OPERATION & MAINTENANCE MANUAL

Air Cooled Screw Chiller

Please read this manual carefully before operating your set and retain it for future reference.

Model: RCAW Series

MFL68865422
Rev.00_071825

www.lge.com

Thank you for using the Air Cooled Screw Chiller of LG Electronics.
After reading the instruction manual, it will become much easier and safer for you to use the product as long as you install it properly.

- Please read this user manual carefully prior to installation in order to install the screw chiller in a safe and correct manner.
- Also it is highly recommended to do commissioning and run inspections according to this user manual after the installation.

※ This manual contains information on the introduction, control, commissioning, maintenance and troubleshooting of the chiller.

※ For ice-thermal-storage screw chillers, brine is used instead of cold water as the fluid in the evaporator.

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1. Safety precautions

Installing the product and moving heavy objects as well as the installation environment can be dangerous due to the pressure inside the product, its electrical devices, and the product installation location (roof, lifting structure, etc.). While moving and installing the product, check the warning / caution statements on the stickers or labels attached to the product and observe the statements.

Please comply with the following instructions to prevent personal injury of the user or anyone as well as property loss.

- Incorrect operation resulting from ignoring the instructions in the manual may result in injury or property damage.
  The severity of such injury or damage is classified according to the following symbols:
- Regardless of the warranty period, we are not liable for malfunctions caused by careless management, natural disasters, or power cord damage.
- The information in this user manual may be revised without notification to improve the product.

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

Warning

This symbol indicates the possibility of death or serious injury.

Caution

This symbol indicates the possibility of loss of or damage to property.

This symbol intends to remind the user of safety related information and potentially dangerous operations.

Make sure to check out all relevant information prior to engaging in the work to prevent any risks.

This symbol indicates incorrect methods of use that should be avoided to prevent risks.

Warning

Installation

- Installation is to be performed by qualified personnel who are familiar with local codes and regulations.
  - There is risk of fire, electric shock, explosion, or injury.
- All wiring must comply with local requirements and the instructions given in this manual.
  - If the power source capacity is inadequate or electric work is performed improperly, electric shock or fire may result.
- Do not use damaged circuit breaker or fuse
  - There is risk of fire, electric shock, explosion or injury.
- Ask the dealer or an authorized technician to install the chiller.
  - Improper installation may result in water leakage, electric shock or fire.
- For re-installation of the installed product, always contact a dealer or an Authorized Service Center.
  - There is risk of fire, electric shock, explosion or injury.
- When transporting the product, use spreader bar in accordance with the manual.
  - arbitrarily moving the product can cause product damage or injury.
- When hanging the product on the hoist to move the chiller, make sure that the load of the product is evenly distributed and leveled during the move.
  - It can cause damage or injury.
- When moving the product using the spreader bar, make sure to select the spreader bar with material and size to sufficiently support the strength spreader bar.
  - Using inappropriate spreader bar can cause the product to fall and cause injury due to the strength or size.
- Always ground the product.
- There is risk of fire or electric shock.
- Always install dedicated circuit and breaker.
  - Improper wiring or installation may cause fire or electric shock.
- Use the properly rated circuit breaker and fuse.
  - There is risk of fire or electric shock.
- Be careful of high voltage
  - Install separate wiring for the power and always Install and use dedicated power supply and circuit breaker.
  - There is risk of fire or electric shock.
- Do not disassemble, repair or modify the product arbitrarily.
  - There is risk of fire or electric shock.
- Install in a location that can support the weight of the product.
  - There is risk of injury or damage to the product
- Do not reinstall or modify the safety device.
  - Modification of the safety device used in the product, short or forced operation may cause fire or explosion.
- Install drainage facilities around the foundation and waterproof it.
  - There is risk of electric shock or injury.
- Prepare for strong wind or earthquake and install the unit at the specified place.
  - Improper installation may cause the unit to topple and result in injury.
- When installing and moving the product to another site, do not charge it with a different refrigerant from the refrigerant specified on the unit.
  - If a different refrigerant or air is mixed with the original refrigerant, the refrigerant cycle may malfunction and the unit may Be damaged.
- Take care to ensure that nobody could step on or fall into the product
  - This could result in personal injury and product damage.
- Use a vacuum pump or Inert (nitrogen) gas when doing leakage test or air purge. Do not compress air or Oxygen and Do not use Flammable gases. Otherwise, it may cause fire or explosion.
  - There is risk of death, injury, fire or explosion.
- Do not install, remove or re-install the unit by yourself (customer).
  - There is risk of fire, electric shock, explosion or injury.
- Securely install the cover of control box and the panel.
  - If the cover and panel are not installed securely, dust or water may enter the unit and fire or electric shock may result.

- Be careful of leakage.
  - If you find a leakage in the connected part such as pump, piping etc., immediately stop the operation. It can cause electric shock, leakage or defects.
- If the product is installed in a small room, measures must be taken to prevent the refrigerant concentration from exceeding the safety limit when the refrigerant leaks.
  - Consult the dealer regarding the appropriate measures to prevent the safety limit from being exceeded.
  - Should the refrigerant leak and cause the safety limit to Be exceeded, hazards due to lack of oxygen in the room could result.
- Ventilate before operating product when gas leaked out.
  - It may cause explosion, fire and burn.
- Do not vent refrigerant relief valves within a building.
  - Outlet from relief valves must Be vented to outdoors
  - the accumulation of refrigerant in an enclosed space can replace oxygen and cause asphyxiation.
  - Provide adequate ventilation in enclosed or low overhead areas. Inhalation of high concentrations of vapor is harmful and may cause heart irregularities, unconsciousness or death. Misuse can be fatal. Vapor is heavier than air and reduces the amount of oxygen available for breathing. Product causes eye and skin irritation.
- Be careful, refrigerant leaks in a closed space can cause oxygen deficiency
  - There is a risk of suffocation or death due to lack of oxygen.
- There must be no obstruction above the unit.
  - It would deflect discharge air downward where It could Be re-circulated back to the inlet of the condenser coil. the condenser fans are propeller type and will not operate with ductwork on the fan outlet.
- Do not install the unit in potentially explosive atmospheres.
  - There is risk of fire or explosion
- Do not store or use flammable gas or combustibles near the product.
  - Do not use or store fire sources (candles, lamps, etc.), combustion devices, or flammable substances (such as ethyl ether, benzene, alcohol, gasoline, diesel fuel, cosmetics, LP gas, flammable sprays, pesticides, air fresheners, and other flammable gases) near the product.
  - There is risk of fire or failure of product.

Use

- Do not damage or use an unspecified POWER CABLE.
  - There is risk of fire, electric shock, explosion, or injury.
- Use a dedicated outlet for this appliance.
  - There is risk of fire or electrical shock.
- Be cautious that water could not enter the product.
  - There is risk of fire, electric shock or product damage.
- Do not touch the power switch with wet hands.
  - There is risk of fire, electrical shock, explosion or injury.
- When the product is soaked (flooded or submerged), contact an Authorized Service Center.
  - There is risk of fire or electric shock.
- This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
  Children should be supervised to ensure that they do not play with the appliance.
- Keep the unit away from children.
  - It can cause the injury, such as cutting the finger. Also the damaged fin may result in degradation of capacity.
- Do not reconstruct to change the settings of the protection devices.
  - If the pressure switch, thermal switch, or other protection device is shorted and operated forcibly, or parts other than those specified by LGE are used, fire or explosion may result.
- Changing the setted value is prohibited.
  - Do not change the set value of the safety device.
  - If you operate the product with incorrectly set values, It can cause defect, fire or explosion.
  - When you change the control setting value, please Consult with the specialized expert.
- Be cautious of fire, earthquake and lightning.
  - If There is natural disaster such as fire or earth-quake or risk of lightning , immediately stop operating the unit
  - If you continue to operate the unit, It can cause a fire or electric shock.
- Do not open the valve or remove the protective cover
  - There is risk of explosion or injury.

- Do not use heat transfer materials other than the specified brine.
  - There is risk of explosion or fire. For low-temperature use, use brine or equivalent ethylene glycol or propylene glycol brine, and regularly manage the brine concentration.
- Do not eat brine or use it for purposes other than freeze protection
  - There is risk of injury or death.
- Do not use fire sources (electricity, fossil fuels, etc.). If the product instaalled in a small room.
  - Refrigerant gases can produce toxic gases when exposed to fire.
  - There is risk of injury or death.
- Be careful of the rotating part.
  - Be careful not to put your finger or a stick in the rotating part of the fan or pump.
  - Do not operating the fan with the protective guard removed. It can cause body injury.
- Be careful of air cooled heat exchanger
  - Because air cooled heat exchanger fins are sharp, Do not touch the heat exchanger.
  - Protective net must always Be kept installed.
  - It can cause an injury.
- Follow all safety codes.
  - When working on This equipment, observe precautions in the literature and on tags, stickers and labels attached to the equipment and any other safety precautions that apply.

Maintenance

- For repairs, contact dealer or authorized service center.
  - There is risk of electric shock or fire, if a problem occurs during repairs
- No one other than a qualified electrician should touch high-voltage equipment.
  - There is risk of fire or electric shock
- Turn the main power off in case of installation or service.
  - There may Be more than one disconnect switch. Tag all disconnect locations to alert others not to restore power until work is completed.
  - There is risk of electric shock, injury or death.
- Electric shock hazard. Can cause severe injury or death. Even when power to the panel is off, output board could be connected to high voltage.
  - There is risk of electric shock or injury.
- Open electrical circuit and mark during service. Check all power is turned off before resume work.
  - There is risk of electric shock or injury.
- Turn off the power. If the work requires removing the protective panel or guide.
  - There is risk of electric shock or injury
- Do not disassemble parts or pipes while the product is in operation.
  - There is a risk of injury due to high pressure and high temperature.
- Use the specified vessel. Always use the specified container and be careful of pressure when recovering refrigerant.
  - Using non-standard vessel may result in explosion or injury.
- Always service the refrigerant cycle in a well-ventilated environment.
  - There is a risk of suffocation.
- Always service the refrigerant cycle in a well-ventilated environment.
  - Refrigerant gases can produce toxic gases when exposed to fire. There is a risk of suffocation.
- Use of undesignated refrigerant and oil is prohibited.
  - Do not use undesignated refrigerant, oil. It can have a critical effect on the compressor and component defects.
  - If you would like to use a substitute for the refrigerant, please contact the manufacturer.
- Follow the permitted pressure level.
  - Follow the regulated pressure for water, refrigerant etc.
  - There is risk electric shock, explosion or injury.
- Redesigning the control box is prohibited.
  - Lock the control box with possible locking device and If you need to open the control box inevitably, turn off the main power first.
  - Do not touch the wiring or parts within the control box.
  - There is risk electric shock, fire or defects.
- Wear safety equipment
  - Wear safety glasses and work gloves.
  - Be careful in handling, rigging and setting This equipment and in handling all electrical components.

- Always run fluid through heat exchangers when adding or removing refrigerant charge.
  - It can damage to heat exchanger tubes, leakage or defect may result
  - use appropriate brine solutions in cooler fluid loops to prevent the freezing of heat exchangers When the equipment is exposed to temperatures below 32°F (0°C).
- Do not heat the weld joint to separate it. If repair is necessary, cut it using a pipe cutter.
  - There may be oil inside the pipes, and oil is flammable.
  - Measure the amount of oil coming out of the pipe and add the measured amount of new oil to the product.
- Do not re-use compressor oil.
  - It may cause damage to the product.

Caution

Installation

- Make the connections securely so that the outside force of the cable may not be applied to the terminals.
  - Inadequate connection and fastening may generate heat and cause a fire.
  - If the power cable is damaged, do not replace it yourself. Contact a service center for replacement.
- Use power cables of sufficient current carrying capacity and rating.
  - Cables that are too small may leak, generate heat and cause a fire.
- Be very careful about product transportation.
- When transporting the product, always Consult with the specialized expert.
- When transporting the product, make sure to comply with the method regulated in the manual. If not, It can cause overturn, fall etc.
- Safely dispose of the packing materials.
  - Packing materials, such as nails and other metal or wooden parts, may cause stabs or other injuries.
  - Tear apart and throw away plastic packaging bags so that children may not play with them. If children play with a plastic bag which was not torn apart, they face the risk of suffocation.
- Do not remove packaging until installation in final location.
  - Removing the packaging beforehand may damage the product.
- Use equipment when there is a risk of slipping or losing balance, even if the part is light.
- Turn off the product when cleaning or checking the water pump connected to the product.
- Always check for gas (refrigerant) leakage after installation or repair of product.
  - low refrigerant levels may cause failure of product.
- Do not install the product where the noise or hot air from the unit could damage the neighborhoods.
  - It may cause a problem for your neighbors.
- Keep level even when installing the product.
  - To avoid vibration or water leakage.
- Do not install the unit where combustible gas may leak.
  - If the gas leaks and accumulates around the unit, an explosion may result.
- Do not use the product in special environments.
  - Oil, steam, sulfuric smoke, etc. can significantly reduce the performance of the product or damage its parts.
- Be sure the installation area does not deteriorate with age.
  - If the base collapses, the product could fall with it, causing property damage, product failure, or personal injury.
- Do not use the product for special purposes, such as preserving foods, works of art, etc. It is a consumer chiller, not a precision refrigeration system.
  - There is risk of damage or loss of property.
- If anyone other than a licensed Professional installs, repairs, or alters LG Electronics Air Conditioning products, the warranty is voided.
  - All costs associated with repair are then the full responsibility of the owner.
- When installing the unit in a hospital, communication station or similar place, provide sufficient protection against noise.
  - The inverter equipment, private power generator, high-frequency medical equipment or radio communication equipment may cause the chiller to operate erroneously or fail to operate. on the other hand, the chiller may affect such equipment by creating noise that disturbs medical treatment or image broadcasting.

- Do not install the product where it is exposed to sea wind (salt spray) directly.
  - It may cause corrosion on the product. corrosion, particularly on the condenser fins, could cause product malfunction or inefficient operation.
- Be careful of product installation
  - Be careful of the clearance of the producct during the installation and make sure There are no surrounding obstacles for the air cooled condenser and that It is well ventilated.
- Be sure to install insulation if there is a risk of condensation.
  - Evaporator and connecting pipes must be insulated to prevent condensation
  - If insulation is not installed, condensation may cause equipment corrosion.
- The product is not designed to be earthquake resistant.

Use

- Be careful of restarting
  - When the safety device of the product operates, remove the cause before restarting
  - There is risk fire or damage to the product.
- Check the valve condition before operation.
  - There is risk of accident or damage to product
- Follow the water quality standards specified in the manual and consult with a water treatment expert if necessary.
  - May need to use water treatment products to prevent sedimentation, corrosion and scale.
  - LG is not responsible for damage to the product or evaporator resulting from the use of untreated or inappropriate water.
- Comply with specified flow rates, temperatures, etc.
  - Ensures product performance and reduces the possibility of heat exchanger tube damage due to corrosion, water stains, sediment, moss, etc.
- Do not operate the product with the panels or guards removed.
  - Rotating, hot or high-voltage parts can cause injuries.
- Use brine or drain water when product is stopped in winter, to prevent freezing
  - If water pipe or heat exchanger tube are filled with water without flow in winter, freezing and water leak may result
- When the outdoor temperature in season below 32 °F (0 °C), take measures to prevent freezing of pipes.
  - Freeze protection measures such as charge brine, heater operation, and pump operation are required.
- When disposing of antifreeze or cleaning fluid, please dispose of it in accordance with relevant laws and regulations.
  - Disposal without complying with relevant laws may adversely affect the environment or health.
- Do not use an automotive antifreeze. Industrial grade glycols must be used. Automotive antifreeze contains inhibitors which will cause plating on the copper tubes within the product evaporator. The type and handling of glycol used must be consistent with local codes.
- When re-running the product after keep product long time in a low temperature conditions, touch function may not work temporarily.
  - Wait for a time. After time, product work normally.

Maintenance

- Be sure to check that the installation is correct. Before startup
  - Check the outline, P&ID, and wiring diagram of the product.
- Field wiring must be installed according to unit wiring diagram.
  - It may cause serious electrical damage can occur.
- Turn on the power at least 12hours before starting operation.
  - Starting operation immediately after turning on the main power switch can result in severe damage to internal parts. Keep the power switch turned on during the operational season.
- Do not touch any of the refrigerant piping during and after operation.
  - It can cause a burn or frostbite.
- Be careful of high temperature
  - There is a risk of injury due to high temperature.
- Do not step on refrigerant lines or stand on the product.
  - This could result in personal injury and product damage.

- Do periodic maintenance and check.
  - Check safety devices thoroughly at least once a year.
  - Keep the maintenance cycle short, If the product is installed in an environment prone to corrosion. Periodic maintenance helps maintain the life and performance of producct.
  - If a problem is found stop the product and contact the service center. Failure to inspect periodically may result in fire, explosion, or defect of product.
- Be sure to comply with local code and regulations when discharging or recovering refrigerant.
  - Complies with EPA requirements related to refrigerant discharge and recovery
- Do not leave refrigerant system exposed to air for longer than necessary.
  - Oil contamination and internal component damage may occur, If the refrigerant cycle is exposed to air. If repairs cannot be completed, close the refrigerant cycle and charge with dry nitrogen.
- Use a nitrogen gas when doing leakage test. Do not use compressed air or Oxygen.
  - There is risk of corrsion on internal parts
- Be careful not to expose any body parts directly to the refrigerant.
  - There is a risk of frostbite or burns.
- If corrosion or scale is found on the safety device, do not repair it yourself but request service.
  - There is a risk of injury
- Only replacement parts that meet the design requirements must be used.
- Do not discharge water contents (brine, etc.) without approval from the responsible department
- Do not directly turn off the main power switch after stopping operation.
  - Wait at least 5 minutes before turning off the main power switch. Otherwise it may result in oil shortage or other problems.
- Use a firm stool or ladder when cleaning or maintaining the chiller.
  - Be careful and avoid personal injury.
- Be careful of disposal
  - When disposing the product, request to the specialized expert.
  - It can cause burns.
- Be careful of sound or odor
  - If you hear a weird sound or smell weird odor, immediately stop operating the unit and contact the service center.
  - It can cause fire, explosion and injury.
- Possible injury because of the wrong tool usage.
  - Use appropriate tools used for the repair and make sure to calibrate the measuring devices precisely before use.
  - If you use inappropriate tools etc, It can cause an accident.
- Do the pre-check and be fullly aware of all the safety devices.
  - Check the safety label of the safety device.
  - Follow the precautions and labels. If not, It can cause injury or damage such as a fire etc.
- Do not use jumpers or other tools to short to bypass or otherwise depart from recommended procedures
  - There is a risk of damage to the parts.
- Do not attempt to bypass or modify factory wiring.
  - If the compressor is running in reverse, the compressor may need to be replaced.
- Do not use any type of detergent on the coil, including chemicals, bleach, acids, or alkaline detergents.
  - These types of cleaners accelerate corrosion of fins and tubes.
- Do not use high-pressure water or air to clean coils
  - It may cause fin damage
  - Fin deformation may increase the pressure drop on the air side, which may result in poor performance or product failure.
- Do not overcharge refrigerant
  - Overcharging increases compressor discharge pressure, increases power consumption, and can damage to the compressor.
- Be careful when charging oil
  - Do not charge oil anywhere other than the compressor.
  - Use only dedicated oil.
  - There is risk of abnormal operation
- Compressor oil is pressurized.
  - Use proper safety precautions When relieving oil.
- Turn controller power off before servicing.
  - There is risk of electric shock or damage to controller.
- Welding is not recommended in the cooler heads or nozzles.
  - If welding is required, disconnect the flow switch and temperature sensor before working. Reinstall the flow switch and temperature sensor after working. This may cause damage to the parts.

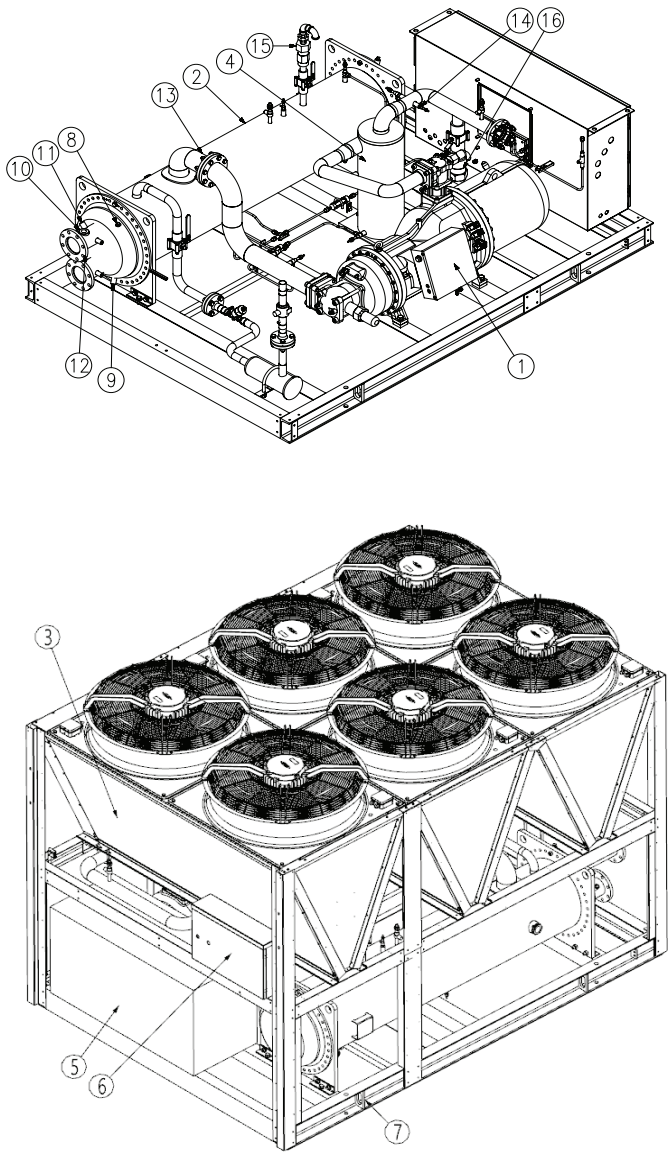
2. Overview

2-1. General

- This manual describes the use and handling of Air Cooled screw chillers with the AI Engine applied.

2-2. Product Structure

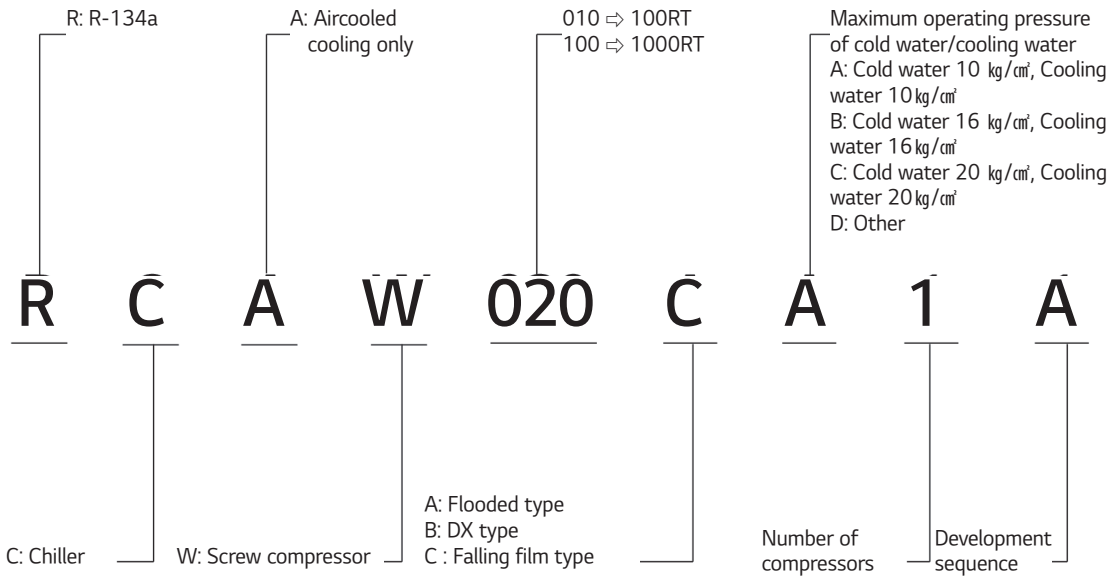
- Figure 1 shows the general structure and components of a Air Cooled screw chiller.
  The position of the control panel, the shape of water box, the inlet/outlet directions of the chilled water (brine), and some pipings may vary depend on the model or customer requirements. For detailed information, please refer approval drawings.



No.	Product Name
1	Screw compressor
2	Evaporator
3	Condenser
4	Oil separator
5	Starter
6	Control panel
7	Lifting holes
8	Air vent
9	Drain
10	Flow switch (for chilled water)
11	Temperature sensor (chilled water outlet)
12	Temperature sensor (chilled water inlet)
13	Temperature sensor (compressor suction)
14	Temperature sensor (compressor discharge)
15	Safety valve (low pressure)
16	Safety valve (high pressure)

Figure 1. General Structure of the Air Cooled Screw Chiller

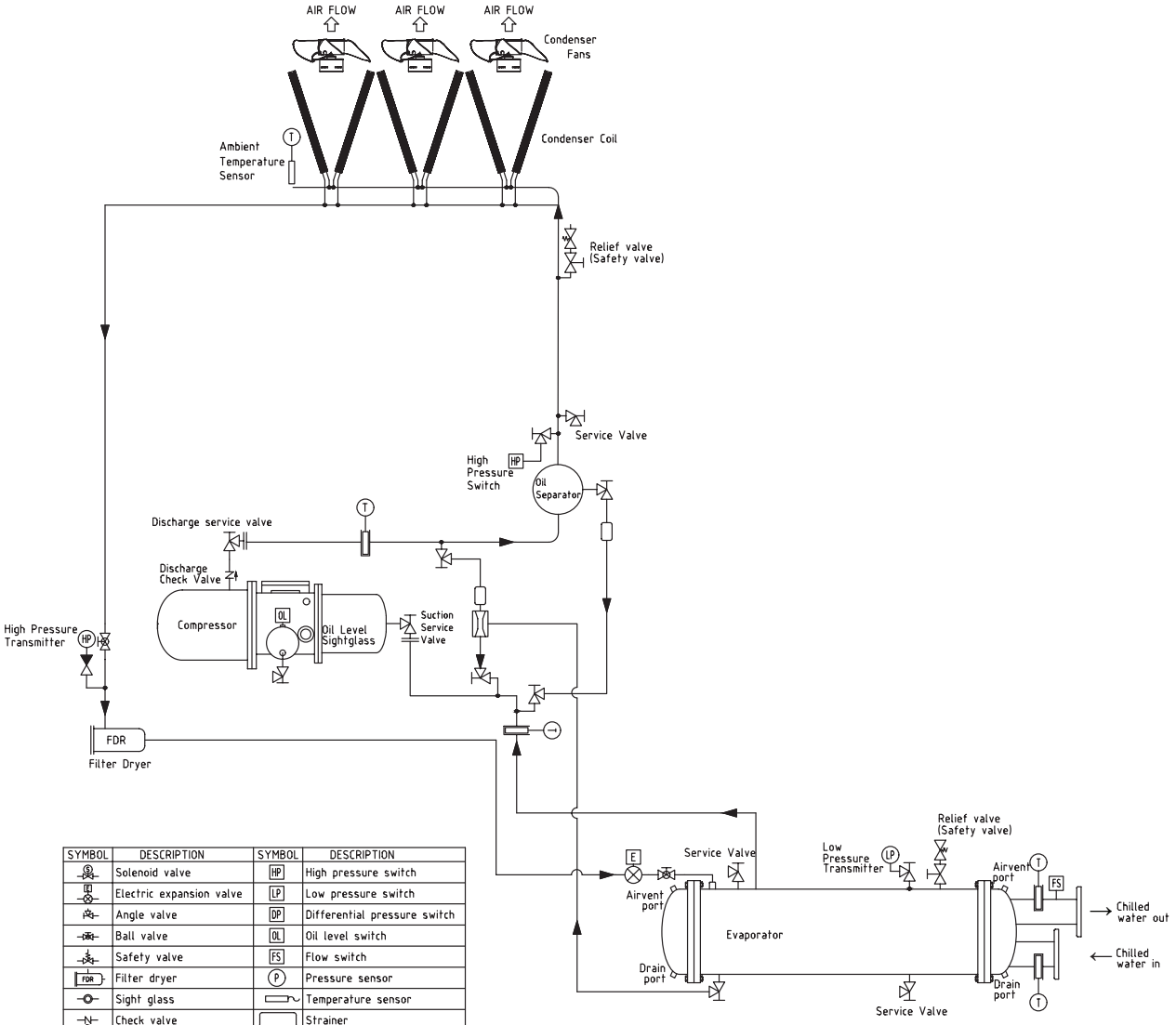
2-3. Model Nomenclature



3. Structure of the Screw Chiller

3-1. Chiller Cycle

- The refrigerant enters the compressor as a low pressure and low temperature vapor.
  Sucked refrigerant is compressed by a compressor, its temperature and pressure increase, and then it is discharged as superheated vapor.
  The high-temperature, high-pressure vapor refrigerant compressed in the compressor loses heat to the air in the condenser, phase changed from gas to liquid.
  As the refrigerant passes through the expansion device, it expands and changes into a two-phase state of low temperature and low pressure before entering the evaporator.
  In the evaporator, the low-temperature refrigerant exchanges heat with cold water, and the refrigerant absorbs heat from the cold water and changes phase from liquid to gas. Conversely, the water loses heat and becomes cold.
  The low-temperature, low-pressure vapor refrigerant in the evaporator is sucked back into the compressor to complete the chiller cycle.



SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	Solenoid valve	HP	High pressure switch
	Electric expansion valve	LP	Low pressure switch
	Angle valve	DP	Differential pressure switch
	Ball valve	OL	Oil level switch
	Safety valve	FS	Flow switch
FDR	Filter dryer	P	Pressure sensor
	Sight glass		Temperature sensor
	Check valve		Strainer
	Tee		Muffler
	Flange connection		
	Ejector		
	Reducer		

Figure 2. Chiller Cycle

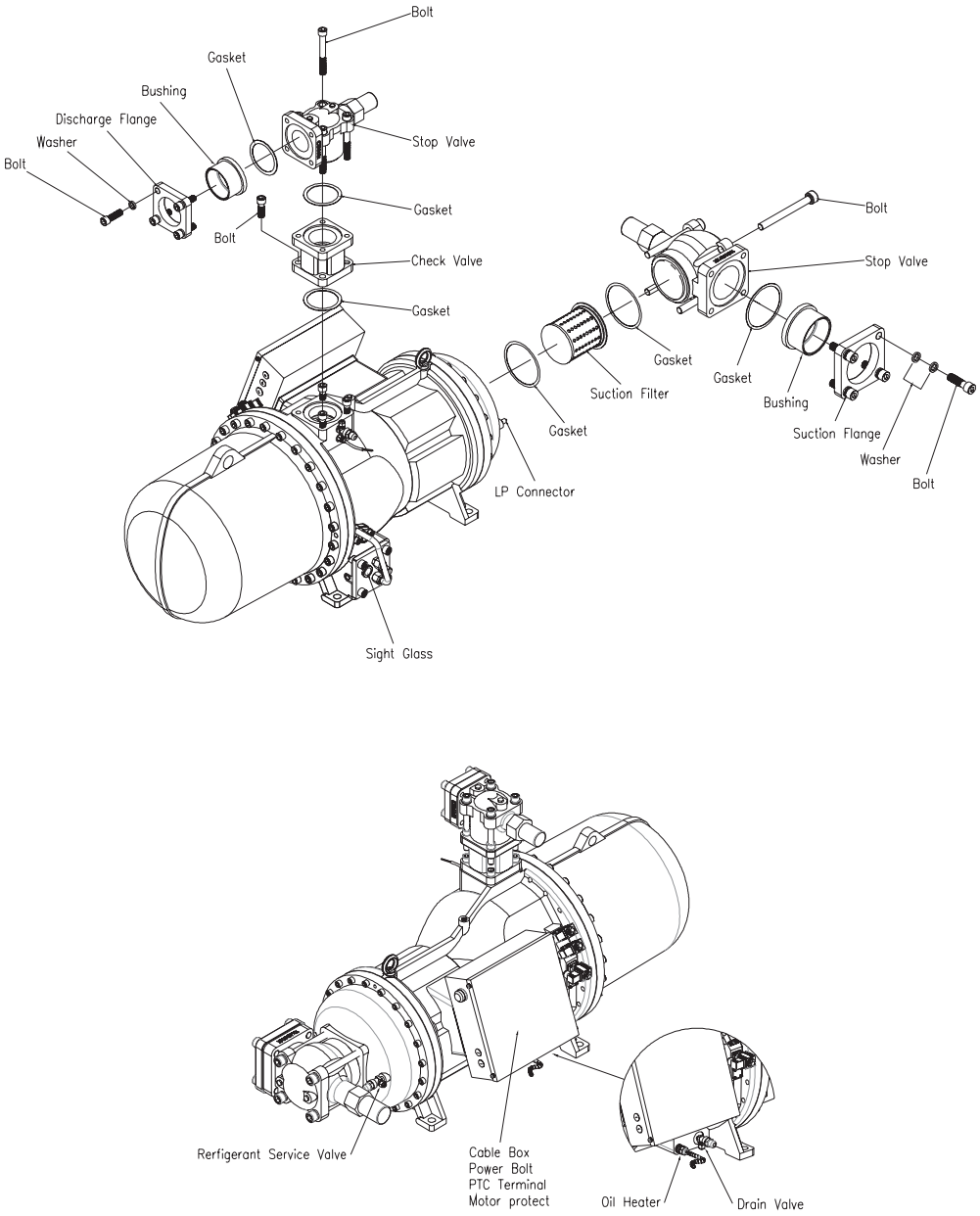


Figure 3. Installation and connection of compressor

As shown in the below, during rotation of the rotors the meshing shifts from the suction side to the discharge side. The meshing rotors enclose a working space, which is continuously reduced as it moves in the axial direction. This causes a V-shaped lobe space to form between each of the male and female lobes. This lobe space increases to a maximum size (suction and sealing process). As the rotors rotate further, the new meshing on the suction side closes the V-shaped lobe space. The lobe space is then constantly reduced by continuing intermeshing of the lobes (compression process).

