H.Stars Group

H.Stars Ice Cold Storage Integrated Equipment

H.Stars (Guangzhou) Refrigerating Equipment Group Ltd.

ISO ISO9000

Company Profile

H.Stars (Guangzhou) Refrigerating Equipment Group Ltd. is a foreign invested enterprise founded in 1992. Based in Guangzhou Economic & Technological Development District, it is an important member of H. Stars (Hong Kong) Group and a professional producer of refrigeration equipment, air-conditioner, and industrial cooling and heating equipment, with the capacity of designing and manufacturing a whole range of special equipment. The company has established itself as a leader in the industry with its long history and rich experience.

The company's main products include refrigeration equipment, air-conditioning equipment, industrial cooling equipment, air handling equipment and various customized equipment (explosion-proof equipment, anti-corrosion equipment, purification equipment, ultra-low temperature equipment, high temperature hot water equipment, heat recovery equipment, cold recovery equipment, and energy-saving equipment).

From the very beginning of its establishment, the company adopted American standards and manufacturing technology and focused on industrial refrigeration equipment. With sophisticated machinery and high quality services, it created the brand of H Stars, has gained recognition and support of the clients, and enjoys high brand reputation and technological leadership in the trade.

- *30+ years of experience in intelligent manufacturing of special equipment*
- *Four major factories and industry chains*
- *Professionally Dedicated to industrial air conditioners*

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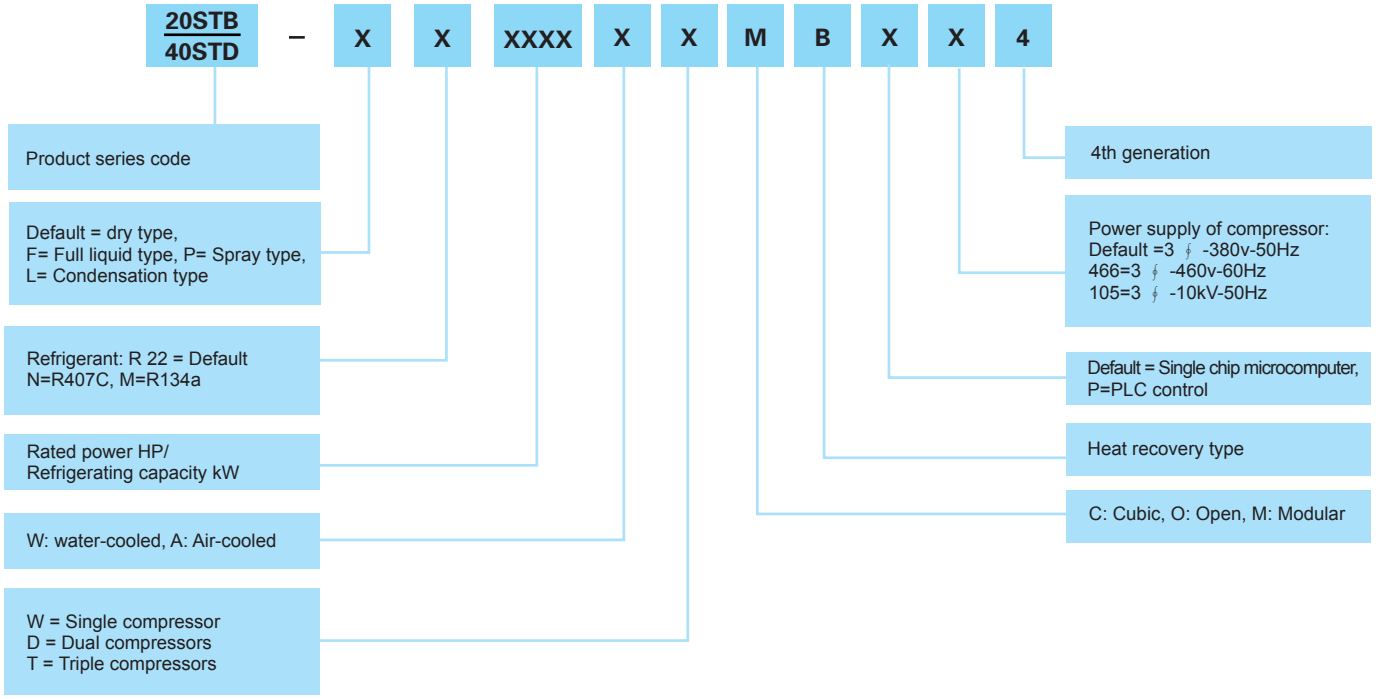
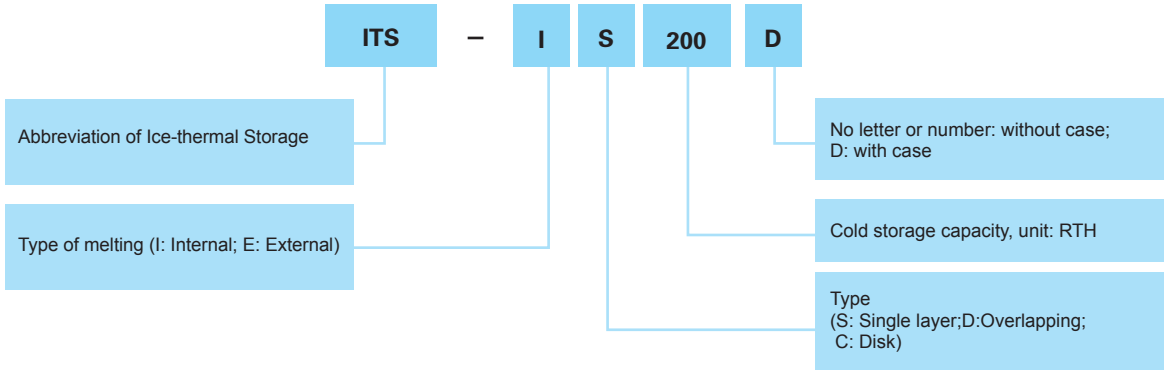


Naming of ice bank



Development history of ice cold storage technology

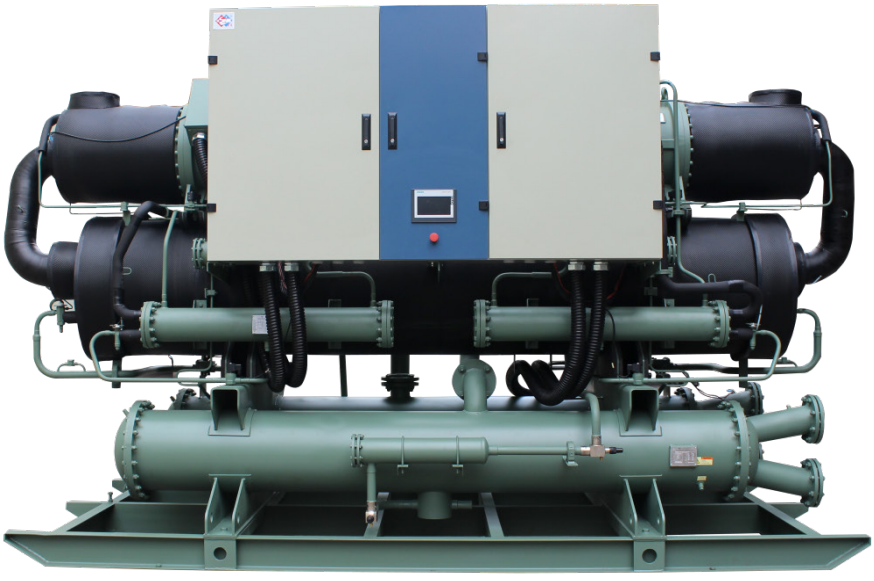
The use of artificial refrigeration for cold storage technology in air conditioning began around 1930 in human society. The global energy crisis in the 1960s and 1970s sent the development of ice cold storage technology to fast track; it was first used as a peak regulation method in electric load management in the United States and Europe and found applications in air-conditioning of buildings; and the 1980s witnessed a wide use of the technology. Economically developed countries such as Europe, America and Japan began research and development of the technology and its applications from early years of 1980s, which resulted in further improvement and upgrade of the cold-storage air-conditioning technology and its vigorously use in specific areas.

