

**Installation, Operation, and
Maintenance
Instruction
For Water Cooled Chiller**

**Prepared By
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Preface

In order to operate the water-cooled screw chiller correctly and reach the expected running effect, please read this specification carefully. The following explanation is made hereby before the operation specification:

1. This specification is applicable to all types of National Chiller water-cooled chiller, including the installation, use, operation and maintenance of the unit. For the operation specification of microcomputer control, please refer to National Chiller
2. Please read this specification before installing and using the unit. If there is any question or puzzle, please contact our sales department of commercial & Industrial Chiller.
3. In order to use this series of unit safely, please make sure to operate according to the requirement of *Cautions for Safety*.
4. It is necessary to make records during the operation so as to find out the using status and the reason of malfunction.
5. Please make sure that this specification is kept directly by the operator and maintainer.
6. In case of any running failure due to malfunction, please contact our sales department of commercial & Industrial Chiller according to the following requirements:
 - (1) The nameplate content of the unit (part number, cooling capacity, code and ex factory date)
 - (2) Malfunction status (explain the state before and after malfunction in details,)
7. Each unit of this series is inspected and tested strictly before delivery. In case any damage due to improper disassembly and inspection, or even inability to run normally, please do not disassemble and inspect the unit by yourself. If it is necessary to disassemble and inspect the unit, make sure to contact with our sales department of commercial air conditioner and disassemble and inspect the unit according to the instruction of our professional staff.

Safety Considerations

It is safe and reliable to operate National Chiller Water-cooled chiller under the designed conditions. When operating this unit, it is a must to take some safety measures so as to prevent from injury and damage.

Before operating National Chiller water-cooled chiller, all the staff involved in on-site installation, running and maintenance should read this specification carefully and ensure that you understand and conform to the correct steps.

Danger

- ⌘ **Avoid leak of refrigerant during debugging and use of this unit. The acceptable density of gassy refrigerant in air (AEL) for human body is 1000ppm, in which situation there is no harm for human body. However, if there is a great amount of leak, the gassy refrigerant will gather near the floor, which will cause oxygen deficit. Before the gassy refrigerant is discharged, do no approach the polluted area in case of harm to human body.**
- ⌘ **Do not clean the pipe or pressurize the unit with oxygen or compressed air.**
- ⌘ **Do not maintain the unit when it is energized.**
- ⌘ **Do not close valves of any safety device.**
- ⌘ **Do not use the test pressure exceeding specified value. Confirm the acceptable test pressure by referring to the designed pressure on the nameplate.**
- ⌘ **No frame cutting or welding on the evaporator and condenser is allowed during running of the unit**



Warning

- ⌘ **It is better to use specialized sucking and charging device when charging the refrigerant into or sucking the refrigerant from the unit. The refrigerant drawn from the unit should be stored in the tank that conforms to designed pressure of the unit and that is designed and manufactured according to related standard of pressure contain.**
- ⌘ **Do not discharge the refrigerant directly into the air or sewer. No direct contact between liquid refrigerant and the skin or eyes to avoid frostbite of skin or eyes.**
- ⌘ **The contact of refrigerant and naked frame will produce poisonous gas.**
- ⌘ **Confirm the refrigerant type before charging it into the unit. Wrong charging will lead to malfunction of the unit.**
- ⌘ **Inspect the safety device such as safety valve at least once every year. If the environment is corrosive, it is necessary to increase the inspection frequency. Once the safety valve is found to be corroded, replace it instead of repairing it.**

Caution

- ⌘ **Do not move the unit with fork truck.**
- ⌘ **Do not tread on the pipes of the unit. Otherwise, it will lead to distortion of the pipe or leak of refrigerant.**
- ⌘ **Use the same type of parts when repairing the unit.**
- ⌘ **Inspect each valve, connector and pipe to check if they are corroded, rusted, leaked or damaged.**
- ⌘ **Do not loosen the screws before completely discharging the water in the pipe.**



1 Introduction

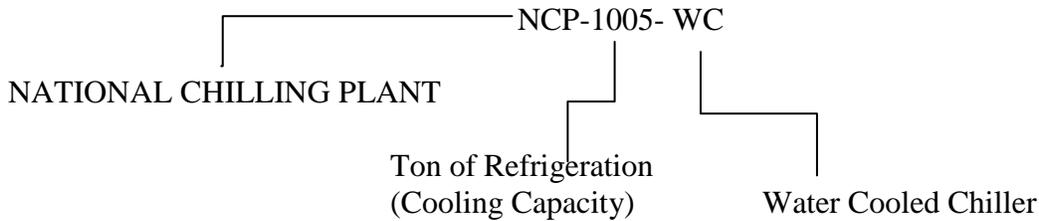
This unit is designed, manufactured and inspected according to **Vapor Compression Cycle Water-cooled Unit for Commercial Use and Industrial Use**. If there is any alternation, execution would be subject to the new standard.

For the main technical parameters, please refer to the nameplate of the unit.

This unit should be used according to related standards of pressure container.

1.1 Introduction of Nameplate

The name plate is on the left side of the electric control cabinet.



1.2 Characters

1. High efficiency, cramped construction, small size, low noise, large cooling capacity, long lifespan, easy operation
2. Adopt widely used, high efficient, reliable and stable twin compressor. The cost of running and maintaining is greatly less than other types of chiller.
3. The flooded evaporator enables the distribution of the refrigerant to be more even so that temperature pattern is optimized and the evaporating temperature is largely increased. Meanwhile, the heat exchange efficiency will be improved. Integrated with high performance and reliable compressor, the cooling capacity and EER is greatly improved.
4. The unit is controlled by the microcomputer control system. Stepless capacity regulation is automatic based on the variation of load. The compressor will start at low load. Between the lowest load and the highest load, stepless capacity regulation is available. During the increase of the load, the output and the load maintain best matching so that highest efficiency and energy-saving running is realized.
5. Safety protection functions include anti-phase protection, overload protection, anti-freezing protection, high and low pressure protection, exhaust high temperature protection, and water flow switch protection.

1.3 Site and Range of Use

National Chiller water-cooled chiller can be used for offering cool water of air conditioning system and integrating with terminal Industrial unit such as Plastics Industrial and combined Process Chiller to constitute various Industrial Chilling system. It can be used for Chilled Water in sites such Industrial cooling, Process chilling, hotel, hospital, mall, office building and place of entertainment.

Range of use: Ambient temperature □ 45 6



Item		Max.	Min.
Evaporator	Inlet water temperature	24°C	7°C
	Outlet water temperature	15°C	4°C
	Differential temperature between inlet and outlet	8°C	2.5°C
Condenser	Inlet water temperature	40°C	18°C
	Outlet water temperature	45°C	23°C
	Differential temperature between inlet and outlet	8°C	3.5°C

Specification of use range

- If the inlet water temperature of evaporator is lower than the value shown in the above form, it is necessary to reselect the model. Please contact National Chiller.
- If the outlet water temperature of evaporator is lower than the value shown in the above form,
it is necessary to add antifreeze into the circulating water system. Please contact National Chiller to buy low-temperature air conditioner.

1.4 Introduction of Structure

National Chiller water-cooled chiller is mainly composed of semi closed twin Compressor, shell and tube condenser, flooded evaporator, oil separator, throttle mechanism, electric control system and so on.

1 Evaporator

During running of the unit, the evaporator maintains low temperature and pressure so that the evaporated refrigerant takes away the heat of the cooling water.

2 Condenser

During running of the unit, the condenser maintains high temperature and pressure so that the cooling water flowing through the condenser will take away the heat of the refrigerant.

3 Compressor

It will push the evaporated refrigerant in the evaporator to the condenser and maintain the differential pressure of the system.

4 Oil separator

It will separate the refrigeration oil from the gassy refrigerant and send it back to the compressor so that the compressor runs safely and reliably.

5 Electric control system

Adopting microcomputer control system, it is possible to adjust the output cooling capacity automatically to meet the users actual needs. It is possible to use side, heat source water pump and cooling tower fan. Displayed parameters include inlet and outlet temperature of cooling water, inlet and outlet temperature of cool water, evaporating and condensing pressure ect. It is possible to check the current malfunction and the previous malfunction record. Please refer to instruction of display for detail.



