PROPERTIES OF SATURATED STEAM

PRESS. PSIG	TEMP. °F	SP. VOL. LIQUID	SP. VOL. VAPOR	ENTHALPY LIQUID	ENTHALPY EVAP.	ENTHALPY VAPOR
0	212.0	.0167	26.80	180.1	970.3	1150.4
5	228.0	.0168	20.09	196.2	960.1	1156.3
10	240.1	.0169	16.30	208.4	952.1	1160.6
15	250.3	.0170	13.75	218.8	945.3	1164.1
20	259.3	.0171	11.90	227.9	939.2	1167.1
25	267.2	.0172	10.50	236.0	933.7	1169.7
30	274.4	.0173	9.40	243.4	928.6	1172.0
40	287.1	.0174	7.79	256.3	919.6	1175.9
50	298.0	.0176	6.66	267.5	911.6	1179.1
75	320.3	.0178	4.90	290.6	894.7	1185.3
100	338.1	.0178	3.88	309.1	880.6	1189.7
125	353.0	.0180	3.22	324.8	868.2	1193.0
150	365.5	.0182	2.77	338.0	857.5	1195.5

FAN LAWS

If fan speed is changed in a given system, with no other system modifications

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

$$TP_2 = TP_1 \times \left(\frac{RPM_2}{RPM_1}\right)^2$$

$$HP_2 = HP_1 \times \left(\frac{RPM_2}{RPM_1}\right)^3$$

To estimate fan horsepower:

$$HP = \frac{CFM \times TP}{6{,}356 \times EFF}$$

$$TR = \frac{HP \times 2{,}310}{CFM}$$

CFM = Airflow, Ft°/Min
RPM = Fan Speed, Revs/Min
HP = Power Input, Horsepower
TP = Air Total Pressure, Inches Water
TR = Air Temp. Rise, °F
EFF = Fan Efficiency

Typical fan efficiencies:
Forward Curved - .65 to .75
Backward Curved - .75 to .85
Axial Flow -.80 to .90

PUMP LAWS

If pump speed is changed in a given system, with no other system modifications:

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

$$H_2 = H_1 \times \left(\frac{RPM_2}{RPM_1}\right)^2$$

$$HP_2 = HP_1 \times \left(\frac{RPM_2}{RPM_1}\right)^3$$

To estimate pump horsepower:

$$HP = \frac{GPM \times H \times SG}{3{,}960 \times EFF}$$

GMP = Liquid Flow, Gais/Min
RPM = Pump Speed, Revs/Min
HP = Power Input, Horserpower
H = Total Head of Liquid, Feet
SG = Liquid Specific Gravity, Water = 1.0
EFF = Pump Efficiency

Typical pump efficiencies:
100 GPM - .55 to .65
200 GPM - .65 to .70
500 GPM - .70 to .75
1000 GPM - .75 to .80

DEFINITIONS OF STANDARD AIR FLOW

English Units: Standard air is air that 70 °F, bone dry, and 29.92 in. Hg barometric pressure. Its density is 0.075 lbs/ft³

Airflow in Standard CFM (SCFM) = Airflow in actual CFM (ACFM) $\times \frac{13.34}{Sp.\ Vol.}$
(Airflow in SCFM) x 4.5 = (Airflow in lbs. dry air/hr)

Metric Units: Normal air is aire at 0 °C, bone dry, and 29.92 in. Hg barometric pressure. Its density is 1.293 Kg/m³.

Airflow in Normal M³/Min (nM³/Min) = Airflow in actual M³/Min $\times \frac{0.773}{Sp.\ Vol.}$
(Airflow in nM³/Min) x 77.58 = (Airflow in Kg. dry air/hr)

FREQUENTLY USED CONVERSION FACTORS

LENGTH

1 Meter = 3.28 Feet
1 Inch = 2.54 cm
1 Mile = 1.61 Km
1 Micron = 1 x 10^{-6} M

AREA

1 M^2 = 10.67 $Ft.^2$
1 Acre = 43,560 $Ft.^2$

VOLUME

1 M^3 = 35.31 Ft^3
1 $Ft.^3$ = 7.49 Gals
1 Gal = 231 In^3
1 Gal = 3.78 Liters

LATENT HEAT

1 BTU/lb = 2326 J/Kg
1 Kg Cal/Kg = 1.8 BTU/lb

SPECIFIC HEAT

1 BTU/lb - °F = Kg Cal/Kg – °K
1 BTU/lb - °F = 4,184 J/Kg – °K

VOLUME FLOW

1CFM - 1.70 M^3/Hr
1 Liter/Sec = 15.9 GPM
1 M^3/Hr = 4.41 GPM

ENERGY & WORK

1BTU = 1,055 Joules
1 Watt-Hr = 3.413 BTU
1 Kg Cal = 3.97 BTU
1 BTU = 778 Ft-lbs

POWER

1 KW = 3,413 BTU/Hr
1 KW = 1.34 HP
1 HP = 2,545 BTU/Hr
1 Hp = 550 Ft-lb/Sec

WEIGHT

1Kg = 2,205 lbs
1 Metric Ton = 2,205 lbs
1 lb = 7,000 Grains
1 lb = 454 Grams

Pressure

1 ATM = 14.696 PSI
1 ATM = 29.92 In Hg
1 Kg/cm^2 = 14.2 PSI
1 PSI = 6.895 KPa
1 PSI = 2.27 In W.C.

ENERGY FLUX

1 BTU/Hr-Ft^2 = 3.15 W/M^2

THERMAL CONDUCTIVITIY

1 W/M °K = 6.93 $\frac{\text{BTU-In}}{\text{Hr-Ft}^2 - °F}$

THERMAL CONDUCTANCE

1 BTU/Hr-Ft^2 – °F = 5.68 w/m^2 – °K

PSYCHROMETRIC CORRECTIONS FOR ALTITUDE

BAROMETRIC PRESSURE

Altitude Feet	Pressure In. Hg
-1000	31.02
-500	30.47
Sea Level	29.92
500	29.38
1000	28.86
2000	27.82
3000	26.82
4000	25.84
5000	34.90
6000	23.98
7000	23.09
8000	22.22
9000	21.39
10000	20.58

Dew Point Humidity for a Given Temperature:

(Humidity @altitude) = (Humidity @ S.L.) x $\frac{29.92}{\text{Baro. Press.}}$

Relative Humidity for a Given Humidity Ratio:

(R.H. @ Altitude) = (R.H. @ S.L.) x $\frac{\text{Baro. Press}}{29.92}$

Specific Volume for a Given Temperature & Humidity Ratio:

(Sp. Vol @ Altitude) = (Sp. Vol @ S.L) x $\frac{29.92}{\text{Baro. Press.}}$

Enthalpy for a Given Temperature & Humidity Ratio:

(Enthalpy @ Altitude) = (Enthalpy @ S.L.)

PSYCHROMETRIC CONVERSION FACTORS

TEMPERATURE

°F = (1.8 X °C) + 32
°C = (°F – 32) / 1.8
°K = °C + 273
°R = °F + 460

HUMIDITY RATIO

1 Gram/Kg = 7 Grains/lb
1 lb = 7000 Grains
1 Grain/Std. Ft^3 = 13.34 Grains/lb

AIRFLOW

1 M^3/Min = 35.31 ACFM
1 nM^3/Min = 38.01 SCFM
1 nM^3/Hr = 0.633 SCFM

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PSYCHROMETRIC CHART

Normal Temperature

I-P Units

SEA LEVEL

BAROMETRIC PRESSURE: 29.921 in. HG