The reduction in lobe space takes place on the lower side of the rotors towards the discharge side. The volume is steadily reduced and it is thereby compressed in the sealed condition. As soon as the peaks of the rotor teeth are free to the outlet port, the vapor is discharge to the high-pressure side and flows to the oil separator where the high-pressure gas will be separated from the lubrication oil. The size and geometry of the discharge port determine the so called "internal volume ratio (Vi)" of the compressor. This ratio must have a defined relationship to operating pressure ratio to avoid losses in efficiency due to under or over compression.

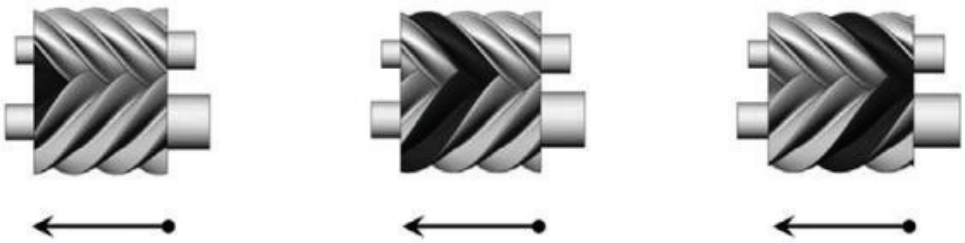


Figure 4. Compression Process

(A) Suction and sealing:
At the beginning of the compression cycle, as the male rotor and female rotor unmesh, gas from suction port fills the interlobe space. Refrigerant at suction pressure continues to fill it, until the trailing lobe crosses the suction area and the gas is trapped inside the interlobe space.

(B) Compression:
As the male rotor and female rotor meshes, the interlobe space moves towards to discharge end and its volume decreases so that gas pressure increases consequently.

(C) Discharge:
Gas is discharged from the interlobe space when the leading lobe crosses the discharge port whose volume ratio is designed differently for various applications.

The main functions of lubrication oil in compressors are lubrication to bearings, compression chamber sealing, cooling and Vi adjustment.

When bearings are in service, they require steady lubrication. Oil flow in compression chamber creates a film of oil for sealing in the compression housing to increase efficiency and dissipate compression heat.

Oil temperature is crucial to compressor bearings' life. Oil is usually lower in viscosity when it is at high temperature.

Low viscosity of oil results in poor lubrication and heat dissipation to compressor.

Viscosity is recommended to keep over 10mm2/s at any temperatures for oil. Oil temperature in the oil sump should be kept above the saturated condensing temperature to prevent refrigerant migration into lubrication system. Oil becomes high viscous in winter time with lower ambient temperature or compressor not started for a long-time. When oil viscosity is high, the lower oil flow speed may cause insufficient lubrication to compressor or delay of the lubrication process. Suggest turn on oil heater to warm up oil when compressor is not in operation.

Every compressor has an oil sight glass on oil sump to monitor the condition of the oil. It is a normal observation the level in sight glass fluctuates when compressor in operation due to pressure differential varies. An optical oil level switch is installed to monitor the oil level at all time and gives alarm or trip the compressor is it is lose of oil.

Evaporator

High-efficiency heat exchanger tube were used to improve heat exchange efficiency.
A shell-and-tube heat exchanger is used with an optimized heat exchanger tube arrangement to minimize part-load efficiency degradation.
A distributor is installed in the heat exchanger to distribute the refrigerant evenly, and a safety valve is installed at the top of the shell.

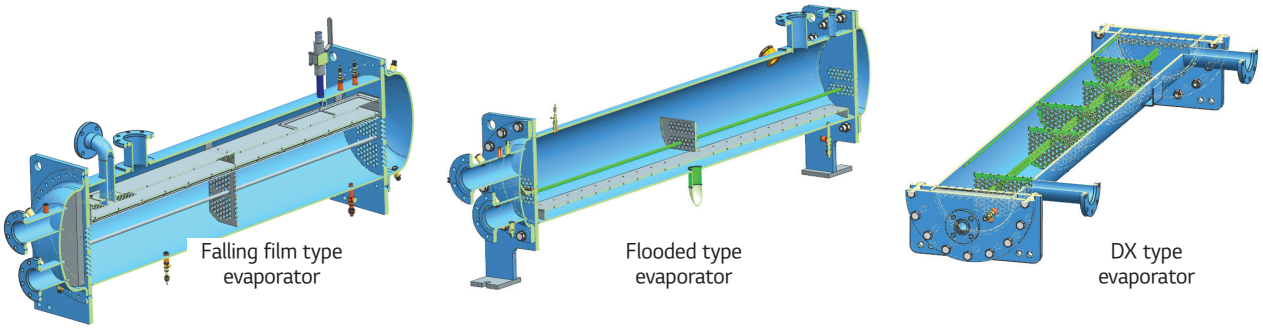


Figure 5. Evaporator

- Heat exchanger tube cleanning:
  For maintain performance and extend life of chilling system, periodical tube cleanning is recommended (Normally every year)
  Water/Brine flows inside of tubes in flooed/falling filme type cooler. To remove chemical / mechnial / biological scale inside tube, mechnical cleaning method is recommended.
  Tube are sealed to the tube sheet with mechnical sealing method. To prevent leakage and damage to tube, do not use excessive force to the tube sheets and tube during tube cleanning.

Condenser

To improve efficiency, a fin-tube heat exchanger with high-efficiency fins was applied. Heat exchanger fin coatings are applied to improve efficiency and corrosion performance, but additional heat exchanger coatings are recommended if the chiller is installed near the coast or in locations with hazardous gases.

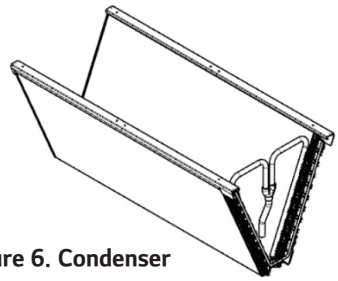


Figure 6. Condenser

- Maintenance and cleaning of condenser coil:
  Periodically cleaning the surface of the coil is essential in maintaining the normal operation of the unit. By removing any contaminant or hazardous substance on the coil, you can extend the life of the coil and the unit. The following maintenance and cleaning method is recommended as part of the periodical maintenance activity to extend the life of the coil.
- Remove contaminant on surface:
  Use the vacuum cleaner to clean any contaminant such as pant debris, pollen and dust on the surface. If vacuum cleaner cleaner is not available, use a soft, non-metallic brush to clean the surface. When clean the surface using any method, clean in the same direction as the fins. Fins can bend very easily, so be careful using cleaning tools on the fins as this may bend fins or scratch the protective coating on the surface.

Caution

When using water to clean the coil, be careful as dust or debris may enter the coil. Completely remove any debris from the surface before cleaning with clean water.

- Periodic water cleaning:
  Periodically washing the fins with water will help maintain coils installed on shore or in industrial sites.
  The condenser coil can be easily deformed, so use low-pressure water when cleaning to prevent damage to the coil.
  Recommend clean once every 1-2 months.

Caution

Do not use any type of detergent on the coil, including chemicals, bleach, acids, or alkaline detergents.
These types of cleaners accelerate corrosion of fins and tubes.

Caution

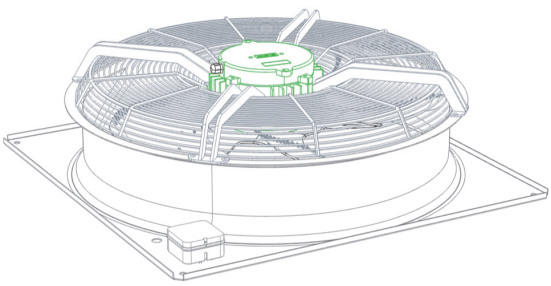
Do not use high-pressure water or compressed air to clean the coil. This can cause deformation of the fins, increasing the pressure drop on the air side of the condenser. This may cause performance degradation or the product to stop working.

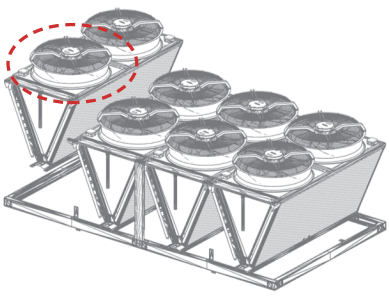
Condenser fan

The fan motor and fan must be securely fastened to the top of the condenser.

It is equipped with a shroud that forms a air flow and a grill that protects the fan that rotates at high speed. The condenser fan and fan motor are assembled as shown.

When reassembling the fan to the fan motor, be sure to correctly insert the fan into the fan motor shaft and tighten the bolts securely to ensure the fan motor operates at maximum performance.





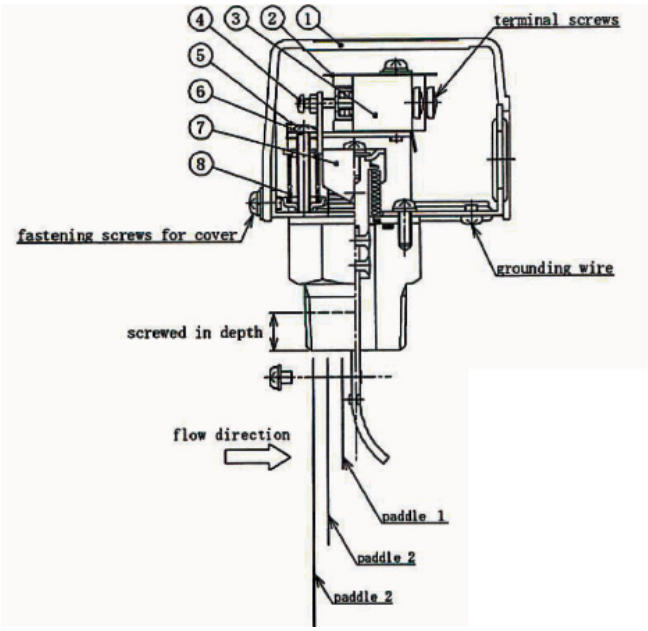
Expansion device

Electronic Expansion Valve installed as an expansion device.
The valve controls the automatic adjustment of refrigerant flow rate and makes the system work under optimized conditions for the purpose of fast cooling, precise temperature control and energy saving.

Figure 7. Electronic Expansion Valve

Flow switch

Flow Switch is installed on the water inlet/outlet nozzle for all units as factory setting.
The following picture show the image of the Differential Pressure Switch.
Please do not change the setting point of this part. If you change the setting point
Without LG's guide, then it can give a serious damage to the chiller.

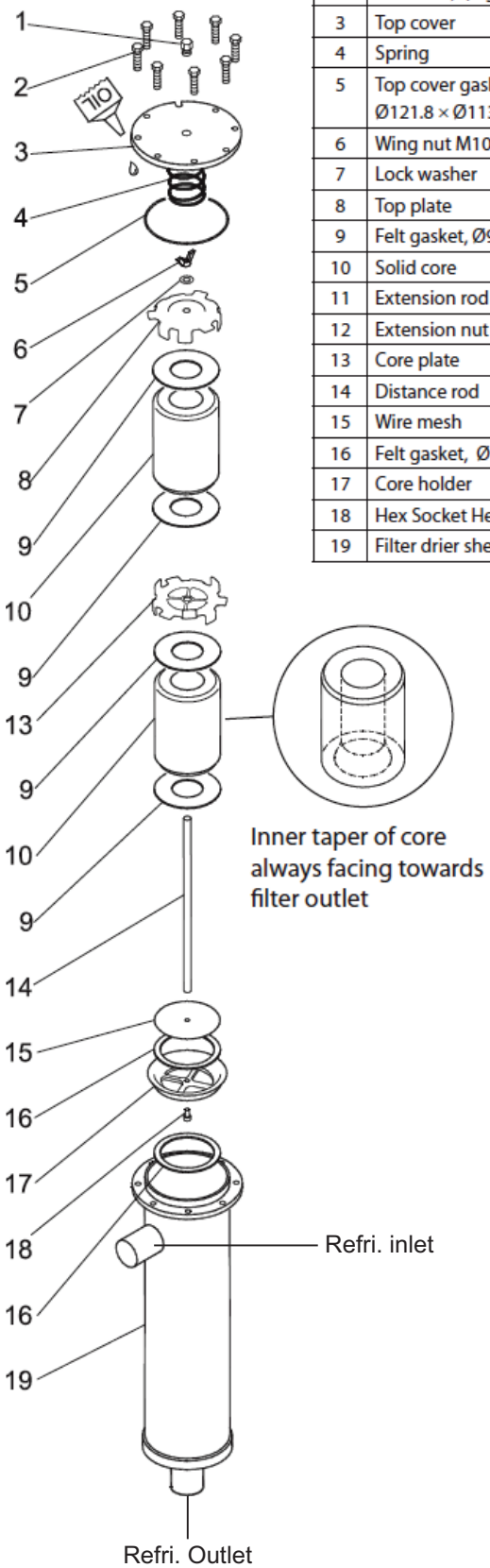


No.	Parts name	Qty
1	Cover	1
2	Insulation plate	1
3	Microswitch	1
4	Adjusting screw	1
5	Metal fitting for flow adjusting screw	1
6	Flow adjusting screw	1
7	Actuating plate	1
8	Adjusting spring	1

Filter Drier

The filter drier is installed on the liquid line from condenser outlet to evaporator. (In case of economizer exist, filter drier is installed on the liquid line from condenser outlet to economizer).
Differential pressure between the inlet and outlet of the filter drier must be checked periodcally.

Pos.	Description
1	Plug , $^1/_4$ in. NPT
2	Top cover bolts M8 × 35 or M12 × 40, (high pressure)
3	Top cover
4	Spring
5	Top cover gasket Ø121.8 × Ø113.6 × 0.8mm
6	Wing nut M10 (torque max. 3 Nm)
7	Lock washer
8	Top plate
9	Felt gasket, Ø95.5 × Ø45.5 × 2 mm
10	Solid core
11	Extension rod
12	Extension nut
13	Core plate
14	Distance rod
15	Wire mesh
16	Felt gasket, Ø95.5 × Ø78 × 2 mm
17	Core holder
18	Hex Socket Head Screw M6
19	Filter drier shell



Oil Recovery System

OThe oil recovery system of the chiller consists of an oil separator installed between the compressor and condenser and an evaporator oil recovery system.

The compressor must maintain an appropriate oil level during operation, and if there is insufficient oil, additional oil filling is required.

If the oil is insufficient, the bearings and rotor of the compressor will wear out and cause damage to the compressor, so periodical inspection is required.

An oil level switch is installed to detect oil level, and a filter is installed to remove foreign substances contained in the oil.

Pre-cautions of changing oil

- Use only qualified oil and do not mix different brands of oil together. Selection of oil should match characteristics of the refrigerant used. Some types of synthetic oil are incompatible with mineral oil. Oil remained in the compressor should be totally cleaned up in the system before charging different brands of oil. Charge the compressor with oil for the first start and then change it into new oil again to ensure that there's no mix at all.
- When using polyester oil for chiller systems, please make sure not to expose oil to the atmosphere for prevention of change in its property. Therefore, it is necessary to vacuum the system completely when installing the compressor.
- In order to ensure no moisture inside the system, it is suggested to clean the system by charging it with dry Nitrogen and then vacuum it repeatedly as long as possible.
- It is a must to change the oil in motor burned out case, because acid debris may still remain inside the system. Check acidity of oil after 72 hours of operation and then change it again until acidity of oil becomes normal.

Oil change

- Change oil periodically: Check lubrication oil every 10,000 hours of continuous running. For the first operation of the compressor, it is recommended to change the oil and clean the oil filter after running 2,000 hours. Check the system whether clean or not and then change oil every 20,000 hours or after 3 years' continuous running while the system operates in good condition.
- Avoid clogging in oil filter with debris or swarf which may cause failure in bearings.

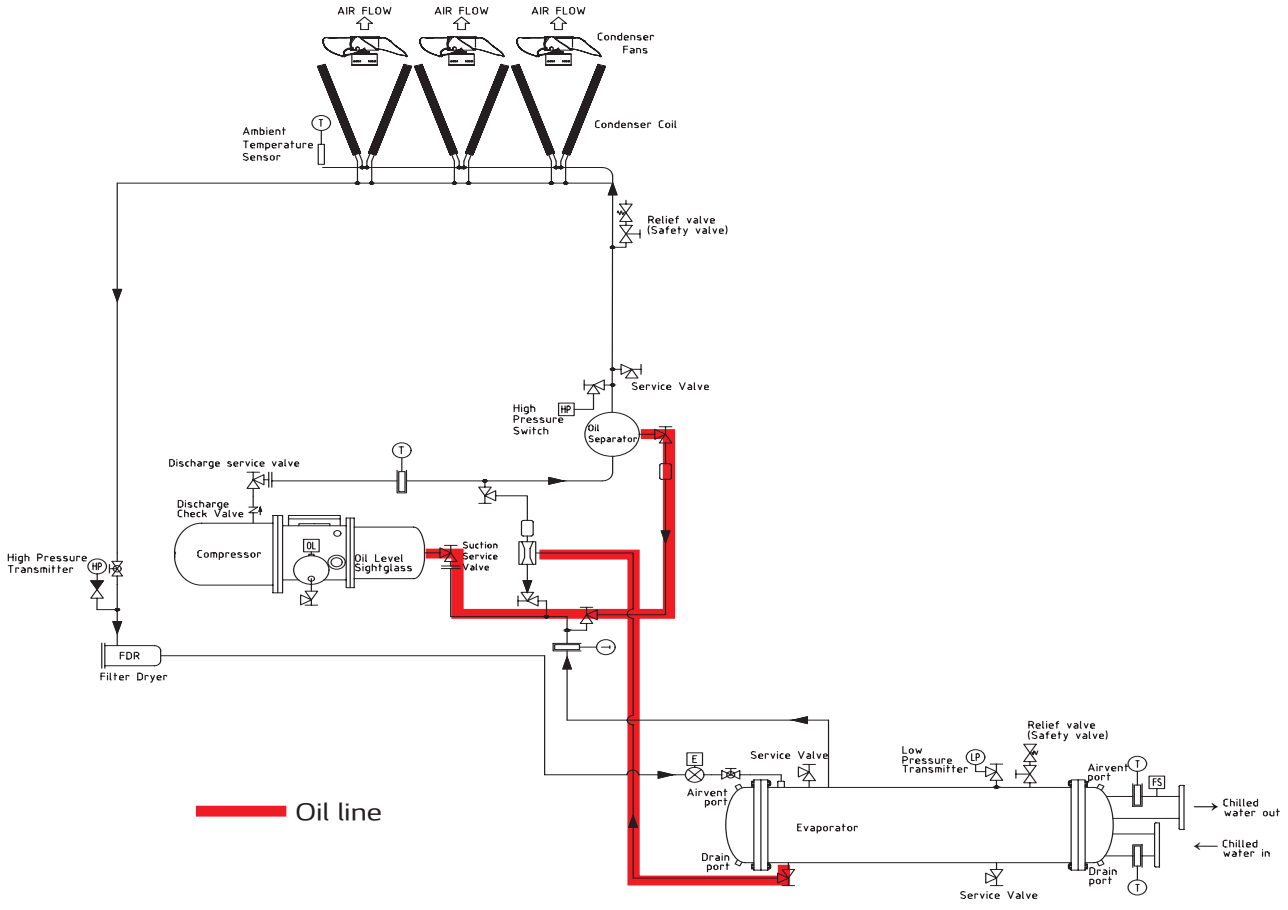


Figure 8. Oil Recovery System

Safety Device

- The following devices are installed for safe operation and equipment protection.

No.	Item	Installation Location	Measurement Target	Description	Quantity
1	Chilled water outlet temperature low	Chilled water outlet nozzle	Chilled water outlet temperature	Chiller stop, when chilled water outlet temperature is lower then set value. (Freeze protection)For details, please refer to 'Setting Abnormal Conditions' in Section 4. Control System.	1
2	Evaporator pressure low	Evaporator	Evaporating pressure	Compressor stop, when evaporating pressure is lower then set value.For details, please refer to 'Setting Abnormal Conditions' in Section 4. Control System.	1 (Compressor each)
3	Condenser pressure high	Condenser outlet pipe	Condenseing pressure	Compressor stop, when condensing pressure is higher then set value.For details, please refer to **'Setting Abnormal Conditions'** in Section 4. Control System.	1 (Compressor each)
4	Compressor discharge temperature high	Compressor discharge pipe	Compressor discharge temperature	Compressor stop, when compressor discharge temperature is higher then set value.For details, please refer to 'Setting Abnormal Conditions' in Section 4. Control System.	1 (Compressor each)
5	Refrigerant differential pressure low	-	Pressure difference between evaporating pressure and condensing pressure	Compressor stop, when refrigerant difference pressure is lower then set value.For details, please refer to 'Setting Abnormal Conditions' in Section 4. Control System.	1 (Compressor each)
6	Water flow low	Chilled water outlet nozzle	Water flow	Chiller stop, when water flow rate is lower then set value.	1
7	Current limit	Starter panel	Motor current	Compressor stop, when motor current is higher then set value.For details, please refer to 'Setting Abnormal Conditions' in Section 4. Control System.	1 (Compressor each)

No.	Item	Installation Location	Measurement Target	Description	Quantity
8	Temperature sensor abnormal	Chilled water nozzle Middle frame	Each temperature sensor	Chiller stop, when temperature sensor disconnected or abnormal value due to sensor malfunction	3 (Chiller each)
		Compressor discharge pipe Compressor suction pipe			2 (Compressor each)
9	Pressure sensor abnormal	Evaporator Condenser outlet pipe	Each pressure sensor	Compressor stop, when pressure sensor disconnected or abnormal value due to sensor malfunction	2 (Compressor each)
10	Pressure abnormal	Compressor discharge pipe	Condenseing pressure	Compressor stop, when condensing pressure is higher then set value.	1 (Compressor each)
11	Motor abnormal	Compressor terminal box	Motor status	Compressor stop, when compressor protection relay make abnormal signal(This function may not applied by starting method)	1 (Compressor each)
12	Power abnormal	Starter panel	Power status	Compressor stop, when cver current relay make abnormal signal	1 (Compressor each)
13	External fault	Control panel	External fault signal	Chiller stop, when activate falut signal maked by user system	1
14	Pump interlock abnormal	Control panel	Pump interlock	Chiller stop, when off water pump interlock signal during chiller running	1
15	Oil abnormal	Compressor	Oil level	Compressor stop, when oil level is low during compressor running	1 (Compressor each)

4. Control System

4-1. Control Panel Components

HMI

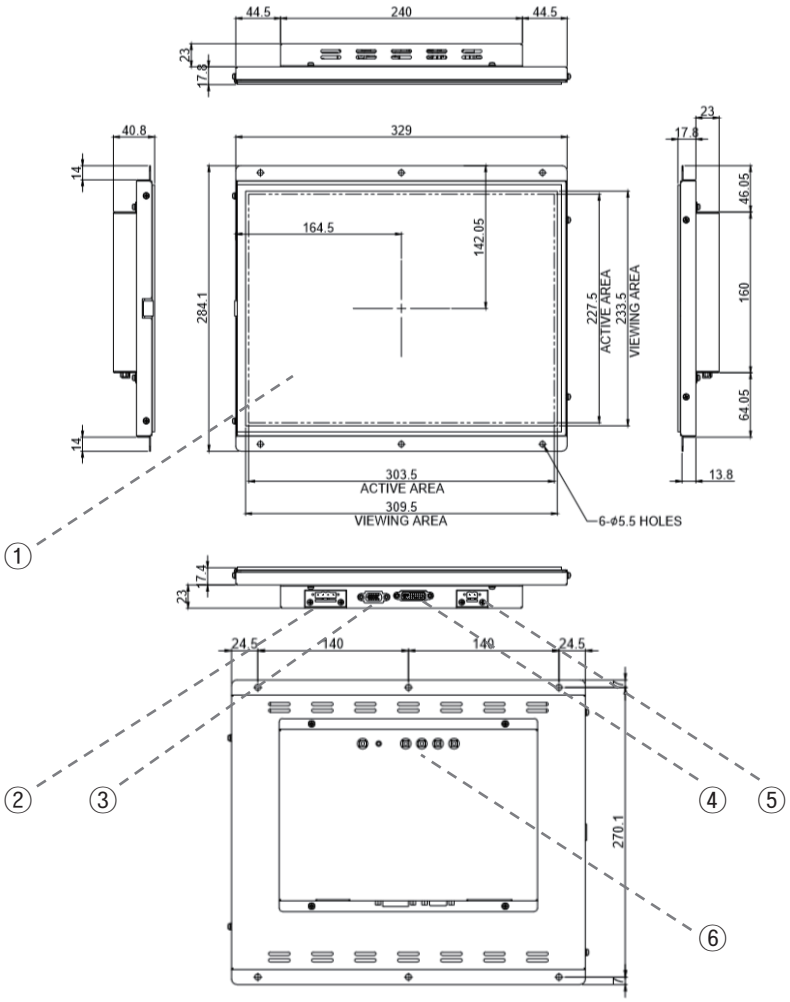


Figure 9. Display apperance

No.	Item	Description
①	Touch screen	15.0 inch LCD touch screen LCD display for product control and product status indication
②	DC power supply terminal	DC 24V power supply
③	DVI-D port	DVI video input (controller video signal input)
④	VGA port	RGB video input (for debugging)
⑤	Touch connection terminal	Communication input (serial) for touch display calibration
⑥	Monitor control/OSD button	On-screen display button (Display settings: Select Power On/Off, select Source, and select Up, Down, Menu)

Table 1. Names and Functions of HMI Components

Other Control Parts

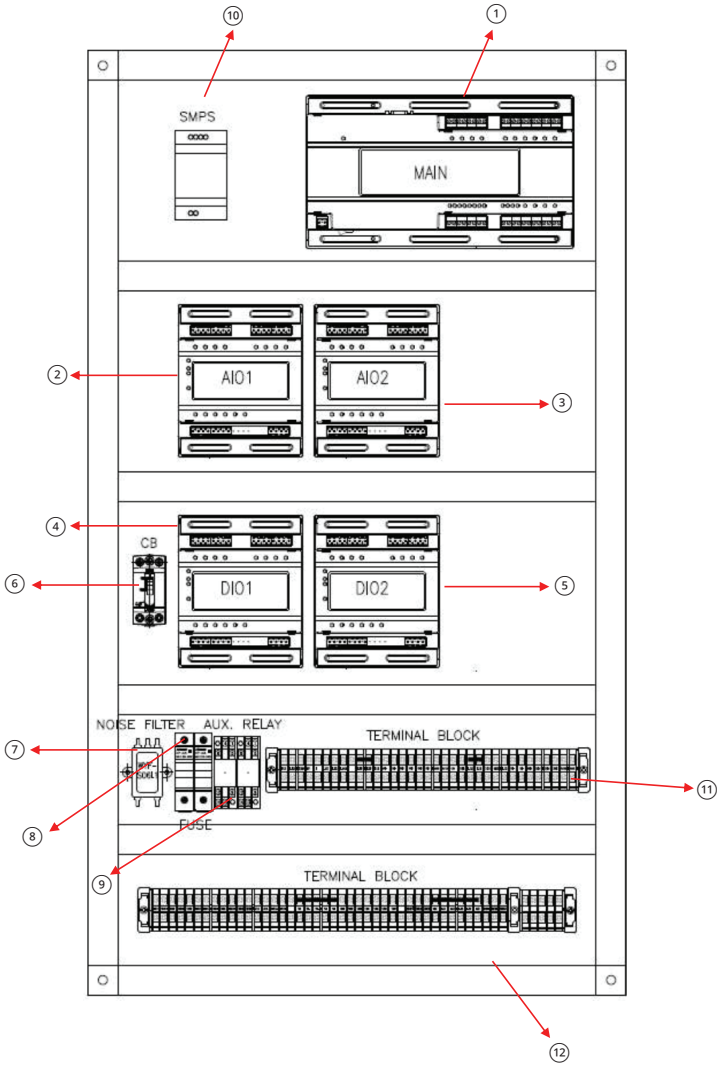


Figure 10. Control System

No.	Item	No.	Item
①	Main controller	⑦	Noise filter
②	Analog I/O controller (AIO controller)	⑧	Fuse
③	Analog I/O controller (AIO controller)	⑨	Relay
④	Digital I/O controller (DIO controller)	⑩	Power supply (SMPS)
⑤	Digital I/O controller (DIO controller)	⑪	Terminal block
⑥	Circuit breaker (CB)	⑫	Enclosure

※ The above arrangement may differ depending on the device type or may be arbitrarily changed for design improvement or user convenience. For more information, please refer to the approved drawings.

4-2. BMS Support Function

- Screw chiller's default communication protocol is Modbus protocol, and it is compatible with the higher level communication methods.

Communication protocols supported

- Communication method
  - Default: RS-485, Ethernet (optional)
- Protocol
  - Default: MODBUS
  - Optional: BACnet, TCP/IP

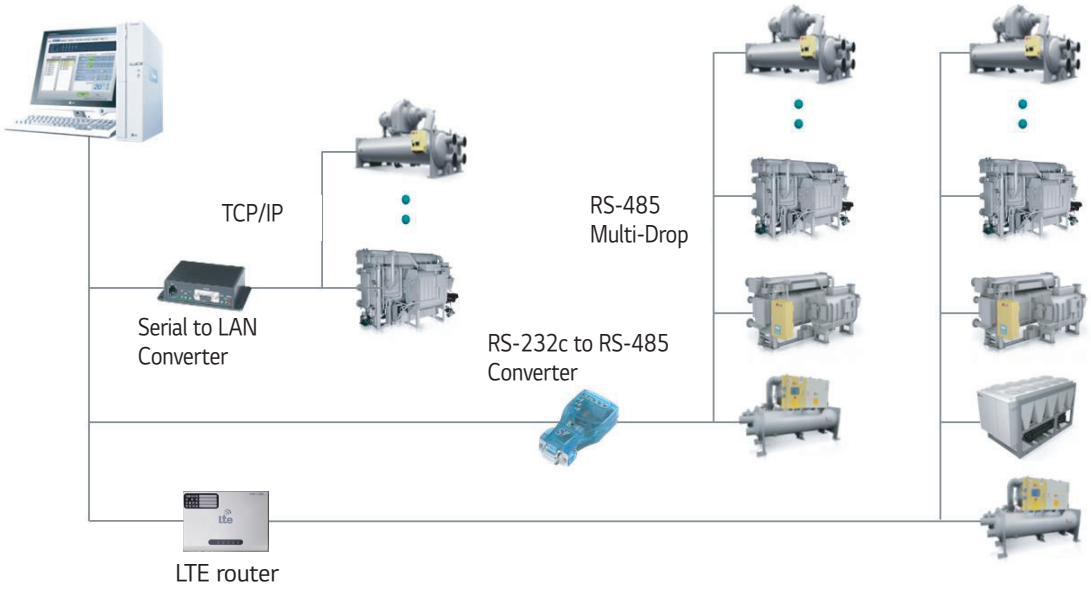


Figure 11. Detailed Diagram of BMS

4-3. Control Panel and Connection Signals

Signal Name	Signal Type	Meaning of Signal	Caution
Chilled water pump interlock	Input (Dry contact)	These are interlocks for checking the operation of an electronic contactor for pump startup. If there is no input signal at the time of starting, the product will not operate. If there is no input even during operation, an error occurs.	Outputs 24 VDC and detects the status of a contact. Make sure to avoid a contact resistance of 100Ω or higher. (You must not handle their electric wire pipes together with other power lines.)
Chilled water pump start/ stop	Output (Dry contact)	These are start/stop signals for the pump or fan. Connect the signals when operating the pump or fan using the start/stop signals from the product.	Use them within 250 VAC, 0.1A (resistance load).

4-4. Central Monitoring Panel and Connection Signals

Signal Name	Signal Type	Meaning of Signal	Caution
Motor run	Output (Dry contact)	ON: Motor run OFF: Motor stop	Use them within 250 VAC, 0.1A (resistance load).
Chiller run / stop	Output (Dry contact)	ON: chiller run OFF: chiller stop	
Fault for displaying errors	Output (Dry contact)	ON: chiller abnormal	
Remote mode operation	Output (Dry contact)	ON: remote operation mode	

5. Display

5-1. Getting Started with the Display

5.1.1 Top Menu

The top menu includes options for display language, device name, date, time, operating status, alarm messages, account information, target temperature, motor current limit criteria, handling mode, operation mode, manual operation button, and start/stop button. When an item is selected, a pop-up window appears, providing additional functions such as changing settings, dismissing alarms, and logging into the account.