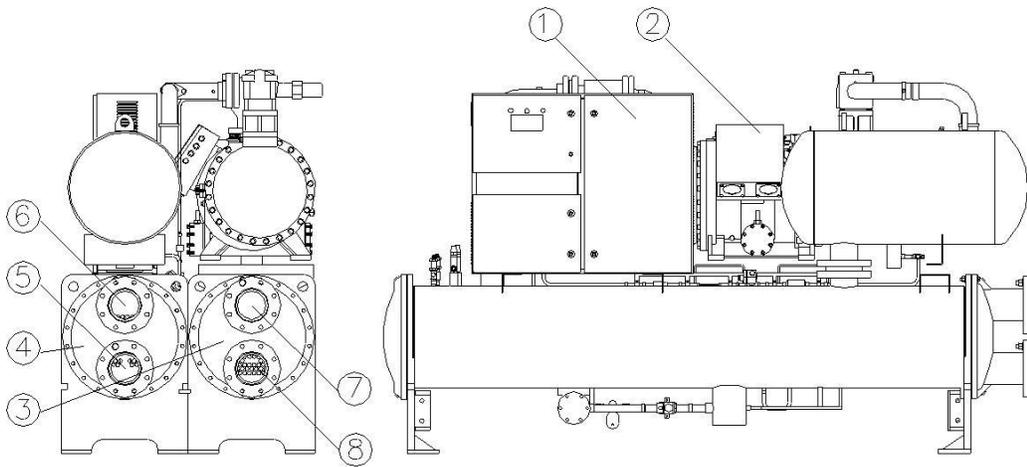


Fig1-1 Appearance of single system unit

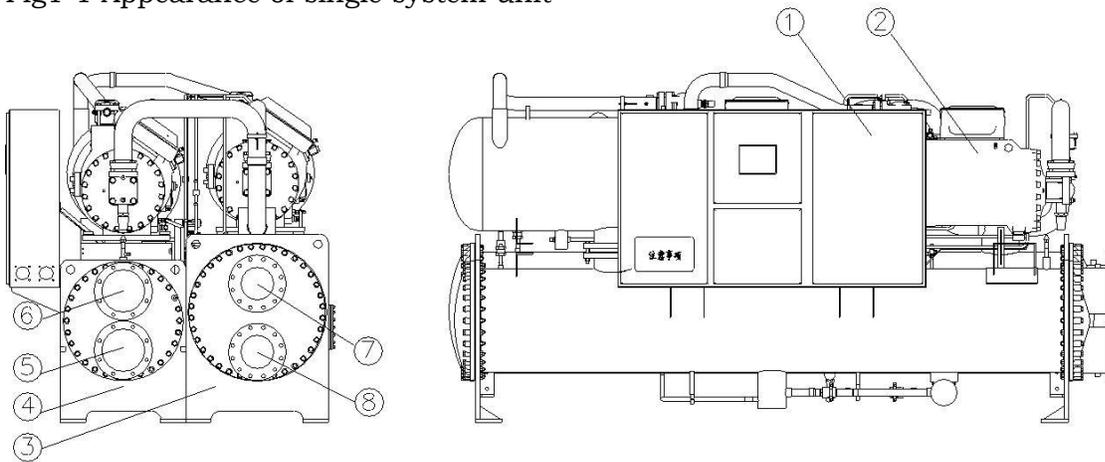


Fig1-2 Appearance of dual system unit

Sheet3-1 Components of National Chiller water-cooled screw chiller

Mark	Name	Mark	Name
1	Electric control cabinet	5	Inlet cooling water
2	Compressor	6	Outlet cooling water
3	Evaporator	7	Inlet chilled water
4	Condenser	8	Outlet chilled water

Note: the picture is for reference only. Actual matter is the standard..

1.5 Introduction of Refrigeration System

1.5.1 Refrigeration Circulating System

Water-cooled screw chiller is a kind of vapor compression refrigerator. It works by energizing the refrigerant vapor via the compressor so that the pressure and temperature increase. Then it is turned to liquid refrigerant of low pressure and temperature by condensing and throttling. When it is evaporated in the evaporator, it obtains heat from the surrounding (cooling medium, such as cool water) to decrease the temperature of the



carrier so that artificial refrigeration is realized. Therefore, vapor compression refrigeration cycle includes the four necessary processes of compression, condensation, reducing expenditure and evaporation. The principles are detailed as below:

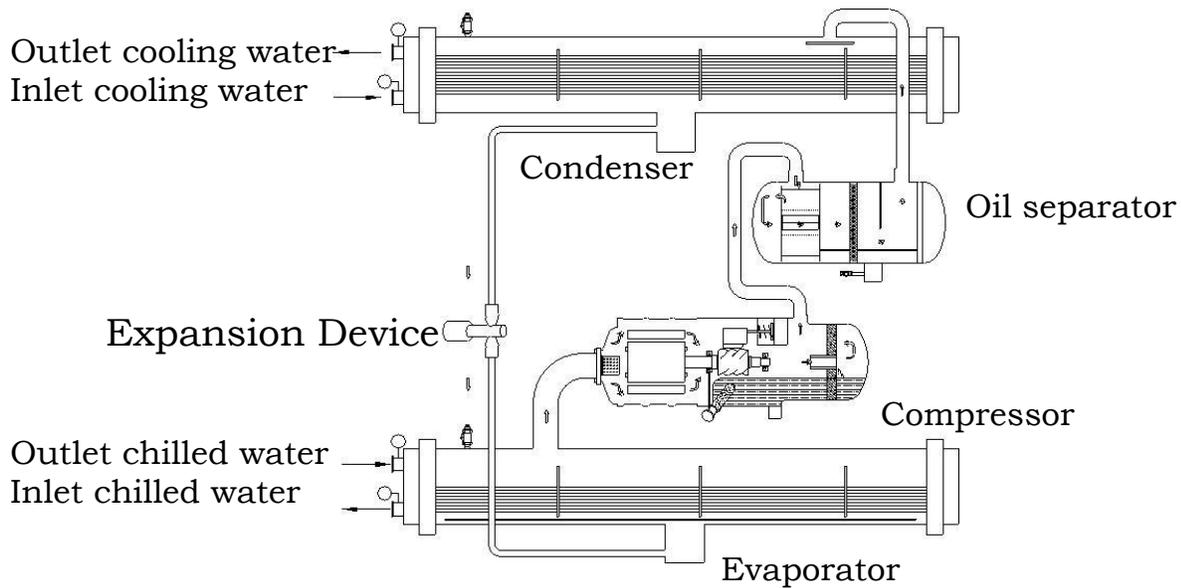


Fig.1-3 Diagram of refrigeration circulating system for National Chiller water-cooled screw chiller

Compression: after the refrigerant vapor in the evaporator is inhaled by the Compressor, the electromotor increases its energy via the rotor of the compressor so that the pressure of refrigerant vapor is increased and it then it enters the condenser. At the same time, the temperature of refrigerant vapor will increase correspondingly after compression.

Condensation: the high-pressure and high-temperature refrigerant vapor from compressor will release heat in the condenser via the cooling water in the pipe. Meanwhile it will be condensed into liquid under the saturation pressure (the corresponding condensation pressure for condensation temperature). In that case, the temperature of cooling water will increase. The temperature of cooling water is directly related to the condensation temperature (condensation pressure).

Reducing expenditure: when the high-pressure and high-temperature liquid refrigerant from the bottom of condenser flows through the throttle device, its pressure will decrease and it will bulge, with both pressure and temperature decreasing. Then the low-pressure and low-temperature liquid enters the evaporator.

Evaporation: the low-pressure and low-temperature liquid refrigerant turns to gas by deriving energy from the cooling carrier (e.g. cool water). At the same time, the temperature of cooling carrier decreases and the artificial refrigeration is realized. The refrigerant vapor in the evaporator is then inhaled by the compressor for compression. The processes of compression, condensation, reducing expenditure and evaporation will repeat circularly to realize the refrigeration. The cooling capacity is in direct proportion to the suction volume. Therefore, the guiding valve is installed in the Compressor for suction volume control of the compressor and evaporating capacity control of the refrigerant, so that the cooling capacity is adjustable in certain range.

1.5.2 Oil Circulating System



In the compressor, the refrigeration oil lubricates and cools the bearing and rotor via the differential pressure of the system and inner oil circuit. During exhaust of the compressor, refrigeration oil will be discharged out of the compressor together with gassy refrigerant. If the refrigeration oil can not return to the compressor, the compressor will lack oil, which will damage the compressor. With patent designed oil reclaim system, National Chiller screw water-cooled chiller ensures that the refrigeration oil discharged together with the gassy refrigerant return to the compressor and that the unit runs safely and reliably.

