LG
Life's Good

ENGLISH

Operation manual

Absorption Chiller

Before installation, be sure to read the safety precautions and use correctly.
It is the content to keep the safety of the user and prevent damage to the property.
After reading the operation manual, keep it where user can see any time.
Only permitted persons can use.

Model name : WCMW**(W-Type, 30~1,020RT)**

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Thank you for using our Absorption chiller product.
You can use it more conveniently and safely if you install following the directions after reading the operation manual.

Be sure to read this operation manual before using in order to install the chiller safely and correctly.
After installation work, be sure to perform commissioning and checking following the operation manual.

❉ This manual consists of product introduction, control, commissioning, maintenance and troubleshooting of the chiller.

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SAFETY CAUTIONS _ caution/warning

Installation of the product, movement or delivery of a heavy object or installation environment can be dangerous due to its pressure, electric devices, installation location(rooftop, lifted structure), etc. Please read carefully the warnings and cautions on this manual and the labels attached on the unit, and follow the instructions.

Please follow the following instructions to prevent any injury to other people or property damage

- Inaccurate operation by ignoring the instructions in this manual may result in an injury or damage. The seriousness of the result can be classified as the following signs.
- Please note that any failure of system caused by user's careless maintenance, natural disaster or the failure of the power cable shall not be warranted regardless of the warranty period.
- Please note that any part of this manual can be revised without notice for the product improvement.

⚠ WARNING

This symbol shows that there is possibility of serious injury or death when the instruction is ignored.

⚠ CAUTION

This symbol shows that there is possibility of minor injury or product damage when the instruction is ignored.

This is the symbol to call attention to the items or operations which may cause danger.

This is the symbol to call attention to the items or operations which may cause danger.
To prevent the occurrence of danger, read carefully and follow instructions.

This is the symbol showing the how-to-use instruction in order to prevent danger.

1-1. WARNING

- Have all electric work done by a licensed electrician according to "Electric Facility Engineering Standard" and "Interior Wire Regulations" and follow the instructions given in this manual and always use a specified circuit.
  - If the power source capacity is inadequate or electric work is performed improperly, electric shock or fire may result.
- The unit should be installed only by an authorized dealer who acquired installation license.
  - Improper installation may result in water leakage, electric shock, or fire.
- For movement or re-installation of the installed product, always contact a dealer or an Authorized Service Center.
  - It may cause fire, electric shock, explosion, or injury.
- Make sure to equip the circuit breaker and authorized fuse.
  - If they are not installed, there is a risk of fire or electric shock.
- Do not disassemble, repair or reconfigure the unit arbitrarily.
  - LG Electronics is not responsible for the any damage or loss from the arbitrary disassembly, repair or reconfiguration of the unit.
- Make sure to ground the unit properly.
  - If not, there is risk of fire or electric shock.
- Do not store or use flammable gas or combustibles near the unit.
  - It may cause fire or failure of product.
- Do not reconstruct or 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.

- Install the unit on a foundation where the heavy weight can be supported.
  - Insufficient strength of the foundation to support the chiller operation may cause the unit failure 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.
- Do not operate the unit arbitrarily.
  - Incorrect operation of the unit may cause dangerous situations such as unit defects, leakage or electric shock. Always consult an authorized dealer.
- Do not use damaged circuit breaker or fuse works all the time.
  - It may cause fire, electric shock or injury.
- Keep the control panel from any water getting in. Do not wash the control panel with water.
  - It can cause electric shock or defects.
- When the product is soaked (flooded or submerged), contact an authorized service center.
  - It may cause fire or electric shock.
- Use a dedicated outlet for this unit.
  - It may cause fire or electric shock.
- Be careful not to leak the exclusive absorption liquid(LiBr) when installing or moving to another location.
  - The absorption liquid causes dehydration when contacted with skin or clothes.
- Do not touch the power switch with wet hands.
  - It may cause fire, electric shock.
- Ventilate before operating the unit when explosive gas has leaked out.
  - Do not use a phone or operate the power switch at this time. It may cause fire or explosion.
- Do not put any heavy object on the top of the unit or climb on the unit.
  - It may cause defects or injury.
- Do not change the set values.
  - Do not change the set values of the controller and safety devices. Operating with inappropriate setting can cause damages. When changing the setting values, please consult a specialist.
- Redesigning the control panel is prohibited.
- Lock the control panel with locking device if possible and if you need to open the control panel inevitably, turn off the main power first.
  - Do not touch the wiring or parts inside the panel.
  - It may cause electric shock, fire or failure.
- Keep the permitted pressure level
  - Keep the regulated pressure for cold water, cooling water, refrigerant etc.
- Use fuse and leakage breaker of rated capacity.
  - If not, it may cause fire and defects.
- Be careful of fire, earthquake and lightening.
  - In case of any natural disaster such as fire, earthquake or lightening, immediately stop operating the unit.
  - If you continue to operate the unit, it can cause a fire or electronic shock.
- Follow all safety codes.
  - When operating the chiller, follow the precautions on the manual, tag, sticker and label.
- Use of undesignated refrigerant and oil is prohibited.
  - Do not use undesignated refrigerant, freezer oil and brine.
  - To use an alternative refrigerant, contact the manufacturer.
- During installation and service, shut down the power supply.
  - It not, electric shock can cause injury and death.
  - Mark and check all switches so that the power is not recovered until the work is completed.
- Wear safety devices.
  - Wear safety glasses and work gloves.
  - Be careful when installing or operating the chiller and operating electrical components.
- Always run fluid through heat exchangers when charging or removing refrigerant.
  - Potential damage to the tube within the heat exchanger can be prevented.

- Use appropriate brine solution or chilled water in water circulation loop to prevent the freezing of heat exchangers when equipment is exposed to temperature below 0°C.

• Be careful of water leakage.
- In case of any water leakage in the connection parts of the pump or pipe, immediately stop operating the unit.
- It may cause electric shock, electricity leakage or defects.

• Be careful of electric shock.
- Always ground the chiller during installation.
- It may cause electric shock.

• Do not leave refrigerant system open to air any longer than necessary.
- If the repair work cannot be completed, seal the loop cycle to prevent any contamination or rust within the unit, and charge dry nitrogen.

1-2. CAUTION

• Always check for gas leakage after installation or repair of product.
- It may cause product failure.

• Do not install the unit where combustible gas may leak.
- It may cause damage to the property.

• Keep level even when installing product.
- Unleveled refrigerant can cause problems to the product.

• Do not use the product for special usage or location such as preserving animal/plant, precision machinery, artifact, etc.
- It may cause property damage.

• Use exclusive wire for the product. Use power cables of sufficient current carrying capacity and rating.
- It may cause fire or electric shock.

• 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 unit to operate erroneously, or fail to operate.
- On the other hand, the unit may affect such equipment by creating noise that disturbs medical treatment or image broadcasting.

• To protect the product from corrosion, do not install the product where it is exposed to sea wind(salt) directly. If necessary, please install shield.
- It may cause product deformation or defects.

• Make the connections securely so that tension may not be applied to the cable.
- If tension is applied, the cable may break or heat may be generated causing fire.
- If the power cable is damaged, do not replace it directly, but call the service center for replacement.

• Do not use the product in special environments.
- Oil, steam and sulfuric fume can deteriorate the product performance or cause damage to the parts.

• Be careful when transporting the product.
- When carrying the chiller, always consult a specialized expert.

• When transporting the chiller, always follow the methods described in the manual. If not, it can be overturned or fallen off.

• Be sure the installation area does not deteriorate with age.
- If the base collapses, the chiller could fall off , causing property damage, product failure, or personal injury.

• Be sure to dispose the packing materials safely.
- Packing materials, such as nails and other metal or wooden parts, may cause stabs or other injuries.
- Tear apart and throw away plastic or vinyl packing 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 touch any of the refrigerant piping during or after operation.
- Pipe during or after the operation can be hot or cold depending on the condition of the refrigerant flowing through the refrigerant pipe, compressor and refrigerant cycle parts. Touching the pipes at this time can cause a burn or a frostbite.

- Turn on the main power 12 hours before operating the product.
  - If you operate the product immediately after turning on the main power, it can severely damage the internal parts. Keep the main power on while operating.
- Do not immediately turn off the main power after the product stops running.
  - Wait at least 5 minutes before turning off the main power. If not, it may cause water leakage or other problems.
- Do not operate the product with the panel or safety devices removed.
  - Rotating parts or high temperature/pressure parts can cause safety accidents.
- Be careful when disposing the product.
  - When disposing the chiller, request to the specialized expert.
- Use a firm stool or ladder when cleaning or maintaining the chiller.
  - It may cause an injury.
- Be careful of high temperature.
  - Be careful not to make body contact to the parts of the chiller in high temperature. It may cause a burn.
- Be careful of high voltage.
  - Install separate wiring for the power and always install and use dedicated power supply and circuit breaker.
  - It can cause electric shock or fire.
- Be careful of chiller installation.
  - Keep enough clearance around the product for service and especially for air cooling type, install the product in a well ventilated location where there is no obstacle.
- Do not use harsh chemical, household bleach or acid cleaner to clean the chiller.
  - These cleaners can be very difficult to rinse off and can accelerate corrosion at the contact surface when dissimilar materials are in contact.
  - Use eco-friendly cleaner.
- Be careful when restarting the product.
  - When a safety device is triggered, remove the cause and then restart the product.
  - Repeating the operation arbitrarily can cause fire or defect.
- Use appropriate tools.
  - Use tools appropriate for the repair work and calibrate the measuring devices accurately before using.
  - Using inappropriate tools can cause accident.
- Be careful of sound and odor.
  - If you hear a weird sound or smell an odor, immediately stop operating the system and contact the service center.
  - It may cause fire, explosion or injury.
- Be careful of injury.
  - Check the safety label of the safety device.
  - Follow the above precautions and the contents in the label. If not, it may cause fire and injury.
- To prevent the formation of the condensed water, the pipe connected to the evaporator as well as the evaporator itself should be well insulated.
- Check.
  - Perform periodic checks. If any problem occurs, stop operation and contact the service center.
  - Insufficient check may cause fire, explosion or error.
- Do not atte`mpt to eliminate or alter any of the factory wiring.
  - If compressor is operated in the opposite direction, the compressor may break and should be replaced.
- Do not use jumpers or other tools to short out components, or bypass the parts differently from recommended procedure.
  - Short-circuiting the control board ground line with other wires can damage the electric module or electric components.
- Water should be within design flow limits, and should be treated cleanly.
  - This ensures proper machine performance and reduce the potential of tubing damage due to corrosion, scaling, algae, etc.
  - LG Electronics is not responsible for any damage caused by chilled water not treated or improperly treated.
- Consult a water treatment specialist for proper treatment procedures.
  - Chemical treatment may be required to prevent or remove scale or corrosion.

- Turn the controller power off before service work.
  - It secures safety and prevents damage to the controller.
- Welding the evaporator head or nozzle part is not recommended.
  - If the part requires welding, remove the chilled water flow switch and entering/leaving fluid thermometers before welding.
  - After the welding is completed, reinstall the flow switch and thermometers
  - Failure to remove these devices may cause component damage.
- For some time after the installation and commissioning, be sure to do a periodic bleeding for 1~2 months.
  - Bleeding is an important process affecting the function of the chiller-heater and the life expectancy of the machine.
  - In air-conditioning mode, conduct at least once per week for the main body and 2~3 times per week for the lower chamber.
  - When heating, conduct 2~3 times per month only for the main body.
- When conducting bleeding, be careful of the processing order.
  - Pressure and temperature may rise due to the effect of air inflow.
- Water leakage may occur due to the effect of vibration during transportation since it is a heavy object.
  - Check the bolt tightening condition before supplying water.
- When supplying water, open the valves in the water system slowly.
  - It can extend the life expectancy of the machine.
- During commissioning, the circulating amount may run short due to improper absorbent control, improper cycle control or excessive differential pressure in the panel type heat exchanger.
  - Crystals may be generated if the circulating amount of the absorbent runs short.
  - It may cause insufficient performance or noise.
- To prevent freeze-ruptures, be sure to connect the interlock wiring so that the chilled water/cooling water pumps can be interlocked when the machine operates/stops.
  - Otherwise, it can cause damage to the machine.
- Do not apply shock to sensors, gauges or switches.
  - It can cause malfunctioning of the electric devices and damage to the machine.
- Be sure to check the circuit diagram in the interlock wiring and electric wiring.
  - Otherwise, it may cause damage to the machine or abnormal operation of the accessory equipment.
- Do not randomly adjust the set values of safety devices, dampers, valves, etc.
  - It can cause malfunctioning of the electric devices and damage to the machine.
- Do not operate with wet hands.
  - It may cause electric shock.
- Do not climb on top of the machine. It may cause injury due to slips and falls. Also do not step on weak parts such as the copper tubes.
  - It may cause falling and damage to the machine.
- Tighten bolts and screws with specified torques.
  - It may cause leakage.

Warning

- Do not operate, inspect and repair except an expert.
  - Failure to do so may result in malfunction or electric shock.
- The protective grounding conductor must be the first one to be connected when installation, and the last one to be disconnected when remove the system.
  - The protective grounding conductor must be the first one to be connected when installation, and the last one to be disconnected when remove the system.
- Use a proper measuring instrument.
  - Failure to do so can cause injury or electric shock.
- Do not operate with wet hands.
  - Failure to do so may result in electric shock.
- Make sure all the power connected to control panel and starter panel of our company is off during the maintenance and repair.
  - Failure to do so may result in electric shock.
- Do not open the doors or protective covers of the control panel or starter panel while the power is being supplied.
  - Failure to do so can cause electric shock.
- Use always after discharging current when maintenance.
  - Failure to do so may result in injury or electric shock
- Do not open the secondary of current transformer while the power is being supplied.
  - Failure to do so can cause electric shock to by high voltage.
- Remove foreign substances (tools, wires, bolts or washers) after an installation, inspection and repair.
  - Failure to do so can cause fire or damage.
- If a condenser is used, make sure to verify complete discharge before supplying the power again. (Re-powering within 5 min. is prohibited.)
  - Failure to do so can cause electric shock, fire, damage or malfunction.
- Change the condenser in case that the expansion exceeds the recommended limit.
  - Failure to do so can cause electric shock, fire, damage or malfunction.

Caution

- Do not open the breaker during the operation at user's disposal.
  - Failure to do so can cause damage or malfunction.
- Tighten up bolts and screws according to the specified torque.
  - Failure to do so can cause fire, damage or malfunction.
- Do not change electric and control devices at user's disposal.
  - Failure to do so can cause fire, damage or malfunction.
- Only the persons who have sufficiently studied the user manual can operate the control panel and starter panel.
  - Failure to do so can cause fire, malfunction or damage.
- Do not weld near the electrical cables of the main unit.
  - Failure to do so can cause fire or damage.
- Connect only the input/output signal cables specified in the drawing to the control panel and starter.
  - Failure to do so can cause malfunction or damage.
- Use the rated electrical cables.
  - Failure to do so can cause fire or damage.
- Use the specified components when repairing.
  - Failure to do so can cause fire or damage.
- Install the machine, the control panel and starter panel in a noncombustible environment.
  - Failure to do so can cause fire.
- Do not apply voltages higher than the values specified in this manual or in the related documents.
  - Failure to do so can cause damage or malfunction.
- Connect the signal cables connected to the control devices according to the circuit diagram.
  - Failure to do so can cause damage or malfunction.
- Do not store the product in a place with risk of flooding or with a lot of moisture.
  - Failure to do so can cause damage or malfunction.
- Do not use the indoor use control panel and starter panel outdoors.
  - Failure to do so can cause damage or malfunction.

1. INTRODUCTION

1-1. Absorption principle

Keeping vacuum is essential for an absorption chiller in cooling operation since it works in a high vacuum state.

1-1-1. Principle of chilled water generation

An absorption chiller is a chilled water generating device that uses water (H_2O) as refrigerant and lithium bromide (LiBr) solution as absorbent.

For cooling, the latent heat of vaporization is generally used. When rubbing alcohol on the skin for injection, it is getting cooler. Because alcohol takes heat off the skin when evaporated.

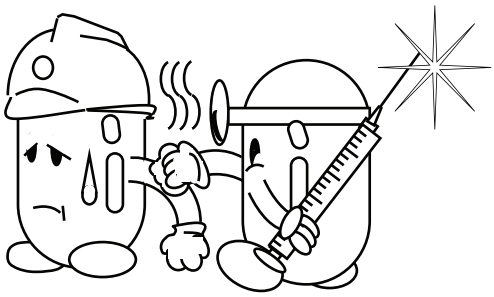
100kcal is needed to heat water 1kg (1ℓ) from

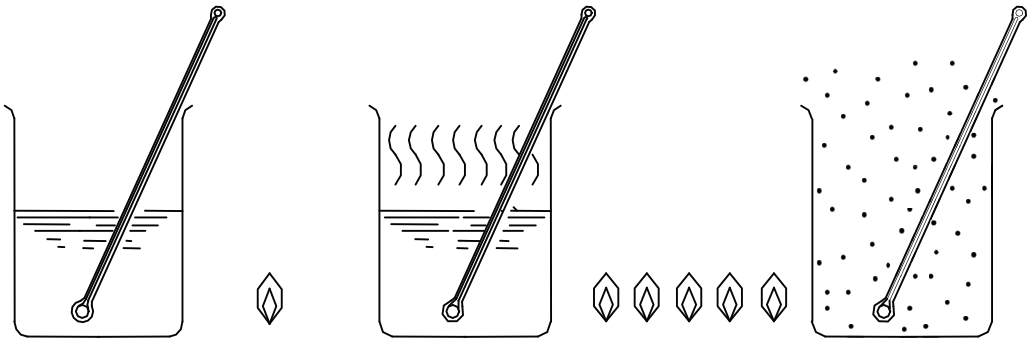
0°C to 100°C and this is referred to as sensible heat.

On the other hand, 540kcal is needed to evaporate

1kg (1ℓ) water at 100°C and this is referred to

as latent heat of vaporization.

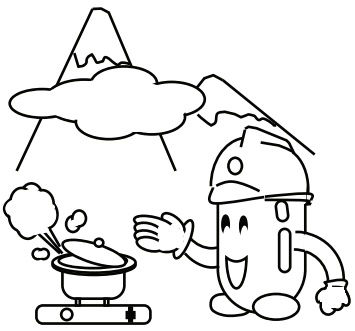




100kcal 540kcal

As shown above, using heat of vaporization rather than sensible heat, generated from 1kg (1ℓ) water, can transfer much more heat capacity. And water is normally evaporated at 100°C. But it can be evaporated at a lower temperature when air pressure is lowered. It is the reason why rice is half-cooked on a high mountain.

For example, water is evaporated at around 89°C on top of Mt. Baekdu. However the lower the air pressure, the higher the mountain. Under pressure of about 1/100 air pressure (absolute pressure 6mmHg-air pressure is absolute pressure 760mmHg), water is evaporated at about 4°C.



In this case, heat of vaporization is 599kcal per 1kg of water.

Using this water as refrigerant produces chilled water at 7°C. Putting refrigerant (water) inside a sealed container and adjusting inside pressure to 6mmHg (that is, only vapor pressure works), refrigerant is evaporated at 4°C and chilled water is produced by passing water through air. (this container is called evaporator)

However, as the inside pressure rises up due to the refrigerant vapor, accordingly refrigerant can't be evaporated at 4°C and the water temperature gradually rise. Thus, to produce chilled water of 7°C, refrigerant should be always evaporated at 4°C.

For this, pressure inside a container has to be maintained at 6mmHg and evaporated refrigerant should be taken out of a container. For repeating this procedure, if a container with a powerful absorptive material inside is connected, it absorbs refrigerant vapor and finally pressure inside a container can be maintained at 6mmHg.

As absorbent, 'Lithium Bromide' (LiBr) solution is used. (this container is called "absorber") LiBr solution is a very powerful absorbent, however, absorptive capacity increases under a higher concentration or a lower temperature. Absorption capacity can be represented by saturation vapor pressure, and the relationship between saturation vapor pressure, concentration and temperature can be represented in duhring diagram as shown in figure 1-3.

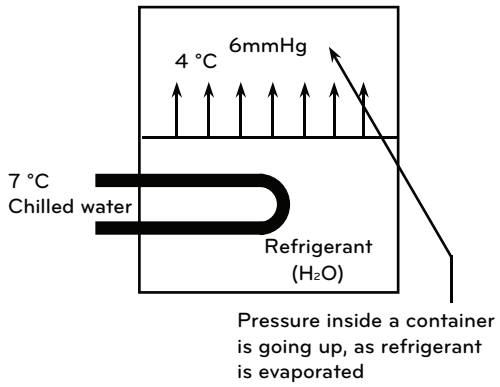


Figure 1-1. Cooling principle (evaporator)

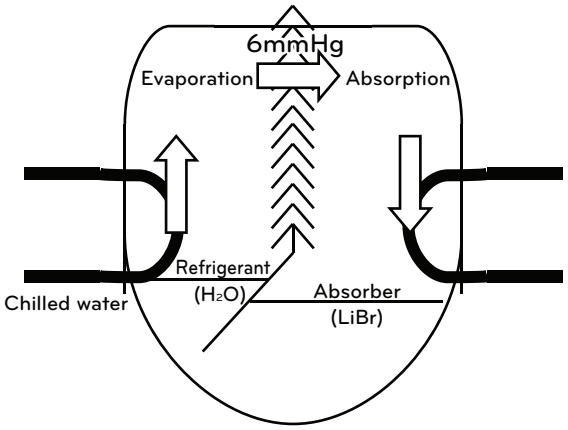


Figure 1-2. Evaporator and Absorber

1. Saturation vapor pressure is a value representing evaporation level, which is distinctive depending on the material state. Neither evaporation nor condensation occurs when the vapor pressure is lower than the saturation vapor pressure around it. (in this case, relative humidity of air is 100%) On the contrary, water is condensed when the vapor pressure is higher than the saturation vapor pressure around it. (dew on a window, for example) In general, the easier the evaporation, the higher the saturation vapor pressure(alcohol) to the contrary, the more difficult evaporation or the easier condensation is, the lower saturation vapor pressure is.

Duhring diagram

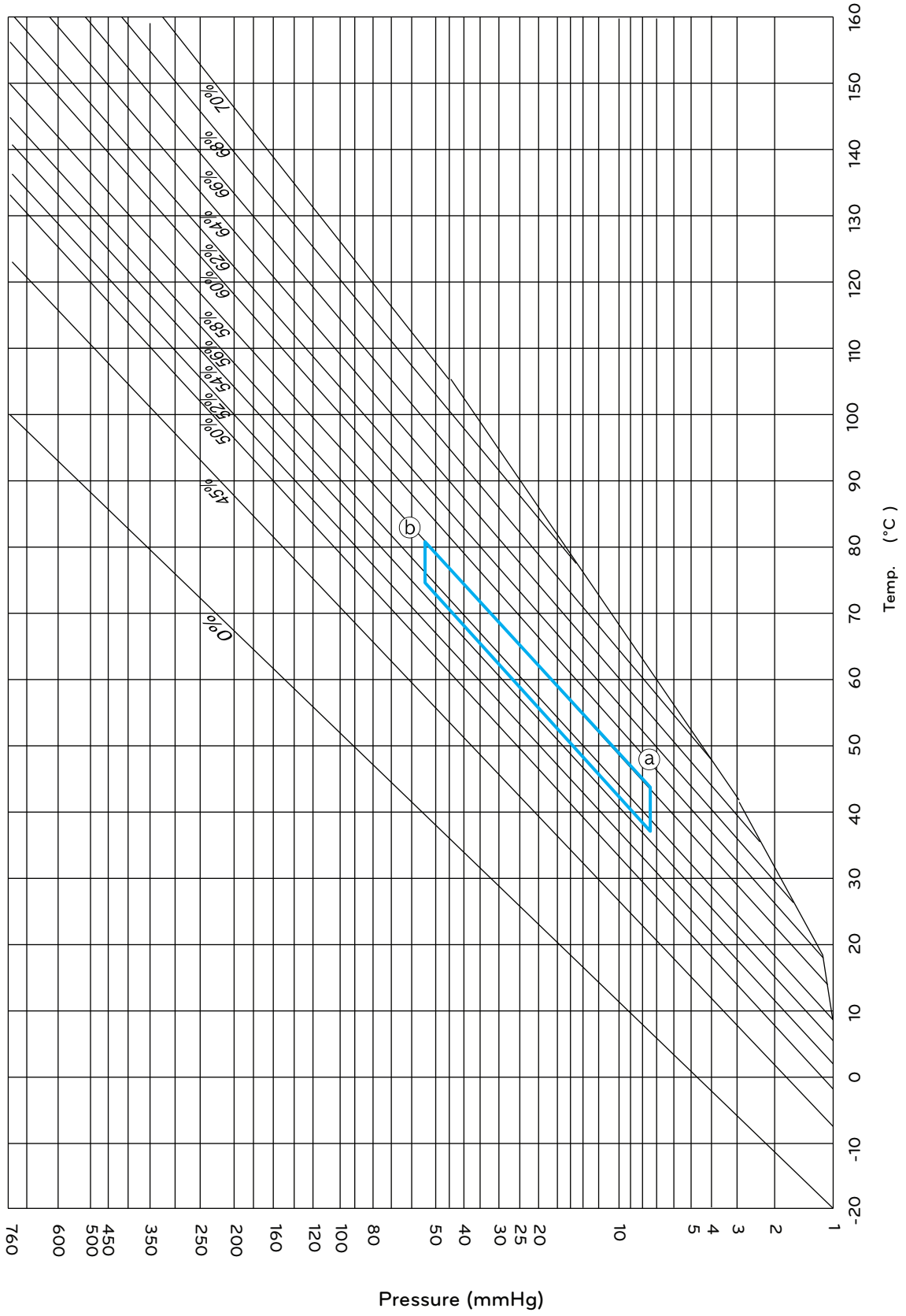


Figure 1-3. Duhring diagram

In the diagram, temperature is represented on horizontal axis, pressure is represented on vertical axis and the first line from the left represents concentration 0% of LiBr, that is water state. Saturation pressure of water at 4℃ is 6mmHg as shown in During graph. That is to say, water at 4℃ is evaporated under pressure of 6mmHg.

For absorbing vapor of this 6mmHg pressure, saturation vapor pressure in absorption solution is maintained lower than that. For example, temperature should be maintained less than 18℃ for aqueous solution of 45% concentration and absorbent liquid of more than about 50% concentration is needed to maintain the temperature at 24℃.

When evaporated refrigerant is absorbed at 4℃, absorbent liquid gives off heat, thus temperature of absorbent liquid rises and absorptive capacity is weakened. Therefore to prevent this, absorbent liquid is cooled with cooling water. This absorbing heat is almost the same as heat of vaporization.

That is, heat of cooling water is delivered to refrigerant vapor in evaporator, refrigerant vapor to absorbent liquid in absorber and absorbent liquid to cooling water.

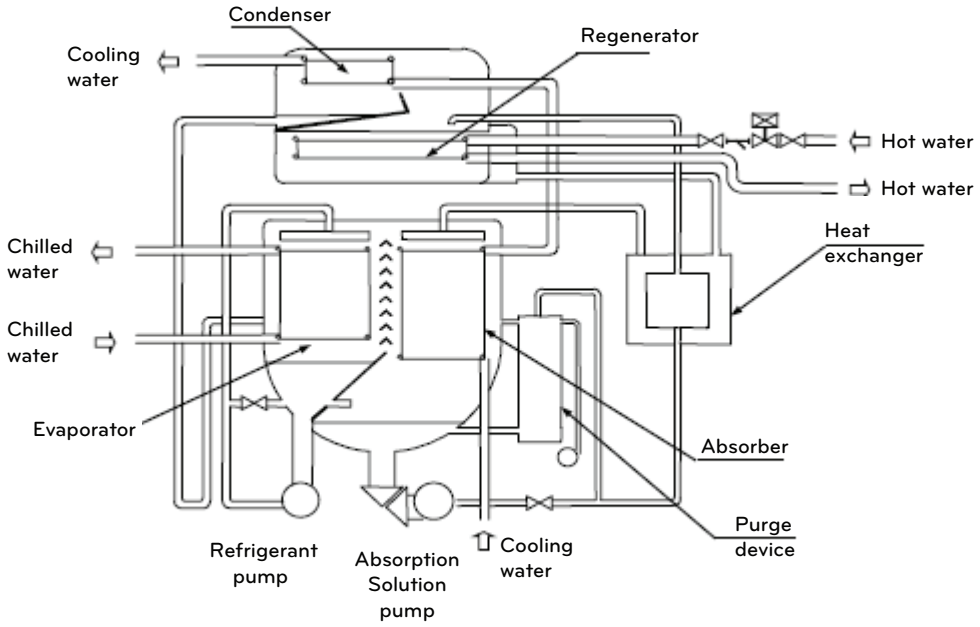


Figure 1-4. Basic cycle of absorption chiller

As absorption solution absorbs refrigerant, its concentration is lowered and thus absorptive power is weakened. To recover weakened liquid, absorption solution is transferred to somewhere else and heated to evaporate refrigerant. (It is referred to as "regenerator") When the absorption solution is returned to the absorber as a condensed state by the evaporation of the refrigerant, the circulation 'Cycle' is completed continuing the cooling effect.

On the other hand, refrigerant vapor generated in regenerator is transferred to another container, then cooled and condensed by cooling water, producing refrigerant liquid as a result, (It is referred to as "condenser") and finally sent to evaporator completing circulation 'cycle' of refrigerant.

It is also efficient to install a heat exchanger that exchanges heat between condensed absorption solution heated in a regenerator and low-condensed absorption solution cooled in absorber.

It is the principle of the chilled water production by an absorption chiller. (basic cycle of absorption figure 1-4)

Refer to 1-3 Components of a chiller for the function of components. Figure 1-3(Duhring diagram) shows absorption solution change of our absorption chiller.

ⓐ is the area in which refrigerant vapor is absorbed in an absorber, resulting in a low concentration. Cooling effect is gained by keeping the pressure of evaporator low.

ⓑ is the area in which regenerator evaporates refrigerant, then condensing absorption solution. Thus external heating source is needed.

ⓒ is the area in which absorption solution is concentrated using refrigerant vapor as the heating source, generated in regenerator.

Thus no external heating source is needed.

Since even regenerator, which has the highest internal pressure, works in less than the air pressure of 760mmHg, absorption chiller is safe and requires no qualified person. But it consists of a high-end vacuum container and furthermore 1/100 of air pressure should be maintained in an evaporator and an absorber.

In addition, the pressure has to be maintained solely with vapor pressure. If even the smallest quantity of air gets in, then internal pressure rises, resulting in disrupting the cooling effect. And 'Lithium Bromide' solution becomes corrosive when it is mixed with Oxygen, therefore air infiltration has a bad influence on the life of the machine.

So 'purging', explained later, is very important when handling absorption chiller.

1-1-2. Nature of absorption solution

Absorption chiller uses a solution of 'Lithium bromide' (LiBr) as absorption solution. 'Lithium bromide' (LiBr) is a chemical compound of 'alkali' metal Lithium(Li) and 'hahistoryen' Brome (Br), similar to salt(NaCl), its absorptive power is strong, and it, as very stable material chemically, doesn't change in the air, such as resolution, volatility. When mixed with Oxygen, it gets corrosiveness on metal but this is not as much as salt.

1) Absorption

   Its absorptive power is very strong as described in chilled water generating principle. And its saturated vapor pressure is reasonably low, thus proper for absorption chiller that uses water as refrigerant.

2) Specific heat

   Specific heat of 'Lithium Bromide' (LiBr) of about 60% concentration is about half of water.

   It means a smaller heat capacity is needed to raise the temperature of 'Lithium Bromide' liquid. It is essential for the efficiency of chiller.

3) Specific weight

   Specific weight of a solution of 'Lithium Bromide' (about 60% concentration) is much greater than that of water(1.0). (about 1.7 times) specific weight is determined by liquid concentration and its concentration can be found from the figure 1-7 duhring diagram, by measuring temperature and specific weight of absorption solution.

4) Corrosiveness

   When 'Lithium Bromide' is mixed with Oxygen, it has corrosiveness. But there is almost no room for Oxygen, for absorption chiller is a vacuum container. Because corrosiveness inhibitor is added in absorption solution and alkali level is adjusted for safety, handling absorption solution requires high attention and regular chemical analysis should be conducted to maintain the amount of addition.

5) Nature of absorption solution depending on temperature and concentration

   Absorption solution has an inverse relationship between temperature and concentration. The lower temperature is, the more powerful absorption force is, and the higher temperature is, the less powerful absorption force is. On the contrary to the temperature, the higher concentration is, the more powerful absorption force is and the lower concentration is, the less powerful absorption force is. And both states have an influence on crystallization.

   Crystallization is a phenomenon in which absorption solution becomes something like jelly or salt. The higher concentration is, the easier crystallization is and the lower concentration is, the more difficult crystallization is. On the other hand the lower temperature is, the easier crystallization is and the higher temperature, the less easier crystallization. It is very important part since this nature has a close relation to the efficiency and performance of absorption chiller and also to crystallization.

   Therefore absorption solution works the best under proper concentration and temperature. That is, heat capacity of fuel, which has a direct influence on temperature and concentration of absorption solution, flux or temperature of cooling water should be maintained in a proper state.

   Emergency stop is needed in Dilution operation or abnormal working due to this nature. And crystal resolution is performed based on this nature. Crystal resolution will be explained in a proper section.

1-1-3. Measuring absorption solution concentration

1) Measuring instruments
   1. Extracting cylinder
   2. A hydrometer(ranging 1.0 ~ 1.8)
   3. A thermometer(100 ~ 150°C)
   4. concentration curve of a solution of Lithium bromide (refer to the figure1-7)
   5. Absorption solution and refrigerant to be measured

2) Procedure
   1. Assemble extracting cylinder, pressure hose and service valve.
   2. Connect pressure hose to service valve (lower part of manometer service valve) of extracting device and operate pump so as to make a vacuum state inside cylinder.
   3. Make the inside of cylinder into vacuum state by opening service valve.
   4. Maintain vacuum state by bending pressure hose when pulling the hose out of service valve.
   5. Connect the end of hose to service valve of solution to measure (diluent solution - discharge part of absorption solution pump, Intermediate solution - high temp. heat exchanger, a thick solution - low temp. heat exchanger).
   6. Open the service valve and extract solution into the cylinder.
   7. Extract about 80% of solution from the device into extracting cylinder. (Be very cautious so as to prevent air from getting in, when extracting solution, for its high vacuum state in the device.)
   8. Remove service valve on the upper part of cylinder after closing the service valve.
   9. Measure temperature and specific weight putting hydrometer and thermometer in the cylinder. (Be very cautious not to get burn when measuring a thick liquid and intermediate liquid, that are very hot during operation)
   10. Store the solution measured in an empty container.
   11. Search concentration line, referring to temperature and specific weight, in concentration curve of Lithium Bromide.
   12. Clean instruments in water after measuring.

3) Note

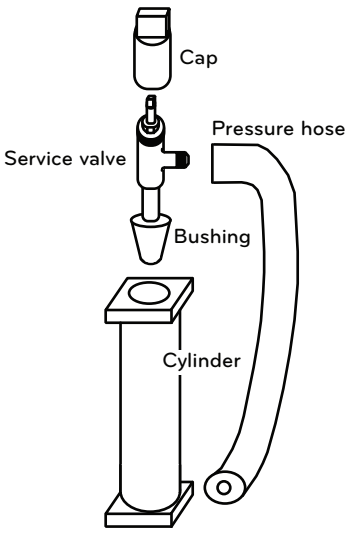
   Be very cautious not to break the fragile hydrometer and thermometer.

   Do not throw away the solution on the floor but store it in a clean container instead.

   Measure both specific weight and temperature at the same time to avoid an error.

   Be aware of the fact that even the smallest quantity of air causes corrosiveness.

   Perform purging immediately when air gets in.



1-1-3-1. Safety issues for absorption solution concentration

1. Emergency fundamentals
   ① Do not inhale dust or powder.
   ② Do not let it touch it with eye, skin or clothes.
   ③ Seal the storage container firmly.
   ④ Wash yourself thoroughly after handling.
   ⑤ Use it in a well-ventilated environment.

2. Emergency measures
   1) Skin contact
      ① Take off contaminated clothes and shoes immediately.
      ② Wash the contact part with soap or light detergent and a bulk of water until no chemical material remains.
   2) Eye contact
      ① Immediately wash eyes with a bulk of water or a solution of salt.
      ② Pull an upper and lower eyelid out and wash inside of the eyelid until no chemical material remains.(at least for 15~20 minute)
   3) Intake
      ① Lay the head lower than the body to avoid suffocation when a user vomits.
      ② Give proper treatment depending on the symptoms.
      ③ Give medical treatment if necessary.
   3. Handling and storing
      Observe the rule related to environment law when storing this material.
   4. Safety and reactivity
      It is stable under the room (normal) temperature and pressure.
   5. Disposal of waste
      Observe environmental regulations when disposing.
   6. Related laws
      ① Industrial Safety and Health Act: Not specified
      ② Harmful Chemical Material Handling Act : Not specified
      ③ The Fire Service Act: Not specified

Specific weight

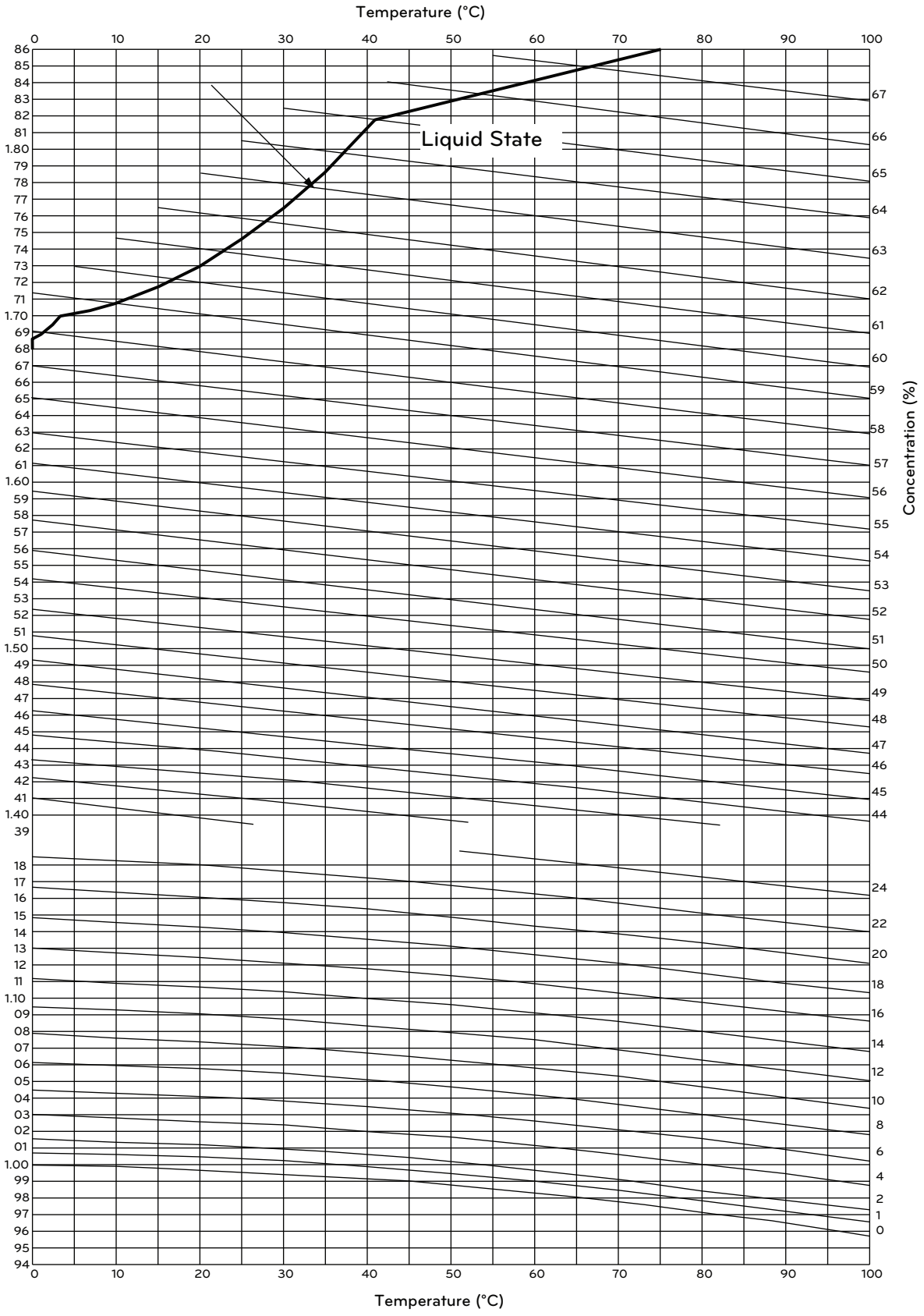


Figure 1-7. concentration curve of absorption solution

1-2. Exterior view and parts of hot water absorption chiller

1-2-1. Main body of absorption chiller

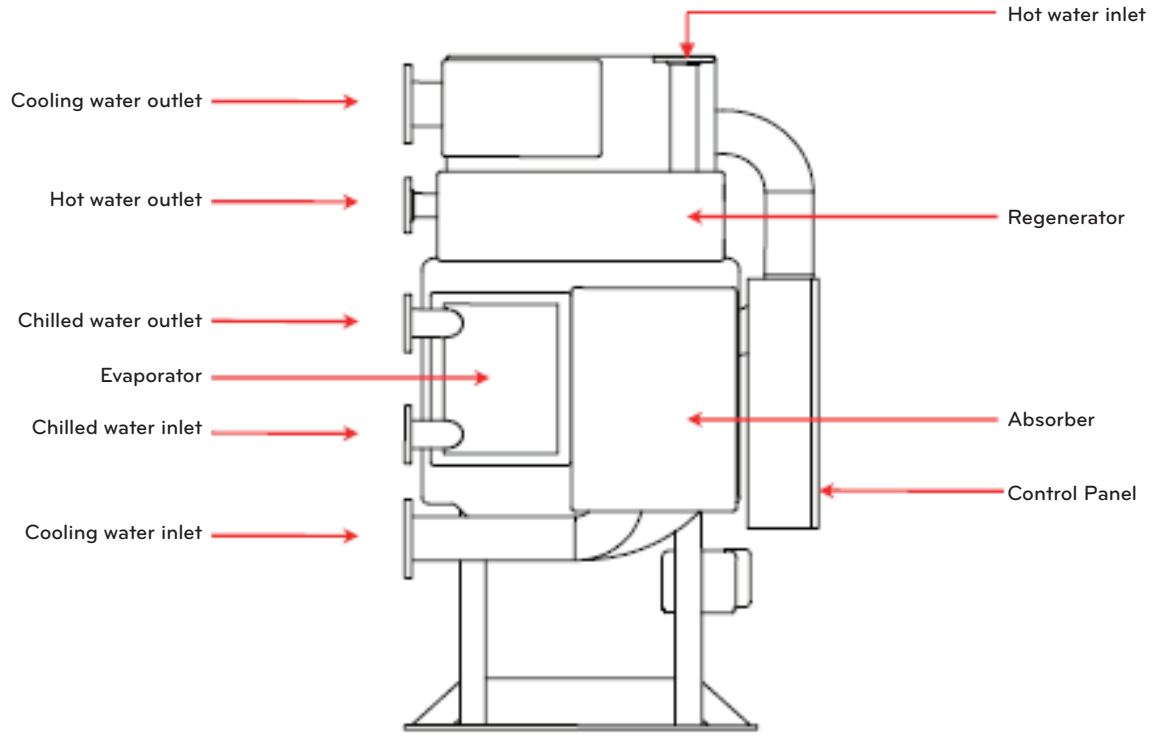


Figure 1-8 Front view of main body

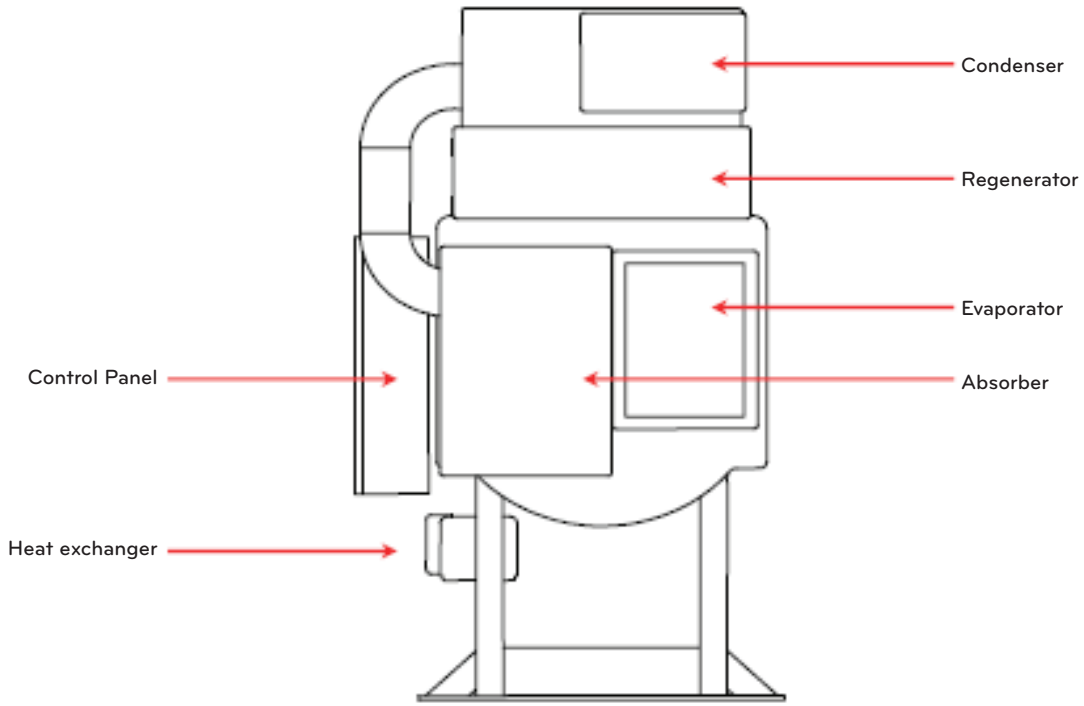


Figure 1-9 Rear view of main body

1-2-2. Main body (side view) of absorption chiller

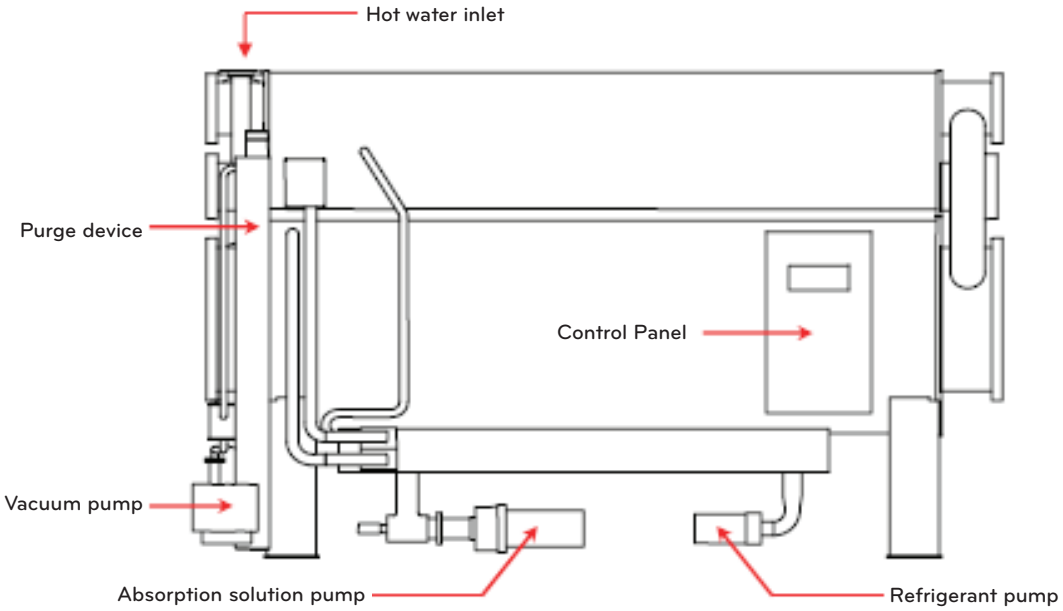


Figure 1-10 Side view of main body (high temp. regenerator side)

