Air-Cooled Modular Ice Storage

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Ice storage technology utilizes off-peak electricity at night to produce ice for cooling storage, then releases cooling during peak daytime hours by melting the ice.

This balances grid load and reduces air conditioning operating costs for users, and has been widely adopted in large central air conditioning systems.

However, ice storage systems are more complex than conventional air conditioning systems, requiring specialized design, installation, and commissioning, which limits their application in small-to-medium-scale projects.

Additionally, the low ice storage temperature reduces refrigeration efficiency.
Both ice production and melting require glycol pump operation, and its "cost-saving but less energy-efficient" nature restricts its use in regions with minimal peak/off-peak electricity price differentials.

The air-cooled modular ice storage system standardizes ice storage engineering into a packaged product. With high integration, it only requires simple piping connections, power, and water supply for operation, making it ideal for small-to medium-scale projects.

Advantages of Air-Cooled Modular Ice Storage

Compared to traditional water-cooled ice storage system, the air-cooled modular system offers the following benefits:

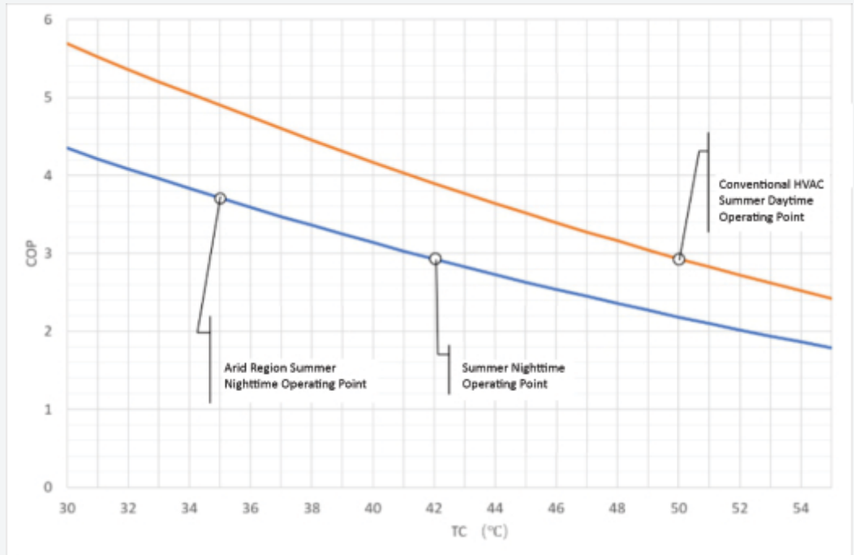
Standardized engineering: Reduces design, installation, and commissioning efforts, better suited for small-to -medium projects.

Lower glycol pump energy consumption: Improves system efficiency by over 10%.

Eliminated intermediate heat exchange: Enhances refrigeration efficiency by 5%+.

Utilizes diurnal temperature differences: Achieves equivalent efficiency in ice storage and refrigeration modes.

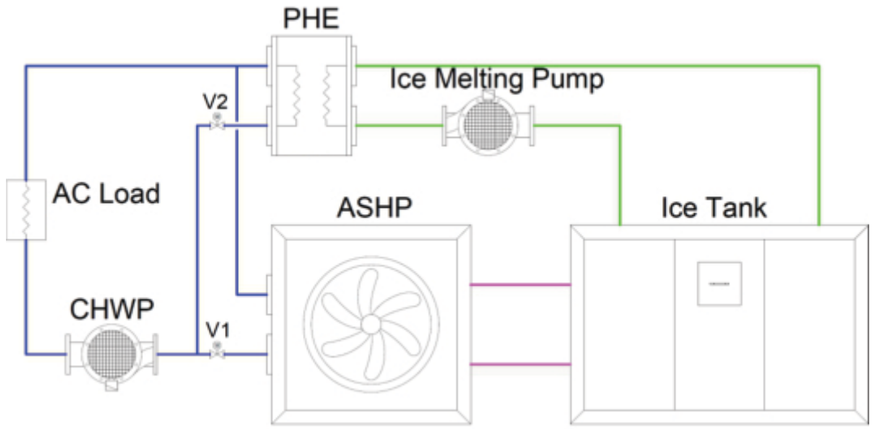
- Traditional water-cooled systems: Condensing temperature depends on wet-bulb temperature (diurnal ΔT ≈1°C).
- Air-cooled modular systems: Condensing temperature aligns with ambient temperature.
  - Subtropical climates: Diurnal ΔT >8°C → Ice storage efficiency matches refrigeration efficiency.
  - Arid regions: Diurnal ΔT >15°C → COP increases by nearly 30% due to lower condensing temperatures.



