UNIT SELECTION: EXHAUST FAN SELECTION

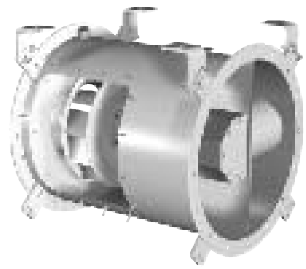
Exhaust fans are an integral component of commercial kitchen ventilation. When the wrong fan is chosen, the system can have inefficient performance and could lead to premature fan failure. These fans must be able to withstand heat and grease laden air and are made differently than an ordinary fan. Fans in grease environments must carry the UL-762 label, which rates them for grease and heat applications. The fan must overcome the losses of the system and be sized to move the correct amount of air. The fan wheel best suited for grease applications while still maintaining air movement at higher static pressures is a centrifugal backward inclined wheel. Also, centrifugal wheels have endurance to withstand grease loading. The following fans use a centrifugal wheel all capable of static pressures up to 5 in. wg.

TYPES OF FANS

Upblast

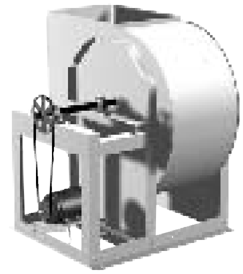
Upblast fans are the most common type of kitchen exhaust fan. They use a centrifugal backward inclined fan wheel, are either direct drive or belt driven with an isolated motor, and can be roof or sidewall mounted. The belt driven units have adjustable pulleys for final system balancing. Be sure to check the current load (amps) on the fan motor after a change has been made. Small increases in fan speed results in large power increases required by the motor. Grease drains/traps should be used on the fan to collect grease that has passed through the filtration system and may cause roof damage. A vented curb may be required in heat applications such as kitchen ventilation. Hinged curb cap and cleanout ports allow easy access to the inside of the fan and duct.

Inline



Inline exhaust fans use a centrifugal backward inclined fan wheel and are mounted as part of the ductwork, usually inside the building. Access panels are located on the housing allowing disassembly of the fan without removal from the ductwork. These fans are best suited for applications where mounting a fan on the exterior of the building is not possible. Examples would be a high-rise building where penetrating multiple floors with ductwork would not be feasible or a building where a fan would detract from its visual appearance. Inline grease fans have an isolated motor, adjustable pulleys, and two grease drain plugs with the capability of being mounted horizontally or vertically.

Utility



Utility fans offer a variety of discharge positions and can be mounted inside or outside of the building, offering flexibility with respect to duct design. Although utility fans use a centrifugal backward inclined type wheel, the airflow pattern is changed such that the air is turned 90° as it passes through the fan. This must be considered when designing the ductwork layout. An isolated motor compartment and adjustable pulleys offer flexible speed adjustment for final system balancing, but check the current load (amps) on the motor after each adjustment.

Fan Selection

A fan should be selected based upon a variety of criteria. First, decide which type of fan is best suited for the application. Next, determine airflow requirements (see determining exhaust rate) and system static pressure (see ductwork and pressure loss). Third, consider the fan sound level. For example, for two fans that produce the same airflow rate, the fan with the larger fan wheel will be running at a lower RPM, thus producing less sound. A fan's sound level at various operating points can be obtained from the fan manufacturer and are given in either decibels or sones. Choose the appropriate voltage and phase for the power going to the motor.

Each fan has a set of fan curves based on airflow, system resistance, motor power, and fan speed. It is crucial to choose a fan within the limits given by the fan manufacturer on the fan curves. The curve that represents system resistance begins at the origin and has an increasing slope on the fan performance graph. The curve that begins at a higher static pressure at zero airflow and tapers to zero pressure with increasing airflow is the fan performance curve. This is a line of constant fan RPM. To find the correct fan, operating points must fall on the fan performance curve to the right of the system resistance curve.

SAMPLE FAN SELECTION

Given the following information, ***Figure 45*** illustrates the properties of two fans that meet the criteria. However, it has yet to be determined which fan is better for this application. ***Figure 46*** will aid in that process.

