



TECH TIP #29

NET POSITIVE SUCTION HEAD (NPSH)

NPSH combines all the factors limiting the suction side of a pump; internal pump losses, static suction lift, friction losses, vapor pressure and atmospheric conditions. It is important to differentiate between REQUIRED NPSH and AVAILABLE NPSH.

NPSH REQUIRED

REQUIRED NPSH is a factor designed into a pump and measurable in the test laboratory by the manufacturer. Testing facilities can determine losses in the suction piping static lift and barometric pressures.

NPSH AVAILABLE

The term for providing sufficient pressure on the suction, at the impeller eye, to prevent "boiling" is known as NPSH AVAILABLE. It is a function of the pumping system and consists of pressure on the liquid at its source, the elevation of the liquid with respect to the impeller centerline, losses in the suction piping and vapor pressure of the liquid.

If the available NPSH is not equal to, or greater than that required by the pump, it must be increased. This is usually done by increasing the static head, Hz.

NPSH FORMULAS

PROPOSED INSTALLATION

To calculate the NPSH available in a proposed application, the following formula is recommended:

$$H_{sv} = H_p \pm H_z - H_f - H_{vp}$$

H_{sv} — Available NPSH expressed in feet of fluid.

H_p — Absolute pressure on the surface of the liquid where the pump takes suction, expressed in feet. This could be atmospheric pressure or vessel pressure (pressurized tank)

H_z — Static elevation of the liquid above, or below the centerline of the impeller, expressed in feet.

H_f — Friction and entrance head loss in the suction piping, expressed in feet.

H_{vp} — Absolute vapor pressure of the fluid at the pumping temperature, expressed in feet of fluid.

PROPERTIES OF WATER			
Temp. °F.	Absolute Vapor Pressure		Specific Gravity
	PSI	Ft. Water	
60	0.26	0.59	0.999
65	0.60	1.4	0.996
70	0.95	2.2	0.993
75	1.69	3.9	0.989
80	2.22	5.0	0.986
85	2.89	6.8	0.983
90	3.72	8.8	0.981
95	4.74	11.2	0.977
100	5.99	14.2	0.974
105	7.51	17.8	0.970
110	8.38	20.0	0.969
115	9.34	22.3	0.966
120	10.38	24.9	0.964
125	11.53	27.6	0.963
130	12.01	28.8	0.962
135	12.51	30.0	0.961
140	13.03	31.2	0.960
145	13.57	32.6	0.960
150	14.12	33.9	0.959
155	14.70	35.4	0.958
160	15.29	37.0	0.957
165	15.90	38.4	0.956
170	16.54	40.0	0.956
175	17.19	41.6	0.955
180	17.86	43.3	0.954
185	18.56	45.0	0.953
190	19.28	46.8	0.953
195	20.02	48.6	0.952
200	20.78	50.5	0.951
205	24.97	61.0	0.947
210	29.83	73.2	0.943
215	67.0	168.6	0.918
220	134.60	349.0	0.891

ATMOSPHERIC PRESSURE AND BOILING POINT OF WATER AT VARIOUS ALTITUDES				
Altitude (feet)	Barometer Inches Mercury	Atmospheric Pressure		Boiling Point °F.
		PSIA	(ft. water)	
-1000	31.0	15.2	35.1	213.8
-500	30.5	15.0	34.6	212.9
0	29.9	14.7	33.9	212.0
+500	29.4	14.4	33.3	211.1
+1000	28.9	14.2	32.8	210.2
+1500	28.3	13.9	32.1	209.3
+2000	27.8	13.7	31.5	208.4
+2500	27.3	13.4	31.0	207.4
+3000	26.8	13.2	30.4	206.5
+3500	26.3	12.9	29.8	205.6
+4000	25.8	12.7	29.2	204.7
+4500	25.4	12.4	28.8	203.8
+5000	24.9	12.2	28.2	202.9
+5500	24.4	12.0	27.6	201.9
+6000	24.0	11.8	27.2	201.0
+6500	23.5	11.5	26.7	200.1
+7000	23.1	11.3	26.2	199.2
+7500	22.7	11.1	25.7	198.3
+8000	22.2	10.9	25.2	197.4
+8500	21.8	10.7	24.7	196.5
+9000	21.4	10.5	24.3	195.5
+9500	21.0	10.3	23.8	194.6
+10000	20.6	10.1	23.4	193.7
+15000	16.9	8.3	19.2	184.0