

OPERATION & MAINTENANCE MANUAL

Chiller Water-cooled Screw R134a

- Please read this Operation & Maintenance Manual completely before Operating & Maintenance the product.
- Operating & Maintenance must be performed in accordance with the national wiring standards by authorized personnel only.
- Please retain this Operating & Maintenance for future reference after reading it thoroughly.

MODELS: RCWW-1 Compressor

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WARNING/CAUTION

The installation, operation and maintenance service of the product can potentially be dangerous depending on the system pressure, electric device, location of installation (Roof, lifting structure) etc. Only the well experienced and qualified installation or service engineer can install or operate the product. While operating the product, always check the warning/caution sticker or label on the product and comply with the details. Always wear safety goggles and gloves. Always be careful when installing or operating all electric devices.

The following directions must be followed to prevent any injury to the user or others or any property damage.

- Improper use operation of the product that does not comply with the directions described in the manual can lead to injury or damage. The severity is classified as follows.
- LG is not responsible for problems out of the warranty period, problems from mishandling by the consumer, problems from natural disaster and power cord defect.
- The details included in the user manual can change without prior notice to improve the product.

⚠ WARNING This symbol means that there is a possibility of death or major injury.

⚠ CAUTION This symbol means that there is a possibility of property damage or minor injury.

- The meanings of the symbols used in this manual are as follows.

	Strictly prohibited.
	Follow the direction.

⚠ WARNING

All wiring must comply with local requirements and the instructions given in this manual.

- If the power capacity is improper or the electrical work is defective, it can cause a fire and electric shock.

Product must be installed only by the service provider with the installation certificate.

- Improper installation can cause a leakage, fire and electric shock.

To move or reinstall the product, consult the installation service provider.

- It can cause a fire, electric shock, explosion or injury.

You must install the leakage current circuit breaker and exclusive switch.

- If not installed, it can cause a fire and electric shock.

Do not disassemble, repair or reconfigure the product on your own.

- It can cause a fire and electric shock.

Do not store or use combustible gas or flammable substance near the product.

- It can cause a fire or a problem to the product.

Install the product where the weight of the product can be supported.

- If the product is installed at location with inappropriate hardness, it can fall over to cause damage.

Do not use damaged circuit breaker or exclusive switch.

- It can cause a fire, an electric shock, an explosion or an injury.

If the product is submersed under water, always consult the installation service provider.

- It can cause a fire and electric shock.

When install the product or moving the product to a different location, do not chart the designated refrigerant (R134a) with a different one.

- If a different refrigerant is mixed with original refrigerant, it can cause problems in the refrigerant cycle and damage the product.

The product must be grounded properly.

- If not grounded properly, it can cause electric shock.

Do not reconfigure or change the setting of the protector.

- If other protective devices such as pressure switch and temperature switch are disconnected or operated by force, or when a different part is used, it can cause a fire or an explosion.

When the product is installed in a small space and the refrigerant is leaked, you must take action to limit the concentration of the refrigerant not to exceed the safety limit.

- For appropriate action to prevent the product from exceeding the safety limit, please consult the distributor. If the leakage of the refrigerant exceeds the safety limit, it can cause a dangerous situation due to lack of oxygen.

Do not arbitrarily operate the product.

- Incorrect installation can lead to a fire, electric shock or water leakage to cause an injury. Always consult the installation service provider.

Be careful not to let water get inside the product (Controller). Especially, do not wash the controller with water.

- It can cause electric shock and problems to the product.

Use the exclusive cable for the product.

- It can cause electric shock and problems to the product.

When explosive has leaked, immediately lock the valve and open the window to ventilate the room before operating the product.

- At this time, do not use the telephone or the power switch. It can cause a fire or an explosion.

Do not put heavy objects or climb on top of the product.

- It can cause a problem or an injury.

Always use fuse and circuit breaker of rated capacity.

- If rated fuse or circuit breaker not used, It can cause a fire or problem to the product.

Comply with the permitted pressure.

- Comply with the regulated pressure for cold water supply, cooling water and refrigerant etc.
- It can cause a fire and electric shock.

Be careful in case of a fire, earthquake or lightning.

- In case of natural disasters including fire, earthquake or lightning or if there is a risk of lightning strike, immediately stop operating the product.
- If you continue to operate the product it can cause a fire or electric shock.

Do not operate the circuit breaker or main power switch with wet hands.

- It can cause a fire and electric shock.

Be careful of the rotating part.

- Do not insert your finger or rod into the rotating part of the pump and fan. It can cause a damage.

Reconfiguring the control panel is prohibited.

- Lock the control panel with a locking device, if possible, and when you have to open the control panel, always shut down the main power switch first.
- Do not touch the wiring or parts within the control panel.
- It can cause an electric shock, a fire or a problem to the product.

Do not change the setting.

- Do not change the setting of the controller and safety device.
- If the product is operated with inappropriate setting, it can cause a defect, a fire or an explosion.
- When changing the control setting, always consult with the expert of the applicable field.

Comply with all the safety regulations.

- When the chiller is operating, follow the precautions indicated on the manual, tag, sticker and label.

Do not use undesignated refrigerant or oil.

- Do not use undesignated refrigerant, cooling oil or brine.
- It can have severe effect on compressor and part defect.
- If you would like to use a substitute refrigerant, please contact LG.

Wear protective gear.

- Wear protective goggles and gloves.
- Always be careful when installing and operating the chiller and when operating electric parts.

When charging/removing the refrigerant, always let the water flow on the heat exchanger.

- It can prevent potential damage of the tube within the heat exchanger.
- When the chiller is exposed to temperature below 0°C, use the brine appropriately within the water circulating pipe to prevent the heat exchanger from freezing.

Be careful of leakage.

- If a leakage is spotted at the joints including pump and pipe, immediately stop the operation.
- It can cause an electric shock, a leakage or a problem to the product.

Do not leave the cooling system in standby condition for more than necessary.

- When the repair cannot be completed, close the cycle to prevent the oil from being contaminated and charge the dry nitrogen.

Always shut down the power during installation and repair service.

- Electric shock can lead to injury or death.
- There could be more than one circuit breaker switches. Indicate and check all switches blocked so that the power will not be recovered until the task is completed.

When providing the service, do not take off the brazing on the existing joint. If necessary, put the pipe with the pipe cutter during the service.

- Compressor oil is combustible and there is no method of detecting the flux in the refrigerant pipe.
- Check the oil within the pipe and use the pan to measure the amount of oil to be added to the cycle.

Do not exhaust refrigerant inside the building through the refrigerant exhaust valve.

- Outlet of the exhaust valve must be directed to outdoors.
- Leakage of refrigerant in closed space can remove the oxygen to cause suffocation.
- Closed space or space with low ceiling must be ventilated appropriately. Suction of refrigerant is hazardous and can cause irregular heart beat, unconsciousness and death. Abuse of refrigerant is critical. Refrigerant is heavier than air and reduces the amount of oxygen. It can stimulate the eye and skin.

Be careful of electric shock.

- After installing the chiller, always make sure to ground the product.
- There is a risk of electric shock.

Do not reuse the compressor oil.

- It can damage the product.

CAUTION

After installing or repairing the product, always check for gas leakage.

- It can cause problems to the product.

When installing the product, make sure to level the product.

- Purpose of preventing vibration or leakage.

Use exclusive cable of the product. Use rated power cable with sufficient capacity over the permitted current.

- It can cause a fire and electric shock.

Do not let children touch the product.

- It can cause a burn or an injury.

Prevent the product from rusting from sea wind (Salt) or install the blocking fence if necessary.

- It can cause deformation or problem to the product.

Do not use the product in special environment.

- Oil, steam, sulfuric smoke can reduce the performance of the product or damage the parts.

Do not install the product at a location where combustible gas is leaking.

- It can cause property damage.

Do not install the product for special usage/location including preservation of animal/plant, precision device, artifact etc.

- It can cause property damage.

When installing the product at the hospital or communication tower, provide sufficient protective device for the noise.

- Inverter, personal generator, high frequency medical device and electronic communication device can cause malfunction or problem to the product. On the other hand, the product can generate noise to interfere with the medical device or video device.

Install the product so that the noise does not affect the neighbors.

- It may cause conflict with neighbors.

Install the product so that the tension is not applied to the cable of the product.

- If tension is applied, the cable can be disconnected or generate heat to cause a fire.
- When the power cable is damaged, do not exchange the cable directly. Contact the service center for replacement.

Be careful when transporting the product.

- When transporting the chiller, always consult with the special expert.
- When transporting the chiller, always follow the regulated method described in the manual. If not, it can fall over or fall down.

Check whether the installation board has been damaged from long use.

- When the base breaks down, the product can fall over to cause property damage, problem in product or injury.

Do not touch the refrigerant during or after the operation.

- The pipe during or after the operation can be hot or cold depending on the condition of the refrigerant passing through the refrigerant pipe, compressor, refrigerant cycle parts etc. If you touch the pipe at this time, it can cause burns or frostbite.

Do not turn off the main power immediately after stopping the operation.

- Always wait at least 5 minutes before turning off the main power. If not, it can cause shortage of oil supply or other problems.

Be careful when disposing the product.

- When disposing the chiller, request to the special service provider.

Be careful of high temperature.

- Be careful not to have any body parts touch the hot part of the chiller.
- It can cause a burn.

Be careful when installing the chiller.

- Be careful of the extra service space for the product during the installation and specially remove any surrounding obstacles for the water cooling type. Install the product where it is well ventilated.

Safely remove the packaging.

- Metal objects such as nail or other wooden packaging can cause skin cut or other injury.
- Rip any plastic or vinyl bags so that children would not play with them, and dispose them safely. Playing with plastic bags can cause suffocation.

Turn on the main power 12 hours prior to starting the operation.

- If you start to operate the product immediately after turning on the main power, it can severely damage the internal part. Keep the main power turned on while operating the product.

Do not operate the product with the panel or safety device removed.

- Rotating, hot or high pressure parts can cause a safety accident.

When cleaning or repairing the chiller, use a firm chair or ladder.

- It can cause an injury.

Be careful of high pressure.

- Always install the power through a separate cable and use exclusive power. Always install exclusive circuit breaker for the power.
- It can cause an electric shock or a fire.

Do not use strong chemical, household bleach or acid solvent to clean the chiller.

- Use proper cleaner which is safe for environment.

Be careful during re-operation.

- When the safety device of the product is operating, remove the cause and operate again.
- If you repeat the operation arbitrarily, it can cause a fire or a problem.

Be careful of sound or noise.

- If you hear a weird sound or smell something weird, immediately stop the operation and contact the service center.
- It can cause a fire, an explosion or an injury.

Check.

- Periodically check the product. When an issue is identified, stop the operation and contact the service center.
- Insufficient check can cause a fire, an explosion or a problem.

When shorting the part using jumper or other tools, do not bypass by deviating from the specified procedure.

- Grounding the control board and short circuiting other cables can lead to electric module or part damage.
- Insufficient check can cause a fire, an explosion or a problem.

Consult with the expert on the appropriate cooling water processing method.

- Chemical processing may be required to prevent or remove sediments or corrosions etc.

Use appropriate tools.

- Use tools appropriate for repair and accurate for measurement.
- Using inappropriate tools can cause an accident.

Be careful of injury.

- Check the safety label of the safety device.
- Follow the above precaution and details on the label. It can cause a fire or an injury.
- To prevent the generation of condensed water, the pipe connected to the evaporator, as well as the evaporator, must be insulated.

Do not remove or change the cable connection when delivering the chiller.

- Operation of the compressor in the opposite direction can cause a problem to the compressor and must be replaced.

The flux must be within the designed range and must be processed cleanly.

- This assures the product performance and reduces the possibility of damage to the tube including corrosion, sediment, scaling etc.
- LG is not responsible for any damage in chiller and condenser from unprocessed or inappropriately processed cooling water.

Do not overcharge the system.

- Overcharging increases the compressor discharge pressure and increases the consumption of refrigerant. Also it can damage the compressor and increase the power consumption.

Welding the evaporator head or nozzle part is not recommended.

- When you need to weld a part, you must remove the flux switch and coolant water inlet/outlet thermometer.
- After the welding is completed, the flux switch and the thermometer must be reinstalled. If the flux switch and thermometer are not removed, it can damage the parts.

Do not add different type of oil.

- It can lead to abnormal operation of chiller.

Maintain the compressor oil pressure to normal level.

- When reducing the pressure, follow the precaution.

Install the device only on the heat exchanger.

- When the device is installed on the lower heat exchanger, the device may not be lifted safely.
- It can cause an injury or damage to the chiller.

Before receiving the service, the controller power must be shut down.

- Ensure the safety and prevent the damage of the controller.

GENERAL

This manual consists of information about control, operation, start, service and problem solving of water-cooling chiller.

■ HMI (Human Machine Interface) Operation

⚠ CAUTION

You should not change the program without consulting LGE service agent. Wrong program can harm the machine.

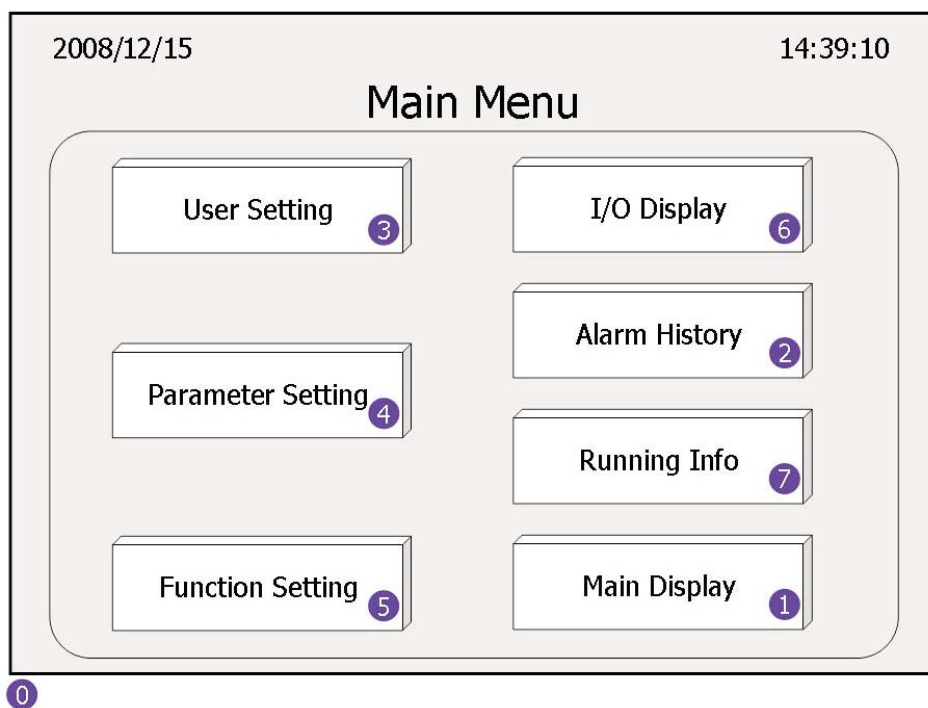


Fig. 1

Menu structure of HMI machine is indicated Fig. 1 above. It consists of 7 menus about User interface. HMI is touch screen, and you can move to the menu you want if you click the menu item with your hand. User Setting, Parameter Setting and Function Setting of menu limit is accessed by certification code system.

Especially Parameter Setting limits access of operator, and operator only has authority to access to User Setting.

In case of approval after power is OFF, basically Main Display screen would show up and operator can move to Main Menu by operating menu item.

Main Display

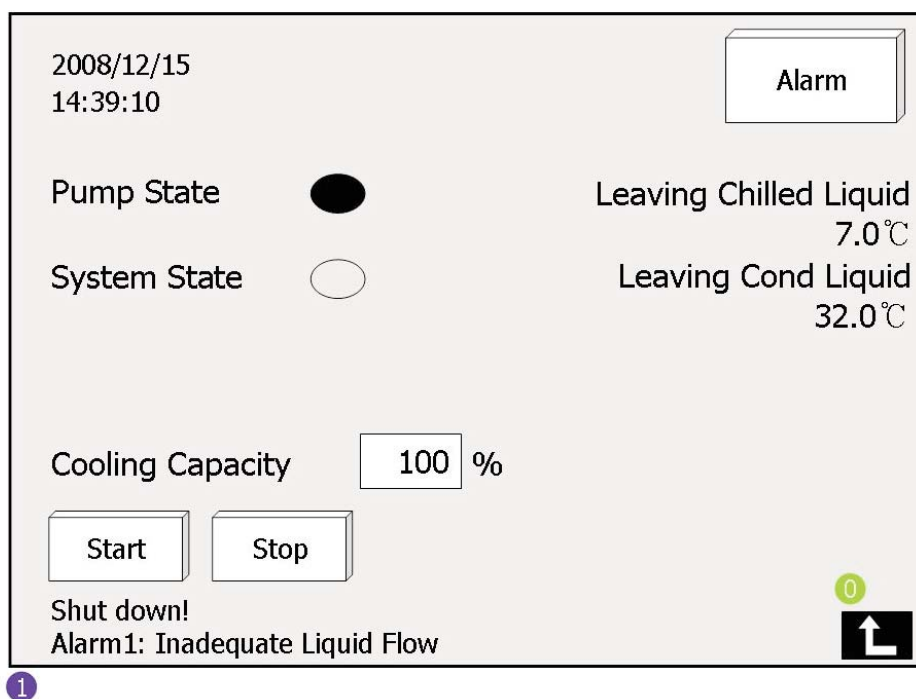


Fig. 2

Main Display consists of one screen, and it is the screen showing up when power is ON in the first stage. Operator can check the present condition of chiller in Main display. Also, operator can start/stop in main display. If pressing Start/Stop button on screen over 3 seconds, chiller may Start/Stop.

Operator can check the condition of pump and system in Main display.

If pump is ON, it means that it is operating and Pump State would be indicated as black oval. If chiller is ON, it means that it is operating and System State would be flickering twice in a second. Actual operating condition of pump can be different from Pump State indication depending upon which part conduct the pump control. Pump state indication in the Fig. 2 above would be applied when the pump is controlled by control signal of chiller.

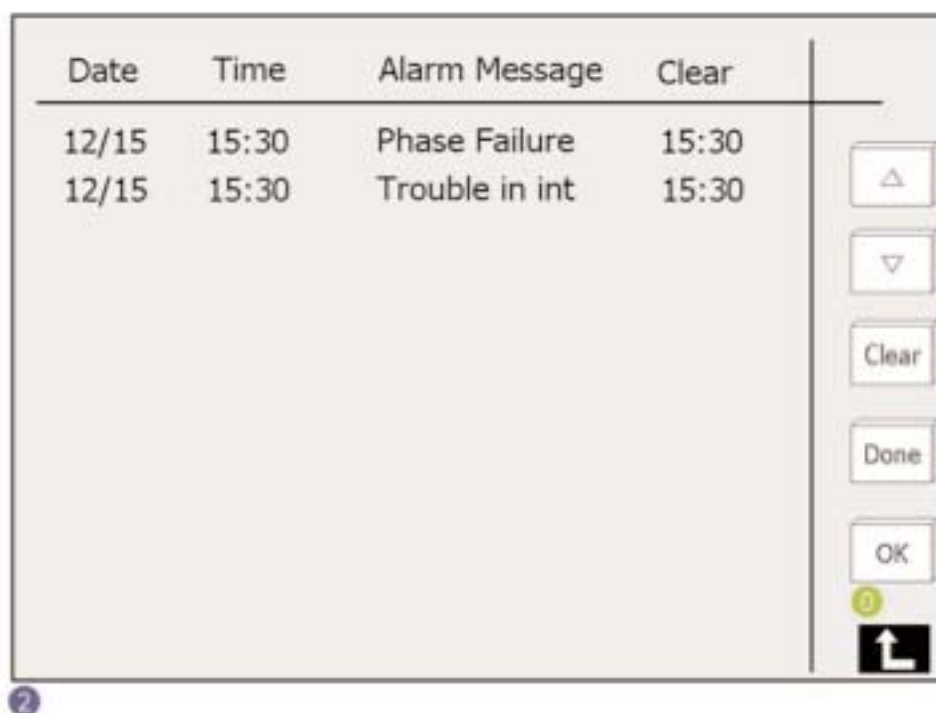
Operator can check the present existence of alarm. It can be checked because there are indications of kinds of alarm in the bottom of screen. When alarm is ON, alarm box on the top would be flickering twice in a second, and it can be eliminated by pushing the alarm box on the top. It would move to Alarm display menu to eliminate it.

Operator can check the date and day on the top of the screen. The date and time is changeable function of setting menu.

Temperature of cold water outlet and cooling water outlet would be indicated in the main display, and operator can check the operation condition of chiller by checking the indication of temperature sensor input on chiller.

Also, operator can check the cooling power of chiller when operating in main display. Cooling power will be indicated as 0~100% by the result of actual compressor capacity control.

Alarm History



Date	Time	Alarm Message	Clear
12/15	15:30	Phase Failure	15:30
12/15	15:30	Trouble in int	15:30

Navigation buttons: Up arrow, Down arrow, Clear, Done, OK, Home icon (house with up arrow).

