HOW TO SELECT A LOW NOISE FAN

The total sound power produced by the fan can be calculated by the empirical formula below. The formula yields the Sound Power Level (PWL) in decibels. Logs are to the base 10:

$$\mathbf{PWL = 55.2 + 30Log\ V_T + 10Log\ HP}$$

Where: V_T = Fan tip speed in ft/min x 10^{-3}
= P x DIA. x RPM/1000
HP = Input Fan Horsepower (Not motor horsepower)

The formula is given here to demonstrate the fact that the tip speed of the blades is by far the strongest indicator of the noise a fan will produce. To select a low noise fan, therefore, it is most effective to reduce the tip speed by lowering the RPM which can be done by increasing the number of blades.

Consider the characteristics of the two fans shown in the table below. Each has been selected to perform identical duties. They are 12 ft (3658 mm) diameter fans, handling 100 o F air at sea level, delivering 120,000 ACFM (56.6 m3/sec) at 0.5" (12.7 mm) static pressure. Fan A is a suitable selection for an application where noise level is of no concern and Fan B is selected for its low noise level.

	Fan A (No noise Concern)	**Fan B** (Low Noise Fan)
Hub Series:	40	60
Number of Blades:	4	7
RPM:	318	200
Tip Speed FPM:	12,000	7,500
m/sec:	61.0	38.1
PWL (dBA):	100.6	94.2

The low noise fan is over 6 dB quieter than Fan A. In linear sound power terms (watts) this corresponds to less than 1/4 of the noise emanating from the fan.

Noise from the low-noise fan could be further reduced by specifying the new low-noise “VT” blades. These blades are provided with aerodynamic winglets added at the tips, an economical way to reduce noise 2 to 3 dB over standard blades in a typical low noise fan. Winglets at the blade tip decrease the tip vortex which occurs as air spills off the tip from the high to the low pressure side of the blade, thus lowering the noise level.

There are some limitations to consider in lowering fan RPM. If the axial velocity of the discharged air is too low compared to the rotational velocity of the air, flow will tend to break down and inefficiency will result. Note in the above example that the fan series was increased from 40 (40" diameter hub) to 60 (60" diameter hub). The increase in hub size results in higher velocity due to the decrease in free fan area and therefor prevents flow breakdown near the hub.

Moore is conducting ongoing noise research with the aim of providing ever more quiet fans. For more information, please Contact Moore.

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