air

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AHRI certification

CRAA certification

Energy conservation certification

ISO9001 ISO14001

OHSAS45001

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HITACHI

# Magnetic Bearing Centrifugal Chiller

## VM Series

Oil free worry free/Highly efficient/Stable & Reliable

R134a REFRIGERANT



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# Development History




Established in 1998, we have strived to become a total HVAC equipment manufacturer by covering water-cooled screw chillers, air-cooled screw chillers, centrifugal chillers, absorption chillers, air-cooled scroll modular chillers(heat pumps), water-cooled IR screw and many more in its product range.
Utilizing the various core technologies and patents Hitachi Cooling & Heating has on HVAC, as well as technical advantages and wealth of experience across product types, we have been on the forefront of innovation, providing reliable, highly efficient and sustainable high quality products to our customers worldwide.

**1998**



**Breakthroughof "0 to 1"**
First Centrifugal Chiller
1933

**High Efficiency and Energy Saving**
First VSD Centrifugal Chiller
1955

**Largest in the World**
10,000 RT Chiller Started
1989

**Sustainable and Efficient**
First"R134a"refrigerant two stage compression centrifugal compressor
1996

**Compact Structure**
Full series compact design compressor implemented
2012

**Technical Innovation**
Use of High speed VSD moto, single bearing direct drive with two stage impellers
2017

**Oil Free Worry Free**
Hitachi Magnetic Bearing VSD Centrifugal Chiller VM Series
2021

And Hitachi will continue to innovate……

**HVAC Manufacturing Bases：**
**3 in Japan**
**4 in China (including Taiwan)**
**8 other global bases**

Since our establishment, we have always been fulfilling our customers 'potential needs, creating new value and realizing their dreams as being the basic management principles of our firm. In order to achieve this, our focus is to develop cutting-edge technology and start from a globalized standpoint to think, innovate and act without boundaries for our innovation, while building the company into somewhere dynamic that fulfills the aspirations of each employee. Additionally, we not only respond to our customers needs, but also provide solutions looking into the medium and long term, what actually brings value to our customers. We operate under the principle of setting grand goals, not being bound by traditional methods, act in innovative ways to improve on existing skills and technology worldwide, while constantly taking in new ideas and knowledge. These are our core values as a company.

# Certified & Trusted



Performance of VM series
receiving US AHRI and China CRAA Certification



ASME Certification



China Specialized Equipment
Production Certification



ISO Environment
Standard Certificate



ISO Health and Safety
Certificate



ISO Quality Management
System Certificate

## Recognized Manufacturing Capability

Top 100 ISO Certified Firms, With ASME Pressure Vessel manufacturing certification, testing equipment verified by US AHRI and China GMPI



US AHRI Certification



CRAA Product Certification



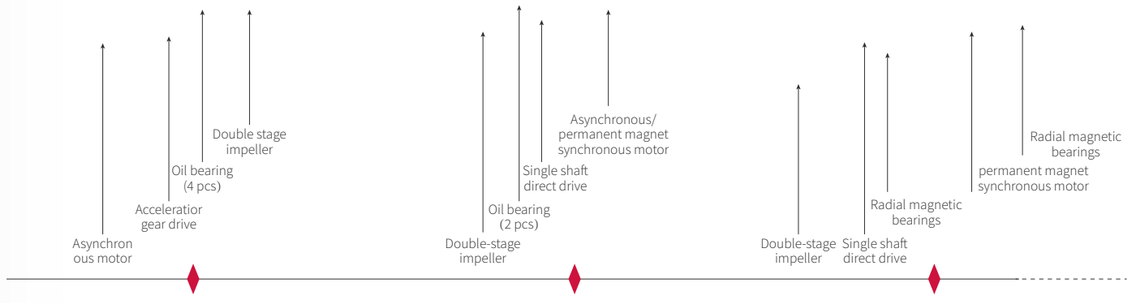
China Energy Efficiency Certificate



China Energy Efficiency Certificate

# Development History

## Hitachi VSD Centrifugal Compressor Development History




**1st Gen SIT Series**

Geared inverter centrifugal compressor
Single unit cooling capacity: 300-3000RT

**2nd Gen VG Series**

Direct drive inverter
centrifugal compressor
Single unit cooling capacity: 300-1100RT

**3rd Gen VM Series**

Magnetic bearing inverter
centrifugal compressor
Single unit cooling capacity: 350-1100RT

## Chiller Structural Components

**01 Magnetic Bearing Compressor**

No friction in operation
No need for oil system

**02 VSD Starter Cabinet**

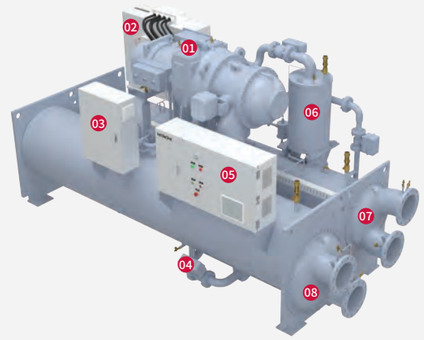
Better part load efficiency
Lower starting current

**03 Magnetic Bearing Controller**

Precise rotor control
Motor Linkage to ensure safety

**04 Electric Expansion Valve**

Flow Meter + Electric Expansion Valve
More precise flow control




**05 Chiller Electric Control Box**

Low voltage power supply for control box
Safer operation

**06 Vertical type Economizer**

Separate from compressor
Highly efficient and energy saving

**07 Highly Efficient Condenser**

High performance heat transfer tubes
Integrated sub-cooler design

**08 Highly Efficient Evaporator**

High performance heat transfer tubes
Optimized tubing placement

# Magnetic Bearing Technology

## Application fields of magnetic levitation technology

Magnetic bearing technology refers to the use of magnetic force to make objects in a frictionless, contactless suspension state, which has been widely used in different fields such as maglev trains, magnetic bearing centrifugal compressors, maglev composite molecular pumps, and maglev turbine vacuum pumps. For example, the magnetic levitation centrifugal compressor achieves frictionless through bearing suspension, without the need for lubricating oil system, efficiency is higher and easier to maintain.



Maglev trains



Magnetic bearing centrifugal compressor



Magnetic levitation composite molecular pump



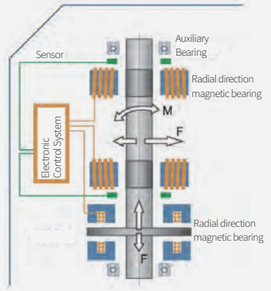
Magnetic levitation turbine vacuum pump

## The working principle of magnetic bearing suspension

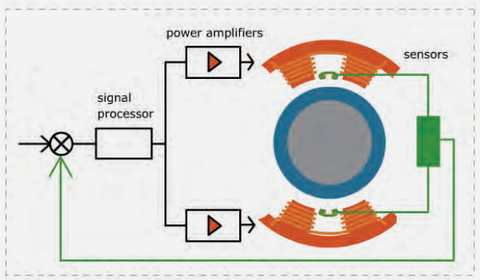
The electromagnets are arranged in the form of radial bearings and axial bearings and provide magnetic pull to lift the rotating shaft of the machine. The current in the electromagnet is regulated by a precise digital electronic control system that provides magnetic force to respond to changes in external loads at any time to keep the shaft well centered. In this way, the shaft is lifted contactless, and the bearing can be adjusted by a digital electronic control system. These features enhance the performance of high-speed rotating machines, making the equipment have remarkable characteristics of high reliability and low energy consumption.

