Condenser Heat Rejection and Heat Rejection Factor

Heat a refrigeration condenser must reject from the evaporator load and compressor power (open or hermetic), the heat rejection factor and the condenser water flow.

Method: ASHRAE Handbook—Refrigeration (2018); ch. 39 (condensers: Q_c = Q_e + W)

Input parameters

Unit system: SI

Parameter	Value	Unit
Refrigeration capacity	350.00	kW
COP on compressor shaft power	4.5000	
Compressor type	Open drive (motor outside)	
Motor efficiency	92.000	%
Condenser water temperature rise	5.0000	K

Calculated results

Parameter	Value	Unit
Compressor shaft power	77.778	kW
Condenser heat rejection	427.78	kW
Heat rejection factor Q_c/Q_e	1.2222	
Condenser water flow	73.579	t/h

Notes for this case

- In hermetic compressors the motor losses are absorbed by the refrigerant and also go to the condenser. Oil coolers and desuperheaters reduce condenser duty when heat is taken separately.

Formula and method

$$Q_c = Q_e + W\ \text{(open)},\quad Q_c = Q_e + \frac{W}{\eta_m}\ \text{(hermetic)},\quad HRF = \frac{Q_c}{Q_e},\quad \dot{m}_w = \frac{Q_c}{c_p \Delta T_w},\ c_p = 4186\ \text{J/(kg K)}$$

Variables

Q_e	Refrigeration capacity	W
COP	COP on compressor shaft power	-
compressor	Compressor type	-
η_m	Motor efficiency	-
ΔT_w	Condenser water temperature rise	K
W	Compressor shaft power	W
Q_c	Condenser heat rejection	W
HRF	Heat rejection factor Q_c/Q_e	-
$\dot{m}_w$	Condenser water flow	kg/s

Method and standards

Energy balance.

Assumptions and limits

- Steady state; heat lost from the compressor shell and discharge line is ignored (all compressor work goes to the condenser).
- Condenser water c_p 4186 J/(kg·K).

References

• ASHRAE Handbook—Refrigeration (2018)
• ch. 39 (condensers: Q_c = Q_e + W)

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/condenser-heat-rejection

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.