YHAU-CW Double Effect Steam-Fired Absorption Chiller (Mod A)

150 ton to 2000 ton, 527 kW to 7033 kW

Installation, Operation, and Maintenance

Form: 155.31-ICOM2.EN.UL (1223)

Issue Date: 2023-12-13

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Contents

General safety guidelines

Important: Read before proceeding

This equipment is a relatively complicated apparatus. During rigging, installation, operation, maintenance, or service, individuals may be exposed to certain components or conditions including, but not limited to: heavy objects, refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled incorrectly, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operating or service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized rigging, installation, and operating or service personnel. It is expected that these individuals possess independent training that enables them to perform their assigned tasks correctly and safely. It is essential that, before performing any task on this equipment, this individual has read and understood the on-product labels, this document and any referenced materials. This individual must also be familiar with and comply with all applicable industry and governmental standards and regulations pertaining to the task in question.

Safety symbols

The following symbols are used in this document to alert the reader to specific situations:

DANGER

Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.

WARNING

Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.

CAUTION

Identifies a hazard which could lead to damage to the machine, damage to other equipment or environmental pollution if proper care is not taken or instructions and are not followed.

Note: Highlights additional information useful to the technician in completing the work being performed correctly.

Wiring warning

WARNING

External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the control cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with Johnson Controls published specifications and must be performed only by a qualified electrician. Johnson Controls will NOT be responsible for damage or problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and may cause serious damage to property or personal injury.

Changeability of this document

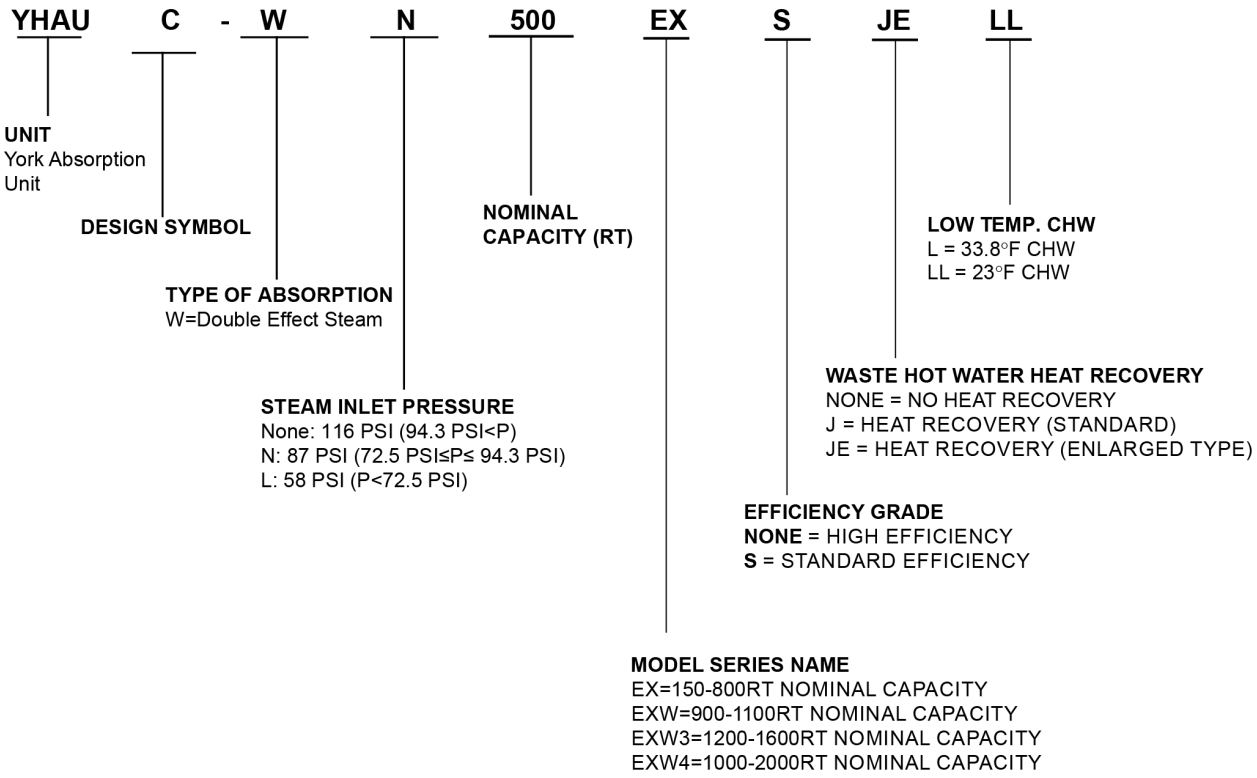
In complying with Johnson Controls policy for continuous product improvement, the information contained in this document is subject to change without notice. Johnson Controls makes no commitment to update or provide current information automatically to the manual or product owner. Updated manuals, if applicable, can be obtained by contacting the nearest Johnson Controls service center.

It is the responsibility of rigging, lifting, and operating or service personnel to verify the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, rigging, lifting, and operating or service personnel must verify whether the equipment has been modified and if current literature is available from the owner of the equipment before performing any work on the chiller.

Associated literature

Manual description	Form number
Absorption Chiller Long Term Storage	50.20-NM11
Long-Term Storage Checklist - Absorption Chiller	50.20-CL10
Long-Term Storage Requirements - General	50.20-NM10
Chiller Start-up and Commissioning Checklist	155.31-CL1
SC-Equipment Communication Card Product Bulletin	450.50-PB1
SC-EQ Communication Card	450.50-N1

Nomenclature



General chiller information and safety

Introduction

York YHAU-CW absorption chillers are manufactured to the highest design and construction standards to ensure high performance, reliability, and adaptability, for all types of air conditioning installations.

The chiller is for air conditioning or cooling a manufacturing process. Use the chiller after installing the chilled water pump, cooling water pump, cooling tower, valves, strainers, pressure gauges, thermometers, or other necessary parts according to the water quality information contained in Maintenance.

About this manual

Documents supplied with the chiller are the property of Johnson Controls and all rights are reserved. Do not reproduce Johnson Controls documentation, in whole or in part, without prior written authorization from an authorized Johnson Controls representative. Read this manual thoroughly before attempting to operate or service the unit.

This manual contains the following information:

- Suggested best working practices and procedures, which are issued for guidance only, and do not take precedence over the stated individual responsibility and local safety regulations.
- All the information required for correct installation and commissioning of the chiller, including operating and maintenance instructions.
- Detailed procedures, including installation, commissioning, and maintenance tasks that must be performed by suitably trained and qualified personnel only.

The manufacturer will not be liable for any injury or damage caused by incorrect installation, commissioning, operation, or maintenance, resulting from a failure to follow the procedures and instructions detailed in this manual.

Warranty

Johnson Controls warrants YHAU-CW chillers in accordance with the *Limited Warranty Engineered Systems Equipment Policy (Form 50.05-NM2)*.

Johnson Controls warrants all equipment and materials against defects in workmanship and materials for a period of 18 months from the date of shipment or 12 months from the date of start-up, whichever comes first, unless labor, or extended warranty, has been purchased as part of the contract.

The warranty is limited to parts only replacement and shipping of any faulty part, or subassembly, which has failed due to defects in workmanship and materials. All claims must be supported by evidence that the failure has occurred within the warranty period, and that the chiller was operated within the designed parameters specified.

All warranty claims must specify the chiller model, serial number, order number, and run hours or starts. The model and serial number information is printed on the unit identification plate.

The chiller warranty will be void if any modification to the chiller is carried out without prior written approval from Johnson Controls. For warranty purposes, the following conditions must be satisfied:

- The initial start of the chiller must be carried out by trained personnel from an authorized Johnson Controls Field Service Office.
- Only genuine Johnson Controls approved spare parts, oils, solutions, chemicals, and refrigerants must be used.

- All of the scheduled maintenance operations detailed in this manual must be performed at the specified times by suitably trained and qualified personnel.

Failure to satisfy any of these conditions will automatically void the warranty. Refer to *Limited Warranty (Form 50.05-NM2)* for complete details.

Quality assurance

The chiller complies with the following directives:

- GB/T 18431-2014 Steam and Hot Water Lithium Bromide Absorption Chiller

For USA:

- UL 60335-1:2016 Ed.6 Safety of Household and Similar Appliances, Part 1: General Requirements
- UL 60335-2-40:2022 Ed.4 Household And Similar Electrical Appliances - Safety - Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers
- UL 508:2018 Ed.18+R:08Jul2021 Industrial Control Equipment
- Pressure vessel will follow ASME

For Canada:

- CSA C22.2#60335-1:2016 Ed.2 Safety of Household and Similar Appliances, Part 1: General Requirements
- CSA C22.2#60335-2-40:2022 Ed.4 Household And Similar Electrical Appliances - Safety - Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers
- CSA C22.2#286:2023 Ed.3 Industrial Control Equipment
- Pressure vessel will follow ASME

Important

The chiller must be grounded. Do not attempt installation or maintenance work on the electrical equipment without first switching the power off, then isolating, and locking-off, the power supply. Do not attempt servicing and maintenance on live equipment. Do not attempt to gain access to the control panel or electrical enclosures during normal operation of the unit.

CAUTION

Components may also have sharp edges. Take care when working in contact with any components to avoid risk of minor abrasions and lacerations.

Emergency shutdown

In case of emergency, the control panel is fitted with an incoming supply circuit breaker with a red handle, see Figure 1. Turn the handle counter clockwise to shut down the chiller.

Figure 1: Emergency shutdown

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High temperature and pressure cleaning

CAUTION

Do not use high temperature and pressure cleaning methods, for example steam cleaning, on any part of the pressure system as this can cause operation of the pressure relief devices. Do not use detergents and solvents that can cause corrosion.

Safety labels on the chiller

Table 1: Safety labels

	For safe operation, read the instructions first.
	⚠ **WARNING:** This machine may start automatically without prior warning.
	⚠ **CAUTION:** Hot surface.
	⚠ **WARNING:** Safety relief valve may discharge gas or liquid without prior warning.

Table 1: Safety labels

	⚠ **WARNING:** Risk of electric shock.
	General attention symbol.
	⚠ **WARNING:** On isolating the supply it may take up to 300 seconds for the capacitor voltage to fall below 50 V.
	⚠ **WARNING:** Risk of fire.
	⚠ **WARNING:** Risk of gas poisoning.
	⚠ **WARNING:** Risk of electrical arc.

Material safety data sheet

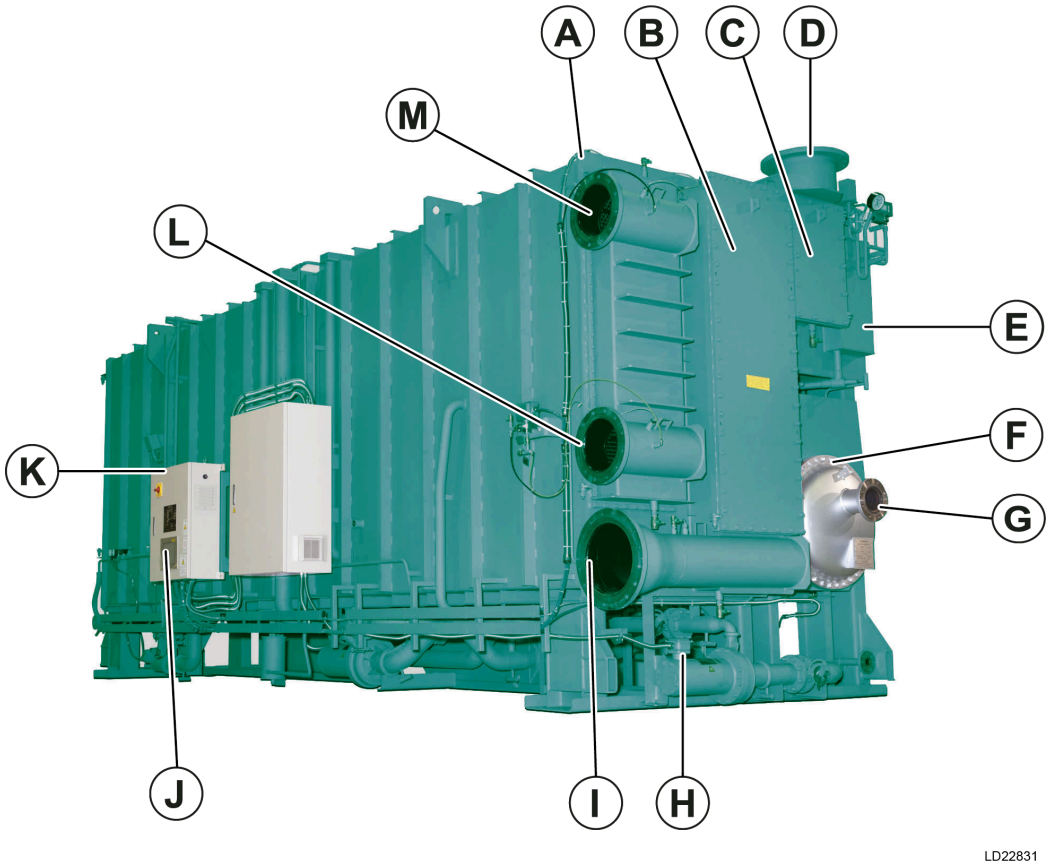
MSDS specify the correct procedures for handling and working with applicable chemicals, including items such as physical data, toxicity, health effects, first aid, storage, disposal, and spill procedures. Refer to the MSDS provided by the material suppliers, or contact Johnson Controls support.

Product description

In absorption liquid chilling, there are four heat exchange surfaces: the evaporator, the absorber, the generator, and the condenser. See Figure 2.

Absorption chilling uses evaporation and condensation to remove heat. The absorption cycle uses water as the refrigerant and lithium bromide (LiBr) as the absorbent. The entire process occurs in an almost complete vacuum.

Figure 2: YHAU-CW components



Callout	Components
A	Evaporator
B	Absorber
C	Condenser
D	Cooling water outlet
E	Low temperature generator
F	High temperature generator
G	Steam inlet
H	Solution pump
I	Cooling water inlet
J	Touch panel display
K	Control panel
L	Chilled water inlet
M	Chilled water outlet

Chiller components

The absorption chiller consists of the following components:

- Evaporator
- Absorber
- Condenser
- Generators
- Solution heat exchangers to heighten the cycle efficiency
- Pumps to circulate the refrigerant and solution in the cycle
- Purge unit to remove non-condensable gas from the chiller

Control panel

The absorption chiller comes with a factory mounted and pre-wired control system. The control panel enclosure is equipped with a hinged access door with a lock and key. The control panel includes a touch panel showing all system parameters in various languages with numeric data in metric units. For details of the control panel, see Operation.

The chiller is also equipped with the following two methods to start and stop operations:

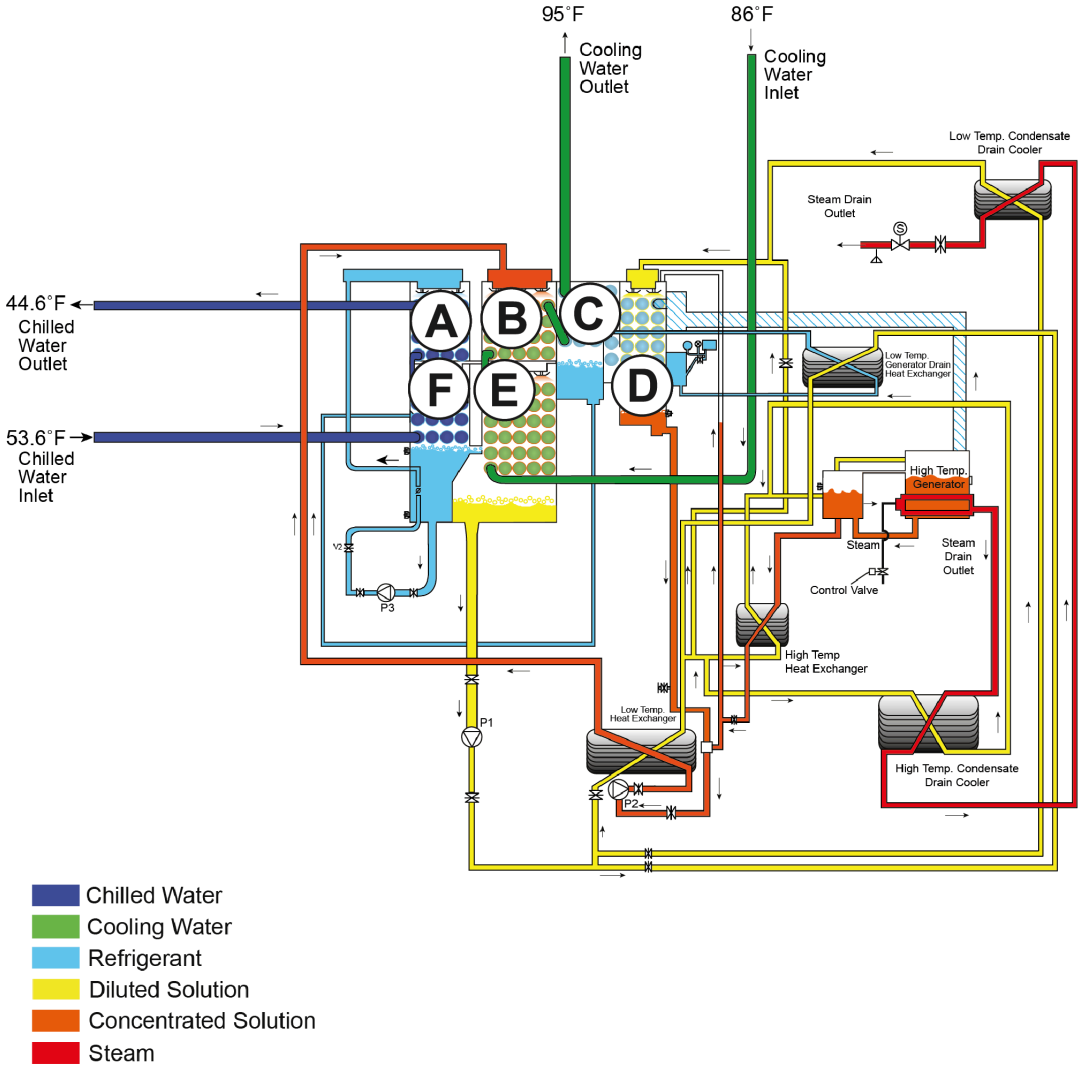
- Touch panel
- External signal

Note: The main switch must be 2 m from the ground. If this is not possible, install the unit on a platform.

How the chiller works

The double effect steam fired absorption chiller cycle uses deionized water as the refrigerant and LiBr as the absorbent. The vapor pressure of the LiBr solution is lower than the vapor pressure of the refrigerant. The vapor pressure of the LiBr solution is directly related to the amount of refrigerant present in solution with the LiBr salt and the solution temperature.

Figure 3: Double effect steam absorption chiller cycle diagram for model EX and EXW



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Callout	Component
A	Evaporator (upper)
B	Absorber (upper)
C	Condenser
D	Low temperature generator
E	Absorber (lower)
F	Evaporator (lower)

Note: Temperatures and pressures on this graphic are representative. Actual values may differ.

Evaporator

1. Liquid refrigerant enters the evaporator and is distributed over the top of the tube bundle.
2. As the refrigerant droplets cover the outside surface of the tubes, the heat from the returning chilled water passing through the tubes causes the refrigerant to evaporate rapidly from a liquid to a vapor. The evaporator shell pressure relates to the absorber section of the chiller, and correlates to the initiation temperature.
3. The refrigerant vapor passes through the mist eliminators and into the absorber section of the chiller.
4. As the liquid refrigerant passes down through the bundle of evaporator tubes, the refrigerant continually vaporizes.
5. The remaining liquid refrigerant at the bottom of the tube drains into the refrigerant tank and is pumped back up to the top of the tube bundle where the process is repeated.

Absorber

1. Concentrated LiBr solution enters the absorber section of the chiller and is sprayed over the absorber tube bundle.
2. The low vapor pressure of the concentrated solution causes the refrigerant vapor from the evaporator to flow into the absorber and be absorbed into the LiBr solution.
3. The mass transfer process lowers the concentration of LiBr solution as the refrigerant is absorbed into the solution.
4. The dilution process generates heat, and if not cooled, eventually stops as the solution temperature rises, with a corresponding increase in vapor pressure. This is similar to closing the vanes, or slowing down a centrifugal compressor on a chiller where the load is constant.
5. The water flowing inside the absorber tube bundle comes from the cooling tower and serves to cool the LiBr solution as it flows down over the tube bundle.
6. The absorption process continues and the solution becomes more diluted as it absorbs more refrigerant vapors.
7. When the LiBr solution reaches the bottom of the absorber section and goes into the suction of the solution pump, it is pumped back into the generators.

Two-step evaporator-absorber

The evaporator and the absorber are split into two sections. This design, similar to a series-counter-flow chiller arrangement along with the parallel flow cycle, enables lower LiBr solution concentrations. This reduces crystallization risk, reduces pressure and the potential for corrosion, and improves efficiency in conjunction with other advanced components described later in this section.

The two evaporators are in series with respect to the chilled water flow through the tubes. The chilled water flows through the lower evaporator tubes first and then to the upper evaporator tubes. Each evaporator operates at a slightly different temperature and pressure. The refrigerant in the lower evaporator boils at a slightly higher temperature than in the upper evaporator, consequently cooling the chilled water in two steps.

The two absorber sections are also split, with the strong solution first entering the top of the uppermost absorber and flowing down through the top absorber bundle. The solution then flows into the top of the lower absorber section. The upper evaporator is able to operate at a lower pressure and temperature due to the lower vapor pressure of the strong solution entering the upper absorber.

When the LiBr solution enters the lower absorber section, it is diluted by the refrigerant vapor that boiled off in the upper evaporator. At this lower concentration, the solution vapor pressure is normally not sufficient to provide an evaporator pressure low enough to comply with the leaving chilled water design. The lower evaporator is the first step of the chilled water cooling cycle, and the dilute solution's vapor pressure is adequate to maintain the lower evaporator at the required temperature and pressure in the lower evaporator.

The cooling tower water enters the lower absorber section first, keeping the vapor pressure of the diluted solution as low as possible.

Both the refrigerant water and LiBr dispersion system are gravity fed and made of stainless steel.

Figure 4: Two-step evaporator-absorber

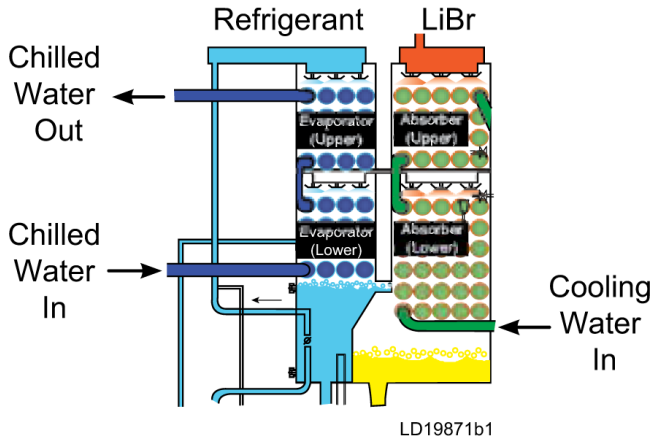
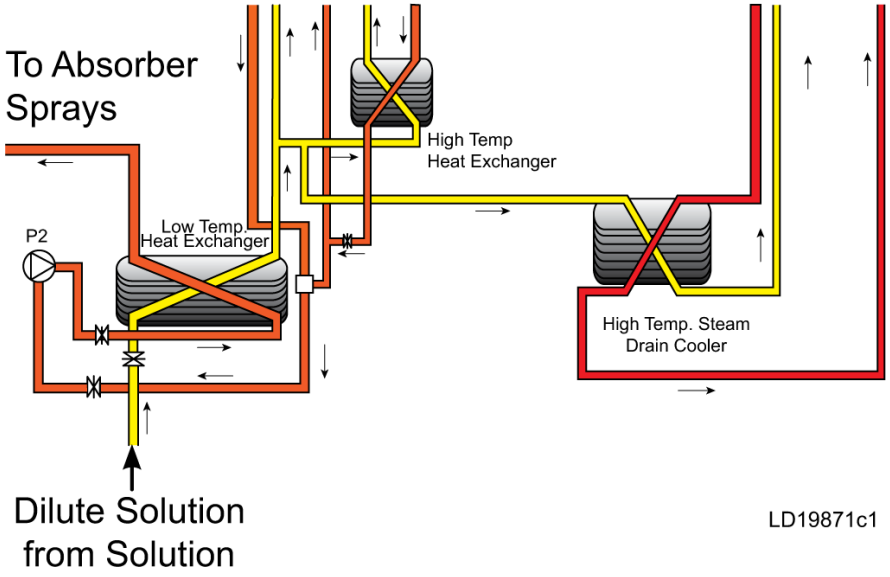


Plate type heat exchangers

The diluted LiBr solution leaving the absorber section is pumped through the plate type heat exchangers: the low temperature heat exchanger, low temperature steam drain cooler, high temperature heat exchanger, high temperature steam drain cooler, and LTG refrigerant condensate heat exchanger. The dilute solution then enters the high temperature generator and low temperature generator sections. The plate type heat exchangers improve the cycle efficiency by pre-heating the dilute solution. Preheating the dilute solution reduces the load of the driving heat source in the high temperature generator section. The concentrated solution flows out of the generators and back through the heat exchangers.

The high temperature solution streams from the two generators and the heat of the steam condensate is used to preheat the diluted solution stream leaving the absorber.

Figure 5: Plate type heat exchanger



Parallel flow

The parallel flow divides the solution between the low temperature generator and the high temperature generator sections, into two parallel, balanced paths. The result is a safer and more efficient operation at a much lower pressure than conventional series-flow designs. The solution to solution plate type heat exchangers optimize efficiency by enabling effective heat transfer between the diluted and the concentrated LiBr solutions.

High temperature generator (HTG)

The high temperature generator section is a flooded design. The steam passes through the stainless steel tubes and heats the preheated dilute solution flowing from the high temperature heat exchanger, and high temperature steam drain cooler.

The hot refrigerant vapor boiled off from the dilute solution is sent to the low temperature generator. The strong solution is left behind and is returned to the high temperature heat exchanger.

Low temperature generator (LTG)

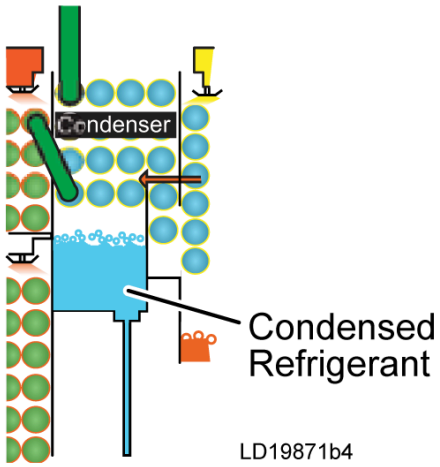
The hot refrigerant vapor from the high temperature generator heats the dilute solution coming from the low temperature heat exchanger and low temperature steam drain cooler. The additional refrigerant vapor migrates to the condenser. The refrigerant vapor from the high temperature generator condenses into a liquid and flows to the condenser.

The low temperature generator is a falling film design, ensuring superior heat transfer and enhanced life by eliminating wear and tear on the tube supports.

Condenser

The refrigerant vapor from the low temperature generator and the condensed refrigerant from the high temperature generator enter the condenser where they condense into a liquid. The coolant in the condenser is water from the absorber section. The cooled refrigerant is sent to the bottom evaporator section through a U-pipe liquid seal.

Figure 6: Condenser



Crystallization

All absorption chillers that use LiBr and water as the solution or refrigerant pair are subject to crystallization. This is because some areas of the chiller operate with solution liquid concentration levels that are only possible at higher than the normal ambient temperature surrounding the chiller. For example, the solution concentration in the generator of a single stage absorption chiller is typically 64.3% LiBr by weight. LiBr solutions begin to crystallize at 110°F.

Crystallization happens when the LiBr solution temperature drops too low, or the concentration is too high. The LiBr solution becomes like slush. At this point the LiBr solution cannot absorb any more water and starts to crystallize.

Crystallization can occur in the solution heat exchanger or in the generator. It can also happen in pipes that are not well insulated and are within rooms where the temperature can affect the solution moving through the pipes.

To prevent crystallization, make sure that you keep the solution temperature high and the concentration at 64%.

The solution temperature in the generator is normally high enough to prevent crystallization, as long as the higher temperature is maintained. Before the chiller is shut down, make sure that the solution is sufficiently diluted in all areas of the chiller to prevent crystallization during the off cycle.

ⓘ **Note:** The solution temperature eventually becomes equal to the ambient temperature of the room.

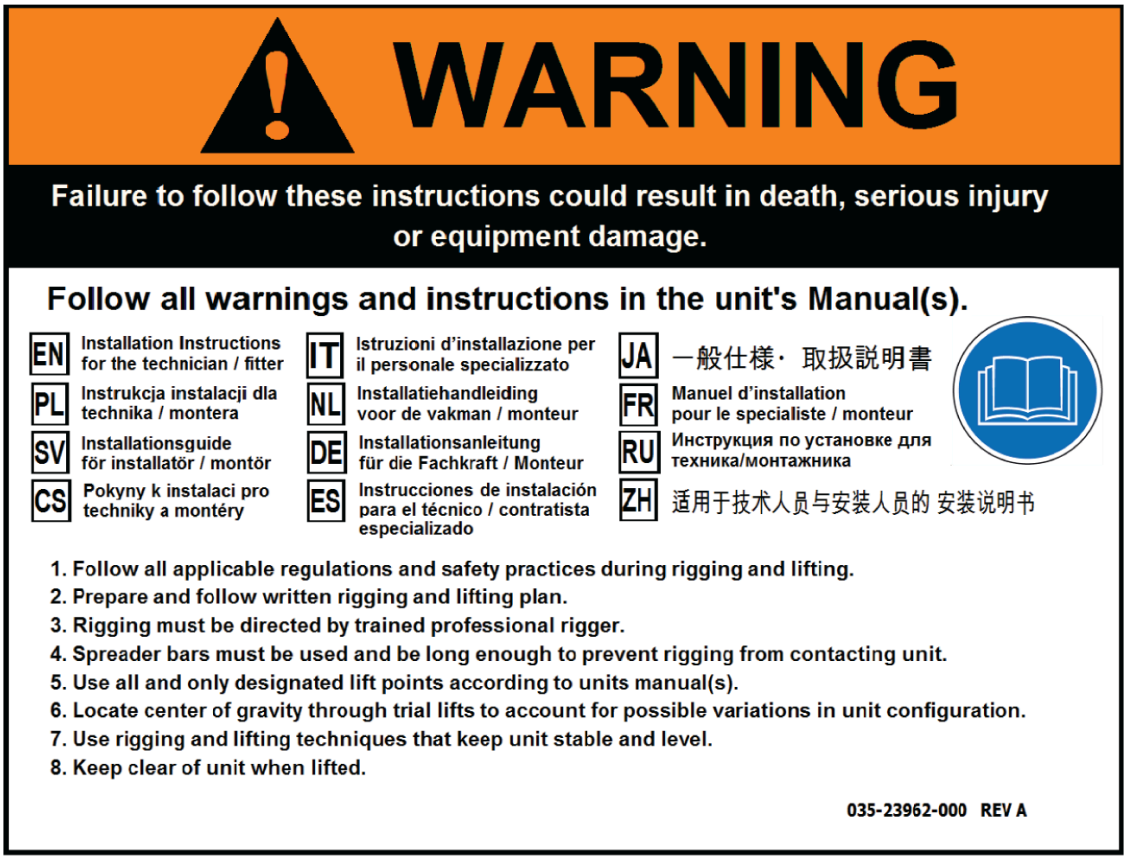
To prevent crystallization, all chiller employ a dilution cycle. As long as the chiller can run the dilution cycle during an orderly shutdown sequence, the chiller can sit idle at fairly low plant room ambient temperatures, without any threat of crystallization. Typically, after a dilution cycle, the average solution concentration within the chiller is below 45% LiBr by weight.

Crystallization risk factors

The most common reason for crystallization is power failure. If a chiller is running at full load and power is interrupted for a sufficient length of time, the concentrated solution in the high side of the chiller eventually cools down. Without a dilution cycle, the solution concentration in some areas of the chiller will still be high. If the temperature of the concentrated solution falls enough, the solution reaches its crystallization point. Plant room temperature, insulation quality, and the solution concentration all influence the time it takes before the solution will crystallize. See Water quality control for information on water quality control and crystallization. The Duhring Diagram / PTX Chart shows the specific temperatures and pressures of the crystallization area. See Figure 97 and Figure 98.

Handling, storage, installation, and reassembly

Figure 7: Warning



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DANGER

Rigging and lifting must only be done by a professional rigger in accordance with a written rigging and lifting plan. The most appropriate rigging and lifting method will depend on job specific factors, such as the rigging equipment available and site needs. A professional rigger must determine the rigging and lifting method to be used. It is beyond the scope of this manual to specify rigging and lifting details.

The chiller is for air conditioning or a cooling manufacturing process. Transport, store, and use this chiller under the following conditions:

Factor	Condition
Installation location	Indoor, non-explosion area
Ambient temperature	50°F to 104°F
Humidity	10% to 90% (RH%)
Altitude	3,333 ft or lower

If the temperature in the plant room drops below 50°F, you must have the cold ambient option.

CAUTION

This chiller cannot be lifted or moved using a forklift.

Inspection

The chiller must be inspected by a Johnson Controls service representative before customer use. All damage or possible damage must be reported to the transportation company. For more information, see Commissioning.

Note: The chiller is delivered without charged solution and refrigerant and requires a charge of N2 to 4.4 psig (0.3 barg) to pressurize the chiller. A tested unit is precharged with N2 to 4.4 psig (0.3barg) before delivery. The solution and refrigerant is delivered in the barrels.

Installation guidelines

DANGER

When evacuating the nitrogen charge from the factory, be sure the area is ventilated correctly. Failure to do this could result in suffocation.

When storing the chiller after delivery, note the following potential issues:

1. Problems with machine in storage:
   a. If the solution and refrigerant is charged, breaking of thin pipes caused by the freezing of the refrigerant sealed in the machine and resulting air leak
   b. Breaking and air leak due to external damage
   c. Deterioration of electrical parts caused by soot and dust
   d. Deterioration of electrical parts caused by rainwater or moisture
   e. Rusting of the machine body caused by rainwater or moisture. Air leaks can cause serious damage and are costly repairs. Use diligence in keeping the machine body free from moisture at all times.
2. **Table 2: Problems and preventative measures**

Problem	Preventative measure
Freezing of refrigerant in machine	Store the machine where the ambient temperature is higher than 32°F. If the ambient temperature drops below 32°F, use a heater to warm the machine. If a heater is not accessible, the following options are available to prevent freezing: • Extraction of the refrigerant • Addition of antifreeze to the refrigerant • Installation of a band heater For further instruction, contact your nearest authorized Johnson Controls service center.
External damage	Avoid storing the machine in a place that is easily accessible or near a construction site. If this is unavoidable, use diligence to protect the machine. For further information contact your nearest authorized Johnson Controls Service Center.
Soot and dust	To protect the machine from soot and dust or other air particulates over the entire machine, including the control panel, instruments and gauges located on top of the machine with a vinyl sheet. Use caution not to apply too much pressure to the controls to prevent damage.
Rainwater	Avoid storing the machine in areas that are exposed to rainwater or other standing water.

3. Periodic inspection and maintenance:
   a. Inspect the machine weekly for damage.
   b. Check the machine compound gauge daily to verify there is no decline in vacuum and record the vacuum value (-760 to -38 mmHg). If the vacuum is below the low limit, contact your nearest authorized Johnson Controls service center immediately.
   c. If the vacuum has dropped as a result of incorrect machine operation, contact your nearest authorized Johnson Controls service center immediately.

⚠ CAUTION

Ensure that foreign matter does not enter the drain valve and air vent valve in the water chamber casing. Keep these valves fully open while the machine is in storage.

Hoisting the machine

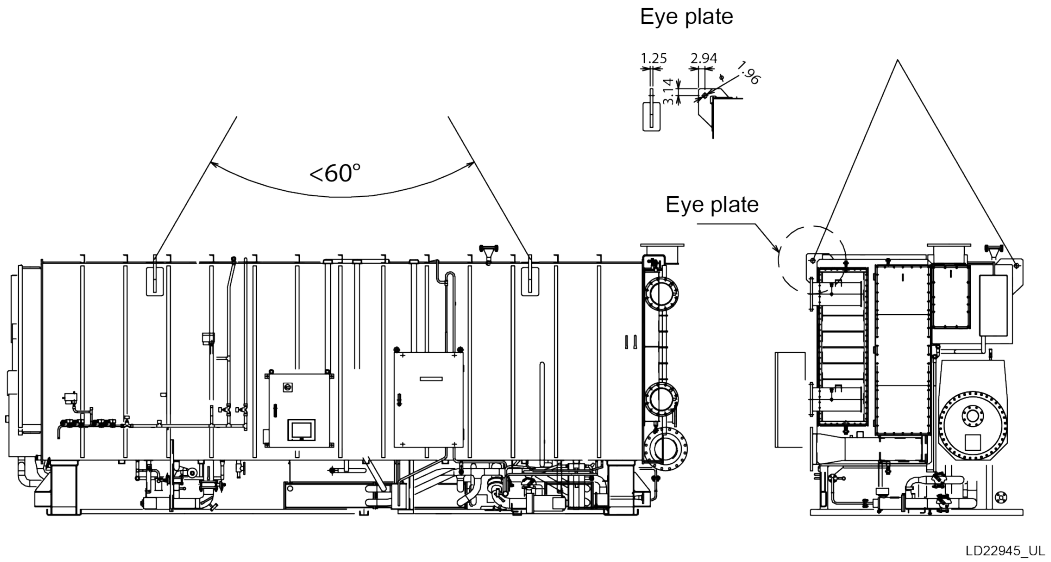
When hoisting the machine, attach a shackle to each of the four eye plates and lift the machine. Ensure that the angle formed by the wire is less than or equal to 60°, as shown in Figure 8.

Do not apply shock to the machine. The machine is a high-vacuum vessel.

⚠ CAUTION

Lift the machine horizontally. If the machine is inclined, it produces an offset load. This can cause damage to the machine and pose a risk to the machine installer or persons moving the chiller.

Figure 8: Hoisting procedures



Moving the machine on rollers

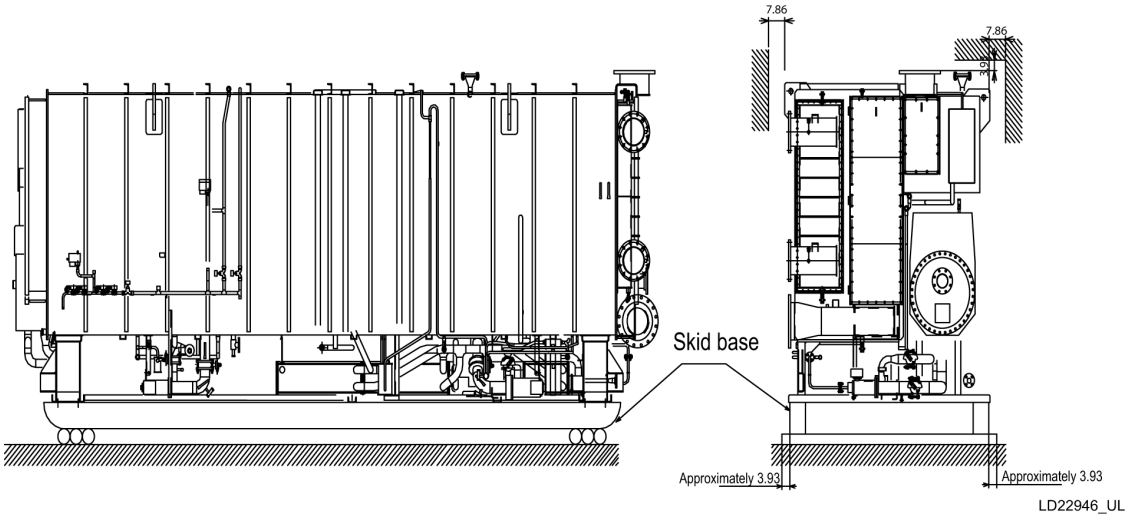
Plan the entrance of the machine.

Do not incline the machine more than 10°. If the machine has to be inclined more than 10°, extract the solution and refrigerant before moving.

Do not to apply shock to the machine. The machine is a high-vacuum vessel.

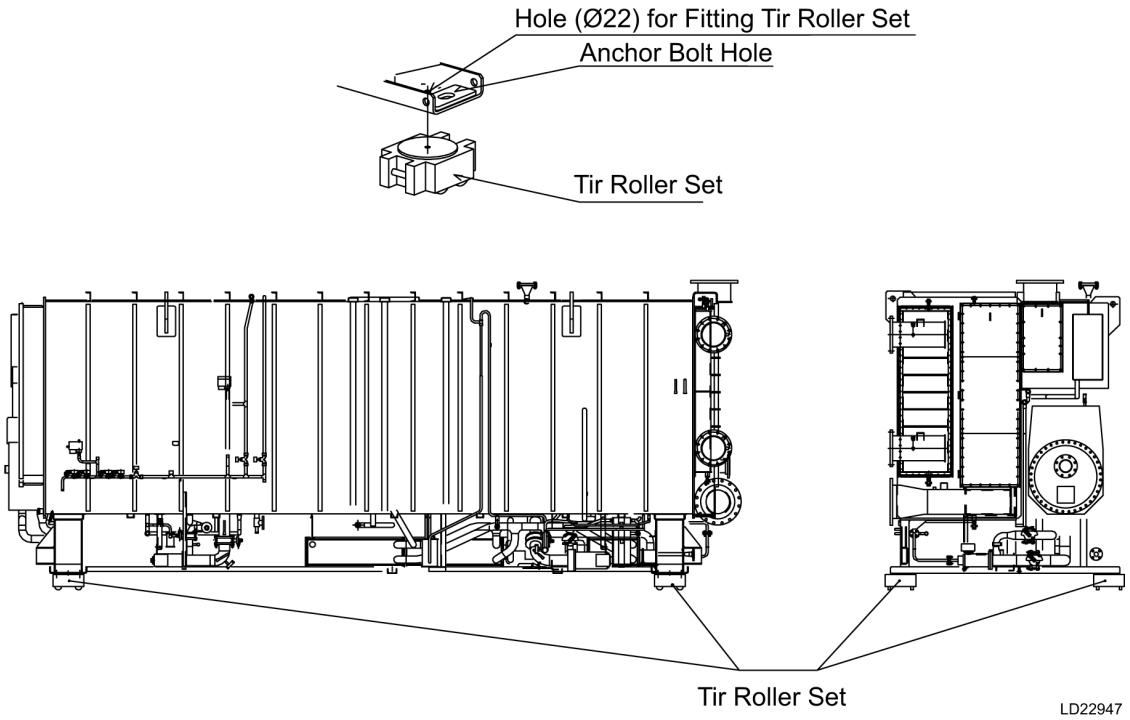
When a skid base is used to move the machine on rollers, secure the skid base and place the machine legs evenly on the skid base before moving the machine.

Figure 9: Moving the machine on rollers



If using a tirroller to move the machine, fit the tirroller set to each of the four holes shown in the following figure.

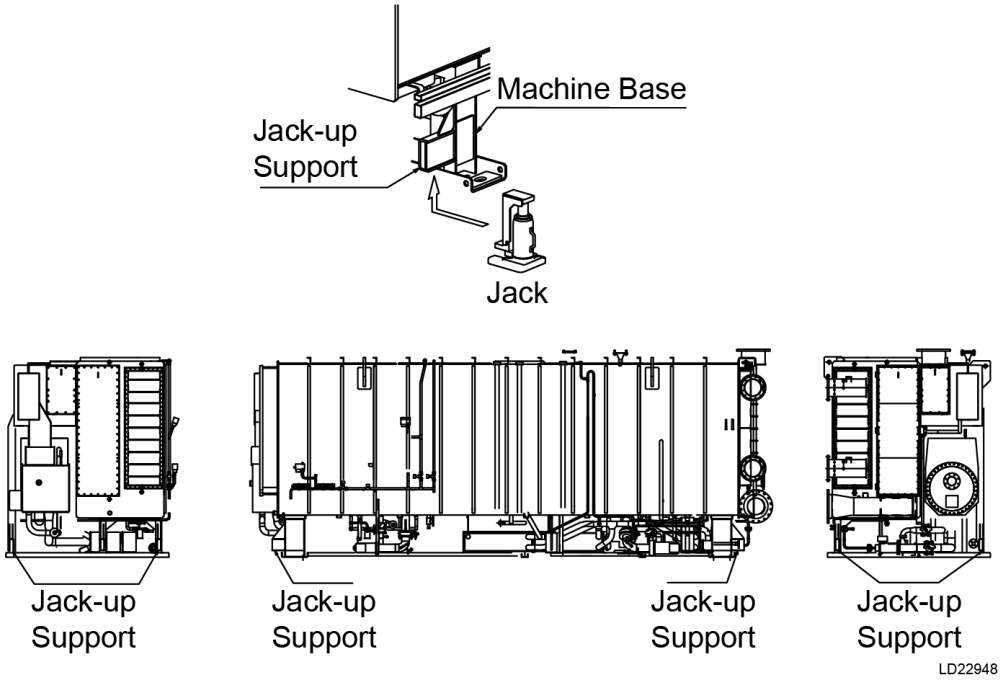
Figure 10: Moving the machine on tirrollers



Jack up procedure

When jacking the machine, be sure to fit the jack in each of the jack-up supports as shown below.

Figure 11: Jack-up procedure

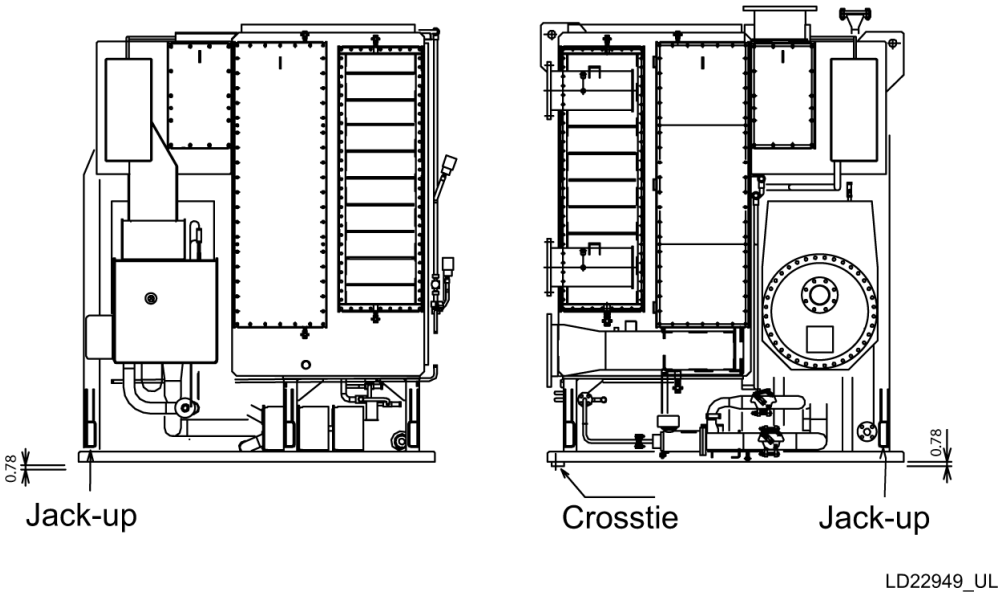


Operate the front and rear jacks alternately.

Do not jack up the machine more than 0.78 in. at a time. Each time the machine is jacked up, adhere it with a suitable crosstie.

Use the jack-up support on the main shell of the body as shown in Figure 12. If using a high temperature generator, use secondary jack-up support.

Figure 12: Jack-up procedure



Structural support and installation

Structural support of the chiller must be provided as indicated for maximum efficiency. Maintain adequate maintenance space around the chiller, so work can be safely performed. To ensure there is adequate clearance for tube removal, the maintenance space at the end of the chiller must equal 1.25 x the length of the chiller.

Foundation bolts must be installed in level concrete to secure the chiller and prevent shifting in the event of an earthquake. Rubber vibration isolator pads must be fit to the machine base before installation as shown on Figure 14. The tolerance for leveling is 1 in. in 1,000 in., or 1 mm in 1,000 mm, according to the bottom edge of the tube plate.

⚠ CAUTION

Waterproof the floor that the machine will be installed on in case of future leaks.

Dimensions can be found in Table 7 and Table

For serviceability and maintenance, leave a minimum of 40 in. space on all sides of the chiller. To be sure there is enough clearance for tube removal, the maintenance space at the end of the chiller must equal 1.25 times the length of the chiller.

Indoor and outdoor installation

This chiller is designed to be used indoors. Exposure to the elements can damage the thermal insulation. The minimum allowable temperature for outdoor installation is 32°F, provided that the chiller includes the cold ambient option. Outdoor installations are considered on a case-by-case basis by a Johnson Controls service representative.

Electrical

The electrical work must be performed in accordance with the wiring diagrams, delivery specifications, and technical standards for electrical equipment found in Technical data. Use the specified cables to complete the wiring, and fasten them to the according terminals securely. Loose fitting cables can cause the terminals to heat up, resulting in fire or electrical shock.

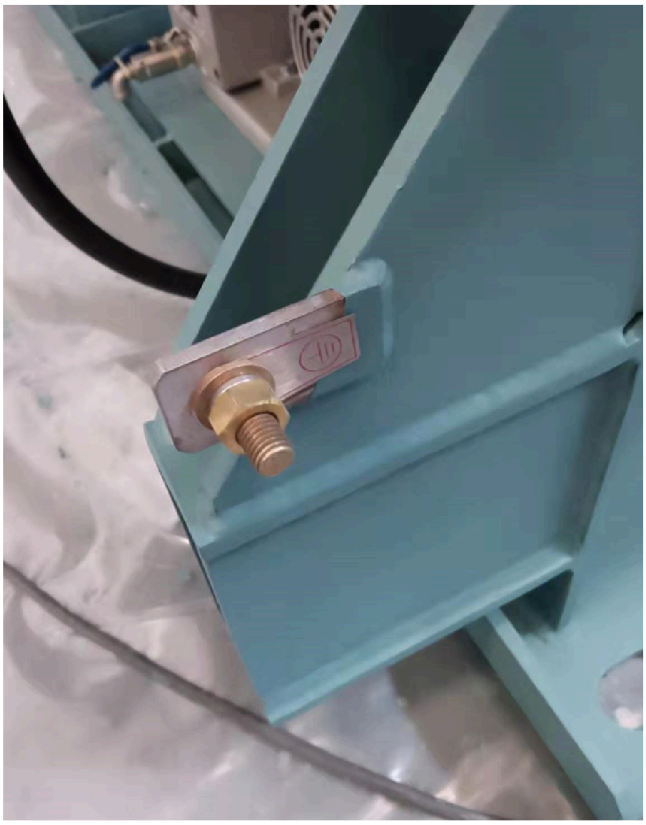
⚠ CAUTION

The chiller does not arrive with a ground fault (earth leakage) circuit breaker installed. Be sure to have the customer install one at the primary side of the chiller.

Electrical work must be supervised or completed by a Johnson Controls service representative.

ⓘ **Note:** Ground the body of the chiller through the ground pole. See Figure 13.

Figure 13: Ground pole



LD31442

Precautions for use

A caution label for a rotating object is pasted around the belt cover of the vacuum pump. When replacing the oil in the vacuum pump, belt, or performing maintenance work, stop the chiller. Turn off the main circuit breaker (MCCB) and lockout or tagout the unit. If this is not done, the vacuum pump could start abruptly and cause injury or damage to the chiller.

Do not place anything heavy on the chiller or its control panel. It may fall and injure someone.

Do not climb up the chiller without safety harnessing.

Contact your local Johnson Controls service center for inspection and maintenance of the chiller. Incorrect inspection and maintenance may cause a chiller problem or injure workers.

Keep the chilled water, cooling water, and steam under the maximum usage pressure. If they exceed the maximum usage pressure, they may spout or leak, which may cause an electric shock and a burn.

Do not change the set values of the safety devices and protective devices. Operation with incorrect values can cause a chiller malfunction.

A caution label for high temperature is pasted at the control panel, solution pump, and vacuum pump. Do not touch the pump during pump operation. It may cause a burn.

Wear protective gloves and goggles when operating the control valve, or other potentially hazardous parts of the chiller.

⚠ CAUTION

During service and maintenance work, turn OFF the main circuit breaker (MCCB) and follow all required lockout/tagout procedures. Close the main valve of the steam line to prevent electric shock and injury.

If the cables of the solution pump, refrigerant pump, or vacuum pump are disconnected for service and maintenance work, check the rotating direction of the pump motor. If not, the chiller may malfunction. When changing the oil of the vacuum pump, stop the purge operation.

In case of an accident, use the emergency stop device (external handle of MCCB) to stop the chiller immediately.

Leak testing

When leak testing, verify the area is well ventilated. Failure to do so may result in suffocation.

Electrical shock cautions

Do not touch the control panel with wet hands. This can cause electric shock. Do not touch the wiring in the control panel.

Do not touch any part other than the control panel of the machine and the valves described in the operating manual. This can cause malfunction and injury.

Only apply the specified source voltage. Application of a different voltage can cause a fire and electric shock.

Only weld in certain circumstances. If welding is done, be careful not to compromise the integrity of the vessel. Before welding, ensure that the electrical system is grounded correctly.

Do not splash water over the machine and its control panel as this can cause an electric shock.

A warning label for electric shock is pasted at the control panel, solution pump, refrigerant pump, and the terminal box of the vacuum pump motor. Before opening the terminal box, stop the chiller and turn OFF the main circuit breaker (MCCB).

