Orifice and Flow Element Permanent Pressure Loss

Permanent pressure loss of an orifice plate from its diameter ratio and DP (ISO 5167-2 approximation), with the pumping power and yearly energy it costs.

Method: ISO 5167-2:2003 clause on pressure loss (approximation 1 − β^1.9)

Input parameters

Unit system: SI

Parameter	Value	Unit
Diameter ratio d/D	0.60000	
Differential pressure at full flow	250.00	mbar
Volume flow (for the pumping power)	100.00	m³/h
Pump efficiency (for the power)	70.000	%
Running hours in a year	8,000.0	h

Calculated results

Parameter	Value	Unit
Loss as a share of the DP 1 − β^1.9	62.113	%
Permanent pressure loss	155.28	mbar
Pumping power for the loss	0.61620	kW
Energy in a year	4,929.6	kWh

Notes for this case

- The energy assumes the full-flow loss for all running hours, so it is an upper bound: at part flow the loss falls with the square of the flow.
- ISO 5167-2 gives 1 − β^1.9 as an approximation for orifice plates; venturi tubes lose only about 5 to 20 % of their DP.

Formula and method

$$\frac{\Delta\omega}{\Delta p} \approx 1 - \beta^{1.9}, \quad P = \frac{Q\,\Delta\omega}{\eta}$$

Variables

β	Diameter ratio d/D	-
Δp	Differential pressure at full flow	Pa
Q	Volume flow (for the pumping power)	m³/s
η	Pump efficiency (for the power)	-
t	Running hours in a year	s
$\Delta\omega/\Delta p$	Loss as a share of the DP 1 − β^1.9	-
$\Delta\omega$	Permanent pressure loss	Pa
P	Pumping power for the loss	W
E	Energy in a year	J

Method and standards

ISO 5167-2 approximation.

Assumptions and limits

- Sharp-edged orifice.
- Annual energy at the full-flow loss for every running hour: an upper bound when the flow varies (the loss falls with flow squared).

References

- ISO 5167-2:2003 clause on pressure loss (approximation 1 − β^1.9)

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/instrumentation/flow/orifice-permanent-pressure-loss

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.