Ice cold storage technology and equipment were first introduced to China in early 1990s. With the policy support of government, ice cold storage technology has been widely used in various industries and fields, playing fully to its advantages in energy saving.

Technology principles

Ice cold storage is such a technology that when electricity price is low at night refrigeration unit is used to make ice, which stores cold energy and is kept in the ice storage device, and during daytime peak period of power consumption, the ice melt into low-temperature water for cooling purpose.

It is a multi-purpose technology that can be used to achieve reduction of air-conditioning operating costs by taking advantage of peak-valley price difference, to produce industrial refrigeration process water, to improve air-conditioning performance and reduce installed capacity required.



Dual-mode cold storage unit

Functions	Applications
○ Take advantage of regional power supply policies to "shave peaks and fill valleys", making ice at night when electricity price is low, and melting ice for cooling when daytime electricity price is high.	○ Suitable for scenarios of cooling demand and process demand in regions where the peak-to-valley electricity price ratio is greater than or equal to 2.5:1.
○ Reduce installed capacity required and supporting facilities, and reduce investment in power distribution.	○ Suitable for scenarios of restricted power grid supply or cost control.
○ Dual-mode refrigeration unit can meet needs of air-conditioning and ice making with just one machine.	○ Suitable for scenarios where ice cold storage air-conditioning and industrial refrigeration are both required.
○ Emergency function: ice in the ice tank can maintain constant cooling supply to effectively prevent losses due to shutdown of supply and production caused by failure of the unit, and ensure safe operation of the system.	○ Suitable for sites where important production processes, production lines, refrigeration houses and important office spaces are located, and may reduce mobilization of spare equipment.
○ The cold storage system can provide a constant supply of low temperature water of 1-4℃ to realize cooling with large temperature difference.	○ Suitable for cooling in precision equipment, food industry, milk processing and other industries.

Incomplete-frozen ice tank

The cold storage refrigeration unit is specially developed based on ice cold storage technology to combine air conditioning and ice making functions. It can be used to produce 7~12 ℃ air-conditioning cooling water or -5~8 ℃ water for ice making. This dual function equipment is automatically controlled. It can be automatically switched between the two modes according to demand. Being developed, designed and manufactured by H. Stars (Guangzhou) Refrigerating Equipment Group Ltd., the company owns all intellectual property rights and core manufacturing technology of the refrigeration unit, which means it can design, configure and customize the equipment according to project needs, integrate extensive functions, and provide multi-purpose products and focused services to smart customers.

Dual-mode centrifugal unit

Dual-mode screw-type unit

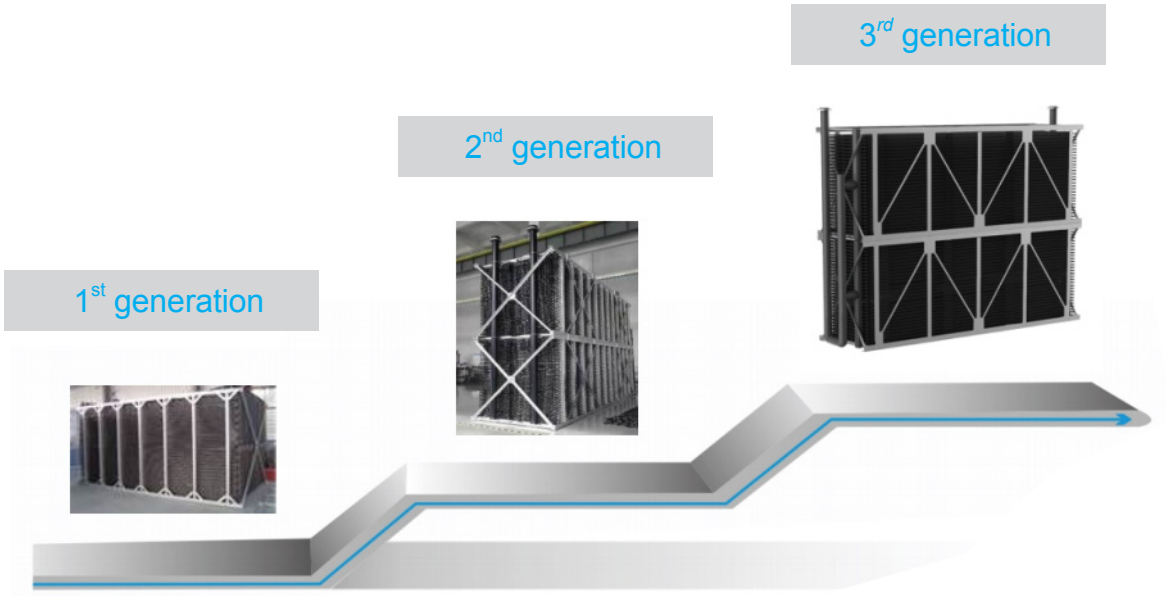
Important materials

○ Select high-efficiency screw-type or centrifugal compressor according to project nature
○ Use self-developed and manufactured special dual-mode heat exchanger
○ Use self-developed dual-mode special controller
○ Use extra-thick copper heat exchange tube or anti-corrosion tube
○ Special refrigerator oil from original manufacturer
○ Eco-friendly refrigerant

