



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
85	0.60	1.4	0.996
100	0.95	2.2	0.993
120	1.69	3.9	0.989
130	2.22	5.0	0.986
140	2.89	6.8	0.983
150	3.72	8.8	0.981
160	4.74	11.2	0.977
170	5.99	14.2	0.974
180	7.51	17.8	0.970
185	8.38	20.0	0.969
190	9.34	22.3	0.966
195	10.38	24.9	0.964
200	11.53	27.6	0.963
202	12.01	28.8	0.962
204	12.51	30.0	0.961
206	13.03	31.2	0.960
208	13.57	32.6	0.960
210	14.12	33.9	0.959
212	14.70	35.4	0.958
214	15.29	37.0	0.957
216	15.90	38.4	0.956
218	16.54	40.0	0.956
220	17.19	41.6	0.955
222	17.86	43.3	0.954
224	18.56	45.0	0.953
226	19.28	46.8	0.953
228	20.02	48.6	0.952
230	20.78	50.5	0.951
240	24.97	61.0	0.947
250	29.83	73.2	0.943
300	67.0	168.6	0.918
350	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
0.0	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