Required Specifications:

1. Upblast Fan
2. 2500 cfm of airflow
3. 0.25 in. wg static pressure

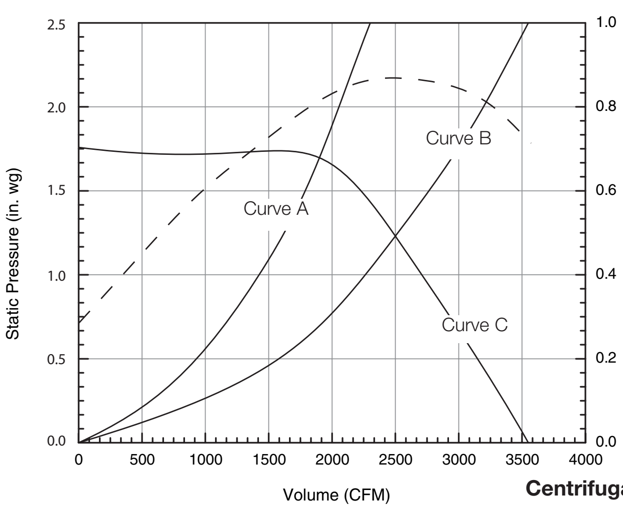
Fan Manufacture Data														
Model	Relative Cost	Volume (cfm)	Fan RPM	Tip Speed (ft./min)	OV (ft./min)	Operating Power (hp)	Motor Size (hp)	Opening width (in.)	Opening length (in.)	Weight (lb)	Baffle	dBA	Sones
1	1.19	2500	1260	6103.0	856	.88	1	20.5	20.5	125	NO	66	14.7
2	1.35	2500	838	5375	665	.91	1	26.5	26.5	174	NO	63	12.7

Figure 45

Analysis and Selection:

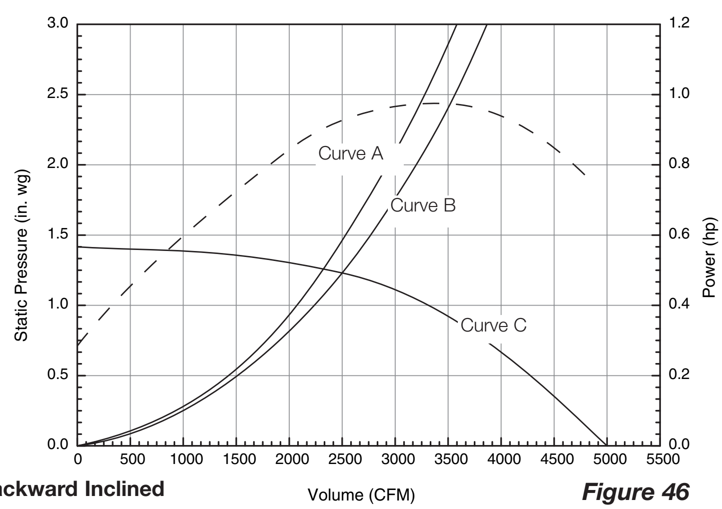
Once airflow and static pressure have been determined from the hood calculations, this data can be entered into the manufacturer's fan selection guide. ***Figure 45*** represents two possible fans to select from. Usually more fans are available to choose from, but only two are represented to simplify this example. From the manufactures data, choose a fan based on these categories. **Relative cost:** a lower relative cost is always a better choice. **Operating power vs. motor size:** make sure the operating power does not exceed the size of the motor. **Sones or decibels:** used to measure the sound of the fan while operating. A lower sound level (lower number) is usually desirable. **Tip speed or Fan RPM**: represents how fast the fan is turning. A slower turning fan wheel is usually quieter. The volume (CFM) will be set where specified.

More importantly, pick a fan based on the fan curves using ***Figures 46***. Curve A represents the system resistance curve. Think of this curve as a boundary. A fan will be unstable while operating to the left of this curve. Curve B represents where the fan will operate given the operating conditions. Curve C is the fan performance curve at a given RPM. Where curve B and C intersect is the operating point and any fluctuation in the system will cause the fan to vary its operating point along Curve C. For example, if static pressure increases in Model 1, Curve B will shift towards Curve A. That is why it is important to select Model 1 over Model 2. Fan Model 1 has room to account for system variances where Model 2 can only see a small increase in static pressure before the fan becomes unstable. It is also beneficial to choose a fan operating on a greater Curve C slope. Model 1 operates on a greater Curve C slope. Model 1 can see a greater static pressure increase than Model 2 before going unstable. The dashed line represents brake horsepower.



Model 1

Centrifugal Backward Inclined



Model 2

Figure 46