NPSH is an acronym that stands for Net Positive Suction Head. NPSH is defined as the difference between the pressure available at the pump inlet and the vapor pressure of the liquid. Vapor pressure is different for different liquids and varies with pressure and temperature.

There are two ways of expressing NPSH relative to a centrifugal pumping system:

- NPSHa: The Net Positive Suction Head Available at the pump impeller inlet.
- NPSHr: The Net Positive Suction Head Required by the pump to operate without experiencing damaging cavitation and a dramatic reduction in pumping production.

NPSHa is a value that expresses the absolute pressure acting on a liquid as it enters the pump. It is a measure of the pressure that stands between the liquid in its current state and the formation of vapor bubbles (boiling).

NPSHr is a value that expresses the minimum absolute pressure that must be acting on a liquid as it enters the pump impeller to avoid excessive cavitation and degradation of pump performance.

How does a pump manufacturer determine the NPSHr of a pump at a given operating condition? They do so by operating the pump continuously at a steady flow, reducing the NPSHa, and measuring the TDH produced by the pump. What they are watching for is a sudden reduction in TDH. When they observe that sudden reduction, the NPSHa at that point is established as the pump's NPSHr.

But who decides how far TDH must fall to establish the NPSHr of the pump at that operating condition? One manufacturer might say that a 1% reduction in TDH marks NPSHr, another might say that a 3% reduction in TDH should be observed to determine NPSHr, finally, a third wants to see a 5% reduction in TDH before establishing the pump's NPSHr. The NPSHr values established by watching for a 1%, 3%, and 5% reduction in TDH will be considerable and result in pumps that have considerably different NPSHr curves even though they exhibit identical perform.

This is where NPSH3 comes into the equation. NPSH3 is a value of NPSHr established based on a 3% reduction in TDH. In other words, during NPSH testing, when a 3% reduction in TDH is measured, the NPSHa at that point is established as the pump's NPSH3 or NPSHr. Using NPSH3 rather than NPSHr ensures that pump manufacturers are using the same reduction in TDH to establish a pump's NPSHr.

Based on the last few paragraphs what you may be realizing for the first time is that operating a pump with NPSHa equal to the pump's NPSHr will mean that the TDH produced by the pump will be reduced by 3%. How can a pump system designer avoid this potentially problematic situation? By requiring a minimum margin between system NPSHa and pump NPSHr. A good rule-of-thumb is to require that NPSHa be greater than NPSHr by at least 10% and not less than 5 Ft.