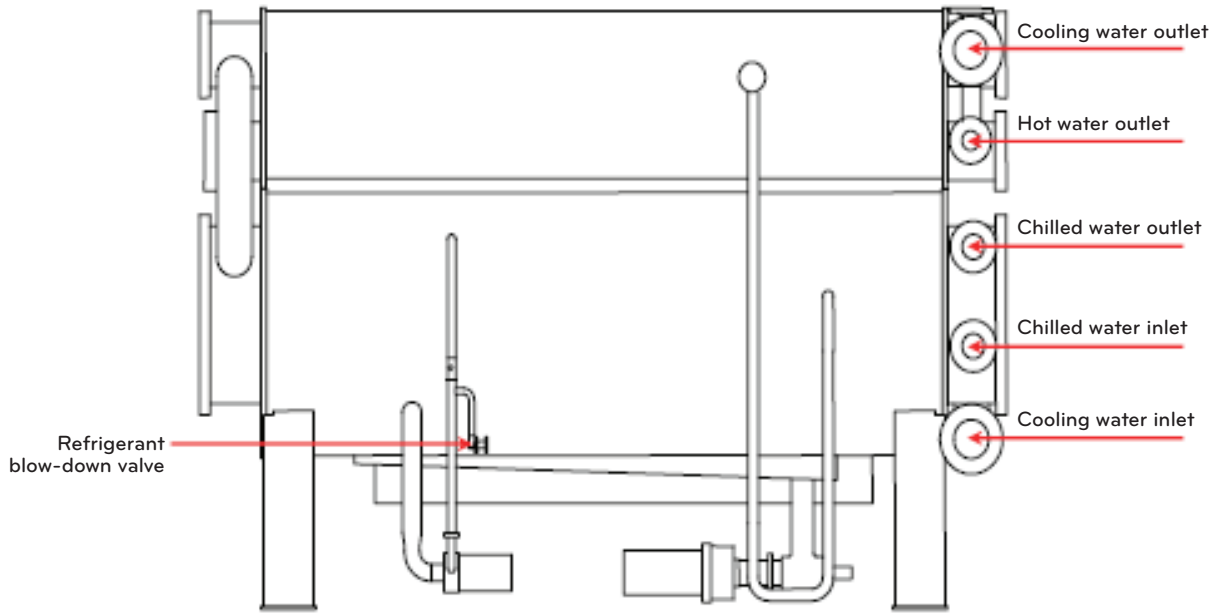


Figure 1-11 Side view of main body (Evaporator side)

❊ The arrangement and quantity of parts may vary depending on model or customer's demand.

1-3. Structure and principle of hot water type absorption chiller

An absorption chiller can be regarded as an aggregate of heat exchangers.

1-3-1. Evaporator

An evaporator consists of heat transfer tube (copper tube), refrigerant tray, refrigerant pump, chilled water chamber and the eliminator linked to the absorber.

An evaporator is a kind of heat exchanger in which refrigerant is evaporated at 4°C under internal pressure of 6mmHg and then exchanges heat with chilled water.

Refrigerant pump transfers refrigerant remaining at bottom of evaporator to the upper part and refrigerant tray spreads it evenly over the evaporator in bubble shape.

Scattered refrigerant in bubble shape has the maximum evaporation surface area, thus is prone to be evaporated. Refrigerant is evaporated at 4°C and at the same time takes away heat from chilled water in tubes. Chilled water, which is deprived of heat, becomes cooler. And evaporated refrigerant passes through the eliminator, then over to the absorber in which it is absorbed in absorption solution. An evaporator repeats this process.

1) Evaporated refrigerant takes heat out of chilled water and moves the latent heat of vaporization to an absorber.
2) Refrigerant pump lifts refrigerant left at the bottom in order that refrigerant can fall down from the upper part.
3) Refrigerant tray spreads refrigerant evenly and makes a bubble shape of large surface area in order that refrigerant is evaporated easily.
4) Eliminator prevents evaporated refrigerant from going over to the absorber and absorption solution from going over to evaporator. Refrigerant is absorbed very rapidly. It prevents refrigerant in liquid state from going directly to an absorber and instead allows refrigerant in vapor to go over to an absorber.

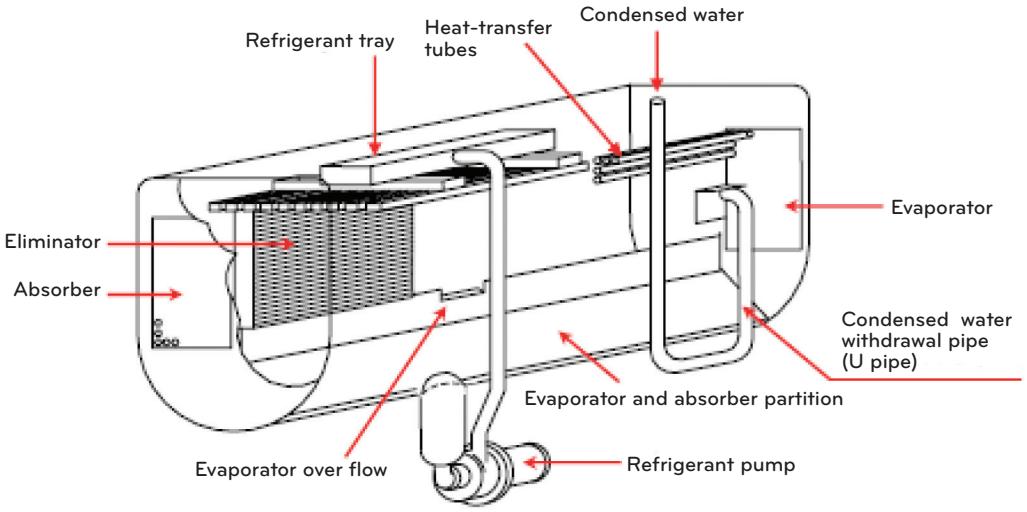


Figure 1-12. Evaporator

1-3-2. Absorber

An absorber consists of absorption solution pump, tray, cooling water tube and the eliminator linked to the evaporator. An absorber is a heat exchanger in which absorption solution and cooling water exchange heat with each other under the internal pressure of 6mmHg(a high-degree vacuum) as in the evaporator. An absorber drops evenly concentrated and low temperature absorption solution from low temp. heat exchanger to the absorption solution tray on the upper part of absorber. Scattered absorption solution absorbs refrigerant vapor passing from the evaporator to absorber.

Absorption solution, which absorbs refrigerant, is diluted, and then spreads at bottom, and absorption solution pump sends it to a regenerator via low temp. and high temp. heat exchanger.

1) Absorption solution absorbs latent heat of vaporization (which refrigerant takes from chilled water) and refrigerant vapor.
2) Absorption solution tray spreads concentrated absorption solution evenly, then makes it into a bubble shape with the maximum surface area for absorption.
3) Tube of cooling water discharges heat which is generated when absorption solution absorbs refrigerant (latent heat of vaporization which refrigerant takes out of chilled water) and heat generated from regenerator outside a chiller(cooling tower).
4) Absorption solution pump forces absorption solution to go up from the low pressure of absorber to the high pressure of a regenerator.
5) Overflow pipe sends absorption solution from low temp. regenerator to absorber during crystallization or oversupply of absorption solution to low temp. regenerator to prevent absorption solution from going from low temp. regenerator to condenser. Specially, this pipe becomes very hot during crystallization process. However, oversupply of absorption solution to low temp. regenerator also makes it very hot. Thus, both cases should be considered.

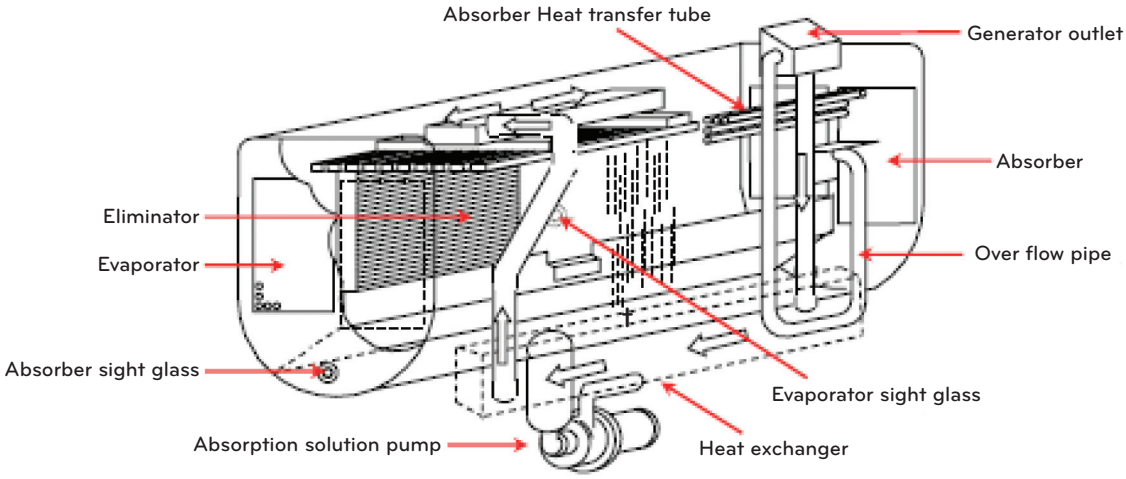


Figure 1-13. Absorber

1-3-4. Low temp. regenerator

Regenerator consists of tubes and eliminator connected to condenser.

The absorption solution from the absorber via the heat exchanger passes the outer surface of the heat transfer tubes and generates refrigerant vapor by exchanging heat with the hot water that is the cause of boiling, and the hot water passing inside the heat transfer tubes boils the dilute solution.

The absorption solution that has refrigerant vapor generated by hot water becomes condensed, and returned to absorber after heat exchangers.

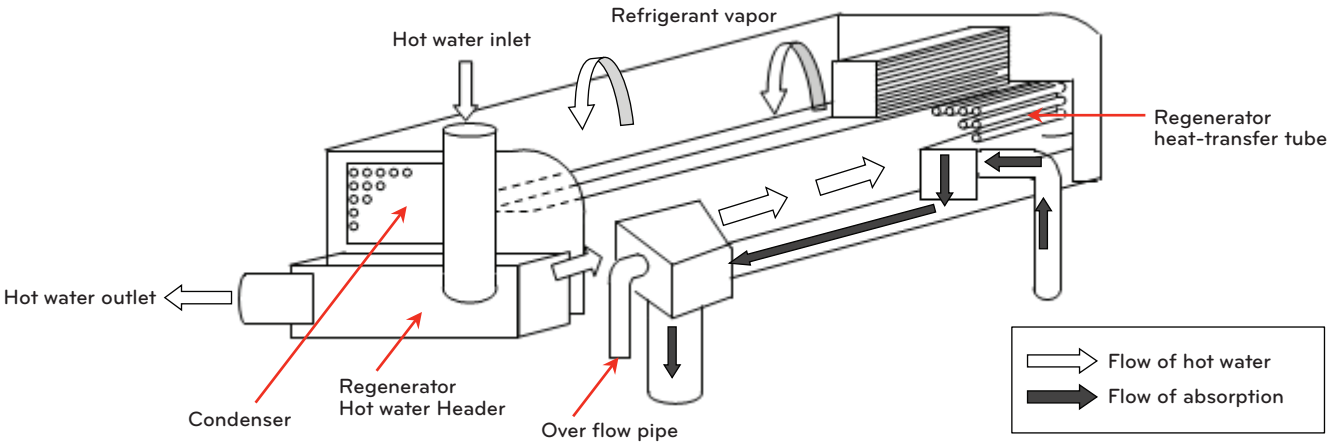


Figure 1-14. Regenerator

1-3-5. Condenser

A condenser consists of heat exchange tubes and eliminator connected to the regenerator. A condenser condenses refrigerant vapor coming from the regenerator using the cooling water in the heat exchange tubes. The condensed refrigerant vapor is returned to the evaporator.

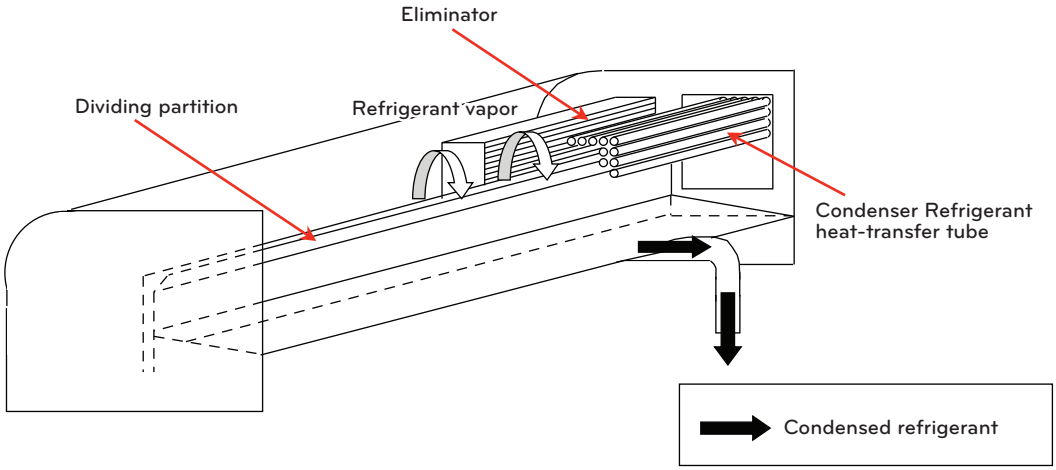


Figure1-15. Condenser

1-3-6. Heat exchanger

The diluted solution from the absorber is branched to the solution cooling absorber and heated by the concentrated solution as passing the heat exchanger. The diluted solution left the heat exchanger flows to regenerator.

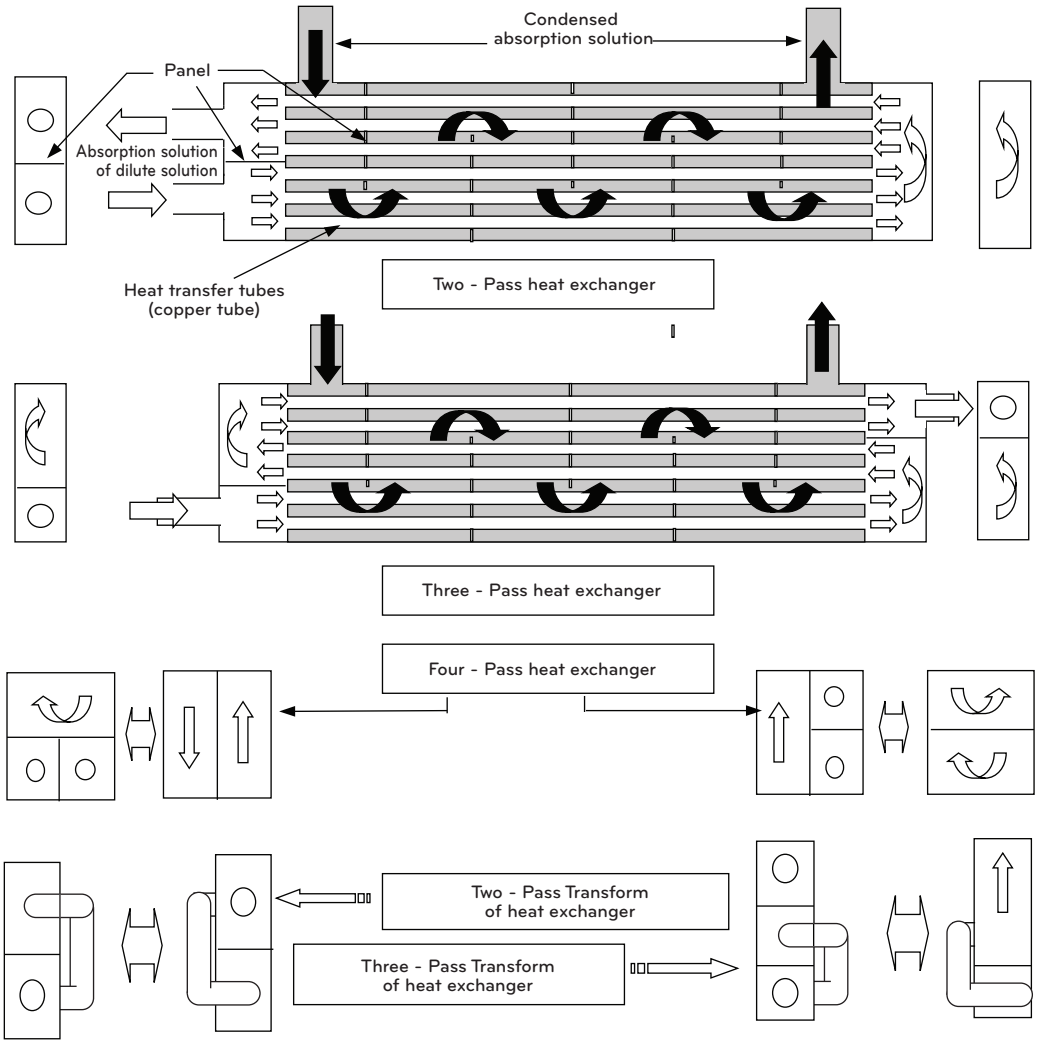


Figure1-16. Heat exchanger

1-4. Pipe layout of hot water type absorption chiller

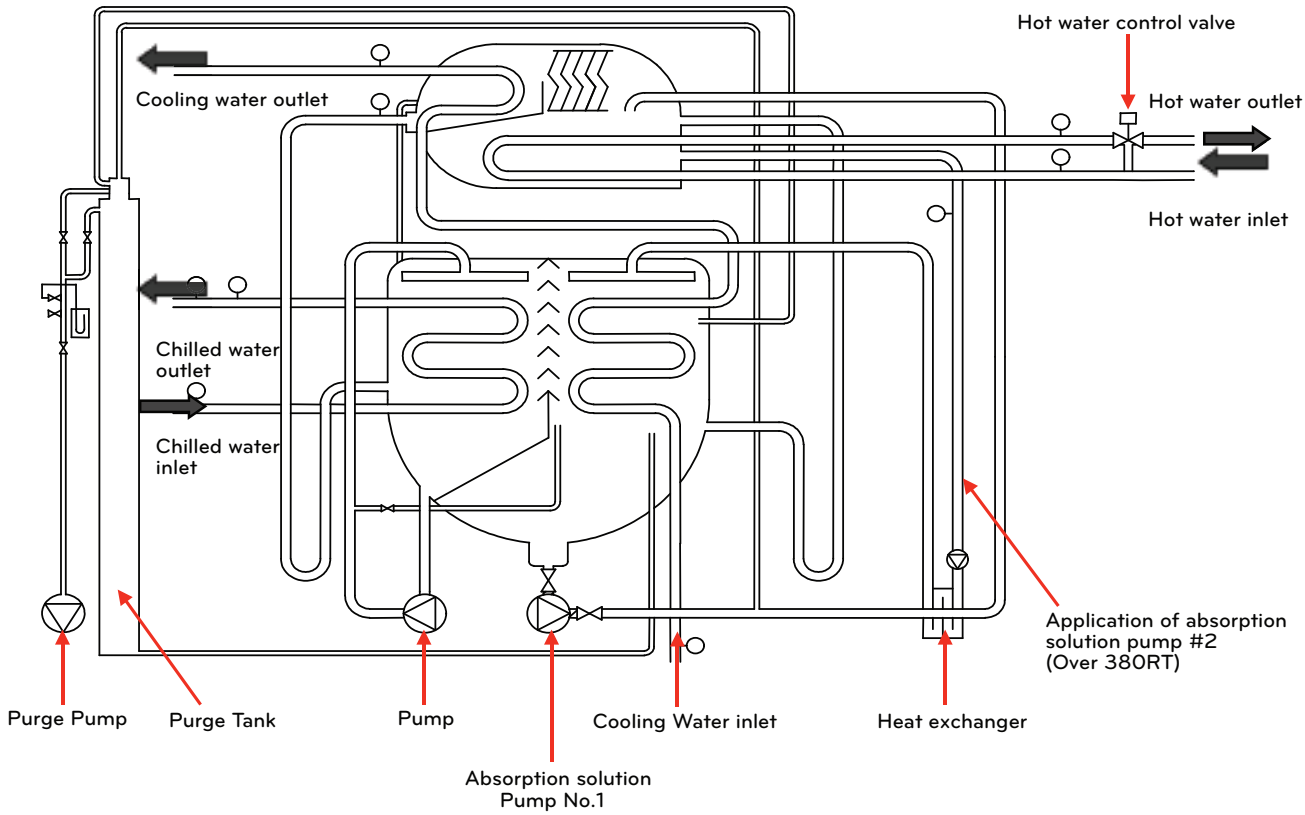


Figure 1-17. Layout of hot water type absorption chiller

1-4-1. Flow of absorption solution in cooling

Absorption solution drops from the tray on the upper part of absorber onto heat transfer tubes inside absorber and gathers at the bottom, absorbing refrigerant that comes from an eliminator.

At this time, absorption solution becomes much more diluted than before it has flown onto the tray.

Concentration is about 58% under normal operation as shown in the Duhring diagram.

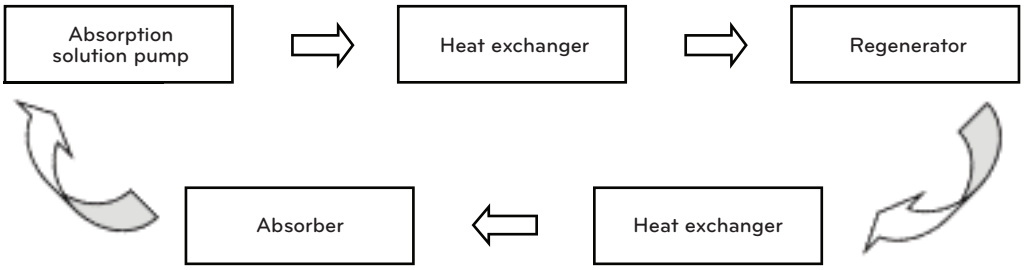
It is called diluted solution. The temperature of diluted solution gathered becomes high exchanging heat via the heat exchangers, and the diluted solution goes up to the regenerator by absorption solution pump. Absorption solution, of which concentration is about 58.5%, is referred to as concentrated solution.

Absorbed solution which has become concentrated solution at the regenerator, returns to the absorber in lower temperature passing through heat exchanger. Absorption solution flows into the absorber by means of height/pressure difference between regenerator and absorber. Absorption solution is circulated absorbing refrigerant again in the same way.

1-4-2. Circulation of refrigerant in cooling

Refrigerant, which is vaporized in evaporator, cools water in the heat transfer tubes. Vaporized refrigerant is absorbed to the absorption solution, and transferred together with the solution to the generator via the heat transfer tubes. The refrigerant vapor generated by the heat from the heat source (hot water) in the generator, moves to the condenser and becomes condensed by the cooling water of the condenser. Refrigerant in condenser returns to evaporator and will be circulated as above.

[The circulation of absorption solution in cooling]



[The circulation of refrigerant in cooling]

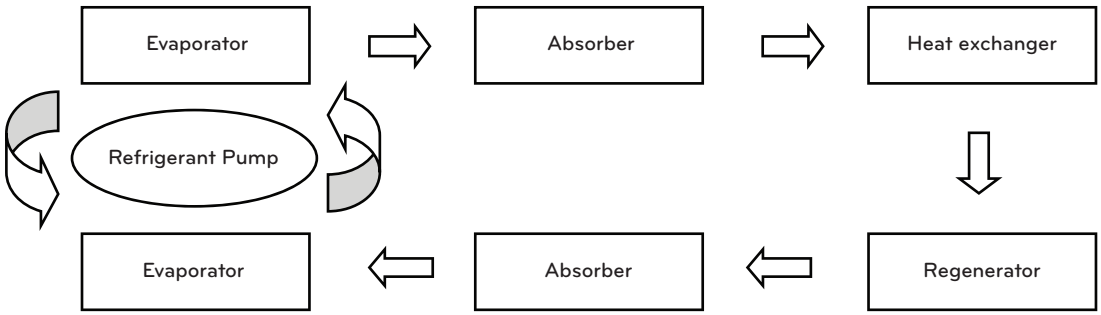


Figure1-18. The circulation cycle of the absorption solution and refrigerant

2. HOW TO RUN THE HOT WATER TYPE ABSORPTION CHILLER

2-1. Operation and stop of hot water type absorption chiller

2-1-1. Check points before operation (auto-operation)

The following items should checked before operating a chiller.

1) Convert chilled water switch, cooling water switch and cooling tower pump switch into AUTO.(Exclude when operated manually, however, the cooling tower must be operable by automatic control.
2) If the manual lamp for the control valve on the control panel is lighted, it means the control valve is in manual mode. Push the manual key for the control valve again to change to the automatic mode.
3) Check whether the valve in the hot water supply pipe in open normally. If the hot water temperature is either lower or higher than normal, check related equipment and take action as needed.
4) Check if the valves of the pipe connected to the chilled water and cooling water pumps are open normally. And check also whether head is open normally in case the pipe is connected to the cooling water head. (Especially, check the open state of valve once again when operating several chilled water and cooling water pumps or spare pump for chilled water or cooling water pump.) The unit can be operated normally when all of above is completed.

2-1-2. How to operate the absorption chiller (remote, auto-operation)

1) Pressing operation key on the control panel of chiller for 3 seconds will automatically put all the system into operation. (in case of remote operation, turn on the remote switch, that is, a computer.)
2) Check the operation of chilled and cooling water pumps when chiller is put into operation. Check the water pressure of each part (manometer of chilled water, cooling water pipe) to assure the normal circulation of chilled water and cooling water. When the outlet pressure of chilled, cooling water pipe is lower than that of inlet, it is the normal state. If pressure values of both outlet and inlet are equal or pressure difference is reduced, stop the chiller immediately and convert chilled/cooling water pump to manual mode, and find the reason and take necessary actions.
   And if the needle of manometer trembles violently or pressure difference is wide, it is usually caused by insufficient water in pipe. Then check the refilling pipes of chilled/cooling water and refill them.
   (However, in case of finding causes in manual mode, manual operation is available for chilled water, but in case of operation in which cooling water is converted to manual mode, operate the chilled water system together.)
3) Check if the cooling tower fan is operating normally.
4) Afterwards, the machine will be run automatically.

※ The chiller is not likely to work unless any of check points above is normal.

The contents after the clause 2) of 2-1-1 do not need for extra handling because it runs automatically and stops under an abonrmal situation. However checking the machine in advance will prevent an abnormal operation(However, be aware of the fact that even though cooling water flow is not sufficient or cooling tower fan is not operating normally, the chiller works anyway.)

2-1-3. How to stop the absorption chiller (stop in auto-operation)

1) Press stop key on the control panel for 3 seconds. (turn the remote stop switch off for remote operation)
2) The steam control valve is closed completely after stop.
3) The cooling water pump stops.
4) The chilled water pump stops.
5) Dilution operation for stop will be done for about 5~20 minutes. (Stop time of chilled water and cooling water pump is determined based on the temperature of regenerator. However, stop time can be adjusted. - Refer to the MICOM manual)
6) Stop AHU, FCU, etc.

※ 2) ~ 5) above will stop automatically, however checking the normal stop once again will prevent an accident by a wrong decision at an abnormal situation in advance.

※ Operate loads such as AHU, FCU, etc. after operating the chiller, and stop it after stopping a chiller. In particular, stopping all the loads such as AHU, FCU, etc. at once, while the temperature of cooling water outlet is low, lowers the temperature of cooling water abruptly, causing ice to be formed inside and danger of freeze rupture, therefore turn the loads off after temperature of cooling water rises sufficiently or cooling water pump stops to work automatically.

2-1-4. How to operate the absorption chiller (manual operation)

1) Operate the chilled water pump manually.
2) Operate the cooling water pump manually.
3) Check the circulation between chilled water and cooling water pump.
4) Press the operation key on the control panel of chiller for 3 seconds.
5) Check for the gradual opening of the hot water control valve.
6) Check whether the cooling tower fan is working normally.
7) After 4) above, the chiller operates by itself.

2-1-5. How to stop the absorption chiller (manual operation)

1) Press the stop key on the control panel of the chiller for 3 seconds.
2) The hot water control valve is closed completely after stop.
3) The chiller stops to operate after about 5~20 minutes of dilution operation.
4) Stop cooling water pump.
5) Stop chilled water pump.
6) Cooling tower fan will stop automatically. (If not, stop it manually.)
7) Stop AHU, FCU, etc.

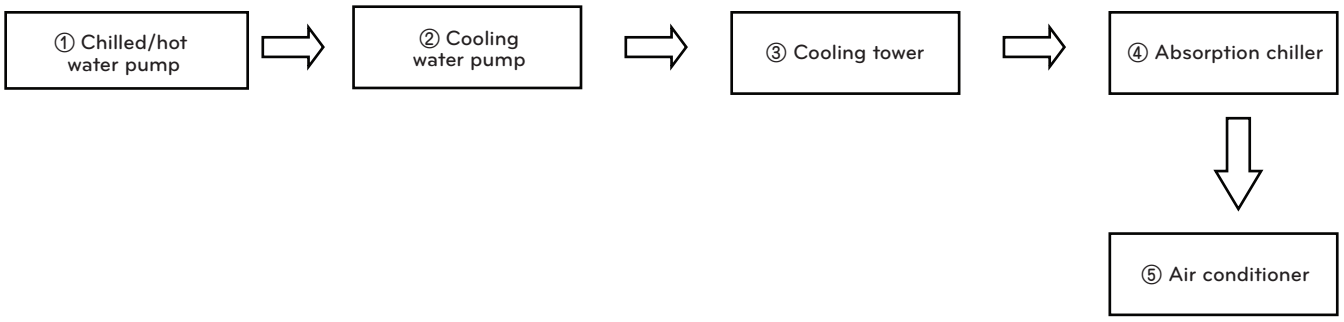
※ In case of manual operation, the order above must be observed. Other internal operations will be done automatically.

2-1-6. Safety issues for operation

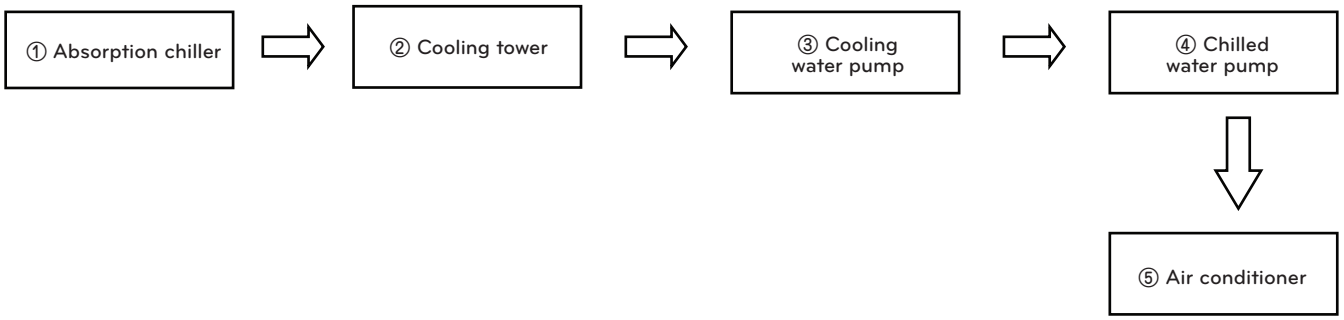
1) Be careful not to forget closing the purge valve. Otherwise air will get inside the chiller causing abnormal operation. Thus in case of vacuum failure, check the cause and extract the air completely by purging operation. Further information will be described in the purging part.
2) During the dilution operation, operate chilled water and an air conditioner until the end of dilution operation. Because during the dilution operation it still has a little cooling power, immediate stop of air conditioner will cause the danger of over-cooling. Especially, cooling water pump should not be operated manually during the operation if possible. It is because when cooling water continues to flow during the stop operation, the chilled water left inside copper tubes of evaporator will be frozen by latent heat left in a chiller.
3) Do not test control circuit for temperature adjustment of MICOM in MΩ level.
4) For auto startup and stop of auxiliary equipment, the interlocking circuits are advised to follow the recommended by LG. The chiller water pump and the cooling water pump are automatically operated by interlocking circuits. However, it can be operated automatically only when there are interlock and auto- contact with the chilled water and the cooling water, and the auto contact to the cooling tower,

The interlocking operations of startup and stop are performed as the following Figure 5-1.

[Startup sequence]



[Stop sequence]



Frigure 2-1. Startup and stop sequence of auxiliary equipment

- In case the cooling tower is controlled in a separate panel from MICOM, cooling tower part is excluded from the sequential operation process and the cooling tower should be controlled automatically based on the temperature in cooling tower MCC panel or other devices (thermostat, DDC panel or computer).
- In case the cooling tower is controlled in MICOM of chiller, an operation joint, which connects cooling tower to the output of MICOM should be additionally installed. Otherwise, cooling tower should be controlled based on the temperature by other devices such as separate panel or thermostat than MICOM.

3. MAINTENANCE

3-1. Maintenance/inspection

3-1-1. Daily maintenance and check

1) Check each part of chiller

Contact our service part when you find any abnormal situation as below.

① Is there any unusual noise in the absorption solution pump, refrigerant pump?

Check auxiliary facilities below and take proper measures if necessary.

① Cleanness of the strainer for cooling water system, cooling tower

② Distribution of cooling water in cooling tower

③ Air exhaust in water pipe.

2) Operation data record

Record the operation data in the regular intervals during the operation to know the state of the chiller. (1 ~ 2 hour interval) Data are written and saved by hour in MICOM by default.

(Time interval can be altered. Refer to menu instruction for time setting.)

But since pressure of chilled/cooling water, the hot water flux and etc. are not recorded, recording the data will be useful in servicing, regular inspection, recovery from failure or error prevention.

3-1-2. Regular inspection

Regular inspection such as purging task, management of absorption solution is needed to operate the machine effectively and keep the expected life span.

※ Inspection for the connections between electrical parts(which are inside the panel) is needed 1 or 2 times per year. It is convenient to use the maintenance contract.

3-1-3. Refrigerant blow-down

Refrigerant blow-down is a regeneration method which turns refrigerant in an evaporator into pure refrigerant at the beginning of commissioning or during cooling operation. When absorption solution in an absorber flows into the evaporator or from low temp. regenerator to the condenser during commissioning or cooling operation, refrigerant becomes heavy resulting in lowering the cooling power efficiency. Blow-down task should be performed in this case.

> The temperature of chilled water outlet rises during refrigerant blow-down task, however after the task is completed and the normal cycle is recovered, the temperature will be lowered.

Blow-down causes chilled refrigerant to flow in the absorber, thus the temperature of dilute solution in the absorber goes down. Diluted absorption solution move to the generator passing the heat exchanger. When the absorption solution is heated in the generator, it generates refrigerant vapor. The refrigerant vapor becomes refined pure refrigerant again after through the condenser.

3-1-3-1. Blow-down task (In case the machine is equipped with a separate blow-down valve)

There is a blow-down valve in the pipe between the refrigerant pump and the evaporator of the chiller, and this valve is a Diaphram valve as the purge system.

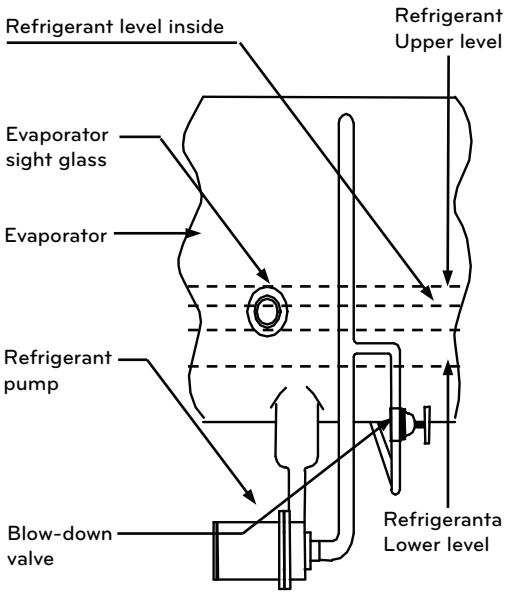


Figure 3-1. Blow-down

① Change the operation mode to manual at the 'Control Valve Manual' on the MICOM panel and close the 'Hot water Control Valve' to make a low heat capacity state. (Control valve opening to 30~50%).

② Rotate the blow-down valve counterclockwise as in Figure 3-1 to open it.

③ Check the amount of refrigerant through the evaporator sight glass.

④ Close the blow-down valve when the amount of refrigerant is reduced down to the bottom level.

⑤ Be aware of that refrigerant can move over to the absorber through the blow-down valve, thus the refrigerant pump performs no-load operation. And in case a refrigerant blow-down valve is attached, do not stop the refrigerant pump. If refrigerant pump stops in auto mode, then convert to MANUAL mode before putting it into operation. (When the temperature of chilled water is going down causing MICOM to be in auto mode, refrigerant pump stops automatically, thus be cautious of the low temperature of chilled water.)

⑥ When blow-down task is terminated, open a control valve in turn up to more than 70%, then convert to AUTO mode.

※ Note: When needed, extract refrigerant(H_2O) from an evaporator to measure the specific weight. Standard specific weight for refrigerant is less than 1.02.

3-2. Purging

It is the task of discharging air or non-condensing gas out of the chiller through a purge pump. Inflow of air or hydrogen gas generated inside diminishes the performance and does harm to chiller's life. Therefore purging task of discharging gas or air is absolutely needed. This task is referred to as purging.

3-2-1. When to perform purging

It is good to do the purge task during the cooling operation or before an operation. However it is the most appropriate during the cooling operation.

3-2-2. Purging frequency

Purging is an important task which has an influence on the performance and life span of machine. purging task, which is discharging the hydrogen gas or inflow air to the out of the main body, is good to be performed more than 1 time per week for main body and over 1~2 times a week for storage tank during the cooling operation. In case of a new chiller which has just finished the commissioning operation, it should have regular purge maintenance for about 1 to 2 months.