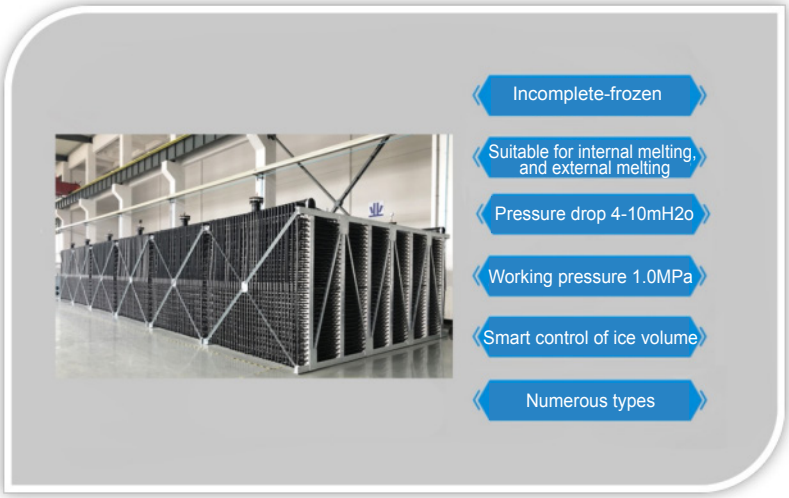
Heat exchanger

A variety of copper tubes are available

Development history of ice storage device



Characteristics of ice storage unit

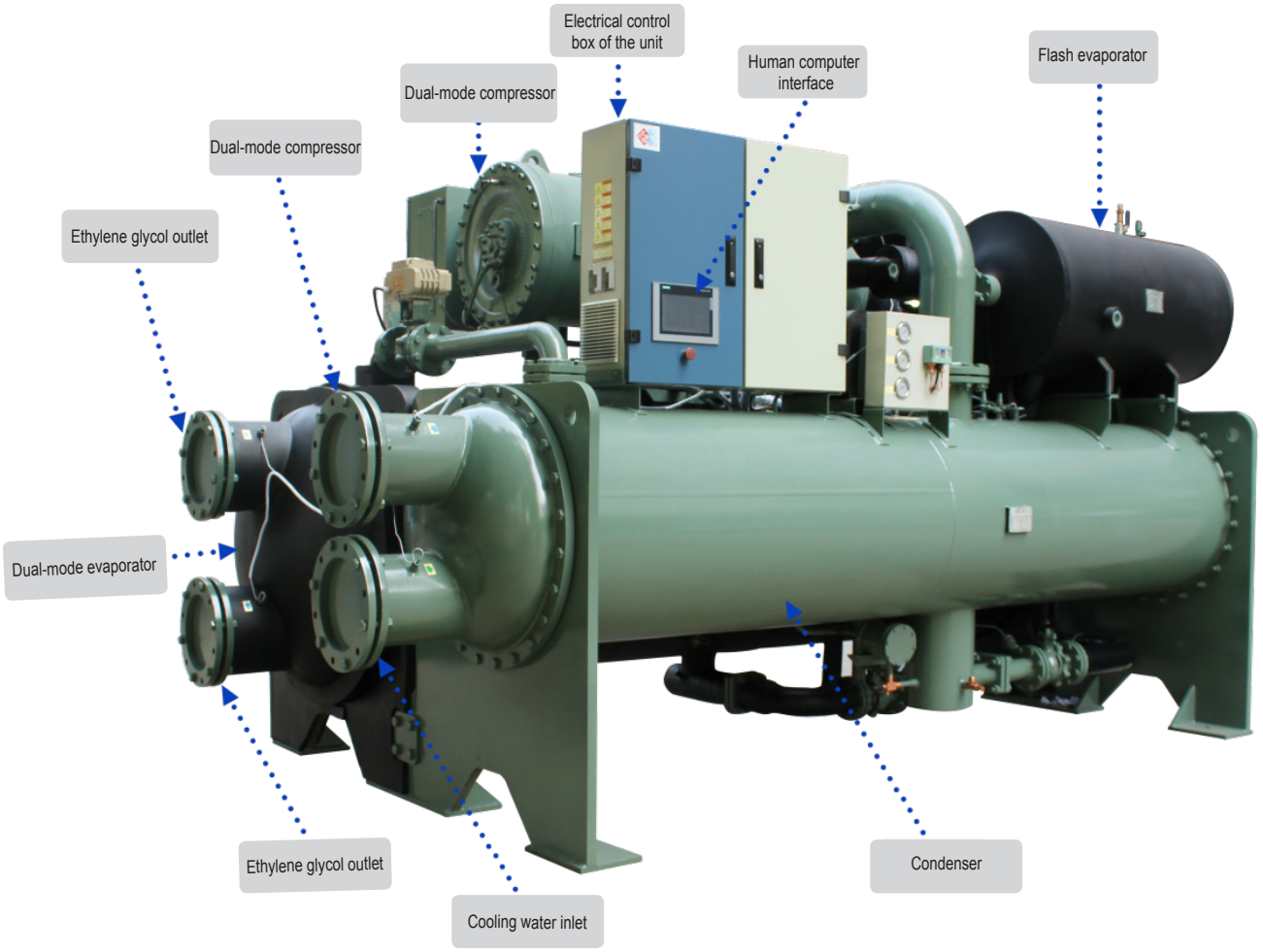


New-type materials

Yuan™ composite coil has a thermal conductivity of 2.14W/(mK), which is 8-10 times higher than that of ordinary plastic ones, and is equivalent to that of ice 2W/(mK), so it fully meets the heat exchange requirements of incomplete frozen ice coil for icing and melting. Without being corroded in water, it has reliability far better than metal coils; it has a design life of more than 50 years; it can withstand the expansion force generated during the icing process, therefore no worrying about excessive icing.

H. Stars dual-mode refrigeration unit is specially designed and manufactured for ice cold storage by H. Stars Refrigerating Equipment with its indigenous intellectual property rights. In addition to regular functions of refrigeration and ice making, the unit can also recover heat generated during cooling to provide 55~60℃ hot water.

Structure schematic of refrigeration unit



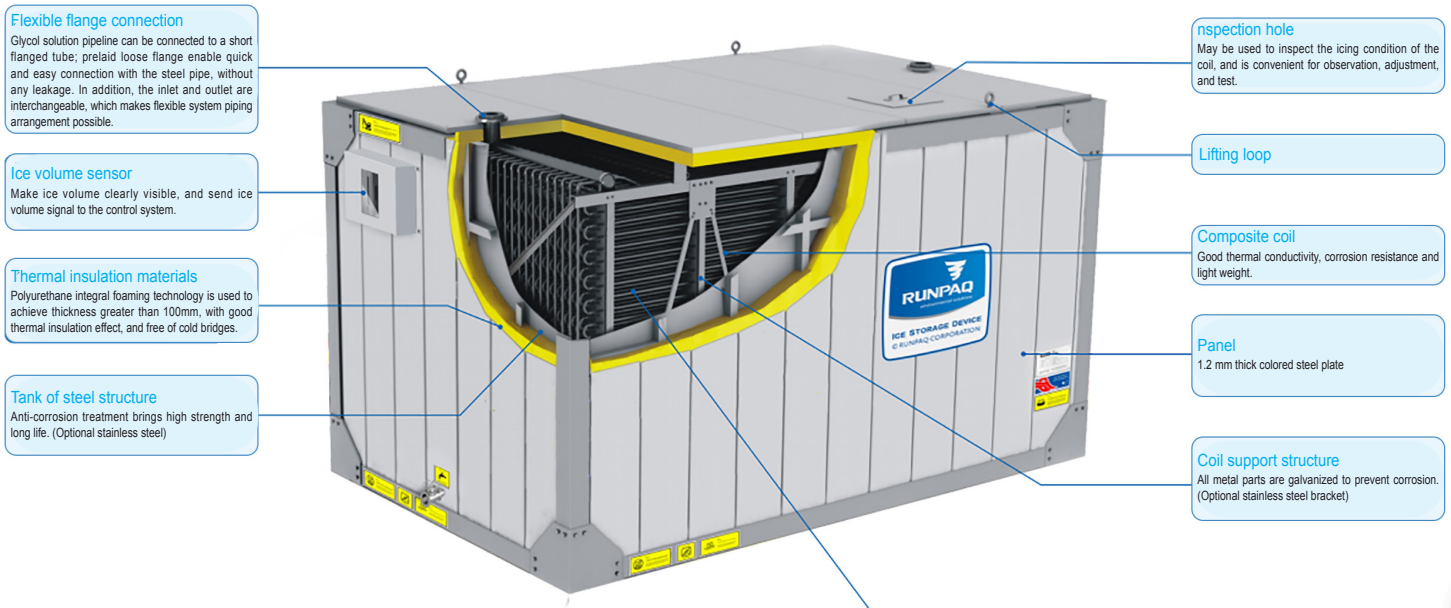
Dual-mode refrigeration unit

Structure schematic of ice storage unit

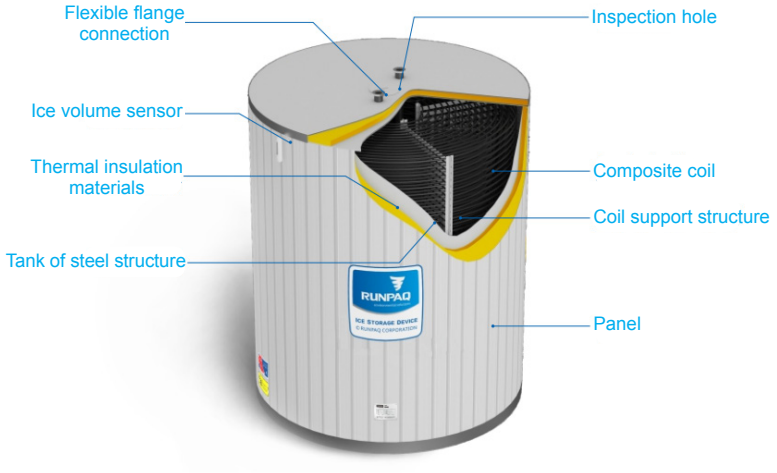
Ice storage unit is important for ice cold storage. We adopt the only patented technology and materials in the world keep our icing and melting technologies advanced and efficient.

The integrated design of ice tank enables quick installation, and a long service life of up to 40 years.