Compressor COP curve showing variations with evaporating/condensing temperatures

System Process & Control

System Flow Diagram



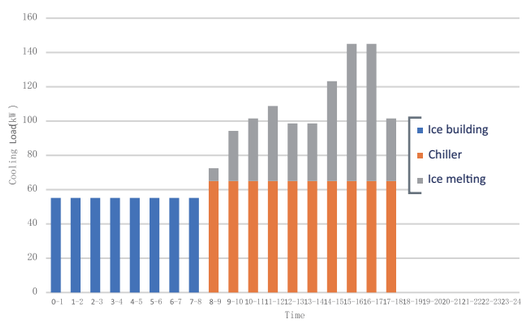
Operational Mode Control Matrix

Operational Mode		Ice Buildin	Chiller Cooling	Ice Cooling	Chiller-Ice Hybrid Cooling
Equipment Status	ASHP	Ice Charging Mode	Ice Charging Mode	Standby	Chiller Cooling Mode
	Ice Tank	Running	Standby	Running	Running
	CHWP	Standby	Running	Running	Running
	Ice Melting Pump	Standby	Standby	Running	Running
	PHE	Standby	Running	Running	Running
	V1	Closed	Open	Closed	Open
Valve Position	V2	Closed	Closed	Open	Open

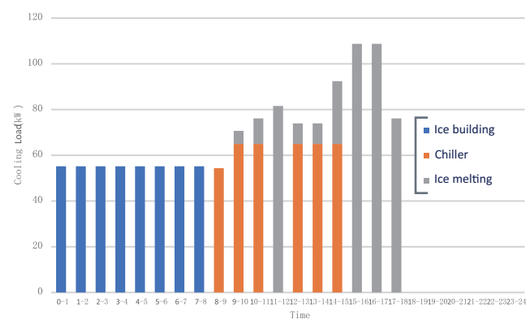
Operation Modes

Cooling Load Threshold	Cooling Strategies			
	highest tariff	On-Peak	Shoulder	Off-Peak
100%Q-design	Chiller Priority	Chiller Priority	Chiller Priority	Ice building
75%Q-design	Ice melting	Ice Priority	Chiller Priority	Ice building
50%Q-design	Ice melting	Ice melting	Ice Priority	Ice building
50%Q-design	Ice melting	Ice melting	Ice melting	Ice building

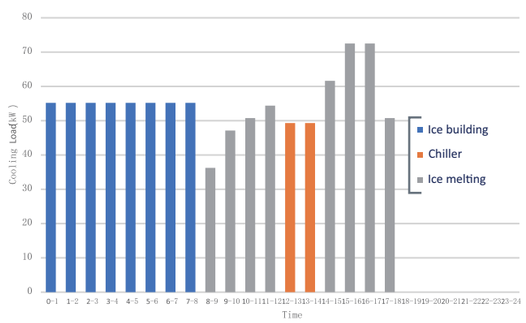
100% Q-design Cooling Strategies



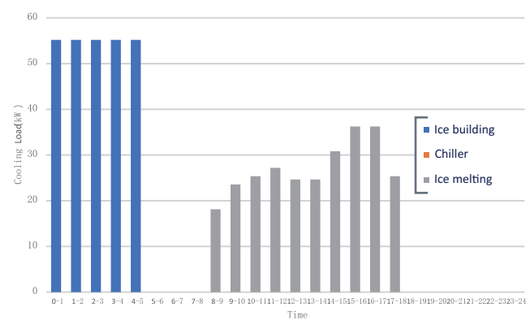
25% Q-design Cooling Strategies



25% Q-design Cooling Strategies



25% Q-design Cooling Strategies



Equipment Installation & Layout

Foundation Requirements

Concrete Base Specifications

- Strength grade: ≥C30 concrete
- Thickness: ≥300mm
- Dimensions: Extend ≥200mm beyond equipment base perimeter
- Flatness tolerance: ≤±3mm/m², with total plane deviation ≤5mm

Drainage Provisions

Install perimeter drainage trenches with ≥2% slope

(to prevent water accumulation)

Roof Installation Precautions

- Structural engineer must verify roof load capacity:
  - Total live load (equipment + water weight) ≤ roof design load
  - Safety margin ≥1.5× operating weight (recommended)
- For existing roofs: Conduct waterproofing integrity inspection

Equinpment Handling

Lifting & Transport

- Use forklifts or cranes with:
  - Anti-slip pallets/load-rated slings (SWL ≥1.5× equipment weight)
  - Forklift forks ≥2/3 equipment width
- Ensure balanced load distribution during hoisting

