Silo and Hopper Volume and Capacity

Volume and capacity of a round silo or bunker with a conical hopper bottom and a heaped top, from diameter, heights, hopper angle and bulk density.

Method: Geometry of cylinder; frustum and cone

Input parameters

Unit system: SI

Parameter	Value	Unit
Silo diameter	4.0000	m
Height of the cylindrical part	6.0000	m
Hopper outlet diameter	300.00	mm
Hopper wall angle from horizontal	60.000	°
Angle of repose of the heaped top (0 = level)	0	°
Bulk density of the material	800.00	kg/m³

Calculated results

Parameter	Value	Unit
Height of the hopper cone	3.2043	m
Volume of the hopper	14.504	m³
Volume of the cylindrical part	75.398	m³
Volume of the heaped top	0	m³
Total volume	89.902	m³
Capacity at the bulk density	71.922	t

Notes for this case

- Geometric volume: the usable capacity is less where material hangs up, rat-holes or cannot be heaped to the top.

Formula and method

$$h_c = \frac{D-d}{2}\tan\theta, \quad V_c = \frac{\pi h_c}{12}(D^2 + Dd + d^2)$$

$$V_s = \frac{\pi}{4}D^2 H, \quad V_t = \frac{\pi D^2}{12}\cdot\frac{D}{2}\tan\phi$$

$$V = V_c + V_s + V_t, \quad W = V\rho_b$$

Variables

D	silo diameter	m
H	height of the cylinder	m
d	outlet diameter	m
θ	hopper wall angle from horizontal	rad
ϕ	angle of repose of the heaped top	rad
ρ_b	bulk density	kg/m³
h_c	hopper height	m
V_c	hopper volume	m³
V_s	cylinder volume	m³
V_t	heaped top volume	m³

V	total volume	m^3
W	capacity	kg

Method and standards

The hopper is a frustum of a cone from the silo diameter to the outlet; the heaped top is a cone at the angle of repose. Capacity is total volume times bulk density.

Assumptions and limits

- Round silo with a single central conical outlet.
- Geometric volume; hang-ups and dead zones reduce live capacity.

References

- Geometry of cylinder
- frustum and cone

Report details

Report reference	FCC-1FE8-X81M (the same inputs always give the same reference)
Generated	17 November 2026, 19:45 UTC
Calculator	Silo and Hopper Volume and Capacity
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/material-handling/hopper-silo-volume

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.