Pressure Vessel Empty, Operating and Hydrotest Weight

Empty, operating and water-full (hydrotest) weight of a cylindrical vessel with 2:1 ellipsoidal or hemispherical heads, from its size, thicknesses and densities.

Method: Vessel weights from shell and head geometry; Megyesy; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Inside diameter	2,000.0	mm
Shell length tangent to tangent	6.0000	m
Shell thickness	16.000	mm
Head thickness	16.000	mm
Head type	2:1 ellipsoidal	
Shell material density	7,850.0	kg/m³
Allowance for nozzles, supports, internals	15.000	%
Operating liquid density	850.00	kg/m³
Operating liquid fill	70.000	%

Calculated results

Parameter	Value	Unit
Internal volume	20.944	m³
Empty weight	6.7615	t
Operating weight	19.223	t
Hydrotest (water-full) weight	27.664	t

Notes for this case

• Shell on its mean diameter; head surface ≈ 1.084D² for 2:1 ellipsoidal and πD²/2 for hemispherical heads; head volumes πD³/24 and πD³/12. The allowance covers nozzles, flanges, skirt or saddles and internals; use the vendor drawing weights when available.

Formula and method

$$m_{shell} = \rho\pi(D_i + t_s)t_s L, \quad V = \frac{\pi D_i^2}{4} L + 2V_{head}, \quad m_h = m_e + \rho_w V$$

Variables

D_i	Inside diameter	m
L	Shell length tangent to tangent	m
t_s	Shell thickness	m
t_h	Head thickness	m
head	Head type	-
ρ_s	Shell material density	kg/m³
k_a	Allowance for nozzles, supports, internals	-
ρ_l	Operating liquid density	kg/m³
ϕ	Operating liquid fill	-
V	Internal volume	m³
m_e	Empty weight	kg
m_o	Operating weight	kg

m_h	Hydrotest (water-full) weight	kg

Method and standards

Vessel weights.

Assumptions and limits

- Cylindrical vessel; uniform thicknesses.

References

Vessel weights from shell and head geometry, Megyesy, Pressure Vessel Handbook (Pressure Vessel Publishing)

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/vessels/vessel-empty-full-weight

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.