Torus (Ring) Volume and Surface Area

Volume and surface area of a torus, such as an O-ring, tyre tube or toroidal tank, from its mean ring and tube diameters, with the mass for a density.

Method: Pappus–Guldinus theorems

Input parameters

Unit system: SI

Parameter	Value	Unit
Mean ring diameter (centreline)	100.00	mm
Tube (cross-section) diameter	5.0000	mm
Material density (0 to skip mass)	1,200.0	kg/m³

Calculated results

Parameter	Value	Unit
Volume	6.1685	cm³
Surface area	49.348	cm²
Outside diameter	105.00	mm
Inside diameter	95.000	mm
Mass	7.4022	g

Notes for this case

• Pappus–Guldinus: the volume is the cross-section area × the path of its centroid, V = (πd²/4)(πD) = π²Dd²/4, and the surface is the circumference × path, S = π²Dd. For an O-ring the mean diameter is ID + d. Mass = volume × density.

Formula and method

$$V = \frac{\pi^2 D d^2}{4}, \quad S = \pi^2 D d$$

Variables

D	Mean ring diameter (centreline)	m
d	Tube (cross-section) diameter	m
ρ	Material density (0 to skip mass)	kg/m³
V	Volume	m³
S	Surface area	m²
D_o	Outside diameter	m
D_i	Inside diameter	m
m	Mass	kg

Method and standards

Torus.

Assumptions and limits

- Circular cross-section; exact geometry.

References

Pappus–Guldinus theorems

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/general/geometry/torus-volume-surface

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.