Deaerator Elevation for Feed Pump NPSH

Minimum height of the deaerator water level above the boiler feed pump for its NPSH required, margin, suction losses and a transient allowance.

Method: ANSI/HI 9.6.1 (NPSH margin)

Input parameters

Unit system: SI

Parameter	Value	Unit
NPSH required by the feed pump at the highest flow	6.0000	m
NPSH margin ratio NPSHa / NPSHr ANSI/HI 9.6.1 gives margin ratios by application; enter the ratio your specification or the pump maker requires.	1.3000	
Suction line losses at the highest flow (incl. strainer)	0.80000	m
Allowance for pressure decay on load rejection On a sudden load drop the deaerator pressure falls faster than the water in the suction line cools; enter the allowance your transient study or specification gives.	1.0000	m
Actual or proposed elevation to check (0 = skip)	12.000	m

Calculated results

Parameter	Value	Unit
Minimum water level above the pump centreline	9.6000	m
NPSH available at the actual elevation	11.200	m
Margin ratio at the actual elevation	1.8667	
Height to spare (negative = too low)	2.4000	m

Formula and method

$$z_{min} = NPSH_r\, R + h_{fs} + h_t \qquad NPSH_a = z_{act} - h_{fs} \qquad \Delta z = z_{act} - z_{min}$$

Variables

$NPSH_r$	NPSH required at the highest flow	m
R	margin ratio $NPSH_a/NPSH_r$	–
h_{fs}	suction line losses at the highest flow	m
h_t	allowance for pressure decay on load rejection	m
z_{act}	actual or proposed elevation	m
z_{min}	minimum water level above the pump centreline	m
$NPSH_a$	NPSH available at the actual elevation	m
$NPSH_a/NPSH_r$	margin ratio at the actual elevation	–
Δz	height to spare	m

Method and standards

NPSH available as defined in ANSI/HI 9.6.1, for saturated water whose vapour pressure equals the vessel pressure. The margin ratio is the form ANSI/HI 9.6.1 uses; its value is your input.

Assumptions and limits

- Water saturated at the deaerator pressure; subcooled water (from a cooler in the suction) gives more NPSH.
- Lowest normal water level in the deaerator is the design level.
- Losses at the highest flow, including strainers (take the dirty-strainer loss for safety).
- The minimum elevation includes the load-rejection allowance; the NPSH available and margin ratio at the actual elevation are steady-state values without it, so compare the height to spare, not the ratio alone, with the transient case.

- The suction velocity head and the difference between the pump centreline and the impeller eye are neglected; a first estimate.
- An elevation of 0 means "not checked"; a pump level with the water has no NPSH available in any case.

References

ANSI/HI 9.6.1 (NPSH margin)

Report details

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

This calculator online

https://calc.firecad.com/boilers-power-plant/boiler-auxiliaries/deaerator-elevation

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Reopens the calculator with the inputs of this report.