

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 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 (Ft.)**

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**

### **Determining NPSH AVAILABLE**

$$\text{NPSH} = (\text{Barometer} + \text{Gauge} - \text{Vapor Pressure}) \times (2.31 \div \text{Specific Gravity}) \pm \text{Static Height} - \text{Pipe Loss.}$$

**BAROMETER** value in pounds per square inch absolute (PSIA) should be lowest likely reading for the area where the pump will be installed. (Use table, page 8 of section 11, to convert barometer reading in inches of mercury to PSIA).

**GAUGE PRESSURE** (PSIG) is the pressure in pounds per square inch ABOVE atmospheric pressure on the surface of the liquid in the supply vessel.

**VAPOR PRESSURE** is the value in pounds per square inch absolute (PSIA) at which the liquid will boil at given temperature.

**STATIC HEIGHT** is the distance in feet between the pump suction centerline and the surface level of the liquid in the supply vessel. If the surface level of the liquid is higher than the pump suction, static height is positive. If the surface level of the liquid is lower than the pump suction, static height is negative.

**PIPE LOSS** is the friction in feet between the supply vessel and the pump.

## **MAXIMUM WORKING PRESSURE**

### **DEFINITIONS**

**WORKING PRESSURE** - The maximum pressure of the pumping system.

**OPERATING PRESSURE** - The pressure added to the pumping system by the pump (total head of the pump).

### **EXAMPLE:**

A pump used for booster service takes liquid from a 50 p.s.i. (335kpa) source and adds 150 p.s.i. (1034kpa). This gives a final discharge pressure of 200 p.s.i. (1379kpa). The system is functioning at 200 p.s.i. (1379kpa) WORKING PRESSURE and the pump is operating at 150 p.s.i. (1034kpa) OPERATING PRESSURE.

**OPERATING PRESSURE** is a function of the basic hydraulic design considerations of the pump, and is determined by capacity and head requirements at given horsepower loads, as established in catalog ratings of the pump.

**MAXIMUM SAFE WORKING PRESSURE** is governed by safe and reasonable life expectancy limits of such items as: mechanical shaft seal, stuffing box, gasket design, bolt strength, bursting strength of case and frame castings, etc.