### Components

- The magnetic bearing itself
- Sensor
- Electronic Control System
- Auxiliary Bearings




## Magnetic levitation electrical principle

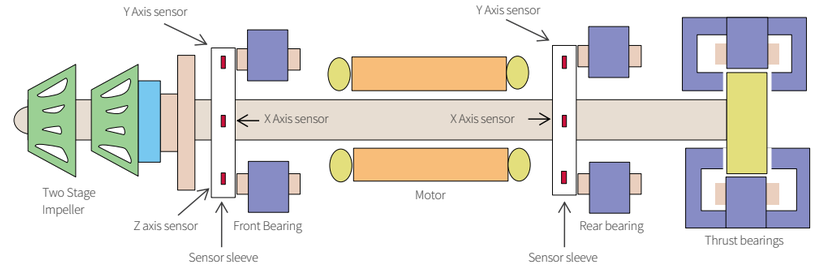



The figure on the left is a simple magnetic levitation electrical schematic diagram, which is composed of four parts: rotor, sensor, controller and actuator, in which the actuator includes two parts: electromagnet and power amplifier.
Suppose that at the reference position, the rotor is disturbed by a downward disturbance and will deviate from its reference position, then the sensor detects the displacement of the rotor to deviate from the reference point, and the signal processor that acts as the controller transforms the detected displacement into a control signal. This control signal is then converted into a control current by a power amplifier, which generates a magnetic force in the actuation magnet and thus drives the rotor back to its original equilibrium position. Therefore, the rotor is always in a stable equilibrium state, regardless of downward or upward disturbances.

# Highly Efficient and Energy Saving

## Highly-efficient magnetic bearing centrifugal compressor to achieve excellent energy saving results with high COP/IPLV

Hitachi Cooling & Heating magnetic bearing centrifugal compressor is designed with high speed direct drive design, without speed increase gear, reducing transmission loss, and based on magnetic levitation technology, the use of proprietary magnetic bearings instead of traditional mechanical bearings, allows for no lubricating oil, further reduce mechanical losses. With Hitachi Cooling & Heating high-efficiency two-stage impeller, the COP at full load can be as high as 6.81 and the comprehensive part-load efficiency IPLV can be as high as 9.29 under the GB standard working conditions.

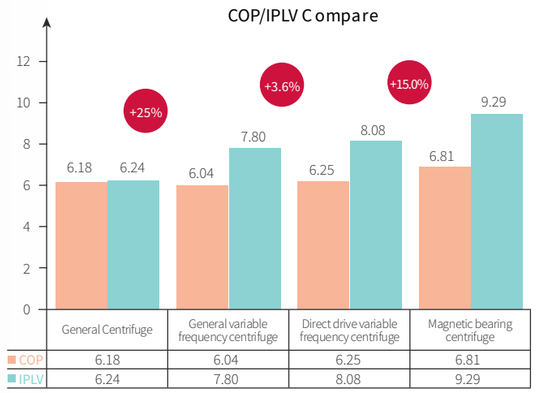



## Professional VSD+precise flow control to achieve better comprehensive part-load efficiency

By using of high-efficiency, easy-to-maintain mounted inverters, Hitachi Cooling & Heating unique pressure ratio inverter control technology and liquid level sensor control throttling mode, the compressor always operates at the optimal speed in all working conditions, while maintaining the optimal refrigerant liquid level height in the heat exchanger, and achieving better comprehensive part-load efficiency.

IPLV(GB)=0.023A+0.415B+0.461C+0.101D
IPLV(GB)=Integrated Part Load Value

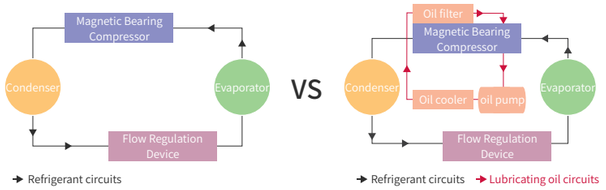
A=COP or EER at 100% load (30°C ECWT)
B=COP or EER at 75% load (26°C ECWT)
C=COP or EER at 50% load (23°C ECWT)
D=COP or EER at 25% load (19°C ECWT)



# Energy Efficient

## The system is oil-free, maximizing system efficiency

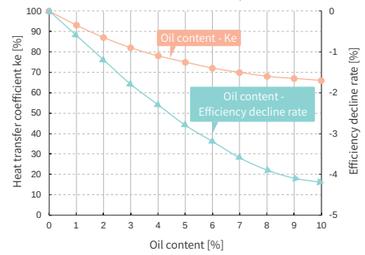
Combined with magnetic bearing technology, the refrigeration system operates without oil. Compared to traditional oil-lubricated bearing solutions, the magnetic bearing system is extremely simple, eliminating the need for complex oil-lubricated circuits, reducing additional losses and maximizing system efficiency by eliminating the adverse effects of lubricating oil on the heat exchanger.




System diagram of magnetic bearing centrifugal unit

System diagram of ordinary centrifugal unit

Effect of oil content on heat transfer performance

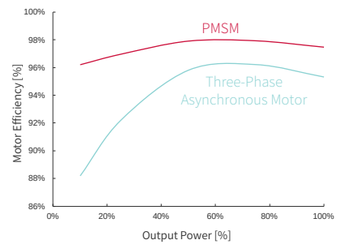



Note: Data from Hitachi test data

## Permanent magnet synchronous motor to improve motor efficiency

Permanent magnet synchronous motors have obvious advantages over asynchronous motors. There is no excitation loss, and within operating range, motor efficiency is high, especially the partial load efficiency is significantly improved, and the power factor is high at the same time, which better improves the quality factor of the power grid, and saves the investment of the power grid. In the main operating range of the unit, that is, 25%~75% load, the efficiency of the permanent magnet synchronous motor is about 5% higher than that of the three-phase asynchronous motor on average.

The permanent magnet synchronous motor adopts the refrigerant injection cooling technology of spiral surrounding, the temperature field of the motor is uniform, and the bounce of the stator silicon steel sheet is low, which ensures the efficient operation of the motor.

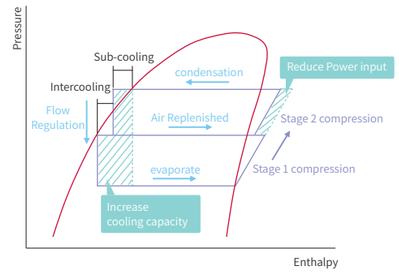



## Patented design of sub-cooler and economizer to improve heat exchange efficiency

The patented sub-cooler and centrifugal economizer are used to improve the subcooling degree and gas-liquid separation performance, thereby improving the cooling capacity and heat exchange efficiency overall.








# Stable and Reliable

## Direct Drive Motor, allowing for lower failure rate

The frequency conversion single-shaft direct drive impeller is adopted, the speed increase gear is canceled, the transmission system is simpler, the moving parts are reduced, the failure rate is lower, and the reliability is higher.

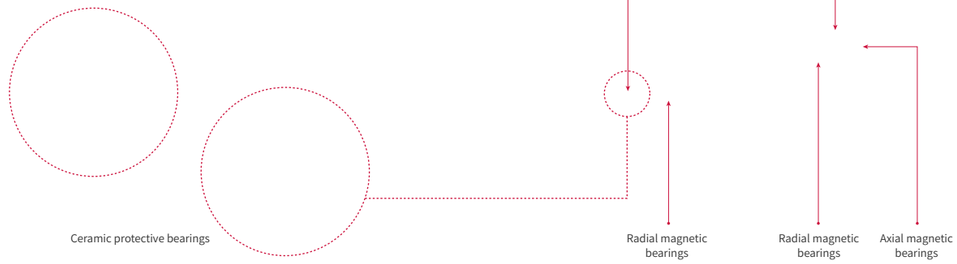



Gear speed drive: many moving parts

Direct drive: few moving parts

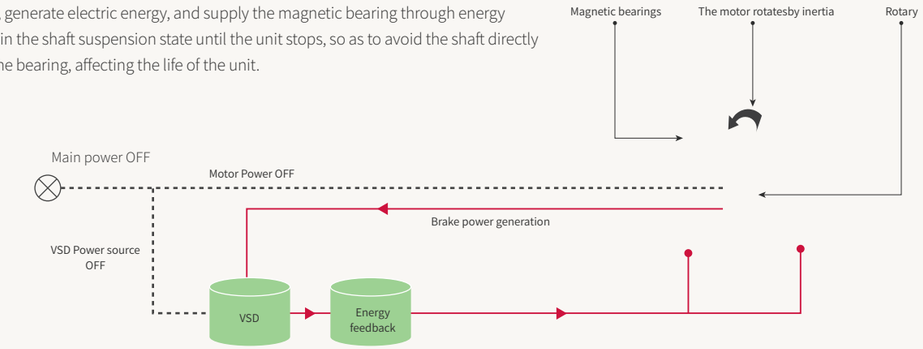
## Auxiliary bearings to avoid damage to magnetic bearings

The compressor comes standard with an auxiliary bearing system, which is custom-designed with ceramic bearings that can adapt to all kinds of harsh operating conditions, ensuring that when the compressor is shut down, the shaft falls directly on the auxiliary bearing, avoiding damage to the magnetic bearing.