2

Fig. 3

Last operated alarm will be indicated on Alarm display with time. Also, operator can cancel alarm on the screen. See the Fig4 below for cancellation of alarm.

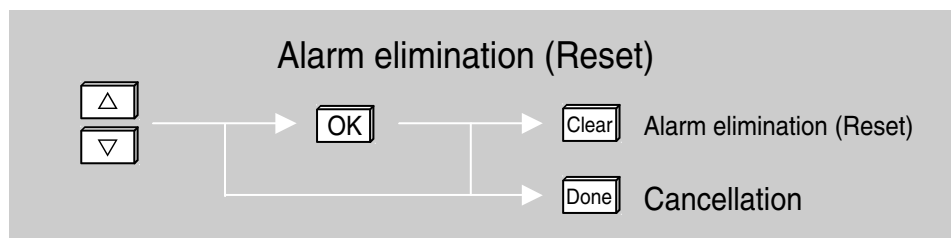


Fig. 4

As explained in the Fig4 above, click the arrow $\nabla \Delta$ to move to the alarm contents which operator wants to eliminate, and select the alarm by clicking OK. Cancel the alarm by clicking Clear. Canceled alarm would be eliminated in the alarm display screen.

If operator does not cancel the alarm after alarm is ON, Chiller would not work even if actual alarm situation is complete. After alarm is ON, always cancel the alarm and re-start it for operation.

User Setting

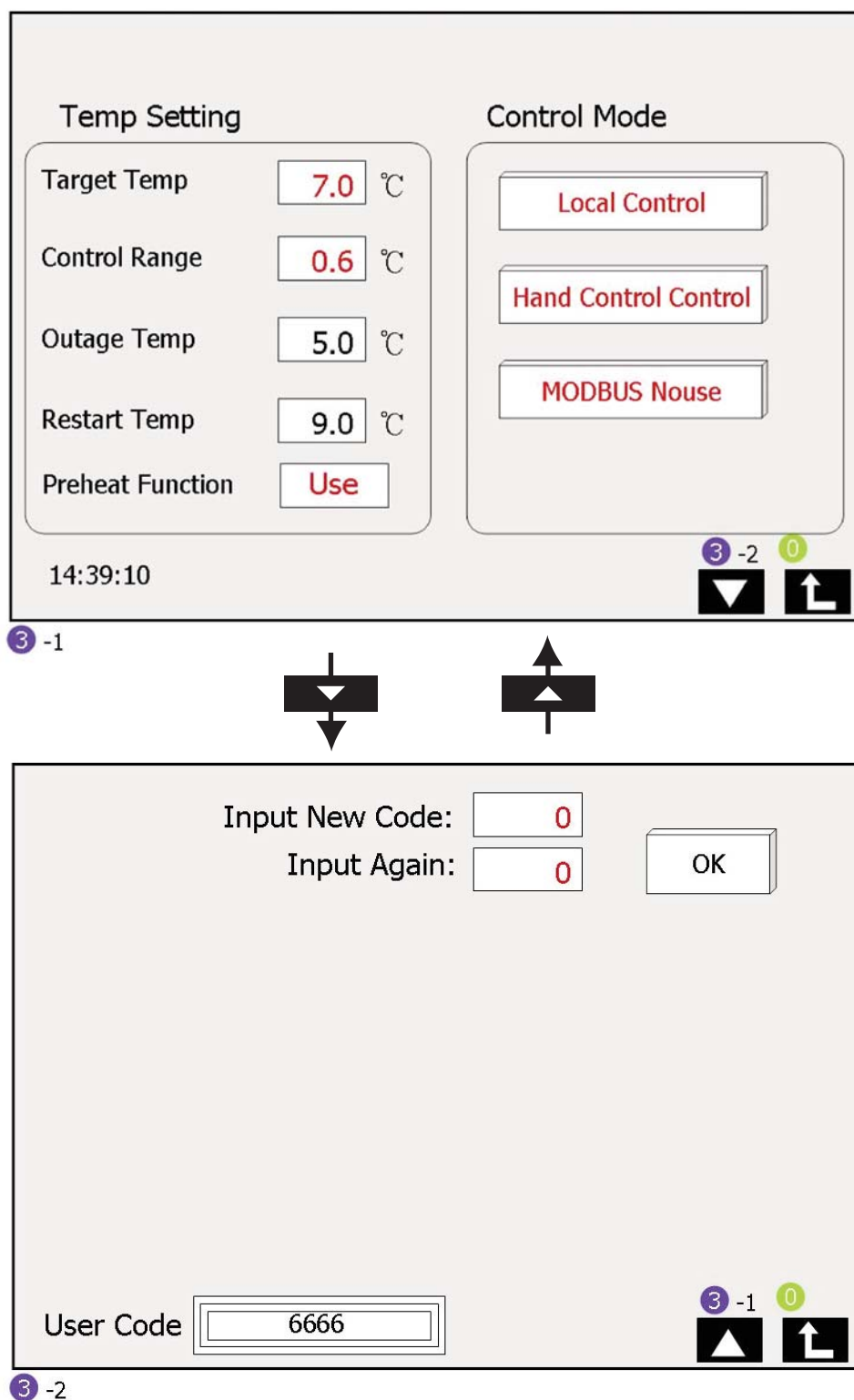


Fig. 5

User setting consists of 2 screens. Movement can be done with clicking arrow ∇ , $\triangle$ Through user setting, operator can make up the control parameter of chiller.

Operator basically can check and change the control setting condition of cold water outlet temperature. Among temperature setting items, target temperature of cold water outlet temperature and control range can be set by operator in user setting screen. Also by setting preheat function, operator can set machine to operate only after ranged preheat time when power is ON.

For changing value, select the part which indicates the value and select the number which operator wants to change to. If operator wants to cancel the change, select CLR, it would be cancelled. Stop and Re-start temperature would be set automatically by setting Stop temperature Dt, Re-start Dt in parameter setting. Stop temperature means the temperature at which compressor would be stopped. Setting condition is 5.0°C. Re-start temperature means the temperature in case that compressor should be re-started after Stop. Setting condition is 9.0°C. Difference of Stop temperature and Re-start temperature prevent often re-start of compressor.

Oil preheat can be set as Use/Nonuse, by minute unit. In the region where outdoor temperature is low, oil needs to be preheated to ensure proper thickness of oil.

Control mode consists of Local Control/Tele Control, Hand Control/Auto control and MODBUS Use/Nonuse. In case of Local Control, chiller may be operated by key controlling of operator. If mode is changed to tele control, Start and Stop of chiller may be done by the condition of tele contact part.

In case of Auto control, chiller would Start and Stop automatically by operator setting operation schedule. Schedule setting can be done in function setting menu. Contrarily, in case of Hand Control, chiller would be operated by key control of operator or tele signals.

MODBUS would be used to conduct the control after connecting chiller to BMS and MODBUS through network.

Operator can change password in second screen. Some function of HMI would be protected by password. Password change can be done by selecting New Password , re-input it and complete it by clicking OK.

Setting range of user setting value is specified below.

Indication	Meaning	Setting Range	Basics
Target Temp	Setting temperature of cold water outlet	5°C~12°C	7°C
Control Range	Control Range	0.6°C~1.5°C	0.6°C
Preheat Function	Preheat function	Use/Nonuse	Use
Local Control/ Tele Control	Local Control/ Tele control	Local Control/ Tele Control	Local Control
Hand Control/ Auto Control	Hand Control/ Auto Control	Hand Control/ Auto Control	Hand Control
MODBUS	MODBUS Use	Use/NonUse	NonUse
Code	User input Password	XXXX	6666

Table 1

Function Setting

System Time:

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Time-Set for Bout of Auto-run

Startup:

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Shutdown:

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Run-set

Startup

Shutdown

MON	00 : 00	00 : 00
TUE	00 : 00	00 : 00
WED	00 : 00	00 : 00
THU	00 : 00	00 : 00
FRI	00 : 00	00 : 00
SAT	00 : 00	00 : 00
SUN	00 : 00	00 : 00

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Fig. 6

Function setting menu consists of 3 screens, and screen movement can be done by using arrow ▽, △.

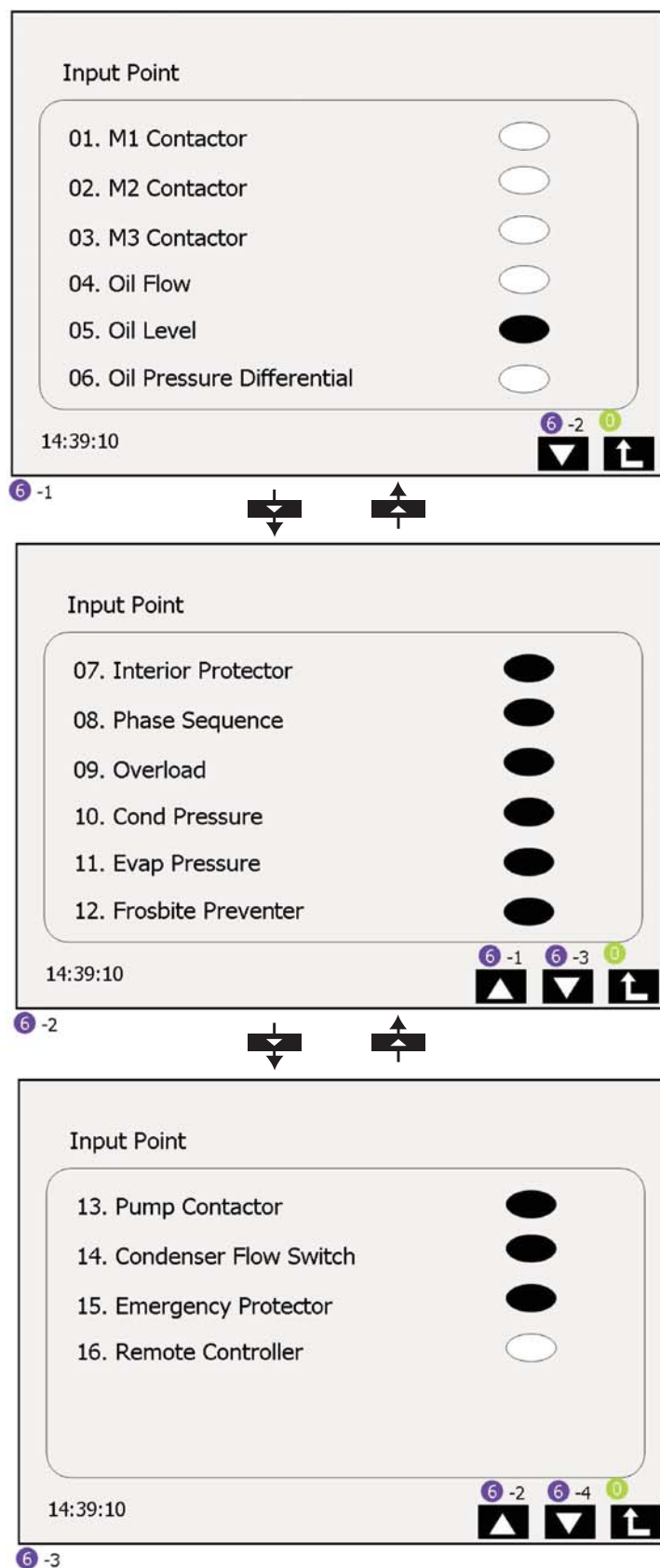
Operator can set the present time in the first screen. It can be done by selecting date and time box which operator wants.

Resting 2nd screens enable operator to set the operation schedule of chiller. In the second screen, operator would set the period to operate the chiller. Input the first start date, time of chiller and input the stop date and time. If operator inputs 00 for the time of operation, it means that it would not be operated. It can be changed by selecting box as explained earlier. Setting operation schedule is used for efficient process operation schedule setting of manufacturing facilities.

The last screen enable operator to set the operation schedule of chiller by a week unit. Input detailed operation time schedule from Monday to Sunday. Time can be set in minute unit. If operator inputs start and stop time as 00:00, it would not be operated. This operation schedule setting would be efficient in the situation where load change happens often like in the normal office building.

In case that 2 schedules are overlapped, schedule in the second screen would take precedence over the others.

I/O Display



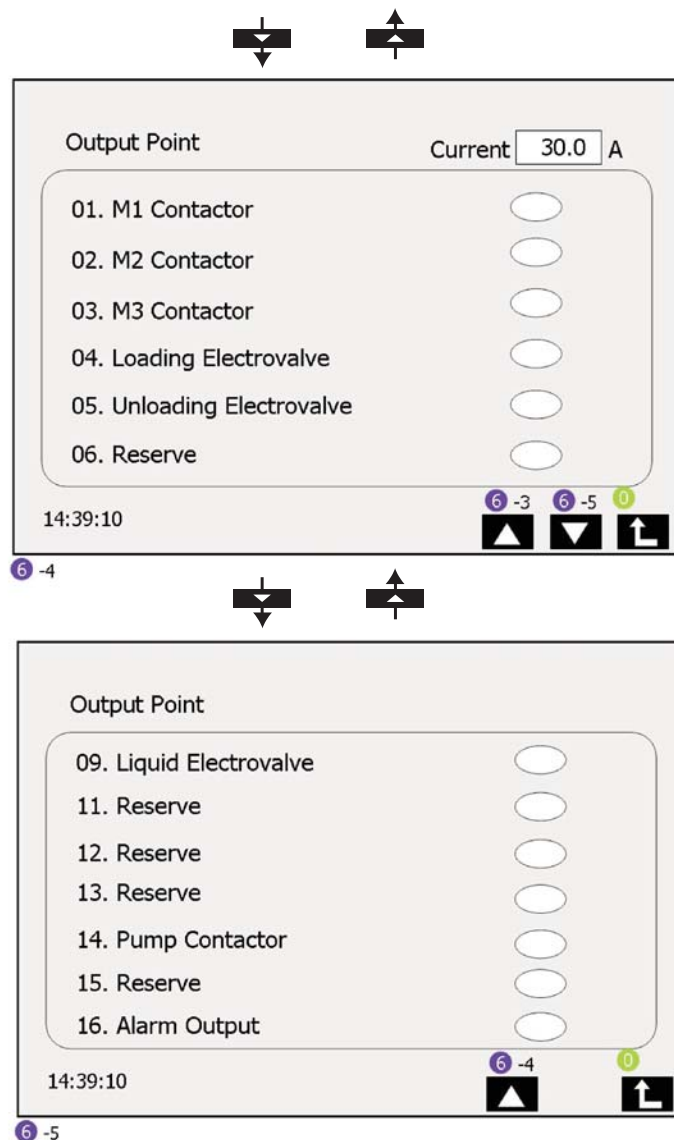


Fig. 7

Input/Output display consists of total 5 screens including 3 screens for expressing the input condition and 2 screens for expressing the output condition. Input/Output display has input information that means switch data that chiller control is inputted, and output information that means output signal approval of load equipment that conduct chiller controller output. Black oval of input/output signal means ON, white oval means OFF.

Input

Indication	Meaning	Normal condition when stopping	Normal condition when operating
M1 Contactor	Main electron contactor	ON	ON
M2 Contactor	Electron contactor for Δ short	OFF	OFF $\rightarrow$ ON
M3 Contactor	Electron contactor for Y short	OFF	ON $\rightarrow$ OFF
Oil Flow	Oil flow switch	OFF	ON (in 5 minutes of operation)
Oil Level	Oil Level switch	ON	ON
Oil Pressure Differential	Oil Pressure differential switch	OFF	ON (in 5 minutes of operation)
Interior Protector	Compressor interior protector	ON	ON
Phase Sequence	Phase sequence voltage watcher	ON	ON
Overload	Overload relay	ON	ON
Cond Pressure	Condenser high-voltage switch	ON	ON
Evap pressure	Evaporator low-voltage switch	ON	ON
Frosbite Preventer	Freezing Preventer	ON	ON
Pump Contactor	Pump operation input interlock	OFF	ON
Condenser Flow Switch	Cold water/cooling water level switch	OFF	ON
Emergency Protector	Emergency stop switch	ON	ON
Remote Controller	Tele operation signal contact part	ON/OFF	ON/OFF

Table 2

Indication value and meaning of input display, and normal value is specified above in the table.

Especially when operating if value is inputted other than the value specified above, PLC judge the wrong value and alarm generated which would stop the chiller.

M3 contractor of input value is electron contactor of Y short of compressor motor and it would be change to OFF after ON about for 5 seconds in the beginning of the compressor operation. After M3 Contactor is Off, compressor would be operated normally through that M2 Contactor, which is electron contactor for Δ short. M1 contactor would be kept ON during operation as Main contactor for power approval.

Oil Flow and Oil Pressure Differential input would be inputted for checking normal function of lubrication with Oil Level during operation. Oil level input always keeps being on during operation and stop which is input for getting the oil level of oil separator. Oil Flow switch monitors actual oil flow from oil separator to compressor, Oil Pressure differential is input for checking the pressure difference between low pressure refrigerant and high pressure of compressor which is power for making oil flow, both inputs are ON when compressor operation is stabilized. Therefore it check if it powers on normally in 5 minutes of compressor operation and it judge if it operates alarm. If it is not ON in 5 minutes of compressor operation, PLC may recognize it alarm and stop the chiller safely.

Delay time is changeable through Parameter Setting, and contact LGE service agent when change is needed because of alarm operation.

Compressor interior protector is equipment for sensing winding wire and discharge temperature of compressor which is installed on compressor. In case that compressor interior protector sense abnormal high temperature from winding wire and discharge temperature, this signal change from ON to OFF, it is kept ON in normal temperature condition.

Phase Sequence is Phase sequence voltage watcher which is installed on Power Panel, it watches input power condition, if it detects abnormality, it change the signal from ON to OFF, if not it is in ON condition. The kinds of abnormal voltage that Phase Sequence can detect is 5, it includes over voltage, low voltage, open, short, imbalance of between phase.

Overload is condition of overload relay for compressor, if it is normal it kept ON, if it is abnormal when over-current flows it changes from ON to OFF.

Cond Pressure is input value of high-pressure switch that detect condenser high-pressure. It would be on in high pressure abnormal condition, it would be On in normal pressure condition. Evap. Pressure also input value of low-pressure switch that detects evaporator low-pressure. It would be OFF in evaporator low-pressure abnormal condition, it would be ON in normal pressure condition.

Frosbite Preventer is low temperature detect switch installed on evaporator, and it is used for preventing ice formation. Low temperature detection would be done by the standard of cold water temperature 2°C, it would be ON in normal temperature and it would be OFF if it is lower than 2°C.

Pump contactor input to the field wire is needed, contact part of electron contactor of cold water and cooling water pump would be inputted to PLC in series. This signal should be ON when pump operation is needed.

Condenser Flow Switch is signal that is inputted into PLC after cold water and cooling water level switch is connected in series. This signal should be ON when pump operation is needed.

Emergency Protector is the condition of Emergency switch that is installed on control. In case that emergency switch is cancelled, it is kept ON, in case that emergency switch is clicked, it is kept OFF.

Remote Controller is contact part signal input for tele controlling in tele control mode of chiller, when it is ON, it operates chiller, when it is OFF, it stops chiller.

Output

Indication	Meaning	Normal condition when stopping	Normal condition when operating
Current	Operation Current	0A	Operation Current
M1 Contactor	Main electron contactor	ON	ON
M2 Contactor	Electron contactor for Δ short	OFF	OFF → ON
M3 Contactor	Electron contactor for Y short	OFF	ON → OFF
Loading Solenoid valve	Control valve for Sliding Valve	It changes depending on operation condition.	
Unloading Solenoid valve			
Liquid Solenoid valve	Valve for Economizer	ON	OFF/ON (100% ON during operation)
Pump Contactor	Pump control	OFF	ON
Alarm Output	Alarm operation	It changes depending on operation condition.	

Table 3

M1 contactor, M2 contactor and M3 contactor indicates condition of electron contactor for compressor with input display. The value indicated on Output display is Output from actual PLC, the value indicated on Input display is extra contact part condition which is inputted to PLC from electron contactor. Therefore, if wiring related to electron contactor is normal, the condition should be consistent. If input condition and output condition is not same due to abnormality of electron contactor, it recognize the situation of alarm generation by PLC.

Loading Solenoid valve and Unloading Solenoid valve is used to control the sliding valve for volume control of the compressor. Loading Valve and Unloading Valve is used to control Sliding Valve by using oil pressure for compressor.

Liquid Solenoid valve is valve for Economizer operation, and it is installed at the pipe that sprays the mid-pressure refrigerant to middle of compressor rotor, and it sprays when it is ON. If it is normal, Liquid Solenoid valve is ON and spray refrigerant 100% in operating condition.

Pump contactor output is output signal for control cold water and cooling water, it should conduct pump control of cold water and cooling water pump in field by field wiring. At least field pump should be kept operating when this output signal is ON.

Alarm Output is the signal that operator can check the alarm operation of chiller in location where it is far from chiller installation field and gives output when alarm is ON. If this signal is ON, chiller has alarm operation, if the signal is OFF, chiller has normal condition.