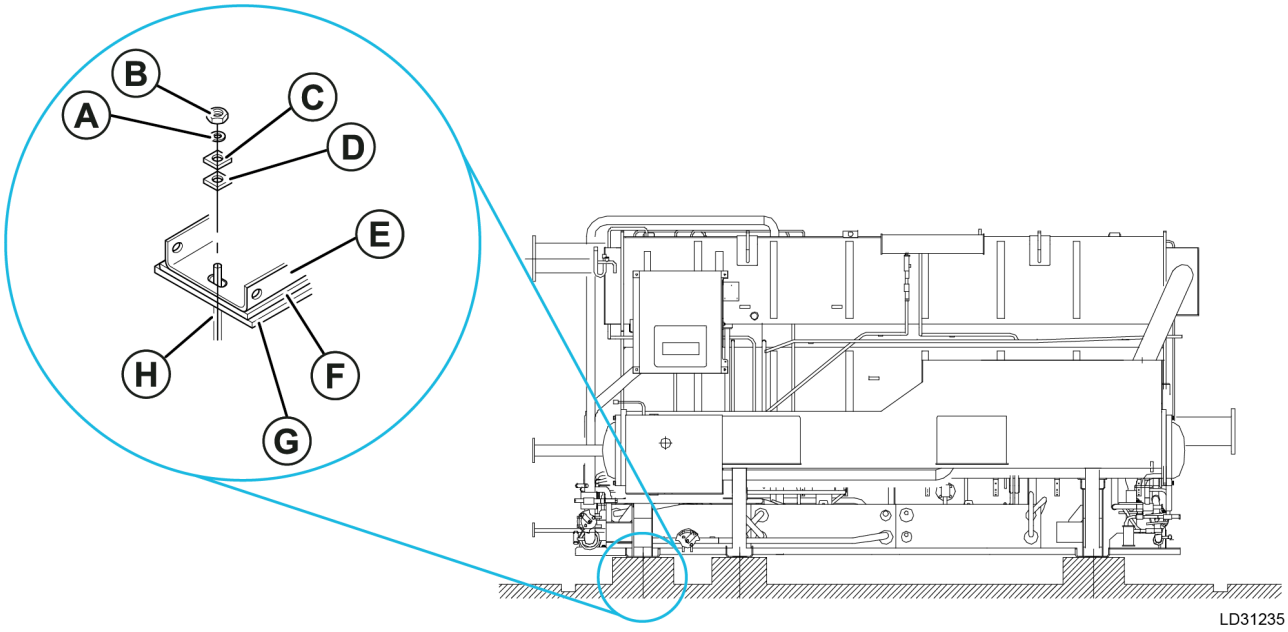
Vibration and isolation details

Before you install the chiller, fit rubber vibration isolators to the chiller base as shown in Figure 14 and Figure 15.

Use liners to adjust the levelness of the chiller. For chiller dimensions, see Table 7, Table 8, Table 9 and Table 10.

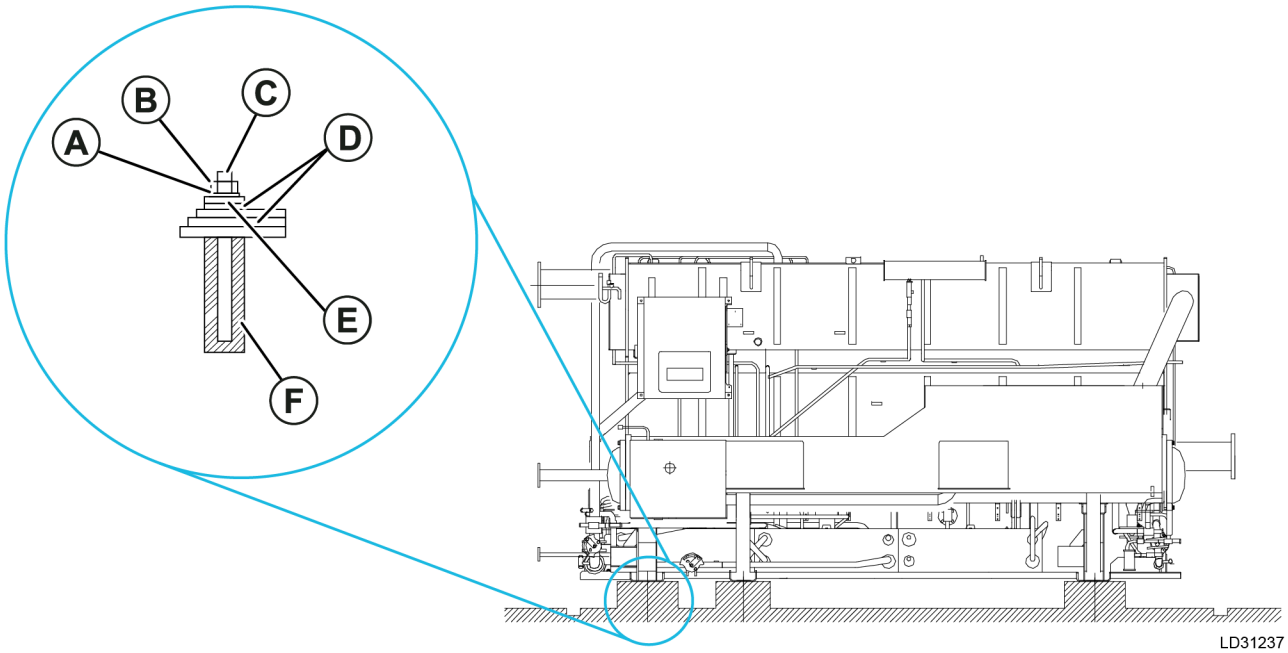
Note: If no vibration conditions are evident, place the chiller on the foundation. The foundation bolts are not necessary.

Figure 14: Vibration and isolation details



Callout	Component
A	Washer
B	Nut
C	Sole plate
D	Rubber vibration isolator
E	Base
F	Rubber vibration isolator
G	Sole plate
H	Foundation bolt

Figure 15: Cross section of vibration and isolation details



Callout	Component
A	Washer
B	Nut
C	Foundation bolt
D	Rubber vibration isolator
E	Sole plate
F	Filling with mortar

Rupture disk and relief piping

ⓘ **Note:** The ANSI/ASHRAE 15-2001 safety standard code was recently revised to include absorption chiller relief devices. Read and follow these instructions closely to ensure the chiller installation is compliant to the revised code.

For YHAU chillers, this device is a metallic, one time use, rupture disk burst rated at 12.0 psig, ± 1.7 psi (83 kPa, ± 12.5 kPa). The size of the rupture disk depends on the chiller capacity.

The rupture disk protects the chiller's integrity in case of a tube rupture, or in the very unlikely event that the chiller's refrigerant vapor pressure gets too high. Unlike vapor compression cooling machines, that relieve refrigerant vapor, if the rupture disk bursts, absorption machines could expel a vapor and a liquid.

The metallic disk is mounted at the factory between two special flanges. The flanges are sealed to the rupture disk using a metal sealing method. The rupture disk is specifically designed with a serrated knife that scrapes the disk when the pressure increases to release pressure.

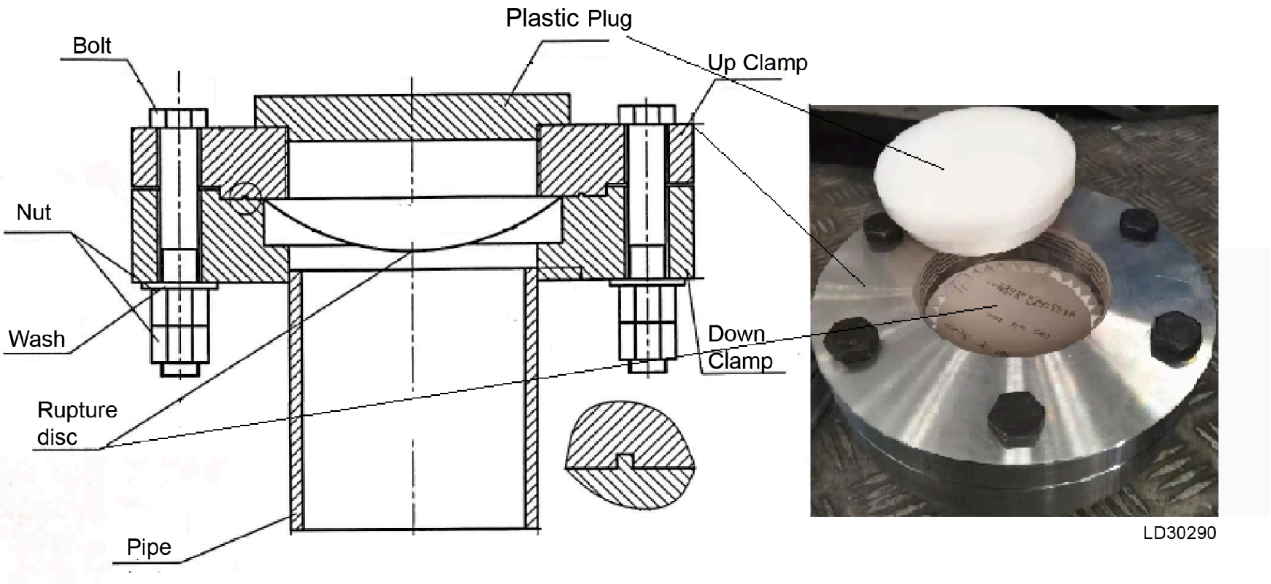
⚠ CAUTION

Liquid coming out of the rupture disk could be in excess of 200°F (93.3°C).

Note: Do not loosen the bolts around the flange or remove the disk from the holder. If the disk is removed for any reason, it must be replaced with a new one.

The outer flange of the disk holder has a plastic pipe stub supplied by the factory for shipping purposes. The plastic stub must be removed. Refer to Figure 16.

Figure 16: Plastic pipe stub on rupture disk



Rupture disk discharge piping material

ANSI/ASHRAE 15-2001 calls for the relief piping material to be compatible with the refrigerant in the system. The refrigerant is de-ionized water and the LiBr solution that could exceed 200°F (93.3°C) in some cases. Use schedule 40 steel pipe for the rupture disk discharge line material.

Rupture disk discharge piping construction

For the piping material, use carbon steel. The relief piping must be fabricated and constructed in accordance with piping best practices. Follow any local codes (if applicable) governing the rupture disk discharge relief piping. Due to the high temperatures of an absorption chiller during operation, and the expansion and contraction associated with this, the rupture disk vent piping must have a flexible connection between the rupture disk outlet and the relief piping. The installing contractor must supply the flexible connection and the relief piping.

Piping supports must be spaced according to the pipe material, size and temperature.

Note: Do not impose any weight or moment arm forces on the flanges of the rupture disk at any time.

Rupture disk discharge piping sizing

The sizing of the rupture disk discharge piping must not be less than the rupture disk diameter. Where two or more relief devices are connected to a common line or header, consider the effect of back-pressure that is developed when more than one relief device operates. The sizing of the discharge line for above condition must be based on the sum of each rupture disk outlet area in addition to the pressure drop allowance through the outlet piping.

Note:

1. Install a flexible connection and fix a support for the pipe to avoid adding weight to the rupture disk.
2. Install a union that is easy to assemble and disassemble to the discharge pipe.

Figure 17: Rupture disk discharge piping system

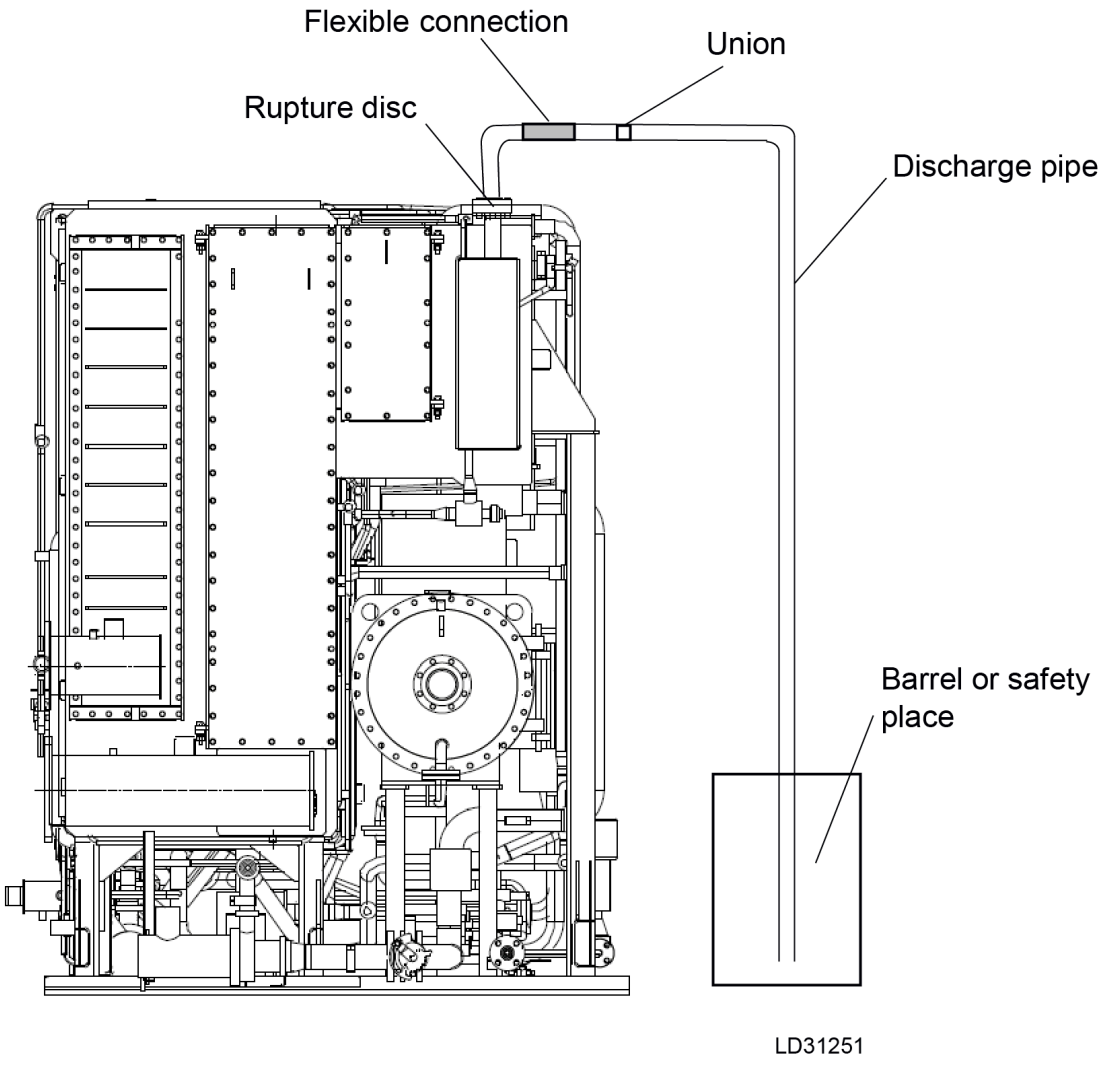


Figure 18: Location of rupture disk

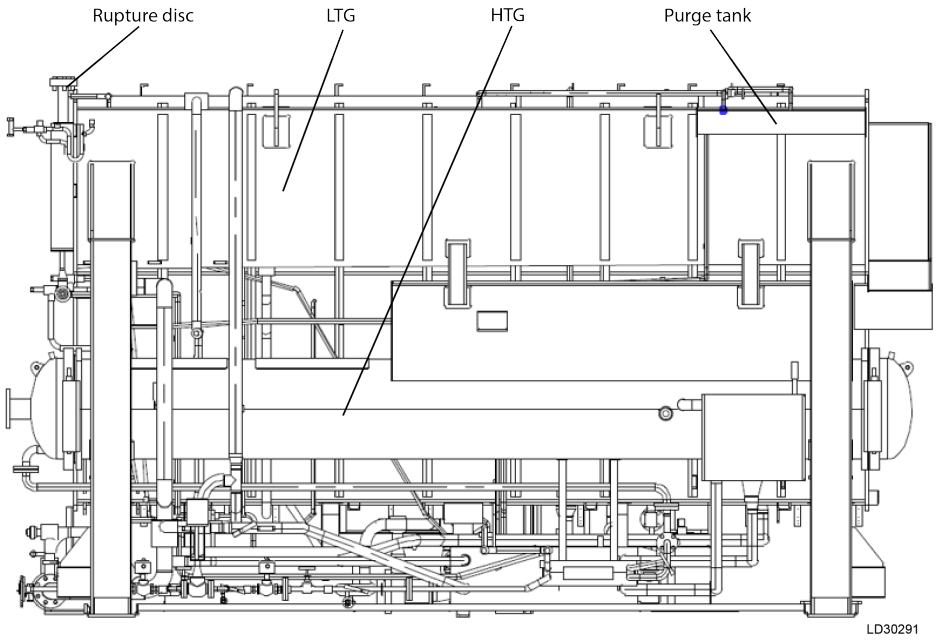
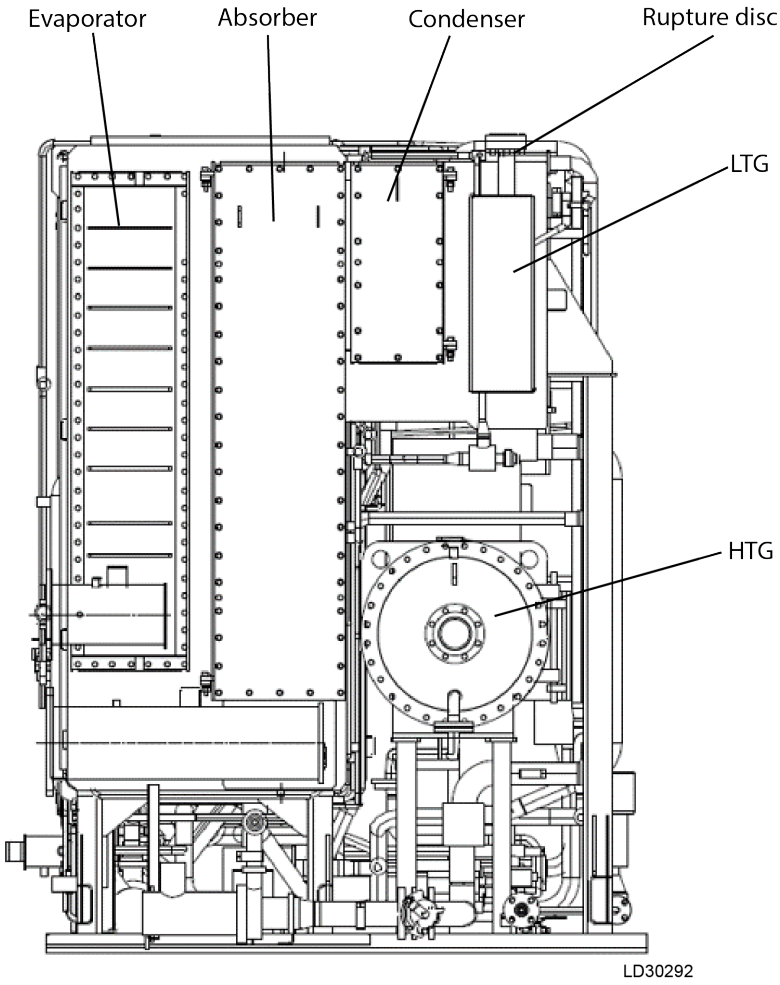


Figure 19: Location of rupture disk



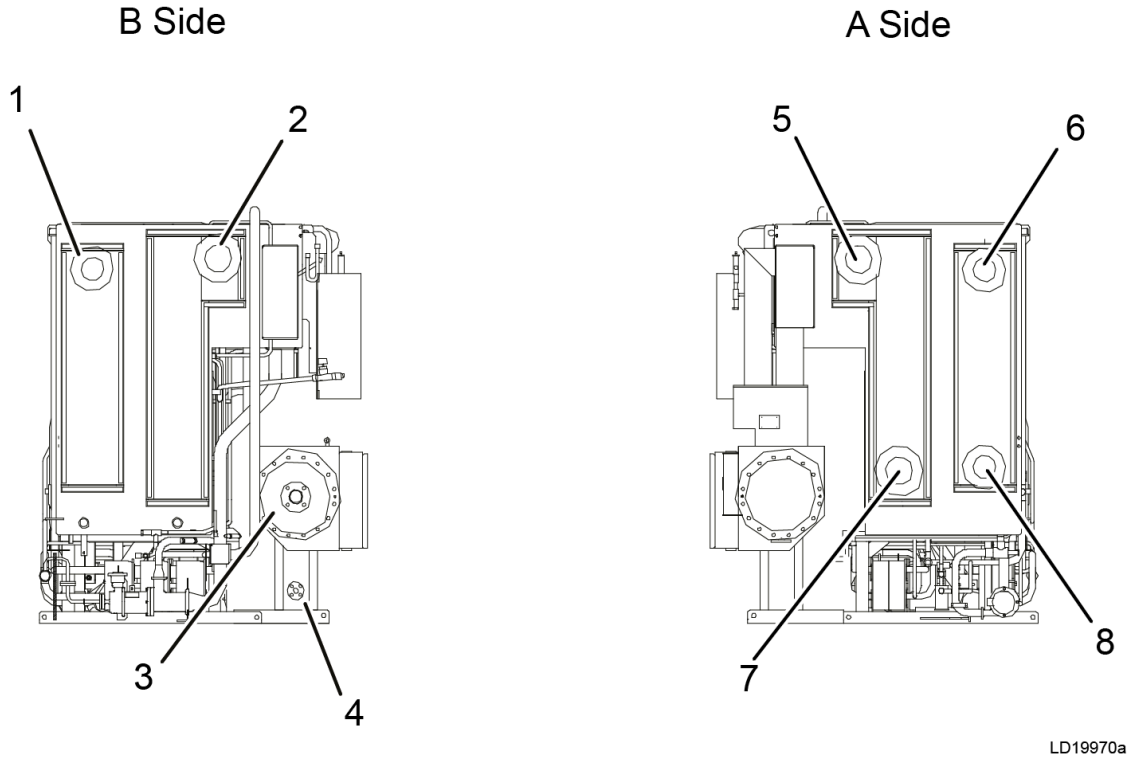
Nozzle arrangements

Table 3: Nozzle arrangements 150-300 EX(S)(L), 360-800 EX(S)(L), 900-1100 EXW(S)(L), 1200-1600 EXW3(S)(L), 1000-2000 EXW4(S)(L)

YHAU-CW	Nozzle location							
	Chilled water (CHW)			Cooling water (CW)			Steam	Steam drain
	Inlet	Outlet		Inlet	Outlet		Inlet	Outlet
150-300EX(S)(L)	A	Odd pass	B	A	Odd pass	B	B	B
		Even pass	A		Even pass	A		
360-800EX(S)(L) 900-1100EXW(S)(L) 1200-1600EXW4(S)(L) 1000-2000EXW4(S)(L)	B	Odd pass	A	B	Odd pass	A	B	B
		Even pass	B		Even pass	B		

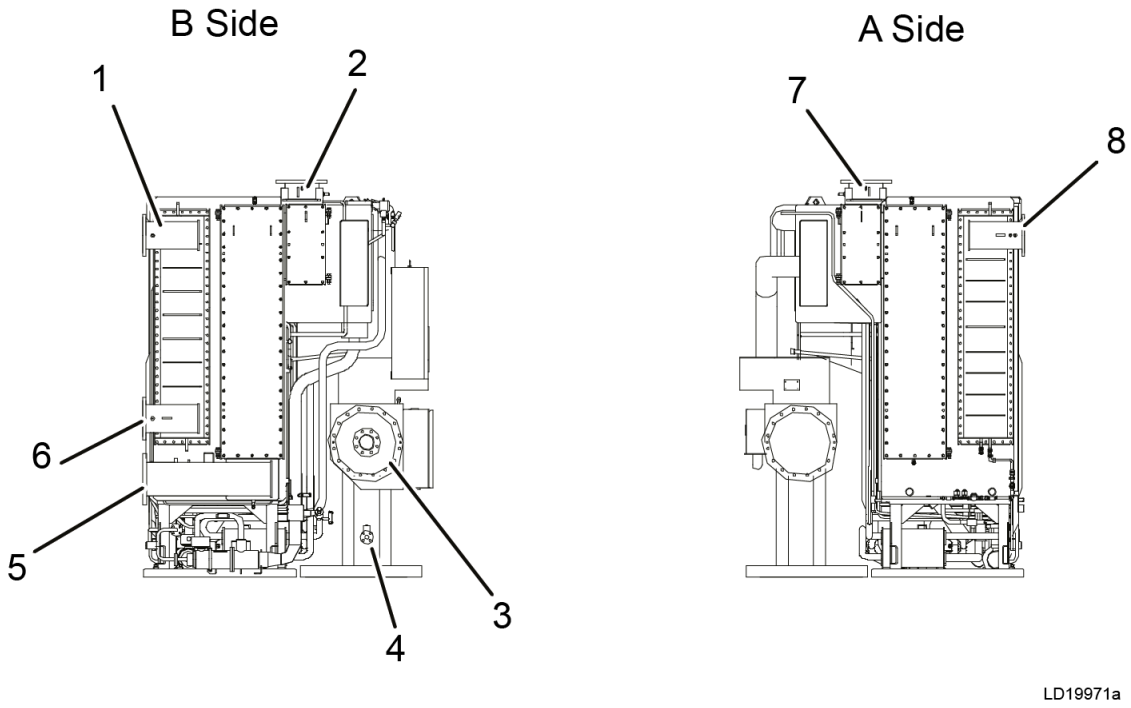
ⓘ **Note:** These images are representations of nozzle arrangements. Reference general arrangement drawings found in the contract documents for detailed nozzle locations for each specific unit.

Figure 20: YHAU-CW 150-300 EX(S)(L) nozzle locations



Callout	Description
1	Chilled water outlet (Odd pass)
2	Cooling water outlet (Odd pass)
3	Steam inlet
4	Drain outlet
5	Cooling water outlet (Even pass)
6	Chilled water outlet (Even pass)
7	Cooling water inlet
8	Chilled water inlet

Figure 21: YHAU-CW 360-800EX(S)(L), 900-1100EXW(S)(L), 1200-1600EXW3(S)(L), 1000-2000EXW4(S)(L) nozzle locations



Callout	Description
1	Chilled water outlet (Even pass)
2	Cooling water outlet (Even pass)
3	Steam inlet
4	Drain outlet
5	Cooling water inlet
6	Chilled water inlet
7	Cooling water outlet (Odd pass)
8	Chilled water outlet (Odd pass)

Hot insulation or cold insulation procedure

1. The recommended materials, and their thickness for hot insulation or cold insulation, are shown in Table 4.
2. Use a bonding agent, iron wire, iron band, or other recommended bonding agents, to fix the hot insulation or cold insulation materials. Never rivet the insulation materials. The use of welding pins is not permitted.
3. Make the outer covering, flanged parts, and evaporator water chamber casing easily removable to facilitate servicing.
4. The points that require hot insulation or cold insulation are shown in Table 4.
5. The casing of the absorber and condenser water chamber does not require hot insulation or cold insulation. If insulation is used, make it easy to remove.
6. For the high temperature generator, install the insulation in a way that makes it easy to remove the front, sides, and rear separately.

Table 4: Insulating material and thickness

	Hot insulation	Cold insulation
Material	Rock wool or glass wool	Polyurethane foam, polystyrene foam, or glass wool
Thickness	1 or 2 in.	1 or 2 in.

Table 5: Points requiring hot or cold insulation

Requires hot insulation	Requires cold insulation	Must not be heat-insulated
High temperature generator	Evaporator shell	Sight glass
Heat exchanger for drain	Evaporator water chamber case	Valve manipulator
Drain piping	Refrigerant spray piping	
Heat exchanger	Refrigerant blow piping	Pressure gauge
Low temperature heat exchanger	Point carrying cold insulation label	Thermometer insertion hole
Point carrying hot insulation label	Valve for vacuuming (factory use only)	Relay insertion hole

Figure 22: Hot and cold insulation

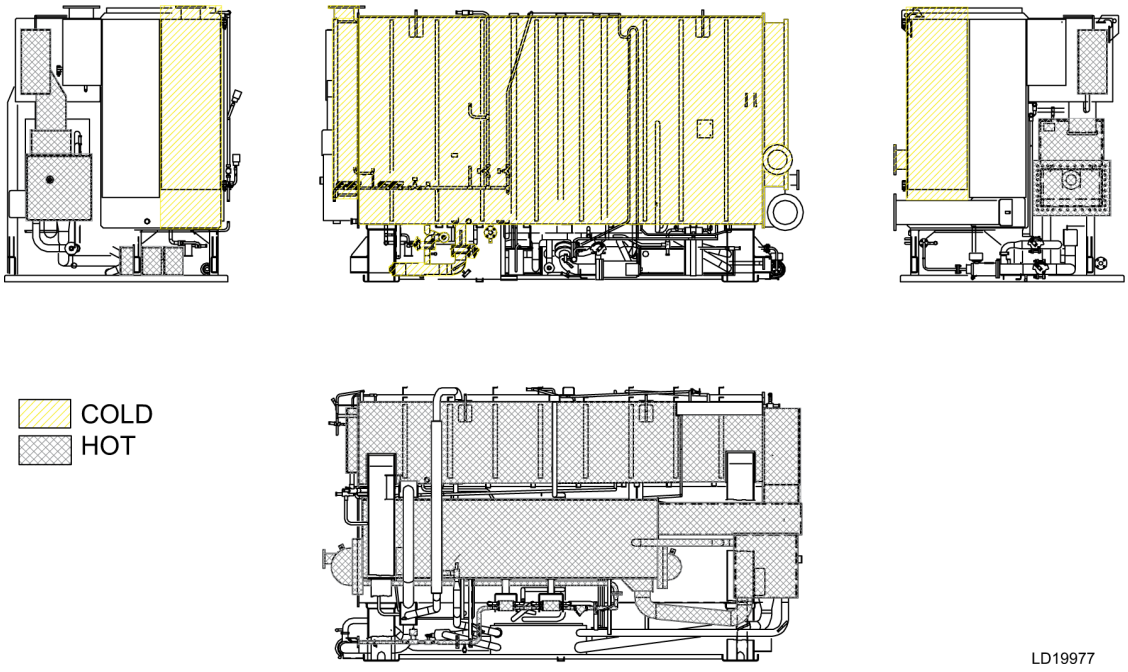


Figure 23: Interior of control panel (in.)

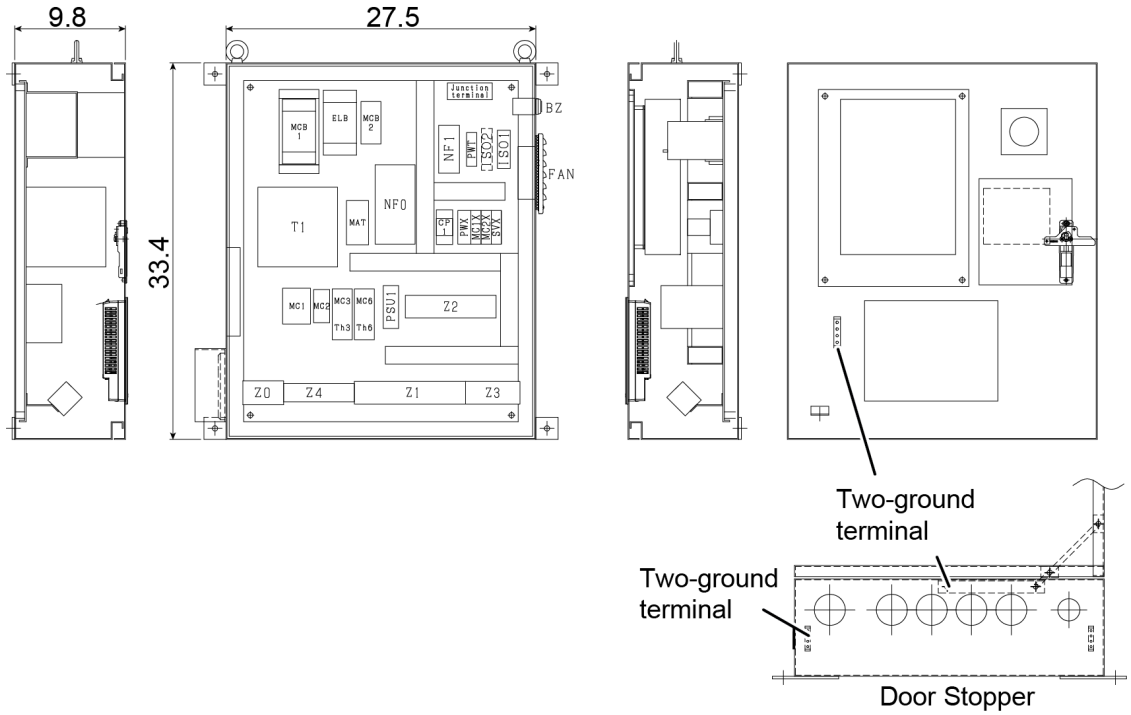
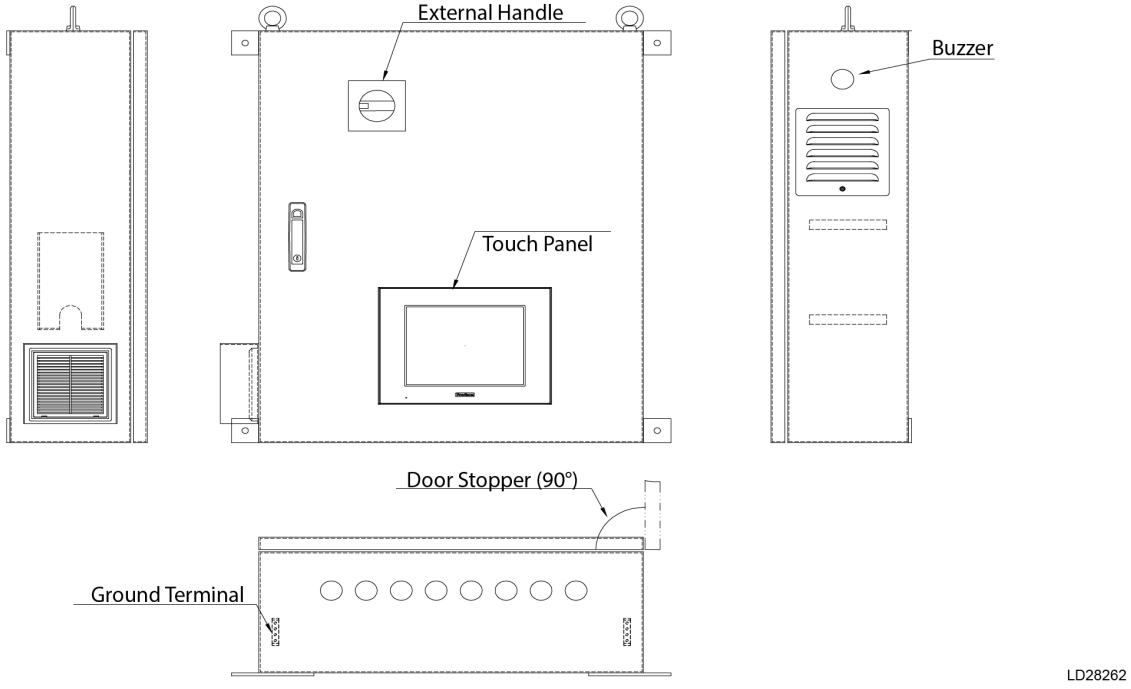


Figure 24: Exterior of control panel



Technical data

This section includes technical information about the chiller, such as weight, dimensions, electrical data, wiring, and sound data.

ⓘ **Note:** The data in this section is for reference only. For actual data, refer to the rating sheet for the chiller.

Operational range

Table 6: Typical operational range

Parameter	Allowable ranges	
	For standard	For option
Chilled water in	44.6°F to 77°F	39.2°F to 44.6°F
Chilled water out	39.2°F to 60.8°F	33.8°F to 39.2°F
Cooling water In	68°F to 98.6°F	
Cooling water out	77°F to 107.6°F	
Steam inlet pressure	29 psig to 145 psig	
Condensate outlet	140°F	

See Table 6 for the parameter ranges. Not all combinations are possible. Check with your Johnson Controls Service Center to see if your temperature differential is possible.

The chilled water and cooling water flow accepts 50% to 120% designed flow. The steam consumption can accept up to 110%. The recommended flow is the designed flow. The acceptable chilled water temperature variation is within ± 0.9°F per minute. The acceptable cooling water temperature variation is 0.9°F per minute. The acceptable steam is saturated designed pressure steam +7.25 psig to -14.5 psig. The maximum temperature is lower than 374°F and pressure is no more than 145 psig. The super heated temperature is no more than 18°F.

Weights and dimensions

Table 7: High efficiency weights and dimensions

Model YHAU-CW(N/L)	Weight								Outline dimensions							
	Dry shipping		Shipping with charge		Operation		Emergency		L		W		H		Tube ext space	
	Ton	Lb	Ton	Lb	Ton	Lb	Ton	Lb	m	inch	m	inch	m	inch	m	inch
150EX(L)	5.9	12942	6.7	14864	7.2	15972	10.7	23552	3.02	118.74	2.29	90.16	2.50	98.43	3.02	118.74
180EX(L)	6.9	15111	7.9	17495	8.6	18862	12.9	28526	3.42	134.49					3.42	134.49
240EX(L)	7.8	17275	9.1	20078	9.9	21745	15.4	33872	4.04	158.90					4.04	158.90
300EX(L)	8.8	19444	10.4	22952	11.3	24980	18.2	40139	4.82	189.61					4.82	189.61
360EX(L)	10.8	23852	13.0	28623	14.3	31467	22.9	50416	5.96	234.65	2.40	9.24			5.96	234.65
400EX(L)	10.8	23852	13.0	28623	14.3	31467	22.9	50416	5.96	234.65					5.96	234.65
450EX(L)	12.7	27914	14.9	32800	16.6	36591	26.2	57657	4.94	194.53	2.58	101.65	3.14	123.70	4.94	194.53
500EX(L)	12.8	28125	15.2	33408	17.0	37486	27.8	61186	5.44	214.21					5.44	214.21
560EX(L)	13.9	30717	16.6	36617	18.7	41113	30.6	67447	5.94	233.90					5.94	233.90
600EX(L)	15.3	33710	18.2	40073	20.4	44900	33.5	73866	6.44	253.58					6.44	253.58
700EX(L)	17.0	37552	20.5	45105	22.9	50394	37.9	83574	7.24	285.08					7.24	285.08
800EX(L)	18.8	41393	22.6	49916	25.4	55999	42.1	92866	7.94	312.64					7.94	312.64
900EXW(L)	19.2	42319	23.7	52274	27.3	60209	45.1	99500	6.76	266.14	2.97	116.81	3.17	124.80	6.76	266.14
1000EXW(L)	22.2	48997	27.1	59834	31.0	68397	50.7	111824	7.37	289.96					7.37	289.96
1100EXW(L)	25.3	55675	30.6	67482	34.8	76673	56.7	124925	8.07	317.52					8.07	317.52

Table 7: High efficiency weights and dimensions

Model YHAU-CW(N/L)	Weight								Outline dimensions							
	Dry shipping		Shipping with charge		Operation		Emergency		L		W		H		Tube ext space	
	Ton	Lb	Ton	Lb	Ton	Lb	Ton	Lb	m	inch	m	inch	m	inch	m	inch
1200EXW3(L)	27.5	60588	33.8	74495	38.8	85427	62.7	138246	8.21	323.19	3.03	119.29	3.35	131.69	8.21	323.19
1300EXW3(L)	28.6	63012	35.2	77625	40.4	89086	66.1	145678	8.71	342.87					8.71	342.87
1400EXW3(L)	29.7	65437	36.5	80512	42.0	92502	69.4	152867	9.21	362.56					9.21	362.56
1500EXW3(L)	31.3	69073	38.7	85207	44.3	97723	73.4	161861	9.71	382.24					9.71	382.24
1600EXW3(L)	33.0	72710	40.6	89571	46.6	102614	77.4	170524	10.21	401.93					10.21	401.93
1000EXW4(L)	29.3	64577	34.5	75993.9	40.3	88821	60.1	132460.4	6.20	244.09	3.10	122.05	3.90	153.54	5.00	196.85
1120EXW4(L)	34.0	74936	39.9	87939.6	45.2	99621	67.7	149210.8	6.90	271.65					5.70	224.41
1250EXW4(L)	35.6	78462	42.1	92832.5	48.9	107776	73.7	162434.8	7.50	295.28					6.30	248.03
1400EXW4(L)	38.9	85736	46.2	101715	53.3	117473	81	178524	8.20	322.83					7.00	275.59
1500EXW4(L)	41.3	91025	49.1	108150	56.5	124526	86.2	189984.8	8.70	342.52					7.50	295.28
1600EXW4(L)	43.7	96315	52.0	114564	59.8	131799	91.4	201445.6	9.20	362.20					8.00	314.96
1680EXW4(L)	44.6	98298	53.4	117716	61.5	135546	95.1	209600.4	9.70	381.89					8.50	334.65
1800EXW4(L)	47.0	103588	56.3	124151	64.7	142599	100.3	221061.2	10.20	401.57					9.00	354.33
1900EXW4(L)	49.5	109098	59.4	130807	68.1	150092	105.6	232742.4	10.70	421.26					9.50	374.02
2000EXW4(L)	52.0	114608	62.4	137419	71.4	157366	110.9	244423.6	11.20	440.94					10.00	393.70

Table 8: Weights and dimensions for standard efficiency model

Model YHAU-CW(N/L)	weight								outline dimensions							
	Dry shipping		Shipping with charge		Operation		Emergency		L		W		H		Tube ext space	
	Ton	Lb	Ton	Lb	Ton	Lb	Ton	Lb	m	inch	m	inch	m	inch	m	inch
150EXS?L?	5.7	12501	6.7	14685	7.2	15794	10.6	23373	3.02	118.74	2.29	90.16	2.50	98.43	3.02	118.74
180EXS?L?	6.7	14668	7.7	17072	8.4	18439	12.8	28103	3.42	134.49					3.42	134.49
240EXS?L?	7.6	16834	8.9	19697	9.7	21363	15.2	33491	4.04	158.90					4.04	158.90
300EXS?L?	8.5	18694	10.0	22135	11.0	24162	17.8	39322	4.82	189.61					4.82	189.61
360EXS?L?	10.4	22816	12.4	27349	13.7	30193	22.3	49142	5.96	234.65	2.40	9.24			5.96	234.65
400EXS?L?	10.4	22816	12.4	27349	13.7	30193	22.3	49142	5.96	234.65					5.96	234.65
450EXS?L?	12.0	26430	14.1	31074	15.8	34865	25.4	55932	4.94	194.53	2.58	101.65	3.14	123.70	4.94	194.53
500EXS?L?	12.1	26642	14.3	31550	16.2	35628	26.9	59328	5.44	214.21					5.44	214.21
560EXS?L?	13.2	29038	15.8	34739	17.8	39236	29.7	65569	5.94	233.90					5.94	233.90
600EXS?L?	14.5	32031	17.4	38328	19.6	43154	32.7	72121	6.44	253.58					6.44	253.58
700EXS?L?	16.1	35573	19.4	42751	21.8	48041	36.9	81220	7.24	285.08					7.24	285.08
800EXS?L?	17.7	39114	21.5	47307	24.2	53390	41.0	90256	7.94	312.64					7.94	312.64
900EXWS?L?	18.2	40221	22.4	49317	26.0	57251	43.8	96542	6.76	266.14	2.97	116.81	3.17	124.80	6.76	266.14
1000EXWS?L?	21.2	46659	25.7	56702	29.6	65265	49.3	108692	7.37	289.96					7.37	289.96
1100EXWS?L?	24.1	53097	29.2	64264	33.3	73455	55.2	121707	8.07	317.52					8.07	317.52
1200EXW3S?L?	26.3	58053	31.8	69999	36.7	80931	60.7	133750	8.21	323.19	3.03	119.29	3.35	131.69	8.21	323.19
1300EXW3S?L?	27.3	60257	33.2	73085	38.4	84545	64.0	141137	8.71	342.87					8.71	342.87
1400EXW3S?L?	28.3	62461	34.4	75906	39.9	87896	67.3	148260	9.21	362.56					9.21	362.56
1500EXW3S?L?	29.3	64665	35.8	78859	41.5	91376	70.6	155513	9.71	382.24					9.71	382.24
1600EXW3S?L?	31.7	69955	38.6	85030	44.5	98074	75.3	165984	10.21	401.93					10.21	401.93
1000EXW4S(L)	28.1	61932	63.3	139491	38.7	85295	58.5	128934	6.20	244.09	3.10	122.05	3.90	153.54	5.00	196.85
1120EXW4S(L)	31.5	69426	71.3	157057	43.2	95213	65.8	145023	6.90	271.65					5.70	224.41
1250EXW4S(L)	34.1	75156	77.7	171339	46.9	103368	71.7	158027	7.50	295.28					6.30	248.03
1400EXW4S(L)	37.2	81989	85.5	188464	51.1	112624	78.8	173675	8.20	322.83					7.00	275.59
1500EXW4S(L)	39.6	87278	91.1	200762	54.2	119457	83.9	184916	8.70	342.52					7.50	295.28
1600EXW4S(L)	41.8	92127	96.6	212818	57.3	126289	88.9	195936	9.20	362.20					8.00	314.96
1680EXW4S(L)	42.5	93670	100.5	221392	58.7	129375	92.3	203429	9.70	381.89					8.50	334.65
1800EXW4S(L)	44.8	98739	106.0	233690	61.8	136207	97.4	214670	10.20	401.57					9.00	354.33
1900EXW4S(L)	47.0	103588	111.5	245768	64.9	143040	102.4	225690	10.70	421.26					9.50	374.02
2000EXW4S(L)	49.3	108657	117.0	257824	67.9	149652	107.4	236710	11.20	440.94					10.00	393.70

ⓘ **Note:** All data in this section is for reference only. For actual data, check the rating table.

Physical data

Table 9: High efficiency physical data

YHAU-CW(N/L)	Cold insulaton area ft² (m²)	Hot insulation area f² (m²)	Radiation heat loss (with insulation, ambient temperature 50°F) (kW)	Radiation heat loss (without insulation, ambient temperature 50°F) (kW)	Water volume		
					Chilled water (evap.) f³ (m³)	Cooling water (abs. and cond.) f³ (m³)	Steam (gen.) f³ (m³)
150 EX(L)	86.11 (8)	204.51 (19)	1	9	7.42 (0.21)	11.65 (0.33)	1.41 (0.04)
180 EX(L)	107.64 (10)	226.04 (21)	1	11	8.83 (0.25)	13.77 (0.39)	1.41 (0.04)
240 EX(L)	129.17 (12)	258.33 (24)	1	15	10.59 (0.3)	16.24 (0.46)	1.41 (0.04)
300 EX(L)	150.69 (14)	301.39 (28)	2	19	12.71 (0.36)	19.78 (0.56)	2.12 (0.06)
360 EX(L)	150.69 (14)	355.21 (33)	2	22	16.24 (0.46)	29.31 (0.83)	2.47 (0.07)
400 EX(L)	150.69 (14)	355.21 (33)	2	22	16.24 (0.46)	29.31 (0.83)	2.47 (0.07)
450 EX(L)	150.69 (14)	355.21 (33)	3	28	19.42 (0.55)	41.32 (1.17)	2.83 (0.08)
500 EX(L)	172.22 (16)	387.5 (36)	3	31	21.19 (0.6)	44.14 (1.25)	3.18 (0.09)
560 EX(L)	182.99 (17)	419.79 (39)	3	35	22.95 (0.65)	49.09 (1.39)	3.53 (0.1)
600 EX(L)	204.51 (19)	430.56 (40)	4	37	25.07 (0.71)	52.27 (1.48)	3.88 (0.11)
700 EX(L)	215.28 (20)	441.32 (41)	4	43	27.9 (0.79)	56.86 (1.61)	4.59 (0.13)
800 EX(L)	247.57 (23)	495.14 (46)	5	50	31.08 (0.88)	66.39 (1.88)	5.3 (0.15)
900 EXW(L)	344.45 (32)	538.2 (50)	5	56	43.79 (1.24)	83.34 (2.36)	6 (0.17)
1000 EXW(L)	376.74 (35)	570.49 (53)	6	62	47.32 (1.34)	88.99 (2.52)	6.71 (0.19)
1100 EXW(L)	409.03 (38)	624.31 (58)	7	68	51.56 (1.46)	95.7 (2.71)	7.42 (0.21)
1200 EXW3(L)	462.85 (43)	688.89 (64)	7	74	59.33 (1.68)	115.83 (3.28)	8.48 (0.24)
1300 EXW3(L)	495.14 (46)	753.47 (70)	8	80	63.57 (1.8)	120.07 (3.4)	9.18 (0.26)
1400 EXW3(L)	516.67 (48)	818.06 (76)	8	87	66.74 (1.89)	125.37 (3.55)	9.89 (0.28)
1500 EXW3(L)	548.96 (51)	882.64 (82)	9	93	70.28 (1.99)	130.66 (3.7)	10.24 (0.29)
1600 EXW3(L)	570.49 (53)	947.22 (88)	10	99	73.45 (2.08)	135.96 (3.85)	10.95 (0.31)
1000 EXW4(L)	365.97 (34)	430.56 (40)	6	62	73.81 (2.09)	124.66 (3.53)	6.71 (0.19)
1120 EXW4(L)	398.26 (37)	484.38 (45)	7	69	79.46 (2.25)	134.2 (3.8)	7.42 (0.21)
1250 EXW4(L)	430.56 (40)	527.43 (49)	7	77	84.76 (2.4)	142.32 (4.03)	8.12 (0.23)
1400 EXW4(L)	473.61 (44)	570.49 (53)	8	87	90.41 (2.56)	151.5 (4.29)	9.18 (0.26)
1500 EXW4(L)	505.9 (47)	602.78 (56)	9	93	94.64 (2.68)	158.21 (4.48)	9.89 (0.28)
1600 EXW4(L)	527.43 (49)	635.07 (59)	10	99	98.53 (2.79)	165.27 (4.68)	10.59 (0.3)
1680 EXW4(L)	559.72 (52)	678.13 (63)	10	104	102.77 (2.91)	171.98 (4.87)	10.95 (0.31)

Table 9: High efficiency physical data

YHAU-CW(N/L)	Cold insulaton area ft² (m²)	Hot insulation area f² (m²)	Radiation heat loss (with insulation, ambient temperature 50°F) (kW)	Radiation heat loss (without insulation, ambient temperature 50°F) (kW)	Water volume		
					Chilled water (evap.) f³ (m³)	Cooling water (abs. and cond.) f³ (m³)	Steam (gen.) f³ (m³)
1800 EXW4(L)	581.25 (54)	710.42 (66)	11	111	107 (3.03)	178.69 (5.06)	11.65 (0.33)
1900 EXW4(L)	613.54 (57)	742.71 (69)	11	118	111.24 (3.15)	185.4 (5.25)	12.36 (0.35)
2000 EXW4(L)	635.07 (59)	775 (72)	12	124	115.13 (3.26)	192.11 (5.44)	13.07 (0.37)

ⓘ **Note:** All data in this section is for reference only. For actual data, check the rating table.