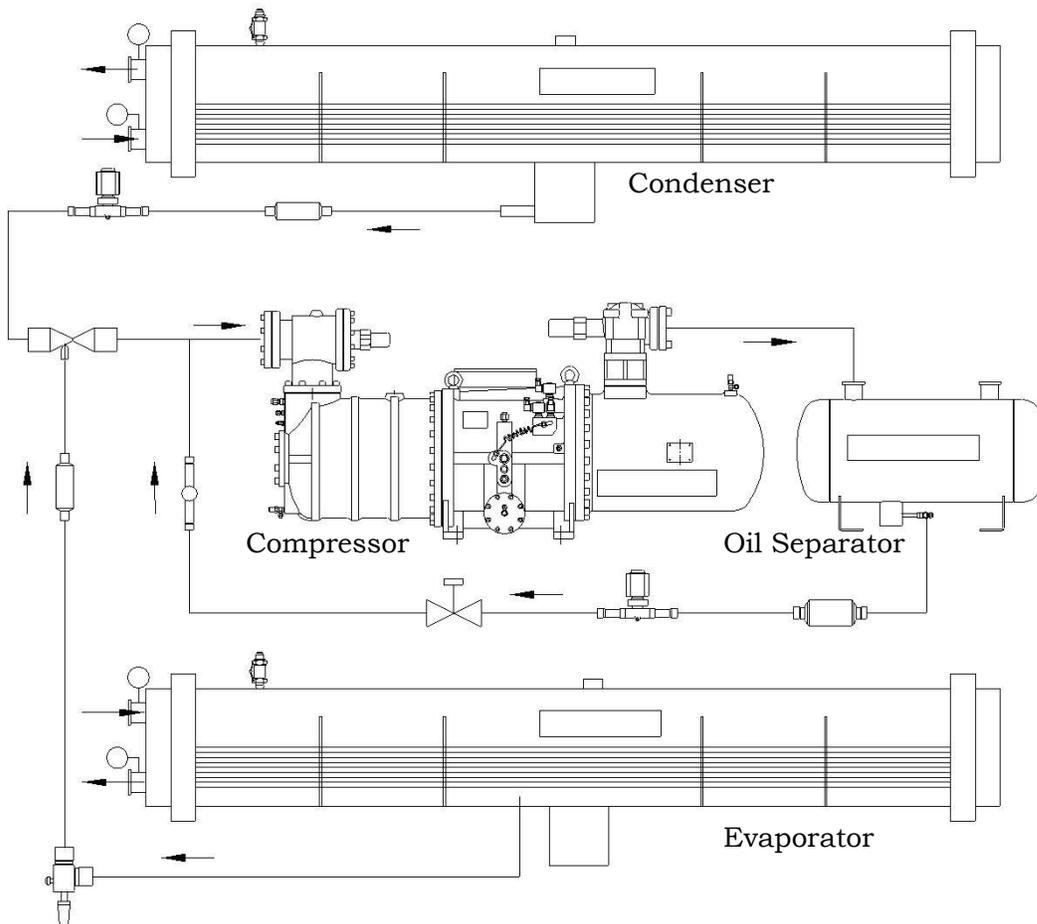


Fig. 1-4 Diagram of oil circulating system for National Chiller water-cooled screw chiller

Oil reclaim system includes:

1. Oil reclaim via oil separator: efficient oil separator is installed between the compressor and condenser. Most refrigeration oil discharged with gassy refrigerant will be hold up by the oil separator and sent back to the compressor via air inlet.
2. Oil reclaim via high-pressure injection: a small amount of refrigeration oil will enter condenser and finally gather in the evaporator. with the help of high-pressure liquid, the refrigeration oil gathering in the evaporator will return to the compressor.

1.6 Introduction of Control System



The control system adopts microcomputer control, with LED of power, running and malfunction on the panel of the control cabinet for intuitive management. In addition, emergency stop button is available on the panel of the control cabinet, which can stop the unit to ensure its safety when the emergency malfunction occurs.

Warning: do not press this emergency stop button when the unit is running. Otherwise, it may damage the unit.

As the compressor is the important part of the unit, the protection includes:

1. Lack phase protection;
2. Thermal overload protection;
3. Exhaust temperature protection of the compressor;
4. Inner overload protection of the compressor;
5. Differential pressure protection.

The above protection functions ensure the normal use of compressor. There is an operation display and a LCD on the door of electric control cabinet. The display will show the running information and system parameters of the unit. Different buttons have different functions, including parameter setting, control of start and stop, status display, temperature display, malfunction display and so on. Operation, setting and inspection are available on this display.

The main functions of the display or touch panel are:

1. Displaying the running information of the system;
2. Displaying status information of the system;
3. Displaying the malfunction information of the unit;
4. Setting the running parameters of the unit;
5. Setting automatic timer for start and stop of the unit.



2 Installation

2.1 Installation Environment

1. The unit should not be close to fire and tinder. If it is installed together with heating unit such as boiler, it is necessary to consider the effect of thermal radiation.
2. Select those sites where indoor temperature is below 45℃ and is drafty. It is not permitted to install and store the unit outside or in the open air or in the environment with corrosive gas.
3. Select the site with less dust.
4. The site should be bright for easy maintenance and inspection.
5. In order to meet the needs of maintaining, inspecting and cleaning the evaporator and the heat exchange tube of the condenser, there should be enough space for tubing, which should be as long as the evaporator and the condenser.
6. For the sake of easy lift and overhaul, it is necessary to install traveling crane or derrick car and ensure that the machine room is high enough.
7. The surrounding of the unit and the whole machine room should be drained completely.

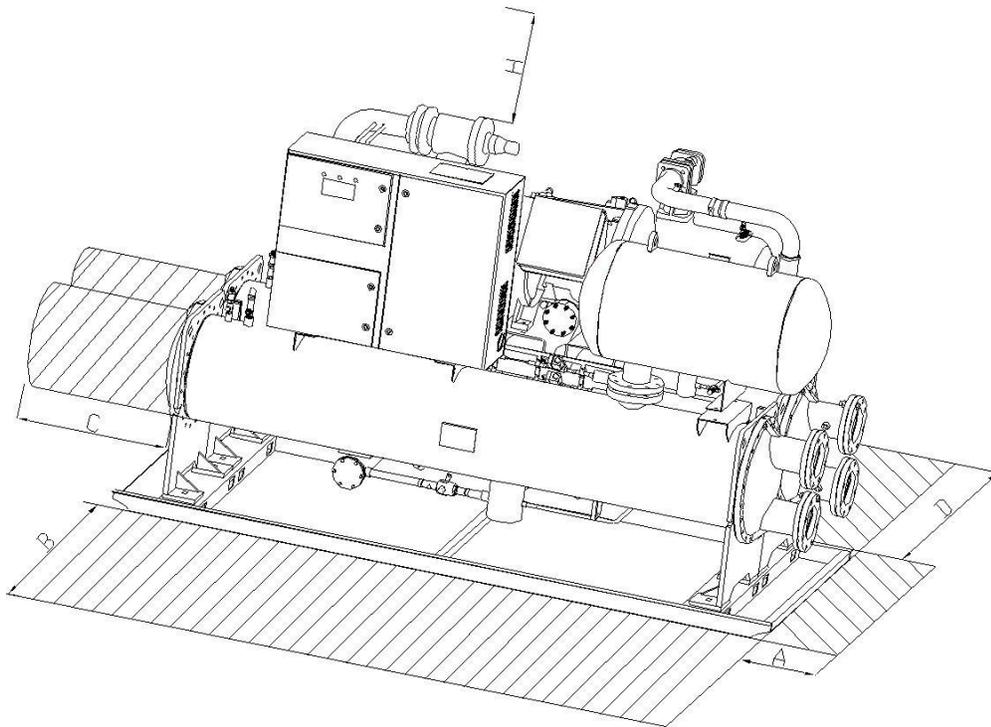


Fig. 2-1 Dimension and diagram of running space
(The diagram is for reference only. Actual matter is the standard.)

