Ice Bank (Ice Builder) Sizing

Ice to build for a peak cooling demand above the chiller's direct capacity, the ice-building refrigeration over the charging hours, and the ice volume.

Method: Mass and energy balances (definitions); latent heat of fusion 333.55 kJ/kg and ice density 916.7 kg/m³ at 0 °C

Input parameters

Unit system: SI

Parameter	Value	Unit
Peak cooling load	500.00	kW
Duration of the peak	4.0000	h
Load met directly by the chiller during the peak	150.00	kW
Ice-building hours	16.000	h
Margin on ice	15.000	%

Calculated results

Parameter	Value	Unit
Cooling to store as ice	1,610.0	kWh
Ice to build	17.377	t
Ice volume	18.956	m³
Ice-building refrigeration	100.62	kW

Notes for this case

- Ice-building compressors run at low suction temperature, so their capacity is below the chiller's rating.

Formula and method

$$E = \max(Q_p - Q_d, 0)\, t_p (1 + f_s), \quad M_i = \frac{E}{\lambda_f}, \quad \dot{Q}_c = \frac{E}{t_c}$$

Variables

Q_p	Peak cooling load	W
t_p	Duration of the peak	s
Q_d	Load met directly by the chiller during the peak	W
t_c	Ice-building hours	s
f_s	Margin on ice	-
E	Cooling to store as ice	J
M_i	Ice to build	kg
V_i	Ice volume	m³
$\dot{Q}_c$	Ice-building refrigeration	W

Method and standards

Latent heat storage balance.

Assumptions and limits

- All stored ice melts in the peak. Only latent heat is counted: the sensible cooling of the returning water to 0 °C and the tank's heat gains while building are left to the margin f_s.
- When the chiller covers the peak the ice is zero and a note says so.

References

- Mass and energy balances (definitions); latent heat of fusion 333.55 kJ/kg and ice density 916.7 kg/m³ at 0 °C

Report details

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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/chemical/food-dairy/ice-bank-sizing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.