of increased horsepower.

Amplly large fans should always be used for both exhaust and supply systems, as there may be and usually is leakage despite the most careful workmanship, necessitating the delivery of more air at the fans than is exhausted from or supplied through the openings in the various rooms.

Long runs of distributing ducts, heaters, and air washers usually are parts of any ventilating system where high static pressures are needed.

TABLE 1. GOOD OPERATING VELOCITIES AND TIP SPEEDS FOR FORWARD CURVED MULTIBLADE VENTILATING FANS

STATIC PRESSURE IN INCHES OF WATER	OUTLET VELOCITY FEET PER MINUTE	TIP SPEED FEET PER MINUTE
$\frac{1}{4}$	1000-1100	1520-1700
$\frac{3}{8}$	1000-1100	1760-1900
$\frac{1}{2}$	1000-1200	1970-2150
$\frac{5}{8}$	1100-1300	2225-2450
$\frac{3}{4}$	1200-1400	2480-2700
$\frac{7}{8}$	1300-1600	2660-2910
1	1500-1800	2820-3120
$1\frac{1}{4}$	1600-1900	3162-3450
$1\frac{1}{2}$	1800-2100	3480-3810
$1\frac{3}{4}$	1900-2200	3760-4205
2	2000-2400	4000-4500
$2\frac{1}{4}$	2200-2600	4250-4740
$2\frac{1}{2}$	2300-2600	4475-4970
3	2500-2800	4900-5365

Under such conditions it is practicable to select fans with higher outlet velocities and peripheral speeds since the duct system itself will tend to muffle objectionable air sounds.

The connection of a fan to a metallic duct system should be made by canvas or a similar flexible material, so as to prevent the transmission of fan vibration or noises. Where fans are connected to concrete ducts such as are used in the ventilation of vehicular tunnels, the connection is made direct.

Fans for Drying

Both propeller and centrifugal types of fans are used for drying work. Propeller fans are well adapted to the removal of moisture-laden air when operating against low resistance and when handling air at low temperatures. Motors on these fans usually are of the fully-enclosed moisture-proof types so that saturated air or air containing foreign material will not injure the motors.

Unit heaters employing disc or propeller type fans are widely used in the drying field. In drying, disc or propeller fans may be used where not too much duct work is required and where air is to be delivered against pressure, since the noise developed from the high peripheral speed of these fans is not ordinarily objectionable in process work of this nature.

Centrifugal fans or blowers of the multiblade type generally are selected to supply air for drying, as they are capable of delivering large volumes against all pressures.

Belt driven fans usually are to be preferred to direct-connected fans as they make a more flexible and economical unit. Wherever drying is done throughout the year and where air requirements change as the drying conditions change, the drying can be speeded up or reduced through control of the fan capacity. This may be done by changing the fan speed or by varying the outlet area with dampers.

Due to the low speeds of forward curved multiblade or yaddle-wheel type fans, these can be direct-connected to reciprocating steam engines.