Table 10: Standard physical data

YHAU-CW(N/L)	Cold insulation area f² (m²)	Hot insulation area f² (m²)	Radiation heat loss (with insulation, ambient temperature 50°F) (kW)	Radiation heat loss (without insulation, ambient temperature 50°F) (kW)	Water volume		
					Chilled water (evap.) f³ (m³)	Cooling water (abs. and cond.) f³ (m³)	Steam (gen.) f³ (m³)
150 EXS(L)	86.11 (8)	204.51 (19)	1	10	7.42 (0.21)	11.65 (0.33)	1.41 (0.04)
180 EXS(L)	107.64 (10)	226.04 (21)	1	12	8.83 (0.25)	13.77 (0.39)	1.41 (0.04)
240 EXS(L)	129.17 (12)	258.33 (24)	2	16	10.59 (0.3)	16.24 (0.46)	1.41 (0.04)
300 EXS(L)	150.69 (14)	301.39 (28)	2	20	12.71 (0.36)	19.78 (0.56)	2.12 (0.06)
360 EXS(L)	150.69 (14)	355.21 (33)	2	24	16.24 (0.46)	29.31 (0.83)	2.47 (0.07)
400 EXS(L)	150.69 (14)	355.21 (33)	2	24	16.24 (0.46)	29.31 (0.83)	2.47 (0.07)
450 EXS(L)	150.69 (14)	355.21 (33)	3	30	19.42 (0.55)	41.32 (1.17)	2.83 (0.08)
500 EXS(L)	172.22 (16)	387.5 (36)	3	33	21.19 (0.6)	44.14 (1.25)	3.18 (0.09)
560 EXS(L)	182.99 (17)	419.79 (39)	4	37	22.95 (0.65)	49.09 (1.39)	3.53 (0.1)
600 EXS(L)	204.51 (19)	430.56 (40)	4	40	25.07 (0.71)	52.27 (1.48)	3.88 (0.11)
700 EXS(L)	215.28 (20)	441.32 (41)	4	47	27.9 (0.79)	56.86 (1.61)	4.59 (0.13)
800 EXS(L)	247.57 (23)	495.14 (46)	5	53	31.08 (0.88)	66.39 (1.88)	5.3 (0.15)
900 EXWS(L)	344.45 (32)	538.2 (50)	6	60	43.79 (1.24)	83.34 (2.36)	6 (0.17)
1000 EXWS(L)	376.74 (35)	570.49 (53)	6	67	47.32 (1.34)	88.99 (2.52)	6.71 (0.19)
1100 EXWS(L)	409.03 (38)	624.31 (58)	7	73	51.56 (1.46)	95.7 (2.71)	7.42 (0.21)
1200 EXW3S(L)	462.85 (43)	688.89 (64)	8	80	59.33 (1.68)	115.83 (3.28)	8.48 (0.24)
1300 EXW3S(L)	495.14 (46)	753.47 (70)	8	87	63.57 (1.8)	120.07 (3.4)	9.18 (0.26)
1400 EXW3S(L)	516.67 (48)	818.06 (76)	9	93	66.74 (1.89)	125.37 (3.55)	9.89 (0.28)
1500 EXW3S(L)	548.96 (51)	882.64 (82)	10	100	70.28 (1.99)	130.66 (3.7)	10.24 (0.29)
1600 EXW3S(L)	570.49 (53)	947.22 (88)	10	107	73.45 (2.08)	135.96 (3.85)	10.95 (0.31)
1000 EXW4S(L)	365.97 (34)	430.56 (40)	6	67	73.81 (2.09)	124.66 (3.53)	6.71 (0.19)
1120 EXW4S(L)	398.26 (37)	484.38 (45)	7	75	79.46 (2.25)	134.2 (3.8)	7.42 (0.21)

Table 10: Standard physical data

YHAU-CW(N/L)	Cold insulation area f^2 (m^2)	Hot insulation area f^2 (m^2)	Radiation heat loss (with insulation, ambient temperature 50°F) (kW)	Radiation heat loss (without insulation, ambient temperature 50°F) (kW)	Water volume		
					Chilled water (evap.) f^3 (m^3)	Cooling water (abs. and cond.) f^3 (m^3)	Steam (gen.) f^3 (m^3)
1250 EXW4S(L)	430.56 (40)	527.43 (49)	8	83	84.76 (2.4)	142.32 (4.03)	8.12 (0.23)
1400 EXW4S(L)	473.61 (44)	570.49 (53)	9	93	90.41 (2.56)	151.5 (4.29)	9.18 (0.26)
1500 EXW4S(L)	505.9 (47)	602.78 (56)	10	100	94.64 (2.68)	158.21 (4.48)	9.89 (0.28)
1600 EXW4S(L)	527.43 (49)	635.07 (59)	10	107	98.53 (2.79)	165.27 (4.68)	10.59 (0.3)
1680 EXW4S(L)	559.72 (52)	678.13 (63)	11	112	102.77 (2.91)	171.98 (4.87)	10.95 (0.31)
1800 EXW4S(L)	581.25 (54)	710.42 (66)	12	120	107 (3.03)	178.69 (5.06)	11.65 (0.33)
1900 EXW4S(L)	613.54 (57)	742.71 (69)	12	127	111.24 (3.15)	185.4 (5.25)	12.36 (0.35)
2000 EXW4S(L)	635.07 (59)	775 (72)	13	133	115.13 (3.26)	192.11 (5.44)	13.07 (0.37)

Load point data

Figure 25: Load points for double-effect steam chillers

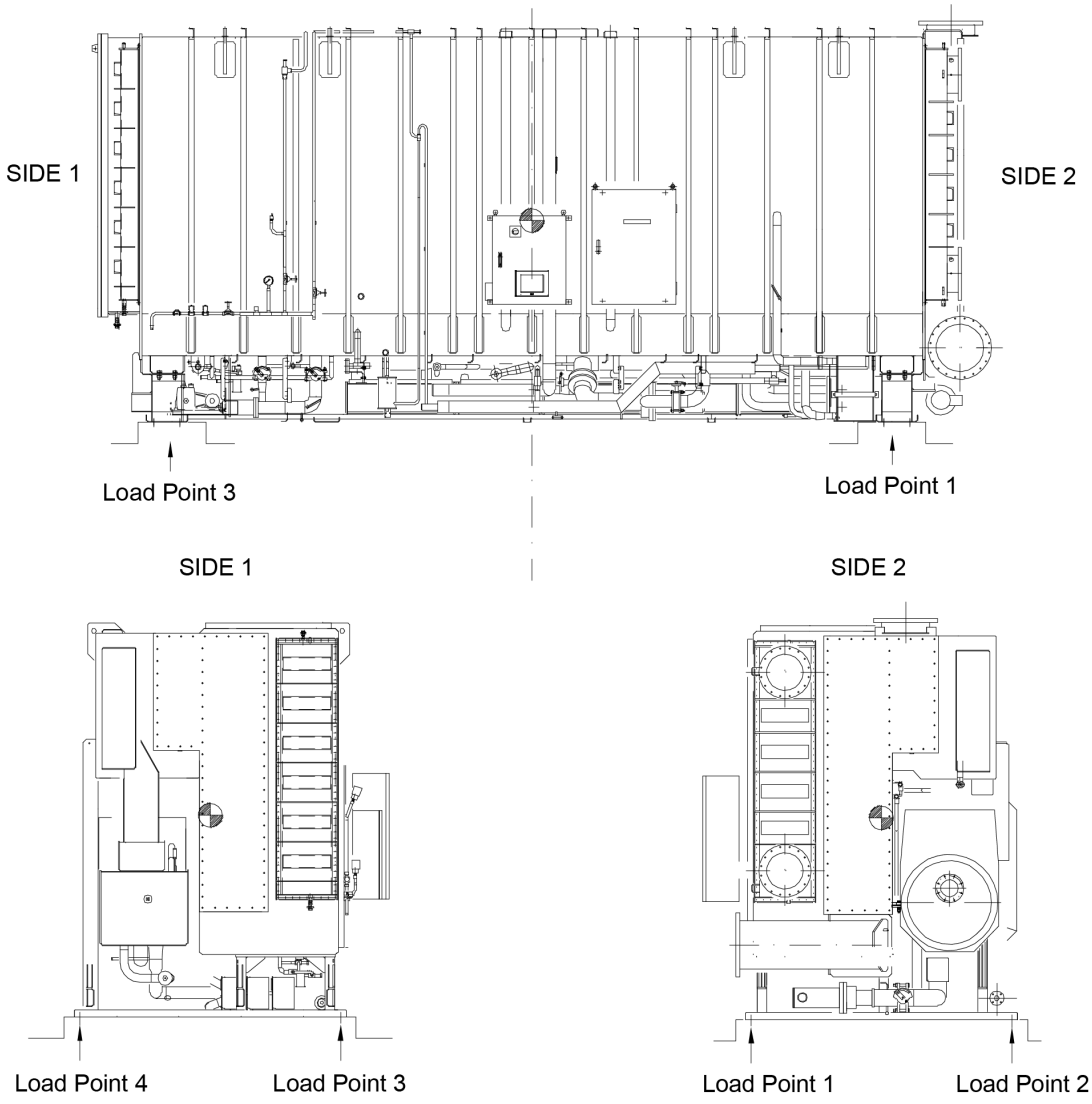


Table 11: Load points for double-effect EX(L) and EXW(L) chillers - high efficiency

Model YHAU-CW(N/L)	Load point 1		Load point 2		Load point 3		Load point 4	
	kg	lb	kg	lb	kg	lb	kg	lb
150EX(L)	1,840	4,055	1,990	4,386	1,620	3,570	1,750	3,857
180EX(L)	2,040	4,496	2,360	5,201	1,900	4,188	2,200	4,849
240EX(L)	2,340	5,157	2,700	5,951	2,250	4,959	2,610	5,752
300EX(L)	2,700	5,951	3,120	6,876	2,680	5,907	3,100	6,832
360EX(L)	3,950	8,706	3,950	8,706	3,950	8,706	3,950	8,706
400EX(L)	3,950	8,706	3,950	8,706	3,950	8,706	3,950	8,706
450EX(L)	4,420	9,742	4,130	9,103	4,420	9,742	4,130	9,103
500EX(L)	5,220	11,505	4,880	10,756	5,220	11,505	4,880	10,756
560EX(L)	5,630	12,409	5,270	11,615	5,630	12,409	5,270	11,615
600EX(L)	6,280	13,841	5,870	12,937	6,280	13,841	5,870	12,937

Table 11: Load points for double-effect EX(L) and EXW(L) chillers - high efficiency

Model YHAU-CW(N/L)	Load point 1		Load point 2		Load point 3		Load point 4	
	kg	lb	kg	lb	kg	lb	kg	lb
700EX(L)	6,950	15,318	6,500	14,326	6,950	15,318	6,500	14,326
800EX(L)	7,780	17,147	7,270	16,023	7,780	17,147	7,270	16,023
900EXW(L)	8,380	18,470	8,380	18,470	8,380	18,470	8,380	18,470
1000EXW(L)	9,130	20,123	9,130	20,123	9,130	20,123	9,130	20,123
1100EXW(L)	9,850	21,709	9,850	21,709	9,850	21,709	9,850	21,709
1200EXW3(L)	11,000	24,244	11,100	24,464	11,000	24,244	11,100	24,464
1300EXW3(L)	11,700	25,787	11,800	26,007	11,700	25,787	11,800	26,007
1400EXW3(L)	12,500	27,550	12,600	27,770	12,500	27,550	12,600	27,770
1500EXW3(L)	13,200	29,093	13,400	29,534	13,200	29,093	13,400	29,534
1600EXW3(L)	14,000	30,856	14,100	31,076	14,000	30,856	14,100	31,076
1000EXW4(L)	10,000	22040	10,100	22,260	10,000	22,040	10,100	22,260
1120EXW4(L)	11,300	24,905	11,300	24,905	11,300	24,905	11,300	24,905
1250EXW4(L)	12,200	26,889	12,300	27,109	12,200	26,889	12,300	27,109
1400EXW4(L)	13,300	29,313	13,400	29,534	13,300	29,313	13,400	29,534
1500EXW4(L)	14,100	31,076	14,200	31,297	14,100	31,076	14,200	31,297
1600EXW4(L)	14,900	32,840	15,000	33,060	14,900	32,840	15,000	33,060
1680EXW4(L)	15,300	33,721	15,400	33,942	15,300	33,721	15,400	33,942
1800EXW4(L)	16,100	35,484	16,200	35,705	16,100	35,484	16,200	35,705
1900EXW4(L)	17,000	37,468	17,100	37,688	17,000	37,468	17,100	37,688
2000EXW4(L)	17,800	39,231	17,900	39,452	17,800	39,231	17,900	39,452

Table 12: Load points for double-effect EX(L) and EXW(L) chillers - standard efficiency

Model YHAU-CW(N/L)	Load point 1		Load point 2		Load point 3		Load point 4	
	kg	lb	kg	lb	kg	lb	kg	lb
150EXS(L)	1,710	3,769	1,850	4,077	1,510	3,328	1,630	3,593
180EXS(L)	1,900	4,188	2,190	4,827	1,770	3,901	2,040	4,496
240EXS(L)	2,170	4,783	2,510	5,532	2,100	4,628	2,420	5,334
300EXS(L)	2,490	5,488	2,880	6,348	2,470	5,444	2,860	6,303
360EXS(L)	3,780	8,331	3,780	8,331	3,780	8,331	3,780	8,331
400EXS(L)	3,780	8,331	3,780	8,331	3,780	8,331	3,780	8,331
450EXS(L)	4,240	9,345	3,960	8,728	4,240	9,345	3,960	8,728
500EXS(L)	4,810	10,601	4,500	9,918	4,810	10,601	4,500	9,918
560EXS(L)	5,370	11,835	5,030	11,086	5,370	11,835	5,030	11,086
600EXS(L)	5,970	13,158	5,580	12,298	5,970	13,158	5,580	12,298
700EXS(L)	6,610	14,568	6,190	13,643	6,610	14,568	6,190	13,643
800EXS(L)	7,360	16,221	6,890	15,186	7,360	16,221	6,890	15,186
900EXWS(L)	7,980	17,588	7,980	17,588	7,980	17,588	7,980	17,588
1000EXWS(L)	8,630	19,021	8,630	19,021	8,630	19,021	8,630	19,021
1100EXWS(L)	9,350	20,607	9,350	20,607	9,350	20,607	9,350	20,607
1200EXW3S(L)	10,400	22,922	10,500	23,142	10,400	22,922	10,500	23,142
1300EXW3S(L)	11,200	24,685	11,200	24,685	11,200	24,685	11,200	24,685
1400EXW3S(L)	11,900	26,228	12,000	26,448	11,900	26,228	12,000	26,448
1500EXW3S(L)	12,600	27,770	12,700	27,991	12,600	27,770	12,700	27,991
1600EXW3S(L)	13,300	29,313	13,400	29,534	13,300	29,313	13,400	29,534
1000EXW4S(L)	9,640	21,247	9,710	21,401	9,640	21,247	9,710	21,401
1100EXW4S(L)	10,800	23,803	10,800	23,803	10,800	23,803	10,800	23,803
1250EXW4S(L)	11,700	25,787	11,800	26,007	11,700	25,787	11,800	26,007
1400EXW4S(L)	12,700	27,991	12,800	28,211	12,700	27,991	12,800	28,211
1500EXW4S(L)	13,500	29,754	13,600	29,974	13,500	29,754	13,600	29,974
1600EXW4S(L)	14,300	31517	14,400	31,738	14,300	31,517	14,400	31,738
1680EXW4S(L)	14,600	32178	14,700	32,399	14,600	32,178	14,700	32,399

Table 12: Load points for double-effect EX(L) and EXW(L) chillers - standard efficiency

Model YHAU-CW(N/L)	Load point 1		Load point 2		Load point 3		Load point 4	
	kg	lb	kg	lb	kg	lb	kg	lb
1800EXW4S(L)	15,400	33942	15,500	34,162	15,400	33,942	15,500	34,162
1900EXW4S(L)	16,200	35705	16,300	35,925	16,200	35,705	16,300	35,925
2000EXW4S(L)	16,900	37248	17,000	37,468	16,900	37,248	17,000	37,468

Note: Refer to the general arrangement drawings for specific center of gravity locations and data.

Split shipment data

Table 13: Split shipment

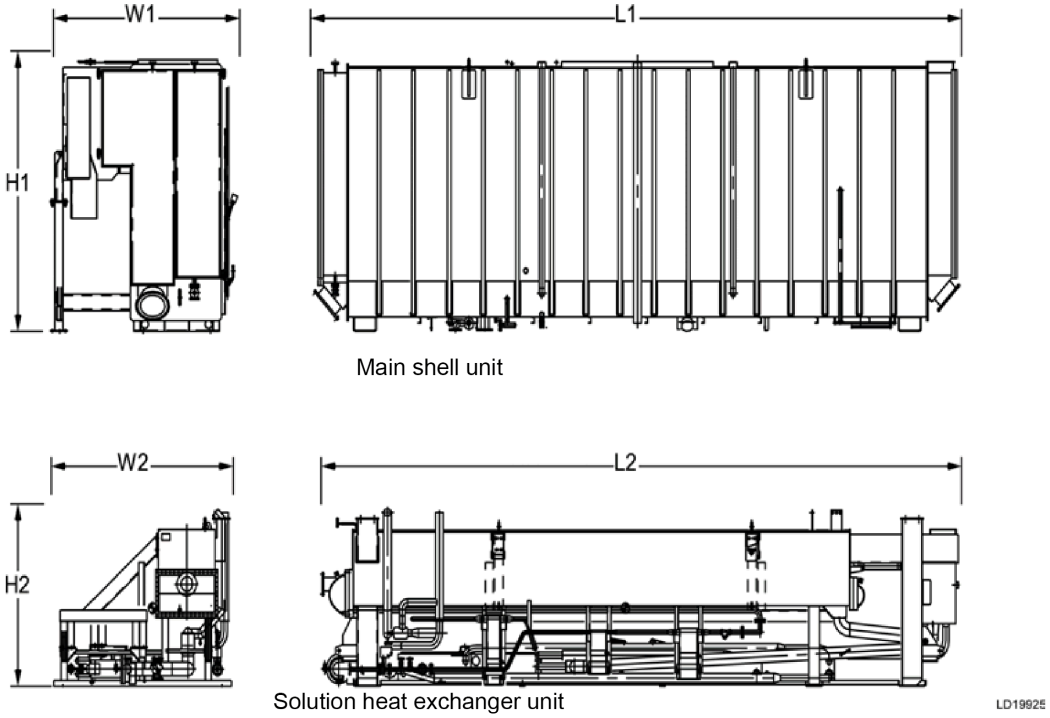
Model YHAU-CW(N/L)	Dimension ft. (m)				Main shell unit	Solution heat exchanger unit	
	Length	Width	Height	Tube extracting space	Weight kg (lb)	Weight for standard kg (lb)	Weight for high efficiency kg (lb)
150EX(S)(L)	9.8 (3.0)	7.5 (2.3)	8.2 (2.5)	6.6 (2.0)	4,300 (9,477)	2,000 (4,408)	2,100 (4,628)
180EX(S)(L)	11.2 (3.4)	7.5 (2.3)	8.2 (2.5)	8.4 (2.6)	4,600 (10,138)	3,100 (6,832)	3,200 (7,053)
240EX(S)(L)	13.2 (4.0)	7.5 (2.3)	8.2 (2.5)	10.5 (3.2)	5,000 (11,020)	3,600 (7,934)	3,800 (8,375)
300EX(S)(L)	15.7 (4.8)	7.5 (2.3)	8.2 (2.5)	13.1 (4.0)	6,000 (13,224)	4,000 (8,816)	4,200 (9,257)
360EX(S)(L)	19.0 (5.8)	7.9 (2.4)	8.2 (2.5)	16.4 (5.0)	7,200 (15,869)	6,200 (13,665)	6,500 (14,326)
400EX(S)(L)	19.0 (5.8)	7.9 (2.4)	8.2 (2.5)	16.4 (5.0)	7,200 (15,869)	6,200 (13,665)	6,500 (14,326)
450EX(S)(L)	15.8 (4.8)	8.0 (2.5)	10.2 (3.1)	13.1 (4.0)	8,600 (18,954)	5,000 (11,020)	5,200 (11,461)
500EX(S)(L)	17.5 (5.3)	8.0 (2.5)	10.2 (3.1)	14.8 (4.5)	9,600 (21,158)	5,600 (12,342)	5,800 (12,783)
560EX(S)(L)	19.1 (5.8)	8.0 (2.5)	10.2 (3.1)	16.4 (5.0)	10,700 (23,583)	6,200 (13,665)	6,500 (14,326)
600EX(S)(L)	20.8 (6.4)	8.0 (2.5)	10.2 (3.1)	18.0 (5.5)	11,500 (25,346)	6,700 (14,767)	7,000 (15,428)
700EX(S)(L)	23.5 (7.2)	8.0 (2.5)	10.2 (3.1)	20.7 (6.3)	13,700 (30,195)	7,700 (16,971)	8,000 (17,632)
800EX(S)(L)	25.7 (7.9)	8.0 (2.5)	10.2 (3.1)	23.0 (7.0)	15,500 (34,162)	8,800 (19,395)	9,200 (20,277)
900EXW(S)(L)	21.6 (6.6)	9.5 (2.9)	10.3 (3.2)	18.7 (5.7)	20,200 (44,521)	8,000 (17,632)	8,300 (18,293)
1000EXW(S)(L)	23.6 (7.2)	9.5 (2.9)	10.3 (3.2)	20.7 (6.3)	21,600 (47,606)	8,500 (18,734)	8,900 (19,616)
1100EXW(S)(L)	25.9 (7.9)	9.5 (2.9)	10.3 (3.2)	23.0 (7.0)	23,400 (51,574)	9,100 (20,056)	9,500 (20,938)
1200EXW3(S)(L)	26.2 (8.0)	9.9 (3.0)	10.8 (3.3)	23.0 (7.0)	25,500 (56,202)	10,400 (22,922)	10,800 (23,803)
1300EXW3(S)(L)	27.9 (8.5)	9.9 (3.0)	10.8 (3.3)	24.6 (7.5)	27,000 (59,508)	11,200 (24,685)	11,700 (25,787)
1400EXW3(S)(L)	29.7 (9.1)	9.9 (3.0)	10.8 (3.3)	26.2 (8.0)	28,500 (62,814)	12,200 (26,889)	12,700 (27,991)
1500EXW3(S)(L)	31.3 (9.6)	9.9 (3.0)	10.8 (3.3)	27.9 (8.5)	29,600 (65,238)	131,000 (288,724)	13.700 (30,195)
1600EXW3(S)(L)	33.0 (10.1)	9.9 (3.0)	10.8 (3.3)	29.5 (9.0)	30,800 (67,883)	41,400 (91,246)	15,000 (33,060)
1000EXW4(S)(L)	19.9 (6.1)	10.0 (3.1)	12.6 (3.8)	16.4 (5.0)	21,300 (46,945)	8,600 (18,954)	9,000 (19,836)
1100EXW4(S)(L)	22.4 (6.8)	10.0 (3.1)	12.6 (3.8)	18.696 (5.7)	23,400 (51,574)	9,300 (20,497)	9,700 (21,379)
1250EXW4(S)(L)	24.3 (7.4)	10.0 (3.1)	12.6 (3.8)	20.664 (6.3)	25,000 (55,100)	10,100 (22,260)	10,500 (23,142)
1400EXW4(S)(L)	26.6 (8.1)	10.0 (3.1)	12.6 (3.8)	22.96 (7.0)	26,800 (59,067)	10,900 (24,024)	11,400 (25,126)
1500EXW4(S)(L)	28.3 (8.6)	10.0 (3.1)	12.6 (3.8)	24.6 (7.5)	28,100 (61,932)	11,800 (26,007)	12,300 (27,109)

Table 13: Split shipment

Model YHAU-CW(N/L)	Dimension ft. (m)				Main shell unit	Solution heat exchanger unit	
	Length	Width	Height	Tube extracting space	Weight kg (lb)	Weight for standard kg (lb)	Weight for high efficiency kg (lb)
1600EXW4(S)(L)	30.0 (9.1)	10.0 (3.1)	12.6 (3.8)	26.24 (8.0)	29,500 (65,018)	12,800 (28,211)	13,300 (29,313)
1680EXW4(S)(L)	31.6 (9.6)	10.0 (3.1)	12.6 (3.8)	27.88 (8.5)	30,800 (67,883)	13,700 (30,195)	14,300 (31,517)
1800EXW4(S)(L)	33.3 (10.1)	10.0 (3.1)	12.6 (3.8)	29.52 (9.0)	32,100 (70,748)	14,900 (32,840)	15,500 (34,162)
1900EXW4(S)(L)	34.9 (10.7)	10.0 (3.1)	12.6 (3.8)	31.16 (9.5)	33,400 (73,614)	16,000 (35,264)	16,700 (36,807)
2000EXW4(S)(L)	36.6 (11.2)	10.0 (3.1)	12.6 (3.8)	32.8 (10.0)	34,700 (76,479)	17,200 (37,909)	17,900 (39,452)

ⓘ **Note:** Allow additional time for installation (1 day), welding (2 days), pressure test (2 days), evacuation (2 days), solution charging (1 day). Values can vary due to site conditions.

Figure 26: Split shipment



Electrical data

Table 14: Electrical data

Chiller model	Power source	Circuit breaker		Solution circulation pump		Solution spray pump	
YHAU-CW(N/L)	(Voltage-phase-frequency)	Rated current	Frame current	Power	FLA	Power	FLA
150EX(S)(L)	208-3-60	35	125	2.2	11.4	1.1	6.2
150EX(S)(L)	460-3-60	15	125	2.2	5.2	1.1	3
180EX(S)(L)	208-3-60	40	125	2.2	11.4	1.1	6.2
180EX(S)(L)	460-3-60	20	125	2.2	5.2	1.1	3
240EX(S)(L)	208-3-60	50	125	3	14.8	2.2	11.4
240EX(S)(L)	460-3-60	25	125	3	7.1	2.2	5.2
300XE(S)(L)	208-3-60	50	125	3	14.8	2.2	11.4

Table 14: Electrical data

Chiller model	Power source	Circuit breaker		Solution circulation pump		Solution spray pump	
YHAU-CW(N/L)	(Voltage-phase-frequency)	Rated current	Frame current	Power	FLA	Power	FLA
300XE(S)(L)	460-3-60	25	125	3	7.1	2.2	5.2
360EX(S)(L)	208-3-60	70	125	5.5	25	2.2	11.4
400EX(S)(L)	208-3-60	70	125	5.5	25	2.2	11.4
400EX(S)(L)	460-3-60	30	125	5.5	11	2.2	5.2
450EX(S)(L)	208-3-60	70	125	5.5	25	2.2	11.4
450EX(S)(L)	460-3-60	30	125	5.5	11	2.2	5.2
500EX(S)(L)	208-3-60	70	125	5.5	25	2.2	11.4
500EX(S)(L)	460-3-60	30	125	5.5	11	2.2	5.2
550EX(S)(L)	208-3-60	70	125	5.5	25	2.2	11.4
550EX(S)(L)	460-3-60	30	125	5.5	11	2.2	5.2
600EX(S)(L)	208-3-60	70	125	5.5	25	2.2	11.4
600EX(S)(L)	460-3-60	30	125	5.5	11	2.2	5.2
700EX(S)(L)	208-3-60	70	125	5.5	25	2.2	11.4
700EX(S)(L)	460-3-60	30	125	5.5	11	2.2	5.2
800EX(S)(L)	208-3-60	70	125	5.5	25	2.2	11.6
800EX(S)(L)	460-3-60	30	125	5.5	11	2.2	5.4
900EXW(S)(L)	208-3-60	80	125	5.5	25	2.2	11.6
900EXW(S)(L)	460-3-60	35	125	5.5	11	2.2	5.4
1000EXW(S)(L)	208-3-60	100	125	7.5	36	2.2	11.6
1000EXW(S)(L)	460-3-60	45	125	7.5	16.5	2.2	5.4
1100EXW(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1100EXW(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1200EXW3(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1200EXW3(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1300EXW3(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1300EXW3(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1400EXW3(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1400EXW3(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1500EXW3(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1500EXW3(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1600EXW3(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1600EXW3(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1000EXW4(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1000EXW4(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1120EXW4(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1120EXW4(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1250EXW4(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1250EXW4(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1400EXW4(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1400EXW4(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1500EXW4(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1500EXW4(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1600EXW4(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1600EXW4(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1680EXW4(S)(L)	208-3-60	110	125	7.5	36	3.7	19
1680EXW4(S)(L)	460-3-60	50	125	7.5	16.5	3.7	8.8
1800EXW4(S)(L)	208-3-60	150	225	11	52	7.5	36
1800EXW4(S)(L)	460-3-60	70	125	11	23	7.5	16.5
1900EXW4(S)(L)	208-3-60	150	225	11	52	7.5	36

Table 14: Electrical data

Chiller model	Power source	Circuit breaker		Solution circulation pump		Solution spray pump	
YHAU-CW(N/L)	(Voltage-phase-frequency)	Rated current	Frame current	Power	FLA	Power	FLA
1900EXW4(S)(L)	460-3-60	70	125	11	23	7.5	16.5
2000EXW4(S)(L)	208-3-60	150	225	11	52	7.5	36
2000EXW4(S)(L)	460-3-60	70	125	11	23	7.5	16.5

Table 15: Additional electrical data

Chiller Model	Power source	Refrigerant pump		Vacuum pump		Power	Consumption	FLA	MCA	MOP	SCCR
YHAU-CW(N/L)	(Voltage-phase-frequency)	Power (kW)	FLA (A)	Power (kW)	FLA	(kVA)	(kW)	(A)	(A)	(A)	(kA)
150EX(S)(L)	208-3-60	0.2	2	0.75	3.21	8.7	7.0	25.2	31.5	35	5
150EX(S)(L)	460-3-60	0.2	1.05	0.75	1.44	9.0	7.2	11.8	14.7	15	5
180EX(S)(L)	208-3-60	0.4	2.8	0.75	3.21	9.0	7.2	26.0	32.5	40	5
180EX(S)(L)	460-3-60	0.4	1.5	0.75	1.44	9.4	7.5	12.2	15.3	20	5
240EX(S)(L)	208-3-60	0.4	2.8	0.75	3.21	12.1	9.7	34.6	43.3	50	5
240EX(S)(L)	460-3-60	0.4	1.5	0.75	1.44	12.6	10.1	16.3	20.4	25	5
300XE(S)(L)	208-3-60	0.4	2.8	0.75	3.21	12.1	9.7	34.6	43.3	50	5
300XE(S)(L)	460-3-60	0.4	1.5	0.75	1.44	12.6	10.1	16.3	20.4	25	5
360EX(S)(L)	208-3-60	0.4	2.8	0.75	3.21	15.8	12.6	44.8	56.0	70	5
400EX(S)(L)	208-3-60	0.4	2.8	0.75	3.21	15.8	12.6	44.8	56.0	70	5
400EX(S)(L)	460-3-60	0.4	1.5	0.75	1.44	15.7	12.6	20.2	25.3	30	5
450EX(S)(L)	208-3-60	0.4	2.8	0.75	3.21	15.8	12.6	44.8	56.0	70	5
450EX(S)(L)	460-3-60	0.4	1.5	0.75	1.44	15.7	12.6	20.2	25.3	30	5
500EX(S)(L)	208-3-60	0.4	2.8	0.75	3.21	15.8	12.6	44.8	56.0	70	5
500EX(S)(L)	460-3-60	0.4	1.5	0.75	1.44	15.7	12.6	20.2	25.3	30	5
550EX(S)(L)	208-3-60	0.4	2.8	0.75	3.21	15.8	12.6	44.8	56.0	70	5
550EX(S)(L)	460-3-60	0.4	1.5	0.75	1.44	15.7	12.6	20.2	25.3	30	5
600EX(S)(L)	208-3-60	0.4	2.8	0.75	3.21	15.8	12.6	44.8	56.0	70	5
600EX(S)(L)	460-3-60	0.4	1.5	0.75	1.44	15.7	12.6	20.2	25.3	30	5
700EX(S)(L)	208-3-60	0.4	2.8	0.75	3.21	15.8	12.6	44.8	56.0	70	5
700EX(S)(L)	460-3-60	0.4	1.5	0.75	1.44	15.7	12.6	20.2	25.3	30	5
800EX(S)(L)	208-3-60	0.4	2.8	0.75	3.21	15.9	12.7	45.0	56.3	70	5
800EX(S)(L)	460-3-60	0.4	1.5	0.75	1.44	15.9	12.7	20.4	25.6	30	5
900EXW(S)(L)	208-3-60	1.3	7.2	0.75	3.21	17.4	13.9	49.4	61.8	80	5
900EXW(S)(L)	460-3-60	1.3	3.4	0.75	1.44	17.4	13.9	22.3	27.9	35	5
1000EXW(S)(L)	208-3-60	1.3	7.2	0.75	3.21	21.4	17.1	60.4	75.5	100	5
1000EXW(S)(L)	460-3-60	1.3	3.4	0.75	1.44	21.8	17.4	27.8	34.8	45	5
1100EXW(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1100EXW(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1200EXW3(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1200EXW3(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1300EXW3(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1300EXW3(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1400EXW3(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1400EXW3(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1500EXW3(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1500EXW3(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1600EXW3(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1600EXW3(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1000EXW4(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5

Table 15: Additional electrical data

Chiller Model	Power source	Refrigerant pump		Vacuum pump		Power	Consumption	FLA	MCA	MOP	SCCR
YHAU-CW(N/L)	(Voltage-phase-frequency)	Power (kW)	FLA (A)	Power (kW)	FLA	(kVA)	(kW)	(A)	(A)	(A)	(kA)
1000EXW4(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1120EXW4(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1120EXW4(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1250EXW4(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1250EXW4(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1400EXW4(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1400EXW4(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1500EXW4(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1500EXW4(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1600EXW4(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1600EXW4(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1680EXW4(S)(L)	208-3-60	1.5	8.4	0.75	3.21	24.5	19.6	69.0	86.3	110	5
1680EXW4(S)(L)	460-3-60	1.5	3.9	0.75	1.44	24.9	19.9	31.7	39.7	50	5
1800EXW4(S)(L)	208-3-60	2.2	11.6	0.75	3.21	37.5	30.0	105.2	131.5	150	5
1800EXW4(S)(L)	460-3-60	2.2	5.4	0.75	1.44	37.4	29.9	47.4	59.3	70	5
1900EXW4(S)(L)	208-3-60	2.2	**11.6**	0.75	3.21	37.5	30.0	105.2	131.5	150	5
1900EXW4(S)(L)	460-3-60	2.2	5.4	0.75	1.44	37.4	29.9	47.4	59.3	70	5
2000EXW4(S)(L)	208-3-60	2.2	11.6	0.75	3.21	37.5	30.0	105.2	131.5	150	5
2000EXW4(S)(L)	460-3-60	2.2	5.4	0.75	1.44	37.4	29.9	47.4	59.3	70	5

