



## Airflow and System Resistance

### Air Systems and System Resistance

An air system is any assembly of ducts, filters, conditioning devices, dampers, louvers, fans, etc., the main purpose of which is to move air from one place to another in a controlled fashion. \* Each of the components in an air system will offer some resistance to airflow. The total of all these resistances in the system is defined as the system pressure, or resistance pressure. The fan in the system must develop sufficient static pressure to be equal to the resistance pressure.

\*AMCA Publication 200-95 Air Systems.

### Example

Using Cook's Compute A Fan selection program, we have plotted a typical fan/system curve. The fan curve shown below is for a model 445CPS-A delivering 25,000 cfm at 3 inches of static pressure. The system resistance curve is the dotted line emanating from the 0-0 point on the graph. We can see from the curve that as we slow the fan down to deliver less air volume and thus air velocity, there is a

corresponding reduction in the system static pressure. As we increase the fan rpm to deliver more air volume, there is a corresponding increase in system static pressure, thus, the fan requires more energy or horsepower to overcome this increase in system pressure. In the next "Did You Know?", we will discuss system and fan laws and how they can be used to predict fan performance in a given system.

Performance

Catalog Number	CFM	SP	Fan RPM	Power* HP	Motor HP	OVEL (fpm)	TSPD (fpm)	SE	TEMP (° F)	ELEV (Ft)	*Drive Loss Included
445 CPS-A	25000	3.00	713	16.23	15	2194	8306	72%	70	0	5%

Class I

### System Resistance Curves

The losses in pressure through a system are caused by two factors:  
 1) Friction losses due to a viscosity as the air flows along the surfaces of ducts and other system elements.  
 2) Dynamic losses due to the turbulence caused by changes in direction and separation of flow.  
 For any fixed air system, there is a defined relationship between airflow volume and static pressure. This relationship can be plotted on a graph showing pressure vs. airflow. The resulting curve is known as a system resistance curve. This system resistance curve can be plotted on the same graph as the fan curve, and the intersection of these two curves defines the point of operation for that fan and system.