3-2-3. Structure and components of purge pump

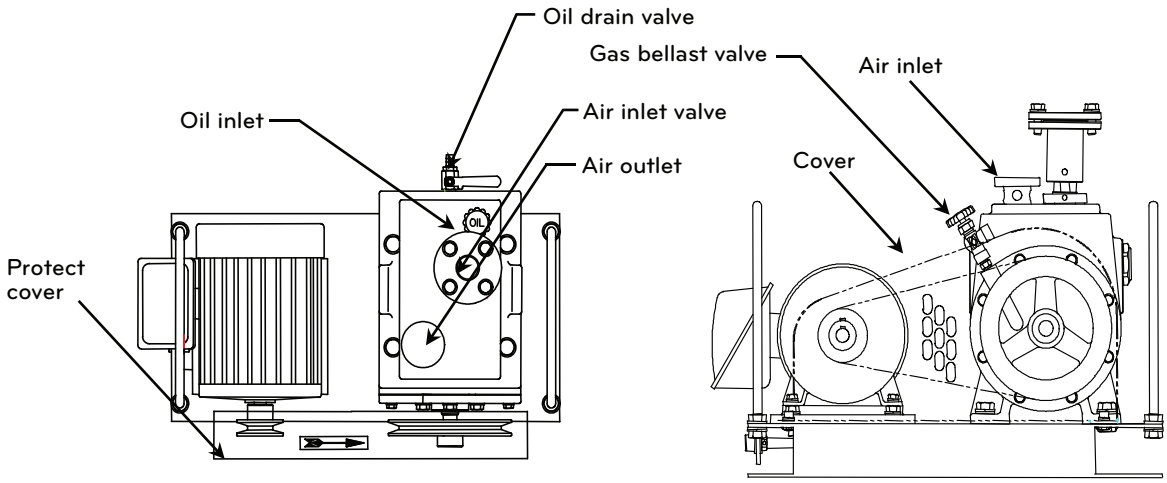
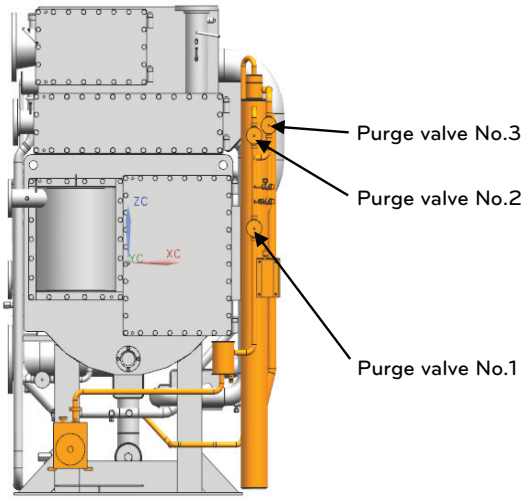


Figure3-2 Name of purge pump parts

3-2-4. Structure and principle of purging system



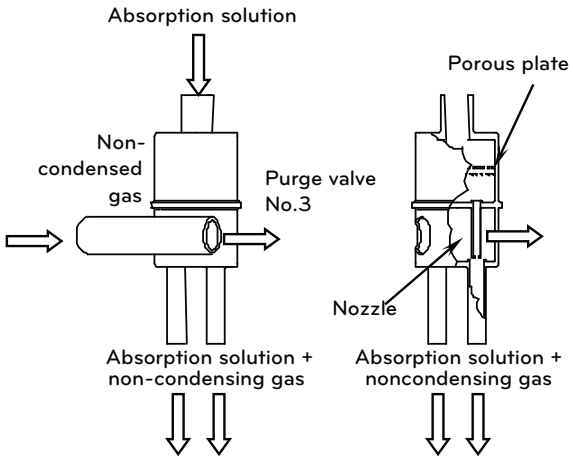


Figure 3-3 Structure of purge unit

3-2-4-1. Principle of purging

Purging is a task of discharging non-condensing gas out of the inside of the chiller main body.

Absorption solution reacts with the internal surface of main body, producing non-condensing gas or H2. Hydrogen gas and air left inside the main body should be discharged, which makes pressure stable for the normal cooling operation.

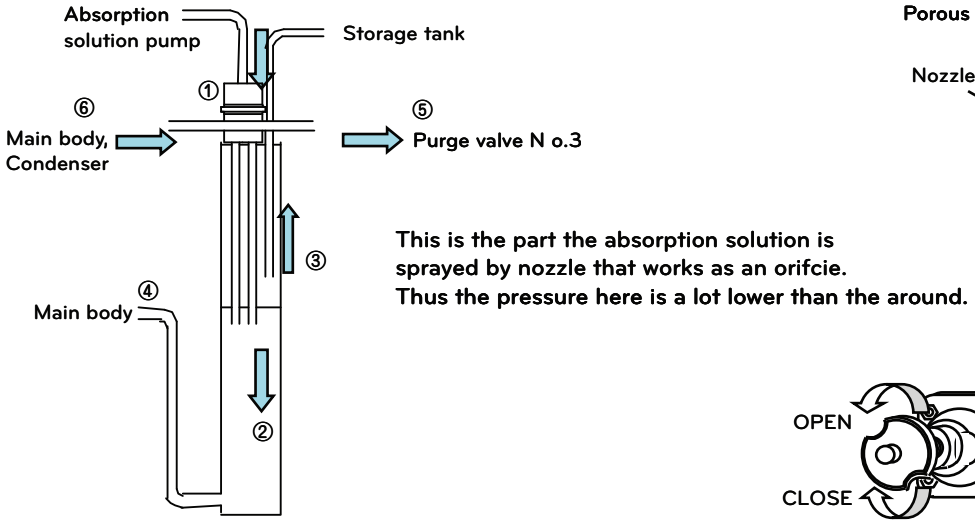


Figure 3-4 Storage tank and the principle of purging

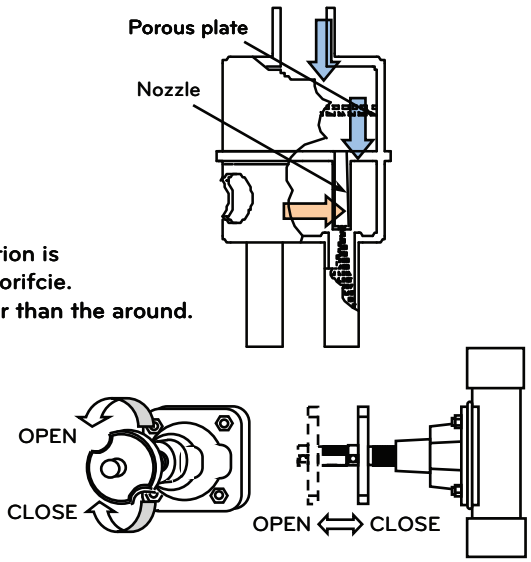


Figure 3-5 Purge valve (Diaphragm valve)

① Absorption solution flows from absorption solution pump to header of storage tank.

② Absorption solution is filtered by porous plate(a plate with small holes used as a filter) and is injected down from the nozzle, which acts as an orifice to make air pressure at the end of nozzle lower than surrounding air pressure. Air of ⑥ goes down in the direction ② with absorption solution, being diluted together.

③ Vapor bubble diluted with absorption solution is put together in storage tank, and gathers in the purge tank along the piping with air and non-condensing gas. This non-condensing gas gathered in the tank is to be discharged when purging for storage tank is performed. Therefore air bubble is not produced when absorption solution pump does not work.

④ Absorption solution gathered in the storage tank returns to the absorber of main body when it reaches the level of piping of ④.

⑤ It is connected to No.3 purge valve. Non-condensing gas will be discharged directly in this direction when performing the purging for main body.

⑥ It is connected to the condenser and the absorber. Non-condensing gas flows through the pipe ⑥, when performing purging for main body or when collecting air bubble by absorption solution pump.

3-2-4-2. Purging task

1) Definition of pressure transmitter

The electrical signal detected and converted by a pressure sensor is signalized such as amplifying and S/N enhancement within the transmitter and processed with non-linear compensation and temperature compensation, and it is the sensor that converts and outputs the processed result as a parallel uniform signal of 4~20mA for the process control.

2) How to read a pressure transmitter

Read the pressure transmitter at the purge device pressure of main screen of the control panel as the figure 3-6. (Purge device pressure may have error depending on the temperature, humidity and others.)

Figure 3-6 Pressure transmitter

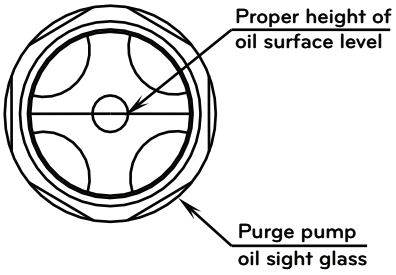


Figure 3-7 Oil sigth glass

3) Diagnosis of the pressure transmitter

3-1) Leakage diagnosis

3-1-1) Leakage can be suspected if the purge device pressure does not drop under 6mmHg when a vacuum pump is started as the purge valve No.3 of main body and purge valve No.2 of the storage tank closed.

3-1-2) Leakage can be suspected if the purge device pressure is increased continuously when the respective valves connected to the main body, storage tank and vacuum pump are closed and left over.

3-2) Leakage diagnosis method

3-2-1) Check purge device pressure as closed and left the service valve of the pressure transmitter.

3-2-1-1) The increase of purge device pressure: The leakage is suspected at the connection part or inside of the pressure transmitter.

3-2-1-2) Fixed purge device pressure: The leakage is suspected at the respective valves to the main body, storage tank and vacuum pump, service valve or others.

3-3) Diagnosis

3-3-1) If the purge device pressure is not changed even after the correction of the respective valves connected to the main body, storage tank and vacuum pump, it is suspected that the abnormal of wiring connection status and the failure of the sensor.

3-3-2) If there is a displaying message of the purge device pressure abnormal on the MICOM screen, it is suspected that an abnormal of wiring connection status and the failure of the sensor.

3-3-3) If the purge device pressure is abnormally output, it is suspected that an abnormal of wiring connection status and the failure of the sensor. (ex. -23mmHg, 799mmHg, etc.)

3-4) Diagnosis method

3-4-1) Check the opening of the service valve of the pressure transmitter and the wiring connection status.

3-4-2) The failure of the purge pump or pressure transmitter is suspected if the purge device pressure does not drop under 6mmHg when a vacuum pump is started and checked for the drop of the purge device pressure under 6mmHg as the valve to vacuum pump closed and the respective valve connected to the main body and storage tank are closed.

4) Cautions when using a pressure transmitter

4-1) External shock: Be aware that the transmission board or internal vacuum of the pressure transmitter can be broken by an external shock.

4-2) Wiring: Be aware that the wire connected can be unplugged if the connected wire to the pressure transmitter or MICOM is pulled by force.

4-3) Water proof:Be careful with water not to get into the wire connection part of the pressure transmitter.

4-4) Replacements: Turn off the power of MICOM when replacing the power transmitter for the danger of electric shock.

After the replacement, check the range specification of the new power transmitter and correct the range specification of the purge device pressure on the MICOM.

5) Check points before purging

① Press 'Run' of manual switch on the control panel to put a purge pump into operation.

② When the purge pump starts working, firstly open the gas ballast valve a little to hear the working sound. Then keep it open always a little for use. Air flows into the gas ballast valve at this moment and is discharged from the outlet of the purge pump. So if you block the gas ballast valve with your finger, you will feel air flowing in. In case oil flows backward and there is no more air flow to feeling when blocking with a finger after the purge pump stops, vacuum inside might have been broken. In this case, close the gas ballast valve and open it little by little for use.

③ Check the oil level in the purge pump.

④ Add oil when the level of oil is low. Add oil while purge pump is still working. The optimum oil level is the red scale on the sight glass.

⑤ Too much oil, that is, oil level goes over 1/2~2/3, should be discharged by opening the oil drain valve.

⑥ When the color of oil is examined and oil is regarded as contaminated seriously, stop the purge pump and open the oil drain valve to replace all of them. When oil is mixed with water and looks milky, it makes the purge pump to perform no-load operation. No-load operation discharges water out of oil, cleaning oil and drying the trap, the absorption hose and pipes used for purging automatically to improve the performance of purge pump. (no-load operation usually takes about 1~2 hours even though it varies by the water level in oil.)

⑦ Read off the scale of manometer with the purge valve NO.1 opened.

⑧ Read off the pressure transmitter and if the scale indicates less than 4mmHg, the vacuum in the purge pump is satisfactory. On the contrary, if it is more than 4mmHg, that is poor level of vacuum, and 10 minute of no-load operation will lower the vacuum level less than 4mmHg. If this does not work, oil and water in trap of upper part of purge pump and absorbing hose of pump inlet should be discharged. In case a liquid trap is attached, open the drain stopper on the lower part of the trap with spanner to discharge oil and water. Check if purge valve NO.1 is closed, if it is, open the stopper of trap with purge pump stopped to discharge oil. When it is made of transparent hose, check oil in hose, then tilt it toward the inlet of purge pump to pour oil into it. It is not necessary to stop purge pump for discharging oil in a transparent hose.

⑨ When nothing failed above, start the purging task.

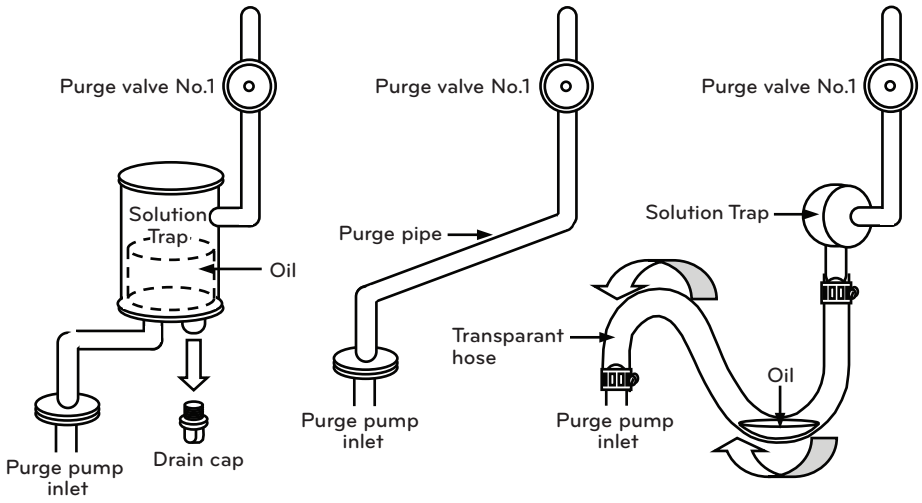


Figure 3-8. Solution trap

※ If there is a trap, inside of the trap should always be kept dry to keep good vacuum level. Get rid of any oil in the trap or a hose by draining.

3-2-5. Managing oil in purge pump

Use vacuum pump oil, MR - 200 or ULTRA-200 if possible. Using other oil is OK but check the oil viscosity before use.

When the oil is seriously contaminated, all of the oil should be replaced. Specially, when absorption solution flows into the purge pump, replace all of the oil and clean the inside of it. First of all, discharge oil through drain valve to clean it. When oil is all taken out, close the drain valve and fill it with water through the oil inlet up to the half of oil inspection sight glass. Operate the purge pump for about 20~30 minutes to perform no-load operation. Stop the purge pump to discharge water through the drain valve. After discharging water, refill the purge pump with oil. Now the cleaning task of the purge pump is finished.

3-2-6. purging in cooling

It is desirable to perform purging in cooling during operation. It is because non-condensing gas gathers in the storage tank during operation. Purging can be performed to the main body when its temperature is low before the operation of storage tank and main body.

However, if purging task is performed when the main body is hot after operation or during dilution operation, lots of refrigerant vapor comes from the main body and goes into the purge pump, harming purge pump. As a result, refrigerant consumption increases.

3-2-6-1. purging for main body in cooling

Purge for main body is performed usually when the pressure of main body is high in cooling or air gets into a main body needing an urgent purge.

The air inside the main body gathers in the storage tank and purge tank automatically by the purging device. However because the storage tank can not absorb completely the non-condensing gas, it is very helpful for the performance and life of machine to practice purging for 20~30 minutes, 1~2 times per week through the main body.

If the pressure of main body is high, then the temperature of regenerator is getting higher, causing an abnormal condition of "temperature high", "concentration high" , etc.

Also, crystallization can occur easily due to the bad flow of absorption solution and the temperature of chilled water won't get low easily. Purging for main body absorbs gas directly from inside by the purge pump and is discharged out of the chiller. Thus refrigerant is consumed little by little but it has little influence to the operation.

< purging for main body >

① Put the purge pump into operation, open the purge valve NO.1. And close the purge valve NO.1 when the scale of manometer indicates less than 4mmHg.

② Open the purge valve NO.3 (main body).

③ Read off the Pressure transmitter to check the pressure of main body.

④ Open the purge valve NO.1 to perform purging when the pressure of pressure transmitter

is more than the permitted vacuum level.

⑤ Close the purge valve NO.3 when purging for main body is completed or the pressure of manometer is less than the permitted vacuum level.

⑥ Read off the pressure transmitter to verify if the scale indicates less than 4mmHg.

⑦ Close the purge valve NO.1.

⑧ Stop the purge pump.

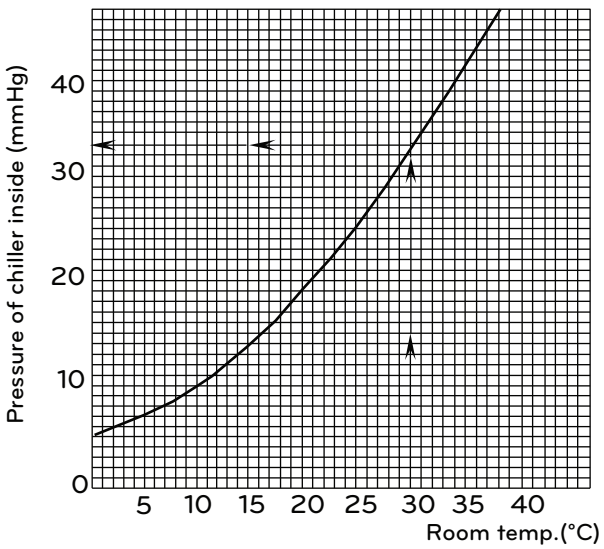


Figure 3-9. Permitted vacuum pressure curve

3-2-6-2. Purging for storage tank in cooling

When the pressure inside the main body is high, absorption solution in the storage tank occasionally flows over through the purge pump. Especially when the pressure of main body is more than 40mmHg, never open the storage tank valve. If air gets in or pressure is high, then perform purging for main body first.

There is almost no loss of the refrigerant since the storage tank purge performs the task after collecting non-condensed gas and air inside the main body to the storage tank. Since gas gathers only during operation, and it is unable to purge at once after collecting large amount , the gas cannot be collected after reaching a certain pressure. Purging should be performed from time to time. (Over 2 times a week)

< Purging for storage tank >

① Put the purge pump into operation.

② Inspect the purge pump.

③ Open the valve NO.1

④ Check if the scale of pressure transmitter indicates less than 4mmHg.

⑤ Close the valve NO.1.

⑥ Open the purge valve NO.2(storage tank)

⑦ Check the pressure of storage tank with pressure transmitter.
When the pressure is higher than the permitted vacuum level, then open the purge valve NO.1 to perform purging.

⑧ Close the storage tank valve NO.2 when purging is done or pressure is low.

⑨ Check the purge device pressure after closing the strange tank valve No.2 and opening the valve No.1 if the storage tank pressure is normal. When purging is done, check if the scale of manometer indicates less than 4mmHg as soon as the storage valve is closed.

⑩ Close the valve NO.1. and stop the purge pump.

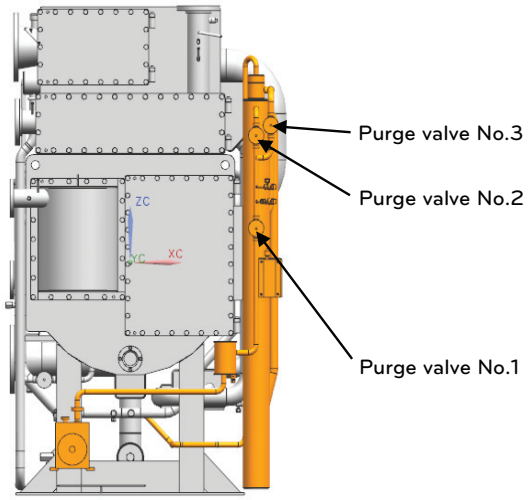


Figure 3-10 Structure of purge unit

< Simple purging when cooling>

① Put the purge pump into operation and check the purge pump.

② Open the valve NO.1.

③ Check if the scale of pressure transmitter indicates less than 4mmHg.

④ Open the valve NO.3.

⑤ Check the pressure of main body with a pressure transmitter. Close the valve NO.3, if it is within the allowable vacuum level. When the regular purging or purging is considered to be needed, perform purging for 10~20 minutes with the valve NO.3 opened.

⑥ Close the valve NO.3, then check if the scale of manometer is less than 4mmHg.

⑦ Open the storage valve NO.2 and perform purging for about 1~2 minutes.

⑧ Close the valve NO.2. (Perform purging until it is equal to the pressure of the main body, then close the valve.)

⑨ Check the purge device pressure becomes under 4mmHg.

⑩ Close the valve NO.1.

⑪ Check if the purge valves NO.1, NO.2, NO.3 all are closed.

⑫ Stop the purge pump.

Simple purging above is a simplified purging procedure when there is nothing wrong after checking before the start of purge pump and performing regular purging. Follow the above simple procedure when performing a regular purging or a general purging. But under the high pressure in the main body, perform purging longer than 20 minutes until it reaches the permitted vacuum level before operation.

And the simple purging of the above should not be used to get the precise pressure in the main body. It should be measured through the normal procedure, that is purging of main body or purging for storage tank.

3-3. Long-term storage and parts replacement

When storing the chiller for a long term or repairing, store or repair with nitrogen gas charged.

3-3-1. Nitrogen (N_2) gas charging

3-3-1-1. Nitrogen (N_2) gas charging procedure

The devices when charging Nitrogen gas

(1) Nitrogen gas

(2) Pressure governor

(3) Pressure-resistant rubber hose (Pressure hose)

(4) Band

(6) Pliers (a kind of monkey spanner)

(6) Valve hand for service valves

(7) Valve hand for nitrogen gas

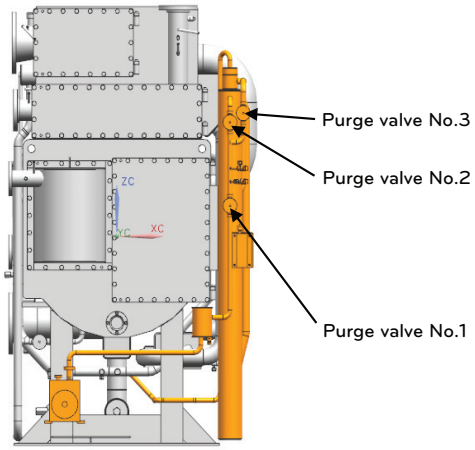


Figure 3-11. The structure of the purge unit

3-3-1-2. Rated pressure

(1) Pressure for long term storing : 0.2~0.3kg/cm^{2}G

(2) Pressure for leak test : 0.7~1.0 kg/cm^{2}G

(3) Pressure for replacement of parts or others : about 0.1 kg/cm^{2}G

3-3-1-3. Procedure

① Prepare nitrogen container and install a pressure governor.
② Connect the pressure-resistant rubber hose to the gas pressure governor and inject the nitrogen gas little by little by opening the valve to purge out the air inside.
③ Link the opposite end of hose to the service valve on the upper part of purge valve NO.1 (the lower part of service valve for manometer connection) and tighten the band.
④ Ensure that the purge valves of no.1, 2, 3 and the service valve connected are closed.
⑤ Open the purge valve No.2.
⑥ Open the service valve linked to the hose.
⑦ Inject nitrogen gas to inside of the main body little by little using the pressure governor.
⑧ Continue injecting nitrogen gas watching the pressure gauge. Close the service valve NO.2 linked to the hose and the outlet valve of nitrogen container when gas reaches the rated pressure.
⑨ Separate the rubber hose from the service valve and cover the service valve with cap.
⑩ Disassemble the pressure governor.

3-3-1-4. Caution

When finishing all of the procedure above, it is possible to do part replacement, leakage test or long-term storing. Be careful when handling the nitrogen container since it is filled with the pressure of 120 kg/cm^{2}G. Do not raise abruptly the 1st and 2nd pressures of pressure controller in the nitrogen container. Otherwise it will force the pressure hose to be pulled out of the service valve or the hose may explode. Never open the purge valve NO.1, 3 during the nitrogen charging task. Absorption solution can flow backward. When replacing parts, check for any leakage on the replaced parts after charging additional nitrogen gas while raising the pressure from the regulated pressure to the pressure of leak inspection after replacing parts.

3-3-2. Discharging nitrogen gas out of main body

It explains the procedure to discharge nitrogen gas charged inside for leakage checking or other purpose. Rated pressure: Air pressure (0 kg/cm2G) on the pressure gauge in the regenerator.

3-3-2-1. Procedure

① Open the purge valve NO.3.
② Open the service cap and discharge nitrogen gas inside the main body until the pressure goes down to air pressure.
③ Close the service valve when the pressure gauge of regenerator indicates air pressure.
④ Close the purge valve NO.3.
⑤ Close the service valve and close the cap.

3-3-2-2. Caution

Never open the purge valves NO.1, 2 while discharging nitrogen gas. Operate the ventilation fan while discharging for better exhaust. When the exhaust is poor in an airtight space, suffocation can occur due to the lack of Oxygen.

And after discharging nitrogen, normal vacuum state should be made by purging to enable cooling or heating operation. Otherwise, that is, if the machine is operated under air pressure state with no purging after discharging nitrogen, it will cause crystallization or REGENERATOR PRESSURE HIGH and other problem.

3.4. Repairing and maintaining water system

3-4-1. Water quality control of chilled/hot water and cooling water

If bad quality water is used in the chiller, it will produce scale in the tube lowering the performance and efficiency of the chiller and further cause corrosion and rupture, finally shortening the life of machine. Water quality control and regular inspection on the heat transfer tube and tube cleaning are needed.

On the other hand, if make-up water of cooling water is mixed with purified water or the cooling tower is installed in an air polluted place around chimney, water quality will be getting worse. Especially when concrete heat reservoir is used, bad scale will be caused by compounds of calcium. Be very cautious of this.

1. The standard of cooling water quality

	Category	Cooling water		Chilled/Hot water		Trend	
		Circulating cooling water	Make-up water	Circulating Chilled/Hot W.	Make-up water	Corrosion	Scale Production
Standard table	PH (25°C)	6.5 ~ 8.0	6.5 ~ 8.0	6.5 ~ 8.0	6.5 ~ 8.0	O	O
	Conductivity (25°CμS/cm)	below 800	below 200	below 500	below 200	O	
	M Alkaline (PPM)	below 100	below 50	below 100	below 50		O
	Total Hardness (PPM)	below 200	below 50	below 100	below 50		O
	Chlorine ion Cl^- (PPM)	below 200	below 50	below 100	below 50	O	
	Sulfate ion SO_4^{2-} (PPM)	below 200	below 50	below 100	below 50	O	
	Fe (PPM)	below 1.0	below 0.3	below 1.0	below 0.3	O	O
	Sulfide ion S^{2-} (PPM)	No detection	No detection	No detection	No detection	O	
	Ammonium ion NH_4^+(PPM)	below 1.0	below 0.2	below 0.5	below 0.2	O	
	Silica SiO_2 (PPM)	below 50	below 30	below 50	below 30		O
	Free carbonic acid (PPM)	3	3	10	10	O	

(Note 1) As any of items in the table has a large influence on inclination of scale or corrosion, if any item is over the standard value it will increase the possibility of scale or corrosion, a regular inspection is required.

(Note 2) Available water quality varies depending on the chemicals used for water handling, thus consult with a company specialized in water handling to perform water quality control at regular intervals with a proper standard.

2. Example of water treatment

Even though make-up water for cooling water lies within the water quality standard value, water quality gets worse when circulated cooling water is condensed. Therefore water treatment is needed as below. Refer to the Figure below for water handling considering that the level of the water treatment depends on chilled water or hot water state. In particular, be very cautious when using concrete heat reservoir.

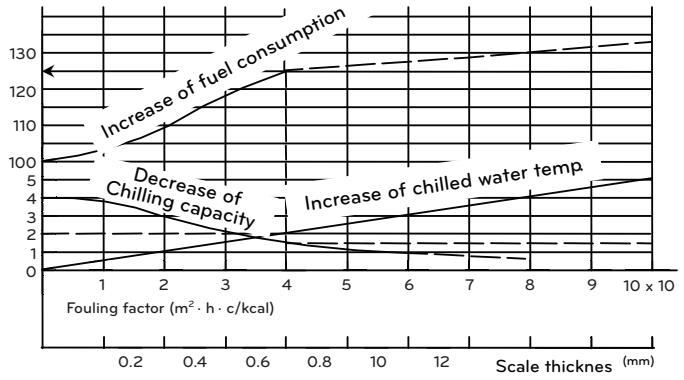
① Blow-down
Regular or continuous blow-down
Blow-down based on the conductivity analysis

② Anticorrosive injection

③ Algicide injection (slime control)

④ Necessary troubleshooting on the basis of regular water analysis

Open the water tank of chiller regularly, check for the contamination of the heat transfer tubes and clean it if needed.



When scale is accumulated up to 0.6mm in the tube, cooling power goes down to 76% and the chilled water temperature rises up by about 2°C. And fuel consumption ratio increases by 25%.

Figure 2-20 Water treatment

3-4-2. Water quality control for long-term stoppage

When chilled water, cooling water and hot water are not circulated for a long period, refer to the principle below for water quality control.

1. Cooling water system

Make it a rule to fill the machine to the full in storing cooling water system.

But in case cooling water in machine is in danger of being frozen, dry the inside of the

tube (water tank) to store. It needs special attention since the valve operations for opening and closing are different for the full water storage and the drying storage.

*When machine inside full water storage

① Discharge the water circulated during operation through the drain pipe.

② Add anticorrosive.
- Check the amount of water and add a proper amount of water according to the mixture ratio.

③ Fill the piping with fresh water.

④ Operate the cooling water pump for a while to mix anticorrosive evenly.

⑤ Close the inlet/outlet valves of cooling water.(cut-off valves of equipment side piping).
Drain some of cooling water and release the pressure of cooling water inside the absorber by opening the cooling water drain valve of the chiller side.

* When machine inside drying storage

- Clean inside of the tube and form an anticorrosive film before drying storage.
  ① Discharge the water circulated during operation through the cooling water drain pipe.
  ② Clean inside of the tube to remove scale and slime.
- Perform a chemical cleaning in addition when the mechanical cleaning is not sufficient.
  ③ Clean inside of the tube thoroughly, inject anticorrosive and fill it with water.
  ④ Operate the cooling water pump for more than 30 minutes to mix anticorrosive completely.
  ⑤ Discharge water, open the cooling water drain valve and store it with the drain valve opened.

2. Chilled water system

The machine inside full water storage is a rule.

3-4-3. Measures for winter season

Various measures are needed to prevent freezing when the surrounding temperature of chiller goes below 0°C. Keep on the heating operation (use the scheduled operation feature in MICOM to operate the chiller at specific time intervals) or keep the chilled water pump working to prevent freezing. In case of drying storage for cooling water system, keep the cooling water drain valve opened to fill the water tank from condensed water or others, to prevent freezing. In case of full water storage for cooling water system, anti-freezing solution should be used. However, since the facility condition depends on the site, consult with the service center for further information.

ENGLISH

4. CONTROL SYSTEM

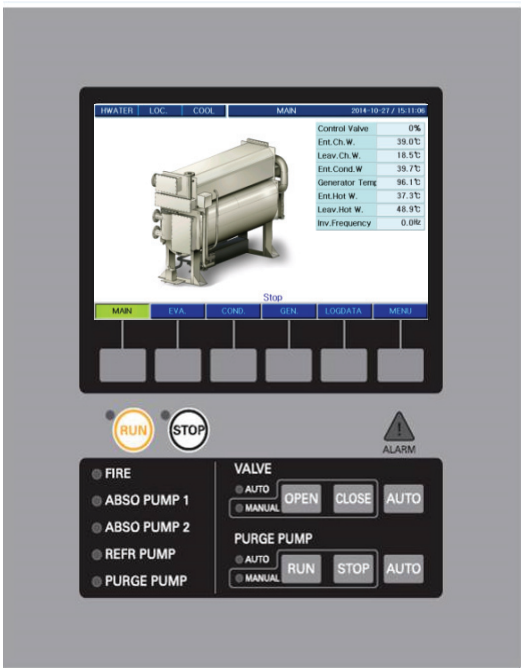
4-1. Components and major parts of control panel

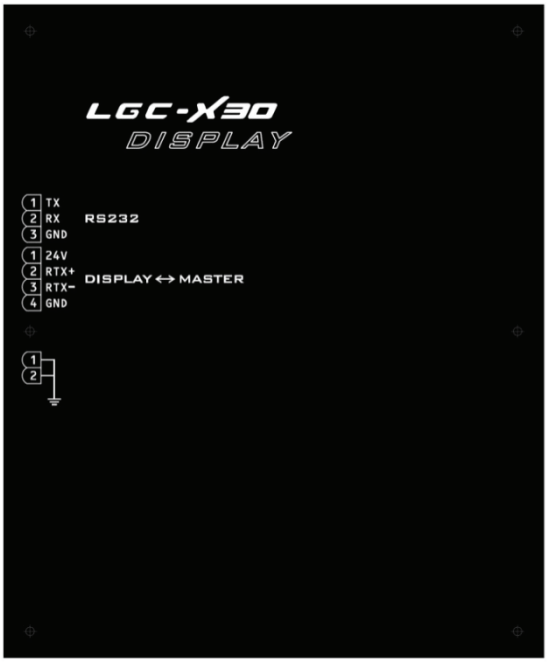
4-1-1. Controller

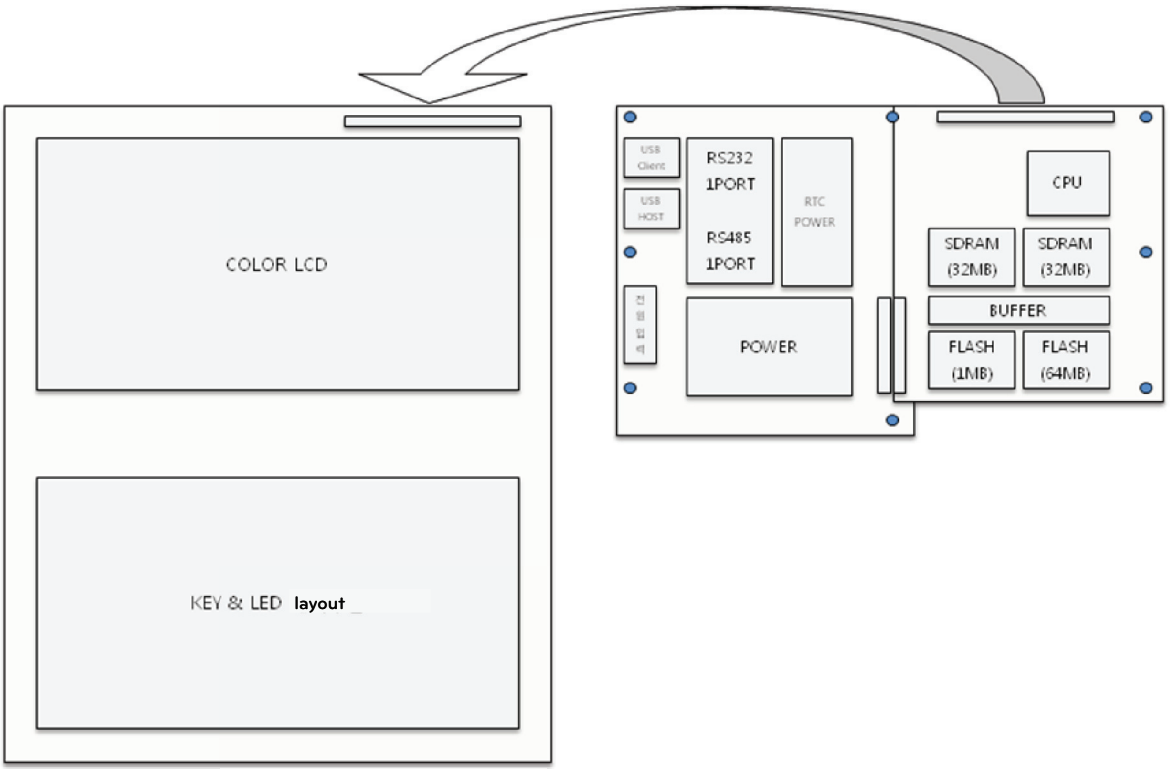
HMI

HMI with 7 inch Color LCD display is composed of graphical interface.

There are run/stop key, manual operation keys for the control valve and purge valve and the run/stop key for combustion, absorption pumps No.1 and No. 2, refrigerant pump and purge pump. In the screen shown below, there is 'function key' which changes function depending on the current screen, allowing access to the lower level items.

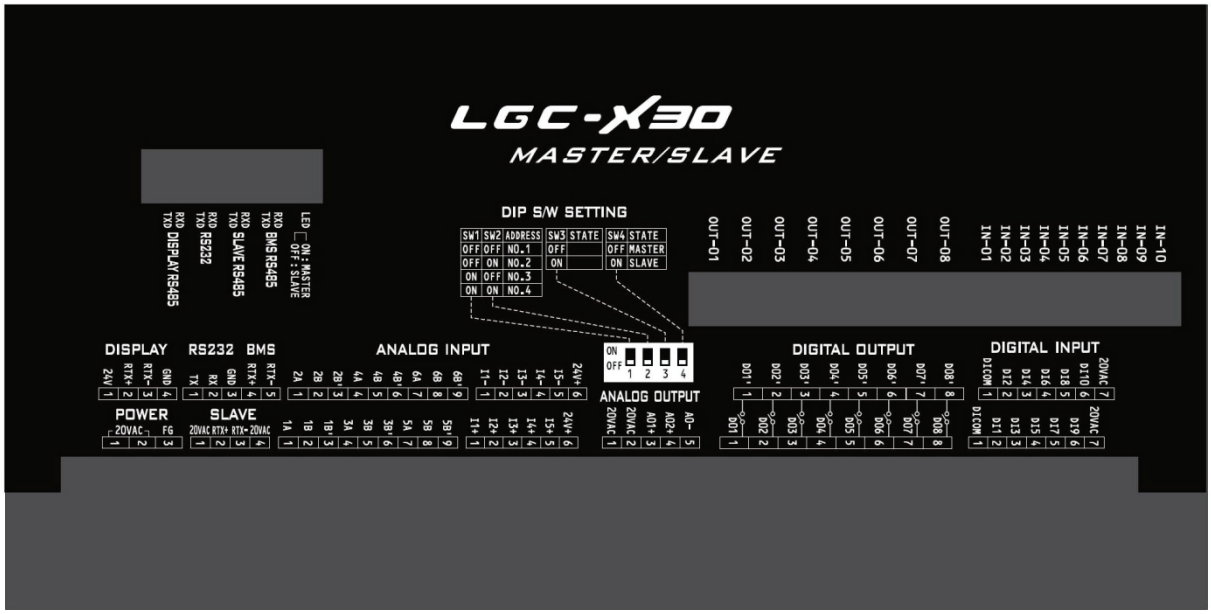


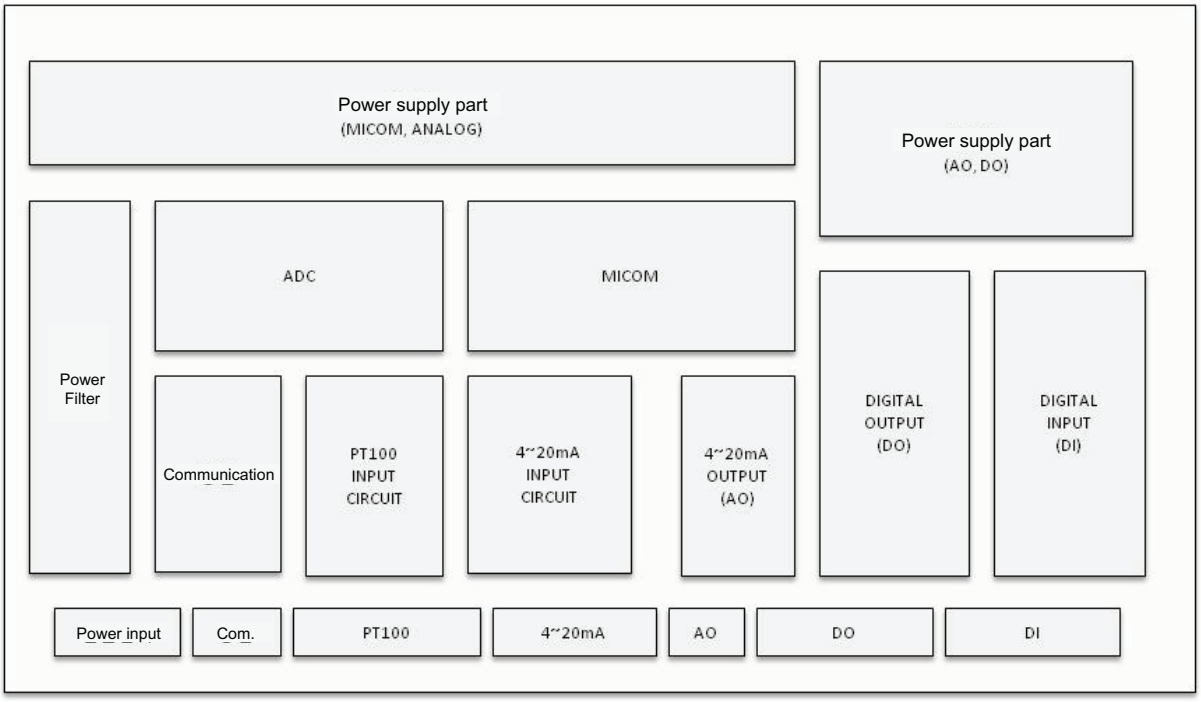




Master /Slave

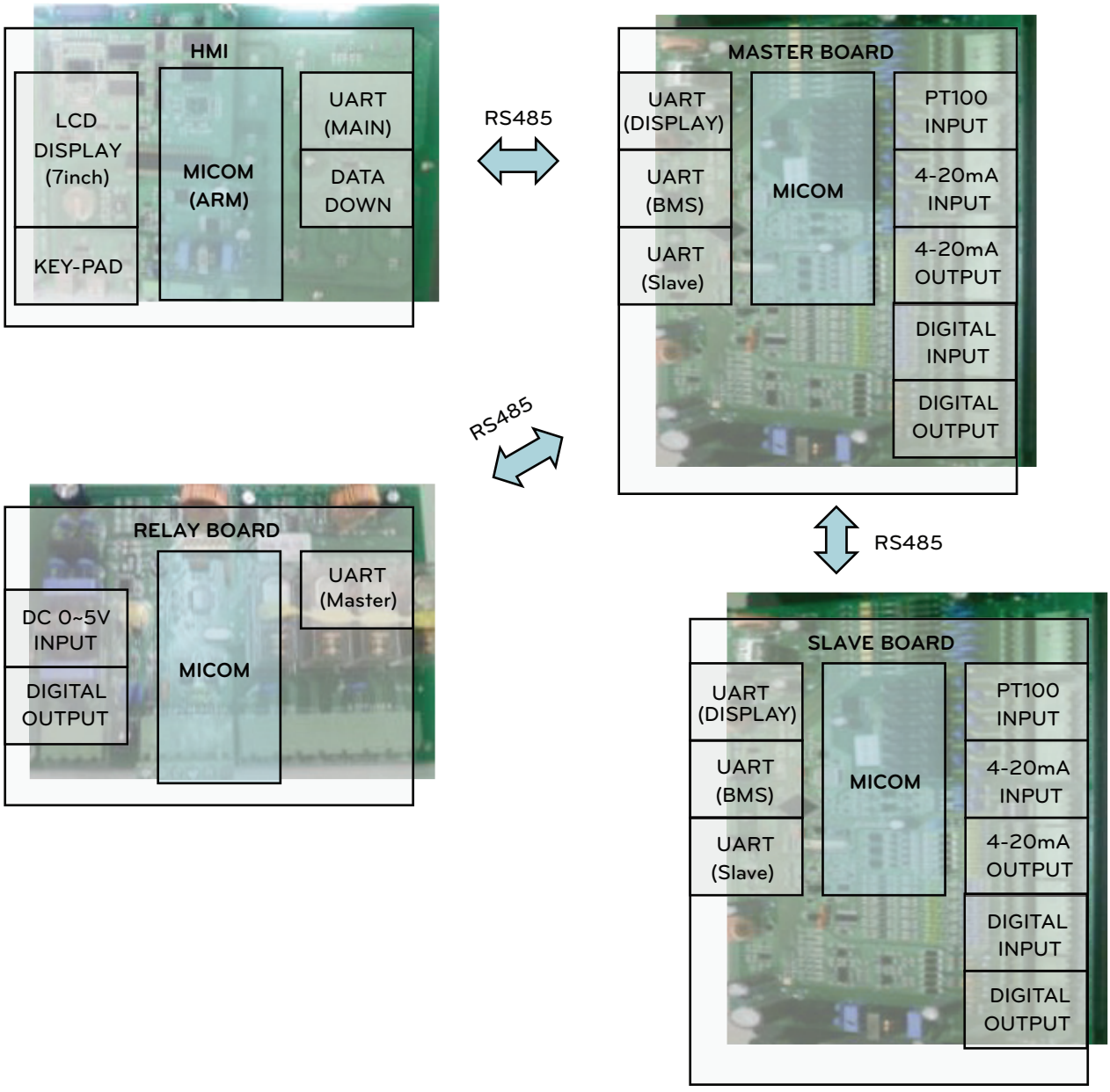
Master board and slave board are identical in hardware. It can be used as either master or slave by setting the DIP switch. (SW4 OFF: Master, ON: Slave). There are Analogue input/output, digital input/output and communication connections of RS232 and RS485 for the user's convenience,





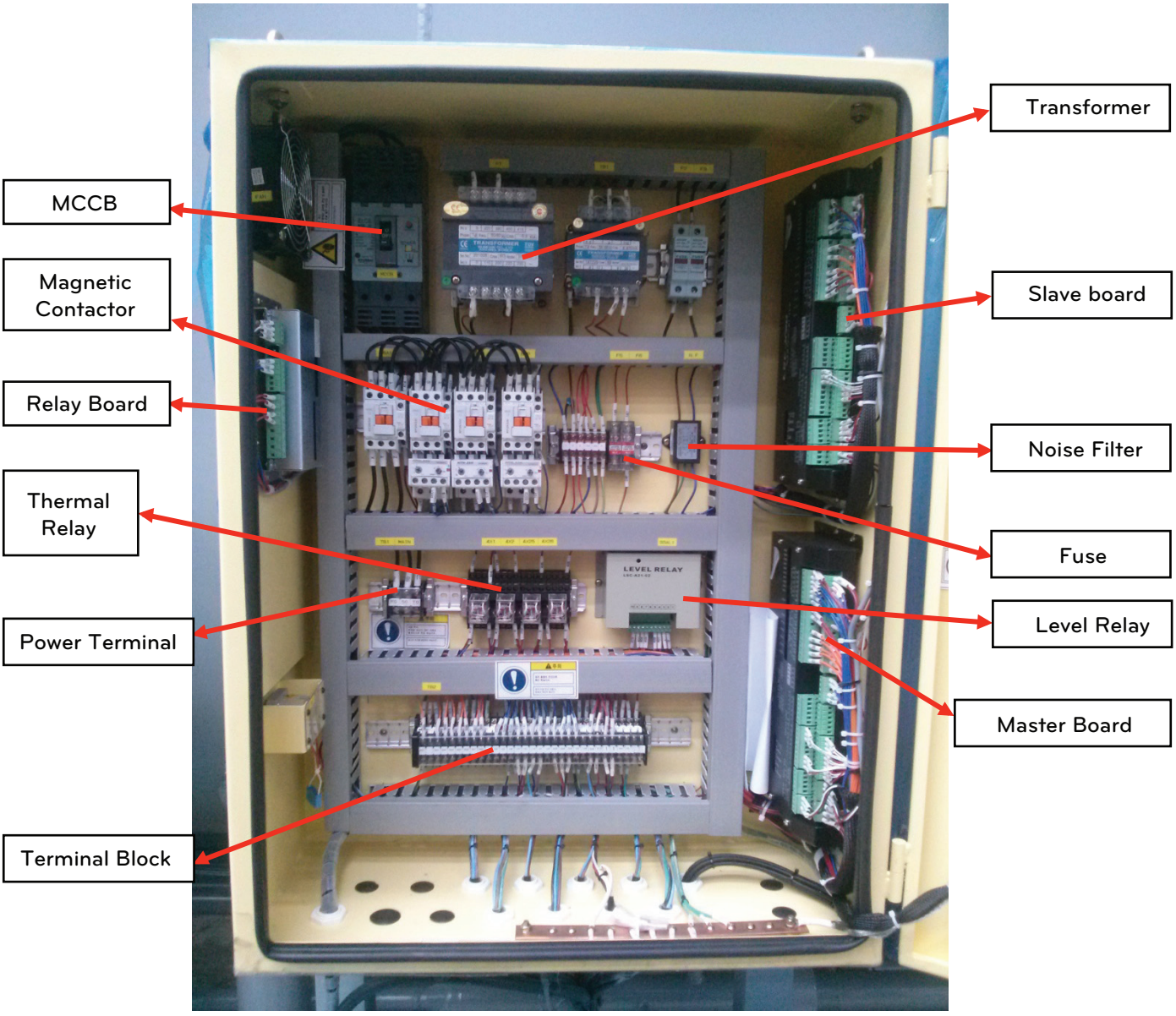
Controller system block diagram

Master, slave, HMI, Relay board communicate s via RS485. On a master/slave board, there are Analog inputs (temp.12 channels, current 10 channels), Analog outputs (current 4 channels), digital inputs (20 channels), and digital outputs (16 channels). Relay board takes care of control of the control valve.`



4-1-2. Other controlling parts

Control Panel



** The above configuration may be changed according to the improvement of design, model or user convenience. Thus, please refer to the approved drawings for details.