Running Information

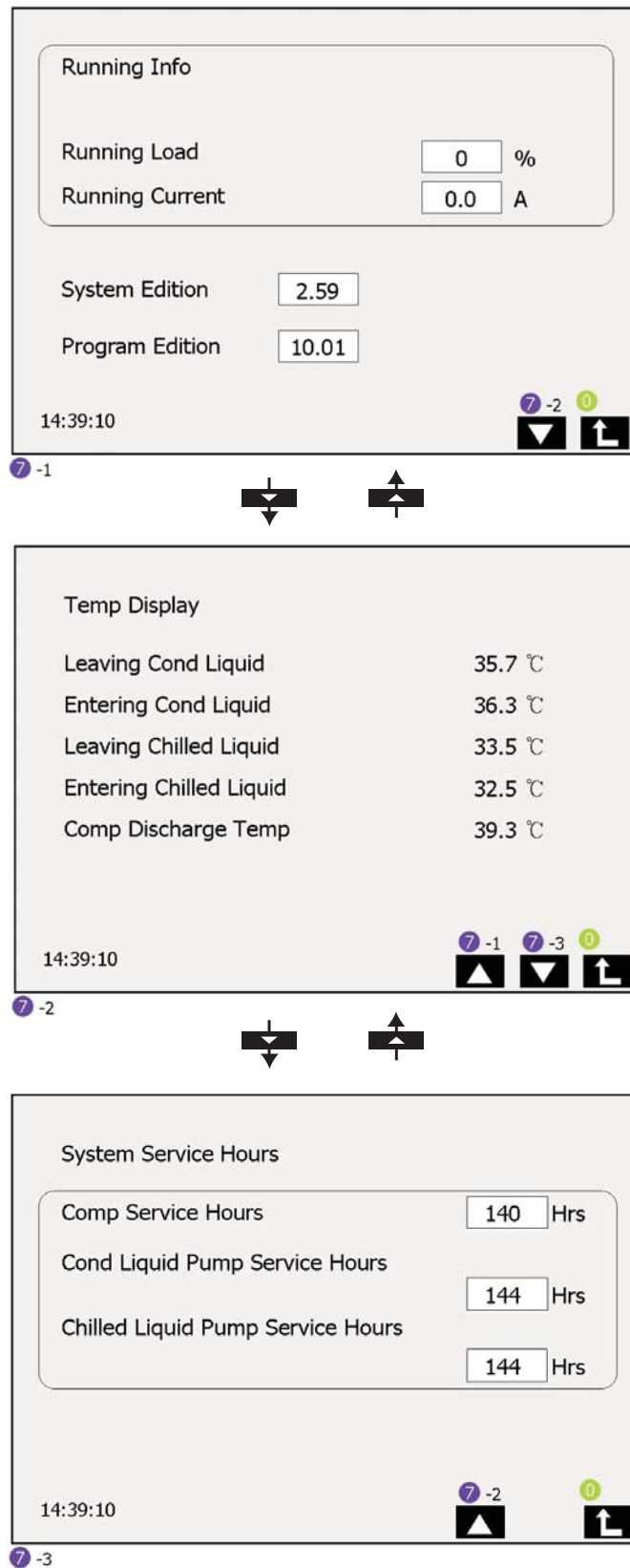


Fig. 8

Operation Information screen indicates operation value state of chiller including chilling cycle, cold water/cooling water temperature.

This operation value state includes chiller operation capability and operation current in present condition, also does accumulate operation time of cold water, cooling water pump and compressor.

Also, operation value state indicates refrigerant temperature of chilling cycle and cold water, cooling water temperature. Indicated temperature would be shown to one place of decimal, and it includes Leaving Cond. Liquid, Entering Cond. Liquid, Leaving Chilled Liquid, Entering Chilled Liquid, and Comp. discharge Temp.

CONTROLS

■ Control Panel

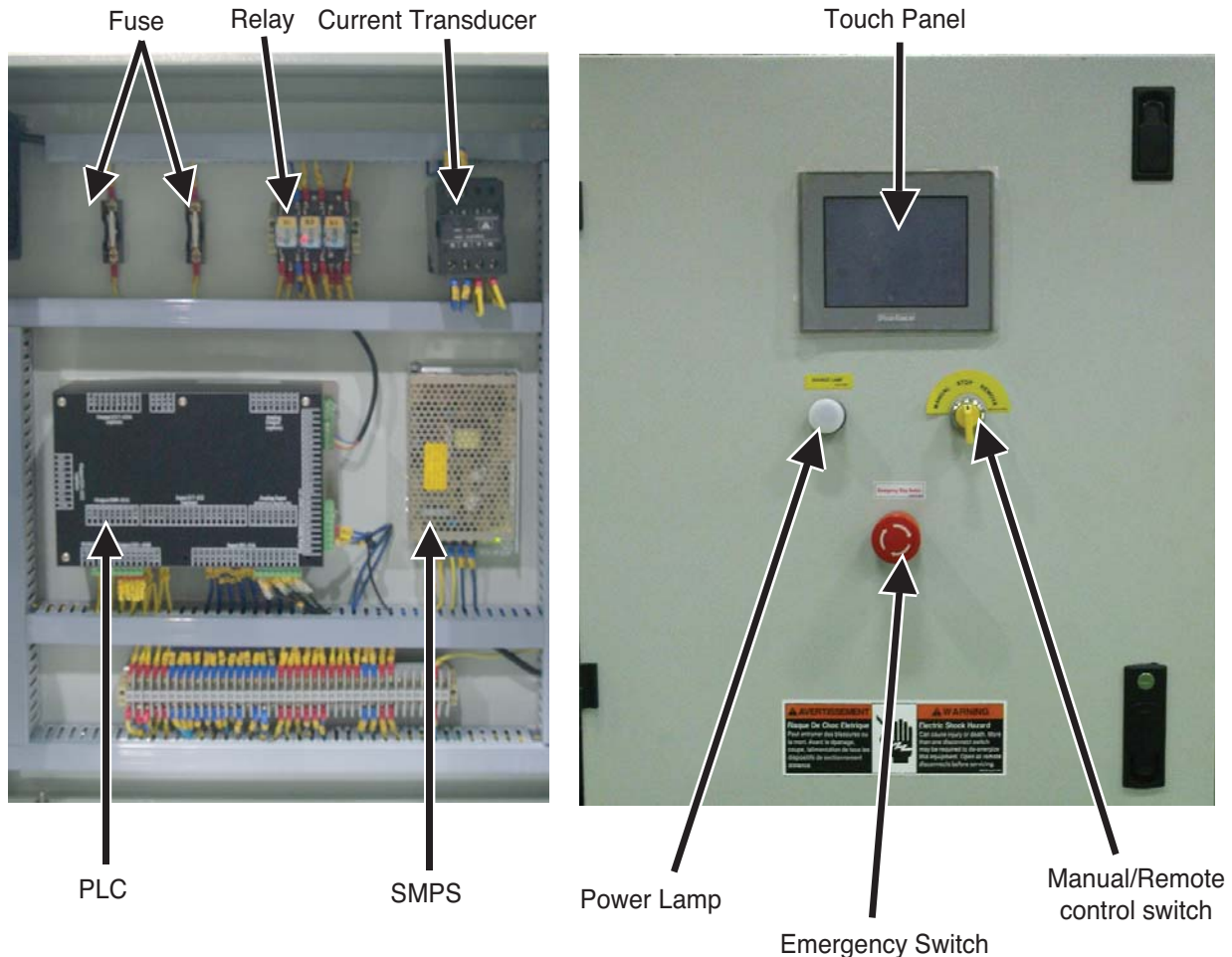


Fig. 9

Inside of control panel, PLC(Programmable Logic Controller) which is actual Main controller and other related components are located.

PLC controls compressor and volume control valve through outlet port sensing sensor and switch condition through input port. Also PLC communicate with touch panel which is HMI(Human Machine Interface) Equipment through exclusive communication port, if it is connected to BMS, it provides interface function through exclusive communication port.

PLC power input is 24V AC 50Hz and it gets its power from transformer which is located in power panel.

SMPS(Switching Mode Power supplier) is equipment that making 24V DC power using 220V AC 50Hz power, it provides power to touch panel.

Fuse protects circuit from over-current used for 220V AC control circuit input and power input of Crankcase Heater.

CONTROLS

Relay is used to recognize the control switch condition and Current Transducer helps to change Current value which is recognized by CT(Current Transformer) to signal that PLC can recognize.

HMI which has touch panel for user interface is installed to door of control panel, it indicates power approval through power lamp.

Also, switch that can set body/remote and emergency stop switch is also installed.

■ PLC and HMI Unit

HMI (Human Machine Interface) which is united with PLC(Programmable Logic Controller) is shown in Fig. 10 described below, it is located in control panel Door. HMI is touch screen for convenient user interface.



Fig. 10

Through touch screen interface, operator can check the chiller operation condition and controls in detail. Control composition can be done through touch screen interface.

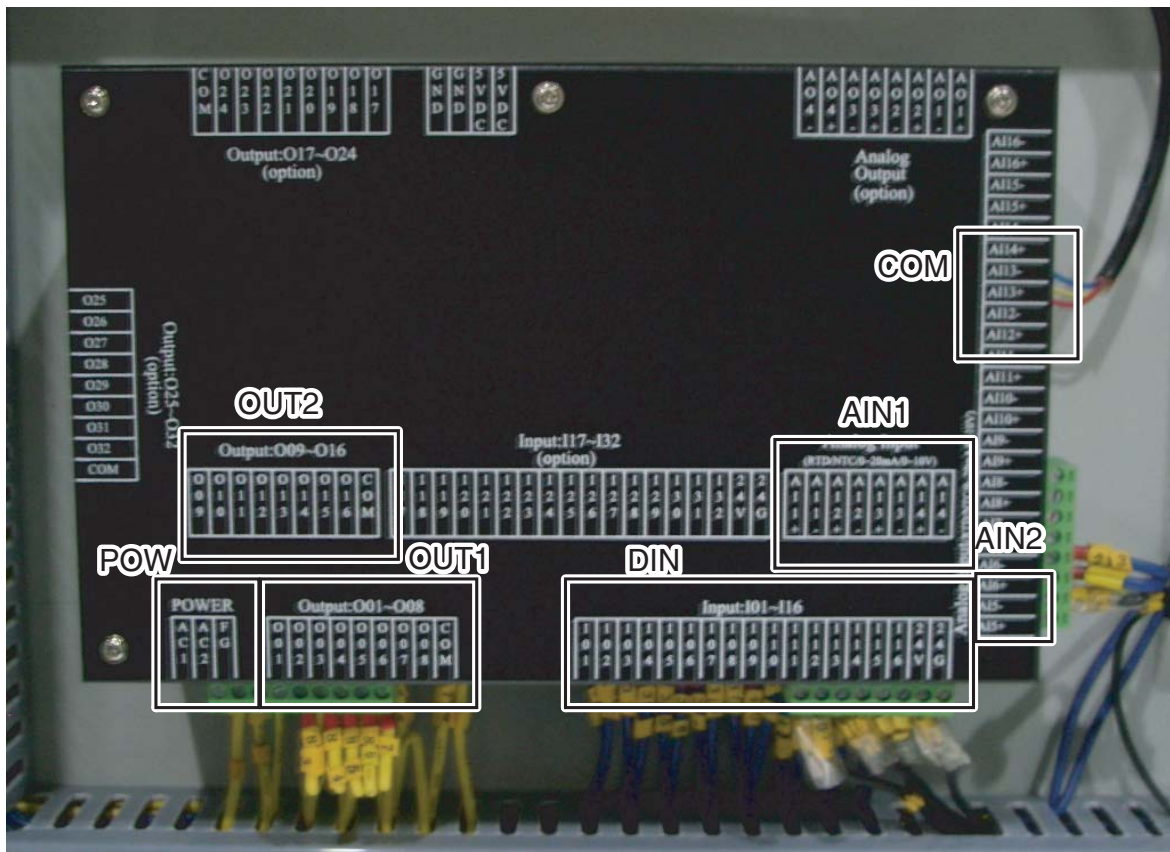


Fig. 11

Fig. 11 describes input/output port composition of PLC. All input/output signal for chiller control is connected to PLC, it is delivered to PLC as input or it is approved output from PLC. Used input/output for this product among input/output of PLC is shown below.

- POW: it is used to provide power to PLC
- DIN: it is used to provide switch input signal to PLC
- OUT1~OUT2: it is used to deliver output signal from PLC.
- AIN1~AIN2: it is used to deliver sensor information to PLC.
- COM: it is used to connect communication between PLC and HMI and MODBUS communication.

DIP switch and indication LED is installed on the top of PLC. Normally D2 LED should be flickering as 4Hz frequency, D3~D6 should be OFF. Other LED is flickering depending on PLC communication condition.

4-position DIP switches should be OFF, 8-position DIP switch should indicate MODBUS slave equipment address. 8-position DIP switch indicates 8 bit, number of 6 figures which has contrary one bit as number of 2 figures. For example, basic setting place described in the picture below (switch 2~8: ON and switch 1: OFF) indicates 0x7E and the contrary value is 0x01. Basic setting of MODBUS slave address of chiller is 0x01.

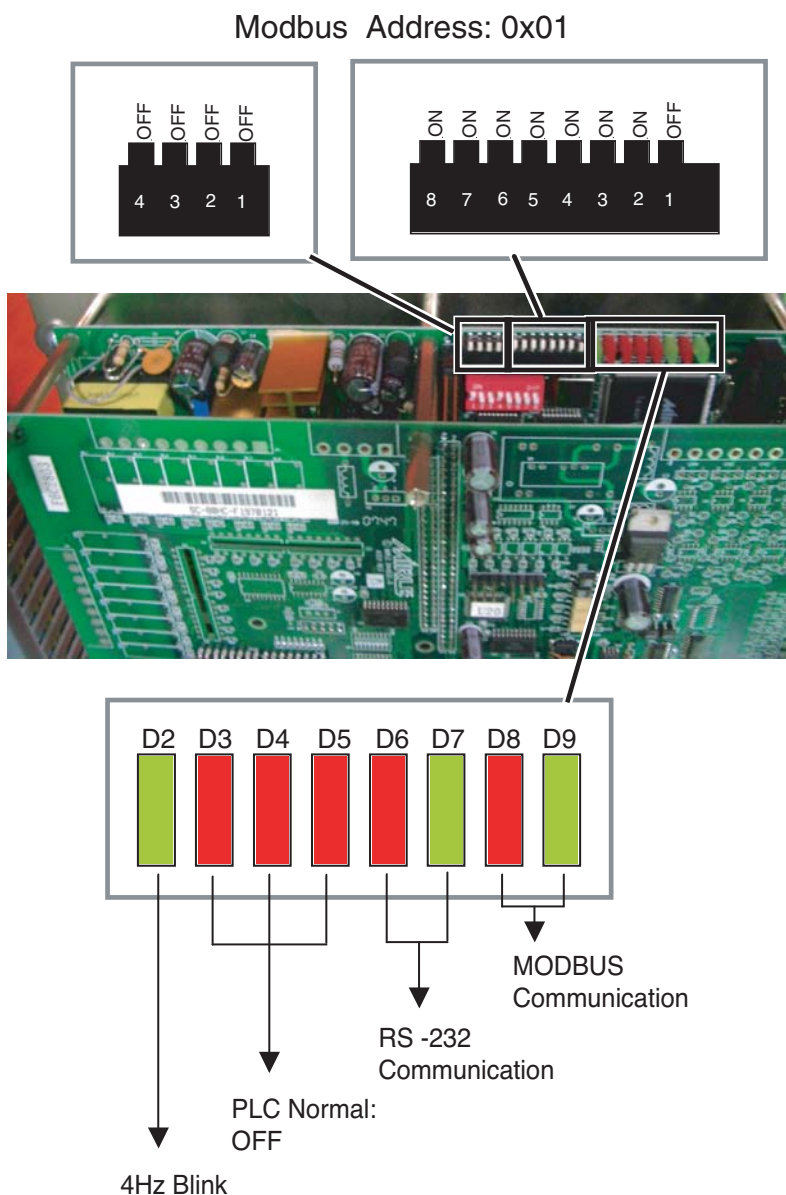


Fig. 12

Connector	Pin	Wire No.	Description
POW	AC1	212	220V AC-L
	AC2	214	220V AC-N
	FG	-	Frame Ground
OUT1	O01	71	1#Main contactor, Oil separator sol. Valve
	O02	72	1# △ Contactor
	O03	73	1# Y Contactor
	O04	74	1# Loading Electrovalve
	O05	75	1# Unloading Electrovalve
	O06	76	1# 75% Electrovalve
	O07	-	-
	O08	78	1# Oil Recover Valve
	COM	7	Common : 220V AC Live
OUT2	O09	-	-
	O10	-	-
	O11	-	-
	O12	-	-
	O13	83	Tower Fan
	O14	84	Cooling Water Pump
	O15	85	Chilled Water Pump
	O16	86	Alarm indication contactor
	COM	7	Common : 220V AC Live

Table 4

Connector	Pin	Wire No.	Description
DIN	I01	31	1#Main contactor
	I02	32	1# △ Contactor
	I03	33	1# Y Contactor
	I04	34	1# Oil flow switch
	I05	35	Oil level switch
	I06	36	Oil Pressure differential switch
	I07	37	1#Interior protection equipment
	I08	38	Power phase sequence monitor equipment
	I09	39	1# Compressor overload relay
	I10	40	High-pressure switch
	I11	41	Low-pressure switch
	I12	42	Freeze and burst prevention switch
	I13	43	Water pump contactor input
	I14	44	Cold water/ cooling water flow switch
	I15	45	Emergency stop switch
	I16	46	Tele- control
	24 V	47	24V AC-Positive
	24 G	-	-

Table 5

Connector	Pin	Wire No.	Description
AIN1	AI1+	11	Cooling water outlet temperature
	AI1-	10	
	AI2+	13	Cooling water inlet temperature
	AI2-	12	
	AI3+	15	Chilled water outlet temperature
	AI3-	14	
	AI4+	17	Chilled water inlet temperature
	AI4-	16	
	AI5+	19	1# Compressor discharge temperature
	AI5-	18	
AIN2	AI6+	22	2# Compressor discharge temperature
	AI6-	23	
	AI7+	-	-
	AI7-	-	
	AI8+	-	-
	AI8-	-	
MODBUS	RX1/D1+	-	Touch Panel Communication Rx
	TX1/D1-	-	Touch Panel Communication Tx
	GND	-	Touch Panel Communication Ground
	RX2/D2+	-	MODBUS on RS485 : D+
	TX2/D2-	-	MODBUS on RS485 : D-

Table 6

MODBUS communication function is provided by standard. Chiller can unify to existing BMS network using MODBUS communication. MODBUS can transmit to Lonworks or BACnet using third transmitter for connection.

MODBUS communication composition is specified below.

- 1) Signal : RS-485
- 2) Mode : RTU
- 3) Baud rate : 19,200BPS
- 4) Parity : same
- 5) Letter : 8 bit
- 6) Pause bit : 2 bit

MODBUS address map is shown in the table below.