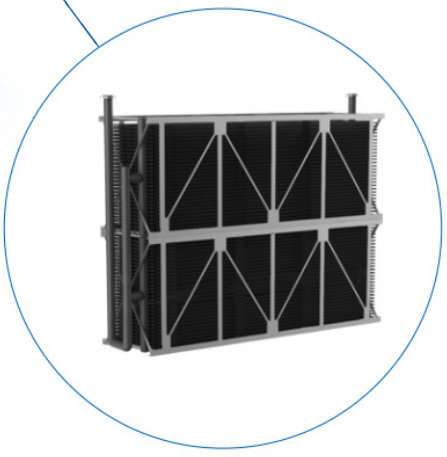
Ice tank structure diagram



Cubic ice tank



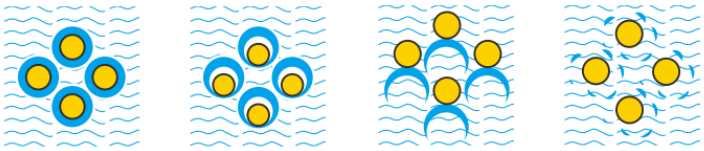
Cylinder ice tank



Heat exchange coil

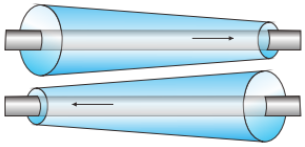
Incomplete-frozen design

The coil adopts a unique configuration of bidirectional countercurrent arrangement, where the fluid in a pipe flows at the opposite direction of that next to it. Since the ice layer at the entrance of the coil is thick, and the ice layer at the exit is thin, the final icicles tend to be in the shape of a cone. The unique configuration makes more effective use of the ice tank space. It is an incomplete frozen ice storage device, where at the end of ice making cycle, there are still gaps between the ice layers that are filled with water at 0°C, so there will be no bridges between ice layers. It can be used in both internal ice melting system and external ice melting system.



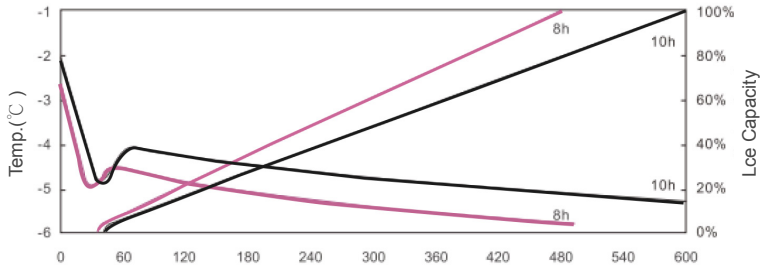
Schematic diagram of coil ice melting

Countercurrent flow



Conical ice layer

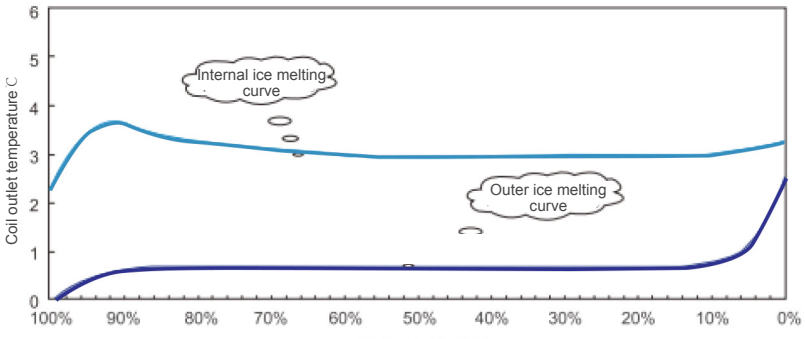
Excellent ice making performance



Ice making performance curve of composite coil

The composite coil has thin ice thickness, low total thermal resistance, and high heat transfer coefficient, making the refrigeration unit high in operating efficiency in ice making. At the same time, the coil's patented structure design (patent No. ZL02265320.1) results in a large specific heat exchange area, and hence excellent heat transfer performance. Temperature at the outlet of the refrigeration unit is about -5.6℃ when ice making is completed in 8 hours.

Efficient ice melting



Ice making performance curve of composite coil

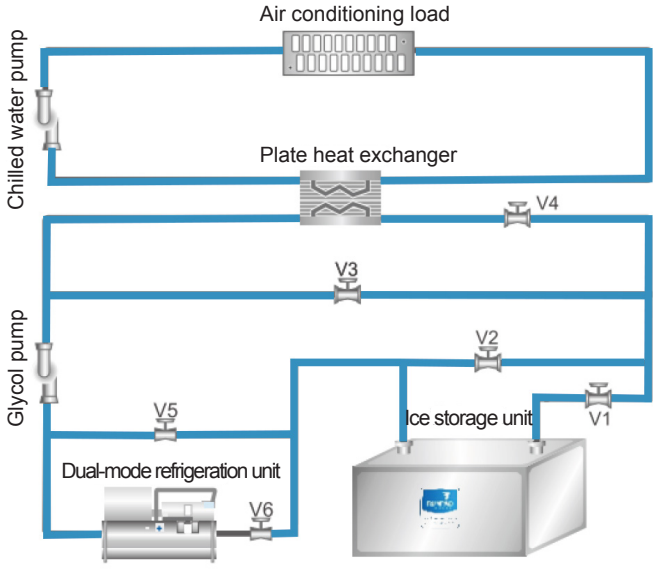
The composite coil for internal ice melting adopts an incomplete frozen approach to ensure stable melting rate and refrigerant outlet temperature; it can provide low temperature solution of 3~4 ℃ . The system has a large temperature difference, which can minimize the capacity of other equipment in the system reducing the initial investment and the energy consumption of the system.

The composite coil for external melting is optimized to ensure good ice-making performance; water and air flow channels are formed during ice melting, which maximizes the use of space. In the case of external ice melting, the melted water is in direct contact with the ice; the heat exchange area of the composite coil is about 30% larger than other similar products, so the ice melting performance is significantly improved, resulting in high heat exchange efficiency and fast ice melting speed to provide water below 1 ℃ . It is especially suitable for local cooling systems and low-temperature air supply systems.

Procedures of ice cold storage system

Ice storage unit with composite coil is selected for various air conditioning load requirements of different buildings; of the various system designs, four are especially recommended to use: upstream internal ice melting system of series single-stage pump, upstream internal ice melting system of series two-stage pump, upstream external ice melting system of series single-stage pump, and upstream external ice melting system of series two-stage pump

Upstream internal ice melting system of series single-stage pump



Schematic of the upstream internal ice melting system of series single-stage pump

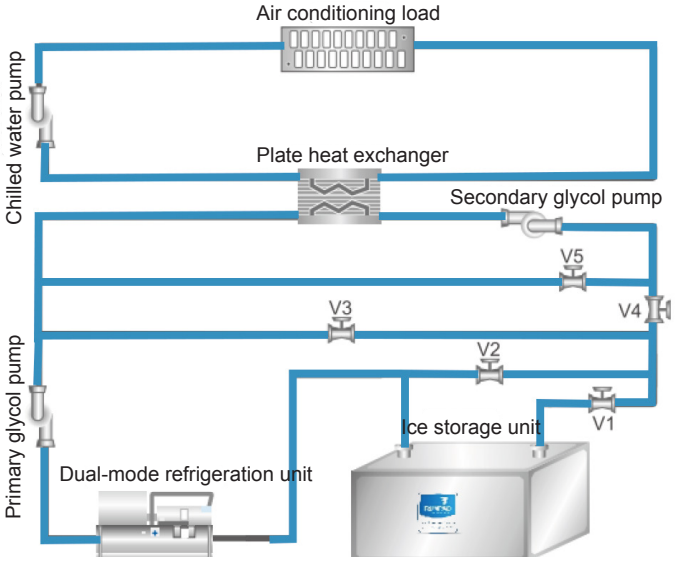
Function in operation	Equipment status			Valve status		
	Dual-mode refrigeration unit	Glycol pump	Chilled water pump	Open	Regulating	Close
Ice making by refrigeration unit	Running	Running	Stop			
Ice melting for cooling	Stop	Running	Running		v1.v2.v3.v4	
Cooling by the main machine	Running	Running	Running		v3.v4	
Combined cooling	Running	Running	Running		v1.v2.v3.v4	

