INSTALLATION&

OPERATION MANUAL

Installation&Operation Manual

Water-cooled Scroll-type Chiller(Heat pump)

Contents

Safety Precautions

◆ Before operating the unit, read in detail the "Safety Precautions" section.

◆ Please comply with all the safety requirements listed.

1. Safety Symbols

 Warning: The instructions must be observed; otherwise, it may cause personal injury due to improper operations of the user.

 Electric shock prevention: This sign applies to electrical installation, maintenance and related operations. Only experienced electricians are qualified to wire this system.

 Caution: The content must be observed. Improper operation may cause damage to the air conditioner.

2. Installation Notes

 Warning

✧ Prepare a base/platform or reserve a flat ground before installation to ensure smooth operation of the unit.

✧ Use only the accessories specified by TICA and ask the manufacturer or authorized distributor to provide installation and technical services.

✧ Do not attempt to install the unit yourself. Improper installation may lead to water leakage, electric shock, or fire.

 Caution

✧ Install a leakage circuit breaker.

✧ The main controller must be connected to the power supply system of the unit, and the data cable must be separated from the power cable to avoid interference.

✧ Be sure to install the grounding wire, which cannot be connected to the gas pipe, tap water pipe, lightning arrester, etc. Improper installation of the earth line easily leads to an electric shock accident.

3. Operation Notes

⚠ Warning

✧ Do not damage the power cord or turn on/off the air conditioner by inserting/pulling out the power plug.

⚠ Caution

✧ Do not use water to flush the air conditioner directly; otherwise, electric shock or other accidents are easily caused.

✧ Avoid frequent power-on/off to prevent damage to the unit.

✧ Do not attempt to repair the unit yourself. Improper repair may lead to running fault or unit burning. Contact a local office of TICA or an authorized distributor to repair the unit.

⚠ **Caution: If the unit is to be left idle for a long time, drain the water inside.**

Part 1 Refrigeration System and Its Installation and Maintenance

1.1 Unit Information

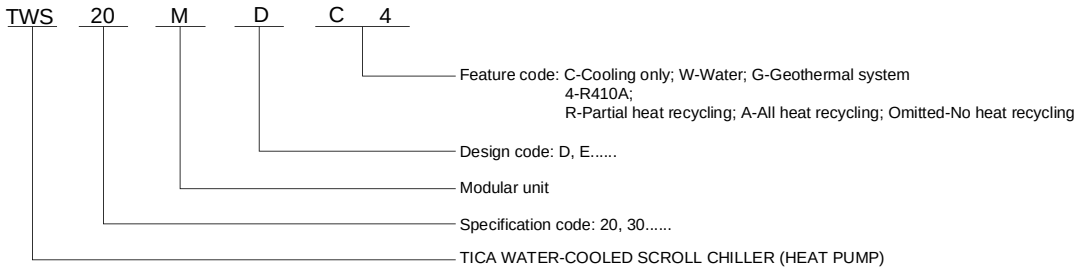
1.1.1 Overview

TICA R410A water-cooled scroll chiller (heat pump) is an eco-friendly and energy-efficient product. The unit adopts the industry-leading technology and experience, optimizes the heat exchange technology to improve the EER, and balances between environmental impacts and economic benefits. It is the best choice for cooling or process cooling with central air conditioning and a new generation of environmental-friendly high efficiency scroll chiller developed by TICA. The unit not only provides a wide range of cooling capacity, low operating costs, but is also very environmental-friendly.

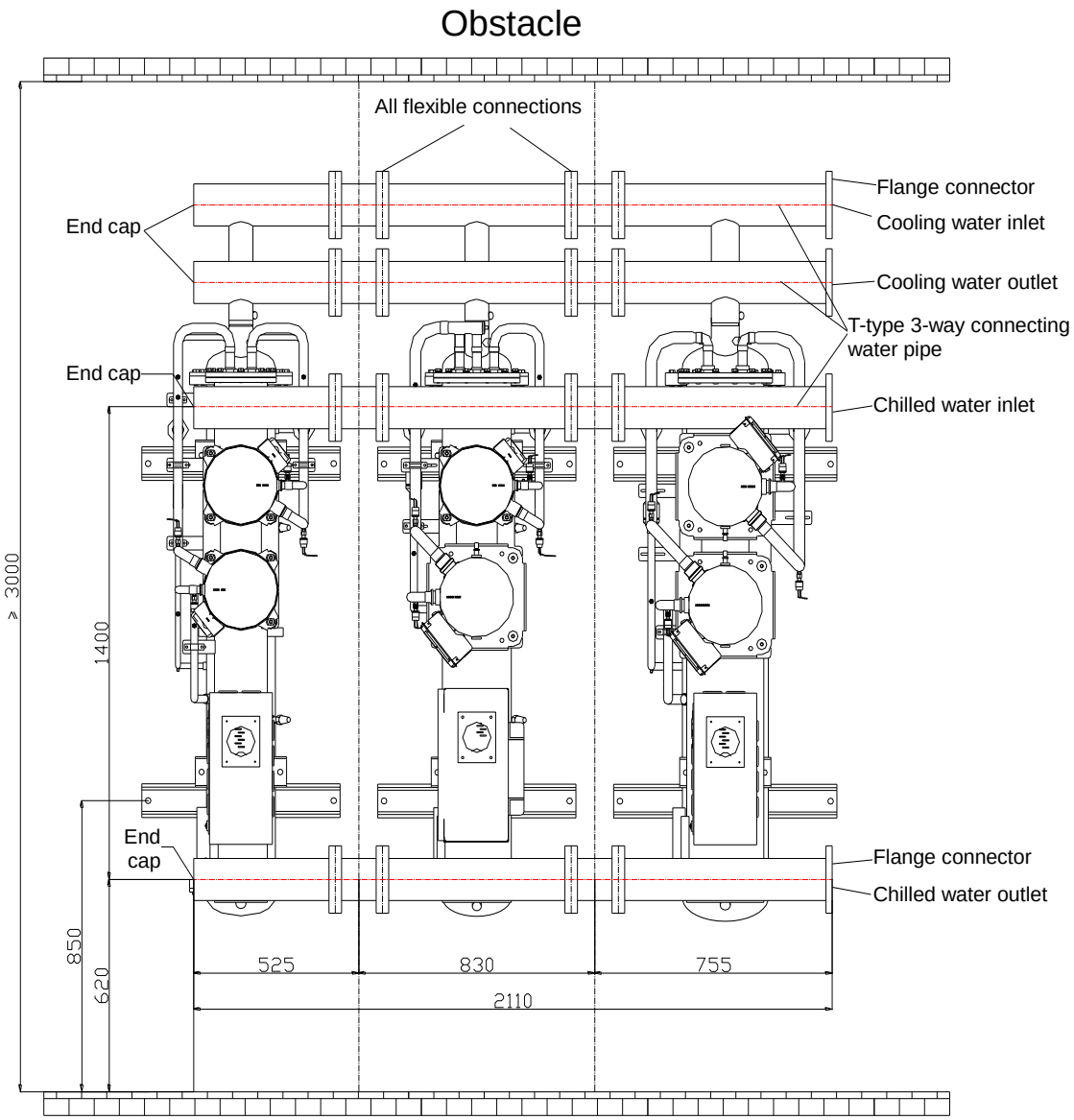
With advanced fully-closed scroll compressors and high-efficiency compact heat exchangers, and cutting-edge microcomputer control technologies and modular refrigeration regulation technologies, this series of units feature high EER, enhanced energy efficiency, excellent system stability and reliability, and less initial investment and OPEX.

It comes with a wide range of cooling capacity. For small-range cooling, a single unit suffices. For larger-range cooling, a maximum of 12 units can be assembled to meet the requirement. There are two assembly series available: 20RT + 30RT, and 40RT + 40RT. Besides the easy installation and maintenance, compact structure, quiet operation, and small footprint, scroll chillers also boast higher EER when compared with screw chillers of the same cooling capacity. They can be widely used in top-grade villas, hotels, hospitals, office buildings, entertainment venues, restaurants, schools, and industrial cooling fields.

1.1.2 Nomenclature



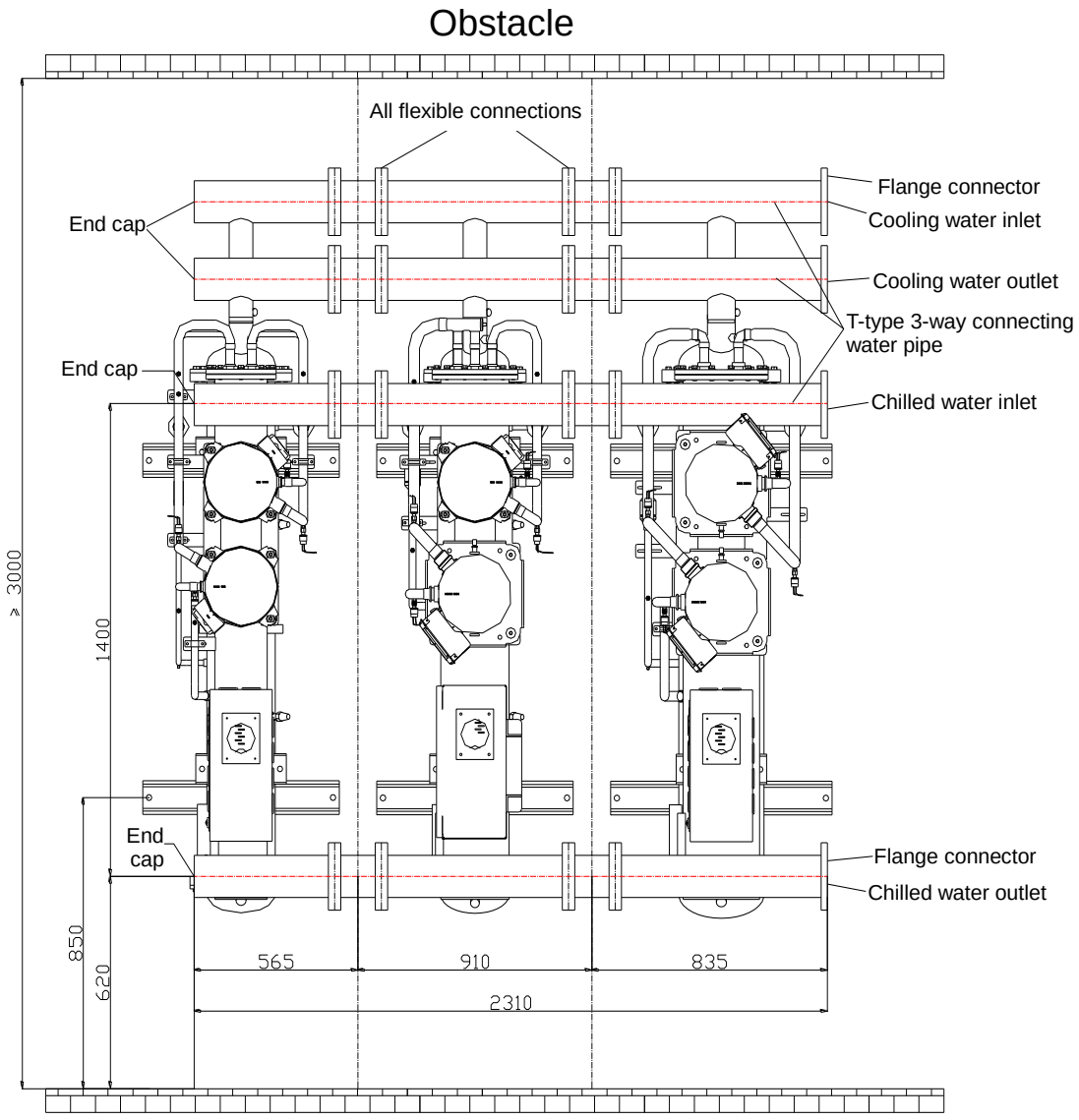
1.1.3 Unit Assembly Diagram: TWS20/30M



Remarks:

1. The assembly spacing is for reference only. Actual spacing must be adjusted during on-site construction to facilitate module maintenance.
2. Water inlet/outlet pipes can be installed based on actual situation. However, the inlet/outlet of the cooling water must be on the same side, and the inlet/outlet of the chilled water must be on the same side.
3. During on-site assembly, the cover of the power distribution cabinet door of the master unit needs to be removed, and the wired controller needs to be installed. While for the slave unit, this operation is not required.
4. The assembly of other unit models can also refer to this diagram.