No	MODBUS address	Meaning	Unit Indication	Writing
1	46101	Cooling water outlet Temperature	Actual Valve X 10[°C]	-
2	46102	Cooling water inlet Temperature	Actual Valve X 10[°C]	-
3	46103	Chilled water outlet Temperature	Actual Valve X 10[°C]	-
4	46104	Chilled water inlet Temperature	Actual Valve X 10[°C]	-
5	46105	Compressor motor Temperature	Actual Valve X 10[°C]	-
6	46106	Operation capacity	%	-
7	46107	Compressor current	Ampere	-
8	46108	Chiller operation time	Hour	-
9	46109.0	Chiller Starting	0 : OFF ; 1 : ON	-
10	46109.1	Chiller Shut-downing	0 : OFF ; 1 : ON	-
11	46109.2	Chiller Stop	0 : OFF ; 1 : ON	-
12	46109.3	Chiller Failure	0 : OFF ; 1 : ON	-
13	46110.0	Comp Main MC	0 : OFF ; 1 : ON	-
14	46110.1	Comp △ MC	0 : OFF ; 1 : ON	-
15	46110.2	Comp Y MC	0 : OFF ; 1 : ON	-
16	06111	Start/stop	1 : Start ; 0 : Stop	Yes
17	41421	chilled water outlet setting temperature	Actual Valve X 10[°C]	Yes

Table 7

* Must not use MODBUS mode, when unit is running on local mode.
LGE doesn't have any responsibility about problem you disobey

■ Power Panel

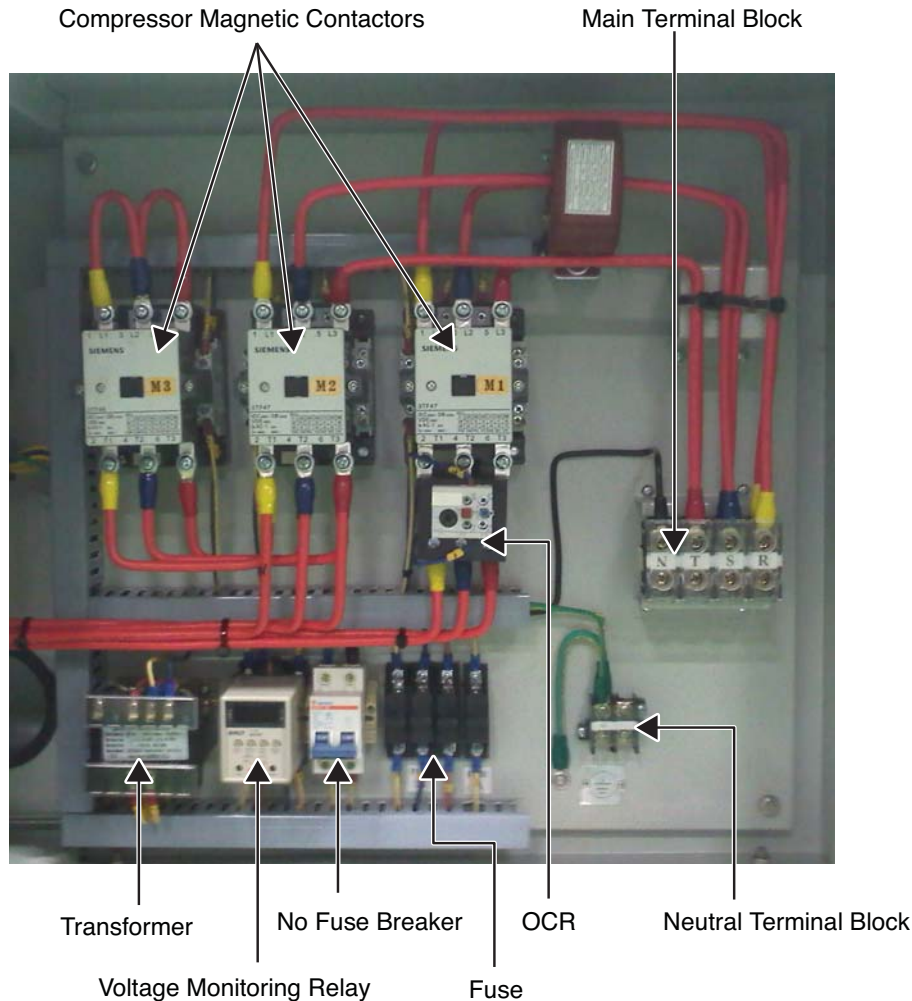


Fig. 13

Rated electrical input power input and related electric control components are installed in power panel. Power input is structured in Terminal Block shape, Rated electrical input power which is approved to terminal block is approved to Magnet switch for compressor control. 3 Phase Rated electrical input power input and Neutral Terminal Block can make normal control power only if it is provided with N phase.

Magnet switch for compressor control consists of total 3, it conducts normal control through Δ operation and Y- Δ operation of compressor. Magnet switch control is done through PLC output of control panel, operation contact part condition of magnet switch is inputted to PLC again and it watches operation condition of magnet switch during PLC control.

OCR(Over Current Relay) which is installed with magnet switch detects over current and send signal to PLC to protect compressor from over current.

Rated electrical input power input normality is watched always by Voltage Monitoring Relay, and when abnormality is detected, it sends signal to PLC and let it conduct alarm operation when abnormal power is provided. Power abnormality that Voltage Monitoring Relay can detect includes over voltage, low voltage, open, short and imbalance between phases.

Different from inputted R phase of 3 phase power, N phase 220V AC power which is neutral is used as power, control power is provided through No Fuse Breaker.

Also, 24V AC which is power provided to PLC is made through Transformer inside power panel.

■ Machine On/Off Control

There are hand mode and auto mode for powering ON/OFF the unit.

1. Hand mode- Hand mode is basic setting mode, and user can turn the unit ON and OFF by pushing Start/Stop button of HMI for 3 seconds. Select [user setting], [Hand/Auto mode] and [Hand control] to set this mode.
2. Auto mode – Auto mode is mode for controlling machine powering ON/OFF by setting Start and Stop time. Select [user setting], [Hand/Auto mode] and [Auto control] to set this mode. Basic ON/OFF time is set as [Start-8:00/Stop-17:00]. For changing operating time for Auto control, select [Function setting] on Main menu. Input operation period in the second screen. Next, input operation time of chiller from Monday to Sunday in detail. Select [User setting] for returning to Main Menu. If user selects [Auto control] in [User setting] mode, chiller would be operated following the ranged schedule for set period.

START UP

■ Pre-start up

Check the following and then operate the chiller.

- Before operating the chiller, check the cold water, cooling water circulation pump, air handling equipment or other supplementary facility such as other equipment. Refer to the direction of the manufacturer. If the device is equipped with the components installed on site, install the equipment properly and accurately and check whether the wire is connected accurately. Refer to the wiring diagram of the device.
- For proper operation of the product, check the flux switch. Check whether the Sensor is operating accurately.
- Open the compressor suction stop valve.
- Open the refrigerant line, oil line and economizer valve.
- For cooling, clean water (Add recommended restraint) or other non-corrosive liquid is filled into the cold water circuit of the chiller. Take out all the air to higher location on the system. Air vent is installed on the evaporator. When the outdoor temperature falls below 0°C and is expected to further drop, sufficiently restrained propylene glycol or other appropriate anti-rust restrained anti-freeze liquid must be added to the cold water and coolant circuit. Cold water and coolant water loop must be cleaned before the device is connected.
- Check all water pipes. Check whether the direction of the water flow is correct and whether the pipe is accurately connected to the evaporator and condenser. Open all the flux valves that flow in the direction to condenser and evaporator.
- Turn ON the chilled water and coolant pump, and measure the water pressure reduced part of the condenser and evaporator to check whether it is accurate or not.
- Check all electric connections from the Control Panel and check whether these are tightly assembled and whether the contact condition is good. Though the connecting part is well tightened up, it could be loosened up in case of a problem during the transportation.
- If the voltage is within 10% of the voltage required on the plate of the compressor, check the actual wire voltage for the device to check whether the phase voltage imbalance does not exceed the 5%. Check whether the power and capacity is appropriate for load processing.
Decide the imbalance of the ratio voltage : The deviation between the maximum voltage deviation and average of all 3rd mode is the maximum voltage deviation.
- Check the order of the power phase.
- Oil heater must be firmly installed on the oil tank side and the power must be supplied 24 hours prior to operation. Oil separator must be warm when was felt.

■ Operating Procedure

Do not operate the contactor manually. It can cause severe damage to the machine.

Follow the below procedure.

- Check whether the air processing equipment that supplies water to the chiller or other devices that operate the water load. Start of the water load equipment can be delayed when the temperature of the chilled water is too high.
- When the Auto control does not work in the chiller, check whether the water circulation pump is operating.
- Check and audit all the fuses. All the fuses on the power and control panel must be installed in the correct location.
- Check and audit the condition of the touch screen of PLC and HMI. HMI will display the LG logo as it is turned on and then the normal screen must be displayed afterwards.
- Check and audit the voltage monitoring meter inside the power panel. The voltage monitoring meter must not display any error code.
- Use the HMI device to check the cold water outlet temperature and coolant water outlet temperature setting.
- Set the start menu of the HMI device to start the system.
- After operating the machine for a short time, check the oil amount inside each compressor and check whether the coolant liquid meter is flashing.
- While the device is operating, the coolant water temperature must be within 20°C~40°C.
- To appropriately control the temperature, the water circulation flux must be within the permitted range.

After the above installation, operate the chiller to check whether all the functions are operating correctly.

Check whether the setting point of the cold water outlet and coolant water outlet are the same.

Also through HMI device, check whether all the Sensors have an effective value.

PLC detects the temperature using the 5NTC Thermistors, and the thermistor detects the compressor discharge temperature, coolant water inlet temperature, coolant water outlet temperature, cold water inlet temperature and cold water outlet temperature.

■ Operation Limit

Temperature

The temperature limit condition during the operation of the chiller is as follows.

- ◆ Minimum cold water outlet temperature : 5°C
- ◆ Maximum cold water outlet temperature : 15°C
- ◆ Minimum coolant water inlet temperature : 24°C
- ◆ Maximum coolant water inlet temperature : 35°C

Voltage

Permitted maximum voltage and minimum voltage are displayed on PDB. And refer to PDB for other details related to electric specification.

For 3 phase voltage, when the imbalance between the phases exceed 5%, the compressor motor will not operate.

The equation to calculate the voltage imbalance is as follows.

Voltage imbalance (%) = $100 \times (\text{Maximum voltage compared to average voltage} / \text{Average voltage})$

Maximum voltage compared to average voltage is the absolute value of the maximum difference from average voltage of 2 phases.

Example)

Voltage source 400-3phase(1,2,3)-50Hz

12 : 405V / 23 : 394V / 31 : 410V

Average voltage : $(405 + 394 + 410) / 3 = 403$

Difference between average voltage and each voltage :

Average – 12 = $|403 - 405| = 2V$

Average – 23 = $|403 - 394| = 9V$

Average – 31 = $|403 - 410| = 7V$

Maximum voltage compared to average voltage : 9V

% Voltage imbalance : $100 \times (9 / 403) = 2.23\%$

Because the permitted range of the imbalance the voltage is less than 5%, the device can operate.

Flow Rate

Basic flow rate of the chiller follows the value indicated on the table showing the maximum, minimum and design flow rate. Higher or lower flow rate is permitted to achieve lower or high rise in temperature. To ensure appropriate heat exchange and turbulence Within the evaporator and condenser, the flow rate must exceed the minimum flow rate.

◆ Evaporator

MODEL	Min		Norminal		Max	
	gpm	l/s	gpm	l/s	gpm	l/s
RCWW200RAAA	411.17	25.94	519.54	32.78	763.60	48.18

Table 9

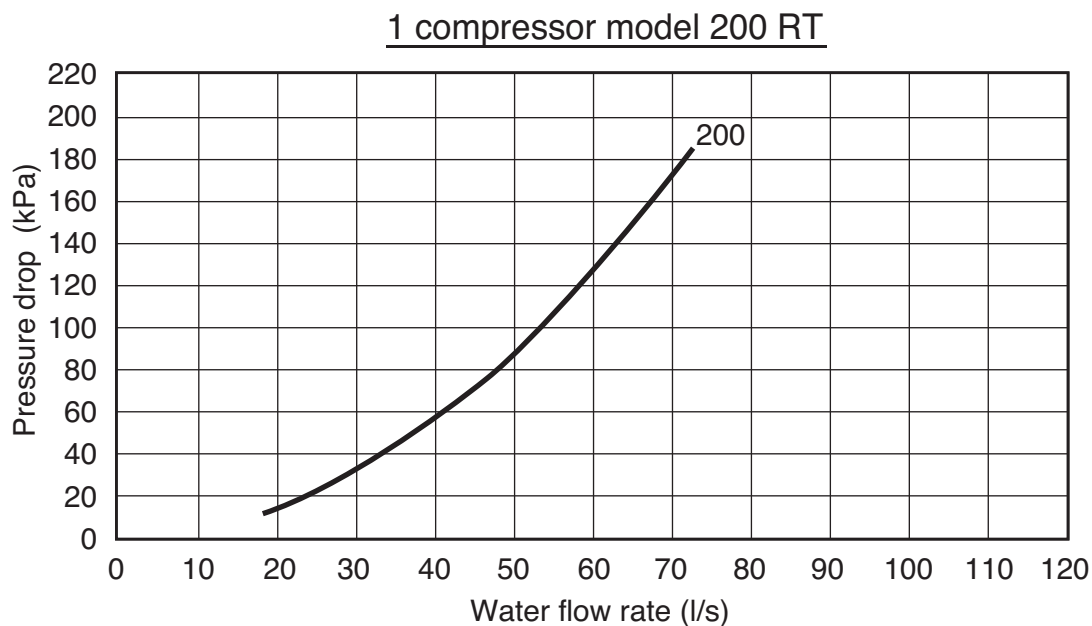
◆ Condenser

MODEL	Min		Norminal		Max	
	gpm	l/s	gpm	l/s	gpm	l/s
RCWW200RAAA	363.68	22.95	587.39	37.06	675.40	42.61

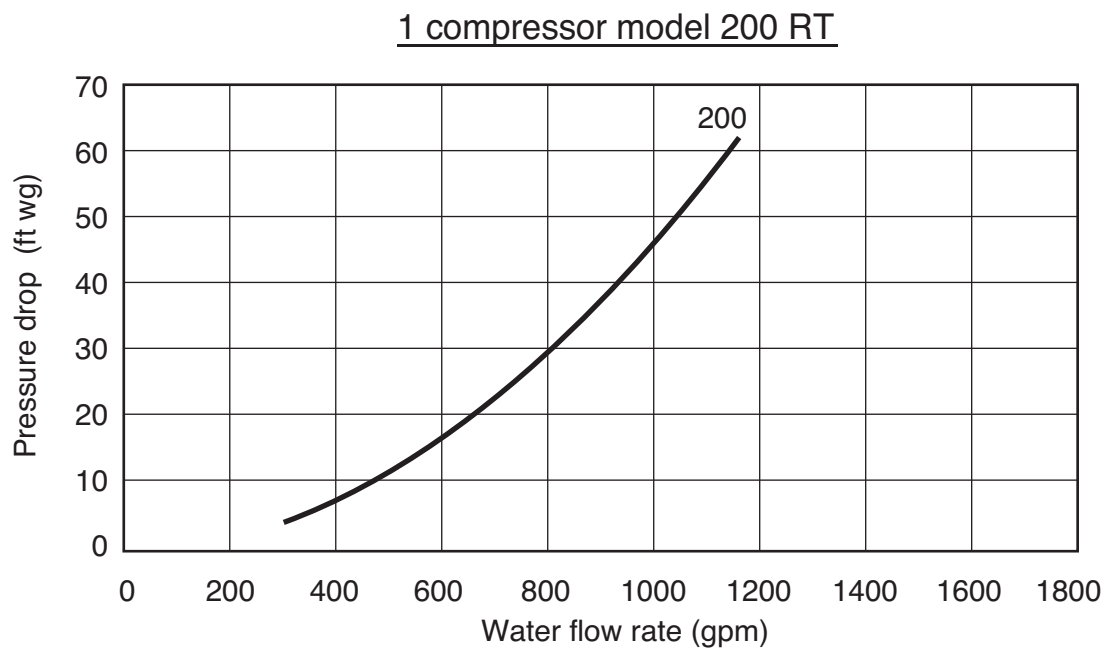
Table 10

Water Pressure Drop (Condenser)

Cooling water pressure drop (SI Unit)



Cooling water pressure drop (English Unit)

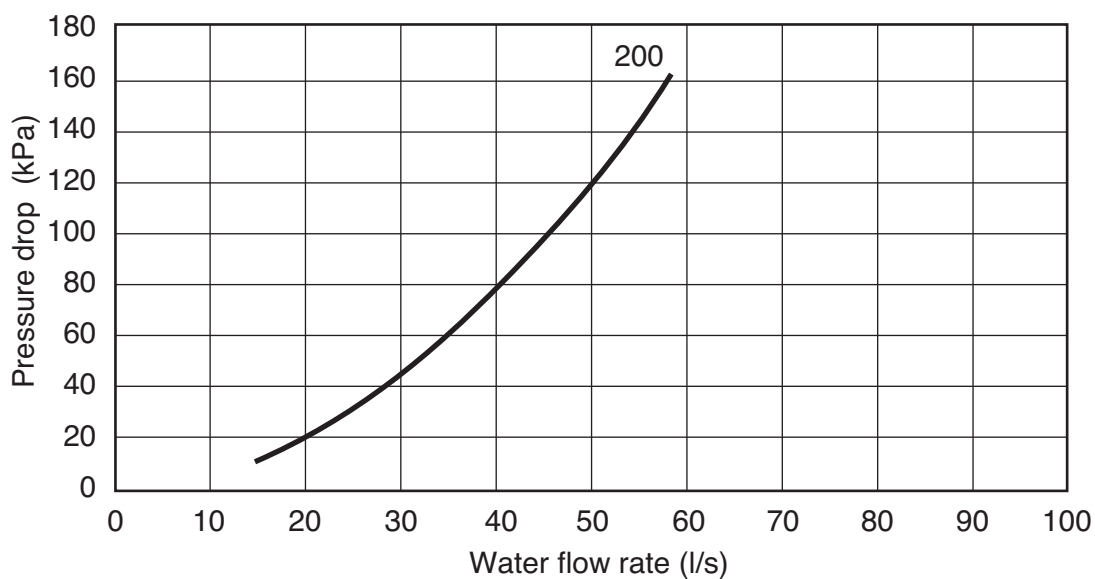


Note: For flow out of this range, consult LG.

Water Pressure Drop (Evaporator)

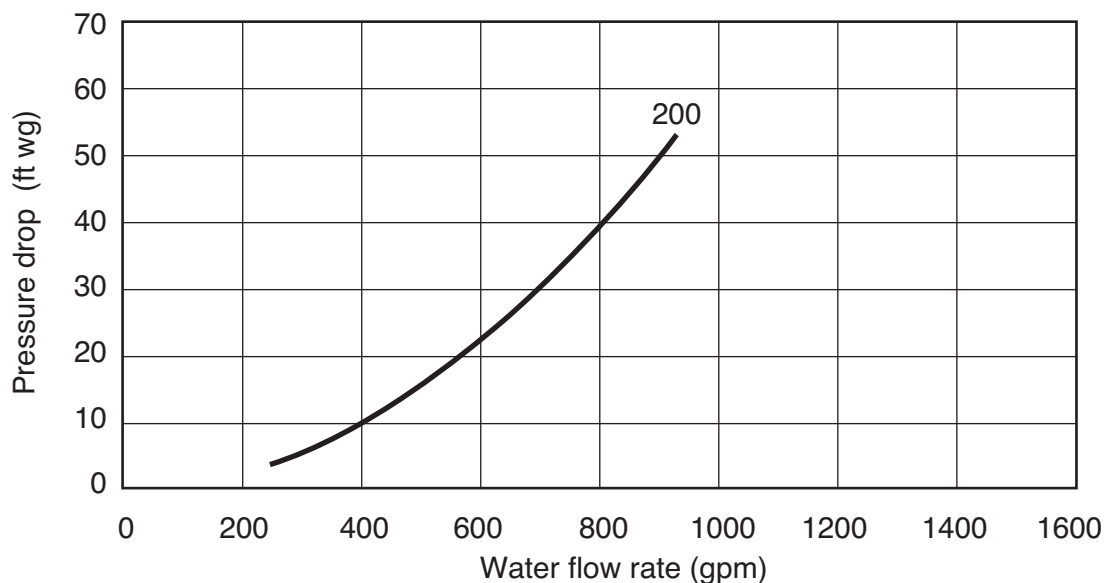
Chilled water pressure drop (SI Unit)

1 compressor model 200 RT



Chilled water pressure drop (English Unit)

1 compressor model 200 RT



Note: For flow out of this range, consult LG.

OPERATION

■ Operation Sequence

When the chiller starts the water pumps will start to operate at the same time. Also the SV1 will be turned on at minimum load location of the compressor. Also after the water pumps operates for 9 seconds, the chiller cold water and cooling water flow will be checked.

If there is any issue with the water flow, the start will be delayed. When the operation is delayed for 30-60 seconds, the cold water leaving temperature and cooling water leaving temperature will be checked to validate whether the water temperatures are high enough to operate the compressor. When the PLC decides to turn on the compressor, it will start the compressor at start and transmit to delta start in 4 seconds. When the compressor starts, the compressor contactor checks to validate if there is any issue in the feedback from the contactor and also checks whether the SV1 oil solenoid valve is opened for appropriate oil circulation.

After start, the normal controller will be initialized. Normal control includes capacity control, mid pressure cooling control to cool the motor and the alarm control. When the chiller must be stopped, the operating condition of the compressor will turn on SV1 and SV2 to change to minimum capacity location. 60 seconds after the stopping is delayed, the compressor will be stopped.

Even when the compressor is stopped, the chilled water pump will prevent the compressor from restarting and operate for another 4-10 minutes to remove the latent heat from the evaporator of the chiller.

Stop delay and water pump operation delay can be set from the delay setting screen of HMI.

Delays of control for the chiller are two essential delays. One is the Start delay from the indicated Stop and the other is the oil preheat delay. Start delay from Stop is the period between the time the compressor is stopped and the compressor is restarted. The basic setting of delay is 10 minutes. Delay is designed to protect the frequent re-operation. The other delay, oil preheat delay, only operates after the power is initialized. Delay can be set through the user setting of HMI device. Delay is designed to prevent the oil from circulating incorrectly in the cooling cycle of the chiller in low surrounding condition.

■ Sensors

Negative Temperature Coefficient

Negative Temperature Coefficient is used to check the cold water inlet temperature, cold water outlet temperature, coolant water inlet temperature, coolant water outlet temperature and compressor discharge temperature.

- ◆ Cold water inlet temperature Sensor
- ◆ Cold water outlet temperature Sensor
- ◆ Coolant water inlet temperature Sensor
- ◆ Coolant water outlet temperature Sensor
- ◆ Compressor discharge temperature Sensor

The resistance of the measured temperature is as follows.