## Emergency power-off protection system to effectively protect bearing life

It is equipped with a complete emergency power-off protection system as standard. In the event of an emergency power failure, the permanent magnet synchronous motor rotates by inertia to brake and generate electricity, generate electric energy, and supply the magnetic bearing through energy feedback to maintain the shaft suspension state until the unit stops, so as to avoid the shaft directly falling and hitting the bearing, affecting the life of the unit.



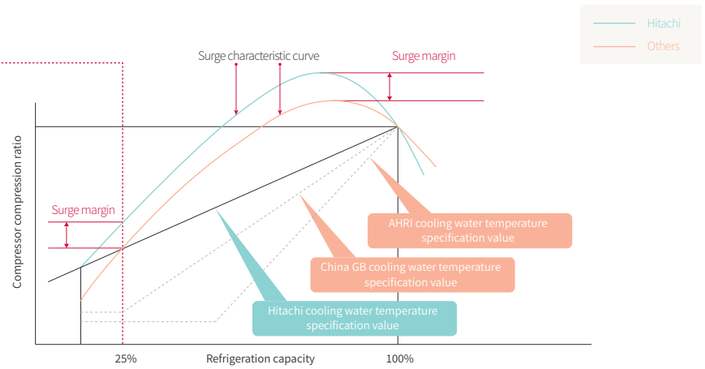
# Stable and Reliable

## Strict anti-surge measures

Due to the high ambient temperature in Japan in summer, the industry standard JIS has high requirements for the stable operation of the unit in a high-temperature environment. Hitachi centrifugal unit strictly abides by the Japanese JIS standard, and adopts a two-stage wing-shaped three-dimensional high-efficiency impeller and vane diffuser, which can operate stably even when the refrigeration load is small and the cooling water temperature is high, preventing the occurrence of surge and ensuring high reliability of operation.
By detecting the unit's pressure ratio of high and low pressure of the unit to change the speed, the unit surge phenomenon caused by the pollution of the heat transfer tube is avoided, and at the same time, the unit is escorted by strict surge detection and avoidance function.
When the compressor is about to stall, the force of the magnetic bearing is uneven, and the signal is fed back to the compressor bearing controller to send a shutdown command。

Cooling water inlet temperature under different loads：

| Load | Hitachi Standard | AHRI Standard | GB Standard |
|---|---|---|---|
| 100% | 32°C | 29.4°C | 30°C |
| 75% | 30.75°C | 23.9°C | 26°C |
| 50% | 29.5°C | 18.3°C | 23°C |
| 25% | 28.25°C | 18.3°C | 19°C |
| 0% | 27°C | 18.3°C | 19°C |



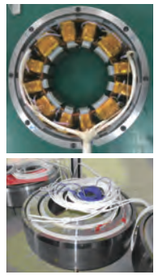

## Key parts, multiple safety guarantees

### Impeller

The impeller is made of special aluminum alloy material with high strength, and the ideal fluid shape is precisely cast through vacuum, and at the same time, the impeller structure is analyzed for strength, three-coordinate detection, dynamic balance test and over-speed test to ensure that the impeller runs reliably at high speed.

### Magnetic bearing

The use of pure electromagnetic force to support the rotor suspension, can well avoid the risk of bearing demagnetization.



### High-frequency vector inverter

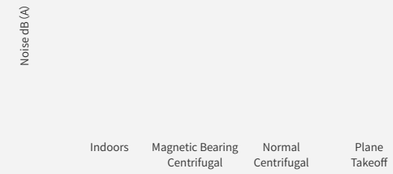
A special refrigerant cold inverter for refrigeration compressors specially developed in the field of central air conditioning, which has the characteristics of small size, high efficiency, low harmonics and high protection. Direct cooling of refrigerant, unique heat dissipation design to ensure the temperature uniformity of the power device, intelligent anti-condensation technology to ensure safe operation in high temperature and high humidity environment.



# Environmental Responsibility

## Quiet Operation and Sustainable for the Environment

Noise is an important factor in evaluating the environmental impact of a unit. VM series adopts magnetic bearing, the moving parts are completely suspended, frictionless operation, and the operating noise is as low as 76dB (A), which is 5~10 decibels less than that of ordinary centrifugal units.
Lower noise means a more comfortable environment in the computer room. The comfortable environment allows the operator to control the efficient and stable operation of the unit.

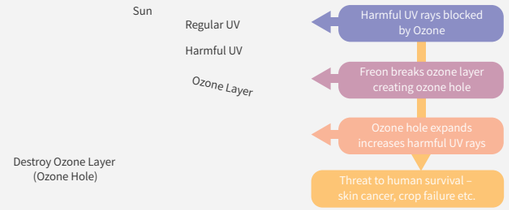



## Smooth operation without vibration

The compressor does not have mechanical contact when working, its vibration level is very low, there is no vibration impact on the surrounding building environment, there is no need to purchase and install expensive noise and vibration reduction components, and the on-site installation is convenient.

## Environmentally friendly refrigerant to protect the ozone layer

R134a refrigerant does not contain chlorine atoms, has no destructive effect on the atmospheric ozone layer, meets environmental protection requirements, and has no ban period in the latest Montreal protocol.




## Oil free system, reducing pollution to the environment

The refrigeration system runs without oil, eliminating a series of devices such as lubrication system, saving space and eliminating the problem of environmental pollution caused by lubricating oil.



# Precise Control



## Color touch screen display, easy to operate

The control center is completely composed of a 10.4-inch color liquid crystal touch display (LCD) with a clean and clear appearance.
The colorful color touch screen improves the convenience of identification, and the operation is simple and fast.
Centralized display of simple process and various operation information of the unit.
Centralized control of various settings and statuses of the unit。
Set up three-level access rights according to the different needs of manufacturers, customer service maintenance and user use.

## Display information

Displays the operation status and operation data of each operation
Displays a trend graph in action

Displays past trend data (updated every minute.)
Display and save fault and alarm history

Displays the corresponding guidance in case of a malfunction

## Displays operating status

The main motor is stopping
The bearing falls in the shaft
Low load stops
The power outage is in progress

ECO mode
Power saving mode
Surge detected
Load limiting

Evaporation pressure is limited
Condensation pressure is limited
Rebooting is being limited

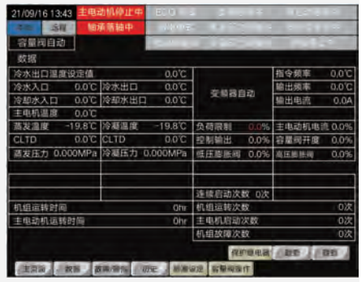



## Displays simulated data

Cold water inlet temperature
Cooling water inlet temperature
Main motor temperature
Evaporation pressure
Output current
High-pressure expansion valve opening

Cold water outlet temperature
Cooling water outlet temperature
CLTD (condenser approximation temperature)
Condensing pressure
Main motor current
Low pressure expansion valve opening

Evaporation temperature
Condensing temperature ELTD (evaporator approximation temperature)
Output frequency
Volumetric valve opening




## Fault and alarm information

The temperature of the main motor is high
Cold water is supercooled
Startup timeout
The inverter is abnormal
The control sensor is abnormal
The potential of the volume control valve is abnormal
Evaporator pressure drops

Inverter failure
Abnormal bearing dropping
Cold water cut-off
Emergency stop
Abnormal economizer
The condenser pressure rises




Low pressure of evaporator
The bearing controller is abnormal
Cooling water cut-off (optional)
Abnormal communication
Abnormal sensor
The potential of the low-pressure expansion valve is abnormal

Condenser high pressure
Abnormal bearings
Cold/cooling water interlocking abnormality
Abnormal frequency
Abnormal battery
The potential of the high-pressure expansion valve is abnormal

## Remote communication functions

Through the RS485 physical bus, using the same communication format as the superior communication MODBUS RTU, communicate with other equipment, collect and monitor the data of the unit in real time, and the user can form a group control system according to the actual needs. The user can control the start and stop of the unit through the remote signal, and set the temperature or load limit value of the chiller outlet by inputting DC4~20mA current signal remotely according to their own needs, and the load limit range is 5%~100%.