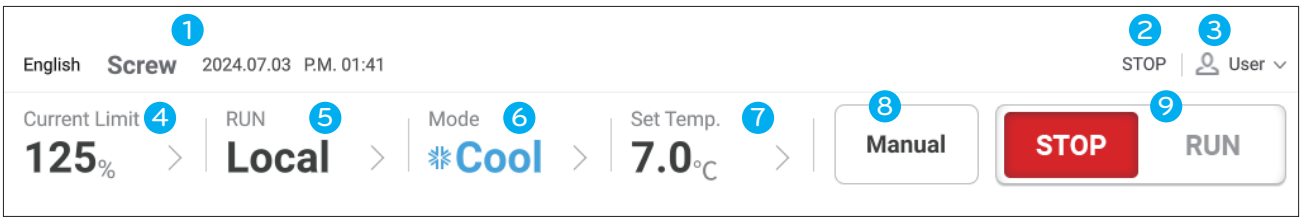


Figure 12. Top Menu

1. Language, device name, date, and time

Displays the information about the connected product, such as display language, device name, and current date and time (with the date followed by the time).

2. Operating status and warning messages

Displays the product operation status and warning messages. When the messages are displayed, warnings are displayed in red color and errors in orange color.

When you select a message indicating an issue on the display, a pop-up window appears, showing the details of the abnormal condition, inspection method, and necessary measures, along with options to clear the alarm and confirm actions.

3. Account information

Displays the ID of the currently used account. If you select a guest account, a login pop-up appears. If you are logging in with a user or installer account, the account information you are logging in with is displayed, and the Edit button and Logout button are displayed.

4. Motor current limit criteria

Displays the motor current limit threshold. When selected, it displays a pop-up to set a motor current limit value.

5. Handling mode

Displays the handling mode. When selected, it displays a pop-up to set a handling mode.

6. Operation mode

Displays the currently set operation mode. If the product type is ice-making or heating, selecting this option displays a pop-up to choose an operation mode.

7. Target temperature

Displays the cooling target temperature (the set value for the cold water outlet temperature). When selected, it displays a pop-up to set a target temperature.

8. Manual operation

Selecting the button opens a pop-up displaying the compressor operation status and providing access to the actuators available for manual operation.

9. Run/Stop control setting

Selecting the Run button starts the product operation. Selecting the Stop button stops the product operation.

5.1.2 Left Menu

The left menu includes the main menu and a login button located at the bottom of the screen.

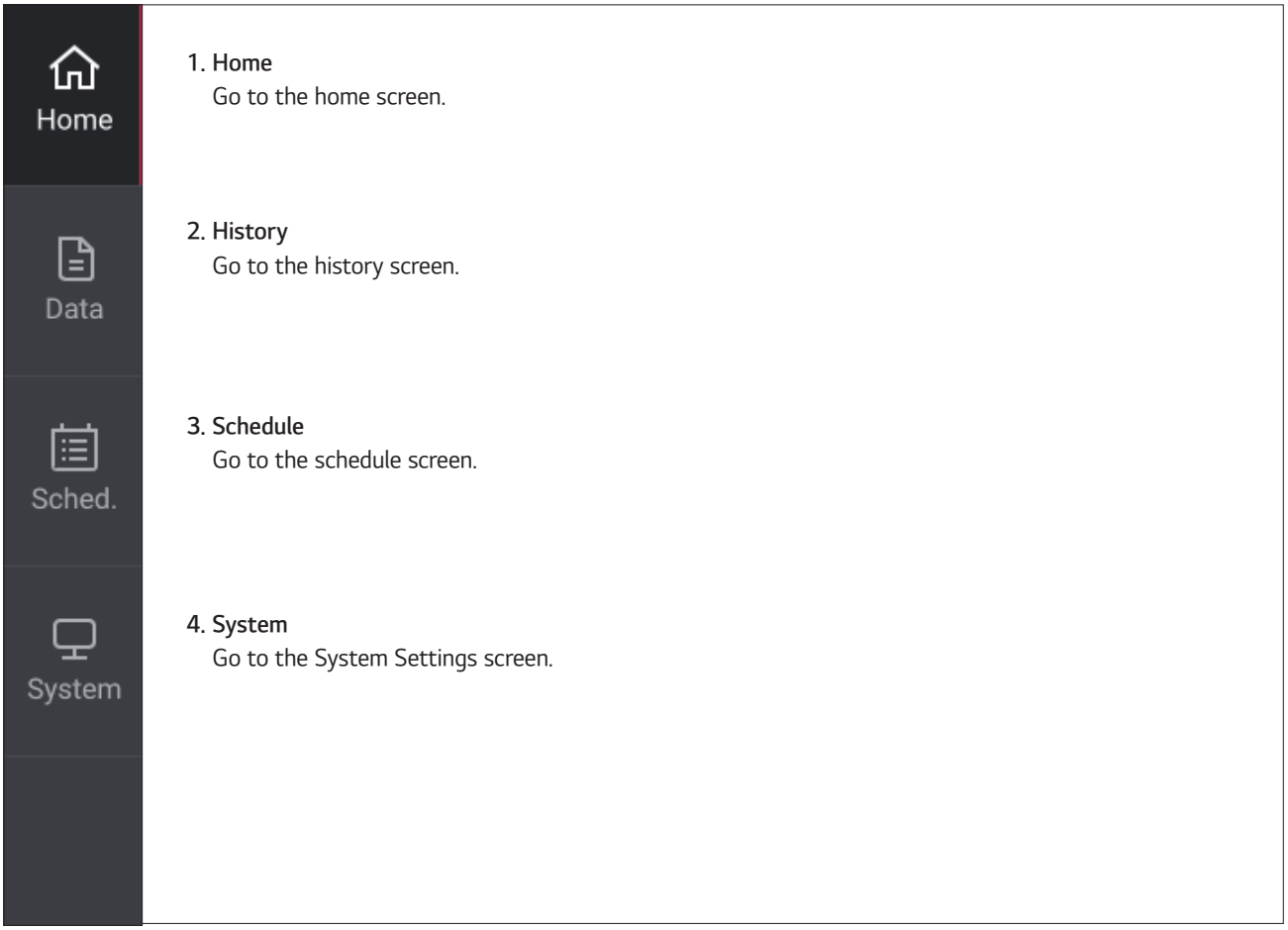


Figure 13. Left Menu

5-2. Home Screen Composition

5.2.1 Full View

The full view includes the main menu and a login button displayed at the bottom of the screen.

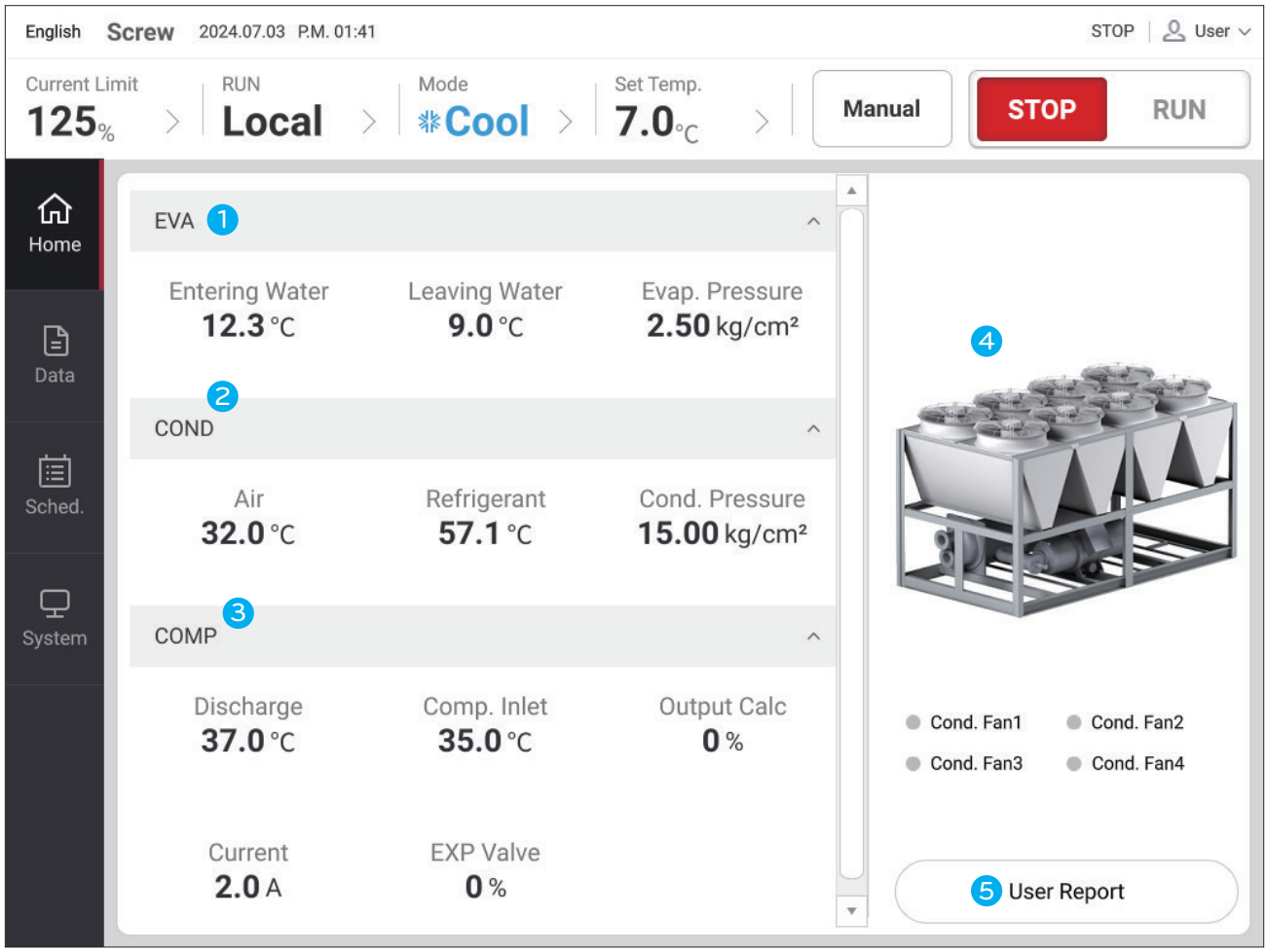


Figure 14. Full View

No.	Component	Description
1	Evaporator tab	Displays evaporator operation data, and displays additional operation data when the tab is selected.
2	Condenser tab	Displays condenser operation data, and displays additional operation data when the tab is selected.
3	Compressor tab	Displays compressor operation data, and displays additional operation data when the tab is selected.
4	Product image	Provides animation of the current product (example: 1 Comp)
5	User Report button	Provides a user report generation screen when selected.

Table 2. Full View Components

5.2.2. Evaporator

This screen displays the data associated with the evaporator animation screen.

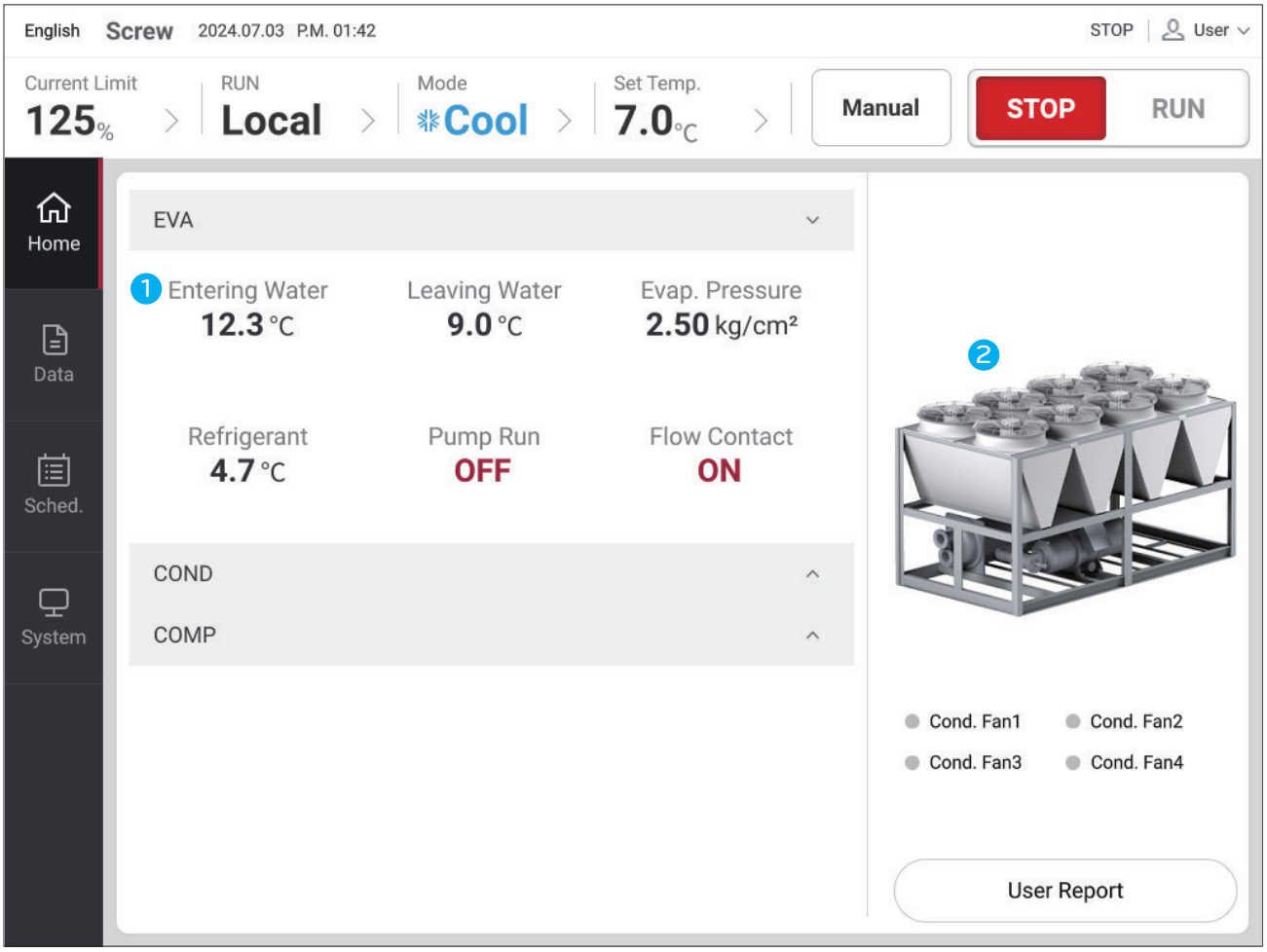


Figure 15. Evaporator

No.	Component	Description
1	Evaporator information	Provides evaporator operation data. Provides information on the evaporator's entering water temperature, leaving water temperature, evaporator pressure, pump operation signal, and flow contact (default).
2	Evaporator image	Provides an evaporator image.

Table 3. Evaporator Components

5.2.3. Condenser

This screen displays the data associated with the condenser animation screen.

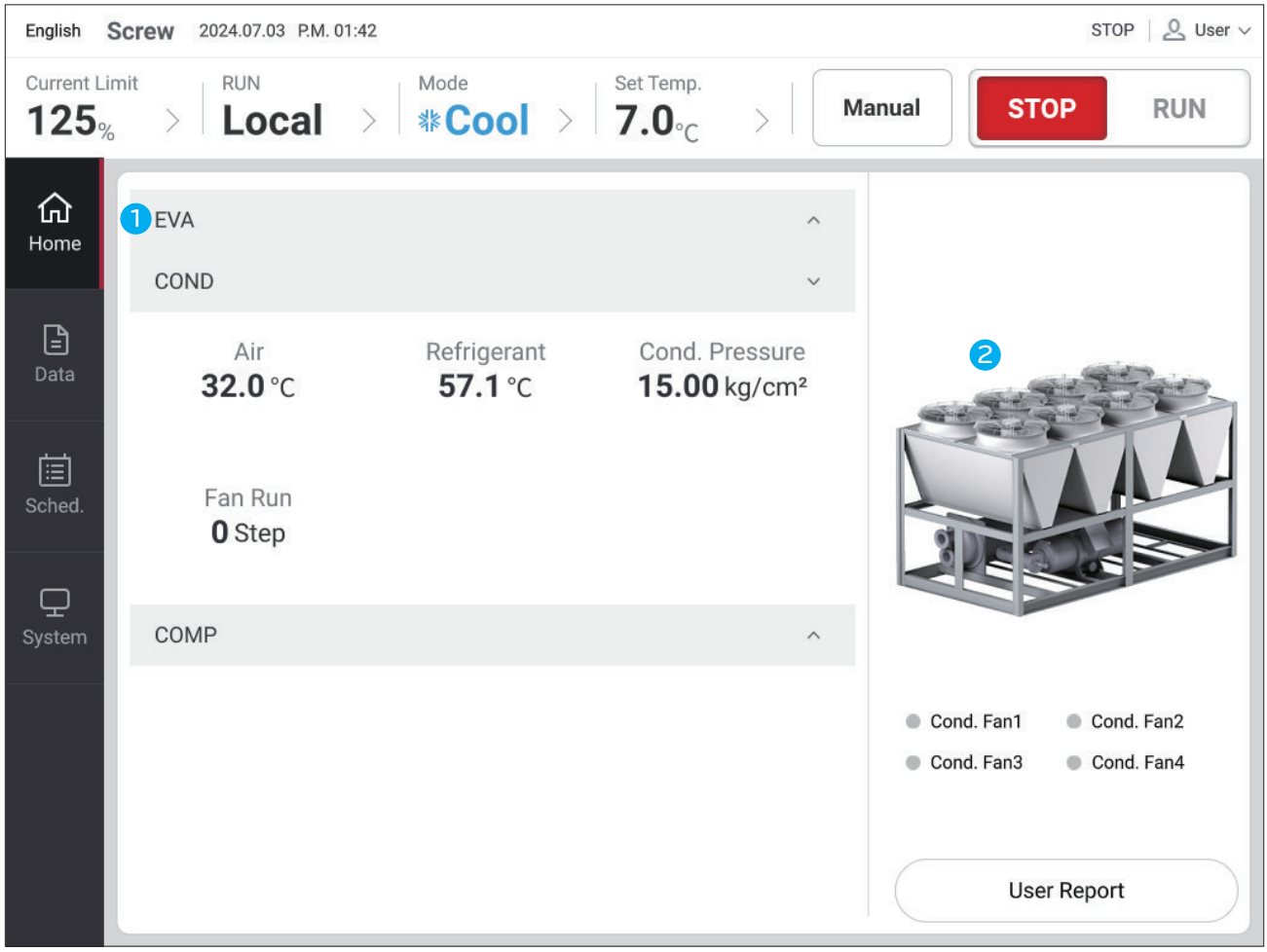


Figure 16. Condenser

No.	Component	Description
1	Condenser information	Provides condenser operation data. Provides information on the condenser's entering water temperature, leaving water temperature, evaporator pressure, pump operation signal, and flow contact (default).
2	Condenser image	Provides a condenser image.

Table 4. Condenser Components

5.2.4. Compressor

This screen displays the data associated with the compressor animation screen.

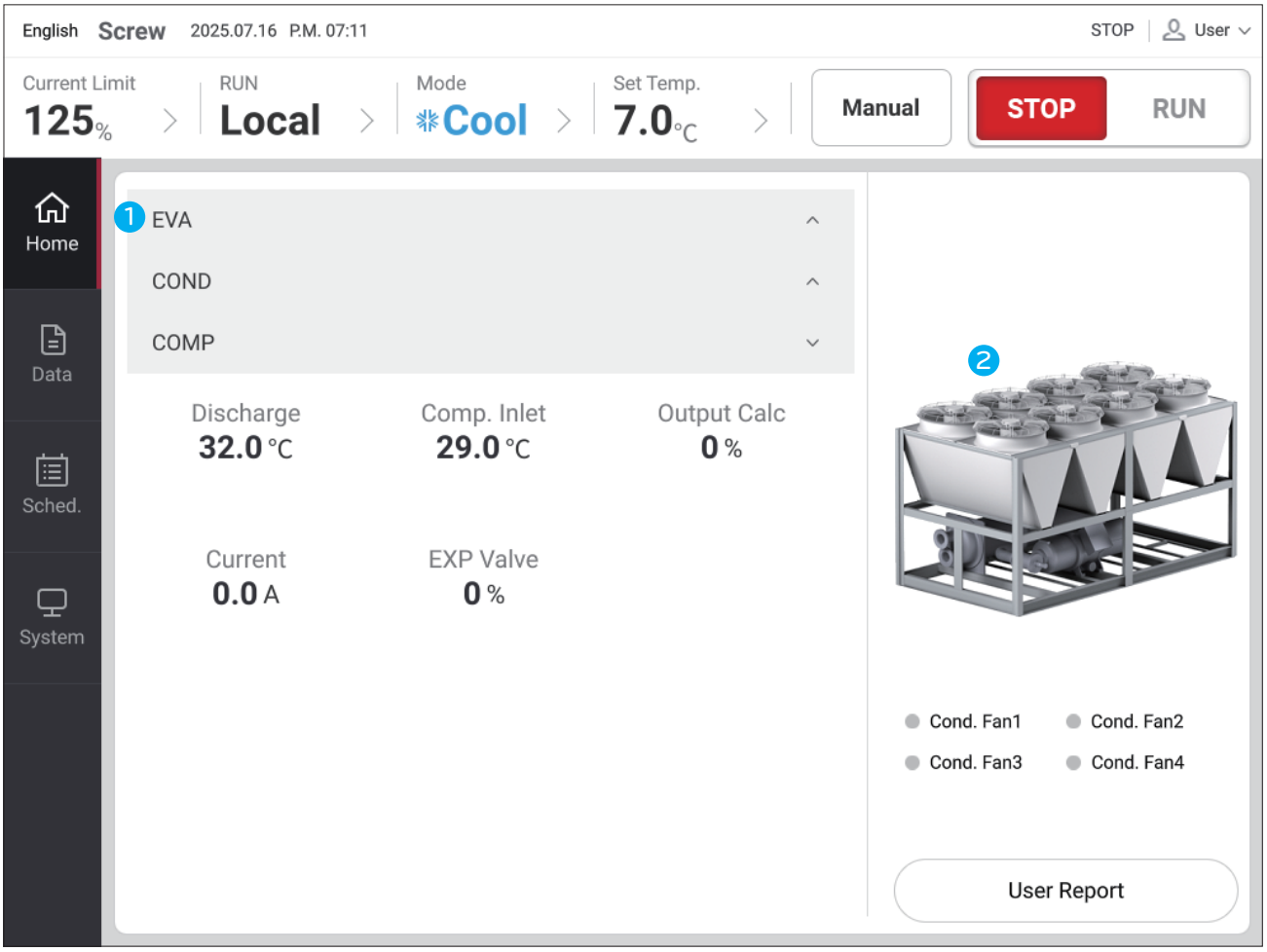


Figure 17. Compressor

No.	Component	Description
1	Compressor information	Provides compressor operation data. Provides information on the compressor discharge, compressor suction, compressor load, current, economizer, and head valve.
2	Compressor image	Provides a compressor image.

Table 5. Compressor Components

5.2.5. Manual Operation

This screen provides manual operation functions for the compressor status and manually controllable loads.

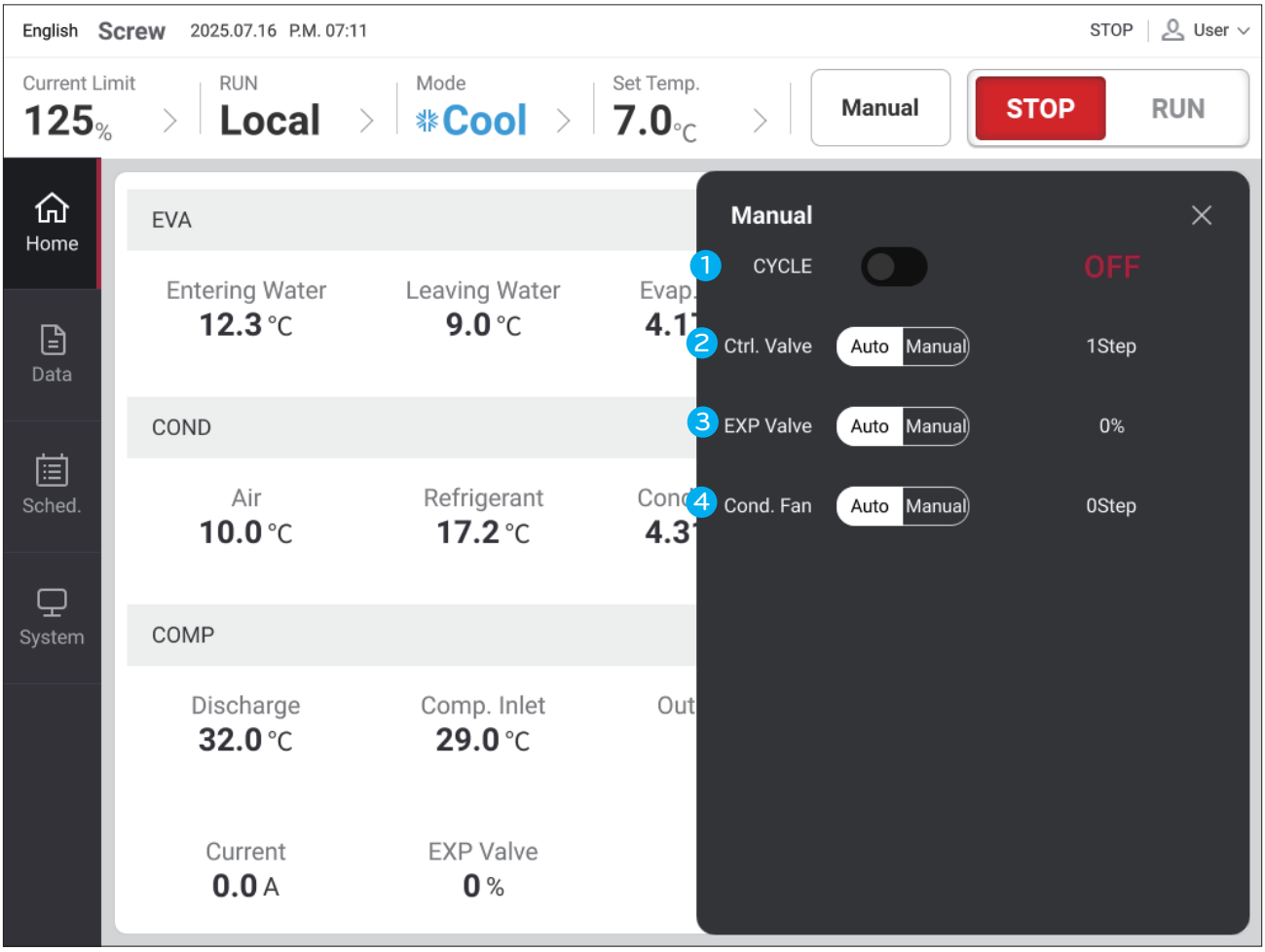


Figure 18. Manual Operation

No.	Component	Description
1	Cycle	Display cycle status as ON/OFF, Manual operation function provided when setting button is selected
2	Capacity control	Displays compressor capacity status. Provides manual control function when select Manual
3	Expansion valve	Displays expansion valve status. Provides manual control function when select Manual
4	Condenser fan	Displays condenser fan statusProvides manual control function when select Manual

Table 6. Manual Operation Components

5.2.6. User Report

This screen provides functions to display and save user report items.

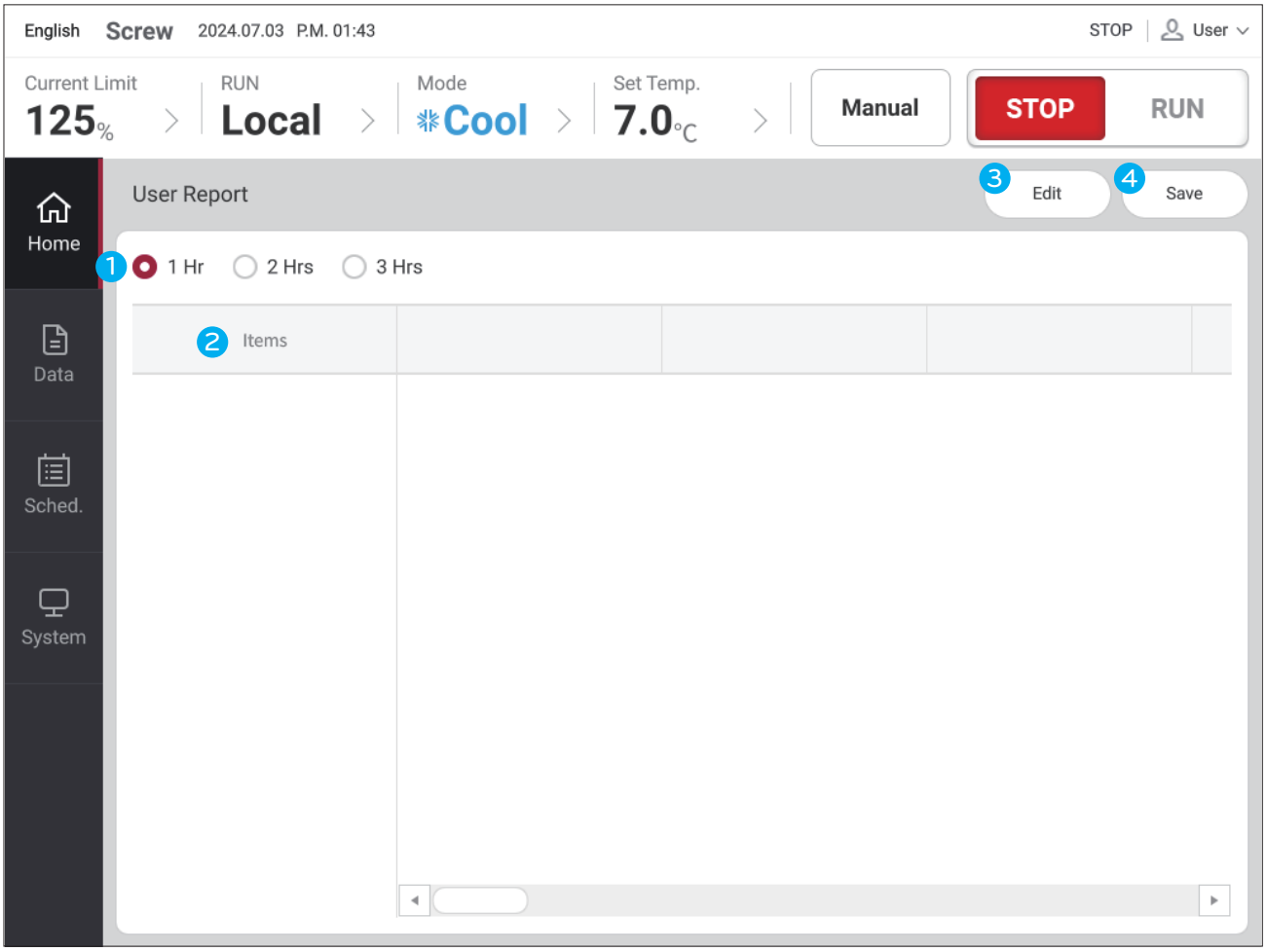


Figure 19. User Report

No.	Component	Description
1	Display/Save cycle	Provides the function to set a data display/saving cycle. You can select among 1 hour, 2 hours, and 3 hours.
2	Display data	Provides the function to display data for each item according to a previously set time cycle.
3	Edit item	Provides the function to select data items to display and save on the screen (select among 20 items).
4	Save	Allows you to save selected items, with options to save files by date to a USB storage or send them via email.

Table 7. User Report Components

This screen provides functions to edit items in the user report.