Electrical diagram for UL

Figure 27: Power wiring

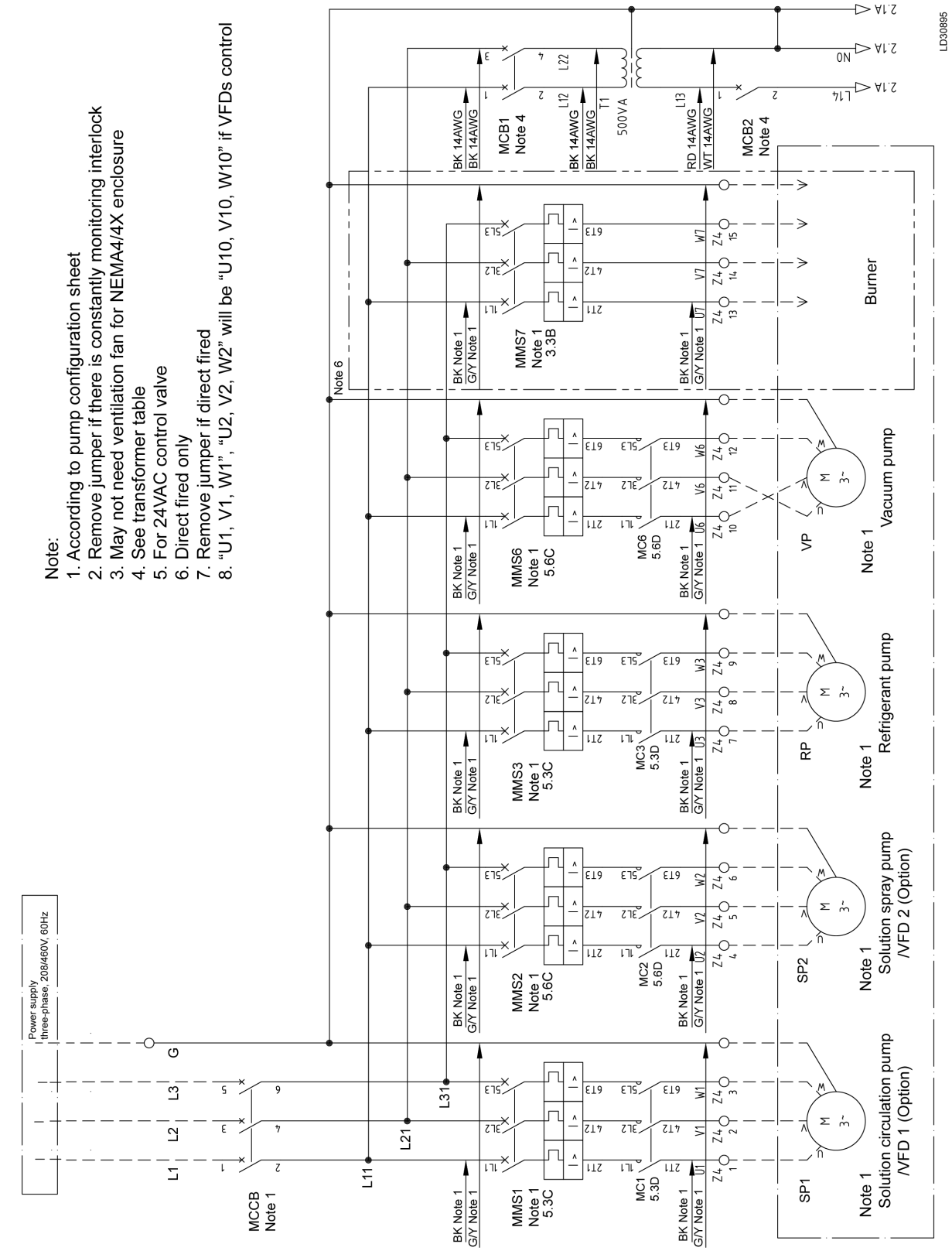


Figure 28: Power wiring for control

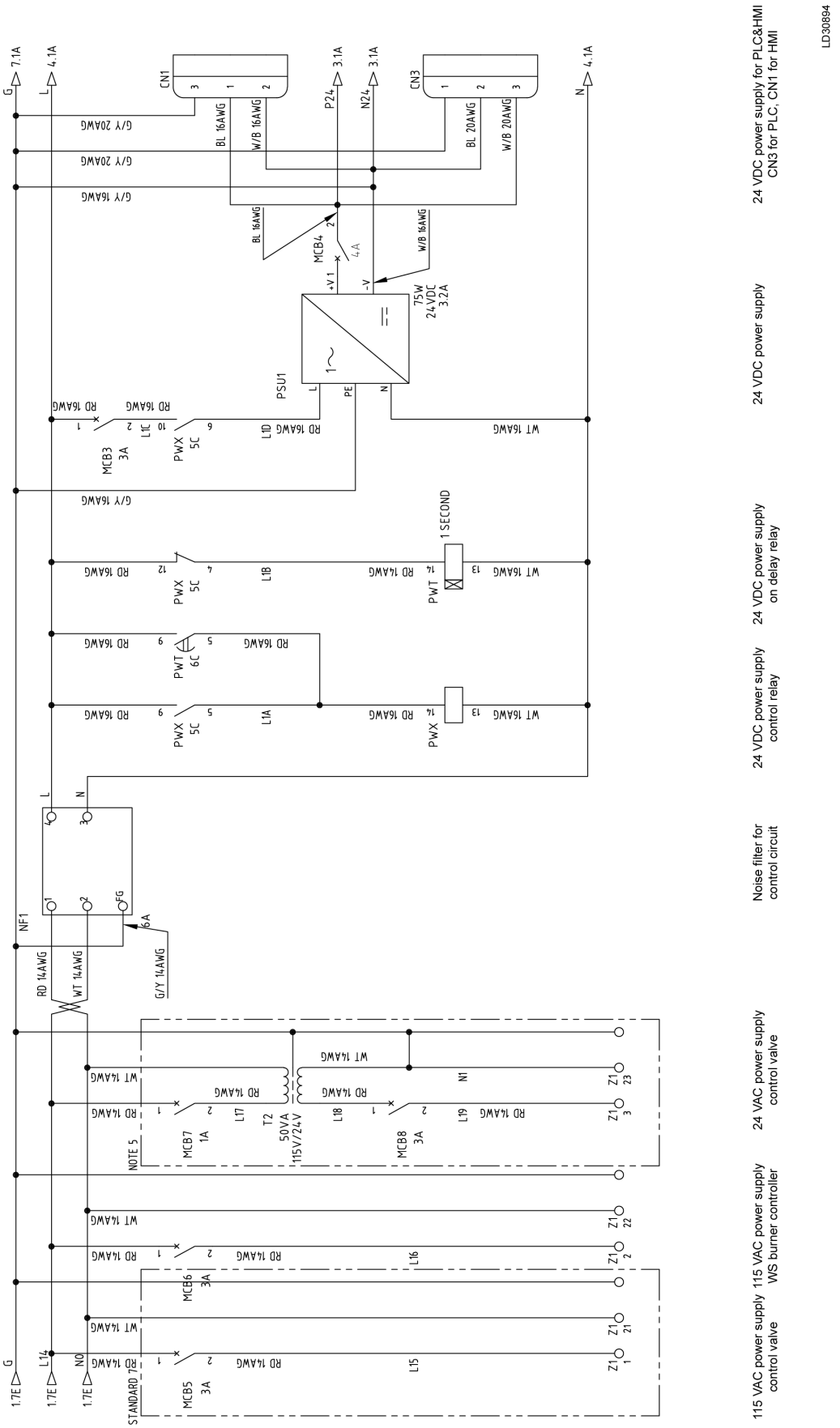


Figure 29: PLC input wiring

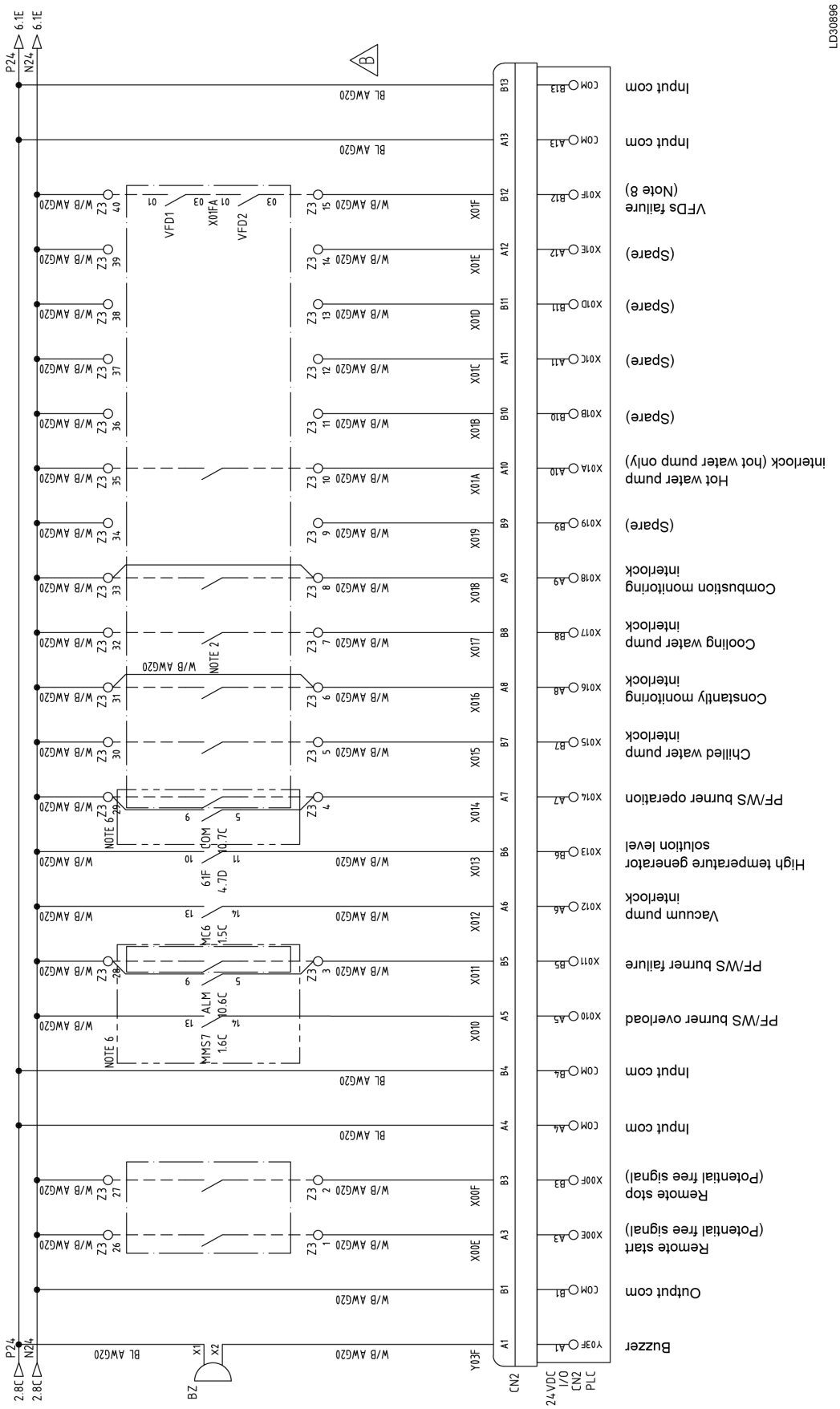


Figure 30: PLC input wiring

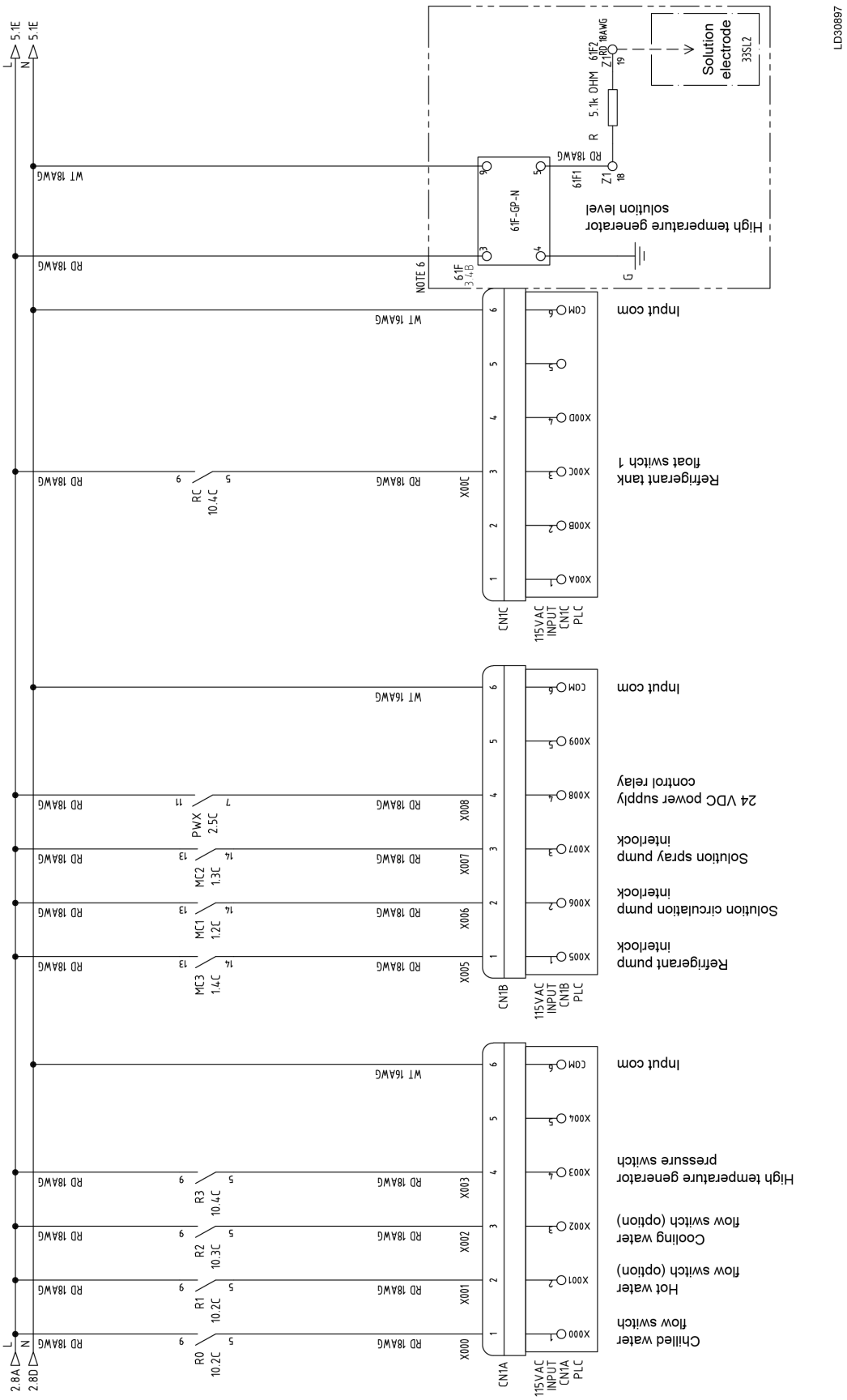


Figure 31: PLC output wiring

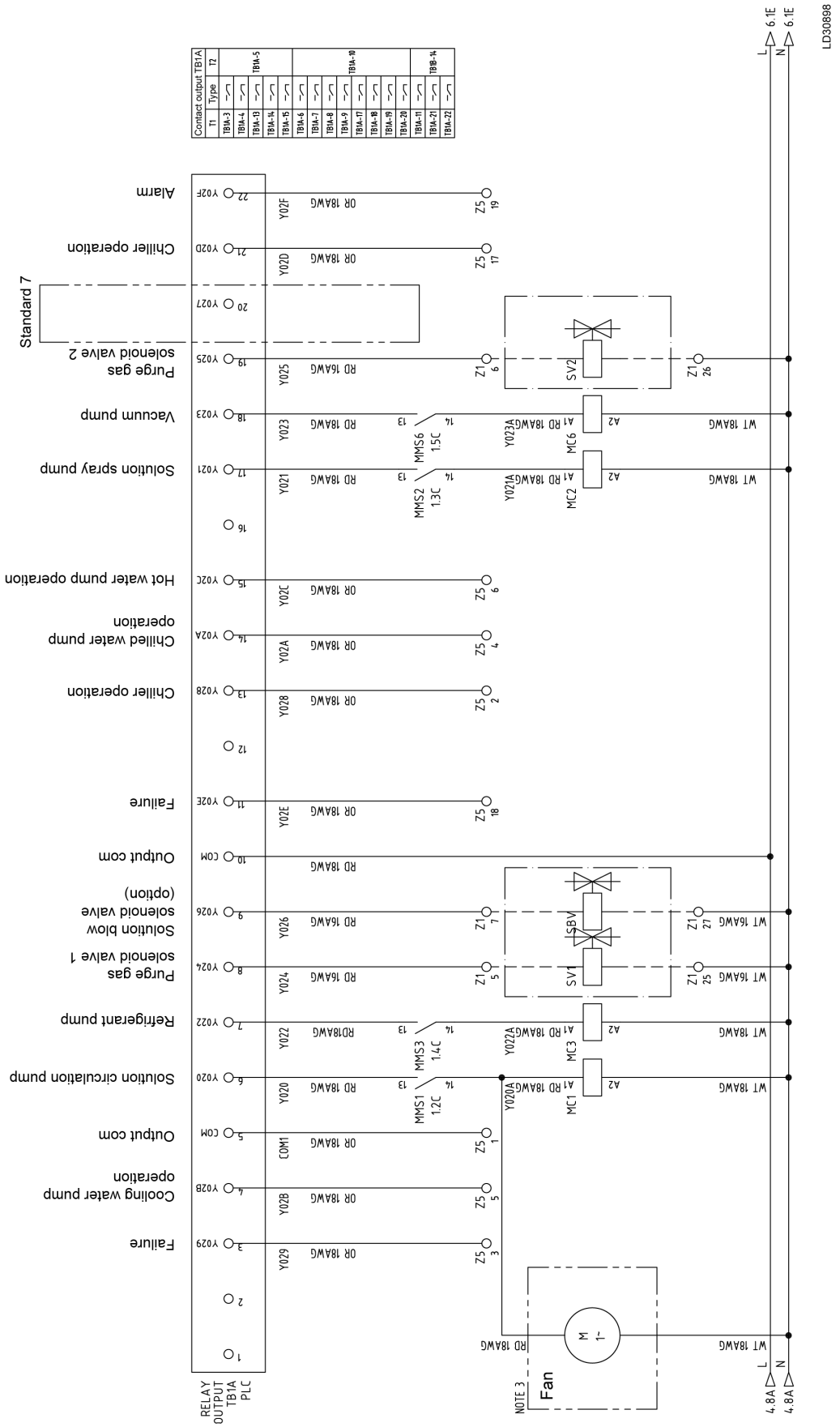


Figure 32: PLC output wiring

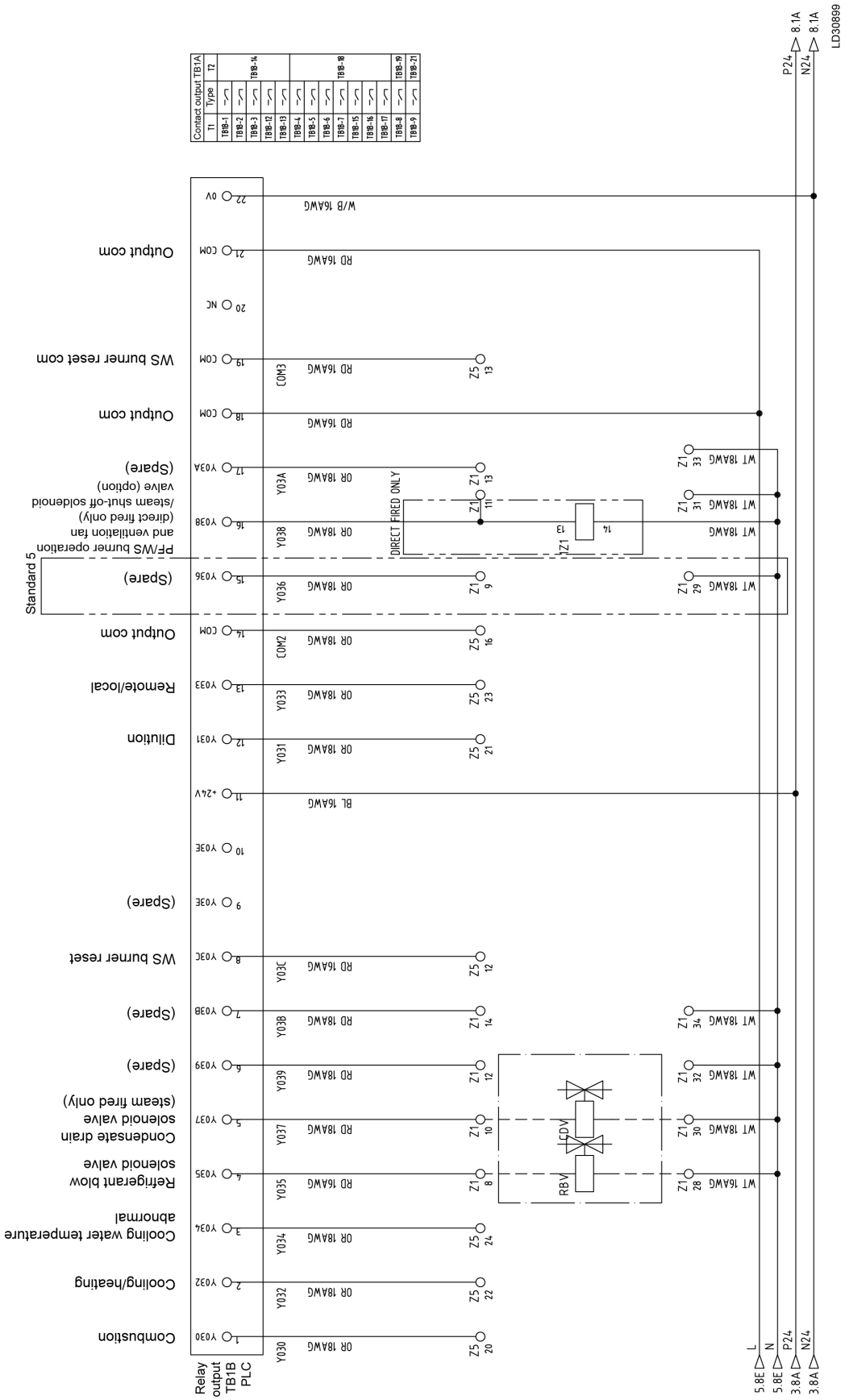


Figure 33: Analog input wiring

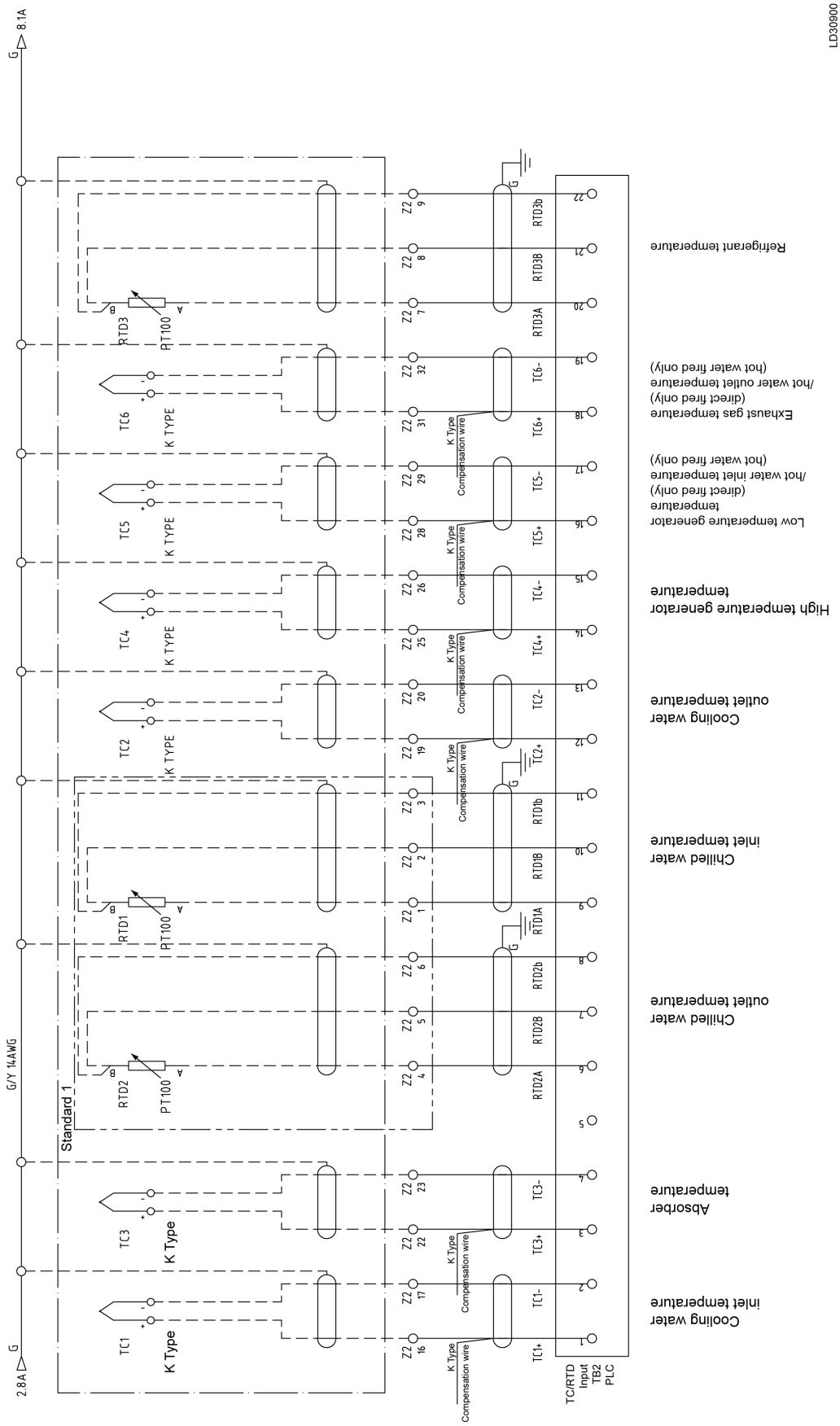


Figure 34: Analog input wiring

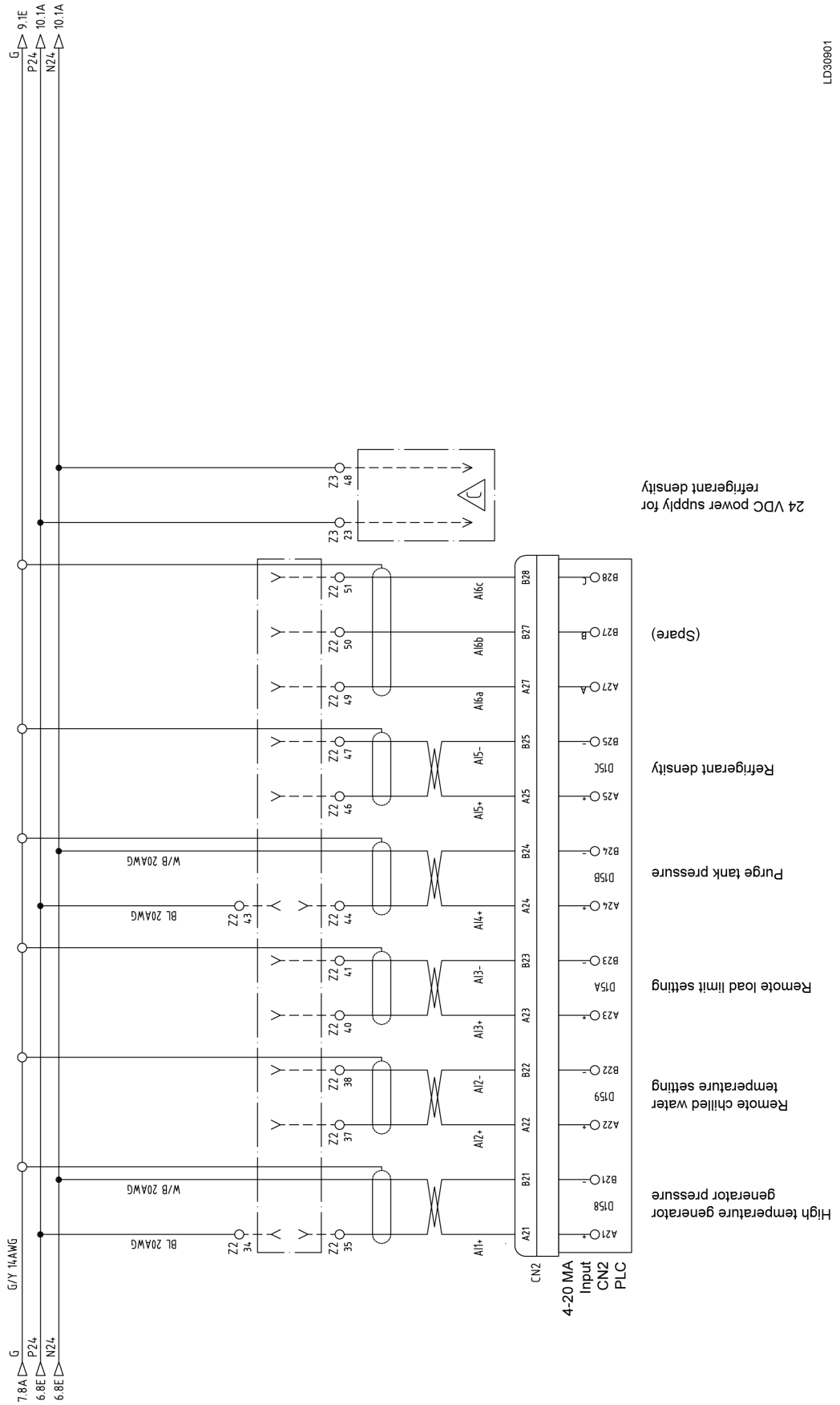


Figure 35: Analog output wiring

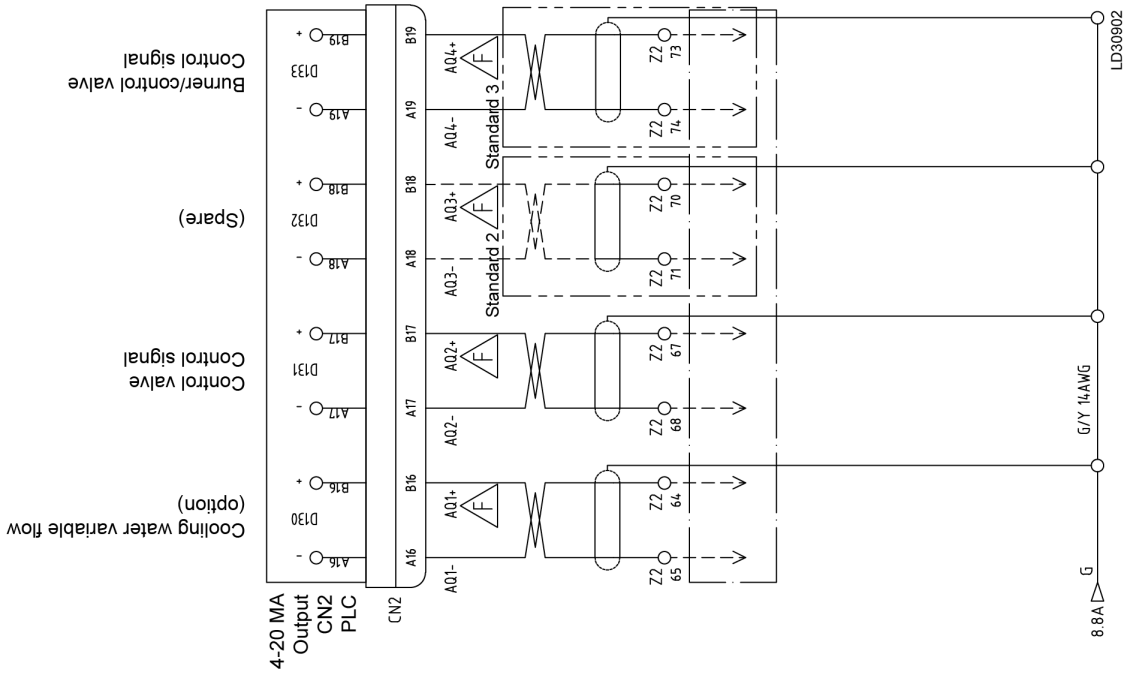


Figure 36: Switch signal input wiring

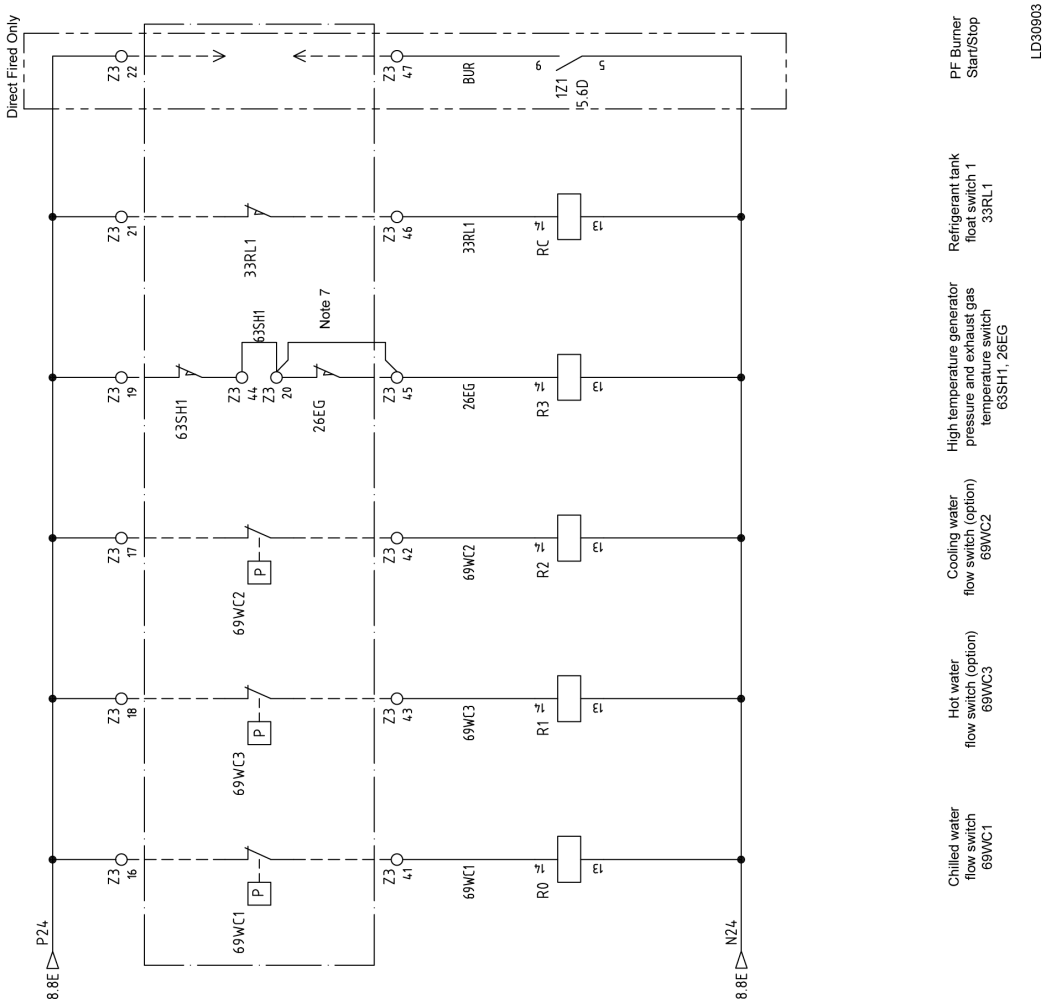


Figure 37: Weishaupt burner control wiring for CGN/CGH

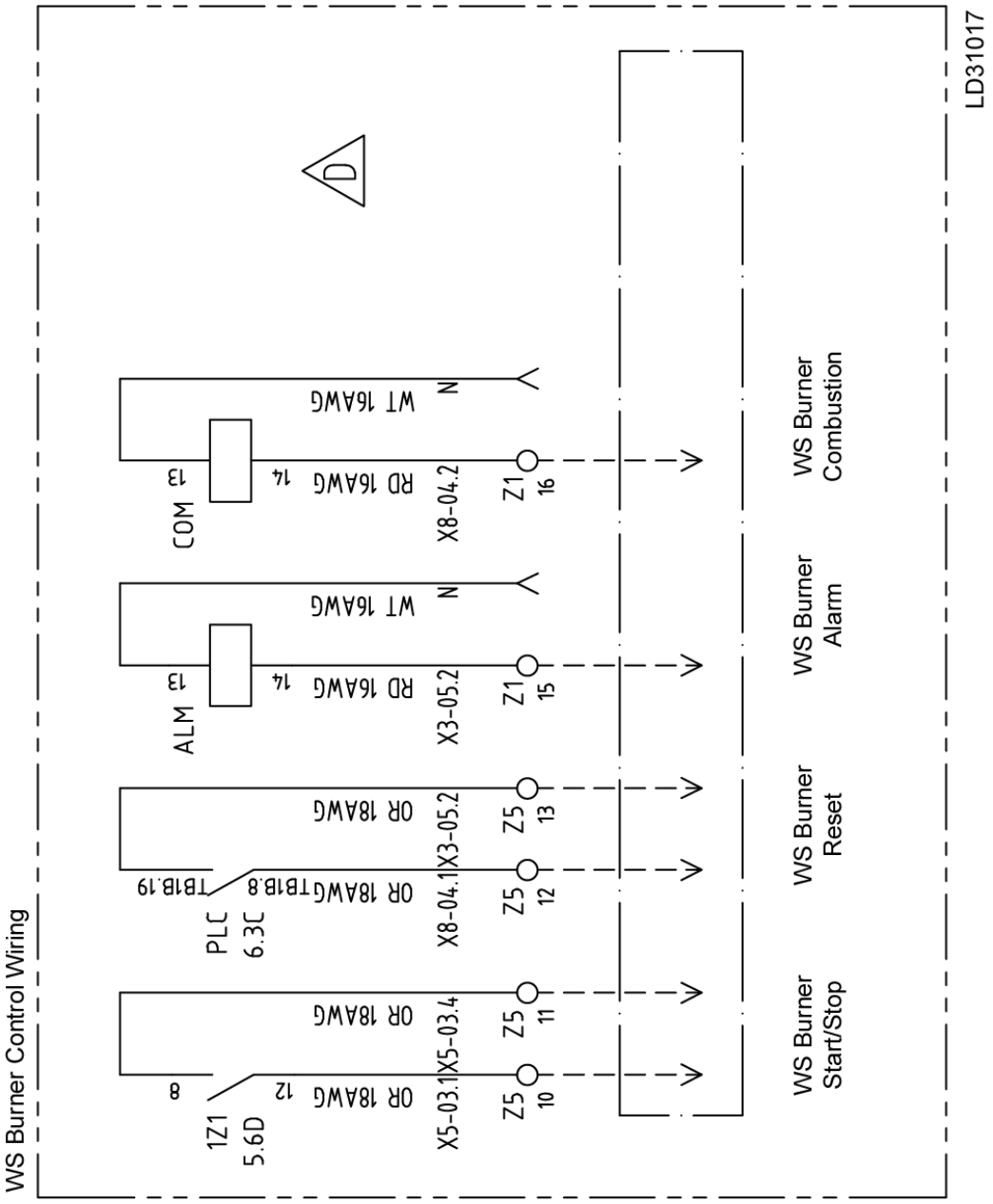


Figure 38: Wiring for external heat exchanger for direct fired chiller

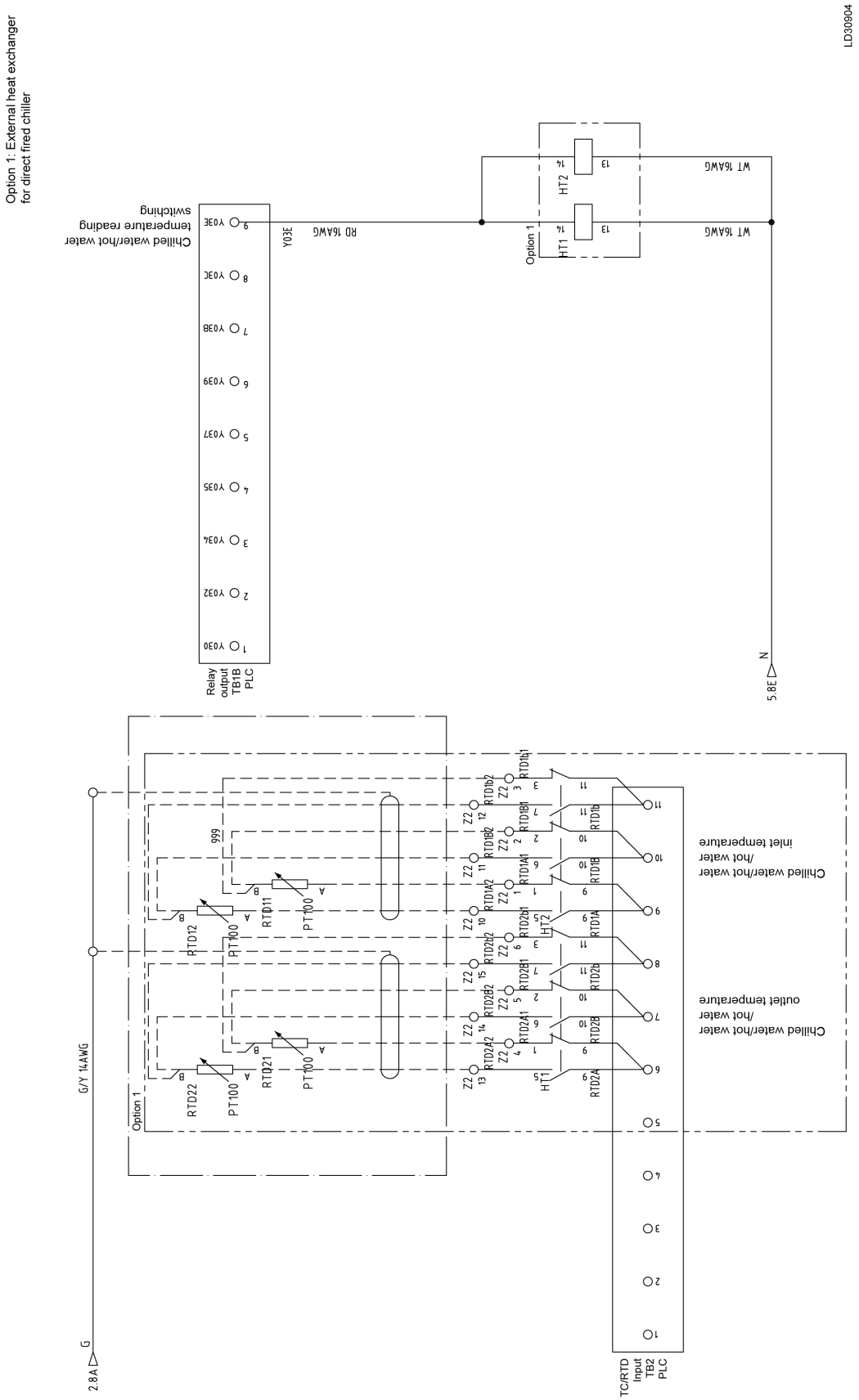


Figure 39: Inverter wiring option

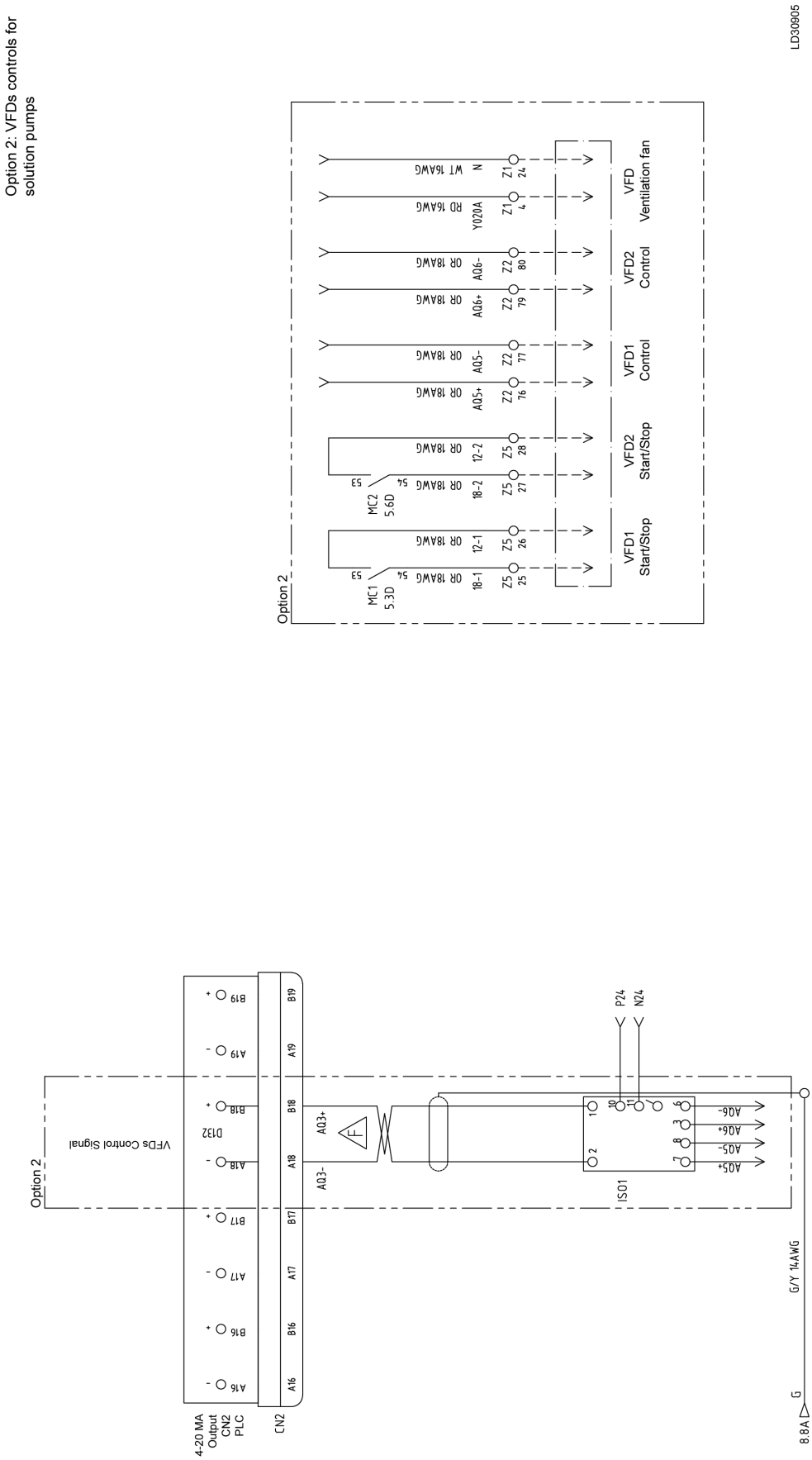


Figure 40: 4 mA to 20 mA signal wiring from weishaupt burner

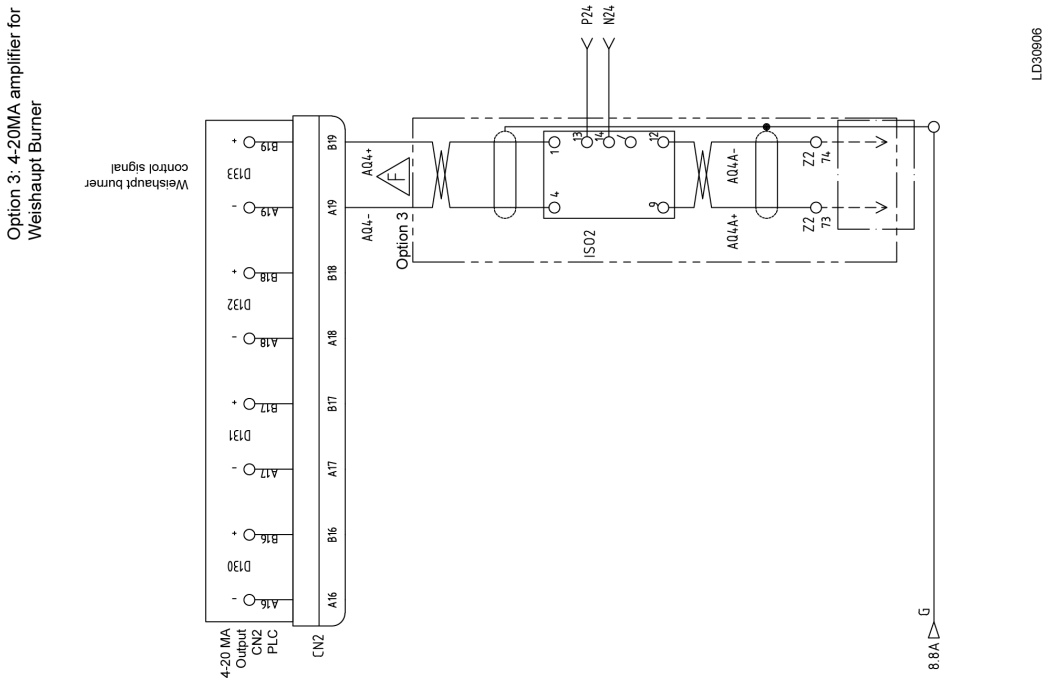


Figure 41: Wiring option for low chilled water supply for double effect chiller

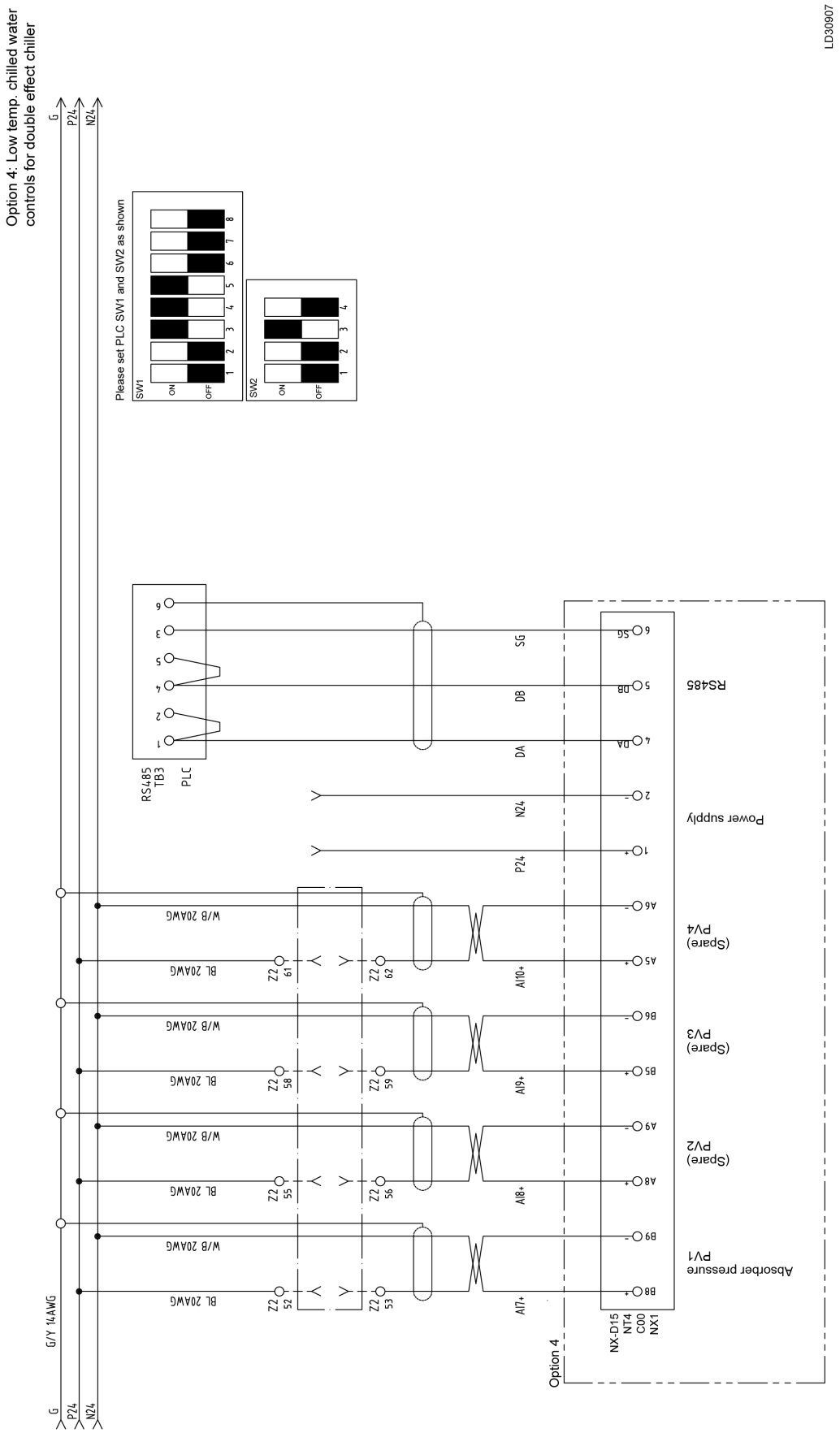


Figure 42: Wiring option for low ambient option

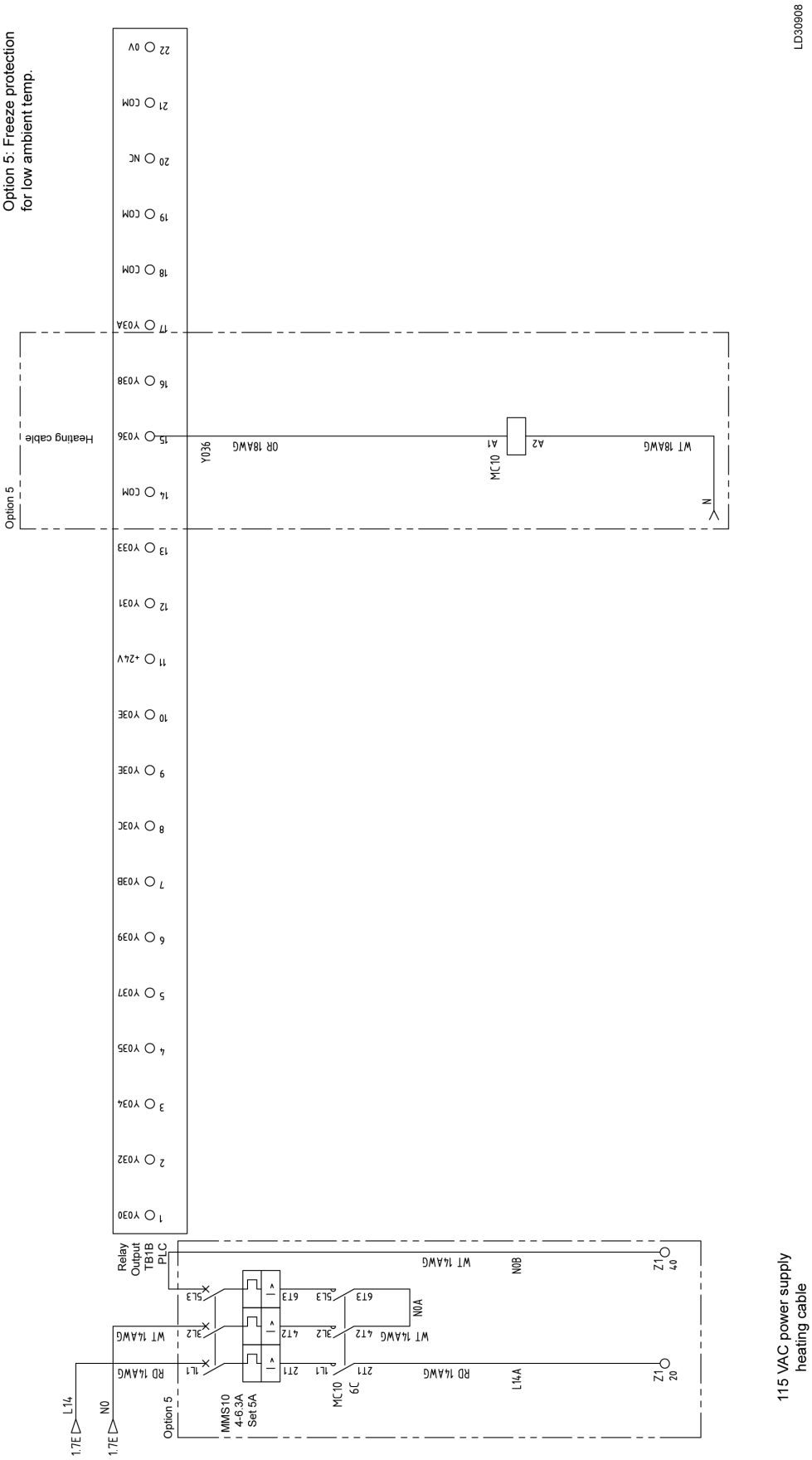


Figure 43: Wiring option for 0V to 10V load limit signal input

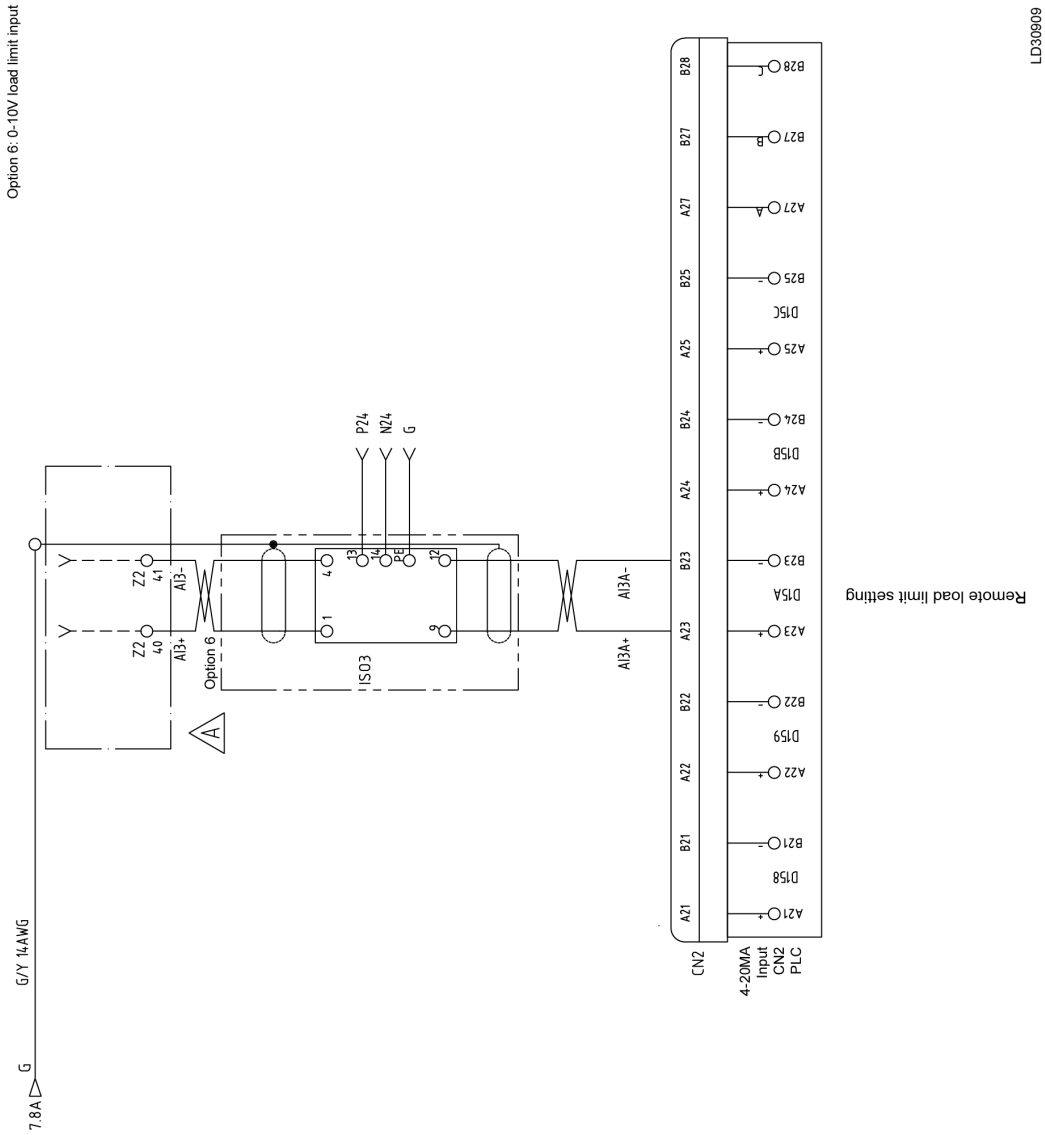


Figure 44: Wiring option for residential hot water temperature control

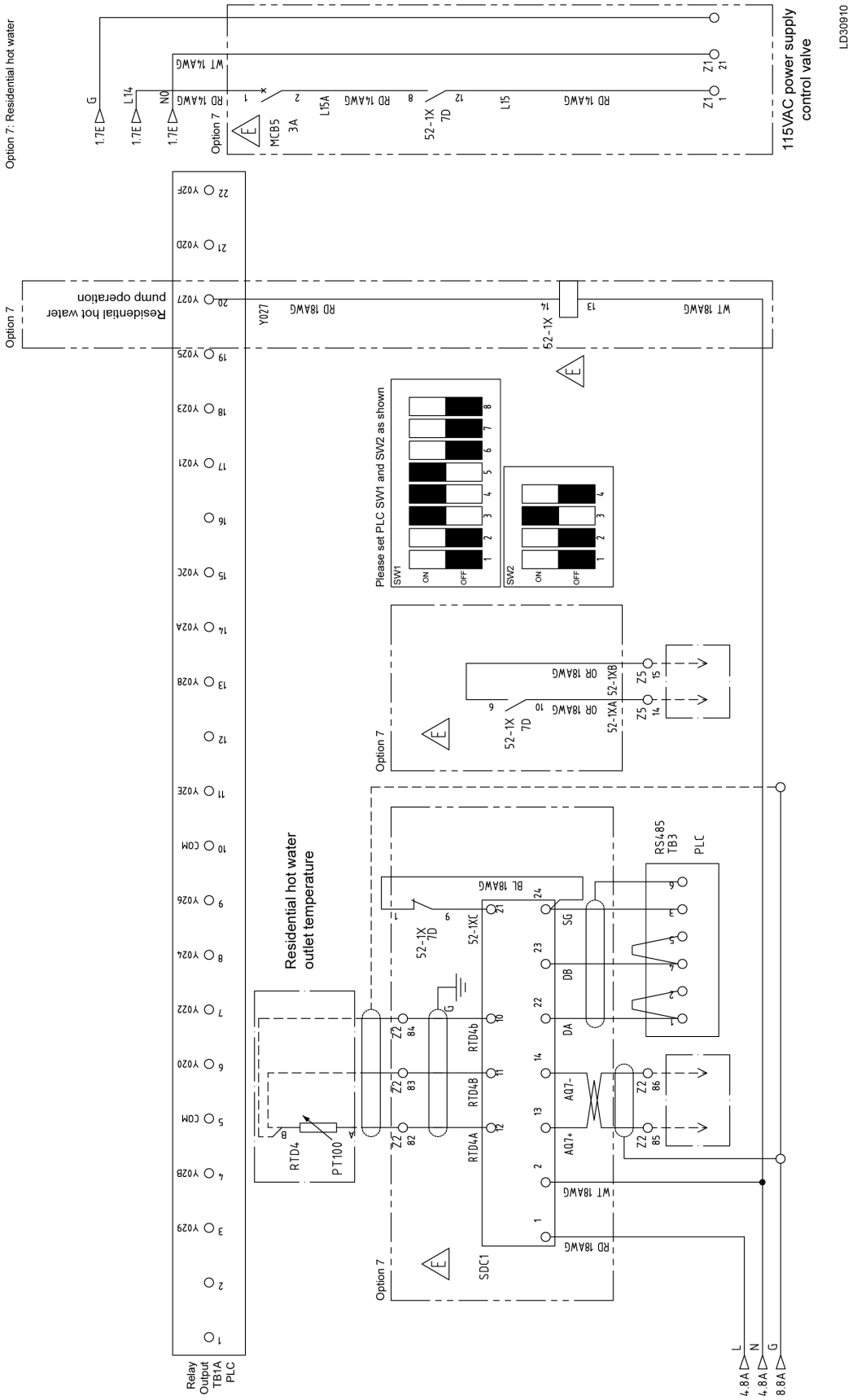


Figure 45: Display input wiring

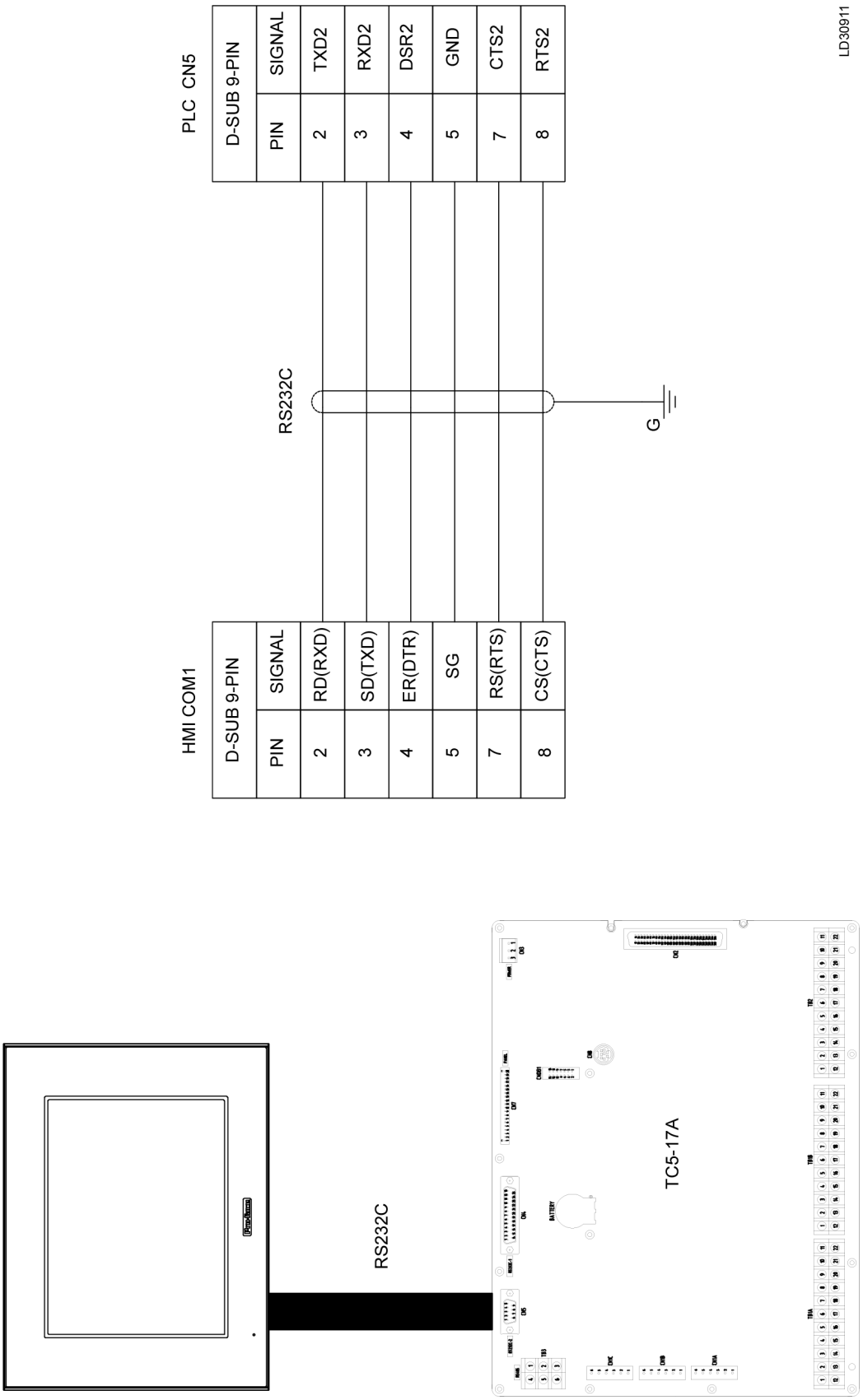


Figure 46: Inverter wiring drawing

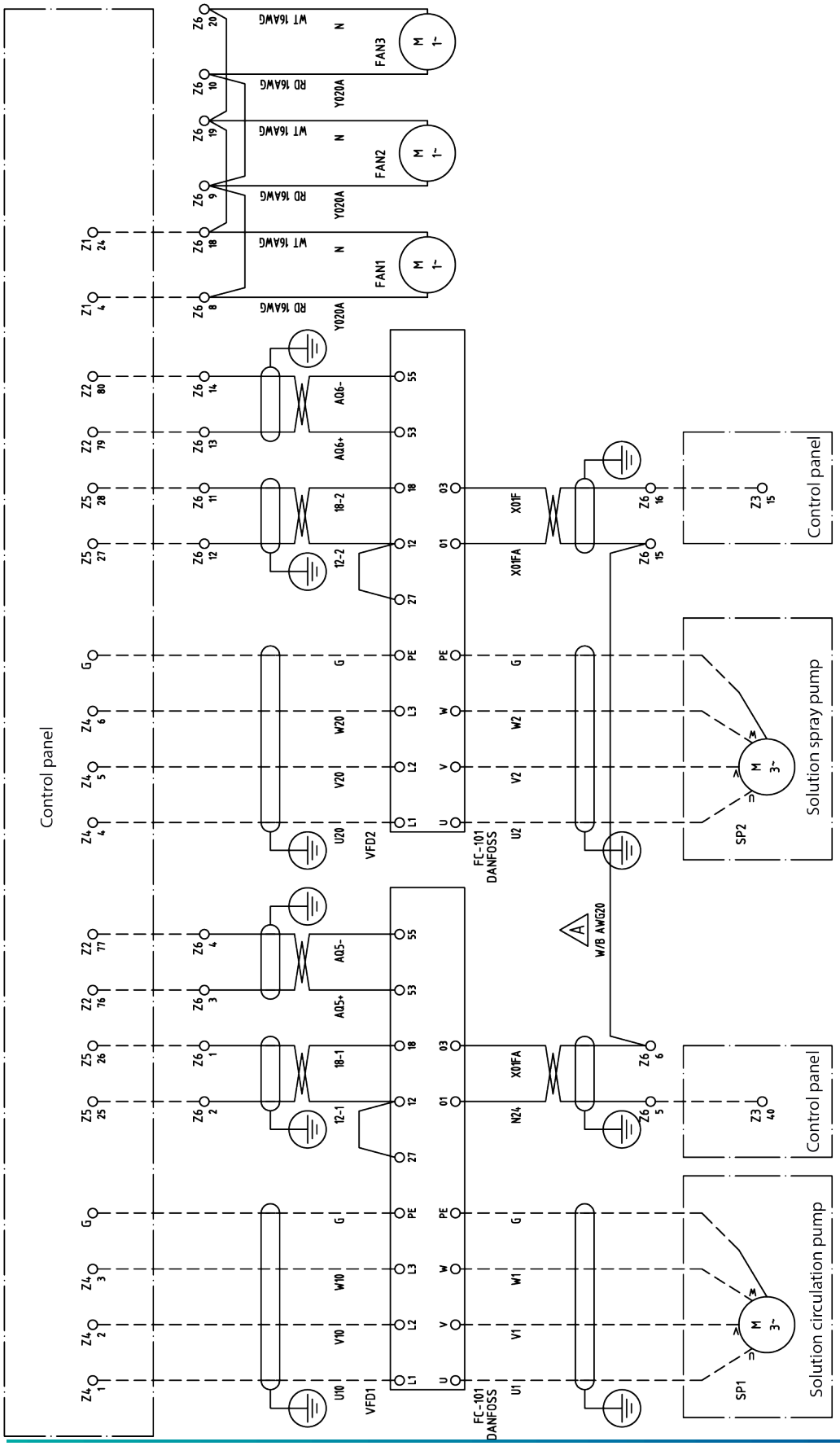
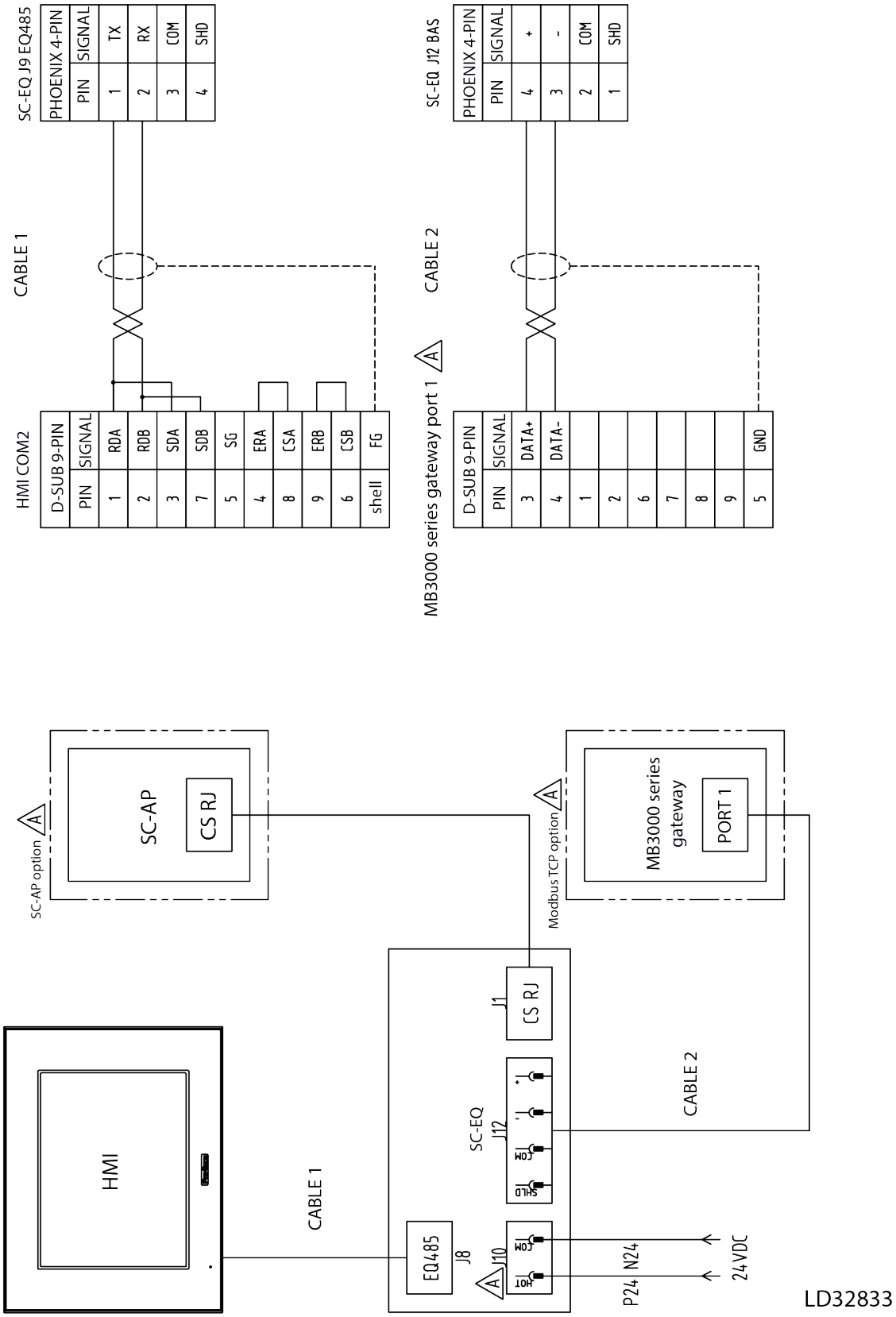
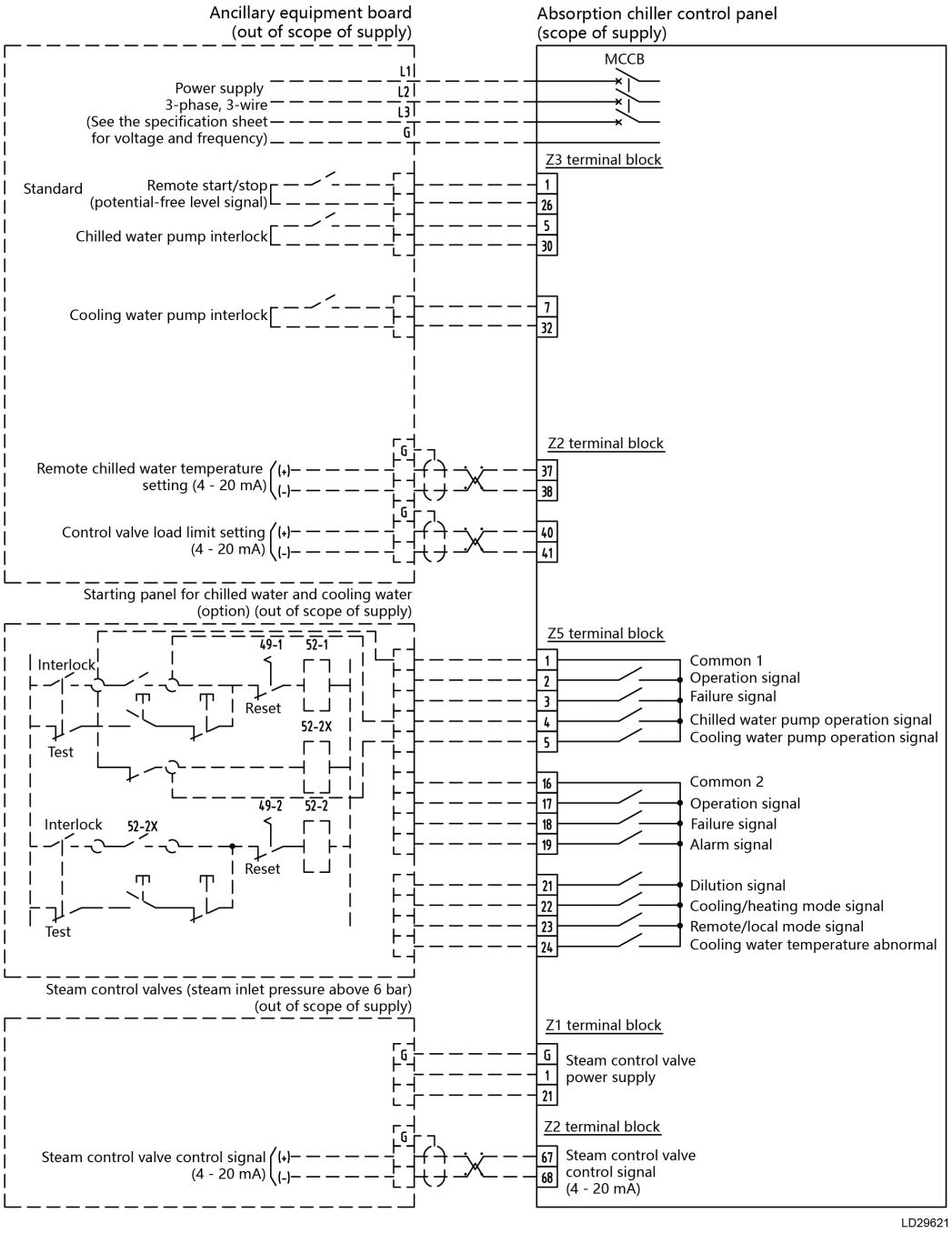


Figure 47: SC-EQ wiring drawing



External connection terminal

Figure 48: External connection terminal details



Note:

1. The steam control valve is not in the factory scope and can be sourced by the local JCI team. The steam drain control valve is in the factory scope.
2. The terminal information is for reference only. Follow the electrical drawing in the control panel for actual data.

