Pyshcrometrics:

Sensible loads: $Q = 1.08 \times CFM \times \Delta T$

Latent loads: $Q = 0.68 \times CFM \times \Delta w$

Total loads: $Q = 4.5 \times CFM \times \Delta h$

Water-side loads: $Q = 500 \times GPM \times \Delta T$

Economizer Outside Air Percentage: $\%_{OA} = \frac{T_{MA} - T_{RA}}{T_{OA} - T_{RA}} \times 100$

where: Q = heat load (Btu/hr)
CFM = cubic feet minute airflow
GPM = gallons per minute water flow
ΔT = change in air or water temp (˚F)
Δw = change in humidity ratio (gr/lb_a)
Δh = change in specific enthalpy (Btu/lb_a)
$\%_{OA}$ = outside air faction
T_{MA} = mixed air temp (˚F)
T_{RA} = return air temp (˚F)
T_{OA} = outside air temp (˚F)

Flow:

Air Pressure: $TP = SP + VP$

Air Velocity: $V = 4{,}005 \times \sqrt{VP}$

Air Flow: $Q = V \times A$

where: TP = total air pressure (in w.c.)
SP = static air pressure (in w.c.)
VP = velocity pressure (in w.c.)
V = velocity (feet per min)
Q = airflow (cubic feet per minute)
A = flow area (square feet)

Load Management:

Boiler: $Q_{equip} = \frac{Q_{load}}{\eta_{dist} \times \eta_{comb} \times \eta_{cyc}}$

Chiller: $Q_{equip} = \frac{Q_{load}}{\eta_{dist} \times \eta_{HGB}} \times \eta_{kW/ton} \times 12{,}000$

where: Q_{equip} = HVAC equipment input (Btu/hr for boiler, kW for chiller)
Q_{load} = local load (Btu/hr)
η_{dist} = thermal distribution efficiency (75-95%)
η_{comb} = heating combustion efficiency (75%-95%)
η_{cyc} = cycling/purge loss efficiency (75%-95%)
η_{HGP} = efficiency from hot gas bypass use (35%-100%)
$\eta_{kW/ton}$ = chiller efficiency in kW per ton (0.5-2.5 kW/ton)

Centrifugal Machines

Pump Equation: $P = \frac{GPM \times \Delta H}{3{,}956 \times \eta_p \times \eta_m \times \eta_{VFD}}$

Fan Equation: $P = \frac{CFM \times \Delta p}{6{,}356 \times \eta_f \times \eta_b \times \eta_m \times \eta_{VFD}}$

Affinity Laws: $Q_2 = Q_1 \times \frac{N_2}{N_1} = Q_1 \times \frac{D_2}{D_1}$

$$H_2 = H_1 \times \left(\frac{Q_2}{Q_1}\right)^2 = H_1 \times \left(\frac{N_2}{N_1}\right)^2 = H_1 \times \left(\frac{D_2}{D_1}\right)^2$$

$$BHP_2 = BHP_1 \times \left(\frac{Q_2}{Q_1}\right)^3 = BHP_1 \times \left(\frac{N_2}{N_1}\right)^3 = BHP_1 \times \left(\frac{D_2}{D_1}\right)^3$$

Motors: $LF = \frac{RPM_{sync} - RPM_{meas}}{RPM_{sync} - RPM_{rated}}$

where: P = pump or fan power (kW)
CFM = airflow (cubic feet per minute)
η_p = pump efficiency (40%-80%)
η_m = motor efficiency (75%-95%)
η_{VFD} = variable frequency drive efficiency (95-99%)
GPM = water flow (gallons per minute)
η_b = drive belt efficiency (90-99%)
Q = flow (cubic feet per minute or gallons per minute)
N = speed (rpm)
D = diameter (in)
H = pressure (inches of water column or feet of head)
BHP = brake horsepower
LF = induction motor load factor
RPM = synchronous, measured, or rated speed (rev per min)

Electrical:

DC Load: $P_{DC} = \frac{I \times V}{1{,}000}$

AC: $P_{1\emptyset} = \frac{I \times V \times PF}{1{,}000}$

$P_{3\emptyset} = \frac{I \times V \times PF \times \sqrt{3}}{1{,}000}$

where: P = electrical power (kW)
I = current (amps)
V = voltage (volts)
PF = power factor