Sheet2-1 Dimension and size of running space unit mm

Name	A	B	C	D	H
NCP-1001	2600	500	600	1000	600
NCP-1040	3000	500	600	1000	600
NCP-1350	3500	500	600	1000	600



2.2 Site Confirmation

In order to perform the installation work safely, correctly and rapidly, the related installer should confirm the following situation beforehand:

1. Installation site: confirm whether it accords with the requirement of section 2.1.
2. Hole for carrying: confirm its size, height and lifting volume and remove the obstacle.
3. Order of carrying: determine the way and the order of carrying according to the situation of installation site and equipment.
4. Access for carrying: remove the obstacle on the access that precludes the carrying.

2.3 Base Construction

The Compressor has relatively less movable parts and is stable, so the live load for base is small. The specific dimension of base is shown in general diagram of refrigerant unit. In case of corrosion of the unit footing, it is required that the surrounding of the unit is in good drain state. The corresponding basic plane to base steel of the unit should be smooth. The specific requirements are as below:

1. The maximum altitude difference (levelness) should be within 3mm.
2. For easy maintenance and inspection of the refrigerant unit, the base should be higher than 100mm
3. It is necessary to install drain ditch around the refrigerant unit.
4. There should be no space between the base steel and the foot plate of the refrigerant unit. Insert the adjusting shim between the base steel and the concrete base. Adjust the base steel to be horizontal (the altitude difference should be within 0.5mm every meter.)
5. The installation base of the unit must be concrete or steely structure, which can bear the running weight of the machine. Besides, the top should be horizontal. It is better to prepare a drain ditch in the installation base.
6. Refer to the diagram of installation base. Put the steel plate and anti-vibration cushion in the correct position. Finish the installation of the unit and the foundation bolt before secondary grouting. The foundation bolt is generally exposed for about 100mm.

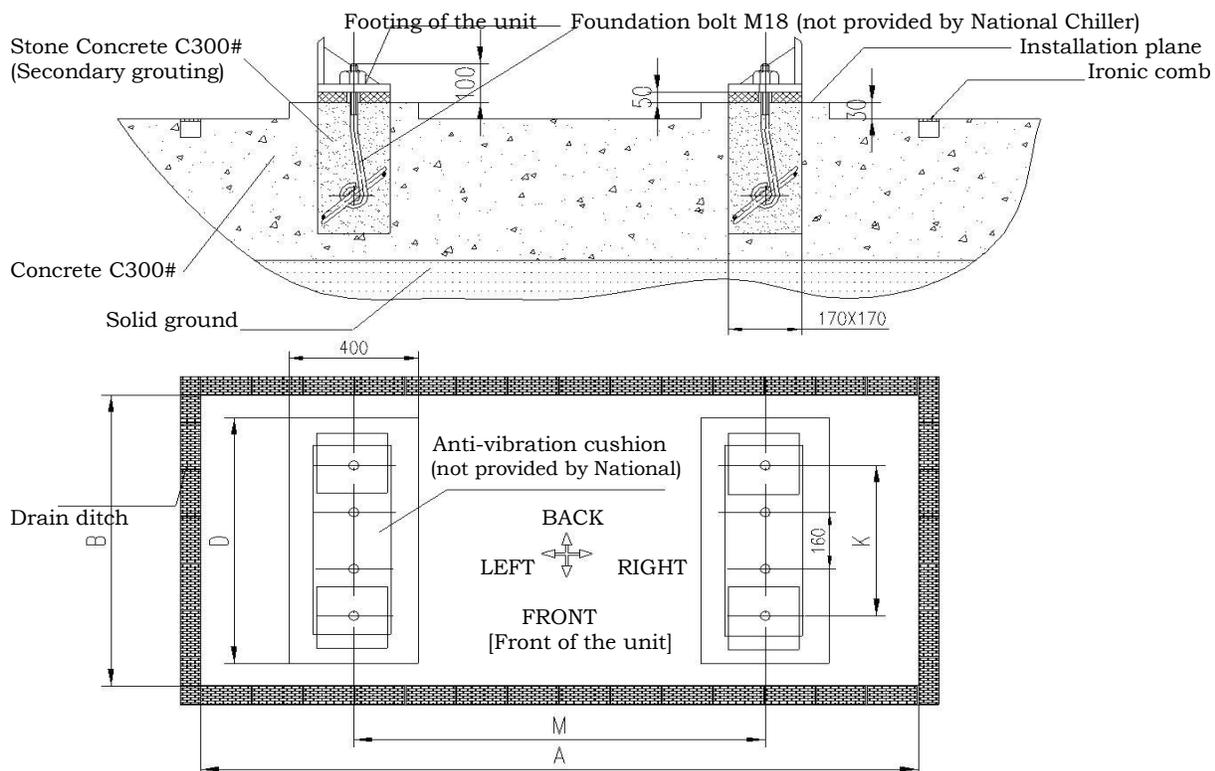


Fig2-2 Diagram of installation base



Sheet 2-2 DIMENSION of installation base Unit: mm

Name	A	B	D	M	K
NCP-1005	3160	1350	925	2630	740
NCP-1030	3160	1350	1150	2630	740
NCP-1050	3160	1600	1400	2630	920
NCP-1100	3160	1720	1520	2630	1100
NCP-150	3400	1900	1700	2830	1210
NCP-1350	3900	2100	1900	3330	1420

2.4 Carrying

1. Inspection of the unit: before unloading the unit, inspect the appearance and accessory of the unit; if it is damaged, please inform the transpiration company and analyze the reason of damage and responsibility.
2. Then check the quantity according to the packing list; check whether there is any lack of piece (including spare piece and spare part.). If there is any lack of part, please notice National Chiller distributor or sales department.
3. Product model, parameter and production date are shown on the nameplate. Please check whether they conform to the contract or related technical decrements.
4. Lifting:
 1. The lifting position is marked on the unit. After confirming the installation of base, shock pad and foundation bolt, place the unit on the shock pad with strong sling (strong enough to bear the weight and impact of the unit during lifting) via the crane.

CAUTION

Please lift the unit in strict accordance with the lifting marks on the outer package. Otherwise, it may cause distortion of the pipe and leak of the refrigerant.

2. During lifting, in order to avoid damaging connectors of the unit, please lift the unit in strict accordance with the lifting marks.
3. Do not enlance the compressor, shell and tube exchanger with slings. Do not lift the unit with bolt hole. Avoid sloping lifting.

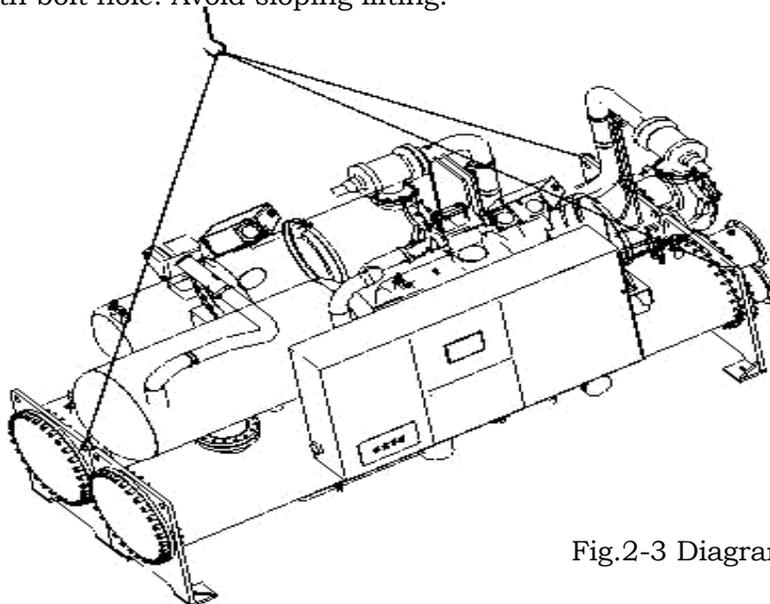


Fig.2-3 Diagram of lifting



2.5 Installation

1. First of all, check whether the base conforms to the footing size of the unit in the general diagram.

The base should be smooth and level.

2. Put the base steel in the prescriptive position.

3. Put the refrigerant unit on the base steel.

4. There should be no space between the base steel and body foot plate of the refrigerant unit.

Adjusting shim should be put between the base steel and the concrete foundation. Adjust the base steel to be level (the altitude difference should be within 0.5mm every meter);

5. Lift the refrigerant unit and put the damper rubber blanket on the base steel, and then put the unit on the damper rubber blanket.

