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► Gree Inverter Centrifugal  
Chiller

Gree Electric Appliances Inc. of Zhuhai, founded in 1991, is the world's largest air conditioner enterprise integrating R&D, manufacturing, marketing and service.

- 2012, Gree became the first listed electrical appliances enterprise in China with sales revenue over 16 billion USD (RMB 100 billion).
- 2013, GREE's sales revenue exceeded 19 billion USD.

Gree has been ranked on the Fortune Magazine as one of the Top 100 Chinese listed companies for 12 consecutive years.

Thanks to 300 million user's choices, Gree products are sold widely in more than 200 countries and regions. Today Gree's annual production capacity of RAC and CAC are more than 60 million sets and 5.5 million sets respectively.

Action makes the future and innovation makes achievement. Looking forward, Gree will firmly persist in the business philosophy of passion, innovation and realization. We aim to build a century's standing air conditioning enterprise, to create a better life for human.

*For the Clearer Sky and Greener Earth.*



1 in 3 air conditioners sold worldwide is made by Gree

مکيفر گازي  
مکيف الهواء  
air conditioner  
냉온풍기  
エアコン  
एर कन्डिशनर  
空调 climatiseur  
acondicionador de aire  
ar condicionado  
300,000,000 users

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## Magnet Suspension Inverter Centrifugal Chiller (CC series)

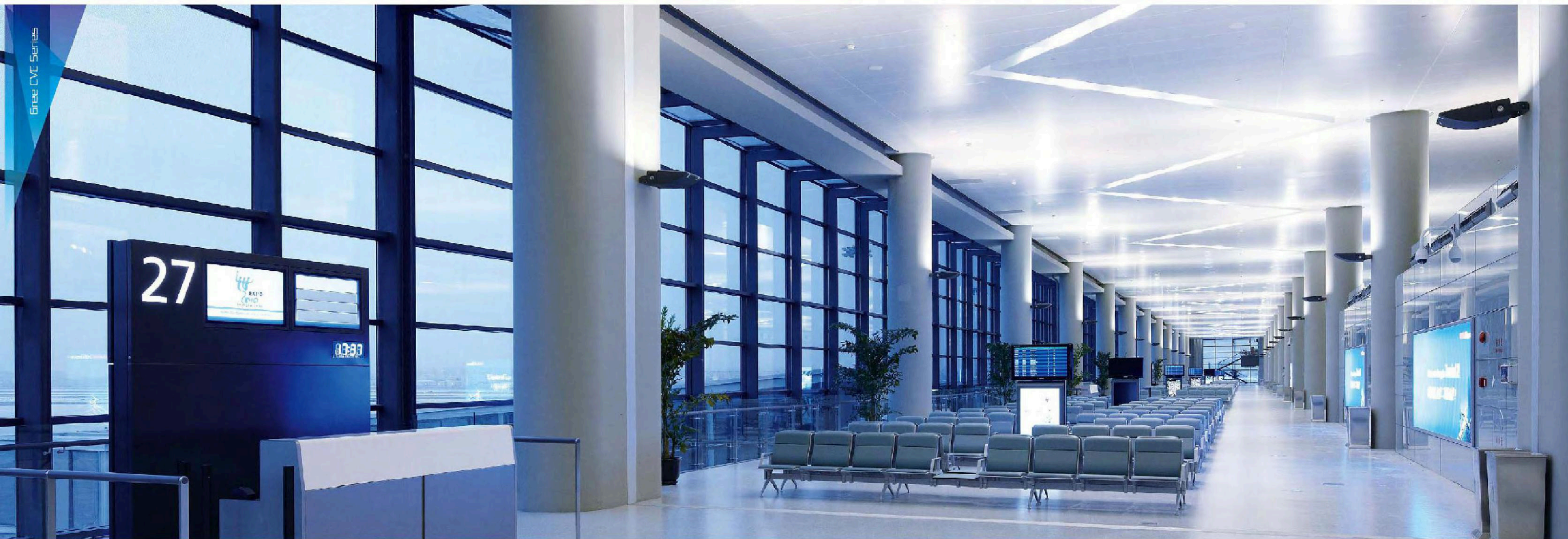
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## C series Centrifugal Chiller

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No. 1  
air conditioner  
manufacturer





## Gree CVE Series Permanent Magnet Synchronous Inverter Centrifugal Chiller

Gree CVE Series Permanent Magnet Synchronous Inverter Centrifugal Chiller was accredited by Chinese Academy of Science, Tsinghua University, Xi'an Jiaotong University, Chinese Association of Refrigeration and China Refrigeration and Air-Conditioning Industry Association as: the world's first high-speed and high-power permanent magnet synchronous inverter centrifugal chiller that reaches world leading standard.

This chiller integrates the latest air conditioning technologies of Gree. It can save at least 40% of power when compared to common centrifugal chiller.

Thanks to PWM controlled rectifying 4-quadrant inverter technology, harmonic wave voltage distortion factor <math><5\%</math> and power factor >math>0.99</math>. Therefore, harmonic wave handling and reactive-load compensation equipment doesn't have to be installed independently. It is exceptionally energy-saving, reliable and adaptive and can be widely used in large buildings, hospitals, schools, supermarkets and factories. Products have gained ARI certificates.



### Nomenclature

LS	D	LX	650	S	V	E
1	2	3	4	5	6	7

No.	Meaning of Code	Options
1	Unit's code	LS- Chiller
2	Compressor model	B Semi hermetic compressor
3	Compressor type	LX- Centrifugal compressor
4	Nominal cooling capacity	Nominal cooling capacity, unit: RT
5	Compressor stage	S-2 stages
6	Inverter	V-Inverter
7	Energy efficiency level	E-Level 1 energy efficiency



## Product Features

Gree CVE series permanent magnet synchronous inverter centrifugal chiller features excellent coefficient of performance. Under ARI550/590-2003 standard working condition, its IPLV is 11.68 and unit is highly efficient no matter at full load or part load, saving 40% of power in minimum when compared to common centrifugal chiller.

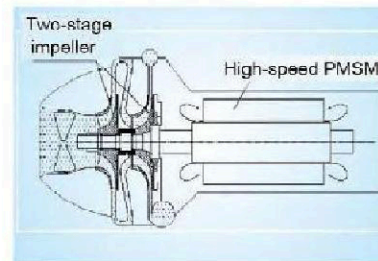
## G CORE TECHNOLOGIES

### High-Speed Direct-Drive Two-Stage Impeller

High-speed motor direct drive two-stage impeller is adopted, which has greatly reduced mechanical loss and improved unit's efficiency. For a 650RT chiller, compressor's mechanical loss is less than 4kW, which is 10kW smaller than the mechanical loss of conventional geared centrifugal chiller.

Compressor's overall size is decreased. Volume and weight of the compressor is only 40% of the same capacity conventional compressor.

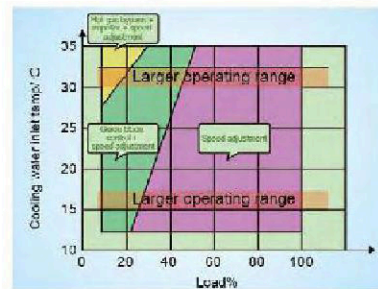
Speed-up gears are canceled. Without the high-frequency noise of gears, compressor's operating sound is much lower. That is 8dBA lower than conventional unit.



### All-Condition "Wideband" Pneumatic Design

"All-condition" design: the optimized design of impeller and diffuser can realize high-efficiency operation of compressor under the load range of 25-100%. Compared with conventional design which is based on full load operation, compressor's efficiency loss is lessened.

Conventional inverter centrifugal chiller realizes capacity control by the variable speed of compressor and the variable opening angle of guide vane which begins to turn down under the load of 50~60%. In comparison, Gree CVE series centrifugal chiller can realize this by directly changing the speed of compressor under the load of 25~100% so that the throttling loss of guide vane will be reduced greatly.

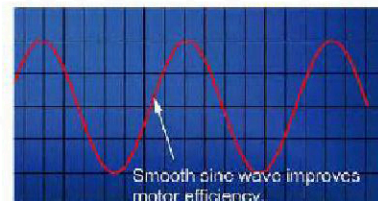


### High-Speed Permanent Magnet Synchronous Inverter Motor

The world's first high-power and high-speed PMSM that is dedicated for refrigerating centrifugal compressor. The power of motor is more than 400 kW and the rotational speed is above 18000 rpm. Within unit's operation range, the motor efficiency is above 96% all the time and 97.5% to the maximum. It is compact and lightweight. A 400kW high-speed PMSM weighs the same as a 75kW AC induction motor. The startup current of motor is low. By adopting spiral refrigerant injection cooling technology to cool down stator and rotor, motor's temperature can be controlled around 40°C, ensuring motor's efficient operation.

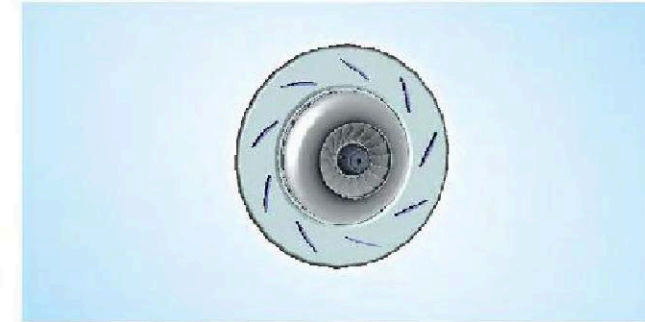
### Onboard Sine-Wave Inverter

Motor's rotor can be positioned without probe. With PWM controlled rectifying technology, inverter can output smooth sine wave to improve motor's efficiency. Inverter is directly installed on the unit, saving floor space for customers. In addition, all communication wires are connected in factory, which has improved unit's reliability.



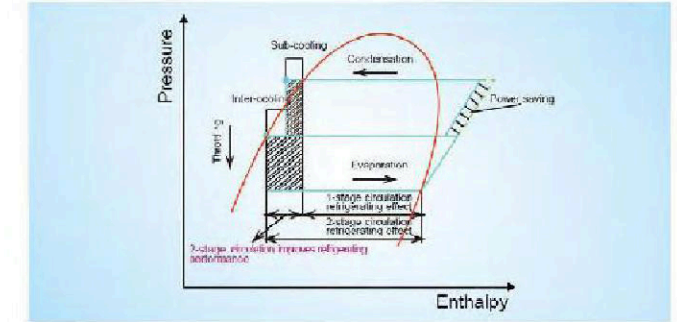
### Low Viscosity Vane Diffuser

Unique low viscosity vane diffuser design and airfoil guide vane can turn high-speed gas into high static pressure gas effectively so as to realize pressure recovery with high efficiency. In partial load, vane diversion reduces backflow loss, improves the performance in partial load, and expands unit's operation range.



### Two-Stage Compression Enthalpy Adding Technology

Compared with single-stage refrigeration system, two-stage compression improves the circulation efficiency by 5 ~ 6%. Compressor's rotational speed is lowered so that compressor is more reliable and durable.



## LEADING TECHNOLOGIES

### Impeller Technology

Compressor impeller is a ternary enclosed impeller that is more efficient and reliable than unshrouded impeller. It adopts airfoil 3-dimensional structure so that it is more adaptive. Through finite element analysis, 3-coordinates inspecting machine, dynamic balance test, over-speed test and actual test under actual working condition, it is made sure that impeller meets design requirement and is capable of stable operation.

Compressor and main shaft adopt keyless connection, which can avoid partial stress concentration and rotor's additive off-balance that is caused by key connection, thus improving compressor's operation stability.

### High-efficiency Heat Exchanger

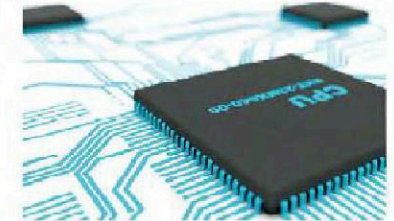
High-efficiency evaporating tube has a special heat exchange surface that is designed based on heat-transfer mechanism and fluid medium. It is optimized in heat transferring efficiency, with less flowing pressure loss and less energy consumption.

Patented sub-cooler is equipped at the bottom of condenser. The sub-cooling degree can be up to 5°C. Copper pipe won't be damaged under the impact of high-speed refrigerant.

3-V grooved tube plate design is adopted, which guarantees sealing effect.

### Advanced Control Platform

Specialized 32-bit CPU and DSP digital signal processor is used for the control system. The high data collection accuracy and data processing capacity ensures the real-time feature and control accuracy of system control. Together with the colorful LCD touch screen, user can easily realize system auto control and manual control in debugging.



## Control Center with Colorful Touch Screen Display

### Wide, Clear and Touchable Screen

Touch screen display center is an advanced microprocessor control system that offers convenient, effective and visual interface to users for real-time monitor, data records, security guard, etc. It adopts 10"800×480 touch screen, whose elementary area is larger than 10.4" screen by 25%. User can enable corresponding functions by pressing on the touch screen. English version and Chinese version are both available.



### Accurate Control and Stable Output

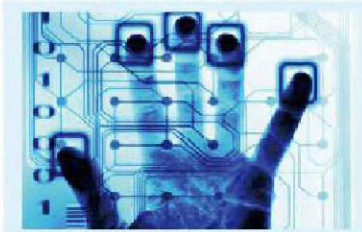


Unit's control system can not only adjust load based on cold water leaving temperature but also predict and compensate the variance of air conditioning load based on the change rate of cold water entering temperature. Unit is faster in load adjustment and more stable in water leaving temperature.

Under bad working condition, unit will adjust its operating data rather than stop frequently to satisfy user's refrigerating demands as much as possible.

### Authority Classification with Passwords

Control center has access passwords for operators so that set values won't be changed without authorization. Access authority is classified to user access and manufacturer access. User password is used to start up unit and enter the interface of user parameter setting. It is managed and can be changed by the user. Manufacturer password is used to enter the interface of manufacture parameter setting. Any change of the manufacture parameters may affect unit's reliability, therefore it shall be owned by professional engineering and debugging personnel.



### Soft Load-On and Soft Shut-down



Unit's control system can not only adjust load based on cold water leaving temperature but also predict and compensate the variance of air conditioning load based on the change rate of cold water entering temperature. Unit is faster in load adjustment and more stable in water leaving temperature.

Under bad working condition, unit will adjust its operating data rather than stop frequently to satisfy user's refrigerating demands as much as possible.

### Intelligent and Long-distance Service System

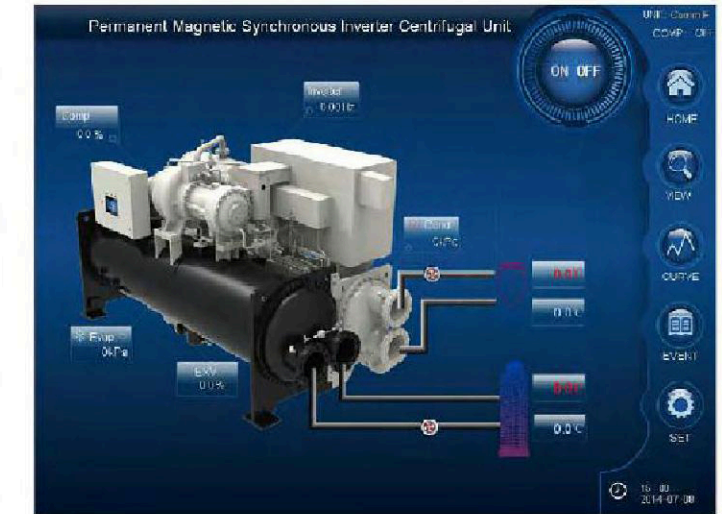
Touch screen is equipped with Modbus slaver communication protocol interface. The centrifugal chiller can be connected with building auto management system via the touch screen. It can also be linked with Gree long-distance intelligent service center by connecting the GPRS long-distance toolkits to the touch screen.



## Main Interface

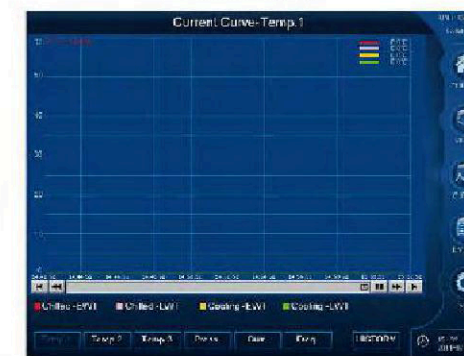
After the centrifugal chiller is connected to power, a welcome page will be shown for 5 minutes. After that, the touch screen will display the main operation interface, where unit's external look and operation data are shown. When the water pump and side water pump are running, their color will turn from grey to green. When the compressor is working, its color will turn from black to green. This interface also presents the key parameters for monitoring:

- ▶ Chilled water outflow temperature
- ▶ Chilled water inflow temperature
- ▶ Cooling water outflow temperature
- ▶ Cooling water inflow temperature
- ▶ Unit's operating condition
- ▶ Compressor's operating condition
- ▶ Compressor's operating current
- ▶ Percentage in relation to the operating current at full load



User needs to enter user password when starting up the unit. The main interface can lead to 4 other interfaces, which are: "Curve Inquiry", "Event Log", "Parameter Setting" and "Status View". From the interface of "Curve Inquiry" and "Event Log", operator can view unit's operation records directly. For the interface of "Parameter Setting", user password must be entered. With "Manufacturer Password", user can gain access to "Manufacturer Parameters" from this interface. Interface of "Status View" allows operator to learn more about the real-time data of the chiller.

Curve Inquiry



Event Log

Inverter Parameter		System Parameter	
Comp A Load	0.0%	Running time	0.00h
Comp B Load	0.0%	Target Flow	0.00m³/h
Comp C Load	0.0%	Swamp Temp	0.00°C
3-Phase Voltage	0.0V	Water Temp	0.00°C
3-T Line Voltage	0.0V	Water Temp	0.00°C
3-T Line Voltage	0.0V	Running time	0.00h
Bus Voltage	0.0V	Running time	0.00h

Parameter Setting



Status View

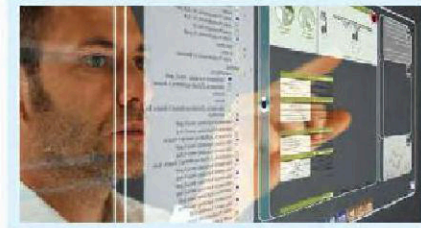


## Display Information


Touch screen can provide continuous monitor on the system. Chiller has 8 operating conditions: off-line, malfunction, urgent stop, operating, standby, starting, closing, and closed. Compressor has 2 operation conditions: stop and operating. If malfunction occurs to the chiller, self-protection function will be energized. All these operating records will be recorded in "Event Log".

