NET POSITIVE SUCTION HEAD

An understanding of "net positive suction head" (NPSH combines all factors limiting the suction side of the pump) is necessary in order to avoid poor application of centrifugal pumps. It is wise to be concerned with NPSH if one of the following conditions is present:

a. High flow and low head relationship
b. High temperature
c. High elevation above sea level
d. Restricted suction (high friction loss)
e. Low static suction head (liquid level above pump)
f. High suction lift (liquid level below pump)
g. High vapor pressure of solution

For a specific TDH and GPM requirement on a pump curve, the corresponding required NPSH is directly below and read off the left ordinate of our flow curves.

Available NPSH must always exceed required NPSH.

REQUIRED NPSH - Refers to internal pump losses and determined by manufacturer's laboratory tests. The greater the capacity, the greater the required NPSH.

AVAILABLE NPSH - Characteristics of the suction system can be calculated or determined. Precise definition: the net positive suction head above the vapor pressure available at suction flange of pump to maintain a liquid state.

EXAMPLE:

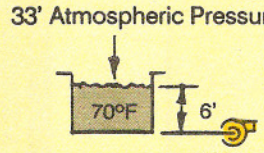
Model HE2x1-1-/1/2 with No. 4 impeller will flow 140 GPM @ 62 ft.TDH. The required NPSH is 17 ft.

To determine the available NPSH in a system, deduct the negative factors from the positive factors. All values are to be "feet", with considerations for specific gravity.

POSITIVE FACTORS		NEGATIVE FACTORS
Static suction head Atmospheric pressure (if open tank) Positive pressure (if pressurized tank)	**minus**	Vapor pressure (PSIA) at operating temperature Friction losses Static suction lift

EXAMPLE A

If pump were connected to the bottom of a 6 ft. deep tank in Chicago, Illinois, (500 ft. elevation) and tank contained water at 70°F and 2" suction pipe one foot long, what is available NPSH?



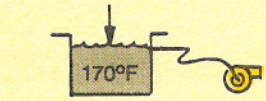
POSITIVE	NEGATIVE
Static suction head 6'	Vapor pressure .8'
Atmospheric pressure 33'	Friction losses .6'
Total 39'	Total 1.4'

39' minus 1.4' = 37.6 available

Since 17 ft. is required, the pump will perform satisfactorily. (Note, if pump were "hosed" over the side of the tank, static suction head would be the same, but friction losses would increase.)

EXAMPLE B

If pump were connected near the top of a 6 ft. deep tank in Denver, Colorado (5,000 ft. elevation) and tank contained water at 170°F and 2" suction pipe were 10 ft. long with 3 elbows, what is available NPSH?



POSITIVE	NEGATIVE
Static suction head 1'	Vapor pressure 13.8'
Atmospheric pressure 28'	Friction loss 16.0'
Total 29'	Total 29.8'

29' minus 29.8' = none available

Since 17 ft. is required and none is available, the pump will experience a reduction in capacity, loss of efficiency, noise, vibration and cavitation. Net answer is a poor application.