### Remote signal output

Chiller operation signal output
Main motor operation signal output
Re-start the limit signal output
Remote/local signal output alarm signal output

Chilled water pump interlocking signal output
Main motor current analog signal output (DC4~20mA)
Condensing pressure analog signal output (DC4~20mA)

Analog signal output of volumetric valve opening (DC4~20mA)
Fault signal output
Low-load stop signal output
Cooling water pump interlocking signal output

## Options

### The evaporator/condenser water side pressure

The standard unit is designed to withstand a pressure of 1.0MPa, and there are 1.6, 2.0MPa specifications and special requirements for selection.

### Refrigerant isolation valves

Isolate and store the refrigerant in the condenser for easy access, eliminating the need for time-consuming and laborious transfer of the refrigerant to other vessels.

### Spring vibration absorber

The standard unit is equipped with a high-elasticity rubber damping gasket, and if there are special application requirements, a spring damping device can be selected to further reduce the vibration transmission of the unit to the load-bearing surface.

### Dismantling and shipping in parts

If the equipment handling space is limited and the whole chiller is not allowed to be lifted, the chiller can be disassembled into several large parts (compressor, heat exchanger, electric control box, economizer) and then hoisted to a smaller space.

### Marine water tank

The marine water tank makes it extremely easy to clean the copper pipes of the heat exchanger without having to remove the water pipes.

### Harmonic Filter (5%)

It is suitable for special needs such as data center, electronic precision, medical cleaning, etc., to suppress harmonics and improve power factor.

# Chiller Specifications

## Technical data sheet

Recommended selection example (power supply AC 380V/50Hz/3ф/3W, VSD start)

| Type | Cooling Capacity | | Input power 1※ | COP 1※ | IPLV (GB) | Input power 2※ | COP 2※ | Rated Current 2※ | Evaporator | | | | Condenser | | | | Overall Dimension | | | Shipping Weight | Operating Weight | Ref.Amount (Initial charge) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Flow rate | Pressure drop | Pipe Diameter | Pass | Flow rate | Pressure drop | Pipe Diameter | Pass | L | W | H | | | |
| — | USRT | kW | kW | — | — | kW | — | A | m³/h | kPa | DN | — | m³/h | kPa | DN | — | mm | mm | mm | t | t | kg |
| HC-F05PM200GPUVM-SC | 200.0 | 703.3 | 123.0 | 5.718 | 7.684 | 129.6 | 5.427 | 210 | 121.0 | 64.1 | 150 | | 142.8 | 62.5 | 150 | | 4100 | 2000 | 2150 | 5.6 | 6.7 | 420 |
| HC-F05PM250GPUVM-SC | 250.0 | 879.1 | 151.6 | 5.799 | 7.793 | 159.7 | 5.504 | 259 | 151.2 | 74.5 | 150 | | 178.1 | 68.1 | 150 | | 4100 | 2000 | 2150 | 5.7 | 6.9 | 420 |
| HC-F05PM300GPUVM-SC | 300.0 | 1055 | 173.6 | 6.076 | 8.166 | 183.1 | 5.760 | 297 | 181.4 | 75.1 | 150 | | 212.3 | 71.8 | 200 | | 4100 | 2000 | 2150 | 5.8 | 7.1 | 450 |
| HC-F10PM350GPUVM-SC | 350.0 | 1231 | 190.4 | 6.465 | 8.813 | 207.2 | 5.940 | 335 | 211.7 | 70.9 | 200 | | 246.6 | 74.0 | 200 | | 4150 | 2000 | 2350 | 6.0 | 7.4 | 550 |
| HC-F10PM400GPUVM-SC | 400.0 | 1407 | 217.2 | 6.475 | 8.827 | 236.4 | 5.950 | 383 | 241.9 | 72.9 | 200 | | 281.8 | 73.1 | 200 | | 4150 | 2000 | 2350 | 6.1 | 7.6 | 570 |
| HC-F10PM450GPUVM-SC | 450.0 | 1582 | 244.4 | 6.475 | 8.827 | 265.9 | 5.950 | 430 | 272.2 | 69.5 | 200 | | 317.0 | 73.1 | 200 | | 4150 | 2000 | 2350 | 6.2 | 7.8 | 600 |
| HC-F20PM500GPUVM-SC | 500.0 | 1758 | 258.8 | 6.793 | 9.260 | 282.2 | 6.230 | 457 | 302.4 | 81.3 | 200 | | 350.0 | 83.1 | 250 | | 4650 | 2150 | 2400 | 7.7 | 9.7 | 750 |
| HC-F20PM550GPUVM-SC | 550.0 | 1934 | 284.7 | 6.793 | 9.260 | 310.4 | 6.230 | 502 | 332.6 | 81.2 | 200 | | 385.0 | 82.7 | 250 | | 4650 | 2150 | 2400 | 7.8 | 9.8 | 750 |
| HC-F20PM600GPUVM-SC | 600.0 | 2110 | 309.6 | 6.814 | 9.289 | 337.6 | 6.250 | 546 | 362.9 | 81.9 | 250 | | 419.8 | 83.0 | 250 | | 4650 | 2150 | 2400 | 8.0 | 10.0 | 800 |
| HC-F20PM650GPUVM-SC | 650.0 | 2286 | 335.4 | 6.814 | 9.289 | 365.7 | 6.250 | 592 | 393.1 | 82.5 | 250 | 2 | 454.8 | 84.0 | 250 | 2 | 4650 | 2150 | 2400 | 8.1 | 10.1 | 800 |
| HC-F25PM700GPUVM-SC | 700.0 | 2461 | 370.2 | 6.649 | 9.064 | 403.5 | 6.100 | 653 | 423.4 | 81.1 | 250 | | 491.4 | 86.5 | 250 | | 4700 | 2480 | 2700 | 10.4 | 12.6 | 870 |
| HC-F25PM750GPUVM-SC | 750.0 | 2637 | 396.6 | 6.649 | 9.064 | 432.2 | 6.102 | 699 | 453.6 | 83.5 | 250 | | 526.5 | 85.7 | 250 | | 4700 | 2480 | 2700 | 10.6 | 12.9 | 870 |
| HC-F25PM800GPUVM-SC | 800.0 | 2813 | 423.1 | 6.649 | 9.064 | 460.8 | 6.104 | 745 | 483.8 | 83.9 | 250 | | 561.6 | 83.8 | 300 | | 4700 | 2480 | 2700 | 10.8 | 13.2 | 900 |
| HC-F25PM850GPUVM-SC | 850.0 | 2989 | 449.5 | 6.649 | 9.064 | 489.5 | 6.106 | 792 | 514.1 | 84.2 | 250 | | 596.6 | 86.5 | 300 | | 4700 | 2480 | 2700 | 11.0 | 13.4 | 900 |
| HC-F30PM900GPUVM-SC | 900.0 | 3165 | 474.5 | 6.670 | 9.092 | 516.7 | 6.125 | 836 | 544.3 | 85.3 | 300 | | 631.4 | 87.2 | 300 | | 4700 | 2580 | 2800 | 11.8 | 14.5 | 1050 |
| HC-F30PM950GPUVM-SC | 950.0 | 3340 | 500.0 | 6.681 | 9.108 | 545.1 | 6.128 | 882 | 574.6 | 85.3 | 300 | | 666.5 | 85.6 | 300 | | 4700 | 2580 | 2800 | 12.0 | 14.8 | 1050 |
| HC-F30PM1000GPUVM-SC | 1000 | 3516 | 526.3 | 6.681 | 9.108 | 573.2 | 6.135 | 927 | 604.8 | 87.0 | 300 | | 701.4 | 85.7 | 350 | | 4700 | 2580 | 2800 | 12.2 | 15.1 | 1100 |
| HC-F30PM1050GPUVM-SC | 1050 | 3692 | 551.8 | 6.691 | 9.121 | 601.5 | 6.138 | 973 | 635.0 | 83.9 | 300 | | 736.5 | 85.4 | 350 | | 4700 | 2580 | 2900 | 12.7 | 15.6 | 1100 |
| HC-F30PM1100GPUVM-SC | 1100 | 3868 | 578.1 | 6.691 | 9.121 | 629.5 | 6.144 | 1018 | 665.3 | 83.3 | 300 | | 771.4 | 80.3 | 350 | | 4700 | 2580 | 2900 | 12.9 | 15.9 | 1100 |

