

Vertical Tank, 2:1 Dished Bottom volume formula tankvolumecalc.com/formulas/dished-bottom-tank/

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

TOTAL VOLUME

$$V = (2/3)\pi r^2 a + \pi r^2 H_{cyl}, \quad a = D/4$$

PARTIAL FILL AT LIQUID DEPTH H

$$h \leq a: V = (r/a)^2 \cdot \pi h^2 (3a - h)/3 \quad | \quad h > a: V = (2/3)\pi r^2 a + \pi r^2 (h - a)$$

Derivation

The bottom head is half a spheroid standing on its pole. Stretch a sphere of radius a horizontally by r/a : areas scale by $(r/a)^2$, so the head's partial fill is exactly $(r/a)^2$ times a spherical cap of radius a . Above the tangent line, linear cylinder math takes over.

Worked example

Take $D = 48$ in, $H_{cyl} = 60$ in. Total capacity: 532.7 gal. At a stick reading of 28.8 in (40% of the 72 in maximum depth), the filled volume is 194.3 gal — 36.5% of capacity. Check it live on the calculator.

Fill ratio: % of depth → % of volume (2:1 head (depth $D/4$), shell = $1.25 \times D$)

Depth	Volume
5%	1.4%
10%	5.1%
15%	10%
20%	15.3%
25%	20.6%
30%	25.9%
35%	31.2%
40%	36.5%
45%	41.8%
50%	47.1%
55%	52.4%
60%	57.6%
65%	62.9%
70%	68.2%
75%	73.5%
80%	78.8%
85%	84.1%
90%	89.4%
95%	94.7%

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 vertical tank, 2:1 dished bottom volume?

Total: $V = (2/3)\pi r^2 a + \pi r^2 H_{cyl}$, $a = D/4$. Partial fill at depth h : $h \leq a: V = (r/a)^2 \cdot \pi h^2 (3a - h)/3$ | $h > a: V = (2/3)\pi r^2 a + \pi r^2 (h - a)$. Derivation and

Vertical Tank, 2:1 Dished Bottom volume formula tankvolumecalc.com/formulas/dished-bottom-tank/

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

a worked example are above.

Total: $V = (2/3)\pi r^2 a + \pi r^2 H_{cyl}$, $a = D/4$. Partial fill at depth h : $h \leq a$: $V = (r/a)^2 \cdot \pi h^2 (3a - h)/3$ | $h > a$: $V = (2/3)\pi r^2 a + \pi r^2 (h - a)$.
Derivation and a worked example are above.

Q. Is the fill-ratio table exact?

Yes — computed by the same engine as our calculators (2:1 head (depth $D/4$), shell = $1.25 \times D$), verified by the automated test suite described on the methodology page.

Yes — computed by the same engine as our calculators (2:1 head (depth $D/4$), shell = $1.25 \times D$), verified by the automated test suite described on the methodology page.

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.

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.