Two-Stage Refrigeration: Optimum Intermediate Pressure

Intermediate (interstage) pressure for a two-stage or compound refrigeration system by the geometric mean rule, with overall and per-stage pressure ratios.

Method: Geometric-mean interstage pressure p_i = √(p_ep_c) (ASHRAE Handbook—Refrigeration (2018), ch. 2, multistage systems)

Input parameters

Unit system: SI

Parameter	Value	Unit
Evaporating pressure (absolute)	0.93000	bar
Condensing pressure (absolute)	15.500	bar

Calculated results

Parameter	Value	Unit
Intermediate pressure	3.7967	bar
Overall pressure ratio	16.667	
Pressure ratio per stage	4.0825	

Notes for this case

- The geometric mean gives equal stage ratios and near-minimum work; the true optimum is a little higher for ammonia with an intercooler. Pressure ratios above about 8–10 in one stage call for two stages.

Formula and method

$$p_i = \sqrt{p_e p_c}, \quad r_s = \sqrt{\frac{p_c}{p_e}}$$

Variables

p_e	Evaporating pressure (absolute)	Pa
p_c	Condensing pressure (absolute)	Pa
p_i	Intermediate pressure	Pa
p_c/p_e	Overall pressure ratio	-
r_s	Pressure ratio per stage	-

Method and standards

Equal pressure ratio.

Assumptions and limits

- Ideal gas; equal stage efficiency.

References

- Geometric-mean interstage pressure p_i = √(p_ep_c) (ASHRAE Handbook—Refrigeration (2018), ch. 2, multistage systems)

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/hvac/refrigeration/two-stage-intermediate-pressure

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.