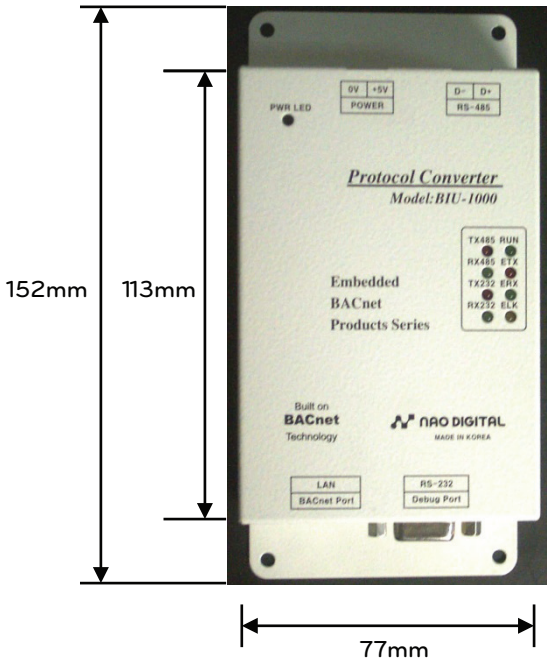
4-1-3. Optional parts related to controller

BACnet Converter

LG's controller basically supports Modbus communication protocol.

If the higher level communication protocol is BACnet, you need to apply a separate BACnet converter to the protocol conversion.

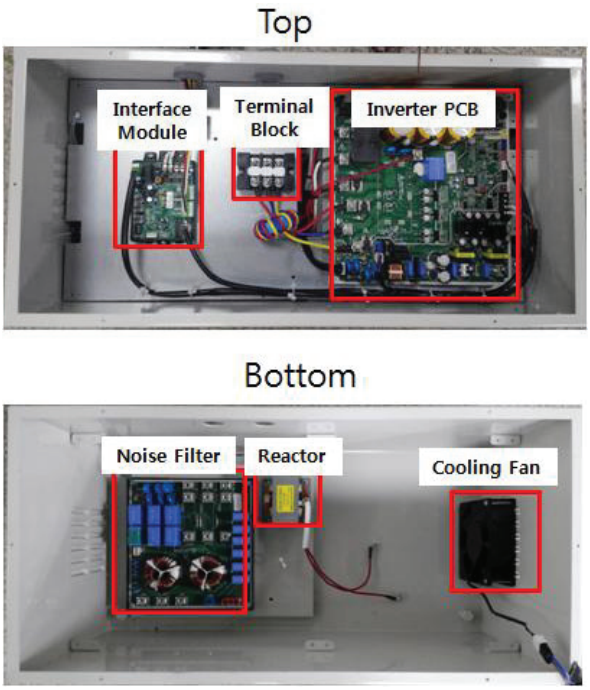
Communication converter is installed inside the control panel. Please refer to the following table for the meaning and description of each lamp.



LED Name	State	Description
TX 485	Flashing	Normal data communication with MICOM
RX 485	Off	Error, Check communication line
TX 232	Flashing	Normal data communication with BACnet
RX 232	Off	Error, Check communication line
RUN	Flashing every second	Board finished Power-on test, and in normal operating
	Maintaining On/Off	Error. Press the reset button or turn power off & reboot.
ETX	LED on at Ethernet Line	ELK is always on when LAN cable is connected. ERX flashes on data reception. ETX flashes on data transmission.
ERX		
ELK		

4-1-4. Absorption solution pump #1 inverter

Inverter Panel

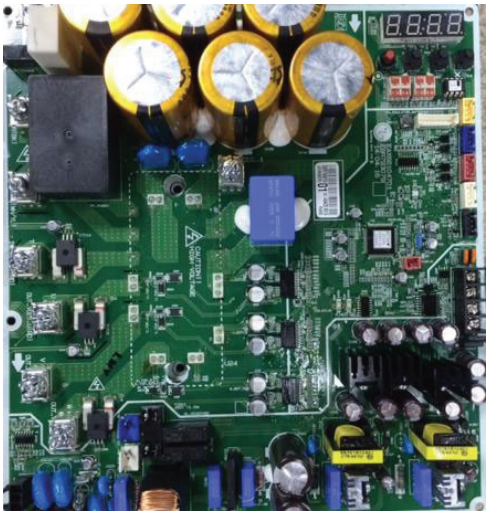


Setting of rated current for an absorptions solution pump

The rated current for an absorption solution pump should be set correctly to be able to run the absorption solution pump normally.

It is possible to set the rated current for an absorption solution pump 1 using the 'DIP_SW" on the inverter PCB.

Please set the pump capacity referring to the followings.



<Inverter PCB>

<DIP_SW>

Setting of rated current for an absorption solution pump

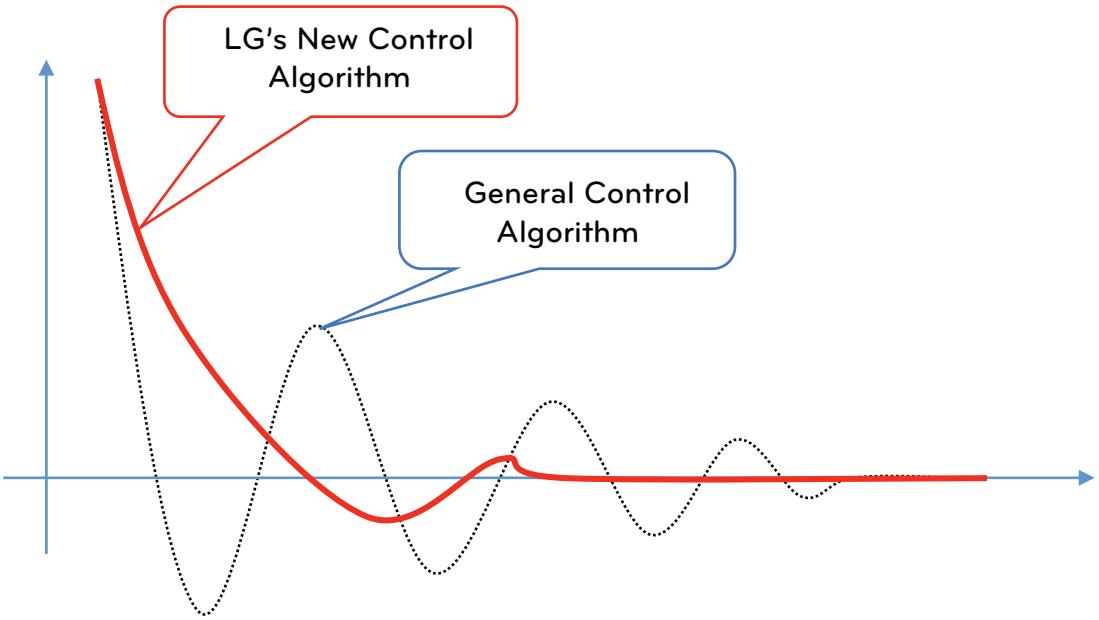
380 Vac					
NO	정격전류 (A)	DIP SW	NO	정격전류 (A)	DIP SW
1	3.6		9	9.0	
2	5.2		10	10.3	
3	5.4		11	11.0	
4	6.0		12	11.5	
5	6.4		13	12.0	
6	7.0		14	15.0	
7	7.5		15	16.0	
8	8.7		16	16.2	
440 Vac					
NO	정격전류 (A)	DIP SW	NO	정격전류 (A)	DIP SW
17	3.1		25	7.8	
18	4.5		26	8.9	
19	4.7		27	9.5	
20	5.2		28	9.9	
21	5.5		29	10.5	
22	6.0		30	13.0	
23	6.5		31	13.8	
24	7.5		32	14.0	

CAUTION

The product will run normally once the Dip S/W is set according to the pump rated current.
If the rated current for the pump is set wrong, it can cause an abnormal noise of motor, vibration and damage
Check always for the correct set of the capacity before applying power.

4-2. Basic control algorithm

Unique P(proportional), I(integral), and D(differential) algorithms are applied to cooling water temp. control, and compared to the existing method, it enables optimal control by minimizing time to approach the target value, and minimizes the remaining deviation, under-shoot and over-shoot during initial start-up and automatic/manual conversion of control valve operation.



Soft Loading

- Approaches to the control target value with Soft start-up
- Eliminate unnecessary abnormal stop caused by the rapid valve opening phenomenon occurring in the start-up period.

Advanced Control

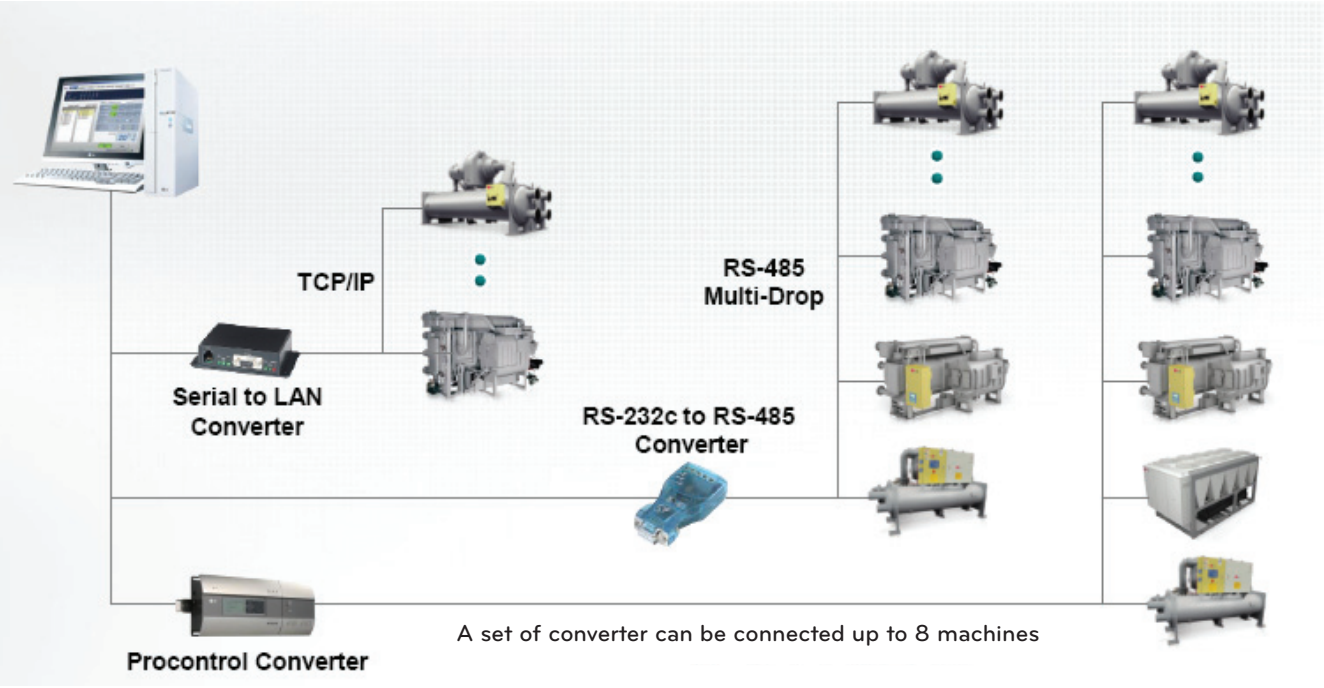
- Realization of high precision control by the advanced high class control algorithm development compared to the existing PID control method
- Prevention of Temp. Cycling due to Overshoot/Undershoot during the conversion from manual to automatic mode
- Intensive safety control
  : By executing preventive control before chiller reaches abnormal stop point, unnecessary stops of the chiller are minimized.

4-3. BMS Supporting feature

Absorption chiller's basic communication protocol is Modbus protocol, and it can be compatible with high level communication methods.

Communication protocol support

- Communication method
  - Basic: RS-485
- Protocol
  - Basic: MODBUS
  - Option: BACnet, TCP/IP



4-4. Controller screen (product functions)

Controller menu composition (user setting)

User set
Run mode set
Chilled water temperature P
Chilled water temperature I
Chilled water temperature D
Auto run temperature (set value+) (cooling)
Auto stop temperature (set value-) (cooling)
Anti-freeze Use function
Anti-freeze operation temperature
Control valve upper limit
Cooling water inlet temperature
Cooling water temperature P
Cooling water temperature I
Cooling water temperature D

Manual Control
Refrigerant pump stop

Scheduled run set
Scheduled operation pattern setting (run)
Scheduled operation pattern setting (stop)
Scheduled operation pattern setting (temperature)

System information
Input status
Output status
Timer check
Operation information saving frequency
Communication address (machine number)
Communication speed
Select language
Select the temperature unit
Select the pressure unit
Select the flux unit
Screen brightness control

System information(input)
Exhaust fan interlocking
Remote Run signal
Absorption solution pump #1 over current
Absorption solution pump #2 over current
Chilled water flux normal contact
Cooling water flux normal contact
Chilled water pump interlock
Cooling water pump interlock
Absorption solution pump #1 state
Absorption solution pump #2 state
Warning_Low Shell Pressure
Refrigerant pump over current
Purge pump over current
High temp. regenerator flux low
High temp. regenerator pressure high
Firing compete
Abnormal Burner
Refrigerant pump operation
Purge pump operation
Purge pump operation pressure switch

System information (output)
Cooling Mode Status
Remote Mode Status
Chilled water pump operation
Cooling water pump operation
Cooling tower fan Run (CF-ON)
Exhaust fan operation (F-ON)
Absorption solution pump #1 Run (A1-ON)
Absorption solution pump #2 Run (A2-ON)
Refrigerant pump operation
Purge pump operation
Buzzer
Run Status Lamp
Absorption solution pump 1 Run_Force
Abnormal status
External circuit power (stop)
Burner Run

System information (Timer)
Chilled water pump stop delay timer
Cooling water pump start delay timer
Flow Chatttering Ignore timer
Absorption solution pump #2 Run
Check firing complete
Refrigerant pump operation delay
Dilution Timrer #1
Dilution Timrer #2
Dilution Timrer #3
Low Fire Run timer
Cooling water low tempera-ture check timer
Operation time for crystallization prevention
High temp. regenerator flux low timer

Login management
Management No. 1
Management No. 2
Management No. 3
System setting password
Run Remaining time
Chilled/hot water inlet temperature sensor
Chilled/hot water outlet temperature sensor
Cooling water inlet temperature sensor
Cooling water outlet temperature sensor
Condenser refrigerant temperature sensor
High temp. regenerator temperature sensor
Low Shell Pressure
Purge Dev. Pressure
Chilled water flow sensor
Cooling water flow sensor
Remote temperature setting signal
Absorption solution pump #1 inverter
Exhaust Fan Interlock
Chilled water flow Contact
Cooling water flow Contact
Chilled water pump Interlock
Cooling water pump Interlock
Absorption solution pump #2 state
Hot water outlet temperature
Hot water Inlet temperature
Evaporator refrigerant temperature sensor
Absorber Liquid solution
Exhaust gas outlet temperature sensor
Steam pressure sensor
Current sensor
Voltage sensor
Power sensor
Medium hot water control valve
Steam Control Valve

Controller menu configuration (System setting)

Control information set
PID Control Period
Control temperature dead band
Model selection
Run Time Limit
Control valve control dead band
Cooling T PID Period
Soft Loading

Timer set
Chilled water pump stop delay timer
Cooling water pump start delay timer
Flow vibration ignore timer
Absorption solution pump #2 operation
Refrigerant pump operation delay
Low Fire Control
Auto purge valve delay timer
Cooling water low Temperature check timer
Operation time for crystallization prevention

Abnormal Condition set
Low Chilled water pump temp. low
Hot water temp. high
High temp. regenerator temperature high in heating
Cooling water inlet temperature low

Safety control setting
Soft loading frequency
Soft loading valve output
Rank up
Chilled/hot water control selection
Set value auto limit
Power interruption operation selection
High temp. regenerator temperature high control
Dilute start after power restoration
Preventing restart after power restoration
purging method selection
Select control valve
Purging operation pressure
Purging stop pressure
Purging alarm pressure
Storage pressure increasing time

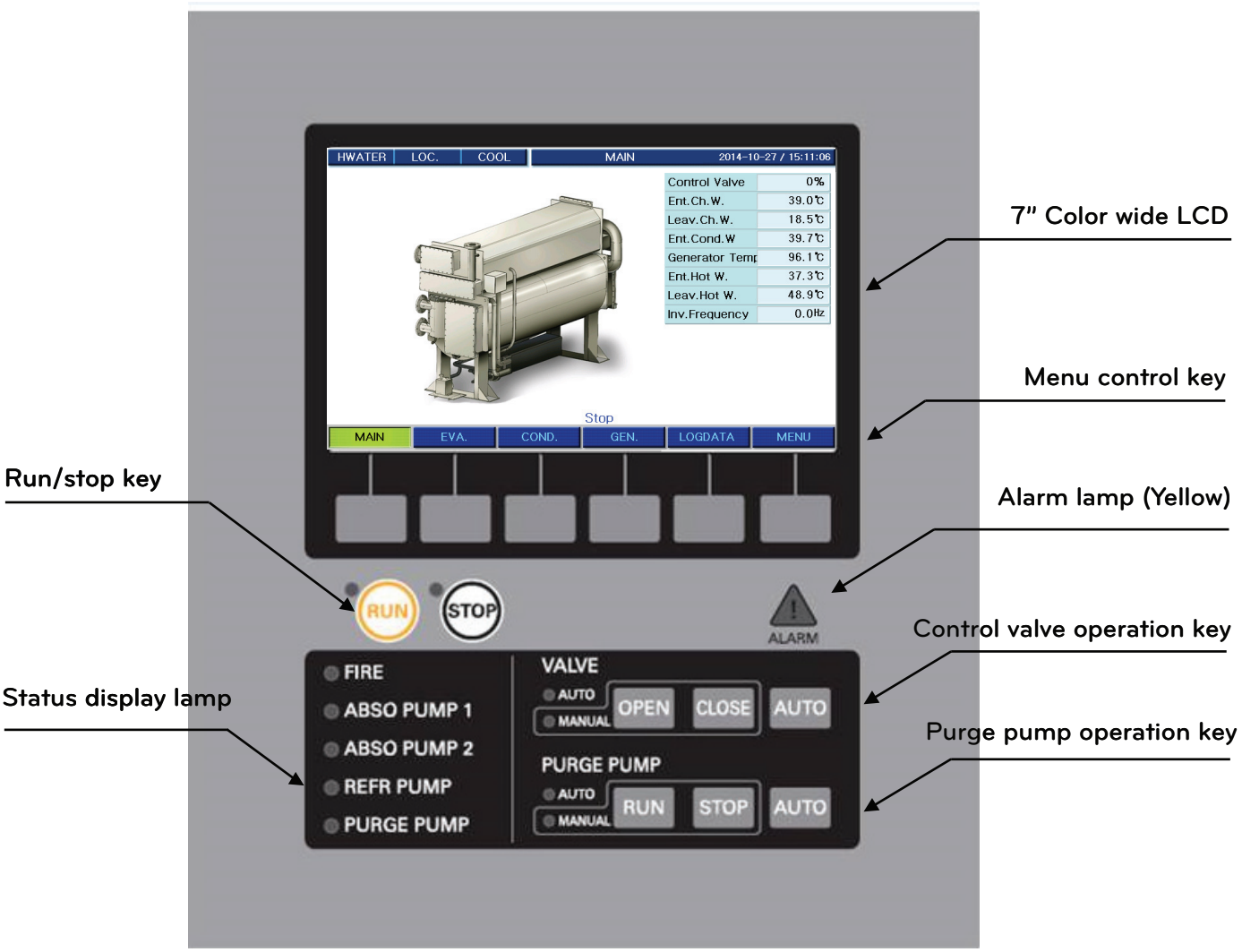
Control operation setting
Inverter control 1
Inverter control 2
Inverter control 3
Inverter control 4
Inverter control 5
Inverter control 6
Max. heat capacity control 1
Max. heat capacity control 2
Max. heat capacity control 3
Max. heat capacity control 4

Sensor offest
Chilled/hot water inlet temperature sensor
Chilled/hot water outlet temperature sensor
Cooling water inlet temperature sensor
Cooling water outlet temperature sensor
Condenser refrigerant temperature sensor
High temp. regenerator temperature sensor
Low shell pressure sensor
Purge Dev. Pressure
Chilled water flux sensor
Cooling water flux sensor
Remote temperature setting signal
Steam control valve
Absorption solution pump #1 inverter
Hot water outlet temperature sensor (80°C)
Hot water inlet temperature sensor (80°C)
Low temp. regenerator temperature sensor
Evaporator refrigerant temperature sensor
Absorber dilute solution temperature sensor
Exhaust gas(drain) temperature sensor
Steam pressure sensor
Current sensor
Voltage sensor
Power sensor
Hot water control valve
Exhaust gas control valve

Sensor setting
Low shell pressure sensor
Purge Dev. Pressure
Chilled water flux sensor
Cooling water flux sensor
Remote temperature setting signal
Steam control valve
Absorption solution pump #1 inverter
Steam pressure sensor
Current sensor
Voltage sensor
Power sensor
Medium hot water control valve
Exhaust gas control valve
Offset setting mode
Control valve minimum
Control valve maximum
Control valve AD value
Min. value setting / Max. value setting

Controlling of menu and the names of control panel part

The display device of the control unit for the absorption chiller is composed of the basic screen where the current condition of the chiller can be checked, the main menu that provides user's convenience such as user's setting and error/warning information, and the system menu where sensor settings and system related settings can be made.



CAUTION

Do not operate controller with a sharp object.
It may cause controller damage.

Name of the control part

LCD screen

It is the LCD screen displaying the operation information and the status of the chiller in text (Korean, English and Chinese) or graphical animation.

Menu Control Key

These are keys to select the menu on the screen such as selection of sub-menu and operation conditions. The functions keys at the bottom screen change depending on the selected mode.

Control valve manual control key

It opens and closes the control valve manually. Manual control of the control valve is possible only when the " Control valve Manual" lamp is on. Open/Close keys operate only while pressed.

Purge pump manual control key

It is the key to operate the purge pump manually run/stop. It is manually operable when “purge pump manual” indicator lamp is ON, and it runs when RUN button is pushed.

Alarm Lamp

It is activated on the condition of abnormality or cautious status. If this is activated, an alarm message explaining the status is displayed on the message line. When alarm is activated, Cancel key is also displayed with buzzer sound. If the Cancel key is pressed, the buzzer sound will stop as the Cancel key disappears.

And If the cause of the abnormality is taken care of, the message will also be disappeared.

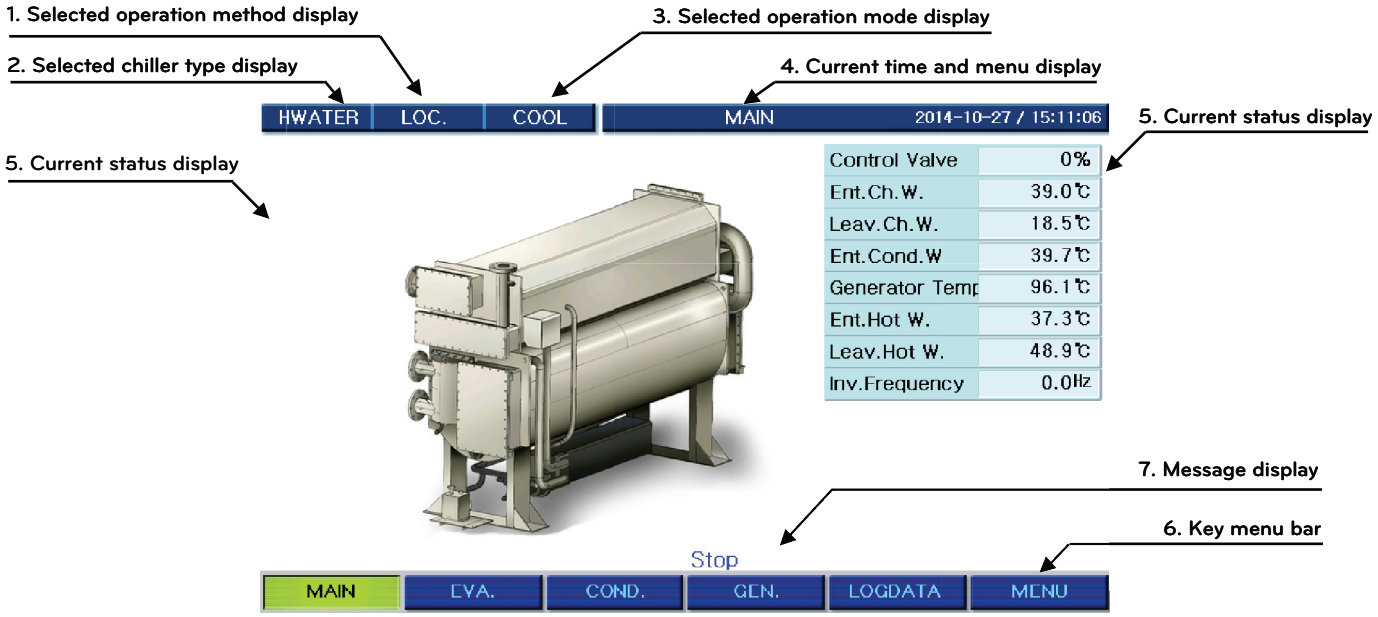
Run/Stop key

It is the key to run or stop the chiller. To activate this button, it should be pressed for more than 1.5 seconds. During the chiller operation, “Run” lamp is on, and when stopped, “Stop” lamp is on.

Status Indicating Lamps

These display the status of operation of the chiller and the devices attached on the chiller such as oil pump, oil heater and the flow condition of chilled & cooling water and the indicating lamps will be turned on when operating oil heater or pump.

Name of display part on Color LCD



1. Selected operation method display

   There are Local, Schedule and Remote modes selecting chiller operation method. That is, Local is to operate the chiller at the local place where the chiller is, Schedule to operate on the scheduled time and Remote to operate in a remote place. It indicates the current operation mode on the screen.

2. Selected chiller type display

   Chiller type can be selected among CH_60, CH_80, D_Steam, S_Steam and HWATER.

   (When one is selected, it automatically resets, and changes to the selected chiller mode.)

3. Selected operation mode display

   There is only the cooling mode for the air-conditioning chillers. Thus only Cooling mode will be displayed. If it is the chiller for low temperature, it will display Cooling and Icing according to the setting. (Refer to the user setting of main menu and control mode)

4. Current time display

   It displays current day, month, year, hour and minute information.

5. Current status display

   It displays current operation temperatures, pressures and other current status information of the parts

6. Key menu bar

   It displays the functions of menu control keys.

7. Message Display

   It displays Run/Stop, operation condition, abnormality/caution, etc.

vBasic screen

It is the screen displaying input value and calculated output status value of each sensor attached to the main body of the chiller. When the controller's power is on, it is displayed as the default screen initially.

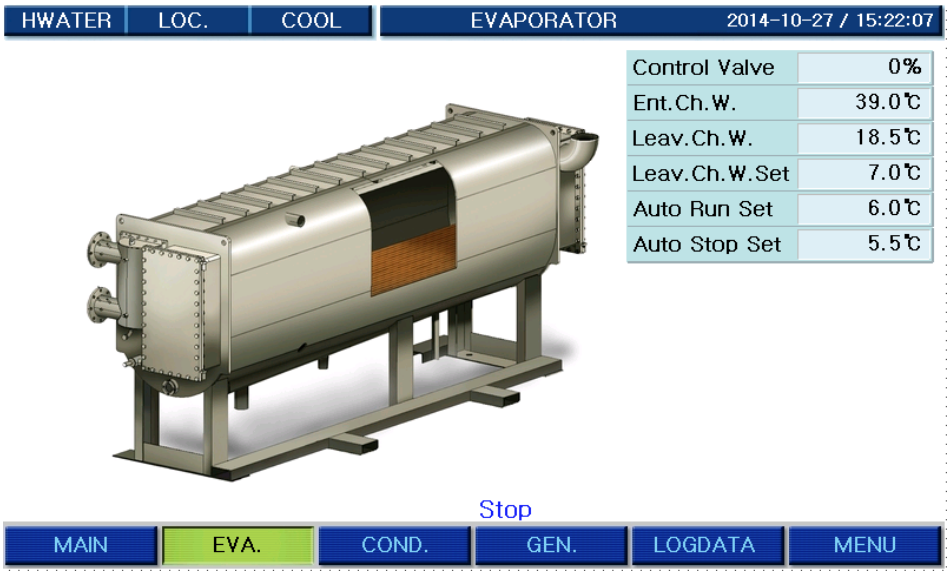
1. Main

※ Route : Press Main key.

' It shows the animation screen and the related data of the entire chiller. '

2. Evaporator

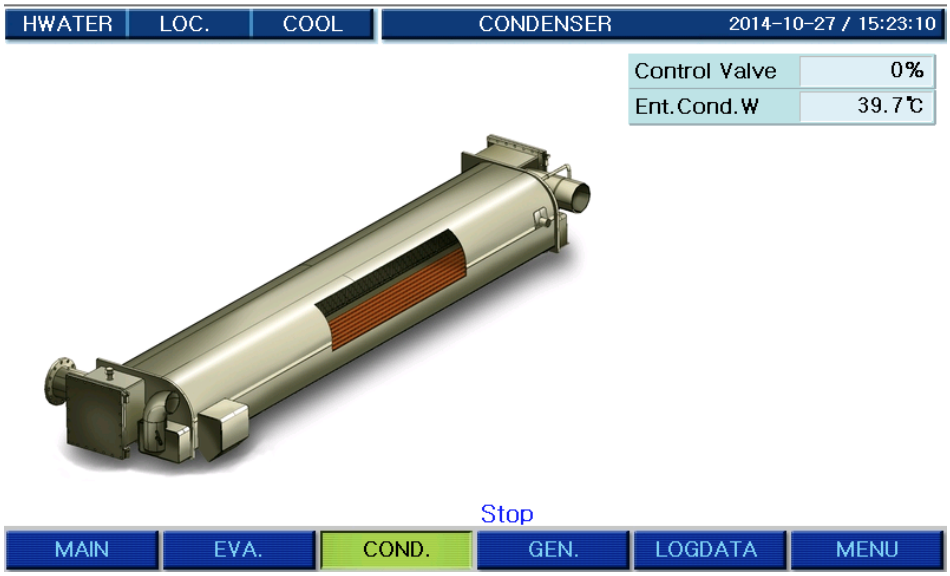
※ Route : Press Evaporator key.



' It shows the animation screen and related DATA of the evaporator.'

3. Condenser

※ Route : Press Condenser key.



'It shows the animation screen and the related data of the condenser.'

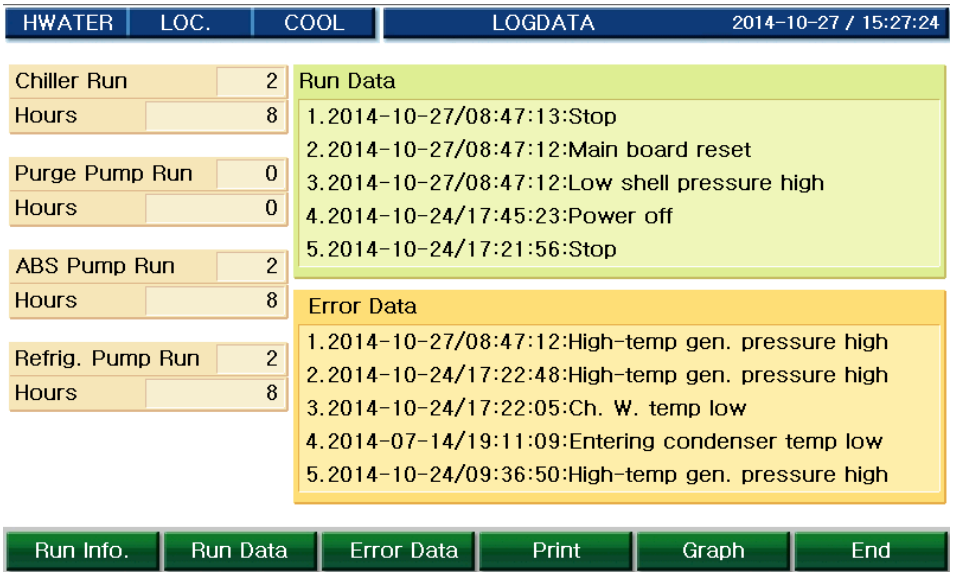
4. Regenerator

※ Route : Press Regenerator key.

' It shows the animation screen and the related data of the regenerator.'

5. History

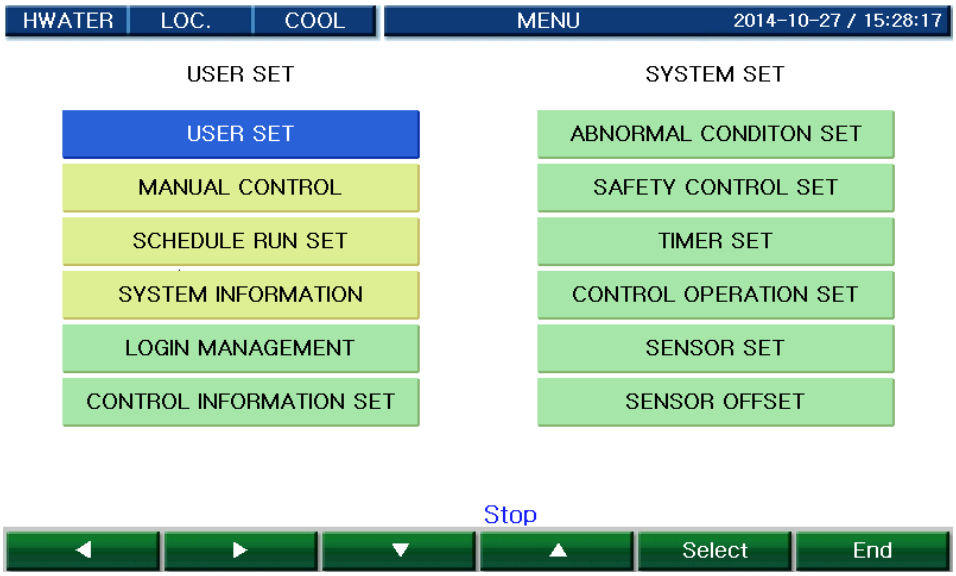
※ Route : Press history key.



' It shows operation information and error history data.'

6. Menu

※ Route : Press Menu key.



' It shows the menu screen.'

Screen display item list

√: Displayable item

No	Display item	Display Range	Chiller-haeater		Chiller		Remark
			Cooling	Heating	Double effect	Single effect	
1	Chilled water inlet temperature	-40~140°C	√	√ (60)	√	√	
2	Chilled water outlet temperature	-40~140°C	√	√ (60)	√	√	
3	Cooling water inlet temperature	-40~140°C	√		√	√	
4	Cooling water outlet temperature	-40~140°C	√		√	√	
5	Condenser refrigerant temperature	-40~140°C	√		√	√	
6	High temp. regenerator temperature	0~399.9°C	√	√	√	√	Note 2.
7	Hot water inlet temperature	-40~140°C		√ (80)		√	Note 1.
8	Hot water outlet temperature	-40~140°C		√ (80)		√	Note 1.
9	Low temp. regenerator temperature	-40~140°C	√		√		
10	Evaporator refrigerant temperature	-40~140°C	√		√	√	Option
11	Absorber dilute solution temperature	-40~140°C	√	√	√	√	Option
12	Exhaust gas temperature Vapor drain temperature	0~399.9°C	√	√	√		
13	Storage tank pressure	0~760mmHgA	√		√	√	Option
14	Purge device pressure	0~750mmHgA	√	√	√	√	Option
15	Remote temperature setting	0~5°C(Cooling)	√		√	√	Option
		0~ -10°C(Heating)		√			
16	Current	0~1999A	√	√	√	√	Option
17	Voltage	0~9999V	√	√	√	√	Option
18	Power	0~9999KW	√	√	√	√	Option
19	Chilled water flux / Hot water flux	0~3000 m^3/h	√	√	√	√	Option
20	Refrigerant flux	0~3000 m^3/h	√	√	√	√	Option
21	Control valve	0~100 %	√	√	√	√	
22	Control valve 2	0~100 %	√	√	√		Back-up
23	Absorption solution pump inverter frequency	0~60.0 Hz	√	√	√	√	Option
24	Control valve 1 output (Air pressure type)	0~100 %			√	√	Option

* Option : It is the item that is installed separately or customized in the production of the unit according to user's request. It may be modified upon the factory shipment or by an LG certified personnel.

Note

1. For single effect utility medium hot water, it is applied as standard, for single effect utility steam, it is applied as option.
2. It is displayed as the temperature of regenerator in the signle effect utility chiller.

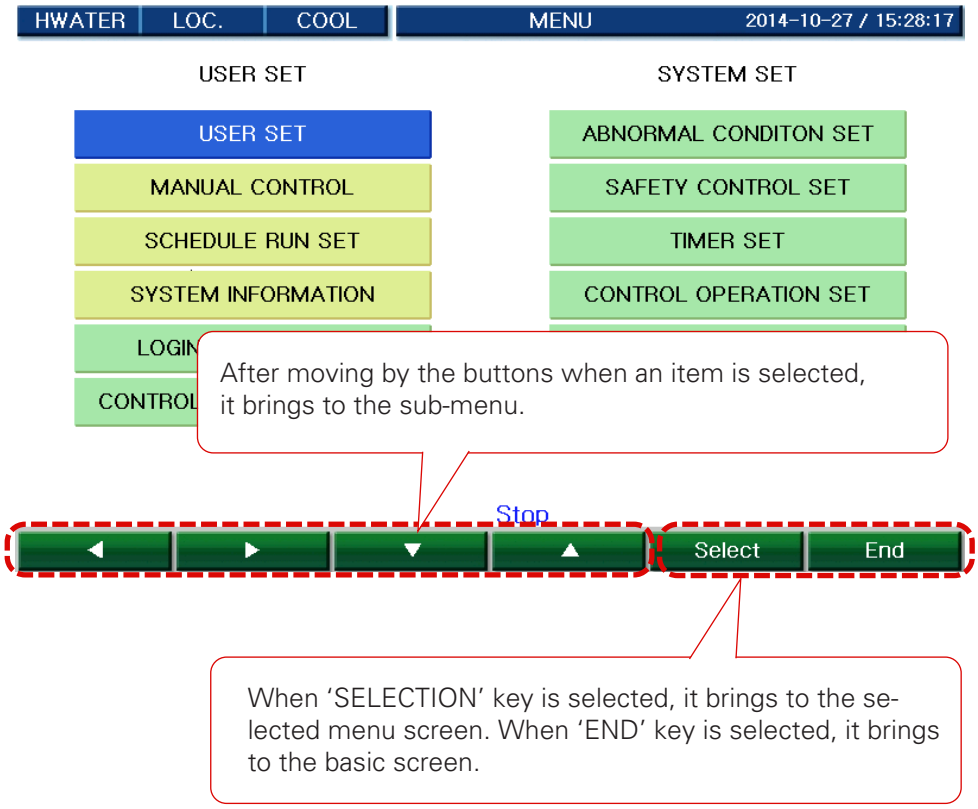
Main menu

Main menu mainly has user 's setting and system setting as in the following figure.

- Users can set user's setting, dual setting, schedule setting and system information.
- Account management, sensor calibration, control information setting, abnormal condition setting, safety control setting, timer setting, control calibration setting and sensor setting, can only be set by system manager with password input.