Note:

(1) The parameter table in the table meets the requirements of AHRI 550/590 and AHRI 551/591, based on Hitachi Chiller Selection V2.11_a0001, and the specific items are subject to the latest version of the computer selection.

Annotation (1*) Applicable working conditions: chilled water outlet temperature：7°C,chilled water flow rate： 0.172 $m^3$/(h.kW), cooling water inlet temperature 30°C， cooling water flow rate: 0.172 $m^3$/(h.kW);

Annotation (2*) Applicable conditions: chilled water inlet/outlet temperature 12/7°C, cooling water inlet/outlet temperature 32/37°C.

(2) This table is based on normal water, so please contact us if you need to use seawater, salt water, etc.

(3) Operating power supply: AC 220V/50Hz/1ф

(4) The operating pressure of cold water and cooling water is 1.0 MPa, if it exceeds this specification, please specify it at the time of inquiry (the maximum pressure used for the alternative is 2.0 MPa)

(5) The fouling coefficient of the water side of the evaporator is 0.018m2°C/kW, and the fouling coefficient of the water side of the condenser is 0.044m2°C/kW.

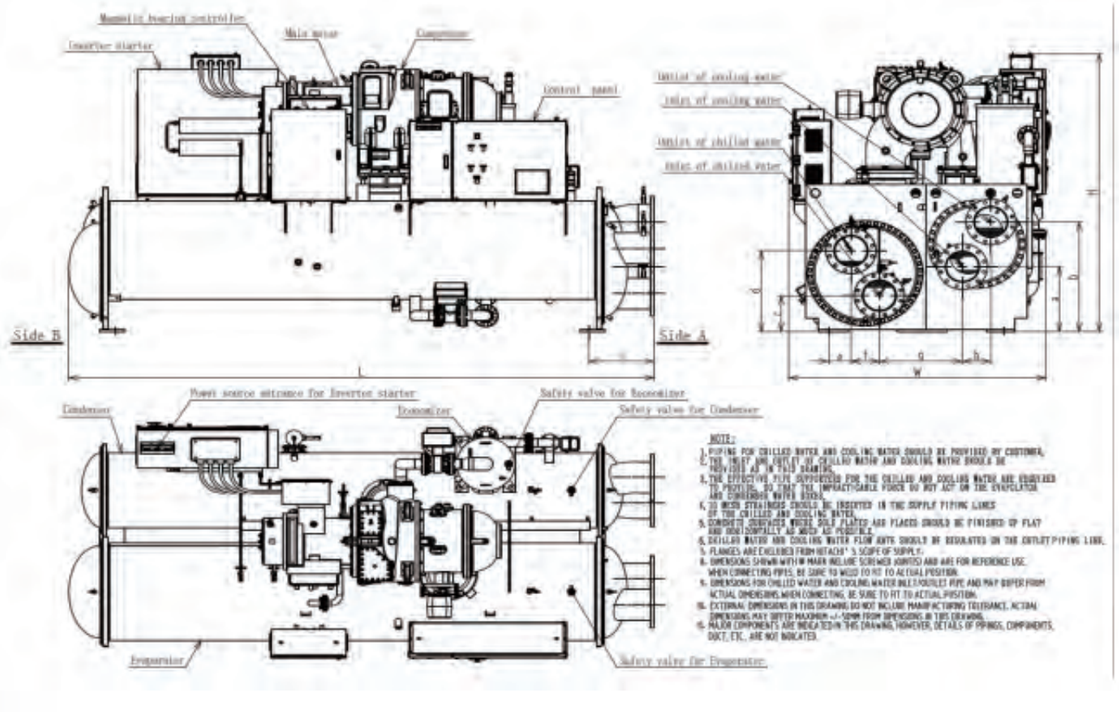
(6) It is the Company's consistent policy to improve our products, and the configuration is subject to change without notice.

## Model description

| HC | — | ※※ | F20PM | 600 | GP | U | VM | — | SC | — | ※※※ | — | ※※※ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ① | | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | | ⑧ | | ⑨ | | ⑩ |

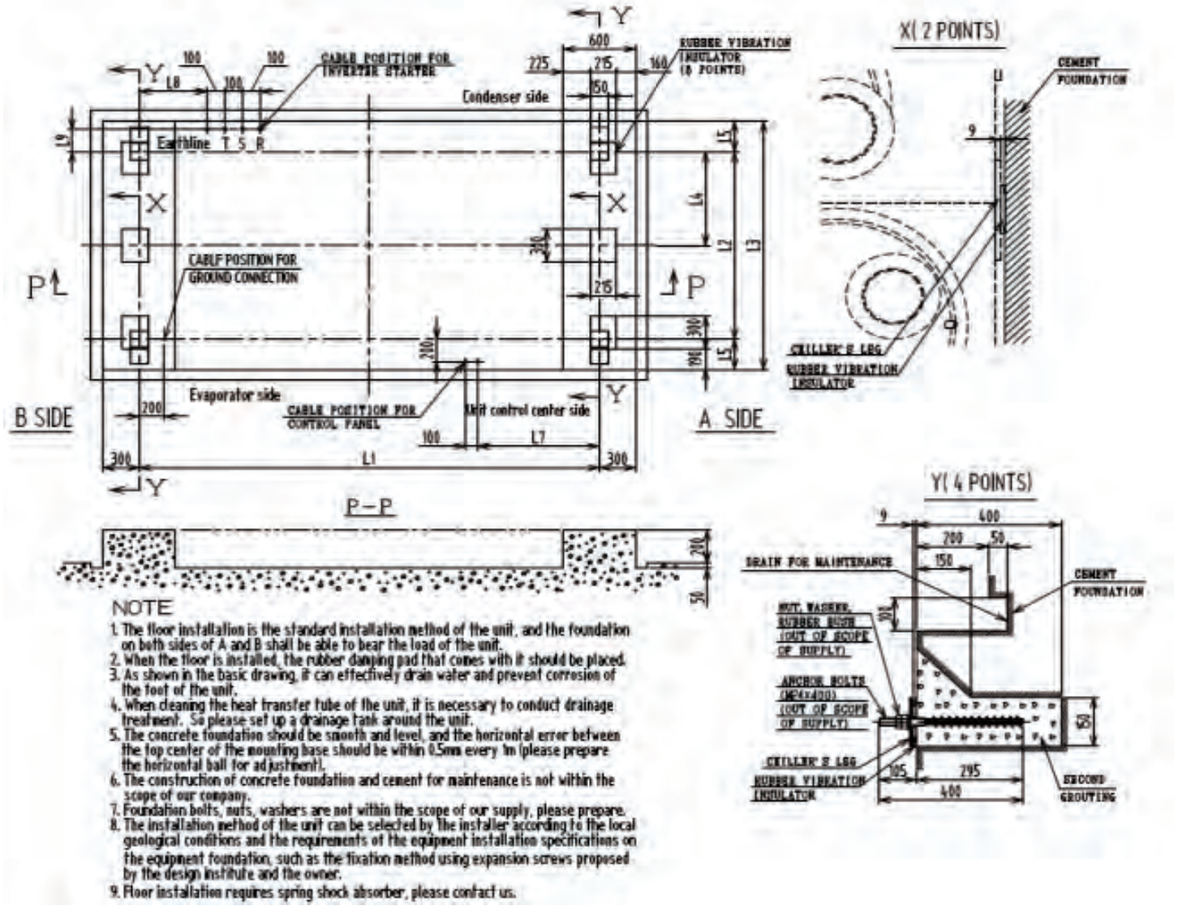
| Number | Code description | Options |
|---|---|---|
| ① | High Pressure Refrigerant Centrifugal Chiller | — |
| ② | Refrigerant Code | Default: HFC-134a |
| ③ | Compressor Model | — |
| ④ | Nominal Cooling Capacity (RT) | — |
| ⑤ | Heat Exchanger Code | GP: Level control type |
| ⑥ | Unit mounted inverter | U: Airborne |
| ⑦ | Product Series Number | VM: Maglev direct drive VSD series |
| ⑧ | Application Product Code | SC：内置过冷却器应用 SCP：板换过冷却器应用 |
| ⑨ | Evaporator / Condenser Code | Default: Standard Product; ※※※: Special Products |
| ⑩ | Motor Code | Default: Standard Product; ※※※: Special Product |