Suitable scenarios

Category 1: No cooling need during electricity valley period at night

Category 2: Certain cooling load during electricity valley period at night, which is satisfied by the main machine

Upstream internal ice melting system of series two-stage pump



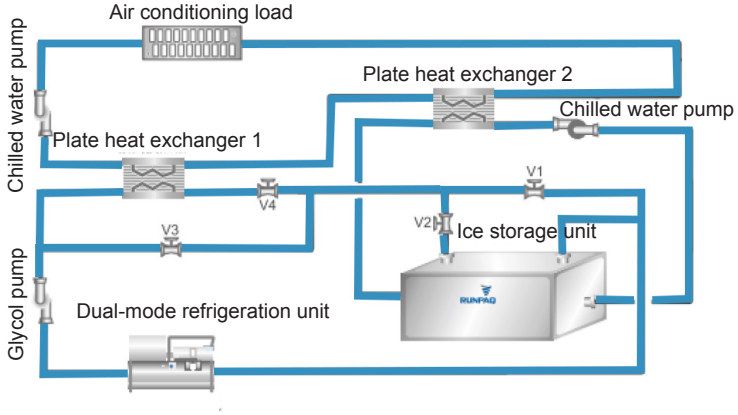
Schematic of the upstream internal ice melting system of series two-stage pump

Function in operation	Equipment status				Valve status		
	Dual-mode refrigeration unit	Primary glycol pump	Secondary glycol pump	Chilled water pump	Open	Regulating	Close
Ice making by the main machine	Running	Running	Stop	Stop	v1.v3		v2.v4.v5
Ice melting for cooling	Stop	Running	Running	Running		v1.v2.v3.v4	v5
Cooling by the main machine	Running	Running	Running	Running	v2	v3.v4	v1.v5
Combined cooling	Running	Running	Running	Running		v1.v2.v3.v4	v5
Ice making and cooling by the main machine	Running	Running	Running	Running	v1.v3	v4.v5	v2

Suitable scenarios

Ice cold storage system with extra high resistance of glycol circulation

Upstream external ice melting system of series connection



Schematic of the upstream external ice melting system of series connection

Function in operation	Equipment status				Valve status		
	Dual-mode refrigeration unit	Glycol pump	Chilled water pump	Chilled water pump	Open	Regulating	Close
Ice making	Running	Running	Stop	Stop	v2.v3		v1.v4
Ice making and cooling	Running	Running	Operation at variable frequency	Running	v2.v3		v1.v4
Internal ice melting only	Stop	Running	Stop	Running		v1.v2.v3.v4	
External ice melting only	Stop	Stop	Operation at variable frequency	Running			
Cooling by refrigeration unit only	Running	Running	Stop	Running	v1.v4		v2.v3
Joint cooling by refrigeration unit and external ice melting	Running	Running	Operation at variable frequency	Running	v1.v4		v2.v3
Joint cooling by internal and external ice melting	Stop	Running	Operation at variable frequency	Running	v4	v1.v2	V3
Joint cooling by refrigeration unit, and internal and external ice melting	Running	Running	Operation at variable frequency	Running	v4	v1.v2	V3
Joint cooling by refrigeration unit, and internal and external ice melting	Running	Running	Operation at variable frequency	Running	v4	v1.v2	V3

Suitable scenarios

Cooling system for large temperature difference, low temperature cooling system, or local cooling system

Layout requirements

The composite-coil ice storage unit is compactly designed, using patented technology in the internal structure. The unit is accessible for maintenance at the upper part; a space of 900mm must be reserved at the upper part during installation for the convenience of pipe connection and maintenance. The ice storage unit must be installed on a horizontal concrete foundation with flat and level surface, and the inclination of the plane should be less than 1‰. The composite-coil ice storage unit comes in different types: integrated single layer,

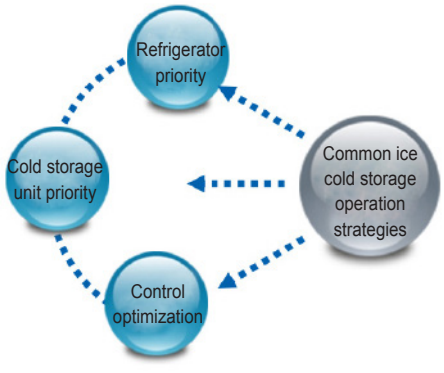
single-layer coil, and overlapping coil.

Operation strategies of ice cold storage system

Refrigerator priority: Set the temperature of the refrigeration unit outlet and run it at full load or at preset cooling capacity. Adjust the flow rate of the cold storage unit to achieve a constant water supply temperature when the air conditioning load exceeds the capacity of the refrigeration unit .

Cold storage unit priority: Set the incoming and outgoing flow rates of the cold storage unit, and run it at full load or at preset cooling capacity. Turn on and run the refrigeration unit to achieve constant water supply temperature when the load of the air conditioning system exceeds the cooling capacity.

Control optimization: based on predicted building load, capacity and characteristics of the cold storage unit, local electricity price structure and other factors, the most optimal method is used to determine the loads of the refrigeration unit and the ice storage unit at different times, so as to guide the stable operation of the system.



Performance parameters of integrated internal melting ice storage unit

Model	ITSI-S910D	ITSI-S828D		ITSI-S745D		ITSI-S610D		ITSI-S499D		ITSI-S427D	ITSI-S313D
		A	B	A	B	A	B	A	B		
Ice storage capacity (RTh)	910	828	828	745	745	610	610	499	499	427	313
L (mm)	6800	6800	6230	6800	6900	6800	6165	5165	5165	5870	4500
W (mm)	3000	2760	300	2520	3000	2520	3000	2520	2520	2520	3000
H (mm)	3176	3176	3176	3176	2696	2696	2936	2936	2616	2936	2376
Net weight (Ton)	10.5	9.9	9.7	9.2	9.2	8.0	7.7	6.7	6.9	5.9	4.8
Operational weight (Ton)	61.3	56.3	56.1	51.2	51.2	42.8	42.5	35.5	35.7	30.9	23.6
Glycol solution volume (m^3)	3.0	2.7	2.7	2.4	2.4	2.0	2.0	1.6	1.6	1.4	1.0
Flow rate (m^3/h)	115.6	105.1	105.1	94.5	94.5	77.5	77.4	63.3	63.3	54.2	39.7
Resistance (mH_2O)	6.3	6.3	4.8	6.3	3.6	3.6	6.4	6.4	6.4	4.1	6.8

Performance parameters of single-layer internal ice melting coil

Model	ITSI-S910D	ITSI-S828D		ITSI-S745D		ITSI-S610D		ITSI-S499D		ITSI-S427D	ITSI-S313D
		A	B	A	B	A	B	A	B		
Ice storage capacity (RTh)	910	828	828	745	745	610	610	499	499	427	313
L (mm)	6560	6560	5990	6560	6560	6560	4925	4925	5630	4260	3410
W (mm)	2760	2520	2760	2280	2760	2280	2760	2280	2280	2280	2760
H (mm)	3066	3066	3066	3066	2586	2586	2826	2826	2506	2826	2266
h (mm)	2726	2726	2726	2726	2246	2246	2486	2486	2166B	2486	1926
Connecting pipe size	DN150	DN150	DN150	DN150	DN150	DN150	DN150	DN150	DN150	DN150	DN150
Net weight (Ton)	3.8	3.5	3.5	3.1	3.1	2.5	2.5	2.1	2.1	1.8	1.3
Glycol solution volume (m^3)	3.0	2.7	2.7	2.4	2.4	2.0	2.0	1.6	1.6	1.4	1.0
Flow rate (m^3/h)	115.6	105.1	105.1	94.5	94.5	77.5	77.4	63.3	63.3	54.2	39.7
Resistance (mH_2O)	6.3	6.3	4.8	6.3	3.6	3.6	6.4	6.4	6.4	4.1	6.8