Figure 49: Remote transmission signal

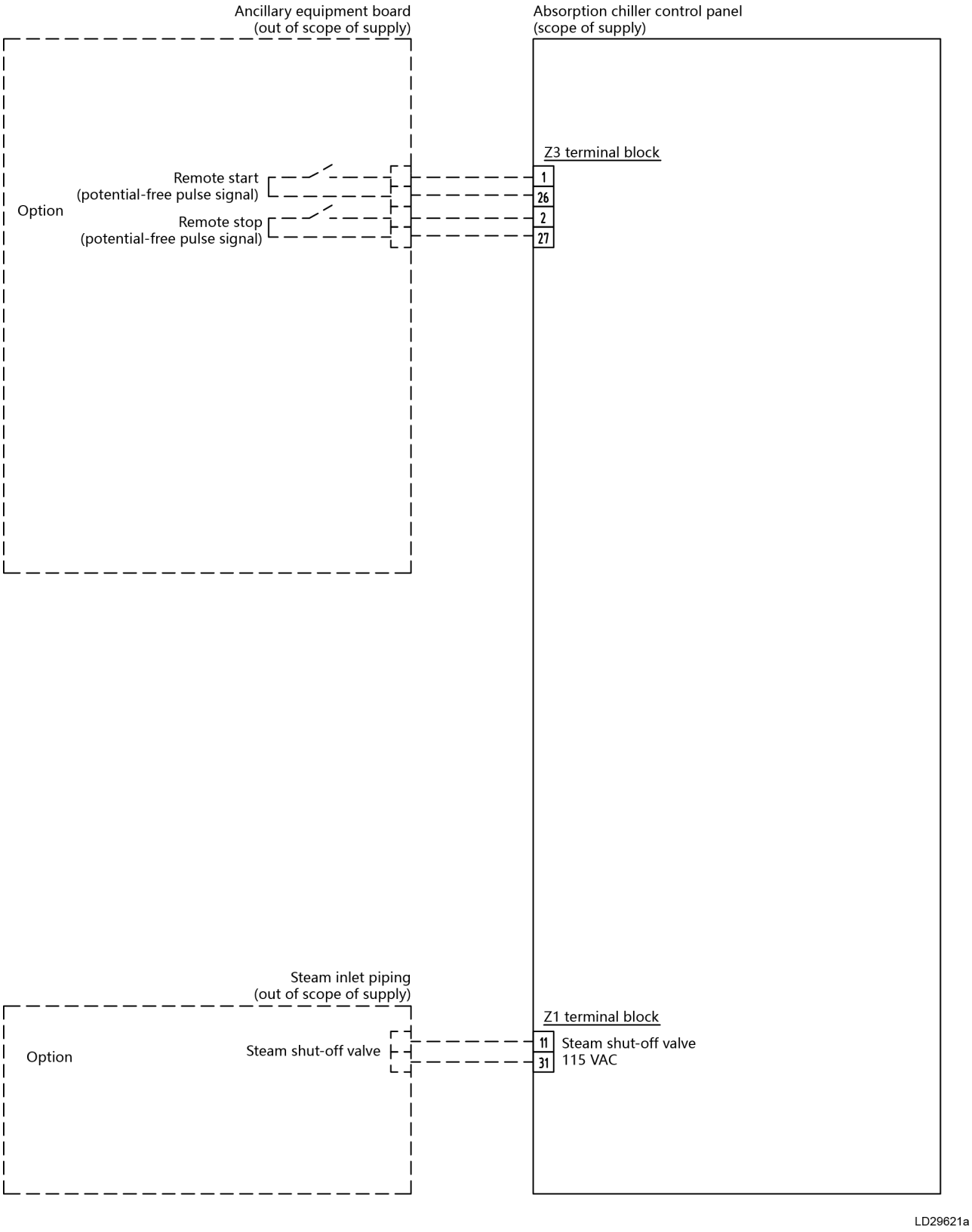


Table 16: Contact specifications

Component	Signal	Contact specification
Absorption chiller control panel - external output terminal	Digital signal	Maximum open/close voltage: AC250 V/DC30 V Maximum open/close current: 2 A/1 point (resistance load) Maximum common current: 8 A (resistance load)
	Analog signal	Allowed resistance load: 430 Ohm
External - absorption chiller control panel	Digital signal	Rating voltage/current: DC24 V/7 m A

Note:

1. Supply power source to absorption chiller is designed as three phase three line (three phase lines and one ground line).
2. See Table 16 for information about the contact specifications,.
3. Connect the absorption chiller interlocks in the following table. The interlocks in the Required column must be connected in order for the unit to start.

   Table 17: Absorption chiller interlocks

Type	Required	Optional
Operating interlock	Chilled water pump operation interlock	Air handling unit interlock
Cooling water pump interlock	Cooling water pump interlock	
Normally monitoring interlock		Seismoscope relay
		Abnormal room temperature sensor

4. See Figure 48 for terminal base position information.
5. Use a shield wire with a maximum extension of 650 ft and more than 0.0027 $in.^2$
6. The terminals that are not shown in the figures have already been connected in the factory.

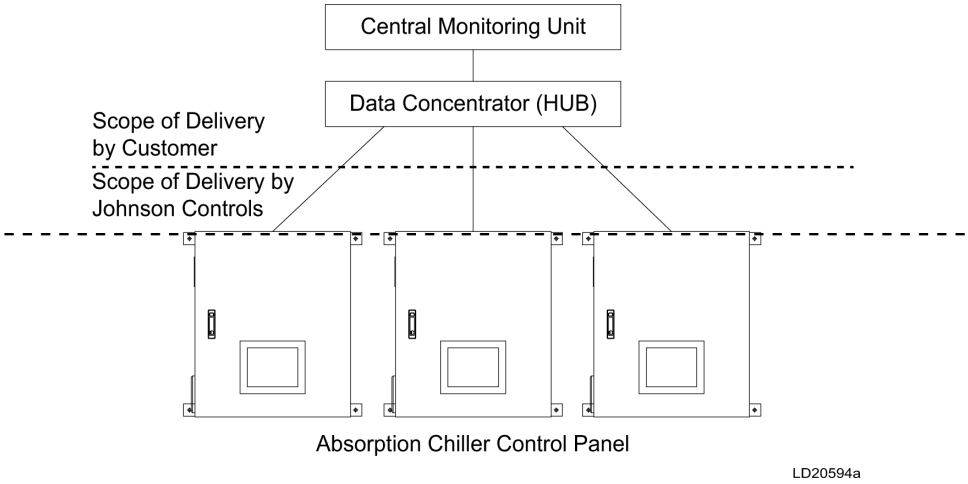
Upper communication specification with Touch Screen

The information in this section applies to both the EX(S)(L) series and the EXW(S)(L) series of steam double effect absorption chillers. the communication protocol will be Modbus RTU as standard and Modbus TCP as option, when make the communication through touch screen directly.

Upper communication system configuration

The configuration of the upper communication system is shown in the following image.

Figure 50: Upper communication system configuration



Communication with Modbus TCP Option

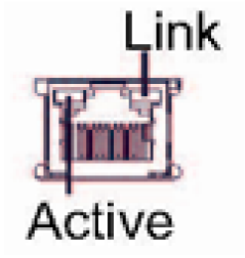
Johnson Controls scope of delivery for the upper communication system covers the control panels for the upper communication function. The customer is responsible to deliver all other related equipment: concentrator (HUB), installation, wiring, communication program for the central monitoring unit, and other relevant equipment.

Item	Customer	Johnson Controls	Remarks
Control panel with upper communication function		X	Communication protocol: Modbus TCP
Data concentrator (HUB)	X		Installation and wiring are included
Wiring work	X		Apply twisted pair cable
Communication program for central monitoring unit	X		Refer to this section for the details of the IP address, function code, communication data address, and other relevant communication information

Connection port for Ethernet communication

Make sure that the Ethernet cable is plugged into the correct port on the Control Panel. The Ethernetconnection port is located at the bottom left on the back of the Control Panel.

Table 18: Ethernet interface specification

Item		Specification	
Communication format		10BASE-T/100BASE-TX	
Connector shape		RJ-45type modular jack connector	
LED function 	Active (green)	Blink	Data sending/receiving
		No light	No data sending/ receiving
	Link (green)	Blink	Data sending/receiving via 10BASE-T/100BASE-TX
		No light	No connection or successor job failure

Communication specification for Modbus TCP

Table 19: Communication specifications for Modbus TCP

Communication Protocol	Modbus TCP
Communication Path Type	10BASE-T/100BASE-TX
IP Address	(No. 1) 192.168.1.1, (No. 2) 192.168.1.2, (No. 3) 192.168.1.3
Subnet Mask	255.255.255.0
Function Code	Read Command (Digital Signal) 01/Read Coil (Analog Signal) 03/Read Holding Register
	Write Command (Digital Signal) 05/Force Single Coil

Communication with Modbus RTU (standard)

Johnson Controls scope of delivery for the upper communication system covers the control panels for the upper communication function. The customer is responsible to deliver all other related equipment: concentrator (HUB), installation, wiring, communication program for the central monitoring unit, and other relevant equipment.

Item	Customer	Johnson Controls	Remarks
Control panel with upper communication function		X	Communication protocol: Modbus RTU
Data concentrator (HUB)	X		Installation and wiring are included
Wiring work for Modbus RTU	X		Apply RS485 communication cable. See Table 20 for more information.
Communication program for central monitoring unit	X		Refer to this section for for details of communication protocol, path type, function code, communication data address, and other details

User-created cable for Modbus communication

The diagrams and tables that follow detail some of the work that must be performed by the customer to be sure that the communication systems work properly.

Figure 51: Connection detail for D-SUB 9pin

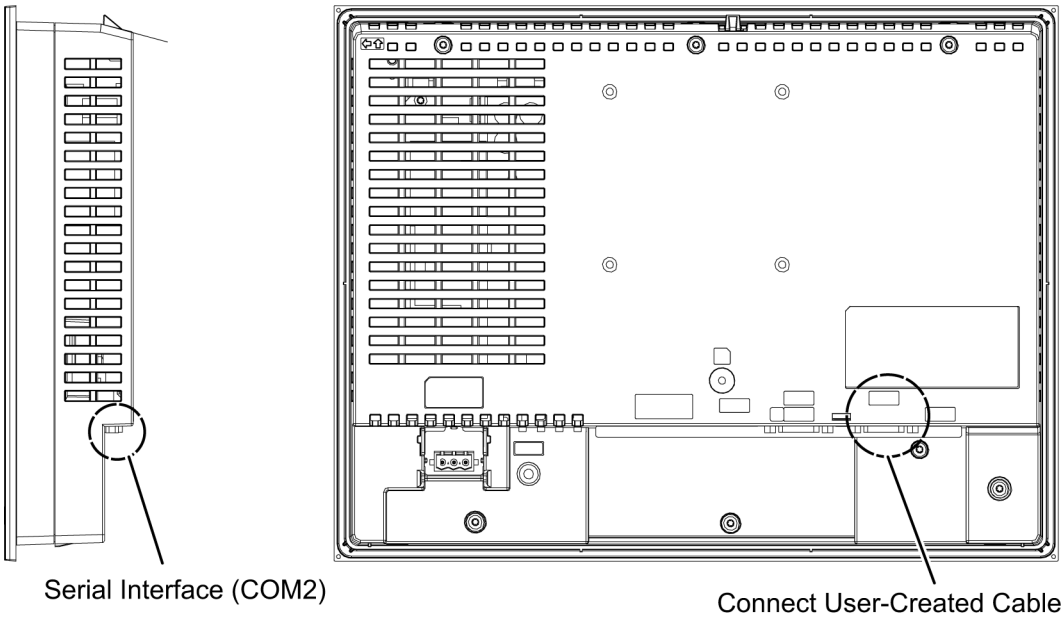
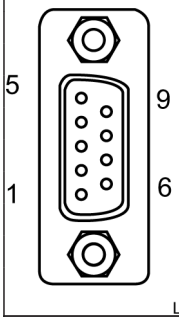


Table 20: Cable diagram (RS422/RS485)

Pin connection	Pin. No.	RS-422/RS-485		
		Signal name	Direction	Meaning
	1	RDA	Input	Receive Data A (+)
	2	RDB	Input	Receive Data B (-)
	3	SDA	Output	Send Data A (+)
	4	ERA	Output	Data Terminal Ready A (+)
	5	SG		Signal Ground
	6	CSB	Input	Send Possible B (-)
	7	SDB	Output	Send Data B (-)
	8	CSA	Input	Send Possible A (+)
	9	ERB	Output	Data Terminal Ready B (-)
	Shell	FG		Frame Ground (Common with SG)

Two-wire type cable diagrams

The following are sample cable diagrams for a two-wire type connection. They use a GP4000 series (COM2).

Figure 52: Two-wire 1:1 connection with user-created cable

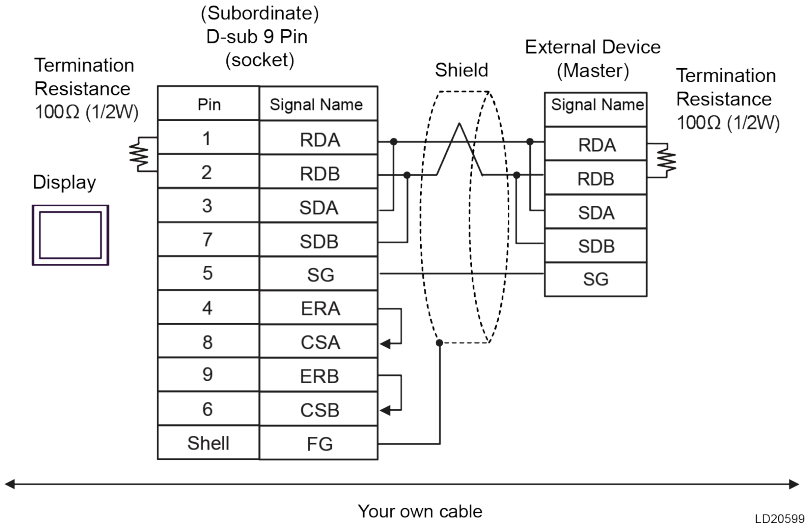
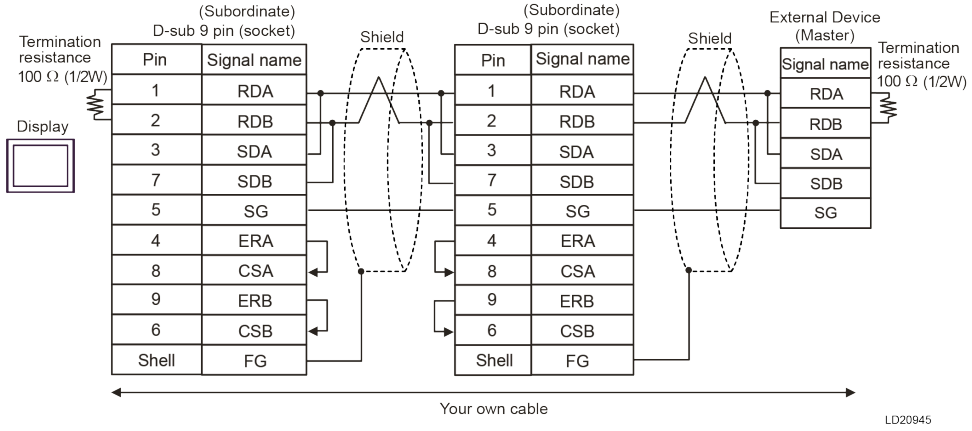


Figure 53: Two-wire N:1 connection with user-created cable



Four-wire type cable diagrams

The following are sample cable diagrams for four-wire type connections. They use a GP4000 series (COM2).

Figure 54: Four-wire 1:1 connection with user-created cable

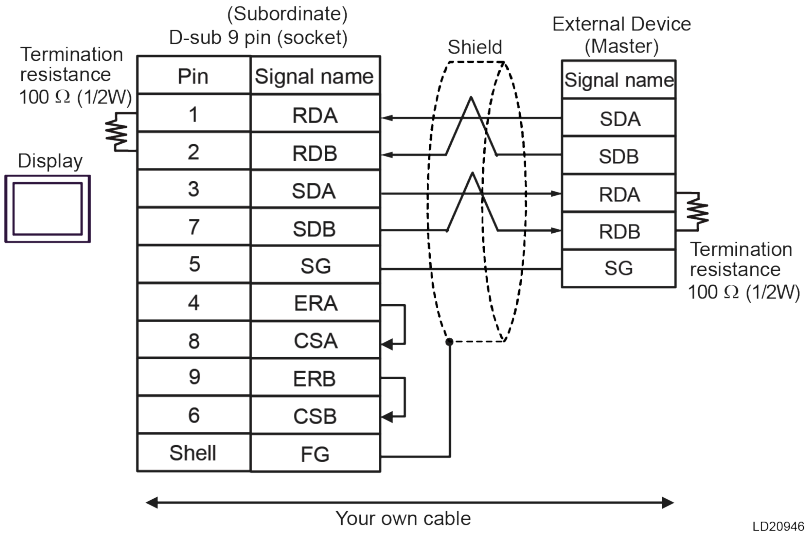
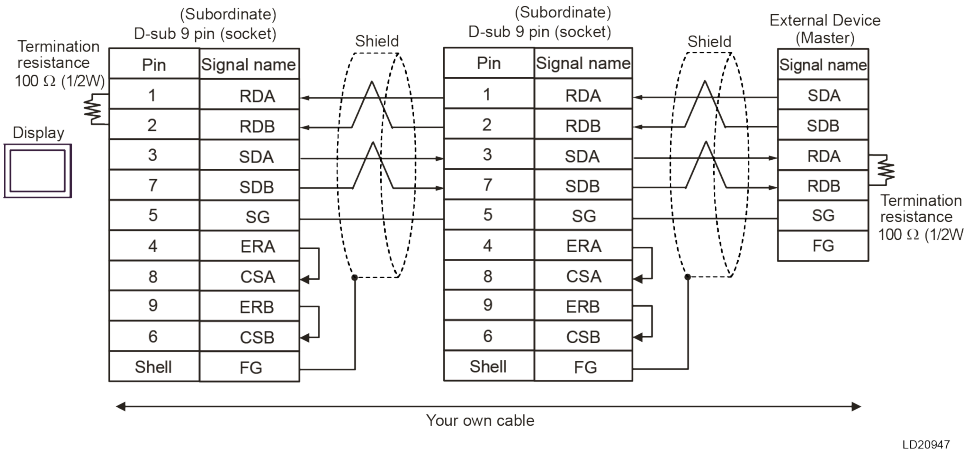


Figure 55: Four-wire N:1 connection with user-created cable



Communication specification for Modbus RTU

Table 21: Communication specification for Modbus RTU

Communication protocol	Modbus/RTU
Communication path type	RS422/RS485 Data Length: 8 Bit Stop Bit: 1 Bit Parity: EVEN Speed: 9600 bps
Connector	D-Sub 9pin
Function code	Read command • Digital signal: 01 (Read coil) • Analog signal: 03 (Read holding register) Write command • Digital signal: 05 (force single coil) • Analog signal: 06 (write holding register
Subordinate equipment address	1

For more information about the Read Command, see Table 22 . For more information about the Write Command, see Table 23.

Communication data with Touch Screen

Table 22: Read command

		Date description	Display	Unit	Modbus RTU/TCP	Value description
Set value	1	Set point	46.4	°F	40001	0320~2120 unit,1unit=0.1°F
	2	Automatic stop temperature (thermo off temperature	41.0	°F	40003	0320~2120 unit,1unit=0.1°F
	3	Temperature difference of automatic stop/start control	9.0	°F	40005	0322~2120 unit,1unit=0.1°F
Operation condition	4	Operation condition	0 or 1		40021	0:STOP, 1:COOLING OPERATION
	5	Local or remote mode setting	0 or 1		01001	0:LOCAL, 1: REMOTE
	6	Solution circulation pump operation	0 or 1		01003	0:STOP, 1:OPERATION
	7	Refrigerant pump operation	0 or 1		01005	0:STOP, 1:OPERATION
	8	Load limit condition	0 or 1		01009	0:NORMALLY OPERATION 1:LOAD LIMIT OPERATION
	9	Control manipulated variable	100.0	%	40023	0000~1100 unit, 1unit=0.1%
	10	Failure signal	0 or 1		01011	0:NORMALLY OPERATION 1:FAILURE OCCUR
	11	Alarm signal	0 or 1		01013	0:NORMALLY OPERATION 1:ALARM OCCUR
Measurement value	12	Evaporator water inlet temperature	53.6	°F	40083	0322~7520 unit,1unit=0.1°F
	13	Evaporator water outlet temperature	44.6	°F	40085	0322~7520 unit,1unit=0.1°F
	14	Evaporator refrigerant temperature	41.0	°F	40087	0322~7520 unit,1unit=0.1°F
	15	Condenser water inlet temperature	89.6	°F	40089	0322~7520 unit,1unit=0.1°F
	16	Condenser water outlet temperature	98.6	°F	40091	0322~7520 unit,1unit=0.1°F
	17	Absorber solution temperature	100.4	°F	40093	0322~7520 unit,1unit=0.1°F
	18	Generator solution temperature	239.0	°F	40095	0322~7520 unit,1unit=0.1°F
	19	Generator pressure	532.0	mmHg	40099	0008~8261unit, 1unit=0.1 mmHg
	20	Purge tank pressure	15.0	mmHg	40103	0008~8261unit, 1unit=0.1 mmHg
	21	Hight temperature generator solution concentration	62.0	%	40101	0001~1100 unit,1unit=0.1%

Table 23: Write command

No.	Data description	Modbus RTU/TCP	Value description
1	Remote operation signal	02001	ON at CHILLER OPERATION,PULSE SIGNAL
2	Remote stop signal	02002	ON at CHILLER STOP,PULSE SIGNAL
3	Control valve upper limit	40201	0000~1000 unit,1unit=0.1%
4	Set point	40203	0000~1000 unit,1unit=0.1°C;

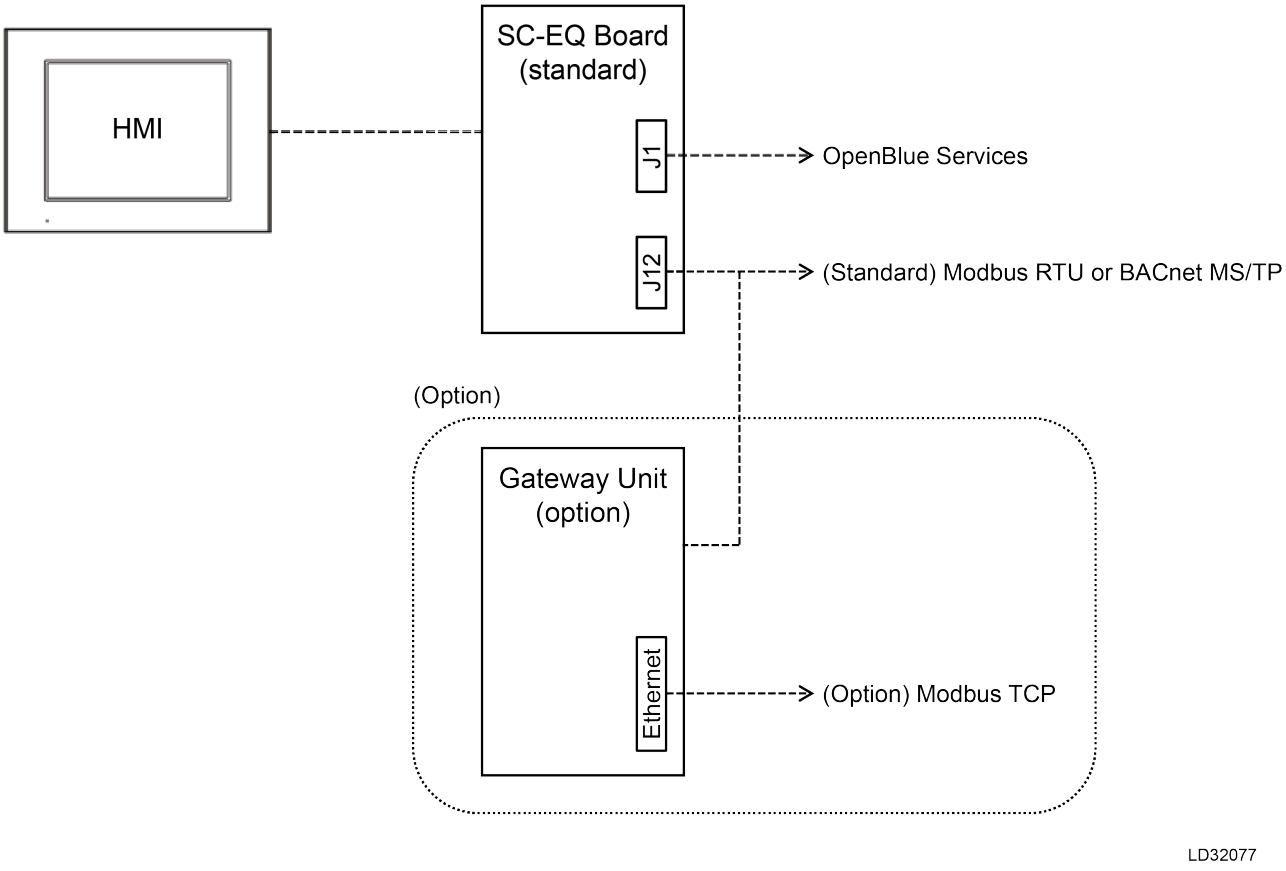
Upper communication specification with SC-EQ board

The information in this section applies to YHAU-CW EX(S)(L) and EXW(S)(L) series of double effect steam absorption chillers.

Upper communication system configuration

The configuration of the upper communication system is shown in the following image.

Figure 56: Upper communication system configuration



Note: If the optional Modbus® TCP is applied, the standard Modbus RTU and BACnet MS/TP are not available.

Modbus RTU and BACnet MS/TP communication (standard)

Johnson Controls scope of delivery for the upper communication system covers the control panels for the upper communication function. The communication port on the SC-EQ board is for Modbus RTU or BACnet MS/TP, you can use either one of them. The customer is responsible to deliver all other related equipment: concentrator (HUB), installation, wiring, communication program for the central monitoring unit, and other relevant equipment. See the following table.

Table 24: Scope of delivery for Modbus RTU and BACnet MS/TP communication

Item	Customer	Johnson Controls	Remarks
Control panel with upper communication function		X	Communication protocol: Modbus RTU
Data concentrator (HUB)	X		Installation and wiring are included
Wiring work for Modbus RTU	X		Apply RS485 communication cable.
Communication program for central monitoring unit	X		Refer to this section for details of communication protocol, path type, function code, communication data address, and other details

Configuration

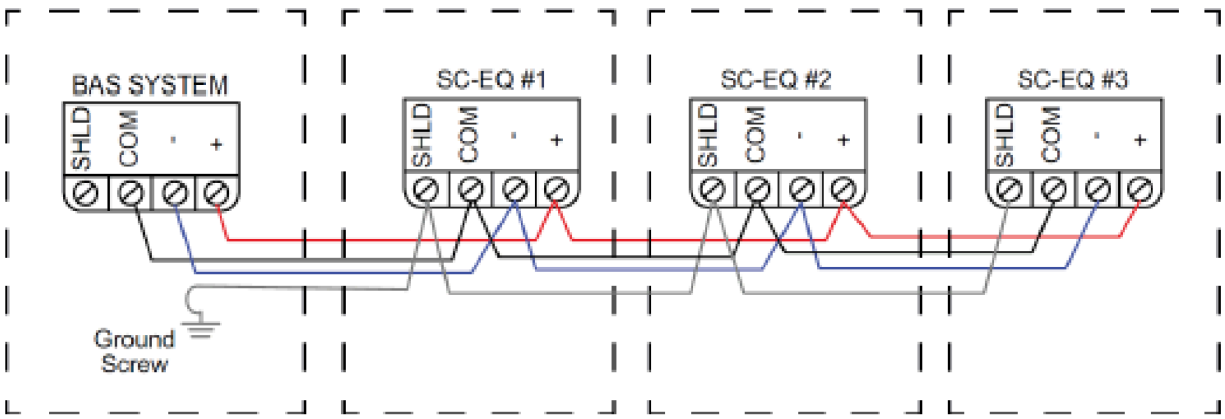
The media access control (MAC) address switch and the end-of-line switch on SC-EQ board are the only switch settings the user must set at the field.

The chiller model is set to SC-EQ board before shipment of the chiller.

Table 25: Specification for Modbus RTU and BACnet MS/TP communication

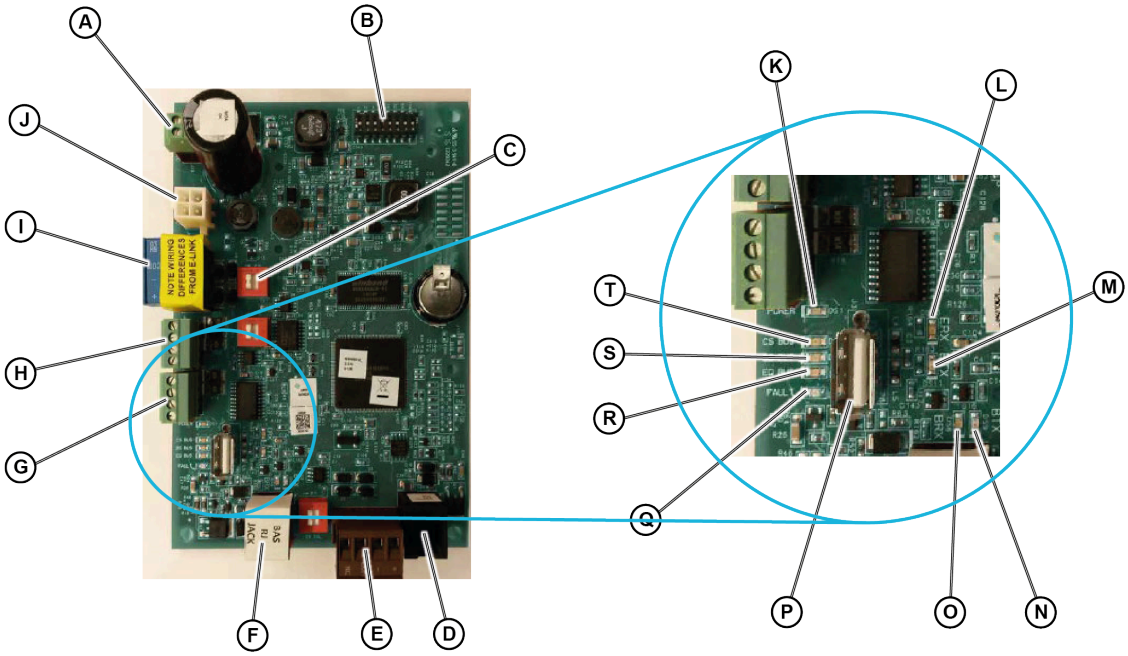
Communication protocol	Modbus RTU	BACnet MS/TP
Connector	J12 Terminal on SC-EQ board (rod terminal)	
Communication pass type	RS485, Data length: 8 Bit, Stop Bit: 1Bit, Parity: None, Speed: 9600bps (default)	RS485, Data length: 8 Bit, Stop Bit: 1Bit, Parity: None, Speed: 38400bps
BAS network address	5~127 (set using DIP-SW 1 through 7 of SW-1 MAC address switch on SC-EQ board). The default address setting is 8. ⓘ **Note:** do not use DIP-SW 8	
Function code	Read command • Digital signal: 01 (Read coil) • Analog signal: 03 (Read holding register) Write command • Digital signal: 05 (force single coil) • Analog signal: 06 (write holding register)	

Figure 57: Wiring between BAS system and each chiller on BAS port J12 (2-wire n:1 connection)



LD32156

Figure 58: SC-EQ board

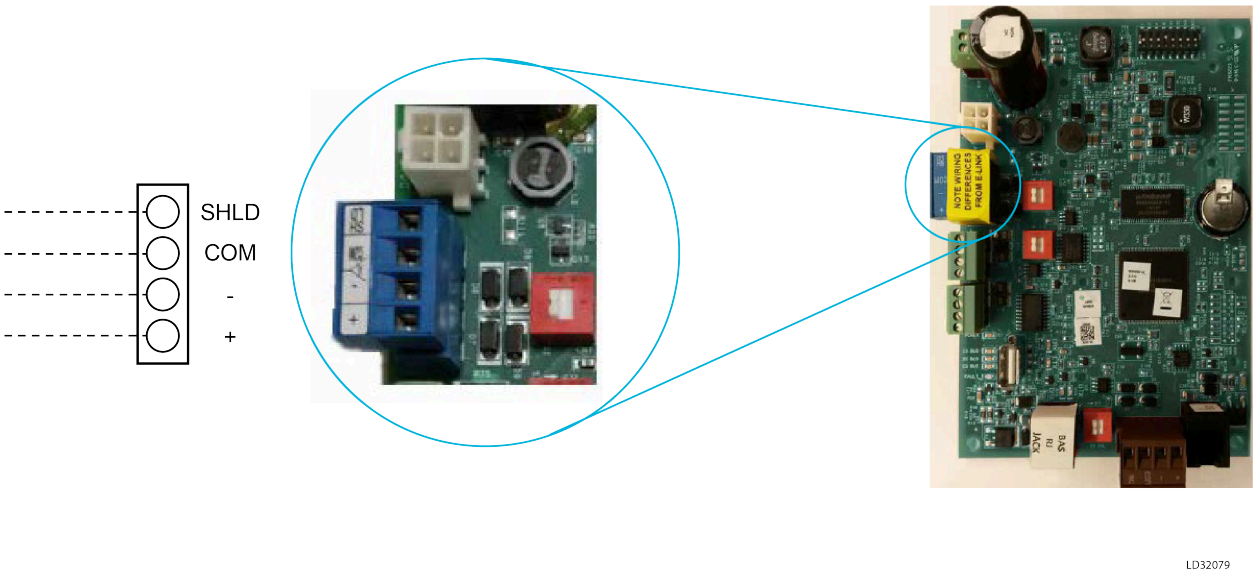


Callout	Component
A	24 VAC or 24 VDC power supply port (J10)
B	MAC address switch (SW1)
C	BAS EOL switch (S2)
D	CS RJ port (J1)
E	Connected service port (J11)
F	BAS RJ port (J2)
G	EQ232 port (J7)
H	EQ485 port (J8)
I	BAS port (J12)
J	12 VDC power supply port (J9)
K	Power LED (POWER)
L	EQ485 receive LED (ERX)
M	EQ485 transmit LED (ETX)
N	BAS transmit LED (BTX)
O	BAS receive LED (BRX)
P	USB port (J3)
Q	Fault LED (FAULT)
R	Chiller communication LED (SQ BUS)
S	BAS communication LED (BS BUS)
T	CS communication LED (CS LED)

Connection port on SC-EQ board.

Make sure that the communication cable is connected into the BAS port J12 on the SC-EQ board correctly. This isolated RS-485 serial port is used to connect the SC-EQ board to a BAS using either Modbus RTU or BACnet MS/TP networking protocol. BAS port J12 is located at the left of the SC-EQ board. The BAS port J12 is the blue pluggable connector. It is an RS-485 port with +, - ,COM, and SHLD marked. On some BAS systems the COM is called REF.

Figure 59: BAS port J12



MAC address

The network hardware address for the SC-EQ board is set on a single 8-way DIP switch SW1. Switch 8 is not used. The switches are binary weighted, allowing the setting of addresses from 5 to 127. The addresses from 0 to 4 are used in the internal system. The address must be provided by the BAS contractor. The default address setting is 8.

- **Important:** The SC-EQ board is intended to provide an input to equipment under normal operating conditions. Use this SC-EQ board only as an operating control. Where failure or malfunction of the SC-EQ board could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of, or protect against, failure or malfunction of the SC-EQ board.

Network termination

Terminate all EOL devices at each end of the RS-485 bus, which connect to only one set of RS-485 network wires. EOL termination provides biasing of the network and assists in returning the signal to a normal state in the event of voltage transients. If the SC-EQ board happens to be an EOL device on the Building Automation System (BAS) network, terminate the network by setting the BAS EOL switch S2 to on.

- **Important:** Ensure that the EOL switches are not set to the ON position for controllers that are not at the end of the BAS RS-485 network.

LED indicators

There are nine LEDs on the SC-EQ board that indicate the operational status of the SC-EQ board and the communication ports.

POWER: A green LED that is ON whenever power is applied to the SC-EQ board.

CS BUS: A green LED that indicates the communication activity on the CS port J11 or CS RJ port J1.

BS BUS: A green LED that indicates the communication activity on the BAS communication port J12.

EQ BUS: A green LED that indicates the communication activity between the SC-EQ board and the chiller control system.

BRX: A green LED that illuminates when the SC-EQ board is receiving data on the BAS network port J12.

BTX: A red LED that illuminates when the SC-EQ board is transmitting data on the BAS network port J12.

ERX: A green LED that illuminates when the SC-EQ board is receiving data from the chiller control system.

ETX: A red LED that illuminates when the SC-EQ is Transmitting data to the chiller control system.

FAULT: A red LED that indicates a problem with the SC-EQ board.

Refer to the *SC-Equipment Communication Card Product Bulletin (450.50-PB1)* and the *SC-EQ Communication Card (450.50-N1)* for the further information.

Optional Modbus TCP communication

The MB3280 Modbus gateway unit for Modbus TCP communication is equipped as an option. The customer is responsible to deliver all other related equipment: concentrator (HUB), installation, wiring, communication program for the central monitoring unit, and other relevant equipment. See Table 26.

Table 26: Scope of delivery for communication through MB3280 gateway unit

Item	Customer	Johnson Controls	Remarks
Control panel with upper communication function		X	Communication protocol: Modbus TCP
Communication interface setting on SC-EQ board and gateway unit		X	Perform configuration at field during commissioning
Data concentrator (HUB)	X		Installation and wiring are included
Wiring work	X		Apply ethernet communication cable
Communication program for central monitoring unit	X		See Modbus TCP protocol for the details of the communication protocol

Table 27: Specifications for Modbus TCP communication

Communication protocol	Modbus TCP
Communication pass type	100 BASE-TX
Connector	RJ-45 modular jack on MB3280 converter
IP Address	192.168.0.66 as default. This can be changed with configuration software MOXA MGate Manager.
Subnet Mask	255.255.255.0
Function Code	Read command • Digital Signal: 01 (Read coil) • Analog Signal: 03 (Read holding register)
	Write command • Digital Signal: 05 (Force single coil) • Analog Signal: 06 (Write holding register)

Figure 60: MB3280 gateway unit

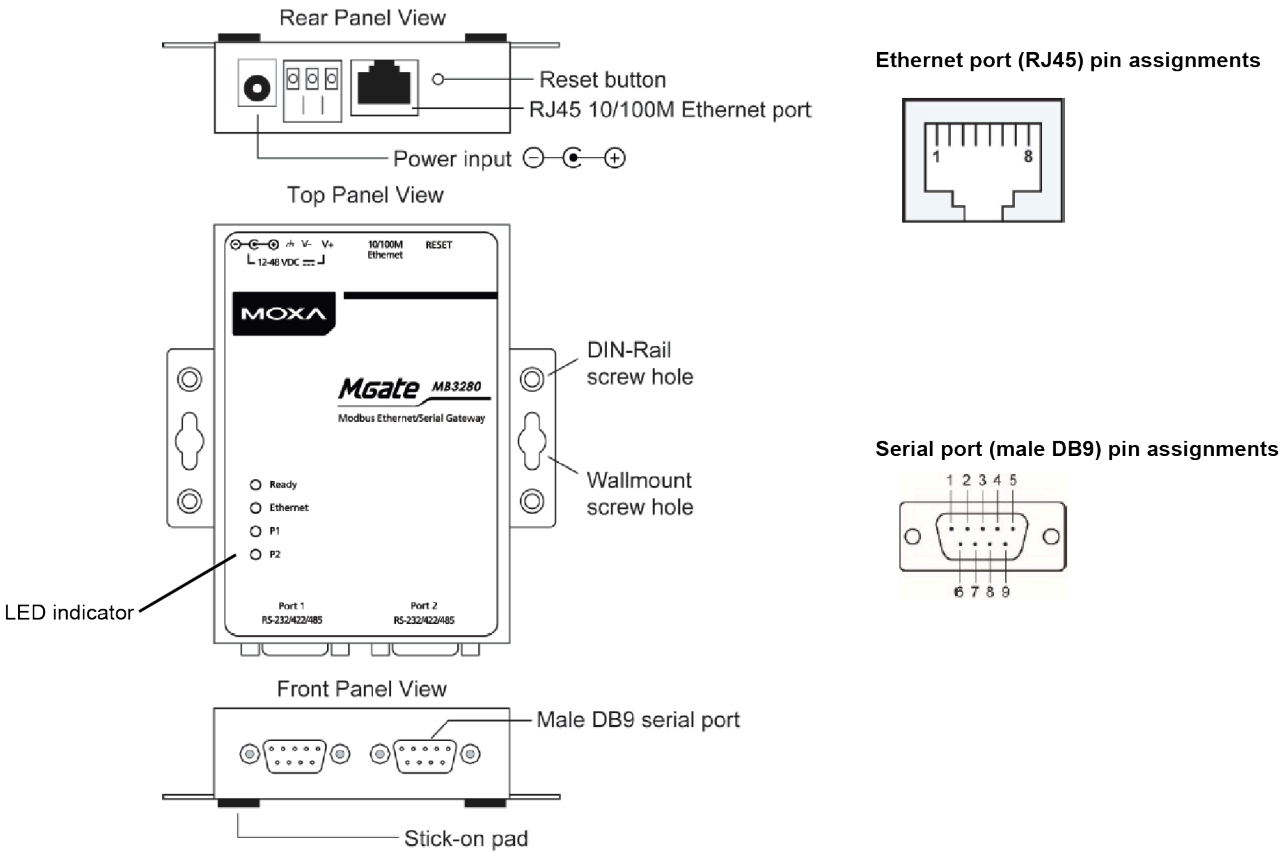


Table 28: LED indicators on MB3280 gateway unit

Name	Color	Function
Ready	Red	Steady on: power is on, and chiller is booting up Blinking: Indicates an IP conflict, or the DHCP or BOOTP server is not responding properly
	Green	Steady on: power is on, and chiller is functioning normally Blinking: chiller is responding to software locate function
	Off	Power is off, or power error condition exists
Ethernet	Amber	10 Mbps Ethernet connection
	Green	100 Mbps Ethernet connection
	Off	Ethernet cable is disconnected, or has a short
P1 and P2	Amber	Serial port is receiving data
	Green	Serial port is transmitting data
	Off	No data is being transmitted or received through the serial port

Connection port on MB3280 unit

Make sure that the communication cable is connected into the RJ45 Ethernet port on the MB3280 unit correctly. RJ45 Ethernet port is located on the rear panel of the MB3280 unit.

MB3280 specifications

LAN

- Ethernet: 10/100 Mbps, RJ45, Auto MDI/MDIX
- Protection: Built-in 1.5 kV magnetic isolation

Software features

- Operation mode: RTU subordinate, RTU master, ASCII subordinate, ASCII master
- Utilities: MGate Manager
- Multi-masters and multi-request: 16 simultaneous TCP masters, 32 simultaneous requests for each TCP master

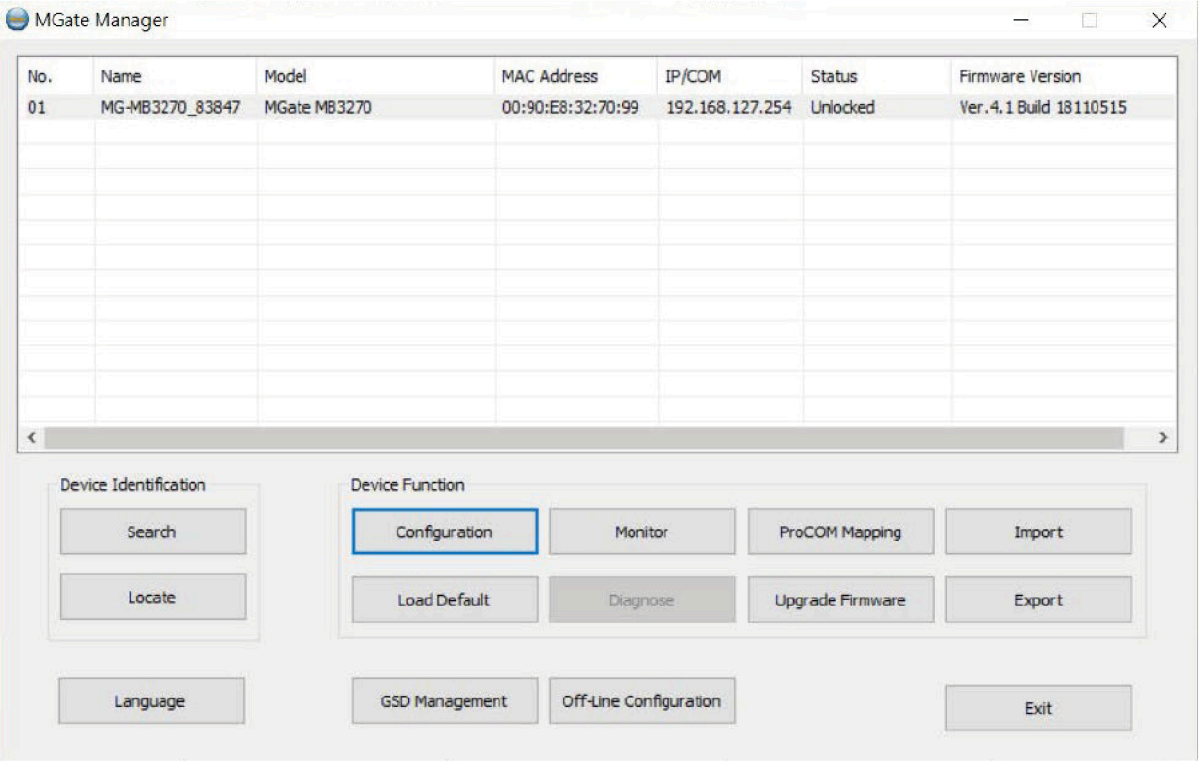
Configuration

MGate Manager, a Windows utility for configuring and monitoring MB3280 unit over the network, is used to make configuration and operation of the MB3280 unit. This utility automatically connects to MB3280 unit on the LAN. Traffic monitoring functions help you troubleshoot Modbus communication problems by tracking items such as connection status and address translation errors.

Installing the software

The Windows management utility MGate Manager is available for download. This utility can be downloaded from Moxa's website; http://www.moxa.com. For additional details, visit http://www.moxa.com/products and refer to *MGate MB3000 Modbus Gateway User Manual*.

Figure 61: Sample of MGate Manager screen



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Communication cable for configuration

For configuring and monitoring the MB3280 unit, connect a communication cable between the Port 2 on the front panel of the unit and your PC with MGate Manager.

If your PC does not have a RS232C port but has a USB port, use a USB-RS232C female DB9 communication cable as shown in Figure 62.

Figure 62: USB-RS232C communication cable

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Note:

The MGate Manager also supports login through a web browser.

- IP address for log-in and configuration through network: 192.168.0.88
- IP address for Modbus TCP routing and communication: 192.168.0.66 (default)
- Default account: admin
- Default password: moxa

Modbus TCP protocol

Check and set various parameters for Modbus TCP communication through the MGate Manager. See Table 29 for the available setting parameters on the configuration screen.

Table 29: Parameters for MB3280 configuration

Page	Parameter		Details
System - Auto Warning	System Event	Cold start	Select warning method: by e-mail alert, SNMP trap message, or cancel
		Warm start	Select warning method: by e-mail alert, SNMP trap message, or cancel
		Power input failure	Select warning method: by e-mail alert, SNMP trap message, open/close relay output, or cancel
		Ethernet 1 link down	Select warning method: by e-mail alert, SNMP trap message, open/close relay output, or cancel
		Ethernet 2 link down	Select warning method: by e-mail alert, SNMP trap message, open/close relay output, or cancel
	Config Event	Console(web/text) login auth failed	Select warning method: by e-mail alert, SNMP trap message, or cancel
		IP changed	Select warning method: by e-mail alert or cancel
		Password changed	Select warning method: by e-mail alert or cancel
System - E-mail Alert	Mail server (SMTP)		Enter mail server's domain name or IP address
	Username		Enter mail server's user name if required
	Password		Enter mail server's password if required
	From e-mail address		Enter e-mail address from which warning message is sent
	To e-mail address (1 to 4)		Enter e-mail address to which warning message is sent
System - SNMP Trap	SNMP trap server IP or domain name		Enter IP address or domain name to receive SNMP trap message
	Trap version		Select version of SNMP trap
	Trap community		Enter name of SNMP trap community
System - SNMP Agent	SNMP		Select to enable or disable SNMP Agent function
	Contact name		Enter additional SNMP contact information if required
	Read community string		Enter text password for authentication of weekly query to agent of managed network devices
	Write community string		Enter text password for authentication of weekly change to agent of managed network devices
	SNMP agent version		V1, V2c, V3
	Read-only username		Enter username to be identified for access to read-only level if required
	Read-only authentication mode		Select authentication method of password encryption for access to read-only level: MD5, SHA, or disable
	Read-only password		Enter password for access to read-only level
	Read-only privacy mode		Select to enable or disable DES_CBC data encryption for access to read-only level
	Read-only privacy		Enter encryption key for access to read only level
	Read/write username		Enter username to be identified for access to read/write level if required
	Read/write authentication mode		Select authentication method of password encryption for access to read/write level: MD5, SHA, or disable
	Read/write password		Enter password for access to read/write level
	Read/write privacy mode		Select to enable or disable DES_CBC data encryption for access to read/write level
	Read/write privacy		Enter encryption key for access to read/ write level
System - Console Setting	Console Settings	HTTP console	Select to enable or disable HTTP web console
		HTTPS console	Select to enable or disable HTTPS web console
		Telnet console	Select to enable or disable MGate Telnet function
		Reset button	Select to enable or disable reset button protect function
		MOXA command	Select to enable or disable access to MGate from DSU
	Session Settings	Maximum login user for HTTP+HTTPS	Enter number of maximum login users for HTTP+HTTPS from 1 to 10
		Auto logout timeout	Enter auto logout timeout time from 60 s to 3,600 s
System - Notification Message	Login message		Enter message which is indicated at login
	Login authentication failure message		Enter message which is indicated at login authentication failure
System - Account Management	Account name		Enter account name for login
	Group		Select access level either admin or user for each account name
System - Login Password Policy	Account Password Policy	Minimum length	Enter minimum number of password characters from 4 to 16
		Enable password complexity strength check	Add check mark to enable password complexity check function Enable or disable three kinds of check method: at least one digit (0~9), mixed upper and lower case letters (A~Z, a~z), and/or at least one special character (~!@# $%^*-_|;:,.<>[]{}())
		Password lifetime	Enter password lifetime period from 90 to 180 days
	Account Login Failure Lockout	Enable	Add check mark to enable account login failure lockout function
		Retry failure threshold	Enter retry failure threshold from 1 to 10 times
		Lockout time	Enter lockout time from 1 min to 60 min

Export and import MB3280 configuration

To back up the existing configuration or apply the same configuration to another MB3280 unit, you can import and export the configuration of MB3280 unit through MGate Manager. The configuration data is saved as a CFG file.