NTC Thermistor Temperature Vs Resistance Table							
Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
-40	235.83	2	25.76	44	5.07	86	1.46
-39	221.67	3	24.67	45	4.9	87	1.42
-38	208.47	4	23.61	46	4.74	88	1.38
-37	196.16	5	22.59	47	4.59	89	1.35
-36	184.67	6	21.63	48	4.44	90	1.31
-35	173.94	7	20.72	49	4.3	91	1.28
-34	163.92	8	19.85	50	4.16	92	1.25
-33	154.55	9	19.02	51	4.03	93	1.22
-32	145.79	10	18.23	52	3.9	94	1.19
-31	137.59	11	17.48	53	3.78	95	1.16
-30	129.91	12	16.77	54	3.66	96	1.13
-29	122.72	13	16.09	55	3.55	97	1.1
-28	115.98	14	15.44	56	3.44	98	1.08
-27	109.66	15	14.82	57	3.33	99	1.05
-26	103.74	16	14.23	58	3.23	100	1.02
-25	98.18	17	13.67	59	3.13	101	0.99
-24	92.95	18	13.13	60	3.04	102	0.98
-23	88.04	19	12.62	61	2.95	103	0.95
-22	83.43	20	12.13	62	2.86	104	0.93
-21	79.1	21	11.67	63	2.78	105	0.91
-20	75.02	22	11.22	64	2.69	106	0.89
-19	71.18	23	10.8	65	2.61	107	0.87
-18	67.57	24	10.39	66	2.54	108	0.85
-17	64.16	25	10	67	2.47	109	0.83
-16	60.95	26	9.63	68	2.4	110	0.81
-15	57.93	27	9.27	69	2.33	111	0.79
-14	55.07	28	8.93	70	2.26	112	0.77
-13	52.38	29	8.6	71	2.2	113	0.76
-12	49.84	30	8.29	72	2.14	114	0.74
-11	47.44	31	7.99	73	2.08	115	0.72
-10	45.17	32	7.71	74	2.02	116	0.71
-9	43.02	33	7.44	75	1.96	117	0.69
-8	40.99	34	7.17	76	1.91	118	0.68
-7	39.08	35	6.92	77	1.86	119	0.66
-6	37.27	36	6.68	78	1.81	120	0.65
-5	35.55	37	6.45	79	1.76	121	0.63
-4	33.92	38	6.23	80	1.71	122	0.62
-3	32.38	39	6.01	81	1.67	123	0.61
-2	30.92	40	5.81	82	1.62	124	0.59
-1	29.54	41	5.61	83	1.58	125	0.58
0	28.22	42	5.43	84	1.54	126	0.57
1	26.98	43	5.24	85	1.5	127	0.56

Table 11

SERVICE

■ Cycle Part

The structure of the cooling cycle of the water cooled chiller is shown below.

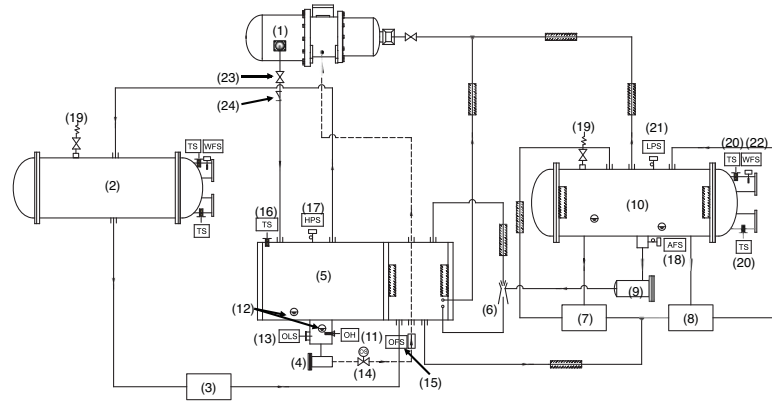


Fig. 16

No.	PART	No.	PART	No.	PART	No.	PART
(1)	Compressor	(7)	Flux controller	(13)	Flux switch	(19)	Safety valve
(2)	Condenser	(8)	Flux controller	(14)	Oil solenoid valve	(20)	Temperature Sensor
(3)	Receiver tank	(9)	Dryer	(15)	Oil flux switch	(21)	Low pressure switch
(4)	Oil filter	(10)	Evaporator	(16)	Temperature Sensor	(22)	Water flux switch
(5)	Oil separator/Economizer	(11)	Oil heater	(17)	Oil high pressure switch	(23)	Refrigerant solenoid valve
(6)	Flux controller	(12)	Sight glass	(18)	Anti-freeze prevent switch	(24)	Check valve

Table 12

Compressor

The unit is equipped with semi-hermetic screw compressor developed especially for applications in air-conditioning. The construction of the compressor is shown in the below.

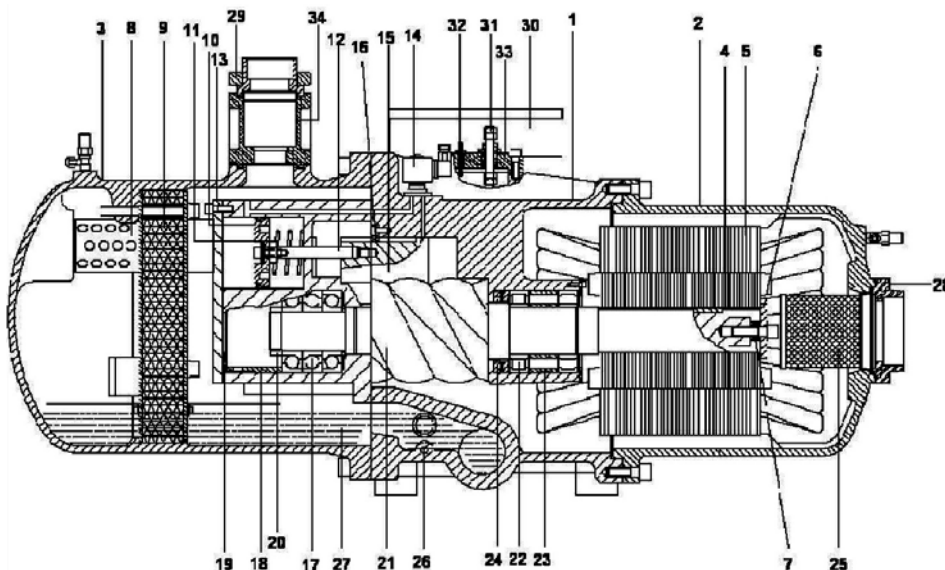


Fig. 17

No.	Description	No.	Description
1	Compressor case	18	Bearing fixation ring
2	Motor case	19	Disk spring
3	Oil separator	20	Bearing lock nut
4	Motor rotor assembly	21	Water rotor
5	Motor stator assembly	22	Suction bearing
6	Motor rotor washer	23	Internal/External spacer ring of suction bearing
7	Motor rotor spacer ring	24	Oil induction ring
8	Oil separator divider	25	Suction filter
9	Oil separator cartridge	26	Oil heater
10	Piston	27	Refrigerator lubrication oil
11	Piston spring	28	Suction flange
12	Piston rod	29	Discharge flange
13	Bearing cover plate	30	Cable box
14	Capacity control solenoid valve	31	Power bolt
15	Slide valve	32	Thermostat terminal
16	Slide valve key	33	Motor cable cover plate
17	Discharge bearing	34	Check valve

Table 13

As shown below, the gear of the rotor moves from the suction to discharge side as the rotor rotates. The corresponding rotor wraps the compression space and continuously reduces the volume as it moves in axis direction. Due to this, the lobe space is formed between the male and female lobe. This lobe space increases to maximum size (Suction and seal process). As the rotor rotates, the lobe space of V shape is closed by the new locking from the suction side. The lobe space will continue to shrink as the lobe process (Compression process) progresses.

The reduction in lobe space occurs at the bottom side of the rotor from the discharge aspect. Volume will gradually be reduced and will be compressed in sealed condition. The peak of the gear of the rotor will be loosened with the discharge port simultaneously and the suction gas will be discharged to the high pressure side as the lubrication oil of the discharged gas will be separated in the oil separator. The size and shape of the discharge port is decided by the "Internal compression ratio (V_i)" of the compressor. This ratio must have the relationship defined by the operating pressure ratio to avoid the efficiency loss from high or low pressure axis.

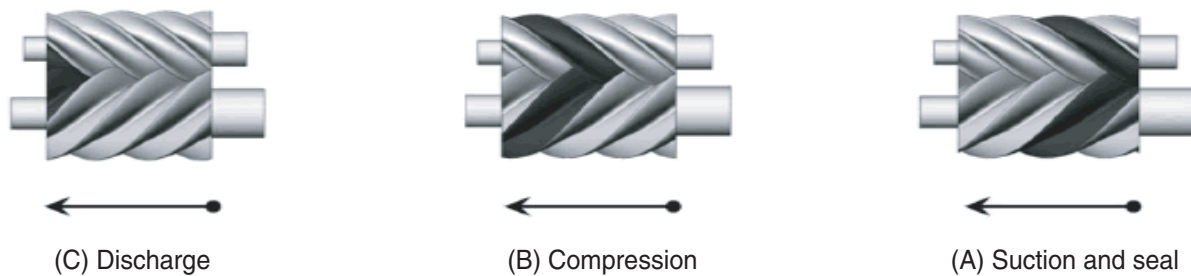


Fig. 18

Screw compressor has the 3~4 gear control or no gear capacity control (Step-less) system installed. Capacity control system is composed of the slide valve, piston rod, cylinder, piston and piston ring. The slide valve and the piston are connected through the piston rod. The operating principle is to push the piston to the cylinder by using hydraulic pressure. Because the pressure of the oil is higher than the spring force, the oil that passed through the oil filter will fill the cylinder through the capillary pipe through the sump. Differential pressure moves the piston to the right side of the cylinder. When the slide valve moves to the right, the effective compression volume inside the compression compartment increases. This increases the displacement of the refrigerant and increases the cooling capacity. But, when the power is supplied to the solenoid valve, the oil in the piston cylinder moves to the suction port and the piston and slide valve moves to the left side, and part of the refrigerant goes around from the compression compartment to the suction end again. In result, the cooling capability is reduced due to the reduction of displacement of the refrigerant flowing inside the system.

Piston spring pushes the piston to its original place, that is minimum load location, to reduce the operating current in the next start up. When the compressor starts from maximum load capacity, it can cause start up in over-current situation. Capillary pipe is used for maintaining and limiting the appropriate amount of oil to flow into the cylinder. Adjustment (Step-less) solenoid valve (SV1, SV2) is controlled by small controller or temperature switch and can be adjusted to make the piston move smoothly for more stable cooling capacity.

If the oil filter cartridge, capillary pipe or adjustment solenoid valve do not operate inside the system, this can cause malfunctioning or inefficiency operation of capacity control system.

To reduce the pressure inside the cylinder before the compressor stops, the unloading valve or solenoid valve of the lowest step must be maintained for 20-30 seconds. For next start up, it must be located in unload position for normal start up.

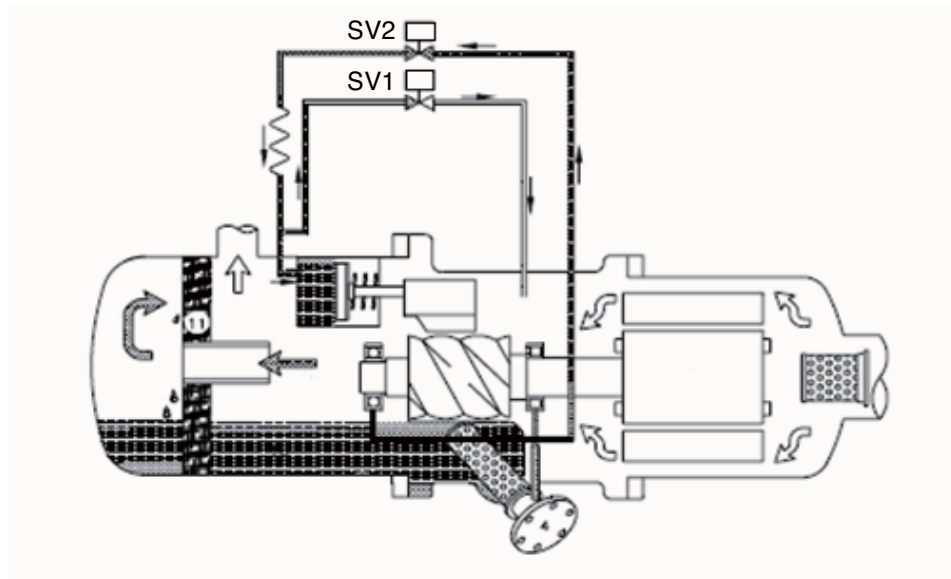


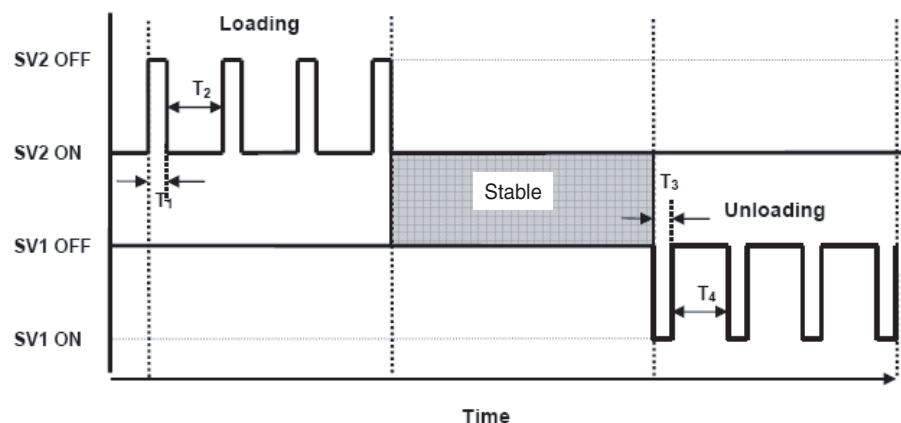
Fig. 19

Solenoid valve (SV2) opened in no gear capacity control and closed solenoid valve (SV1) are installed on the inlet and outlet of the piston cylinder. Because the solenoid valve is controlled by the temperature controller of the freezer, the cooling capability control is controlled within 33%~100% (RC10~11) and 25%~100% (RC12~24). Therefore, the solenoid valve (SV2) of the inlet and solenoid valve (SV1) of the inlet can be controlled to control the cooling capability in stable condition.

The no gear capacity control system is related to the controller to control the system in the desired condition. It is very important to control the load and unload from the controller in stable condition. If the load changes suddenly, install the orifice valve additionally for a more stable control.

	SV1(NC) [Unloading]	SV2(NO) [Loading]
Start	Energize	Energize
Loading	Not Energize	Not Energize
Unloading	Energize	Energize
Stable	Not Energize	Energize

Table 14



ON : Solenoid valve energized
OFF : Solenoid valve not energized

T_1, T_3 : Pulse time 0.5 ~ 1.5 seconds
 T_2, T_4 : Pause time 10 ~ 20 seconds

Fig. 20

Main function of the lubrication oil within the screw compressor is to lubricate, seal internally, cool and control the capacity. Hydraulic pressure within the cylinder moves the piston connected to the piston rod and the slide valve back and forth. The design of screw compressor includes the lubrication system by the differential pressure between the high and low pressure, and does not require separate installation of additional oil pump within the compressor. But for some special equipment, additional installation of the oil pump is required for safety purposes.

Bearing used in the compressor requires small but a certain amount of lubrication oil and the reason for inserting the oil into the compressor compartment is to increase the efficiency and to create an oil seal within the compression housing to absorb the compression heat. To separate the oil from the refrigerant with the oil mixed, the oil separator is designed to let minimum amount of oil get into the system. Special care is needed for the temperature, which is the significant element in the life of the compressor bearing. High oil temperature reduces the viscosity and deteriorates the lubrication within the compressor and the heat absorption condition. It is recommended to maintain the oil viscosity at 10mm²/s or above at any temperature range. Oil temperature must be maintained to system condensation temperature or above to avoid the mixed refrigerant from penetrating into the system during summer. Oil viscosity must be high and the compressor must have high durability when the external temperature is low to reduce the hydraulic pressure within the oil pipe to load the compressor. A better solution is to preheat the oil to create higher condensation temperature in a short period of time.

Compressors must be installed on the 2 sight glass by default and one is the sight glass for the top and the other for the bottom. Normal flux within the compressor oil tank must be maintained above the top range of the bottom sight glass and the middle level of the top sight glass when the compressor is operating. The applicable oil type is shown below.

		Unit	CPI SOLEST					MOBIL EAL		ICI EMKARATE		
			68	120	170	220	370	68	100	RL411	RL375	RL421
Color, ASTM		-	-	-	-	-	-	0.5	0.5	1.5	L2.0	L1.0
Specific weight		-	0.945	0.94	0.95	0.95	0.955	0.971	0.966	0.9723	0.9783	0.9759
Viscosity	40°C	mm²/s (cSt)	64	131	175	215.9	385.96	62.5	95.8	48	74.1	134
	100°C		8.9	14.53	16.5	20.8	29.23	8.3	10.5	7.3	10.1	15
Ignition point		C	266	254	265	271	302	254	260	273	246	265
Pour point		C	-43	-36.5	-30	-25	-21	-43	-37	-40	-35	-37
T.A.N		Mg KOH/g	-	-	-	-	-	-	<0.05	<0.05	<0.05	-
Copper stain 100C /3time		-	-	-	-	-	-	-	-	-	-	-
Humidity		ppm	-	-	-	-	<100	<100	-	-	-	-
Sediment generation point		C	-	-	-	-	-	-	-	-	-	-
Insulation durability 2.5mm		kV	-	-	-	-	-	-	-	-	-	-

Table 15

Symptom	Cause	Solution
Compressor is not operating	Wire open Control fuse open High pressure switch (HPS) stop Connection to terminal in loose condition Incorrectly connected controller	Check unconnected part Check grounded or shorted condition of control circuit. Replace fuse Use navigator to initialize current alarm Check connection from CCP to contactor Check and reconnect wire
	Excessive voltage drop	Check wire voltage Decide voltage drop location and resolve defect
	Compressor motor defect	Check motor coil open or short condition Replace compressor if necessary
	Compressor abnormal stop Prior lubrication defect.	Replace compressor Check oil pump operation, check oil pressure converter, check oil. solenoid valve operation
Abnormally low pressure stopped the compressor operation	Leakage Defect converter Insufficient refrigerant Defective expander Full/Partial clog in strainer	Repair and recharge leakage part Replace converter Add refrigerant Repair/Replace as needed Disassemble and clean strainer
Abnormally high pressure stopped the compressor operation	High pressure switch malfunction Compressor discharge valve partially closed. Condenser water pipe clogged. Issue of condenser scale	Replace switch Open valve or replace valve with defect Check pipe. Repair or replace defect Clean condenser
Long or continuous chiller operation	Insufficient refrigerant charged amount Control fuse issue Full/Partial clog in strainer Insulation defect Service load above design capacity Inefficient compressor	Add refrigerant Replace controller Clean or replace Replace or repair Review load condition Check loader solenoid valve and replace if necessary
Abnormal noise	Pipe vibration	Install support pipe if necessary
	Expansion valve noise	Add refrigerant Check clogged pipe strainer
	Compressor noise	Replace compressor (Worn bearing) Check loose bolt for compressor on the chiller
Oil loss of compressor	Leakage from system Mechanical damage of rotor	Identify and repair leakage Replace compressor
High temperature pipe	Insufficient refrigerant from leakage	Repair and recharge leakage
Low temperature pipe	Stop valve is partially closed or limited	Open valve or remove limit
Compressor loader abnormal operation	Electronic coil defect Loading solenoid valve defect Misconnected solenoid valve	Replace coil Replace valve Connect the wire correctly

Table 16

To protect the compressor, there are 2 PTC temperature Sensors installed inside the gas discharge side of the compressor and inside the motor coil. These Sensors are connected to INT69 control module to check the motor coil temperature and discharge gas temperature. When the temperature of one location of the areas that can be checked, exceeds the set response temperature of each PTC thermistor, the Sensor resistance increases and the INT69 control module is blocked from the motor contactor. The block temperature of the motor coil temperature is 120°C and the temperature to restart the operation is 75°C. The compressor discharge productive block temperature is 110°C and the temperature to restart the operation is 60°C. The troubleshooting of the compressor is described in the above table.

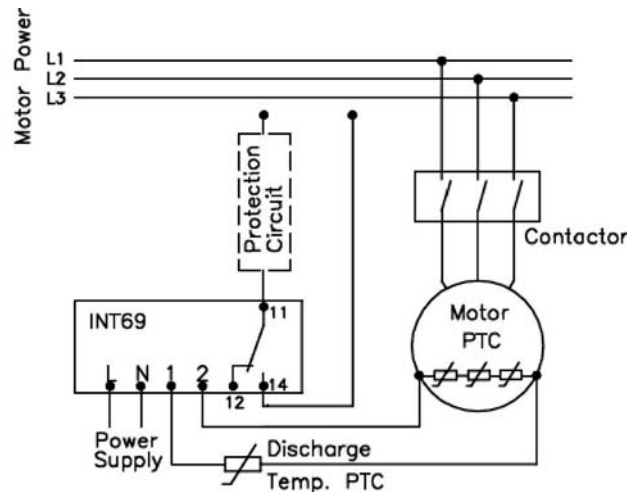


Fig. 21

Heat Exchanger

◆ Evaporator

In the chiller, shell and tube type evaporator must be installed. The evaporator has the internal structure of spraying the liquid refrigerant to the outer wall of the heat exchange tube. This structure increases the heat exchange efficiency at the designed pressure of 1.0MPa and the evaporation temperature is higher than the dry type evaporator by 3~4°C.

