

Horizontal Cylinder volume formula

tankvolumecalc.com/formulas/horizontal-cylinder/

Total volume, exact partial fill, derivation, worked example and a copy-ready fill table.

TOTAL VOLUME

$$V = \pi r^2 L$$

PARTIAL FILL AT LIQUID DEPTH H

$$V(h) = [r^2 \cdot \text{acos}((r-h)/r) - (r-h) \cdot \sqrt{(2rh-h^2)}] \cdot L$$

Derivation

The wetted cross-section at liquid depth h is a circular segment. Its area follows from the sector swept by the chord (angle $\theta = 2 \cdot \text{acos}((r-h)/r)$, area $\frac{1}{2}r^2\theta$) minus the triangle above the chord — simplifying to the closed form shown. Multiply by length because every slice along the tank is identical.

Worked example

Take $D = 48$ in, $L = 96$ in. Total capacity: 752 gal. At a stick reading of 19.2 in (40% of the 48 in maximum depth), the filled volume is 280.9 gal — 37.4% of capacity. Check it live on the calculator.

Fill ratio: % of depth → % of volume (any horizontal cylinder (curve is proportion-independent))

Depth	Volume
5%	1.9%
10%	5.2%
15%	9.4%
20%	14.2%
25%	19.6%
30%	25.2%
35%	31.2%
40%	37.4%
45%	43.6%
50%	50%
55%	56.4%
60%	62.6%
65%	68.8%
70%	74.8%
75%	80.4%
80%	85.8%
85%	90.6%
90%	94.8%
95%	98.1%

Need the full inch-by-inch table for specific dimensions? The dip chart generator prints it as a laminate-ready PDF.

FAQ

Q. What is the formula for a horizontal cylinder volume?

Total: $V = \pi r^2 L$. Partial fill at depth h : $V(h) = [r^2 \cdot \text{acos}((r-h)/r) - (r-h) \cdot \sqrt{(2rh-h^2)}] \cdot L$. Derivation and a worked example are above.

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Total: $V = \pi r^2 L$. Partial fill at depth h : $V(h) = [r^2 \cdot \arccos((r-h)/r) - (r-h) \cdot \sqrt{(2rh-h^2)}] \cdot L$. Derivation and a worked example are above.

Q. Is the fill-ratio table exact?

Yes — computed by the same engine as our calculators (any horizontal cylinder (curve is proportion-independent)), verified by the automated test suite described on the methodology page.

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Q. Can I use this in a spreadsheet?

Yes — the formulas are closed-form (acos and sqrt only). Copy the 5%-step table for quick interpolation, or implement the formula directly for exact values.

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