Hydraulic Pressure Intensifier: Pressure and Flow

Outlet pressure and flow of a single-acting or reciprocating pressure intensifier from the inlet pressure, area ratio of the two pistons and efficiency.

Method: Force balance on stepped pistons (definitions)

Input parameters

Unit system: SI

Parameter	Value	Unit
Inlet (low) pressure (absolute)	100.00	bar
Large (low-pressure) piston diameter	100.00	mm
Small (high-pressure) piston diameter	40.000	mm
Inlet flow	30.000	L/min
Mechanical efficiency	90.000	%

Calculated results

Parameter	Value	Unit
Area (intensification) ratio	6.2500	
Outlet pressure	557.81	bar
Outlet flow	4.8000	L/min

Notes for this case

- Force balance on the two pistons; leakage neglected in the flow. Rate all high-pressure components for the intensified pressure.

Formula and method

$$p_2 - p_a = \eta(p_1 - p_a)\frac{A_1}{A_2}, \quad Q_2 = Q_1\frac{A_2}{A_1}$$

Variables

p_1	Inlet (low) pressure (absolute)	Pa
D_1	Large (low-pressure) piston diameter	m
D_2	Small (high-pressure) piston diameter	m
Q_1	Inlet flow	m³/s
η	Mechanical efficiency	-
p_a	Atmospheric pressure, 101 325 Pa	Pa
A_1/A_2	Area (intensification) ratio	-
p_2	Outlet pressure	Pa
Q_2	Outlet flow	m³/s

Method and standards

Force and volume balance.

Assumptions and limits

- No leakage.
- Pressures absolute; the backs of both pistons are vented to atmosphere (p_a = 101 325 Pa), so the intensification applies to gauge pressure.

References

- Force balance on stepped pistons (definitions)

Report details

Report reference	FCC-6QCP-M0EE (the same inputs always give the same reference)
Generated	17 November 2026, 19:46 UTC
Calculator	Hydraulic Pressure Intensifier: Pressure and Flow
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	2 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/hydraulics-pneumatics/hydraulic-pressure-intensifier

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.