### Display ON/OFF Status

- ▼ Status of compressor main AC contactor
- ▼ Status of oil pump AC contactor
- ▼ Status of oil heater contactor
- ▼ Status of chilled water pump
- ▼ Status of cooling water pump
- ▼ Status of bypass valve (for some units)



### Display Simulation Status

- 
- ▼ Cooling water inflow temperature
  - ▼ Cooling water outflow temperature
  - ▼ Guide vane pulse
  - ▼ Current of main unit
  - ▼ Tank temperature
  - ▼ Chilled water inflow temperature
  - ▼ Chilled water outflow temperature
  - ▼ Discharge temperature
  - ▼ Condensation pressure
  - ▼ Evaporation pressure
  - ▼ Oil supply pressure
  - ▼ Oil tank pressure
  - ▼ Operating frequency
  - ▼ Oil supply temperature
  - ▼ Motor winding temperature

### Input Quantity

- 
- ▼ Language
  - ▼ Chilled water outflow temperature
  - ▼ Oil pump control mode
  - ▼ Control mode
  - ▼ Operating mode
  - ▼ Long-distance ON/OFF function (ON/OFF)
  - ▼ Timer
  - ▼ Change user password
  - ▼ Long-distance address
  - ▼ System clock
  - ▼ Touch sounds (ON/OFF)

### Alarm and Malfunction Information of Chiller

- ▼ Oil pressure difference alarm
- ▼ Compressor high pressure alarm
- ▼ Compressor low pressure alarm
- ▼ Guide vane error alarm
- ▼ Main unit over-current alarm
- ▼ Oil pressure difference protection
- ▼ Oil supply temperature protection
- ▼ Oil pump over-load protection
- ▼ Main unit winding over-heat protection
- ▼ Suction temperature sensor error
- ▼ Guide vane malfunction
- ▼ Startup cabinet malfunction
- ▼ Compressor high pressure protection
- ▼ Compressor low pressure protection
- ▼ Anti-freezing protection
- ▼ Chilled water flow switch protection
- ▼ Cooling water flow switch protection
- ▼ Phase loss and phase failure protection

- ▼ Main unit over-current
- ▼ Chilled water inlet sensor error
- ▼ Chilled water outlet sensor error
- ▼ Cooling water inlet sensor error
- ▼ Cooling water outlet sensor error
- ▼ Oil tank temperature sensor error
- ▼ Oil supply temperature sensor error
- ▼ Motor winding sensor error
- ▼ Discharge temperature sensor error
- ▼ Condensation pressure sensor error
- ▼ Evaporation pressure sensor error
- ▼ Oil supply pressure sensor error
- ▼ Oil tank pressure sensor error
- ▼ Main unit current sensor error
- ▼ Guide vane motor sensor error
- ▼ Urgent stop switch
- ▼ Interlocked stop switch
- ▼ Long-distance stop switch
- ▼ Startup forbidden for frequent ON/OFF

## Mechanical Features

Summary: Gree CVE series centrifugal chiller is completely assembled by the factory, including its evaporator, condenser, compressor, motor, lubricating system, chilling system and control system. Strict tests are made to the chiller to make sure each chiller can run stably.

### Compressor

Gree's latest high-tech product—high-efficiency DC inverter centrifugal compressor is adopted. Compressor adopts high-speed permanent magnet synchronous motor to directly drive the high-speed rotation of two-stage impeller. Because speed-up gears are cancelled, compressor's mechanical loss is reduced, with sound level lowered by 8dBA. Compressor has only one mobile part—the rotating shaft, which has reduced the volume and weight of compressor by 50%. Besides, the rotating shaft is of rigid rotor design without point of resonance so that compressor is more stable and durable. Multiple oil wedge high-speed bush bearing is used for stronger rigidity. Even in bad working condition, the chiller is still adaptive and reliable.

Ternary enclosed impeller is designed especially for R134a refrigerant. The impeller is of airfoil 3-dimensional structure so that it is more adaptive and efficient. The shroud and hub of impeller are made of special aluminum alloy; therefore it is harder and more anti-corrosive. Through finite element analysis, 3-coordinates inspecting machine, dynamic balance test, over-speed test and actual test under actual working condition, it is made sure that impeller meets design requirement and is capable of stable operation.

Compressor and main shaft adopt keyless connection, which can avoid partial stress concentration and rotor's additive off-balance that is caused by key connection, thus improving compressor's operation stability.

Low viscosity vane diffuser is set at the outlet of impeller. Airfoil guide vane can turn high-speed gas into high static pressure gas effectively so as to realize pressure recovery with high efficiency. In partial load, vane diversion reduces backflow loss, improves the performance in partial load, and expands unit's operation range.

### Two-stage Compression + Air Makeup

Compressor adopts high-efficient two-stage compression and air makeup technology to improve unit's energy efficiency. Due to the "360°annular" air makeup, 2-stage compression structure, compressor can operate more efficiently and stably, with long service life.



### Wide Operation Range

By integrating inverter control and guide vane (IGV), unit can operate stably at 10%~100% of load. At 25%~100% of load, guide vane is turned on completely and compressor's operating frequency is automatically optimized so that compressor can work effectively with less power consumption. When the load is below 25%, guide vane starts to turn down and adjust cooling capacity. In addition, when compressor is under small load and large pressure ratio, compressor's rotation speed will be increased properly to avoid surge.

## Lubricating System

Lubricating system is composed of oil storage tank, oil pump, oil filter, emergency oil supply tank, oil heater, relevant temperature and pressure sensors, and the control system.

Oil tank is made independently, which includes one oil pump and one oil heater. Oil heater of the auto thermostat is used to remove refrigerant from oil. Lubricating oil will be pumped out from oil pump and then flows through a high-accuracy oil filter (filter is replaceable) and finally enters emergency oil supply tank and further gets into each bearing. Pipeline system is all installed inside the factory.

Before unit is energized, oil pump is started in advance. Oil pump keeps running when unit is in operation or halt inertial operation stage. A gravity oil supply tank is set at the top of compressor so as to ensure sufficient lubricant in case of power failure.

The end of motor shaft adopts patented helixseal and labyrinth double seal method. With the high-speed revolution of shaft, screw pump oil is formed. Along with the comb seal, lubricant internal leak can be effectively avoided, which will prolong the maintenance period.

The injection oil return system extracts oil from the refrigerant so that the fineness of refrigerant is improved. The extracted oil will be sent back the oil tank to guarantee unit's stable operation.

## PMSM + Onboard Sine-Wave Inverter

The high-speed PMSM is especially developed for the centrifugal compressor. Its rotational speed can reach 18000rpm. Its rotor is a permanent magnet, with little motor harmonic wave loss, ensuring the efficiency of motor under high rotational speed. It is an enclosed type motor that doesn't need shaft seal, which will eliminate the leakage of refrigerant and lubricant caused by shaft seal and therefore reduce the maintenance cost of shaft seal. Insulated bearing is set at the end of motor rotor, which can effectively avoid electrolytic corrosion to the bearing. Besides, the motor adopts double bracing structure, ensuring stable and reliable operation.

High-power and high-speed PMSM uses a specialized onboard sine-wave inverter, which adopts high-speed permanent magnet synchronous position-sensor-free technology to sensor the position of rotor accurately without probe. With PWM controlled rectifying 4-quadrant inverter technology, harmonic wave distortion factor is smaller than 5% and power factor is above 0.99 without the need of harmonic wave handling equipment. Current of electric apparatus is lowered by 10% and power compensator is not necessary, which will save the cost of electrical fitting. Inverter is installed on the unit, which will help reduce floor space for customer. Meanwhile, communication connection is completed in factory so as to increase unit's stability.

## Heat Exchanger

Evaporator and condenser tubes are made of low carbon steel. Tube plate is welded at each side of the tube. Holes of the tube plate are connected with heat transferring tube and shoe plate is set in the middle of pipe bundle. Shoe plate is made of carbon steel.

The most advanced and high-efficiency heat exchanging copper tube is adopted. The heat transmission of inner and external wall is optimized. Tube bundle of evaporator and condenser adopts expansion joint with shoe plate so that copper tube and shoe plate will not be damaged under the impact of high-speed refrigerant. This can avoid pipe leakage and extend the service life of heat exchanger. Tube plate holes are 3V slotted holes, ensuring the sealing quality.

Evaporator is a flooded type shell-and-tube heat exchanger. Due to the liquid balance sheet, refrigerant can be balanced all the way through so as to optimize the heat transferring effect. On top of the tube bundle, aluminum separate mesh is used to prevent liquid refrigerant from flowing into the compressor. 2~3 pieces of liquid level glass are equipped to facilitate refrigerant charging. Refrigerant safety valve is installed on the evaporator.

Condenser is a horizontal shell-and-tube heat exchanger. Baffle plate is installed at the gas outlet of compressor to prevent high-speed refrigerant's impact on tube bundle and also balance the flow to improve condenser's heat transferring effect.

At the bottom of condenser, there is a built-in sub-cooler that provides high condensate depression for liquid refrigerant so as improve cooling capacity and energy efficiency. Refrigerant safety valve is also installed on the condenser.

The left and right water chambers can be exchanged. Design pressure is 1.0MPa; however the pressure can be adjusted to 1.6MPa according to actual needs. Standard water pipe connection is flange connection (plate type common welded flange HG20592 1.6MPa).

## Damping Device

The rotor of the centrifugal compressor has passed strict static balance and dynamic balance test so that the dynamic load to the foundation will be relatively low. Usually, it is ok that the user just put a damping rubber cushion of 15~20mm's thick on the base steel of unit.

## Insulation of Evaporator and Motor

The surface of evaporator adopts two layers of sponge for insulation. The bottom layer adopts PE of 20mm's thick and surface adopts forming rubber of 20mm's thick. The 40mm-thick insulation layer can ensure good insulation, no condensation on unit's surface, as well as good fire resistance.

## Waterflow Switch

The unit is integrated with high-precision differential pressure waterflow switch, whose operation pressure reaches 1.6MPa. It is installed at the chilled water and cooling water inlet and outlet pipelines with power of 24V, 50Hz, 1ph.

## Paint

The paint is orange-grey with good anti-corrosive performance. In neutral salt spray test, heat and humidity resistance test and high/low temperature performance test, its performance is one time better than conventional anti-corrosive paint.

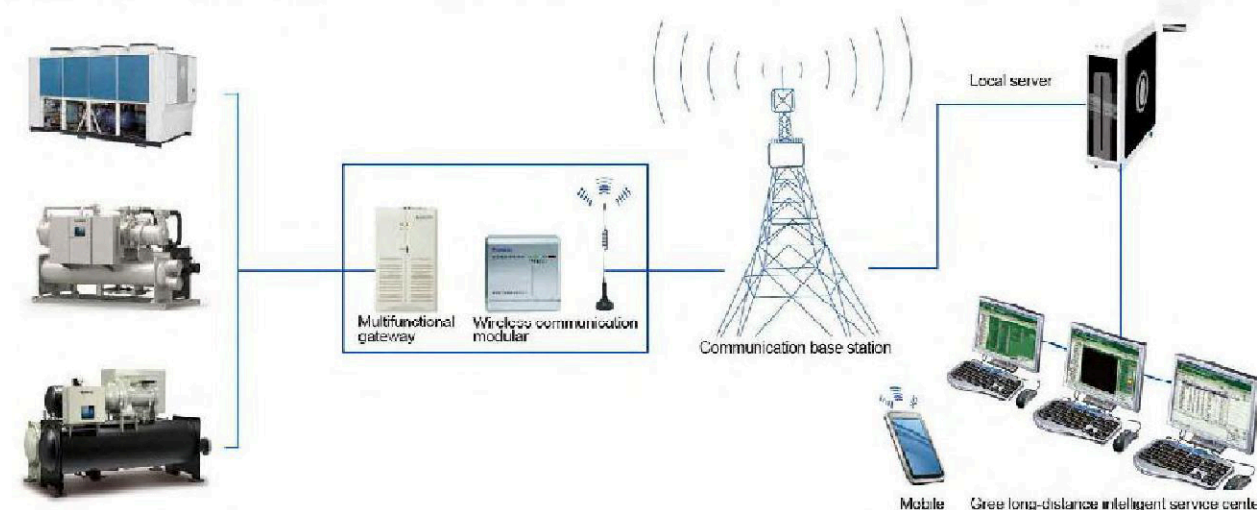
## Transportation

The unit will be transported as a whole. The whole unit will be protected by a cover and there is a sheet at the joint of water pipe for sealing.

## Long-distance Intelligent Service Center

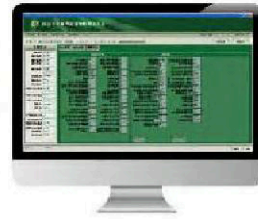
Gree long-distance intelligent service center is an advanced after-sales service platform, providing malfunction warning, operation diagnosis, operation data analysis, maintenance reminder, etc. so that the unit can operate in the optimal status, reducing maintenance cost and prolonging unit's lifespan.

Long-distance intelligent service is supported by Gree's professional technical team, integrating wireless communication technology and computer software technology. It can arrange long-distance collection and long-distance analysis on the unit's operation data and provide daily maintenance information of unit to the user, in order to effectively reduce unit's malfunction rate and malfunction influence, improve economical efficiency and safe operation, and provide the more favorable service for central air conditioner.



### Five functions of Gree long-distance intelligent service center

**Inquiry of long-distance data** With the help of wireless network, it can receive and check data from every GREE central air con and examine their real-time operation status.



**Malfunction prevention** By analyzing real-time data, system can identify malfunction in advance and inform engineer to prevent it from happening.



**Malfunction quick response** 24 hours on guard, system can identify malfunction in 5s and react quickly in 30min to minimize user's loss.



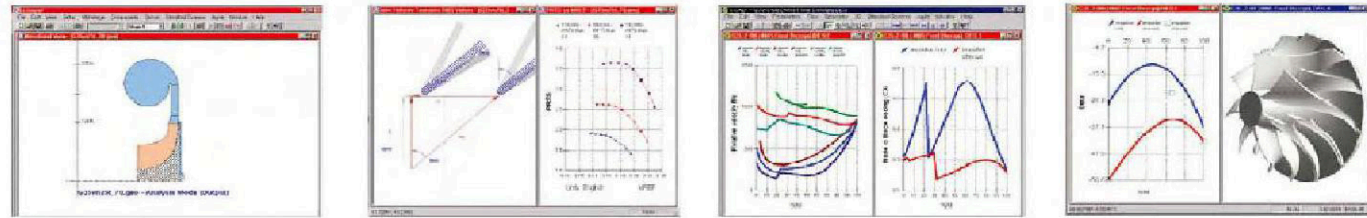
**Data memory** System can remember data and malfunction in the past and is able to quickly identify malfunction based on the historical record.



## Powerful Design and Manufacture

### Top Design and Analysis Platform

The compressor is designed and manufactured with the control software from the dominating software producer—Concepts NREC, U.S., which is also used for the aero-engine. Using the software Ansys, DyRoBeS etc to analyze the vibration and critical speed of rotation can basically guarantee the reliability of the unit.



### Advanced Numerical Control Machines

GREE has purchased a considerable number of large-sized horizontal boring-and-milling machines produced by DMG (Germany) and Toshiba (Japan), so as to guarantee each compressor part is of the optimum machining accuracy.

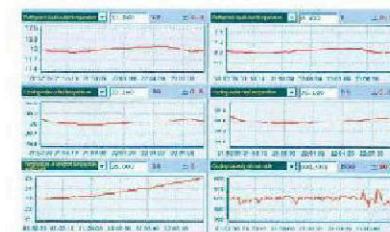
Swedish HEXAGON high-precision three-coordinates measuring machine with Germany Leitz instrument head is adopted to accurately measure the impeller vane shape, vane diffuser vane shape, backflow vane shape and body of centrifugal chiller.

HM3UB Shenck dynamic balance tester is adopted to test the impeller dynamic balance of centrifugal compressor with max testing diameter of 1200mm and testing length of 1500mm. It will ensure that the impeller imbalance degree of centrifugal compressor is below 50mg and guarantee unit's operation stability in maximum.



### Authorized Testing Center

Gree has the first-class centrifugal chiller on-line testing equipment with the capacity up to 8800kW, which comply with GB/T10870, and GB/T18430.1 and other national standards. Each unit has been tested in the factory to ensure its performance.