1.1.4 Unit Assembly Diagram: TWS40/40M



Remarks:

1. The assembly spacing is for reference only. Actual spacing must be adjusted during on-site construction to facilitate module maintenance.
2. For 70~160RT units, DN125 pipes are recommended as main inlet/outlet pipes and installed in the same section.
3. For 160~240RT units, DN150 pipes are recommended as main inlet/outlet pipes and installed in the same section.
4. Water inlet/outlet pipes can be installed based on actual situation. However, the inlet/outlet of the cooling water must be on the same side, and the inlet/outlet of the chilled water must be on the same side
5. During on-site assembly, the cover of the power distribution cabinet door of the master unit needs to be removed, and the wired controller needs to be installed. While for the slave unit, this operation is not required.
6. The assembly of other unit models can also refer to this diagram.

Caution

Based on the design, the unit supports TWS20 + TWS30 assembly and TWS40 + TWS40 assembly.

1.2. System Installation

1.2.1 Unit Installation

(I) Mounting position selection

The unit can be installed on base-prepared ground, balcony, corridor, special platform or any other place that facilitates installation and is able to bear the unit's operating weight. Pay attention to the following requirements:

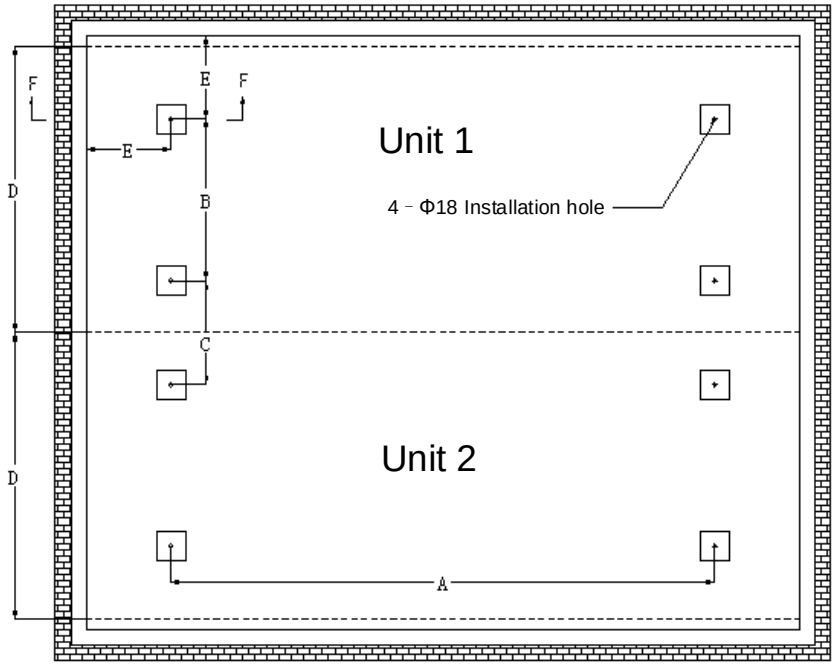
A. The unit should be located away from surrounding objects to facilitate unit installation and maintenance.

B. If there is room after installation, reserve sufficient space for unit disassembly and maintenance on any side of the unit.

C. To ensure normal operation, keep the unit away from sunlight and rainfall.

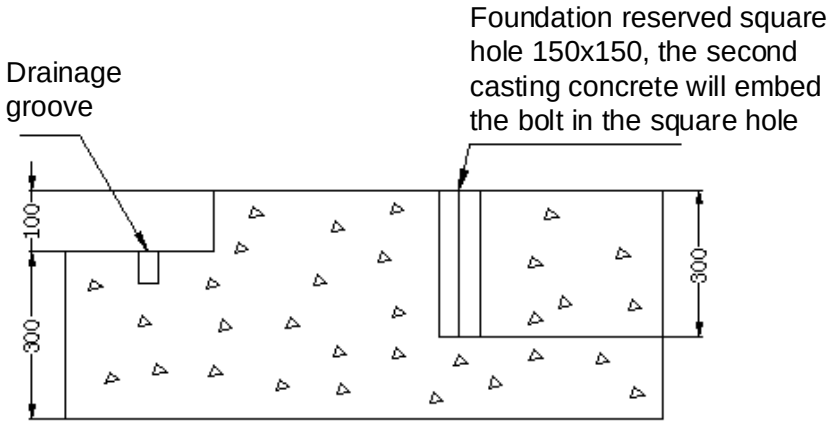
D. The unit should be installed close to the master power supply to avoid excessive voltage drop that will affect the normal startup of the unit.

Diagram of Unit Installation Size (in mm)



Positions of Base Anchors (in mm)

Model	A	B	C	D	E
TWS20/30MDC(W/G)4	1000	590	240	830	500
TWS40MDC(W/G)4	1000	670	240	910	500



Remarks:

1. Usually, the unit needs to be installed on a specialized concrete foundation. In exceptional situations, it can also be installed on a rigid base that does not deform (such as channel steel).
2. The concrete foundation or rigid base must be strong enough to bear the weight of the unit during operation.

(II) Precautions for hoisting

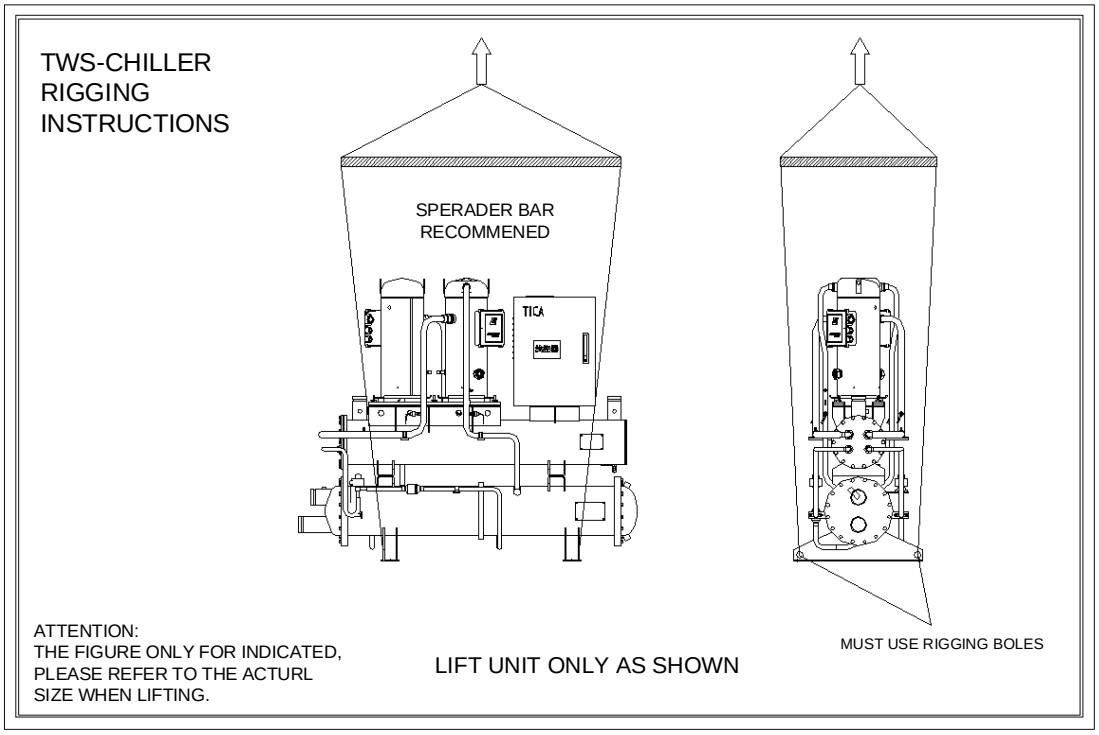
Caution

After a unit is delivered from the factory to the installation site, keep the proper package before hoisting. Pay attention to the following points during hoisting:

A. Handle with care to ensure the machine is vertical.

B. When hoisting the unit, avoid colliding with other objects and sliding. No person is allowed to stand below or near the unit for the sake of safety. Select the round steel, rope, and crane based on the weight of the unit.

C. To prevent scratching or deforming the unit surface, protective pads must be placed on the contact part between the steel ropes and the machine body, and supports should be added between the ropes to prevent the rope from damaging the machine.



1.2.2 Water System Installation

Caution

To facilitate on-site installation, for 20/30RT modules, DN50 pipes are used for chilled

water inlet/outlet, and DN65 pipes are used for cooling water inlet/outlet; for 40RT modules, DN65 pipes are used for chilled water inlet/outlet, DN80 pipes are used for cooling water inlet/outlet. All connectors adopt flexible clamp connections. Units must be placed in order according to their external labels, because the unit control DIP switch varies with each unit.

Refer to the following specifications for the diameters of the main water inlet and outlet pipes of the unit:

For 40-60RT units, pipe size ≥ DN80; for 70-160RT units, pipe size ≥ DN125; for 160~240RT units, pipe size ≥ DN150.

Caution

The water flow switch is delivered as an accessory to the unit. The water flow switch must be installed on the main outlet pipe of the cooling water and chilled water. After the water system is installed, the water flow switch must be cleaned before the unit can run. The air-conditioning water temperature sensor on the master unit is used for regulating energy consumption of the entire unit, and must be installed on the main return water pipe of the chilled water pipe. For details, see the following installation description.