1. Menu screen

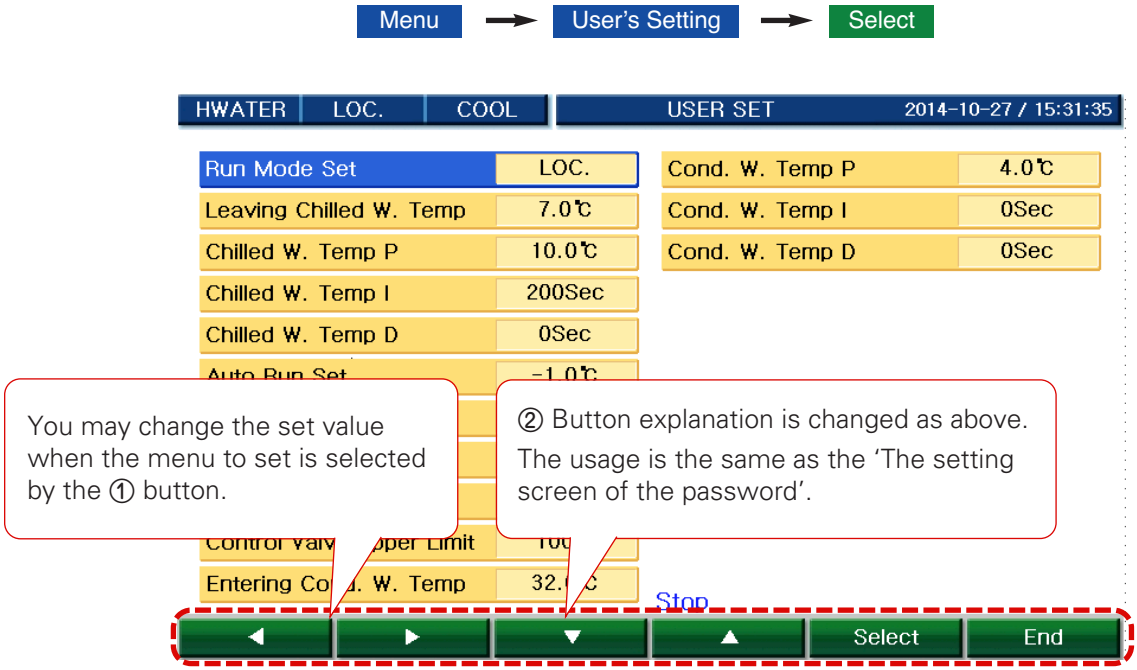
※ Route : Press **Menu** key.



• Main menu category detail

Displayed items	Usage
USER'S SETTING	It is the menu for users to set values required for chiller operation such as control target temperature, PID value, etc.
MANUAL OPERATOIN	It is the menu where the manual operation of the refrigerant pump is enabled.
SCHEDULED RUN SETTING	It is the menu to set time for chiller to automatically start/stop at the designated time and the temperature for each time period.
SYSTEM INFORMATION	It is the menu to check the overall system information such as input/output timer operation check, version check, present time, operation information saving cycle, communication address, communication speed, language setting or type selection.
ACCOUNT MANAGEMENT	It is the menu to change password and management number.
CONTROL INFORMATION SETTING	It is the menu to set the most basic information in the chiller operation.
ABNORMAL CONDITON SETTING	It is the menu to set abnormal stop conditions of the chiller.
SAFETY CONTROL SETTING	It is the menu to set categories related to safety control to prevent abnormal stops during operation.
TIMER SETTING	It is the menu to set the timer for the major sequences.
CONTROL CALC. SETTING	It is the menu to set the categories that is used in the calculation of inverter and max. heat capacity.
SENSOR SETTING	It is the menu to set 4~20mA sensor setting and control valve.
SENSOR CALIBRATION	It is the menu to calibrate each sensor.

2. USER'S SETTING



User's setting

Operation mode setting screen consists of the menu for selecting the operation mode of Local, Timer, Reserved and Remote, and operation type selection for Icing or Cooling. Note that, "operation mode selection" menu is displayed only when Icing mode is set.

OPERATION MODE selection

- Local: To run and stop the chiller at the local site where the chiller is installed using Run/Stop switch on the controller.
- Remote : To run and stop the chiller at a remote place like site office or automatic control panel using remote Run/Stop signals(no voltage contact signals: switch, relay contact signals)
- Schedule: To run and stop the chiller automatically on the basis of the scheduled program by the user's setting at the 'Scheduled operation setting' that sets the time and temperature for the run and stop of the chiller at the controller. (Refer to the "Scheduled operation setting")

CONTROL MODE selection

This menu can be used when it is installed in a chiller manufactured for chilled and hot water with heating operation available.

Cooling: It is the chiller operation mode cooling at the room temperature(7~12°C).

Heating: It is the chiller operation mode heating by hot water(60~75°C).

Other settings

It is the menu to set values needed for the chiller operation and its initial conditions.

Move to the category where to set by pressing MENU selection bar and SELECT key for selection. Then the menu will be changed to arrows of; previous, next, down and up by which you can move to the item to set with the cursor flashing.

Designate the digit by Previous or Next key, change the value by Up or Down key, and press SELECT key to set the value.

Setting display screen

<User's setting screen category>

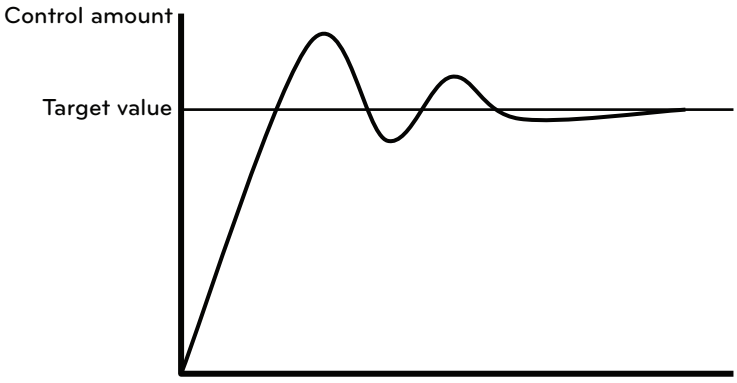
Categorym	Setting range	Standard set value	Setting unit	Time possible to set
Operation mode setting	Local/Remote/ Scheduled	Local	-	During stop
Chilled water outlet temperature	3.0°C~ 20.0°C	7.0°C	0.1	Note 0
Chilled water temperature P	1.0°C~ 30.0°C	10.0°C	0.1	Always
Chilled water temperature I	0 sec.~ 3600 sec.	200sec	1	Always
Chilled water temperature D	0 sec.~ 360.0 sec.	0sec	0.1	Always
Auto run setting	-5.0~5.0	-1	0.1	Always
Auto stop setting	-5.0~5.0	-1.5	0.1	Always
Anti-freezing operation function	Use / not in use	Not in use	0.1	When cooling Note 1
Anti-freezing operation temperature	0.0~10.0	3	0.1	
Control valve upper limit	0~100	100	1	Always
Cooling water inlet temperature	10.0°C~ 50.0°C	32.0°C	0.1	Always
Cooling water temperature P	1.0°C~ 30.0°C	4.0°C	0.1	Always
Cooling water temperature I	0 ~ 3600 sec.	0sec	0	Always
Cooling water temperature D	0 ~ 360.0 sec.	0sec	0	Always
Chilled water inlet temperature	3.0°C~ 50.0°C	7.0°C	0.1	Note 2

* Note 0. Displays hot water outlet temperature when the chiller is heating.
  Note 1. Available in cooling. Temperature can be set when using anti-freezing operation feature.
  Note 2. Safety control setting when chilled water inlet temperature control is used.

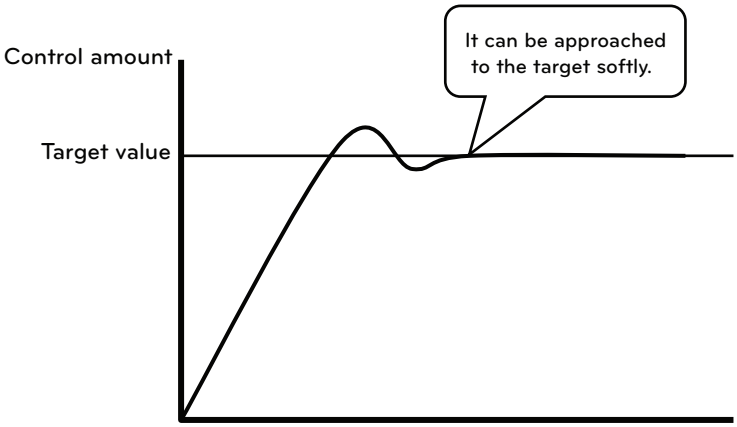
PID temperature control

Unique P(proportional), I(integral), and D(differential) algorithms are applied in controlling chilled water temperature. Comparing to the existing method, it has optimized the control by minimizing time to approach the target value, remaining deviation and under-shoot and over-shoot during the initial start-up and automatic/manual conversion of vane operation.

- Existing control method



- LG new P.I.D control



1. Chilled water outlet temperature

   It is the Menu to set chilled water outlet P.I.D control temperature during cooling operation. It is the set temperature that becomes the control target value in the PID control calculation. *If it is set in Reserved operation mode, this category will not be displayed.*

2. Chilled water temperature P value (proportional)

   It sets the proportional control range of P value which is used to control PID of the chilled water temperature during cooling operation.

3. Chilled water temperature I value (integral)

   It sets the integral control range of I value which is used to control PID of the chilled water temperature during cooling operation.

4. Chilled water temperature D value (derivative)

   It sets the derivative control range of D value which is used to control PID of the chilled water temperature during cooling operation.

5. Hot water outlet temperature - Heating

   It is the menu to set the control of the outlet temperature in heating mode.

Cooling tower fan control

It is the operation method provided for cooling tower fan control for stable cooling water inlet temperature control.
Standard type provides start/stop function for 1 cooling tower fan connected to the chiller control panel.

CAUTION

Set after checking the specifications of the cooling tower fan motor maker.

If cooling tower is connected to the controller, check and set the possible number of operations per day and times possible for reactivation of the cooling tower fan motor. If it is not set correctly, operation may stop due to damage and overheating of the cooling tower fan motor.

Control valve upper limit

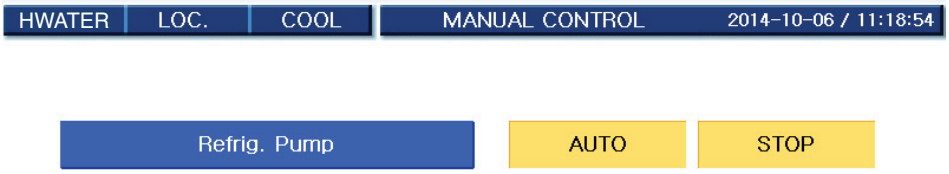
It is the function to limit the chiller load intentionally. It limits the opening of the control valve within the set value.

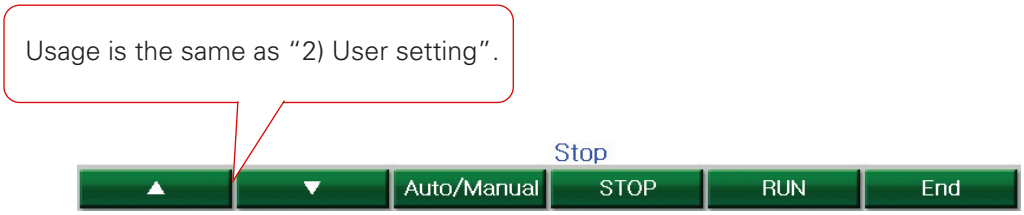
Freezing prevention operation function

It prevents freeze rupture during stop when the exterior temperature is low by operating the chilled water pump below the set temperature of freezing prevention operation if the function is set under the condition of possible freeze rupture.

Manual operation

※ Route : Menu → Manual operation → Select

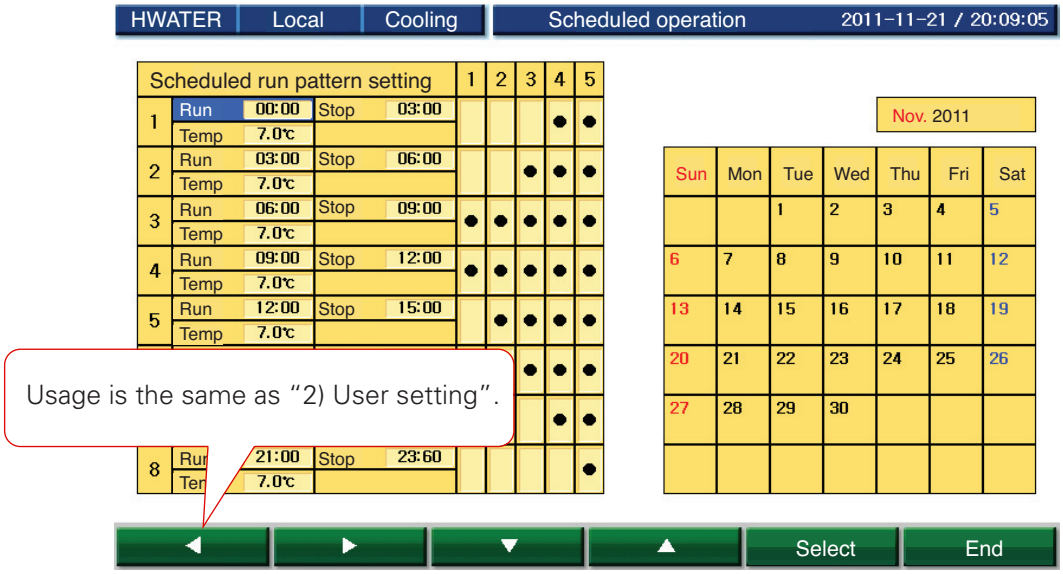




It is the screen where the refrigerant pump can be operated manually.

Scheduled operation setting

※ Route : Menu → Scheduled operation → Select



' Please refer to the example) for the setting.'

Example)

① 8 patterns for scheduled operating are available. (Setting values of run/stop time, temperature and current)

② Pattern applications are classified to total of 5 types.

③ Select the day for scheduled operation in the calendar screen, and select one out of the "5 types".

► Explanation for setting scheduled operation for the example

① 2009. 8. 1: 06:00 RUN / 09:00 STOP, 09:00 RUN/ 12:00 STOP

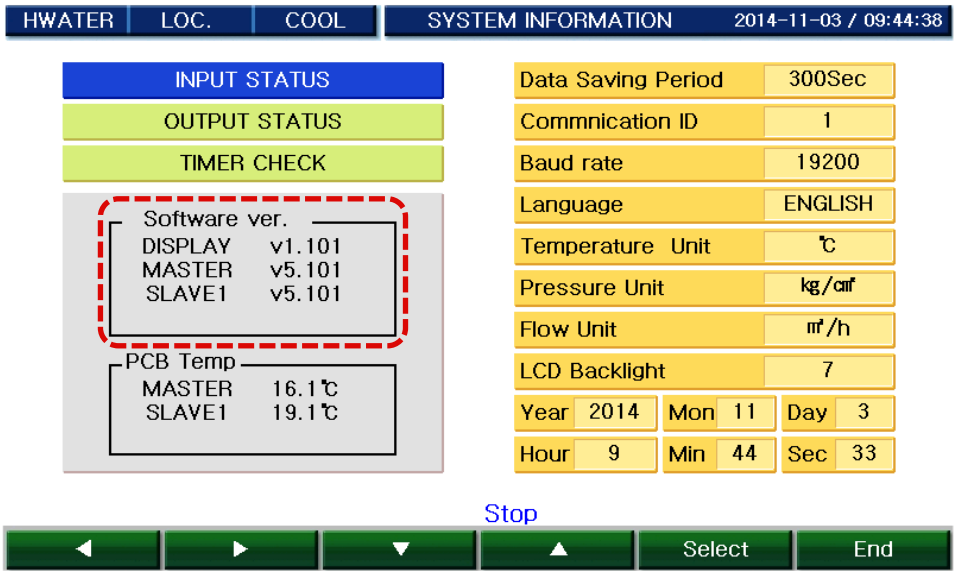
② 2009. 8. 9: 06:00 RUN / 09:00 STOP, 09:00 RUN/ 12:00 STOP
12:00 RUN/ 15:00 STOP, 15:00 RUN/ 18:00 STOP

You can set run/stop time, day, and control temperature in each step.

Confirm whether the current day and time are correct at the User's setting page.

System Information

※ Route : Menu → System Information → Select



It is the screen displaying the version of the program (Master, Slave and Display) applied to the controller. The "Program version number" is displayed here for the follow-up management, and it is useful when an error occurred in the controller.

Year, month, day, day of week, hour, minute, second

It is the place to set the date and time. They will be the standard for information save time, problem/caution occurrence time and scheduled operation time. It is the time that will be the standard for controller operation. Thus, please check if there is any deviation with the current time and correct if there is.

Run information saving frequency

It is the menu to set the frequency for saving the running information. Run information is the of sensor measurement values displayed on the basic screen, and is saved on every set time during the chiller operation. However, an error related information is saved immediately in the controller memory as soon as it occurs regardless of the saving cycle.

Screen brightness adjustment

It is the menu to adjust LCD brightness. You can control the brightness of LCD by pressing up and down buttons. Up to brighten screen and down to darken. Pressing 'End' key will end the screen brightness adjustment.

Baud rate setting

It is the place to set the baud rate to one of 9,600bps, 19,200bps or 38,400bps.

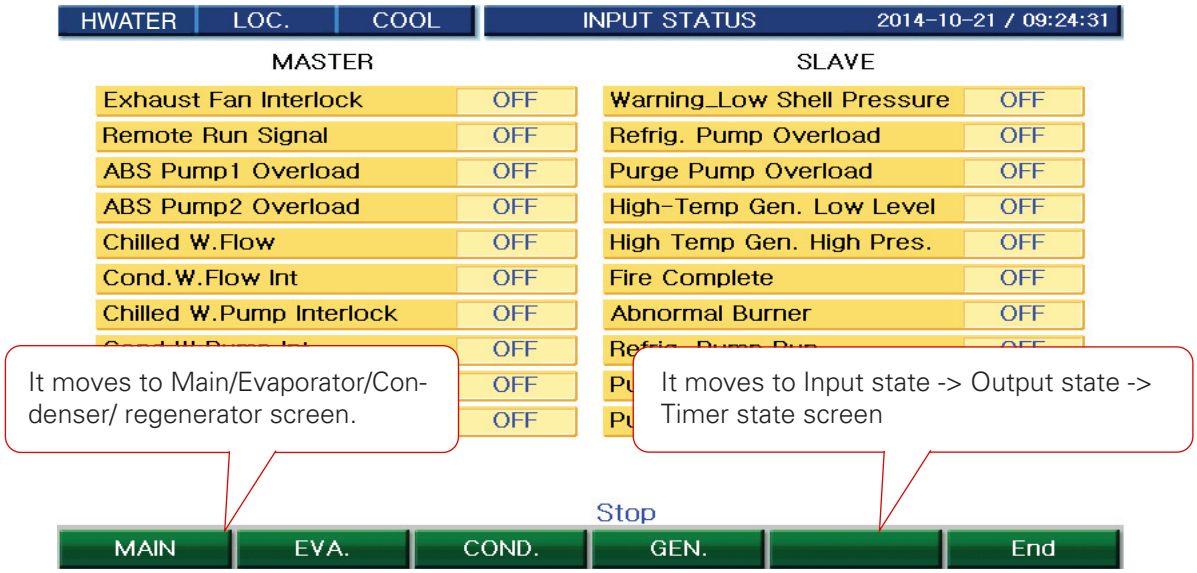
Check input status

It shows the status of the digital input port as ON (closed circuit) or OFF (open circuit).

It is the menu to check the status of the input signal contact connected to the control panel of the chiller. When checking the digital input status, make sure to check the control circuit diagram so as other signals not to be connected to the controller's input terminal.

If the connections are mixed with other signal lines, the controller PCB may be damaged.

※ Route : Menu → System Information → Check input status → Select



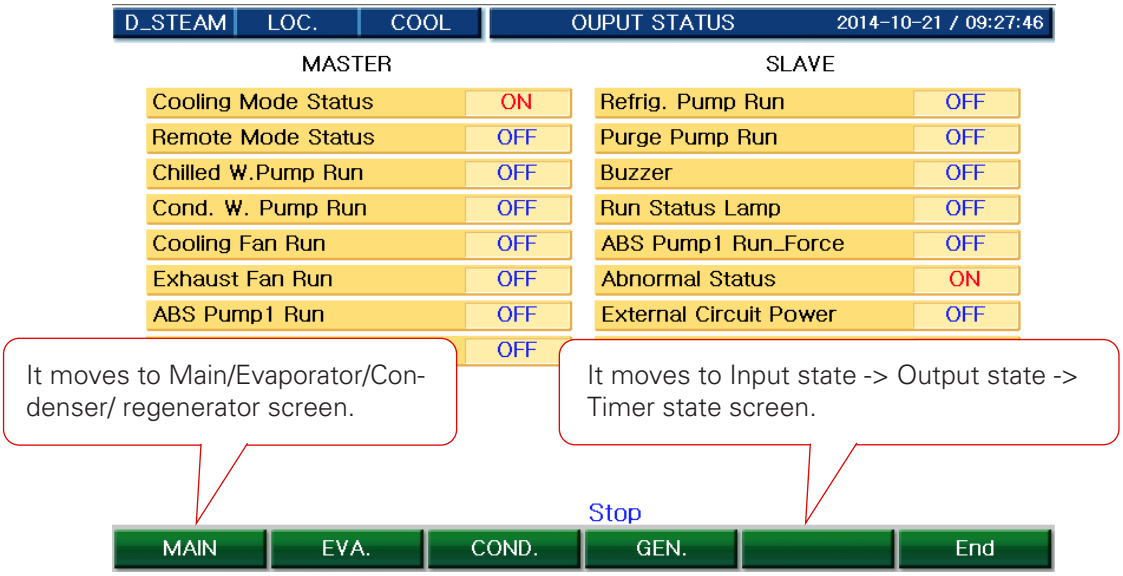
<Digital Input display categories>

Display category	Display state	Contact action status	Remark
Ventilation fan interlock	ON/OFF	When fan is operated: Circuit closed	
Remote operation signal	ON/OFF	When operated by remote control: Circuit closed	
Absorption solution pump #1 over current	ON/OFF	Over current: Circuit closed	
Absorption solution pump #2 over current	ON/OFF	Over current: Circuit closed	
Chilled water flux normal contact	ON/OFF	Flux normal: Circuit closed	
Cooling water flux normal contact	ON/OFF	Flux normal: Circuit closed	
Chilled water pump interlock	ON/OFF	When pump is running: Circuit closed	
Cooling water pump interlock	ON/OFF	When pump is running: Circuit closed	
Absorption solution pump #1 state	ON/OFF	When pump is running: Circuit open	
Absorption solution pump #2 state	ON/OFF	When pump is running: Circuit closed	
Storage tank pressure alarm	ON/OFF	Pressure increase: Circuit open	
Refrigerant pump over current	ON/OFF	Over current: Circuit closed	
purge pump over current	ON/OFF	Over current: Circuit closed	
High temp. regenerator flux low	ON/OFF	Regenerator flux low: Circuit open	
High temp. regenerator pressure high	ON/OFF	Regenerator pressure high: Circuit open	
Firing complete	ON/OFF	When firing is successful: Circuit closed	
firing failure	ON/OFF	When burner is abnormal: Circuit closed	
Refrigerant pump run	ON/OFF	When pump is running: Circuit closed	
purge pump run	ON/OFF	When pump is running: Circuit closed	

Check output status

It displays the ON (=close) or OFF (=open) status of digital output port along with the analog output status. This menu displays the output status by internal calculation in the controller, and it is composed to be able to check the output result of the controller calculation. If the actual output status is different from the one in the menu, you should check the status of controller I/O board and its wiring.

※ Route : Menu → System Information → Check output status → Select



<Output display category>

Display category	Display state	Contact action status	Remark
Cooling display contact	ON/OFF	When cooling selected: Circuit closed	
Remote selection display	ON/OFF	When remote operation selected: Circuit closed	
Chilled water pump run	ON/OFF	When pump run: Circuit closed	
Cooling water pump run	ON/OFF	When pump run: Circuit closed	
Cooling tower fan run	ON/OFF	When fan run: Circuit closed	
Ventilation fan run	ON/OFF	When fan run: Circuit closed	
Absorption solution pump #1 run	ON/OFF	When pump run: Circuit closed	
Absorption solution pump #2 run	ON/OFF	When pump run: Circuit closed	
Refrigerant pump run	ON/OFF	When pump run: Circuit closed	
purge pump run	ON/OFF	When pump run: Circuit closed	
Buzzer	ON/OFF	When buzzer alarms: Circuit closed	
Operation status display	ON/OFF	When in operation: Circuit closed	
Absorption solution pump forced operation	ON/OFF	When forced operation: Circuit closed	
Display of abnormal status	ON/OFF	When abnormal occurs : Circuit closed	
External circuit power	ON/OFF	External circuit power: Circuit closed	
Combustor run	ON/OFF	When combustor run: Circuit closed	

☞ ON : Relay Close, OFF : Relay Open

Timer status check

It displays the operation status of various timers calculated in the controller.

This menu is designed for easier view of the operation status. In this menu, you cannot set the timer.

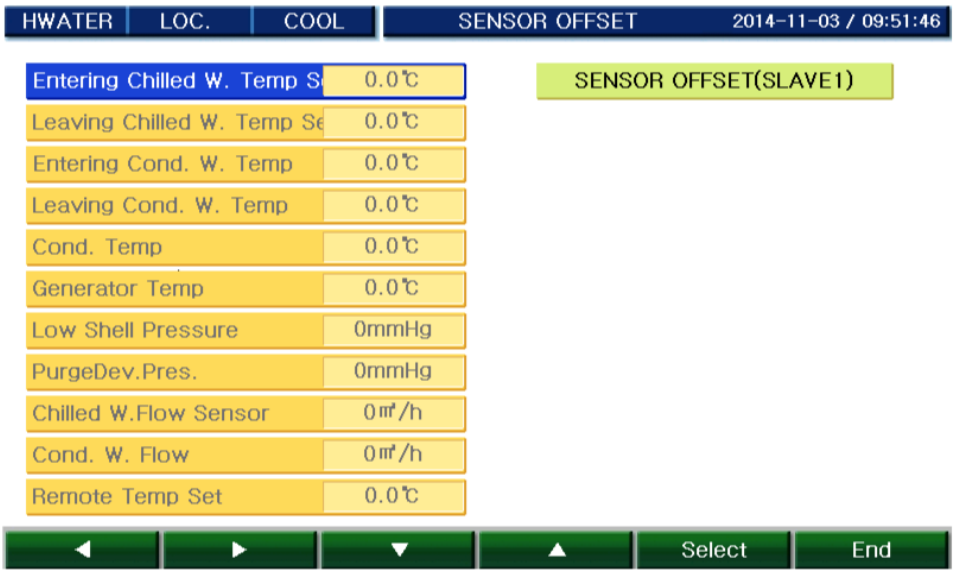
※ Route : Menu → System Information → Check timer → Select

<Timer display categories>

Sensor Calibration

Each sensor value can be calibrated. The calibration set boundary is -5~5°C for temperature, -2kg/cm^2~2kg/cm^2 for pressure, -50m^3/h~50m^3/h for flow rate, -200~200A/V/KW for current, voltage, and power.

※ Route : Menu → sensor offset → Selection



< Sensor off-set calibration categories >

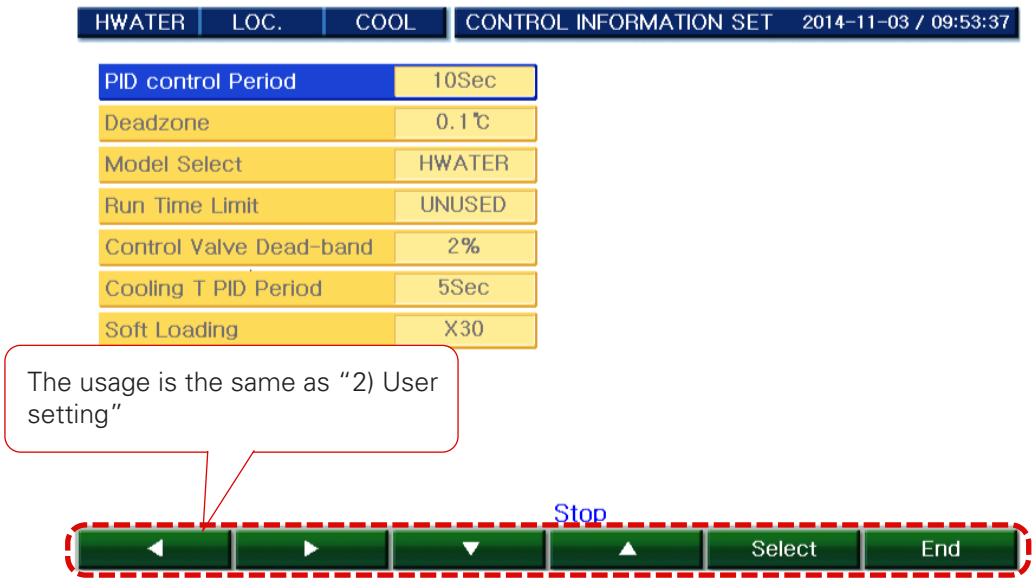
No	Set category	Setting range				Default value / unit	Remark
		Chiller		Chiller			
		Cooling	Heater	Double effect	Single effect		
1	Chilled/hot water inlet temperature	-5.0~5.0	X	-5.0~5.0	-5.0~5.0	0.0°C	
2	Chilled/hot water outlet temperature	-5.0~5.0	X	-5.0~5.0	-5.0~5.0	0.0°C	
3	Cooling water inlet temperature	-5.0~5.0	X	-5.0~5.0	-5.0~5.0	0.0°C	
4	Cooling water outlet temperature	-5.0~5.0	X	-5.0~5.0	-5.0~5.0	0.0°C	
5	Condenser refrigerant temperature	-5.0~5.0	X	-5.0~5.0	-5.0~5.0	0.0°C	
6	High temp. regenerator temperature	-5.0~5.0	-5.0~5.0	-5.0~5.0	-5.0~5.0	0.0°C	
7	Reservoir pressure	-50~50		-50~50	-50~50	0mmHgA	Option
8	Purge device pressure	-50~50	-50~50	-50~50	-50~50	0mmHgA	
9	Chilled water flux	-50~50	-50~50	-50~50	-50~50	0cm^3/h	Option
10	Cooling water flux	-50~50	X	-50~50	-50~50	0cm^3/h	Option
11	Remote temperature setting	-5.0~5.0	-5.0~5.0	-5.0~5.0	-5.0~5.0	0.0°C	
12	Hot water inlet temperature	X	-5.0~5.0	X	-5.0~5.0	0.0°C	
13	Hot water outlet temperature	X	-5.0~5.0	X	-5.0~5.0	0.0°C	
14	Low temp. regenerator temperature	-5.0~5.0	-5.0~5.0	-5.0~5.0	X	0.0°C	
15	Evaporator refrigerant temperature	-5.0~5.0	X	-5.0~5.0	-5.0~5.0	0.0°C	Option
16	Absorber dilute solution temperature	-5.0~5.0	-5.0~5.0	-5.0~5.0	-5.0~5.0	0.0°C	Option
17	Exhaust gas temperature	-5.0~5.0	-5.0~5.0	-5.0~5.0	X	0.0°C	
18	Steam pressure			-2~2	-2~2	0kg/cm^2	Option
19	Current	-200~200	-200~200	-200~200	-200~200	0A	Option
20	Voltage	-200~200	-200~200	-200~200	-200~200	0V	Option
21	Power	-200~200	-200~200	-200~200	-200~200	0KW	Option

Control information setting

This is the place to set values related to safety control of the chiller.

Move to the category where to set by pressing MENU selection bar and SELECT key for selection. Then, the key MENU will be changed to Previous, Next, Down and Up arrow by which you can move to the item to set where the cursor is flashing. Then designate the digit by Previous and Next key, change the value by Up and Down key, and press SELECT key will set the value.

※ Route : Menu → Control Information setting → Select



< Control information setting category >

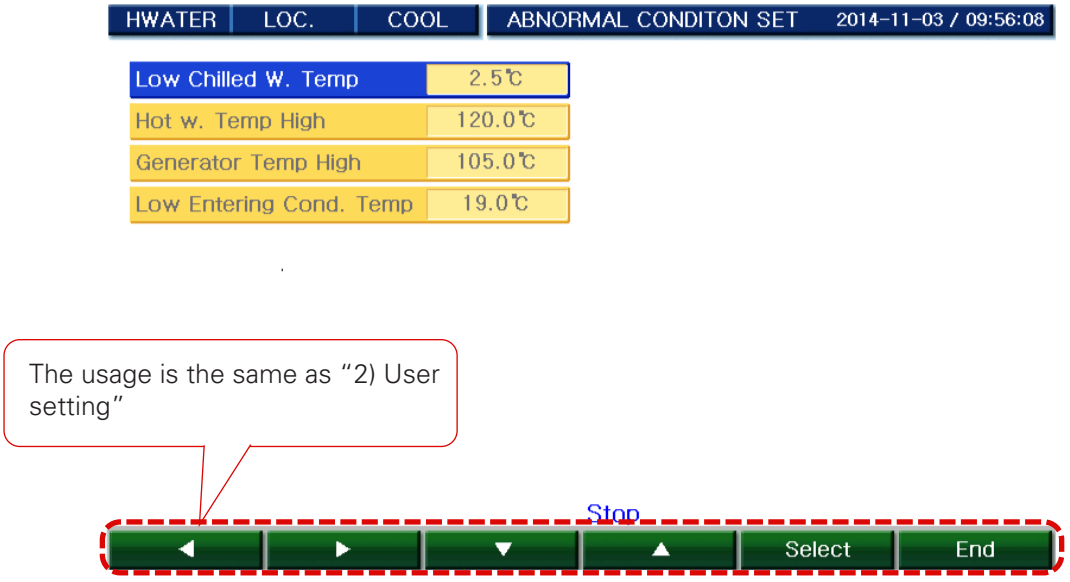
Display category	Display range	Default value (Standard setting)	Remark
Control calculation frequency	1~50	1 second	
Control temperature dead band	0~5	0.1°C	
Model selection	D_CH60/D_CH80/ D_STEAM/S_HWATER /S_STEAM	D_CH60	
Operation time limit setting	Use/Not in use	Use	
Control valve dead zone	0~10	2%	
Cooling tower PID calcula-tion cycle	1~600	5	
Select soft loading	X21~X30	X30	

Abnormal Condition Setting

This is the place to set the values related to abnormal stop of the chiller.

Move to the category where to set by pressing MENU selection bar and SELECT key for selection. Then, the key MENU will be changed to Previous, Next, Down and Up arrow by which you can move to the item to set where the cursor is flashing. Then designate the digit by Previous and Next key, change the value by Up and Down key, and press SELECT key will set the value.

※ Route : Menu → Abnormal condition setting → Select



<Abnormal condition setting category>

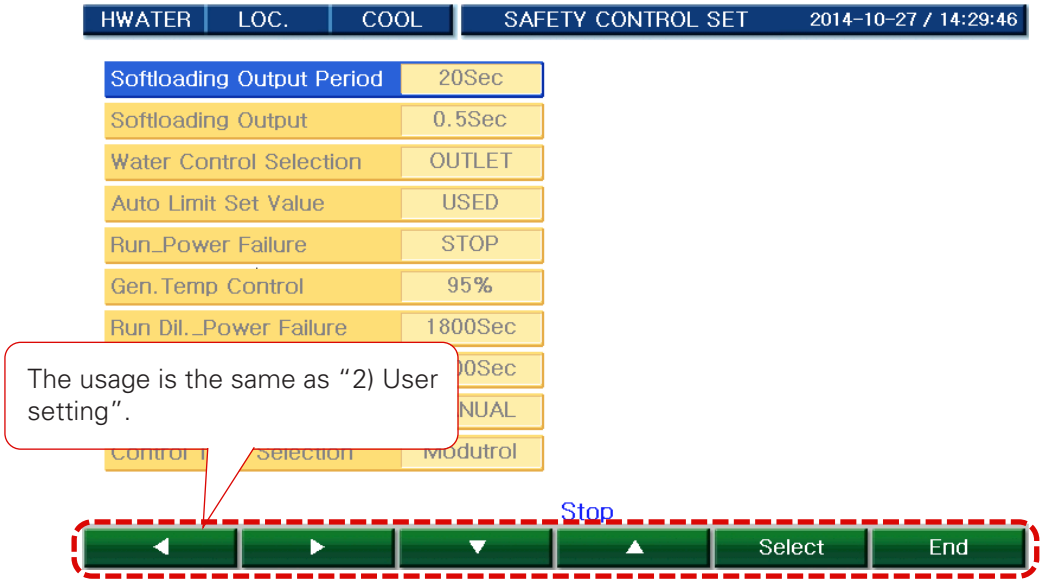
Display category	Display range	Default value (Standard setting)	Remark
Chilled water temperature lower limit	0~50	2.5°C	
Cooling High temp. regenerator temperature high (Heating High temp. regenerator temperature high)	50~200 (100~200) 50~150	165°C (130°C) 105°C	When cooling (when heating) Single effect chiller
Cooling water inlet temperature low	15~30	19°C	
Exhaust gas outlet temperature high	200~390	300°C	
Evaporator refrigerant temperature low	0~50	2.5°C	When using sensor
Chilled water flux low	0~2000	50m^3/h	When using sensor
Cooling water flux low	0~2000	50m^3/h	When using sensor
Voltage abnormal	5~20	10%	When using sensor
Current high upper limit	50~200	100%	When using sensor

Safety Control setting

This is the place to set values related to safety control of the chiller.

Move to the category where to set by pressing MENU selection bar and SELECT key for selection. Then, the key MENU will be changed to Previous, Next, Down and Up arrow by which you can move to the item to set where the cursor is flashing. Then designate the digit by Previous and Next key, change the value by Up and Down key, and press SELECT key will set the value.

※ Route : Menu → Safety control setting → Select



<Safety control setting category>

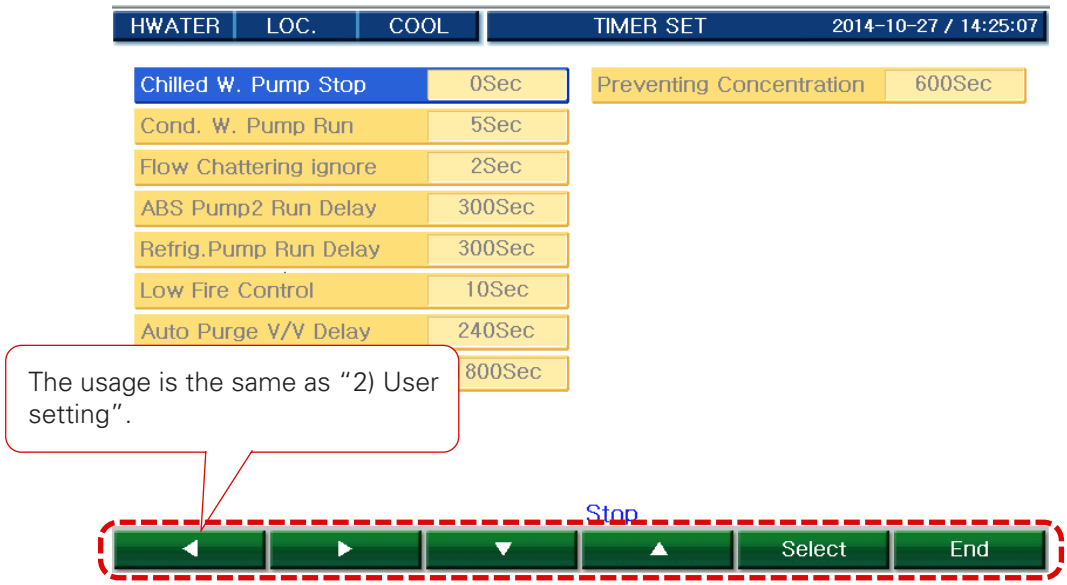
Display category	Display range	Initial value / unit	Remark
Softloading cycle	1.0~60.0	20.0 sec	
Softloading output	0.5~60.0	0.5 sec.	
Chilled water control selection	Outlet/inlet	Outlet	
Set value auto limit	Use/not in use	Use	When cooling
Power interruption operation selection	Re-startup/stop	Stop	
High temp. regenerator high temperature control	0~100	90%	
Dilute startup after power restore	0~3600	1800 sec.	
Prevent startup after power restore	0~10000	3600 sec.	
Control valve selection	Modutrol / Air-pressure type / P	Modutrol	

Timer setting

This is the place to set the values related to timer required for chiller operation.

Move to the category where to set by pressing MENU selection bar and SELECT key for selection. Then, the key MENU will be changed to Previous, Next, Down and Up arrow by which you can move to the item to set where the cursor is flashing. Then designate the digit by Previous and Next key, change the value by Up and Down key, and press SELECT key will set the value.

※ Route : Menu → Timer setting → Select

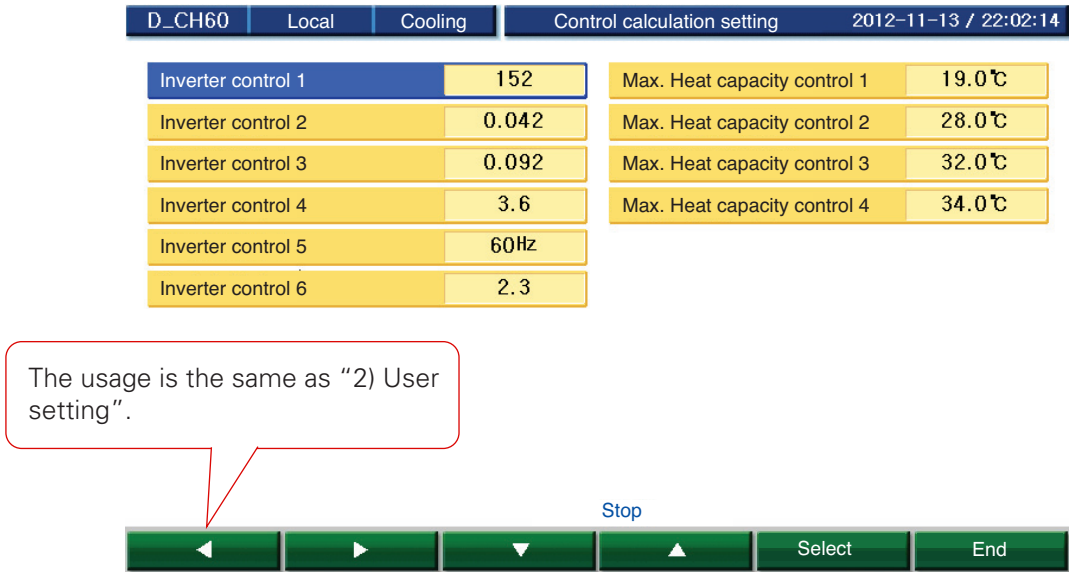


Display Cateogry	Display Range	Default value (Standard setting)
Chilled water pump stop delay	0~1800	0 sec.
Cooling water pump startup delay	0~60	5 sec.
Cooling water pump stop delay	0~1800	30 sec.
Flux vibration ignorance	0~60	2 sec.
Absorption solution pump #2 delay	1~1800	300 sec.
Refrigerant pump operation delay	0~500	2 sec. (Medium hot water: 300 sec.)
Low combustion run timer	0~600	180 sec.(chiller) 60 sec.(double effect chiller) 10 sec.(single effect)
Check cooling water temperature low	0~3600	1800sec.
Run time for crystallization prevention	0~1800	600sec.
High temp. regenerator flux low	0~300	60sec.
Check firing complete	0~500	180sec.

Control calculation setting

It is the menu to set the categories used for the inverter calculation and the chilled water temperature for the control of maximum heat capacity. Only the system manager should change the setting since the categories are the ones highly affectting the MICOM internal calculation on the inverter control and the safety control.

