Displacer Level: Buoyancy Force and Range

Buoyancy force and apparent weight of a level displacer at a level from its diameter, length and the liquid density, and the force change over the range.

Method: Archimedes' principle

Input parameters

Unit system: SI

Parameter	Value	Unit
Displacer diameter	60.000	mm
Displacer length (measuring range)	1.0000	m
Displacer mass	5.0000	kg
Liquid density	850.00	kg/m³
Vapour density above the liquid	1.2000	kg/m³
Level on the displacer (from its bottom)	0.40000	m

Calculated results

Parameter	Value	Unit
Buoyancy at the level	9.4474	N
Apparent weight at the level	39.586	N
Force change over the full range	23.535	N
Level as a share of the range	40.000	%

Notes for this case

- The span is set by the density difference: recalibrate when the liquid changes.

Formula and method

$$F_b = gA[\rho h + \rho_v(L-h)], \quad W_a = mg - F_b, \quad \Delta F = gAL(\rho - \rho_v)$$

Variables

d	Displacer diameter	m
L	Displacer length (measuring range)	m
m	Displacer mass	kg
ρ	Liquid density	kg/m³
ρ_v	Vapour density above the liquid	kg/m³
h	Level on the displacer (from its bottom)	m
F_b	Buoyancy at the level	N
W_a	Apparent weight at the level	N
ΔF	Force change over the full range	N
h/L	Level as a share of the range	-

Method and standards

Archimedes' principle.

Assumptions and limits

- Vertical cylindrical displacer; liquid denser than the vapour.
- A negative apparent weight (the displacer would float) is flagged.

References

- Archimedes' principle

Report details

Report reference	FCC-QED0-9H25 (the same inputs always give the same reference)
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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/instrumentation/pressure-level/displacer-level

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.