Cooling Water System Installation Diagram

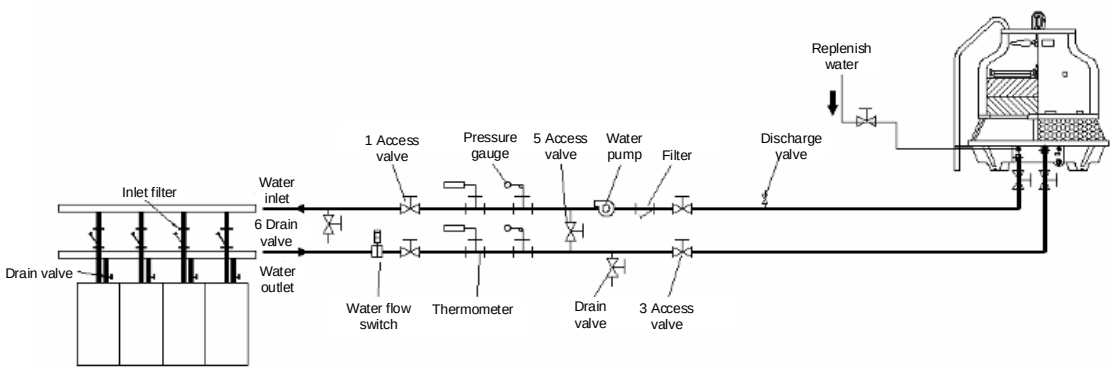


Diagram of Cooling Water Pipe Installation

Chilled Water System Installation Diagram

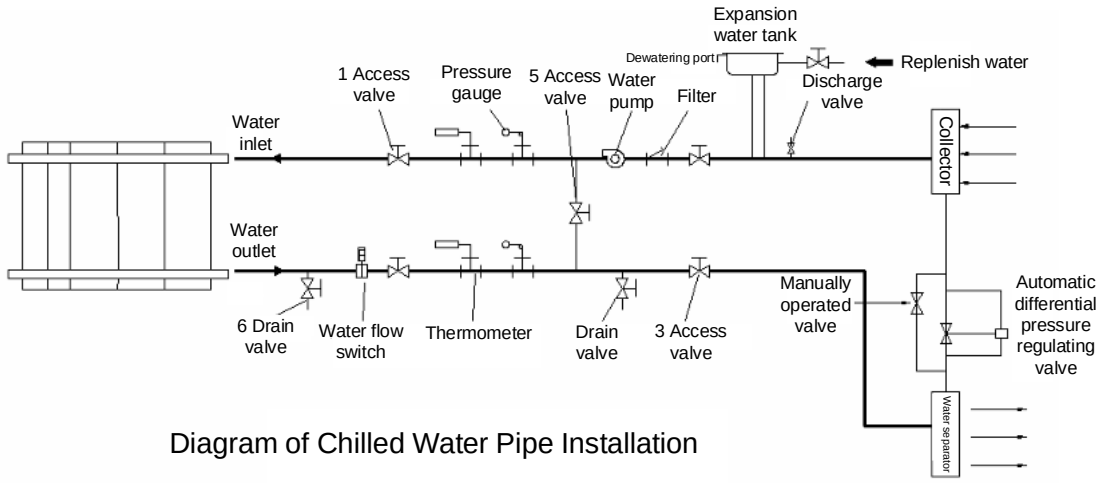
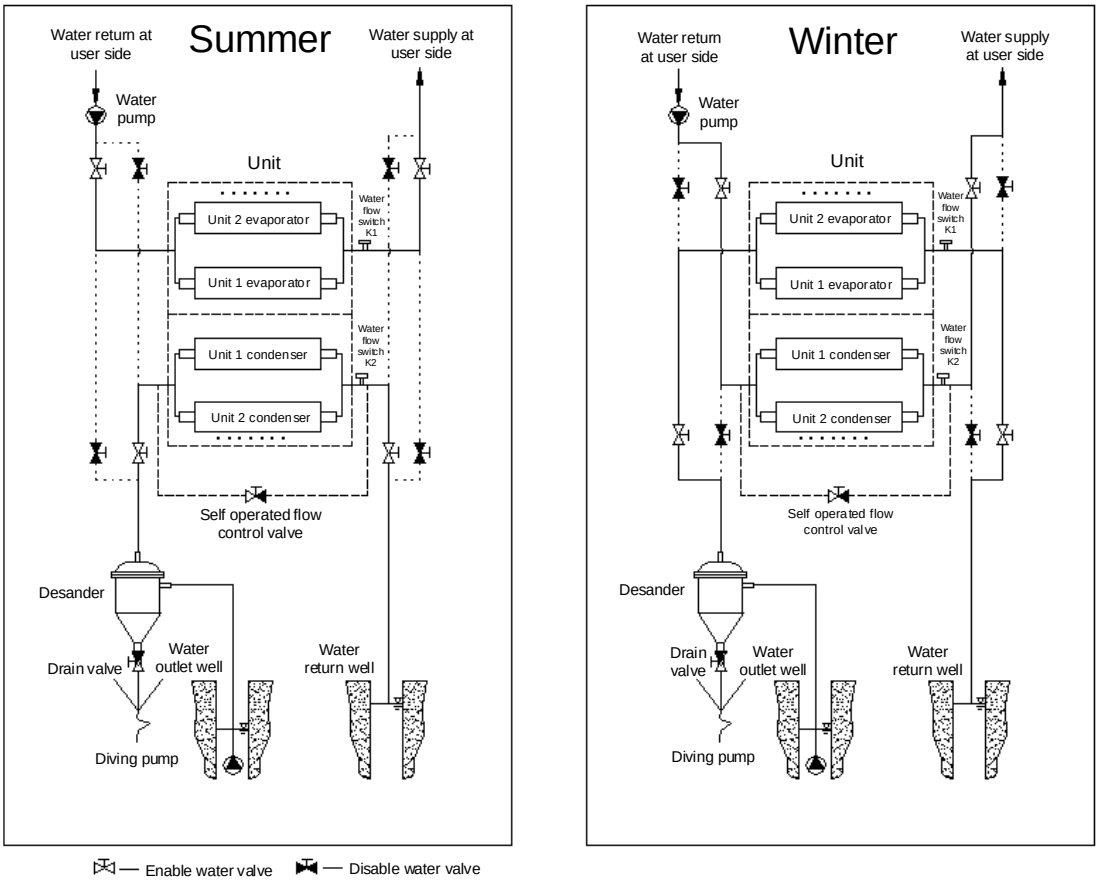


Diagram of Chilled Water Pipe Installation

Water Source Heat Pump Unit



Notes:
Optional: self operated flow control valve

Precautions of pipeline design and installation:

The design of the water circulation system should be as simple as possible and avoid too many elbows. Straight pipes should be kept on the same plane as much as possible.

The following precautions must be taken during pipe connections:

1. Pay attention to the positions of the water inlet/outlet of the condenser and evaporator to prevent connection errors.

2. Install manual or automatic exhaust valves at all the highest points of the water circulation system.

3. Use an expansion water tank to maintain the pressure of the system, and install a safety valve.

4. Install thermometers and pressure gauges at the chilled water and cooling water inlet/outlet.

5. Install drain valves at the bottom of all local elbows to empty water of the entire system.

6. Install check valves on the chilled water pipe at the junction between the unit and the user's water pipe.

7. Install elastic connectors to reduce vibration of the pipeline.

8. After the pipeline leak test is completed, wrap the pipeline with thermal insulation material to reduce heat loss and avoid condensation.

9. Wrap a layer of moisture-proof material outside the insulation material.

10. Install filters before water pumps because impurities will cause fouling of the heat exchanger.

Notes:

A. The expansion water tank should be made of anti-corrosion and rust-proof material, and must be installed at the highest point of the entire piping system to provide automatic exhaust and water capacity change functions.

B. After the pipeline of the water circulation system is completed, empty the air in the water system before starting the unit to avoid damage caused by waterless operation.

C. Install automatic air discharge valves at the highest point of the water circulation system.

D. To prevent frequent trips due to the too-small load during operation, users can install energy storage water tanks.

E. To improve the cooling (heating) performance and save energy, insulate the

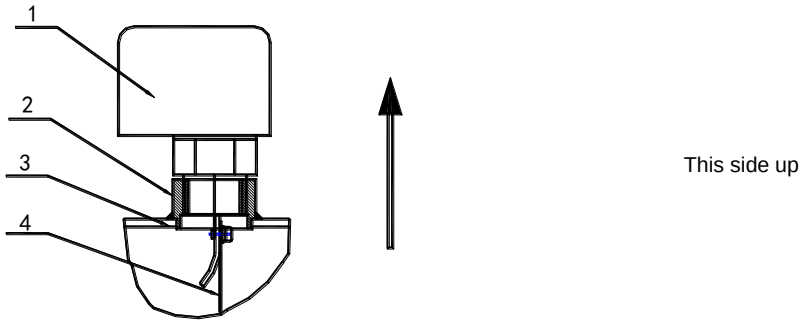
pipes.

F. When the outdoor ambient temperature drops below 0°C and the unit is not used for a long time due to power failure, the drain valve (plug and discharge valve (plug)) on shell covers on both sides of the evaporator and condenser must be opened to drain the water system and the water inside the evaporator and condenser of the unit to prevent the evaporator and condenser from being damaged by freezing. After the water is drained, screw on the exhaust valve (plug) and keep the drain valve (plug) open until the next water injection. When the unit is used in cold weather, pay attention to anti-freezing protection.

1.2.3 Water Flow Switch Installation

Caution

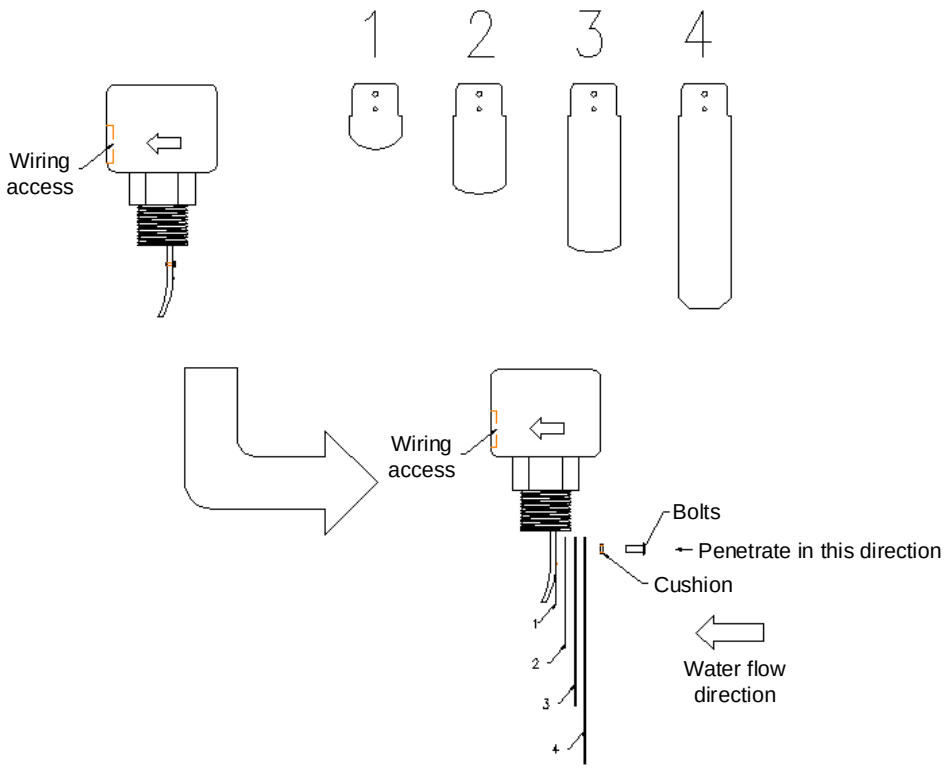
The water-cooled chiller must be equipped with water flow switches to ensure that water flows through the unit during normal operation of the unit, so as to prevent damage to the heat exchanger due to insufficient water flow. Two water flow switches are delivered with the unit, with one installed at the cooling water main outlet pipe and the other at the chilled water main outlet pipe. The water flow switches must be used with the NPT 1" inner-threaded valve seat. They are connected to the specified terminal in the unit control cabinet through a control cable. A φ40 hole must be reserved on the main outlet pipe of the condenser for installing the water flow switch connector seat.



As shown in the above figure, a water flow switch is composed of a water flow switch controller 1, a paddle 4, a water flow switch connector 2, and a short tube 3. When water

passes, it impacts the paddle, which drives the water flow switch movement sheet to close the water flow switch and then connect the circuit. When no water passes or the water flow is small, the circuit will be disconnected and the unit will stop.

The requirements for installing a paddle type water flow switch are as follows:



Pipe Model (mm)	DN50	DN65	DN80	DN100	DN125	DN150	DN200	DN250
Water Flow Switch Configuration	1,2	1,2	1,2,3	1,2,3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4

If the paddle is found to be get in touch with the inner wall of the pipe, remove the surplus with scissors to ensure that the spacing between the lower part of the paddle and the inner wall of the pipe exceeds 5 mm.

Warning

Improper installation can lead to malfunction of the water flow switch. As a result, the unit may fail to start, or incorrectly start when there is no water flow and then cause damage to the water-side heat exchanger. Therefore, the following instructions must be paid attention

to during installation of the water flow switch:

A. The flow direction indicated by the arrow must be consistent with the direction of the water flow.

B. The water flow switch can be installed in the water system only after the water system is cleaned. Otherwise, debris generated during pipeline cleaning may stuck the water flow switch.

C. Avoid the paddle of the water flow switch from contacting other fixed parts.

D. The water flow switch must be installed on a horizontal pipe, with the valve body vertically upward and the spacing between the valve body and front/rear elbows and other local resistance components (such as tees) more than 5 times of the pipe diameter.

E. After the water flow switch is installed, connect it to the control computer board through a control able to achieve protection in actual operation. Adjust the water flow thresholds based on the unit's rated water flow. Generally, it is recommended that the water flow for disconnection is less than 55% of the rated water flow. The maximum flow (110% of the rated water flow) and pressure drop of the evaporator and condenser (hereinafter referred to as the "vessel") must not be exceeded at any time.

1.2.4 Water Pipeline Installation

Main water inlet/outlet pipes

For details about main water inlet/outlet pipe installation, unit spacing, and hole size, see the unit assembly diagram. Drill holes in the water inlet/outlet pipe position of each unit, and weld pipes that match the diameter of the inlet/outlet pipes of the unit. A position must be reserved for the flexible clamp between the pipes and unit to connect to the inlet/outlet pipes of the evaporator and condenser.

Other pipes

The pipeline installation directly affects the use effect of air-conditioning units. Only qualified installation team is allowed to install pipelines and the installation must comply with industrial standards. The following are some suggestions on pipeline installation:

A. Water pipelines should be installed based on the hoisting height of air-side devices as well as the height of beam bottom. The installation height determines the pipeline elevation and arrangement. Pipelines can be arranged in parallel or in staggered manner. Staggered arrangement is allowed if the condition permits. In this case, the pipeline center elevation is subject to the connector center of the air-side devices. If this is infeasible, the connector center of the air-side devices prevails to reduce the number of branch pipe elbows.

B. Pipes are generally fastened using supports or hangers. For the form and fastening method of supports and hangers, see the national installation standard atlas. Pipes should be isolated from supports and hangers via wood or other insulation materials based on the on-site conditions, to prevent the occurrence of cold bridge.

C. Pipes must be kept horizontally (pipe center) or installed based on 1/1000～3/1000 slope. Tilted stand pipes facilitate pipeline exhaust. The spacing between two pipes must be consistent and suffice thermal insulation. The stand pipes and horizontal main pipes must be horizontal and vertical, respectively. U-shaped bending and door-shaped bending should be eliminated to avoid partial blockage and exhaust failure that affect the circulation of the water system. Pay attention to the treatment of the intersection of the pipeline.