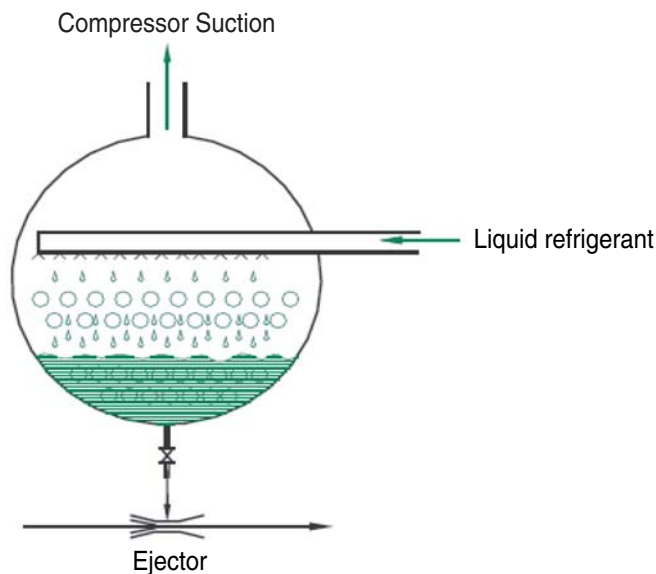


Fig. 22

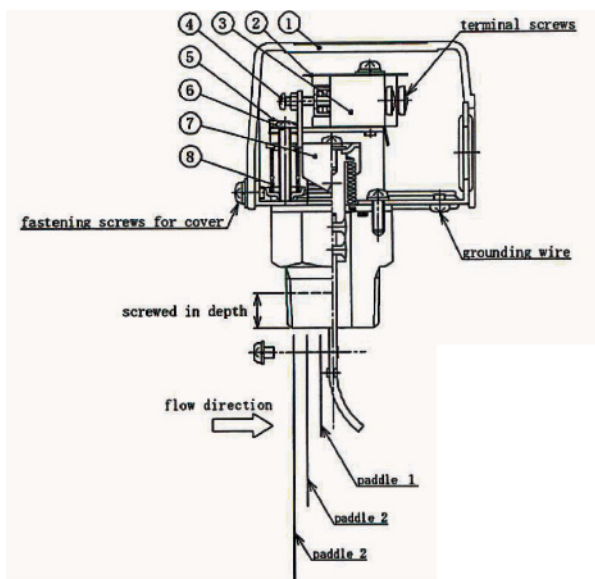
◆ Condenser

Condenser uses the shell and tube type. Internal structure reduces the condensation temperature by 1~2°C compared to other products in 1.0 MPa design condition by improving the general condenser structure.

Safety Device

◆ Flow Switch

Flow switch is installed on the water outlet nozzle of all device as basic setting. The following figure shows the flux switch installed in general method.



No.	Part name	QTY
①	Cover	1
②	Insulation board	1
③	Micro switch	1
④	Adjustment screw	1
⑤	Metal installation for flow adjustment screw	1
⑥	Flow adjustment screw	1
⑦	Operating plate	1
⑧	Adjustment spring	1

Table 17

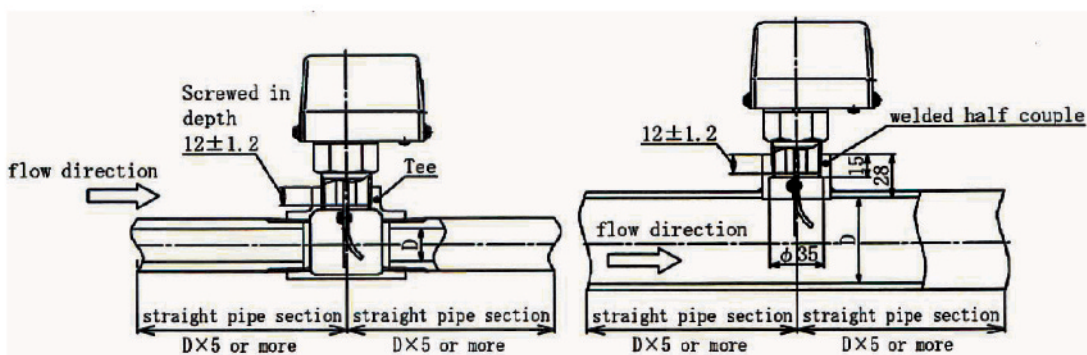


Fig. 23

◆ Dual Pressure Switch

Dual pressure switch has the low pressure block switch and high pressure block switch equipped. The blocking pressure can be adjusted. Default setting is shown below.

Low pressure block	3.2kgf/cm ²
High pressure block	10.5kgf/cm ²

Table 17

Low pressure switch and high pressure switch are closed in normal conditions and when the detected pressure exceeds the set value, it will open. After recovering from high or low pressure condition, the switch will automatically return to normal location.



Fig. 24

◆ Differential Pressure Switch

Differential pressure switch is used for checking the lubrication problem. When the differential pressure between the condenser and evaporator is higher than the set value (4kgf/cm²), the switch will be closed. On the other hand, if the value is below the set value, the switch will be open. This switch will automatically be closed when the differential pressure is recovered to below set value.



Fig. 25

In the following cases, differential pressure switch works frequently.

- 1) In case of which condensation temperature is too low because of low outdoor air temperature
- 2) In case of which cooling water temperature is too low because of cooling water flow rate is too high
- 3) In case of which cooled water temperature doesn't lower, because of cooled water flow rate is too high
- 4) In case of which cooled water temperature doesn't lower, because cooling load is too high

In this case, an operator operates the machine to generate discharge/suction pressure difference by controlling cooling tower fan, cooling water flow and cooled water flow in the equipment following direction.

- 1) Install 3-way valve to control cooling/cooled water flow rate
- 2) Use Inverter type pump to control cooled water flow rate
- 3) Control cooling tower fan by manual until cooling water temperature reach proper status

◆ Anti-freezing Switch

Anti-freezing switch is used for detecting very low temperature. In normal condition, the switch is closed and when the cold water outlet temperature is below 2°C, it will be open. When the temperature rises by 5°C or more, it will return to its normal condition. Anti-freezing switch is installed on the evaporator.



Fig. 26

Refrigerant Cycle

◆ Leakage Test

As described in the installation manual, the chiller must be charged with sufficient set amount of refrigerant R134a. When the refrigerant pressure is below the initial setting, the leakage test must be done. When the pressure within the chiller drops, use nitrogen for the leakage test. When repairing a leaking part, you must use a good refrigeration practice. After the leaking part is repaired, the water inside the chiller must be removed completely to form a vacuum condition.

◆ Refrigerant Charge

Insert the coupling to the refrigerant charge port. To prevent the damage of the tube from freezing of the residual moisture inside the evaporator, you must circulate the water in the evaporator and condenser, charge the set amount of refrigerant. For the amount of refrigerant to charge, refer to the installation manual or PDB.

◆ Oil Charge

Insert the coupling to the oil gas port. Check in the sight glass window on oil separator that more than 1/2 of oil is shown. Remove the coupling and insert the oil supply port cap. After supplying the oil and operating the product, check with the naked eye whether the sight glass has more than 1/2 or oil. If the amount of oil is not 1/2 or above, supplement the oil.

◆ Oil Filter

Oil filter is installed on the oil separator on the pipe that returns the oil to the compressor. The differential pressure between the inlet and outlet of the oil filter must be checked periodically. Core valve to connect the inlet/outlet equipped with the pressure gauge on the oil separator must be installed. If the differential pressure is 4kgf/cm² or above, it is recommended to disassemble the oil filter and wipe the oil filter mesh.

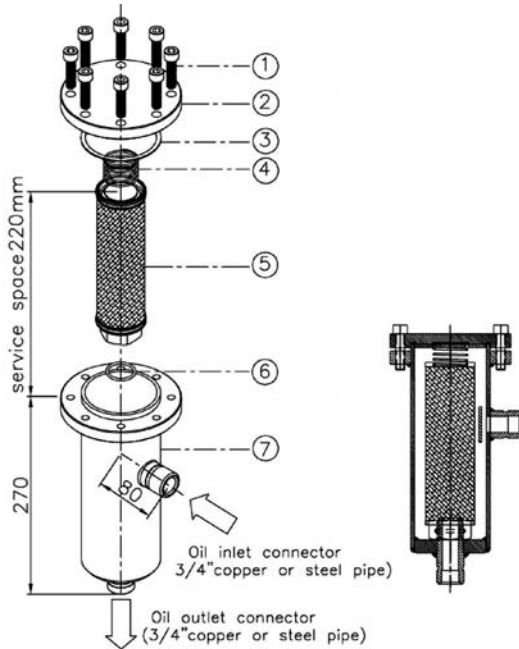


Fig. 27

Item	Name	Note	Qty
①	Bolt	M10 x 40L	8
②	Service flange	Ø136 x 15t	1
③	Gasket	90 x 1.5t	1
④	Spring	Ø37 x 2d	1
⑤	Oil filter cartridge	30 mesh/inch	1
⑥	O-Ring	Ø28.24 x 2.62W	1
⑦	Oil filter main unit	Ø136 x 270L	1

Table 19

◆ Oil Flow Switch

Oil flow switch is also installed on the oil separator on the pipe that returns the oil to the compressor. The setting range of the flow switch is 3.4~4.2 l/min from where the flow rate increases and 3.0~3.8 l/min from where the flow rate decreases. Maximum flow rate of the flow switch is 67 l/min.

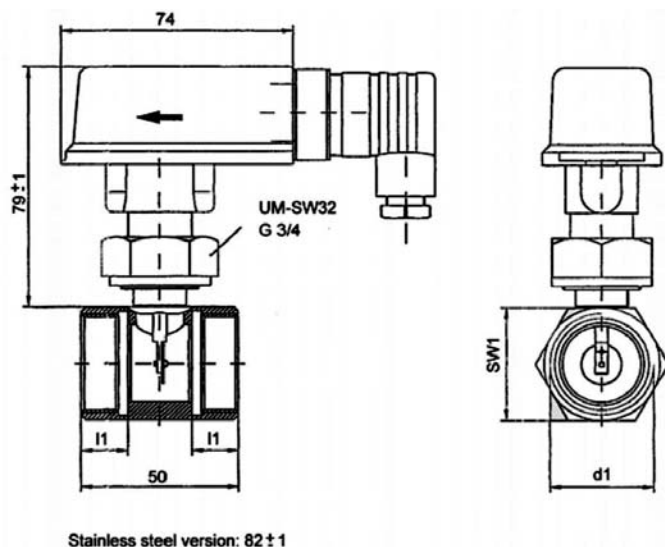


Fig. 28

◆ Oil Heater

Oil heater prevents the lubrication condition from being reduced due to the low viscosity. The oil heater is also installed on the oil separator. 150 W oil heater is equipped with 220 V AC power input.



Fig. 29

◆ Solenoid Valve

Solenoid valve is installed on oil return pipe between oil filter and compressor by factory default. The valve on the oil filter side is turned ON during the device operation so that the oil can circulate to the compressor and when the operation stops, it will be turned OFF so that the oil will not back-flow.

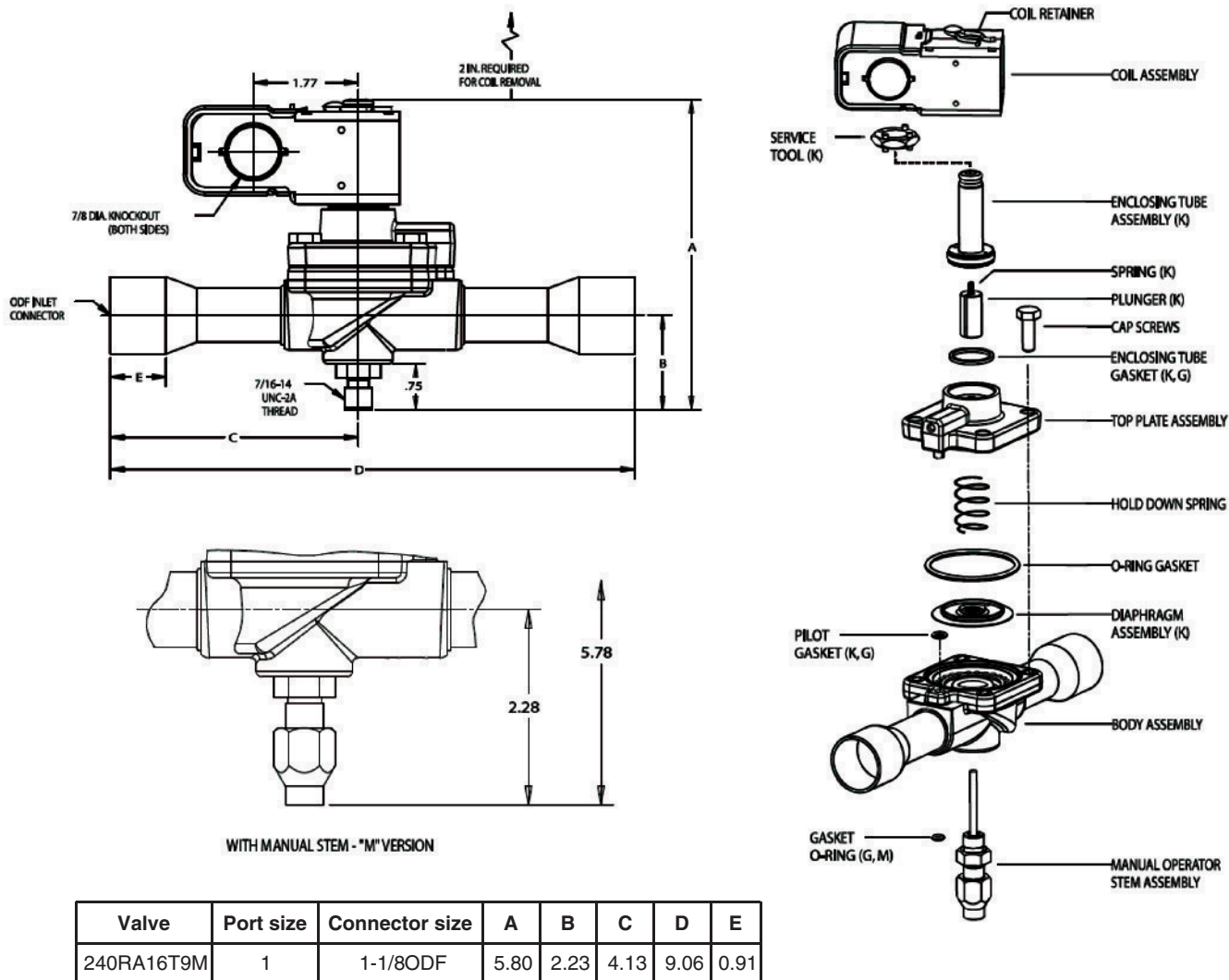


Fig. 30

■ Control System

Structure of power panel and control panel is shown below. Left power panel is composed of the electric parts related to Rated electrical input main power and the right control panel is composed of low voltage parts such as PLC and HMI device.

Panel is designed to be water proof through the dual door system. Panel is not appropriate for IP55.

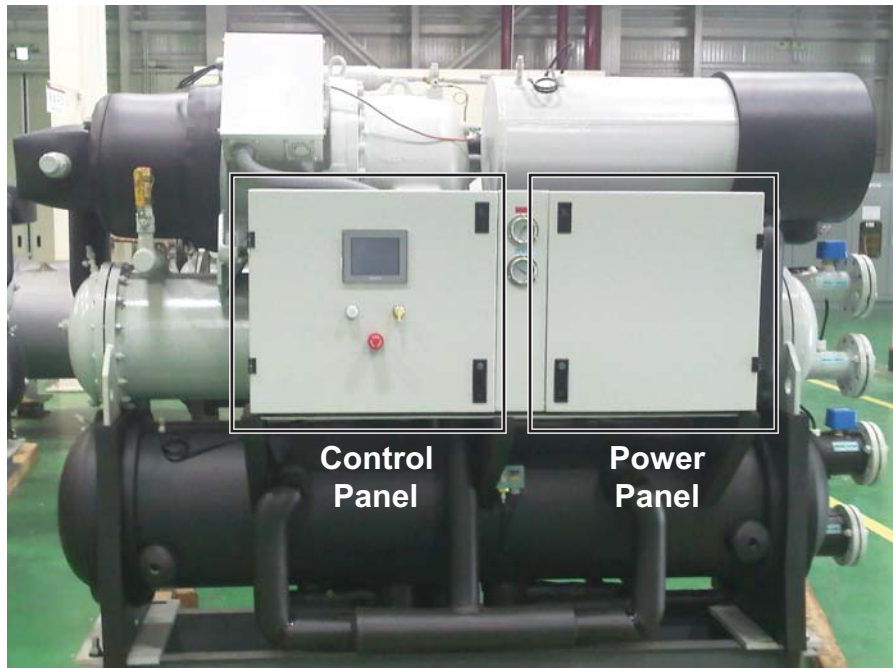


Fig. 31

Power Panel

On the right side of the power panel, the terminal block for the main power connection is installed. This part is connected to the Rated electrical input main power cable for control power and to neutral line to the terminal block.

There is the OCR (Over-Current Relay) for 3 magnetic contactors and compressors to start the Wye-delta of the compressor. 3 magnet contactors are installed to start Wye-delta within the power panel.

The starting inflow of current by Wye-delta start up is reduced by 1/3 by the direct start method. All wire voltages (VL) of Wye and Delta coil configuration are Rated electrical input, but the phase voltage (VP) of the Wye coil configuration is reduced by 1/3 of the Delta coil configuration. Also the line current (IL) is reduced by 1/3 of the Delta coil. By using this principle, the compressor is equipped with the Wye coil configuration. Coil configuration changes to Delta configuration after a few seconds for normal operation of the compressor.

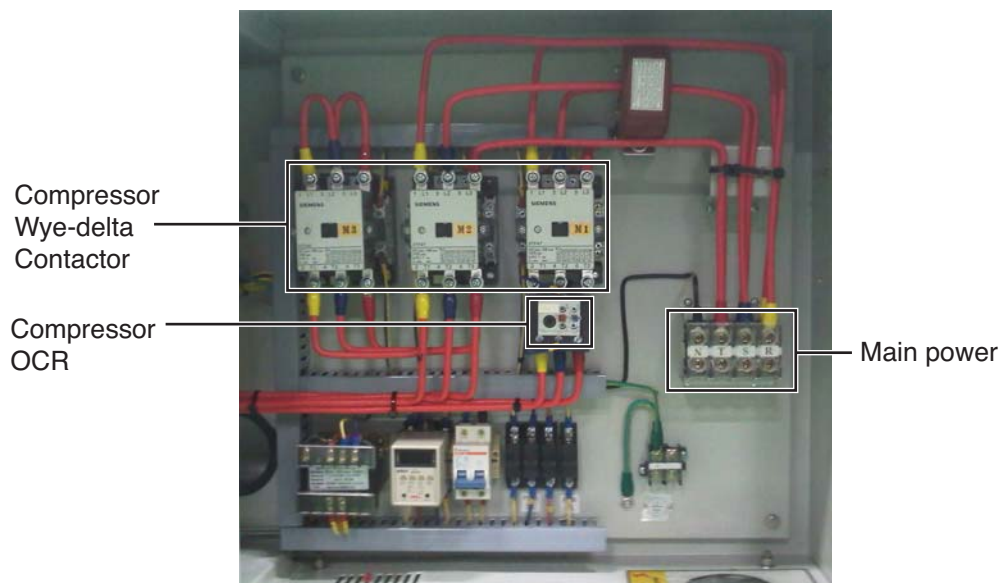
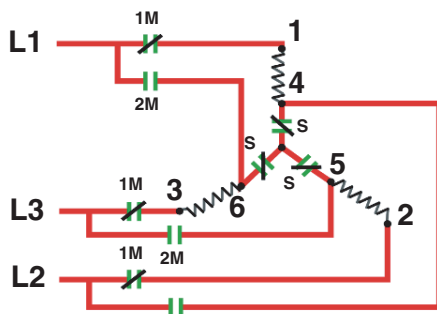


Fig. 32

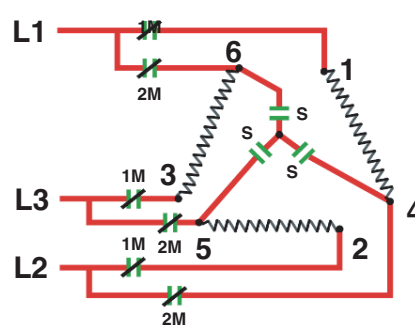
Wye Starting



$$V_P = \frac{V_L}{\sqrt{3}}$$

$$I_L = I_P$$

Delta Running



$$V_P = V_L$$

$$I_L = \sqrt{3} \times I_P$$

Fig. 33

At the bottom right of the power panel, the voltage monitoring relay is to check whether the power is appropriately installed. There are 3 fuses installed for the Rated electrical input power input to the voltage monitoring relay. The ventilation fan of the power panel controls the thermostat. When the internal temperature of the power panel is 35° or above, the ventilation fan will operate.