## Powerful Design and Manufacture

### Specification Sheet in National Standard Working Conditions

Model: LSBLX cc SVE		250	275	300	350	400	450	500	550	600	650	700	
Cooling capacity	kW	600	807	1055	1201	1406	1502	1750	1904	2110	2205	2401	
	RT	250	275	300	350	400	450	600	650	600	850	700	
Power input	kW	146	160	174	199	224	250	275	298	320	337	362	
COP	-	6.03	6.04	6.05	6.19	6.28	6.33	6.30	6.49	6.59	6.78	6.8	
IPLV	-	8.5	8.52	8.53	8.68	8.81	8.89	8.99	9.11	9.26	9.54	9.56	
Allocation power	kW	162	178	183	222	249	279	306	332	358	374	402	
Evaporator	Water flow volume	m <sup>3</sup> /h	151	189	181	212	242	272	302	333	363	393	423
	Water pressure drop	kPa	70	70	75	75	75	75	75	75	80	80	80
	Pass quantity	-	2	2	2	2	2	2	2	2	2	2	2
	Connection pipe	mm	150	150	150	200	200	200	200	250	250	250	250
Condenser	Water flow volume	m <sup>3</sup> /h	109	200	227	205	302	340	370	410	454	492	529
	Water pressure drop	kPa	65	65	70	70	70	70	70	70	85	85	85
	Pass quantity	-	2	2	2	2	2	2	2	2	2	2	2
	Connection pipe	mm	150	150	150	200	200	200	200	250	250	250	250
Outline dimension	W	mm	3770	3770	3770	3650	3650	3650	3850	4200	4200	4250	4250
	D	mm	1580	1580	1580	1810	1810	1810	1810	1920	1920	2020	2020
	H	mm	1840	1840	1840	2000	2000	2000	2000	2250	2250	2300	2300
Weight	Net weight	kg	5150	5250	5400	5500	5700	6100	6600	7200	8300	8400	8500
	Operating weight	kg	5600	5700	6200	6400	6700	7200	7600	8600	9000	9900	10200

Model: LSBLX cc SVE		750	800	850	900	950	1000	1100	1200	1300	1400	1500	
Cooling capacity	kW	2637	2813	2989	3164	3340	3516	3668	4220	4572	4923	5275	
	RT	750	800	850	900	950	1000	1100	1200	1300	1400	1500	
Power input	kW	367	419	439	476	497	519	556	598	650	710	767	
COP	-	6.84	6.71	6.81	6.65	6.72	6.77	6.98	7.06	7.03	6.93	6.88	
IPLV	-	9.34	9.43	9.57	9.34	9.44	9.53	9.88	10.02	9.99	9.85	9.77	
Allocation power	kW	442	487	488	530	553	577	614	684	722	788	851	
Evaporator	Water flow volume	m <sup>3</sup> /h	454	404	514	544	574	605	665	726	706	847	907
	Water pressure drop	kPa	90	90	90	115	115	115	115	115	115	115	115
	Pass quantity	-	2	2	2	2	2	2	2	2	2	2	2
	Connection pipe	mm	250	250	250	300	300	300	300	350	350	350	350
Condenser	Water flow volume	m <sup>3</sup> /h	567	605	643	681	718	756	832	907	983	1058	1134
	Water pressure drop	kPa	65	85	85	100	100	100	100	105	105	105	105
	Pass quantity	-	2	2	2	2	2	2	2	2	2	2	2
	Connection pipe	mm	250	250	250	300	300	300	300	350	350	350	350
Outline dimension	W	mm	4250	4250	4250	4580	4580	4580	4580	4720	4720	4720	4720
	D	mm	2020	2020	2020	2210	2210	2210	2210	2550	2550	2550	2550
	H	mm	2300	2300	2300	2430	2430	2430	2430	2680	2680	2680	2680
Weight	Net weight	kg	9100	9500	9900	10000	10150	10500	11000	12700	13000	13500	14000
	Operating weight	kg	10500	11000	11500	12000	12200	12700	13500	16000	16500	17200	18000

- Note:
- Above selections are applicable in ARI working condition: chilled water outlet temperature is 6.7°C, and cooling water inlet temperature is 29.4°C.
  - Standard water side bearing pressure is 1.0MPa while 1.6MPa is optional.
  - Fouling factor of chilled water and cooling water is 0.006m<sup>2</sup>·°C/kW.
  - If the specifications are changed due to product improvement, please refer to the parameters on the nameplate.
  - IPLV listed in the sheet is tested according to the conditions specified in ARI 550/560-2003.
  - Startup current of compressor started in variable frequency < rated current; Power factor=0.99.
  - If the specifications are changed due to product improvement, please refer to the parameters on the nameplate.

Specification Sheet in ARI Working Conditions

Model: LSBLX in SVE		250	275	300	350	400	450	500	550	600	650	700	
Cooling capacity	KW	860	967	1055	1231	1406	1582	1756	1934	2110	2285	2461	
	RT	250	275	300	350	400	450	500	550	600	650	700	
Power input	KW	147	161	175	201	226	253	278	301	323	340	365	
COP	-	5.99	6.01	6.03	6.12	6.22	6.25	6.32	6.43	6.53	6.72	6.74	
IPLV	-	9.94	9.98	10.01	10.18	10.34	10.43	10.55	10.69	10.88	11.2	11.22	
Allocation power	KW	182	178	193	222	249	279	306	332	356	374	402	
Evaporator	flow volume	m <sup>3</sup> /h	136	150	163	191	218	245	272	299	327	354	381
	Water pressure drop	kPa	60	55	60	60	60	60	60	60	75	75	75
	Pass quantity	-	2	2	2	2	2	2	2	2	2	2	2
	Connection pipe	mm	150	150	150	200	200	200	200	250	250	250	250
Condenser	flow volume	m <sup>3</sup> /h	171	188	205	239	273	308	342	376	410	444	478
	Water pressure drop	kPa	55	55	55	55	55	55	55	55	70	70	70
	Pass quantity	-	2	2	2	2	2	2	2	2	2	2	2
	Connection pipe	mm	150	150	150	200	200	200	200	250	250	250	250
Outline dimension	W	mm	3770	3770	3770	3650	3650	3650	3950	4200	4200	4250	4250
	D	mm	1580	1580	1580	1810	1810	1810	1810	1920	1920	2020	2020
	H	mm	1840	1840	1840	2000	2000	2000	2000	2250	2250	2300	2300
Weight	Weight	kg	5150	5250	6400	5600	5700	8100	6800	7200	8800	8400	8500
	Operating weight	kg	5600	5700	6200	6400	6700	7200	7800	8600	9800	9500	10200

Model: LSBLX in SVE		750	800	850	900	950	1000	1100	1200	1300	1400	1500	
Cooling capacity	KW	2637	2813	2989	3164	3340	3516	3868	4220	4572	4923	5275	
	RT	750	800	850	900	950	1000	1100	1200	1300	1400	1500	
Power input	KW	401	424	443	481	502	510	580	608	661	720	775	
COP	-	6.58	6.63	6.75	6.58	6.65	6.89	6.91	6.94	6.92	6.84	6.81	
IPLV	-	10.95	11.06	11.23	10.95	11.08	11.98	11.98	11.70	11.66	11.51	11.47	
Allocation power	KW	442	467	488	530	553	557	628	664	722	788	851	
Evaporator	flow volume	m <sup>3</sup> /h	408	435	463	490	517	544	600	654	709	763	818
	Water pressure drop	kPa	75	75	75	100	100	100	115	115	115	115	115
	Pass quantity	-	2	2	2	2	2	2	2	2	2	2	2
	Connection pipe	mm	250	250	250	300	300	300	300	350	350	350	350
Condenser	flow volume	m <sup>3</sup> /h	513	547	581	615	649	684	750	818	887	955	1023
	Water pressure drop	kPa	70	70	70	85	85	85	105	105	105	105	105
	Pass quantity	-	2	2	2	2	2	2	2	2	2	2	2
	Connection pipe	mm	250	250	250	300	300	300	300	350	350	350	350
Outline dimension	W	mm	4250	4250	4250	4580	4580	4580	4720	4720	4720	4720	
	D	mm	2020	2020	2020	2210	2210	2210	2210	2550	2550	2550	
	H	mm	2300	2300	2300	2430	2430	2430	2430	2680	2680	2680	
Weight	Weight	kg	9100	9500	9800	10000	10150	10500	11000	12700	13000	13500	14000
	Operating weight	kg	10500	11000	11500	12000	12200	12700	13500	16000	16500	17200	18000

- Note:
- Above selections are applicable in ARI working condition: chilled water outlet temperature is 6.7°C and cooling water inlet temperature is 29.4°C.
  - Standard water side bearing pressure is 1.0MPa while 1.8MPa is optional.
  - Fouling factor of chilled water and cooling water is 0.086m<sup>2</sup>·°C/kW.
  - If the specifications are changed due to product improvement, please refer to the parameters on the nameplate.
  - IPLV listed in the sheet is tested according to the conditions specified in ARI 550/580-2003.
  - Startup current of compressor started in variable frequency < rated current; Power factor=0.99
  - If the specifications are changed due to product improvement, please refer to the parameters on the nameplate.

Operation Range

Chilled water		Cooling water	
Outlet temperature(°C)	Temperature difference between inlet and outlet(°C)	Inlet temperature(°C)	Temperature difference between inlet and outlet(°C)
5-15	2.5-8	16-35	3.5-8

If customer requires higher temperature difference, please consult the manufacturer.

Product Installation

Installation Environment and Foundation

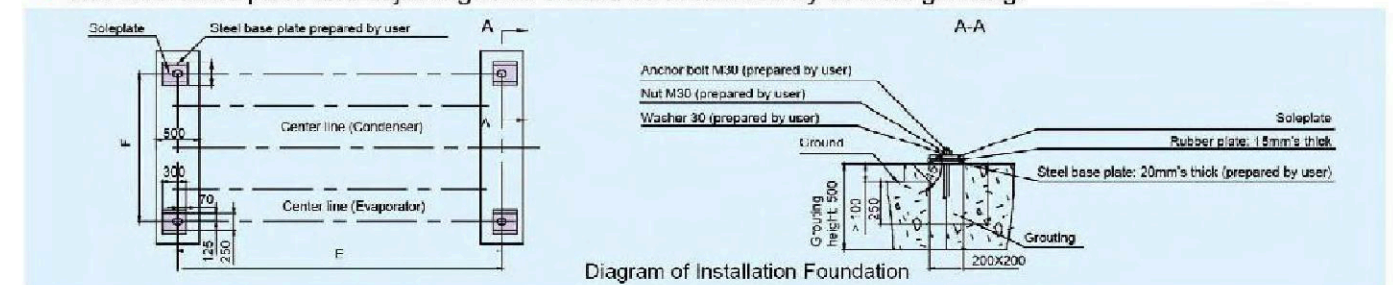
Installation Environment

- The unit should not be close to fire and inflammables. If it is installed together with heating unit such as boiler, it is necessary to consider the effect of thermal radiation.
- Select sites where room temperature is below 40°C and is drafty. (High temperature will cause malfunction and accelerate corrosion.) When ambient temperature is 40°C, relative humidity should be below 90%. It is not allowed to install or store unit outside or in the open air.
- Select sites with less dust (Dust will cause electrical malfunction).
- The site should be bright for the convenience of maintenance and inspection.
- In order to meet the needs for maintaining, inspecting and cleaning the heat exchange tube of condenser and evaporator, there should be enough space around the unit (See diagram of Maintenance Space for specific dimensions).
- For the sake of easy lifting and overhaul, it is necessary to install travelling crane or derrick car and make sure that the machine room is high enough.
- The surrounding of the unit and the whole machine room should be able to be drained completely.
- Avoid direct sunlight.

Note: Please contact the manufacturer if the installation site is 1000m or more above sea level

Installation Foundation

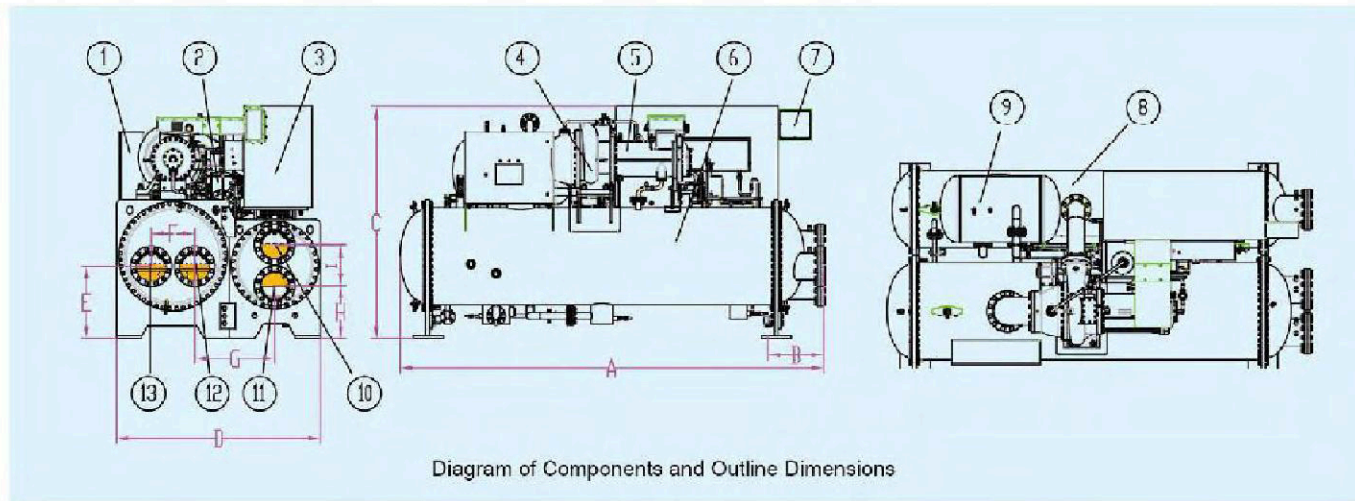
- The rotor of centrifugal compressor has passed strict static balance and dynamic balance test, so its dynamic load against the foundation is very small. Please see table "Unit Foundation Dimension". To prevent unit's footings from being corroded, please be sure that there is good drainage around the unit and unit's steel base plate is flat and smooth. Specifically:
  - The maximum fall difference (levelness) between each base should be within 3mm.
  - For the convenience of maintenance, the base should be 100mm above the floor.
  - Set drain ditch around the unit.
  - There shouldn't be any gap between steel base plate and soleplate of the unit. Insert some adjusting shim into the space between base plate and the concrete base. Adjust the base plate to be level (the fall difference should be within 0.5mm per meter).
  - Lift up the unit and place damping rubber blocks on the steel base plate. Then place the unit on the damping rubber blocks.
  - The steel base plate and adjusting shim should be reinforced by second grouting.



Unit Foundation Dimension(mm)

Model and dimension	E	F	Model and dimension	E	F
LSDLX250SVC	2990	1330	LSBLX750SVE	3290	1770
LSBLX275SVE	2990	1330	LSBLX800SVE	3290	1770
LSBLX300SVE	2990	1330	LSBLX850SVE	3290	1770
LSBLX350SVE	2790	1580	LSBLX900SVE	3590	1980
LSBLX400SVE	2790	1580	LSBLX950SVE	3590	1980
LSDLX450SVC	2780	1580	LSBLX1000SVE	3580	1880
LSBLX500SVE	2600	1560	LSBLX1100SVE	3690	1900
LSRI X550SVE	3280	1670	LSRI X1200SVE	3780	2150
LSBLX600SVE	3280	1670	LSBLX1300SVE	3780	2150
LSRI X650SVE	3280	1770	LSRI X1400SVE	3780	2150
LSRI X700SVE	3280	1770	LSRI X1500SVE	3780	2150

## Diagram of Components



No.	Name	No.	Name
1	Electric control cabinet	8	Condenser
2	Oil tank	9	Flash type evaporator
3	Converter	10	Leaving cooling water
4	Compressor	11	Entering cooling water
5	Motor	12	Entering chilled water
6	Evaporator	13	Leaving chilled water
7	客户接线架		

## Dimensions of centrifugal chiller

Model	A	B	C	D	E	F	G	H	I	Chilled water port	Cooling water port
LSBLX260SVE	3770	530	1840	1580	595	350	815	330	350	150	150
LSBLX275SVE	3770	530	1840	1580	595	350	815	330	350	150	150
LSBLX300SVC	3770	530	1840	1580	595	350	815	330	350	150	150
LSBLX350SVE	3850	550	2000	1810	575	350	780	450	350	200	200
LSBLX400SVE	3850	550	2000	1810	575	350	780	450	350	200	200
LSBLX450SVE	3850	550	2000	1810	575	350	780	480	350	200	200
LSBLX500SVE	3850	550	2000	1810	575	350	780	450	350	200	200
LSRI X550SVE	4200	600	2250	1920	665	430	770	455	415	250	250
LSBLX800SVE	4200	600	2250	1920	665	430	770	465	415	250	250
LSRI X850SVE	4250	600	2300	2020	715	430	795	510	430	250	250
LSBLX700SVC	4250	600	2300	2020	715	430	795	510	430	250	250
LSBLX/50SVC	4250	600	2300	2020	715	430	795	510	430	250	250
LSBLX800SVE	4250	600	2300	2020	715	430	795	510	430	250	250
LSRI X850SVE	4250	600	2300	2020	715	430	795	510	430	250	250
LSBLX900SVE	4580	605	2430	2210	815	470	870	560	470	300	300
LSBLX950SVE	4580	605	2430	2210	815	470	870	550	470	300	300
LSRI X1000SVE	4580	605	2430	2210	815	470	870	560	470	300	300
LSRI X1100SVE	4580	605	2430	2210	815	470	870	560	470	300	300
LSBLX1200SVE	4720	605	2580	2550	900	635	870	1150	530	350	350
LSBLX1300SVE	4720	605	2580	2550	900	635	870	1150	530	350	350
LSRI X1400SVE	4720	685	2680	2550	900	635	870	1150	530	350	350
LSBLX1600SVE	4720	685	2680	2550	900	635	870	1150	530	350	350

## Dimension of Installation and Maintenance Space

### Dimension of Installation and Maintenance Space

Model	A	B	C	D
LSRI X260SVE	1500	3500	1500	1220
LSBLX275SVE	1500	3500	1500	1220
LSBLX300SVE	1500	3500	1500	1220
LSBLX350SVE	1500	3500	1500	1220
LSBLX400SVE	1500	3500	1500	1220
LSBLX450SVE	1500	3500	1500	1220
LSBLX500SVE	1500	3500	1500	1220
LSBLX550SVE	1500	3800	1500	1220
LSBLX800SVE	1500	3800	1500	1220
LSRI X850SVE	1500	3800	1500	1220
LSBLX700SVE	1500	3800	1500	1220
LSBLX/50SVE	1500	3800	1500	1220
LSBLX900SVE	1500	3800	1500	1220
LSBLX850SVE	1500	3800	1500	1220
LSRI X900SVE	1500	4000	1650	1320
LSBLX950SVE	1500	4000	1650	1320
LSRI X1000SVE	1500	4000	1650	1320
LSBLX1100SVC	1500	4000	1650	1320
LSRI X1200SVE	1500	4000	1650	1320
LSBLX1300SVC	1500	4000	1650	1320
LSBLX1400SVE	1500	4000	1650	1320
LSBLX1500SVE	1500	4000	1650	1320