D. Air discharge valves on pipelines need to be set based on on-site environment. They are generally set at the end of horizontal pipeline (long pipeline), upper position of stand pipes, and elevated position of some areas, to ensure smooth air discharge of the pipeline system.

E. It is recommended to set a bypass valve for each layer of the multi-layer air-conditioning pipeline, to regulate the water flow. A drainage valve needs to be set at the lowest point of the pipeline to facilitate system overhaul and water drainage when the unit is not used in winter, thereby preventing water pipe damage caused by frosting.

Open expansion water tank is used, and it is installed at a height at least one meter higher

than the highest point of the system. The water tank should be connected to the return pipe of the pump (the expansion water tank must also have an air discharge valve).

Caution

The pipe diameter affects the system operation resistance at the same flow rate. Choose pipes with a larger diameter when the condition permits, to reduce the system operation resistance and pump head. The following table lists recommended values.

Theoretical flow rate of water in m/s

Position	Water Pump Outlet	Water Pump Inlet	Main Pipe	Stand Pipe	Branch Pipe
Flow rate	2.4~3.6	1.2~2.1	1.2~4.5	0.9~3.0	1.5~2.1

Caution

The water flow rate of the unit ranges from 80% to 120% of the rated flow rate. Flow rate that exceeds the range will cause damage to the unit. Select pumps based on this range.

Pipe pressure test and pipe washing

A. The test pipe pressure must be 1.25 times greater than the operating pressure of the pipe and 0.6Mpa. Keep the pressure 5 minutes with the pressure drop no more than 0.02Mpa. The unit is qualified if no leakage is detected.

B. The test can be conducted at temperature higher than 5°C. The pressure gauge must be checked and its precision should not be smaller than 1.5 and the highest measurable pressure is 1.5~2 times of the maximum test pressure.

C. Water is added from the lower part of the system and air is discharged from the upper part. During the pressure test, add water slowly and evenly to reach the pressure, stop the pump, and check the system. Repair cannot be performed when there is pressure in the system.

D. After the pressure test is qualified, rinse the water pipeline repeatedly (do not pass the equipment) till impurities such as silt and iron filings are not contained in the drained water and water is clear.

1.2.5 Precautions of Construction

Caution

A. Complete piping for the water system as per the method described in this manual, and correctly perform construction according to the water heating pipe construction standard.

B. Determine the diameters of trunk pipes based on pipe sizes, water flow, and cooling capacity of the unit.

C. It is recommended to connect indoor air-side devices using the direction-changing water return method to ensure even allocation of water.

D. Avoid air in the system pipeline in the piping design and construction. Install automatic air discharge valves at the highest positions of water supply and return pipes, so as to discharge air in the system.

E. Install Y-type filters at the water inlet of the unit to avoid waste in the water system from blocking the heat exchanger. Pay attention to the flow direction during installation. Check valves must be installed at both ends of the Y-type water filter so that the filter can be dismounted for cleaning.

F. Install a thermometer and a pressure gauge on the water inlet and outlet pipes of the unit so as to check the operation status of the unit conveniently.

G. Install water discharge valves at the water inlet and outlet pipes of the unit so that unit water is drained from the two outlets at the same time to avoid water freezing in the heat exchanger and water pump if the unit is unused in winter and protect the unit.

H. After the water system is installed, conduct an airtightness test and drain water based on the HVAC installation specifications. The system inside should be cleaned to avoid any rust and residue from blocking the pipeline, heat exchanger and water pump and protect the unit.

I. Water supply valves and check valves must be installed indoor, lest water supply pipes and valves will crack due to water freezing in winter.

J. The indoor unit and pipeline system should be designed and installed by

professionals based on the actual pipeline direction of buildings in accordance with relevant technical specifications. Avoid "U-shaped" bending and "n-shaped" bending. Otherwise, poor air discharge may be incurred and water resistance may be increased, causing air clogging.

K. Install water pipes horizontally or vertically. No leakage is allowed on pipelines and connection parts, and the thermal insulation effect should be good. Install an air discharge valve and a filling expansion water tank (open-type water tank) at the highest position of pipes, and install a pressure relief valve on the water outlet side of the water pump.

L. Keep a certain slope when installing horizontal pipes so that air can be discharged smoothly.

Warning

A filter (mesh number: 60) must be installed at the water inlet of the system and periodically cleaned to avoid blocking the heat exchanger and protect the unit.

Caution

The water return pipe of the water system must be equipped with an energy storage water tank to regulate energy and reduce the frequency of compressor start/stop during air condition system load change, improve system running efficiency, and prolong service life of the unit.

1.2.6 Component Selection of Water System

A. Check valve: Determine the valve based on the pipe diameter. Generally, the valve pipe diameter must be consistent with the water pipe diameter.

B. Water filter: Filter impurities in the water system and protect the heat exchanger. Recommended mesh number: 60.

C. Check valve: Prevent water back flow and protect the water pump.

D. Bypass valve: Clean pipeline, and prevent impurities from breaking through the filter and damaging the heat exchanger; associate with the indoor coil two-way valve

to regulate energy, direct surplus chilled water to enter the unit from a bypass, and prevent damage to the heat exchanger if the water volume is reduced. Pressure differential bypass valve (used with the two-way valve of the indoor air-side device) is recommended.

E. Thermometer: Facilitate repair and maintenance and observe unit running. Usually the range of 0 to 100°C is selected.

F. Water pump: The pump water volume is selected according to the system water flow rate. Pump water volume = L * 1.1 (L—system water flow rate). The pump head is calculated according to the following formula:

Pump head = {Unit water resistance + Most unfavorable pipe length * (2%~5%) + Water resistance at the end of the most unfavorable path} * 1.1

G. Automatic air discharge valve: Empty air in the water system so that the unit can work normally. It is installed at the highest point of the system.

H. Expansion water tank: Accommodate excessive water, stabilize the water pressure in the system, and supplement the water in the system. Generally it is installed at the return water pipe, higher than the water pipe in the system, so that the unit can operate properly. Its capacity is calculated according to the following formula:

Volume of expansion water tank V = (0.03~0.034)Vc Vc—Water volume

Caution

A. The water flow switch must be installed and interlocked with devices.

When the water system is cut off or when the water flow is too small, the flow switch will not close. This prevents the unit from running when operating conditions are not met, so as to ensure its safe, reliable and durable operation.

B. The automatic air discharge valve must be installed at the highest point of the water system.

When there is air in the water system, the air must be squeezed to the highest point of the system due to the effect of water pressure. At this time, because the automatic air discharge valve loses the function of water buoyancy, the air discharge valve automatically opens to release the air in the water system.

C. The expansion water tank must be installed at the highest point of the water system and insulated.

1. When there is air in the water system, the automatic air discharge valve loses the function of water buoyancy, and the air discharge valve opens automatically. At this time, water must be added into the pipeline with certain pressure, so the expansion water tank must be installed at certain height and with certain water volume. Generally, the height is 2 m higher than the highest point of the water system, and the water storage capacity is 0.5-1.5 cubic meters (depending on the size of the unit) to ensure that there is sufficient pressure inside the pipeline to discharge air.

2. When the water volume in the water system changes due to the change in water temperature, the expansion water tank regulate the water volume in the system to avoid any damage caused by the pressure increase due to water expansion.

3. Thermal insulation of the expansion water tank is meant to avoid water freezing due to the low ambient temperature in winter and preserve the function of the expansion water tank.

D. The diameter of the main pipe of the water system should not be smaller than the diameter of the water inlet and outlet of the air conditioner.

The water pipe diameter of the unit is designed based on the heat exchange capacity of the heat exchanger and the corresponding water flow. The pipe diameter in a program must be greater than or equal to the diameter of the water inlet and outlet pipes of the equipment to ensure that the water flow reaches the rated flow of the unit.

E. The water flow of the system should not be equipped with too many sharp elbows. Otherwise, the resistance of the water system will be increased, causing uneven water distribution. If the water flow does not reach the rated flow of the unit, the entire system cannot normally work. Performance:

① If the temperature of the water outlet changes greatly, the unit starts frequently, causing damage to the compressor or shortening the life.

② The overall water temperature of the system does not meet the requirements, reducing the effect of the air conditioning effect and resulting in different effect of the

air-side devices.

F. The horizontal pipes of the water system must be installed with a certain slope so that air is guided to the highest point along the pipeline and released through the air discharge valve.

G. The pump's chain control access point must be connected to the corresponding contact on the master unit controller. See the circuit diagram for the location.

For the water source heat pump unit, its water system has unique characteristics and different forms and must be installed in a way different from that of the water system of the single cooling unit, which will not be described here.

1.2.7 Water Quality Requirements

Because composition of water in different places is relatively complicated, if general water (such as industrial wastewater, groundwater, etc.) is used, the water quality should be checked and treated before it enters the heat exchanger of the unit. The quality of water directly affects the performance and service life of the chiller. If the water quality does not meet the requirements of the air conditioning water, the operating efficiency of the chiller will be reduced and the heat exchange tubes of the water system, evaporator and condenser will be damaged. The water quality must meet the cooling water quality requirements in Appendix D of GB/T 18430.1-2007 *Water Chilling (Heat Pump) Packages Using the Vapor Compression Cycle - Part 1: Water Chilling (Heat Pump) Packages for Industrial & Commercial and Similar Application*.

Monthly inspection of water quality shall meet the requirements in the table below:

Table 1 Water quality requirements

Item			Reference Value	Trend	
				Corrosion	Fouling
Reference Item	pH (25°C)		6.5 - 8.0	O	O
	Conductivity (25°C)	μS/cm	< 800	O	O
	Chloridion Cl^-	mg(Cl^-)/L	< 200	O	
	Sulfate ion SO^{2-}	mg(SO^{2-})/L	< 200	O	
	Acid consumption (pH=4.8)	mg(CaCO3)/L	< 100		O
	Full hardness	mg(CaCO3)/L	< 200		O

Reference items	Iron Fe	mg(Fe)/L	< 1.0	O	O
	Sulfion S^{2-}	mg(S^{2-})/L	Cannot be detected	O	
	Ammonium ion NH^{+}	mg(NH^{+})/L	< 1.0	O	
	Silica SiO2	mg(SiO2)/L	< 50		O
Note: O indicates the relevant factors of corrosion or scaling tendency.					

If the water quality cannot meet the requirements in the above table, refer to GB50050-2007 *Code for Design of Industrial Recirculating Cooling Water Treatment* for treatment, or consult the local water treatment company for treatment according to the above water quality requirements.

The failure or improper water treatment will cause corrosion, scaling or moss in the water system of the unit, and even damage to the cylinder/heat exchange tube, which will reduce the heat exchange effect and affect the normal use of the unit. Therefore, qualified water treatment experts must be asked to provide professional water treatment services and monitor the water system of the unit.

With regard to the fluid media used in standard heat exchangers, the following provisions shall also be followed:

The inlet water must go through water quality analysis and proper filtration. Water treatment and control equipment must be suitable for the water system and capable of preventing pump contamination, scaling and cross contamination. Consult water treatment experts or relevant literature.

1. There should be no $NH4^{+}$ ions in the water. $NH4^{+}$ ions have strong corrosion to copper and greatest influence on the service life of copper tube. Even $NH4^{+}$ ions of a few tenths of mg/L can seriously corrode copper tubes. If necessary, the sacrificial anode protection may be used to remove $NH4^{+}$ ions.

2. Corrosion of copper tube by Cl^{-} ions will result in perforation of the tube and shall be kept below the concentration of 10 mg/L as far as possible.

3. The concentration of $SO4^{2-}$ ions should be less than 30 mg/L, otherwise perforation corrosion may occur.

4. There should be no fluoride ions (i.e., < 0.1 mg/L).

5. The total iron index in circulating water should be ≤0.5 mg/L; Total iron content in refilled

water is generally required to be < 0.2~0.5 mg/L.

6. Dissolved silicon: Silicon is an acidic substance that causes corrosion, and the concentration should be < 1 mg/L.

7. Water hardness: When TH > 2.8°C, the recommended value is 10-25. At this hardness, it is easy to produce water rust precipitates and reduce cross-contamination of copper tubes. Too high TH value will cause pipeline blockage. The total alkaline calibration had better be less than 100.

8. Dissolved oxygen: Sudden changes in solubility in water must be avoided. Deoxidizing with inert gas is as dangerous as increasing the oxygen content with pure oxygen. The oxygen imbalance produces copper hydroxides and macroparticles.