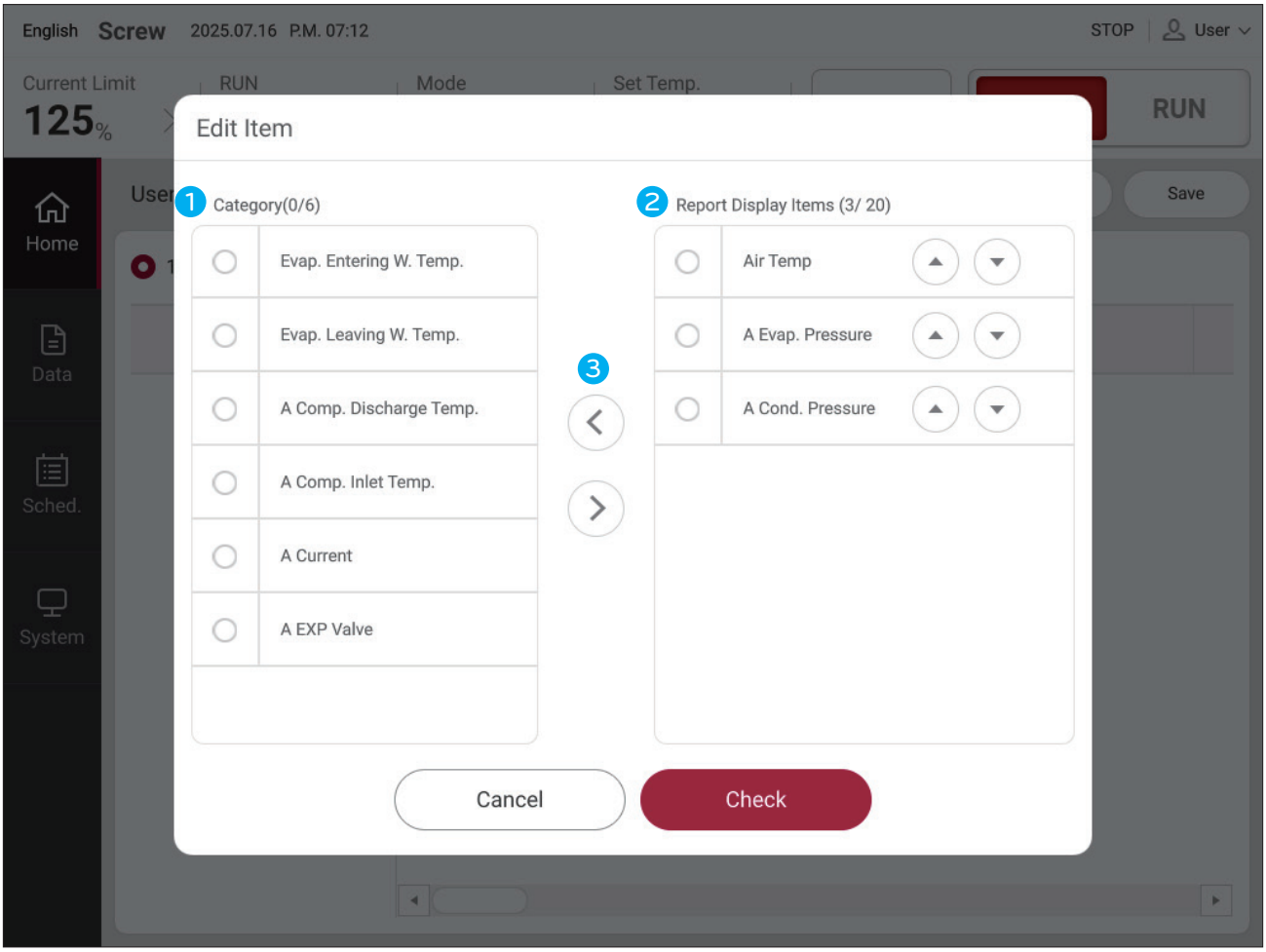


Figure 20. User Report - Edit Item

No.	Component	Description
1	Items	Displays all items that can be shown in the report. You can select the items you want to include in the report.
2	Items displayed on report	Shows the items selected to be displayed on the report (up to 20 items) from all available items.
3	Move items	Provides the function to select items to be displayed on the report or delete them from the report.

Table 8. User Report Components

This screen provides functions to save the user report.

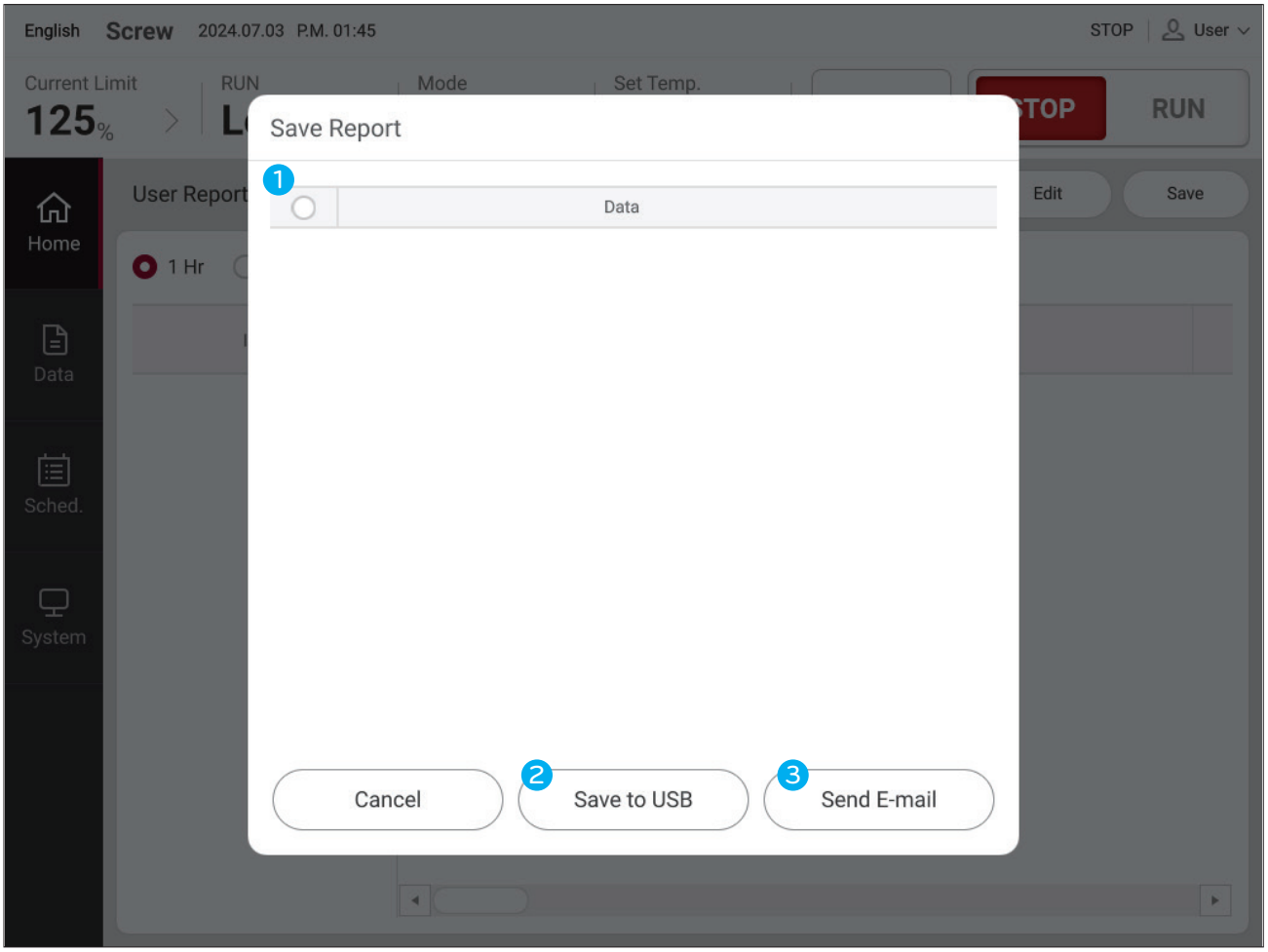


Figure 21. User Report

No.	Component	Description
1	Report list	Displays a list of reports that can be saved and allows you to select the report you want to save.
2	Save in a USB storage	Provides the function to save selected reports to a USB storage. This function is activated when the controller recognizes a USB storage.
3	Send email	Provides the function to send selected reports via email. If the controller is connected to a network, the report will be sent to a pre-registered email address.

Table 9. User Report Items

5.2.7 Home Screen Display Information

No.	Display Menu	Display Information	Display Range	Display Unit	Remark
1	View All	Evaporator entering water temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
2		Evaporator leaving water temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
3		Evaporator pressure	3 digits in the integer part, 2 digits in the decimal part (XXX.XX)	kg/cm2	
4		Condenser entering water temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
5		Condenser leaving water temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
6		Condenser pressure	3 digits in the integer part, 2 digits in the decimal part (XXX.XX)	kg/cm2	
7		Compressor discharge temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
8		Compressor suction temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
9		Compressor load	0% - 100% (XXX)	%	
10		Current	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	A	
11	Evaporator	Evaporator entering water temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
12		Evaporator leaving water temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
13		Evaporator pressure	3 digits in the integer part, 2 digits in the decimal part (XXX.XX)	kg/cm2	
14		Evaporator pump operation signal	On/Off	-	
15		Evaporator flow contact	On/Off	-	
16		Evaporator refrigerant temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	Note 1
17		Evaporator LTD	4 digits in the integer part, 2 digit in the decimal part (XXXX.X)	°C	Note 1
18	Condenser	Condenser entering water temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
19		Condenser leaving water temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
20		Condenser pressure	3 digits in the integer part, 2 digits in the decimal part (XXX.XX)	kg/cm2	
21		Condenser pump operation signal	On/Off	-	
22		Air temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	Note 1
23		Condenser refrigerant temperature	4 digits in the integer part, 2 digit in the decimal part (XXXX.X)	°C	Note 1
24		Condenser flow contact	On/Off	-	
25	Compressor	Compressor discharge temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
26		Compressor suction temperature	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	°C	
27		Compressor load	0% - 100% (XXX)	%	
28		Current	4 digits in the integer part, 1 digit in the decimal part (XXXX.X)	A	
29		Expansion valve opening	0% - 100% (XXX)	%	Note 1
30		Economizer condition	On/Off	-	Note 1
31		Reversing valve condition	On/Off	-	Note 1
32		Head valve condition	On/Off	-	Note 1
33		Oil cooler condition	On/Off	-	Note 1
34	Manual operation	Cycle	On/Off	-	
35		Capacity control valve	Auto/Manual, 1 step to 4 steps	Step	
36		Expansion valve	Auto/Manual, 3 digits in the interger part(XXX)	%	
37		Condenser fan	Auto/Manual, 1 step to 4 steps	Step	

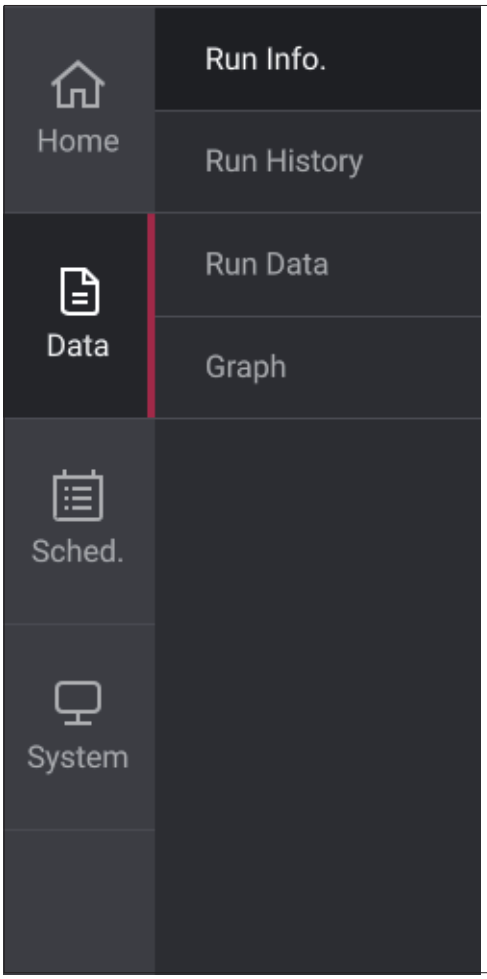
Table 10. Home Screen Display Components and Settings

Note 1. These items are optionally displayed depending on whether the sensor is enabled or disabled.

5-3. History

History is the function to check the operation information and history of the chiller. It consists of: 1) 'Operation Information' for checking the number of operations and operation time for the product and compressor, 2) 'Operation History' for checking operation, alarm, or error messages; 3) 'Operation Data' for checking detailed operation data; and 4) 'Graph' for displaying operation data using a graph.

5.3.1. History View (Operation/Error)



1. Run Info
   Display the number of chiller operation and accumulated running hours, the number of compressor operation and accumulated compressor running hours.
2. Run History
   Display operation/alarm/error message.
3. Run Data
   Display detailed running data
4. Graph
   Display a graph that plots running data in real time / by date.

Figure 22. Left Menu

5.3.2. Operation Information

This screen displays the number of operations and operation time for the product and compressor.

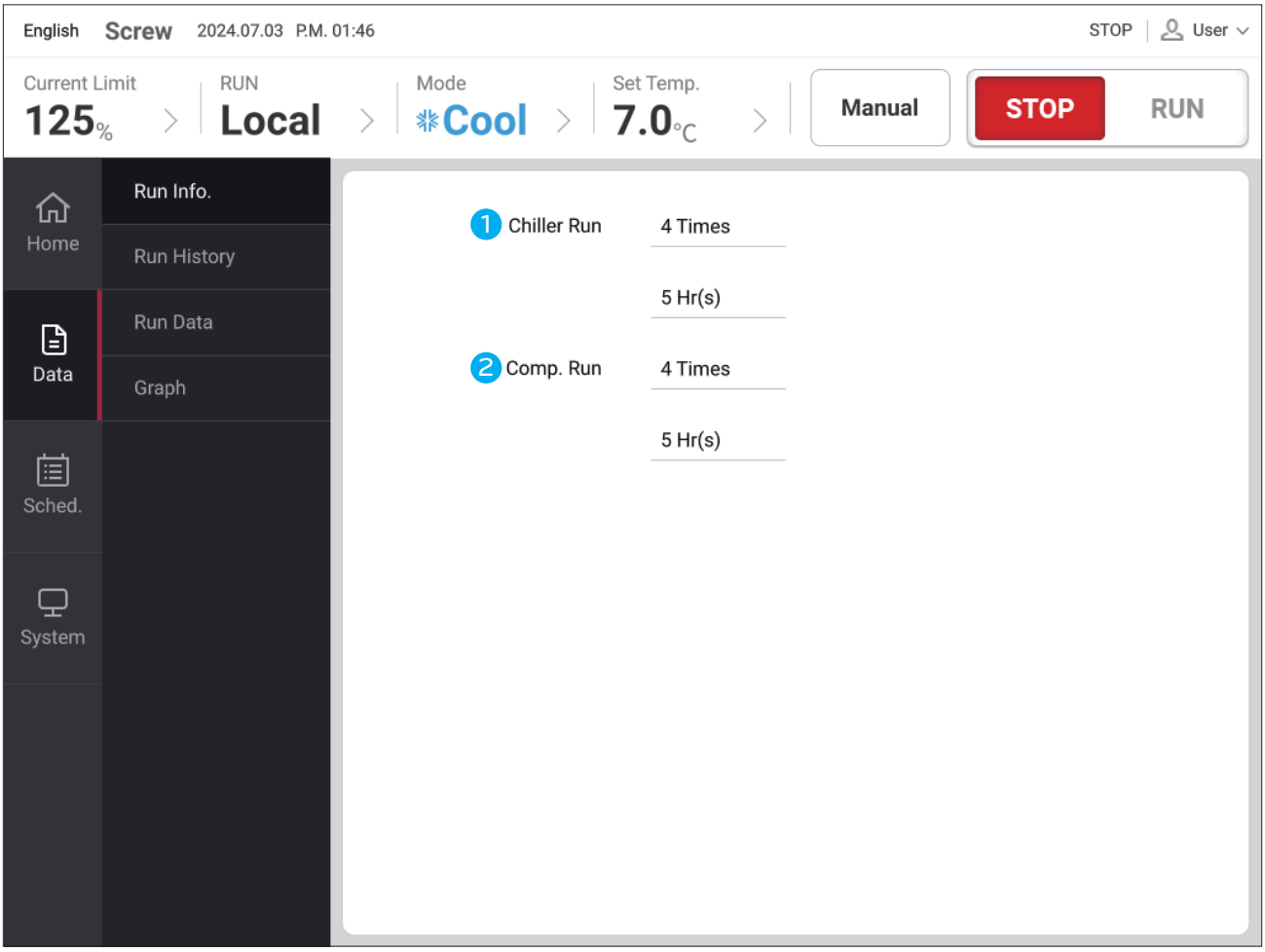


Figure 23. Operation information

No.	Component	Description
1	Product operation	Displays the number of product operations and operation time.
2	Compressor operation	Displays the number of compressor operations and operation time.

Table 11. Operation Information Components

5.3.3. Operation History

This screen displays the information on the product operation history. It displays operation, alarm and error messages. You can view them after logging in to the user error account.

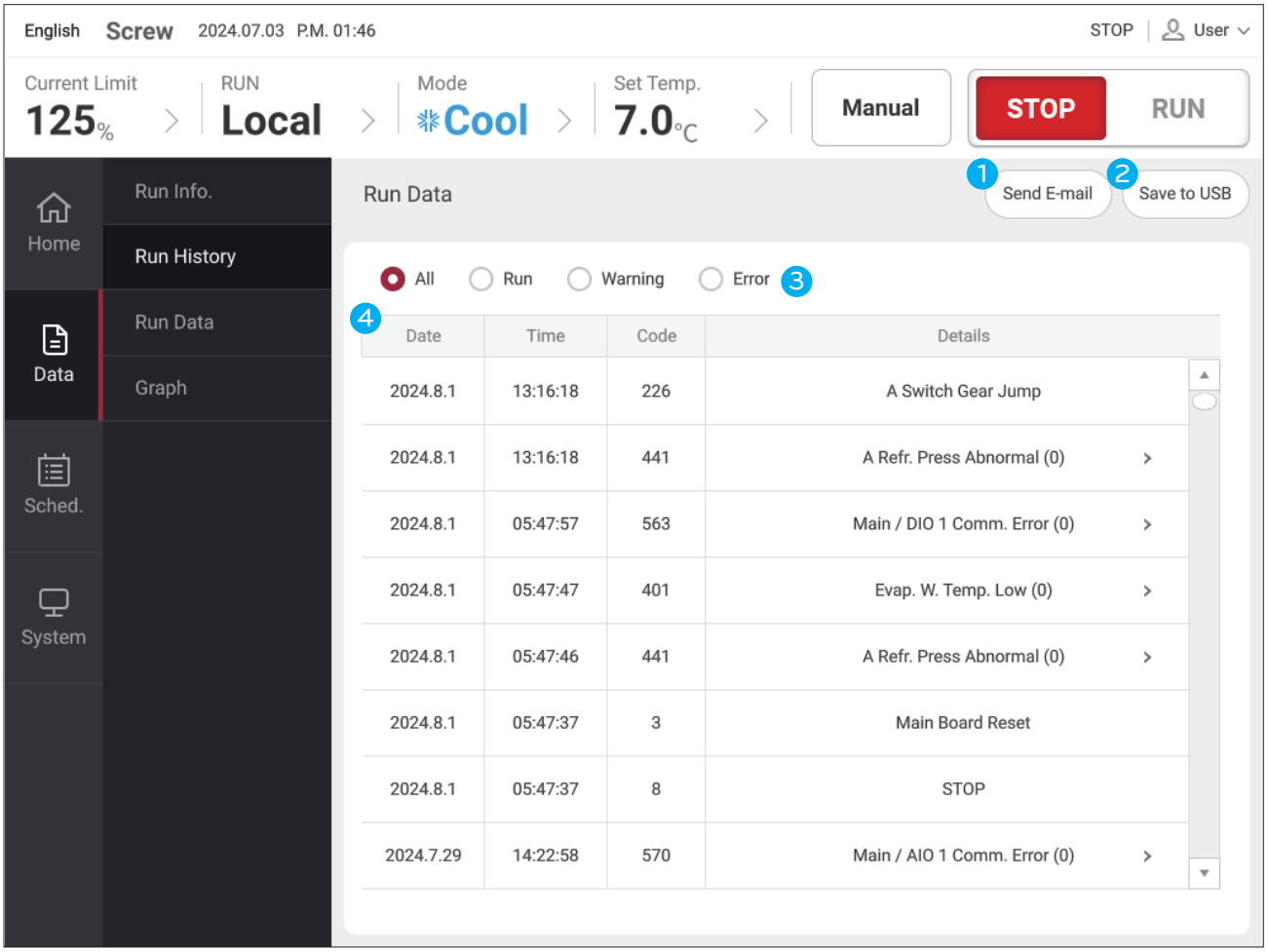


Figure 24. Operation History

No.	Component	Description
1	Send email	Provides the function to send messages via email in CSV file format, organized by date.
2	Save in a USB storage	Provides the function to save messages to a USB storage in CSV file format, organized by date.
3	Select message type	Provides the function to select the type of messages to display. You can select from All, Operation, Alarm and Error.
4	Message	Provides the function to display the occurrence date, time, code, and detailed information of messages.

Table 12. Operation History Components

5.3.4. Operation Data

This screen provides functions to display product temperature and actuator operation data in 5-second intervals.

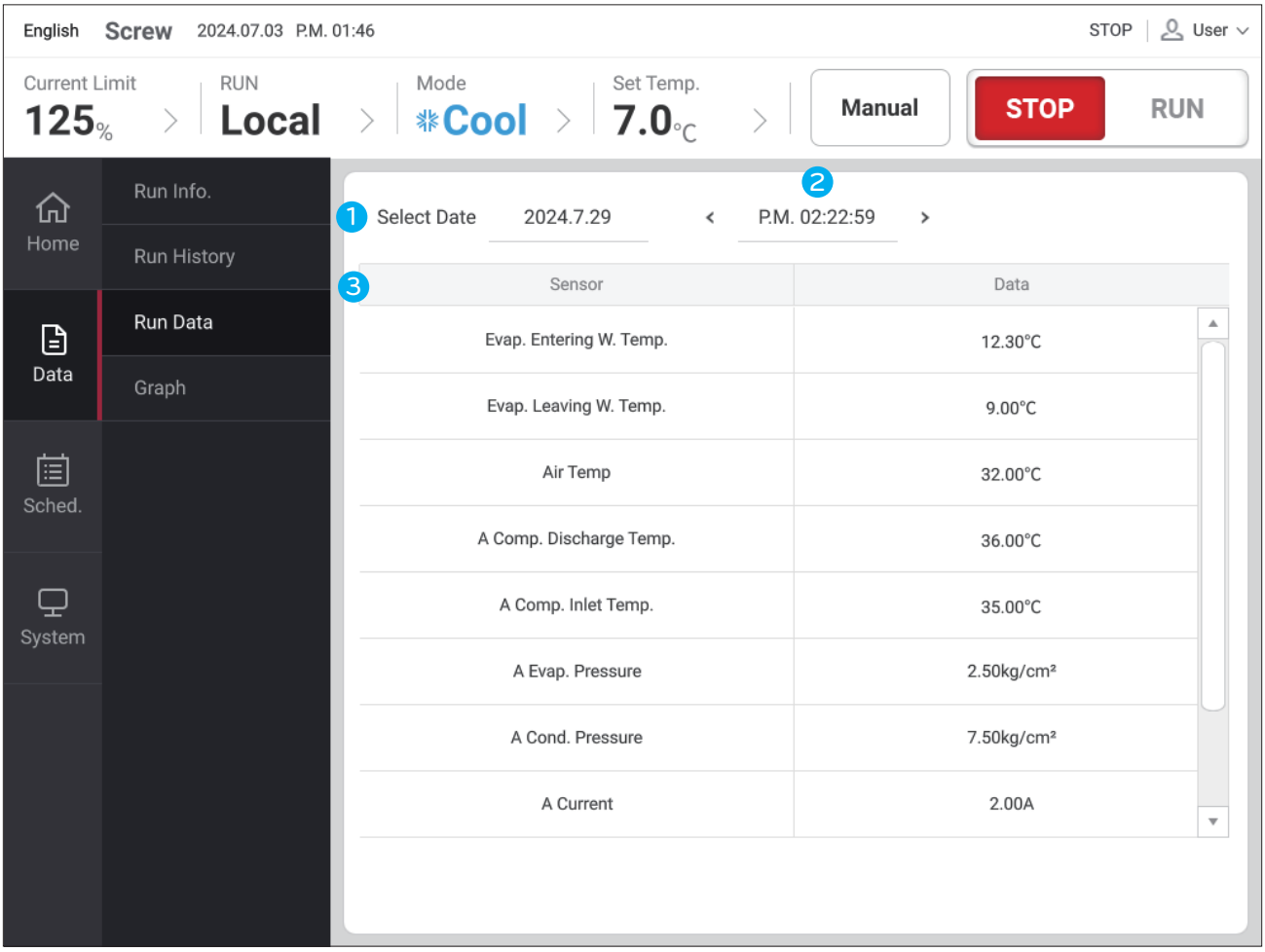


Figure 25. Operation Data

No.	Component	Description
1	Select date	Allows you to select the date of the operation you want to check and displays the selected date.
2	Select time	Allows you to select the time of the operation you want to check in 5-second intervals.
3	Display data	Displays product temperature and actuator operation data.

Table 13. Operation Data Components

5.3.5. Graph

This screen provides functions to display product operation data using a graph. You have two different options to view the graph: either by monitoring real-time data from the last 4 minutes or by reviewing operation data from a specific day. You can view data for up to 10 items among those selected in the port settings.

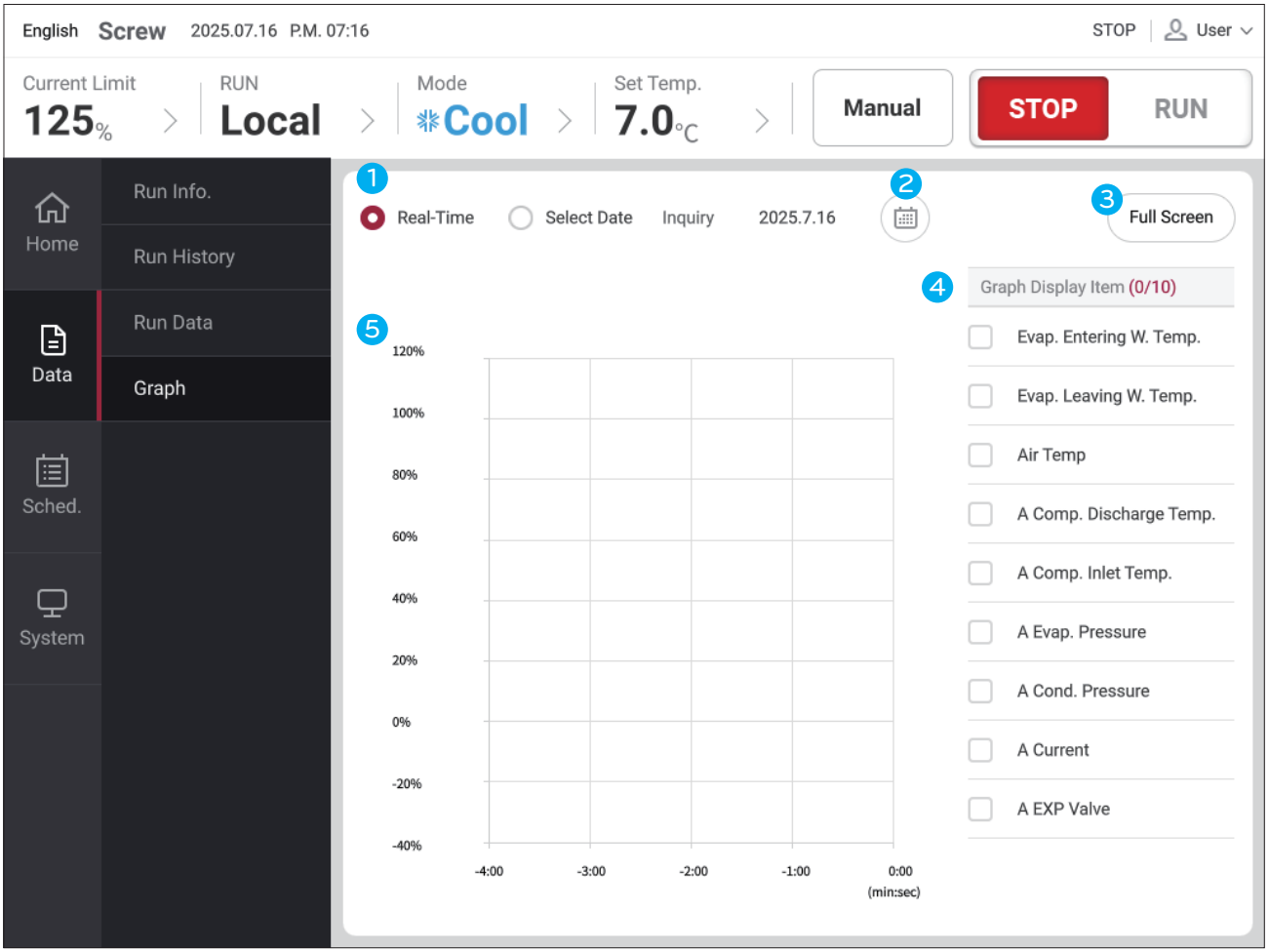


Figure 26. Graph

No.	Component	Description
1	Graph type	Choose the type of graph you wish to display. You can select either Real-time or Select Date.
2	Select date	When selecting a specific date, you can check the operation data for the relevant date.
3	Select display method	You can select either 'Full Screen' or 'Select Item.'
4	Items displayed on graph	Select items to check on the graph. You can select up to 10 items.
5	Graph	Displays the selected items over time on the graph.

Table 14. Graph Components

5-4. Schedule

Schedule is a function to designate a device operation in advance and make the device perform the designated operation at a specific time. If you need scheduled control of the device, you can make it automatically operate based on the set schedule.
However, in the case of an operation to start the product, scheduled control is performed only when the product is in the standby state for a scheduled operation.
Usage examples are provided below.

5.4.1. Schedule View

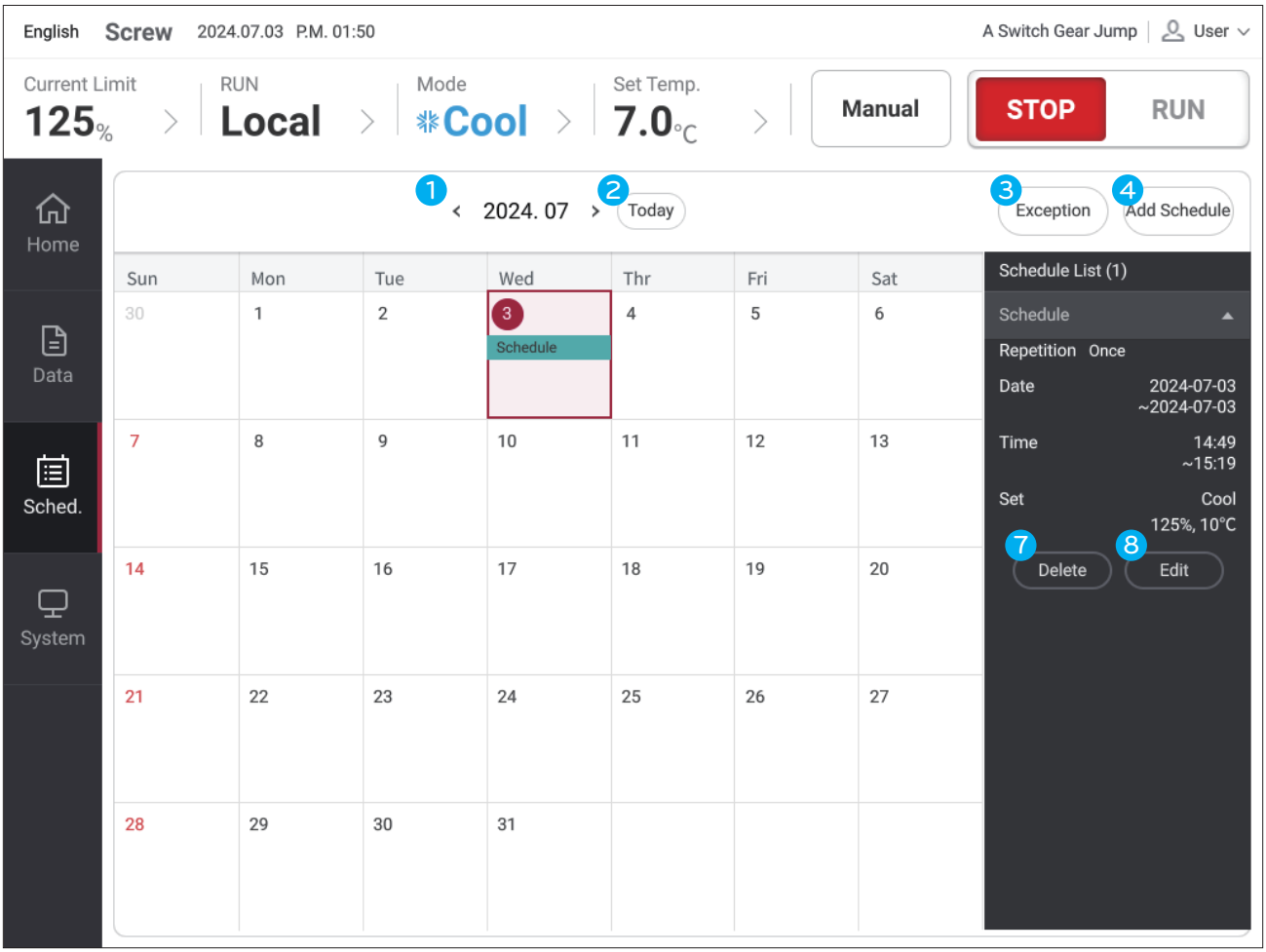


Figure 27. Schedule

No.	Component	Description
1	Select the month to display	You can change the schedule you want to check by month.
2	Move to today	You can navigate the calendar to display today's date.
3	Set exception date	You can set an exception date for a scheduled operation. You can set it by day.
4	Add schedule	Provides the function to set a schedule. You will be moved to the Schedule Setting screen.
5	Schedule chart (calendar)	Displays a schedule (calendar) for the selected month. You can check whether there is a reservation for a specific date of the month. You can select a date you want to check the schedule for.
6	Schedule list	Displays the schedule list of the selected date.
7	Delete schedule	Provides the function to delete the selected schedule.
8	Edit schedule	Provides the function to edit the selected schedule.

