

NPSHA

Net Positive Suction Head Available (NPSHA), is a measure of the total energy available at the suction of the pump, above the vapor pressure head, to suppress boiling. Since the total energy is the same at any point in the system, except for dynamic losses, we can pick any convenient location to find out the total. We then simply calculate and subtract the losses between that location and the pump suction.

The most convenient location to sum the energy is at the liquid surface in the receiver. Our reference datum is the pump suction centerline because that's where we want the energy sum. Since the receiver liquid level is more or less constant, the velocity at the surface is zero, and the velocity head is then zero. The pressure head is equal to the absolute pressure acting on the fluid surface divided by the weight density of the fluid. Finally, the static head is the height of the liquid surface above our datum, the pump suction centerline. To obtain the energy sum at the pump suction, subtract the friction and fitting losses between the liquid surface and the suction flange. Since we are interested in the available head above the vapor pressure head of the liquid, we must subtract the vapor pressure head as well. We can now express NPSHA, mathematically as:

$NPSHA = H_p + H_s - H_1 - H_{vp}$, where

H_p = Absolute pressure head acting on fluid free surface, expressed in feet of the given fluid.

H_s = Static head of fluid above pump suction centerline.

H_1 = Head loss due to friction and turbulence in the pump suction piping, expressed in feet of the fluid.

H_{vp} = Vapor pressure head of the fluid at the pumping temperature, expressed in the feet of the fluid.

In an accumulator or receiver, the pressure acting on the liquid is the vapor pressure. Subsequently, if we add in the vapor pressure and subtract it again, all we're left with is the static head of the fluid above the pump suction minus whatever the losses in the suction piping are. So, for a liquid overfeed system, we can define NPSHA as liquid height minus losses:

$NPSHA = H_s - H_1$

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