9. Resistivity: The higher the resistivity, the less likely the corrosion. The resistivity shall be greater than 3000 Ohm.cm. The resistivity is the highest under neutral conditions. The conductivity is preferably on the order of 200-600 μS/cm.

10. pH: ideal neutral pH at 20~25°C: 7<pH<8.

Loss due to water quality shall be borne by users. Users are required to test the water quality regularly according to the above requirements before unit installation and in use. Once the water quality exceeds the allowable value for a long time, the high-efficiency heat exchanger tube of the heat exchanger may be corroded and seriously fouled, which will lead to the leakage of the heat exchanger tube or reduce the heat exchange effect, affecting the normal use of the unit.

If the water in the pipe is drained for more than one month, the entire pipe must be filled with nitrogen to prevent pipe corrosion under different climatic conditions.

If the unit needs to be restarted after long-term shutdown, the water system pipeline needs to be cleaned.

⚠ Caution

TICA shall not be responsible for any damage to the unit caused by the use of untreated or improperly treated water, seawater or saline water.

1.3 Commissioning, Operation and Maintenance

1.3.1 Startup, Commissioning and Operation

⚠ Caution

Before trial operation, check the entire air conditioning system from the following aspects:

(1) Checking the air side equipment

A. Check whether all the power supply connections of indoor air side equipment are correct and whether the fan operates normally.

B. Check whether all the check valves at the inlet and outlet of the air side equipment are opened.

C. Check whether the water system of the air side equipment is emptied. If there is air in the coil, open the air discharge valve to release the air.

(2) Checking the pipeline system

A. Check whether system pipeline, water refill pipeline, pressure gauge and thermometer are correctly installed.

B. Check whether the net pressure at the water return of the unit is normal (more than 5.0mH_2O).

C. Check whether the system pipeline is cleaned, refrigerant in the pipeline is full, and air is emptied.

D. Check whether all the valves in the system that should be opened have been opened and all the valves that should be closed have been closed.

E. Check whether the thermal insulation and condensate discharge measures of the pipeline system are proper.

F. Check whether the expansion water tank and water refill device are sensitive and whether air in the water pipes is discharged thoroughly. Before starting water pumps, open the air discharge valves to check whether water flows out. If no, air is not thoroughly discharged. In this case, do not start water pumps. Check the expansion water tank and water refill system to ensure that air is discharged thoroughly. After

confirming that the pipeline is fully filled, start the water pumps. Never operate the unit in the event of water shortage.

G. Check whether the water system filter is smooth without any blockage.

(3) Checking the power distribution system

A. Check whether the power supply is consistent with that required in the instructions and on the unit nameplate.

B. Check whether all the power supply and control lines are connected in positions, whether the wires are connected correctly according to the wiring diagram, whether grounding is reliable, and whether all the connection terminals are fastened.

(4) Checking the unit

A. Check the unit appearance and check whether the pipeline system is not damaged after transportation and handling.

B. Check the unit water pipes for air. If any, open the manual air discharge valve on the water pipes and that on the water pumps to empty the air in the pipes.

Caution

Unit trial operation must be conducted by qualified technicians. Users should never commission the unit on their own. Otherwise, random commissioning may cause damage to the air conditioning system or even results in personal injury. Pay attention to the issues in the following aspects during trial operation:

A. After checking the entire system comprehensively and confirming that it meets the requirements, start overall trial operation.

B. Connect the unit to a power system, and start the main controller. The water pumps start first. After confirming that the water pumps run normally, check whether the operating current of the compressor is normal and whether the compressor is noisy.

C. If the main controller displays a power supply fault, the power phase sequence of the inlet cable is wrong. In this case, only the phase sequence of the external power supply can be changed (exchange either two items). The internal circuit must not be changed. Otherwise, the compressor is damaged.

D. Regulate the water supply valves of the air side equipment in different rooms so that the water supply flow of the rooms meets design requirements.

E. Observe whether the room temperature change control comply with requirements. After trial operation for a period of time (3 days generally), confirm that no fault occurs and then put the unit into normal use.

F. After the trial operation, clean the water filter and fasten all the electrical connection terminals again. Then, the unit can be put into normal use.

G. Avoid frequently starting or stopping the unit to extend its service life.

H. If an alarm is reported, the unit is exceptional. Check and troubleshoot the fault and then manually start the corresponding compressor.

I. All protective switches are preset before delivery. Users should never modify their values. Otherwise, TICA will not be held liable for any damage arising from the random modification.

Caution

The following situations indicate normal phenomenon.

During unit running, when temperature reaches a user-defined value, the unit will automatically stop running. After the temperature rises, the unit will run again in the user-defined running mode.

Warning

The scroll cooling compressor of this unit should not run reversely. Periodically check the power supply and electric accessories of the unit. During unit running, never close the inlet/outlet valves of the indoor air side equipment to avoid impacting unit running and causing damage to the heat exchanger of the unit.

1.3.2 System Maintenance

TICA TMS water-cooled scroll chiller is a highly automated equipment. When it is in use, regularly check the unit's operating status. If it gets long-term and effective maintenance and servicing, the unit's operating reliability and service life will be greatly improved.

Unit

To guarantee that the unit can normally run and no fault occurs and damages the unit when it is operated under the maximum load, inspect the unit periodically based on the following check items. During inspection, use check items as a guide and refer to the cooling and electric experience to ensure that the unit runs in faultless manner.

Cooling system

Observe the humidity indicating sight glass on each liquid supply pipe of the system to confirm that the unit is full of liquid inside and the humidity indication is in dry state. If the humidity is high or there are bubbles in the sight glass, replace the filter element even if the unit has been charged with sufficient refrigerant.

Water system

In some areas, hard water will cause the condenser to scale, which increases the condensing pressure or reduces the heat exchange effect of the evaporator, and causes the unit to stop or run at high expenses. Before the water enters the unit vessel, check the water quality. If the water quality does not meet the requirement of air conditioning water, the water must be treated. For details about the water treatment standard, see GB50050-2007 *Code for Design of Industrial Recirculating Cooling Water Treatment*. After the water enters the unit, the copper tubes inside the vessel will still scale, which increases the condensing pressure or reduces the heat exchange effect of the evaporator, and causes the unit to stop or run at high expenses. For this reason, chemical descalers or mechanical methods should be used to clean the water side of the vessel when necessary.

Cleaning of Evaporator and Flow Unit

Check and clean the evaporation tube after the first quarter of unit operation. The evaporator shall be inspected and cleaned every subsequent year. By checking the fouling condition of the evaporation tube, you can evaluate the working condition of the water treatment equipment in the pipe network and determine whether to clean the pipe in advance. The operation parameters of the unit can also be used to determine whether it is necessary to conduct scaling inspection of the evaporation tube. Check and clean the evaporator as follows:

1. Disconnect all power supplies of the unit.

2. Close the chilled water pump and the water inlet and outlet pipe valves of the evaporator, and open the water discharge valve of the unit water chamber to drain the residual water in the unit.

3. Disconnect the unit from the water system, dismantle the water chamber bolts at both ends of the evaporator of the unit, and dismantle the water chamber respectively.

4. The components (flow meter, temperature sensor, etc.) on the evaporation tube and water system can be checked at this time.

5. Clean the evaporation tube. If the flow meter, sensor and other parts are corroded or fouled, replace them or remove the fouling.

6. After cleaning, reinstall the water system.

Cleaning of Condenser and Flow Unit

Check and clean the condensation tube after the first quarter of unit operation. Subsequent cleaning should be carried out with a rotary cleaning system at least once a year. If the water system is found to be contaminated through water quality inspection, it should be cleaned more frequently.

Similarly, the operation parameters of the unit can also be used to judge whether it is necessary to conduct scaling inspection of the condensation tube and clean it if necessary.

If the condensation pressure is higher than normal, scaling in the pipe or non-condensable gas in the unit is a common cause. If the temperature difference between the cooling water outlet temperature and the condenser refrigerant temperature is greater than the expected design temperature difference, the condensation tube may become fouled (or the water flow is incorrect). R134a and R22 are high-pressure refrigerants, so generally it is not easy for non-condensable gases to enter the unit.

The cleaning of condenser is consistent with steps of evaporator. It is also necessary to protect the condensation tube during cleaning. Properly inspect and handle the components on the pipe network while cleaning.

⚠ **Caution**

1. When dismantling and hoisting the water chamber, pay attention to protect the insulating layer.

2. The evaporation tube and condensation tube must be cleaned by professional cleaning system. It is recommended that the user hire a professional cleaning company or contact our after-sales department.

3. Chemical treatment is required to prevent or remove hard scales. With regard to water treatment plans, water treatment experts should be consulted with.

4. Cleaning tools should avoid scratching the heat exchange tubes. Do not use line brushes.

5. After each disassembly, inspection or cleaning of the water chamber, the water chamber gasket should be replaced.

1.3.3 Troubleshooting

During unit running, the unit probably fails due to different faults. The following table lists common faults and their troubleshooting methods. In case of a unit failure, contact an authorized dealer or TICA branch. Never try to repair it on your own.

Symptom	Possible Cause	Solution
The compressor cannot be normally started and is silent	☆ The main controller has a power failure or communication cable fault ☆ The alarm indicator of the main controller lights up ☆ The unit controller is in preheating status ☆ The main controller has wrong data settings	☆ Start the power supply to check whether its communication indicator lights up ☆ Check the unit and contact the maintenance personnel ☆ It is normal and for protection purpose ☆ Read the **User Operation Manual** and follow instructions to reset parameters
The compressor starts but frequently stops	☆ The refrigerant is excessive or inadequate, causing too high discharge pressure or too low air suction pressure ☆ Water temperature drops and rises quickly, water circulation is poor or the load of indoor air side equipment is too low ☆ The main controller has too low temperature control cycle value	☆ Check the refrigerant volume. If two much, release some through the air discharge valve. If too little, check for leakage, repair the leakage, and refill refrigerant ☆ If the water flow is inadequate, check whether the water line is smooth and whether the loop is too short. If the load of the air-side devices is too low, add an energy storage water tank ☆ Change the parameters based on the advice of the maintenance personnel

The compressor makes a lot of noise	☆ The power phase sequence of the compressor is wrong ☆ The liquid refrigerant returns to compressor ☆ The components of the compressor are faulty	☆ Check the power cord of the main power and incoming wire of the compressor ☆ Check whether the expansion valve works normally and whether the temperature sensors and intake duct are disconnected ☆ Repair or replace the compressor
The cooling capacity is relatively low	☆ Insufficient refrigerant, insufficient cooling capacity and low evaporation temperature ☆ The thermal insulation of the water system is poor ☆ The expansion valve is not properly adjusted ☆ The filter is clogged	☆ Check for leakage, repair the leakage, and refill refrigerant ☆ Strengthen thermal insulation of the pipeline and expansion water tank ☆ Adjust the expansion valve ☆ Replace the filter
The intake duct of compressor is frosted	☆ The chilled water flow is too small ☆ The water line is blocked or air is not discharged thoroughly	☆ Check whether the water pump motor matches the unit ☆ Unclog the water line or empty air
Too high condensation pressure	☆ Too much refrigerant ☆ Insufficient cooling water flow or the heat exchanger pipe is scaled ☆ There is air or non-condensable gas inside the refrigerant or the system	☆ Discharge excessive refrigerant ☆ Rule out other contributory factors and improve condensing conditions ☆ Discharge air or non-condensable gas through air outlet
Too low condensation pressure	☆ Insufficient refrigerant ☆ There is something wrong with the valve plate of the compressor, thus reducing efficiency	☆ Check and repair the leaks, and add refrigerant ☆ Replace the compressor
Too high air suction pressure	☆ Too much refrigerant ☆ The return water temperature is high and the heating load is high ☆ The opening of the expansion valve is too large	☆ Discharge excessive refrigerant ☆ Reduce the chilled water flow and reduce the heating load ☆ Regulate the expansion valve or remove the filter to clean it
Due to too low air suction pressure, low pressure protection frequently occurs	☆ Insufficient refrigerant ☆ The water return temperature is low, the water pipe of the indoor air side equipment is clogged, or the fan does not rotate ☆ The expansion valve has too small opening or is clogged ☆ The capillary tube of temperature sensor of expansion valve leaks	☆ Check and repair the leaks, and add refrigerant ☆ Rectify the fault occurring on the air-side device and unclog the water line ☆ Regulate or clean the expansion valve ☆ Replace the expansion valve
After the main controller is started, the water pump does not work (contactor is pulled in)	☆ The power supplied to the water pump power wire in the customer control cabinet is unavailable ☆ The motor of the water pump is burned ☆ The bearing of the water pump is damaged	☆ Locate the line fault ☆ Replace the motor of the water pump ☆ Replace the bearing and seal.