Table 15. Schedule Components

5.4.2. Scheduled Date Management

This screen provides functions to add or change exception dates for a scheduled operation. You can add or change exception dates by day.

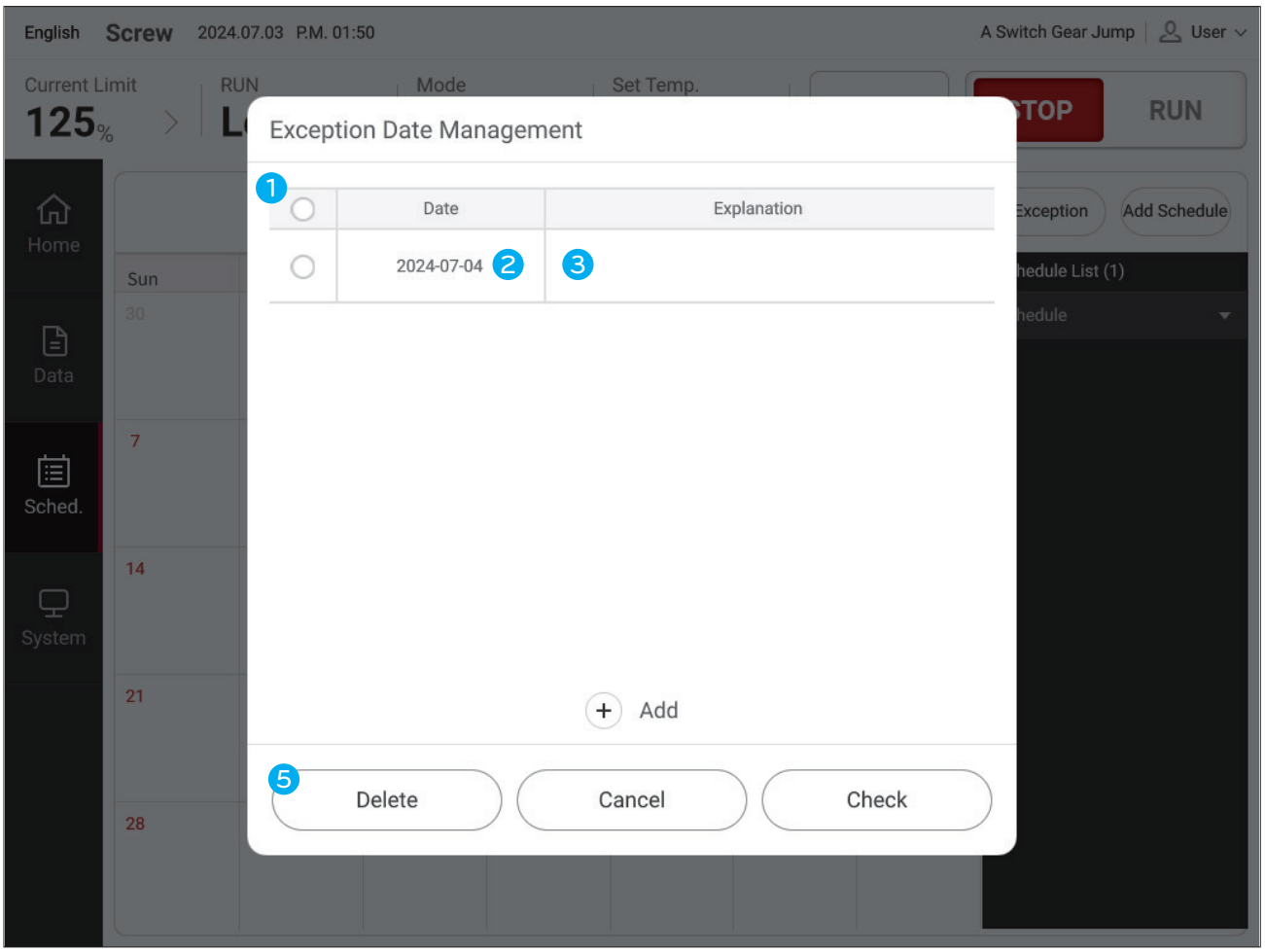


Figure 28. Scheduled Date Management

No.	Component	Description
1	Select exception date	Provides the function to select exception dates to be deleted.
2	Change date	Provides the function to change exception dates.
3	Add/change description	Provides the function to add or change the description for the exception date.
4	Add exception date	Provides the function to add exception dates by day.
5	Delete exception date	Provides the function to delete the selected exception dates.

Table 16. Components for Scheduled Date Management

5.4.3. Schedule Settings

This screen provides functions to set an operation schedule to make the device operate automatically.

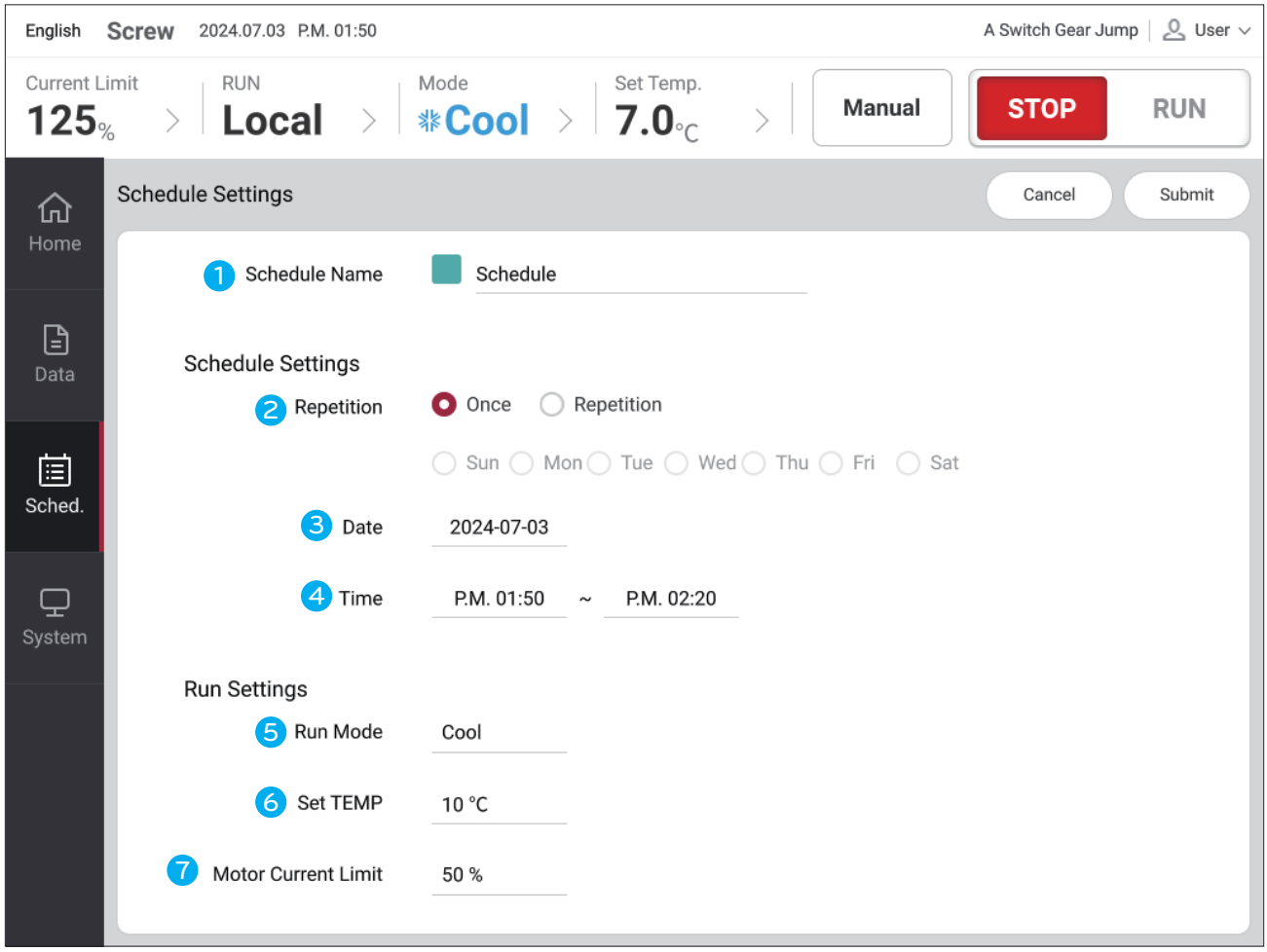


Figure 29. Schedule Settings

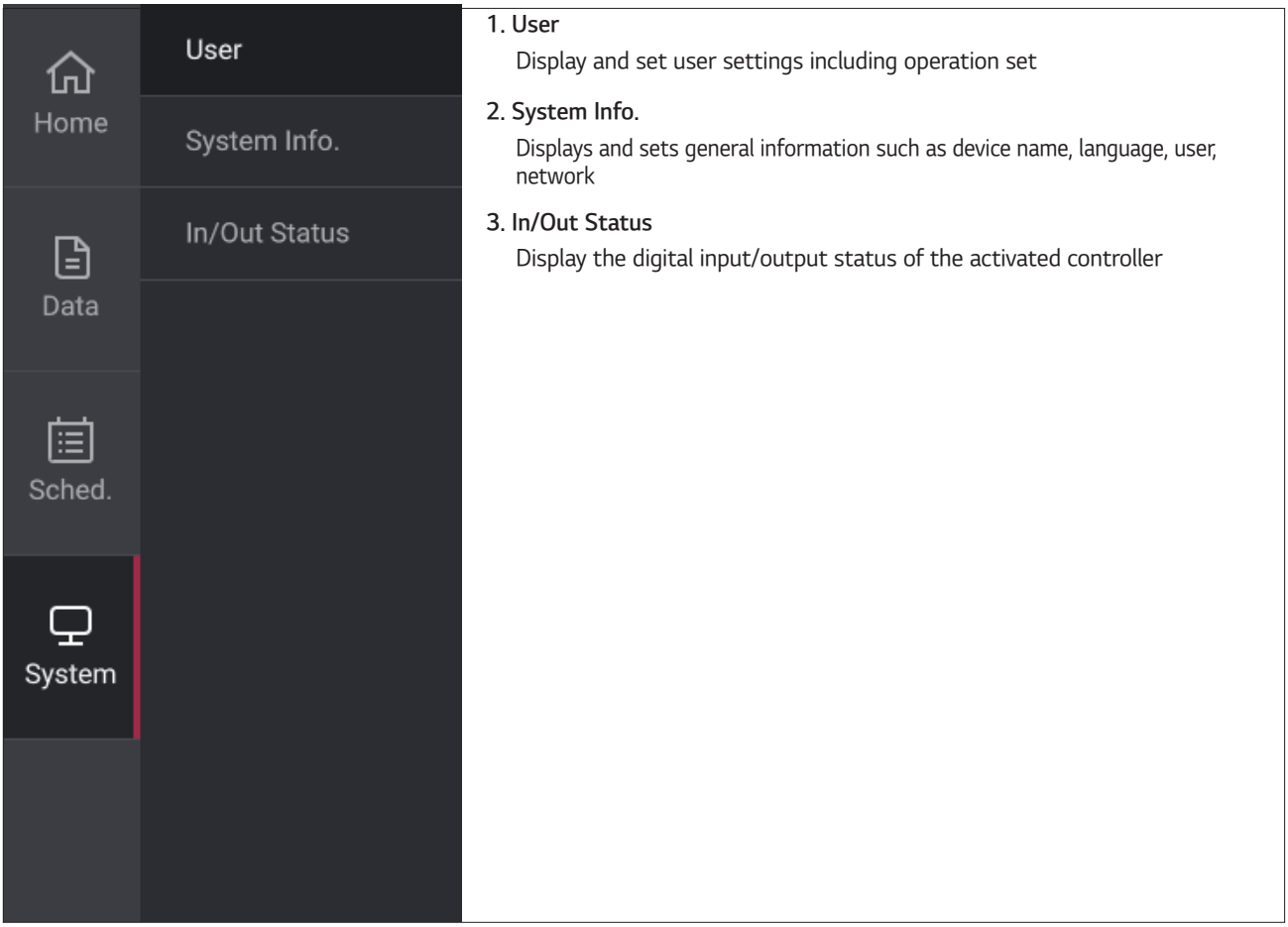
No.	Component	Description
1	Schedule name	Provides the function to name the schedule you wish to set.
2	Setting schedules - Repetition	Provides the function to set details of the operation schedule. 1. Select One-time or Repeat. 2. Provides the function to repeat on each day of the week when Repeat is selected.
3	Setting schedules - Date	Provides the function to set details of the operation schedule. 1. When One-time is selected: Select the date of the schedule. 2. When Repeat is selected: Select the period of the schedule.
4	Setting schedules - Time	Provides the function to set details of the operation schedule. 1. Set the operation time, including start and end times.
5	Setting operation details - Operation mode	Provides the function to select the operation mode. The modes that can be set may differ depending on the product type (Cooling/Ice-making/Heating).
6	Setting operation details - Temperature	Provides the function to set the target temperature. The temperature can be adjusted in increments of 0.1°C. Settable range: Cooling: 3.0°C - 50.0°C, Ice-making: -20.0°C - 30.0°C, Heating: 0.0°C - 90.0°C
7	Setting operation details - Motor current limit	Provides the function to set the motor current limit. The limit can be adjusted in increments of 1%. Settable range: 50% - 100%

Table 17. Schedule Settings Components

5-5. System

This menu provides system-related settings, relevant information, and input and output check functions. You can use it after logging in to the user error account.

5.5.1. System



1. User
   Display and set user settings including operation set
2. System Info.
   Displays and sets general information such as device name, language, user, network
3. In/Out Status
   Display the digital input/output status of the activated controller

Figure 30. Left Menu

5.5.2. User Settings

Provides the function to check and set basic user settings for product control.

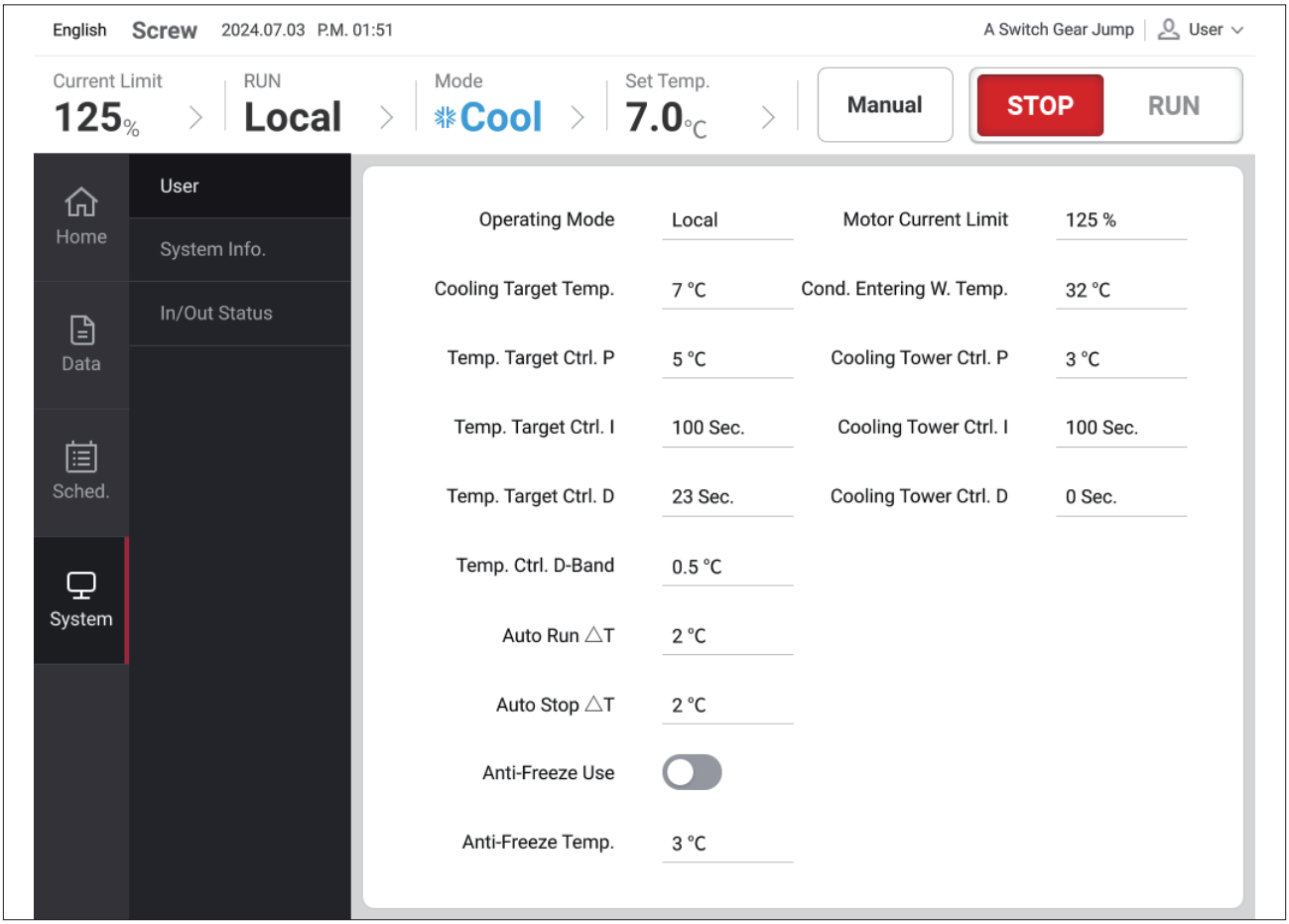


Figure 31. User Settings

Component	Settability	Setting Method	Unit	Minimum	Maximum	Increment	Remarks
Handling mode	●	Select a list	-	-	-	-	Local/Scheduled/ Remote Software/ BMS
Target cooling temperature	●	Select a number	℃	3	50	0.1	
Target temperature control P	●	Select a number	℃	1	10	0.1	
Target temperature control I	●	Select a number	sec.	0	3600	1	
Target temperature control D	●	Select a number	sec.	0	360	1	
Target temperature control dead zone	●	Select a number	℃	0	5	0.1	
Automatic start temperature (ΔT)	●	Select a number	℃	0	10	0.1	
Automatic stop temperature (ΔT)	●	Select a number	℃	0	10	0.1	
Freezing prevention operation function	●	Press a button	-	-	-	-	On/Off
Freezing prevention operation temperature	●	Select a number	℃	0	10	0.1	
Motor current limit	●	Select a number	%	50	100	1	
Cooling water inlet temperature	●	Select a number	℃	10	50	0.1	
Cooling tower control P	●	Select a number	℃	1	10	0.1	
Cooling tower control I	●	Select a number	sec.	0	3600	1	
Cooling tower control D	●	Select a number	sec.	0	360	1	

Table 18. User Settings Components

5.5.3. System Information

5.5.3.1. General

This menu provides functions to check devices, settings, and software information.

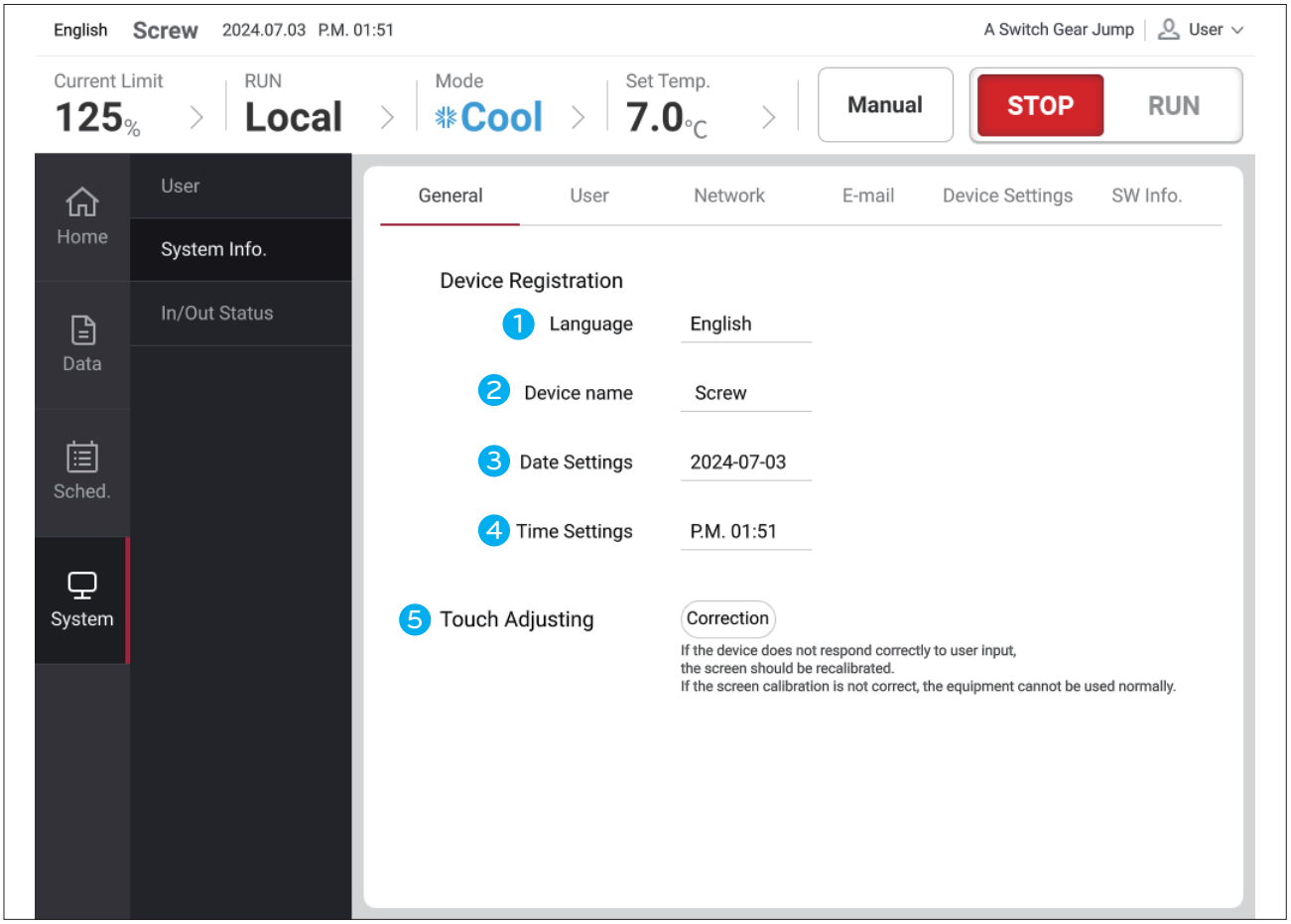


Figure 32. System Information_General

No.	Component	Description
1	Language	Set the language to use on the controller (among Korean, English, and Chinese).
2	Device name	Set the current device name.
3	Date setting	Set the current date.
4	Time setting	Displays the current time
5	Touch calibration	Provides the function to recalibrate when touch inputs do not produce desired results.

Table 19. Components of System Information_General

5.5.3.2. User

Provides functions to check and manage the user account.

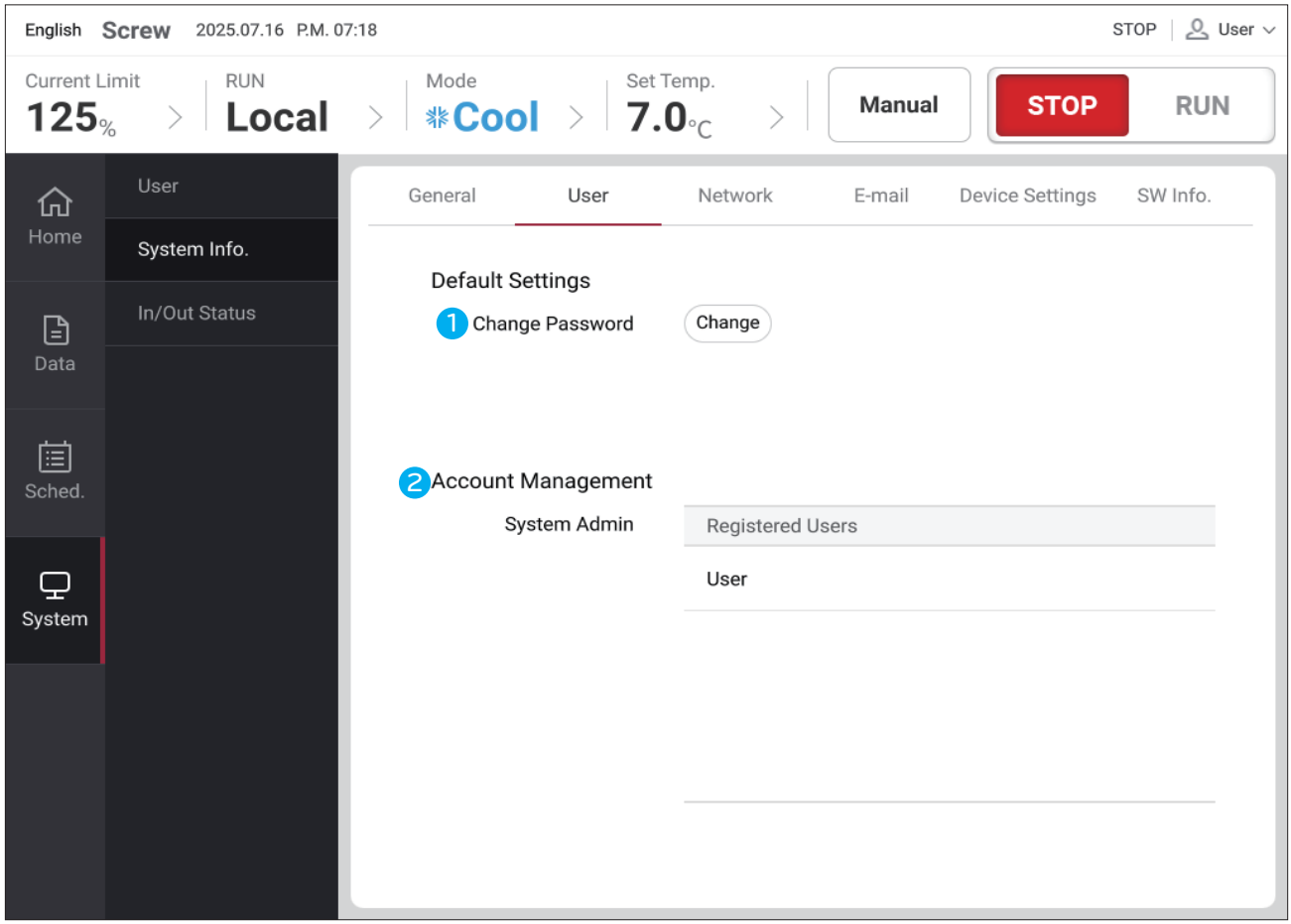


Figure 33. System Information_User

No.	Component	Description
1	Change password	Set a new password of the account currently logged in (the password must consist of 10 or more characters, including English letters and numbers).
2	User	You can add a user account.

Table 20. Components of System Information_User

5.5.3.3. Network

This menu provides a screen for setting an IP address to use network functions such as email.

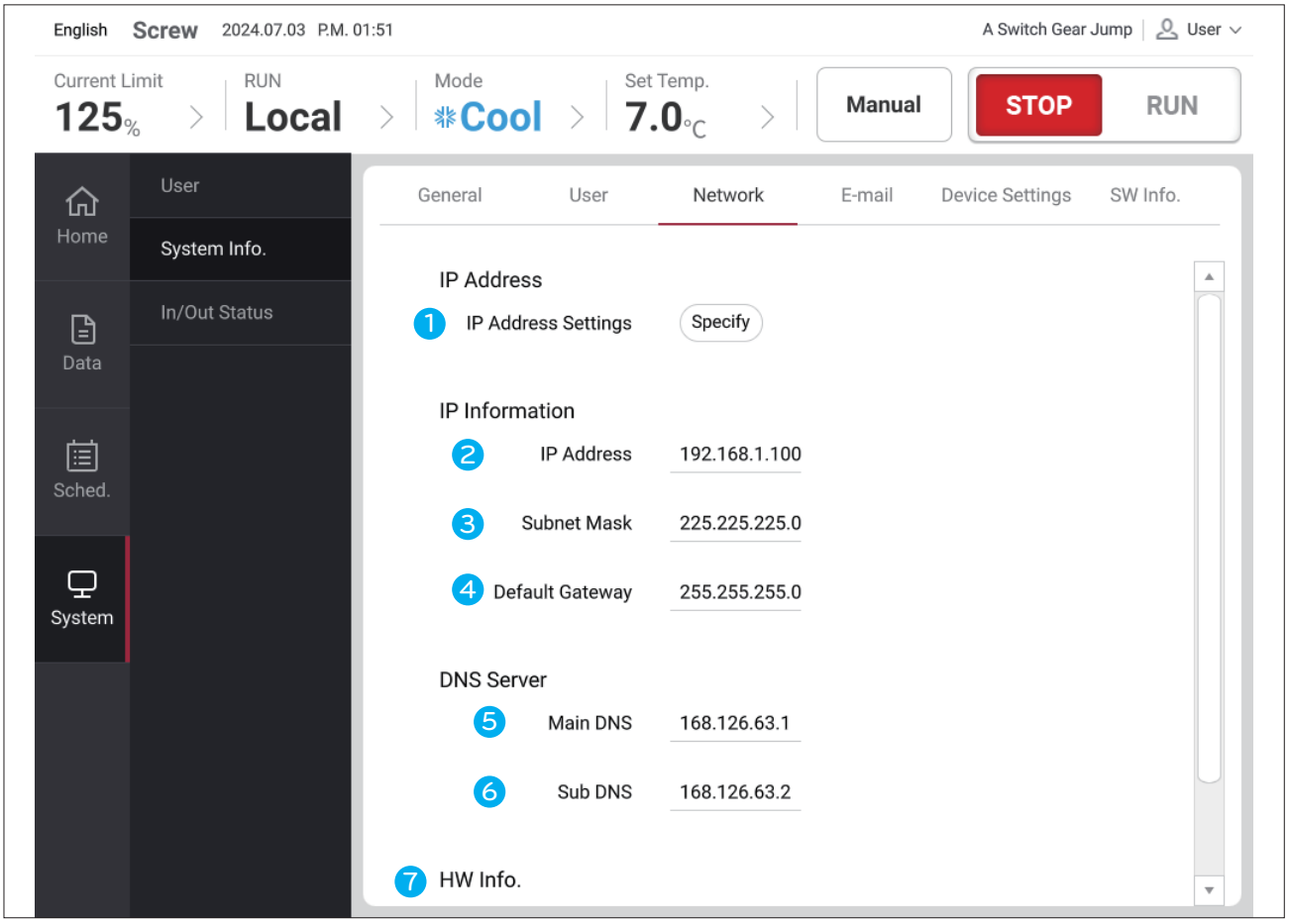


Figure 34. System Information_Network

No.	Component	Description
1	Set IP address	Select the method to set an IP address. You can choose to set the IP address automatically via DHCP or manually by specifying the address.
2	IP address	If you choose to set an IP address via DHCP, an IP address is automatically allocated. Or you can enter the address manually.
3	Subnet mask	Enter a subnet mask. The field is enabled when you choose to specify an IP address manually.
4	Default gateway	Enter a default gateway. The field is enabled when you choose to specify an IP address manually.
5	Primary DNS	Enter a primary DNS. The field is enabled when you choose to specify an IP address manually.
6	Secondary DNS	Enter a secondary DNS. The field is enabled when you choose to specify an IP address manually.
7	Hardware address	Enter a MAC address. The field is enabled when you choose to specify an IP address manually.

Table 21. Components of System Information_Network

5.5.3.4. Email

This menu provides functions to set email settings to receive the operation information via email.

