

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

STATIC PRESSURE INCHES OF WATER	FORWARD CURVED BLADE FANS		BACKWARD TIPPED AND DOUBLE CURVED BLADE FANS		TUBEAXIAL AND VANEAXIAL FANS
	Outlet Velocity Feet per Minute	Tip Speed Feet per Minute	Outlet Velocity Feet per Minute	Tip Speed Feet per Minute	Wheel Velocity ^a Feet per Minute
1/4	800-1100	1300-1500	800-1100	2500-3100	1100-1500
3/8	800-1250	1600-1850	800-1250	3000-3750	1250-1700
1/2	900-1450	1850-2150	900-1450	3400-4250	1400-1900
5/8	1000-1600	2050-2350	1000-1600	3800-4750	1500-2100
3/4	1100-1750	2250-2600	1100-1750	4150-5200	1650-2350
7/8	1200-1900	2450-2850	1200-1900	4500-5600	1800-2500
1	1250-2000	2600-3000	1250-2000	4800-6000	1900-2700
1 1/4	1400-2300	2900-3350	1400-2300	5350-6700	2150-3000
1 1/2	1550-2500	3200-3700	1550-2500	5900-7400	2350-3300
1 3/4	1700-2700	3400-3950	1700-2700	6350-7950	2500-3550
2	1800-2900	3700-4300	1800-2900	6800-8500	2700-3800
2 1/4	1900-3050	3900-4500	1900-3050	7200-9000	2900-4050
2 1/2	2000-3200	4100-4750	2000-3200	7600-9500	3100-4300
3	2200-3500	4500-5200	2200-3500	8300-10500	3300-4600
3 1/2	2400-3800	4900-5650	2400-3800	9000-11500	
4	2550-4050	5200-6000	2550-4050	9600-12000	
4 1/2	2700-4300	5500-6350	2700-4300	10000-12500	
5	2850-4550	5800-6700	2850-4550	10500-13000	
5 1/2	2950-4750	6100-7050	2950-4750	11000-13750	
6	3100-5000	6400-7400	3100-5000	12000-15000	
7	3350-5400	6900-7950	3350-5400	12700-16000	
8	3600-5750	7350-8500	3600-5750	13500-17000	
9	3800-6100	7800-9000	3800-6100	14500-18000	
10	4000-6400	8200-9450	4000-6400	15000-18500	

^a Wheel velocity is the axial mean air velocity through the inside diameter of the housing cylinder at the point of wheel location.

may determine the type of fan to be used. Where the system resistance is indefinite or variable, the pressure, horsepower and noise characteristics of centrifugal fans usually indicate their selection. Under such conditions, a steep and constantly rising pressure curve permits less variation in air delivery when the resistance varies. Likewise, a flat sound curve minimizes the change of moving into a region of increased noise. A fan having a high efficiency over a wide range is more desirable than one which reaches an even higher maximum efficiency, but decreases more rapidly on either side of a narrow range. A self-limiting horsepower curve may permit more accurate selection of motor size.

The selection of size of fan usually involves balancing cost and space against sound and efficiency. Unless the pressure involved is so high that a smaller fan running at greater speed requires a higher class² of construction, the smallest fan is the cheapest in first cost of the fan only. However, as the cost of the driving equipment is also involved in the total installation cost, fan efficiency must be considered for that reason as well as its bearing on the cost of operation. In some cases where large fans operate long hours per year, selection at absolute maximum efficiency is indicated. Generally, however, the power saving by selecting for optimum efficiency does not justify the extra cost, and a slightly smaller fan gives the best balance of cost and efficiency. Reference to Figs. 2 to 4 shows that all types tend to have a minimum sound near maximum efficiency so, when noise is a consideration, selection approaching maximum efficiency is indicated. Too large a fan may not only mean an unnecessary investment and an increased

power consumption and sound, but may also give faulty performance if of a type having an unstable pressure characteristic at low capacity.

Table 1 shows the outlet velocities and impeller tip speeds recognized as good practice for various static pressures for centrifugal, tubeaxial and vaneaxial fans applied to average heating, ventilating and air conditioning applications. Fans for churches, schools, residences and other buildings having a low prevailing noise level should be selected for lower than average outlet velocities.

FAN INSTALLATION

In designing heating, ventilating and air conditioning systems, the characteristics of the fans available for use therewith should not be ignored. If double inlet fans or multiple fans in parallel are used, care must be taken that both inlets have the same free area and general approach conditions.

The dimensions of the ductwork and the size of the various devices whose individual resistances determine the static pressure, dictate the fan selection. Often a minor modification of the system may permit use of a smaller motor, and even a lower class² of fan, with considerable saving of cost. Invariably, the sound generated is affected, as fans operating at high pressure produce more noise than at lower pressure (see Chapter 40). Minimizing the resistance may be the best insurance against noise. On the other hand, sometimes the lowest overall cost results from selecting the minimum size of system equipment, and then installing adequate acoustical and vibration treatment.

All ducts should be connected to fan outlets and inlets by means of unpainted canvas or other flexible material. Access should be provided in the connections for periodic removal of any accumulations tending to unbalance the rotor. When operating against high resistance, or when ambient noise levels are low, it is preferable to locate the fan in a room removed from occupied areas or acoustically treated to prevent sound transmission. The lighter building constructions which are common today, make it desirable to mount fans and driving motors on resilient bases designed to prevent transmission of vibrations through floors to the building structure. Conduits, pipes and other rigid members should not be attached to fans. Noises due to high velocities, abrupt turns, grilles and other items not connected with the fan, may be present. Treatment of such problems, as well as the design of sound and vibration absorbents, are covered in Chapter 40.

FAN APPLICATIONS

Many fan applications and the corresponding types of fan commonly used are listed in the following paragraphs. Reference is also made to the chapters where the applications are discussed.

Central System Supply Fans (Chapter 29) are usually of the centrifugal type, since this application requires a wide range of satisfactory and quiet operation against relatively high pressures. They can readily be connected to apparatus of large cross-section on the inlet side, and to relatively small ducts on the outlet side.

Comparative sizes have been standardized among manufacturers,² and most rating tables cover a range of 700 to 500,000 cfm, and static pressures from 1/4 to 15 in. of water.

Central system exhaust fans are predominately centrifugal, but the space