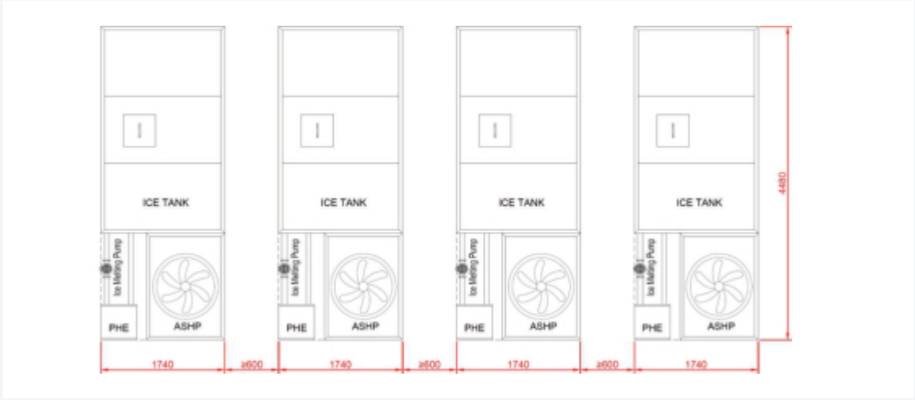
Crane Selection Criteria

Match crane capacity to lifting height/boom length

Operation Modes

Equipment Arrangement

Minimum 600mm clearance between adjacent units as shown in Figure below



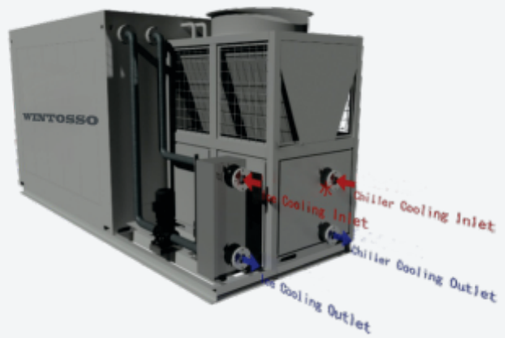
Piping Connections

Piping Connections

The integrated air-cooled modular ice storage unit contains factory prefabricated internal piping. Only external chilled water piping connections are required.

Each unit features 4 standardized external interfaces:

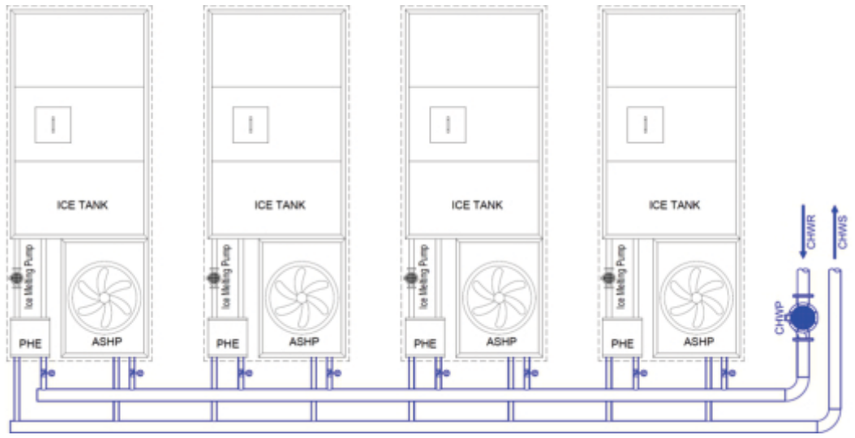
Chiller Cooling Inlet- Chiller Cooling Outlet- Ice Melting Cooling Inlet and Ice Melting Cooling Outlet（As shown in the following figure)

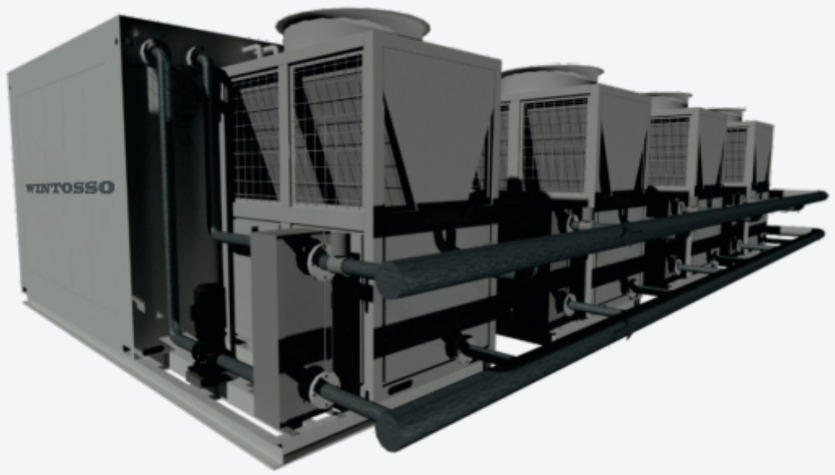


Equipment Installation & Layout

Foundation Requirements

The piping configuration for multiple modular ice storage units is illustrated in the diagram below.





Selection Parameters Table

Model	RC-140
Rated Cooling Capacity	140kW
Rated Power Input	23kW
Rated Current	46A
Maximum Power Input	30.3kW
Maximum Current	65A
Rated Outlet Water Temperature	7℃
Maximum Water Flow Rate	25m³/h
Water Pressure Drop	≤80kPa
Overall Dimensions	4480*1740*2200(mm)
Connection Size	DN50
Net Weight	2400kg
Gross Weight	2500kg
Operating Weight (Water-filled)	10500kg
Power Supply	380VAC50HZ