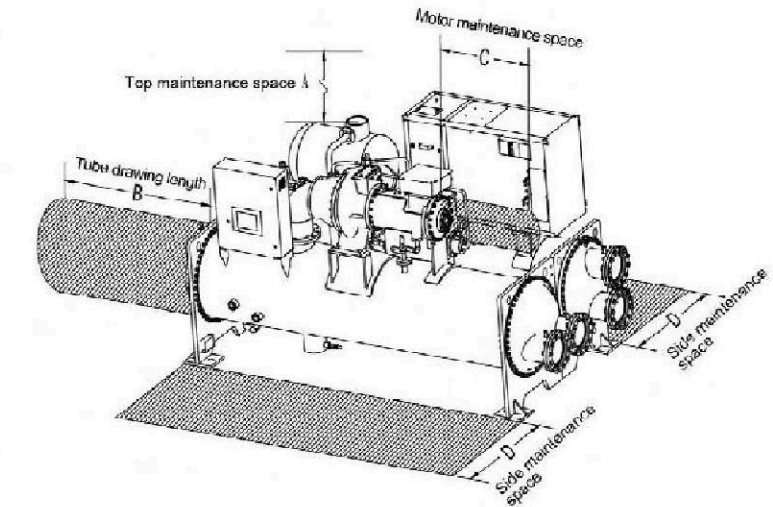
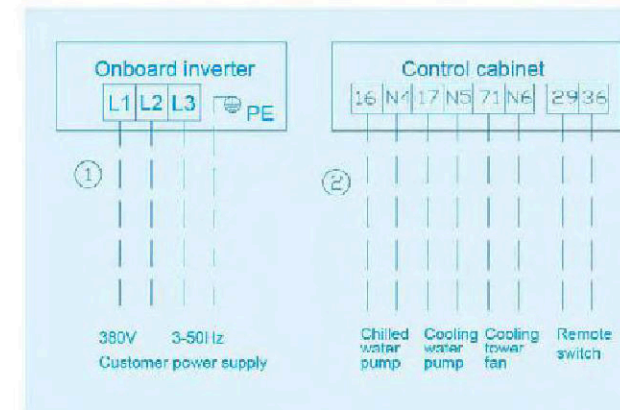


Diagram of Maintenance Space

## Electrical Installation



**Note for wiring:**  
 Line ① represents the power cable between customer's power distribution cabinet and the onboard inverter startup cabinet. The required power supply is 380V 3~ 50Hz. The power cord shall enter from the side or bottom of startup cabinet and the cable size varies with the change of unit's power.  
 Line ② represents the communication line from the main control cabinet to the water pump control cabinet and remote switch. The cable size should be equal to or above 1.0mm<sup>2</sup>.  
 Note: The water pump control cabinet should be prepared by the user. Please refer to the diagram attached inside the cabinet.

## Scope of Supply

S= Standard Supply; O= Owner's Supply; P= Purchased Supply

Supply Items	Specification	Typet	Note
Main unit	Set	S	
Refrigerant	R134a	S	
Lubricating oil	68# synthesis lipid lubricating oil	S	
Inverter startup cabinet	Set	S	Onboard or not onboard
Oil filter	PC	P	

Note: If long-distance monitoring or other functions are needed, please purchase related accessories.



## Gree CC Series Magnetic Suspension Inverter Centrifugal Chiller

Gree CC Series Magnetic Suspension Inverter Centrifugal Chiller is a small-scale DC inverter centrifugal chiller. Its cooling capacity is 130RT-1000RT. The application of PMSM, 2-stage compression, motor direct-drive impeller, flooded type evaporator, etc has greatly improved the chiller's energy-saving performance. Meanwhile, magnetic suspended shaft bearing is adopted to realize oil-free operation. The advanced microcomputer control system, group control technology and building communication interface have also contributed to the fine operation quality. This chiller is applicable for hotels, office buildings, business clubs, etc.

### Nomenclature

LS	D	LX	130	S	C	E
1	2	3	4	5	6	7

No.	Meaning of Code	Options
1	Unit's code	LS-Chiller
2	Compressor model	B Semi hermetic compressor
3	Compressor type	LX-Centrifugal compressor
4	Nominal cooling capacity	Nominal cooling capacity, unit: RT
5	Compressor stage	S-2 stages
6	Magnetic suspension	C-Magnetic suspended shaft bearing
7	Energy efficiency level	E-Level 1 energy efficiency

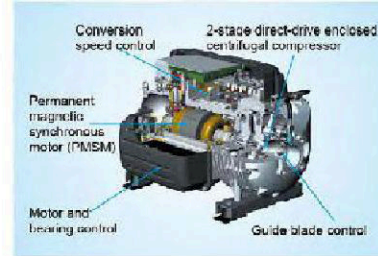


## Product Features

### High-efficiency & Energy-saving

#### PMSM Direct-Drive Impeller

Compressor adopts high-speed permanent magnetic motor to directly drive impeller, which has greatly reduced mechanical loss. Compared with conventional geared centrifugal chiller, compressor's mechanical loss is decreased by 70% and motor efficiency is improved by more than 5%.

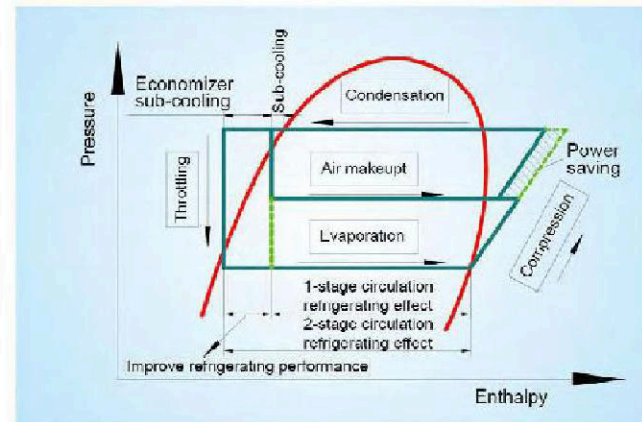


#### Advanced Magnetic Suspended Shaft Bearing

Compressor adopts magnetic suspended shaft bearing so that there is no mechanical friction and mechanical loss is further reduced. Because compressor is running in oil-free condition, the refrigeration cycle doesn't have lubricating oil, which has avoided the heat exchange efficiency decrease caused by oil film coated on heat exchanging tubes. The heat exchange is less influenced and the machine can keep producing good performance in its service life.

#### Two-Stage Compression

Two-stage compression with air makeup is more efficient in refrigeration circulation than single-stage compression by at least 5%.



### Stable & Reliable

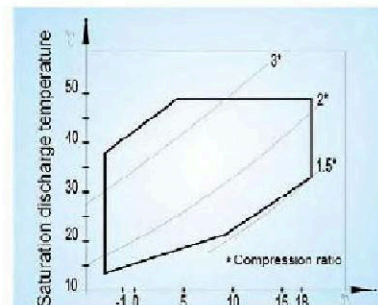
#### Less Moving Parts, Friction-Free Operation

Compressor adopts high-speed motor to directly drive the 2-stage impeller. Speed-up gears are cancelled and the entire refrigeration system has one moving part only—the impeller.

Compressor adopts magnetic suspended shaft bearing to avoid bearing friction. Without structural vibration, the operating sound is low. There is no need to maintain the bearing within the operation period. The chiller is more reliable when the control of lubricating oil becomes unnecessary.

#### Complete Surge Prevention

Compressor's operating status is monitored in real-time so as to adjust the speed of compressor in time and make sure the compressor is always running in a safe range.



### Reliable Power-off Protection

In case of sudden power failure, motor will switch to the mode of electric generator to keep the capacitor in charge and then lower the speed of rotor in a safe way. Meanwhile, the radial bearing of compressor ceramic bearing will support the rotor after power failure so as to prevent the rotor from touching any metal surface.

### Multiple Protections

Compressor low pressure protection, compressor high pressure protection, high discharge temperature protection, evaporator anti-freezing protection, chilled water flow switch protection, phase loss and phase failure protection, electric component over-temperature protection, machine winding over-heating protection, bearing error protection and different kinds of communication failure protection.



### Strict Tests

Components are strictly tested before entering the factory. Heat exchangers are designed in strict accordance with relevant codes of pressure vessels and tested in 1.5 times of working pressure. The machine will take complete performance tests and reliability tests before leaving factory.



### Powerful Functions. Easy Operation

#### Colorful Touch Screen

The machine has a colorful touch screen that offers comprehensive monitor and control on the system via texts, images, tables, curves, etc. It records and displays system's operating status, sensor status, valve status and operation parameters.



#### Group Control and Building Management

Advanced and reliable industry microcomputer control system, powerful group control module and the building management interface.



#### Operating Data Records

The operating data records can show unit's operating trend and key data, which is easy for management.



### Long-distance Control

Standard building control protocol (Modbus RTU) is equipped to realize long-distance control on the unit.



### Operating Data Records

The operating data records can show unit's operating trend and key data, which is easy for management.



## Strong Adaptability

### Compact Structure

Size and weight of the compressor are only 20% of the size and weight of a common compressor. Inverter is carried by the machine, which is floor saving.



### Stepless Load Adjustment

Inverter control and guide vane control are integrated to realize stepless adjustment of refrigerating output in 10%~100%.



### Quiet Operation

Sound level of the complete unit is lower than 70dB(A).



### Operation with Low-temperature Cooling Water

Unit can operate even when cooling water is as low as 12°C. Under the condition of low outdoor temperature, unit can still operate normally.



### Low startup Current

The startup current is only 2A, which has minimizes the impact on power line. Expensive startup cabinet is not necessary.



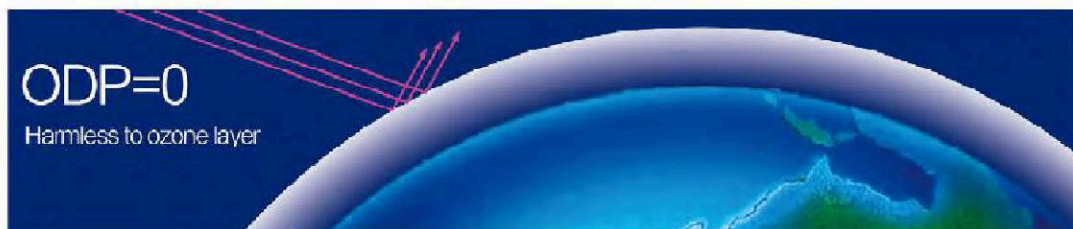
## Eco-friendly

This chiller is especially designed for refrigerant R134. It is a fluoride-free refrigerant (ODP=0), which is harmless to the ozone layer. During operation, incondensable gas will not enter the system, which ensures system's cleanliness. Gas extraction device is not needed. Unit is compact in structure, saving a lot of floor space.



ODP=0

Harmless to ozone layer



## Mechanical Features

### Magnetic Suspended Shaft Bearing

Two radial bearings and an axial bearing make up the digital magnetic suspended bearing system. The permanent magnet and electromagnet are the suspended moving part of compressor. Alignment sensor of the magnetic bearing provides real time relocation for 6 million times per minute to ensure accurate positioning. Rotor rises before unit is started up and adjusts the space interval automatically to ensure there is no friction between parts.



### Permanent magnetic synchronous motor (PMSM)



Compressor adopts PMSM. Its rotor is a permanent magnet, with little motor harmonic wave loss, ensuring the efficiency of motor. It is an enclosed type motor that is cooled by refrigerant. Motor temperature is controllable.

### Load Adjustment Mechanism

Inverter control and inlet guide vane control are integrated to realize energy-saving and stable operation under 10%~100% of load. At 25%~100% of load, guide vane is turned on completely and compressor's operating frequency is automatically optimized so that compressor can work effectively with less power consumption. When the load is below 25%, guide vane starts to turn down and adjust cooling capacity. In addition, when compressor is under small load and large pressure ratio, compressor's rotation speed will be increased properly to avoid surge.

### Liquid Level Control and Throttling Device

YVB type liquid level meter is used to continuously measure the liquid level in condenser. With admittance compensation technology, sensor's effective liquid change can be measured directly and then converted to standard signal (4~20mA), which contacts directly with the touch screen. Liquid level is measured, displayed and controlled at all times.



### Heat Exchanger

The most advanced and high-efficiency heat exchanging copper tube is adopted. The heat transmission of inner and external wall is optimized. Tube bundle of evaporator and condenser adopts expansion joint with shoe plate so that copper tube and shoe plate will not be damaged under the impact of high-speed refrigerant. This can avoid pipe leakage and extend the service life of heat exchanger. Tube plate holes are 3V slotted holes, ensuring the sealing quality. Evaporator is a flooded type shell-and-tube heat exchanger. Due to the liquid balance sheet, refrigerant can be balanced all the way through so as to optimize the heat transferring effect. On top of the tube bundle, aluminum separate mesh is used to prevent liquid refrigerant from flowing into the compressor. 2~3 pieces of liquid level glass are equipped to facilitate refrigerant charging. Refrigerant safety valve is installed on the evaporator. Condenser is a horizontal shell-and-tube heat exchanger. Baffle plate is installed at the gas outlet of compressor to prevent high-speed refrigerant's impact on tube bundle and also balance the flow to improve condenser's heat transferring effect. At the bottom of condenser, there is a built-in sub-cooler that provides high condensate depression for liquid refrigerant so as improve cooling capacity and energy efficiency. Refrigerant safety valve is also installed on the condenser. The left and right water chambers can be exchanged. Design pressure is 1.0MPa; however the pressure can be adjusted to 1.6MPa if it is required.

## Insulation of Evaporator and Low-temperature Parts

The surface of evaporator, inhalation tube, refrigerant runner and other low-temperature parts adopts two layers of sponge for insulation. The bottom layer adopts PE of 20mm's thick and surface adopts forming rubber of 20mm's thick. The 40mm-thick insulation layer can ensure good insulation, no condensation on unit's surface, as well as good fire resistance.

## Waterflow Switch

The unit is integrated with high-precision differential pressure waterflow switch, whose operation pressure reaches 1.6MPa. It is installed at the chilled water and cooling water inlet and outlet pipelines with power of 24V, 50Hz, 1ph.

## Paint

The paint is with good anti-corrosive performance. In neutral salt spray test, heat and humidity resistance test and high/low temperature performance test, its performance is one time better than conventional anti-corrosive paint.

## Transportation

The unit will be transported as a whole. The whole unit will be protected by a cover and there is a sheet at the joint of water pipe for sealing.

## Others

During operation, compressor's shaft is suspended. Moving parts are frictionless and vibration is close to 0, so the dynamic load against foundation is very small. Generally, there is no need to add a damping device. In case of special needs, customer may add a rubber pad of 15~20mm's thick below unit's steel base plate.

## Control Center with Colorful Touch Screen Display

### Wide, Clear and Touchable Screen

Touch screen display center is an advanced microprocessor control system that offers convenient, effective and visual interface to users for real-time monitor, data records, security guard, etc. It adopts 10"800×480 touch screen, whose elementary area is larger than 10.4" screen by 25%. User can enable corresponding functions by pressing on the touch screen. English version and Chinese version are both available.



### Accurate Control and Stable Output

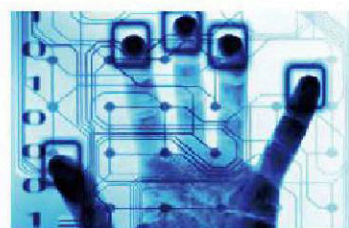


Unit's control system can not only adjust load based on cold water leaving temperature but also predict and compensate the variance of air conditioning load based on the change rate of cold water entering temperature. Unit is faster in load adjustment and more stable in water leaving temperature.

Under bad working condition, unit will adjust its operating data rather than stop frequently to satisfy user's refrigerating demands as much as possible.

### Authority Classification with Passwords

Control center has access passwords for operators so that set values won't be changed without authorization. Access authority is classified to user access and manufacturer access. User password is used to start up unit and enter the interface of user parameter setting. It is managed and can be changed by the user. Manufacturer password is used to enter the interface of manufacture parameter setting. Any change of the manufacture parameters may affect unit's reliability, therefore it shall be owned by professional engineering and debugging personnel.



## Soft Load-on and Soft Shut-down



Unit's control system can control the load-on gradually by capacity control and electric current limit so that unit won't be on and off frequently.

When unit is going to shut down, the control system will turn down the inlet guide vane (IGV) to a preset value and then disconnect power. This can effectively reduce impact on the unit and extend starter's service life.

## Intelligent and Long-distance Service System



Touch screen is equipped with Modbus slaver communication protocol interface. The centrifugal chiller can be connected with building management system via the touch screen. It can also be linked with Gree long-distance intelligent service center by connecting the GPRS long-distance toolkits to the touch screen.