Communication data with SC-EQ board

Table 30: Read command

		Date description	Display	Unit	Address		Value description
					Modbus RTU/TCP	BACnet	
Set value	1	Set point	44.6	°F	40001	AV3	0320~2120 unit,1unit=0.1°F
	2	Automatic stop temperature (thermo off temperature	41.0	°F	40003	AV4	0320~2120 unit,1unit=0.1°F
	3	Temperature difference of automatic stop/start control	9.0	°F	40005	AV5	0322~2120 unit,1unit=0.1°F
Operation condition	4	Operation condition	0 or 1		40021	MV1	0:STOP, 1:COOLING OPERATION
	5	Local or remote mode setting	0 or 1		01001	BV3	0:LOCAL, 1: REMOTE
	6	Solution circulation pump operation	0 or 1		01003	BV4	0:STOP, 1:OPERATION
	7	Solution spray pump operation	0 or 1		01101	BV5	0:STOP, 1:OPERATION
	8	Refrigerant pump operation	0 or 1		01005	BV6	0:STOP, 1:OPERATION
	9	Load limit condition	0 or 1		01009	BV9	0:NORMALLY OPERATION 1:LOAD LIMIT OPERATION
	10	Control manipulated variable	100.0	%	40023	AV14	0000~1100 unit, 1unit=0.1%
	11	Failure signal	0 or 1		01011	BV10	0:NORMALLY OPERATION 1:FAILURE OCCUR
	12	Alarm signal	0 or 1		01013	BV11	0:NORMALLY OPERATION 1:ALARM OCCUR
Measurement value	13	Evaporator water inlet temperature	53.6	°F	40083	AV50	0322~7520 unit,1unit=0.1°F
	14	Evaporator water outlet temperature	44.6	°F	40085	AV51	0322~7520 unit,1unit=0.1°F
	15	Evaporator refrigerant temperature	41.0	°F	40087	AV52	0322~7520 unit,1unit=0.1°F
	16	Condenser water inlet temperature	89.6	°F	40089	AV53	0322~7520 unit,1unit=0.1°F
	17	Condenser water outlet temperature	98.6	°F	40091	AV54	0322~7520 unit,1unit=0.1°F
	18	Absorber solution temperature	100.4	°F	40093	AV56	0322~7520 unit,1unit=0.1°F
	19	Generator solution temperature	293.0	°F	40095	AV57	0322~7520 unit,1unit=0.1°F
	20	Generator pressure	458.1	mmHg	40099	AV58	0008~8261unit, 1unit=0.1 mmHg
	21	Purge tank pressure	15.0	mmHg	40105	AV62	0008~8261unit, 1unit=0.1 mmHg
	22	Generator concentration	63.0	%	40103	AV61	0001~1100 unit,1unit=0.1%
	23	Absorber pressure (only for EX(S)L and EXW(S)L)	7.5	mmHg	40139	AV69	0008~8261unit, 1unit=0.1 mmHg
	24	Absorber concentration (only for EX(S)L and EXW(S)L)	58.0	%	40141	AV70	0001~1100 unit,1unit=0.1%
	25	Refrigerant density (only for EX(S)L and EXW(S)L)	62	$lb/feet^3$	40137	AV68	62~250 unit,1unit=$1lb/feet^3$

Table 31: Write command

No.	Data description	Modbus RTU/TCP	BACnet address	Value description
1	Remote operation signal	02001	BV1	ON at CHILLER OPERATION,PULSE SIGNAL
2	Remote stop signal	02002	BV2	ON at CHILLER STOP,PULSE SIGNAL
3	Control valve upper limit	40201	AV1	0000~1000 unit,1unit=0.1%
4	Set point	40203	AV2	0000~1000 unit,1unit=0.1°C;

OpenBlue application

OpenBlue: OpenBlue provides connected experiences to increase productivity, optimize processes, and ultimately provide higher tenant satisfaction. It features a suite of tailored, AI-powered service solutions such as remote diagnostics, predictive maintenance, and advanced risk assessments. OpenBlue also powers easy-to-use smartphone applications that empower people to personalize their building experience and handle all kinds of day-to-day building-related issues.

OpenBlue Smart Connected Chillers Dashboard: This customer application is a comprehensive, analytical, Azure cloud-based application that proactively analyzes chillers energy and equipment data to identify issues, faults, and opportunities for efficient performance and operational savings. Access the customer application on a computer or tablet, and view active alarms, trends, warnings, health checks, and reports. Historical data is examined and analyzed to diagnose and troubleshoot machine problems, observe long term trends, and to investigate events leading up to a failure. It's all designed to take a more strategic approach to maintenance and saving time and money. The necessary devices to enable this function must be sourced by the local Johnson Controls branch, and must be installed and checked at the site by trained personnel from an authorized Johnson Controls Field Service Office.

Figure 63: Simplified architecture of OpenBlue Smart Connected Chillers application

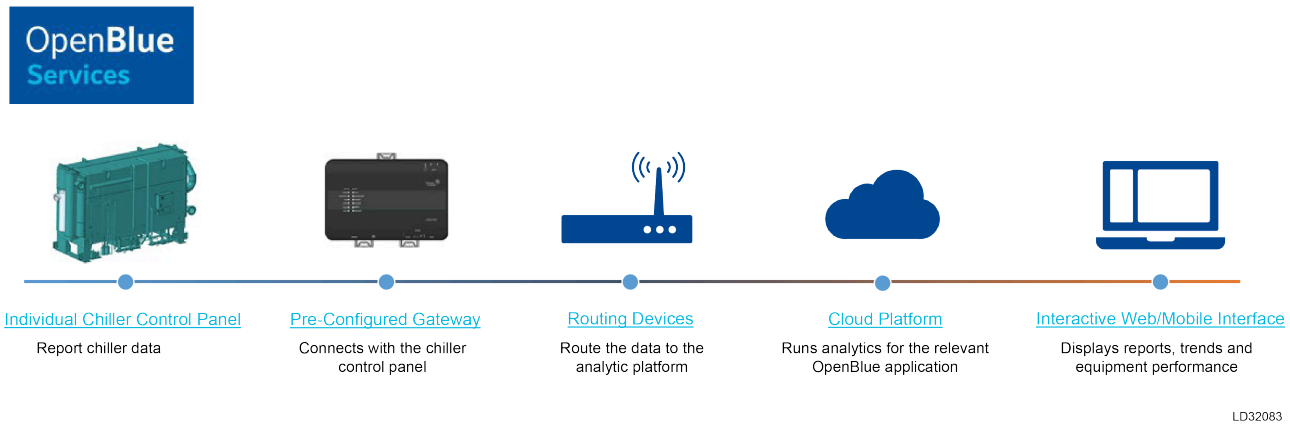
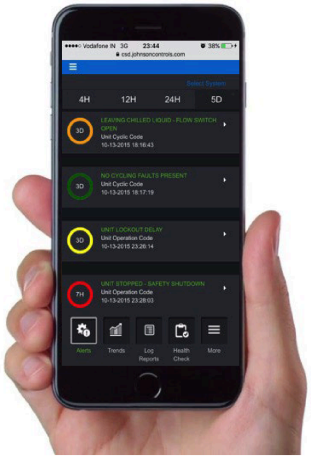


Figure 64: OpenBlue Smart Connected Chillers Dashboard

OpenBlue Services



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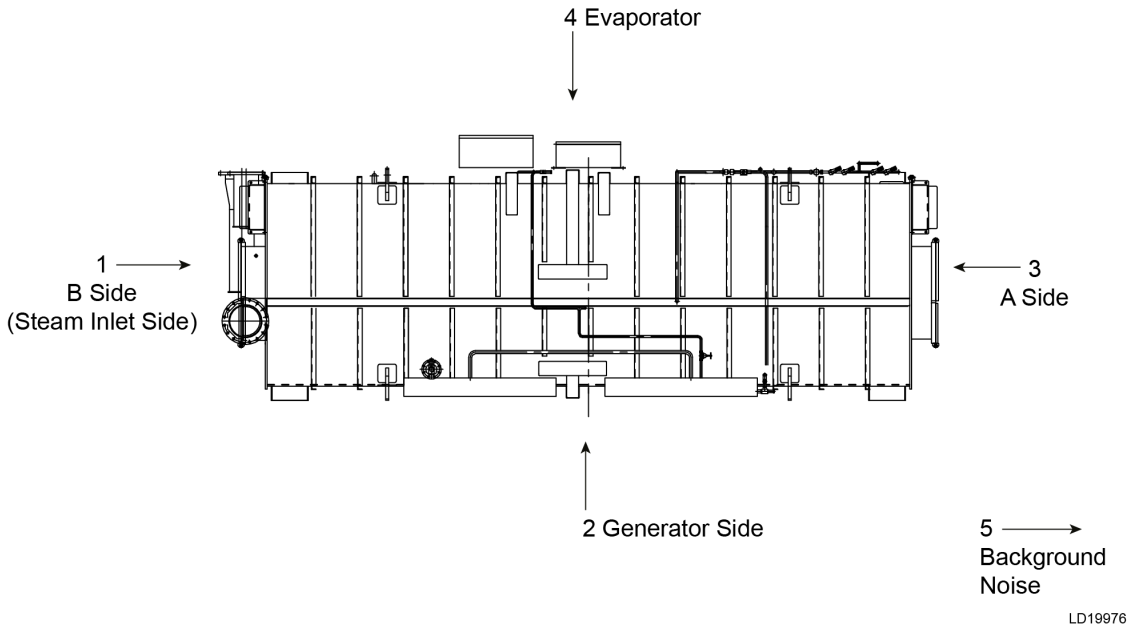
Noise emisson

The steam chiller may produce the A-weighted emission sound power level in excess of 80 dB (A), normally the A-weighted emission sound pressure level is less than 100 dB(A). Hearing protection must be worn at all times when operating the steam chiller. This hearing protection may impact the manner in which operators must communicate to be understood.

Figure 65: Sample sound testing for YHAU-CW chiller



Location	Overall	Octave band									
		31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
1	80/ 83	37 / 76	48 / 74	57 / 73	64 / 73	69 / 72	73 / 73	75 / 74	75 / 74	70 / 71	56 / 63
2	77 / 83	40 / 79	49 / 75	56 / 72	62 / 71	68 / 71	70 / 70	71 / 70	70 / 69	70 / 71	53 / 60
3	75 / 83	41 / 80	49 / 75	59 / 75	62 / 71	65 / 68	69 / 69	71 / 70	67 / 66	58 /59	44 / 51
4	78 / 84	40 / 79	50 / 76	61 / 77	64 / 73	71 / 74	71 / 71	74 / 73	71 / 70	65 / 66	50 / 57
5	64 / 80	37 / 76	44 / 70	60 / 76	56 / 65	54 / 57	57 / 57	56 / 55	50 / 49	36 / 37	26 / 33

ⓘ **Note:** The location is the position of the measuring instrument.

Height: 59 in. and Width: 39 in. from the chiller surface.

The data in the table is for reference only. The chiller is not covered with the thermal insulation materials and the water pipes for chilled water, cooling water, and steam are temporary during the measurement.

Commissioning

General guidelines for use

Charge the solution and the refrigerant water if the solution and refrigerant water is in the barrels during the delivery.

During commissioning, check the motor's rotating direction of the solution pump, refrigerant pump, and purge pump:

ⓘ **Note:** The flow of fluid cannot be seen because the solution and refrigerant pumps are hermetically sealed.

⚠ CAUTION

Do not run the solution pump without solution. Do not run the refridgerant pump without refrigerant water.

The rotation direction can be tested by using a rotation detector (Bell and Gosset or WILO DKG). If a rotation detector is not available, use the following procedure:

1. Remove the plugs at the solution and refrigerant sampling valves.
2. Make sure the valves are completely closed.
3. Confirm that the absorber and refrigerant tank contain enough solution and refrigerant.
4. Connect a compound gauge (NPT 1/2 in.) to the sampling valve with Teflon tape.

   ⓘ **Note:** The gauge's scale must be -760 mm Hg. to 2 kg/cm^{2}g, or -30 in. Hg. to 30 psig. To prevent corrosion of the gauge, clean it thoroughly and check for leaks after use.
5. Operate the pump.
6. Open the valve.
7. Read and record the delivery pressure of the solution pump and the refrigerant pump.
8. Close the valve.
9. Check the pressure readings. See to see if your pump rotation is in the right direction. The correct direction shows a higher discharge pressure.

   ⓘ **Note:** The delivery pressure reflects the high vacuum condition of the machine. If the inside pressure is atmospheric, add 1.0 kg/cm^2 (14.3 psig) to the standards in .
10. Remove the compound gauge.
11. Put the plugs back on the valves.
12. Clean the gauge with water.
13. For refrigerant, confirm the correct rotation by viewing the refrigerant spray through the sight glass.

Table 32: Pump pressure for correction rotation

	Correction rotation pressure
Solution circulation pump	14.5 psig to 29 psig
Solution spray pump	-7.25 psig to -2.90 psig
Refrigerant pump	-11.6 psig to -2.90 psig

After the completion of the equipment work (installation of the chiller, thermal insulation for cold or hot surfaces, and other relevant installation processes), operate the chiller and measure the noise around the chiller.

The noise data of the chiller unit was measured in decibels at the factory. See Figure 65.

Important: An Earth Leakage Breaker (ELB) is not installed on this chiller. You must install an adequate ground fault circuit breaker at the primary side of the chiller.

The Chiller Pre-Start Up and Commissioning Checklist contains specific information for the installation and start-up of the chiller. The steps and procedures must be performed by a YORK or Johnson Controls Service person before customer use.

All items on the checklist must be completed before charging and initial operation. Failure to do this may result in machine malfunction, damage, and/or injury.

Precautions for the use of steam and water

Absorption chillers driven by steam use corrosion- resistant stainless steel (SUS) tubes in the high temperature generator.

Staining and corrosion of the tubes in the evaporator, absorber, and condenser largely depend on the quality of the water used as chilled water and cooling water. As a result, since the water is supplied from the boiler, observe the following precautions for control of the boiler water.

Water quality must be checked periodically for stain and corrosion to prevent problems. If water quality is not controlled and maintained correctly, premature tube failure can result. Causes of bad quality water include:

- Polluted seawater
- Polluted underground water
- Cooling tower located near a chimney or in dirty air

Note:

- Analyze the chilled water and the cooling water within one month after commissioning. See Table 42.
- Use glycol or another antifreeze agent in the chilled water for low temperature chilled water supply chillers.

Install strainers of 10 mesh and above to the chilled water and cooling water inlets.

Shut off valves are installed in the chilled water and cooling water inlets as well as the outlets. Be sure the valves are completely open when supplying water. If not, the water flow can become turbulent (at the shut off valves). If that happens, the water chamber case and tubes may be damaged. If you need to reduce the quantity of the chilled water and cooling water, use the valves to adjust the flow.

When the flow rate change of the chilled water is controlled, the load change speed is limited. The flow rate change function must be installed first.

- The load change condition to limit the chilled water temperature at the outlet is ±0.9°F maximum per minute.
- The critical load change condition to prevent an overcooling trip of the chiller is maximum 5% per minute.

Set the steam feed pressure at the inlet of the steam control valve to the specified level. If the pressure is lower than the specification, performance may be insufficient. Limit the steam pressure fluctuation in the range of the specification value +7/-14 psig. If the pressure fluctuation is too big, control becomes unstable. The valve may start to hunt for the correct chilled water temperature at the outlet. As a result, performance suffers, and the operation may stop.

ⓘ **Note:** The steam control valve is for the CW model chiller as part of the standard design. The steam drain control valve is for the CWN/CWL model chiller.

Be sure to install a strainer of 60 to 70 mesh on the steam inlet pipe or before the steam control valve. If the steam control valve is clogged, the control valve has a problem and the steam flow rate cannot be controlled. If the system has a non-leak steam control valve, does not have a steam shut-off valve, and the control valve is clogged, the steam leaks while the chiller is stopped. The solution in the high temperature generator may crystallize.

Adjust the pressure at the steam drain outlet to the specified level at the specification point with the regulator valve on the facility side.

If steam drain or air may flow back while the chiller is stopped, install a check valve to the middle of the drain return piping. If two or more chillers are installed and their drain return pipes are joined together to return the drain to the hot well tank, install the check valve before the junction of the pipes.

Install a drain trap at the lowest place of the control valve before the steam control valve inlet side to prevent an inflow of drain to the high temperature generator. And install a mist separator if too much mist is contained in the steam.

ⓘ **Note:** The inlet steam cannot have a temperature higher than 374°F and cannot have a saturation pressure higher than 145 psig. If it surpasses this, use the temperature reducer and pressure reducer. The superheated temperature must be lower than 18°F.

A drain trap does not need to be installed in the steam drain line between the chiller and the hot well tank. The presence of a drain trap causes the steam flow to become unstable. In this case, the condensed water draining from the chiller is sub-cooled enough so that a drain trap is unnecessary.

Isolate the main steam supply valve when servicing the chiller or during an extended shut down.

Chilled water outlet temperature controller

The chilled water outlet temperature controller (23A) is located on the sequencer. It controls the chilled water outlet temperature.

Liquid level gauges

Liquid level gauges are used to check the condition of the chiller components.

Table 33: Liquid level gauges

Liquid level gauge name	Symbol	Function
Refrigerant overflow monitoring level gauge	G101	Checks refrigerant overflow level
Refrigerant tank level gauge	G102	Checks lower limit of refrigerant tank level
Absorber level gauge	G103	Checks lower limit of absorber
HT-GEN level gauge	G104	Checks condition of solution in high-temperature generator
LT-GEN level gauge	G105	Checks condition of solution in low-temperature generator

Start the chiller

Before starting the chiller, inspect the following items:

- Check that the steam supply valve is open.
- Check the steam drain manual valve.
- Check that the refrigerant blow valve V8 is closed.
- Open the steam shut off valve and keep the steam inlet pressure at specification.
- Check that the refrigerant pump **Auto** button is pressed.

After the review is complete, start the chiller.

Note: The **OPER.** and **STOP** buttons are available on the Main, Data, and Setting screen. Use these buttons on the Main screen whenever possible.

1. Navigate to the main screen on the control panel.
2. Press the **OPER.** button on the control panel to start the chiller. To start the chiller from a remote location, enter the remote start signal.

When the chiller starts, the following occurs:

- The solution circulation pump, solution spray pump, and refrigerant pump start.
- The steam control valve or steam drain control valve, steam drain solenoid valve, and steam shut-off valve (option) open.
- The low drive source lamp lights and the low opening of the control valve is held for about 10 minutes.
- After 10 minutes, the steam volume is controlled automatically according to the cooling load and the temperature control lamp lights.

Stop the chiller

1. Navigate to the main screen on the control panel.
2. Press the **STOP** button on the control panel to stop the chiller. To stop the chiller from a remote location, enter the remote stop signal.

When the chiller stops, the following occurs:

- The steam control valve or steam drain control valve, steam drain solenoid valve , and steam shut-off valve (option) close.
- The dilution operation starts and continues for 7 minutes to 30 minutes.
- During the dilution operation, the solution circulation pump, solution spray pump, and refrigerant pump operate.
- When the dilution operation is complete, the solution circulation pump, solution spray pump, and refrigerant pump stop. Then the chiller water pump, cooling water pump, and cooling tower stop.
- Close the steam supply manual valve and steam drain manual valve.

Figure 66: Cooling start diagram

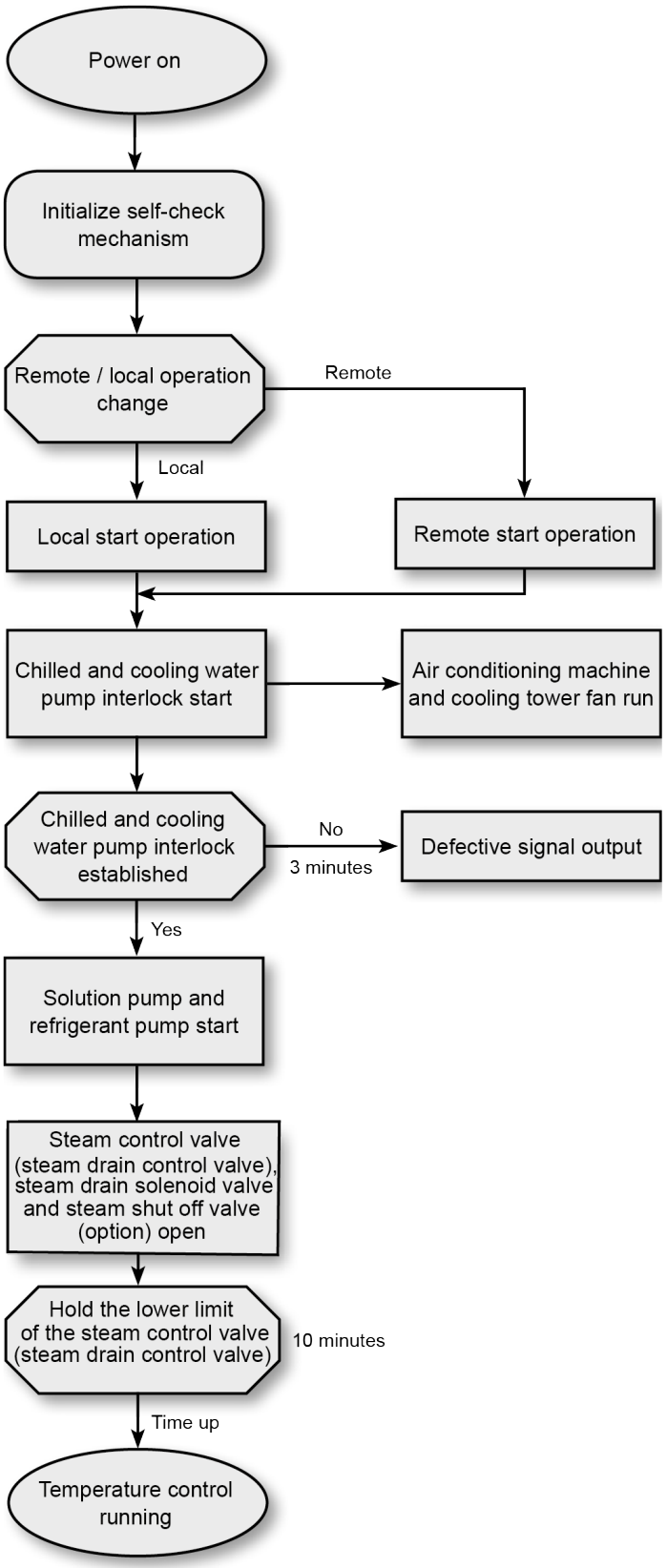


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Figure 67: Cooling stop diagram

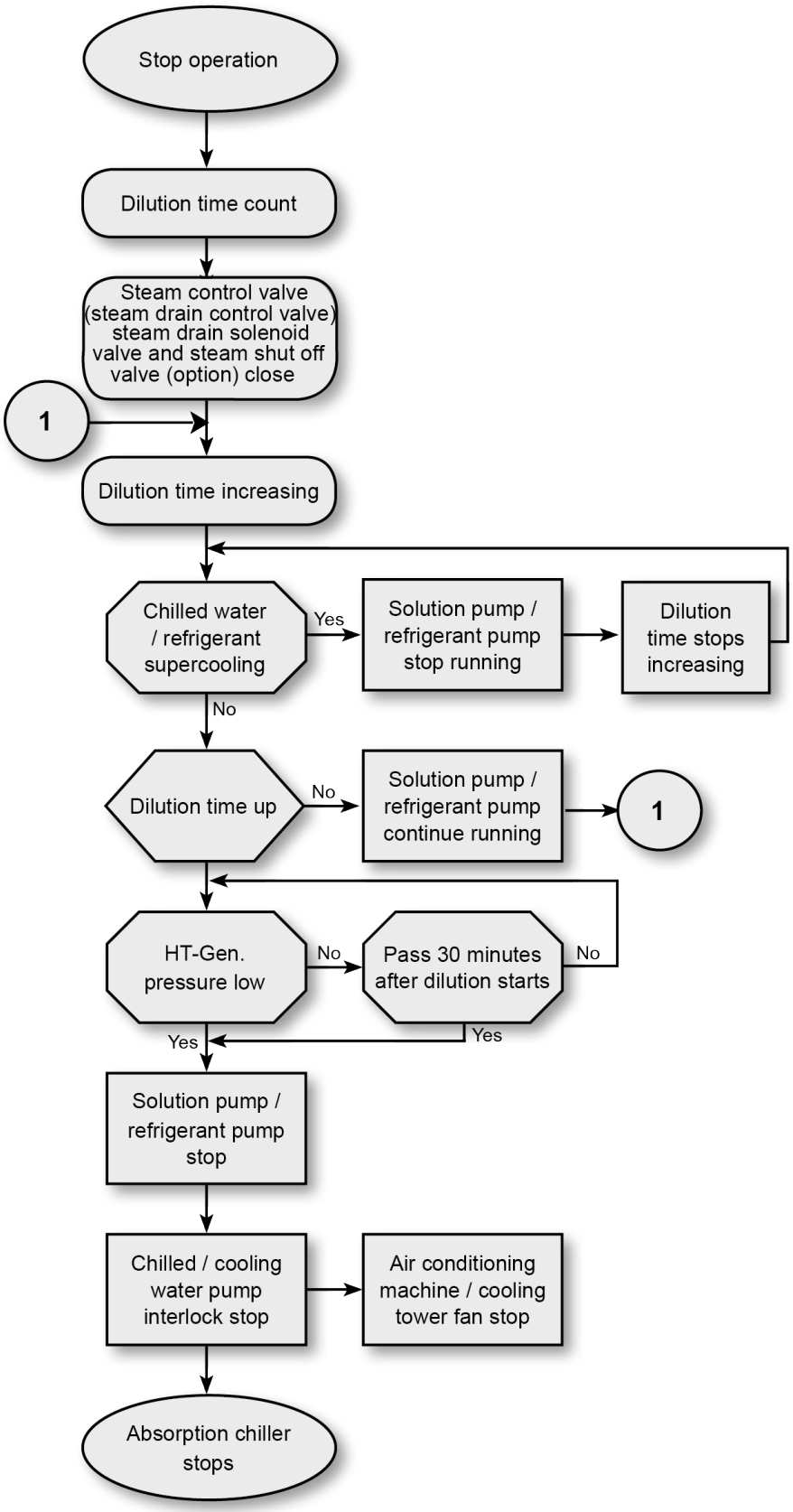
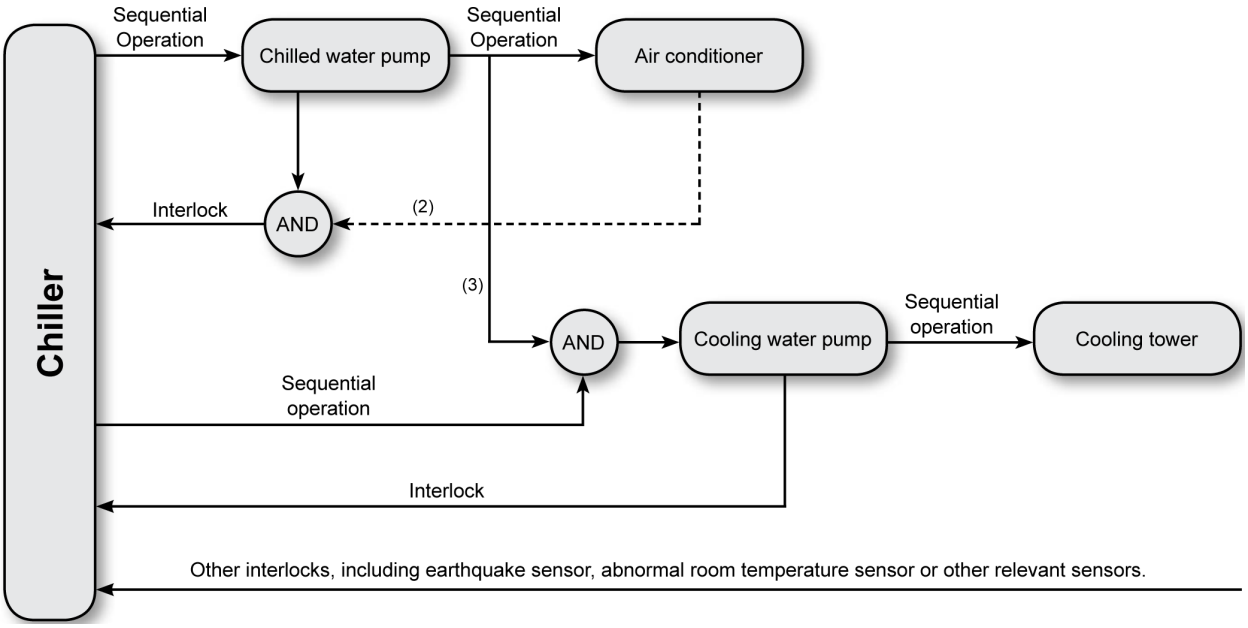


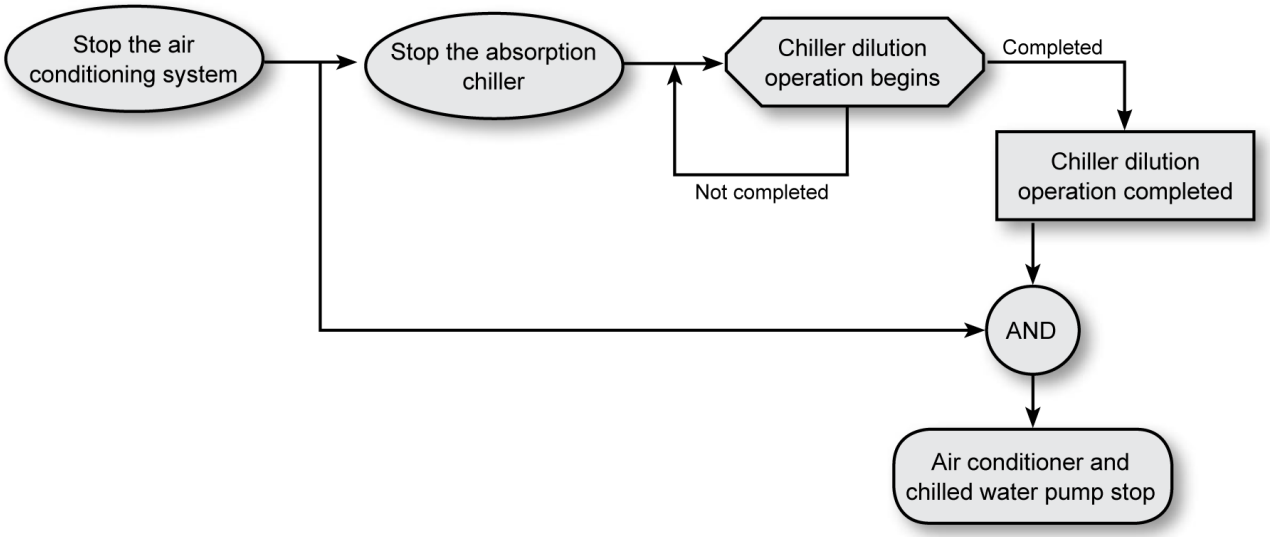
Figure 68: Steam sequential operation flowchart



Note:

1. Be sure to implement sequential operation of the chilled water pump and the cooling water pump from the chiller.
2. If there is only one air conditioner, secure interlock for the air conditioner operation which is indicated by broken lines.
3. Implement sequential operation in such a way that when the chilled water pump stops, the cooling water pump must also stop.
4. If the chilled and cooling water system is the common system, you must install the isolation valve on the chilled water and cooling water inlet pipe entering the chiller, and interlock these isolation valves with the chiller control panel. This is imperative for safe and reliable operation of the chiller as well as to prevent potential crystallization of lithium bromide solution and freezing of the evaporator tubes.

Figure 69: Stopping absorption chiller steam flowchart



Note:

Verify that the air conditioner has stopped after the chiller dilution operation is complete. Otherwise, the chiller may become damaged due to freezing of the chilled water or crytallisation of the solution.

Close the steam supply main valve and steam drain manual valve when the chiller has stopped.

YORK®	YHAU-CW DOUBLE EFFECT STEAM FIRED ABSORPTION CHILLER	
CHECKLIST	Supersedes: 155.31-CL1.EN.UL (1121)	Form 155.31-CL1.EN.UL (1223)

CHILLER START UP AND COMMISSIONING CHECKLIST

CUSTOMER: _____ JOB NAME: _____

ADDRESS: _____ LOCATION: _____

PHONE: _____ CUSTOMER ORDER NO: _____

JCI TEL NO: _____ JCI ORDER NO: _____ JCI CONTRACT NO: _____

CHILLER MODEL NO: _____ **UNIT SERIAL NO**: _____

The work (as checked below) is in process and will be completed by: _____ / _____ / _____
Month Day Year

The following work must be completed in accordance with installation instructions:

PRE-START UP

A. General

1. All major pieces, boxes, and crates have been received and accounted for by a YORK/Johnson Controls Service Representative. ☐
2. Any damage, or signs of possible damage, have been documented to the transportation company.... ☐
3. Unit installed in an area protected from weather and maintained at a temperature above freezing. ... ☐
4. Vibration-proof rubber sheets are installed between the chiller base and the site foundation ... ☐
5. Unit is located in accordance with minimum clearance dimensions. (Required maintenance space is available around the machine)... ☐
6. Foundation bolts are properly installed.... ☐
7. The levelness of the unit is within acceptable range (The tolerance for leveling length and width: (1.0 inch for every 1,000 inch). ... ☐
8. THE HG compound gauge displays the same pressure reading, or nearly the same reading, as prior to shipment. ... ☐
9. Thermal insulation is done according to the specifications detailed in this manual.... ☐
10. The following items are NOT covered with insulation:
    a. Valves ... ☐
    b. Thermo wells ... ☐
    c. Plugs... ☐
    d. Sight glasses ... ☐

B. Piping

1. Piping is installed between the unit at the source of supply... ☐
2. Air vent valves and drain valves are closed for:
    a. Chilled water... ☐
    b. Cooling water... ☐
3. Loosen the U-band fixing bole around the steam drain cooler... ☐
4. Close the drain valve for the steam drain pipe..... ☐
5. Install the plug to the drain valve for the steam drainpipe... ☐
6. The pressure gauge and siphon tube are installe-before the HTG... ☐
7. The pressure gauge, check valve and adjusting valve are installed at the outlet line of the steam drain outlet line... ☐
8. The following and its related equipment are ready for operation:
    a. Chilled water pump... ☐
    b. Cooling water pump... ☐
    c. Cooling tower fan... ☐
    d. Steam boiler or steam generation facility ... ☐
9. Detachable flanges are properly installed close to the:
    a. Chilled water box.... ☐
    b. Cooling water box.... ☐
    c. Steam box. ... ☐

10. A mesh strainer is installed on the:
    a. Chilled water inlet line..... ☐
    b. Cooling water inlet line. ..... ☐
    c. Steam supply line. ..... ☐
11. Air piping work is complete, leak tested, and flushed for the following lines:
    a. Chilled water..... ☐
    b. Cooling water..... ☐
    c. Steam supply and steam drain return..... ☐
12. Clean the mesh strainers on the line..... ☐
13. Start the chilled water and cooling water pump..... ☐
14. The water box pressure does not exceed the maximum pressure for the:
    a. Chilled water..... ☐
    b. Cooling water..... ☐
15. The flow rate is adjusted within acceptable range for:
    a. Chilled water..... ☐
    b. Cooling water..... ☐
16. Steam supply pressure is stable and within acceptable range..... ☐
17. Steam supply temperature does not exceed its saturation..... ☐

C. Valve and Sensor Check

1. Adjusting valves are set correctly..... ☐
2. The diaphragm valves on the purge line are closed. ☐
3. Open the spindle valve in the purge line.. ..... ☐
4. The detection component of the thermosensor is inserted into the thermowell according to design requirement. ..... ☐

D. Electrical

1. The main and control power supply is available. ..... ☐
2. The insulation resistance of each motor and the MCB secondary side is within acceptable range. .... ☐
3. The power supply voltage is set within acceptable range..... ☐
4. The control panel wiring is correctly connected to the hot water control valve. ..... ☐
5. The external control wiring is complete from the control panel to the water pump motor starter and other related equipment. ..... ☐

E. Vacuum Pump

1. Vacuum pump is charged with the correct amount of lubricant oil. ..... ☐
2. Vacuum pump motor rotation is correct. ..... ☐

F. Evacuate Nitrogen Charge

1. Remove plug in the purge line ..... ☐
2. Release Nitrogen gas until the high-temperature generator compound gas reads approximately 0.005 MPa.G. (0.725 PSI). ..... ☐
3. Re-install the plug in the purge line. ..... ☐
4. Navigate to the Control Panel Setting screen. ..... ☐
5. Press the Purge Pump **ON** button. ..... ☐
6. Check the oil level in the purge pump. ..... ☐
7. Using the vacuum pump, evacuate the nitrogen gas until the generator compound gauge indicates almost -0.1 MPa.G (-14.5 PSI). ..... ☐
8. Close all open manual valves. ..... ☐
9. Press the Purge Pump **OFF** button..... ☐
10. Turn the power switch (MCB) off..... ☐
11. Replace or add oil to the purge pump. ..... ☐

NOTES:

G. Panel Checks

1. The thermal relays conform to the factory inspection sheet. ☐
2. The interlock and answerback signals for the following work properly:
   a. Chilled water pump. ☐
   b. Cooling water pump ☐
3. The indicators on the Control Panel are correct. ☐
4. The temperature setting parameters for capacity control are correct ☐
5. Date and time reflect the local time zone. ☐
6. The rotation director is correct for the following:
   a. Solution circulation pump ☐
   b. Solution spray pump ☐
7. The water flow suspension switch works properly ☐

START UP CHECKLIST

A. Operation Check

1. Manually start each water pump ☐
2. Confirm the water box covers do not leak during water pump operation ☐
3. Stop each water pump manually ☐
4. Set each water pump operation mode to automatic mode ☐
5. Navigate to the Setting screen. ☐
6. Press the Manual Purge **ON** button. ☐
7. Purge non condensable gas from the absorber continuously. Use the procedure detailed in the MAINTENANCE section of the manual ☐
8. Open the refrigerant manual blow valve ☐

NOTES:

9. Navigate to the Control Panel Setting screen. ☐
10. Press the Control Valve Mode **Manual** button. ☐
11. Make sure that the Refrigerant Pump **Auto** button is pressed. ☐
12. Verify that the steam control valve is closed. ☐
13. Press the **OPER.** button on the Control Panel Setting screen. ☐
14. Check that the following start properly:
    a. Solution circulation pump. ☐
    b. Solution spray pump. ☐
    c. Refrigerant pump. ☐
15. Check for abnormal noise or vibration. ☐
16. Gradually open the steam control valve or steam drain control valve. ☐
17. Press the Control Valve Mode **Auto** button. ☐
18. Check that the steam control valve or steam drain control valve works automatically according to the chilled water outlet temperature ☐
19. Press the **STOP** button on the Control Panel. ☐
20. Check that the dilution process is complete. ☐
21. Press the **OPER.** button on the Control Panel. ☐
22. Operate the chiller for 3 hours or longer. ☐
23. Close the refrigerant manual blow valve. ☐
24. Operate the chiller for an additional hour or longer. ☐
25. Check that the cooling water temperature is controlled within the acceptable range. ☐
26. Check that the specific gravity of the refrigerant is within the acceptable range. ☐
27. Check that the chilled water outlet temperature is lower than the chilled water inlet temperature. ☐
28. Record the running data on the data sheets. ☐

B. Purge Amount Check

1. Verify that the purge amount from the absorber is within acceptable range ☐
2. Close the spindle valve to facilitate purging from the absorber ☐
3. Continuously purge contents from the purge tank until the exhausted gas amount reduces and becomes stable ☐
4. Operate the chiller for 1 hour without operating the vacuum pump ☐
5. Verify that the amount of purge from the purge tank is within acceptable range ☐

C. Purge System Check

1. Press the Purge Mode **Auto** button. ☐
2. Change the lubricant oil in the vacuum pump. ☐
3. Open the valve of the ballast valve part-way. ☐

D. Remote Operation Check

1. Confirm that the chiller starts and stops correctly using the remote signal..... ☐

E. Operation Instruction

Review the operation and maintenance instructions in the manual with the customer..... ☐

a. Customer Names:

1. _____
2. _____
3. _____

Customer Signature: _____

Title: _____

Form Completed by: _____

: _____ / _____ / _____
Month Day Year

NOTES:

_____

_____

_____

_____

_____

_____

TABLE 1 - DOUBLE EFFECT STEAM ABSORPTION CHILLER COMMISSIONING DATA SHEET (1/2)

User:		
Model:	**MFG.No.:**	**User's machine code:**

Insulation Resistance					**Electric Power Supply**		
Standard: 5 MΩ or more (with 500 V megger)		R-Gnd	S-Gnd	T-Gnd	Specification: AC ☐ V / ☐ Hz		
Circuit breaker	MΩ				Standard: Within +/- 10% of spec.		
					R-S	V	
		U-Gnd	V-Gnd	W-Gnd	R-T	V	
Solution circulation pump	MΩ				S-T	V	
Solution spray pump	MΩ				R-Gnd	V	
Refrigerant pump	MΩ				S-Gnd	V	
Purge pump	MΩ				T-Gnd	V	

Thermal Relay Setting			**Refrigerant Purity**		**Temperature Setting**		
Solution circulation pump	A		Standard: ≤1.04(kg/L) For EXL or EXWL: according to design		Cooling		
Solution spray pump	A		Specific gravity		Set. base temp.	°F	
Refrigerant pump	A		Turbidity		Auto. stop temp.	°F	
Purge pump	A				Auto. restart diff.	°F	

Pump Discharge Pressure		**Purge Amount**	
Solution circulation pump	PSIG	Standard: 4 cc/min or less	
Solution spray pump	PSIG	Purge tank	cc
Refrigerant pump	PSIG	Absorber	cc

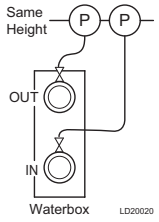
Refrigerant Density setting table for Model EXEL/EXWL	
Specification Chilled Water Outlet Temp °F (°C)	**Appropriate Range of Refrigerant Density lb/in³ (kg/L)**
32 to 33.6 (0.0 to 0.9)	39.54 to 40.26 (1.095 to 1.115)
33.8 to 35.4 (1.0 to 1.9)	38.93 to 39.65 (1.078 to 1.098)
35.6 to 37.2 (2.0 to 2.9)	38.27 to 39.0 (1.060 to 1.080)
37.4 to 39.0 (3.0 to 3.9)	37.59 to 38.31 (1.041 to 1.061)

TABLE 2 - DOUBLE EFFECT STEAM ABSORPTION CHILLER COMMISSIONING DATA SHEET (2/2)

User:								
Model:		**MFG.No.:**			**User's machine code:**			
Running Data								
Date:			**Measured by**	**Specification**	**Standard**	**:**	**:**	**:**
Steam	Steam control valve or steam drain control valve position	%	Control panel					
	Steam primary pressure	PSIG	Pressure gauge		≤ 116PSI			
	Steam secondary pressure	PSIG	Pressure gauge					
	Steam temperature	°F	Thermometer		≤347°F			
	Drain outlet (back) pressure	PSIG	Pressure gauge					
	Drain temperature	°F	Thermometer		≤ 203°F			
	Steam consumption	ft3/h	Flow meter					
Chilled Water	Inlet temperature	°F	Control panel					
	Outlet temperature	°F	Control panel					
	Inlet pressure	PSIG	Pressure gauge					
	Outlet pressure	PSIG	Pressure gauge					
	[3] Pressure drop	PSIG	DPM or calculation	[4]				
	[1] Flow rate	ft3/h	FM or calculation	[2]				
Cooling Water	Inlet temperature	°F	Control panel		68~89.6 °F			
	Outlet temperature	°F	Control panel		68~99.5°F			
	Inlet pressure	PSIG	Pressure gauge					
	Outlet pressure	PSIG	Pressure gauge					
	[7] Pressure drop	PSIG	DPG or calculation	[8]				
	[5] Flow rate	ft^3/h	FM or calculation	[6]				
Absorption Cycle	Generator press. (Gauge)	PSIG	Compound gauge					
	Generator press. (Sensor)	mmHG.abs	Control panel					
	Generator temperature	°F	Control panel		<212°F			
	Generator conc.	%	Control panel					
	Absorber temperature	°F	Control panel					
	Refrigerant temperature	°F	Control panel					
	Refrigerant density for EX(S)L/EXW(S)L	$lb/inch^3$	Control panel					
	Absorber pressure for EX(S)L/EXW(S)L	mmHg.	Control panel					
	Absorber concentration for EX(S)L/EXW(S)L	%	Control panel					
Liquid Level	Generator	–	Level gauge			○	○	○
	Absorber	–	Level gauge		●	○	○	○
	Evaporator (Lower)	–	Level gauge		●	○	○	○
	Evaporator (Upper)	–	Level gauge			○	○	○

NOTES:
Operating hours hours
Number of purge times times
Fill out each specification pressure drop according to the factory inspection report (actual value).
If differential pressure gauge (DPG) is not available, calculate each pressure drop.
If flow meter (FM) is not available, calculate each flow rate as below.

$[1] = [2] \times \sqrt{[3]/[4]}$ $[5]=[6] \times \sqrt{[7]/[8]}$ $[9]=[10] \times \sqrt{[11]/[12]}$



JOHNSON CONTROLS

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TABLE 3 - PURGE AMOUNT MEASUREMENT DATA SHEET (1/1)

User:		
Model: YHAU -	**MFG.No.:**	**User's machine code:**
Measured Date:	Measured by:	

Purge Amount from Purge Line	Flame Reaction Test
Standard: 4.0 cc/min. or smaller	Reaction (Strong/Weak/None)
Amount of Gas (P) cc/min	

Purge Amount from Purge Tank					
Elapsed time		1 hour			
Consumed time for measurement (m)	min.				
Total gas amount (a)	cc				
Actual gas amount (b)	cc				

(b) = (a) - (P) x (m)

Purge Amount from Absorber									
Standard: 4.0 cc/min. or smaller									
Elapsed time (T)	min.	1	2	3	5	10	15	20	30
Total gas amount (A)	cc								
Increased gas amount (B)	cc								
Actual gas amount (C)	cc/min.								
(B) = (A) - previous(A) (C) = $\frac{(B) - (P) \times \{ (T) - \text{previous}(T) \}}{(T) - \text{previous}(T)}$									

Operation

YHAU-CW control center

The YHAU-CW control center, equipped as standard on each chiller, allows for efficiency, monitoring, data recording, chiller protection, and operating ease. The control center is factory-mounted, wired, and tested. It is used as a control system for LiBr absorption chillers.

The panel is configured with a color TFT display with buttons that are integrated into the display. A single button reveals a wide array of information on a large, full-color illustration of the appropriate component, making information is easier to interpret.

The LCD display allows for a graphic animated display of the chiller, its sub-systems and system parameters. In addition, you can view the historical operation of the chiller as well as the present operation. A status bar displays at all times on all screens. It contains the system status line and details line, the control source, access level, time and date.

The panel display is available in multiple languages. The language can be changed without having to turn off the chiller.

Data can be displayed in metric and imperial units plus keypad entry of set points to 0.1 increments.

Security access using passwords is provided to prevent unauthorized changes of set points. There are three levels of access. Each level has its own password. There are certain screens, displayed values, programmable set points, and manual controls not shown that are used for servicing the chiller.

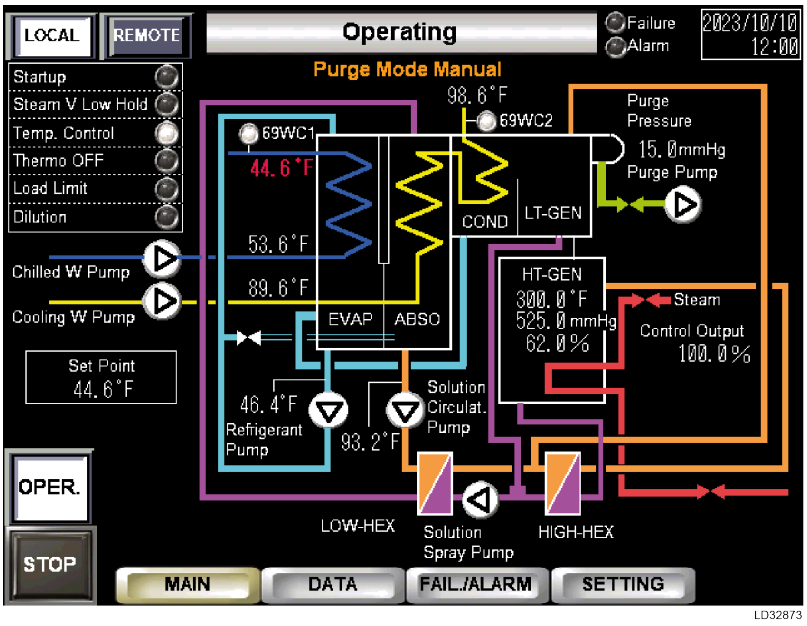
Common items

ⓘ **Note:** Buttons are listed in the order they are seen on the screen: left to right and top to bottom.

The control center screens have items that are applicable to each feature of the control center. This includes the following common items:

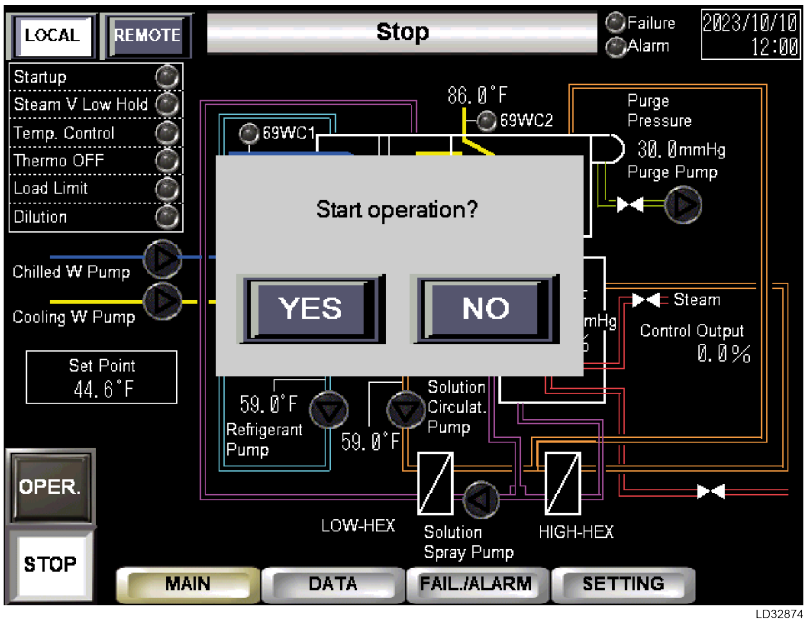
- **LOCAL** and **REMOTE:** Use these buttons to switch the operating location between remote and local. The setting can be changed while the chiller is operating. Press and hold the appropriate button for 2 seconds to make the change.
- **Operating status:** The display appears at the center top of the screen. It shows the following operating conditions: Stop, Operating, and Failure Activating.
- **Failure** and **alarm:** Warning lamps that light if the chiller has a failure or a warning alarm.
- **Date**and **time:** Shown on the upper right corner of each screen.
- **OPER.** and **STOP:** Buttons in the lower left corner to allow you to stop or start the chiller.

Figure 70: Control center



When you press the **OPER.** button while the chiller is stopped, or **STOP** while the chiller is operating, a confirmation message appears. Press **YES** or **NO** depending on whether you want to continue or cancel your selection.