Part 2 Electrical Installation and Control System Maintenance

2.1 Electrical Installation

Caution

A. The power supply must comply with requirements of the used unit.

B. An adverse impact will be caused to the unit when the voltage is too high or too low. If the voltage is unstable, excessive current will be generated at the moment when the unit starts for operation. Consequently, the unit cannot start. Conduct checking from time to time. If the operation voltage is lower than 342V or higher than 418V, trip will occur. Immediately stop the operation to ensure unit safety.

C. The lowest startup voltage of the unit should not be less than 90% of the rated voltage. The operation voltage should range ±10% of the rated voltage. The voltage difference of different phases should be in the ±2% range.

D. All conductive wires must be connected firmly and should not contact with movable parts.

E. The cross sectional area of the conductive wires must meet the requirement in this manual.

F. Ensure that the unit is reliably grounded.

Warning

To ensure personal safety, ground the unit according to related technician regulations.

Caution

Refer to the wiring diagram to set correct addresses for units and connect them with communication cables.

The communication cables should be separately wired from strong current part and shielded.

2.1.1 Electrical Specifications

Electrical specifications of unitary modules

The following table lists electrical specifications of unitary modules. For the power cable specifications of assembled units, refer to this table.

Model		TWS20MD(W/G)4	TWS30MDC(W/G)4	TWS40MDC(W/G)4
Power Supply		380V/3N~/50Hz	380V/3N~/50Hz	380V/3N~/50Hz
Maximum Input Power of the Unit (kW)		28.4	42.6	56.7
Maximum Operation Current of the Unit (A)		48	71.9	95.8
Power Cable of the Unit	Cross Sectional Area	16 mm^2×5	25mm^2×3+16 mm^2×2	50mm^2×3+25 mm^2×2
	Pieces	5	5	5

Notes:

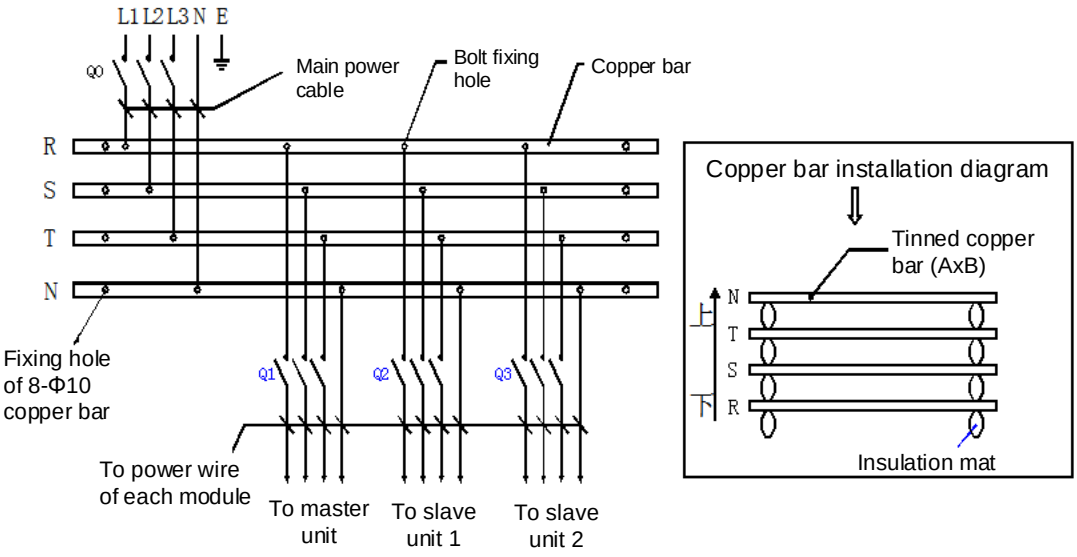
1. The preceding specifications are recommended configurations for standard units. For nonstandard units, contact TICA.

2. The recommended power cable is 70°C multi-core PVC insulated cable that is laid in insulated walls (if the ambient temperature is 30°C in the air and 20°C on the ground) (with specifications refer to IEC_60364-5-523 Current-Carrying Capacities in Wiring Systems). If the actual installation conditions on site are different, check the selection manual provided by the wire manufacturer to decide the wire specifications and laying conditions.

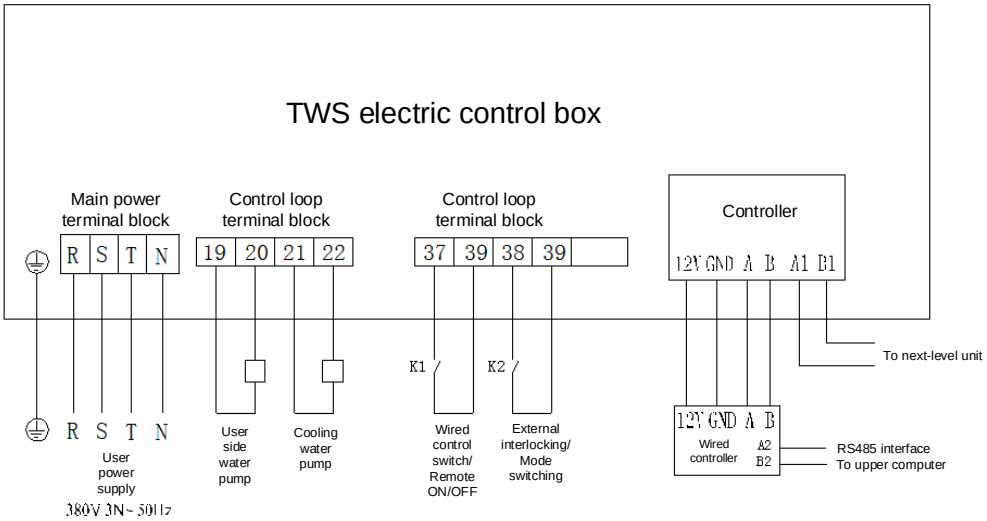
3. The selection of power cables is closely related to the local climate, soil characteristics, cable laying length and method. Such unit engineering projects are usually designed by the design institute, **so the design of the institute prevails**.

2.1.2 Unit Wire Configuration Diagram

The following figure shows the wire configuration and installation diagram of TWS20. For details about the wire configuration of other units, refer to this diagram.

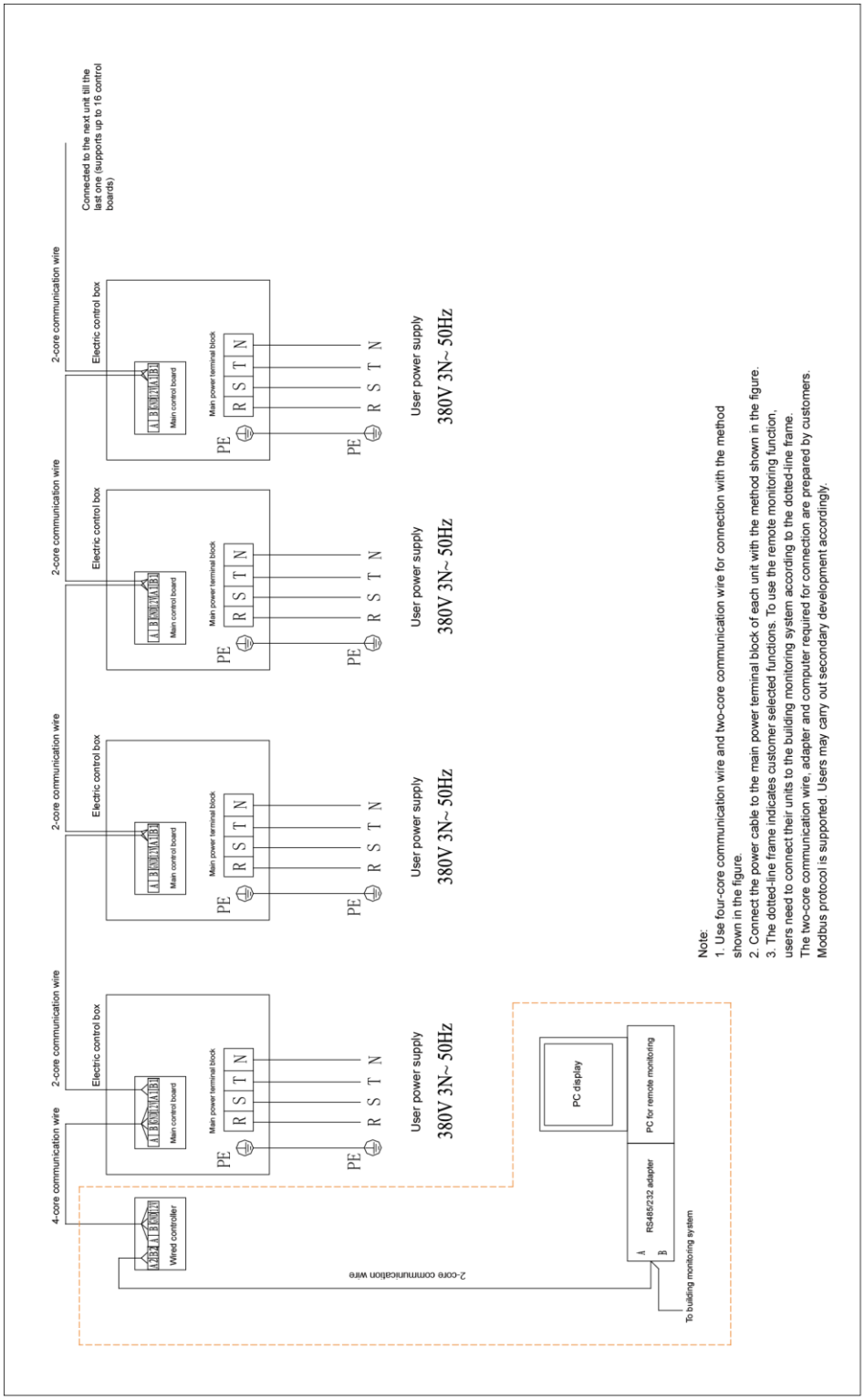


2.1.3 Electrical Wiring Diagram



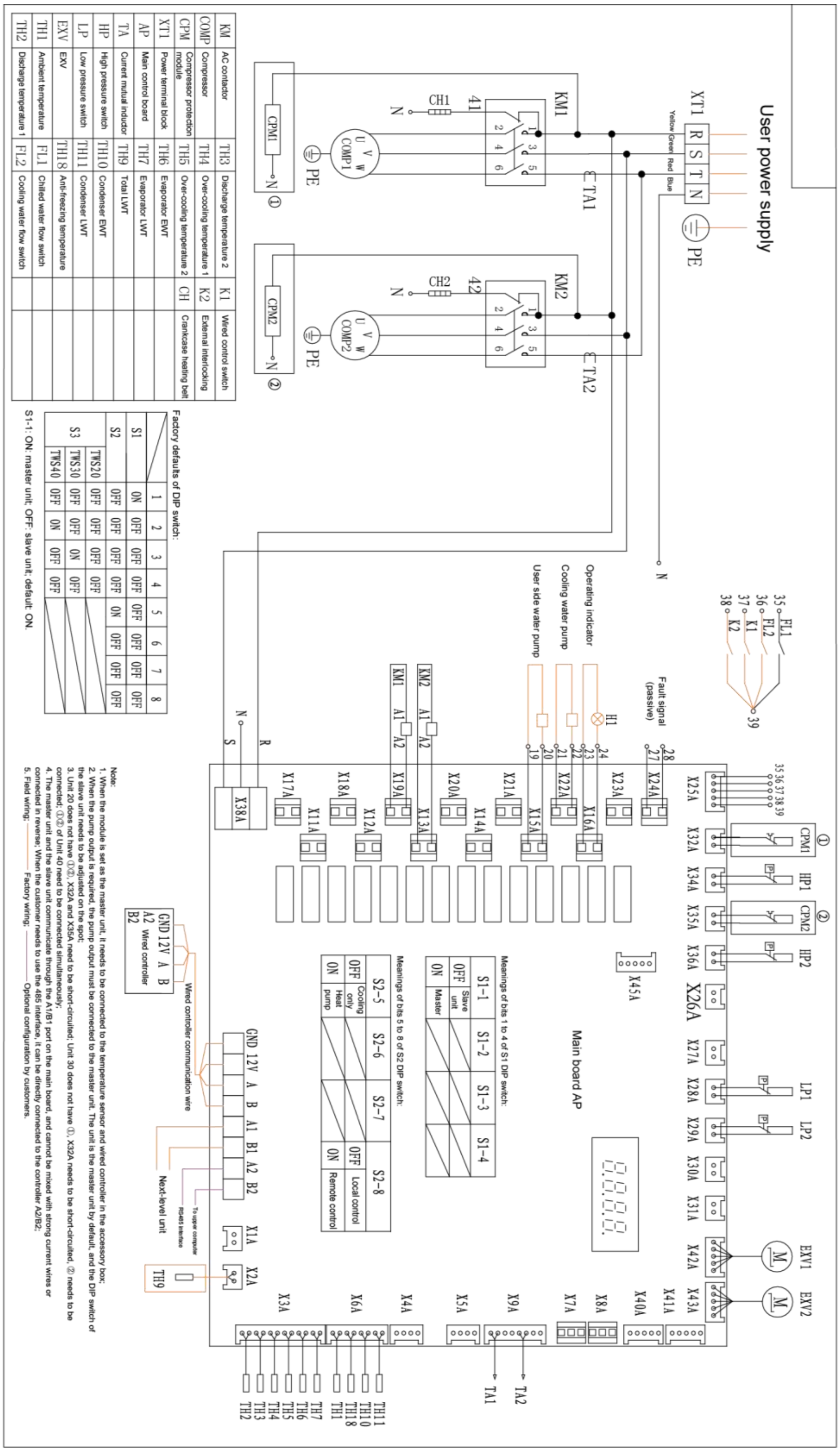
Notes:
1. The preceding figure shows an on-site wiring diagram.
2. When the unit is configured as the master unit, cables should be connected according to this wiring diagram.
3. The mode switch and remote power-on/off functions of the standard unit are not enabled. To use the functions, set the DIP to remote control, and use K1 for power-on/off (off: shutdown; on: startup) and k2 for mode switch (off: cooling; on: heating). The wired controller cannot be used to start or shut down the unit;
4. During local control, buildings can be controlled through the RS485 interface on the wired controller. The wired controller does not need to be connected in remote control;
5. The figure is for reference only. The attached circuitry diagram of a unit prevails.