Technical parameters of dual-mode ice cold storage unit

Refrigerant: R22 Power supply: 3φ-380V-50Hz

Model	Operating conditions of air-conditioning		Operating conditions of ice cold storage					Energy control %	Refrigerant charge kg	Condenser				Evaporator				Operating noise dB(A)	Gross machine weight kg	Operating weight kg
	Nominal cooling capacity kW	Input power kW	Nominal cooling capacity kW	Nominal ice-making capacity T/h	Total ice storage capacity T	Total cold storage capacity kW	Input power kW			Inlet/outlet pipe diameter in	Water flow rate m3/h	Max. pressure at water side MPa	Water pressure drop Kpa	Inlet/outlet pipe diameter in	Water flow rate m3/h	Max. pressure at water side MPa	Water pressure drop Kpa			
40STD-IF190WS4	188	37	115	1.4	11	917	36	33 66 100	41	3″	39	1	45	3″	32	1	69	75	1250	1410
40STD-IF260WS4	257	50	157	1.9	15	1254	49		54	3″	53	1	50	3″	44	1	70	75	1400	1580
40STD-IF320WS4	318	60	194	2.3	18	1552	59		70	4″	65	1	52	4″	55	1	72	76	1880	2030
40STD-IF440WS4	431	83	263	3.1	25	2103	82	25 50 75 100	92	5″	88	1	53	4″	74	1	72	76	2840	3060
40STD-IF610WS4	614	111	375	4.4	36	2996	109		126	5″	125	1	54	5″	106	1	73	77	4100	4410
40STD-IF800WS4	792	143	483	5.7	46	3865	141		163	5″	161	1	58	5″	136	1	74	78	4740	5190

Notes:

1. Nominal air-conditioning conditions: Glycol temperatures at evaporator inlet and outlet 12°C/7°C, water temperatures at condenser inlet and outlet 30°C/35°C, and fouling coefficient 0.088 ㎡ ·°C /kW;
2. Nominal ice storage conditions: Glycol temperatures at evaporator inlet and outlet -0.5℃ /-5.5℃ , water temperatures at condenser inlet and outlet 30℃ /35℃ , and fouling coefficient 0.088 ㎡ ·℃ /kW;
3. Chilled water temperature range: -8~12℃ ;
4. Cooling water temperature range: 15~40℃ ;
5. Any change in specifications or size due to product improvement will not be further notified.

Table for unit selection

Table for selection of appropriate ice tank						
Unit model	40STD-IF190WS4	40STD-IF260WS4	40STD-IF320WS4	40STD-IF440WS4	40STD-IF610WS4	40STD-IF800WS4
Optional ice tank models	ITSI-S390	ITSI-S490	ITSI-S590	ITSI-S680	ITSI-S780	ITSI-S880
Nominal ice-making capacity T/h	1.4	1.9	2.3	3.1	4.4	5.7
Total ice storage capacity T	11	15	18	25	36	46
Total cold storage capacity kW	917	1254	1552	2103	2996	3865

Performance parameters of single-layer external ice melting coil

Model	ITSE-S693	ITSE-S633	ITSE-S577	ITSE-S573	ITSE-S527	ITSE-S477	ITSE-S441	ITSE-S368
Ice storage capacity (RTh)	693	633	577	573	527	477	441	368
L (mm)	6000	5500	6000	5000	5500	5000	4000	4000
W (mm)	2998	2998	2512	2998	2512	2612	2998	2512
H (mm)	2806	2806	2806	2806	2806	2806	2746	2746
h (mm)	2466	2466	2466	2466	2466	2466	2406	2406
Connecting pipe size	DN150	DN150	DN150	DN150	DN150	DN150	DN150	DN150
Net weight (Ton)	3.0	2.8	2.5	2.5	2.3	2.1	1.9	1.6
Glycol solution volume (m^3)	2.5	2.5	2.1	2.1	1.9	1.7	1.6	1.3
Flow rate (m^3/h)	91.4	83.5	76.2	75.6	69.6	54.0	58.2	48.5
Resistance (mH_2O)	9.2	7.3	9.2	5.6	7.3	4.3	8.8	8.8

Notes to model selection

Definition

Total cooling demand during the peak periods of the electricity price at daytime: Q0

Total cooling capacity of the refrigeration unit during the valley periods of electricity price at night: Q1 total cold storage capacity of the ice storage unit: Q2

Full capacity operation of ice storage

In the scenario, Q1 ≥ Q0; Q2 ≥ Q0

An example of selection:

There is an air conditioning project that requires a cooling load of 350kW per hour

The peaks and valleys of electricity consumption in the area are as follows:

Peak hours: 14:00-17:00; 19:00-22:00 (6 hours in total)

Valley hours: 0:00-8:00 (8 hours in total)

Then Q0=350×6=2100kW Select H Stars special refrigeration unit 40STD-IF440WS4, which has a cooling capacity of 263kW per hour for cold storage.

Then Q1=263×8=2104kW

Q1 > Q0, the demand is satisfied.

Select H Stars ice storage unit ST-S610D, which has a total cold storage capacity of Q2=2145kW

Q2 > Q0, the demand is satisfied.

Partial capacity operation of ice storage

In the scenario, 2×Q1 ≥ Q0; 2×Q2 ≥ Q1

An example of selection:

There is an air conditioning project that requires a cooling load of 350kW per hour

The peaks and valleys of electricity consumption in the area are as follows:

Peak hours: 14:00-17:00; 19:00-22:00 (6 hours in total)

Valley hours: 0:00-8:00 (8 hours in total)

Then Q0=350×6=2100kW

Select H.Stars special refrigeration unit 40STD-IF260WS4, which has a cooling capacity of 157kW per hour for cold storage.

Then Q1=157×8=1256kW

2×Q1 > Q0, the demand is satisfied.

Select H.Stars ice storage unit ST-S313D, which has a total cold storage capacity of Q2=1100kW

2×Q2 > Q1, the demand is satisfied.

Recommended ice storage volume corresponding to different peak-valley price spreads in the event of partial capacity operation

Select Q1 and Q2 from the suggested values in the table below

Recommended ice storage volume corresponding to different peak-valley price spreads		
Peak-valley price spread	Recommended ice storage volume	Recommended cooling capacity of refrigeration unit
0.5 yuan	Q2≥0.5×Q0	Q1≥0.5×Q0
0.6 yuan	Q2≥0.6×Q0	Q1≥0.6×Q0
0.7 yuan	Q2≥0.7×Q0	Q1≥0.7×Q0
0.8 yuan	Q2≥0.8×Q0	Q1≥0.8×Q0
0.9 yuan	Q2≥0.9×Q0	Q1≥0.9×Q0

An example of selection

There is an air conditioning project that requires a cooling load of 350kW per hour

The peaks and valleys of electricity consumption in the area are as follows:

Peak hours: 14:00-17:00; 19:00-22:00 (6 hours in total)

Peak electricity price: 1.08 yuan / kWh

Valley hours: 0:00-8:00 (8 hours in total)

Valley electricity price: 0.33 yuan / kWh

Then Q0=350×6=2100kW

The peak-valley spread is 1.08-0.33=0.75 yuan ≈ 0.8 yuan

Based on the above table, Q2 ≥ 0.8×Q0=0.8×2100=1680kW, that is, Q2 ≥ 1680kW

Q1 ≥ 0.8×Q0=0.8×2100=1680kW, that is, Q1 ≥ 1680kW

Select H Stars special refrigeration unit 40STD-IF440WS4, which has a cooling capacity of 263kW per hour for cold storage.