## Unit dimensions




| Type | Overall Dimension | | | Pipe Position Dimensions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | W | H | a | b | c | d | e | f | g | h | i |
| — | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| HC-F05PM200GPUVM-SC | 4100 | 2000 | 2150 | 417 | 697 | 331 | 643 | 117 | 180 | 562 | 213 | 528 |
| HC-F05PM250GPUVM-SC | 4100 | 2000 | 2150 | 417 | 697 | 351 | 663 | 117 | 180 | 562 | 213 | 528 |
| HC-F05PM300GPUVM-SC | 4100 | 2000 | 2150 | 373 | 741 | 351 | 663 | 117 | 180 | 562 | 213 | 528 |
| HC-F10PM350GPUVM-SC | 4150 | 2000 | 2350 | 511 | 857 | 352 | 692 | 170 | 196 | 652 | 200 | 528 |
| HC-F10PM400GPUVM-SC | 4150 | 2000 | 2350 | 511 | 857 | 371.5 | 711.5 | 170 | 196 | 652 | 200 | 528 |
| HC-F10PM450GPUVM-SC | 4150 | 2000 | 2350 | 511 | 857 | 391 | 731 | 170 | 196 | 652 | 200 | 528 |
| HC-F20PM500GPUVM-SC | 4650 | 2150 | 2400 | 573 | 967 | 318 | 712 | 176.2 | 227.5 | 667.5 | 227.5 | 524 |
| HC-F20PM550GPUVM-SC | 4650 | 2150 | 2400 | 573 | 967 | 338 | 732 | 176.2 | 227.5 | 667.5 | 227.5 | 524 |
| HC-F20PM600GPUVM-SC | 4650 | 2150 | 2400 | 573 | 967 | 338 | 732 | 176.2 | 227.5 | 667.5 | 227.5 | 524 |
| HC-F20PM650GPUVM-SC | 4650 | 2150 | 2400 | 573 | 967 | 357 | 751 | 176.2 | 227.5 | 667.5 | 227.5 | 524 |
| HC-F25PM700GPUVM-SC | 4700 | 2480 | 2700 | 512 | 962 | 438.5 | 832.5 | 231 | 227.5 | 773 | 260 | 524 |
| HC-F25PM750GPUVM-SC | 4700 | 2480 | 2700 | 512 | 962 | 438.5 | 832.5 | 231 | 227.5 | 773 | 260 | 524 |
| HC-F25PM800GPUVM-SC | 4700 | 2480 | 2700 | 512 | 962 | 458 | 852 | 231 | 227.5 | 773 | 260 | 524 |
| HC-F25PM850GPUVM-SC | 4700 | 2480 | 2700 | 512 | 962 | 458 | 852 | 231 | 227.5 | 773 | 260 | 524 |
| HC-F30PM900GPUVM-SC | 4700 | 2580 | 2800 | 645 | 1095 | 442 | 927 | 245 | 280 | 800 | 260 | 521 |
| HC-F30PM950GPUVM-SC | 4700 | 2580 | 2800 | 645 | 1095 | 442 | 927 | 245 | 280 | 800 | 260 | 521 |
| HC-F30PM1000GPUVM-SC | 4700 | 2580 | 2800 | 627.5 | 1112.5 | 461.5 | 946.5 | 245 | 280 | 790 | 280 | 521 |
| HC-F30PM1050GPUVM-SC | 4700 | 2580 | 2900 | 627.5 | 1112.5 | 461.5 | 946.5 | 245 | 280 | 790 | 280 | 521 |
| HC-F30PM1100GPUVM-SC | 4700 | 2580 | 2900 | 627.5 | 1112.5 | 481 | 966 | 245 | 280 | 790 | 280 | 521 |

## Basic Installation Dimensions for the unit

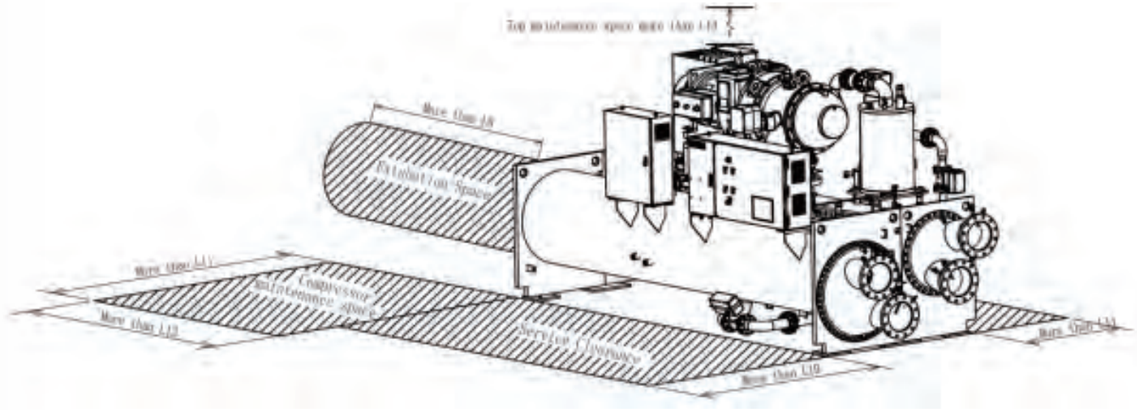



NOTE

1. The floor installation is the standard installation method of the unit, and the foundation on both sides of A and B shall be able to bear the load of the unit.
2. When the floor is installed, the rubber damping pad that comes with it should be placed.
3. As shown in the basic drawing, it can effectively drain water and prevent corrosion of the foot of the unit.
4. When cleaning the heat transfer tube of the unit, it is necessary to conduct drainage treatment. So please set up a drainage tank around the unit.
5. The concrete foundation should be smooth and level, and the horizontal error between the top center of the mounting base should be within 0.5mm every 1m (please prepare the horizontal ball for adjustment).
6. The construction of concrete foundation and cement for maintenance is not within the scope of our company.
7. Foundation bolts, nuts, washers are not within the scope of our supply, please prepare.
8. The installation method of the unit can be selected by the installer according to the local geological conditions and the requirements of the equipment installation specifications on the equipment foundation, such as the fixation method using expansion screws proposed by the design institute and the owner.
9. Floor installation requires spring shock absorber, please contact us.

