

ASME F&D (Torispherical) Heads volume formula tankvolumecalc.com/formulas/torispherical-heads/

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

TOTAL VOLUME

$$V \approx \pi r^2 L_{cyl} + 2 \cdot 0.0809 \cdot D^3$$

PARTIAL FILL AT LIQUID DEPTH H

$$V(h) \approx \text{seg}(r, h) \cdot L_{cyl} + (0.1545 \cdot D/r) \cdot \pi h^2 (3r - h)/3$$

Derivation

True torispherical geometry (dish radius D , knuckle $0.06D$, depth $0.1693D$) has no tidy closed form, so we scale the spherical cap by an effective depth $a_{\text{eff}} = 0.1545D$ chosen to match the standard $0.0809D^3$ full-head volume. Measured against exact numerical integration of the real profile, the worst error is 0.8% of head-pair volume — under 0.06% of a whole 500-gallon vessel. Both checks run in CI.

Worked example

Take $D = 37.5$ in, $L_{cyl} = 94$ in. Total capacity: 486.4 gal. At a stick reading of 15 in (40% of the 37.5 in maximum depth), the filled volume is 180.9 gal — 37.2% of capacity. Check it live on the calculator.

Fill ratio: % of depth → % of volume (a 500-gal-class vessel (shell $\approx 2.5 \times D$))

Depth	Volume
5%	1.8%
10%	5%
15%	9.2%
20%	13.9%
25%	19.3%
30%	25%
35%	31%
40%	37.2%
45%	43.6%
50%	50%
55%	56.4%
60%	62.8%
65%	69%
70%	75%
75%	80.7%
80%	86.1%
85%	90.8%
90%	95%
95%	98.2%

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 asme f&d (torispherical) heads volume?

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Q. Is the fill-ratio table exact?

Yes — computed by the same engine as our calculators (a 500-gal-class vessel (shell $\approx 2.5 \times D$)), 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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