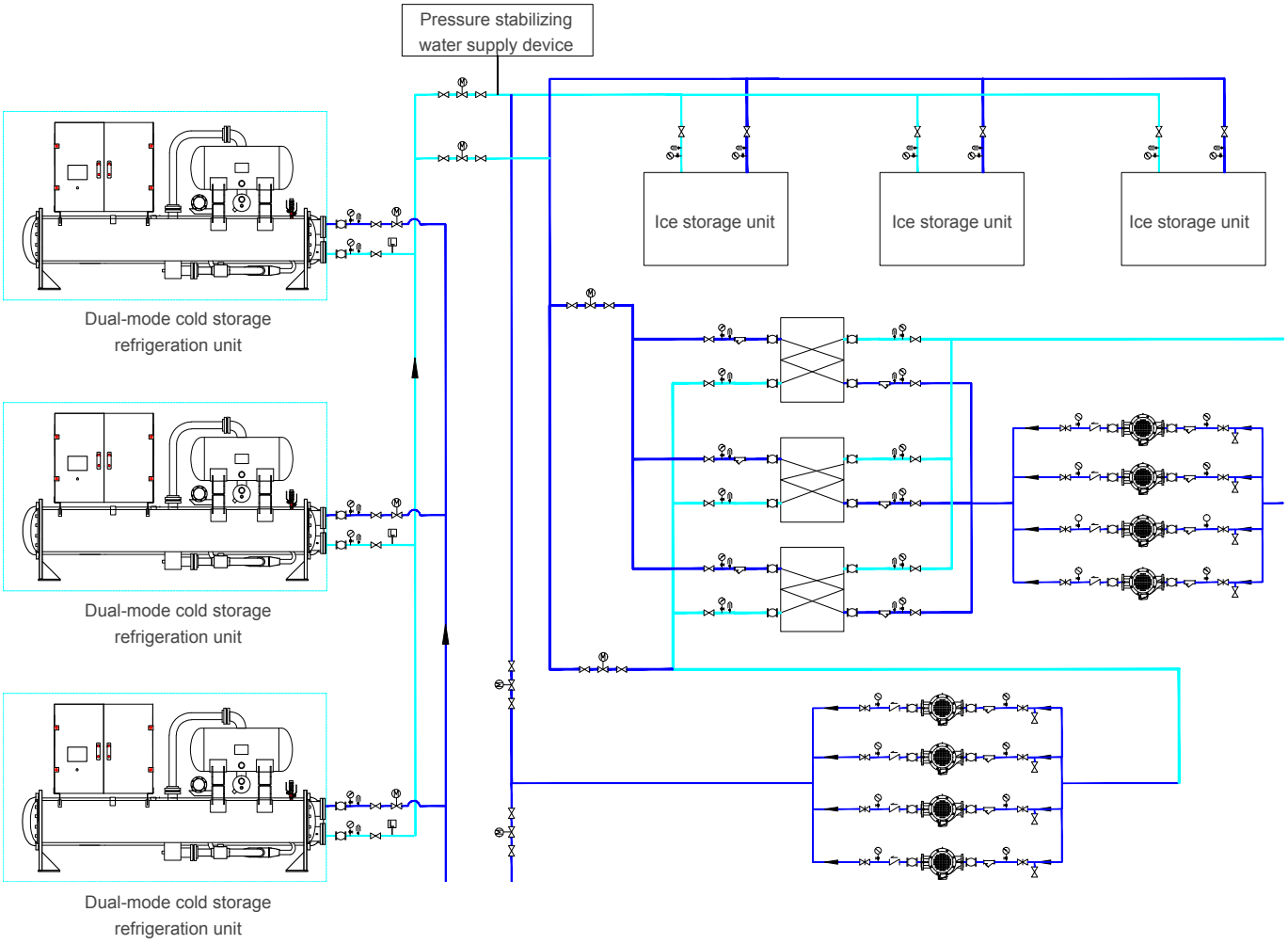
Then Q1=263×8=2104kW

Q1 ≥ 0.8×Q0, the demand is satisfied.

Select H Stars ice storage unit ST-S499D, which has a total cold storage capacity of Q2=1755kW

Q2 ≥ 0.8×Q0, the demand is satisfied.

Ice cold storage system schematic

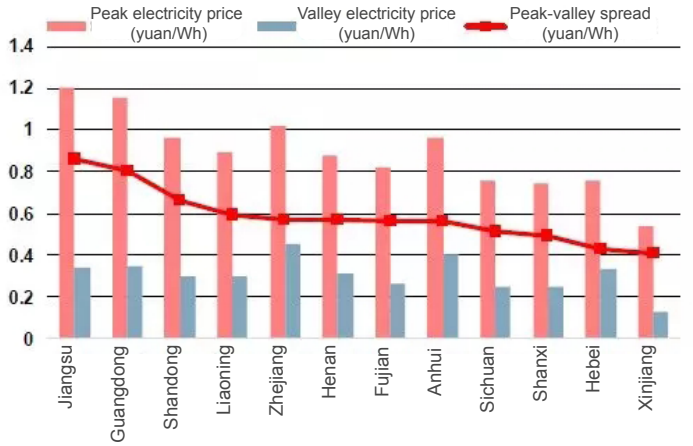


System instructions

1. During electricity price valleys, the refrigeration unit may be run at the ice storage mode.
2. The glycol pump conveys cold energy generated by the refrigeration unit to the ice storage unit.
3. The ice storage unit absorbs the cold energy from the refrigeration unit, and converts the water into ice and stores it in the ice tank.
4. During electricity price peaks, the refrigeration unit may be shuts down.
5. The glycol pump conveys the cold energy stored in the ice storage unit to the plate exchange for heat exchange
6. The ice storage unit converts the stored ice into water and releases cold energy

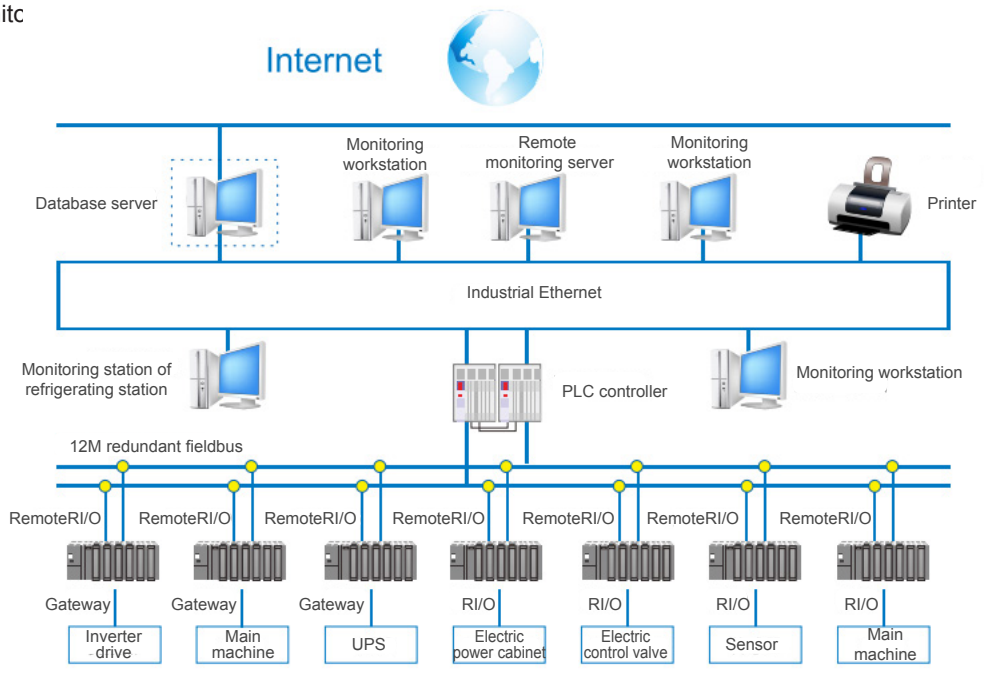
Calculation table of economic benefit of ice storage

