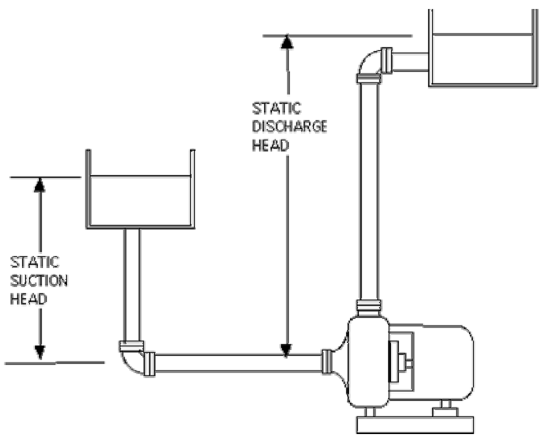
valves and fittings, add them together and multiply the total by the V2/2g number shown in the fourth column of the friction loss piping chart. Example: A 2 inch long radius screwed elbow has a K number of 0.4 and a 2 inch globe valve has a K number of 8. Adding them together (8 + 0.4) = 8.4 x 0.6 (for 65 gpm) = 5 feet of loss.

In the following examples we will be looking only at the suction side of the pump. If we were calculating the pump's total head we would look at both the suction and discharge sides.

Let's go through the first example and see if our pump is going to cavitate:

Given:

- Atmospheric pressure = 14.7 psi
- Gage pressure =The tank is at sea level and open to atmospheric pressure.
- Liquid level above pump centerline = 5 feet
- Piping = a total of 10 feet of 2 inch pipe plus one 90° long radius screwed elbow.
- Pumping =100 gpm. 68°F. fresh water with a specific gravity of one (1).
- Vapor pressure of 68°F. Water = 0.27 psia from the vapor chart.
- Specific gravity = 1
- NPSHR (net positive suction head required, from the pump curve) = 9 feet



Now for the calculations:

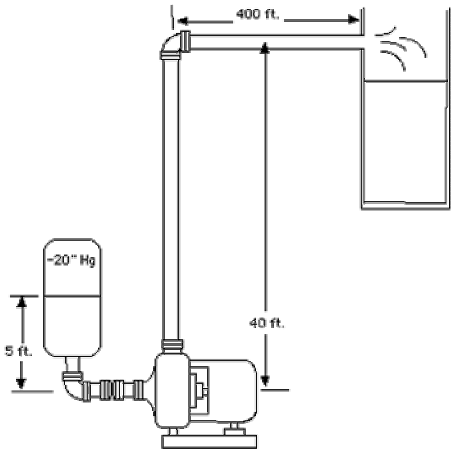
NPSHA = Atmospheric pressure(converted to head) + static head + surface pressure head - vapor pressure of your product - loss in the piping, valves and fittings

- Static head = 5 feet
- Atmospheric pressure = pressure x 2.31/sg. = 14.7 x 2.31/1 = 34 feet absolute
- Gage pressure = 0
- Vapor pressure of 68°F. water converted to head = pressure x 2.31/sg = 0.27 x 2.31/1 = 0.62 feet
- Looking at the friction charts:
  - 100 gpm flowing through 2 inch pipe shows a loss of 17.4 feet for each 100 feet of pipe or 17.4/10 = 1.74 feet of head loss in the piping
  - The K factor for one 2 inch elbow is 0.4 x 1.42 = 0.6 feet
- Adding these numbers together, 1.74 + 0.6 = a total of 2.34 feet friction loss in the pipe and fitting.

NPSHA (net positive suction head available) = 34 + 5 + 0 - 0.62 - 2.34 = 36.04 feet

The pump required 9 feet of head at 100 gpm. And we have 36.04 feet so we have plenty to spare.

Example number 2 . This time we are going to be pumping from a tank under vacuum.



Given:

- Gage pressure = - 20 inches of vacuum
- Atmospheic pressure = 14.7 psi
- Liquid level above pump centerline = 5 feet
- Piping = a total of 10 feet of 2 inch pipe plus one 90° long radius screwed elbow.
- Pumping = 100 gpm. 68°F fresh water with a specific gravity of one (1).
- Vapor pressure of 68°F water = 0.27 psia from the vapor chart.
- NPSHR (net positive suction head required) = 9 feet

Now for the calculations:

NPSHA = Atmospheric pressure(converted to head) + static head + surface pressure head - vapor pressure of your product - loss in the piping, valves and fittings

- Atmospheric pressure = 14.7 psi x 2.31/sg. =34 feet
- Static head = 5 feet
- Gage pessure pressure = 20 inches of vacuum converted to head
  - inches of mercury x 1.133 / specific gravity = feet of liquid
  - -20 x 1.133 /1 = -22.7 feet of pressure head absolute
- Vapor pressure of 68°F water = pressure x 2.31/sg. = 0.27 x 2.31/1 = 0.62 feet
- Looking at the friction charts:
  - 100 gpm flowing through 2.5 inch pipe shows a loss of 17.4 feet or each 100 feet of pipe or 17.4/10 = 1.74 feet loss in the piping
  - The K factor for one 2 inch elbow is 0.4 x 1.42 = 0.6 feet
- Adding these two numbers together: (1.74 + 0.6) = a total of 2.34 feet friction loss in the pipe and fitting.

NPSHA (net positive suction head available) = 34 + 5 - 22.7 - 0.62 - 2.34 = 13.34 feet. This is enough to