TYPICAL PUMP APPLICATIONS

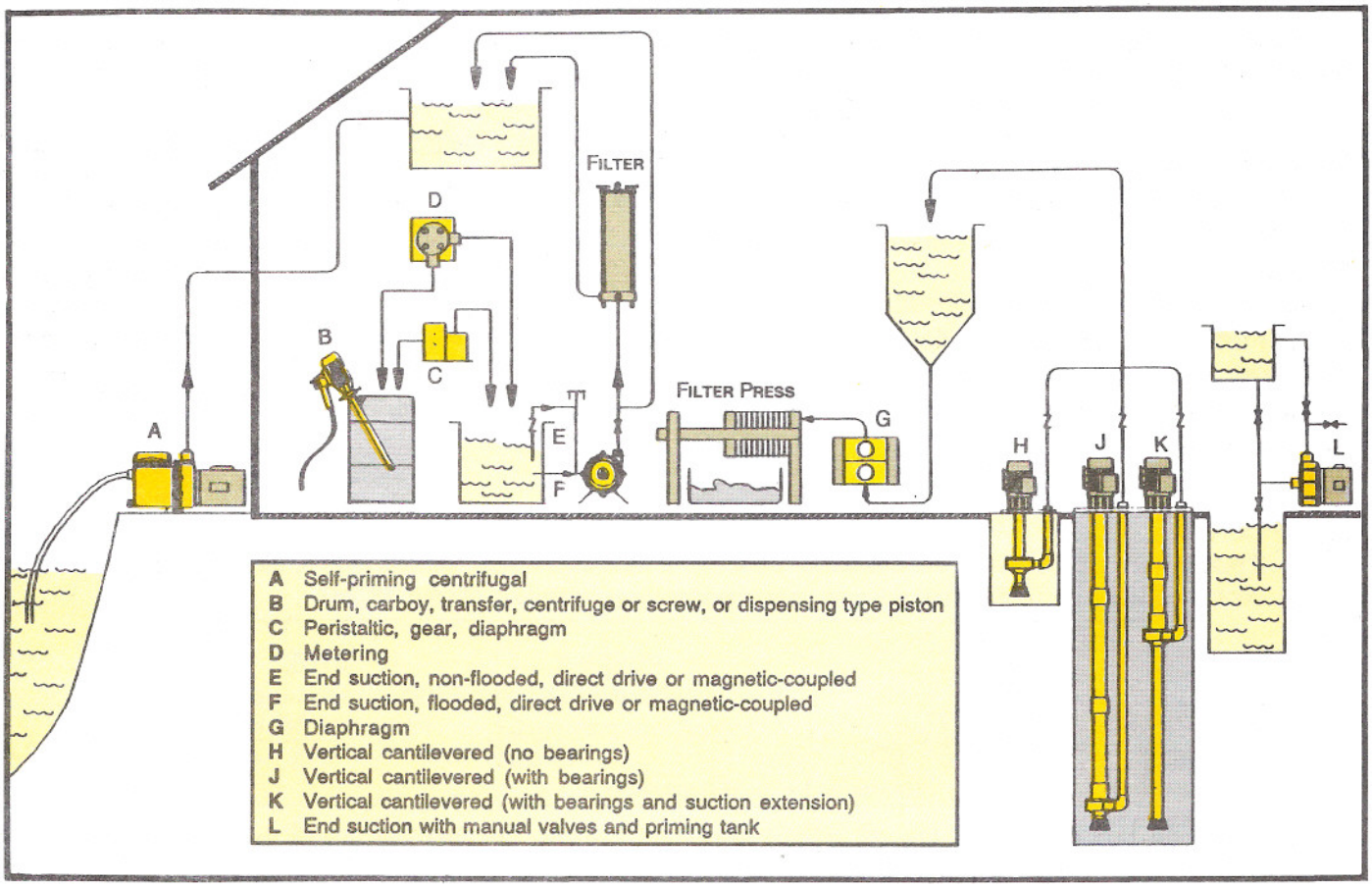
Many different types of pumps with a wide range of flow rates and discharge pressures are available to meet the requirements of various applications. In order to achieve the desired flow and pressure, all considerations should be made to determine the TDH of the pump, which includes the vertical suction lift, the friction loss incurred between the pump suction and discharge destination. These losses should include losses incurred from length of pipe line, fittings, valves and any other possible impediment in the line, plus the desired discharge pressure.

The inlet and outlet port sizes of the pump selected do not necessarily indicate the actual size of either the suction or discharge piping.

The utilization of properly selected valves is an integral part of any pumping system, in order to maintain the pump prime and control the flow and pressure.

When specific gravities higher than 1.0 are encountered, oversized motors are required.

In order to prevent backsiphoning, loss of solution or loss of prime, check valves should be utilized and consideration must be given to ensure that the pump will be capable to develop adequate pressure to open the check valve at time of start-up. A globe valve, ball valve or plug valve should be installed on the discharge line directly after the pump discharge nozzle. (Gate valves are not recommended to throttle or regulate flow.)



Reference **E** in the above illustration indicates that the horizontal pump would have to be manually primed at least the first time used, and a foot valve (check valve) should be used on the suction side of the pump to maintain the primed condition when the pump is not operating.

The illustration also indicates the employment of three different length vertical pumps, the shortest of which will generally be considered to be the most dependable. The slightly longer pump with a suction extension could continue to lift the liquid, provided the level is slightly above the suction strainer (flooded suction). If the pump was shut off and the liquid level falls below the pump and suction strainer, it would lose its suction or prime and the pump would then require priming or a flooded suction. Therefore, use of the very longest pump may be required under certain conditions, particularly when it would be necessary to pump at any given time from any level within the reservoir.

If the installation requires constant pumping or pumping upon demand, it is recommended that standby pumps are included in the installation. If the desired flow rate reaches its peak only occasionally, then it might be possible to use a smaller pump with the second being energized only when required. In such an instance, a third pump might be suggested to make absolutely certain that two of the three pumps are available at any one time.

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