※ Route : Menu → Control operation set → Select



<Control calculation setting category>

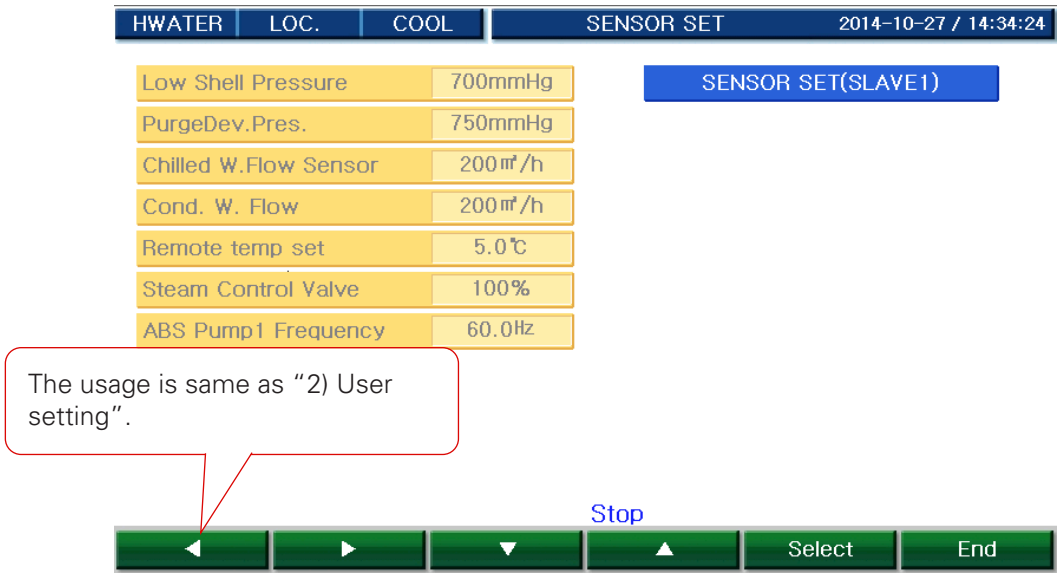
No	Set category	Set range	Initial value / unit	Remark
1	Inverter control 1	50~200	152	Single effect : 78
2	Inverter control 2	0.0~.0.1	0.042	
3	Inverter control 3	0.0~.0.1	0.092	
4	Inverter control 4	2~10	3.6	
5	Inverter control 5	30~60	60Hz	
6	Inverter control 6	2~3	2.3	
7	Max. Heat capacity control 1	10~23	19.0	
8	Max. Heat capacity control 2	24~30	28.0	
9	Max. Heat capacity control 3	31~34	32.0	
10	Max. Heat capacity control 4	31~40	34.0	

Sensor setting

It is the menu to set each pressure sensor, current sensor and others. You should set precisely and it is only effective for the sensors set for use.

After changing AD value of the guide vane and diffuser vane to min./max. by manual operation, change Offset Mode Setting to ON, and finish the setting by selecting the corresponding settings(min. value setting, max. value setting).

※ Route : Menu → Sensor set → Select



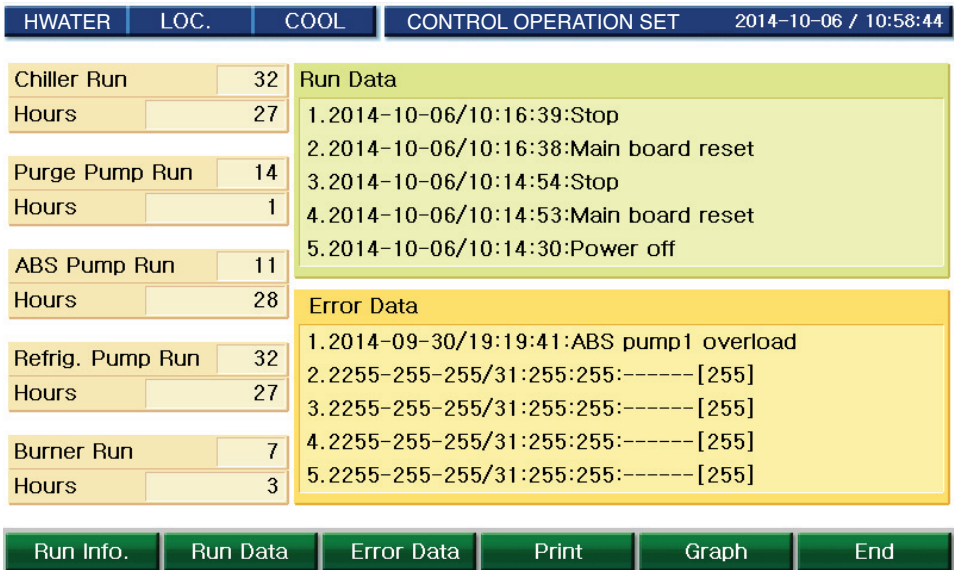
<Sensor setting category>

Setting category	Setting range	Initial value/ unit	Remark
Storage tank pressure sensor	0~760	760mmHg	When using sensor
Purging pressure sensor	0~800	300mmHg	When using sensor
Chilled water flux sensor	0~3000	200m^3/h	When using sensor
Cooling water flux sensor	0~3000	200m^3/h	When using sensor
Remote temperature setting signal	0~10	5°C	
Steam control valve	0~100	100%	When using sensor
Absorption solution pump #1 inverter	0~100	60Hz	When using inverter
Steam pressure sensor	0~50	16kg/cm^2	When using sensor
Current sensor	0~3000	100A	When using sensor
Voltage sensor	0~20000	6600V	When using sensor
Power sensor	0~3000	1143W	When using sensor
Control valve setting	0~1023	-	Control valve setting

History

It is the menu to check operation data, temperature control graph, start/stop information, etc. stored in the controller of the chiller. You can also check the information of the total accumulated number of operations (number of start/stop) and total accumulated operation time of the chiller and main auxiliary devices.

※ Route : history



Operation information

※ Route : history → Run inform

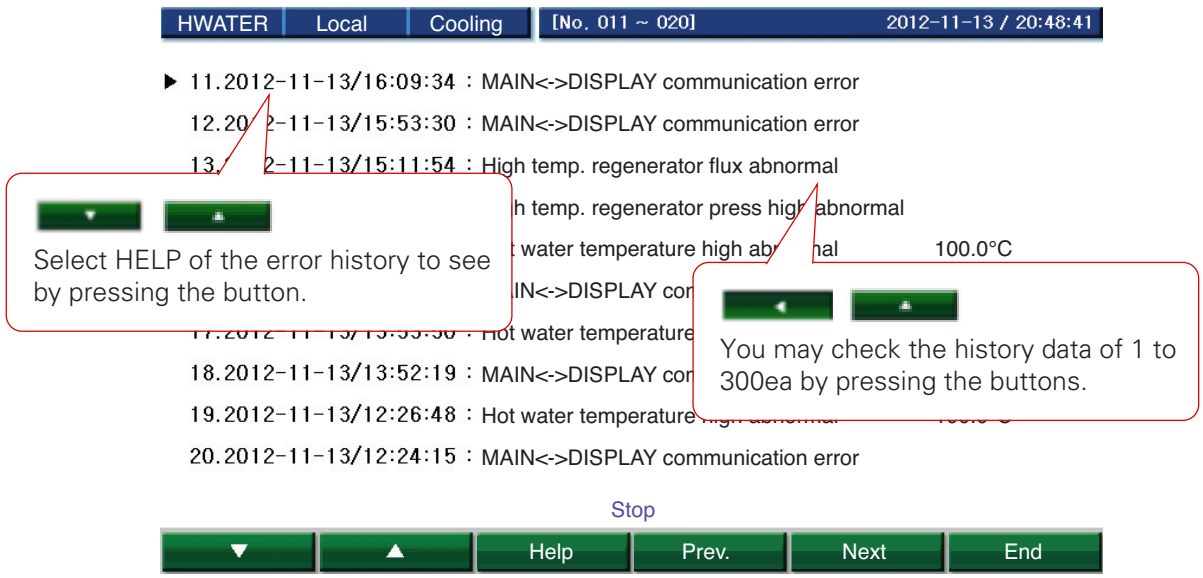
Operation history

※ Route : Menu → operation history

'It shows the operation history data.'

Error history

※ Route : history → Error history



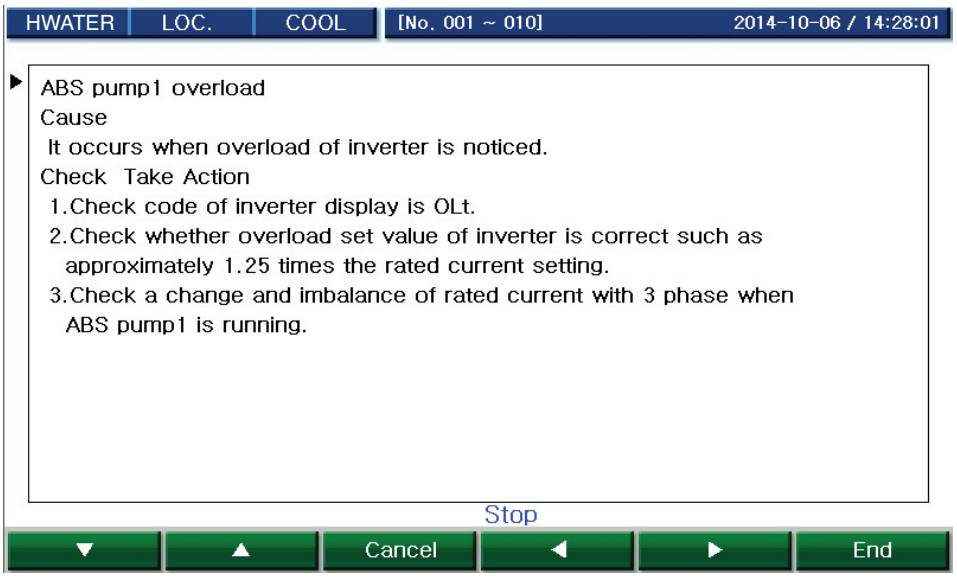
'It shows the error history data.'

Help Function

It displays the help messages about the errors and cautions.

If Help key is pressed on the error and caution screen, the help message for the corresponding message will be displayed on the help screen. Previous key will show the help message of the previously numbered and Next key for the next numbered help message.

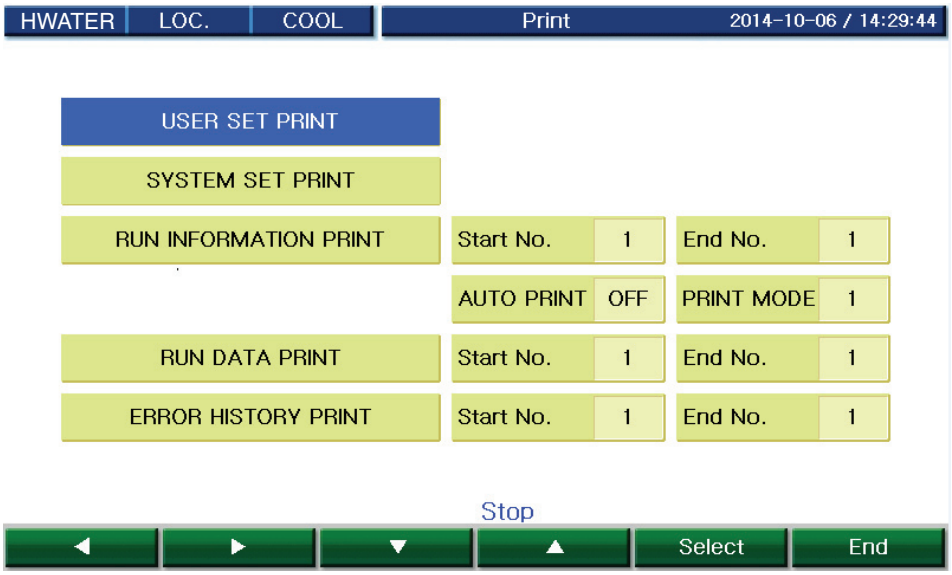
※ Route : history → Error history → Help



' It shows the help message of the selected abnormal history.'

Print function

※ Route : history → Print → Select

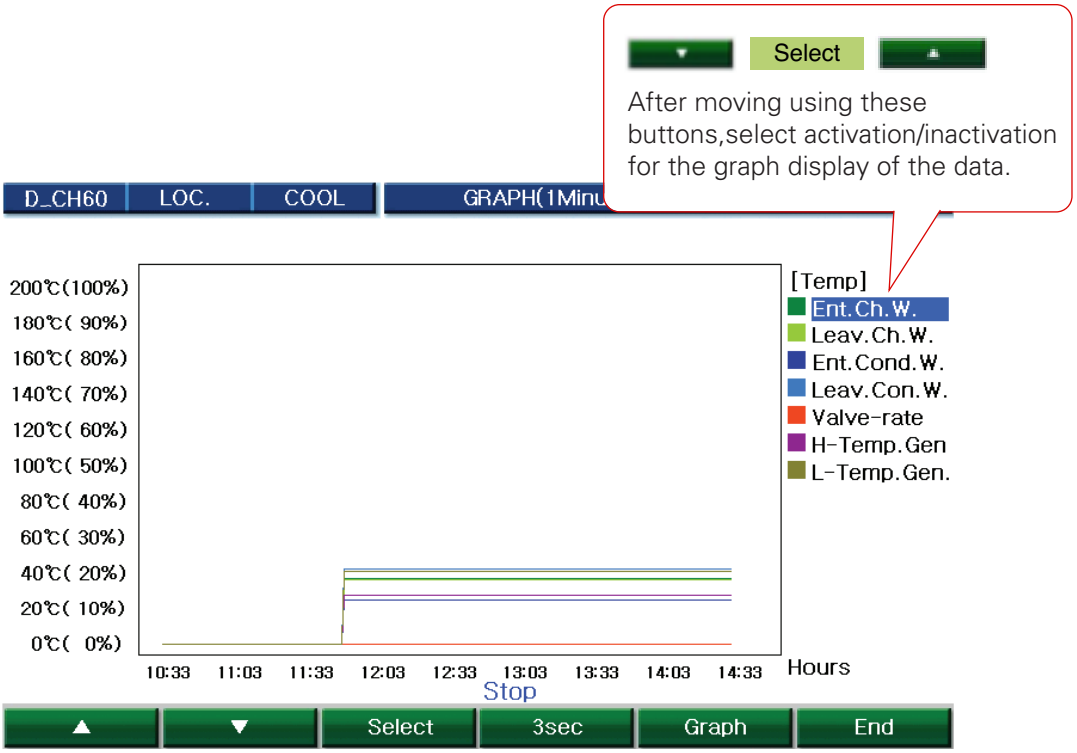


① Print user setting.: It prints the user set values through menu.
② Print system setting.: It prints the current system set value.
③ Print run information.: It prints run information of 1to 300ea.
- Auto print: Print run information with regular time interval.
- Print mode: "1"– print every data, "2"– print only value and unit (used by the commissioner)

④ Print operation history: It prints operation history of 1to 300ea.
⑤ Error history Print: It prints error history of 1to 300ea.

Graph

※ Route : history → Graph



Manual operation screen

Control valve

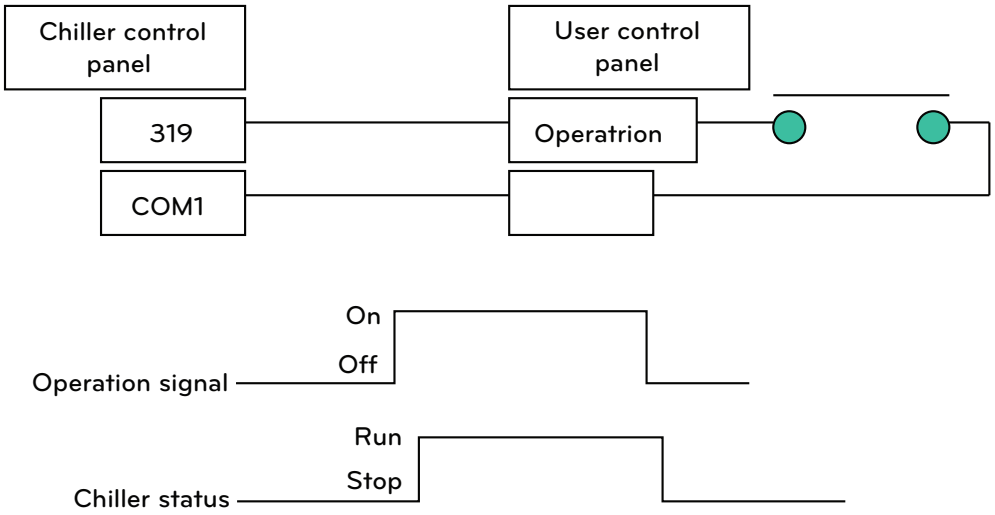
- Control valves can be operated manually in the menu.
- It is designed to be operated in the same way with the operation of the control valve auto/manual conversion key and open/close key in the front side of the display device.
- When ‘Forced close’ is activated by circuit, the manual open cannot be activated.

Purge pump

- Purge pump is operated only manually at this menu. (Keep manual operation)
- It is designed to to be operated in the same way with the operation of the purge pump auto/manual conversion key and the run/stop key in the front side of the display device.

Remote control signal and the status signal connection
Remote run/stop signal connection method

No voltage contact continuous signal 2 wire type



* The minimum keeping time of run/stop pulse: Min. 2 seconds.

Auxiliary facilities and connection signals

Signal name	Signal type	Meaning of signal	Caution
• Chilled water pump interlock • Cooling water pump interlock	Input (no voltage contact)	• It is the interlock to check for the action of electronic contact of pump starter. • The chiller does not run if there is no input signal when starting. • If there is no input, it detects as abnromal even during operation	• It detects the contact status by outputting DC24V. • Do not let it load over 100Ω contact resistance. (Do not place in the same cable conduit with other power line.)
• Chilled water pump run/stop • Cooling water pump run/stop • Cooling tower fan run/stop	output (No voltage contact)	• It is the signal to run/stop for the pumps or fan. • Connect when interlocking the run/stop signal from the chiller.	Use within the AC250V 0.1A. (load resistance).

Central monitoring panel and the connection signals

Signal name	Signal type	Meaning of signal	Caution
• Contact for displaying cooling/heating selection	output (No voltage contact)	• ON when cooling mode is selected • OFF when heating mode is selected	Use within the AC250V 0.1A. (load resistance)
• Contact for displaying the run/stop	output (No voltage contact)	• ON when chiller runs • OFF when chiller stops	
• Contact for displaying abnormality	output (No voltage contact)	• ON when chiller is abnormal	
• For displaying the remote selection	output (No voltage contact)	• On when remote operation mode is selected	
• Cotact for displaying the cooling tower fan run/stop	output (No voltage contact)	• On when the cooling tower fan in operation	

Check points before inspection

1) Thorough preparation
   Check first aid method, arrangements around the work site, and safety of the facility and machine.

2) Review with circuit diagram
   If power system receives power from another source, check the powers to the panels, power application to the 1st side of the circuit breaker and proper grounding.

3) Contact
   Check if you can closely contact with the relevant departments.

4) Check for no voltage state and safety measures
   During the inspection of the main circuit, please review the following issues for safety.
   a) Open the related breakers and disconnecting switches and make no voltage on the main circuit.
   b) Check no voltage status with electroscope, and make groundings where necessary.
   c) Open circuit breakers and disconnect switches and attach a warning sign board "Checking".
   d) Use the disconnection switches operation after power is disconnected.
   e) Especially when the power is supplied via another source such as consumer side power distribution panel, automatic control, MCC panel, etc., take the above c) and d) actions to the switches of the other party.

5) Cautions for current and voltage
   Discharge the remaining charges and conduct grounding before you inspect the condenser and cable connection points.

6) Prevention of wrong operation
   Disconnect the power and attach a caution mark.

7) Prepare insulated protection devices
   Wear safety protection devices such as insulated gloves, safety helmet, insulated boots, and safety apparel fit for the rated voltage.

8) Measures against mice, insects, etc.
   Take measures to prevent mice, insects and snakes from entering into the panel.

Check points after inspection

1) Final check
   a) Check whether any staff is inside the panel.
   b) Check whether the removal of the temporary building for inspection is being delayed.
   c) Make sure not to forget bolt tightening work.
   d) Check if any tools are left.
   e) Check whether mice or insects intruded.

2) Recording of the inspections
   After the inspection, make sure to record the summary of the inspections and repairs, status of the failure and date, etc. to utilize them as the reference for the next inspection.

Periodic inspection

Caution

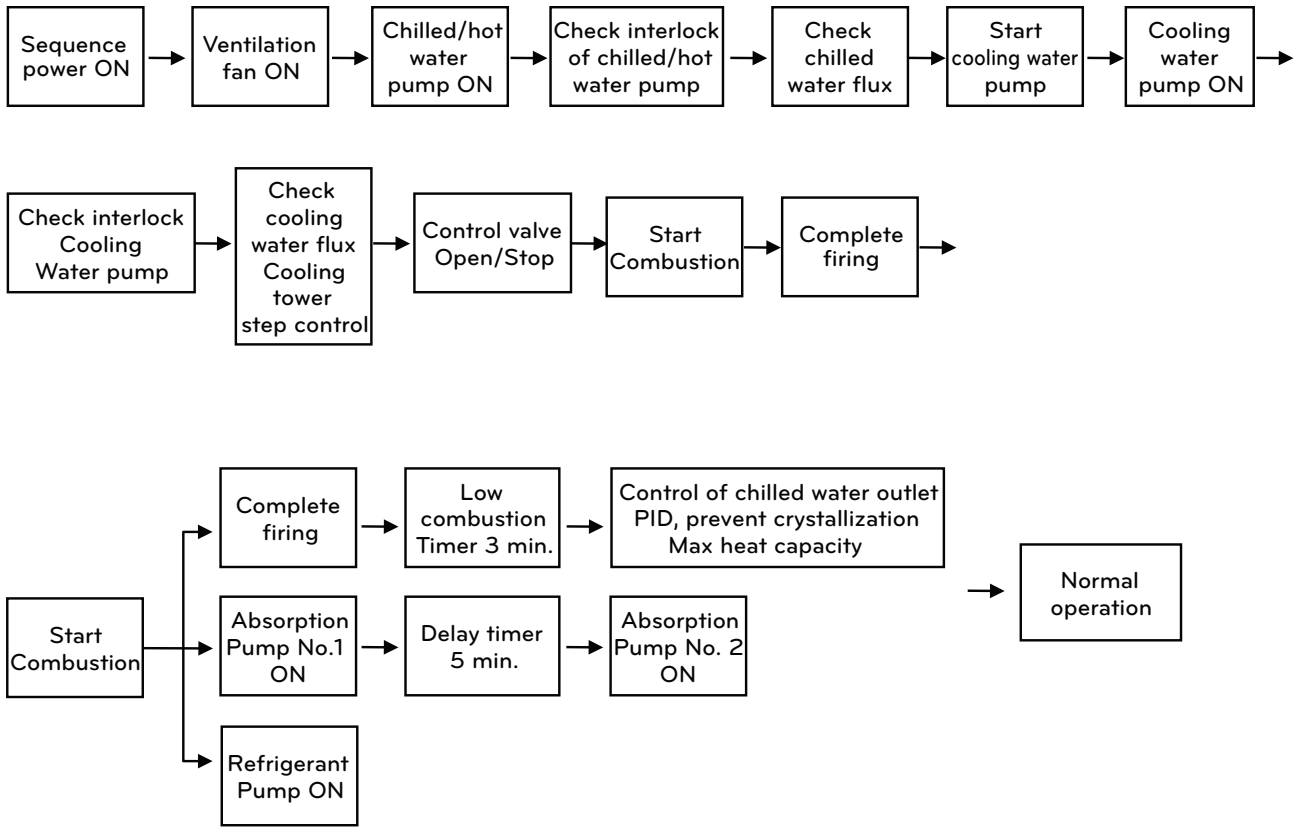
- Establish the daily inspections to be able to check the load of the machine in operation, operation time, operation environment, etc.
- The inspection period stated in this manual is the general inspection period. Therefore establish a inspection plan according to the load status of the machine and usage frequency.
- Do not perform the insulation resistance test on the 2nd side of the transformer or controller.
- Do not perform the insulation resistance test on the parts like sensor, switch, etc. which are connected to the controller.

General inspection items

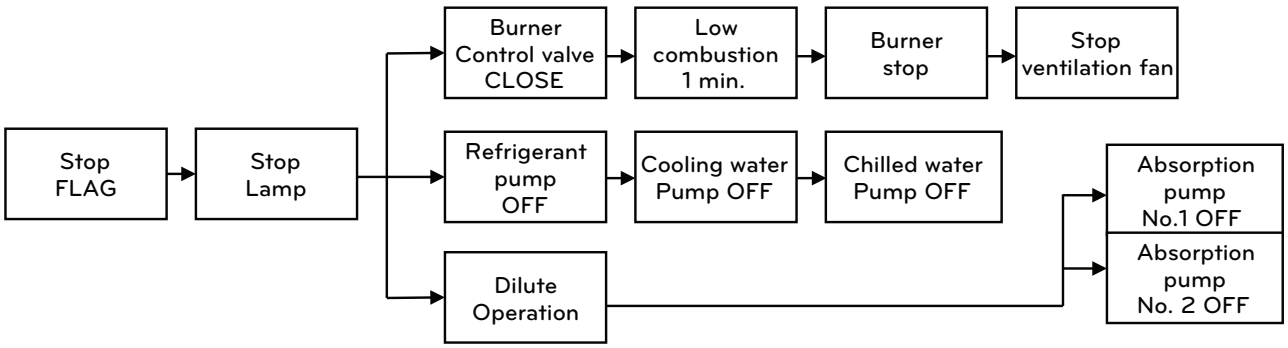
Site	Inspection item	Inspection content	Frequency			Judging criteria
			Daily	1y.	2y.	
Overall	Environment	Are there any dust around? Are the temperature and moisture within the standard? Is there any abnormal vibration?	O			Refer to the chapter 1. Envrironment.
	Unit	Is there any unusual vibration or sound?	O			Should be normal
Main circuit/control circuit	Input power	Is the main circuit voltage normal? Is the control circuit voltage normal?	O			Refer to the chapter 1. Envrironment.
	Insulation resistance test	Cut-off all the power before the insulation resistance test. Disconnect all the ground wires to the bus-bar when test the insulation resistance between transformer 1st side and the ground bus-bar.		O		* Low voltage(below 600Vac) Should be over DC 500V megger, 5MΩ. * High voltage (over 600Vac and 7000Vac) Should be over DC 1000V megger, 30MΩ.
	Overheat	Is there any trace of overheat for each part?		O		Should be normal
	Fixed parts	Is there any loss of fixed parts?		O		Should be normal
	Conductors /wires	Is there any contamination on conductors? Is there any damage on electric wires?		O		Should be normal
	Terminal box	Is there any damaged part?		O		Should be normal
	Relays/contactors	Is there any vibration/sound during operation? Is there any damage to the contactors?		O		Should be normal
	Sensors/switches	Is there any disconnection or short circuit? Is there any damage on the contact part?		O		Should be normal
	Ground	Is there any rust on the connect part? Is there any damage to the gound conductor? Is there any noise in the ground system? Note: Ground resistance should be within the specified code and spec.		O		Should be normal
	Phase advance capacitor	Is there any damaged part? Is the swelling within the allowance?	O			Should be normal
	Cooling fan	Is there any abnormal noise? (Controller)	O			Should be normal
Control	Safety device	Is safety function normally working? Is the startup sequence normal? Is the stop sequence normal? Is the control of temp. within the spec.?		O		Normal control
Display	Analog value	Is the displayed value accurate?		O		Should be within allowance limit
	Display lamps	Is the lamp display in normal brightness?	O			Lamp is ON during operation.

4-5. Startup and control sequence

Run sequence



Stop sequence



4-6. Product protection function

4-6-1. Error/Warning/Normal message

Class	Message	Cause	Range	Action	State
Sen-sor	Temperature Seonsor Error	Sensor detection abnormal	-40~400°C	When it detects abnormality of temperature sensor , error occurs and stops the chiller.	Error
Interlock	Chilled(hot) water Pump Interlock abnormal	Pump interlock is open during operation.	ON : Normal OFF : Abnormal	When it detects abnormalty of pump interlock during operation, error occurs and stops the chiller.	Error
	Cooling water pump Interlock abnormal	Pump interlock is open during operation.	ON : Normal OFF : Abnormal	When it detects abnormalty of pump interlock during operation, error occurs and stops the chiller.	Error
	Ventilatioin fan Interlock abnormal	Fan interlock open during operation	ON : Normal OFF : Abnormal	When it detects abnormalty of flux during operation, error occurs and stops the chiller.	Error
	Chilled(hot) water flux low abnormal	Fan interlock open during operation	ON : Normal OFF : Abnormal	When it detects abnormalty of flux during operation, error occurs and stops the chiller.	Error
	Cooling water flux low abnormal	Fan interlock open during operation	ON : Normal OFF : Abnormal	When it detects abnormalty of interlock during operation, error occurs and stops the chiller.	Error
Temperature	Hot water temperature high abnormal	Hot water outlet temp. is higher than the set temp. when heating.	Set range: 50~100°C Initial value: 70°C	When it detects abnormalty of hot water temperature high, error occurs and stops the chiller.	Error
	Chilled water temperature low abnormal	Chilled water outlet temp. is lower than the set temp. when cooling.	Set range : 0~50°C Initial value : 2.5°C	When it detects abnormality of chilled water outlet temperature low, error occurs and stops the chiller.	Error
	(High temp.) regenerator temperature high abnormal	(High temp.) regenerator temperature is higher than the set temp.	Set range : 100~200°C Initial value : 165°C(Cooling) 130°C(Heating)	When it detects abnormalty of (High temp.) regenerator temperature high, error occurs and stops the chiller.	Error
	Exhaust gas Temperature high abnormal	Exhaust gas temperature is higher than the set temp.	Set range : 200~390°C Initial value : 300°C	When it detects abnormality of exhaust gas temperature high, error occurs and stops the chiller.	Error
	Evaporator refrigerent temperature low abnormal	Evaporator refrigerant temperature is lower than the set temp.	Set range : 0~50°C Initial value : 2.5°C	When it detects abnormalty of evaporator refrigerent temperature low, error occurs and stops the chiller.	Error
Pump	Absorption solution pump 1 overheat	Trigger of the thermal over current relay attached on the absorption solution pump 1 power line	ON : Normal OFF : Abnormal	When it detects the contact of absorption solution pump 1 over heat, error occurs and stops the chiller.	Error
	Absorption solution pump 2 overheat	Trigger of the thermal over current relay attached on the absorption solution pump 2 power line	ON : Normal OFF : Abnormal	When it detects the contact of absorption solution pump 2 over heat, error occurs and stops the chiller.	Error
	Refrigerant pump overheat abnormal	Trigger of the thermal over current relay attached on the refrigerant pump power line	ON : Normal OFF : Abnormal	When it detects the contact of refrigerant pump over heat, error occurs and stops the chiller.	Error
	purge pump overheat abnormal	Trigger of the thermal over current relay attached on the purge pump power line	ON : Normal OFF : Abnormal	When it detects the contact of purge pump over heat, warning occurs and stop the chiller.	Warn-ing

Class	Message	Cause	Range	Action	State
Safety swtich	(High temp.) regenerator pressure high Abnormal	Pressure switch contact is open due to the (High temp.) regenerator pressure high.	ON : Normal OFF : Abnormal	When it detects (High temp.) regenerator pressure switch open, error occurs and stops the chiller.	Error
	(High temp.) regenerator level abnormal	Flux contact is open due to the abnormalty of (High temp.) regenerator dilute solution level.	ON : Normal OFF : Abnormal	When it detects the contact of (High temp.) regenerator flux abnormal, error occurs and stops the chiller.	Error
	Burner system abnormal	When burner abnormal contact is closed.	ON : Normal OFF : Abnormal	When it detects the burner abnormal contact close, error occurs and stops the chiller.	Error
Concentration	concentration high limit operation	When absorption solution concentration is above 65% (calculated by low temp. regenerator, condenser temperature)	Condition: concentration above 65%(fixed), settable range for crystallization prevention time. Setting range: 120~1800 sec. Initial value: 600sec.	If the concentration of absorption solution is above 65% by calculation, run for 10 minutes at the fixed rate of 60 %of the current output (PID calculation) and display 'In Operation of Crystallization Prevention' on the screen.	Caution
	Absorption solution concentration high abnormal	When absorption solution concentration level is maintained at over 65%	Setting range : 50~70% Initial value : 65%	If the concentration is still above 65% even after 10 minutes, execute 'Solution concentration high ' abnormal stop dilute run.	Error
Caution / Alarm	Chilled water flux interlock jump alarm	When the chilled water flux interlock contact is closed during stop	ON : Caution OFF : Normal	Display Caution message of chilled water flux interlock jump	Caution
	Chilled water pump interlock jump alarm	When the chilled water pump interlock contact is closed during stop	ON : Caution OFF : Normal	Display Caution message of chilled water pump interlock jump	Caution
	Cooling water flux interlock jump alarm	When the cooling water flux interlock contact is closed during stop	ON : Caution OFF : Normal	Display Caution message of cooling water flux interlock jump	Caution
	Cooling water pump interlock jump alarm	When the chilled water pump interlock contact is closed during stop	ON : Caution OFF : Normal	Display Caution message of cooling water pump interlock jump	Caution
	Ventilation fan interlock jump alarm	When the ventilation fan interlock contact is closed during stop	ON : Caution OFF : Normal	Display Caution message of ventilation fan interlock jump	Caution
	Absorption solution pump 1 interlock jump	When the absorption pump 1 interlock contact is closed during stop	ON : Caution OFF : Normal	Display Caution message of absorption pump1interlock jump	Caution
	Absorption solution pump 2 interlock jump	When the absorption pump 2 interlock contact is closed during stop	ON : Warning OFF : Normal	Display Caution message of absorption pump2 interlock jump	Caution
	Purge pump interlock jump alarm	When the purge pump interlock contact is closed during stop	ON : Warning OFF : Normal	Display Caution message of purge pump interlock jump	Caution
	Combustion signal interlock jump alarm	When burner operation interlock contact is closed during stop	ON : Warning OFF : Normal	Display Caution message of combustion interlock jump	Caution
	Refrigerant pump interlock jump alarm	When refrigerant pump interlock contact is closed during stop	ON : Caution OFF : Normal	Display Caution message of refrigerant pump interlock jump	Caution
	Refrigerant pump run no signal	Refrigerant pump interlock is open during operation	ON : Caution OFF : Normal	Display Caution message of no operation siganl of refrigerant pump	Caution
	Purge pump run no signal	Purge pump interlock is open during operation	ON : Caution OFF : Normal	Display Caution message of no operation siganl of purge pump	Caution

Class	Message	Cause	Range	Action	State
Startup sequence	Checking the ventilation fan interlock	Since ventilation fan interlock is open during startup sequence, it is on standby for checking.	ON : Run OFF : Standby	Display of operation message 'In the process of checking the ventilation fan interlock during startup'	Normal
	Checking chilled(hot) water pump interlock	Since chilled (hot) water pump interlock is open during startup sequence, it is on standby for checking.	ON : Run OFF : Standby	Display of operation message 'In the process of checking the chilled (hot) water pump interlock during startup'.	Normal
	Checking chilled(hot) water flux	Since chilled (hot) water flux interlock is open during startup sequence, it is on standby for checking.	ON : Run OFF : Standby	Display of operation message 'In the process of checking the chilled (hot) water flux during startup'.	Normal
	Checking cooling water pump interlock	Since cooling water pump interlock is open during startup sequence, it is on standby for checking.	ON : Run OFF : Standby	Display of operation message 'In the process of checking the cooling water pump interlock during startup'.	Normal
	Checking cooling water flux interlock	Since cooling water flux interlock is open during startup sequence, it is on standby for checking.	ON : Run OFF : Standby	Display of operation message 'In the process of checking the cooling water flux during startup'.	Normal
	Checking firing complete	Since burner operation interlock is open during startup sequence, it is on standby for checking.	ON : Run OFF : Standby	Display of operation message 'In the process of checking the firing completeness during startup'.	Normal
Temperature of cooling water	Control of maximum heat capacity	When the cooling water inlet temperature is below 28°C or above 32°C during operation	Set range (Initial value) Maximum heat capacity control 1: 10~23°C (19°C) Maximum heat capacity control 2: 24~30°C (28°C) Maximum heat capacity control 3: : 31~34°C (32°C) Maximum heat capacity control 4: 31~40°C (34°C)	Display of operation message of maximum heat capacity	Normal
	Overheating absorption solution pump 1	When operating with the cooling water inlet temperature below the set temperature over 30min. (initial value)	1. Set temperature Set range : 15~30°C Initial value : 19°C 1. Set time Set range: 0~3600 sec. Initial value : 1800 sec.	'Cooling water inlet temperature low abnormal' occurred. Stop the chiller.	Error

5. CAUSES OF TROUBLE

5-1. Crystal (crystallization and dissolution)

Crystallization means that absorption solution changes from liquid state to solid state.

It occurs mainly in cooling operation. Almost no crystallization occurs in heating because heat exchanger is not used and the overall temperature and concentration are low.

5-1-1. Crystallization

It is caused by the high concentration or the low temperature of absorption solution.

Crystallization prevents chiller from cooling causing errors of "HIGH TEMP. regenerator PRESSURE HIGH" or "HIGH TEMP. regenerator TEMPERATURE HIGH", and may strain the machine. Therefore inspect the chiller at any time to check crystallization.

MICOM of the chiller has a program to avoid crystallization and it drives the crystallization avoidance operation. However the chiller does not detect crystallization by itself and instead it performs just the crystallization avoidance operation. Therefore, it is the user who should make the decision on crystallization.

5-1-1-1. Cause of crystallization

Crystallization occurs when the temperature of cooling water is too low or the concentration of absorption solution is too high.

1) When the cooling water temperature is too low

   When the temperature of cooling water is too low, highly concentrated absorption solution coming from the low temp. regenerator exchanges heat with low temperature absorption solution (dilute solution), the temperature of absorption solution goes below the crystallization point, thus the crystallization occurs.

   When the temperature of cooling water is too low, MICOM of the chiller closes the control valve on the basis of the inlet temperature of cooling water to prevent crystallization.

   But since the temperature of high temp. regenerator is already high and the concentration of absorption solution is high, it is not easy to prevent crystallization. Thus it is recommended to always maintain the temperature of cooling water between 28°C and 32°C.

2) When the temperature of cooling water is too high

   Crystallization can also occur, when the temperature of cooling water is too high. Theoretically, crystallization won't occur when the temperature of absorption solution is high. If the temperature of cooling water is high, that of absorption solution will become high, thus the temperature of absorption solution(dilute solution) goes up even in the low temp. heat exchanger of which the temperature is the highest. Consequently, crystallization should not occur. However, high temperature of cooling water lifts up the overall pressure of a chiller. As a result, the temperature and the pressure of high temp. regenerator go up more. This situation makes the concentration of absorption solution higher. And the lowered pressure difference between the low temp. regenerator and the absorber disturbs smooth flow of absorption solution. Finally, absorption solution stays for a long time in the low temp. heat exchanger and its concentration rises high. And the reduced absorption power in absorber causes crystallization. Mostly, it is caused by the problem in the cooling tower. It is necessary to maintain the cooling tower against water shortage of cooling tower or malfunction of cooling tower. Since inlet temperature of cooling water has so much influence on the chiller, sufficient flux and proper temperature keeping are needed.

3) In case of air inflow or bad purging. (in case pressure inside the chiller is high)

   Crystallization can occur easily when the pressure inside the chiller is high. That is, when air gets in or non-condensing gas gathers in the machine due to the lack of purging, flow of absorption solution is not smooth and its concentration rises high, which causes crystallization easily. It is necessary to check the pressure inside the chiller and perform purging if needed. And when a leakage occur, it is also necessary to find the leaking area.

4) In case of cooling water flux shortage

   Crystallization can also occur when cooling water flux is short. The reason for crystallization under cooling water flux shortage is same as the 3 cases above. Cooling water flux shortage makes big temperature difference between the normal inlet and the outlet, making the flow of absorption solution not smooth. Cooling water flux should be sufficient.

5) In case absorption solution is circulated badly or is short

When the damper which controls cooling cycle of the chiller is too widely open or closed, causing bad flow of absorption solution, crystallization occurs. It is the same for the case of the absorption solution shortage. If the damper (dilute solution, intermediate solution, condensed solution) of the chiller is too widely open, then ON/OFF operation of absorption solution pump will occur frequently, and the solution level of high temp. regenerator will rise but absorber will be empty eventually and finally absorption solution will not be supplemented timely. On the contrary, when it is too much closed, absorption solution is not supplemented smoothly causing the temperature and the pressure of high temp. regenerator to go up, and further errors.

5-1-1-2. Symptom of crystallization

Crystallization makes almost no temperature difference between the chilled water inlet and outlet and makes the chilled water temperature go up higher. The temperature of high temp. regenerator continues to rise and the concentration of absorption solution also continues to rise. And refrigerant level of evaporator rapidly goes higher than normal state and the temperature difference between the cooling water inlet and outlet reduces. And the temperature of piping, which goes from the low temp. regenerator to the absorber, becomes abnormal. (refer to the Dhuring diagram) And over flow piping gets hot. (For the large size model, the temperatures of 3 points of H piping can be all identical.)

Or, no-load operation of absorption solution pump makes noise and the temperature and the pressure of high temp. regenerator go high sounding the buzzer, finally stopping the chillers automatically.

Crystallization can be judged on the basis of the conditions above.

5-1-2. How to dissolve crystal

5-1-1-1. Low combustion operation

The easiest method is to close the control valve in manual mode to perform low combustion operation. Low combustion operation lowers the overall concentration of absorption solution and dissolves crystal. It is possible only when crystallization is not intense. After about 20 minutes to an hour of low combustion operation, convert the control valve to auto mode to perform normal operation.

5-1-1-2. Blow-down

The second easiest method is to perform blow-down. Performing blow-down 2 or 3 times dissolves crystal. Refer to 7-1 Blow-down for blow-down task. It is necessary to perform blow-down while performing the low combustion operation with enough time.

5-1-1-3. Heating with torch or other heating apparatus

The third one is to heat the low temp. heat exchanger, the piping linking the low temp. heat exchanger with the absorber and another piping going down from the low temp. regenerator to the low temp. heat exchanger with torch or other heating instruments.

Oxygen welding which has a very strong flame shouldn't be used. Steam or torch is the most suitable. (Be very cautious of burn or fire by torch or steam. And be aware of that sensors or power line around machine can be burned or damaged.)

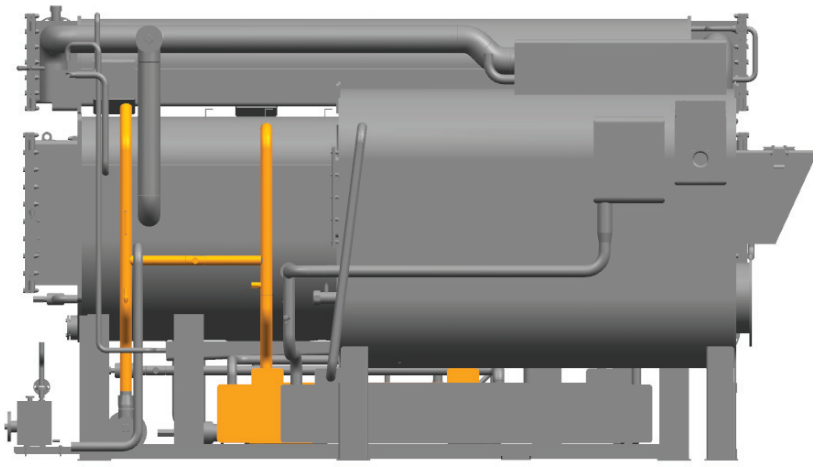


Figure 5-1. Crystal dissolution

Heat the low temp. heat exchanger or the piping linking a low temp. heat exchanger (inlet of low temp. heat exchanger and outlet of low temp. heat exchanger) with torch slowly. Do not heat a specific part intensely or crystallization can be more developed. When crystal is dissolved, the temperature difference between the chilled water inlet and outlet and the temperature of parts come back to the normal state. Convert to normal operation after performing blow-down 1 or 2 times.