## Product Specifications

### Specification Sheet in National Standard Working Conditions

Model: LSBLX-m SCE		130	150	250	275	300	350	
Cooling capacity	kW	457	528	879	879	1055	1231	
	RT	130	150	250	250	300	350	
Motor power input	kW	78	94	145	145	181	190	
COP	-	5.86	5.62	6.06	6.06	5.83	6.40	
PLV	-	0.44	0.09	0.73	0.73	0.39	0.33	
Allocation power	kW	05	103	160	160	199	212	
Refrigerant charge volume	kg	235	200	255	255	305	425	
Evaporator	Water flow volume	m <sup>3</sup> /h	79	91	151	151	182	212
	Water pressure drop	kPa	75	75	85	85	85	75
	Pass quantity	-	2	2	2	2	2	2
	Connection pipe	mm	150	150	150	150	150	200
Condenser	Water flow volume	m <sup>3</sup> /h	98	114	189	189	227	285
	Water pressure drop	kPa	70	70	80	80	80	70
	Pass quantity	-	2	2	2	2	2	2
	Connection pipe	mm	150	150	200	200	200	200
Connection type		Der clasp					Flange	
Outline dimension	W	mm	3000	3000	3800	3800	3800	3650
	D	mm	1250	1250	1250	1250	1250	1810
	H	mm	2000	2000	2000	2000	2000	2000
Weight	Net weight	kg	2200	2200	3000	3000	3000	5500
	Operating weight	kg	2600	2800	3700	3700	3700	6400

Model: LSBLX mm SCE			400	450	500	900	950	1000
Cooling capacity	kW		1400	1582	1738	3104	3340	3510
	RT		400	450	500	900	950	1000
Motor power input	kW		218	245	266	461	482	492
COP	-		6.51	6.54	6.61	6.66	6.93	7.18
PLV	-		9.37	9.42	9.52	9.65	9.86	10.34
Allocation power	kW		240	270	286	513	536	542
Refrigerant charge volume	kg		450	560	575	900	925	950
Evaporator	Water flow volume	m <sup>3</sup> /h	242	272	302	544	574	605
	Water pressure drop	kPa	75	75	75	115	115	115
	Pass quantity	-	2	2	2	2	2	2
	Connection pipe	mm	200	200	200	300	300	300
Condenser	Water flow volume	m <sup>3</sup> /h	302	340	378	601	710	756
	Water pressure drop	kPa	70	70	70	100	100	100
	Pass quantity	-	2	2	2	2	2	2
	Connection pipe	mm	200	200	200	300	300	300
Connection type			Bar clamp					
Outline dimension	W	mm	3650	3650	3850	4580	4580	4580
	D	mm	1810	1810	1810	2210	2210	2210
	H	mm	2000	2000	2000	2430	2430	2430
Weight	Net weight	kg	6700	6100	6800	10000	10150	10500
	Operating weight	kg	6700	7200	7800	12000	12200	12700

Note:  
 1. Above selections are applicable when chilled water outlet temperature is 7°C and cooling water inlet temperature is 30°C.  
 2. Standard water side bearing pressure is 1.0MPa while 1.6MPa is optional.  
 3. Fouling factor of chilled water and cooling water is 0.086m<sup>2</sup>·°C/kW.  
 4. If the specifications are changed due to product improvement, please refer to the parameters on the nameplate.

#### Specification Sheet in ARI Working Condition

Model: LSBLX mm SCE			130	150	250	275	300	350
Cooling capacity	kW		457	528	679	967	1055	1231
	RT		130	150	250	275	300	350
Motor power input	kW		79	95	147	165	193	192
COP	-		5.79	5.56	5.98	5.05	5.76	6.41
PLV	-		10.3	10.10	10.5	10.42	10.2	10.8
Allocation power	kW		97	105	102	102	201	212
Refrigerant charge volume	kg		235	260	255	200	305	425
Evaporator	Water flow volume	m <sup>3</sup> /h	71	82	138	160	193	191
	Water pressure drop	kPa	65	65	75	75	75	60
	Pass quantity	-	2	2	2	2	2	2
	Connection pipe	mm	150	150	150	150	150	200
Condenser	Water flow volume	m <sup>3</sup> /h	80	108	171	188	205	230
	Water pressure drop	kPa	60	60	70	70	70	55
	Pass quantity	-	2	2	2	2	2	2
	Connection pipe	mm	150	150	200	200	200	200
Connection type			Bar clamp					Flange
Outline dimension	W	mm	3000	3000	3000	3000	3000	3650
	D	mm	1250	1250	1250	1250	1250	1610
	H	mm	2000	2000	2000	2000	2000	2000
Weight	Net weight	kg	2200	2200	3000	3000	3000	5500
	Operating weight	kg	2600	2600	3700	3700	3700	6400

Model: LSBLX mm SCE			400	450	500	900	950	1000
Cooling capacity	kW		1400	1582	1738	3104	3340	3510
	RT		400	450	500	900	950	1000
Motor power input	kW		218	245	266	461	482	492
COP	-		6.45	6.46	6.61	6.79	6.86	7.15
PLV	-		10.67	10.69	9.52	11.44	11.56	12.05
Allocation power	kW		240	270	286	513	536	542
Refrigerant charge volume	kg		450	560	575	900	925	950
Evaporator	Water flow volume	m <sup>3</sup> /h	218	245	302	490	517	544
	Water pressure drop	kPa	80	80	75	100	100	100
	Pass quantity	-	2	2	2	2	2	2
	Connection pipe	mm	200	200	200	300	300	300
Condenser	Water flow volume	m <sup>3</sup> /h	273	300	378	615	649	604
	Water pressure drop	kPa	55	55	70	85	85	85
	Pass quantity	-	2	2	2	2	2	2
	Connection pipe	mm	200	200	200	300	300	300
Connection type			Bar clamp					
Outline dimension	W	mm	3650	3650	3850	4580	4580	4580
	D	mm	1810	1810	1810	2210	2210	2210
	H	mm	2000	2000	2000	2430	2430	2430
Weight	Net weight	kg	6700	6100	6800	10000	10150	10500
	Operating weight	kg	6700	7200	7800	12000	12200	12700

Note:  
 1. Above selections are applicable in ARI working condition: chilled water outlet temperature is 6.7°C and cooling water inlet temperature is 29.4°C.  
 2. Standard water side bearing pressure is 1.0MPa while 1.6MPa is optional.  
 3. Fouling factor of chilled water and cooling water is 0.086m<sup>2</sup>·°C/kW.  
 4. If the specifications are changed due to product improvement, please refer to the parameters on the nameplate.

#### Operation Range

Chilled water		Cooling water	
Outlet temperature(°C)	Temperature difference between inlet and outlet(°C)	Inlet temperature(°C)	Temperature difference between inlet and outlet(°C)
5-18	2.5-8	12-35	3.5-8

## Product Installation

### Installation Environment and Foundation

#### Installation Environment

- The unit should not be close to fire and inflammables. If it is installed together with heating unit such as boiler, it is necessary to consider the effect of thermal radiation.
- Select sites where room temperature is below 40°C and is drafty (High temperature will cause malfunction and accelerate corrosion). When ambient temperature is 40°C, relative humidity should be below 90%. It is not allowed to install or store unit outside or in the open air.
- Select sites with less dust.
- The site should be bright for the convenience of maintenance and inspection.
- In order to maintain, inspect and clean the heat exchange tube of condenser and evaporator, there should be enough space around the unit (See diagram of Maintenance Space for specific dimensions).
- For the sake of easy lifting and overhaul, it is necessary to install travelling crane or derrick car and make sure that the machine room is high enough.
- The surrounding of the unit and the whole machine room should be able to be drained completely.
- Avoid direct sunlight.

Note: Please contact the manufacturer if a unit with 350RT or more cooling capacity is to be installed 1000m or more above sea level.

### Installation Foundation

- The installation foundation must be made of cement or steel and should be able to bear the chiller's operating weight. Its upper surface must be level. It's better to set drain ditch around the unit.
- Place the chiller on the foundation correctly by referring to the diagram of installation foundation.
- The steel base plate and damping rubber pad should be reinforced by second grouting after the chiller is installed with anchor bolts. Anchor bolts should be about 100mm above the installation surface.

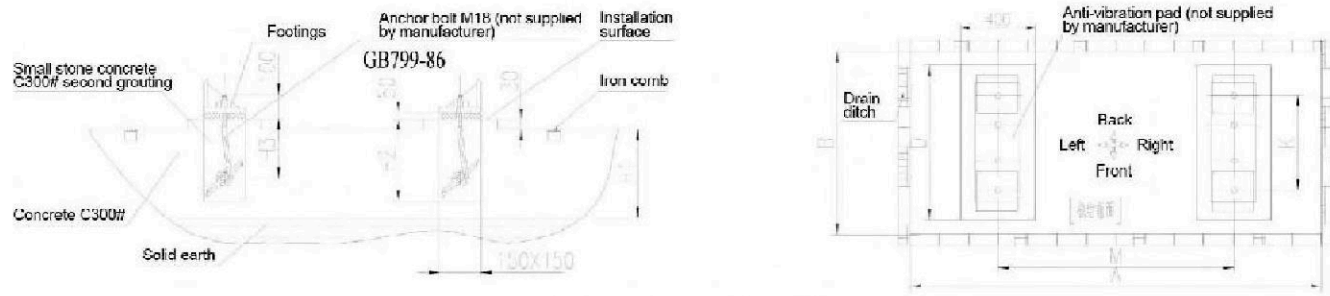
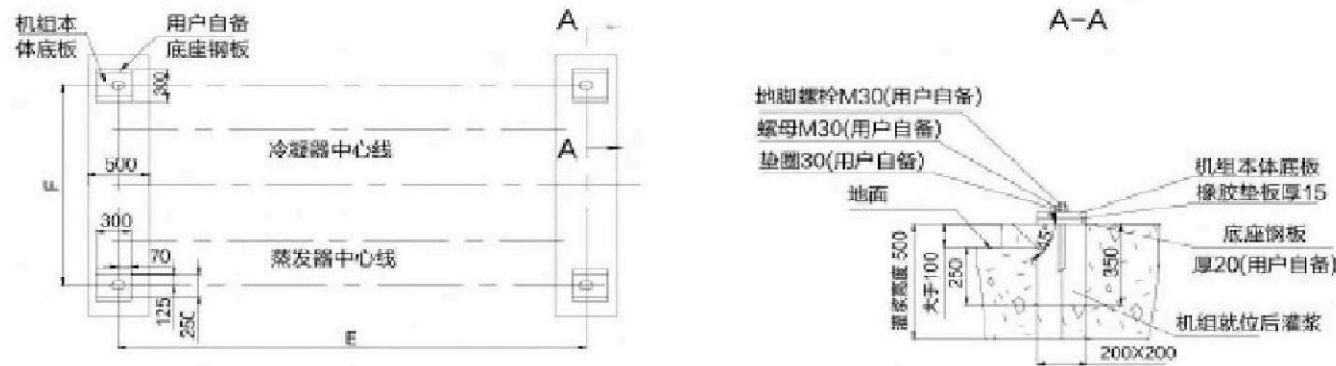


Diagram of Installation Foundation (130RT~300RT)

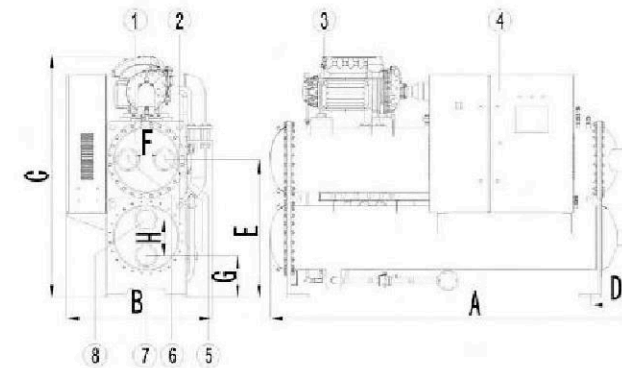
### Unit Foundation Dimension (130RT~300RT) (mm)

Model and dimension	A	B	D	M	K
LSBLX130SCE	2750	1090	880	2235	530
LSBLX150SCE	2750	1090	880	2235	530
LSBLX250SCE	3520	1090	880	3035	530
LSBLX275SCE	3520	1090	880	3035	530
LSBLX300SCE	3520	1090	880	3035	530



机组安装基础示意图 (350RT~1000RT)

### Diagram of Components

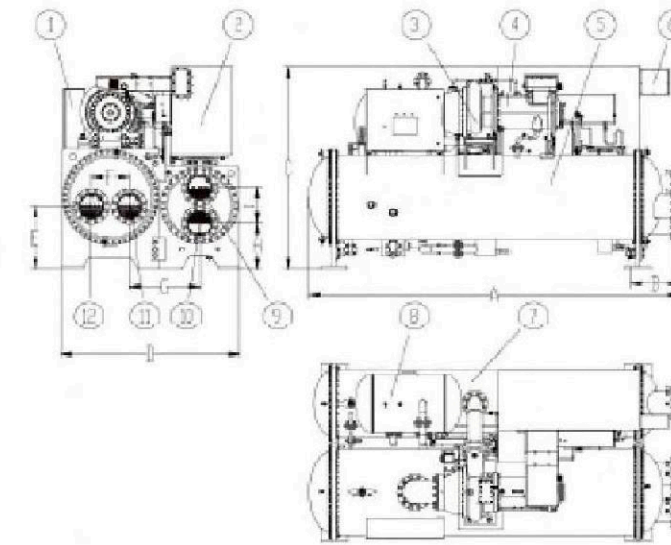


### Outline and Connection Dimensions— Single Compressor LSBL X 130SCE

No.	Name
①	Evaporator
②	Condenser
③	Magnetic Suspension Centrifugal Compressor
④	Electric control cabinet
⑤	Entering chilled water
⑥	Leaving chilled water
⑦	Entering cooling water
⑧	Leaving cooling water

### Dimensions of Gree Magnetic Suspension Centrifugal Chiller (130RT~300RT) (mm)

Model	A	B	C	D	E	F	G	H	Chilled water port	Cooling water port
LSBLX130SCE	3000	1250	2000	540	1160	280	330	290	DN150	DN150
LSBLX150SCE	3000	1250	2000	540	1160	280	330	290	DN150	DN150
LSBLX250SCE	3800	1250	2000	540	1160	280	290	310	DN150	DN200
LSBLX275SCE	3800	1250	2000	540	1160	280	290	310	DN150	DN200
LSBLX300SCE	3800	1250	2000	540	1160	280	290	310	DN150	DN200



### 机组部件示意图及外形尺寸图 (350RT~1000RT)

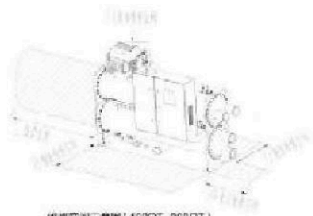
标记	名称
①	电控柜
②	变频器
③	压缩机
④	电机
⑤	蒸发器
⑥	客户接线端
⑦	冷凝器
⑧	闪发器
⑨	冷却出水
⑩	冷却进水
⑪	冷冻进水
⑫	冷冻出水

### ◆格力磁悬浮离心式水冷水机组尺寸 (350RT~1000RT) (单位: mm)

机组名称	A	B	C	D	E	F	G	H	I	冷冻水接口	冷却水接口
LSBLX350SCE	3650	550	2000	1810	575	350	780	450	350	200	200
LSBLX400SCE	3650	550	2000	1810	575	350	780	450	350	200	200
LSBLX450SCE	3650	550	2000	1810	575	350	780	450	350	200	200
LSBLX500SCE	3850	550	2000	1810	575	350	780	450	350	200	200
LSBLX900SCE	4580	605	2430	2210	815	470	870	550	470	300	300
LSBLX950SCE	4580	605	2430	2210	815	470	870	550	470	300	300
LSBLX1000SCE	4580	605	2430	2210	815	470	870	550	470	300	300

## Installation and Maintenance Space

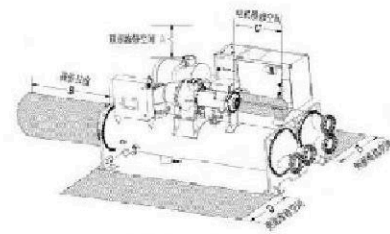
- (1) Leave enough space for installation, operation and maintenance.
- (2) The installation location should protect unit from sunlight and rain. Please keep the chiller from fire, inflammables, corrosive gas or waste gas. Leave some space for ventilation. Please take appropriate measures to reduce noise and vibration as much as possible.



标准空间示意图 (130RT~300RT)

▲尺寸及运行空间示意图 (130RT~300RT) (单位: mm)

型号规格	A	B	C	D	E
LSBLX130SCE	600	600	2000	1000	500
LSBLX150SCE	600	600	2400	1000	500
LSBLX200SCE	600	600	3200	1000	500
LSBLX275SCE	600	600	3000	1000	500
LSBLX300SCE	600	600	3200	1000	500



标准空间示意图 (350RT~1000RT)

▲尺寸及运行空间示意图 (350RT~1000RT) (单位: mm)

型号规格	A	B	C	D
LSBLX350SCE	1500	3500	1500	1220
LSBLX400SCE	1500	3500	1500	1220
LSBLX450SCE	1500	3500	1500	1220
LSBLX500SCE	1500	3500	1500	1220
LSBLX600SCE	1500	4000	1650	1320
LSBLX700SCE	1500	4000	1650	1320
LSBLX800SCE	1500	4000	1650	1320

## Electrical Installation

### Model 130RT~300RT

#### Diagram of External Wiring



#### Electrical Installation

- (1) Electrical installation must be performed by professional technicians according to national and local laws and regulations.
- (2) Chiller must be reliably grounded in compliance with requirements of standard GB 50169.
- (3) On-site wiring must be done according to the wiring diagram attached to the machine.
- (4) Line① represents the power cable (3ph with neutral wire and ground wire) between customer's power distribution cabinet and chiller's main control cabinet. The required power supply is 380V 3~ 50Hz. The power cord shall enter from the top of control cabinet and the cable size varies with the change of unit's power. Air switch and power cord selection:

型号 LSBLX__SCE	130	150	250	275	300
电源相线线径 (mm <sup>2</sup> )	95	95	95X2	95X2	95X2
电源接地线线径 (mm <sup>2</sup> )	50	50	95	95	95
断路器额定容量 (A)	200	200	400	400	400

- ① Above selection of circuit breaker and power cord is based on unit's maximum power (maximum current).
- ② Above power cord size is based on the working condition where ambient temperature is 35°C and multi-core copper cable (working temperature is 90°C, e.g. power cable with YJV cross-linked copper, insulated PE and PVC sheath) is lying on the surface of slot. If working condition is different, please adjust the size according to national standard.
- ③ Above circuit breaker specification is based on the working condition where ambient temperature is 40°C and the height above sea level is below 2000m. If working condition is different, please adjust the specification accordingly.
- ④ Line① represents the communication line from the main control cabinet to the water pump control cabinet and remote switch (See above diagram of wiring). The cable size should be equal to or above 1.0mm<sup>2</sup>. Note: The water pump control cabinet should be prepared by the user.
- ⑤ Line② represents the local group control interface reserved for chiller's main control cabinet. Connect wires as required by the chiller. Cable side should be equal to or above 0.75 mm<sup>2</sup>.

