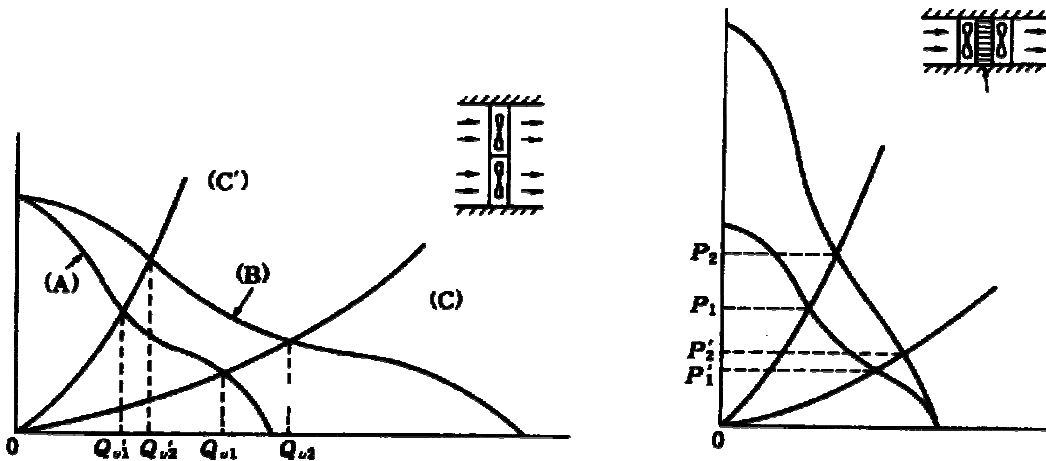


Using Fan by Parnell and Series Arrangement

When applying more than one fan in a system?

"n" fans in series will increase pressure "n" times at a given flow rate, with no additional free delivery flow. Fans in series can be useful in high resistance systems.

"n" fans in parallel will increase flow "n" times at a given pressure level, with no additional shutoff pressure generated. Fans in parallel can be useful in low resistance systems.



Fans in Serial vs. Fans in Parallel

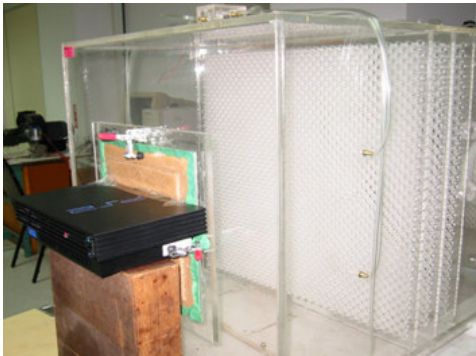
For identical fans in parallel, $P_{\max} = P_{\max, \text{single}}$
 $Q_{\max} = Q_{\max, \text{single}} \times \text{no. of fans}$

For identical fans in serial, $Q_{\max} = Q_{\max, \text{single}}$
 $P_{\max} = P_{\max, \text{single}} \times \text{no. of fans}$

where P = pressure drop inches of water (inches w.g.).
 Q = airflow in cu. ft/min (CFM).
 K = a constant determined by the characteristics of the system.
 n = a constant depending upon the type of flow.

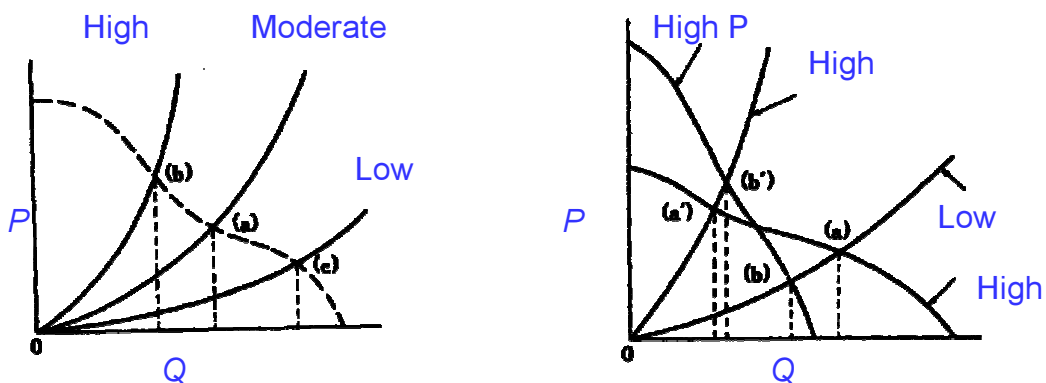
p = density of air in lb. per cubic foot.

(n will assume a value from 1 to 2 depending upon whether the flow in the system is completely laminar ($n=1$) or completely turbulent ($n=2$). For most electronic equipment, n will be found to be nearly equal to 2, and this value may be assumed for calculation purposes in absence of other data.)



Due to the complex nature of the flow path typically found in electronic equipment, pressure drop calculations do not yield easily to the customary fluid flow equations, and most equipment designers find it best to resort to testing the equipment for its resistance characteristics.

When a fan is used to move air through electronic equipment, the flow through the systems is determined by the intersection of the performance curve and the resistance curve (Figure 1). At this point of operation, the pressure available from the fan to force air through the system is equal to the pressure required by the system for that flow.



Every system has an impedance curve. System impedance is generally proportional to Q^2 . Operating point is the intersection of P-Q curve and the impedance curve. The use of impedance curves is to select a fan that provides maximum air flow rate at the operating point.