NPSH Available (Water)

Net positive suction head available at a pump handling water, from the suction vessel pressure, water temperature, static height and suction losses.

Method: ANSI/HI 9.6.1 (NPSH margin); IAPWS R7-97(2012) IF97 (vapour pressure, density)

Input parameters

Unit system: SI

Parameter	Value	Unit
Pressure on the liquid surface (absolute) Atmospheric for an open tank; the deaerator or vessel pressure for a closed one. Absolute; choose a gauge unit to enter gauge readings.	1.2090	bar
Water temperature	105.00	°C
Liquid level above the pump centreline (negative for a lift)	8.0000	m
Friction loss in the suction line	0.60000	m
NPSH required by the pump (0 = skip)	5.0000	m

Calculated results

Parameter	Value	Unit
NPSH available	7.4000	m
Margin over NPSH required	2.4000	m
Head from pressure above vapour pressure	0	m
Vapour pressure of water	1.2090	bar
Water density	954.71	kg/m³

Notes for this case

- NPSH margin ratio NPSHa/NPSHr = 1.48. ANSI/HI 9.6.1 expresses the margin as this ratio; NPSHr is at 3 % head drop, so a ratio above 1 is needed to avoid cavitation damage; take the ratio for your service from the pump maker or the standard.

Formula and method

$$NPSH_a = \frac{p_s - p_v}{\rho g} + z - h_f$$

Variables

p_s	absolute pressure on the liquid surface	Pa
T	water temperature	K
z	liquid level above the pump centreline (negative for a lift)	m
h_f	friction loss in the suction line	m
$NPSH_r$	NPSH required by the pump	m
$NPSH_a$	NPSH available	m
$NPSH_a - NPSH_r$	margin (the ratio NPSHa/NPSHr is given in a note)	m
h_p	head from pressure above the vapour pressure	m
p_v	vapour pressure of water at T	Pa
ρ	density of saturated water at T	kg/m³
g	standard gravity, 9.806 65	m/s²

Method and standards

The definition of NPSH available of ANSI/HI 9.6.1, referred to the pump centreline. Vapour pressure and liquid density come from FireCAD's IAPWS-IF97 implementation on the saturation line at the water temperature.

Assumptions and limits

- Water only (0.01 °C to 350 °C).
- Lowest liquid level and highest temperature are the design case; use them.
- Velocity head at the suction flange is included in the friction loss you enter, as is common practice.
- Dissolved gas and transient pressure decay in a deaerator on load rejection are not covered; they need extra margin.

References

• ANSI/HI 9.6.1 (NPSH margin)
• IAPWS R7-97(2012) IF97 (vapour pressure, density)

Report details

Report reference	FCC-PTWC-MK43 (the same inputs always give the same reference)
Generated	17 November 2026, 19:45 UTC
Calculator	NPSH Available (Water)
Method last reviewed	10 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	4 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/pumps/npsh-available

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Reopens the calculator with the inputs of this report.