### Model 350RT~1000RT

#### Diagram of External Wiring

#### Electrical Installation

- (1) Line① represents the power cable between customer's power distribution cabinet and the onboard inverter start-up cabinet. The required power supply is 380V 3~ 50Hz. The power cord shall enter from the side or bottom of startup cabinet and the cable size varies with the change of unit's power.
- (2) Line② represents the communication line from the main control cabinet to the water pump control cabinet and remote switch (See above diagram of wiring). The cable size should be equal to or above 1.0mm<sup>2</sup>. Note: The water pump control cabinet should be prepared by the user. Please refer to the diagram attached inside the cabinet.
- (3) Because of PWM controlled rectifying 4-quadrant inverter technology, harmonic wave distortion factor is smaller than 5% and power factor is over 99%. Allocated electric current can be lowered by 10%. Power compensator and harmonic wave handling equipment are not needed.

## Scope of Supply

### 七、供货范围

S= 标准配置件; O= 用户自备件; P= 用户选购件

供货内容	型号规格	类别	备注
主机	台	S	
制冷剂	R134a	S	



## GREE C Series Centrifugal Chiller

GREE C Series Centrifugal Chiller is a new generation of high-efficiency chiller developed by Gree independently, integrating advanced design, manufacturing technique, and microcomputer control system. With cooling capacity ranging from 1000kW to 7800 kW, it is applicable to be widely used in large-size office buildings, hotels, schools, supermarkets etc. This series has got ARI certification.



### Nomenclature

LS	B	LX	3600	S	II	G
1	2	3	4	5	6	7

No.	Meaning of Code	Options
1	Unit's code	LS Chiller
2	Compressor model	B-Semi-hermetic compressor
3	Compressor type	LX-Centrifugal compressor
4	Nominal cooling capacity	Nominal cooling capacity, unit: kW
5	Compressor stage	Default-Single-stage; S-Two-stage
6	Voltage of motor	Default-380V; M-6000V; H-10000V
7	Energy efficiency code.	Default-Normal; G-High-efficiency



## Product Features

### Control Center with Colorful Touch Screen Display

The colorful touch screen, taken as the man-machine interface, can fully monitor and control the unit with the data information displayed in various ways, like text, graph, table, and curve etc. Additionally, it can display the unit's operation status, each sensor's status, each valve's status and operation parameters. It records the unit's major actions and errors.



### Environment Conservation and Positive Pressure Design

The system uses R134a as positive pressure. During operation, no non-condensable gases enter the system, so the cleanness of system is high and air extracting and recycling device is not needed. Compared with the unit of negative pressure design, its structure is compact and size is small, which greatly reduce the occupying area of machine room.



### Reliable Semi-hermetic Motor

The high-efficiency closed motor with liquid refrigerant cooling is adopted. Such design sufficiently reduces the potential of refrigerant and lubricant leakage, and do not radiate too much heat to the machine room, reducing initial investment on cooling device and operation cost. Gree patented cooling method provides precise control on operation temperature and stable and high-efficiency operation.

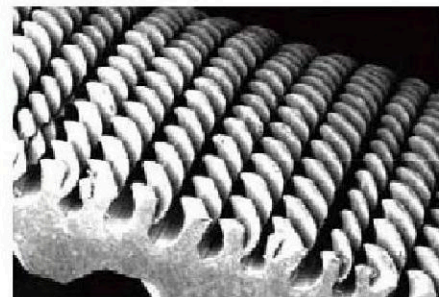
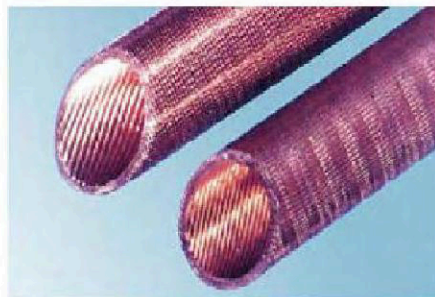
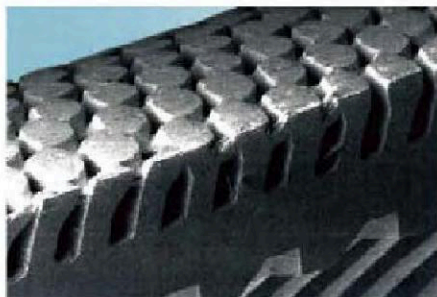


### Wide Operation Range

The patented diffuser technology and oil return technology with small pressure difference greatly extend the operation wide of unit. The unit can achieve stable operation under entering cooling water temperature of 16~35°C and achieve capacity step-less regulation at 10~100% load in order to match the actual load.

### Heat Exchange Tube and Heat Exchanger

The heat exchanger especially designed for the centrifugal chiller is capable of distributing the refrigerant more evenly and arranging the temperature field more practically so that the heat exchange efficiency will be enhanced dramatically. Meanwhile, the applied heat exchange tube is capable of effectively reducing the thermal resistance so that the cooling capacity and energy efficiency ratio will go up greatly.



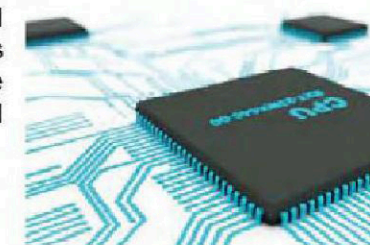
### High Fouling Factor Design

Based on the water quality of our country, the fouling factor of evaporator and condenser is designed as  $0.086\text{m}^2\cdot\text{C}/\text{kW}$ , higher than the international requirement of condenser of  $0.044\text{m}^2\cdot\text{C}/\text{kW}$  and evaporator of  $0.018\text{m}^2\cdot\text{C}/\text{kW}$ . There is no capacity attenuation for long-term operation, which reduces operation cost and prolong unit's maintenance period.



### Advanced Control Platform

Specialized 32-bit CPU and DSP digital signal processor is used for the control system. The high data collection accuracy and data processing capacity ensures the real-time feature and control accuracy of system control. Together with the colorful LCD touch screen, user can easily realize system auto control and manual control in debugging.



## Control Center with Colorful Touch Screen Display

### Wide, Clear and Touchable Screen



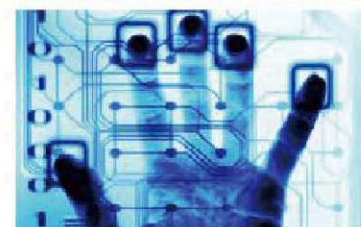
Touch screen display center is an advanced microprocessor control system that offers convenient, effective and visual interface to users for real-time monitor, data records, security guard, etc. It adopts 10"800×480 touch screen, whose elementary area is larger than 10.4" screen by 25%. User can enable corresponding functions by pressing on the touch screen. English version and Chinese version are both available.

### Accurate Control and Stable Output

Unit's control system can not only adjust load based on cold water leaving temperature but also predict and compensate the variance of air conditioning load based on the change rate of cold water entering temperature. Unit is faster in load adjustment and more stable in water leaving temperature. Under bad working condition, unit will adjust its operating data rather than stop frequently to satisfy user's refrigerating demands as much as possible.



### Authority Classification with Passwords



Control center has access passwords for operators so that set values won't be changed without authorization. Access authority is classified to user access and manufacturer access. User password is used to start up unit and enter the interface of user parameter setting. It is managed and can be changed by the user. Manufacturer password is used to enter the interface of manufacture parameter setting. Any change of the manufacture parameters may affect unit's reliability, therefore it shall be owned by professional engineering and debugging personnel.

### Soft Load-On and Soft Shut-down

When unit is going to shut down, the control system will turn down the inlet guide vane (IGV) to a preset value and then disconnect power. This can effectively reduce impact on the unit and extend unit's service life.



### Intelligent and Long-distance Service System



Touch screen is equipped with Modbus slaver communication protocol interface. The centrifugal chiller can be connected with building auto management system via the touch screen. It can also be linked with Gree long-distance intelligent service center by connecting the GPRS long-distance toolkits to the touch screen.

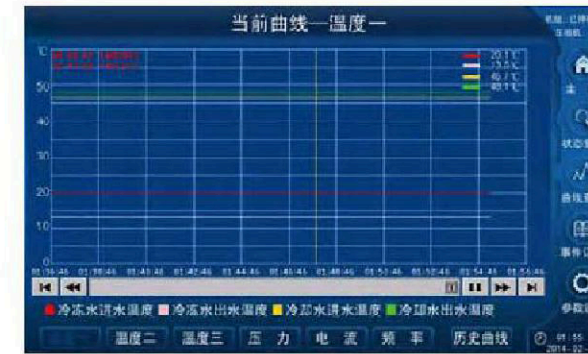
### Main Interface

After the centrifugal chiller is connected to power, a welcome page will be shown for 5 minutes. After that, the touch screen will display the main operation interface, where unit's external look and operation data are shown. When the water pump and side water pump are running, their color will turn from grey to green. When the compressor is working, its color will turn from black to green. This interface also presents the key parameters for monitoring:



- ▶ Chilled water outflow temperature
- ▶ Chilled water inflow temperature
- ▶ Cooling water outflow temperature
- ▶ Cooling water inflow temperature
- ▶ Unit's operating condition
- ▶ Compressor's operating condition
- ▶ Compressor's operating current
- ▶ Percentage in relation to the operating current at full load

User needs to enter user password when starting up the unit. The main interface can lead to 4 other interfaces, which are: "Curve Inquiry", "Event Log", "Parameter Setting" and "Status View". From the interface of "Curve Inquiry" and "Event Log", operator can view unit's operation records directly. For the interface of "Parameter Setting", user password must be entered. With "Manufacturer Password", user can gain access to "Manufacturer Parameters" from this interface. Interface of "Status View" allows operator to learn more about the real-time data of the chiller.



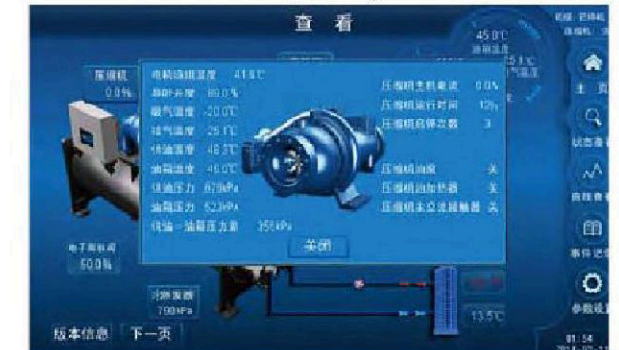
Curve Inquiry



Parameter Setting



Event Log



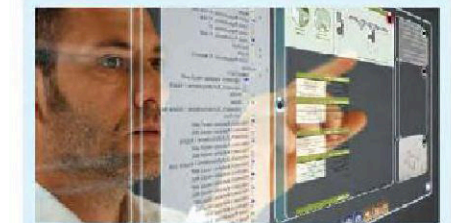
Status View

### Display Information

Touch screen can provide continuous monitor on the system. Chiller has 8 operating conditions: off-line, malfunction, urgent stop, operating, standby, starting, closing, and closed. Compressor has 2 operation conditions: stop and operating. If malfunction occurs to the chiller, self-protection function will be energized. All these operating records will be recorded in "Event Log".

### Display ON/OFF Status

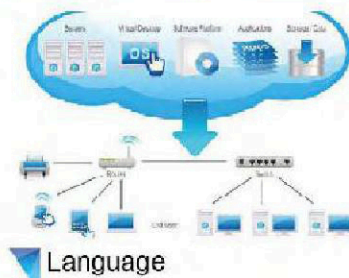
- ▶ Status of compressor main AC contactor
- ▶ Status of oil pump AC contactor
- ▶ Status of oil heater contactor
- ▶ Status of chilled water pump
- ▶ Status of cooling water pump
- ▶ Status of bypass valve (for some units)



### Display Simulation Status

- ▶ Cooling water inflow temperature
- ▶ Cooling water outflow temperature
- ▶ Guide vane pulse
- ▶ Current of main unit
- ▶ Oil tank temperature
- ▶ Chilled water inflow temperature
- ▶ Chilled water outflow temperature
- ▶ Discharge temperature
- ▶ Condensation pressure
- ▶ Evaporation pressure
- ▶ Oil supply pressure
- ▶ Oil tank pressure
- ▶ Oil supply temperature
- ▶ Motor winding temperature

## Input Quantity



- Chilled water outflow temperature
- Oil pump control mode
- Control mode
- Operating mode
- Language
- Timer
- Change user password
- Long-distance address
- System clock
- Touch sounds (ON/OFF)

## Alarm and Malfunction Information of Chiller

- Oil pressure difference alarm
- Compressor high pressure alarm
- Compressor low pressure alarm
- Guide vane error alarm
- Main unit over-current alarm
- Oil pressure difference protection
- Chilled water inlet sensor error
- Chilled water outlet sensor error
- Cooling water inlet sensor error
- Cooling water outlet sensor error
- Oil tank temperature sensor error
- Oil supply temperature sensor error
- Oil supply temperature protection
- Oil pump over-load protection
- Main unit winding over-heat protection
- Guide vane malfunction
- Startup cabinet malfunction
- Compressor high pressure protection
- Motor winding sensor error
- Discharge temperature sensor error
- Condensation pressure sensor error
- Evaporation pressure sensor error
- Oil supply pressure sensor error
- Oil tank pressure sensor error
- Compressor low pressure protection
- Anti-freezing protection
- Chilled water flow switch protection
- Cooling water flow switch protection
- Phase loss and phase failure protection
- Main unit over-current
- Main unit current sensor error
- Guide vane motor sensor error
- Urgent stop switch
- Interlocked stop switch
- Long-distance stop switch
- Startup forbidden for frequent ON/OFF

## Mechanical Features

Summary: Gree CVE series centrifugal chiller is completely assembled by the factory, including its evaporator, condenser, compressor, motor, lubricating system, chilling system and control system. Strict tests are made to the chiller to make sure each chiller can run stably.

### Compressor

The centrifugal compressor is semi-hermetic structure driving by closed motor. Speeding up by high-precision skew gear, the closed type impeller installed on the high-intensity alloy steel shaft rotates. With simpler entire structure and less moving parts, the operation is safe and reliable. The compressor impeller is new high efficiency closed impeller designed according to ternary flowing principle, which is more efficient and reliable compared with open impeller. The impeller is made up of long and short vanes to ensure the unit's efficiency in full load and partial load.



The impeller is made up by light and high-intensity aluminium alloy with high intensity and corrosion resistance. Through a series of strict tests, such as dynamic balance test and over-speed test, the impeller is capable of stable and reliable operation. The specially designed high-speed gear transmitting device adopts high-precision modified gear with more stable rotation and lower noise, and lifespan up to 25 years. The impeller, gear and main shaft adopt keyless connection to prevent stress raisers and rotor additional unbalance caused by key connection, greatly improving compressor's reliability and operation stability. Volute and gear case are integrated and they are made by particle ion with rare earth. Higher assembly precision is ensured by less components. The inner side of gear case is equipped with two-layer soundproof structure, which effectively reduces the operation noise of unit.



### Diffuser + Vane River Diversion Technology (Patented Design, Patent No.: 200920169419.2)

Adopting variable-section diffuser and vane river diversion technology, unit's operation range and performance are greatly improved and the compressor surge is effectively avoided. Variable-section diffuser and vane river diversion technology provide wider stable operation range. When the load changes, variable-section diffuser and vane river diversion technology can optimize the performance by reducing diffuser stalling region and regulating the air flow inside diffuser, so as to achieve more stable and more efficient operation of unit.

### Control of Cooling Capacity

The imported guide vane regulating mechanism can adjust unit's cooling capacity from 100% to 10% of design value. Through an external executive motor driving vane regulating mechanism, the vane opening degree is controlled so as to control refrigerant flow and maintain constant leaving chilled water temperature.

### Lubricating System

The lubricating system consists of oil storage tank, oil pump, oil cooler, oil filter, high-level oil space, oil heater and corresponding temperature sensor, pressure sensor and control system.

The bottom of gear case is also served as the oil storage tank, consisting of one oil-immersed pump and one oil heater.

The oil heater with auto constant-temperature control is adopted to remove the refrigerant in the oil in order to guarantee the quality of lubricant. After pumped out through the oil pump, the lubricant oil will enter the oil cooler and be cooled by refrigerant, with no need of on-site pipe connection. After flowed out from the oil cooler, the lubricant will go through a high-precision oil filter (filtration core can be replaced) to remove the impurities, and enter the high-level oil space and then enter each bearing surface and gear surface. The installation of all pipeline system will be done in the factory.

Before the unit starts, the oil pump will start in advance for lubricating. The oil pump will maintain operation during unit operation period and inertial operation period after stopping. There is a gravity oil supply high-level oil tank at the top of compressor gear case. When power failure occurs to the unit and oil pump, sufficient lubrication still can be guaranteed to ensure safe operation of unit.

The independent oil return system with small pressure difference separates the lubricant mixed in the refrigerant in order to improve the purity of refrigerant and then send the separated lubricant back to the oil tank to ensure stable operation of unit.

### Motor

The motor adopts closed structure. The shaft gland of open motor is not needed for refrigerant cooling, which eliminates refrigerant and lubricant leakage due to shaft gland and reduces maintenance cost of shaft gland. Motor shaft drives gear or impeller directly, solving the problems of shaft dissymmetry and damage to shaft gland caused by different expansion amount. Meanwhile, it can effectively reduce startup electricity load so as to ensure the normal operation of user's electric system.

The two sides of motor rotor are equipped with bearing. It is the most mature and reliable double-bracing motor, which is capable of more stable and reliable operation and avoid big vibration and unbalance of cantilever structure.

## Heat Exchanger

Evaporator and condenser tubes are made of low carbon steel. Tube plate is welded at each side of the tube. Holes of the tube plate are connected with heat transferring tube and shoe plate is set in the middle of pipe bundle. Shoe plate is made of carbon steel.

The most advanced and high-efficiency heat exchanging copper tube is adopted. The heat transmission of inner and external wall is optimized. Tube bundle of evaporator and condenser adopts expansion joint with shoe plate so that copper tube and shoe plate will not be damaged under the impact of high-speed refrigerant. This can avoid pipe leakage and extend the service life of heat exchanger. Tube plate holes are 3V slotted holes, ensuring the sealing quality.