5-1-1-4. Others

There are other methods. For example, heating when stopping the cooling water pump and the chilled water pump, which requires much more attention and can be dangerous, therefore it won't be explained here.

When the solutions presented above do not work, please contact the service center.

5-2. Troubleshooting

Precede the followings when an abnormality occurred.

1) Check error messages.
2) Click 'Help' in MICOM menu and check the massages it provides.
3) Check out the part which 'Help' messages indicate.
4) In case of emergency, give first-aid treatment, first.
5) Inspect the state of chiller and other peripheral devices (Pressure, Temperature, etc.).

5-2-1. Abnormality of High temp. regenerator system

5-2-1-1. HIGH TEMP. GEN. PRESSURE HIGH

1) Symptom

   The pressure gauge of high temp. regenerator pressure is over 0kg/cm2 and the temperature of high temp. regenerator is over 165°C. The refrigerant overflow (comparing with standard level) and the temperature of chilled water may not cool down normally. If this problem goes on, crystal can be formed easily. When it's not operated normally, chiller may stop automatically with starting abnormal stop dilution operation. It makes burner stop, and makes the pressure down in high temp. regenerator. Pumps of chiller and cooling water stop in order.

2) Causes (In case of chiller)

   ① Temperature of the cooling water inlet is too high.

   ② Crystal is formed.

   ③ The gas consumption amount supplied to chiller is too much. - When it is over supplied to the standard gas(oil) consumption amount

   ④ Cooling cycle is not appropriate.

   ⑤ Absorption solution is not supplemented to the high temp. regenerator

3) Troubleshooting

   If you drop the pressure, problems with high temp. regenerator may be solved automatically. When it has no special problem, press Cancel button and inspect the peripheral devices after stopping operation, then reset the machine.

   ① The cooling tower which doesn't work properly causes problems. Check if the temperature of cooling tower is set precisely in MICOM, and set the temperature as a standard value (Operation. 34°C, Stop . 30°C). Check if the automatic switch of the MCC panel works properly. If it is in manual mode, convert it to automatic mode. Check whether the cooling tower automatic switch of the panel is in automatic mode normally. If it is in manual mode, convert it to automatic mode. If the cooling tower setting is operated by thermostat or the other devices, inspect related parts.

   ② When you find out crystals, melt them down. (Refer to crystal dissolution)

   ③ Measure the gas (oil) wastage, and contact the service center or the burner company.

   ④ If everything above is all right, the cooling cycle is not appropriate. Contact with the service center.

   ⑤ At first, inspect if the absorption solution pump is rotating properly. Then, check the circulating system from absorption solution to high temp. regenerator.

5-2-1-2. HIGH temp. REGENERATOR TEMPERATURE HIGH

1) Symptom

Same problems occur as 'HIGH TEMP. REGENERAOR PRESSURE HIGH'. The pressure of high temp. regenerator may go up to 0kg/cm2, and the refrigerant may overflow. Finally it stops operating as 'HIGH TEMP. REGENERAOR PRESSURE HIGH' of 14-1-1.

2) Possible Causes

Causes are the same as that of 'HIGH TEMP. REGENERAOR PRESSURE HIGH' (Except ⑤ of 2) and 3) in 14-1-1)

3) Troubleshooting

The procedure is the same as 14-1-1. The temperature of high temp. regenerator may fall down after dilution operation. Then malfunction state may be canceled automatically. Operate the abnormal stop, and press 'Cancel button'. Then inspect the peripheral devices, and operate the chiller.

5-2-1-3. HIGH TEMP. REGENERATOR SOLUTION LEVEL LOW

1) Symptom

Absorption solution pump performs no-load operation or abnormal operation because the absorber is empty. Because the level of high temp. regenerator is getting lower, it causes the problems. It makes chiller to stop. Absorption solution pump may be operated continuously during dilution operation until the level come back to the normal level.

2) Cause

① Malfunction of the absorption solution or its abnormal discharge may cause these problems.

② In case that surface relay is defective, the high temp. regenerator may be out of order even though the solution seems to be full enough in the inspection window.

③ In case of inferior electrode, it causes the devices malfunction like ② above.

3) Troubleshooting

① Check if the operating state of absorption solution pump and see if the level is empty. If the pump of absorption solution doesn't work properly, the level relay may cause the problem. Check if the pump of absorption solution works properly. If the pump works properly, inspect the surface level of the absorber. When the surface is getting lower continuously, you can expect that there is crystal or that the cooling cycle must be abnormal. Perform crystal dissolution process first, and if the problem goes on, contact the service center.

② Check the contact state of the surface level relay.

③ Check the contact state of electrode.
If problems above happen, it is the best way to contact the service center.

5-2-2. Error in temperature sensor system

5-2-2-1. OOOOO TEMP SENSOR ABNL

1) Symptom

'(All kinds of) Sensor Name + Temperature Sensor Errors' shows up on message window. The temperature '0 or 399.9°C' or '.40 or 140°C' is displayed on the temperature window of abnormal temperature sensor. Some sensors can still work and it depends on the type of sensor. generally chiller will stop, or cannot work. In case that the chiller can be operated, for the sensor with optional specifications, it will work even when it has this kind of problems.

2) Causes

① Short circuit or disconnection of each sensor.

② Resistance value is unstable because of a shock.

③ The main board cannot read the resistance value.

④ The sensor with optional specifications is not set properly.

3) Troubleshooting

① The sensor should be changed.

② The sensor should be changed.

③ Inspect or change the main board.

④ You can set the sensor on the subordinated part on the system menu in Menu window. Change the setting of the sensor you are not using from 'Use' to 'Not in use'. When the problems go on after the sensor is installed, contact the service center.

※ You can operate the machine for a while with emergency measures, but it is so dangerous that you should operate the machine after proper measures.

5-2-3. Error in chilled/hot water system

5-2-3-1. CHILLED WATER PUMP INTERLOCK ABNL

1) Symptom

The chiller stops immediately when a malfunction occurs in chilled water pump interlock. All the pumps of chiller including absorber pump and burner stop working. At this time, it can be operated only during the dilution operation time. It can be freeze-ruptured when high temp. regenerator is high and chiller inlet's temperature is low during normal operation. In this case, emergency measures are needed because it is seriously dangerous. When you try to start operating, the chiller will not be started with the message 'Check chilled water pump'.

2) Cause

① The chilled water pump stops working suddenly while the chiller is in operation.

② When the chilled water pump is switched from 'MAN' to 'AUTO' momentarily while the chiller is operating.

③ When the wire of chilled water pump interlock is not well connected, or the signal is not sent.

3) Troubleshooting

① In this case, it's seriously dangerous. Restart the cooled water pump immediately regardless of the state of chiller. Especially when the temperature of the high temp. regenerator is high, and the temperature of cooled water is low (below 10°C), you have to make the cooled water flow into chiller with all methods. And the cooling water will stop flowing immediately when the abnormality occurs, but in any case, the cooling water flow should be stopped.(only when it is in automatic mode). (When it is in manual mode, you should stop the cooling water pump immediately.) However it is not dangerous when the temperature of cooled water is high, and the temperature of high temp. regenerator is low(below 80°C). But remember that chilled water should be circulated, and cooling water should not be flowing. When the main pump of chilled water is malfunctioning, immediately start the auxiliary pump to flow chilled water to chiller. If it is impossible, open the cooling/heating conversion valves A and C to stop the cooling operation, and open the chilled water drain valve to drain water tank and make chilled water flow into the chiller. The freeze rupture progresses fast in three conditions; the temperature of high temp. regenerator is high, the temperature of chilled water is low and the absorbing power of absorber is strong while cooling water is flowing through absorber. When there is a problem in the chilled water pump during operation, try not to make the above three conditions to prevent the freeze rupture. When the chilled water pump stops working, restart the system after you find out the cause and take proper measures. When the chilled water main pump is out of order, operate auxiliary pump after inspecting pipe for chilled water checking whether the circulation is normal. At that time set the auxiliary pump in 'MAN' or 'AUTO' mode, then restart the chiller system. If there is no switch or relay to convert the main pump to the auxiliary pump, you must install it.

② Never change the chilled water pump mode while operating. If it is converted, return to its previous mode immediately and restart in the following two ways : First, turn off the power of MICOM and turn it on again, then restart the chiller. Second, restart chiller after chiller stops completely and convert manual mode to automatic mode.

③ Check if the contact point works normally when the pump is started in order to check the interlock contact in the MCC panel of the chilled water pump. If the contact point of chilled water pump is normal, the main board may be defective. In this case contact LG.

5-2-3-2. CHILLED WATER FLUX LOW ABNORMAL

1) Symptom

When the chilled water flux is not enough, chiller stops immediately and is operated in the same way with the chiller pump interlock malfunction. It is also seriously dangerous. It needs the faster emergency measure than in the case of the chiller pump interlock malfunction. When the operation has been started while the chilled water flux is not enough, the chiller will not be started, with the message showing 'Check chilled water flux', and the chiller will not be operated until the flux returns to normal..

2) Cause

① It occurs when the chilled water cannot flow normally and the flux is not enough. The shortage of the chilled water flux occurs when the chilled water pump doesn't work properly or it is in the no-load operation mode or the pump itself has a problem, such as, bearing damage, etc.

② It occurs when there is air in pipes and it interrupts chilled water flowing.

③ It occurs when the chilled water pipe valve or valve of chilled water head is locked, it interrupts the normal circulation.

④ It occurs when the differential pressure valve of by-pass pipe doesn't work properly, or by-pass valve of pipe is not handled properly.

⑤ It occurs when the flux pressure control switch or the flow switch of chiller is malfunctioning and the control is abnormal.

⑥ It occurs when the flux doesn't flow instantaneously after chilled water pump has been started (when the flux is changed).

3) Troubleshooting

① Check the pipe for supplying water in the chilled water pipe. Check if the drain valve among pipe lines is open or broken and it causes a water leakage or not, then close the valve or fill up the water through the supply water pump. Check if the pump works normally and any other pumps operate regardless of the chiller in operation now. If the pump is malfunctioning, convert to the auxiliary pump. If a pump is working regardless of the chiller in operation now, modify the condition.

② Get rid of the air using the air vent of the chilled water pipe or any other devices.

③ Open the valve of the chilled water pipe or valve of chilled water header. Especially be careful not to close the header valve even though the air handling unit or other FCU are not used, because it causes flux shortage. Open all these valves.

④ When there is a pressure regulating valve in chilled water header or a 3-way valve in FCU, check if these valves are normal by manometer test and other methods. If the valves are not normal, replace, repair or adjust them.

⑤ If above ① ~ ④ checking points are all normal, the flow switch is malfunctioning or not set properly. Contact LG for proper troubleshooting. The chilled water flow switch and the differential pressure control switch are immediate causes of serious accident such as freeze rupture problem, so they should not be control led arbitrarily.

⑥ If there is a pressure drop or change after operating the chiller water pump, the differential pressure control switch can be reduced momentarily causing malfunction. malfunctioned due to the decrease of pressure difference. That means two or more chillers are operated and connected to the same header with the chilled water pipe, the problem can be occurred easily. So change the equipment or find out the cause and eliminate it.

5-2-3-3. CHILLED WATER TEMPERATURE LOW

1) Symptom

As the temperature of chilled water falls almost to the set value, chiller close the control valve automatically in proportion to the chilled water temperature to keep the temperature stay near the set value. When the temperature is -1.5°C lower than the set value, the refrigerant pump may stop. When chilled water is too low (2.5°C lower than the set value of chiller), the chiller will show the message saying' CHILLED WATER TEMPERATURE LOW', and the alarm buzzer will sound, and end up in abnormal stop automatically. At this time the refrigerant pump stops automatically, so sometimes the ice can be seen through the evaporator window. The set value above can be revised.

2) Cause

① When the chilled water temperature is too low, cooling load becomes so small that the cooling cycle has been formed already even though the chiller controls the temperature, making the temperature go down further.

② When you decrease the cooling load at once (air handling unit and FCU) while normal operating, cooling load may be decreased suddenly, and the chiller will not catch up the gap as well as the chilled water temperature go down further, causing the problem.

3) Troubleshooting

To solve ①, ② above, increase the cooling load by operating the air handling unit or FCU if the chilled water temperature falls too much. It is not serious that refrigerant is frozen when you look into the evaporator inspection window, but it can cause freeze rupture easily. So as far as possible, do not allow the chilled water pump to stop running. The refrigerant ice may be melted immediately by operating the refrigerant pump momentarily in 'MAN' mode. (But when the chilled water temperature is too low and the refrigerant pump stops automatically, do not operate the refrigerant pump in manual mode. In other words, it is the desirable to leave the refrigerant pump in stop state.)

5-2-3-4. CHILLED WATER FLUX SENSOR ABNL

1) Symptom

This kind of problems occur only for the machine where the chilled water flux sensor is attached. Stop the operation immediately in the same way as the chilled water flux low error in 13-3-2.

2) Cause

When error occurs in the chilled water flux sensor or flux is abnormal, it causes the flux sensor to be activated.

3) Troubleshooting

Find out and troubleshoot the causes of chilled water flux sensor activation. Take measures in the same way as 4-2-3-2.

5-2-3-5. ①CHILLED WATER PUMP INTERLOCK JUMPED ALARM ②CHILLED WATER FLUX INTERLOCK JUMPED ALARM

1) Symptom

When you operate the chilled water pump in 'MAN' mode and try to start chiller, chiller may not operate with the alarm and alert message. The messages concern the 'chilled water pump jump alarm' or 'chilled water flux interlock jump alarm'.

2) Cause

Both ① and ② occur when you are operating the chilled water in 'MAN' mode or other pump pumps the chilled water before operating the chiller. This is because the 'chilled water flux interlock' and 'chilled water pump interlock' on MICOM system menu is set to 'Use'.

3) Troubleshooting

If the chilled water pump interlock and chilled water flux interlock are set to 'Use', you should convert to 'not in use'. If you set to 'Use', you can operate the chilled water pump in 'MAN' mode, but you can not operate the chiller. Because when the chilled water pump interlock (or chilled water flux interlock) is set to 'Use', the state must be input according to the starting order of chiller. At this time, convert the chilled water pump to 'AUTO' mode and have the pump of chiller started. There is another way, that is, select the system menu on MICOM and input the password (_ _ _ _). Then set the chilled water pump interlock (chilled water flux interlock) to 'Not in use'. In this condition only, you can operate manually.

5-2-4. Error in cooling water system

5-2-4-1. COOLING WATER INTERLOCK ABNL

1) Symptom

When the cooling water pump stops operating, the chiller stops working with the message saying 'COOLING WATER INTERLOCK ABNL' and alarm. At this time, the chiller stops performing dilution operation under abnormal stop.

2) Cause

① It happens if the cooling water pump stops while the chiller is operating.

② It happens if the cooling water pump is turned to 'AUTO' from 'MAN' mode or 'MAN' from 'AUTO' mode when chiller is operating.

③ It happens if interlock contact point is bad.

3) Troubleshooting

① Find and remove the cause of the cooling water pump stop. Thereafter, start up chiller again.

② The cooling water pump should not be switched to 'auto' from 'manual' mode or 'manual' from 'auto' mode. Once the chiller stopped completely, switch the cooling water pump to 'auto' mode and start the chiller again.

③ Check whether interlock contact point of MCC panel in the cooling water pump works according to the start state of the pump.

5-2-4-1. COOLING WATER INTERLOCK ABNL

1) Symptom

When the cooling water pump stops operating, the chiller stops working with the message saying 'COOLING WATER INTERLOCK ABNL' and alarm. At this time, the chiller stops performing dilution operation under abnormal stop.

2) Cause

① It happens if the cooling water pump stops while the chiller is operating.

② It happens if the cooling water pump is turned to 'AUTO' from 'MAN' mode or 'MAN' from 'AUTO' mode when chiller is operating.

③ It happens if interlock contact point is bad.

3) Troubleshooting

① Find and remove the cause of the cooling water pump stop. Thereafter, start up chiller again.

② The cooling water pump should not be switched to 'auto' from 'manual' mode or 'manual' from 'auto' mode. Once the chiller stopped completely, switch the cooling water pump to 'auto' mode and start the chiller again.

③ Check whether interlock contact point of MCC panel in the cooling water pump works according to the start state of the pump.

5-2-4-2. COOLING WATER TEMP LOW ABNL

1) Symptom

If it operates over 30 minutes under condition that cooling water's temperature is below 19°C, the message of 'Cooling water temperature abnormal low' is indicated, and buzzer rings, and it stops doing dilution operation. If it operates for a long time under condition that cooling water's temperature is low, it stops automatically to prevent crystallization. (when it is operated below the lowest temperature, 19°C for more than 30 minutes, the conditions of time and temperature can be set.)

2) Cause

① It happens if cooling tower keeps on operating due to the wrong setting of cooling tower's temperature.

② It happens if it keeps on operating in manual mode of cooling tower.

③ It happens if cooling water's temperature lowers because the temperature of the outer air is too low even though cooling tower doesn't operate. In other words, it happens when the load is too little.

3) Troubleshooting

① In case of setting cooling tower's temperature at the chiller, check whether cooling tower fan's stop temperature and start temperature are set right on user's setting of MICOM main menu. If they are wrong, correct them. In case that the cooling tower is controlled through thermostat or DDC panel's auto-control, check and correct them.

② Switch cooling tower to auto mode.

③ If the outer air's temperature is low and the load is too little, cooling water's temperature does not rise because the amount of heat exchange inside chiller is considerably less than the amount of heat exchange of the cooling tower located outside. In that case, using air ventilation unit, make natural air environment without chiller's operation, or make a bypass to prevent cooling water from circulating through cooling tower.

5-2-4-3. COOLING WATER FLUX SENSOR ABNL

1) Symptom

This applies to only machines on which cooling water flux sensor is attached. In this case, it stops in the same way as in 'cooling water's low flux' of 5-2-4-5.

2) Cause

The cooling water flux sensor is activated.

3) Troubleshooting

Find out the cause and resolve it. Troubleshooting is the same as those of section 5-2-4-5.

5-2-4-4. ① COOLING WATER PUMP INTERSLOCK JUMPED ALARM ② COOLING WATER FLUX INTERLOCK JUMPED ALARM

1) Symptom

Chiller doesn't operate, and a message of 'cooling water pump interlock jump alarm' is indicated, and buzzer rings.

2) Cause

Cooling water pump runs in manual mode. This is the same as the cause of chilled water pump/flux interlock alarm of Section 9.

3) Troubleshooting

Set cooling water pump interlock jump alarm and cooling water flux interlock jump alarm to 'not in use'. In the same way as in13-3-5 COOLING WATER FLUX LOW

5-2-4-5. COOLING WATER FLUX LOW

(This is optional because flow switch or differential pressure switch is generally not on the chiller and equipped only by customer order.)

1) Symptom

If cooling water flux is not sufficient, it stops in the same way as that of cooling water pump interlock error. In this case, the pressure of cooling water pump shakes or falls. This leads to a rise of chiller's inner pressure, and a steep rise of high temp. regenerator's pressure from the normal pressure, and errors of 'high temp. regenerator's high pressure' and the like. In addition, high temp. regenerator's pressure stays on higher state, and crystallization is likely to happen because the flow of absorption solution is not smooth.

2) Cause

① It happens if dispersed cooling water amount is too much because cooling tower's fan has some trouble, or the amount of filling water is less than that of dispersed cooling water.

② It happens if cooling tower is not sufficiently supplied with filling water, or cooling tower lacks water on account of the open drain valve of cooling water.

③ It happens if air is mixed on account of cooling water's low flux inside cooling tower when cooling water pump starts up at the beginning.

3) Troubleshooting

① Consult with the manufacturer of cooling tower about the cause of excessive dispersion.

② Check up filling water pipe, valve and so on in order that the supplement goes on smoothly.

③ Check up whether cooling tower's tank is always filled with water during starting up at the beginning.

5-2-5. Error in combustion system

5-2-5-1. BURNING-IGNITION FAILURE

1) Symptom

If burner fails to ignite, it stops, and burner's PR (protector relay) is lit in red. MICOM not only displays error message and rings buzzer but also performs dilution operation at the same time.

2) Cause

① It happens mainly when the chiller starts up with the gas valve locked.

② It happens if the amount of gas or air is too much at the initial ignition.

③ It happens if flame is not sensed at the ignition.

④ It happens if spark is not generated at the ignition or the pilot is not ignited.

3) Troubleshooting

① Check up all gas valves and open all of them. When all valves become normal, press the PR's red button of burner to relieve it, and start up chiller again.

② Check up the flame state after restarting the burner. If it is extinguished as soon as it ignites but its color is deep red or it has blowup ignition and extinguished soon, the amount of gas is too much. If blue flame flutters and extinguished, air is too much. In these cases, contact LG to get service.

③ A user should check up the flame within 4 seconds after igniting. If you fail to check up, gas valve will be closed and fire will be extinguished. If flame sensor is stained with foreign materials, clean it. If flame sensor is defective, replace it with a new one.

④ If it is other than the above, it may be electric leakage or abnormal interval of ignition. In this case, contact LG to get service.

5-2-5-2. BURNER SYSTEM ABNL

1) Symptom

Burner won't start up. The alarm lamp for combustion system abnormal is lit on and the burner stops immediately.

2) Cause

① It happens if burner system has some trouble before starting up chiller.

② It happens if the gas pressure drops during operation after ignition or it isn't ignited on account of imperfect combustion

3) Troubleshooting

① Check up whether PR's alarm lamp of gas pipe in burner side or other burner is lit on red, and adjust the abnormal part of gas pipe, and reset PR.

② If gas pressure falls, contact the gas provider to adjust the governor in the main pipe. If it is in imperfect combustion, contact LG to get service.

5-2-5-3. EXHAUST GAS TEMPERATURE HIGH

1) Symptom

when the temperature of waste gas is higher than 300°C, the chiller performs a dilution operation automatically to stop error.

2) Cause

① When gas heat capacity is oversupplied.

② When exhaust is bad at the waste gas chimney.

③ When the temperature sensor for waste gas is defective.

3) Troubleshooting

① When gas heat capacity is oversupplied, the temperature of waste gas rises high abruptly. Therefore measure the amount of gas to check the oversupply of gas heat capacity and contact the service center.

② Bad exhaust is caused by the small sized chimney or too many curved parts in chimney. It needs mending. And the first curved part should begin properly after initial part of chimney straightens up at least more than 1m. When the height of chimney is too low, natural exhaust can be disturbed. If it doesn't work well, compulsory exhaust fan can be installed as an alternative.

③ Exhaust temperature sensor should be replaced.

5-2-5-4. BURNER GAS PRESSURE ABNL

1) Symptom

When the gas pressure is too low or too high, the burner doesn't work and pressure error message will be displayed.

2) Cause

① For low pressure, it occurs when supplied gas pressure at the first side is too low.

② For high pressure, it occurs when applied gas pressure at the second side is set too high.

3) Troubleshooting

① When gas pressure at the first side is too low, the gas valve is likely to be in closed state. So check the valve and take proper measures. On the other hand, when gas pressure at the first side is high, the governor of main piping seems to be defective. Contact the gas company for troubleshooting.

② Gas pressure switch should be set again.

PGSL (1st side) = 12~14mbar (for low pressure)

PGSH (2nd side) = 100mbar or 150mbar (for intermediate pressure)

5-2-5-5. ①CONTROLLER 1 FEEDBACK ABNL ② CONTROLLER 2 FEEDBACK ABNL

1) Symptom

The control valve opening of the burner displays error and then 1 feedback error on the control part occurs. The control valve of the burner doesn't work normally in opening and closing.

2) Cause

① When potential meter of burner is not normal.

② When MICOM main board doesn't recognize the opening of burner.

3) Troubleshooting

① Abnormal potentiometer in control valve motor of burner causes defective input/output signal. Potentiometer should be replaced.

② When the output of resistance value in potentiometer is normal, check the terminal contact of wiring.

5-2-5-6. ①BURNER OIL PUMP OVERHEAT ②BURNER BLOWER OVERHEAT

1) Symptom

Over-current flows into the thermal relay of the burner oil pump or blower magnet and as a result it is overloaded. A thermal relay works to stop the burner and the chiller performs the abnormal stop operation.

2) Cause

① When the burner oil pump or motor in blower is overloaded by over current.

② When the thermal relay is wrongly set.

③ When over-current thermal relay of the burner doesn't work normally.

3) Troubleshooting

① Measure the current of the oil pump or the blower during its operation to check if it lies within rated voltage and current. When an error is found, contact LG.

② If it is lower than rated current, then over-current thermal relay doesn't work normally or rated current is set low. Accordingly raise the setting.

③ The state of contact point is defective. The thermal relay should be replaced.

5-2-5-7. VENTILATIOIN FAN INTERLOCK ABNL

1) Symptom

The chiller works only when ventilation fan works. And when ventilation fan doesn't work any more, the chiller performs the abnormal stop operation.

2) Cause

It occurs when ventilation fan stops.

3) Troubleshooting

Find the reason why ventilation fan doesn't work and take proper measures. When there is no ventilation fan, wiring must be missing. Check it also for troubleshooting (※Check it at LG's SVC during the commissioning.)

5-2-6. Error in main body and chiller

5-2-6-1. STORAGE TANK PRES SENR ABNL

1) Symptom

Only when pressure sensor for storage tank is installed, it occurs.

2) Cause

It occurs when there is an error in the output value of the storage tank pressure sensor.

3) Troubleshooting

It is necessary to inspect the storage tank pressure sensor. .

5-2-6-2. ABSORPTION SOL concentration HIGH

1) Symptom

When the concentration of absorption solution is higher than 65% and it lasts more than 10 minutes 'ABSORPTION SOL concentration HIGH' message is displayed and a buzzer sounds performing the dilution operation under abnormal stop.

2) Cause

① When crystallization increases concentration.

② When cooling system doesn't work normally.

③ When fuel is consumed too much.

3) Troubleshooting

① When crystallization forms an abnormal cycle and disturbs the flow of absorption solution increasing concentration, it can occur. Crystal dissolution task is needed for this.

② When the temperature of cooling water is too high or too low, concentration goes up abruptly causing error. Inspect cooling water the chiller, the temperature of the high temp. regenerator gets high and the concentration goes up causing error. Check the adjustment state of burner.

5-2-7. Error in electric motor system

5-2-7-1. ① NO SIGNAL-REFRIGERENT PUMP
② NO SIGNAL-purge pump

1) Symptom

The output signal for refrigerant pump shows up in MICOM but the input signal does not. chiller is working normally but warning message shows up.

2) Cause

Magnet does not contact properly in the refrigerant pump or input contact point is defective in I/O board.

3) Troubleshooting

Check the contact point of magnet in the refrigerant pump. Replace magnet or change the contact point if there is a problem.

5-2-7-2. ① ABS SOL PUMP NO1. ABNL
② ABS SOL PUMP 2 ABNL
③ REFRIGERANT PUMP ABNL
④ Purge pump ABNL

1) Symptom

"Name of corresponding part + overheating" message shows up and dilution operation stops when electric current flows excessively in each electric motor pump attached in the chiller. In case of absorption solution pump 1, the effect of dilution operation is less as it does not work.

2) Cause

① It occurs when foreign material gets in each pump or pump performs no-load operation for a long time.

② It occurs when insulation of each pump is bad.

③ It occurs when thermal relay attached in each pump does not work properly or the current is set low.

3) Troubleshooting

① Check whether the pump performs reverse rotation or no-load operation when it runs. If the pump performs no-load operation, it means there is crystallization, insufficient absorbent or abnormal flow of cooling water (Refer to the troubleshooting of "Cooling water's abnormal low flux"). Refrigerant pump performs no-load operation when refrigerant is insufficient or cooling cycle is built abnormally. Perform crystal dissolution when it is due to crystal. Adjust the cooling cycle or add refrigerant when refrigerant is insufficient. (Excluding the no-load operation of the purge pump).

② Check insulation of each pump by MΩtest on 3 phases of R, S and T. Replace the pump if insulation is bad. The insulation of contact point and each phase should be over 500 MΩ.

③ Check whether the current value set in thermal relay of each pump magnet is normal or not. Replace the thermal relay in case that the current value is normal when the current value of each pump is measured while thermal relay is defective when the value of it is increased.

5-2-7-3. ① ABS SOL PUMP NO1. INTERLOCK JUMPED ALARM
② ABS SOL PUMP 2 INTERLOCK JUMPED ALARM
③ purge pump 1 INTERLOCK JUMPED ALARM
④ REFRIGERANT PUMP INTERLOCK JUMPED ALARM

1) Symptom

Alarm message shows up when the condition signal of each pump attached in the chiller is input or jumped regardless of the control of the chiller.

2) Cause

It occurs when condition signal of each pump attached in the chiller is input or jumped regardless of the control of the chiller.

3) Troubleshooting

Release the jumped part if absorption solution pump or refrigerant pump is jumped as they operate according to the control of chiller. Contact LG as there is a possibility that MICOM has trouble when there are troubles although the jumped part is disengaged.

5-2-8. Error in MICOM

5-2-8-1. Error message

1) Symptom

The message shows up when communication between main board, display board, I/O (Input/Output) board A, and I/O board (Input/Output) -B is bad.

2) Cause

The contact between main board, display board, I/O board A and I/O board B is bad.

3) Troubleshooting

Check the jack in each part as these troubles occur because contact parts of power or communication in each board are bad. Contact the service center when there are troubles after troubleshooting them.

5-2-8-2. MAIN CONTROLLER RESET

1) Symptom

The message shows up when resetting the system.

2) Cause

The system is reset.

3) Troubleshooting

It is necessary to reset the system again. Contact the service center.

5-2-9. Other errors

5-2-9-1. Temperature of chilled water does not fall

1) Cause

① Crystal is formed.

② Cooling does not work when the temperature of cooling water is too high.

③ Cooling does not work when the refrigerant is mixed with absorption solution or it is contaminated.

④ The pressure inside the chiller is high due to poor purging.

⑤ The speed that temperature of chilled water falls is slow when the control valve is changed to 'Manual' and low combustion is maintained.

⑥There is very small leakage in some place of chiller.

2) Troubleshooting

① Perform crystal dissolution operation when crystal is formed. (Refer to Crystal dissolution).

② The fan of cooling tower does not work properly or water circulation is not normal due to the shortage of cooling water flux when the temperature of cooling water is too high. Check cooling water circulation and supply water more or make the fan of cooling tower work properly.

③ Evaporation capacity of refrigerant gets lower when refrigerant is mixed with absorption solution. Therefore temperature of refrigerant does not fall and absorption capacity is reduced. Perform the blow-down.

④ Cooling cycle is not formed and crystal is easily formed and pressure and temperature of high temp. regenerator gets higher when the pressure inside chiller is high. Perform purging task.

⑤ The control valve does not move d in low combustion and the temperature keeps low in high temp. regenerator when the control valve is in Manual. The low temperature of high temp. regenerator means the cooling capacity of the chiller is decreased. Convert the control valve of MICOM panel to Automatic.

⑥ Cooling does not work and the temperature of chilled water does not fall and the inside of the equipment corrode when there is a leakage. Therefore, contact the service center immediately when there is a leakage.

5-2-9-2. Temperature of cooling water does not fall

1) Cause

There is a trouble in cooling water flux, the fan of cooling tower or cooling tower itself. It is possible for cooling tower not to work properly due to the troubles in control of cooling tower.

2) Troubleshooting

Check whether cooling water flux is enough or not and supplement if needed. Contact the company involved cooling tower when there is a trouble in the fan of cooling tower or cooling tower itself.

5-2-9-3. Too much refrigerant in sight glass

1) Cause

Too much refrigerant is in the sight glass of refrigerant or the temperature of high temp. regenerator is high.

2) Troubleshooting

When the temperature of high temp. regenerator is 156°C, it is normal as the refrigerant is filled by half of the sight glass of evaporator and overflows automatically. However, perform Blow-down and Crystal Dissolution operation if the cause is judged to be the crystallization.

5-2-9-4. Burner switch ON and OFF too often

1) Cause

The temperature variation of chilled water is too big as cooling load is low.

2) Troubleshooting

Increase the cooling load. Contact the service center when burner turns ON/OFF abnormally (regardless of chilled water outlet temperature, i.e., in case chilled water outlet temperature is higher than the set temperature).

5-2-9-5. Abnormal noise occurs

1) Cause

① Chiller makes a noise like rolling stones inside regenerator when it operates for the first time in the low temperature state of high temp. regenerator. This noise is generated when absorption solution is heated by burner.

② When burner is firing, it makes a noise like bursting out and it means explosive combustion by imperfect combustion or waste gas emission malfunction.

③ Pump makes a noise severely when absorption solution pump performs no-load operation.

④ Heat exchanger makes a hammering noise when operating cooling. It is caused as circulation cycle of absorption solution is not proper.

2) Troubleshooting

① The noise is normal and it will go away when high temp. regenerator is heated in some degrees. The opening rate of the control valve can be adjusted to decrease the noise as it is caused by flame and heating time in burner.

② Adjust again the fuel consumption rate or make waste gas emit smoothly as explosive firing occurs because of imperfect combustion.

③ If it makes an abnormal noise severely, absorption solution pump performs no-load operation. Bearing of absorption solution pump may be damaged and pump is stuck and broken when absorption solution pump performs no-load operation. Therefore, perform Blow-down or close the control valve manually to decrease the amount of evaporation in high temp. regenerator and make absorption solution be collected in absorber. And then judge whether there is crystallization, and based on the judgment, decide which is needed among crystal dissolution and re-operation.

④ The hammering noise is made when the flow of absorption solution is interrupted momentarily between high temp. regenerator and low temp. regenerator. It is usually caused before low-combustion goes to high-combustion or does in reverse. Thus, adjust again the cycle with intermediate solution damper or readjust the entire cycle. However, noise to some extent is normal one as it is impossible to make absorption solution flow perfectly continuous according to the status of chiller. It is recommended to adjust it when the noise occurs often and severely.

5-3. Emergency trouble

5-3-1. Freeze rupture

5-3-1-1. What is freeze rupture?

Freeze rupture means the copper pipe inside evaporator, absorber, condenser and so on is ruptured by freezing. It occurs as volume is increased when water changes to ice. Usually evaporator is ruptured by freezing in the cold season. Absorber or condenser is ruptured by freezing as the remaining water inside is frozen to make copper pipe ruptured when it is kept for a long time in winter season. As freeze rupture occurs in the water part, it is recommended to control chilled water part thoroughly to prevent freeze rupture from happening.

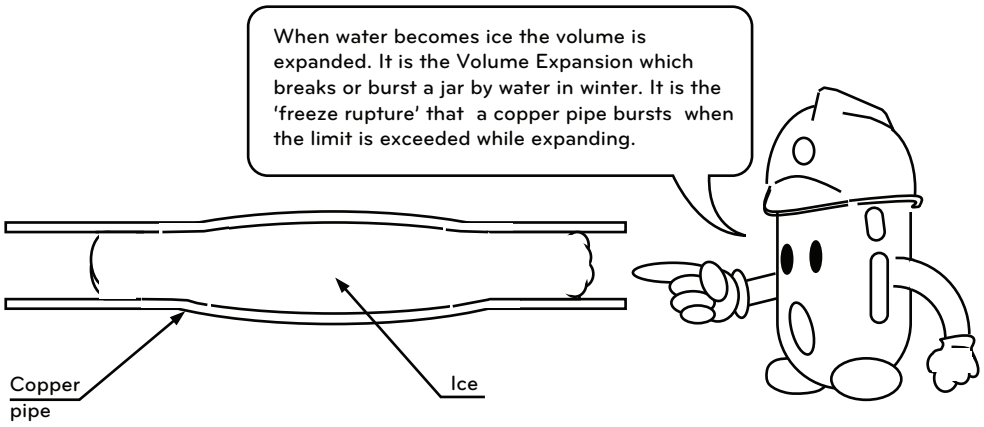


Figure 5-2 Freeze rupture

5-3-1-2. Cause of freeze rupture

1) Chilled water is ruptured by freezing inside copper tube when chilled water does not flow normally by foreign materials sticking in water tank part of evaporator. Therefore check if chilled water flows smoothly all the time when operating chiller. If there is a trouble in it, take an action as soon as possible. chiller stops operating immediately when chilled water temperature goes down too low(under 2.5°C, adjustable in MICOM). However, the chiller does not stop as MICOM cannot detect whether the inside of copper pipe is blocked. Freeze rupture occurs by this reason.
2) When the chiller is running under full load, if the load of air-handling unit or other equipment is stopped suddenly, the temperature of chilled water falls rapidly and chiller starts controlling immediately. However, the cooling capacity is maintained with the remaining heat as absorption capacity of absorption solution is maintained in high temperature inside the high temp. regenerator. Therefore, it is recommended not to decrease suddenly the load of air-handling unit (AHU or FCU) or other equipment as it causes copper pipe ruptured.
3) Chilled water does not circulate if there is air a lot inside the pipe for chilled water. Air inside the pipe disturbs circulation of chilled water inside the evaporator. It also causes freeze rupture as it is the same as sticking foreign material inside copper pipe described in 1).
4) Contaminated chilled water or cooling water accumulates scale in the pipe and can block it. It also causes freeze rupture as it is the same as sticking foreign material inside copper pipe described in 1).
5) Chilled water or cooling water makes copper pipe corrode and cause rupture when they are contaminated and water quality gets worse. It is different from pipe rupture caused by the lowering of temperature but it is important to control water quality as it is also fatal. Especially copper tube can be corroded with remaining chemical material during cleaning pipe if it is not neutralized enough after cleaning the tube. Therefore, it is recommended to use the contract system for maintenance that LG recommended.

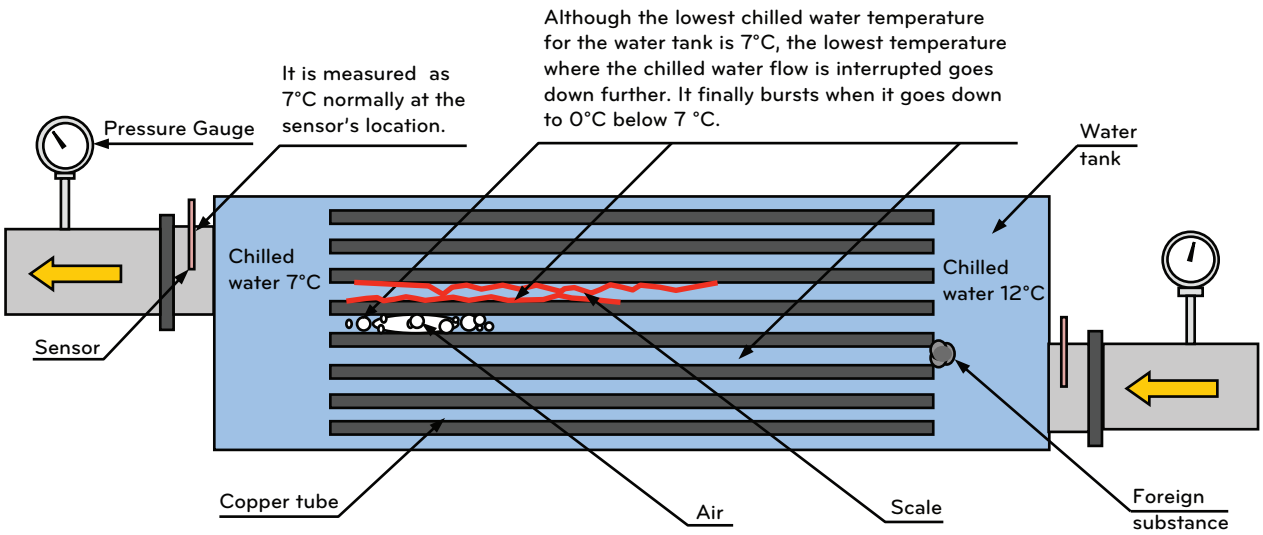


Figure 5-3. The cause of copper tube burst

5-3-1-3. Freeze rupture prevention

1) To prevent freeze rupture, it is important to control the water circulation thoroughly . Usually the pump should be operated after supplying chilled water and cooling water at the beginning of commissioning. And then clean perfectly the inside of pipe and remove foreign material thoroughly by draining it out 2~3 times after water circulation. Mainly foreign material (bolt, nut, welding slug, gloves and so on) is stuck inside pipe not allowing chilled water to flow at the beginning of commissioning. As shown in Figure 14-2, sensor indicates the normal temperature but MICOM does not detect that temperature of some part in copper pipe falls down when foreign material is stuck inside of it. That is the cause of the freeze rupture. It is very important to clean the inside of pipe at the beginning of commissioning to remove it.
2) High temperature in high temp. regenerator means the cooling capacity is at the maximum having a sufficient cooling capacity. Temperature of chilled water falls drastically as chiller has sufficient cooling capacity and cooling load is small when cooling load is decreased drastically. MICOM starts controlling according to the load capacity, but temperature of chilled water falls continuously by the cooling capacity regardless controlling in high temp. regenerator. Therefore, it is very dangerous to decrease drastically the cooling load in subsidiary equipment such as air-handling unit, fan coil, etc. To prevent danger, cooling load of subsidiary equipment such as air-handling unit, fan coil, etc. should always be decreased after completion of chiller operation or decreased step by step.
3) Air inside the pipe for chilled water should be removed completely and an automatic air bent should be installed to remove air as the air is still generated continuously by pump after purging completely. Also it is necessary to check water circulation by installing pressure gauge in the pipe for chilled water as water does not circulate well when air is filled in it. As shown in Figure 14-2, outlet side always forms lower pressure than inlet side because of the loss of pressure when chilled water flows inside the chiller. By this, it can be checked that whether water circulates normally through it or not. Pressure difference is too greatly or little between inlet and outlet when water does not circulates normally. Also the needle of pressure gauge shakes severely if opening status of pressure regulating valve in pipe for chilled water or valve in header is improper or expansion tank operates abnormally. In this case, check it out and take action to correct the phenomena. Pressure difference is different depending on the model of chiller. Usually it is normal to be above minimum 0.3~0.5kgf/cm2. It is normal for the temperature difference between inlet and outlet for chilled water to be under 5°C. Check water circulation and take action to correct as flux of chilled water is smaller if temperature difference is over 5°C. Therefore, install a pressure gauge if possible and check it often while operating.
4) It is necessary to clean periodically as it is a cause of freeze rupture when efficiency drops by scaling from contamination of chilled or cooling water.
5) Replace chilled or cooling water completely or neutralize it with a proper chemical to avoid corrosion inside of the pipe when chilled or cooling water is contaminated. Especially neutralize it completely before use when pipe is cleaned with a chemical at the beginning of commissioning.

5-3-1-4. Troubleshooting on freeze rupture

1) When freeze rupture occurs, chilled water is going up to the upper side of refrigerant sight glass in evaporator and cooling does not work. It is also possible for chiller to be deformed by water pressure when pressure of pipe is high.
2) Turn off the power of chiller immediately in case of freeze rupture.
3) Stop pumps of chilled and cooling water. They stop as soon as the power of chilled and cooling water are turned off. (Stop it by pressing switches on MCC panel in case pumps are operating manually).
4) Lock off completely valves of chilled and cooling water as soon as possible.
5) High temp. regenerator can be deformed if the pressure of pressure gauge in it is over 0.5kg/cm2. In this case, put a big container like a drum under service valve of heat exchanger or high temp. regenerator and discharge absorption solution by opening valves so that its interior pressure can be lowered below atmospheric pressure(0kg/cm2).
6) Contact the service center immediately when freeze rupture occurs. In case the pressure of chilled water is high, contact the service center after doing troubleshooting as above.

5-3-2. Troubleshooting on power interruption

Chiller stops immediately upon power failure when operating. chiller operates normally by supplement function of MICOM when power is interrupted instantaneously (0.2 ~0.3 seconds). When power is interrupted for a long time, the chiller operates normally by operation function for power recovery at power interruption in MICOM. (only when "Select Operation for Power Interruption" is selected). chiller operates by the operation timer "Operation and dilution at power recovery" (1 to 360 minutes: Default value is 30 minutes). chiller operates again when it is within the power recovery set time, and stops and performs dilution operation when it exceeds the set time.

chiller is stopped completely by "Prevention for operation at power recovery" function (1 to 999 minutes: default value is 60 minutes) when it exceeds the set time in "Prevention for operation at power recovery"

Follow the sequence below in the main menu to select operation at power interruption.