Figure 71: Confirmation message



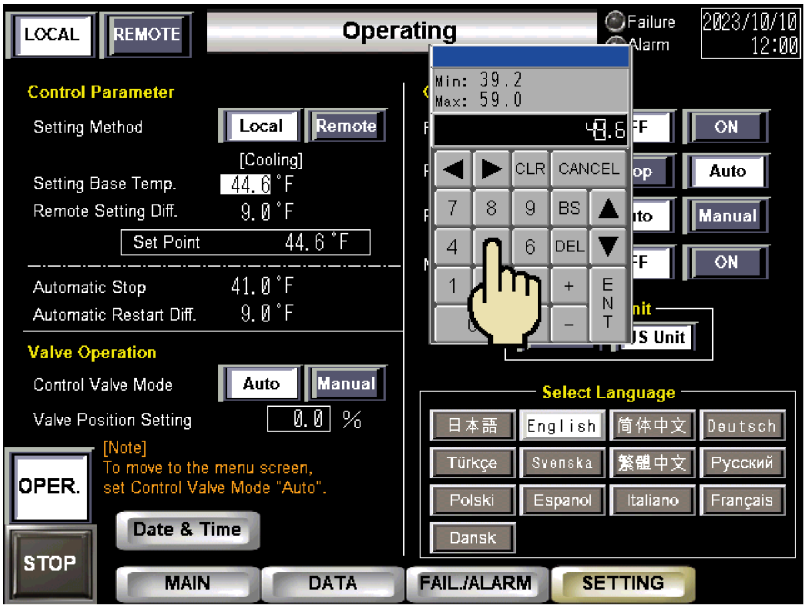
- **Screen name buttons:** Located along the bottom of the screen. These are used to change screens. The selected button lights when it is active.

Change numeric values

Many numeric values, such as the set point and the ranges on the trend screen, can be changed. Here's how:

1. Touch the number to be changed. A numeric keypad appears.

Figure 72: Numeric keypad

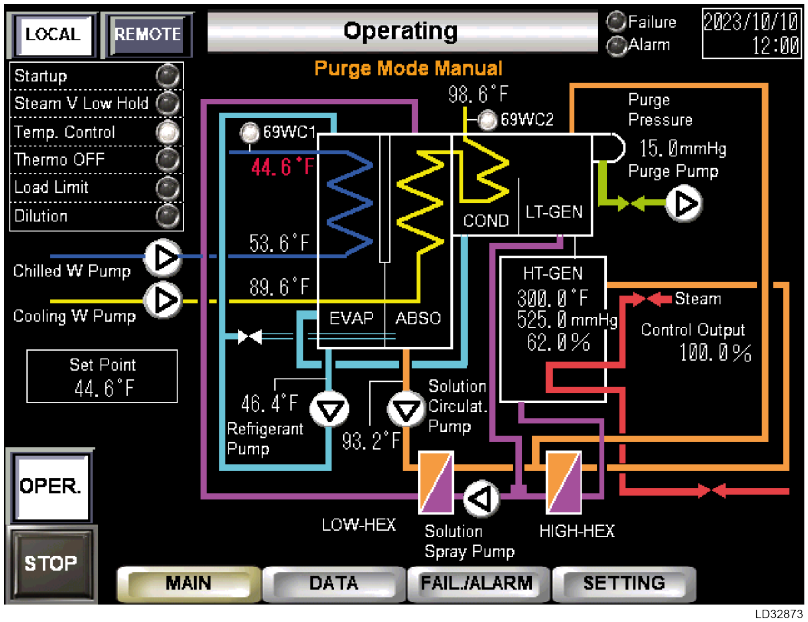


LD32875

2. Enter the new value on the keypad.
3. Press the **ENT** button to set it.

Main screen

Figure 73: Main screen for model EX(S) and EXW(S)



LD32873

The main screen displays the equipment status (chiller start or stop, operating, pumps ON or OFF, purge pump ON or OFF, and chilled, and cooling water pumps ON or OFF). Also, the operating status of the various modes of chiller operation.

Operating status

On the upper left of the screen below the **LOCAL** and **REMOTE** buttons is a list of options. Each has a lamp to indicate on or off for the following:

- **Startup:** Lights if the chiller is ready to start. Light is off if the chiller is stopping or if it is not ready to start.
- **Steam V Lo Hold:** The steam control valve or steam drain control valve low hold light is on if the steam control valve low hold is operating. The steam control valve stays in the low position before the automatic temperature control process runs.
- **Temp. Control:** Light is lit if the temperature control of the microcomputer panel changes to RUN status. Turns off if the chiller stops.
- **Thermo OFF:** Lights if the chilled water temperature falls to the automatic stop temperature. Turns off when the temperature rises enough to allow an automatic restart.
- **Load Limit:** Light is lit if the load restriction activates due to the cooling water temperature, refrigerant temperature, or HG temperature or pressure is higher than the set point. Light turns off when the load restriction is removed.
- **Dilution:** Light is lit during the dilution operation after the chiller stops. It turns off when the dilution operation is complete.
- **Chilled W Pump:** Indicates the status of the chilled water pump.
- **Cooling W Pump:** Indicates the status of the cooling water pump.

Set Point: The set point of chilled water leaving temperature is shown on the left of the screen.

The system illustration lights (lines fill in) when the system is operating.

An illustration of the system shows the following information:

- steam control valve or steam drain control valve output
- chilled water entering and leaving temperature
- cooling water entering and leaving temperature
- refrigerant temperature
- absorber temperature
- high temperature generator pressure
- high temperature generator temperature
- high temperature generator concentration
- purge tank pressure

This screen shows the status of the equipment in the chiller process diagram.

Items in the chiller process diagram are:

Icon	Name	Description
	Pump	• Solution Circulating Pump, Solution Spray Pump, Refrigerant Pump, Purge Pump, Chilled Water pump, Cooling Water pump. • Flickers white during operation. Remains black when the pump is stopped.
	69WC1 or 69WC2 (option)	• Differential pressure switch of chilled water (69WC1) and cooling water (69WC2). • White when water is flowing. Turns black when the water is stopped.
	Valve	• Steam control valve or steam drain control valve, steam drain solenoid valve, refrigerant blow valve, purge tank valve. • White indicates valve is shut off. Any other color indicates the valve is open.

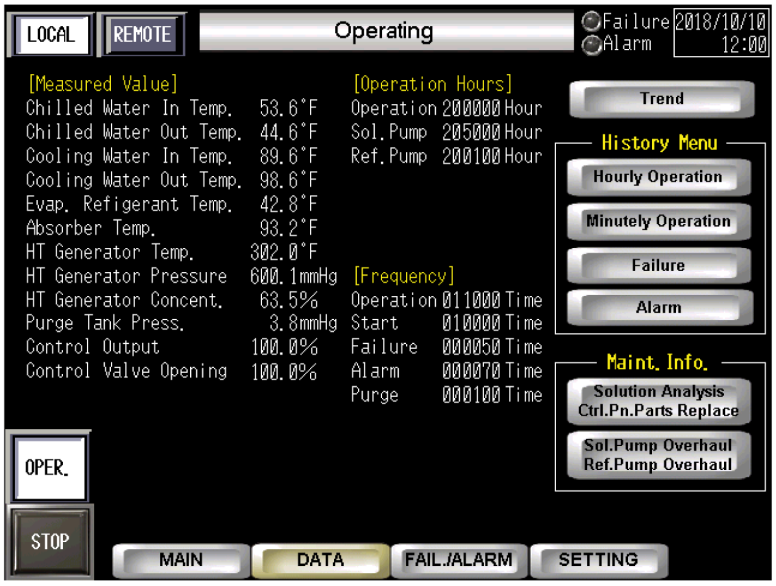
The condition lights show the current operating mode and status of the system.

The four buttons along the bottom of the main screen are common to many of the other screens in the control panel. They can all be used to move around and access other screen information. Their functions are the following:

- **MAIN:** return to the initial screen
- **DATA:** move to the Data screen
- **FAIL** or **ALARM:** move to the Failure and Alarm screen
- **SETTING:** move to the Setting screen

Data screen

Figure 74: Data screen for model EX(S) and EXW(S)



LD20044_UL

LD20044

The Data Screen displays values showing temperatures, operating hours, operating frequency, data trends and a history of failures, alarms, and time based temperature trends.

In the Measured Value section of the Data screen the following display:

Chilled Water In Temp.: temperature of the chilled water measured as it enters the evaporator

Chilled Water Out Temp.: temperature of the chilled water measured as it leaves the evaporator

Cooling Water In Temp.: temperature of the cooling water measured as it enters the absorber

Cooling Water Out Temp.: temperature of the cooling water measured as it leaves the condenser

Evap. Refrigerant Temp.: temperature of the refrigerant in the evaporator

Absorber Temp.: temperature of the diluted solution in the absorber

HT Generator Temp.: temperature of the concentrated solution in the high temperature generator

HT Generator Pressure: pressure in the high temperature generator

HT Generator Concent.: concentration of the concentrated solution in the high temperature generator

Purge Tank Press.: pressure in the purge tank Control Output is shown as a percentage.

Control Output is shown as a percentage.

The Operation Hours section shows the following:

- **Operation:** displays how long the chiller has been running.
- **Sol. Pump:** displays how long the solution pump has been running.
- **Ref. Pump:** displays how long the refrigerant pump has been running.

The frequency of failures, alarms, and purges is shown in the Frequency section:

- **Operation:** displays how many times the chiller has started using the **OPER.** button or the remote start signal
- **Start:** displays how many times the heat source (steam) input has started.
- **Failure:** displays how many times the system has experienced a failure.
- **Alarm:** displays how many times an alarm has been activated.
- **Purge:** displays how many times the purge system has started automatically.

To move to the Trend screen, press the **Trend** button at the upper right of the screen.

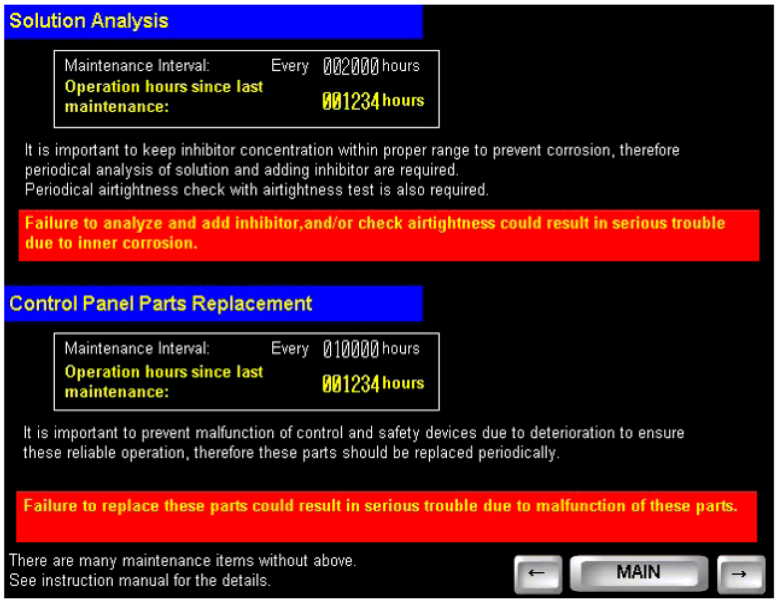
The History Menu section on the right side of the screen gives you access to the Operation History, Alarm History and to the Failure History screens. It contains four buttons:

- **Hourly Operation:** move to the Hourly Operation History screen
- **Minutely Operation:** move to the Minutely Operation History screen
- **Failure:** move to the Failure History screen
- **Alarm:** move to the Alarm History screen

The Maintenance Information section on the right side of the screen gives you access to the detailed maintenance information. If the maintenance interval has passed, the color of the button lettering changes to red. It contains two buttons:

- **Solution Analysis and Control Panel Parts Replace:** move to the Solution Analysis and Control Panel Parts Replacement screen
- **Solution Pump Overhaul and Refrigerant Pump Overhaul:** move to the Solution Pump Overhaul and Refrigerant Pump Overhaul screen

Figure 75: Solution analysis and control panel parts replacement screen



LD21347

The Solution Analysis section of the screen shows the maintenance interval and current operation hours since the last inhibitor solution maintenance.

Keep the inhibitor concentration within the proper range to prevent corrosion. Periodic analysis of the solution and addition of inhibitor is required.

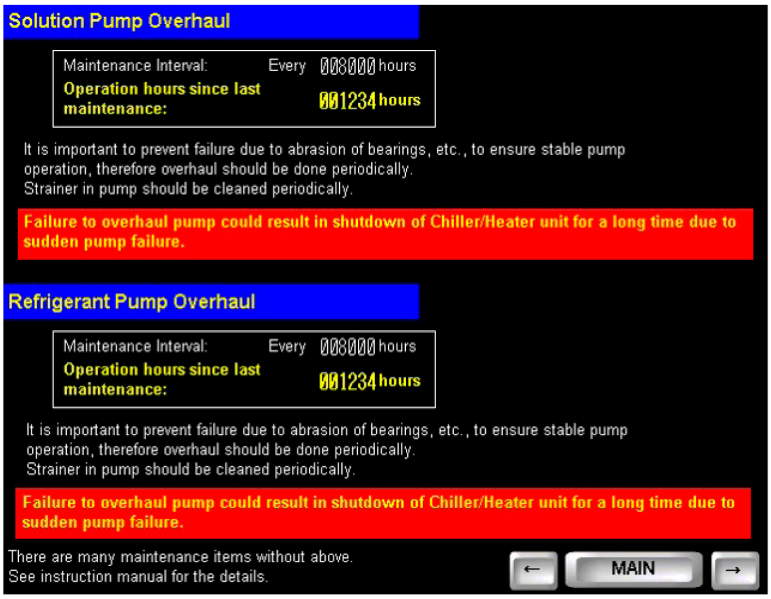
When maintenance is overdue, the maintenance alarm is activated with the warning `Solution analysis should be done`. When the warning appears, contact your local Johnson Controls service center.

The Control Panel Parts Replacement section of the screen shows the maintenance interval and current operation hours since the last control panel maintenance.

Periodic maintenance prevents malfunctions of the control panel. It also helps keep safety devices from deteriorating.

When maintenance is overdue, the maintenance alarm is activated with the warning `Control panel parts should be replaced`. When the warning appears, contact your local Johnson Controls service center.

Figure 76: Solution pump overhaul and refrigerant pump overhaul screen



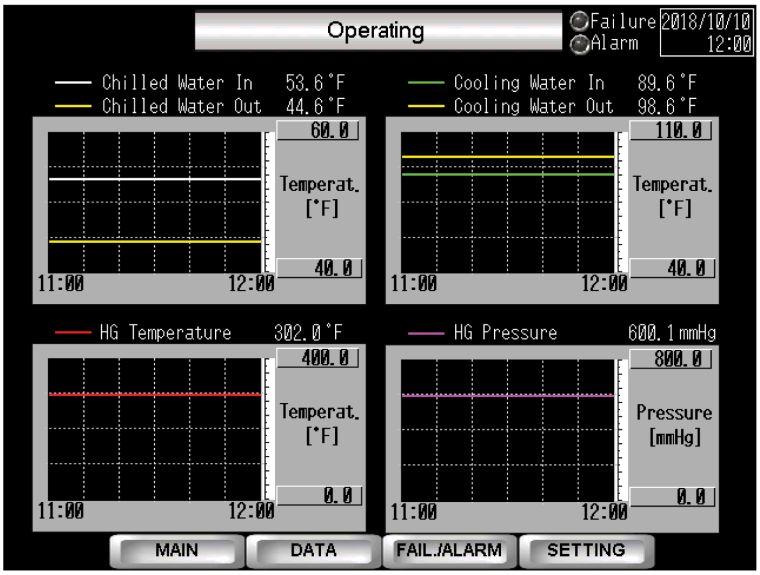
LD21554

The Solution Pump Overhaul section of the screen and the Refrigerant Pump Overhaul section of the screen both indicate the maintenance interval and the current operation hours since the last maintenance.

When the required maintenance period has passed, the maintenance alarm is activated with the warning, `Solution Pump should be overhauled` or `Refrigerant Pump should be overhauled`. When the maintenance period has passed and the warning appears, contact your local Johnson Controls service center.

Trend screen

Figure 77: Trend screen



LD20045_UL

To view the Trend Screen, press the **Trend** button above the History Menu section on the Data screen.

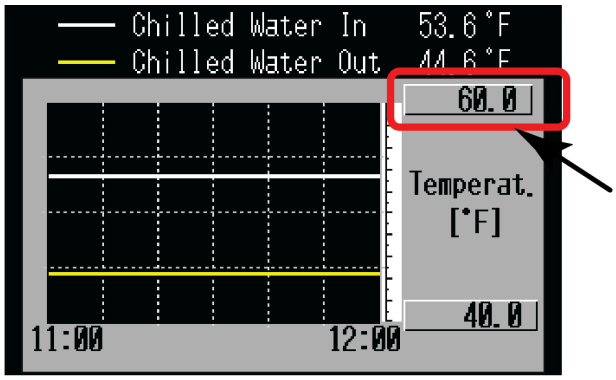
This screen graphically illustrates the trend of the temperature and the pressure for the following:

- **Chilled Water In:** temperature of the chilled water measured as it enters the evaporator
- **Chilled Water Out:** temperature of the chilled water measured as it leaves the evaporator
- **Cooling Water In:** temperature of the cooling water as it enters the absorber
- **Cooling Water Out:** temperature of the cooling water as it leaves the condenser
- **HG Temperature:** temperature of the concentrated solution in the high temperature generator
- **HG Pressure:** pressure in the high temperature generator

The graphs are updated constantly regardless of the operating status of the chiller.

The display ranges in the Trend screen can be changed.

Figure 78: Trend screen graph



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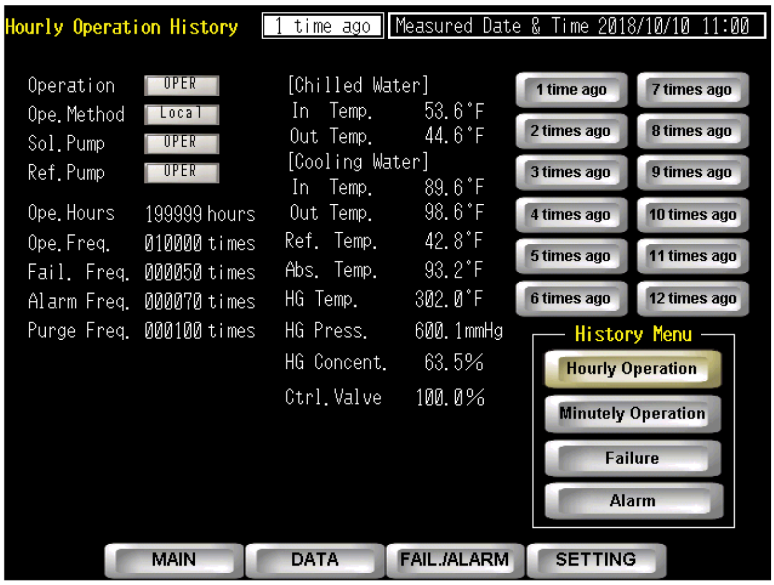
Use the numeric keypad to make the changes. For more information on the procedure, see Change numeric values.

To move to another screen, press the any of the available buttons along the bottom of the screen.

Hourly operation history screen

Figure 79: Hourly operation history screen by hours



To view the Hourly Operation History screen, press the **Hourly Operation** button in the History Menu screen section of the Data screen.

The Hourly Operation History screen shows operational information for the last 12 hours and contains the following fields of information:

The heading of the screen includes the X time ago and the Measured Date and Time. Buttons are available to select measurements for up to 12 times ago, to cover the 12 hour period.

The following information displays:

Operation: operation status of the chiller.

Ope. Method: selected operation method (local or remote).

Sol. Pump: operation status of the solution pump.

Ref. Pump: operation status of the refrigerant pump.

Ope. Hours: how many hours the chiller has been operating.

Ope. Freq.: how many times the chiller has started using the **OPER.** button or the remote start signal.

Fail. Freq.: how many times the chiller has had a failure alarm.

Alarm Freq.: how many times an alarm has been triggered for the chiller.

Purge Freq.: how many times a purge has been performed automatically.

The Chilled water section of the screen shows you the following information:

In Temp.: temperature of the chilled water measured as it enters the evaporator.

Out Temp.: temperature of the chilled water measured as it leaves the evaporator.

The Cooling Water section shows you:

In Temp: temperature of the cooling water measured as it enters the absorber.

Out Temp.: temperature of the cooling water measured as it leaves the condenser.

Ref. Temp.: temperature of the refrigerant in the evaporator.

Abs. Temp.: temperature of the diluted solution in the absorber.

HG Temp.: temperature of the concentrated solution in the high-temperature generator.

HG Press.: pressure in the high-temperature generator

HG Concent.: concentration of the concentrated solution in the high-temperature generator.

Ctrl Valve: percentage that the valve is open.

There are two sets of buttons on the right side of the screen. The first set gives you access to information about past occurrences. For instance, if you press the **3 times ago** button, the settings display as they appeared 3 hours ago.

The buttons in the History Menu section allow you to move between the history screens:

Hourly Operation: Press this button to access the Hourly Operation History screen.

Minutely Operation: Press to view the Minutely Operation History screen.

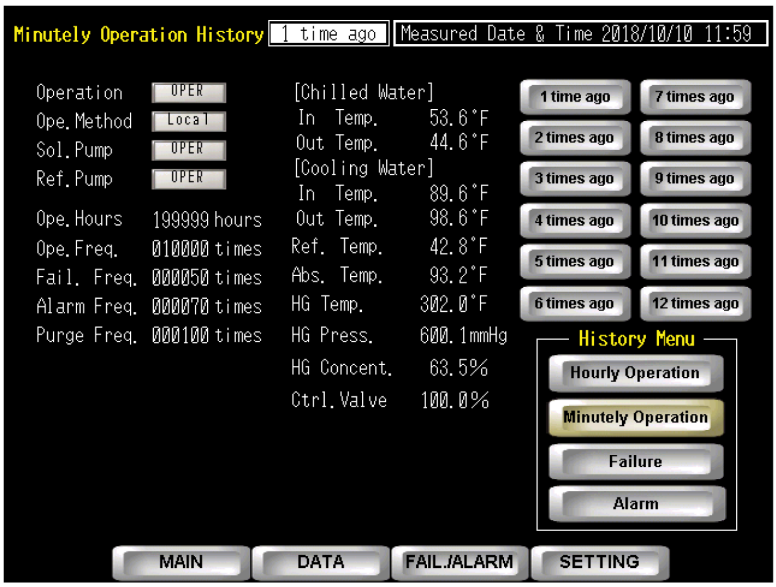
Failure: Press this button to see the Failure History screen.

Alarm: Press to see the Alarm History screen.

To move to another screen, press the any of the available buttons along the bottom of the screen.

Minutely operation history screen

Figure 80: Operation history screen by minutes



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To view the Minutely Operation History screen, press the **Minutely Operation** button in the History Menu section of the Data screen.

The Minutely Operation History screen shows operational information for the last 12 minutes and contains the following fields of information:

Operation: operation status of the chiller.

Ope. Method: selected operation method.

Sol. Pump: operation status of the solution pump.

Ref. Pump: operation status of the refrigerant pump.

Ope. Hours: how many hours the chiller has been running.

Ope. Freq.: how many times the chiller has started using the **OPER.** button or the remote start signal.

Fail. Freq.: how many times the chiller has had a failure alarm.

Alarm Freq.: how many times an alarm has been triggered for the chiller.

Purge Freq.: how many times a purge has been performed automatically.

The Chilled water section of the screen shows you the following information:

In Temp.: temperature of the chilled water measured as it enters the evaporator.

Out Temp.: temperature of the chilled water measured as it leaves the evaporator.

The Cooling Water section shows you:

In Temp.: temperature of the cooling water measured as it enters the absorber.

Out Temp.: temperature of the cooling water measured as it leaves the condenser.

Ref. Temp.: temperature of the refrigerant in the evaporator.

Abs. Temp.: temperature of the diluted solution in the absorber.

HG Temp.: temperature of the concentrated solution in the high temperature generator.

HG Press.: pressure in the high temperature generator.

HG Concent.: concentration of the concentrated solution in the high temperature generator.

Ctrl Valve: percentage that the valve is open

There are two sets of buttons on the right side of the screen. The first set gives you access to information about past occurrences. For instance, if you press the **3 times ago** button, you will see the settings as they appeared 3 minutes ago.

The buttons in the History Menu section allow you to move between the screens:

Hourly Operation: Press this button to access the Hourly Operation History screen.

Minutely Operation: Press to view the Minutely Operation History screen.

Failure: Press this button to see the Failure History screen.

Alarm: Press to see the Alarm History screen.

To move to another screen, press the any of the available buttons along the bottom of the screen.

Failure history screen

Figure 81: Failure history screen

You move to the Failure History screen after you press the **Failure** button in the History Menu screen section.

The Failure History screen shows failure information for the last failure and up to six previous failures. The Failure section contains the following fields of information:

Failure Name: name or type of failure.

Measured Date and Time: date and time of the failur.e

Operation: operation status of the chiller.

Ope. Method: selected operation method.

Sol. Pump: operation status of the solution pump.

Ref. Pump: operation status of the refrigerant pump.

Ope. Hours: total operation hours.

Ope. Freq.: how many times the chiller has started using the **OPER.** button or the remote start signal.

Fail. Freq.: how many times the chiller has had a failure alarm.

Alarm Freq.: how many times an alarm has been triggered for the chiller.

Purge Freq.: how many times a purge has been performed automatically.

The Chilled water section of the screen shows you the following information:

In Temp.: temperature of the chilled water measured as it enters the evaporator.

Out Temp.: temperature of the chilled water measured as it leaves the evaporator.

The Cooling Water section shows you:

In Temp.: temperature of the cooling water measured as it enters the absorber.

Out Temp.: temperature of the cooling water measured as it leaves the condenser.

Ref. Temp.: temperature of the refrigerant in the evaporator.

Abs. Temp.: temperature of the diluted solution in the absorber.

HG Temp.: temperature of the concentrated solution in the high temperature generator.

HG Press.: pressure in the high temperature generator.

HG Concent.: concentration of the concentrated solution in the high temperature generator.

Ctrl. Valve: percentage that the valve is open.

There are two sets of buttons on the right side of the screen. The first set gives you access to information about past occurrences. For instance, if you press the **3 times ago** button, you will see the settings as they appeared 3 events ago. You can see up to 6 past events.

The buttons in the History Menu section allow you to move between the various screens:

Hourly Operation: Press this button to access the Hourly Operation History screen.

Minutely Operation: Press to view the Minutely Operation History screen.

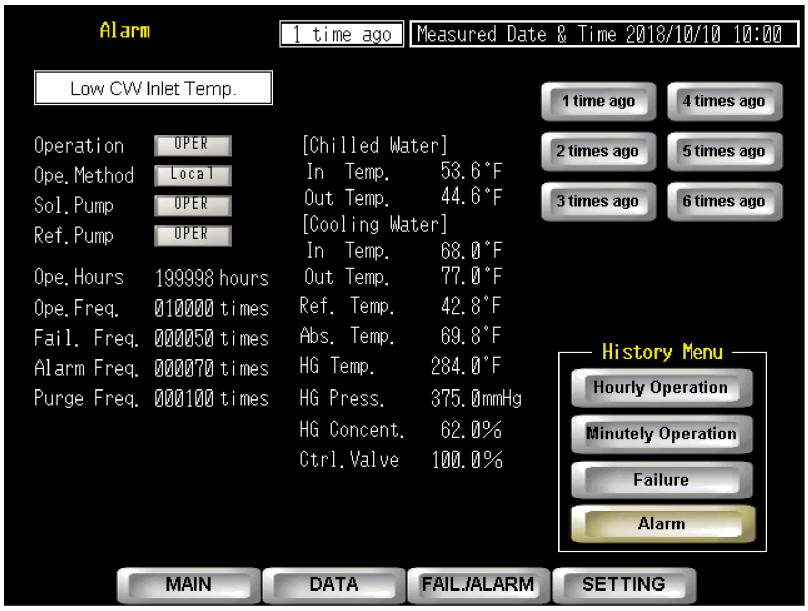
Failure: Press this button to see the Failure History screen.

Alarm: Press to see the Alarm History screen.

To move to another screen, press the any of the available buttons along the bottom of the screen

Alarm history screen

Figure 82: Alarm history screen



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View the Alarm History screen after you press the **Alarm** button in the History Menu section of the screen.

The Alarm History screen shows alarm information for the last alarm and up to six previous alarms. The alarm section contains the following fields of information:

Alarm Name: name or type of alarm.

Measured Date and Time: date and time of the alarm.

Operation: operation status of the chiller.

Ope. Method: selected operation method.

Sol. Pump: operation status of the solution pump.

Ref. Pump: operation status of the refrigerant pump.

Ope. Hours: total operation hours.

Ope. Freq.: how many times the chiller has started using the **OPER.** button or the remote start signal.

Fail. Freq.: how many times the chiller has had a failure alarm.

Alarm Freq.: how many times an alarm has been triggered for the chiller.

Purge Freq.: how many times a purge has been performed automatically.

The Chilled Water section of the screen shows you the following information:

In Temp.: temperature of the chilled water measured as it enters the evaporator.

Out Temp.: temperature of the chilled water measured as it leaves the evaporator.

The Cooling Water section shows you:

In Temp.: temperature of the cooling water measured as it enters the absorber.

Out Temp.: temperature of the cooling water measured as it leaves the condenser.

Ref. Temp.: temperature of the refrigerant in the evaporator.

Abs. Temp.: temperature of the diluted solution in the absorber.

HG Temp.: temperature of the concentrated solution in the high temperature generator.

HG Press.: pressure in the high temperature generator.

HG Concent.: concentration of the concentrated solution in the high temperature generator.

Ctrl. Valve: percentage that the valve is open.

There are two sets of buttons on the right side of the screen. The first set gives you access to information about past occurrences. For instance, if you press the **3 times ago** button, you will see the settings as they appeared 3 events ago. You can see up to 6 past events.

The buttons in the History Menu section allow you to move between the various screens:

Hourly Operation: Press this button to access the Hourly Operation History screen.

Minutely Operation: Press to view the Minutely Operation History screen.

Failure: Press this button to see the Failure History screen.

Alarm: Press to see the Alarm History screen.

To move to another screen, press the any of the available buttons along the bottom of the screen.

Failure and alarm screen

Figure 83: Failure and alarm screen for model EX(S) and EXW(S)

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This screen displays failure indications (time-outs, operation interlock, overcooled refrigerant, over and under temperatures, and problems with the chiller's pumps) and system alarms.

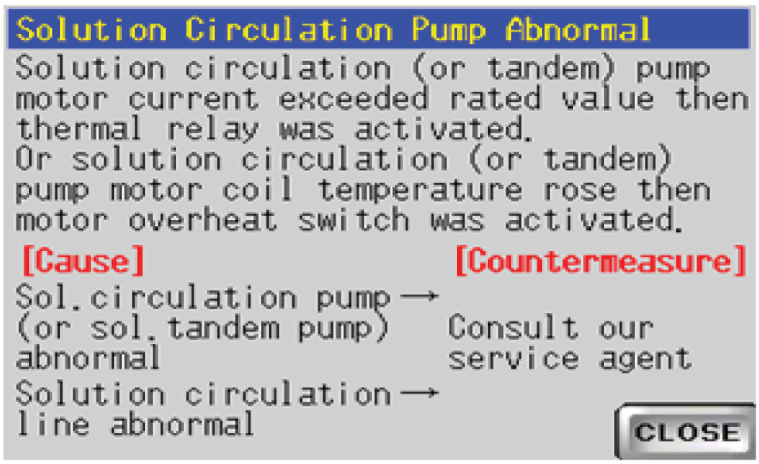
The failure light in the upper right corner is red. The alarm light is orange.

Failure

When a failure occurs, an alarm sounds (buzzer). The type of failure button lights in the Failure section of the screen. Press the **BUZZER STOP** button to turn off the alarm sound. This can be done even before the failure is addressed. Turning off the buzzer does not fix the problem.

Press the lit failure button to access an on-screen handling guide for each item. An on-screen guide is available for each item in the Failure and the Alarm sections. See the following example.

Figure 84: Solution Circulation Pump Abnormal



Press the **CLOSE** button to return to the Failure and Alarm screen.

After fixing the problem, press the **FAILURE RESET** button to reset the lighted failure button.

If you press the **FAILURE RESET** button before fixing the problem, the lighted failure button will not go out, and the buzzer will sound again.

The failures addressed in Failure section of this screen are:

Table 34: Failure list

Button label (failure name)	Operation at failure occurrence	Cause	Counter measures
Chilled W. Time Out (Chilled Water Time Out)	Not start	Chilled water pump operation interlock or chilled water suspension relay was not established within a set time while start-up.	• Check the chilled water pump. • Check the chilled water line. • Check the chilled water flow. • Check the chilled water suspension relay. • Check whether or not the pipe is clogged.
Cooling W. Time Out (Cooling Water Time Out)		Cooling water pump operation interlock was not established within a set time while start-up.	
Operation Interlock	Stop after dilution	Operation interlock was not established during solution pump automatic operation.	Check interlocked equipment.
CW Pump Interlock (Cooling Water Pump Interlock)		Cooling water pump interlock was not established during cooling water pump operation command output.	Check the cooling water pump interlock.
Monitor Interlock (Constant Monitoring Interlock)		Constant monitoring interlock was not established.	• Check the components of the constant monitoring interlock. • If any of the components are not working, contact your local Johnson Controls Service Center.
Chilled W. Suspension (Chilled Water Suspension)	Stop without dilution	Chilled water flow was not detected continuously during solution pump automatic operation.	• Check the chilled water pump. • Check the chilled water line. • Check the chilled water flow. • Check the chilled water suspension relay. • Check whether or not the pipe is clogged.
Chilled W. Overcooled (Chilled Water Overcooled)		Chilled water outlet temperature was abnormally low during cooling operation.	• Check equipment in cooling load line. • Check the chilled water flow. • Check the chilled water flow control system. • Contact your local Johnson Controls Service Center.
Refrigerant Overcooled		Low refrigerant temperature during cooling operation, and then refrigerant overcool relay was activated.	• Check the chilled water line. • Check the chilled water flow. • Contact your local Johnson Controls Service Center.
Low Cool. W. Inlet Temp. (Low Cooling Water Inlet Temperature)	Stop after dilution	Cooling water inlet temperature had been kept at its lower limit or lower for 30 minutes or longer during cooling operation.	Check the cooling water inlet temperature control system.
Low Refrig. Concentration (Low Refrigerant Concentrtion) (Model EX(S)L/EXW(S)L Only)	Stop after dilution	Evaporator refrigerant concentration fell abnormally.	• Check the cooling water line. • Check the cooling water flow rate. • Check the cooling tower. • Purge manually (according to instructions shown in Maintenance • Contact your local Johnson Controls Service Center.

Table 34: Failure list

Button label (failure name)	Operation at failure occurrence	Cause	Counter measures
HG High Temperature	Stop after dilution	HG solution temperature rose abnormally.	• Check the cooling water line. • Check the cooling water flow rate. • Check the cooling tower. • Purge manually (according to instructions in Maintenance.
HG High Pressure		HG pressure rose abnormally.	
High Cut		HG high pressure relay was activated.	
Sol. Circu. P. Abnormal (Solution Circulation Pump Abnormal)	Stop without dilution	Solution circulation pump thermal relay, or overheat switch was activated.	Contact your local Johnson Controls Service Center.
Sol. Spray P. Abnormal (Solution Spray Pump Abnormal)		Solution spray pump thermal relay, or overheat switch was activated.	
Refrigerant P. Abnormal (Refrigerant Pump Abnormal)		Refrigerant pump thermal relay, or overheat switch was activated.	
Control Sensor Abnormal	Stop after dilution	Temperature sensor or pressure sensor detected abnormal value due to disconnection, short circuit, or other applicable sensors.	• Tighten terminal in control panel. • Contact your local Johnson Controls Service Center.
CPU Abnormal		CPU was judged to be abnormal.	Contact your local Johnson Controls Service Center.
SP Invert. Abnormal (Solution Pump Inverter Abnormal)	Stop without dilution	The protection function of the solution pump inverter activated. Then, the inverter output stopped.	• Check the alarm code of the inverter. • Contact your local Johnson Controls Service Center.

Alarm

When an alarm occurs, the type of alarm lights up in the Alarm section of the screen. See Figure . There is no buzzer.

Press the lit alarm button to access an on-screen handling guide for each item. An on-screen guide is available for every item in the Alarm section.

After fixing the alarm, press the **ALARM RESET** button to reset the lighted alarm button. If you press the **ALARM RESET** button before fixing the problem, the lit alarm button does not go out.

The alarms addressed in the Alarm section of the screen are:

Table 35: Alarm list

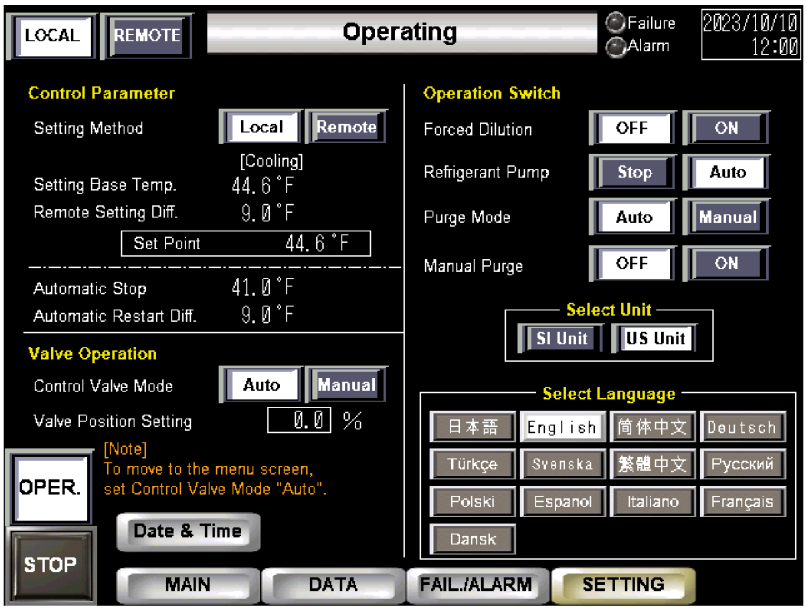
Button label (alarm name)	Cause of alarm and condition to reset	Counter measures
Abnormal Purge Freq. (Abnormal Purge Frequency)	• Purge frequency within a set time exceeded its defined value. Chiller is suspected of poor air-tightness, or other air leakages. • Press the **ALARM RESET** button to clear the alarm.	• Purge manually according to instructions in Maintenance. • Contact your local Johnson Controls Service Center.
Purge Abnormal (Purge System Abnormal)	• Purge switch was not turned OFF while automatic purge operation. • Press the **ALARM RESET** button to clear the alarm.	
Ch. W. Overcool Prevent. (Chilled Water Overcool Prevention Control)	Low chilled water outlet temperature during dilution operation. The dilution operation was interrupted (cooling water pump, solution pump, and refrigerant pump operations were suspended). The dilution operation resumes if the chilled water outlet temperature rises.	• Check the equipment in cooling load line. • Check the chilled water flow. • Check the chilled water flow control system.
Refrig. Overcool Prevent. (Refrigerant Overcool Prevention Control)	Low refrigerant temperature during dilution operation. The dilution operation was interrupted (cooling water pump, solution pump, and refrigerant pump operations were suspended). The dilution operation resumes if refrigerant temperature rises.	
HG Hi Press. Prevention (HG High Pressure Prevention Control)	HG pressure rose and the load limit operation was activated. The alarm resets if the HG pressure falls.	• Check the cooling water line. • Check the cooling water flow rate. • Check the cooling tower. • Purge manually according to instructions in Maintenance. • Contact your local Johnson Controls Service Center.
HG Hi Temp. Prevention (HG High Temperature Prevention Control)	High generator solution temperature and load limit operation was activated. The alarm resets if the HG temperature falls.	
Cooling W. Tube Fouling (Cooling Water Tube Fouling)	• Temperature difference between the absorber temperature and cooling water inlet temperature widened. Fouling of cooling water tube inside is likely to be accumulated. • Press the **ALARM RESET** button to clear the alarm.	• Check the cooling water line. • Check the cooling water flow.
Refrigerant Pump Stop (Refrigerant Pump Stop Time Out)	The Refrigerant Pump **Stop** button was pressed. The refrigerant pump has been off for 1 hour or more..	Press the Refrigerant Pump **Auto** button.
Low Cool W. Inlet Temp. (Low Cooling Water Inlet Temperature)	Cooling water inlet temperature fell down to its lower limit or lower during cooling operation, and then load limit operation was activated. The alarm resets if the cooling water inlet temperature rises.	Check the cooling water inlet temperature control system.
High Cool. W. Inlet Temp (High Cooling Water Inlet Temperature)	Cooling water inlet temperature rose to or above it's upper limit or higher during cooling operation, and the load limit operation was activated. The alarm resets if the cooling water inlet temperature falls.	• Check the cooling water inlet temperature control system. • Check the cooling tower.
HG Hi Conce. Prevent. (HG High Concentration Prevention Control)	High solution concentration and load limit operation was activated. The alarm resets after 600 seconds.	• Check the cooling water line. • Check the cooling water flow rate. • Check the cooling tower. • Purge manually (according to instructions in Maintenance). • Contact your local Johnson Controls Service Center.

Table 35: Alarm list

Button label (alarm name)	Cause of alarm and condition to reset	Counter measures
Recording Sensor Abnormal	• Chilled water inlet temperature sensor, cooling water inlet temperature sensor, or absorber temperature sensor detected abnormal value, due to disconnection, short circuit, or other abnormal sensor readings. Remote setting signal was abnormal during remote SP mode (remote chilled water outlet temperature setting mode) • Press the **ALARM RESET** button to clear the alarm.	• Check the remote setting signal. • Tighten the terminal. • Contact your local Johnson Controls Service Center.
Low Battery Voltage	• Voltage level of the battery in the control board fell down. • Press the **ALARM RESET** button to clear the alarm after you replace the battery in the control board.	Replace the battery on the PWB.
ELB Trip (Earth Leakage Breaker Trip)	The Earth leakage breaker for the surge arrester activated.	Contact your local Johnson Controls Service Center.
Low Refrig. Conc. Prevent. (Low Refrigerant Concentration Prevention Control) (Model EX(S)L/ EXW(2)(S)L Only)	The evaporator refrigerant concentration fell abnormally during operation. The alarm resets when the evaporator refrigerant concentration rises.	• Check the cooling water line. • Check the cooling water flow rate. • Check the cooling tower. • Purge manually according to instructions shown in Maintenance. • Contact your local Johnson Controls Service Center.
ABSO Hi Conce. Prevent. Absorber High Concentration Prevention Control) Model EX(S)L/ EXW(S)L Only)	The absorber solution concentration rose and load limit prevention was activated. The alarm resets when the concentration has been lower than defined value for determined period.	• Check the cooling water line. • Check the cooling water flow rate. • Check the cooling tower. • Purge manually according to instructions shown in Maintenance. • Contact your local Johnson Controls Service Center.

Setting screen

Figure 85: Setting screen



This screen displays control parameters (setting method and each setting parameter), valve operation (control valve mode auto / manual and valve position setting), operation switch (forced dilution, refrigerant pump, purge mode, and manual purge), language (Japanese, English, German, Chinese, and Deutsche) and date and time parameters.

Press the **SETTING** button to access this screen.

Control parameter

The Control Parameter section of the Setting screen is used to enter parameters for the cooling operation, such as target temperature, automatic stop temperature, and differential to automatic restart.

Setting Method: The **LOCAL** and **REMOTE** buttons control whether the set point is being set using the Control Panel or from a remote location. The button that is lit indicates if the set point is being set using the Control Panel or from a remote location

Setting Base Temp.: the base temperature for calculating the set point

Remote Set. Diff.: the setting range with external 4-20 mADC signal

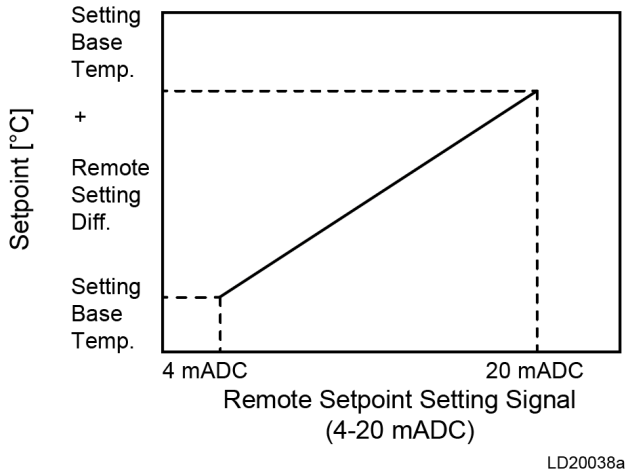
Set Point (Display): the set point of the chilled water leaving temperature

Automatic Stop: the temperature at which the chiller will automatically stop

Auto. Restart Diff.: temperature difference between the temperature at which the chiller will automatically stop and the temperature at which the chiller will automatically restart.

If you press the **LOCAL** button, the entered base temperature corresponds to the present target temperature. This temperature is shown in the Set Point field.

Figure 86: Setpoint field



If you press the **REMOTE** button, the setting characteristics of the remote set point are determined based on the setting base temperature and the remote setting differential. The actual target temperature is calculated depending on these settings and the remote Set Point setting signal (4-20 mADC).

This calculated temperature is shown in Set Point as the present target temperature. If remote set point setting signal (4-20 mADC) is out of its range when you press the **REMOTE** button, the **Recording Sensor Abnormal Alarm** button lights. The target temperature changes to the Local setting.

If a failure occurs, you automatically see the Failure Alarm screen.

For detailed information on how to change an entry in one of these fields, see Change numeric values.

Valve operation

Control valve mode: The **Auto** and **Manual** buttons indicate whether the control valve is being operated automatically or manually. To change to manual operation mode, press and hold the **Manual** button for 3 seconds.

ⓘ **Note:** The Valve Position Setting can only be changed when the Control Valve Mode Manual button is pushed.

Valve position setting: Shows the Steam Control Valve or Steam Drain Control Valve Position Setting, expressed as a percentage.

For detailed information on how to change the valve position settings, see Change numeric values.

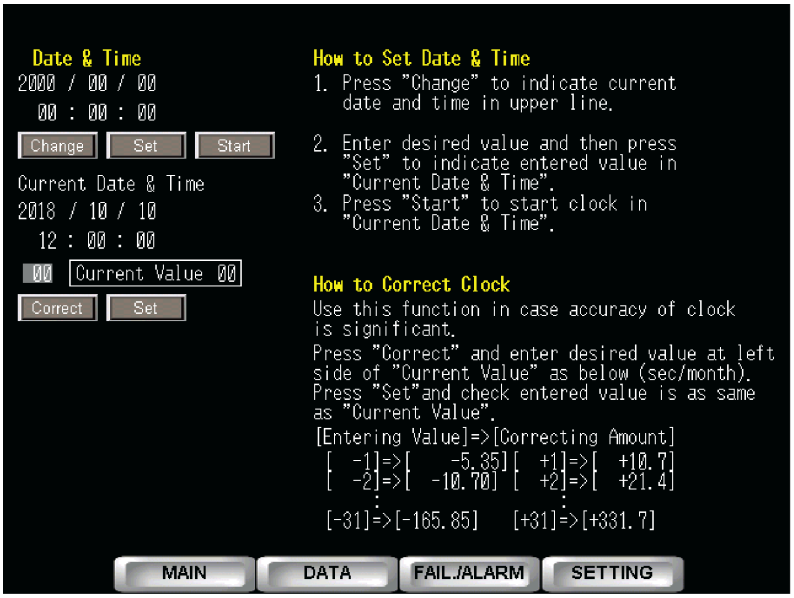
ⓘ **Note:** To move to the Menu screen, press the Control Valve Mode Auto button.

Date and time

To set the date and time, press the **Date and Time** button above the **MAIN** button. The Date and Time screen displays. Use the following procedure:

Note: The date information format to use is: YYYY / MM / DD.

Figure 87: Set date and time



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1. Press the **Change** button.
2. Enter the correct date and time.
3. Press the **Set** button to set the time.
4. Press the **Start** button to restart the clock.

If the clock is not keeping the correct time, complete the following steps to fix it:

1. Press the **Correct** button to specify a correcting amount (+ or -).
2. Press the **Set** button to update the time.

Operation switch

In this screen section, choices can be made about the mode of operation for the various devices. Use the buttons to make your choice. These can be changed at any time. The choices are:

- **Forced Dilution:** indicates whether forced dilution is ON or OFF.
- **Refrigerant Pump:** indicates whether the refrigerant pump is operating automatically (Auto mode) or is stopped (Stop mode)
- **Purge Mode:** The **Auto** and **Manual** buttons control the purge operation. The lit button indicates if the purge mode is Automatic or Manual.
- **Manual Purge:** The **ON** and **OFF** buttons control the manual purge operation. The lit button tells you if the manual purge operation is running or not. If you press the Purge Mode **Auto** button, the purge is done automatically. If you press the Purge Mode **Manual** button, the purge starts when you press the Manual Purge **ON** button. The purge stops when you press the Manual Purge **OFF** button.

Select unit

SI unit: To select the metric unit display.

US unit: To select the imperial unit display.

Select language

Press the button to choose the language to display the language you want to use in the Control Center. Multiple languages are available.

Maintenance

When inspecting and maintaining the absorption chiller, observe the following items:

- Never splash water over the electrical parts installed to the control panel and absorption chiller.
- Do not change the set values of the control devices and safety switches without permission.
- Do not turn the internal cycle control valve of the absorption chiller without permission.
- When replacing the oil in the vacuum pump, be sure to turn OFF the main circuit breaker (MCCB) in the control panel.

Valve inspection

The chiller is equipped with a refrigerant manual blow valve (V8) that blows refrigerant from the refrigerant tank directly into the absorber. See Figure 91.

The valve must not be tampered with or settings altered, except for daily maintenance and inspection.

⚠ CAUTION

During service and maintenance work, be sure to turn OFF the main circuit breaker (MCCB) and fully close the main valve of steam line. If not, it may cause electric shock and burn.

⚠ CAUTION

Contact your local Johnson Controls service center for inspection and maintenance of the machine. Improper inspection and maintenance can cause a chiller malfunction or injury.

Solenoid valves

The absorption chiller is equipped with the following solenoid valves.

Table 36: Solenoid valves

Solenoid valve name	Symbol	Function
Purge solenoid valve (1)	SV1	Open/close vacuum pump piping
Purge solenoid valve (2)	SV2	
Refrigerant blow solenoid valve for EX(S) and EXW(S)	SV3	Open/close automatic refrigerant blow piping
Solution blow solenoid valve for EX(S)L and EXW(S)L	SV4	Open/close automatic solution blow piping

Pump shut off valves (option)

The chiller is equipped with the pump shut off valves shown in Figure . They are used for inspection of the pumps.

If the absorption chiller is operated with incorrect valve settings, the pump may be damaged. Do not tamper with the valves.

Air releasing valves and draining valves

The chiller is equipped with air release valves and drain valves for chilled water, and cooling water. It is equipped with a drain valve for the steam condensate (drain). They are used to drain the chilled water, cooling water, steam condensate (drain), and release air when water is supplied.

Purging valves

The chiller is equipped with the purging valves shown in Figure 88, Figure 89, and Figure 90. For operation of those valves, see Purge procedure.

Start the chiller after it has been stopped for a long period

When you start the chiller after it has not run for more than 15 days, use the procedure below:

Checks before operation starts

1. Check the insulation of the Control Center and electric system.
2. Check the operation of the Control Center and safety devices.
3. Check that the refrigerant blow valves V8 are fully closed.
4. Check the vacuum level in the machine. Use the pressure gauge of the high temperature generator.

   ⓘ **Note:**
   - The vacuum level must be close to -145 psig.
   - If the chiller is EX(S)L and EXW(S)L type, before starting, check the refrigerant density. If the density is too high, open the refrigerant blow valve. If the density is too low, the solution blow solenoid valve opens automatically. For the density sheet, see Table 58.
5. Check the steam supply system and steam drain system.
6. Press the Refrigerant Pump **Stop** button.

If the checks validate, start the chiller.

Checks after operation starts

1. 10 to 15 minutes after the chiller and the solution pump start, check the level gauge of the refrigerant tank.
2. If the refrigerant level is within the level gauge, press the Refrigerant Pump **Auto** button.
3. Observe the operation for several minutes. Check that the refrigerant liquid level does not drop.
4. Use the procedure shown in Purge procedure to purge air from the low pressure side (absorber).

ⓘ **Note:** Only deionized water can be used as the refrigerant in the chiller.

Purge procedure

Air must be purged from the chiller to maintain peak performance and prevent deterioration of the internal parts. This chiller has an automatic purge system.

Even if the automatic purge mode is used during normal operation, perform the manual operation for the purging tank and absorber periodically. For the purging period, see Table 38.

Capacity check method of vacuum pump

For commissioning and regular maintenance, check the capacity of the vacuum pump first according to the following procedure.

1. Check the oil level in the vacuum pump.
2. If the oil is cloudy, it contains water and must be replaced with new oil.

   ⓘ **Note:** See the Operation Manual for the Vacuum Pump for more information on how to change the oil.

3. Close the gas ballast valve.

   ⓘ **Note:** Keep the gas ballast valve open partly during the automatic purge operation to ensure the refrigerant water is discharged on time and doesn't mix with the oil. This prevents having to frequently change the oil.

4. Set the valves according to pattern A. See Figure 91.
5. Press the Purge Mode **MANUAL** button.
6. Press the Manual Purge **ON** button. The vacuum pump starts. The solenoid valves SV1 and SV2 open.
7. 1 to 2 minutes after the vacuum pump starts, confirm that the vacuum gauge stands at 0 psi.abs to 0.15 psi.abs.
8. Press the Manual Purge **OFF** button. The vacuum pump stops.
9. Wait for 30 minutes.
10. Confirm that the vacuum down is within 0.3 psi.