Area	Peak electricity price (¥)	Low electricity price (¥)	Cooling capacity (kW)	Total ice storage (Ton)	Ice storage power consumption (kW)	Conventional power consumption (kW)	Peak cost (¥)	Low cost (¥)	Cost savings (¥ /day) 8h/day
Guangdong Province	1.14	0.25	180	2	53	36	41	13	28
	1.14	0.25	360	4	106	72	82	26	56
	1.14	0.25	540	6	159	108	123	40	83
	1.14	0.25	720	8	212	144	164	53	111
	1.14	0.25	900	10	265	180	205	66	139
	1.14	0.25	1080	12	318	216	246	79	167
	1.14	0.25	1260	14	371	252	287	93	195
	1.14	0.25	1440	16	424	288	328	106	222
	1.14	0.25	1620	18	476	324	369	119	250
	1.14	0.25	1800	20	529	360	410	132	278
Beijing	1.42	0.29	180	2	53	36	51	15	36
	1.42	0.29	360	4	106	72	102	31	72
	1.42	0.29	540	6	159	108	153	46	107
	1.42	0.29	720	8	212	144	204	61	143
	1.42	0.29	900	10	265	180	256	77	179
	1.42	0.29	1080	12	318	216	307	92	215
	1.42	0.29	1260	14	371	252	358	107	250
	1.42	0.29	1440	16	424	288	409	123	286
	1.42	0.29	1620	18	476	324	460	138	322
	1.42	0.29	1800	20	529	360	511	154	358
Zhejiang Province	1.21	0.37	180	2	53	36	44	20	24
	1.21	0.37	360	4	106	72	87	39	48
	1.21	0.37	540	6	159	108	131	59	72
	1.21	0.37	720	8	212	144	174	78	96
	1.21	0.37	900	10	265	180	218	98	120
	1.21	0.37	1080	12	318	216	261	118	144
	1.21	0.37	1260	14	371	252	305	137	168
	1.21	0.37	1440	16	424	288	348	157	192
	1.21	0.37	1620	18	476	324	392	176	216
	1.21	0.37	1800	20	529	360	436	196	240



System composition

The automatic control system for ice cold storage is composed of hardware equipment and control software.The hardware equipment includes PLC controllers, actuators (electric valves, inverters, soft starters, etc.), sensors (temperature, humidity, pressure, flow, etc.), and master computer monitc software includes PLC programming control software, master computer configuration and operation software, remote monitoring software, and SMART-ICE control optimization software of which YuanTM owns independent intellectual property rights.



Structure schematic of automated control system

Control functions

· Mode switch and parameter control

Automatically switch between modes to control the target operating parameters according to preset time or estimated load.

·Data recording and management

Record ice volume, flow rate, temperature, pressure and other data; provide a variety of data management functions, including data collection and management, historical data storage, query, printing, export of database and generation of various data reports.

·Equipment monitoring

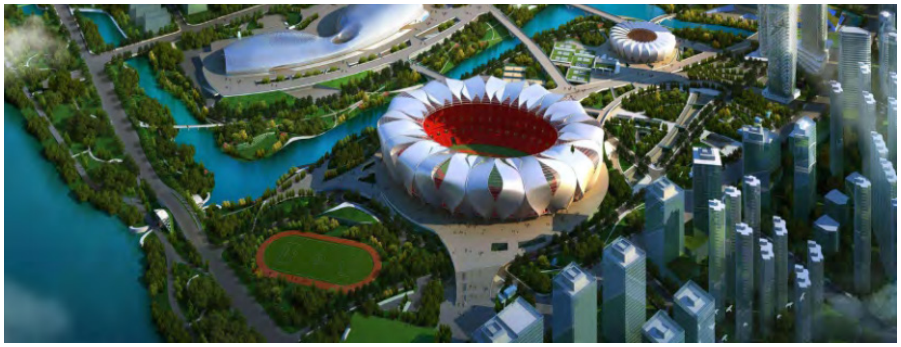
Perform centralized monitoring and control of the refrigeration unit, water pumps, cooling towers, valves and other device, in addition to failure alarm, failure analysis and other functions.

·Remote monitoring

Connected with the building's BAS system and third-party systems, it can carry out remote monitoring through IE.

Commercial Tower
Building area: 43,700 ㎡
Cold storage capacity: 35,032RTh

Station Integrated Transportation Hub (2011)
Building area: 30,000 ㎡ Cold storage capacity: 19,910RTh



Swimming Stadium Building area: 397,000 ㎡
Cold storage capacity:29,712RTh

Industrial Park Building area: 300,000 ㎡
Cold storage capacity: 20,930RTh

Civic Center Building area: 580,000 ㎡
Cold storage capacity: 39,360RTh

Industrial Park Building area: 197,781 ㎡
Cold storage capacity: 16,380RTh

Technology City Centre Building area: 800,000 ㎡
Cold storage capacity: 42,398RTh

Project reference of ice storage unit

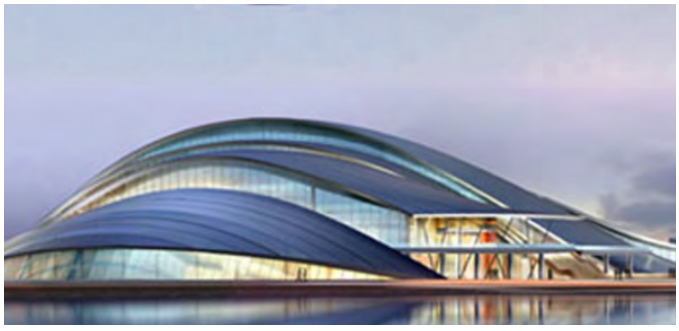
Railway Station Transportation Hub Building area: 832,900 ㎡
Cold storage capacity: 44,906RTh

International Airport Terminal Expansion Project
Building area: 248,000 ㎡ Cold storage capacity: 21,000RTh

Plaza
Building area: 170,000 ㎡ Cold storage capacity: 11,788RTh

Plaza Finance Center
Building area: 199,000 ㎡ Cold storage capacity: 18,752RTh
Building area: 320,000 ㎡ Cold storage capacity: 14,670RTh

Oriental Pearl
Building area: 182,000 ㎡ Cold storage capacity: 29,470RTh



Grand Theater
Building area: 55,000 ㎡ Cold storage capacity: 8,116RTh

Commercial Building
Building area: 65,000 ㎡
Cold storage capacity: 3,852RTh

Hospital
Building area: 160,000 ㎡ Cold storage capacity: 8,960RTh

Government Office Building
Building area: 48,000 ㎡
Cold storage capacity: 4,8000RTh

Project reference of ice storage unit

Textile factory

Building area: 250,000 ㎡ Cold storage capacity: 8,420RTh

Plaza

Building area: 170,000 ㎡ Cold storage capacity: 10,424RTh

International Aviation Service Center

Building area: 274,924 ㎡ Cold storage capacity: 12,600RTh

Exhibition Center Building area: 150,000 ㎡

Cold storage capacity: 14,748RTh

Business Center Building area: 201,154 ㎡

Cold storage capacity: 12,864RTh

Commercial Building

Building area: 200,000 ㎡ Cold storage capacity: 16,162RTh

Hospital

Building area: 73,818 ㎡ Cold storage capacity: 4,290RTh

Commercial Building

Building area: 46,870 ㎡

Cold storage capacity: 5,904RTh

Cultural Center

Building area: 312,000 ㎡ Cold storage capacity: 10,430RTh

Building Center

Building area: 65,516 ㎡ Cold storage capacity: 10,020RTh

H.Stars (Guangzhou) Refrigerating Equipment Group Ltd.

Address: No.1 Guoyuan 4th Road, Guangzhou Economic & Technological Development Zone,

HuangPu District, Guangzhou, China Zip Code 510530

Email: sales@hstars.com.cn

Tel: +862062266755 ext. 886

Fax: +862082266081

Website: www.hstarschiller.com

Twitter: twitter.com/HStarsGroup

Facebook: www.facebook.com/Hstarsgroup

LinkedIn: www.linkedin.com/company/hstarsgroup

Instagram: www.instagram.com/hstars_chiller_maker