2.1.4 Unit Connection Diagram



2.1.5 Unit Electrical Conceptual Diagram

TWS20/30/40:



2.2 Electrical Operation

This section applies to water-cooled scroll chiller (heat pump). During reading, pay attention to the function of the selected unit model.

2.2.1 Safety Precautions

⚠ Caution

The controller of the water-cooled scroll chiller is a precise component. Before operating it, read the corresponding controller instructions. Misoperation may cause damage to the unit or personal injury.

Pay attention to the following points during installation and use:

(1) Installation precautions

- Read through this manual carefully before installation and connect wires by referring to the wiring diagram.
- The controller must be installed on a solid plane, and keep it away from rain, static electricity, shock, or dust accumulation, which has an adverse effect on the control board and even cause the controller damage.
- Only accessories provided or specified by TICA can be used. Using any unauthorized accessories may result in a failure of the controller or an electric shock.
- Wiring should be conducted in accordance with the principle of separating strong electric wires from weak electric wires. The control cables should be routed separately from strong electric wires and they should be shielded. If they cannot be routed separately, keep a distance of at least 50 mm between them and take shielding measures. It is absolutely forbidden to bind strong and weak electric wires together for cabling. Otherwise, the controller may fail to work properly or may be damaged.
- Power cords must be connected reliably, they are in good contact, and the insulating layer is in good condition. Loose or broken power wires may lead to electric shocks, short circuits and even fire. Air-conditioning units must be properly grounded.

(2) Use precautions

- Do not use sharp objects when operating the unit. Do not impose strong force, lest the controller panel may be damaged. Do not twist or pull the controller's wires. Otherwise, control components may fail.
- It is necessary to use the power supply that meets requirements. The use of a substandard power supply may damage the controller.
- The controller board is supplied with a 220V AC strong power. Therefore, exercise caution when operating the controller.
- Be sure to control the running status of the air-conditioning unit through the controller. It is forbidden to insert and remove the power plug to switch on/off the unit.

(3) Maintenance precautions

- When the controller is faulty, users are not allowed to repair it at discretion but contact the manufacturer in a timely manner.
- The unit can be maintained and repaired only when the unit is powered off and the power supply is cut off.
- **The controller and product mentioned in this document are those used in universal environments. If a product is to be used in a harsh environment (including harsh environments with electromagnetic interference), enhanced anti-interference products need to be specified in advance. Universal products are delivered if no requirement is specified.**

Maintenance

- When the controller is faulty, users are not allowed to repair it at discretion but contact the manufacturer in a timely manner.
- The unit can be maintained and repaired only when the unit is powered off and the power supply is cut off.

The controller and product mentioned in this document are those used in universal environments. If a product is to be used in a harsh environment (including harsh

environments with electromagnetic interference), enhanced anti-interference products need to be specified in advance. Universal products are delivered if no requirement is specified.

⚠ Warning

2.2.2 System Characteristics

(1) Applicable air conditioning system

Each unit of the water-cooled scroll chiller has the same electrical control function. The master and slave units are set through the address DIP on the electrical control board. A single unit must be configured as a master unit before it can communicate with the wired controller, control water pumps and measure the temperature of the main water outlet.

TWS water-cooled scroll chiller (heat pump) includes two independent cooling systems, which allows a maximum of 12 units to be assembled. They are controlled through a wired controller that is equipped with RS485 interfaces. The master unit can automatically control water pumps.

(2) Networking control

RS485 serial buses are used. Communication cables can be connected simply to implement on-site networking.

(3) Basic functions

Information display in four lines (eight characters at most in each line);

User-defined heating/cooling operation;

Timed power-on/off function, which allows setting the weekends and three holiday time periods for the unit operation;

Automatic fault diagnosis and processing, smart anti-freezing control

Unique fuzzy energy control method and optimal load matching.

(4) Digital filtering processing is performed on all collected input signals to ensure the

reliability of input signals. Output signals are buffered in multiple levels and no misoperation or jitter occurs, thereby ensuring the reliable and stable operation of the unit.

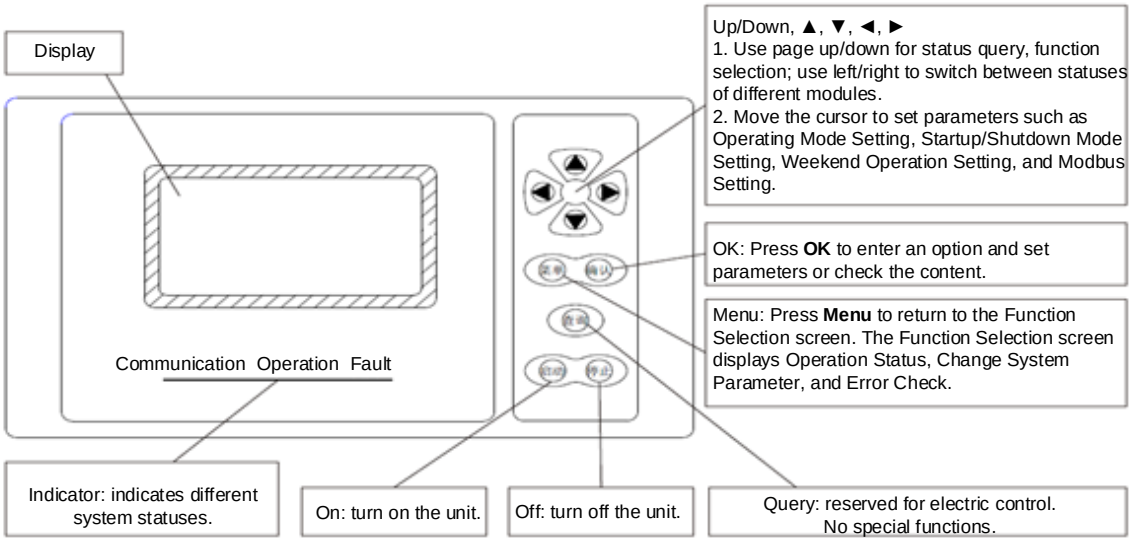
(5)Password protection permissions are used for parameter setting. All parameters that need to be set have appropriate default values, which are used at the first startup or when default values need to be restored.

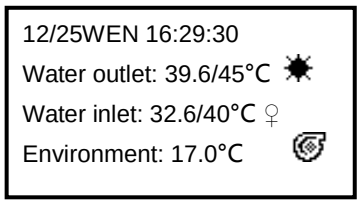
2.2.3 Operation

(1) Wired controller instructions

(A) Output of button-type wired controller:

Main interface

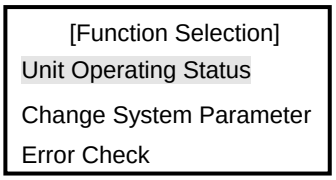




The display screen displays current time information in the first line, the current water inlet and outlet temperatures and set values of the unit in the second and third lines respectively, and the ambient temperature of the main module in the fourth line. The operating mode area displays the operating mode of the unit (cooling ❄, heating ☀, or anti-freezing ◈). In the remote control status area, ♀ is displayed if the unit is remotely controlled and the symbol is not displayed if the unit is controlled by a wired controller. In the operation status area, "Stop" is displayed if the unit is shut down. If the water pump is started, the water pump symbol (🌀) is displayed; if the water pump is not started, the symbol is not displayed. If the

word "Ambient" blinks, the ambient temperature for unit (including submodules) operation does not meet operating conditions.

Function Selection



On the main screen, press **Menu** to access the **Function Selection** screen. The [**Function Selection**] screen displays **Operation Status**, **Change System Parameter**, and **Error Check**.

(If one page cannot display all information, page down/up buttons will be displayed in the lower right corner. Press ▲ or ▼ in the lower right corner of the screen to open the preceding or next page.) The selected menu item is displayed on a white background. After selecting a menu item, press **OK** to enter the selected screen or press **Menu** to return to the main screen.

Interface Function Description

Interface	Display
Unit Operating Status	1) System Operating Status; 2) Module Communication Status; 3) Module Port Status; Including (1) temperature sensor values (such as the ambient temperature, discharge temperature, condenser temperature, evaporator temperature, anti-freezing temperature, etc.); (2) Operating current of unit; (3) EXV steps; 4) Program Version.
Change System Parameter	1) Modify user parameters (such as set the running mode, startup/shutdown mode, date and time, Modbus address, manual reset); 2) Modify service parameters (such as centralized control parameters); 3) Modify factory parameters; 4) Unit timing settings

Error Check	1) Current errors; 2) Historical faults; 3) Clear historical faults.

Others

Parameter Saving Prompt Box **Parameter Saving Output Information**

The parameter is modified! Are you sure you want to save? Press **OK** to save! Press **Menu** to exit!	The parameter modification is saved! Press any key to continue!

Note: After a parameter is modified, a message is displayed, asking you whether to save the modified parameter when you return to the main menu. The controller saves the modified parameter only after you press OK. Otherwise, the modification is not saved.

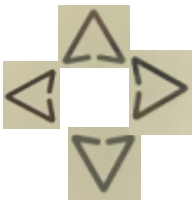
Unit Information

Model: TWS (EXV) Refrigerant: R410A Water system: shared water

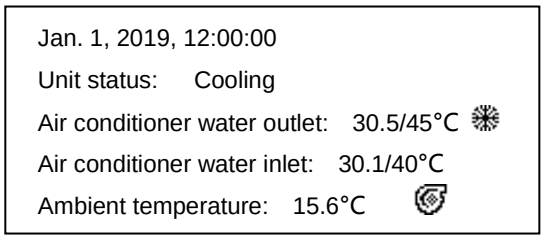
On the main screen, press **Query** to display unit information, including model, refrigerant and water system.

(B) Output of 120 touch button-type wired controller:

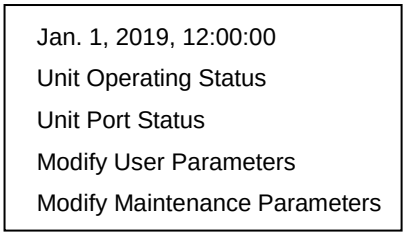
Icon	Name	Function
	Query	1) Query errors on the main interface.

