Tank Wetted Area at a Liquid Level

Wetted surface area of a vertical or horizontal cylindrical tank at a liquid level, with ends or bottom, for heat loss, fire exposure or coating estimates.

Method: Circular segment geometry (definitions)

Input parameters

Unit system: SI

Parameter	Value	Unit
Tank orientation	Horizontal (flat ends)	
Diameter	3.0000	m
Length (horizontal) or height (vertical)	10.000	m
Liquid level	2.0000	m

Calculated results

Parameter	Value	Unit
Wetted area	67.331	m²
Total surface area	108.38	m²
Wetted share	62.122	%
Liquid volume	50.060	m³

Notes for this case

- Flat ends and bottom assumed; dished heads add a little area. For fire relief, the applicable code defines which wetted area counts (often up to a height above grade).

Formula and method

$$\theta = 2\arccos\frac{r-h}{r}, \quad A_w = r\theta L + 2\cdot\frac{r^2}{2}(\theta - \sin\theta)\ \text{(horizontal)}, \quad A_w = \pi r^2 + \pi D h\ \text{(vertical)}$$

Variables

$\mathrm{orientation}$	Tank orientation	-
D	Diameter	m
L	Length (horizontal) or height (vertical)	m
h	Liquid level	m
A_w	Wetted area	m²
A_t	Total surface area	m²
A_w/A_t	Wetted share	-
V	Liquid volume	m³

Method and standards

Segment geometry.

Assumptions and limits

- A level above the tank height (vertical) or diameter (horizontal) is taken as full and flagged.
- The result is the geometric wetted area. Fire-relief codes count only the wetted area up to a set height above grade (and treat heads in their own way); apply that limit yourself.
- Flat ends.

References

- Circular segment geometry (definitions)

Report details

Report reference	FCC-551Y-CM0K (the same inputs always give the same reference)
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Release checks	2 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/vessels/tank-wetted-area

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.