6. After installation, ensure that the horizontal slope should be within $1 \square 1000$. If it is beyond the range, adjust the unit. Put a pad (the pad is provided by the installer) between the footing and the shock pad, and then check the horizontal slope until it is passed.

2.6 Piping

1. After leveling the unit, connect the chilled water pipe and cooling water pipe. Piping should have flexible parts and independently supportive capability to avoid any distortion or vibration. The pipe should be supported and correctly joined. Shock pad can be added to the pipe supporter so as to reduce the vibration.

2. There are marks near the inlet and outlet for reference when connecting the pipe. It is necessary to connect the pipe according to the marks on the unit. Refer to Fig. 2-4 for piping pattern.

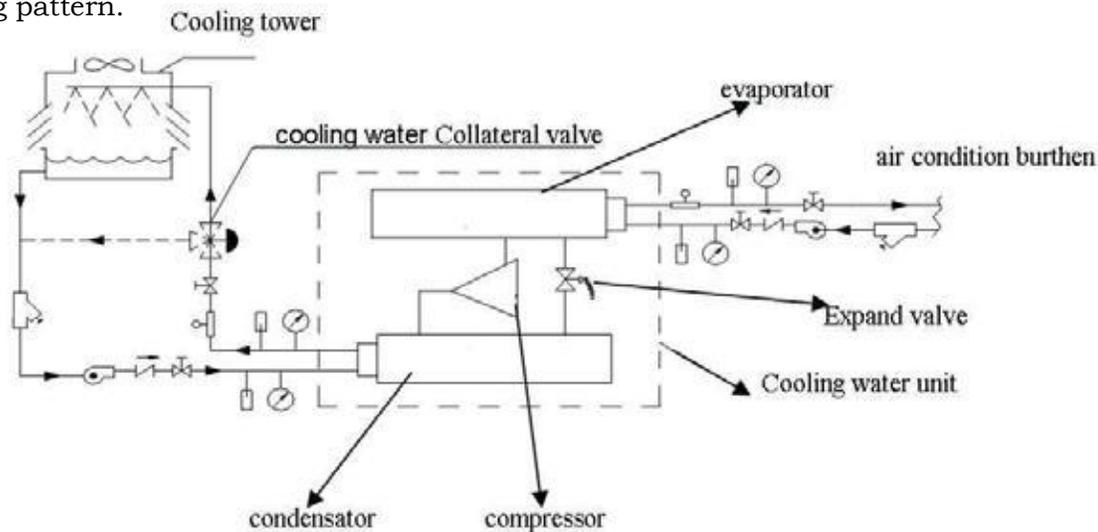


Fig. 2-4 piping diagram

3. According to the general diagram, connect the pipe for cool water and cooling water (flange or clamping band connection), and set a filter in the inlet. Whether the pipe is horizontally or vertically led from the unit to the water pump is decided by the user based on the site condition.

Manometer should be set on the inflow pipe and outflow pipe of the unit so as to measure the differential pressure of the inlet and outlet and thus estimate whether the water flow conforms to the rated water flow. The control valve of cool water and cooling water must be installed on the outflow pipe of the refrigerant unit to avoid disorder of the water flow as well as eroding the heat transfer tube near the inlet.



4. When the water quality is bad, there will be much deposit such as scale and sand in the shell and tube exchanger, which will decrease the water flow and affect the rate of heat exchange. Meanwhile, if the quality of chilled water and cooling water is bad, it will not only cause scaling, affecting the rate of heat exchange and the performance of the unit, but also cause erosion of the heat exchange pipe which may lead to serious leak. Thus, the water must be filtered and softened by the water-softening equipment before flowing into the system. If the water quality is too bad, treat the water according to **Treatment and Design Regulation of Industrial Circulating Cooling Water**. The inclosed chilled water system should adopt soft water. During running of the unit, it is necessary to sample the water for analysis and the water quality should conform to the requirement of sheet 2-3. Otherwise, the water must be treated. Currently the commonly used water treating device is sand eliminator and water-softening equipment. If the water quality still can not reach the requirements, add a heat exchanger between the water on side of heat source and the water-cooled screw chiller. Actually, even if the above actions are taken, there will be deposit such as scale and sand in the shell and tube exchanger, which will decrease the water flow and affect the rate of heat exchange and even freeze the evaporator. Therefore, it is necessary to inspect and maintain the unit periodically.

Sheet 2-3 Quality of cooling water

basic item	item		standard value	trend	
				erosion	scaling
	PH value	25	6.5 – 8.0	0	0
	specific conductance	25 μ S/cm	< 800	0	0
	chloride ion Cl-	Mg Cl- /L	< 200	0	
	sulfate radical ion SO ₂ -2	Mg SO ₂ -2 /L	< 200	0	
	acid depletion PH4.8	Mg(CaCO ₃)/L	< 100		0
	Full hardness	Mg(CaCO ₃)/L	< 200		0
reference item	Ferrous Fe	mg(Fe)/L	< 200	0	0
	Sulphur Ion S ₂ -	mg(S ₂ -) / L	< 1.0	0	
	Ammon Ion NH ₄ ⁺	mg(NH ₄ ⁺)/L	< 1.0	0	
	Monox SiO ₂	Mg(SiO ₂)/L	< 50		0

2.7 Wiring

1. Before electrical installation, make sure to cut off the general power supply and install the switch cabinet in the suitable position.
2. Connect the main power cord and the earth wire to the electric control cabinet through the service entrance. Connect the wire to the corresponding wire holder and earth wire holder. It is a must to ensure the correct connection of L1□L2□L3.
3. Ensure that the voltage fluctuation of main power supply is within $\pm 10\%$ of the value shown on the nameplate and that the voltage unbalance is within $\pm 2\%$. If it exceeds this range, stop the unit and contact with the electric department.

The formula of calculating voltage unbalance:

Voltage unbalance % = maximum deviation from average voltage / average voltage

4. Before connecting wire of main power supply, check the phase sequence of each power cord.
5. Connect the control circuit
 - 1 Connect the control wire of the AC contactor in chilled water pump, cooling water pump and cooling tower with the flow switch and the electric control system.



2 The unit must be energized 8 hours before running of the unit and should be kept energizing in working seasons so that the heating tape of the compressor can heat without running of the compressor. In that case, the liquid refrigerant gathering in the compressor will evaporate and avoid damaging the compressor.

3 Ensure the unit is earthed reliably.

6. Inlet wire of electric control cabinet

A dismountable square sheet-metal piece is fitted in the inlet of electric control cabinet. When installing, please remove the sheet-metal piece and hole it according to the size of cable terminal. Lead the cable through the hole and fix it.

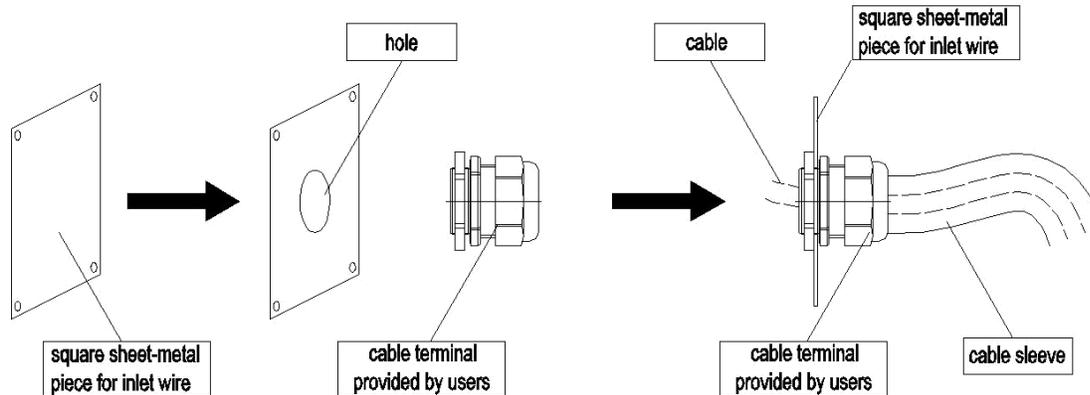


Fig. 2-5 Diagram of inlet wire

7. Refer to the following sheet for specification of power supply and circuit breaker.

Sheet 2-4 Selection of power cord and circuit breaker (R22 series)

Model NCP-1	005	010	020	030	040	050	100	150	350
Diameter of power cord (mm ²)	50	70	95	150	185	240	150x2	185x2	240x2
Diameter of earth wire (mm ²)	25	35	50	70	95	120	70x2	95x2	120x2
Rated capacity of circuit breaker (A)	125	200	250	20	400	500	630	800	1000

Sheet 2-5 Selection of power cord and circuit breaker (R134a series)

Model NCP-1	005	010	020	030	040	050	100	150	350
Diameter of power cord (mm ²)	50	70	70	95	95	150	185	240	150x2
Diameter of earth wire (mm ²)	25	35	35	50	70	70	95	120	70x2
Rated capacity of circuit breaker (A)	125	160	200	250	320	320	400	500	630

Note:

- The specification of power cord refers to the specification which is chosen when the cable is led overhead and the ambient temperature is 40°C. The circuit breaker is used when the temperature is 40°C and it is Model
- The selection of power cord and circuit breaker is related to the local climate, nature of oil, cabling and so on. This project is usually designed by the designing institute. The lecto type calculated by the designing institute based on the maximum output is the standard.