Evaporator is a flooded type shell-and-tube heat exchanger. Due to the liquid balance sheet, refrigerant can be balanced all the way through so as to optimize the heat transferring effect. On top of the tube bundle, aluminum separate mesh is used to prevent liquid refrigerant from flowing into the compressor. 2~3 pieces of liquid level glass are equipped to facilitate refrigerant charging. Refrigerant safety valve is installed on the evaporator.

Condenser is a horizontal shell-and-tube heat exchanger. Baffle plate is installed at the gas outlet of compressor to prevent high-speed refrigerant's impact on tube bundle and also balance the flow to improve condenser's heat transferring effect. At the bottom of condenser, there is a built-in sub-cooler that provides high condensate depression for liquid refrigerant so as improve cooling capacity and energy efficiency. Refrigerant safety valve is also installed on the condenser.

The left and right water chambers can be exchanged. Design pressure is 1.0MPa; however the pressure can be adjusted to 1.6MPa according to actual needs. Standard water pipe connection is flange connection (plate type common welded flange HG20592 1.6MPa).

## Damping Device

The rotor of the centrifugal compressor has gone through strict static balance and dynamic balance test so that the dynamic load to the foundation will be relatively low. Usually, it is ok that the user just put a damping rubber cushion of 15~20mm's thick on the base steel of unit.

## Insulation of Evaporator and Motor

The surface of evaporator adopts two layers of sponge for insulation. The bottom layer adopts PE of 20mm's thick and surface adopts forming rubber of 20mm's thick. The 40mm-thick insulation layer can ensure good insulation, no condensation on unit's surface, as well as good fire resistance.

## Waterflow Switch

The unit is integrated with high-precision differential pressure waterflow switch, whose operation pressure reaches 1.6MPa. It is installed at the chilled water and cooling water inlet and outlet pipelines with power of 24V, 50Hz, 1ph.

## Paint

The paint is orange-grey with good anti-corrosive performance. In neutral salt spray test, heat and humidity resistance test and high/low temperature performance test, its performance is one time better than conventional anti-corrosive paint.

## Transportation

The unit will be transported as a whole. The whole unit will be protected by a cover and there is a sheet at the joint of water pipe for sealing.

## Optional Devices

### Soft Starter

Soft starter is a kind of motor control device integrating motor soft start, soft stoppage, light-load energy-saving function and multiple protection functions. For the connection between soft startup cabinet and unit, you only need to connect the power cord to the compressor motor and connect the communication cable of soft startup cabinet to the control cabinet of unit, with convenient installation and reliable performance.

Main protection functions of soft startup: overload protection, phase loss and reverse phase protection, overheating protection, overpressure protection, low-pressure protection, etc.



### Spring Vibration Damper

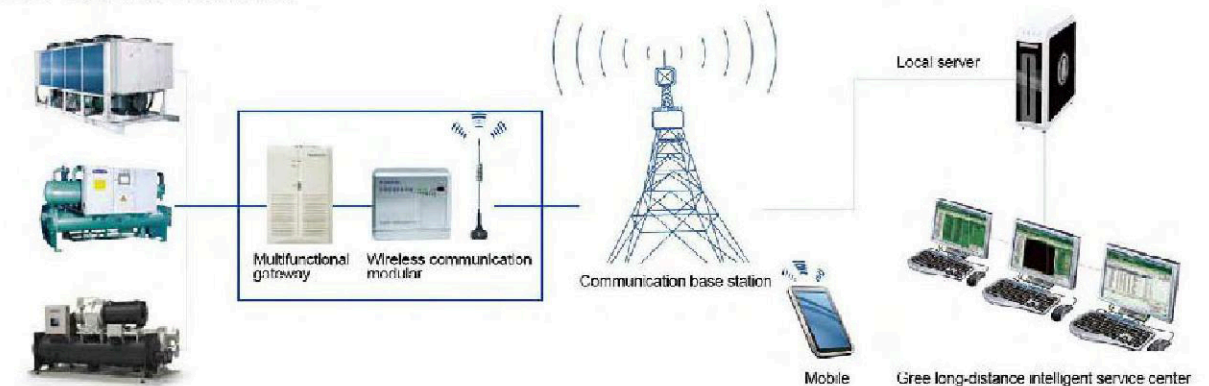
If the unit is to be installed at the floor, please use spring vibration damper instead of rubber damping washer. It is a kind of adjustable low-frequency steel spring vibration damper, consisting of multiple combined springs, upper and lower steel plates and rubber non-slid mat sticking on the surface of steel plates. The spring vibration damper features flexible installation, good stability, low free frequency and good damping effect.

## Long-distance Intelligent Service Center

### Control Center with Colorful Touch Screen Display

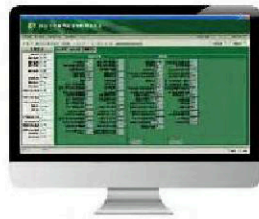
Gree long-distance intelligent service center is an advanced after-sales service platform, providing malfunction warning, operation diagnosis, operation data analysis, maintenance reminder, etc. so that the unit can operate in the optimal status, reducing maintenance cost and prolonging unit's lifespan.

Long-distance intelligent service is supported by Gree's professional technical team, integrating wireless communication technology and computer software technology. It can arrange long-distance collection and long-distance analysis on the unit's operation data and provide daily maintenance information of unit to the user, in order to effectively reduce unit's malfunction rate and malfunction influence, improve economical efficiency and safe operation, and provide the more favorable service for central air conditioner.



## Five functions of Gree long-distance intelligent service center

**Inquiry of long-distance data** With the help of wireless network, it can receive and check data from every GREE central air con and examine their real-time operation status.



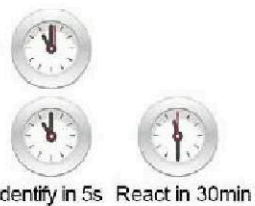
**Malfunction prevention** By analyzing real-time data, system can identify malfunction in advance and inform engineer to prevent it from happening.



**Malfunction quick response** 24 hours on guard, system can identify malfunction in 5s and react quickly in 30min to minimize user's loss.



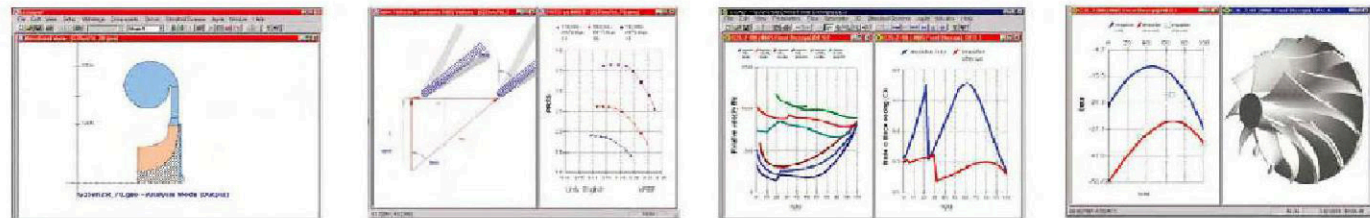
**Data memory** System can remember data and malfunction in the past and is able to quickly identify malfunction based on the historical record.



## Powerful Design and Manufacture

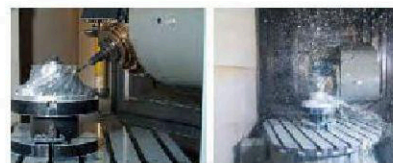
### Top Design and Analysis Platform

The compressor is designed and manufactured with the control software from the dominating software producer—Concepts NREC, U.S., which is also used for the aero-engine. Using the software Ansys, DyRoBeS etc to analyze the vibration and critical speed of rotation can basically guarantee the reliability of the unit.



### Advanced Numerical Control Machines

GREE has purchased a considerable number of large-sized horizontal boring-and-milling machines produced by DMG (Germany) and Toshiba (Japan), so as to guarantee each compressor part is of the optimum machining accuracy.



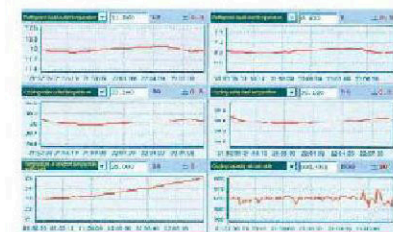
Swedish HEXAGON high-precision three-coordinates measuring machine with Germany Leitz instrument head is adopted to accurately measure the impeller vane shape, vane diffuser vane shape, backflow vane shape and body of centrifugal chiller.



HM3UB Shenck dynamic balance tester is adopted to test the impeller dynamic balance of centrifugal compressor with max testing diameter of 1200mm and testing length of 1500mm. It will ensure that the impeller imbalance degree of centrifugal compressor is below 50gm and guarantee unit's operation stability in maximum.

### Authorized Testing Center

Gree has the first-class centrifugal chiller on-line testing equipment with the capacity up to 8800kW, which comply with GB/T10870, and GB/T18430.1 and other national standards. Each unit has been tested in the factory to ensure its performance.



## Product Specification

Model: LSR1 Xn-B		1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	
Cooling capacity	kW	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	
	RT	284	341	398	456	511	568	625	682	740	798	854	900	
Compressor type	Single-stage													
Power supply	V-ph-Hz	380/6000/10000V 3N ~ 50Hz												
Power input	kW	191	227	261	293	321	354	383	416	448	480	523	554	
COP	W/W	5.24	5.29	5.36	5.46	5.61	5.65	5.74	5.74	5.8	5.83	5.74	5.78	
IPLV	W/W	5.96	6.02	6.1	6.21	6.38	6.43	6.54	6.53	6.6	6.64	6.53	6.57	
Allocation power	kW	210	250	287	322	353	389	421	460	493	528	575	608	
Refrigerant charging amount	kg	300	300	330	360	600	625	650	700	725	750	775	800	
Evaporator	Water flow volume	m <sup>3</sup> /h	172	200	241	275	310	344	378	413	447	482	500	
	Water pressure drop	kPa	75	75	75	75	75	75	75	90	90	90	90	
	Pass quantity		2	2	2	2	2	2	2	2	2	2	2	
	Connection pipe	mm	200	200	200	200	250	250	250	250	250	250	300	
Condenser	Water flow volume	m <sup>3</sup> /h	215	258	301	344	387	430	473	516	559	602	645	
	Water pressure drop	kPa	70	70	70	70	70	70	70	85	85	85	85	
	Pass quantity		2	2	2	2	2	2	2	2	2	2	2	
Connection pipe	mm	200	200	200	200	250	250	250	250	250	250	300		
Outline dimension	Width	mm	3630	3630	3630	3630	4150	4150	4150	4530	4530	4530	4530	
	Depth	mm	1680	1680	1680	1680	1900	1900	1900	2070	2070	2070	2120	
	Height	mm	2060	2060	2060	2080	2250	2250	2250	2500	2500	2500	2600	
weight	Net weight	kg	5700	6000	6300	6600	8900	9200	9400	10800	11200	11600	12000	
	Operating weight	kg	6200	6800	6800	7100	9800	10200	10800	12800	13000	13200	14000	

Operation range	Chilled Water		Cooling Water	
	Outlet water temperature(°C)	Inlet&outlet water temperature difference(°C)	Inlet water temperature(°C)	Inlet&outlet water temperature difference(°C)
	5-15	2.5-8	16-35	3.5-8

(Note: If you have any special request, please contact us.)

Model: LSBLX-H-G		3400	3600	3800	4000	4400	4800	5200	5600	6000	6400	6800	7200	7600	
Cooling capacity	KW	3400	3600	3800	4000	4400	4800	5200	5600	6000	6400	6800	7200	7600	
	RT	967	1023	1081	1136	1251	1364	1479	1591	1706	1818	1934	2044	2217	
Compressor type		Single stage						Two stage							
Power supply		380/6000/10000V 3N ~ 50Hz						6000/10000V 3 ~ 50Hz							
Power input	KW	582	632	682	732	784	825	880	950	1010	1072	1136	1195	1205	
COP	W/W	5.84	5.7	5.74	5.81	5.78	5.82	5.91	5.80	5.94	6.07	6.08	6.03	6.02	
IPLV	W/W	6.65	6.48	6.53	6.62	6.55	6.62	6.72	6.71	6.78	6.79	6.8	6.86	6.85	
Allocation power	KW	640	665	720	757	840	900	960	1045	1111	1179	1252	1315	1425	
Refrigerant charging amount	kg	820	900	925	950	1000	1000	1100	1500	1200	1600	1500	1900	2000	
Evaporator	Water flow volume	m <sup>3</sup> /h	585	610	654	688	757	826	894	963	1032	1101	1170	1238	1342
	Water pressure drop	kPa	90	115	115	115	115	115	115	125	125	125	125	125	125
	Process amount		2	2	2	2	2	2	2	2	2	2	2	2	2
	Connection pipe	mm	300	300	300	300	350	350	350	350	350	400	400	400	400
Condenser	Water flow volume	m <sup>3</sup> /h	731	774	817	860	946	1032	1118	1204	1290	1376	1462	1548	1677
	Water pressure drop	kPa	85	100	100	100	105	105	105	125	125	125	125	125	125
	Process amount		2	2	2	2	2	2	2	2	2	2	2	2	2
	Connection pipe	mm	300	350	350	350	350	350	350	400	400	450	450	450	450
Outline dimension	Width	mm	4530	4750	4750	4750	4750	4750	4750	5350	5350	5350	5350	5350	5750
	Depth	mm	2120	2330	2330	2330	2400	2400	2400	2620	2620	2620	2620	2620	2920
	Height	mm	2500	2750	2750	2750	2750	2750	2750	3100	3100	3100	3100	3100	3300
Weight	Net weight	kg	12200	14600	14800	15200	15800	16200	16600	22500	23800	25500	26100	26500	27000
	Operating weight	kg	14500	16500	17000	17500	18000	18500	19000	25950	27500	29450	30200	31000	32000

Note:  
 The model selection listed above is applicable to leaving chilled water temperature of 7°C and entering cooling water temperature of 32°C.  
 The standard bearing-pressure capacity of the water system of the unit is 1.0Mpa, and 1.6Mpa optional.  
 Fouling Factor of chilled water and cooling water is 0.086m<sup>2</sup>·°C/kW.  
 IPLV listed in the table is tested according to the conditions specified in National Standard GB/T 18430.1-2007.  
 The starting current of direct starting compressor is less than 8 times of rated current; the starting current of star-delta starting compressor is less than 3.5 times of rated current; the starting current of soft starting compressor is less than 4.2 times of rated current; direct starting is about 4s; star-delta starting is about 4s; soft starting is about 10s; power factor is 0.9.  
 If the specifications are changed due to product improvement, please refer to the parameters on the nameplate.

## Product Installation

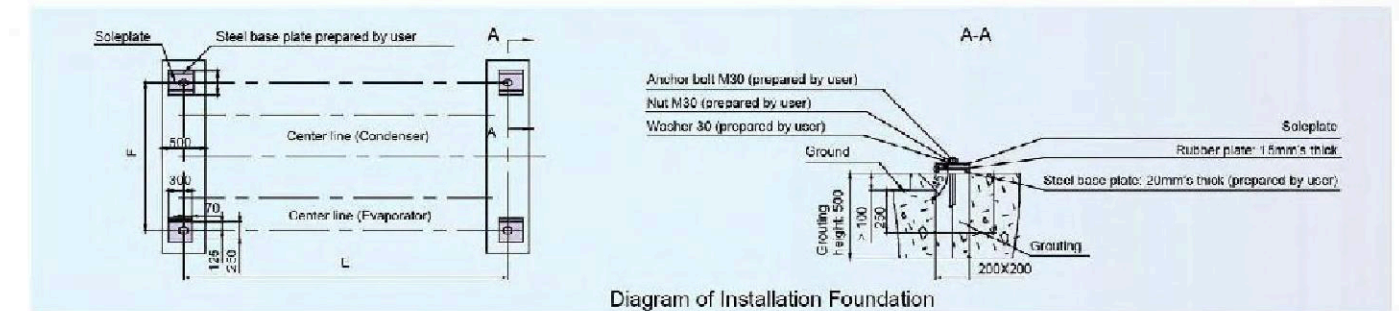
### Installation Environment and Foundation

#### Installation Environment

- The unit should not be close to fire and inflammables. If it is installed together with heating unit such as boiler, it is necessary to consider the effect of thermal radiation.
- Select sites where indoor temperature is below 40°C and is drafty. The ambient relative humidity in 40°C shall be below 90%. It is not allowed to install or store the unit outside or in the open air.
- It is better to install the unit where dust is as little as possible, as dust is one of most commonly causes of electrical faults.
- It is better to install the unit where the sunlight is sufficient for convenient maintenance.
- Enough space around the unit should be left for maintaining, inspecting and cleaning the heat exchange tube of the condenser and evaporator (Detailed dimension please refer to the maintenance space diagram of each unit).
- The derrick crane or similar special equipment should be used for hoisting and servicing the unit. Moreover, the machine room should be of proper height.
- Drainage should be available for the unit and the whole machine room.

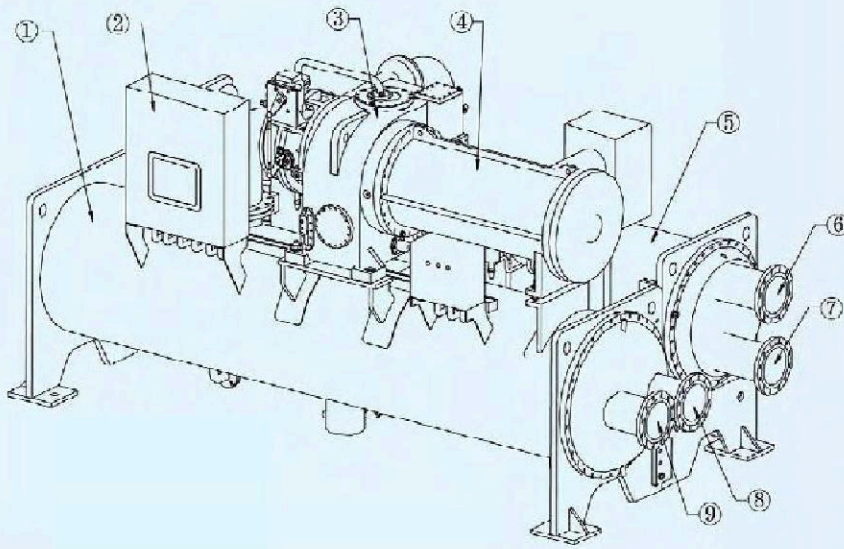
#### Direct sunlight should be avoided.