| Type | Unit base installation dimensions | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | L1 | L2 | L3 | L4 | L5 | L6 | L7 | L8 |
| — | mm | mm | mm | mm | mm | mm | mm | mm |
| HC-F05PM200 ~ 300GPUVM-SC | 3300 | 1136 | 1896 | 546 | 380 | 800 | 210 | 170 |
| HC-F10PM350 ~ 450GPUVM-SC | 3300 | 1303 | 2063 | 617 | 380 | 800 | 162 | 98 |
| HC-F20PM500 ~ 650GPUVM-SC | 3800 | 1402 | 2162 | 654 | 380 | 800 | 166 | 151 |
| HC-F25PM700 ~ 850GPUVM-SC | 3800 | 1662 | 2502 | 782 | 420 | 800 | 241 | 258 |
| HC-F30PM900 ~ 1100GPUVM-SC | 3800 | 1764 | 2604 | 805 | 420 | 800 | 115 | 256 |

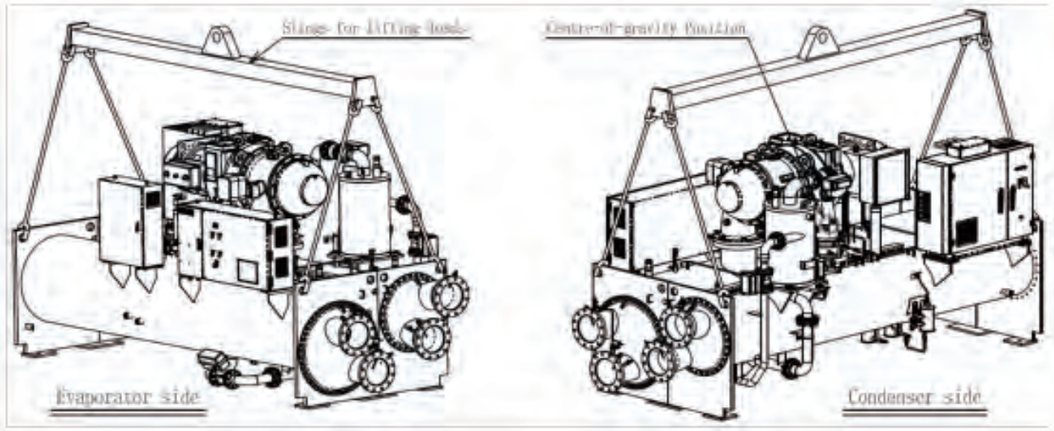
## Unit maintenance space



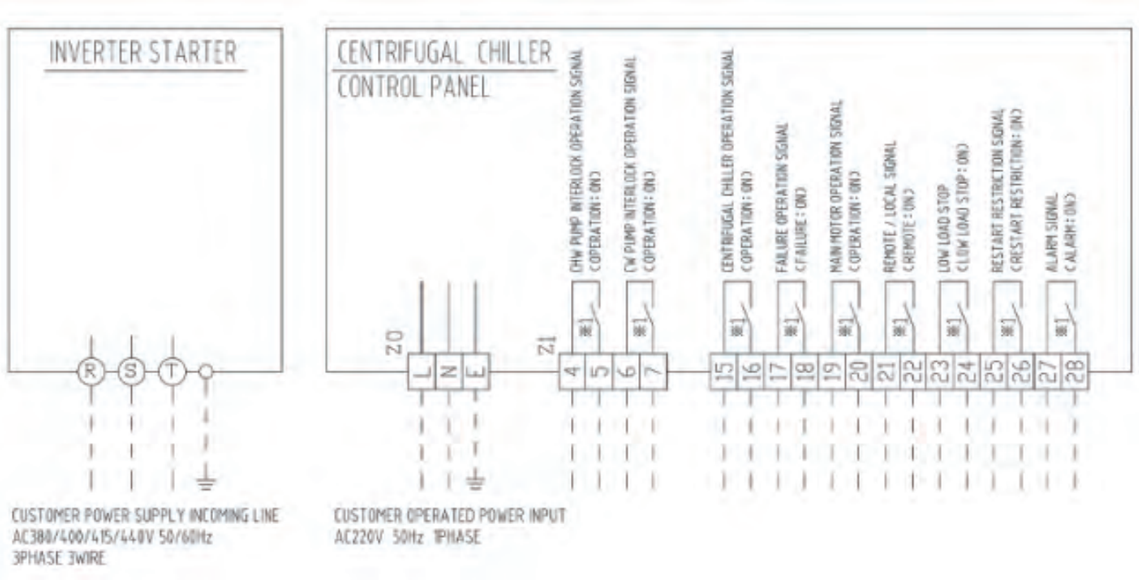

| Type | Unit Maintenance Space | | | | | |
|---|---|---|---|---|---|---|
| | L9 | L10 | L11 | L12 | L13 | L4 |
| — | mm | mm | mm | mm | mm | mm |
| HC-F05PM200 ~ 300GPUVM-SC | 3800 | 1500 | 2000 | 2500 | 850 | 500 |
| HC-F10PM350 ~ 450GPUVM-SC | 3800 | 1500 | 2000 | 2500 | 850 | 500 |
| HC-F20PM500 ~ 650GPUVM-SC | 4300 | 1500 | 2000 | 2500 | 850 | 500 |
| HC-F25PM700 ~ 850GPUVM-SC | 4300 | 1500 | 2000 | 2500 | 850 | 500 |
| HC-F30PM900 ~ 1100GPUVM-SC | 4300 | 1500 | 2000 | 2500 | 850 | 500 |

## Unit hoisting

There are four hoisting holes (2 at each end) on the end plate of each unit, which can be used to lift the unit. The center of gravity of the chiller must be considered when lifting, so as to ensure the safety of the chiller when it is suspended and balanced on both sides. When hoisting and installing, it is not allowed to use a sling to wrap the motor/compressor assembly for lifting, not to use the bolt holes in the unit to lift, not to dump the unit for lifting, and not to lift the unit vertically. To avoid damage to the unit and external connections, use a beam/I-beam lifting assembly to safely position the chiller to the final installation position. When lifting the unit, it is important to ensure that the lifting capacity of the sling is comparable. (Slings and spreaders for lifting are not within the scope of our supply, please prepare in advance)



## Schematic diagram of wiring




## Delivery and Installation Chart

| | Category | GA Scope (Domestic) | Customer Scope | Notes |
|---|---|---|---|---|
| Delivery Scope | Centrifugal Chiller Unit | ● | | ①Evaporater ②Condenser ③Compressor ④Electric Control Box ⑤Bearing Control Box ⑥Inverter Box |
| | Parts with Chiller | ● | | ①Anti-vibration rubber for Chiller ② Chiller technical documents*1 |
| Moving-in | From Factory to Site | ● | | — |
| | Installation base for unit on site | | ● | — |
| Assembly | On-site assembly | ● | | If chiller unit shipped on a disassembled form |
| | Unit Installation | | ● | — |
| Installation | Commissioning | ● | | Once |
| | Operation Instruction | ● | | — |
| Electical Works | External electrical wiring installation | | ● | Please install wiring all the way to terminal strip within the inverter box |
| Other Works | Basic Contracting Works | | ● | — |
| | External wiring works | | ● | — |
| | Prevent freezing of chilled water piping | | ● | During operation stop in the winter, please have anti-freeze treatment or release all water for the chilled water and cooling water piping |
| | Water mgmt. for chiller water | | ● | Please setup chiller water piping with appropriate water quality management |
| | Evaporator insulation | ● | | — |
| | Chilled water piping works | | ● | — |
| Painting | Chiller Unit | ● | | Use anti-rust base paint and gray anti-corrosion paint |
| | Electical Control Box | ● | | Anti-rusting processing (Use anti-rust base paint: Munsell 5Y 8/1 bright) |
| | Starter Box | ● | | Anti-rusting processing (Use anti-rust base paint: Munsell 5Y 7/1 semi-gloss) |
| Others | Electricity, water, sand etc. for on-site installation | | ● | — |
| | Electricity, water etc. for on-site calibration | | ● | — |