2.8 Cold Insulation

There are two situations for the cold insulation of the unit:

1. The cold insulation has been finished in the factory.
2. Due to other reasons, the cold insulation should be executed in the installation site. In that case, it is necessary to perform leak inspection, running and test running before cold insulation. During cold insulating, pay attention to the following points□
 - a) Cold insulation should not impede the movable parts (e.g. adjustable device of inlet guide blade, hand grip of the valve).
 - b) Open the cover of water chamber when cleaning the pipe of evaporator. Do not embed the connecting bolt in the cold insulation layer. (Please also pay attention to the flange that requires frequent disassembly).
 - c) Please do not embed the temperature sensor on the cool water outflow pipe in the cold insulation layer
 - d) In order to find the leak source in the air tightness test, please do not embed the auxiliary connecting pipe and the connector of gauge pressure tube in the cold insulation layer or apply removable cold insulation layer.
 - e) Please do not embed the nameplate in the cold insulation layer.

3 Debugging and Trial Running

After finishing the installation, piping and cabling, the next step is debugging. The debugging and operation should be monitored and instructed by specified staff on site.

Caution: the unit can control the chilled water pump, cooling water pump and fan motor of cooling tower. However, it is not allowed to control the debugging of water pump through the master unit. The debugging can be realized by temporary wiring.

3.1 Prepare for Debugging

3.1.1 Prepare the Documents

1. Installation and use specification
2. Quality certificate
3. Wiring diagram
4. Table of saturation temperature and pressure

3.1.2 Prepare the tools

1. Major refrigerant tools
2. Digital voltage meter
3. Forcinate amperemeter
4. Electric leak tester
5. Megohmmeter

3.2 Inspection before Debugging

3.2.1 Inspection of Installation Status

It is necessary to check if the location, environment, base and space for maintenance meet the requirements.



3.2.2 Inspection of Water System

1. Check if the flowing direction for water of evaporator and condenser is correct.
2. Check if the cooling water pipe and chilled water pipe is clean, if there is foreign matter in cooling tower, water pool and position connecting to outside, if the water quality meets the requirements.
3. Check the thermal retardation of the chilled water pipe.
4. Check if the connection of pressure meter and temperature meter is correct. The pressure meter should be 90° vertical to water pipe. Ensure that the sensor of temperature meter should be immersed in the water. Check if the original state of pressure meter value and temperature meter value conform to the requirements before debugging.
5. Check if the flow switch of chilled water/cooling water is correctly installed. Ensure that the flow switch and control cabinet are correctly connected.
6. Stir the chilled water pump and cooling water pump to check the rotational direction. The correct rotational direction should be clockwise. Otherwise, please recheck the wiring of water pump.
7. Operate the chilled water pump and cooling water pump to check if the water pressure is stable through the pressure meter. Check if the current is within the range of rated current. If it exceeds the rated value, please check if the resistance of the system is too large. Please remove the system malfunction until the current meet the requirements.
8. Check if the automatic water replenishing equipment of cooling tower/ expansion water tank is free. Check if the automatic exhaust valve is normal. If it is a manual exhaust valve, open the exhaust valve of chilled water pipe and cooling water pipe to discharge all the interior gas.
9. Ensure the equipment such as fan of cooling tower is normal, without abnormal noise. Check if the belt of the fan is too tight or too loose. Ensure the connecting belt of fan and electromotor is not slipped, without abnormal noise.

3.2.3 Load Inspection

Check if the air handling system is correctly connected. Check if the outlet is free, if the load space and insulation meets the requirement. Check if the load is matched with unit.

3.2.4 Wiring Inspection

Caution: do not check the power supply without suitable inspection tooling and precautions. Otherwise, it may cause serious injury.

Every unit should be fitted with special power supply according to the requirement of the Nameplate. After wiring, check the following items. Refer to “Sheet 3-1 Inspection and record before debugging” for specific inspection items and record before debugging.

1. Check if the wiring and the specification of air switch is correct.
2. Check if the circuit arrangement conforms to the standard or electric regulation.
3. Check if the cable connection is correct.
4. Check if the interlocking function is normal,
5. Check if the connection point of contactor is working precisely.
6. Check the power supply and insulation status of the unit.
7. Check if the original values of control and protection parts reach the requirements.

3.3 Debugging and Trial Running

After finish the inspection, the next step is debugging and trial running.



1. It is necessary to energize the unit before starting it so that the heating belt of the compressor works. The heating hours should not be less than 8 hours.
 2. Adjust the flow control valve or the inlet isolating valve of the chilled / cooling water system so that the water flow reaches the standard.
 3. Check the malfunction record through the operation display. If there is any malfunction, it is necessary to repair it.
 4. After verifying the setting parameter of the controller, press the ON button to start the unit.
 5. After starting the unit, check the rotational direction of the compressor. If reversal occurs, please adjust two of the phase wire of the power cord. Ensure the lubricating oil shown in the mirror is in the visible position.
 6. Set the inlet water temperature according to the actual situation of load and water system so that the unit runs normally. Perform the trial running for 30 min. After stopping for 10 min, restart it.
- Finally, check the setting parameters of the operation display and finish debugging and trial running.

Note:

1. Do not start the unit during water scouring.
2. Do not start the unit before completely discharging the water in the water system.
3. Install the water valve on the water pipe and it must concatenate the unit. Otherwise, the malfunction due to water break during running of the machine should be responsible by the user.



Attachment 1: sheet of Inspection and record before debugging

Sheet 3-1 Inspection and record before debugging

Installation	location (outdoor/indoor)				does the space for repair meet the requirements?						
	base (concrete/steel frame)				does the damping measure meet the requirements?						
check	pipe water system	Cooling Water Pipe		M ₃ /h flow of water pump		Status of Stop Valve (Open/Close/none)		Status of Blow Valve	Is the Water Filter Clean?	Status of exhaust valve (Open/Close/non)	
		Water pressure		Temperature		Is the Flow Switch Normal?					
		Inlet	Out Let	Inlet	Out Let						
		Chilled Water Pipe		M ₃ /h flow of water pump		Status of Stop Valve (Open/Close/none)		Status of Blow Valve	Is the Water Filter Clean?	Status of exhaust valve (Open/Close/non)	
		Water Pressure		Temperature		Is the Flow Switch Normal?	Status of Thermal retardation				
		Inlet	Out Let	Inlet	Out Let						
Does each stop valve on the water pipe meet the requirements?				Times of water Scouring		Water Quality					
Load		Is the end equipment key ON?		Is the Air outlet free?		Load space & heat insulation Status		The Load of Chiller			
Power Supply		Voltage		Required Value	380 Volt	Voltage Fluctuation	%	Allowance	±1	0%	
Refrigeration Circulating Systems		Does the Pipe Leak?		Status of each stop valve on the pipe (open / close)			Thermal Retardation				



Attachment 2: Installation specification of water switch

1. General Introduction

- A. It is used for sensing the flow variation in the pipe and water interception protection.
- B. The switch can be adjusted based on different demand of flow.
- C. This switch is single-pole double-throw (SPDT) micro-active switch of ultimate load, with speed character, ensuring the instantaneity of the switch.
- D. The housing design adopts hermetically sealed structure. The inner component is made of stainless steel and anti-corrosive material, ensuring the normal work of the switch.