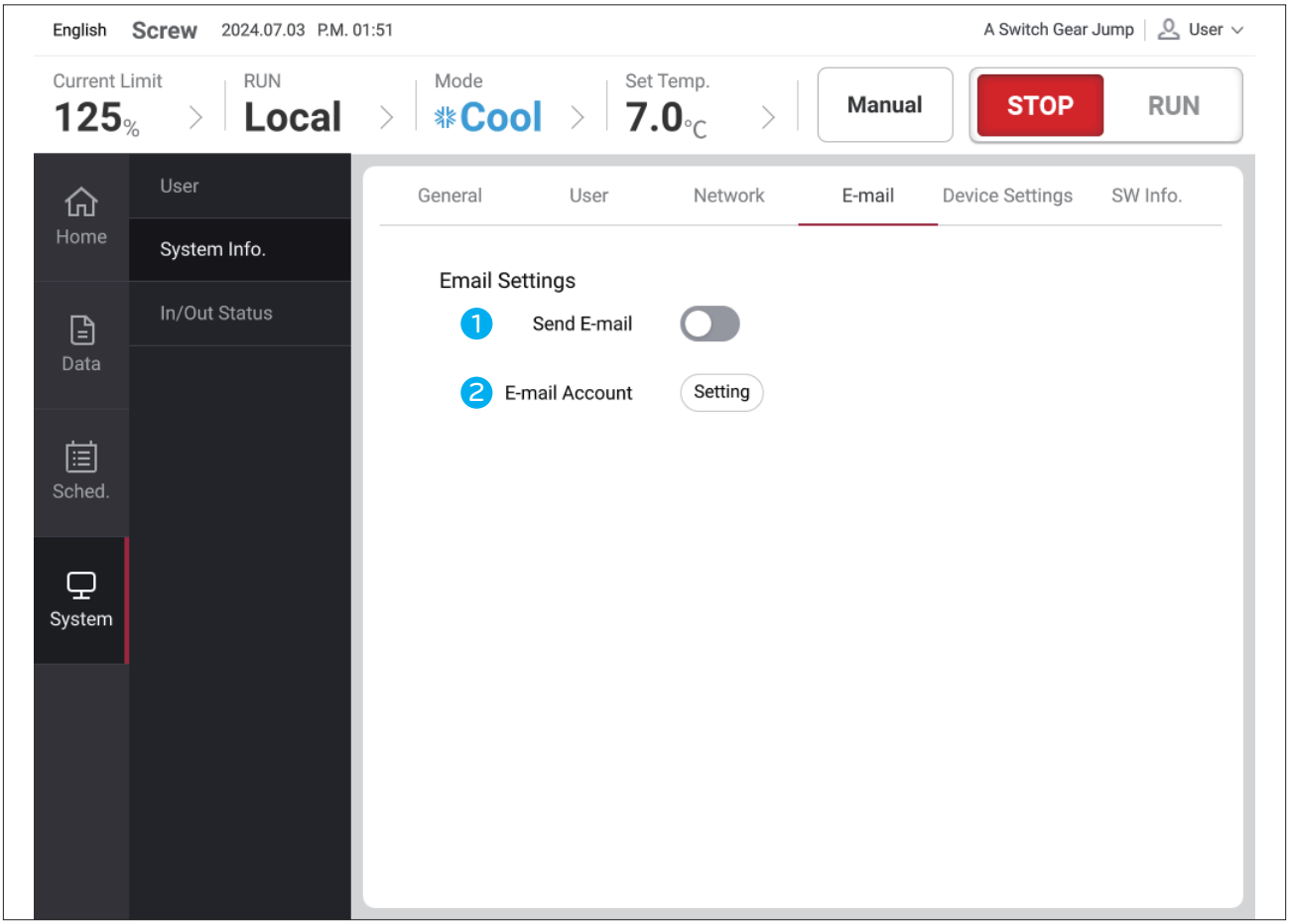


Figure 35. System Information_Email

No.	Component	Description
1	Send email notifications	You can set whether to receive notifications via email. If you choose to use email, a pop-up is provided to allow you to set email account settings.
2	Email account	Displays the email account configured.

Table 22. Components of System Information_Email

5.5.3.5 Device Settings

This menu provides functions to set a 485 communication channel for remote control as well as the operation limit.

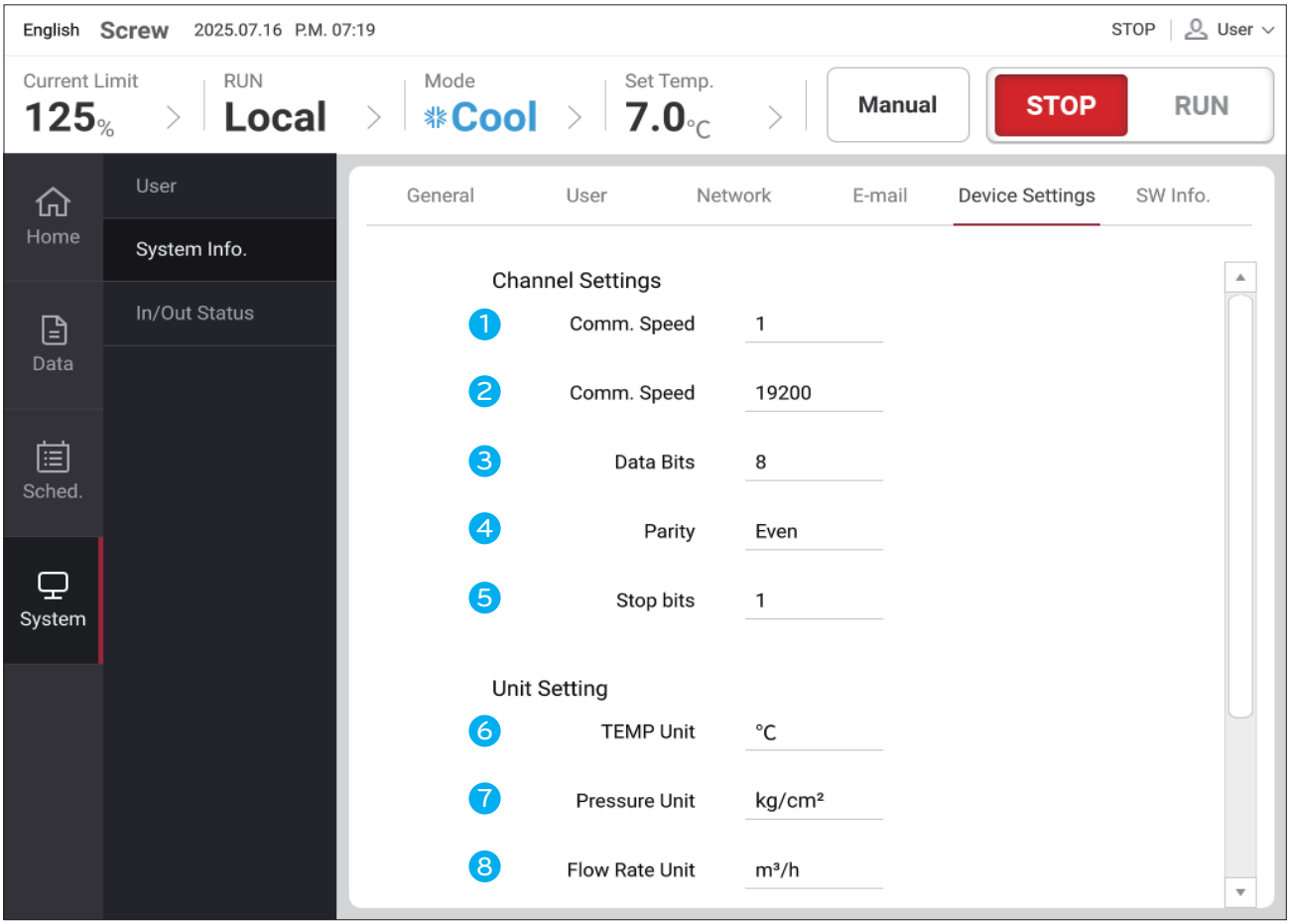


Figure 36. System Information_Device Settings

No.	Component	Description
1	Communication address	Set the communication address of CH1, CH5, and CH7. Enter a number between 1 and 255.
2	Communication speed	Set the communication speed of CH1, CH5, and CH7. Choose one among 9600, 19200, 38400, 57600, and 115200.
3	Data bits	Set the data bits of CH1, CH5, and CH7. Select between 7 and 8.
4	Parity	Set the parity of CH1, CH5, and CH7. Select among None, Odd, and Even.
5	Stop bits	Set the stop bits of CH1, CH5, and CH7. Select between 1 and 2.
6	Operation time limit	Set the operation time limit if the function is used. Enter a value between 0 and 2400 (hours).
7	Remaining operation time	Displays the remaining operation time if the operation time limit function is used.
8	Flow rate unit setting	Set the flow rate unit. Select between m3/h and gal/min.

Table 23. Components of System Information_Device Settings

5.5.3.6. Software Information

This menu displays the versions of the software parts applied to different controllers.

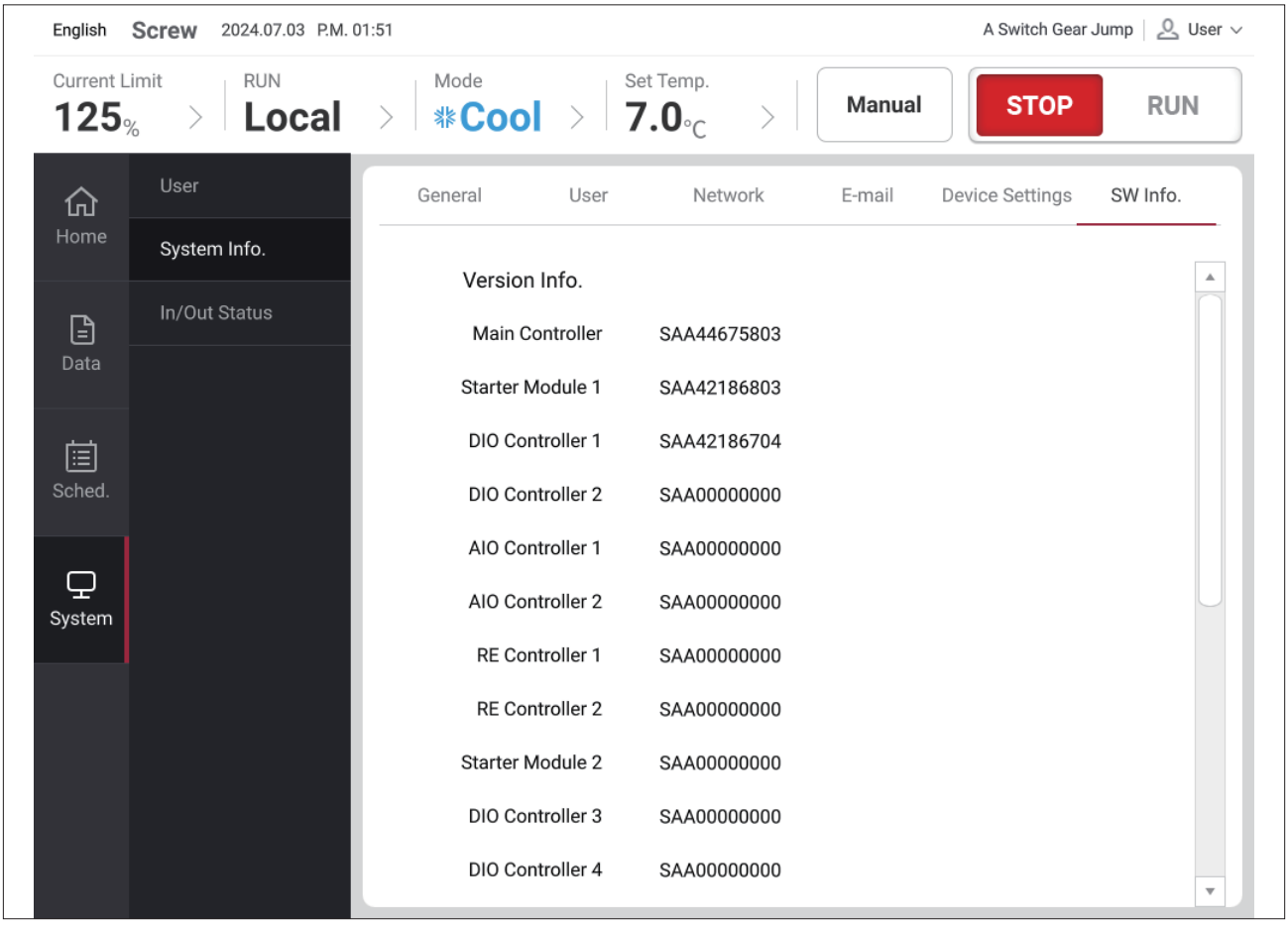


Figure 37. System Information_Software Information

5.5.4. Input/Output Check

5.5.4.1. DIO 1

This screen displays the digital input and output status of the DIO controller.

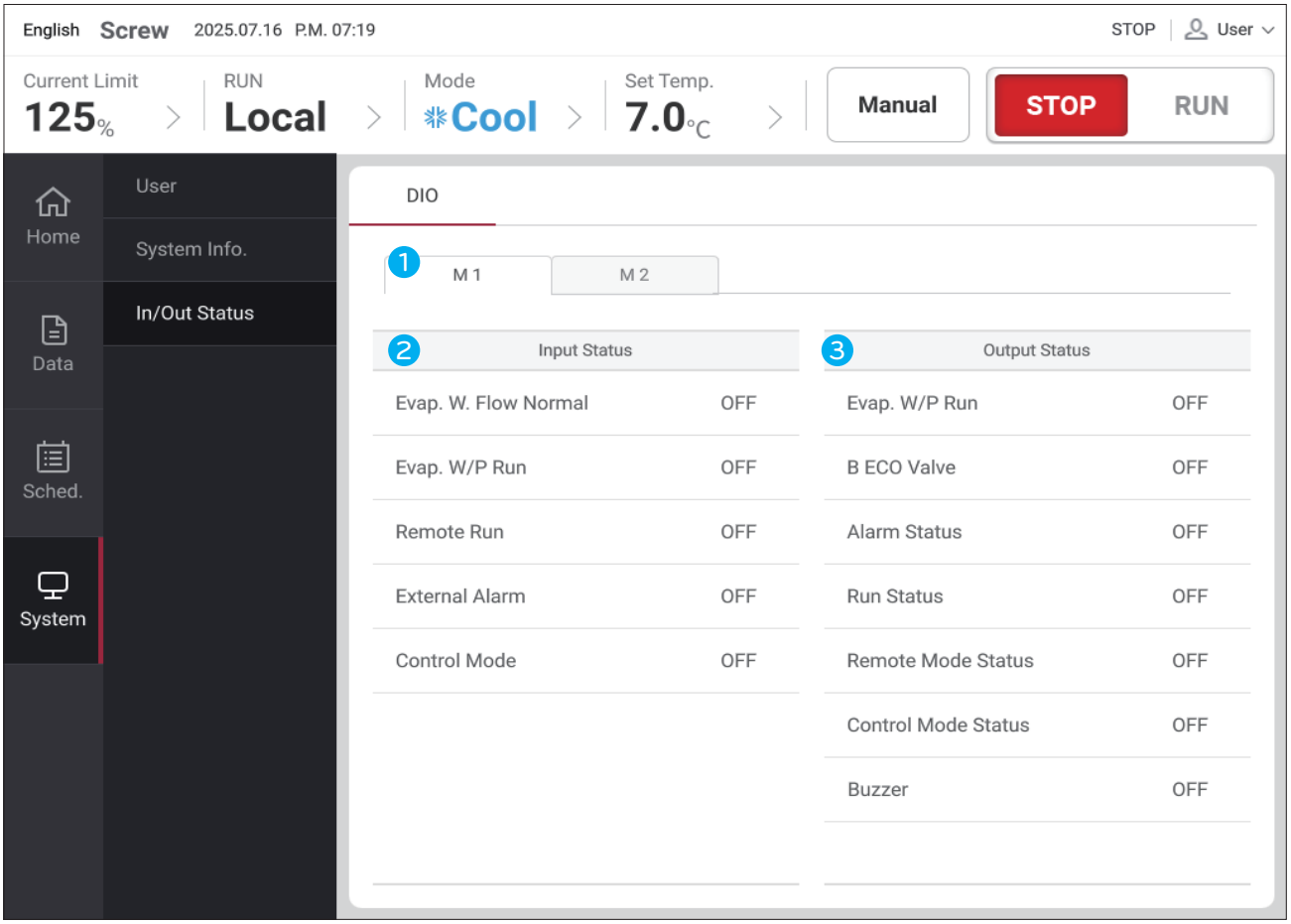


Figure 38. Input/Output Check_DIO

No.	Component	Description
1	Select a controller	Select the controller to check. This section displays controllers activated on the device settings.
2	Input status	Displays the ON/OFF status of input ports activated in the sensor settings.
3	Output status	Displays the ON/OFF status of output ports activated in the sensor settings.

Table 24. Input/Output Check Components

5.5.4.2. DIO 2

This screen displays the digital input and output status of the DIO controller.

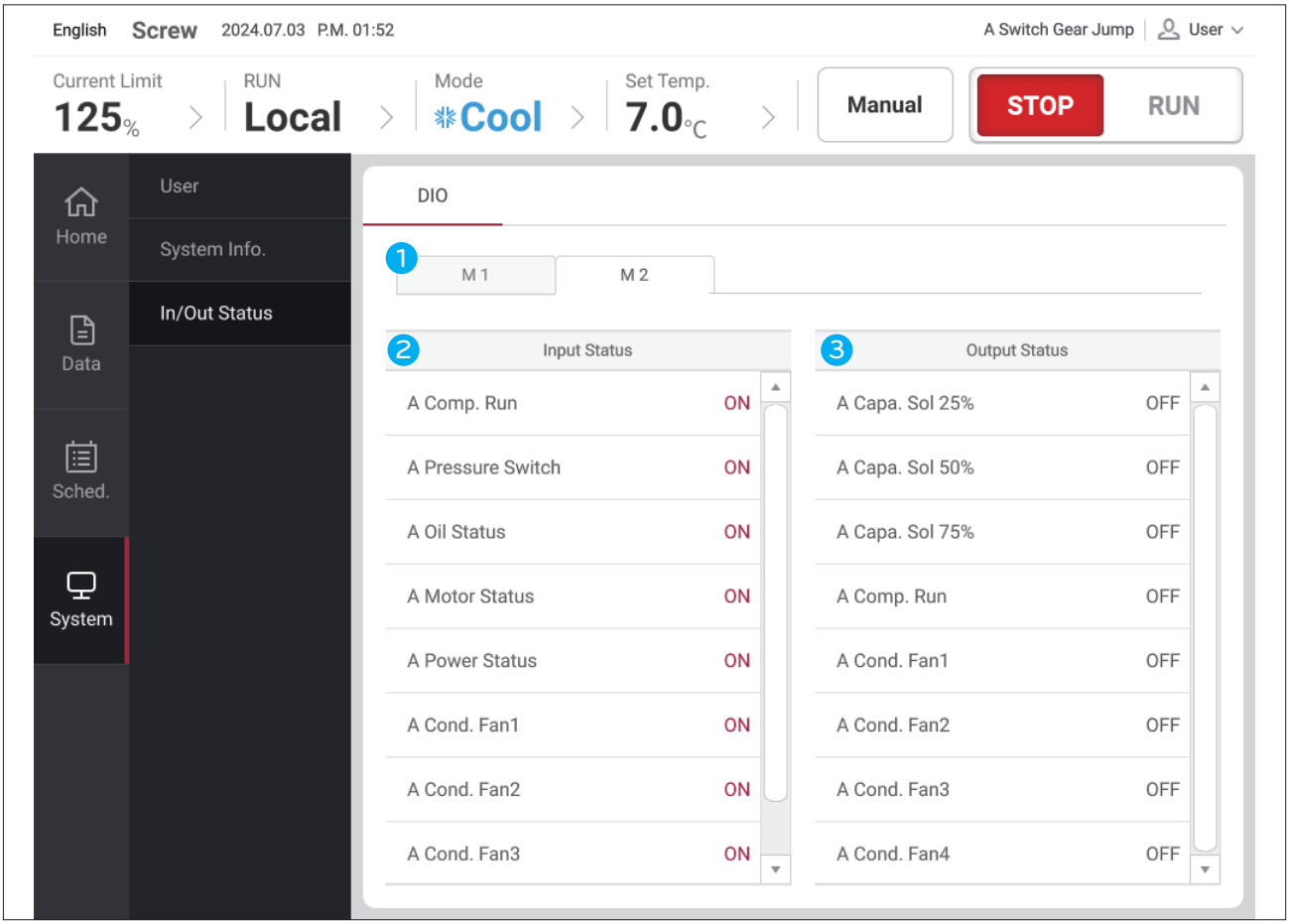


Figure 39. Input/Output Check_DIO 2

No.	Component	Description
1	Select a controller	Select the controller to check. This section displays controllers activated on the device settings.
2	Input status	Displays the ON/OFF status of input ports activated in the sensor settings.
3	Output status	Displays the ON/OFF status of output ports activated in the sensor settings.

Table 25. Input/Output Check Components

5-6. Open Source License

Open Source Software Notice	OSSNotice-5980_Screw Chiller Ai Engine application GUI PGM_SAA44675801_231107.html

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OFL-1.1

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Version 1.1-26 February 2007 PREAMBLE

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6. Commissioning

6-1. Install and start-up procedure

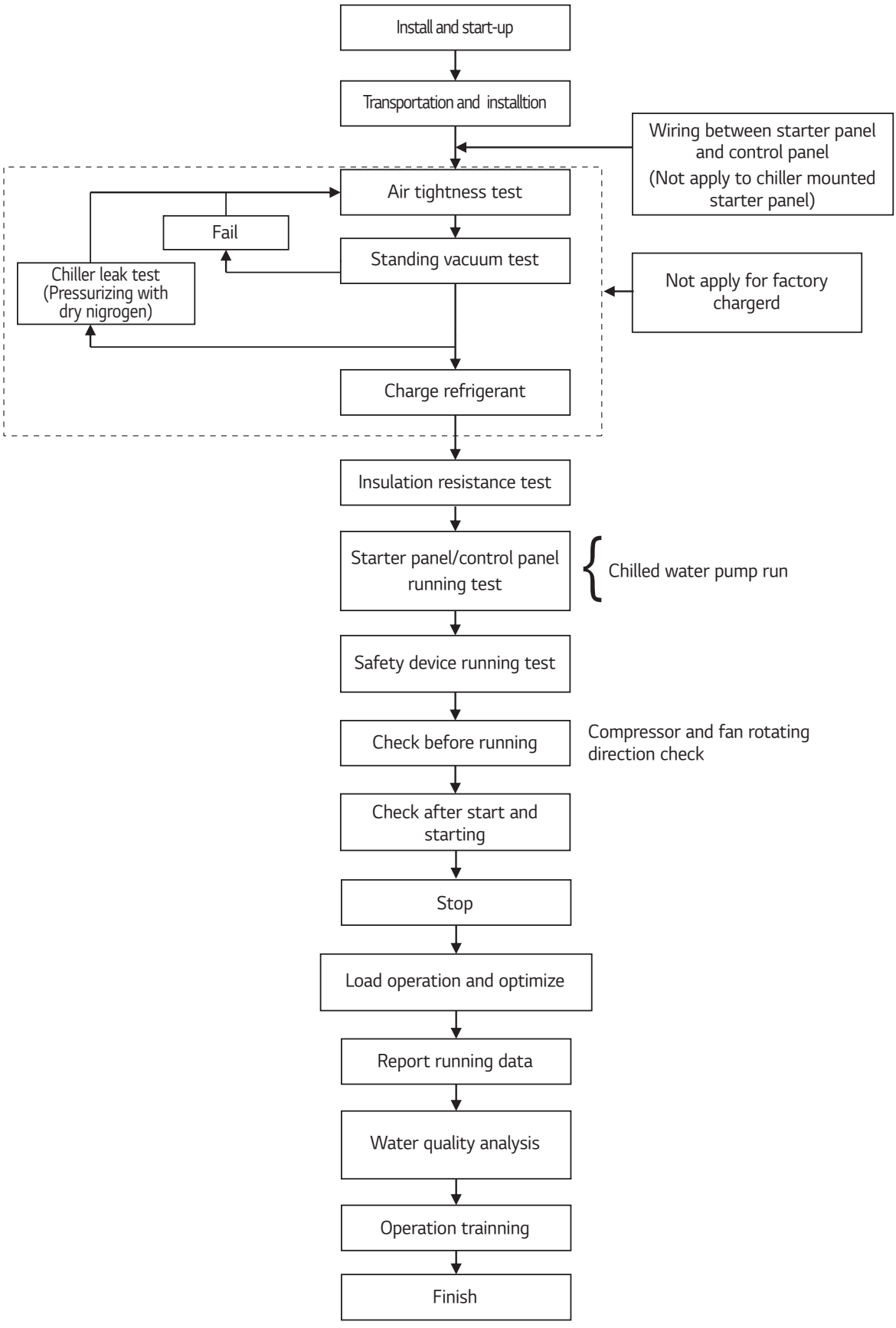


Figure 40. Procedure for Install and start-up

Selecting the location

- Maintain a distance of at least 5 meters from boilers and heaters, and at least 2 meters from other heating devices.
- Avoid places with high temperatures and choose a well-ventilated place.
- Choose a place with low humidity.
- Reserve enough space for service (for operating, maintenance and heat exchanger tube replacement)

Foundation

- Build the foundation to withstand the concentrated load of the chiller.
- The foundation must be above water level and drainage installed around it.
- Install a drain pipe in the drainage

Delivery and installation

- Move the chiller horizontally if possible.
- Place the vibration pad on the foundation and level it to within ±1mm before installing the chiller.
- Make sure the chiller is level to within ±1 mm. If not, use spacers to adjust the level to within ± 1mm.

6-2. Pre-start-up

- Pre-start-up is work for before start-up running after installation or before operation after long-term stoppage (approximately 1 month or more).
  Pre start up is a maintenance procedure that should be performed at least once a year after installation.

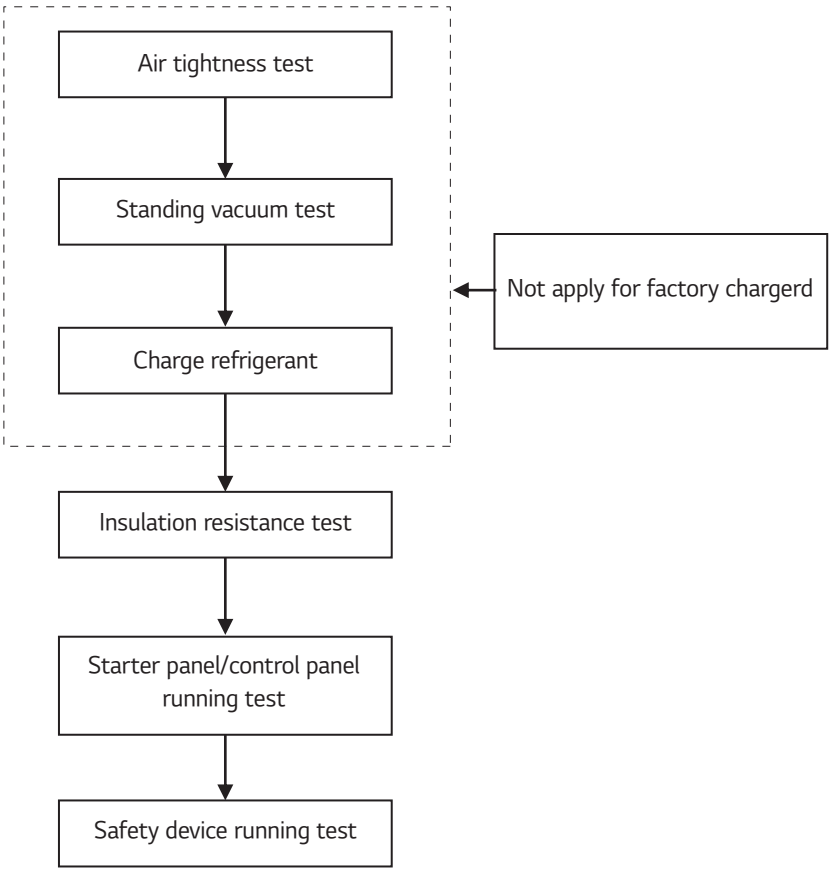


Figure 41. Procedure for pre-start-up

Leak Test

When leak test is required

- After the chiller is disassembled and repaired
- Lower than factory charged nitrogen pressure during transportation and before start-up

Leakage expected area

- Gasked used
- Screw tightened, Bolt/nut fastened
- Copper tube connections
- Areas welded to a sight glass

Test method

1) Charge nitrogen until the internal pressure becomes 2 kg/cm^2, 5 kg/cm^2, 9~9.5 kg/cm^2, and in each pressure point carry out a leakage test in order.
2) Perform a soapy water test on every connecting part.
3) If the inspection pressure maintains for 30 minutes, prepare for an inspection on smaller parts.
4) Mark the leaking parts.
5) Eject inner pressure.
6) Repair every leaking part.
7) Do a leakage test again on the repaired parts.
8) After performing a large leaking test, increase the pressure up to the value of 9~9.5 kg/cm2.
9) Do a small leakage test and fix leaking parts.
10) After the leakage test is finished, release nitrogen carefully.

* When you increase the pressure in the chiller, close the valve of the evaporator, as the evaporator safety valve may open.

Vacuum Drying and Vacuum Test

- If the machine is exposed to the atmosphere for a considerable period, it is found that moisture exists in the machine, or refrigerant pressure is lost due to leakage, vacuum drying should be done to remove moisture from inside the machine completely.

Warning

Do not start the compressor motor or oil pump motor or conduct insulation resistance test during the vacuum drying work.
Even if you perform a momentary rotation to check the rotation, it may damage the electrical insulation and cause serious product damage.

- Generally, vacuum drying is carried out at room temperature.
  The higher the room temperature, the faster the pace of vacuum drying.
  To remove the moisture by evaporating it at a lower room temperature, a stronger vacuum is required.
  Vacuum drying procedure is as follows:

1. Connect a high-capacity vacuum pump (approximately more than 120 LPM) to the valve for refrigerant filling.
   To minimize gas flow resistance, keep the piping from the pump to the machine as short as possible and use the widest diameter feasible.
2. To measure the vacuum, use the pressure value displayed on the controller or on the installed pressure gauge, if available.
3. During vacuum work, open all of the shutoff valves except the ones connected to the ambient air.
4. When the pressure indicates 756 mmHg while the vacuum pump is running in the ambient temperature of 15.6°C or above outside the machine, operate the vacuum pump for about 2 hours.
   If the pressure inside the machine remains below 756 mmHg, the moisture within the machine will freeze into ice, causing it to evaporate more slowly and delaying the vacuum drying process. In such cases, if hot water is available, make the hot water flow through the evaporator and condenser, and then operate the vacuum pump.
5. Close the valve of the vacuum pump, stop the pump, and then record the vacuum gauge value.
   When reading the vacuum level, if the ambient temperature changes, convert the temperature change into pressure using the equation below.

$$\Delta P + (760 + H)x \left[\frac{t2}{273+ t2} - \frac{t1}{273+ t1} \right] mmHg$$

H: Pressure inside the machine before test (mmHg)
t1: Ambient temperature before test (°C)
t2: Ambient temperature after test (°C)

6. After waiting about 4 hours, read the value of the vacuum gauge. If the value has not been changed, the vacuum drying work is completed.
   If the leakage rate is 0.1 mmHg/h (=0.1 Torr/h) or less, the machine is regarded as fully sealed.
   If the value of the vacuum gauge went up, repeat the steps in paragraphs 4) and 5) above.
7. Upon conducting the vacuum drying work several times, if its value continues to change, increase the pressure in the machine to over 9 - 9.5 kg/㎠.g before conducting the leak test. After repairing the leak areas, perform the vacuum drying work again.

Oil Charge

1. The chiller is shipped with compressor oil filled, but in case the oil is not filled, fill the oil as follows:
2. Use the oil filling valve installed at the bottom of the compressor. At this stage, use a vacuum pump to evacuate the machine.
   (If the refrigerant is filled first, the filled refrigerant will evaporate, and thus the pressure will rise; therefore, fill the oil first.)
   If the pressure inside the machine is high, the oil should be filled from the oil container using the pump.
   In this case, the discharge pressure of the pump used should be 14 kg/㎠.g or higher when the suction pressure is 0 kg/㎠.g. However, the oil should be removed or filled while the chiller is stopped.
3. The oil level should be maintained at at least 2/3 full in the sight glass. Additionally, oil foaming is acceptable as long as the oil pressure and temperature remain within specified limits.
4. Be careful that the air should not be introduced while the oil is being filled.

Refrigerant Charge

Caution

When you fill, remove or add refrigerant to/from the machine that is equipped with springs to prevent vibration, the springs should be fixed to prevent them from moving up and down. Otherwise, the connection pipes may be subjected to significant stress.

1. In case the chiller is filled with nitrogen, remove the nitrogen from the machine at the site, and then fill the refrigerant.
2. When filling the refrigerant, be sure to start the cold water pump and cooling water pump to prevent freezing.
3. It is ideal to adjust the refrigerant amount while the chiller is operating at its designed load. Adjust the refrigerant quantity based on the difference between the cold water outlet temperature and the evaporation temperature, while monitoring through the sight glass.

Insulation Resistance Test

1. The megger test measures insulation resistance by applying a voltage directly to the insulation material and then measuring the leakage current flowing through it.

$$\text{Insulation resistance} = \frac{\text{Applied voltage}}{\text{Leakage current}}$$

For 380 and 440 V classes, use a megger for 500 V.

2. Prevent access by unnecessary personnel during the test since high-voltage is used.
3. Conduct the test after all external power supplied to the chiller has been shut off.
4. In case of a three-phase motor, there is a danger due to the electric charge, therefore always discharge electricity after the test and use a ground terminal.
5. In the vacuum state, do not conduct a high voltage megger test.
6. The electrical insulation resistance decreases as temperature increases, and this change due to temperature fluctuation is significant. The extent of temperature change is expressed through a temperature coefficient. Below are the temperature coefficient and its application equation for the motor.

Temperature of the Insulator When Testing (℃)	Temperature Coefficient	Temperature of the Insulator When Testing (℃)	Temperature Coefficient
0	0.40	40	2.50
5	0.50	45	3.15
10	0.63	50	3.98
15.6	0.81	55	5.00
20	1.00	60	6.30
25	1.25	65	7.90
30	1.58	70	10.00
35	2.00	75	12.60

Table 26. Temperature Coefficient Based on the Insulator Temperature

7. Other factors affecting the insulation resistance

   <Insulator surface contamination> If absorbable or deliquescent substances such as acid or salt are attached on the insulator surface, they will affect insulation resistance.

