FAN LAWS

Fan Laws are the basic proportional relationships between fan speed, flow, pressure, and power. They are most useful for determining the impact of extrapolating from a known fan performance to a desired performance for the same fan at constant air density. The most common change made to a fan is that of altering its rotational speed.

$$\frac{CFM_2}{CFM_1} = \frac{RPM_2}{RPM_1}$$

$$\frac{SP_2}{SP_1} = \left[\frac{CFM_2}{CFM_1}\right]^2 = \left[\frac{RPM_2}{RPM_1}\right]^2$$

$$\frac{BHP_2}{BHP_1} = \left[\frac{CFM_2}{CFM_1}\right]^3 = \left[\frac{RPM_2}{RPM_1}\right]^3 = \left[\frac{SP_2}{SP_1}\right]^{1.5}$$

$$BHP = \frac{CFM \times SP \times SP.GR.}{6356 \times FAN_{EFF.}} \qquad MHP = \frac{BHP}{M/D_{EFF.}}$$

CFM = Cubic Feet/Minute
RPM = Revolutions/Minute
SP = in. W.G.
BHP = Brake Horsepower
FANEFF = 40-60%
M/DEFF = 80-95%
M/D = Motor/Drive

PUMP LAWS

Pump Laws are used in hydraulics, hydronics and/or HVAC to express the relationship between variables involved in pump or fan performance (such as head, volumetric flow rate, shaft speed) and power. They apply to pumps, fans, and hydraulic turbines.

$$\frac{GPM_2}{GPM_1} = \frac{RPM_2}{RPM_1}$$

$$\frac{HD_2}{HD_1} = \left[\frac{GPM_2}{GPM_1}\right]^2 = \left[\frac{RPM_2}{RPM_1}\right]^2$$

$$\frac{BHP_2}{BHP_1} = \left[\frac{GPM_2}{GPM_1}\right]^3 = \left[\frac{RPM_2}{RPM_1}\right]^3 = \left[\frac{HD_2}{HD_1}\right]^{1.5}$$

$$HD = \frac{P \times 2.31}{SP.GR.}$$

$$BHP = \frac{GPM \times HD \times SP.GR.}{3960 \times PUMP_{EFF.}} \qquad MHP = \frac{BHP}{M/D_{EFF.}}$$

GPM = Gallons/Minute
RPM = Revolutions/Minute
P = pressure, psi
HD = ft. H2O
BHP = Break Horsepower