◆ Compressor OCR (Over-Current Relay)

Compressor OCR is heat type and is used for preventing the compressor from overheating. OCR contact part used for control system is closed when normal and OCR contact switch is open when over-current is detected.

For OCR, the switch on OCR must manually be initialized to recover normally. Tripping point scope and initial setting is are shown below.

Model	Range [A]	Trip[A]
RCWW200RAAA	120~150	140

Table 20

At the bottom right of the power panel, the voltage monitoring relay is to check whether the power is appropriately installed. There are 3 fuses installed for the Rated electrical input power input to the voltage monitoring relay. The ventilation fan of the power panel controls the thermostat. When the internal temperature of the power panel is 35° or above, the ventilation fan will operate.

◆ Voltage Monitoring Relay (5E)

Voltage monitoring relay is used for checking the appropriate power of Rated electrical input. Voltage monitoring relay is show below. Existing 3 phase voltage is displayed in order of every 3 seconds.

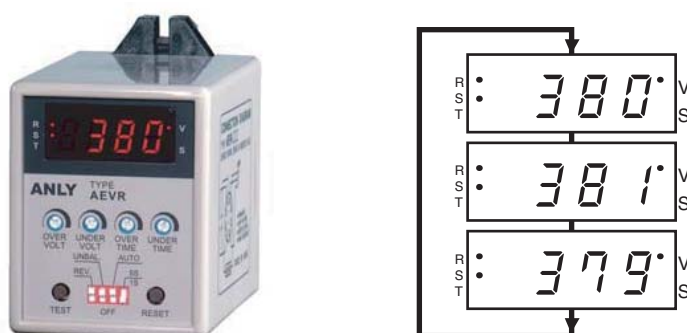


Fig. 34

Voltage monitoring relay monitors 5 abnormal condition of the power. Abnormal conditions include over-voltage, under-voltage, reverse phase, phase loss and voltage unbalance. Of the abnormal conditions, reverse phase and voltage unbalance are selectively protected. The rest are mandatory. In case of an abnormal condition, the abnormal condition type and the abnormal value are shown on the normal display. Partial abnormal conditions are shown below as examples.

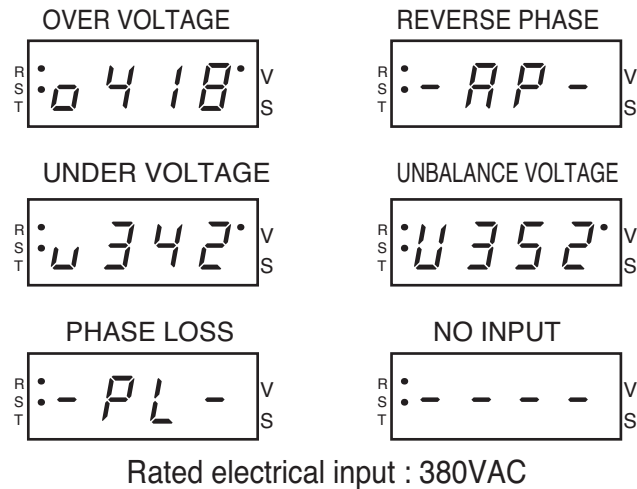
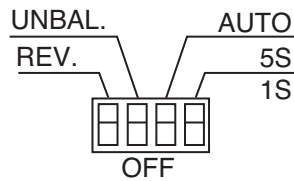


Fig. 35

The DIP switch can be configured in 4 ways based on the selective protection and initialization method. Function of DIP switch is shown below. Based on the default setting, only the switch located on '5S/1S' will be turned OFF and the rest ON. Do not change the initial setting to keep the protection.



REV.	ON	Protect reverse phase
	OFF	Do not protect reverse phase
UNBAL.	ON	Protect imbalance
	OFF	Do not protect imbalance
AUTO	ON	Auto initialization
	OFF	Manual initialization
5S/1S	ON	Auto initialization delay 5 seconds
	OFF	Auto initialization delay 1 second

Table 21

Voltage unbalance trips when the unbalance exceeds more than 3 seconds in the range of +5%. In the same token, phase loss trip delays 2 seconds, and the reverse phase trip delays 0.5 seconds.

Over-voltage trip location and trip delay can be configured through the rotator switch on the voltage monitoring relay. Under-voltage trip location and trip delay can be configured through other rotor switch on the voltage monitoring relay. Default setting of rotary switch is shown below.

Over voltage Value	Rated Voltage(380VAC) : 418VAC Rated Voltage(400VAC) : 440VAC Rated Voltage(415VAC) : 457VAC
Over Voltage Delay	4S
Under Voltage Value	Rated Voltage(380VAC) : 342VAC Rated Voltage(400VAC) : 360VAC Rated Voltage(415VAC) : 374VAC
Under Voltage Delay	4S

Table 22

◆ Assist Relay

Assist Relay is to check whether the power of the controller is 220V. Assist Relay is shown below.

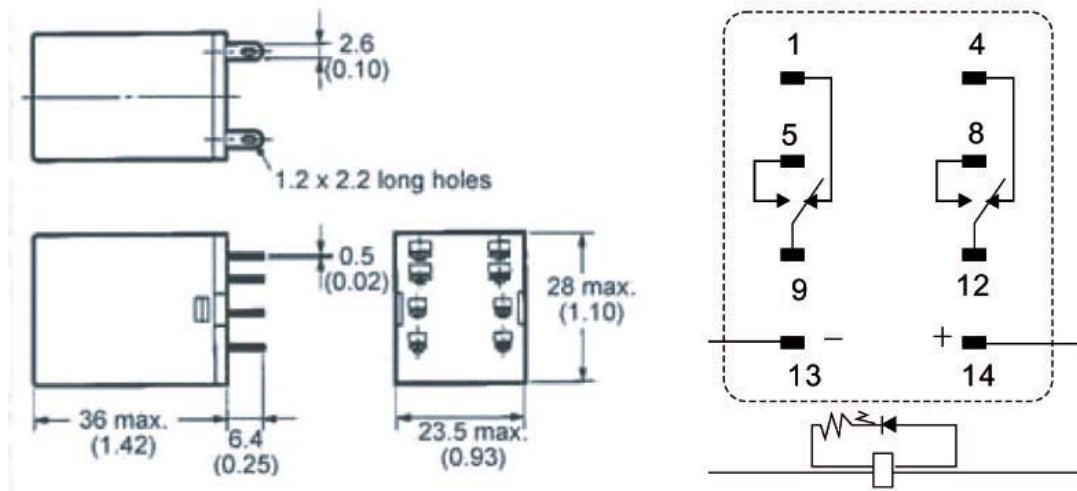


Fig. 36

◆ Compressor Contactor

Compressor contactor starts, stops and controls the fixed range of the compressor motor when the product is operating. The rated voltage of the compressor contactor is rated electrical input.

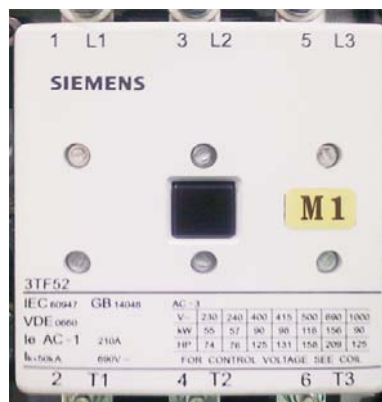


Fig. 37

Control Panel

On the external door of the control panel there is an emergency switch to immediately block the control output from PLC. You can press the emergency switch to instantly block the 220V AC power supplied from the PLC relay. You can turn the switch in clockwise direction to recover the output power.

From the internal door of the control panel, the operator can access the HMI device and depending on the HMI device, the power lamp and Start/Stop/Remote control switches are installed on the door. Start/Stop/Remote switch turns on the control power to the control system, and the remote control switch uses BMS etc. to enable the control. The power condition shows the power lamp etc.

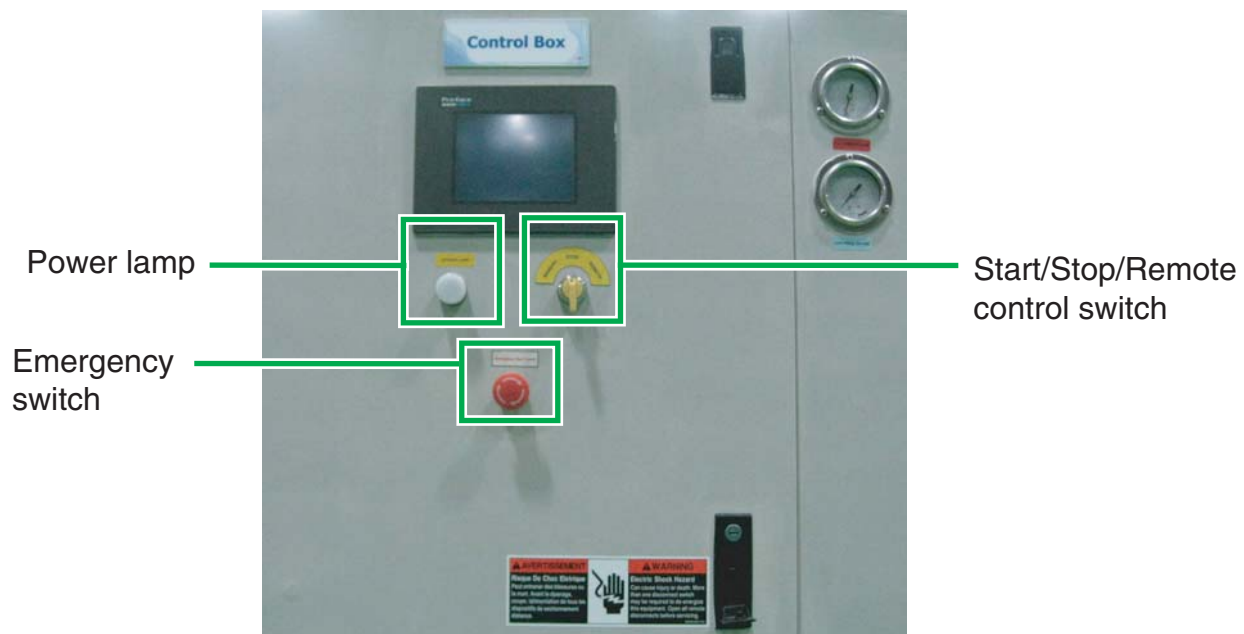


Fig. 38

PLC on the control panel is installed on the central control station. PLC is assembled as HMI in the black box. PLC receives 24V DC power from the right SMPS (Switched mode power).

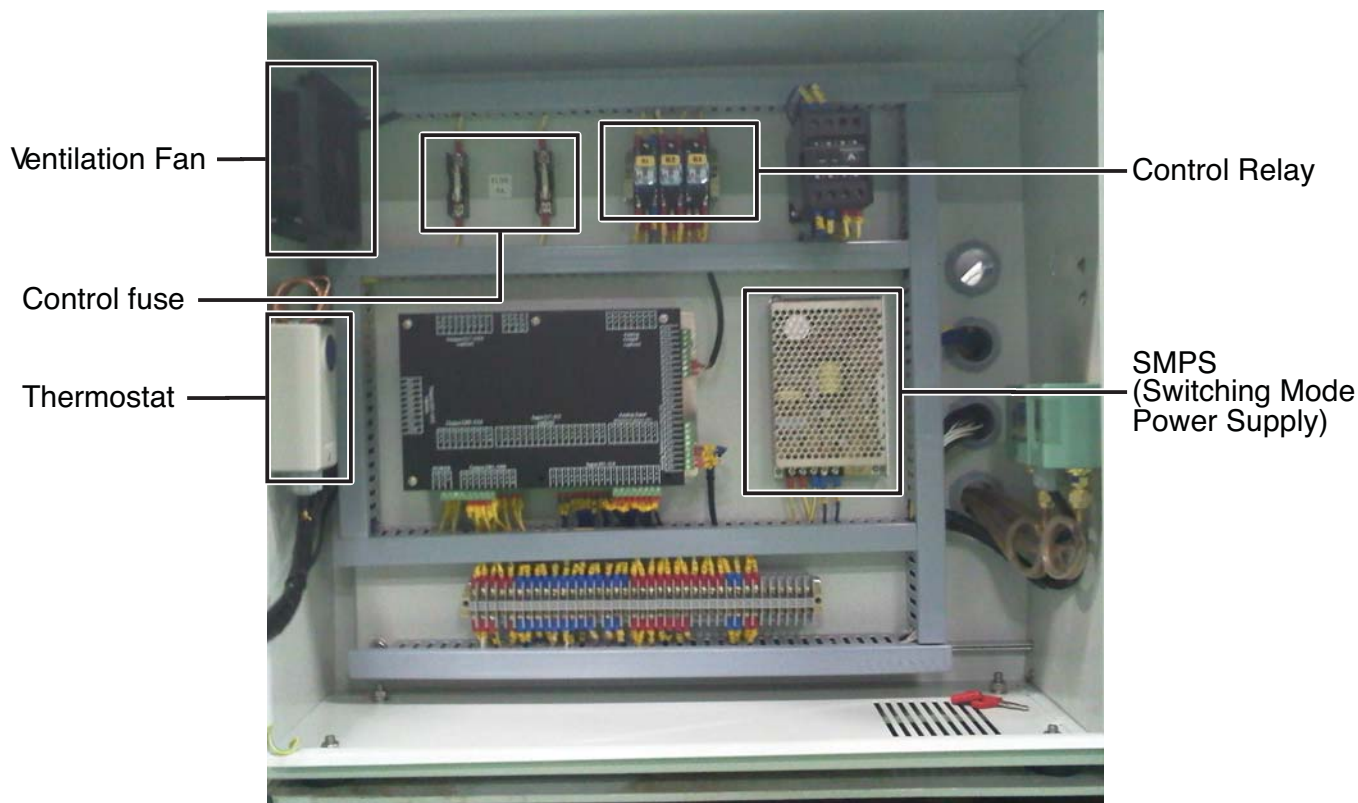


Fig. 39

Relay is to check the appropriateness of 220V AC and the Start/Stop/Remote control switch installed on the door is located at the starting part. The ventilation fan of the control panel operates permanently after the power is turned ON.

◆ Temperature Sensor Inside control Panel

When operating the product, this is used for measuring the temperature inside the control panel. The shape and characteristics are as follows.

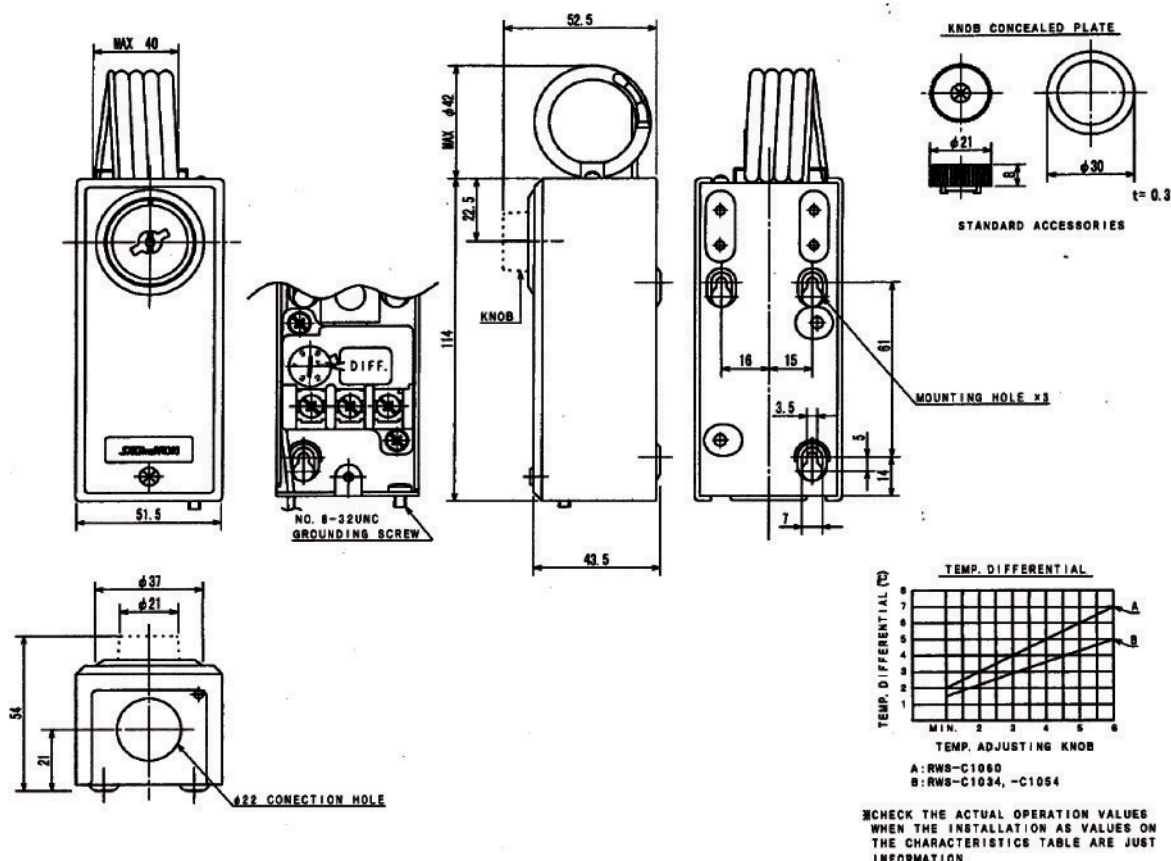


Fig. 40

◆ Ventilation Fan

Ventilation fan has two sides attached; power panel and control panel. This fan sends air externally to respond to the temperature rise within both boxes when the product is operating, to prevent any problem when the temperature of each box rises.

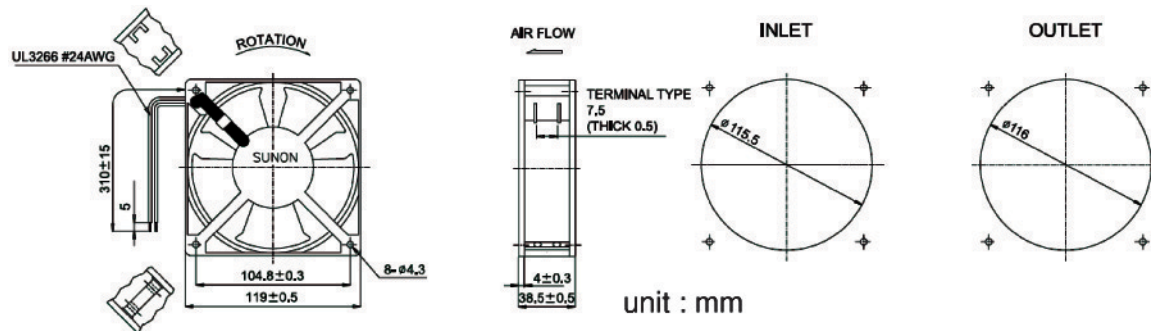


Fig. 41

Maintenance

Maintenance/Repair schedule

Checkpoint	Daily	Monthly	Every 2 months	Every 3 months	Every 6 months	Every 1 year	Every 2 years	Every 3 years	Every 6 years
	10 h	500 h	1000 h	1500 h	2500 h	5000 h	10000 h	15000 h	30000 h
1. Cycle condition	Check	-	-						
2. Electric part	-	Check	Monthly check						
3. Safety switch	-	Check	Monthly check						
4. Cold water, Coolant water circulation system	-	Check	-	Check	Check every 6 months				
5. Evaporator, Condenser cleanness	-	-	-	-	Check every 6 months. When the operating pressure of the cooler is out of the range, clean the unit.				
6. Cooling tower cleanness	-	-	-	Check	Check	Annual clean			
7. Cooling system leakage	-	Check	Monthly check						
8. Oil filter	-	Check	Check	Check	Check every 6 months. Clean if necessary.				
9. Dryer filter	Check	-	-	-	Replace	Annual replacement			
10. Oil amount	Check	Annual check							
11. Oil color	Check	-	-	-	-	Replace	-	-	
12. Compressor insulation	-	-	-	-	Check	-	Annual check		
13. Temperature sensor	-	-	Check	Check every 6 months					
14. Compressor bearing	-	-	-	-	-	-	Check	-	Check or replace

Table 23

TROUBLE SHOOTING

CAUTION

When the device is stopped more than once from the safety device, identify and correct the cause before restarting.

General Malfunction

Before resolving a special trouble shooting, this introduces the general troubles and troubleshooting methods. When the chiller is not operating at all, the power, refrigerant, configuration and alarm setting of the chiller must be checked. To check the power, the voltage connected to the terminal block within the power panel must be checked. If there is no power, check the power supply and check whether the protective device is tripped. When power is properly connected, the refrigerant pressure must be checked by the pressure gauge installed on the chiller, and if the pressure is out of the range, check for any leakage using the soap test. If there is any trouble with the PLC configuration or if the delay time is too long, the chiller will not Start to the Start time and will be significantly delayed. Reset the setting to the default setting before starting the chiller. Lastly you must check the alarm setting. You can check whether the alarm is turned ON through the HMI device. If the alarm is turned ON, follow the alarm troubleshooting procedure.