   Remove these substances before test.

   <Condensed water> If the temperature of the insulator is below dew point temperature, water will condense on the surface of the insulator (particularly on the cracks or dents) affecting the insulation resistance greatly. The test should be done when the insulator temperature is higher than the dew point temperature of the ambient air. Make sure that the dry-bulb and wet-bulb temperatures of the ambient air are recorded.

   <Absolute humidity> Even if the temperature of the insulator is above dew point temperature, the water vapor in the atmosphere still affects the insulation resistance. Avoid conducting the test in a place with high absolute humidity.

8. Apply electric current for one minute to the spot where insulation is to be measured and read the scale and record.

   Apply the test standards for the insulator temperature of 20°C.

   (If measured at a different temperature, convert the value indicated after one minute using the temperature coefficient.)

9. Take following actions based on the insulation condition.

Status	Indicated Value after 1 Minute	Action
Danger	2 MΩ or less	Repair or replace
Poor	Less than 50 MΩ	Troubleshoot
Re-check	50 - 100 MΩ	Troubleshoot
Fair	100 - 500 MΩ	
Good	500 - 1000 MΩ	
Excellent	1000 MΩ or bigger	

Table 27. Insulation Conditions

※ Motors falling in "Poor" or "Re-check" in the megger insulation test are required to take a polarization index test.

10. Polarization index test

    Record the indicator values after one minute and after ten minutes in the megger test.

$$\text{Insulation absorption rate} = \frac{\text{Indicated value after ten minutes}}{\text{Indicated value after one minute}}$$

Status	Insulation Absorption Rate
Danger	1 or lower
Poor	Less than 1.5
Uncertain	1.5 or higher - lower than 2
Fair	2 or higher - lower than 3
Good	3 or higher - lower than 4
Excellent	4 or higher

Table 28. Insulation Absorption Rate Conditions

Motors falling in the "Danger" insulation absorption rate should be returned or replaced.
Motors falling in the "Poor" or better insulation absorption rate should be run carefully for four hours, and an additional test should be conducted.

11. The following should be recorded in a megger test.

- Type and voltage of the megger tester
- Connecting parts of the megger tester
- Ambient temperature and humidity of the testing place. For an enclosed type, the pressure of the container inside
- Residence time of the machine before testing

6-3. Commissioning and Starting

- When you start the chiller on the site, operate safely according to the checking sequence below.
  If you observe any abnormalities, stop the chiller immediately and follow the instructions in the "Troubleshooting" section.
  For detailed reference values for each item, please refer to the "Checklist."

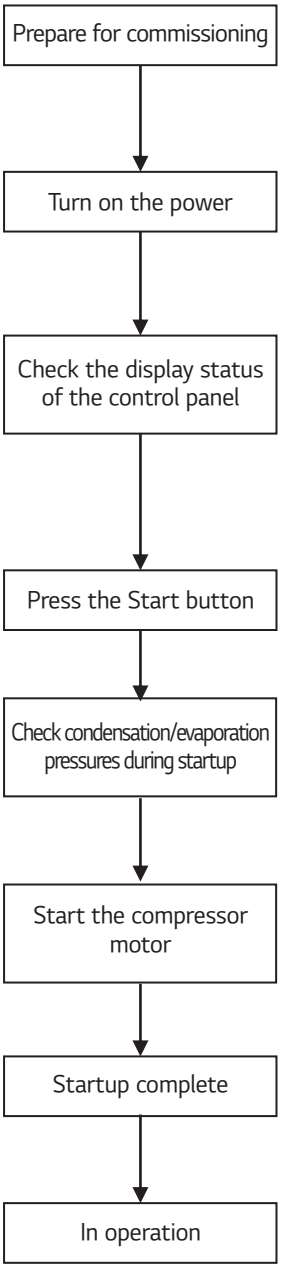


Figure 42. Commissioning Procedure

1. Supply power to the control panel and the startup panel and check the result.
2. Supply power to the oil heater 8 to 16 hours before startup.
3. 3) Start the cold water pump. During the startup, close the pump outlet valve, open the air outlet valve, and then carefully open the valve a little to let the water flow while avoiding water hammering.
   If water flows out continuously after air is expelled through the air outlet, close the air valve.
4. Check whether the display window in the control panel is working.
   Check whether the status of the chiller on the site is displayed as operational in the display window.
5. Check the condensing and evaporating pressures at startup.
   Ensure that the condensing pressure increases and the evaporating pressure decreases during the startup.
   If the opposite is observed, the power connection should be re-checked.
6. Check the operation current.
   When the startup is complete, the operation current will increase. Make sure that the operation current does not exceed the motor's rated current.
7. Check all kinds of pressure status.
8. Check the operation sound and vibration.
9. Cold water inlet/outlet temperature

6-4. Startup Procedure after Stopping the Operation for a Long Time

- If stopping the operation for an extended period, transfer the refrigerant to a separate refrigerant container to reduce pressure inside the machine and minimize the risk of leakage.

  Replenish approximately 5 kg of refrigerant to prevent the air from entering the machine.

  If the location where the machine is installed frequently experiences temperatures below zero, drain the cold water, cooling water, and condensed water to prevent freezing. Additionally, leave the water chamber drain open.

  Leave the oil filled in the machine as is, and supply power to the oil heater enough to maintain the minimum oil temperature or above.

  In case of stopping the chiller for a long term (1 month or longer) or temporarily (shorter than 1 month), check the following items before operating again.

1. Troubleshoot the unsafe or erratic areas for the proper operation of the machine.
2. Make the following inspections mandatory in order to avoid refrigerant loss due to leakage during the stop period.

   1) Lubrication system
   ◇ Loosening and cracking of oil pipes
   ◇ Oil change

   2) Chilling system
   ◇ Refrigerant contamination check ◇ Ejector cleaning
   ◇ Heat transfer pipe cleaning ◇ Water quality analysis
   ◇ Cleaning or change of filters

   3) Controlling moisture in the condenser and evaporator (corrosion prevention measures during the stop period)
   Take into account the following to prevent the heat transfer pipes of the condenser and evaporator from being corroded during a long stop period.
   * Make it a rule to drain water before storage.
   * Carefully conduct all regular preliminary checks as well as system inspections during operation, and conduct a control test before startup.
3. Check the steps 1 - 2 above and start the machine in accordance with “Commissioning and Startup.”

6-5. Stopping the Product

- When stopping the product, follow the procedure below.

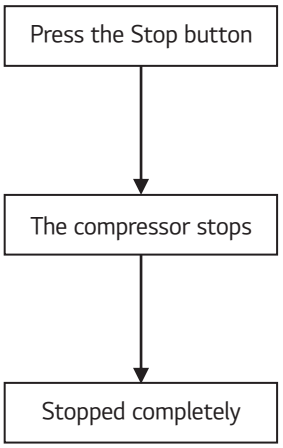


Figure 43. Stop Procedure

1. If you press the Stop button on the control panel, the compressor stops.
2. Things to check after stopping
   * Stop the cooling water pump.
     Close the pump outlet valve slowly before stopping the pump.
   * Stop the cold water pump.
     Close the pump outlet valve slowly before stopping the pump.
   * Record the levels of the refrigerant and oil after stopping.

Operation range and limit

Temperature

Temperature limits during the operation of the unit are as follows.

Ambient temperature	Max.	120.2°F(49°C)
	Min.	41°F(5°C)
Outlet water temperature	Max.	59°F(15°C)
	Min.	37.4°F(3°C)

* Maximum ambient temperature: 125.6 °F(52°C) with high ambient option
* Temperature of inlet water must not exceed 68°F(20°C) during continuous operation.

Power

- Voltage limitation is like this :
- Long-term running : rated voltage ±5%
- Instant running : rated voltage ±10%

* When using the 3 phase voltage, never operate the motor of the compressor when the imbalance among the phases exceed 5%

The formula to calculate the voltage imbalance is as follows.

$$\text{Voltage Imbalance (\%)} = 100 \times \frac{\text{Maximum deviation from average}}{\text{Average Voltage}}$$

*Max Voltage from average voltage is the absolute value of the maximum gap from the average voltage of the 2 Phases.

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

V_{12} : 405 V
V_{23} : 394 V
V_{31} : 410 V
Average voltage: (405 + 394 + 410) / 3 = 403

Deviation from average : $|\text{Average} - V_{12}| = |403 - 405| = 2$ V
$|\text{Average} - V_{23}| = |403 - 394| = 9$ V
$|\text{Average} - V_{31}| = |403 - 410| = 7$ V

Maximum deviation from average : 9 V

$$\text{Voltage imbalance (\%)} = 100 \times \frac{9}{403} = 2.23\ \%$$

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

7. Maintenance

7-1. Maintenance and Inspection Standards

Maintenance and Overhaul Inspection (Repair)

- **Change in machine conditions over time**
  In general, the structure or function of a machine can age or wear out after using for a long duration even though there have been no breakdowns.
  Even with continued operation over time, the insulation in the motor may deteriorate and rotating parts may wear out due to secondary substances resulting from oil carbonization or degradation.
  Such change in the machine conditions over time can often be detected externally due to vibration or abnormal sound. In this case, it is critical to keep the operation in good condition by taking preventive measures in order to prolong the lifespan of the machine.

- **Timing for overhaul inspection (repair)**
  Generally, machine failure rate is distributed as shown in the graph below.

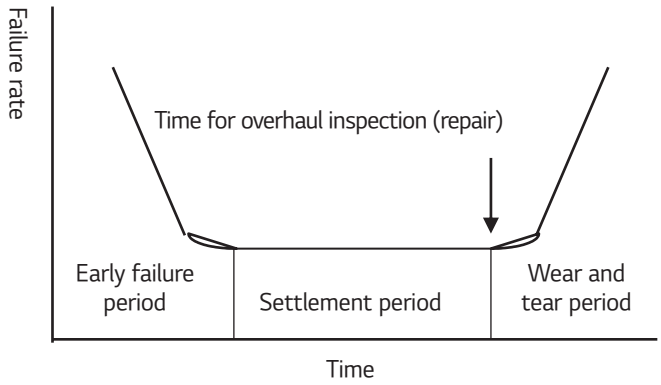


Figure 44. Machine Failure Rate

The early breakdowns occurring during the <initial breakdown period>, which are caused by faulty manufacturing, should be prevented by checking and eliminating potential problems in the factory before shipping out.
After a certain amount of time has passed during the <stable period>, the machine enters into the <breakdown period by wear> due to changes in machine conditions. In this stage,
the failure rate increases drastically, therefore, conducting the overhaul inspection (repair) just before this stage will prevent accidents and allow the optimum operation.
Accordingly, we recommend you to conduct the overhaul inspection (repair) as follows, based on the statistics accumulated for a long time.
1) Machines exclusively used for air conditioning: Every 5 years
2) When used in factory processes where the machine continuously operates throughout the year, or when used for other important purposes, requiring a high reliability: Every year

- **Overhaul inspection (repair) criteria**
  An accident can occur when certain limits are exceeded due to uncontrollable abrasion or deformation in different machine parts. For example, an over-worn bearing with its oil film destroyed will have a direct contact with metal, with a high likelihood of causing damage to the bearing.
  Therefore, LG Electronics has established the criteria for (1) usage limits and (2) replacement, which form the basis of our "Overhaul Inspection (Repair) Criteria." These criteria can be used to decide the timing of the next overhaul inspection (repair) and maintain good operating conditions until the inspection.
  LG Electronics recommends inspecting components or replacing them according to these criteria.

- **Advantages of a maintenance contract system**
  (1) Cost savings
  - By establishing and implementing a maintenance plan, the aging of the machine can be minimized.
  - By increasing the lifespan of a machine, the likelihood of major accidents is reduced, thereby saving on maintenance costs.
  - By fulfilling the contract provisions with a fixed annual amount of money, the budget can be managed efficiently and unnecessary expenses due to unexpected failures can be avoided.
  - Such a system eliminates any opportunity losses due to an unexpected downtime in the production process.

(2) Safety
- Through maintenance on a number of safety devices installed on the machine, the machine can be operated safely without accidents.
- Unexpected breakdowns can be prevented by conducting a periodic check proactively.
- Once a maintenance contract is made, the machine operator can improve their maintenance skills through on-site technical trainings.

(3) Speed
- As our service technicians can have up-to-date information on the machine conditions through regular maintenance, they can provide accurate advice to the machine operator quickly via telephone upon occurrence of any failures.
- Even during the busy season for service work, prompt actions can be provided preferentially for the machine operators with a maintenance contract.

Content of Maintenance Contract (Standard)

- **Machine for air conditioning only**

1. Inspection before air conditioning
   (1) Tightness test (5) Operation test between the startup panel and the control panel
   (2) Refrigerant filling (6) Vacuuming
   (3) Electrical insulation test (7) Chiller operation tuning
   (4) Safety device inspection/tuning

2. Inspection during air conditioning period (once)
   (1) Electrical insulation test (3) Chiller operation tuning
   (2) Operation log check

3. Inspection after completion of air conditioning
   (1) Refrigerant extraction (6) Oil extraction
   (2) Nitrogen gas sealing (7) Tightness test
   (3) Filter check (replacement) (8) Electrical insulation test
   (4) Operation log check (9) Chiller operation tuning
   (5) Sensor check (replacement)

4. Water quality analysis (once)

- **Machine operating throughout the year**

1. Inspection during operation (5 times)
   (1) Electrical insulation test (3) Chiller operation tuning
   (2) Operation log check

2. Overall inspection (once)
   (1) Refrigerant extraction (6) Oil extraction
   (2) Nitrogen gas sealing (7) Tightness test
   (3) Filter check (replacement) (8) Electrical insulation test
   (4) Operation log check (9) Chiller operation tuning
   (5) Sensor check (replacement)

3. Water quality analysis

- **Inspection frequency standards**

(1) Air conditioning only equipment: At the start of air conditioning x 1, during air conditioning x 1, at the completion of air conditioning x1
(2) Machine operating throughout the year. During operation x 5, overall inspection x 1

- **Works other than standard works**

(1) Heat exchanger cleaning
(2) Overhaul inspection (repair)
(3) Other works not specified in the contract

7-2. Inspection by Period

Daily Inspection

- Check the evaporator and condenser pressures of the chiller. Read and compare the values with those provided in the General Chiller Operation Characteristics table.

  - Daily inspection criteria for compressor and motor

Classification	Inspection Item	Inspection Method	Criteria
Compressor	Compressor discharge gas temperature	Check temperature at the control panel	40℃ - 90℃
	Vibration/Noise	Check with hands and ears. If the vibration is measured with a vibration meter, the noise should be 91 dBA or less. If there is no abnormal vibration, the vibration should be x, y, z : 25 μm or less.	

Table 29. Daily Inspection Criteria for Compressor

※ Check whether the color of the moisture indicator in the refrigerant supply line is green. If green changes to yellow, it shows that the moisture amount in the machine is above the permitted limit. In this case, replace the filter drier.

  - Daily inspection criteria for condenser

Classification	Inspection Item		Inspection Method	Criteria
Condenser	Cooling water	Inlet	Check on the panel	34℃ or less
		Outlet	Check on the panel	21℃ or more
	Condensing pressure condition		Check on the panel	6 - 10 kg/cm² (R134a) 8 - 16 kg/cm² (R22)
	Heat exchange status		Difference between the condensing temperature and the cooling water outlet temperature	0.5 - 3℃

Table 30. Daily Inspection Criteria for Condenser

※ If the cooling water outlet temperature reaches 21°C or lower, the condensing pressure decreases, making the oil required for the compressor insufficient.

※ The biggest reason for the worsened heat exchange would be the scale accumulated inside the heat transfer pipes and insufficient amount of cooling water.

  - Daily inspection criteria for evaporator

Classification	Inspection Item		Inspection Method	Criteria
Evaporator	Cold Water	Inlet	Check on the panel	5 - 15℃ or less
		Outlet	Check on the panel	3℃ or more
	Evaporation pressure (temperature)		Check on the panel	2 - 5 kg/cm² (R134a) 4 - 8 kg/cm² (R22)
	Heat exchange status		Difference between the evaporating temperature and the cold water outlet temperature	0.5 - 3℃
	Amount of the refrigerant filled		Check through the sight glass	
	Refrigerant condition		Check through the sight glass	

Table 31. Daily Inspection Criteria for Evaporator

※ If the evaporation pressure becomes low, the copper tubes in the evaporator may freeze, resulting in damage. The major reasons for the lowering of the evaporation pressure are insufficient refrigerant, lowering water temperature and poor heat exchange.

※ As in the case of the condenser's heat transfer pipes, if foreign substances enter into the pipes or scale accumulates inside the pipes, corrosion may occur, lowering the heat exchange capacity.

- Daily inspection criteria for lubrication system

Classification	Inspection Item	Inspection Method	Criteria
Oil	Oil amount	Visual inspection	Existence of an oil film observed with the sight glass
	Leakage	Check oil system visually	There should be no leakage.

Table 32. Daily Inspection Criteria for Lubrication System

- Oil replenishment

  Enough amount of lubrication oil is filled into the chiller before shipping. When the chiller is operating normally, the oil level in the compressor's oil sight glass is typically around one-fourth full. The oil level should not drop below this amount under normal conditions. If there is too much or too small amount of oil in the chiller, it affects the chiller's refrigeration function and may cause serious damage to the compressor. To check the oil level in the compressor, the chiller should be in the stable running condition. (Generally, a chiller reaches the stable condition 30 minutes to 1 hour after the startup.) If oil replenishment is needed due to oil shortage, first close the suction and discharge valves of the compressor while the operation is stopped. Through the channel located in the suction and discharge valves of the compressor, discharge the remaining gas from the compressor. Then, use a vacuum pump to achieve a vacuum state inside the compressor. If the oil pipe is connected to the valve, the oil will be drawn into the compressor until it reaches atmospheric pressure. At this time a close attention should be given so as the air not to be sucked into the oil pipe. Lastly, when the oil reaches the designated level, immediately close the oil valve. After the pressure went up, open the suction valve and discharge valve and start the chiller.

- Oil change

  In normal situations, it is not necessary to change oil frequently.

  When the chiller's total operation time reaches 2,500 hours, perform a sampling test to judge whether the oil change is needed and, if needed, change the oil. Since adding or changing oil is a professional work, it should be done by an experienced and qualified technician. This chiller is designed to be used with the oil provided by LG Electronics only.

Monthly Inspection

- Monthly inspection criteria for compressor

Classification	Inspection Item	Inspection Method	Criteria
Compressor	Motor insulation	Measure at 1000 V	100 MΩ or higher
	Startup characteristics	Mark ● for the startup method of yours. 1. Full voltage startup 2. Wye-delta (Y-Δ) startup 3. Kornd⊠rfer startup 4. Reactor startup * In case where the cold water outlet temperature is _℃	Startup current flow time t: 5 - 25 sec
			Startup current: A
			Timer setting (seconds)

Table 33. Monthly inspection Criteria for Compressor

※ Generally, motor startup current is about 600% of the rated current for full voltage startup and 200% for wye-delta.
※ Perform the specified daily/monthly inspections at least once per month, and record the measured values.
This data can be a clue to solving problems of the motor.

- Monthly inspection criteria for lubrication system

Classification	Inspection Item	Inspection Method	Criteria
Oil	Oil filling amount	Check through the compressor's sight glass	Please refer to the specifications for standard filling amount.

Table 34. Monthly inspection Criteria for Lubrication System

Yearly Inspection

Classification	Inspection Item	Inspection Method	Criteria
Compressor	Compressor terminal connecting bolt	Check for loosening	Whether loosened or not Terminal block condition
Condenser	Chemical analysis	Water quality analysis	Water quality criteria
	Heat transfer pipe status	Check daily operation records or check after opening the water box (water chamber).	There should be no contamination.
Evaporator	Chemical analysis	Water quality analysis	Water quality criteria
	Heat transfer pipe status	Check daily operation records or check after opening the water box (water chamber).	There should be no contamination.
Oil	Ejector cleaning	Disassemble and clean	There must be no abnormality.
	Filter cleaning	Filter change, housing cleaning	There must be no abnormality.
	Oil change		2,500 hours or 1 year

Table 35. Yearly Inspection

‹Water quality analysis›

The cooling water in the open circulation cooling tower is re-used after dropping the water temperature using the latent heat of vaporization.

At this time, as the water vaporizes, the amount of chloride ions, acid ions, etc. increases in the water. That is, the enrichment of ions in the cooling water gradually deteriorates the water quality.

Also, the pollutants in the air (automobile exhaust gas, sulfurous acid gas, dust, gases from chemical plants such as ammonia and organic chemicals, etc.) deteriorate the water quality even more.

Corrosion on the copper pipe or scale buildup due to contamination of the cooling water can result in blockages or holes forming in the copper tube, reducing the heat exchange capacity. This can lead to the need for tube replacement, increased power consumption, or chiller breakdowns. Therefore, it is essential to maintain the cooling water quality adequately.

Perform regular water quality analyses, and if the results exceed the specified water quality criteria, the water should be replaced. Conduct a water quality analysis at the start of each season or when the chiller is installed and operated for the first time.

To prevent the concentration of cooling water, you can periodically drain a portion and introduce fresh cooling water during circulation, or employ chemical treatment for water quality management.

Engage a certified water treatment specialist for effective water quality management.

‹Heat transfer pipe status›

Please note that, if water scale forms on the inner wall of the tube or foreign substances enter and block the tube, the heat resistance increases, leading to a decrease in refrigerating capability.

If hard foreign objects, such as sand, enter the cooling water, erosion or corrosion may occur in the inlet/outlet areas of the tube; therefore, make sure to check the inner wall of the tube during the tube cleaning.

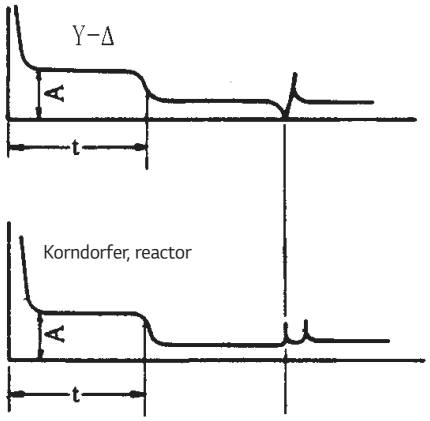
Install a filter at the inlet of the cooling water pipe.

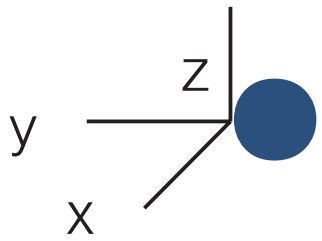
A cooling water system usually includes a cooling tower, but if you use underground water or stream water, the water quality is typically lower, resulting in more frequent scale formation compared to the cold water side.

7-3. Maintenance during off-season

1. If the operation needs to be stopped, to reduce the machine pressure and possibility of leakage, remove the refrigerant to a separate refrigerant container.
2. To prevent air from entering the machine, store it with approximately 5 kg of refrigerant filled or with 0.5 kg of pressurized nitrogen.
3. If the location where the machine is installed frequently experiences temperatures below zero, drain the cold water, cooling water, and condensed water to prevent freezing. Additionally, leave the water chamber drain open.
4. Leave the oil filled in the machine as is, and supply power to the oil heater enough to maintain the minimum oil temperature or above.

7-4. Periodic Maintenance and Inspection Table

<table>
<tr><th colspan="3">Inspection Item</th><th>Inspection method</th><th>Standard</th><th>Actual measurement value</th><th>Judgment</th></tr>
<tr><td rowspan="10">Compressor</td><td>O</td><td>Motor cooling status</td><td>Check refrigerant flow status from the moisture indicator.</td><td>Check the flow status</td><td>Yes No</td><td></td></tr>
<tr><td>O</td><td></td><td>Touch the surface of the motor with hand.</td><td>10 ~ 30 ℃</td><td>Yes No</td><td></td></tr>
<tr><td>O</td><td>Motor insulation</td><td>Measure at 1000V.</td><td>100 MΩ or more</td><td>MΩ</td><td></td></tr>
<tr><td>O</td><td>Startup characteristics (mark O in the corresponding startup method)</td><td rowspan="3"> 

냉수출구온도()°C의 경우</td><td>Startup time
t=5~25 sec.</td><td>t=
sec.</td><td></td></tr>
<tr><td colspan="2"></td><td>Startup current: A</td><td>A=
A</td><td></td></tr>
<tr><td colspan="2"></td><td>Timer set value (sec.)
<table>
<tr><th colspan="2">Timer</th><th>Y-Δ</th><th>Korndorfer</th><th>Reactor</th><th>Actual measurement</th></tr>
<tr><td rowspan="2">High pressure</td><td>T1</td><td>10/0.5</td><td>10</td><td>10/0.5</td><td></td></tr>
<tr><td>T2</td><td>20</td><td>20</td><td>20</td><td></td></tr>
<tr><td rowspan="2">Low pressure</td><td>T1</td><td>10/0.5</td><td>15</td><td>10/0.5</td><td></td></tr>
<tr><td>T2</td><td>30</td><td>20</td><td>30</td><td></td></tr>
</table>
Check the timer set value with an independent timer operation test after disconnecting high voltage.</td><td></td><td>T1: Startup timer
T2: Subsidiary timer</td></tr>
<tr><td>O</td><td>Operation current</td><td>Check the current value.</td><td>105% of the rated current or less</td><td>A</td><td></td></tr>
<tr><td>O</td><td>Motor stopped time</td><td>Check the stopped time of the motor shaft on the motor half-load side
after the chiller shuts down.</td><td>10 – 60 sec.</td><td>sec.</td><td></td></tr>
<tr><td>O</td><td>Discharge gas temperature</td><td></td><td>About 30~90°C</td><td>°C</td><td></td></tr>
<tr><td>O</td><td>Vibration noise</td><td>Touch with hand or check with ears
 
</td><td>When there is no problem</td><td>Yes No
xa =μ
ya =μ
za =μ
xb =μ
yb =μ
zb =μ</td><td></td></tr>
</table>

Inspection Item				Inspection method	Standard	Actual measurement value	Judgment
Condenser	O	Cooling water	Inlet	Check with a thermometer.	34 ℃ or less (standard condition)	℃	
			Outlet	Check with a thermometer.	24 ℃ or more (standard condition)	℃	
	O	Condensing pressure		Check with a manometer.	6 ~ 10 kg/cm² (R134a) 8 ~ 16 kg/ cm2(R22) kg/cm²(g)	kg/cm²(g)	
	O	Heat exchanging status		Difference between the condensing temperature and the cooling water outlet temperature	1 ~ 3 ℃	℃	
Evaporator	O	Cooling water	Inlet	Check with a thermometer.	34 ℃ or less (standard condition)	℃	
			Outlet	Check with a thermometer.	24 ℃ or more (standard condition)	℃	
	O	Vaporizing pressure		Check with a manometer.	2 ~ 5 kg/cm² (R134a) 4 ~ 8 kg/cm2(R22) kg/cm²(g)	kg/cm²(g)	
	O	Heat exchanging status		Difference between the cold water outlet temperature and the vaporizing temperature.	1 ~ 3 ℃	℃	
	O	Amount of the refrigerant filled		Check through the site glass		Yes No	
	O	Boiling status		Visual Inspection		Yes No	
	O	Refrigerant contamination		Check through the site glass	Whether contaminating material, moisture, or oil is included	Yes No	
Lubrication system	O	Oil amount		Visual inspection	Check through the site glass on the gear box during operation	Yes No	
	O	Oil filling amount		Accumulated filling amount after filling new refrigerant	Refer to 10.5 Standard filling amount.	Month Day	
	O	Oil leakage		Visual inspection of the oil system		Yes No	
Safety device	O	Cold water flow switch		Decrease the cold water amount to check the operation.		Yes No	
	O	Cooling water flow switch		Decrease the cooling water amount to check the operation.		Yes No	

Table 36. Periodic Maintenance and Inspection Table

7-5. Preparation for Commissioning

LG

Checklist on the Preparation for Commissioning of Screws

[R-134a / R-22]

Receipt No.:

Customer Name		**Customer Address/Phone No.**	(Signature)
Model		**Customer Confirmation**	(Signature)
Manufacturing No.		**Inspector**	
Power Specifications		**Inspection Date**	MM/DD/YYYY - MM/DD/YYYY

*** Caution:** The details of this preparation for commissioning must be **confirmed** by both our **relevant personnel** and the **contractor's representative** in charge of installation. Accidents caused by abnormalities of or damages to the equipment or its parts after the completion of the work are not covered by our warranty. So we ask you to **check and confirm the preservation status of the equipment at all times**.

*** Please fill in the actual measurements and verified facts for each item.**

1. Clearance space around the chiller installation: ☐
   - If smaller than the specified space, please indicate the distances:

   Back: 2.0 m or more (m)

   Left side m or more (m) | Right side m or more (m)

   Front: 2.0 m or more (_____m)

   Height: 2.0 m or more (_____m)

   - Foundation installation: Yes ☐ No ☐

   ◎ Clearance space larger than the length of the chiller is required for future replacement of heat transfer pipes.
2. Appearance check: ☐
   1) Nitrogen sealing pressure kg/cm² / Refrigerant filling ☐
   2) Installation status of parts
   - Control Panel: Check internal parts ☐
   - Startup Panel: Check internal parts ☐
   - Damage of copper pipes: Yes ☐ No ☐
   - Water pipe inlet and outlet directions: Checked ☐
   - Support for preventing water pipe sagging: Yes ☐ No ☐
   - Oil filling level status
   - Check for broken parts: Yes ☐ No ☐
3. Connection of control and power supply wiring ☐
   (Mark ○ in the appropriate box.)
   Starting method of the startup panel:
   Y-△ / Other ( )
4. Leakage check ☐
   Whether the chiller is shipped filled with refrigerant: Yes ☐ No ☐

   ※ In the case of a shipment with refrigerant filled, only perform a soapy water leak test with the internal refrigerant pressure.
   Nitrogen gas injection: ( ) BT, ( ) kg/cm²
   Soapy water leak test of the equipment body (visual) Yes ☐ No ☐
   Leakage area
5. Vacuuming and waiting ☐
   Ambient temperature: _____℃
   Reached vacuum level _____ mmHg (in case of a gauge)
   Vacuuming and waiting Start (_____), Complete (_____)
   Total _____hrs
   Leakage Yes ☐ No ☐
   Leakage area _____
6. Refrigerant and oil filling
   1) Cold water and cooling water circulation Yes ☐ No ☐
   2) Refrigerant filling amount: _____ kg
7. Measurement of the compressor insulation resistance
   R: _____ MΩ
   S: _____ MΩ
   T: _____ MΩ
8. Cold water and cooling water interlock construction
   Interlock wiring installation: Yes ☐ No ☐
9. Comment

⊘ Not required ◯ Good ☒ Poor ⊠ Good after Repair

7-6. Oil Maintenance

Compressor Oil Change

- **Lubrication System Inspection**
  Mark the oil level on the oil tank sight glass and observe the level when the chiller is stopped. If the level goes below the level of the sight glass inspection window, you need to check whether the oil recovery system is properly working. If oil replenishment is required, add oil through the oil filling valve. To add oil against refrigerant pressure, a pump is needed. Please refer to Oil Filling Amount by Model for oil filling amount. The added oil should be compatible with the chiller specifications. The added oil amount and oil filling date should be recorded.

<Compatible oil>
- LG genuine oil

- **Oil change**
  We recommend changing the oil at the first year of the operation and every three years based on the annual oil analysis.
  1. Mark the present oil level.
  2. Open the control circuit breaker and oil heater circuit breaker.
  3. Open the oil filling valve slowly to drain the oil. Open the valve slowly against the chiller pressure.
  4. After closing the valves at both ends of the oil filter, use the upper side valve to gradually reduce the pressure applied to the oil filter, and then change the oil filter.
  5. Refill oil into the machine using a pump.
     To fill the oil to the middle level or higher at the sight glass, about 16 - 28ℓ of oil is needed.
     Turn on the oil heater and heat the oil until it reaches a temperature of at least 40℃.
     The oil level should be visible through the sight glass while the chiller is stopped.

Oil Filter Change

- **Oil filter change**
  Change oil filter every year or when the inside of the machine was exposed for maintenance.
  The chillers manufactured by LG Electronics are equipped with oil filters, which can be separated for filter change while the refrigerant is filled in the machine.
  1. Check whether the compressor is in the stop state and its circuit breaker is in the open state.
  2. Close the oil filter separation valves.
  3. Slowly open the oil filter housing.
  4. After changing the filter and reassembling the housing, conduct vacuuming of the filter housing. When vacuuming is complete, open the separation valves. If oil is insufficient, add oil through the oil filling valve.

Caution

Reduce pressure slowly since the oil filter housing is pressurized.

7-7. General Maintenance

Non-periodic Maintenance

Compressor coil insulation inspection

Using an appropriate device, measure the insulation values between windings in the compressor and between windings and the ground.

This test should be conducted before supplying power to the compressor.

Caution

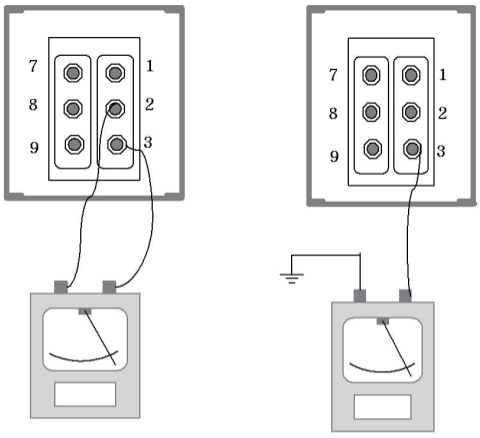
Before performing the procedure described below, check whether the auxiliary power to the chiller is cut off.
Also, make sure that the chiller's power switch is 'OFF'.

