R.A. Ross Useful Formulas

NPSH

Net positive suction head available ($NPSH_a$) is the total suction head minus the vapor pressure (both expressed in feet)

$$NPSH_a = \frac{2.309(P_a - P_{vp})}{S.G.} \pm H_e - H_f$$

P_a is the atmospheric or tank pressure (psi absolute), P_{vp} is the vapor pressure (psi absolute), H_e is the elevation head (negative if suction lift) expressed in feet and H_f is the friction loss thru the suction piping expressed in feet.

HEAD

psi = (14.50) (bar)
psi= (.4912) (in. Hg)
psi= (.4331) (ft.) (S.G.)

in. Hg = (2.036) (psi)
in. Hg = (.8819) (ft) (S.G.)
1 atm = 760 mm Hg
1 atm = 29.92 in. Hg

$$ft. = \frac{2.309\ (psi)}{S.G.}$$

$$ft. = \frac{(1.134)\ (in.\ HG\ )}{S.G.}$$

CAPACITY

GPM = (7.481) (Cu. ft. / min.)
GPM = (.2642) (Liter / min.)

GPM = (264.2) (Cu. meter / min.)
GPM = (4.403) (Cu. meter / hr.)

HP

$$BHP = \frac{(GPM)\ (ft)\ (S.G.)}{(3960)\ (E)}$$

HP = (1.341) (KW)
KW = (.7457) (HP)

$$KWinput = \frac{(GPM)\ (ft)\ (S.G.)}{(5308)\ (E)\ (M.E.)}$$

$$HP = \frac{(lb.ft.)\ (RPM)}{5250}$$

E= pump efficiency M.E. = motor efficiency.

TEMPERATURE

$$^oF = \frac{9}{5}\ (^oC) + 32 \qquad ^oC = \frac{5}{9}\ (^oF - 32)$$

Heat added to fluid due to pump inefficiency.

$$\text{Total Heat}_{\text{(BTU per hr.)}} = \frac{(ft.)\ (GPM)\ (S.G.)}{1.557}\ \left(\frac{1}{E} - 1\right)$$

LENGTH

(mm) = (25.40) (inches)

meters = (.3048) (ft.)

SPECIFIC GRAVITY

Water = 1.0 S.G. = 62.43 lb. / Cu. ft.

1 gallon water = 8.3453 lb.
1 Cu. ft. water = 7.48052 gal.

VISCOSITY

$$Centistokes = \frac{(centipoise)}{Specific\ Gravity}$$

Above 50 centistokes, SSU = 4.55 (centistokes)

If over 2500 SSU, a centrifugal pump smaller than 2-1/2" in impractical. If over 5000 SSU, any centrifugal pump is impractical.

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