Pump Temperature Rise (Minimum Flow Check)

Temperature rise of the liquid through a pump from its head and efficiency, and the heat the losses put into the liquid: the check behind minimum-flow lines.

Method: Karassik et al.; Pump Handbook (temperature rise); IAPWS-IF97 (source of the water c_p values quoted in the help text)

Input parameters

Unit system: SI

Parameter	Value	Unit
Head at the operating point	900.00	m
Pump efficiency at the operating point At low flow the efficiency falls steeply; read it from the maker's curve at that flow.	70.000	%
Specific heat of the liquid Water: 4.18 kJ/(kg·K) at 20 °C, 4.23 at 105 °C, 4.31 at 150 °C.	4.2300	kJ/(kg·K)
Flow at the operating point	65.000	m³/h
Liquid density	955.00	kg/m³

Calculated results

Parameter	Value	Unit
Temperature rise through the pump	0.89422	K
Loss energy per kg of liquid	3.7826	kJ/kg
Heat put into the liquid	65.223	kW

Formula and method

$$e = g\,H\left(\frac{1}{\eta} - 1\right) \qquad \Delta T = \frac{e}{c_p} \qquad P_{heat} = \rho\,Q\,e$$

Variables

H	head at the operating point	m
η	pump efficiency at the operating point	–
c_p	specific heat of the liquid	J/(kg·K)
Q	flow at the operating point	m³/s
ρ	liquid density	kg/m³
ΔT	temperature rise through the pump	K
e	loss energy per kg of liquid	J/kg
P_{heat}	heat put into the liquid	W
g	standard gravity, 9.806 65	m/s²

Method and standards

Energy balance on the pump: the shaft power not delivered as head (the losses) heats the liquid passing through, as given in Karassik's Pump Handbook. The specific heat is your input; the water values quoted in the help text are IAPWS-IF97 values. The calculator does not look up properties itself.

Assumptions and limits

- All losses go into the pumped liquid; bearing and seal losses and heat to the casing are neglected (conservative).
- The calculator does not compare ΔT with the margin to flashing: check that the suction temperature plus ΔT stays below the saturation temperature at the pump's internal pressure (use the NPSH available calculator for the suction margin).
- The minimum flow itself comes from the maker; this calculator checks the rise at a flow and efficiency you enter.

References

- Karassik et al.
- Pump Handbook (temperature rise); IAPWS-IF97 (source of the water c_p values quoted in the help text)

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/mechanical/pumps/pump-temperature-rise

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.