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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Release checks	3 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/boilers-power-plant/steam/deaerator-elevation

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Reopens the calculator with the inputs of this report.