2. Electric data

Sheet 3-2 Related electric data

Rated Voltage		COSΦ Power	125 VAC	250 VAC
Rated Current				
Non Inducted Load Current		1	15	15
Inducted Load	Full Load Current	0.75	3.5	2.5
Current	Instantaneous Current	0.45	21	15

Note: flow switch is only used for controlling. In the places where the operate miss may cause injury and loss of property, installers should be responsible for added safety, limit control, alarm or monitoring system in case of invalid control.

3. Specification of Parameter

1. Specification of Parameter

3-3 Refer to sheet 3-3 for specification of parameter.

Sheet 3-3 parameter specification

Model	Size of Draw gate	Connec tor	Maximum Working pressure (Mpa)	Fluid Temperat ure	Weight Kg	Adjusting range of Flow M3/Hr				
						Size of Pipe	Min		Max	
							Reduce d Flow	Increas e Flow	Reduced Flow	Increase Flow
	3"	1"-11 ½ NPT	1.6	0- 120	0.6	1"	2.5	4.2	8.5	8.8
						2"	9.5	13.7	27	29
						3"	19	27.5	50	53

Note: when the sufficient liquid flowing through the pipe and makes the flow switch work, the red-yellow contactor loop is connected.

2. Outline Dimension of Flow Switch and Template

The flow piece should not contact the pipe or any throttling gear so that the switch can sense the flow variation.

Flow Meter is mounted with removable 1-inch, 2-inch, 3-inch and additional 6-inch flow piece.

If other dimension is needed, the flow piece can be clipped according to the template. The arc should be matched with the pipe.

3. Mounting Position of Flow Switch

FSF50P flow switch must be mounted on a length of straight pipe, with at least 5 times straight length of diameter length on both sides. Refer to Fig 3-1 for switch mounting. The connecting terminal should be in the position easy for connection.



The flow switch can be mounted on the level pipe or on the vertical pipe in which the water flow is upward but not downward. When it is mounted on the vertical pipe in which the water flow is upward, it is necessary to consider the effect of gravity.

4. Adjustment of flow switch

Steps of adjusting flow switch

- a) Remove the housing of flow switch.
- b) Screw clockwise to increase the flow value. Screw anticlockwise to decrease the flow value.
- c) Ensure that the setting flow value is not lower than the defaulting setting by pressing the main lever for several times. If the lever resumes without Click sound, screw clockwise until the lever resumes with Click sound.

The defaulting setting is the minimum value. The flow value shall not be lower than the defaulting value, as this may cause the situation that the switch can not resume to □no fluid stream position. The set point of the stop-off lacquer shall not be changed casually. Otherwise, it may destroy control or lead to invalid adjustment, and it is not included in warranty.

Before finishing mounting, it is necessary to observe for three month to ensure the normal running of the system connected with the flow switch.

Sheet3-4 Malfunction analysis

Stop-off lacquer/problem	Solution
The liquid permeates into the housing as the accordion is damaged.	Exchange
As the chippings jam the mechanical part of the switch, the switch can not work.	Remove the chippings inside the mechanical part and test it for several times to ensure the normal Working of the switch.
The control switch works reversely.	check and connect the wire according to the wiring Diagram.
The control switch does not work.	Check the wiring.
When there is fluid stream, the switch work. When there is not fluid stream, it can not resume.	Ensure the flow is upward in the vertical pipe. The arrow on the switch should point to the flow direction (downward).
When the flow increases, the switch does not work.	Check if the flow piece is cracked. Change it if it is necessary.



4 Maintenance

For the sake of long-term reliable running of the unit, the debugging should be performed by our professional staff or by the person with certain air conditioning knowledge under the instruction of our professional staff. The daily operation and maintenance should also be performed by professional person.

The normal usage time for water-cooled chiller is about 3000h/year (according to the climate and geographic condition of our country). For the sake of long-term reliable running of the unit and the increasing of lifespan as well as reducing of cost, it is important to maintain the unit.

The daily maintenance during running and inspection process is called preventive maintenance. Users are responsible for establishing the yearly, monthly maintenance plan according to the actual running state of the unit and performing the daily and periodical maintenance.

4.1 Daily Start and Stop of the Unit

There are two modes---manual and automatic---for the daily start and stop of the unit. Refer to

Operation Specification of Controller for setting of automatic start and stop of the unit. ON/OFF button on the controller is used for manual start and stop of the unit. The emergency stop button on the door of the electric control cabinet is used for the emergency stop of the unit during maintenance and debugging.

4.2 Maintenance of Main Parts

1. During running of the unit, pay attention to the exhaust and suction pressure of the system. If there is abnormality, find out the reason and remove the malfunction.
2. Do not casually adjust the set point of the control and protection parts.
3. Check if the wire is loose. Fix it if it is loose.
4. Check the reliability of the electric parts periodically and replace the invalid or unreliable parts.

4.3. Contaminant Release

After long-term running, there will be calcium oxide and other minerals accumulated on the heat transfer surface of the shell and tube heat exchanger. If there is too much scaling, it will affect heat transfer performance and lead to increase of electricity depletion and exhaust pressure. It can be released by organic acid such as formate, citric acid and acetic acid.

4.4 Stop of the Unit in Winter

When stop the unit in winter, it is necessary to clean and dry the inner and outer surface of the unit. Open the discharging valve to release the water in the shell and tube heat exchanger in case of freezing.

4.5 Start of the Unit in Spring

After long-term stop, prepare the following process before starting the unit.

1. Fully check and clean the unit.
2. Clean the water pipe.
3. Check the water pump.
4. Screw all the connector.
5. Preheat the compressor according to the requirement.



4.6 Replacement of Components

The applied renewal part should be provided by National Chiller. Generally, they can not be replaced by the similar parts provided by other company.

4.7 Leak and Supplement of Refrigerant

Make sure of the charging of the refrigerant by check the suction and exhaust pressure. If there is leak, replenish the refrigerant. Perform air tightness test when replenishing the refrigerant or replacing the parts of circulating system. Charging refrigerant should be different based on the following two situations.

1. Complete Leak of Refrigerant

In this situation, perform leak test with high-pressure nitrogen (15~20 kilogram air pressure) or refrigerant. If repair welding is necessary, it is required to discharge the gas inside the system before welding. The system must be dried and vacuumized before charging the refrigerant. Steps are:

- 1) Ensure that all the stop valves are open. Connect the vacuum lead to the Freon inlet of the stop valve on the suction pipe of compressor and on the discharge pipe of the condenser.
- 2) Vacuumize the pipe with the vacuum pump.
- 3) When the vacuum level is reached, charge the refrigerant via Freon inlet of the stop valve on the discharge pipe of the condenser. The charging volume is shown on the nameplate.

2. Replenishing the Refrigerant

- a) Connect the refrigerant filling tank to the Freon inlet on the suction pipe of the compressor.
- b) Circulate the chilled/cooling water and start the unit.
- c) Charge the refrigerant into the system and check the suction and exhaust pressure.

Caution: when performing leak test and air tightness test, do not charge flammable, poisonous gas such oxygen and ethylene, but only pressure nitrogen or refrigerant.

Warning

- **Only charge gassy refrigerant of the same type as is shown on the nameplate.**
- **When charging and releasing gassy refrigerant, please start the water pump to keep circulation in the evaporator and condenser in case of freezing. Otherwise, National Chiller will not be responsible for loss as a result of such mistakes.**
- **Do not charge too much refrigerant. otherwise, it may cause decrease of high pressure and high cooling capacity and increase of electricity depletion or even damage of the compressor.**

4.8 Anti-freezing

If the flow passage of the shell and tube heat exchanger is frozen seriously, it may be crack and leaked, which is not included in warranty. As a result, please pay attention to protection of frost, especially the following three points.

1. If the unit is stored in the environment where outdoor temperature is lower than 0, it is necessary to discharge the water in the evaporator and the condenser.
2. During running, invalid flow switch of cooling water may freeze the pipe. As a result, the flow switch and the unit must be interlocked.



3. During maintenance, charging or releasing refrigerant may frost the evaporator. Therefore, keep the water flowing in the evaporator or completely discharge the water.