System Menu - Safety Control Setting - Select Operation at Power Interruption When "Re-operation" is set instead of "Stop" in "Select Operation at Power Interruption", chiller operates automatically again when power interruption time is within 30 minutes (It is possible to adjust the set time), or performs dilution operation when it exceeds 30 minutes according to the set function. However, chiller stops completely by "Prevention for operation at power recovery" when power interruption time is over 60 minutes.

5-3-2-1. Instantaneous power interruption

Chiller operates continuously by supplement function (within 0.2~0.3 seconds) of MICOM when power is interrupted instantaneously. It operates normally the same as it does continuously in this case. (But it can be stopped abnormally by closing the electric valve of burner even if it is within 0.2 ~0.3 seconds). chiller operates again after stop when performing dilution operation. Also it can be operated again by pressing operation button immediately, when it does not work at all after it is turned off and on and stopped completely. (In case that "Select operation at power interruption" has not been set).

5-3-2-2. Long time power interruption

① Crystallization can occur easily when power is interrupted for a long time. Use the "Select operation at power interruption" function to avoid it. Then chiller operates again or performs dilution operation at power recovery after power interruption described in 14-2. However, take a proper action immediately when power is interrupted for a long time (Usually 20~30 minutes although it depends on the temperature of outlet for chilled water and high temp. regenerator) as it can be ruptured by freezing in this case. Chilled water should be circulated continuously as the first priority.

② If there is an electric generator, upon power interruption, all the subsidiary equipment (chilled water, cooling water, cooling tower and so on) of chiller should be connected electric generator to operate it again by being automatically connected to the electric generator and turned on the power.

③ If there is no electric generator (or power supply is delayed to pump for chilled water as the electric generator does not operate in short time), open slowly valve A for cooling and heating conversion of chiller to input directly refrigerant vapor from the high temp. regenerator to the main body and lower the pressure inside the high temp. regenerator and feed the refrigerant vapor to absorber and evaporator to raise the temperature inside of them, not allowing them to perform cooling operation. Or it is also possible to let chilled water flow even a small amount by opening drain valve for chilled water temporarily. However it is complicated chilled water should be filled again and the chiller should be operated again after air purging because air goes into the pipe. Check whether crystal is formed or not when chiller operates normally after power recovery. Perform crystal dissolution operation when crystal is formed. (Refer to "Crystal and crystal dissolution" part).

5-3-3. In case of absorption solution outflow

When absorption solution flows out due to external damage or leakage of chiller, put the solution in a clean container. On finding leakage or outflow, stop operation and contact LG. Clean it with a dried duster if it is a small quantity and put it in a clean container if it is a large quantity. If skin or cloths is stained with solution while putting it in a container, clean it with soapy water.

5-3-4. In case of fire

5-3-4-1. In case of fire in a chilled-heater burner

Because the chiller uses gas or oil as heat source, be very cautious of fire caused by gas explosion or oil leakage. For oil or gas burner, close the main valve when the chiller doesn't work long time. When fire occurs, stop the operation immediately and close the main valve for gas or oil to prevent great fire. When flame continues to occur in a high temp. regenerator, lift down the power switch for burner and stop the chiller. Use fire extinguisher or contact fire station at hand if necessary. (The chiller is equipped with a safety device, so it has almost no danger of fire. But since the fire breakout is unpredictable, take action with the safety as the first priority.)

① For an oil burner, when oil is left in a high temp. regenerator and the chiller is put into operation, oil left inside can be ignited. In this case, stop the operation immediately and contact the service part to have the burner examined.

② For a gas burner, it is highly possible that explosion or suffocation occurs by gas leakage, thus ventilate in the machine room. Check gas leakage regularly and operate the ventilation fan in the machine room before operation for ventilation.

Perform gas leakage inspection periodically, and ventilate using the fan in the machine room before the chiller operation.

Generally, a gas burner has its own safety device and performs free purging before firing to discharge internal gas, but be aware of that exhaust damper or exhaust gas passage may have been blocked.

X. Trouble Shooting

Causes of alarms and troubleshooting

Troubleshooting for abnormality

Troubleshooting for the display of abnormality on the MICOM.
Take action following the troubleshooting shown below for the error display on the MICOM.
Check the troubleshooting and refer to the HELP message.
Check the content of abnormality and troubleshooting on the HELP message on the screen.
Remove the cause of the abnormality following the part on the related circuit, drawing and the manual.
If there is no information in the manual or the drawing about the abnormality, please consult the LG service engineer.
Check the temperature control status, the pressure status and others.

Abnormality category	Display message	Cause	Action
Chilled water inlet temperature sensor	Chilled water inlet temperature sensor abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Chilled water outlet temperature sensor	Chilled water outlet	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Cooling water inlet temperature sensor	Cooling water inlet temperature sensor abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Cooling water outlet temperature sensor	Cooling water outlet temperature sensor abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Hot water inlet Temperature sensor	Hot water inlet temperature sensor abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Hot water outlet temperature sensor	Hot water outlet temperature	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Condenser temperature sensor	Condenser refrigerant temperature sensor abrnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Low temp. regenerator temperature sensor	Low temp. regenerator	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Evaporator refrigerent temperature sensor	Evaporator refrigerent	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Dilute solution temperature sensor	Dilute solution temperature sensor abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
High temp. regenerator temperature sensor, regenerator temperature sensor	High temp. regenerator temperature sensor abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Exhaust gas temperature sensor (Vapor drain temperature sensor)	Exhaust gas temperature sensor, (Vapor drain temperature sensor) abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Storage tank pressure transmitter	Storage tank pressure sensor abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
purging system pressure	purging system pressure sensor abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.

Abnormality category	Display message	Cause	Action
Current converter	Current sensor abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Voltage converter	Voltage sensor abnormal	• Sensor disconnection / short circuit • Malfunction of main board	• Check the part state or wiring. • Replace the part or rewire.
Chilled (Hot) water flux converter	Chilled water flux sensor abnormal	• Sensor disconnection / short circuit • Malfunction of the main board	• Check the part state or wiring. • Replace the part or rewire.
Hot water temperature (in heating)	Hot water temperature high abnormal	• It detects as the hot water temperature is higher than the set value. • Too small of heating load.	• Check the current hot water outlet temperature displayed on MICOM screen or thermometer. • Check the control temperature and set temperature • Check whether the set value for abnormal is too low. • Check and correct the set value if set wrong.
Chilled water pump interlock	Chilled water pump interlock abnormal	• Pump interlock signal is disconnected during operation. • Pump stopped. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.
Chilled water flux	Chilled water flux abnormal	• Flux signal is disconnected during normal operation • Pump stopped. Flow(differential pressure) switch set abnormal • Wrong wiring • Malfunction of the Master board	• Correct and check the set value • Check the part state or wiring. • Replace the part or rewire.
Chilled water inlet(outlet) temperature	Chilled water temperature low abnormal	• It detected as the chilled water inlet/ outlet temperature is lower than the set value. • Too small or no load for cooling	• Check the current temperature displayed on MICOM screen or thermometer. • Check the chilled water outlet temperature displayed on MICOM or the temperature displayed on a thermometer. • Check the cooling load and correct the set value. • Check the set value and correct the input value if wrong.
Hot water pump interlock	Hot water pump interlock abnormal	• Interlock is disconnected during load operation. • Pump is stopped or wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.

Abnormality category	Display message	Cause	Action
Hot water flux	Hot water flux low abnormal	• Flux signal is disconnected during normal operation • Pump stopped. Flow (differential pressure) switch set abnormal • Wrong wiring • Malfunction of the Master board	• Check and correct the set value. • Check the part state or wiring. • Replace the part or rewire
Power voltage	Main power voltage abnormal	• The main power voltage is lower than the set value. • Malfunction of current transducer	• Check the main power voltage and the voltage set value. • Check the part state or wiring. • Replace part or repir
Absorption solution pump1	Absorption solution pump1 over heat abnormal	• When the loaded current is over the set value. • Wrong set of over current relay or malfunction	• Check the load current and remove the cause. • Check the set value and correct. • Check the related parts and wiring. • Replace the malfunctioning part or correction.
Main power current	Main power voltage abnormal	• When the set value of main power current is abnormal • Malfunction of current transducer	• Check the main power voltage and the voltage set value. • Check the part state or wiring. • Replace the part or rewire.
Refrigerant pump	Refrigerant pump overheat abnormal	• When the loaded current is over the set value. • Wrong set of over current relay or malfunction	• Check the load current and remove the cause. • Check the set value and correct. • Check the related parts and wiring. • Replace the malfunctioning part or correction.
High temp. regenerator pressure	High temp. regenerator pressure high abnormal	• Pressure switch is operated • The high temp. regenerator pressure is higher the set value. • Wrong set value or wrong wiring • Malfunction of the Slave board	• Check the cooling water temperature and correct the set value within the allowed limit. • Check the normal operation of the fule control valve. • Check and correct the set value. • Check the related parts and wiring. • Replace the malfunctioning part or correction.
High temp. regenerator temperature	High temp. regenerator temperature high abnormal	• The high temp. regenerator temperature is higher the set value. • Wrong set value or wrong wiring • Malfunction of the Slave board	• Check the cooling water temperature and correct the set value within the allowed limit. • Check the normal operation of the fule control valve. • Check and correct the set value. • Check the related parts and wiring. • Replace the malfunctioning part or correction.
High temp. regenerator liquid level	High temp. regenerator liquid level low abnormal	• The liquid level is lower than the guide level. • Error in set value or wrong wiring • Absorption solution pump stopped • Malfunction of the liquid level relay module • Malfunction of the Slave board	• Check the rotation direction of the pump. • Check the operation of the liquid level relay. • Check the related parts and wiring. • Replace the malfunctioning part or correction.

Abnormality category	Display message	Cause	Action
Exhaust gas temperature	Exhaust gas temp. high abnormal	• Exhaust gas temperature is higher than the set value. • Wrong set value or wire • Malfunction of the main board	• Check the temperature of the exhaust gas and change the set value within the allowed limit. • Check the normal operation of the fuel control valve. • Correct the set value • Check the contamination of combustion room. • Check the part state or wiring. • Replace the malfunctioning part or correct.
Burner system	Burner system abnormal	• Burner safety relay operated • Abnormality in the burner system occurred • Wrong wiring • Malfunction of burner safety relay	• Check the burner operation • Check the part state or wiring. • Replace the part or rewire.
Concentration of solution	Absorption solution concentration high abnormal	• The concentration is maintained higher than the set value for the duration of the set time.	• Check the operation of fuel control valve. • Check the operation of the absorption solution pump. • Check the cooling water inlet temperature and the flux. • Check the temperature of low temp. regenerator and the condenser refrigerant. • Check the parts state or wiring. • Replace the part or rewire.
Evaporator refrigerant temperature	Evaporator refrigerant temperature low abnormal	• It detects the refrigerant temperature as lower than the set value. • No or too small cooling load	• Check the displayed value of MICOM or the thermometer. • Check the refrigerant temperature of the displayed value of MICOM or the thermometer. • Check the cooling load and correct the set value within the allowed limit. • Check the set value and correct if the input value is wrong.
Vapor drain temperature	Vapor drain temperature sensor abnormal	• Sensor disconnected / short circuit • Malfunction of the main board	• Check the part state or wiring. • Replace the part or rewire.
Burner firing	Failure of firing	• The combustion check signal is not closed when the burner starts.	• Check the burner circuit. • Check the fuel supplying status. • Check the part state or wiring. • Replace and correct the malfunctioning part
Hot water pump interlock	Hot water pump interlock jump alarm	• Pump interlock is closed during stop. • Wrong wiring • Malfunction of the Master board	• Check the related parts and wiring. • Replace malfunctioning parts or correct.

Abnormality category	Display message	Cause	Action
Cooling water pump interlock	Cooling water pump interlock abnormal	• Pump interlock signal is disconnected during operation • Pump stopped. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.
Cooling water flux interlock	Cooling water flux low abnormal	• Pump interlock signal is disconnected during operation • Pump stopped. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.
Cooling water inlet temperature	Cooling water temperature low abnormal	• Cooling water inlet temperature is lower than the set temperature.	• Check the temperature of MICOM or the thermometer. • Check the temperature of the chilled water outlet displayed on the MICOM or the thermometer. • Check the set value and correct if the input value is wrong.
Chilled water flux interlock	Chilled water flux interlock jump alarm	• Flux interlock is closed during stop. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.
Chilled water pump interlock	Chilled water pump interlock jump alarm	• Pump interlock is closed during stop. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.
Power failure	Display of power failure abnormal	• Main power shut-off • Main power switch is open • Fuse is damaged. • Disconnected connector or wire	• Check the status of the main switch and motor power. • Check fuse. • Check the connector or wiring. • Part replacement or rewiring.
Hot water flux interlock	Hot water flux interlock jump alarm	• Flux interlock is closed during stop. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.

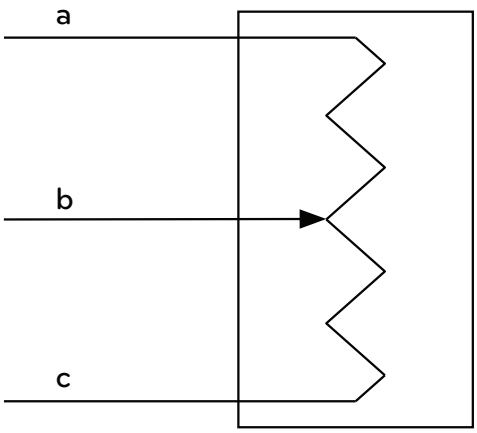
Abnormality category	Display message	Cause	Action
Concentration of solution	Run within the high concentration limit	• Concentration of solution is higher the set value	• Check the operation of the fuel control valve. • Check the operation of absorption solution pump. • Check the cooling water inlet temperature and flux level. • Check the temperature of the low temp. regenerator and the condensed refrigerant. • Check the related parts and wiring. • Replace or correct parts.
Cooling water pump interlock	Cooling water pump interlock jump alarm	• Pump interlock is closed during stop. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.
Cooling water flux interlock	Cooling water flux interlock jump alarm	• Flux interlock is closed during stop. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.
Absorption solution pump1 interlock	Absorption solution pump1 interlock jump	• Pump interlock is closed during stop. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.
Absorption solution pump2 interlock	Absorption solution pump2 interlock jump	• Pump interlock is closed during stop. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire
Purge pump interlock	Purge pump interlock jump warning	• Pump interlock is closed during stop. • Wrong wiring • Malfunction of the Slave board	• Check the part state or wiring. • Replace the part or rewire
Combustion signal interlock	Combustion signal interlock jump warning	• Combustion signal interlock is closed during stop. • Wrong wiring • Malfunction of the Slave board	• Check the part state or wiring. • Replace the part or rewire
Refrigerant pump interlock	Refrigerant pump interlock jump warning	• Pump interlock is closed during stop. • Wrong wiring • Malfunction of the Slave board	• Check the part state or wiring. • Replace the part or rewire

Abnormality category	Display message	Cause	Action
Max. heat capacity control	Control of max. heat capacity	• Chilled water inlet temperature is lower than the safety set value.	• Check the cooling water inlet temperature and correct the set value.
Purge pump	Purge pump overheat	• When the load current is higher the set value. • The set value of over-current relay is not proper or malfunctioning	• Check and remove the cause of over-current. • Check and correct the set value. • Check the related parts. • Replace or correct the malfunctioning parts.
Storage tank pressure	Storage tank pressure high abnormal alarm	• Storage tank pressure is rising higher the set value	• Perform purging task and check the leak part.
Refrigerant pump interlock	No operation signal of the refrigerant pump	• Pump interlock is open during stop. • Wrong wiring • Malfunction of the Slave board	• Check the part state or wiring. • Replace the part or rewire.
Storage tank pressure	Storage tank pressure high alarm	• The degree of vacuum of the storage tank is higher the set value.	• Purging task
Purge pump	No signal of operation of purge pump	• Pump interlock is open during stop. • Wrong wiring • Malfunction of the Slave board	• Check the part state or wiring. • Replace the part or rewire.
Chilled water interlock	Chilled water pump interlock abnormal	• Pump interlock signal is disconnected during operation • Pump stopped. • Wrong wiring • Malfunction of the Master board	• Check the part state or wiring. • Replace the part or rewire.
Storage tank pressure	Storage tank pressure high warning	• The degree of vacuum of the storage tank is higher the set value.	• Purging task
Purge pump	No signal of interlock of purge pump	• Pump interlock is open during stop. • Wrong wiring • Malfunction of the Slave board	• Check the part state or wiring. • Replace the part or rewire.
Chilled water pump	In the process of checking the chilled water pump interlock	• Interlock is closed during startup. • Checking action	• Check the part state or wiring. • Replace the part or rewire.

Abnormality category	Display message	Cause	Action
Chilled water flux	In the process of checking the chilled water flux	• Interlock close check action when startup	• Check the part state or wiring. • Replace the part or rewire.
Cooling water pump	In the process of checking the cooling water pump interlock	• Interlock close check action when startup	• Check the part state or wiring. • Replace the part or rewire.
Hot water pump	In the process of checking the hot water pump interlock	• Interlock close check action when startup	• Check the part state or wiring. • Replace the part or rewire.
Hot water flux	In the process of checking the hot water flux	• Interlock close check action when startup	• Check the part state or wiring. • Replace the part or rewire.
Firing(ignition)	In the process of checking the burner firing	• Interlock close check action when startup	• Check the part state or wiring. • Replace the part or rewire.
Communication	MAIN<->I/O-A Communication error	• Communication error between boards	• Check the part state or wiring. • Replace the part or rewire.
Main board	Reset main board	• Main board is reset during operation	• Check the voltage applied to MICOM and wire. Remove the cause of noise.

Troubleshooting for abnormality

Control valve sensor abnormal



Control valve sensor

Disassemble the wire of the control valve sensor from the MICOM board. When measured by a tester after converting to manual measurement mode, the resistance value between 'a' and 'b' should be constant. When the control valve is moved after conversion to manual operation mode of control valve, there should be change of the control valve sensor and the resistance accordingly. No change of the resistance even with the movement of the control valve sensor, there must be a wrong wire or failure of the control valve sensor.

The control valve sensor is normal if the resistance between 'a' and 'b' increases constantly and the value between 'b' and 'c' decreases constantly when the control valve is moved from close position and to open position. The resistance between 'a', 'b', 'c' and main body should not be an angled line.

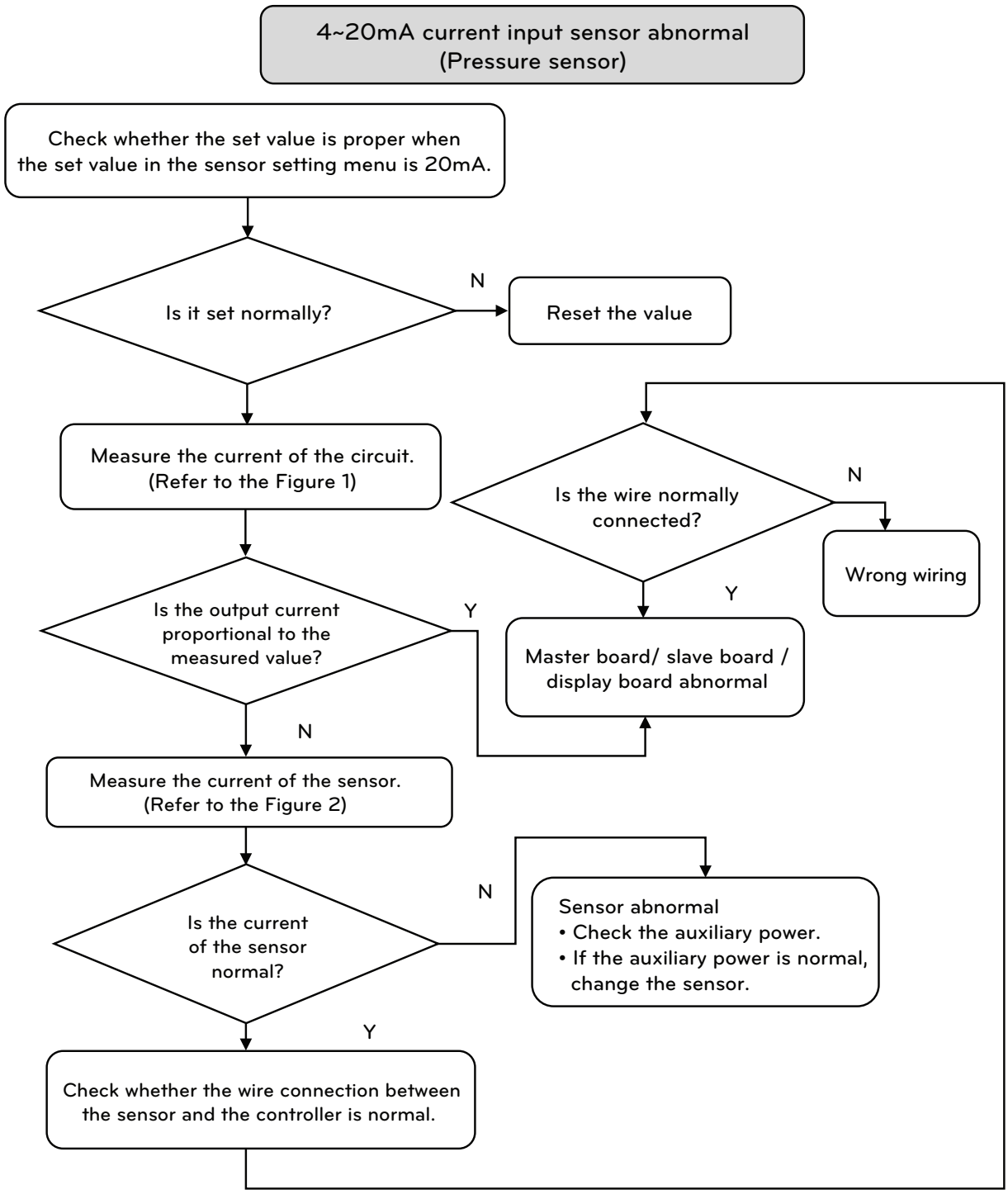
If the control valve sensor is normal, close the valve and check whether the control valve value is 0%, and open the valve and check whether it is '100%' after reconnecting the sensor. If the value is changed and the control valve opening % is not matched, the sensor should be set again.

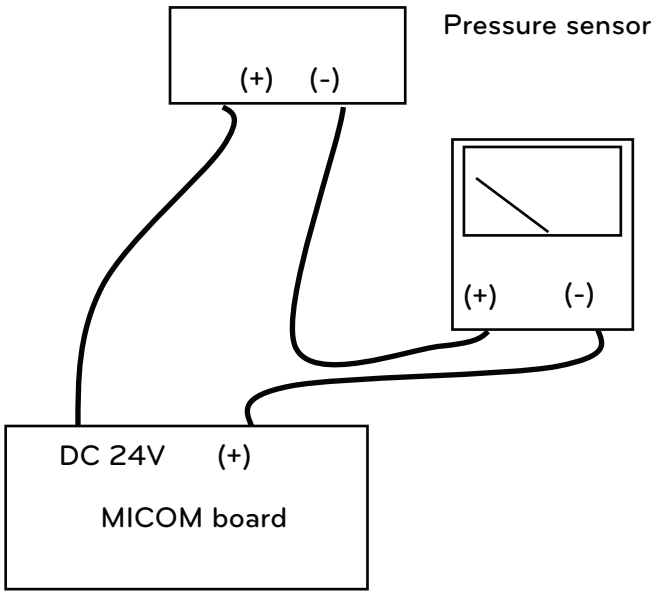
If there is no change, set the option setting mode to ON in "System menu-sensor setting-sensor setting(Slave1)' and set again the minimum value and maximum value referring to control valve AD. To check whether the board is normal, set the tester into DC voltage measure position and connect the connection point of control valve sensor "a" in the MICOM terminal to its + terminal, and connect the connection point of control valve senor "c" to its (–) terminal. If the measured voltage is DC5V, then the board is normal. If the measured voltage is not normal, check the main input power of MICOM. While the main input power of MICOM and the control valve sensor are normal and the sensor value does not change, then the relay board should be changed.

Use 4mA~20mA , 2 wire type sensor the controller power

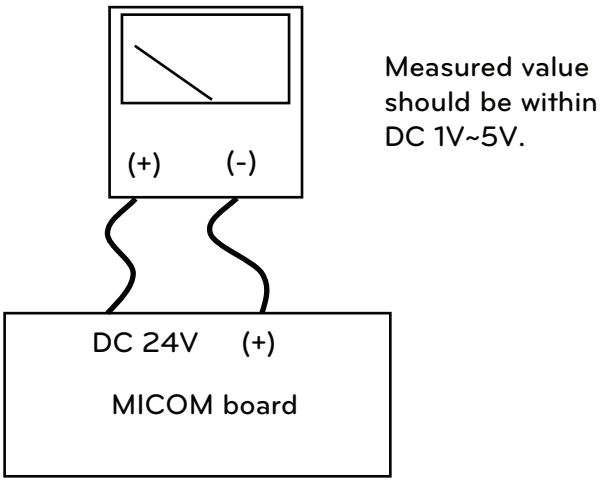
Check for the wire connection between the sensors and the controller.

Inspect the system following the flow chart and referring to the Figures 1,2 and 3 below.



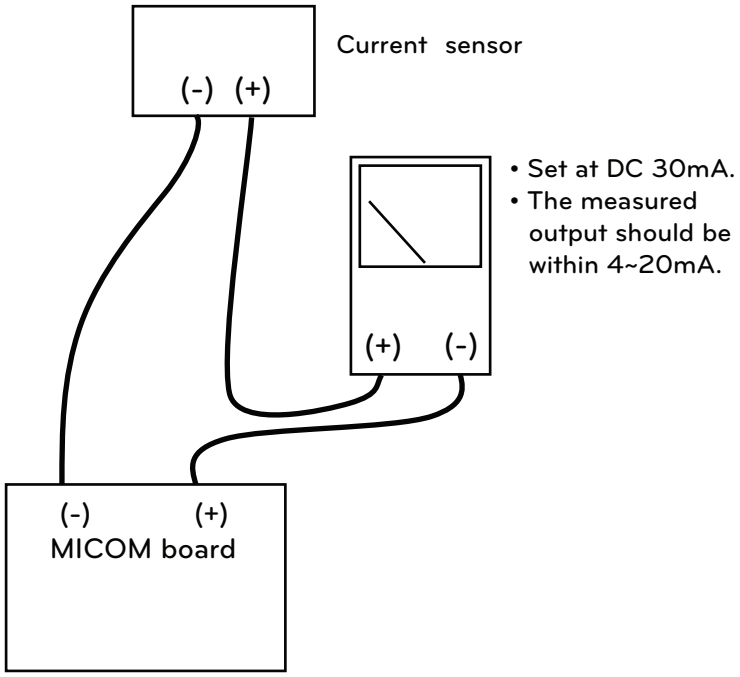


<Figure1: Current loop measuring circuit>

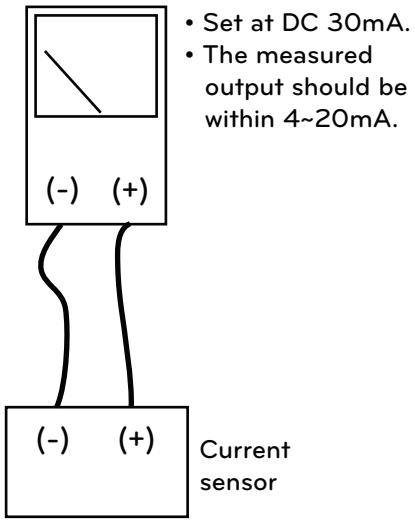


<Fig. 2: Voltage measuring circuit for 4~20mA output range >

If the cause has not still been identified after the check was performed as above, connect current generator to MICOM and check whether the indicated value in the MICOM changes following the changed current value of the current generator. In this case, if the indicated value of the MICOM is not changed against the change of the current, it is judged as the MICOM fault.



<Figure1>



<Figure 2>

Digital input signal is not checked at the controller

If the controller checks as abnormal or there is no change of every digital input signal even if the normal input of no voltage contact signal to the digital input of the controller is normal, it is because the faulty connection of the power connector, or no communication between Display board and the Master board.

Check the connection status of the communication line between display board and master board, and if there is no problem, short an idle terminal among the controller digital input part to the DIC terminal of the controller master/slave board, and check whether the corresponding LED lamp to the input terminal lights.

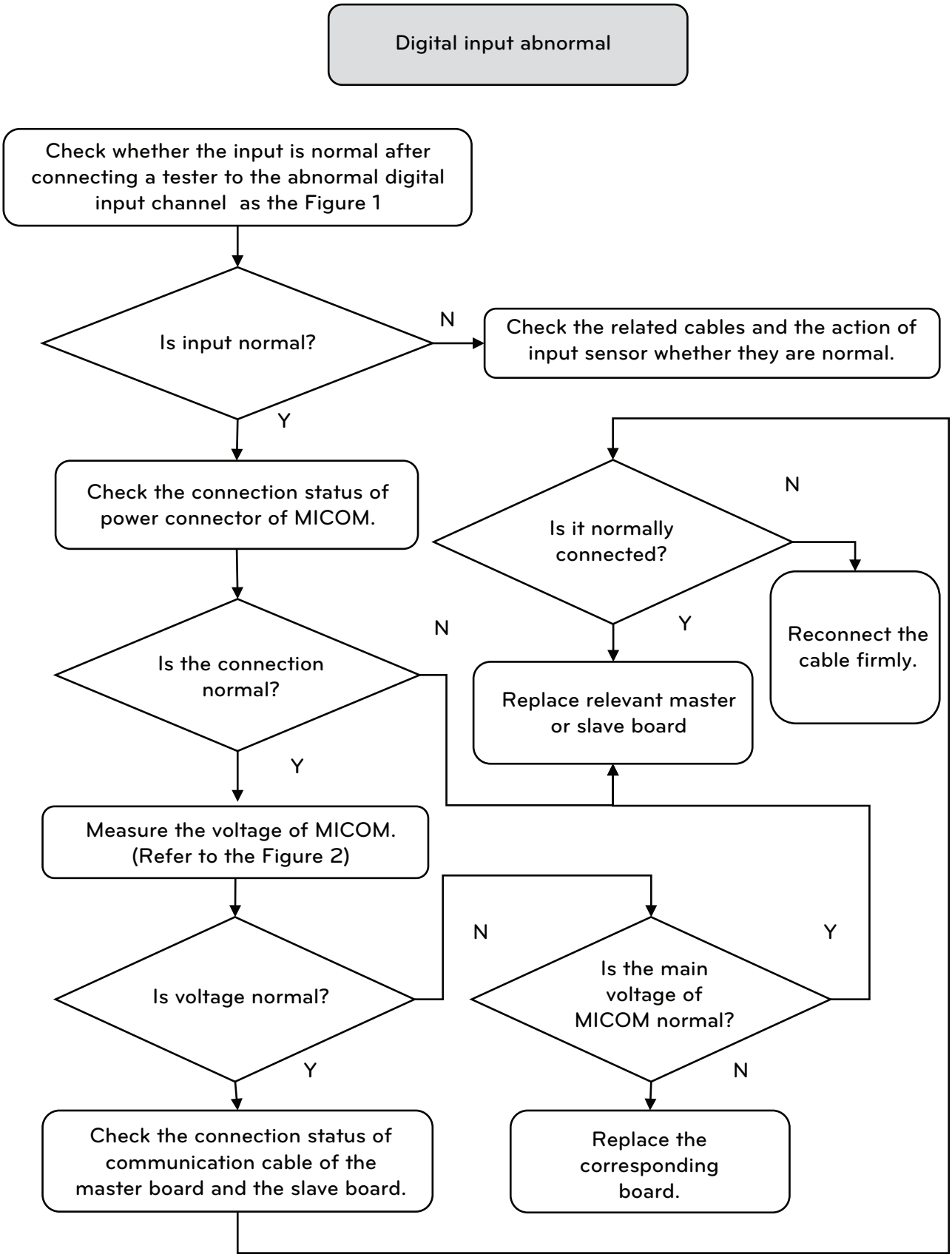
Select "Menu key"-"System information"-"Check input status" of the controller and short to find out the faulty terminal, and short/open the faulty terminal to DIC terminal to check whether the system status changes to "ON"/"OFF".

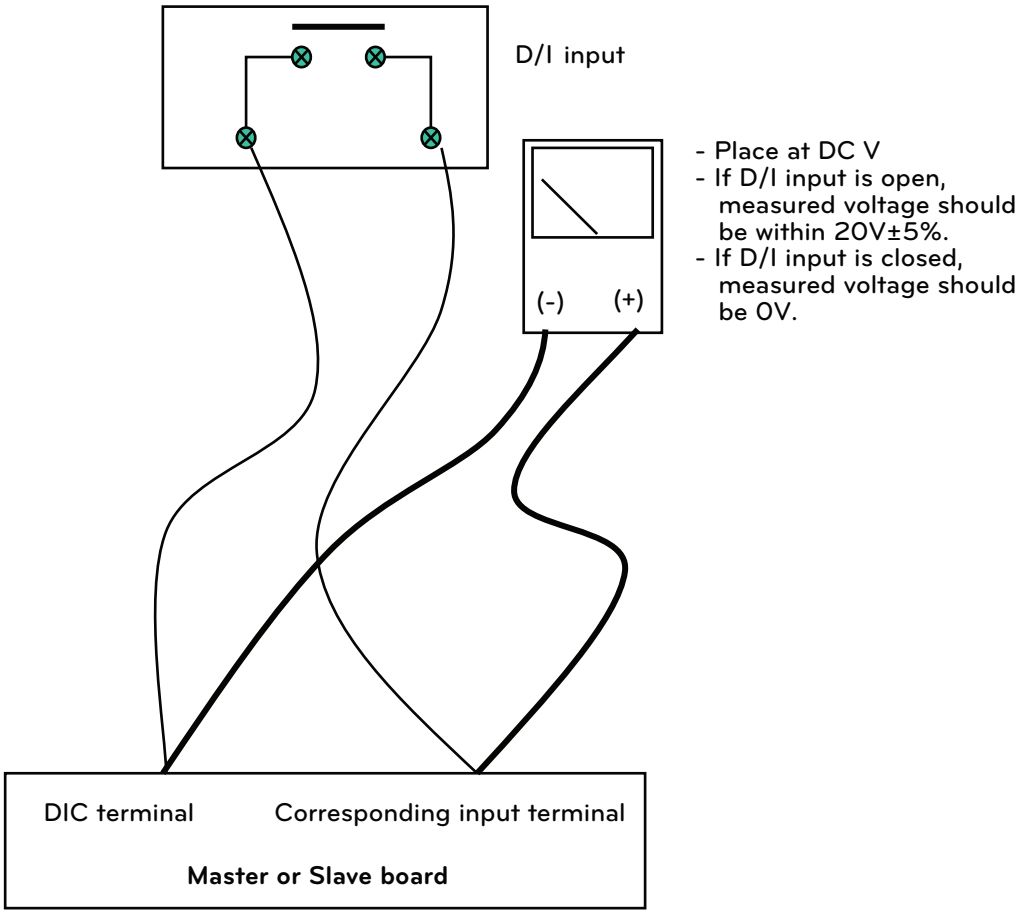
Check whether the digital input voltage of the controller is AC17V.

If normal, reconnect and check the action.

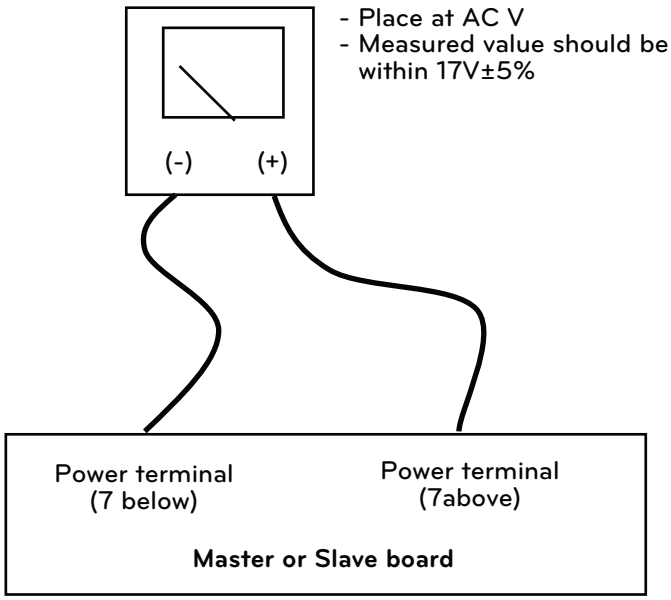
If the board's main power and communication is normal but I/O input does not work, replace the board.

Check referring to the flow chart and connection drawing with a circuit tester below.


Digital input abnormal
Check whether the input is normal after connecting a tester to the abnormal digital input channel as the Figure 1
Is input normal?
N
Check the related cables and the action of input sensor whether they are normal.
Y
Check the connection status of power connector of MICOM.
Is it normally connected?
N
Reconnect the cable firmly.
Y
Is the connection normal?
N
Replace relevant master or slave board
Y
Measure the voltage of MICOM. (Refer to the Figure 2)
Is voltage normal?
N
Is the main voltage of MICOM normal?
Y
Y
N
Check the connection status of communication cable of the master board and the slave board.
Replace the corresponding board.



<Figure 1>



<Figure 2>

Communication error

It is the error that occurs when there is no communication corresponding to the display message between the boards. First, check the connection status of the communication lines between the boards.

The 2 lines of RDX+ and RDX- of the master board should be connected to the same polarity of the slave and the relay board RDX+ and RDX- respectively, and the 2 lines of RDX+ and RDX- of the master board should also connected to the same polarity as well.

Make sure to connect to the designated connectors since there will be no communication if the communication is connected abnormally.

6. Maintenance

6.1 Maintenance and repair contract

• About yearly maintenance contract

It requires daily repair management and periodic maintenance to use the product safely, to operate with high efficiency and to prolong the life.

LG service team will inspect and repair by periodic site visit to prevent a failure in advance and prolong the life from the commissioning test after delivery during the warranty period. You may contract yearly maintenance contract around the time of warranty expiration.

• The major inspection items are as follows.

1) Checking of the action of various safety devices and adjustment
2) Diagnosis of the operation condition and measurement recording
3) Management of absorption solution and refrigerant
4) Management of combustion unit
5) Maintenance of vacuum level
6) Diagnosis and repair of the absorption solution pump, refrigerant pump and purge pump
7) Others.

6-1-1. Yearly repair contract convention

It is recommended to use yearly maintenance contract to perform periodic inspection and repair so as to use the chiller stably. Once the contract is made, the chiller will be run at its optimum condition by LG's own plan of repair, inspection and correction. In case of a failure, we provide the part and service by priority.

generally overhaul of the chiller is performed every 3 to 5 years for to maintain the performance and life of the chiller aside from the periodic maintenance, correction and repair.

If an overhaul is necessary, the diagnosis for time and the part will be covered by the items included in the yearly maintenance contract. The cleaning of heat transfer tubes in water system is performed by a separate contract.

6-1-2. Inspection sheet

When there is a maintenance inspection by yearly maintenance contract, and inspection sheet will be made. The inspection by the sheet will check every inspection items in detail without a miss. the service agent will write the inspection and correction items and submit a copy to the customer and another for the management of the customer's chiller in LG.

6-1-3. Operation record

(example) <Operation record>

Date: Machine no. Serial no. 1

Category	Unit							
Time	:							
Chilled/hot water inlet temperature	°C							
Chilled/hot water outlet temperature	°C							
Low temp. regenerator temperature	°C							
High temp. regenerator temperature	°C							
Cooling water inlet temperature	°C							
Cooling water outlet temperature	°C							
Refrigerant condensed temperature	°C							
Exhaust gas temperature	°C							
Control valve opening	%							
High temp. regenerator pressure	cm/Hg							
regenerator sight glass	○	○	○	○	○	○	○	○
Evaporator sight glass	○	○	○	○	○	○	○	○
Absorber sight glass	○	○	○	○	○	○	○	○
Inverter frequency	Hz							
Main body Vacuum pressure	mmHg							
Storage tank Vacuum pressure	mmHg							
The first gas supply pressure	mmAq							
The second gas supply pressure	mmAq							
Oil discharge pressure	kg/cm^2							
Oil return pressure	kg/cm^2							
Chilled water inlet pressure	kg/cm^2							
Chilled water outlet pressure	kg/cm^2							
Cooling water inlet pressure	kg/cm^2							
Cooling water outlet pressure	kg/cm^2							
< Others > ❉ You may chage the above 'Operation history' for your convenience.								

Chilled water flux: m^3/h Cooling water flux: m^3/h Gas(oil) amount : $m^3/h(\ell/h)$

6-2. Part replacement

Chiller maintenance table for Industrial, 24 hours operation, standard operation (2000hrs/yr)

Classification	Part name	Inspection part		Inspection items	Inspection method	Inspection timing		Remarks
		Vacuum	No Vacuum			24 hours operation for industry	Standard operation (2000hr/yr)	
Main body	Chilled water system Heat transfer tube	●		Exterior corrosion of heat transfer tube	Eddy current test Inner tube diameter Visual inspection, etc.	3 years	3~5 year	Machine or chemical tube cleaning depending on the condition
			●	Interior corrosion of heat transfer tubes, Scale attached.		1 year	1 year	
	Cooling water system Heat transfer tube	●		Exterior corrosion of heat transfer tube	Eddy current test Inner tube diameter Visual inspection, etc.	3 years	3~5 years	Machine or chemical tube cleaning depending on the condition
			●	Interior corrosion of heat transfer tube, Scale attached.		1 year	1 year	
	High, Low temp. heat exchanger	●		Interior/exterior corrosion of heat transfer tubes, scale attached	Open and inspect	3 years	7~10 years	
	High temp. regenerator		●	Check the contamination inside	Visual inspection	1 year	1 year	Cleaning
Solution	Absorption solution	(●)		Solution analysis • Concentration, copper meltage, alkalinity • Iron meltage, inhibitor level	Sampling of solution	6 times /year	1 time /year	Adjusted by management standard ; For 24hour operation for industry, 6 times inspection per year.
Pump	Absorption solution pump	●		Main body, impeller, shaft, coil	Disassembly inspection	When needed	When needed	Durable period over 30,000 hours
	Refrigerant pump	●		Main body, impeller, shaft, coil	Disassembly inspection	When needed	When needed	Durable period over 30,000 hours
	Purge pump	(●)		Main body	Disassembly inspection	When needed	When needed	
				V-belt	Periodic Replacement	When needed	When needed	
Combustion	Protect relay		●	Periodic check by maintenance contract		When needed	When needed	
	Flame detector		●					Durable period over 12,000 hours
	Manual cut-off valve		●	Periodic check by maintenance contract				
	Fuel automatic cut-off valve		●					
	Governor		●					
	Blower motor		●					
	Fan		●					

Classification	Part name	Inspection part		Inspection items	Inspection method	Inspection timing		Remarks
		Vacuum	No Vacuum			24 hours operation for industry	Standard operation (2000hr/yr)	
Safety device / control equipment	Pressure gauge	(●)		Periodic replacement in principle.		3 years	3~5 years	Regenerator pressure system
	Flow switch			Periodic check by maintenance contract.		When needed	When needed	
	Pressure transmitter		●					
	Temperature sensor	(●)		Periodic check by maintenance contract.		When needed	When needed	
	Magnet switch							
	Relay		●					
	Timer		●					
	Control valves	●	●					
	Modutrol motor		●					
	Inverter		●			1 year	1 year	
Others	Liquid level relay electrode	●		Periodic replacement in principle.		3 years	3~5 years	
	Sight glass	●				3 years	3~5 years	
	Diaphragm valve packing	●				3 years	3~5 years	
	Other valve packing	●	●			3 years	3~5 years	
	Paradigm cell	●				3 years	3~5 years	
	Combustor room cover		●	Periodic check by maintenance contract.		When needed	When needed	
	Packing for water system		●			When inspected	When inspected	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