# Advisory Notes

## Unit storage environment

| Category | Contents |
|---|---|
| Ambient Temperature | Below 40°C (When the ambient temperature is lower than 0°C, water side of evaporator and condensor must release pressure and add appropriate amount of anti-freeze, or release all water) |
| Relative Humidity | Relative humidity in environment should be under 80%， without condensing water |
| Atmosphere Corrosive Gas Content | $SO_2$: ≤10mg/m³ HCN: ≤5mg/m³ $H_2S$: ≤5mg/m³<br>Nitrogen Oxides: ≤5mg/m³ HCL: ≤5mg/m³ CL: <1mg/m³ |
| Storage | ① Please store the unit in the room with ventilation facilities, do not store outdoors in direct contact with rain, water and sunlight.<br>② The unit must not be placed in a corrosive, flammable and explosive, and oil mist environment |

## Unit operating environment

| Category | Contents |
|---|---|
| Voltage Fluctuating Range | Rated running voltage ±10% |
| Voltage Imbalance | ≤2% |
| Operating Environment Temperature | 3°C～40°C(Chiller plant room ambient temperature) |
| Relative Humidity | Relative humidity in environment should be under 80%， without condensing water |
| Altitude | ＜1000 meters(High altitiude will influence the electric insulation and conductive performance of the unit, need special adjustmenets) |
| Atmosphere Corrosive Gas Content | $SO_2$: ≤10mg/m³ HCN: ≤5mg/m³ $H_2S$: ≤5mg/m³<br>Nitrogen Oxides: ≤5mg/m³ HCL: ≤5mg/m³ CL: <1mg/m³ |
| installation | ①The unit cannot be installed in a corrosive, flammable and explosive environment or a place with special requirements such as oil mist, otherwise it will cause the unit to fail to operate normally or shorten the service life of the unit, and even cause fire or serious injury. If installed together with heating elements such as boilers, full attention should be paid to the impact of thermal radiation<br>②Please install the unit in a well-ventilated place, because over-high temperature is the cause of electrical failure and can accelerate the corrosion of the equipment<br>③Please choose a place with less dust, because excessive dust is also one of the causes of electrical failure<br>④Please choose a place with good lighting, which is conducive to maintenance and inspection<br>⑤In order to meet the needs of maintenance, overhaul and cleaning of the evaporator-condenser heat exchange tube, there must be enough space around the unit<br>⑥To facilitate machine lifting and maintenance. The crane or boom crane should be installed, and pay attention to the machine room to have sufficient height<br>⑦Around the unit and the whole machine room should be able to achieve complete drainage |

## Unit insulation

The factory has laid a 20mm thick insulation layer on the evaporator shell (including end covers, feet, etc.), compressor suction pipes and motor housings and other parts that mainly need to be insulated.
For different use environments, 25mm, 40mm and other thickness non-standard options can be provided according to customer requirements, please specify when ordering. You can refer to the following table to select the thickness of the insulation layer:

| Chilled water outlet Temperature | Ambient temperature | Relative humidity | Recommended insulation thickness |
|---|---|---|---|
| ℃ | ℃ | % | mm |
| teo≥5 | 10～32 | RH≤70 | 20 |
| | | 70＜RH≤73 | 25 |
| | | 73＜RH≤80 | 40 |
| 4≤teo<5 | 10～32 | RH≤73 | 40 |

Note:
If the unit exceeds the above range, please contact the factory technical support to confirm the thickness of the corresponding unit insulation material.

## Chilled water & cooling water variable flow control

The inverter water pump can change the water flow rate of the system according to the load change, thereby reducing the pump consumption of the system, so when the customer needs to control the variable flow of the chilled water & cooling water pump of the centrifuge, in order to ensure the normal operation of the chiller and let the system run stably and efficiently, the following precautions need to be taken into account:

(1) Chilled water & cooling water variable flow control conditions

| Items | Contents | Notes |
|---|---|---|
| Variable flow range | 50% ～ 100% | In order to prevent the chiller from entering the over-cooling protection during startup, follow the 100% flow rate during startup |
| Rate of flow change | Not more than 30% per minute | If the flow change (increase or decrease) is too large, the opening and closing speed of the chiller capacity control device blade can not immediately catch up, which can lead to the chilled water outlet temperature overcooling alarm, so that the host fault shutdown. Therefore, please pay full attention to the appropriateness of the rate of change of water flow |
| Start-up flow rate | Rated flow, maintenance time about 30 minutes | In order to prevent the chiller from entering the over-cooling protection during startup, follow the 100% flow rate during startup |
| The signal interrupts | Force the operation to follow the rated flow rate | When the variable flow signal is interrupted or short-circuited, the variable frequency pump is generally used to restore the rated frequency control mode. Therefore, the chilled water and cooling water will be forced to adjust to the rated flow rate when the signal is interrupted |

(2) Precautions for variable flow control of chilled water & cooling water

The chilled water circuit adopts variable flow rate, which can reduce the pump consumption of the system, and will not lead to the reduction of unit efficiency.
The cooling water circuit adopts variable flow rate, although it can reduce the system pump consumption, but it will bring about the increase of the condensation pressure of the unit, and the pressure head of the compressor rises, which is easy to make the unit enter the surge area, and the power consumption of the compressor increases. In the end, the energy saved by the pump only compensates for the increased power consumption of the compressor. Therefore, when the cooling water is transformed, the temperature of the cooling water outlet should be controlled below 37°C as much as possible, and in order to ensure that the overall energy consumption of the system is reduced, it is recommended to carry out the cooling water flow according to the following table:

| | |
|---|---|
| **cooling capacity** | 20% ～ 70% ～ 100% |
| **cooling water flow rate** | 50% ～ 100% ～ 100% |

When the chilled water & cooling water need to be controlled by variable flow, pay attention to the flow ratio can not be reversed, and the water pump of chilled water & cooling water should be controlled by frequency conversion, please ensure that the flow ratio of chilled water/cooling water is ≤1.

(3) The flow rate of water in the container must be kept within a certain range, and the maximum should not exceed 3.0m/s. If the flow rate is too low, it is easy to attach scale or rust to the inner wall of the pipe, which is easy to cause problems such as the reduction of the efficiency of the main engine; if the flow rate is too high, it will lead to excessive pressure drop and increase the wear of the pipeline. Please confirm with our company for specific flow rate and flow limit, and at the same time, in terms of daily maintenance, please strictly manage water quality and clean copper pipes regularly.

## Water quality management

When the unit is running, the quality of chilled water & cooling water directly affects the performance and life of the unit. Therefore, it is necessary to investigate the water quality well in advance and manage the water quality while the unit is running. It is recommended that the water used in the system meet the following parameters:

| Category | | Unit | Benchmark | Corrosion | Fouling |
|---|---|---|---|---|---|
| Standard Items | PH(25°C) | – | 6.5 ～ 8.0 | ● | ● |
| | Conduciveness(25°C) | μs/cm | <800 | ● | ● |
| | CL- ions | mg(CL-)/L | <200 | ● | |
| | $SO_4^{2-}$ ions | mg$SO_4^{2-}$/L | <200 | ● | |
| | Acid Consumption(PH=4.80) | mg($CaCO_3$)/L | <100 | ● | |
| | Water Hardness | mg($CaCO_3$)/L | <200 | | ● |
| Reference Items | Fe | mg(Fe)/L | <1.0 | | ● |
| | $S^{2-}$ | mg($S^{2-}$)/L | – | ● | |
| | NH+ions | mg(NH+)/L | <1.0 | ● | |
| | $SiO_2$ | mg($SiO_2$)/L | <50 | | ● |

Note:
1. The water quality index refers to the "Vapor Compression Circulating Chilled Water (Heat Pump) Unit" GB/T18430.1-2007, and the appendix cools the water quality.
2. The "●" in the table indicates the relevant factors of corrosion or scaling tendency.
3. If the water quality does not meet the requirements of GB/T18430.1-2007, please refer to the GB50050-2007 "Design Code for Industrial Circulating Cooling Water Treatment" for treatment.