- The rotor of the centrifugal compressor has gone through strict static balance and dynamic balance test so that the dynamic load to the foundation will be relatively low. To prevent corrosion of the foundation, good drainage around the unit is required and the surface of the foundation should be smooth and even. See the following for more detailed requirements:
- The maximum fall difference on the foundation should be within 3mm.
- The foundation should be at least 100mm higher than the ground for easy service.
- Drainage channels should be arranged around the unit.
- No gap between the steel base plate and the soleplate of the unit should be kept. The steel base plate should be kept horizontal by sandwiching filler between the steel base plate and the concrete foundation.
- Hoist the unit, put the rubber on the steel base plate, and then place the unit on the rubber pad.
- The steel base plate and filler should be reinforced by second grouting.



Model and dimension	E	F	Model and dimension	E	F
LSBLX1000(H)G	2790	1430	LSBLX3600(H)G	3790	2080
LSBLX1200(H)G	2790	1430	LSBLX3800(H)G	3790	2080
LSBLX1400(H)G	2790	1430	LSBLX4000(H)G	3790	2080
LSBLX1600(H)G	2790	1430	LSBLX4400(H)G	3790	2230
LSBLX1800(H)G	3290	1650	LSBLX4800(H)G	3790	2230
LSBLX2000(H)G	3290	1650	LSBLX5200(H)G	3790	2230
LSBLX2200(H)G	3290	1650	LSBLX5600(H)G	4190	2370
LSBLX2400(H)G	3590	1820	LSBLX6000(H)G	4190	2370
LSBLX2600(H)G	3590	1820	LSBLX6400(H)G	4190	2570
LSBLX2800(H)G	3590	1820	LSBLX6800(H)G	4190	2570
LSBLX3000(H)G	3590	1870	LSBLX7200(H)G	4190	2570
LSBLX3200(H)G	3590	1870	LSBLX7800(H)G	4590	2670
LSBLX3400(H)G	3590	1870			

### Diagram of Components

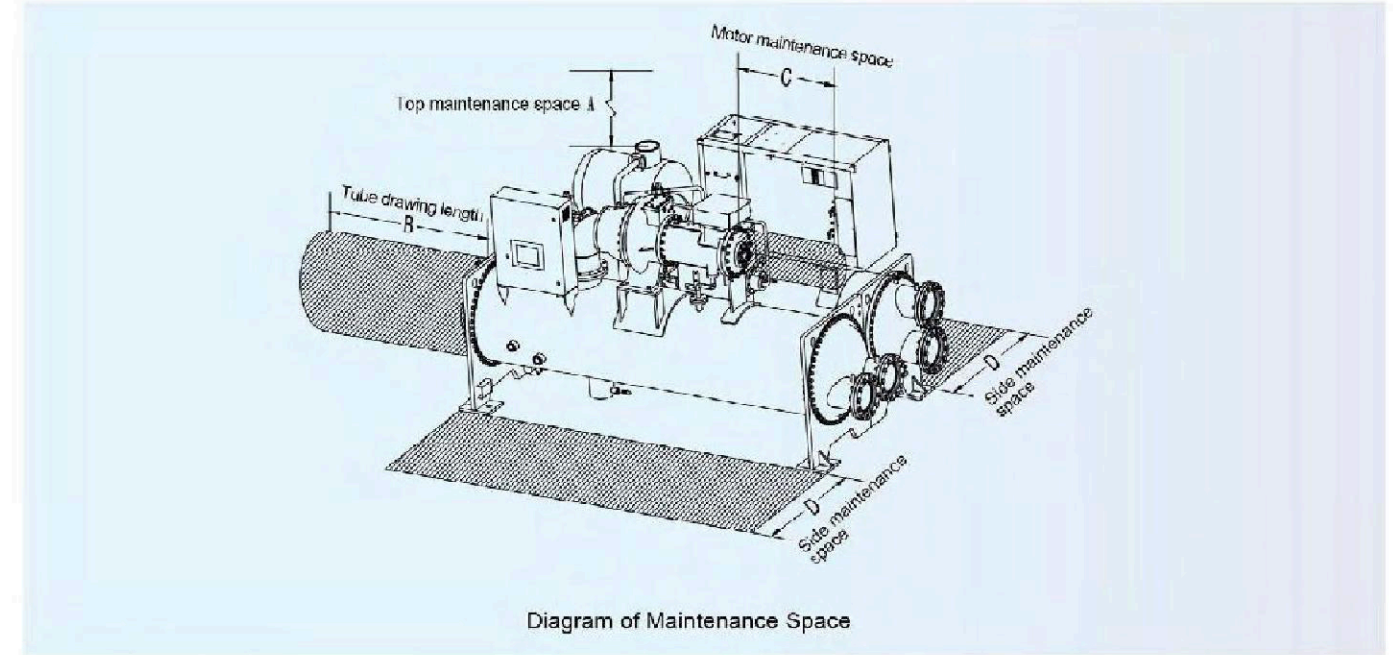


Component name

No.	Name
①	Evaporator
②	Electric control cabinet
③	Compressor
④	Motor
⑤	Condenser
⑥	Leaving cooling water
⑦	Entering cooling water
⑧	Entering chilled water
⑨	Leaving chilled water

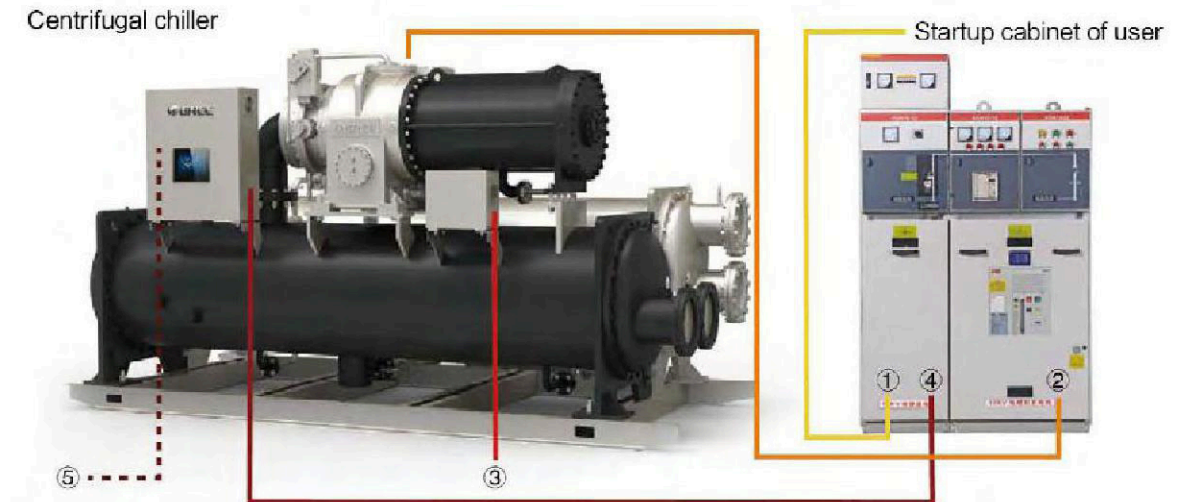
### Dimension of Installation and Maintenance Space

机型号	A	B	C	D
LSBLX1000(H)G	1500	3500	1500	1220
LSBLX1200(H)G	1500	3500	1500	1220
LSBLX1400(H)G	1500	3500	1500	1220
LSBLX1600(H)G	1500	3500	1500	1220
LSBLX1800(H)G	1500	3500	1500	1220
LSBLX2000(H)G	1500	3500	1500	1220
LSBLX2200(H)G	1500	3500	1500	1220
LSBLX2400(H)G	1500	3800	1650	1320
LSBLX2600(H)G	1500	3800	1650	1320
LSBLX2800(H)G	1500	3800	1650	1320
LSBLX3000(H)G	1500	3800	1650	1320
LSBLX3200(H)G	1500	3800	1650	1320
LSBLX3400(H)G	1500	3800	1650	1320
LSBLX3600(H)G	1500	4000	1800	1320
LSBLX3800(H)G	1500	4000	1800	1320
LSBLX4000(H)G	1500	4000	1800	1320
LSBLX4400(H)G	1500	4000	1800	1320
LSBLX4800(H)G	1500	4000	1800	1320
LSBLX5200(H)G	1500	4000	1800	1320
LSBLX5600SHG	1500	4400	1800	1520
LSBLX6000SHG	1500	4400	1800	1520
LSBLX6400SHG	1500	4400	1800	1520
LSBLX6800SHG	1500	4400	1800	1520
LSBLX7200SHG	1500	4400	1800	1520
LSBLX7800SHG	1500	4800	1800	1520



### Electric Installation

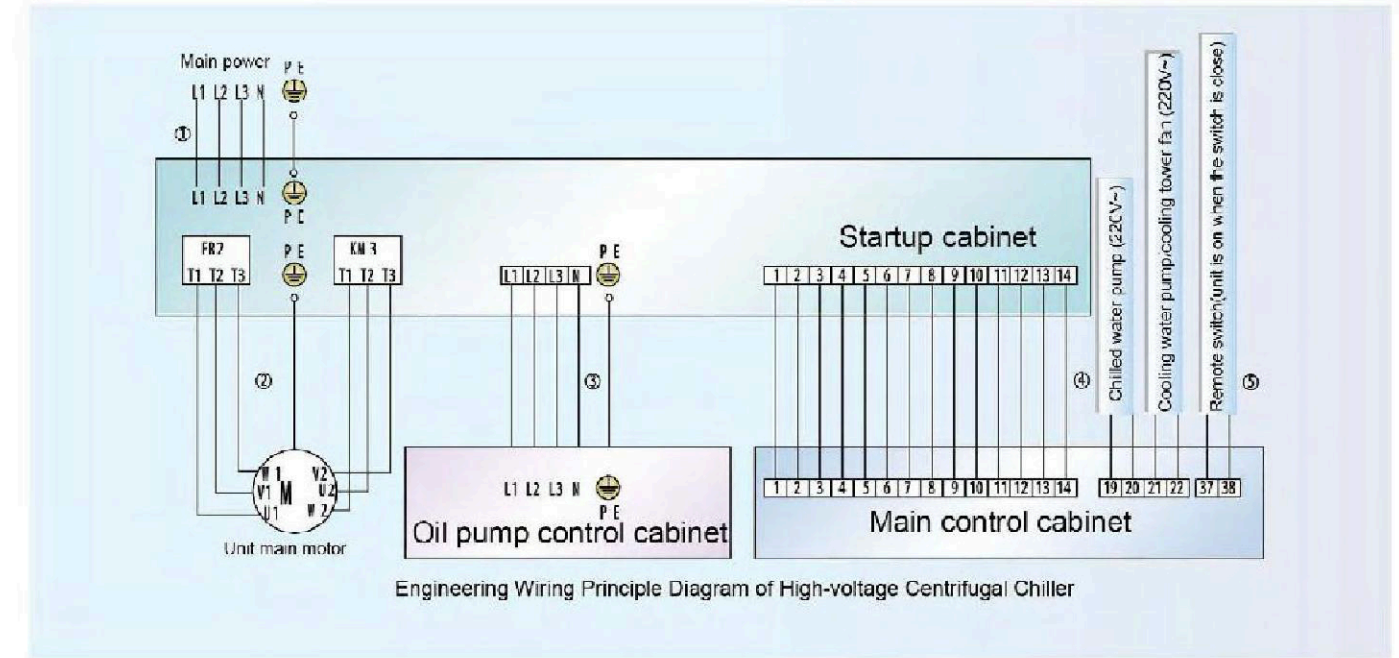
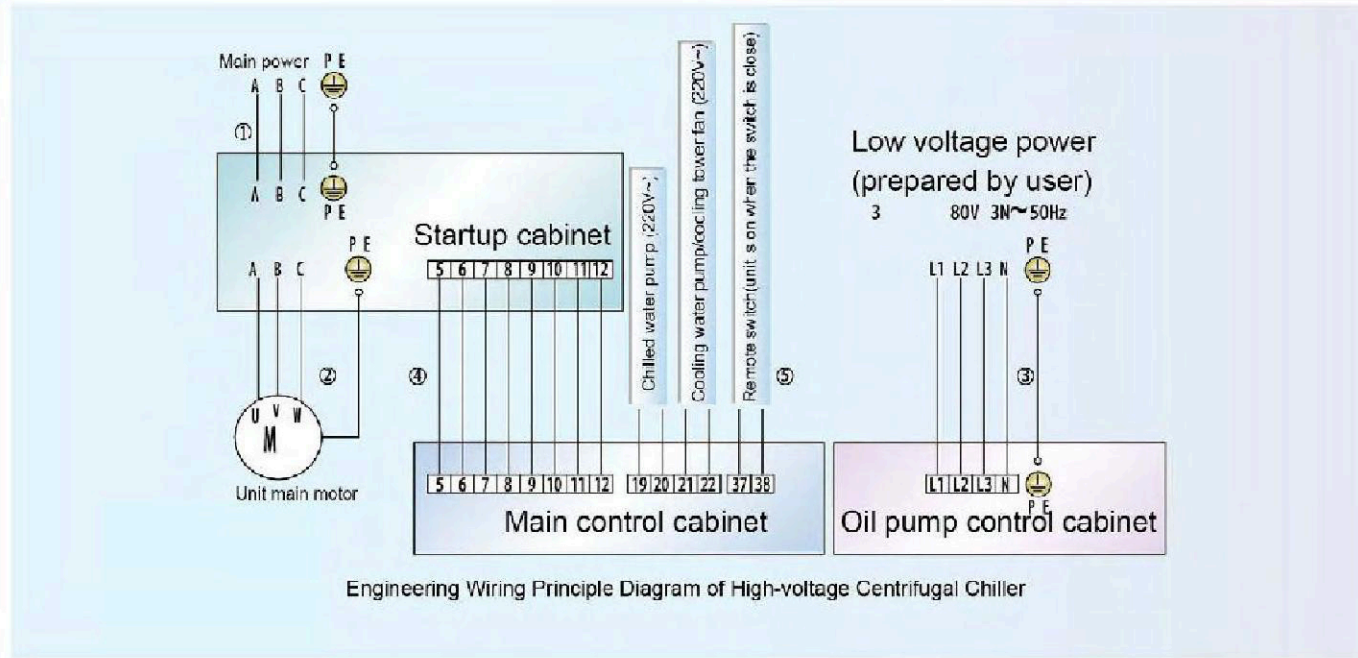
Engineering wiring diagram of the high-voltage centrifugal chiller: (Note: The appearance of the product is subject to continuous update due to design modification. Please refer to the actual product.)



**Note for wiring:**

- Line① presents the power cable between the local high-voltage distribution cabinet and the startup cabinet. The required power supply is 10kV 3~50Hz. The power cord shall enter from the bottom of startup cabinet and the cable size varies as the change of unit's power.
- Line② represents the drive cable between the startup cabinet and the master motor of the chiller. The drive cable shall go out from the bottom of startup cabinet and the cable size varies as the change of unit's power.
- Line③ represents the power cable between the local low-voltage distribution cabinet and the oil pump control cabinet of the chiller (three phase model is with neutral wire and grounding wire). The cable size should be equal to or more than 2.5mm<sup>2</sup>. The power supply specification is 380V 3N~50Hz.
- Line④ represents the communication line between the startup cabinet and the main control cabinet of the chiller. The size of the cables connecting the terminals "5" and "6" should be equal to or more than 2.5mm<sup>2</sup> and others should be equal to or more than 1.0mm<sup>2</sup>.
- Line⑤ represents the communication line from the main control cabinet to the water pump control cabinet and remote switch(Detailed connection please refer to the following diagram). The cable size should be equal to or more than 1.0mm<sup>2</sup>.

Note: The water pump control cabinet should be prepared by the user.



Engineering Wiring Diagram of Low-voltage Centrifugal Chiller (Note: The appearance of the product is subject to continuous update due to design modification. Please refer to the actual product.)



**Note for wiring:**

Line① presents the power cable between the local distribution cabinet and the startup cabinet(three phase with neutral wire and grounding wire). The required power supply is 380V, 3N~50Hz. The power cord shall enter from the top of startup cabinet and the cable size varies as the change of unit's power.

Line② represents the drive cable between the startup cabinet and the master motor (star-delta starter with grounding wire) of the chiller. The drive cable shall go out from the bottom of startup cabinet and the cable size varies as the change of unit's power.

Line③ represents the power cable between the startup cabinet and the oil pump control cabinet(three phase with neutral wire and grounding wire). The cable size should be equal to or more than 2.5mm<sup>2</sup>.

Line④ represents the communication line between the startup cabinet and the main control cabinet of the chiller(detailed connection please refer to the following diagram). The size of the cables connecting the terminals "5" and "6" should be equal to or more than 2.5mm<sup>2</sup> and others should be equal to or more than 1.0mm<sup>2</sup>.

Line⑤ represents the communication line between the main control cabinet and the water pump control cabinet(detailed connection please refer to the following diagram). The cable size should be equal to or more than 1.0mm<sup>2</sup>.

Note: The water pump control cabinet should be prepared by the user.

## Scope of Accessories Supply

### Scope of accessories supply

S=Standard Supply, O=User's Supply, P= Purchased Supply

Accessory name	Specification	Type	Note
Main unit	Set	S	
Refrigerant	R134a	S	
Lubricating oil	UO# synthesis lipid lubricating oil	S	
Low voltage startup cabinet	Set	S	Applicable for 380V models
High-voltage startup cabinet	Set	P	Applicable for 10kV and 6kV models
Oil filter	Piece	P	

Note: If long-distance monitoring, group control function or other functions are needed, please purchase related accessories.