Generally the compressor of the chiller operates by the cold water outlet temperature, compressor stop temperature and the compressor restart temperature. But, the compressor can operate for a long period of time without circulating. If the refrigerant is not sufficient, the chiller will operate continuously as it cannot be operated at 100% power. In this case, the leakage test must be done. When the magnetic contactor for the compressor contacts mechanically, the chiller will continue to operate as the PLC cannot stop the compressor by the control signal even when the compressor must be stopped. If there is no trouble with the refrigerant and compressor contactor, it can be caused from the air inside the water circulation pipe that blocks the heat exchanger. If air exists, the air must be purged. If there is uncondensed refrigerant in the pipe, it must be removed and recharged. If the temperature is not recognized even after operating the cold water pump or if the compressor does not operate due to the alarm issue, follow the alarm troubleshooting procedure.

Symptom	Potential cause	Potential solution
Chiller does not work.	Chiller power check	Check over-current protector Check whether fuse is not disconnected (If there is a fuse) Power recovery of chiller
	Insufficient refrigerant	Check leakage and add refrigerant
	Incorrect or inaccurate chiller configuration	Check device configuration
	Alarm operated	Check alarm condition. Check separate alarm troubleshooting procedure and follow the troubleshooting direction. To check the alarm condition pressure, check the PLC input channel diagram
	Active operating mode	Check the oil preheat time and temperature reach Check compressor start delay time reach Check cold water outlet temperature Check flux
Compressor operates for a long period of time.	Insufficient refrigerant	Check leakage and add refrigerant
	Compressor or control contactor error	Replace contactor
	Air in cold water circulation pipe	Remove air
	Non-condensed material within refrigerant circuit	Remove and recharge refrigerant
Circuit does not operate at all.	Alarm operated	Check alarm condition. Check separate alarm troubleshooting procedure and follow the troubleshooting direction
	Active operating mode	Check input temperature Check operation and control Check capacity control stop device Check the PLC input channel diagram and check the alarm condition input

Table 24

Alarm

Specific alarm identification method and potential cause of the issue are listed below. To cancel and recover the alarm, remove the cause and delete the alarm detail.

Emergency alarm means that the operator pressed the emergency switch installed on the door of the control panel. This switch input means that the switch input is open, which is normally closed. When the emergency switch is open, the output power to control the output from the PLC is disconnected. Turn the emergency switch in clockwise direction to correct the alarm.

5E relay and voltage monitoring relay send the alarm signal when there is an issue with the power. This issue includes over-voltage, under-voltage, reverse phase, phase loss and voltage unbalance. In case of phase loss alarm, check whether all the fuses are not melted for the power check.

Water flow issue means that there is no water flow or more than 30% of the flow is short from the set value. To resolve this issue, water pump error and insufficient water flow issues must be checked simultaneously.

Pressure issue means that the high pressure switch or low pressure switch is tripped. These are included in the dual input switch. In case of any issue, first check whether there is an appropriate amount of refrigerant within the chiller. If there is no issue with the amount of refrigerant, the contaminated heat exchanger could be the cause. Consider that coolant outlet temperature range operates 20°C~40°C.

Oil issue means that there is no oil flow from the oil separator to the compressor or the amount of oil in the oil separator is too low. This alarm can be checked after the delay time set by the user after the compressor operates.

Delay can be adjusted through the alarm delay setting of HMI device. Insufficient oil must be checked first. If the chiller operates at low ambient temperature without properly preheating the device, the large amount of oil can be left in the evaporator rather than in the oil separator. In this case, the oil from the evaporator must be collected to the oil separator.

The low differential pressure between the evaporator and condenser must be checked through the pressure as the appropriate oil circulation is not ensured.

M1 and M2 are magnet contactors for screw compressor. The malfunctions of the magnet contactor mean that the OCR trip occurred due to the overload condition and the problem of the magnetic contactor itself.

INT69 issue means that abnormally high temperature for the motor coil or compressor discharge inside the compressor terminal box.

The two causes of anti-freeze switch are as follows. Actually the alarm is recognized by the anti-freeze switch of low water temperature detected by the temperature sensor. For low water temperature, the alarm setting temperature can be changed by the HMI.

In case of any mechanically welded contactor problem of the magnetic contactor of the compressor, PLC cannot stop the compressor. Due to this reason, the alarm will not be generated in this case. Therefore, in this case, the circuit breaker in front of the magnet contactor with the error must be turned OFF.

Discharge temperature issue occurs when the compressor discharge temperature is 80°... or above. This occurs when the refrigerant is insufficient or the coolant water outlet temperature is too high.

COMM error issue means the communication error between HMI device and PLC and the loose connection is identified as the frequent cause.

Displayed alarm message	Recognition	Potential cause	Potential solution
Emergency stop	Emergency switch input (Switch off)	Emergency switch trip	Turn the emergency switch in clockwise direction
Dp alarm	After compressor operation differential, pressure switch trip (Switch off) (Basic: DP<4kgf/cm²)	Cold water temperature too high	Review cold water temperature sensor
5E alarm	Voltage monitoring relay trip (Switch off)	- Over-voltage - Under-voltage - Reverse phase - Voltage imbalance - Missing phase	- Check power - Repair or replace 5E protective switch
Flow alarm	After cold water pump, cool water switch (Switch off)	- Cold pump error - Insufficient cold water - Cold water pipe valve closed - flow switch setting or error in device itself	- Repair or replace cold water pump - Purse air and supplement water - Cold water pipe valve open - Change flow switch operation setting value or replace device
Pressure alarm	High pressure switch trip	- Overcharge refrigerant - High pressure switch error - Air mixed to refrigerant - High pressure switch setting is too low - Controller DI point error - Insufficient refrigerant	- Remove overcharged refrigerant - Repair or replace high pressure switch - After removing refrigerant, execute vacuum work and recharge - Increase high pressure switch setting - Repair or replace controller - Charge refrigerant

Displayed alarm message	Recognition	Potential cause	Potential solution
Pressure alarm	Low pressure switch trip	- Insufficient refrigerant - Refrigerant leakage - Low pressure switch setting is too high - Low pressure switch error - Controller DI point error	- Charge additional refrigerant - Necessary test/repair and charge additional refrigerant - Increase low pressure switch setting. - Repair or replace low pressure switch - Repair or replace controller
System oil alarm	Oil amount switch input 120 seconds after the compressor operates (Switch off)	- Oil dryer clogged - Oil service valve error or closed - Oil amount switch error - Controller DI error - Insufficient oil	- Replace oil dryer - Repair or replace oil service valve - Repair or replace flux switch - Repair or replace controller - Charge oil
M1 contactor alarm	After operating the compressor, M1 magnet contractor contact input or overload relay contact input (Switch off)	- M1 error - Compressor overload - Controller DI or DO point error	- M1 repair - Check voltage, clean heat exchanger, repair overload relay, repair or replace compressor - Repair or replace controller
M2 contactor alarm	After operating the compressor, M2 magnet contactor contact input	- M2 error - Controller DI or DO point error	- M2 repair - Repair or replace controller
Compressor overload alarm	Compressor internal protector trip by high coil temperature within compressor (Switch off)	- Voltage error - Controller DI or DO point error - Compressor error - Internal protective switch error	- Check voltage - Repair or replace controller - Test or replace compressor - Test or replace internal protective switch
	Compressor internal protector trip by high temperature discharge temperature (Switch off)	- Insufficient coolant flux - Controller AI point error - Compressor error - Internal protective switch error - External temperature too high	- Charge refrigerant or review valve condition - Repair or replace controller - Test or replace compressor - Test or replace internal protective switch - Check external temperature
Low temperature	Anti-freeze switch trip (Switch off) (Basic: Cold water outlet temperature $\leq 2^{\circ}\text{C}$)	- Insufficient cold water - Cold water outlet temperature setting too low - Anti-freeze setting too high - Anti-freeze switch error - External temperature too low - Controller DI error - Insufficient refrigerant - Evaporator tube contamination - M1 or M2 error	- Increase cold water or replace pump - Increase setting of cold water outlet temperature - Set lower anti-freeze setting - Replace anti-freeze switch - Check external temperature - Repair or replace controller - Supplement refrigerant - Clean evaporator tube - Replace M1 or M2

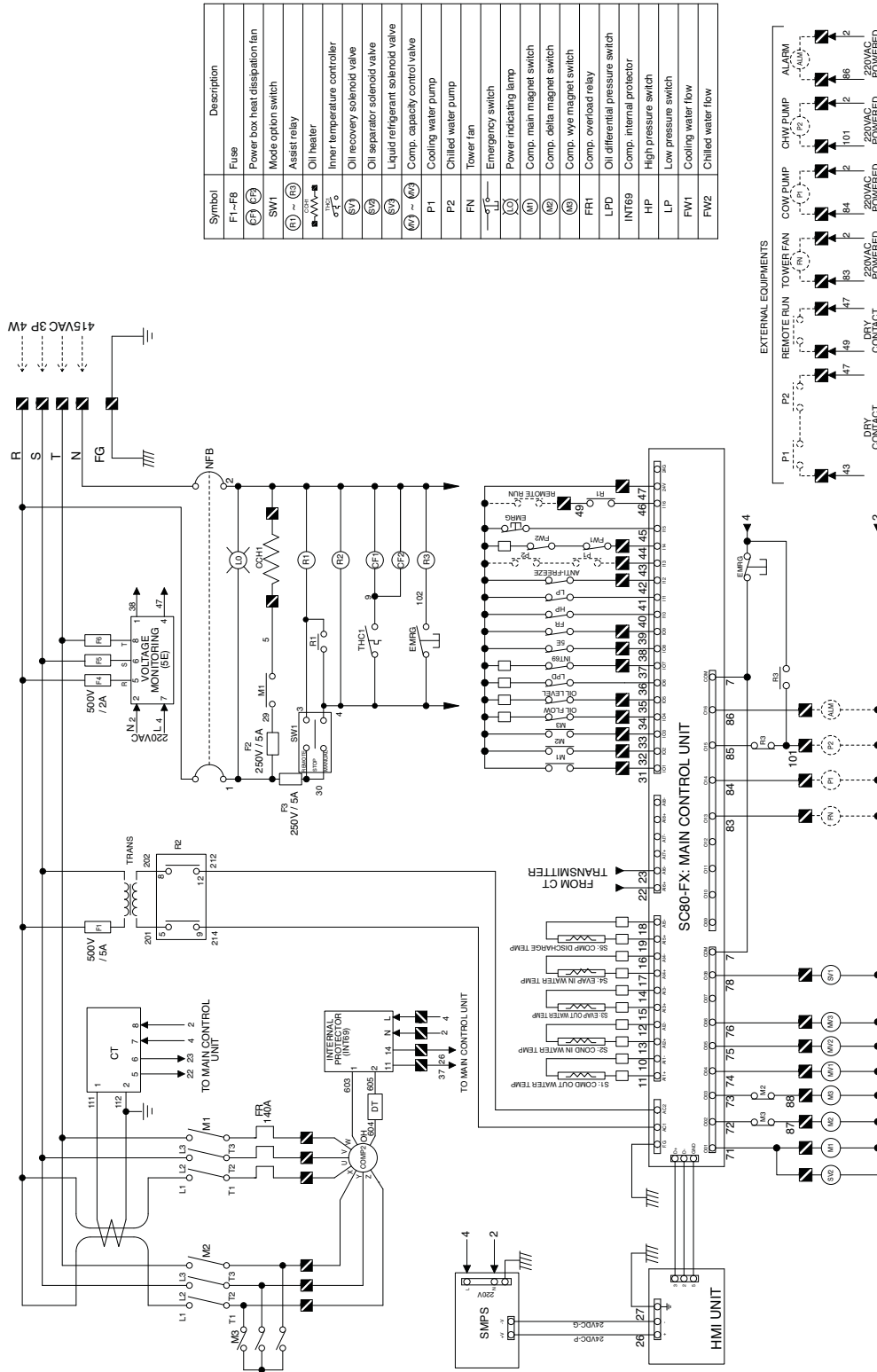
Displayed alarm message	Recognition	Potential cause	Potential solution
Compressor discharge temperature alarm	Compressor discharge temperature is 90 °C or above operate the compressor operates	- Insufficient refrigerant flux - Compressor error - External temperature too high	- Charge refrigerant or review valve condition - Repair compressor - Check external temperature
Communication error alarm	Communication error	Communication error between PLC and HMI device	Check connected condition between PLC and HMI device
Compressor discharge temperature sensor closed	Compressor discharge temperature sensor closed	- Sensor line short - Sensor error	- Check sensor line - Change sensor
Compressor discharge temperature sensor open	Compressor discharge temperature sensor open	- Sensor line blocked or loose - Sensor error	- Check sensor line - Change sensor
Cold water inlet temperature Sensor closed	Cold water inlet temperature Sensor closed	- Sensor line blocked or loose - Sensor error	- Check sensor line - Change sensor
Cold water inlet temperature Sensor open	Cold water inlet temperature Sensor open	- Sensor line blocked or loose - Sensor error	- Check sensor line - Change sensor
Cold water outlet temperature Sensor closed	Cold water outlet temperature Sensor closed	- Sensor line short - Sensor error	- Check sensor line - Change sensor
Cold water outlet temperature Sensor open	Cold water outlet temperature Sensor open	- Sensor line blocked or loose - Sensor error	- Check sensor line - Change sensor
Coolant water outlet temperature Sensor closed	Coolant water outlet temperature Sensor closed	- Sensor line short - Sensor error	- Check sensor line - Change sensor
Coolant water outlet temperature Sensor open	Coolant water outlet temperature Sensor open	- Sensor line blocked or loose - Sensor error	- Check sensor line - Change sensor
Coolant water inlet temperature Sensor closed	Coolant water inlet temperature Sensor closed	- Sensor line short - Sensor error	- Check sensor line - Change sensor
Coolant water inlet temperature Sensor open	Coolant water inlet temperature Sensor open	- Sensor line blocked or loose - Sensor error	- Check sensor line - Change sensor

Table 25

Appendix

Wiring Diagram

RCWW0200RAAA



MEZ61916909

Fig. 42

Cycle Diagram

NO	DESCRIPTION
1	Compressor
2	Condenser
3	Expansion Device
4	Oil Filter
5	Oil separator
6,7	Expansion Devices
8	Filter Drier
9	Evaporator
10	Ejector for Oil Return
11	Economizer (Flash gas tank)

LEGEND

SYMBOL	DESCRIPTION
[OH]	Oil heater
[HP]	High pressure switch
[LP]	Low pressure switch
[DP]	Different pressure switch
[OF]	Oil flow switch
[WF]	Water flow switch
[AF]	Anti-freezing switch
[T]	Temperature sensor
[OL]	Oil level sensor
[X]	Relief valve
[Insulation]	Insulation
[Sight glass]	Sight glass
[Solenoid valve]	Solenoid valve
[Check valve]	Check valve
[Shut-off valve(Angle valve)]	Shut-off valve(Angle valve)
[HP Gauge]	High Pressure Gauge
[LP Gauge]	Low Pressure Gauge
[M]	Muffler

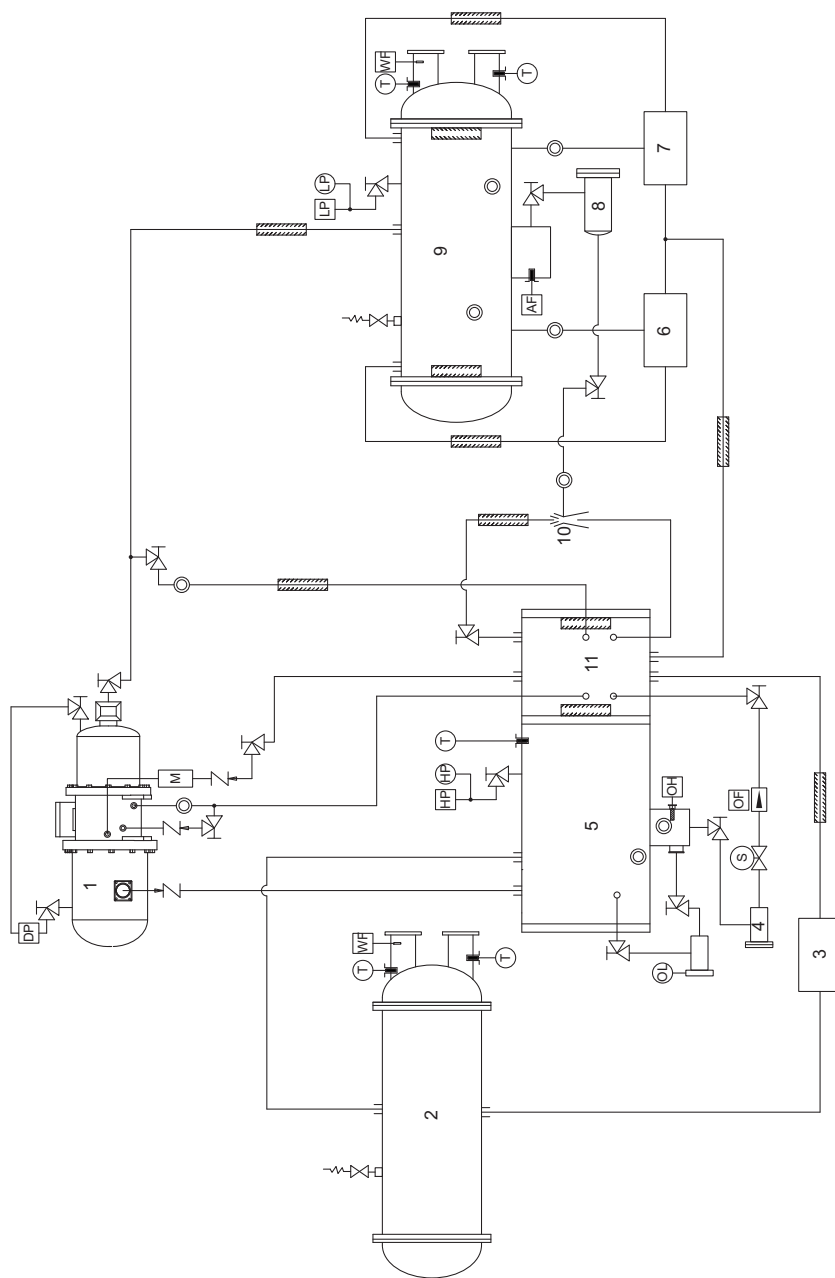


Fig. 43

■ Check List

1. Project Information

Content	Information
Project name	
Address	
Installing contractor	
Sales office	
Start-up performer	

2. Model Information

Content	Information
Product	Model: Serial:
Compressor A	Model: Serial:
Compressor B	Model: Serial:

3. Prior Equipment Check

Content	Check	
	Yes	No
Any damaged part?	Yes	No
Comply with start-up?	Yes	No
Bolts/Nuts tightened well?	Yes	No
Does the power specification comply with the product specification?	Yes	No
Is the cable correctly connected?	Yes	No
Is the product correctly installed?	Yes	No
Is the electric circuit protector correctly installed in accordance with the correct specification?	Yes	No
Are all terminal blocks connected well?	Yes	No
Are all plugs connected well?	Yes	No
Is the product preheated for more than 8 hours before starting?	Yes	No
Is the air in the pipe purged from the relief valve properly according to the region?	Yes	No

4. Chilled Water System Check

Contents	Check	
	Yes	No
Are all valves of the chiller open?	Yes	No
Are all pipes correctly connected?	Yes	No
Is there any clog in the drain pipe?	Yes	No
Is there any leakage?	Yes	No
Is the air within the system well discharged?	Yes	No
Does the cold water pump operate correctly?	Yes	No
Is the cold water pump start connected well to the chiller?	Yes	No
Is the cold water flux switch operating?	Yes	No
Is the strainer on the pipe connected to the evaporator installed?	Yes	No

5. Start-up & Operation

Contents	Check	
	Yes	No
Are all service valves of the refrigerant pipe open? (Discharge, suction, economizer, oil pipe etc.)	Yes	No
Is there any leakage of refrigerant? (Compressor, condenser, economizer, evaporator etc.)	Yes	No
Is the voltage of the terminal block within 10%?	Yes	No
Is the voltage imbalance within 2%?	Yes	No
Is there any abnormal noise or vibration?	Yes	No
Does the alarm work normally?	Yes	No
Compressor capacity	%	
External temperature	°C	
Cold water inlet temperature	°C	
Cold water outlet temperature	°C	
Coolant water inlet temperature	°C	
Coolant water outlet temperature	°C	
Compressor discharge temperature	°C	
Brine density	%	
Evaporator pressure drop	psig	
Cold water flux	Gpm(l/s)	
Refrigerant high pressure	kPa	
Refrigerant low pressure	kPa	
Additional refrigerant supplement	kg	
Additional oil supplement	kg	