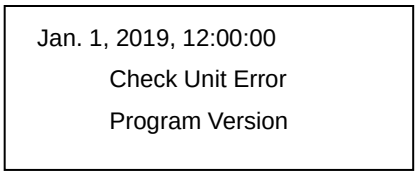
	Menu	1) Tap **Menu** to enter the function menu on the default interface. 2) Tap **Menu** to return to the preceding level of menu on the setting interface or query interface.
	Directions	1) Tap the direction button on the menu interface to enter the next level of menu. 2) Tap the direction button on the setting interface to modify the parameter values or set functions.
	OK	1) Tap **OK** to enter the next level of menu on the menu interface. 2) Tap **OK** on the setting interface to confirm the parameter setting.
	ON/OFF	1) In power-on state, tap **ON/OFF** to shut down the unit. 2) In power-off state, tap **ON/OFF** to start up the unit.

Main interface



The display screen displays current time information in the first line, the current water inlet and outlet temperatures and set values of the unit in the second and third lines respectively, and the ambient temperature of the main module in the fourth line. The operating mode area displays the setting mode of the unit (cooling ❄, heating ☀, water pump, or anti-freezing ◈). In the remote control status area, ♀ is displayed if the unit is remotely controlled and the symbol is not displayed if the unit is controlled by a wired controller. In the operation status area, "Stop" is displayed if the unit is shut down. If the water pump is started, the water pump symbol () is displayed; if the water pump is not started, the symbol is not displayed. If the word "Ambient" blinks, the ambient temperature for unit (including submodules) operation does not meet operating conditions.





Menu interface

Menu interface: Tap the up or down button to switch between menus, tap **OK** to enter a selected menu interface, and tap **Menu** to go back to the home page.

Unit Operating Status page: tap **Menu** to go back to the menu page.

Unit Port Status page: tap **Menu** to go back to the menu page, tap left or right button to switch between unit models, and tap up or down to display unit port information.

Modify User Parameters page: tap **Menu** to go back to the menu page, tap up or down button to switch between menus, tap **OK** to enter the setting menu, tap left or right button to modify parameter value, tap **OK** to confirm the setting, and tap **Menu** to go back to the original page.

Modify Maintenance Parameters page: tap **Menu** to go back to the menu page, tap up or down button to switch between parameters, tap left or right button to change parameter value, and tap **OK** to confirm the setting.

Check Unit Error page: tap **Menu** to go back to the menu page, tap left or right button to switch between unit models, and tap up or down to display unit error information.

Program Version page: tap **Menu** to go back to the menu page, and tap left or right button to switch between unit models.

Interface Function Description

Interface	Display
Main Interface	1) Operating mode 2) Real-time water temperature; 3) Error icon, water pump icon, anti-freezing icon, etc. 4) Error message
Unit Operating Status	1) Water pump status 2) Number of systems loaded by the compressor

Unit Port Status	1) Temperature sensor values (such as the ambient temperature, discharge temperature, condenser temperature, evaporator temperature, anti-freezing temperature, etc.); 2) Operating current of unit 3) EXV steps
Modify User Parameters	1) Operating mode settings, including mode, temperature and humidity 2) Configuration parameter settings, including centralized control parameter 3) Date and time settings 4) Unit timing settings
Check Unit Error	1) Current errors 2) Historical errors
Program Version	1) Main controller program version 2) Wired controller program version

(2) List of Adjustable Parameters

No.	Parameter	Scope	Default	Remarks
1	Operating mode	Cooling-Heating		It needs to be manually set.
2	Cooling water outlet temperature	5°C-20°C	7°C	
3	Cooling water inlet temperature	10°C-25°C	12°C	
4	Heating water outlet temperature	30°C-55°C	45°C	
5	Heating water inlet temperature	25°C-50°C	40°C	
6	MODBUS address	1-255	1	Used for remote monitoring
7	Baud rate	Four options	19200	Used for remote monitoring

(3) Description of the DIP Switch on the Main Board

S1 DIP:

1		2	3	4	5~8
OFF	Slave unit	/	/	/	Slave unit ID (if any)
ON	Master	/	/	/	Master unit ID (if any)

S2 DIP:

1~4	5		6	7	8	
/	OFF	Cooling only	/	/	OFF	Local control
/	ON	Heat pump	/	/	ON	Remote control

S3 DIP:

1	2	3	4	Remarks
0	0	0	0	TWS20
0	0	1	0	TWS30
0	1	0	0	TWS40

(4) Unit configuration

Model	**Refrigerant**	**Expansion Valve Type**	**Water System**
TWS20/30/40	R410A	EXV	Shared water

2.2.4 Error Display

When the unit is faulty, its background color changes to red. The failure indicator lights up, and an error code is displayed on the main board.

Error Code	
1	Inadequate water flow at user side
2	External interlocking
3	Wired control switch
4	Slave unit communication with master unit failure
5	Ambient temperature sensor
6	Anti-freezing temperature abnormal
7	Main water outlet fault (occurring on the master unit only)
8	Insufficient water flow at the hot source side
9	System 1# air discharge temperature high
10	System 2# air discharge temperature high
11	1# discharge temperature failure

12	2# discharge temperature failure
13	1# over-cooling temperature failure
14	2# over-cooling temperature failure
15	1# compressor overload
16	2# compressor overload
17	1# air discharge low temperature
18	2# air discharge low temperature
19	
20	
21	Condenser inlet temperature failure
22	Condenser outlet temperature failure
23	
24	
25	Evaporator water inlet temperature fault
26	Evaporator water outlet temperature fault
27	Evaporator low temperature
28	
29	Evaporator high temperature
30	Unrecoverable failure
31	
32	
33	
34	
35	Misphase protection
36	Open-phase protection
37	1# compressor low current
38	2# compressor low current
39	1# compressor over-current
40	2# compressor over-current

41	1# system cooling low pressure
42	2# system cooling low pressure
43	1# system heating low pressure
44	2# system heating low pressure
45	
46	
47	
48	
49	Slave module 1 communication failure
50	Slave module 2 communication failure
51	Slave module 3 communication failure
52	Slave module 4 communication failure
53	Slave module 5 communication failure
54	Slave module 6 communication failure
55	Slave module 7 communication failure
56	Slave module 8 communication failure
57	Slave module 9 communication failure
58	Slave module 10 communication failure
59	Slave module 11 communication failure
60	Slave module 12 communication failure
61	Slave module 13 communication failure
62	Slave module 14 communication failure
63	Slave module 15 communication failure
64	

Note: For unrecoverable failures, either of the following methods can be used for resetting:

Method 1: Restart the unit to automatically reset the unit.

Method 2: Manually reset the unit.

2.2.5 Maintenance and Servicing

⚠ Caution

The place where the control box is used must be well ventilated. Ambient temperature: 45°C; relative humidity < 90%. Never expose the control box to water.

Do not place foreign objects in the control box.

The circuit breaker and AC contactor in the control box should be maintained at least once a year. Tighten the bolts and remove dust and foreign objects.

For the wired controller and the single-chip microcomputer green board, check whether their external cables are connected reliably. In case of any exception, contact the manufacturer.

Contactor

Wipe the rust-proof grease on the pole surface of the iron core or the rust scale adhered to the pole surface with gasoline to avoid the contactor being stuck by the grease, which will cause the contactor to fail to release when it is powered off.

Unless otherwise specified, the contactor should generally be installed on a vertical surface with a tilt not exceeding 5°C. Otherwise, operating characteristics of the contactor will be affected.

When installing and wiring the contactor, avoid dropping any part into the contactor to prevent jamming and burning the coil. Tighten the screws to prevent vibration and loosening.

Regularly clean the heads of the contactors and kept them tidy. Do not oil them. When metal beads are formed on the head surface due to arcing, they should be removed in time. The oxide film produced on the surface of silver and silver alloy heads can be neglected because the contact resistance is so small.

Sensor

The sensor is a precision measuring element. It should be avoided from impact by external forces during installation and use. It should be installed in a relatively protected position to avoid hoists or moving parts from contacting the sensor.

Regularly tighten terminals to reduce measurement errors.

Avoid corrosive substances contacting the sensor.

To reduce interference, connect the sensor with shielded cables.

Control the sensor to operate under the normal range.

Ensure that the air holes are unobstructed. Do not use metal wires to draw air holes to prevent damage to the paddle.

Prevent water or other foreign objects from entering the sensor, and protect the cables.

Ensure that the power supply is stable.

Thermal relay

The setting value should be set properly, generally it is 0.95~1.1 times of the rated operating current of the compressor.

The thickness of the thermal relay lead wire must be proper to avoid malfunction.

Wire and cable

Regularly check the working status of wires and cables: running current, temperature rise, and insulation aging.

The routing should be correctly designed to avoid interference and damage of various external factors, or corresponding protective measures can be taken.

Cables and wires should be connected in accordance with the performance characteristics of the products, and terminal treatment and cable/wire connection should be conducted according to requirements.

Wires and cables should be kept away from heat sources. Do not move wires and cables if possible. Do not bend or twist them violently.

2.2.6 Troubleshooting

1. Fault symptom: **Unit not start after Start button pressed**

   Troubleshooting: A. If the unit fails (a failure code is displayed on the screen), rectify the failure based on the information on the screen, and reset and restart the unit.

B. If the unit is started remotely, check whether the Start button on the wired controller is On.

C. If the unit is started locally, check whether the remote switch on the board of the single-chip microcomputer is Short-circuited.

2. Fault symptom: **Compressor overload**

Troubleshooting: A. Check whether the thermal relay acts. If any, check whether the setting value is correct. If the setting value is correct, check whether the thermal relay is damaged.

B. Listen to the compressor operation sound and check whether the compressor stator is exceptionally hot.

3. Fault symptom: **High/low pressure protection**

Troubleshooting: A. Check whether all valves of the unit are fully open.

B. Check whether the high/low pressure switch acts and it is wired correctly.

C. Check whether the alarm setting is correct.

4. Fault symptom: **Wire overheating**

Troubleshooting: A. Check whether the operating current of the unit exceeds the threshold.

B. Check whether any heat source is present around the wire.

C. Check the stud bolts of all wires for looseness.

D. Check whether the wire diameter is correct.

⚠ **Warning: Unauthorized change of wiring and layout structure in the electric control box may cause the equipment to fail to operate normally. Unauthorized change is strictly forbidden!**

After-sales Service and Warranty

- **Maintenance and repair must be carried out by dealers**

⚠ **Caution:** Improper maintenance or repair may cause leakage, electric shock, or fire. If the unit must be moved or reinstalled, ask authorized dealers or TICA service personnel for help.

- **Daily servicing**

In addition to performing daily maintenance and servicing, users are advised to sign a maintenance contract with professional service companies to guarantee that the machine can run for a long life. For details, contact the seller or TICA Service Department.

- **Warranty period**

After the air conditioner is installed, the commissioning personnel will offer a warranty card to users after filling in the necessary information. Users are advised to check the content of the warranty card and keep it properly.

The warranty period of the whole machine is 14 months starting from the date of purchase. For details, see the warranty application form.

In the warranty period, failures caused by air conditioning quality problems will be repaired and parts will be replaced free of charge.

The product comes with life-long after-sales service. After the warranty period expires, maintenance service will be charged as appropriate.

To ask for repair service, users must provide the following information: air conditioner model, factory No. and installation date; detailed description of the failure; user's name, address and telephone number.

- **Inquiry**

For details about after-sales services, contact the dealers or call TICA customer service hotline.

Freezing Point of Glycol Aqueous Solution

As the coolant of the refrigeration unit, the physical properties of the glycol aqueous solution are very important for the normal operation of the equipment and system. The relationship between the freezing point and concentration of the glycol aqueous solution is as follows.

Glycol Concentration		Freezing Point (°C)
Mass Concentration	Volume Concentration	
0.0	0.0	0.0
5.0	4.4	-1.4
10.0	8.9	-3.2
15.0	13.6	-5.4
20.0	18.1	-7.8
21.0	19.2	-8.4
22.0	20.1	-8.9
23.0	21.0	-9.5
24.0	22.0	-10.2
25.0	22.9	-10.7
26.0	23.9	-11.4
27.0	24.8	-12.0
28.0	25.8	-12.7
29.0	26.7	-13.3
30.0	27.7	-14.1
31.0	28.7	-14.8
32.0	29.6	-15.4
33.0	30.6	-16.2
34.0	31.6	-17.0
35.0	32.6	-17.9
36.0	33.5	-18.6
37.0	34.5	-19.4
38.0	35.5	-20.3
39.0	36.5	-21.3
40.0	37.5	-22.3
41.0	38.5	-23.2
42.0	39.5	-24.3
43.0	40.5	-25.3
44.0	41.5	-26.4
45.0	42.5	-27.5

Note: The above data is based on the pressure of 100.7KPa

Appendix: Maintenance (Repair) Record

No.	Fault Description	Troubleshooting Measures	Troubleshooting Result	Recorded By	Date
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

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