The measurement of insulation resistance values should be conducted as follows:

- Turn off the auxiliary power switch.
- Open the compressor wiring box.
- Disengage the compressor power supply line.
- Measure the resistance.

Caution

This test should not be performed in a vacuum state.
Otherwise, it may cause damage to the windings.



2.Resistance value between phases	1.Resistance between the windings and ground
Between 1 and 2	Between 1 and ground
Between 2 and 3	Between 2 and ground
Between 1 and 3	Between 3 and ground

When the test voltage is 500 V, the resistance should be at least 3 MΩ.

After measurement, restore the connections by referring to the schematic.

Especially, a special attention should be taken to align the compressor's motor wire terminal with the measurement terminal in the direction of phase rotation.

Caution

Due to the compressor's properties, the phase connection should be made very accurately.
Otherwise, the compressor may be damaged. So, give a special attention to the connection work.

- **Adjustment of refrigerant filling amount**
  In the case it is necessary to adjust the refrigerant filling amount to enhance the performance of the machine, run the machine at the designed load, and slowly add or remove refrigerant until the difference
  between the cold water outlet temperature and the evaporator refrigerant temperature reaches the designed value or the minimum. Do not overfill the refrigerant.
  Refrigerant may be added through a storage tank or directly filled to the chiller.

- **Refrigerant leakage inspection**
  Since the refrigerant has a higher pressure than the atmospheric pressure at room temperature, leakage inspection is necessary. Carry out the leakage inspection
  using an electronic detector, halogen leakage detector, or soap bubbles. Ensure adequate room ventilation and check for any accumulation of refrigerant in one location to prevent incorrect measurements.
  Before performing any repair work on leakage, remove all of the refrigerant from the leaked container to a separate container.

- **Refrigerant leakage**
  If refrigerant leakage is extensive and significantly impairs chiller performance, rendering operation impractical, it is advisable to discontinue the use of the chiller and initiate repair work promptly.

- **Refrigerant filter**
  Refrigerant filter/drier installed in the refrigerant cooling pipe of the motor needs to be replaced once a year. It may require more frequent replacement depending on the filter condition.
  To find the existence of moisture in the refrigerant, a sight glass is installed next to the filter.
  If you see moisture through the sight glass, conduct a thorough leakage test to find the source of the moisture.

Heat Exchanger Tube Cleaning (Evaporator/Condenser)

Heat exchanger tube inspection

- **Evaporator**
  When the first operation season is over, clean the evaporator tubes. These tubes have foreign substances inside. So, to completely clean the tubes, a special caution is required. The tube condition at this time will be used as the data to decide how often the tube needs to be cleaned and whether water treatment in the cold water (brine) system is appropriate.
  Check the corrosion or scale in the cold water inlet/outlet temperature sensors, and if there is corrosion, replace the sensor, and if there is scale, remove the scale.
- **Condenser**
  Since cooling water circuitry is generally of an open system, the tubes are easily contaminated and the scale easily accumulates. Therefore, condenser tubes need to be cleaned at least once a year, and if the water is contaminated, should be cleaned more frequently.
  Check the corrosion or scale in the cooling water inlet/outlet temperature sensors, and if there is corrosion, replace the sensor, and if there is scale, remove the scale.
  The reason for the need of higher-than-normal condenser pressure while failing to achieve previous chilling load is typically due to tube contamination or air trapped in the machine.
  If the difference between cooling water outlet temperature and condenser refrigerant temperature is big, condenser tubes may be contaminated or water flow may not be in good condition.
  Since the refrigerant is used at a high pressure, it is easier to have leakage than to have air inside.
  When cleaning the tube, use a specially designed brush not to scratch the tube wall. Never use a wire brush.

Caution

To prevent severe scale formation or remove the scale, conduct chemical treatments. For proper treatments, consult a water treatment specialist.

8. Troubleshooting

8-1. Display of Errors on the Controller

When an error occurs in the chiller, you can check the displayed content under [History] > [Error History], and consult the table below for details regarding each item.

You can navigate to [History] > [Help] and view a brief explanation of the causes and actions required.

For more accurate causes and recommended actions, please contact our service center.

Error Description	Meaning	Cause and Action
Cold water inlet temperature sensor abnormal	Bad temperature sensor or bad wiring	• Check for disconnected or loose sensor wiring and inspect the wiring condition; then reconnect as needed. • Inspect the faulty sensor and assess its condition; replace it if necessary.
Cold water outlet temperature sensor abnormal		
Outside air temperature abnormal		
Cooling water outlet temperature sensor abnormal		
A compressor discharge temperature sensor abnormal		
Cooling water inlet temperature sensor abnormal		
A compressor inlet temperature sensor abnormal		
B outside air temperature sensor abnormal		
B compressor inlet temperature sensor abnormal		
B compressor discharge temperature sensor abnormal		
C compressor discharge temperature sensor abnormal		
C compressor inlet temperature sensor abnormal		
D compressor inlet temperature sensor abnormal		
D compressor discharge temperature sensor abnormal		
B evaporator pressure sensor abnormal	Bad pressure sensor or bad wiring	• Check for disconnected or loose sensor wiring and inspect the wiring condition; then reconnect as needed. • Inspect the faulty sensor and assess its condition; replace it if necessary.
B condenser pressure sensor abnormal		
A evaporator pressure sensor abnormal		
A condenser pressure sensor abnormal		
D evaporator pressure sensor abnormal		
D condenser pressure sensor abnormal		
C evaporator pressure sensor abnormal		
C condenser pressure sensor abnormal		
B current sensor abnormal	Faulty current sensor or faulty wiring	• Check for disconnected or loose sensor wiring and inspect the wiring condition; then reconnect as needed. • Inspect the faulty sensor and assess its condition; replace it if necessary.
A current sensor abnormal		
D current sensor abnormal		
C current sensor abnormal		
High discharge temperature of A compressor	The compressor discharge temperature is higher than the upper limit of compressor discharge temperature.	• Check for low refrigerant flow. Check refrigerant filling or valve open status. • Abnormal rise in ambient temperature. Check whether the ambient temperature is normal. • Compressor abnormal. Check the condition of the compressor and repair it if necessary. • Incorrect upper limit setting of the discharge temperature. Check the setting and change it if necessary.
High discharge temperature of B compressor		
High discharge temperature of C compressor		
High discharge temperature of D compressor		
A compressor current abnormal	The compressor operating current is higher than rated current setting.	• Check for excessive refrigerant flow. Check refrigerant discharge or valve closed status. • Abnormal rise in ambient temperature. • (Air cooled) condenser fan/motor abnormal. Check the fan/motor. • (Air cooled) condenser fin contamination. Clean condenser fins. • (Air Cooled) high cooling water temperature. Check the cooling tower condition. • Compressor abnormal. Check the condition of the compressor and repair it if necessary. • Incorrect setting of the rated operating current. Check the setting and change it if necessary.
B compressor current abnormal		
C compressor current abnormal		
D compressor current abnormal		

Error Description	Meaning	Cause and Action
High pressure of B condenser	The condenser pressure is higher than the upper limit of the condenser pressure.	• Check for excessive refrigerant flow. Check refrigerant discharge or valve closed status. • Abnormal rise in ambient temperature. • (Air cooled) condenser fan/motor abnormal. Check the fan/motor. • (Air cooled) condenser fin contamination. Clean condenser fins. • (Air Cooled) high cooling water temperature. Check the cooling tower condition. • (Air Cooled) insufficient cooling water flow. Check the cooling water flow rate. • Faulty high pressure sensor. Check the pressure sensor and replace it if necessary. • Incorrect upper limit setting of the condenser pressure. Check the setting and change it if necessary.
High pressure of A condenser		
High pressure of D condenser		
High pressure of C condenser		
B refrigerant differential pressure abnormal	The refrigerant differential pressure is lower than the lower limit (high pressure - low pressure).	• Low ambient temperature. • Low cooling water temperature. • High cold water temperature. • Incorrect limit setting of the refrigerant differential pressure. Check the setting and change it if necessary.
A refrigerant differential pressure abnormal		
D refrigerant differential pressure abnormal		
C refrigerant differential pressure abnormal		
Low cold water temperature abnormal	The cold water outlet temperature is lower than the lower limit of the cold water temperature.	• Insufficient cold water flow. Check the cold water flow rate. • Incorrect lower limit setting of the cold water temperature. Check the setting and change it if necessary.
Low cold water inlet temperature.	The cold water inlet temperature is lower than the lower limit of the cold water temperature.	• Insufficient cold water flow. Check the cold water flow rate. • Incorrect lower limit setting of the cold water temperature. Check the setting and change it if necessary.
B compressor motor abnormal	Faulty protection device (INT69) inside the compressor terminal box	• High compressor discharge temperature. Check the discharge temperature. • Check the compressor power supply for abnormalities (reverse phase, phase loss) and rewire the power supply if necessary. • Faulty compressor protection device (INT69). Replace the compressor protection device.
A compressor motor abnormal		
D compressor motor abnormal		
C compressor motor abnormal		
B startup failure	No compressor operation signal input (2M) within the set duration	• 2M magnet operation or wiring abnormal. Replace or rewire the magnet. • Y-D startup timer abnormal. Replace or rewire the start timer if necessary. • Incorrect setting of the compressor startup check timer value. Check the setting and change it if necessary.
A startup failure		
D startup failure		
C startup failure		
Low pressure of A evaporator	The evaporator pressure is lower than the lower limit of the evaporator pressure.	• Insufficient refrigerant. Add additional refrigerant. • Refrigerant leakage After checking for leaks, add additional refrigerant. • Blockage of refrigerant piping. Check the condition of the piping. Check for the valve open state. • Clogged filter drier. Replace the filter core. • Insufficient cold water flow. Check the cold water flow rate. • Faulty low pressure sensor. Check the pressure sensor and replace it if necessary. • Incorrect limit setting of the refrigerant low pressure. Check the setting and change it if necessary.
Low pressure of B evaporator		
Low pressure of C evaporator		
Low pressure of D evaporator		
Cold water pump interlock abnormal	This occurs when the interlock disengages while the cold water pump is operating under cold water pump conditions.	• Cold water pump interlock contact abnormal. Check the wiring.
Cooling water pump interlock abnormal.	This occurs when the interlock disengages while the cooling water pump is operating under cooling water pump conditions.	• Cooling water pump interlock contact abnormal. Check the wiring.

Error Description	Meaning	Cause and Action
A refrigerant pressure abnormal contact operation	This message is displayed when the condensing pressure exceeds the high pressure switch setting or when the evaporation pressure falls below the low pressure switch setting.	• Excessive or insufficient refrigerant. Check the refrigerant amount. • Abnormal rise in ambient temperature. • (Air cooled) condenser fan/motor abnormal. Check the fan/motor. • (Air cooled) condenser fin contamination. Clean condenser fins. • (Air Cooled) high cooling water temperature. Check the cooling tower condition. • Refrigerant leakage After checking for leaks, add additional refrigerant. • Blockage of refrigerant piping. Check the condition of the piping. Check for the valve open state. • Clogged filter drier. Replace the filter core. • Insufficient cold water flow. Check the cold water flow rate. • Insufficient cooling water flow. Check the cooling water flow rate. • Faulty pressure switch. Check the pressure switch and replace it if necessary.
B refrigerant pressure abnormal contact operation		
C refrigerant pressure abnormal contact operation		
D refrigerant pressure abnormal contact operation		
External abnormal switch operation	This message is displayed when an external error signal is ON.	• External abnormal contact signal. Check the signal and wiring.
B motor power abnormal	This error occurs when an abnormal contact is made in the compressor motor protection relay (OCR).	• Overcurrent trip in OCR. Check the setting of the rated current. • Reverse phase trip in OCR. Check the power wiring. • Phase loss trip in OCR. Check the power wiring.
A motor power abnormal		
D motor power abnormal		
C motor power abnormal		
Cold water flow rate low.	This message is displayed when the cold water flow rate falls below the setting during chiller operation.	• Check the cold water flow rate - Check whether the cold water pump is operating. - Check for the open status of the cold water pipe valve. • Operate the cold water flow switch or cold water differential pressure switch. Check the setting of the switch. • Faulty switch wiring. Check the wiring condition and replace it if necessary. • Faulty switch. Check the switch condition and replace it if necessary.
Low cooling water flow rate	This message is displayed when the cooling water flow rate falls below the setting during chiller operation.	• Check the cooling water flow rate. - Check whether the cooling water pump is operating. - Check for the open status of the cooling water pipe valve. • Operate the cooling water flow switch or cooling water differential pressure switch. Check the setting of the switch. • Faulty switch wiring. Check the wiring condition and replace it if necessary. • Faulty switch. Check the switch condition and replace it if necessary.
B refrigerant compression ratio abnormal	This occurs when the compression ratio (condensation pressure/evaporation pressure, based on absolute pressure) exceeds the setting.	• This occurs when the pressure ratio is high. Check the high/low pressure status. • Incorrect limit setting of the pressure ratio. Check the setting and change it if necessary.
A refrigerant compression ratio abnormal		
D refrigerant compression ratio abnormal		
C refrigerant compression ratio abnormal		
Delta contactor open during A operation	This message is displayed when the startup completion signal (2M) is generated while the chiller is in operation.	• 2M magnet operation or wiring abnormal. Replace or rewire the magnet.
Delta contactor opening during B operation		
Delta contactor opening during C operation		
Delta contactor opening during D operation		
B oil abnormal	This error occurs if the oil contact switch (oil level switch, oil differential pressure switch, etc.) operates.	• Oil level switch triggered. Check oil level and refill if necessary. • Oil differential pressure switch triggered. Check oil filter and replace it if necessary. • Faulty oil level switch or wiring. Replace or rewire the switch. • Faulty oil differential pressure switch or wiring. Replace or rewire the switch.
A oil abnormal		
D oil abnormal		
C oil abnormal		

Error Description	Meaning	Cause and Action
A Cond. Fan1 Abnormal	A message is displayed if the fan contactor opens during product operation.	• Fan motor failure (locked, overheated, etc.) Check and replace the fan motor. • Fan motor magnetic contactor or wiring error. Rewire or replace the magnetic contactor.
A Cond. Fan2 Abnormal		
A Cond. Fan3 Abnormal		
A Cond. Fan4 Abnormal		
B Cond. Fan1 Abnormal		
B Cond. Fan2 Abnormal		
B Cond. Fan3 Abnormal		
B Cond. Fan4 Abnormal		
C Cond. Fan1 Abnormal		
C Cond. Fan2 Abnormal		
C Cond. Fan3 Abnormal		
C Cond. Fan4 Abnormal		
D Cond. Fan1 Abnormal		
D Cond. Fan2 Abnormal		
D Cond. Fan3 Abnormal		
D Cond. Fan4 Abnormal		
Communication error between MAIN ↔ DISPLAY	Communication error between boards	• Board error or faulty wiring. Replace or rewire the board.
Communication error between MAIN ↔ SLAVE1		
Communication error between MAIN ↔ SLAVE2		
Communication error between MAIN ↔ RELAY		
Communication error between MAIN ↔ RELAY2		
Communication error between MAIN ↔ SLAVE3		
Communication error between MAIN ↔ SLAVE4		

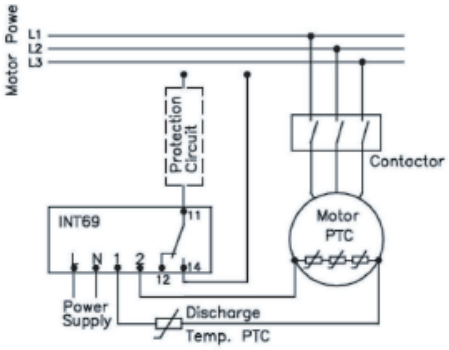
8-2. Measures by Chiller Condition

Symptom	Cause	Measure
Very high discharge temperature	1) Air or non-condensable gas is present in the system. 2) The cooling water inlet temperature is high or the cooling water flow rate through the condenser is insufficient. 3) Scaly substances (lime, corrosion, etc.) have accumulated on the condenser's heat transfer pipe. 4) The water pump is malfunctioning. 5) Liquid refrigerant has accumulated in the condenser's heat transfer pipe due to excessive amount of refrigerant. 6) The gas intake valve of the condenser does not fully open. 7) The suction pressure is higher than normal.	1) Release air or gas from the condenser. 2) Adjust the water system, check the cooling tower fan operation, or check the pipeline filter. 3) Clean the heat transfer pipe. 4) Check the cooling water pump. 5) Drain excess refrigerant from the system. 6) Open the valve. 7) Refer to the 'Very high suction pressure' section.
Very low discharge temperature	1) The flow rate of water passing through the condenser is excessive, or the water temperature is very low. 2) Oil bubbles due to the liquid refrigerant flowing from the evaporator to the compressor 3) There is a leak in the liquid outlet valve of the condenser. 4) The suction pressure is lower than normal. 5) Gas refrigerant enters the liquid pipe due to insufficient refrigerant.	1) Adjust the water valve and brake valve: Check the cooling tower fan operation status. 2) Check and adjust the expansion valve. Ensure the temperature sensor in the suction pipe is well-fixed and insulated. Verify if the cooling water inlet temperature is higher than the limit value. 3) Check the operating status of the condenser and replace the outlet valve if necessary. 4) Refer to the 'Very low suction pressure' section. 5) Fill the refrigerant sufficiently.
Very high suction pressure	1) The discharge pressure is very high. 2) The refrigerant is overfilled. 3) Liquid refrigerant flows from the evaporator into the compressor. 4) Cold water pipe insulation is poor.	1) Refer to the 'Very high discharge pressure' section. 2) Discharge the excess refrigerant. 3) Check and adjust the expansion valve. Ensure the temperature sensor in the suction pipe is well-fixed and insulated. Verify if the cooling water inlet temperature is higher than the limit value. 4) Check the insulation condition of the pipeline.
Very low suction pressure	1) The liquid refrigerant outlet valve of the condenser does not fully open. 2) The liquid pipe or suction pipe is clogged. 3) The expansion unit is defective or not properly adjusted. 4) The refrigerant is not sufficient. 5) The amount of lubricant in the lubrication cycle is excessive. 6) The cold water inlet temperature is lower than the standard value. 7) The cold water flow rate passing through the evaporator is insufficient. 8) The discharge pressure is very low.	1) Open the valve. 2) Check the refrigerant filter. 3) Adjust the opening of the butterfly valve. 4) Perform a refrigerant leak test. 5) Check the amount of lubricant. 6) Adjust the temperature control settings. 7) Reduce the pressure in the cold water pipeline. 8) Adjust the valve in the water system.
Compressor high-pressure valve triggered	1) The cooling water is insufficient. 2) The condenser is clogged, or the inlet valve is blocked. 3) The high-pressure prevention valve setting is abnormal. 4) The refrigerant was overfilled.	1) Check the water system valve. 2) Check the condenser's heat transfer pipe and water valve. Accurately identify the cause of the current pressure. 3) Check the setting. 4) Check the refrigerant filling amount.
Compressor motor overload	1) The voltage is very high or low. 2) The discharge temperature is very high. 3) The temperature of the recovered water is very high. 4) The electric motor or wiring is short-circuited.	1) Check that the voltage matches the relevant value of the equipment and correct the phase imbalance if necessary. 2) Check the discharge pressure and accurately identify the cause of excessive discharge pressure. 3) Determine the reason for the excessive temperature of the recovered water. 4) Check the insulation resistance between the wiring blocks of the electric wire and ground wire.
High motor winding temperature of the compressor	1) The voltage is very high or low. 2) The discharge pressure is very high. 3) The temperature of the recovered cooling water is very high. 4) The motor winding temperature is abnormal. 5) The system refrigerant is not sufficient.	1) Check that the voltage matches the relevant value and correct the phase imbalance if necessary. 2) Check the discharge pressure, identify the cause, and solve the problem. 3) Identify the cause and solve the problem. 4) Check the contact status of the elements of the compressor temperature sensor wiring block under the cooling condition (the compressor must be stopped for more than 10 minutes). 5) Check the cause of the refrigerant leakage.
Compressor low pressure switch triggered	1) The refrigerant liquid pipe filter is clogged. 2) The expansion unit is defective. 3) Refrigerant filling is insufficient. 4) The liquid outlet valve is not fully open.	1) Check and clean the filter net and filter. Replace it if necessary. 2) Check the expansion unit. 3) Replenish the refrigerant. 4) Open the valve.
Noise from the compressor	Liquid refrigerant has flowed from the evaporator into the compressor.	Adjust the liquid refrigerant level until it disappears from the evaporator, and then check the expansion valve and the degree of heat.
Compressor inoperable	1) The fuse for protective operation or in the compressor control circuit has blown. 2) There is poor contact in the control circuit. 3) The power was cut off. 4) The compressor relay's winding has burnt. 5) The direction of rotation is incorrect.	1) Identify the reason for the protective operation, solve the problem, and restart the chiller. 2) Check and repair the control circuit. 3) Check the power supply. 4) Replace the burnt-out component. 5) Switch the two phases according to the direction of correct rotation.
Unloading system inoperable	1) The cold water outlet temperature setting is abnormal, or the temperature sensor is defective. 2) The unloading solenoid valve is defective. 3) The compressor is damaged.	1) Adjust the temperature setting or replace the temperature sensor. 2) Check the solenoid valve winding and check if the oil passage is blocked. 3) Check the unloading system components.

8-3. Measures by Screw Compressor Status

Symptom	Cause	Measure
The compressor is not working.	Open wires Open control fuse Stopped high pressure switch (HPS) Loose terminal connection Incorrectly connected control unit	Check for disconnected parts. Replace the fuse that detects the ground or short-circuit of the control circuit. Reset the current alarm using the navigator. Inspect the connection from the CCP to the contact. Check the wires and reconnect them if necessary.
	Excessive voltage drop	Check the line voltage. Determine the location of the voltage drop and correct the problem.
	Faulty compressor motor	Check motor windings for an open circuit or short circuit. Replace the compressor if necessary.
	Compressor stoppage Unsuccessful pre-lubrication	Check the oil pump operation and the oil pressure transducer. Check whether the oil solenoid valve operates.
Compressor operation is stopped due to abnormally low pressure.	Leakage Bad transducer Insufficient refrigerant Broken expansion unit Fully or partially clogged strainer	Repair leaks and refill. Replace the transducer. Add refrigerant. Repair or replace if necessary. Remove and clean the strainer.
Compressor operation is stopped due to abnormally high pressure.	Abnormal operation of a high-pressure switch Partially closed compressor discharge valve Clogged condenser water pipe Condenser scale problem	Replace the switch. Open the valve or replace it if it is defective. Check the pipes and repair or replace them if any defects are found. Clean the condenser.
Abnormally long or continuous operation of the chiller	Insufficient refrigerant filling amount Control fuse failure Partially or completely clogged strainer with poor insulation The service load exceeding the design capacity Inefficient compressor	Add refrigerant. Replace the control unit. Clean or replace. Replace or repair. Review load conditions. Check the loader solenoid valve and replace it if necessary.
Abnormal noise	Plumbing vibration	Install support pipes if necessary.
	Expansion valve noise	Add refrigerant. Check for clogged pipe strainers.
	Compressor noise	Replace the compressor (worn bearings). Check for loose compressor bolts securing the compressor to the chiller.
Oil loss in the compressor	Leakage in the system Mechanical damage to the rotor	Find the location of the leak, and repair or replace the compressor if necessary.
Piping with abnormally high temperature	Refrigerant shortage due to leakage	Repair the leaks and refill.
Piping with abnormally low temperature	Partially closed or constrained stop valve	Open the valve or remove the constraint.
Abnormal operation of the compressor loader	Faulty electromagnetic valve coil Faulty loading solenoid valve Incorrectly wired solenoid valve	Replace the coil. Replace the valve. Reconnect the wires correctly.

To protect the compressor, two PTC temperature sensors are installed: one on the discharge gas side and the other inside the motor coil. These sensors are connected to the INT69 control module to monitor temperatures in both areas. When either sensor detects a temperature exceeding the respective PTC thermistor's response threshold, the sensor's resistance increases. In response, the INT69 control module disengages the motor contactor. The cut-off temperature of the motor winding is set at 120°C, with a restart temperature of 75°C. The cut-off temperature for the compressor discharge protection is 110°C and the restart temperature is 60°C. Please refer to the troubleshooting table above for guidance on compressor issues.



9. Operation Inspection Records

9-1. Checklist for Commissioning

LG

Checklist on the Preparation for Commissioning of Screw Chiller

[X–30 MICOM] [R-134a / R-22]

Receipt No.:

Customer Name		**Customer Address**	
Model		**Customer Confirmation**	(Signature)
Commissioning Date		**Staff in Charge of Commissioning**	(Signature)
Type		**Motor Capacity**	KW A
Cooling Capacity	USRT	**Power Spec.**	Power. V Control: V
Statutory RT	RT	**Cold Water Temperature**	Inlet: °C Outlet: °C
Manufacturing No.		**Cooling Water Temperature**	Inlet: °C Outlet: °C
Settings for Safety Valves	Evaporator. Kg/cm²,cm², Condenser. kg/cm²	**Maximum Operating Pressure**	Cold water. kg/cm², Cooling water. kg/cm²

*** Caution:** These commissioning inspection details must be mutually verified by the service personnel appointed by our company and the on-site facilities manager. Any heat transfer pipe rupture resulting from abnormalities in the water circulation system after commissioning is not covered by our company's defect warranty. Therefore, we recommend that you continuously monitor the circulation conditions of cold water (for general air conditioning) and cooling water (after completing ice making using ice thermal storage).

1. Appearance check: ☐
   1) Damage to the machine body's appearance and parts
   Damaged parts: _____
   2) Leakage in fastening parts
   Leakage area:
   3) Panel cleanliness
   Startup panel:
   Chiller control panel: _____
2. Operation-related condition check ☐
   1) Oil levels (before / during operation)
   Check with the sight glass: _____
   2) Check the evaporator and condenser pressures.
   3) Vibration or abnormal noise during operation: _____
   4) Compressor motor insulation resistance test
   MΩ tester type: DC _____ V _____
   Measurement result: _____ MΩ _____
   Comment: _____
3. Component assembly conditions ☐
   1) Instrumentation (manometers, switches)
   2) Valves
   3) Sight glass
   4) Safety valve sealing
   5) Oil piping and refrigerant piping conditions
   *Check valve opening.
   6) Others
   _____
   _____
4. Electrical circuit check ☐
   1) The wiring connections of each part
   2) Grounding of the machine body and panels
   3) Conditions of the control power wiring connection
5. Function test of the startup panel ☐
   Startup method: Y-△ / Full voltage / ( )

☒ Not required ◯ Good ☒ Poor ☒ Good after Repair

LG

Operation Inspection Records

[R-134a / R-22]

Model: _____

Manufacturing No.: _____

6. Safety device function test
   Operation at low oil pressure (differential pressure)
   Operation at abnormally low cold water temperature
   Operation at abnormally low evaporator pressure
   Operation at abnormally high motor temperature (INT69)
   Abnormally high condenser pressure (HP)
   Various sensors (PT 100 Ω)
   Check pressure and differential pressure switch settings during operation.
   Cold water inlet and outlet pressure: /
   Setting:
   Cooling water inlet/outlet pressure: /
   Setting:

7. Check auxiliary equipment ☐
   1) Piping connection directions for cold water and cooling water
   2) Drain piping for cold water and cooling water
   3) Attachment of instrumentation Y/N

Classification	AIR Vent	Manometer	Thermometer
Cold water	Yes / No	Yes / No	Yes / No
Cooling water	Yes / No	Yes / No	Yes / No

   4) Pumps

Classification	Capacity (kW * # of units)	Flow Rate (m^3/Hr)	Head Pressure (m)
Cold water			
Cooling water			

   5) Interlock circuit configuration (PUMP start and stop methods)
   Cold water pump Auto/Manual
   Cooling water pump Auto/Manual

   6) Interlock configuration
   Cold water pump Yes/No
   Cooling water pump Yes/No

   7) Cooling tower temperature control method
   Micom linkage / Centralized monitoring / Thermostat
   Other.

8. Comment ☐
   1) Preparation for commissioning and measures against abnormality after commissioning
   2) Attach photos for replaced parts and leakage areas in the refrigerant and oil lines and record the relevant information.
   3) Oil name:

Initial oil filling amount (liter)	Classification
Oil type	CPI Solest 220 (for R134a) ☐
	Suniso 5GS (for R22) ☐
	Other ( ) ☐

   4) Check the installation conditions
   *Installation location of the chiller (indoor/outdoor)
   Ground / Basement / Rooftop / Other. floor

☒ Not required ○ Good ☒ Poor ☒ Good after Repair

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Operation Inspection Records

[R-134a / R-22]

Model: _____

Manufacturing No.: _____

Measured Item		Unit	1	2	3	4	5	6	7	8
		Hour:Minute	:	:	:	:	:	:	:	:
Cold water	Inlet pressure	kg/cm²								
	Outlet pressure	kg/cm²								
	Inlet temperature	°C								
	Outlet temperature	°C								
Evaporator	Pressure	kg/cm²								
	Refrigerant temperature	°C								
	LTD	°C								
Cooling water	Inlet pressure	kg/cm²								
	Outlet pressure	kg/cm²								
	Inlet temperature	°C								
	Outlet temperature	°C								
	Outdoor air temperature (Air cooled)	°C								
Condenser	Pressure	kg/cm²								
	Refrigerant temperature	°C								
	LTD	°C								
Compressor	Current limit	%								
	Operation current	A								
	Discharge gas temperature	°C								
	Operation capacity	%								
Others										

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Operation Inspection Records

[R-134a / R-22]

Model: _____

Manufacturing No.: _____

※ If on-site conditions do not allow you to print a printout, please write your own!

[Check MICOM settings]

1. User Set Data

Operation mode setting	Local/Reservation/Remote
Control mode setup	Cooling/Ice-making
Cold water outlet temperature	°C
Ice-making outlet temperature	°C
Cold water temperature P value	°C
Cold water temperature I value	Sec
Cold water temperature D value	Sec
Automatic start temperature (set value+)	°C
Automatic start temperature (set value -)	°C
Antifreeze operation function	Enabled/Disabled
Antifreeze operation temperature	°C
Motor current Limit	%
Cooling water inlet temperature	°C
Cooling water temperature P value	°C
Cooling water temperature I value	Sec
Cooling water temperature D value	Sec

2. Link mode setting (2-Comp Type)

Link conversion type selection	Auto/Manual
Link transition time selection	Hr
LAG starting load (current)	%
LAG start-up delay time	sec.
LAG stop load (current)	%
LAG stop delay time	sec.
Compressor 1 control selection	Sec
Compressor 2 control selection	Sec

3. System information

< Check input status >

Software version (X-30)

DISPLAY (DISPLAY)	V:
MASTER (MAIN)	V:
SLAVE-1 (IN/OUT)	V:
SLAVE-2	V:
Operation information storage cycle	Sec
Communication address (unit number)	
Communication speed	4800 / 9600 / 19200 / 38400
Language selection	Korean / English / Chinese / Other
Temperature unit selection	°C/ F
Pressure unit selection	kg/cm²
Flow rate unit selection	m³/h
Screen brightness adjustment	Sec
Time setting	Year
	Month Day

4. Control information

Control calculation cycle	Sec
Control temperature no-detection section	°C
Motor rated current	A
Motor rated voltage	V
Model selection	R134a, R22, R134a-D, R22-D
Cooling tower fan control calculation	Sec
Flexible starting output cycle	Sec
Flexible starting valve output	Sec
Control valve selection	4 steps / stepless
Communication mode selection	Modubus/X21
Motor rated current 2	A
Economic valve opening temperature	°C
Head valve opening temperature	°C
Head valve closing temperature	°C
Step temperature	°C
Startup method selection	Inside/Outside

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Operation Inspection Records

[R-134a / R-22]

Model: _____

Manufacturing No.: _____

5. Abnormal condition setting

Bottom limit for the cold water temperature	℃
High compressor discharge temperature	℃
Low evaporator refrigerant temperature	℃
Low evaporator pressure	kg/cm²
High condenser pressure	kg/cm²
Low refrigerant differential pressure	kg/cm²

6. Safety control setting

Prevention of high temperature of compressor discharge	%
Prevention of low temperature of evaporator refrigerant	%
Prevention of low pressure of evaporator	%
Prevention of high pressure of condenser	%

7. Timer settings

Cold water pump stop delay timer	Sec
Cooling water pump start timer	Sec
Cooling water pump stop timer	Sec
Flow tremor ignore timer	Sec
Pressure control timer 1	Sec
Pressure control timer 2	Sec
Pressure control timer 3	Sec
Pressure control timer 4	Sec
50% operation open delay timer	Sec
75% operation open delay timer	Sec
Oil pressure check timer	Sec
Valve closing timer when started	Sec
Valve closing timer when stopped	Sec
Valve opening delay timer	Sec
Compressor startup check timer	Sec
Restart prevention timer	Sec
100% valve opening delay timer	Sec
2M start delay timer	Sec
Compressor stop delay timer	Sec

Note

Note

Note

Note

Note