Horizontal Tank Volume at a Liquid Level

Liquid volume in a horizontal cylindrical tank at any level, with flat, 2:1 ellipsoidal or hemispherical heads, and the total volume and percentage full.

Method: Geometry of the circular segment and ellipsoidal head

Input parameters

Unit system: SI

Parameter	Value	Unit
Inside diameter	2.5000	m
Length of the cylindrical shell (tangent to tangent)	8.0000	m
Liquid level from the bottom	0.90000	m
Heads	2:1 ellipsoidal	

Calculated results

Parameter	Value	Unit
Liquid volume	13.936	m³
Total volume	43.361	m³
Share full by volume	32.140	%
Liquid in the cylindrical shell	12.728	m³
Liquid in both heads	1.2087	m³

Notes for this case

- Heads are treated as true half-ellipsoids or hemispheres; torispherical (dished) heads hold slightly less than 2:1 ellipsoidal ones.

Formula and method

$$V_s = L\left[R^2 \arccos\frac{R-h}{R} - (R-h)\sqrt{2Rh-h^2}\right] \qquad V_h = \frac{\pi h^2(3R-h)}{3}\frac{a}{R}$$

$$V = V_s + V_h \qquad V_t = \pi R^2 L + \frac{4}{3}\pi R^2 a \qquad a = 0,\ R/2,\ R$$

Variables

D	inside diameter	m
L	shell length	m
h	liquid level	m
heads	head type	–
V	liquid volume	m³
V_t	total volume	m³
V/V_t	share full	–
V_s	liquid in shell	m³
V_h	liquid in heads	m³
R	radius	m
a	head depth	m

Method and standards

Circular segment area times length; heads as half-ellipsoids (sphere segment scaled by a/R).

Assumptions and limits

- Level horizontal tank; true ellipsoidal or hemispherical heads.

References

- Geometry of the circular segment and ellipsoidal head

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/mechanical/vessels/horizontal-tank-partial-volume

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.