Warning

- **The medium for water-cooled screw chiller is water. Thus, it is necessary to take the following actions in when used in area where temperature is lower than 0° in winter. Otherwise, the manufacturer will not be responsible for any malfunction due to frost.**
- **It is necessary to add anti-freezing fluid (glycol) into the water system according to the required ratio.**
- **Do not cut off the power. Otherwise automatic anti-freezing protection will not work.**

Sheet 4-1 Parallel table of consistency and freezing point for glycol

Consistency %	freezing point °C	Consistency %	freezing point °C	Consistency %	freezing point °C
4.6	-2	19.8	-10	35	-21
8.4	-4	23.6	-13	38.8	-26
12.2	-5	27.4	-15	42.6	-29
16	-7	31.2	-17	46.4	-33

The above consistency of glycol is mass concentration.

4.9 Others

Caution

- **Maintain the unit periodically according to the specification to ensure the normal running.**
- **If fire occurs, switch off the general power and eradicate the fire with fire extinguisher.**
- **The working environment should be far away from the flammable matter such as gasoline and alcohol in case of explosion.**
- **If the unit stops due to malfunction, it is required to find out the reason and repair it before restart it. If there is refrigerant leak or chilled water leak, turn off all of the switches. If the unit can not be stopped through the controller, stop it through the emergency stop button on the electric control cabinet and cut off the general power.**
- **The unit is fitted with a variety of automatic protection device. The setting value of each protection is set before delivery. Do not change it casually.**
- **Do not stop the unit by cutting off the main power unless it is emergent.**



- **Check the running state of the unit frequently, including water quality of cooling water and chilled water, water temperature, water pressure, water filter, water pump, cooling tower. If they are abnormal, repair them in time.**
- **Keep the machine room dry, clean and ventilative.**
- **Do not open or close any stop valve during debugging and running of the unit.**

Caution

Our company will not be responsible for the malfunction due to the following situations.

- **Users open the valve or disconnect the connector by themselves, which causes refrigerant leak.**
- **Users disassemble the water-cooled chiller without permission of our company.**
- **Users connect the power to the control cabinet or the motor of the compressor by themselves.**
- **Users charge the lubricating oil into the compressor or charge refrigerant into the unit by themselves.**
- **Users start the system by themselves without debugging by our professional staff.**
- **Users charge the hot water or vapor into the evaporator or condenser.**
- **Users do not operate the unit according to the installing, use and maintenance instruction.**

In order to increase the lifespan of the unit, improve efficiency and save energy, it is a must to inspect and maintain the unit periodically. Users should record the inspection and maintenance of each month, each quarter and each year so that it is convenient for the repairer to handle the malfunction. Refer to Sheet 4-2 Maintenance period of the system for the maintenance period.

Sheet 4-2 Maintenance period of the system

Inspect the oil level of the compressor	Weekly
Inspect the water flow of the circulating system	Monthly
Inspect the pressure and power supply	Monthly
Inspect refrigerant capacity (via mirror)	Monthly
Inspect the connection of wire and electric insulation	Quarterly
Inspect and adjust setting temperature	Quarterly
Inspect device for drying and filtering	Quarterly
Replace oil filter of the compressor	40,000 hours
Replace bearing of the compressor	40,000 hours



5 Trouble Shooting

Sheet 5-1 Malfunction analysis and solutions

Malfunction	Possible Cause	Solution
Exhaust pressure is too high.	<p>There is air or other incoagulable gas</p> <p>The fan of cooling tower is wrong.</p> <p>The suction pressure is too High</p> <p>The ambient temperature is too high</p> <p>The flow of cooling water is too small</p> <p>The oil level of compressor is too low</p>	<p>Release the gas from Freon inlet. Vacuumize the system again if necessary</p> <p>Repair the fan of cooling tower.</p> <p>Refer to “The suction pressure is too high”</p> <p>Inspect the cooling water system and increase the water flow.</p> <p>Inspect the oil level and increase chilled oil.</p>
Exhaust pressure is too low.	<p>The suction pressure is too low.</p> <p>The refrigerant is leaked or not enough.</p> <p>Them temperature of cooling water is too low.</p>	<p>Refer to “The suction pressure is too low”.</p> <p>Perform leak hunting and charge Freon.</p> <p>Check if the capacity of cooling tower is too large or if the ambient temperature is too low.</p>
Suction pressure is too high.	<p>Exhaust pressure is too high.</p> <p>Too much refrigerant is charged</p> <p>Liquid refrigerant flows into the compressor through evaporator.</p> <p>The temperature of inlet chilled water is too high.</p>	<p>Refer to “Exhaust pressure is too high”. discharge part of the refrigerant.</p> <p>Inspect and adjust the expansion valve. Ensure the sensor of expansion valve and the air inlet pipe is closely connected and is isolated from the outside.</p>
Suction pressure is too low.	<p>Device for drying and filtering is blocked.</p> <p>The expansion valve is not adjusted or wrong.</p> <p>The refrigerant is not enough.</p> <p>The temperature of inlet chilled water is lower than rated value.</p> <p>The flow of chilled water is not enough.</p>	<p>Replace the core of dry filter.</p> <p>Adjust the temperature or inspect if the sensor of expansion valve is leaked.</p> <p>Perform leak hunting and charge Freon.</p> <p>Check if the inlet and outlet pipe pressure of the evaporator is too low.</p> <p>Adjust the chilled water flow.</p>



<p>The compressor stops due to high pressure protection.</p>	<p>The temperature of chilled water is too high.</p> <p>The fan of cooling tower is wrong.</p> <p>The setting value of high pressure stop is not correct.</p>	<p>Inspect and repair the fan of cooling tower.</p> <p>Inspect the high pressure switch.</p>
<p>The compressor Stop due to overload of motor.</p>	<p>The voltage is too high or too low.</p> <p>Exhaust pressure is too high.</p> <p>The temperature of cooling water is too high.</p> <p>The overload parts are wrong.</p> <p>Short circuit occurs in motor or connecting terminal</p>	<p>The voltage should not exceed the range of $\pm 10\%$ of the rated voltage.</p> <p>”Refer to “Exhaust pressure is too high”.</p> <p>Check if the capacity of cooling tower is too small.</p> <p>Compare the current of the compressor to the specified full load current.</p> <p>Check the corresponding resistance of the motor and terminal.</p>
<p>The compressor stops due to temperature protection.</p>	<p>The voltage is too high or too low.</p> <p>Exhaust pressure is too high.</p> <p>The temperature of inlet chilled water is too high.</p> <p>There is something wrong with the temperature protection switch inside the compressor.</p> <p>The refrigerant is not enough.</p>	<p>Inspect the voltage. It should not exceed the above range.</p> <p>Refer to “Exhaust pressure is too high”.</p> <p>Replace parts.</p> <p>Check if the Freon is leaked.</p>
<p>The compressor stops due to low pressure protection.</p>	<p>The dry filter is blocked.</p> <p>Malfunction of the expansion valve</p> <p>Incorrect setting value of low pressure stop</p> <p>Insufficient refrigerant</p>	<p>Replace the core of dry filter.</p> <p>Adjust or replace the expansion valve.</p> <p>Inspect the low pressure switch.</p> <p>Charge refrigerant.</p>
<p>Too much noise of compressor</p>	<p>Insufficient chill oil in compressor.</p>	<p>Inspect the oil level and increase chilled oil.</p>
<p>The compressor can not be started.</p>	<p>The over current relay starts aside. Fuse is burnt.</p> <p>The control circuit is not connected.</p> <p>No current</p>	<p>Replace the damaged parts.</p> <p>Inspect the wiring of control system.</p> <p>Inspect the power supply.</p>



<p>High pressure protection or low pressure protection</p> <p>Contactor loop is burnt.</p> <p>Sequence of power phase is wrong.</p> <p>Water system is wrong.</p> <p>Flow switch is short-circuit.</p> <p>There is alarm signal in operation display.</p> <p>The setting time of start and stop is wrong.</p> <p>The temperature tested by temperature sensor exceeds setting Temperature.</p>	<p>Refer to the previous section of suction and exhaust pressure error.</p> <p>Replace the damaged parts.</p> <p>Reconnect the wire and adjust two of the wires.</p> <p>Inspect the water system.</p> <p>Inspect the alarm and take corresponding actions.</p> <p>Inspect and reset the time.</p> <p>Inspect and reset the temperature.</p>
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Thank you for choosing NATIONAL CHILLER for correct operation, please read this owner's manual carefully before operating the unit and keeps it carefully for consultation.

M/s NATIONAL COOLING TOWERS

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