Figure 88: Manual valve of purge system for YHAU-CW(N)150-300EX(S)(L)

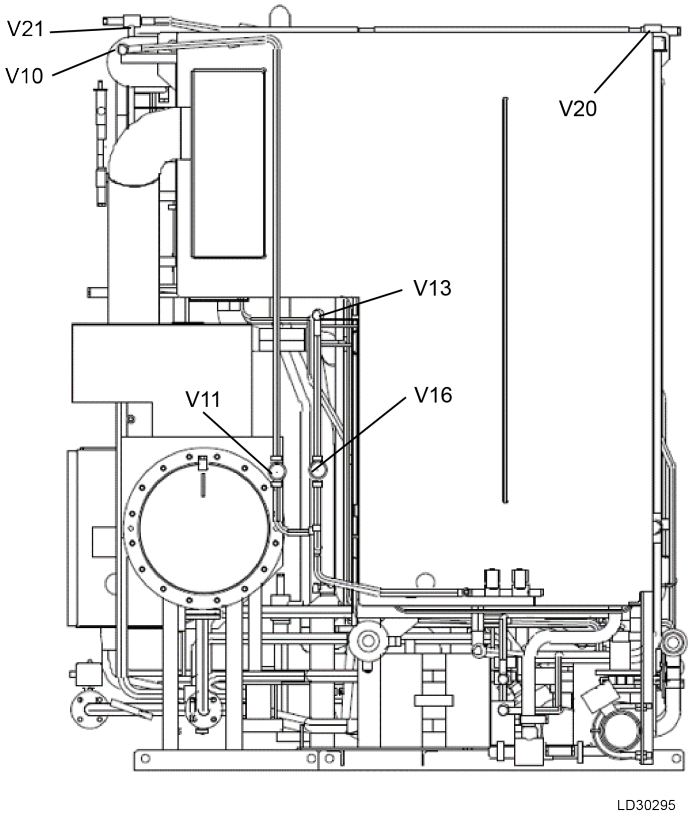


Figure 89: Manual valve of purge system for YHAU-CW(N)360-2000EXW4(S)(L)

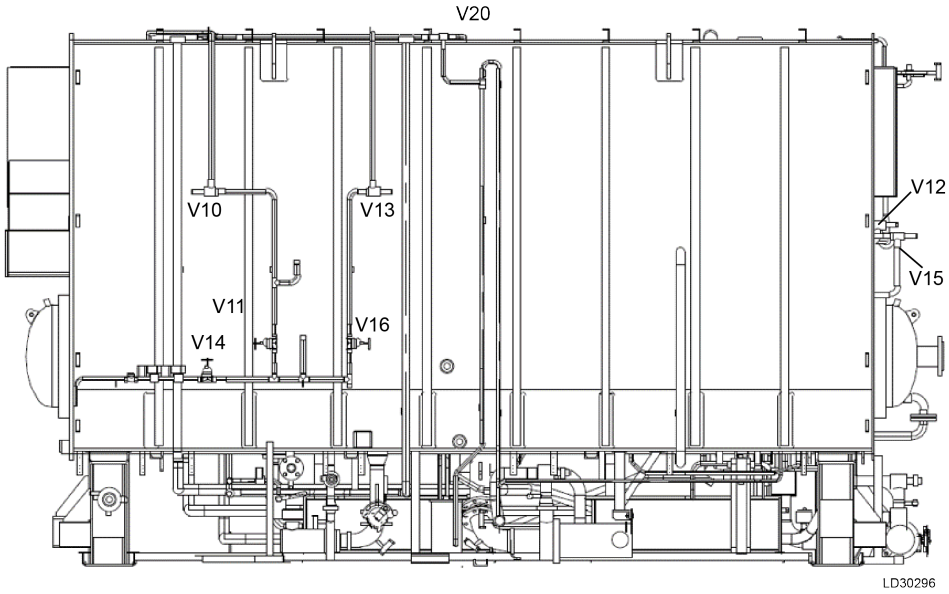


Figure 90: Manual valve of purge system for YHAU-CW(N)360-2000EXW4(S)(L)

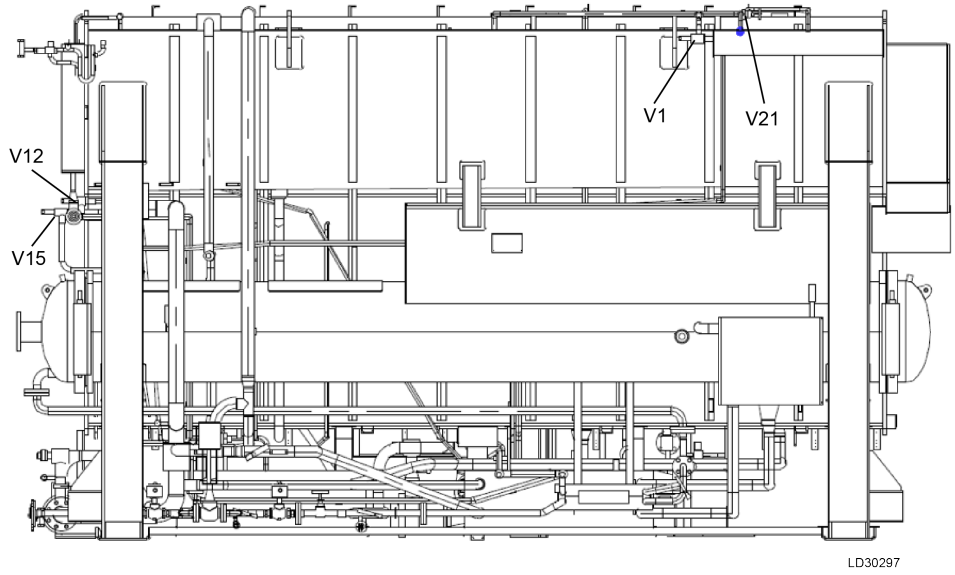


Table 37: Manual Valve of purge system

Valve number	Function
V10, V11	Purge operation valve for purge tank
V13, V16	Purge operation vale for absorber
V14	Main purge operation valve
V20	Purge operation valve for ejector
V21	Direct purge operation valve for condenser
V12	Purge operation valve for up absorber
V15	Purge operation valve for low absorber

Manually purging non-condensable gas directly from the absorber with the vacuum pump

When the chiller operates at a lower capacity than usual for a long period of time or when it restarts after a power failure, the absorber may contain non-condensable gases. If the machine starts under these conditions, its performance and efficiency decrease. If this happens, manually purge non-condensable gas directly from the absorber according to the following procedure:

1. Set the valves according to pattern B. See Figure 91.
2. Close the vacuum pump ballast valve.
3. Press the Purge Mode **MANUAL** button.
4. Press the Manual Purge **ON** button. The vacuum pump starts. The solenoid valves SV1 and SV2 open.
5. After step 3 begins, confirm that vacuum gauge stands at 0 -0.15 PSI.abs.
6. Reading the vacuum gauge, open valve V13.
7. Then, open valve V16 gradually. Confirm that the pressure on the vacuum gauge increases slightly.

   ⓘ **Note:** If the pressure decreases when valve V16 opens, the vacuum pump capacity is too small. Close valve V16 at once. See Table 52 and check the purge line.

8. If no problems are found, open valve V16 completely.

⚠ CAUTION

Make sure the valve is completely open.

9. Continue to purge for 2 to 3 hours.
10. While the vacuum pump continues to run, open the ballast valve partially.
11. Close valves V13 and V16.
12. Press the Manual Purge **OFF** button. The vacuum pump stops.

For information on how to set up an automatic purge, see Automatically purging non-condensable gas from the purging tank.

Manually purging non-condensable gas from the purging tank with the vacuum pump

While the absorption chiller operates, non-condensable gas collects in the purging tank. You can purge those gases manually using the following procedure.

1. Set the valves according to pattern C. See Figure 91.
2. Close the vacuum pump ballast valve.
3. Press the Purge Mode **Manual** button.
4. Press the Manual Purge **ON** button. The vacuum pump starts. The solenoid valves SV1 and SV2 open.
5. 3 minutes to 4 minutes after the vacuum pump starts, confirm that the vacuum gauge stands at 0 psia to 0.15 psia.
6. Verify that valve V10 is open.
7. Reading the vacuum gauge, gradually open valve V11.

8. The manual purge procedure is complete when the pressure reaches 0.44 psia or less on the vacuum gauge.
9. Close valve V11.
10. Press the Purge Pump **OFF** button. The vacuum pump stops.

For information on how to set up an automatic purge, see Automatically purging non-condensable gas from the purging tank.

Automatically purging non-condensable gas from the purging tank

This chiller has an automatic purge system. The vacuum pump starts and stops by detecting the pressure inside the purge tank.

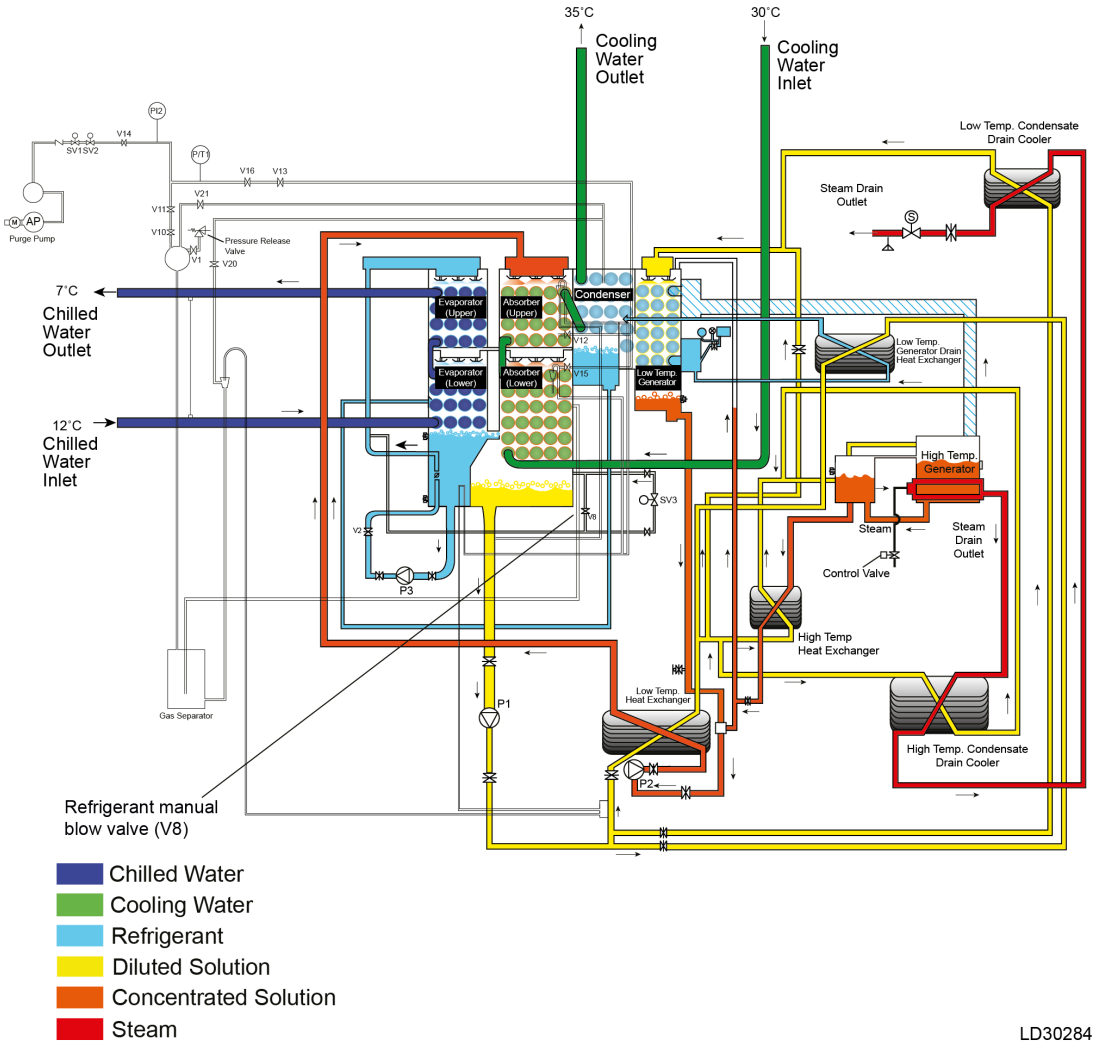
1. Set the valves in accordance with purge pattern D. See Figure 91.
2. Press the Manual Purge **OFF** button.
3. Press the Purge Mode **AUTO** button.
4. The purge solenoid valves automatically open and close.

During the automatic purge operation, the vacuum pump starts when the purging tank pressure increases to 1 psi abs and stops when it decreases to 0.44 psi abs.

⚠ CAUTION

When you replace the oil in the vacuum pump or belt or perform maintenance work while the absorption chiller is running, be sure to turn off the circuit breaker of the vacuum pump in the control panel. If not, the vacuum pump could start abruptly and cause injury.

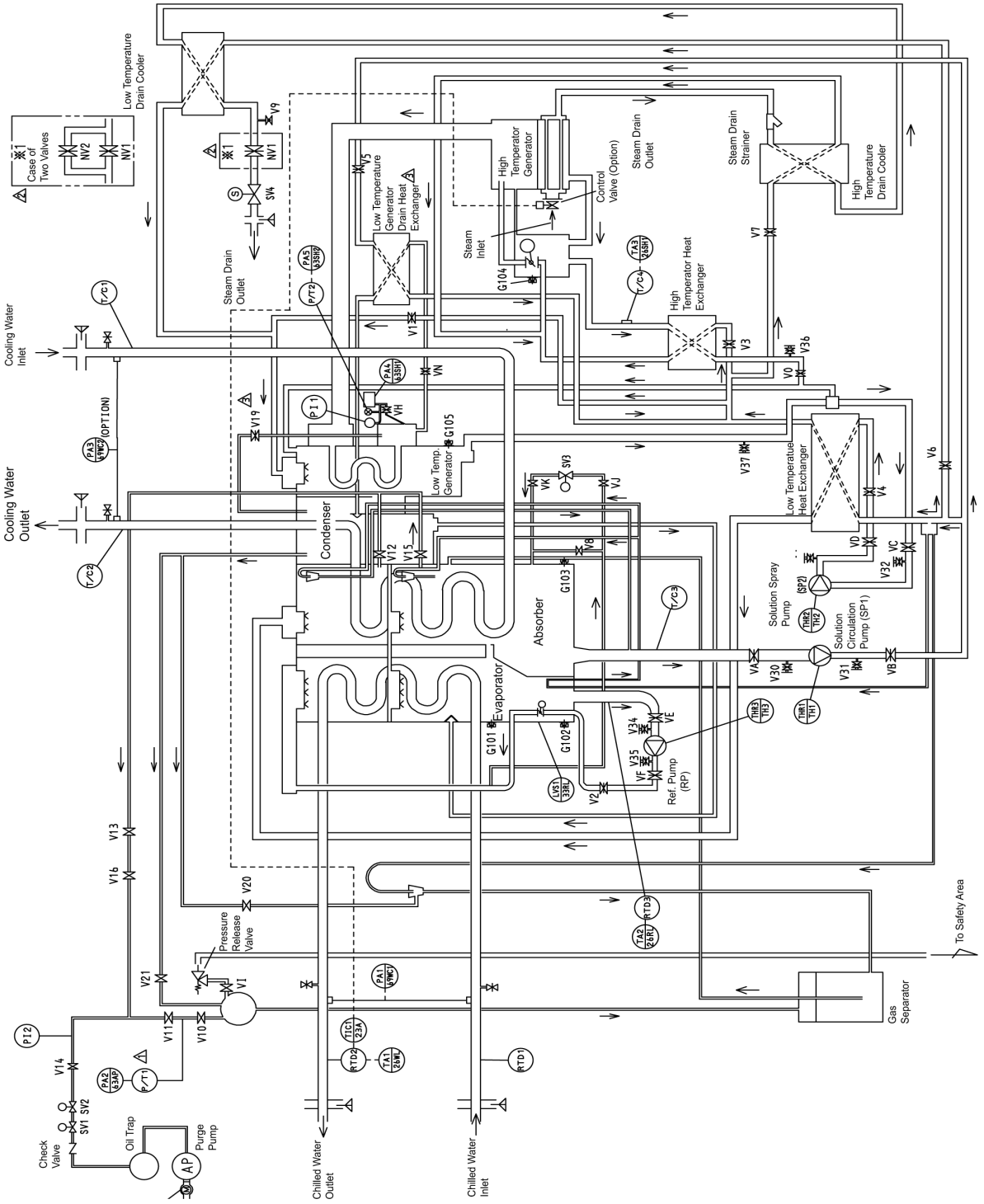
Figure 91: Purging system for YHAU-CW



Purging pattern	Use	Operation	Valve operation/location					
			V10	V11	V14	V13	V16	V21
A	Check capacity of vacuum pump	—	X	X	O	X	X	X
B	Direct purging from absorber	Preparation	X	X	O	O	X	X
		Starting purging	X	X	O	O	O	X
C	Manual purging from purging tank	Preparation	O	X	O	X	X	X
		Starting purging	O	O	O	X	X	X
D	Automatic purge of the purging tank	—	O	O	O	X	X	X
E	Manual purging from condenser	—	O	O	O	X	X	O

Note: O: Open valve. X: Closed valve.

Figure 92: Process and instrumentation diagram for EX(S) and EXW(S)



Refrigerant refining method

With an increase in the operation time of the chiller, some of the solution can mix in with the refrigerant. Mixing the solution and the refrigerant lowers the refrigerating capacity. To prevent this, the refrigerant must be refined periodically.

Refine the refrigerant according to the following procedure. The chiller must be operating to refine refrigerant.

Note:

- Only deionized water can be used as the refrigerant in the chiller.
- If the chiller model is EX(S)L/EXW(S)L, control the refrigerant density according to Table 58.

When refining refrigerant, operate the absorption chiller under a low load of 50% or less for higher refining efficiency. Note that the refrigerating capacity is dramatically reduced during the refrigerant refining operation.

1. Remove the cap of the refrigerant manual blow valve.

   Note: For the location of the refrigerant manual blow valve, see Figure 91.

2. Turn the spindle in the valve to the left using an 0.3 in. (8 mm) hexagon wrench to start refining the refrigerant.
3. After the refining process is complete, close the spindle in the valve. Turn it to the right until it stops.
4. Return the valve cap. There is an O-ring between the cap and valve. When fitting the cap, make sure that the O-ring is set normally.

Note: The time required for refinement of the refrigerant depends on the current load condition. Constantly check the liquid level in the refrigerant tank while the refrigerant is refined. If the refrigerant liquid level appears in the level gauge of the refrigerant tank, close the valve immediately and fully.

Manual refrigerant blow down and diluting method

When the chiller stops suddenly due to a power failure, the solution can become crystallized. If this happens, dilute the solution manually according to the following procedure.

Note:

- Perform the following procedure immediately after the power is restored.
- If the chiller model is EX(S)L/EXW(S)L, control the refrigerant density according to Table 58.

1. Press the Forced Dilution **ON** button. The solution pump and the refrigerant pump start.
2. Remove the cap of the refrigerant manual blow valve.

   Note: For the location of the refrigerant manual blow valve, see Figure 91.

3. Turn the spindle in the valve to the left with the 0.3 in. (8 mm) hexagon wrench. The refrigerant in the refrigerant tank is diverted into the absorber.
4. Watch the liquid level of the refrigerant tank. Immediately after the refrigerant liquid level appears in the level gauge of the refrigerant tank, close the valve (turn it to the right until it stops).
5. Press the Refrigerant Pump **Stop** button. The refrigerant pump stops.
6. Let the solution pump operate independently for 30 minutes.
7. Press the Forced Dilution **OFF** button to stop the solution pump.
8. Press the Refrigerant Pump **Auto** button.

9. Return the valve cap. There is an O-ring between the cap and valve. When fitting the cap, make sure that the O-ring is set normally.

Decrystallization method

Even if the solution in the absorption chiller is crystallized during operation, it can be melted if the crystallization is not severe. Because it becomes more difficult to melt the crystals as time passes, perform the following operation immediately when crystallization is detected. If the crystals cannot be melted by the following procedure, notify your local Johnson Controls service center immediately.

Indications of crystallization

- The refrigerating capacity goes down. The liquid level in the absorber drops. Cavitation noise comes out of the solution pump.
- One of the following buttons is lit and the solution pump trips:
  - **Sol. Circu. P. Abnormal**
  - **Sol. Spray P Abnormal**
- The solution level can be seen through the level gauges on the high temperature generator level gauges (G104).
- The liquid level in the absorber drops. The temperature of the solution returning from the generator also falls.

Decrystallization

1. Stop the chiller. If the solution pump tripped, reset the thermal relay.
2. Disconnect the electrical wiring of the solution pump.
3. Navigate to the Setting screen on the Control Panel.
4. Press the Forced Dilution **ON** button.

   ⓘ **Note:** Because the electrical wiring of the solution pump is disconnected, only the refrigerant pump starts.

5. Remove the cap of the refrigerant manual blow- down valve.

   ⓘ **Note:** For the location of the refrigerant manual blow valve, see Figure 91.

6. Turn the spindle in the valve to the left with the 0.3 in. (8 mm) hexagon wrench.

   ⓘ **Note:** The refrigerant in the refrigerant tank diverts into the absorber.

7. Watch the liquid level of the refrigerant tank.
8. Immediately after the refrigerant liquid level appears in the level gauge of the refrigerant tank, close the refrigerant manual blow-down valve (turn it to the right until it stops).
9. Press the Refrigerant Pump **Stop** button. The refrigerant pump stops.
10. Press the Forced Dilution **OFF** button.
11. Re-connect the electrical wiring of the solution pump.
12. Press the Forced Dilution **ON** button. The solution pump starts.
13. Press the Control Valve Mode **Manual** button.
14. Set the Valve Position Setting to 30% to 40%. For detailed information on how to change the setting, see Change numeric values.
15. Observe the liquid level in the absorber.
16. When the liquid level in the absorber drops, press the Forced Dilution **OFF** button.

17. Repeat steps 12 through 16 three - four times. If the liquid level in the absorber does not go down, the crystals have melted.
18. Let the solution pump operate independently for about 30 minutes. Constantly observe the liquid level in the absorber while the solution pump operates.
19. After about 30 minutes, stop the solution pump.

    ⓘ **Note:** If the chiller model is EX(S)L and EXW(S)L, check and adjust the refrigerant density when the decrystallization is finished according to Table 58.

20. Press the Refrigerant Pump **Auto** button.
21. Return the valve cap. There is an O-ring between the cap and valve. When fitting the cap, make sure that the O-ring is set normally.

Precautions for decrystallization

- Cycle the chilled and cooling water pumps off and on during the melting process.
- Remove any sensors that are sensitive to heat before you start the melting operation. The temperature of the chilled and cooling water that remains in the absorption chiller may rise to about 158°F.
- When you start the chiller after melting the crystals, discharge the chilled and cooling water first. If that water is left in the machine, the paint on the inside walls may deteriorate.

Maintenance items

Maintenance and inspection items along with standard inspection periods are shown in the next table. For details, contact your local Johnson Controls service center.

Inspection frequency can be adjusted according to the actual operating conditions.

Table 38: Maintenance and inspection

Task	Contents	Frequency	Scope
Recording of operation data	Collect the operation data (Refer to*155.31-CL1*) and check the data with the data collected during the factory test.	Weekly	C
Check the steam control valve	Check to see that the steam control valve operates smoothly.		C
Check of liquid level	See Table . Check the liquid level at each part.	Daily	C
Refine refrigerant	Refine the refrigerant.	Every 2-3 weeks	S
Manual purging from purging tank	See Purge procedure. Manually purge non-condensable gas from the purging tank.	Because the chiller has an automatic purge system, perform the purge once at beginning of the seasons every year.	S
Manual purging from absorber	See Purge procedure. Manually purge non-condensable gas from the absorber.	Every 2-3 months	S
Replacement of oil in vacuum pump	Replace the oil in the vacuum pump.	Monthly	C
Check of Vacuum Pump	After replacing the lubricant oil for the vacuum pump, be sure to pull the pulley belt and check the smooth motion of the pulley.		C
Appearance check	Check the outside of the machine for damage. For example, leakage for chilled water and cooling water, rusting, and other evident deterioration of the chiller. Check the solution pump and refrigerant pump for abnormal sounds and vibration.		C
Measurement of insulation resistance of electric devices	Measure the insulation resistance of the main circuit and motors (solution pump, refrigerant pump) mainly to check for lowering of insulation. When measuring the insulation resistance, be sure to disconnect the wires of the temperature controller, and other related controls.	Yearly	S
Check of terminals for looseness	Check each terminal in the control panel for looseness.		S
Check of operation of control panel	Check the operation of the control panel to prevent troubles caused by malfunction of the control panel.		S
Check capacity of purge unit	See Purge procedure. Check the capacity of the purge unit.	Monthly	S
Check of leakage through purge solenoid valves	By measuring vacuum down speed, check for leakage through purge solenoid valves.	Yearly	S
Overhaul check of purge solenoid valves	Perform overhaul of purge solenoid valves.		S
Check of airtightness	Measure the quantity of non-condensable gas discharged from the vacuum pump.	Every 2-3 months	S
Check continuity of protective bonding circuit	Check continuity of protective bonding circuit.	Yearly	S

Table 38: Maintenance and inspection

Task	Contents	Frequency	Scope
Analysis of quality of chilled water, cooling water, and steam drain	Reliable water treatment companies are available in most larger cities to supply a water treating process that will greatly reduce the corrosive and scale forming properties of almost any type of water. Be sure to request the first analysis within one month after the test operation is started.	Every 2-3 months	C
Check of quantity of solution and refrigerant	The solution is not consumed, but the refrigerant is discharged little by little each time purging is performed. If the quantity of the refrigerant becomes insufficient, the condensation preventive function does not work normally. Accordingly, check the quantity of the refrigerant.	Yearly (during operation at 100%)	S
Disassembly inspection and cleaning of solution pump and refrigerant pump	Sleeve bearings are used for the solution pump and refrigerant pump, and they are normally lubricated with water solution of lithium bromide and refrigerant. Because excessive wear can cause a pump problem, disassemble and inspect the bearings. The internal strainer must also be cleaned.	2-3 years or 10,000 hrs	S
Disassembly inspection and cleaning of vacuum pump	Disassemble, inspect, and clean the vacuum pump to maintain its capacity.	4 years	S
Replacement of gaskets of airtight parts	Replace the gaskets of the airtight parts to maintain the airtightness of the absorption chiller.	4 years	S
Inspection of chilled water box and replacement of packing	Open the waterbox cover, check the inside paint for damage, and check the inside of the tubes for scales.	Every 2 years	S
Inspection of cooling waterbox and replacement of gasket		Every 1 year	S
Inspection of the steam box and replacement of gasket	• Open the steam box. • Check the tube plate and the expanded sections of the tubes for abnormal thinning.	Every 3 years	S
Repair of paint (tar epoxy paint) of inside wall of chilled water and cooling waterboxes	Repair the paint of the inside wall.	Chilled water: 2 years Cooling water: 1 year	S
Analysis of solution and addition of inhibitor	The concentration of the inhibitor must be kept proper to prevent corrosion of inside parts. Analyze the solution to detect leakage in the early stage of running the machine	Every 6 months	S
Filtration and refining of solution	As the inside of the chiller is corroded, corrosion particles are increased. Particles accumulated on the heat exchange tube surfaces lower the heat exchange rate, that is, the performance. Accordingly, filter the solution.	5-6 years	S

Table 38: Maintenance and inspection

Task	Contents	Frequency	Scope
Check of operation of various safety relays	Check the operation of the safety relays.	Yearly	S
Cleaning of tubes with brush or water jet (Absorber, condenser)	If foreign matter sticks to the inside of the tubes of the chiller, refrigerating performance is lowered and the tubes become corroded. Accordingly, remove slime, soft scales, and other foreign matter from the inside of the tubes.		S
Cleaning of tubes with brush or water jet (Evaporator)		Every 2 years*	S
Cleaning of tubes with brush or water jet (High temperature generator)		Every 4 years	S
Chemical cleaning of tubes (Absorber, condenser)	Because hard scales sticking to the tubes cannot be removed with a brush or water jet, remove them chemically, depending on the condition.		S
Chemical cleaning of tubes (Evaporator)		Every 4 years*	S
Chemical cleaning of tubes (High temperature generator)		Every 8 years*	S
Check for slight leakage	Vacuum and airtightness must be maintained to ensure the reliability and performance of the absorption chiller. Accordingly, the machine must be checked for slight leakage with a special vacuum and airtightness diagnostic device.	Every 2 years	S
Eddy current test on tubes (Absorber, condenser)	Check the inside of the tubes for corrosion caused by bad quality chilled water, and cooling water.	Every 4 years	S
Eddy current test on tubes (Evaporator)		Every 6 years	S
Eddy current test on tubes (High temperature generator)	Check the inside of the tubes for corrosion caused by bad quality steam.	Every 4 years or 10,000 hours	S
Check of steam control valve seat	Check the steam control valve seat for leakage while the chiller is stopping.	Yearly	S
Check of the steam control valve regulator filter (pneumatic type steam control valve only)	Check the air filter of the steam control valve regulator for clogging.	Yearly	S

ⓘ **Note:** C = Customer, S = Johnson Controls Service

*If water quality analysis indicates necessity.

Refrigerant pump manual stop

The refrigerant pump can be stopped manually for maintenance purposes. It can be stopped even while the chiller operates.

1. Navigate to the Control Panel Setting screen.
2. Press the Refrigerant Pump **Stop** button.

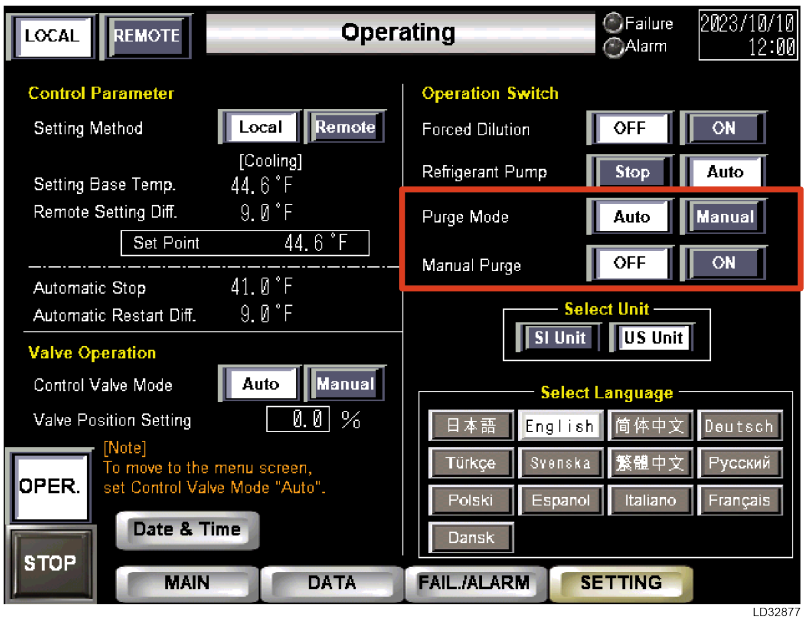
ⓘ **Note:** After maintenance of the refrigerant pump is complete, be sure to reset the pump to Auto. Continued operation in stop state may cause damage to and failure of the chiller.

Purge manual start and stop

The purge can be started or stopped manually.

1. Navigate to the Control Panel Setting screen.

Figure 93: Control panel setting screen



2. Press the Purge Mode **Manual** button.
3. Press the Manual Purge **ON** button.

The purge solenoid valves open. The purge operation begins.

1. Press the Manual Purge **OFF** button when the purge process is complete.
2. The solenoid valves close.

   ⓘ **Note:** After maintenance of the purge system is complete, be sure to reset the purge valve to Auto. Continued operation in stop state may cause damage to and failure of the chiller.

3. Press the Purge Mode **Auto** button.

Lifespan for various parts

The replacement periods for some parts are shown in the next table. The following life spans are shown for reference only. The replacement period may be changed according to the actual environment, frequency of use, or other contributing factors. Other parts may need to be replaced if used incorrectly.

Table 39: Lifespan of common parts

Description	Applicable models or sections	Lifespan of common parts
Gasket	CHW Water Box	Every 2 years
Gasket	CW Water Box	Every 1 year
Gasket, O-Ring, Diaphragm		Every 24,000/Hr
Evaporator Tube		About 15 years Depends on the eddy current result at interval 24 - 36 KHr.
Absorber Tube		
Condenser Tube		
HT-G Tube		
LTG Tube		About 15 years
Gasket	HT-G Channel Box	Every 2 years
Main Circuit Board		Every 30,000/Hr
Relay	MY-2N, MY-4N	Every 30,000/Hr
Timer	H3Y-2	Every 30,000/Hr
Power Unit	RWS series	Every 30,000/Hr
Magnet Switch, Thermal Relay	AF and MS series	Every 30,000/Hr
Battery for main circuit board	CR2032	Every 3 years
Battery for touch panel	PFXZCBBT1	Every 5 years
Touch Panel	GP4000 series	Every 30,000/Hr
Inverter (Option)	FC series	Every 30,000/Hr
Temperature Controller (Option)	SDC series	Every 30,000/Hr
Fan for Control Panel		Every 30,000/Hr
Steam Control Valve		Every 60,000/Hr
Steam Shut-Off Valve (Option)		Every 60,000/Hr
Steam Drain Solenoid Valve	AVF series	Every 30,000/Hr
Differential Pressure Switch	69WC1(69WC2)	Every 30,000/Hr
Pressure Switch	63SH1	Every 30,000/Hr
Pressure Sensor	FST800	Every 30,000/Hr
Resistance Temp. Sensor	Pt100 Ω	Every 30,000/Hr
Thermocouple		Every 30,000/Hr
Float Switch	Ref. tank	Every 60,000/Hr
Bearing Kit for Sol. Circulation Pump		Every 20,000/Hr
Sol. Circulation Pump		Every 60,000/Hr
Bearing Kit for Sol. Spray Pump		Every 20,000/Hr
Sol. Spray Pump		Every 60,000/Hr
Bearing Kit for Refrigerant Pump		Every 20,000/Hr
Refrigerant Pump		Every 60,000/Hr
Vacuum Pump	PVD series	Every 60,000/Hr
Pump Shut Off Valve		Every 48,000/Hr
Pressure Release Valve		Every 48,000/Hr
Purge Solenoid Valve	AB41	Every 30,000/Hr
Refrigerant Blow Solenoid Valve	AB41	Every 30,000/Hr
Float Valve	For HG float box	Every 60,000/Hr
Float Valve	For ref. tank	Every 60,000/Hr
Compound Gauge		Every 48,000/Hr
Vacuum Gauge		Every 48,000/Hr
Rubber Hose Set For Purge Line		Every 18,000/Hr
Oil For Purge Pump	ULVOIL	Every 3,000/Hr

Table 39: Lifespan of common parts

Description	Applicable models or sections	Lifespan of common parts
Rupture disc		Every 20,000/Hr
Refrigerant density meter (model EX(S)L/EXW(S)L only)	Proline Promass I 300	Every 60,000/Hr
Solution blow solenoid valve (model EX(S)L/EXW(S)L only)	AB41	Every 30,000/Hr
Pressure sensor for Absorber	FST800	Every 30,000/Hr

Water quality control

Use the following guidelines to be sure of the highest water quality control standards:

- Limit the water pressure to the maximum safe working pressure for chilled and cooling water.
- Install a 10-20 or finer mesh strainer in the chilled and cooling water piping.
- Install a thermometer and a pressure gauge in the inlet and the outlet of the chilled and cooling water piping.
- Install tapping (with valve) for chemical cleaning of the inlet and the outlet of the chilled and cooling water piping.
- Install an air vent valve at the highest part of the piping and a drain valve at the lowest part of the piping.
- Replace the water regularly and control the water quality. Operating the chiller for long periods of time with low quality water will cause corrosion and the production of scale.
- Make sure the shut off valves installed at the chiller inlet of the chilled and cooling water are completely open.

ⓘ **Note:** If the chiller runs without the valves completely open, a strong turbulent flow can be generated. The turbulence may cause damage in the water chamber case and the copper tube of the chiller. If you need to adjust the flow rate of the chilled and cooling water, be sure to adjust the valves installed at the outlet side of the chiller.

Chemical water treatment

Since the mineral content of the water circulated through the evaporator, condenser, absorber, and generator varies, the water used may corrode the tubes or deposit heat resistant scale in them.

Perform a chemical analysis of the water before the system is installed. Consult a reliable water treatment company to determine if treatment is necessary. If it is, the water treatment company can provide treatment for the water to help prevent damage to the tubes.

Replacement of water

Since the cooling water system can be polluted by various factors, it must be cleaned and the water it in must be replaced periodically. Generally, if the water is not treated at all by the cooling tower, the recommended interval to replace the cooling water is:

- District polluted with sulfurous acid gas --- 5 days
- Common district --- 10 days

If the water is blown manually or automatically, the replacement period may be lengthened as follows.

- District polluted with sulfurous acid gas --- 1 month
- Common district --- 1 month

Treatment for long stoppage of the absorption chiller

If the absorption chiller is stopped for 15 days or longer, bacteria in the water or in the tubes may grow. The bacteria can corrode the tubes. When stopping the chiller for more than 15 days, drain the water from the absorber, condenser, evaporator, and high temperature generator (steam drain line) through the drain valve at the bottom of the waterbox.

Chemical treatment

Corrosion inhibitors are attracted chemically to corroded metal surfaces. Or, they form inert protective compounds over the metal surfaces. For effective use of the corrosion inhibitors, be sure to choose the correct type and concentration. Water quality, temperature, flow speed, metals used, existence of crevices and deposits and type of water system are also part of the equation. For more information about corrosion preventive measures, consult a water treatment company.

Flow speed in tubes

Since the water flow speed in the tubes is closely related to any existing corrosion, do not increase the water supply rate more than recommended. If the flow speed reaches 11.6 ft/sec to 13.3 ft/sec, the tubes may erode. When changing the flow rate, contact your local Johnson Controls Service Center.

If the water supply rate is adjusted at the inlet side of the heat exchanger (evaporator, condenser, and absorber), the eddy current at the inlet may corrode the tube.

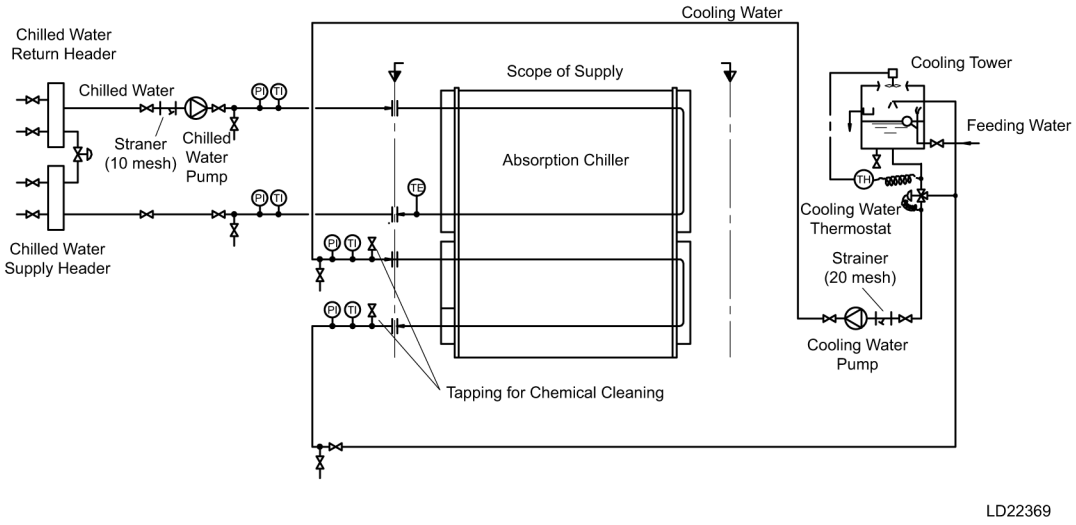
Be sure to control the flow rate on the outlet side.

The eddy current caused by foreign matter in the heat exchanger is also a factor in corrosion. Be sure to install a strainer on the inlet side of the heat exchanger and clean the strainer monthly.

Table 40: Tendency of generation of scales and corrosion by quality of cooling water

Type of factor	Quality of cooling water	General tendency			
		Scale and its color		Corrosion and its color	
Water quality	Low pH of the water	Hard scales are generated and iron bacteria propagate	—	Bad corrosion of iron and copper	Dark brown or pale greenish blue
	High pH of the water	Calcium carbonate scales are generated easily.	Pale yellow	—	—
	Water contains many calcium ions (Ca^{2+}) and magnesium ions(Mg^{2+})	Sulfuric ion SO_4^{2-}, silica SiO_2 and 2 carbonate ion CO_3^{2-} combine together to generate hard scales.	Pale yellow	—	—
	Water contains chlorine ions (Cl^-)	—		Iron and copper tubes are corroded badly.	—
	Water contains many sulfuric ions (SO_4^{2-}) and silica (SiO_2)	Calcium sulfide ($CaSO_4$) and calcium silicate ($CaSiO_3$) combine together to generate hard scales.	Gray	SO_4^{2-} corrodes copper tubes.	Greenish Blue
	Water contains many iron (Ferrous ion (Fe^{2+}),ferric ion (Fe^{3+}))	Fe^{3+} becomes ferric hydroxide ($Fe(OH)_3$) to make red water and sets red rust of ferric dioxide (Fe_2O_3). Iron bacteria propagate remarkably.	Reddish brown-black	Fe^{3+} corrodes iron and copper tubes.	Reddish brown-black
Environmental	Water smells bad (Containing compounds of sulfur, hydrogen sulfide (H_2S), ammonium ion (NH_4^+), methane, or other gases)	Scales are generated easily, and slime is generated.	Greenish blue – dark brown	H_2S and NH_4^+ corrodes copper tubes.	Black – greenish blue
	Water contains organic matters (High COD and BOD)	Scales are generated easily, and slime is generated.	—	—	—
	Exhaust gases (Sulfurous acid gas (SO_2), nitrogen oxide (NO_2), hydrogen chloride (HCl), ammonia (NH_3), or other attributing gases) mixed in water in cooling tower	If organic nitrogen and inorganic nitrogen are contained, algae propagate. SO_2 becomes SO_4^{2-} and combines with Ca^{2+} and Mg^{2+} to generate scales.	Algae: green pale yellow	Exhaust gas from automobiles, factories, sewage plants, ammonia refrigerating machine, or other environmental elements, lower or heighten PH number. As SO_4^{2-}, Cl^- and NH_4^+ are increased, tubes are corroded and pitted very quickly.	—
	Solid matter (Mud, sand, fibers, dust, insects) in water in cooling tower	Scales are generated easily. Solid matters set. Slime is generated.	—	—	—
	Sea wind (district by sea)	Scales are generated easily.	—	Tubes are heavily corroded.	Reddish brown-black

Figure 94: Chilled water and cooling system



Note: Install expansion joints for the chilled water and cooling water connections.

Figure 95: Steam and drain system with steam control valve

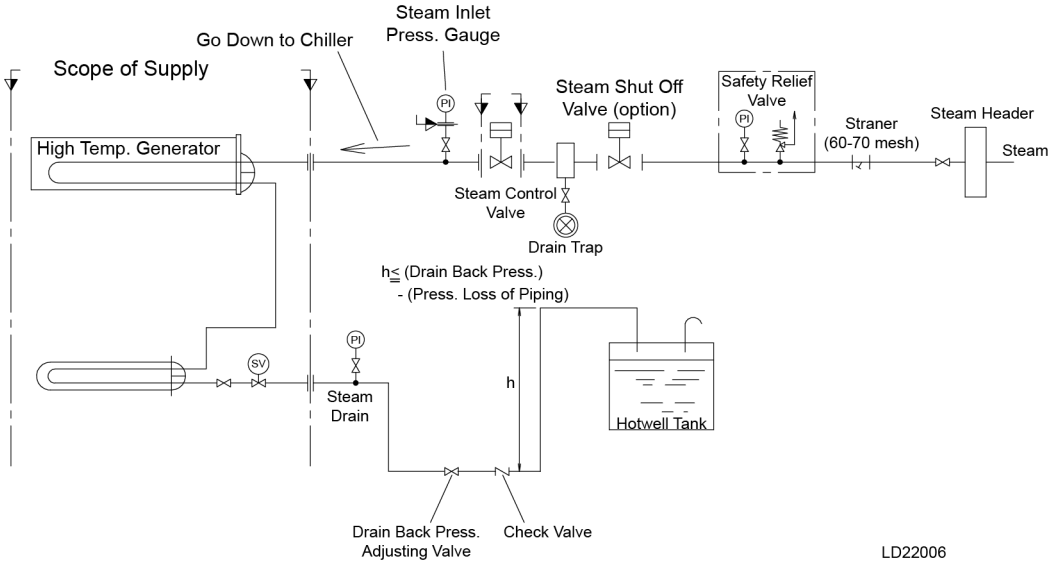


Figure 96: Steam and drain system with steam drain control valve

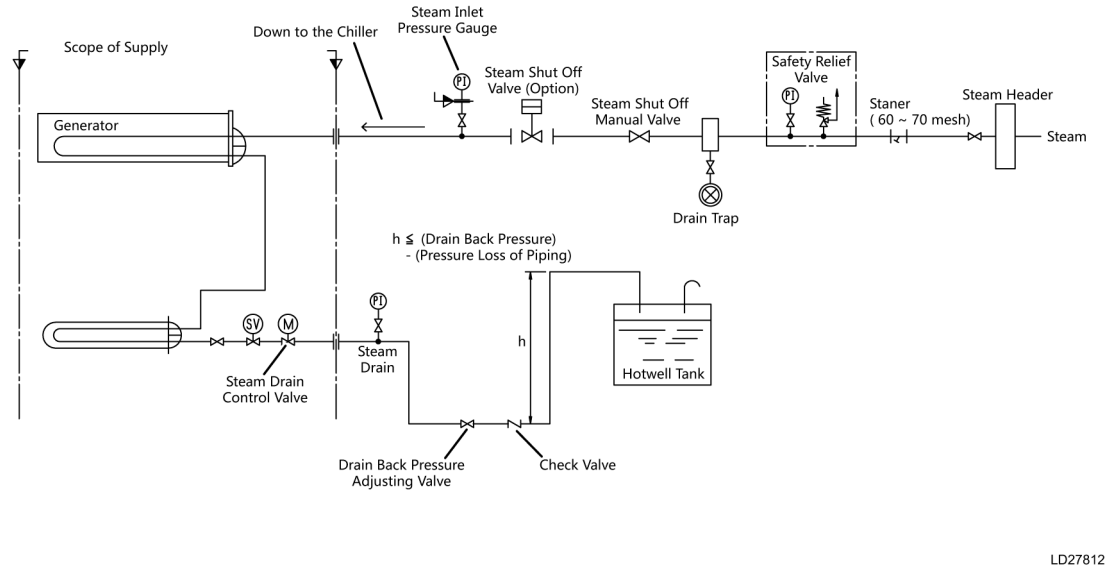


Table 41: Steam drain quality control

Component	Standard value
pH	7.5 - 8.5
Cl^- (ppm)	≤ 20
SO_4^{2-} (ppm)	≤ 10
H_2S (ppm)	nil
DO (ppm)	≤ 0.5
All carbonate (ppm)	≤ 20

Table 42: Chilled and cooling water quality control (maximum concentrations)

Element		Cooling water system			Chilled water system		Tendency	
		Circulating type		Non-circulating water				
		Circulating water	Replenish water	Passing water	Circulating water (68°F or lower)	Replenish water	Corrosion	Scale forming
Standard items	pH (77 °F)	6.5-8.2	6.0-8.0	6.8-8.0	6.8-8.0	6.8-8.0	O	O
	Electric Conductivity (mS/m) (77 °F) (μS/cm) (77 °F)(1)	Max. 80 (Max. 800)	Max. 30 (Max. 300)	Max. 40 (Max. 400)	Max. 40 (Max. 400)	Max. 30 (Max. 300)	O	O
	Chloride Ion ($MgCl^-$/L)	Max. 200	Max. 50	Max. 50	Max. 50	Max. 50	O	
	Sulfulic Acid Ion ($mgSO_4^{2-}$/L)	Max. 200	Max. 50	Max. 50	Max. 50	Max. 50	O	
	Acid Consumption (pH4.8) ($mgCaCO_3$/L)	Max. 100	Max. 50	Max. 50	Max. 50	Max. 50		O
	Total Hardness ($mgCaCO_3$/L)	Max. 200	Max. 70	Max. 70	Max. 70	Max. 70		O
	Calcium Hardness ($mgCaCO_3$/L)	Max. 150	Max. 50	Max. 50	Max. 50	Max. 50		O
	Ionized Silica ($mgSiO_2$/L)	Max. 50	Max. 30	Max. 30	Max. 30	Max. 30		O
Reference items	Iron (mgFe/L)	Max. 1.0	Max. 0.3	Max. 1.0	Max. 1.0	Max. 0.3	O	O
	Copper (mgCu/L)	Max. 0.3	Max. 0.1	Max. 0.1	Max. 0.1	Max. 0.1	O	
	Sulfurization Ion (mgS^{2-}/L)	No ions allowed						
	Ammonium Ion ($mgNH_4^+$/L)	Max. 1.0	Max. 0.1	Max. 1.0	Max. 1.0	Max. 0.1	O	
	Residual Chlorine (mgCl/L)	Max. 0.3	Max. 0.3	Max. 0.3	Max. 0.3	Max. 0.3	O	
	Free Carbonate Acid ($mgCO_2$/L)	Max. 4.0	Max. 4.0	Max. 4.0	Max. 4.0	Max. 4.0	O	
	Stability Index	6.0-7.0	–	–	–	–	O	O

Note:

1. The item names, their definitions, and units are based on JIS K 0101. Units and figures in parentheses () are those which were previously used. They are shown here for reference purposes.
2. In the Tendency column, a white circle (O) indicates that a particular item is a factor in corrosion or scale formation.
3. Generally speaking, when the water temperature is high (104°F or higher), noticeable corrosion develops. Especially when steel material which makes direct contact with water has no protective covering, it is desirable to provide a suitable corrosion-preventive measure, such as adding a corrosion-preventive agent or applying deaeration treatment.

4. In a cooling water system using a closed cooling tower, the closed-circuit circulating water and its replenishment water must meet the quality standards for a hot water system, and the sprinkling water and its replenishment water must meet the quality standards for a circulation-type cooling water system.
5. The supply water and replenishment water can be tap water, industrial water, or ground water. Do not use demineralized water, neutral water, or softened water.
6. The items shown in Table 42 are representative factors in corrosion and scale formation.

Storage method of the chiller

If the chiller is being stored for three days or longer, the storage method varies depending on the storage period and machine room temperature condition. If the machine room temperature is below 32°F, drain off the chilled water, cooling water, and steam condensate (drain). Dry the tube insides and all equipment installed in chilled water, cooling water, and steam condensate (drain) lines completely.

Nitrogen gas pressurization inside the absorption chiller is required when the storage period exceeds 6 months. Contact your local Johnson Controls service center for more details.

⚠ DANGER

The chiller is not explosion proof. Do not handle or store highly flammable items, gas, or liquids near the chiller. Failure to do this may result in explosion, injury, or damage to the equipment or building.

There are two storage methods of chiller for a long stoppage during off-season (winter) or plant suspension, wet storage method and dry storage method. The wet storage method is only available in cases where chilled water and cooling water will not freeze.

Select the storage method to use based on the plant's features and the storage period.

Wet storage method

The wet storage method is applicable in cases where there is no concern of chilled water or cooling water freezing in winter. Store the machine in a place where the ambient temperature will remain higher than 32°F.

If it is likely that the temperature will drop below that, provide a heater for the machine. If a heater is not possible, contact your local Johnson Controls service center for further information. For details on the wet storage method, see Table 43.

If either the chilled water line or the cooling water line is an open system, follow these instructions:

1. Completely drain the water from the systems if it has deteriorated in quality.
2. Clean the water systems by passing clear water through them from a position higher than the chiller.
3. Fill the water systems with clear water.
4. Circulate the clear water through the water pump for 30 minutes to one hour to clean it.
5. Drain the water.
6. Completely fill the water systems with clear water again.
7. Store the machine.

Dry storage method

Use the dry storage method if the chilled or cooling water system might freeze in the winter or, if the chilled or cooling water system has a lining tube. Do not simply drain the chilled or cooling water and store the machine. This significantly increases the possibility of corrosion of the heat transfer tube and rust. For details, see Table 44.

The dry storage procedure is as follows if either the chilled water line or the cooling line is an open system:

1. Completely drain the water.
2. Clean the water systems by passing clear water through them from a position higher than the chiller.
3. Fill the water systems with clear water.
4. Circulate the clear water through the water pump for 30 minutes to one hour to clean it.
5. Drain the water from each waterbox.
6. Dry the interior of each waterbox and the heat transfer tube.
7. Store the machine.

Precautions against external damage

Avoid storing the machine in a place that is easily accessible or near a construction site. If this is unavoidable, provide the machine with protection.

If it is not possible to protect the machine, fill the interior with N2 to minimize the amount of air leakage. For details, contact your local Johnson Controls service center.

Table 43: Wet storage method

	Part	Storage method	Notes
Storage period: Less than 2 months	Chilled water line	Filled with water	1. The manual valve on the purge piping must be fully closed (See Figure 88). 2. The main supply valve supplying steam must be closed. 3. If the storage period exceeds 2 months, algae and bacteria may propagate and corrode the tubes depending on the water quality. Add chemicals to avoid such propagation. 4. If the storage period exceeds 2 months, water inside the chiller must be replaced. If the same water remains in the chiller for more than 2 months, bacteria may propagate and corrode the tubes depending on the environmental condition and water quality. Hence, the chilled water and cooling water pumps must be operated for a short time and the water inside chiller must be replaced completely at least once a month. 5. If the storage period exceeds 6 months, apply pressure 1.5 psig to 3 psig with N2 inside the shells and leave as it is. Check internal-pressure at least once a week to confirm that no pressure drop occurs.
	Cooling water line		
	Steam line	Vacuum	
	Inside of shells		
Storage period: More than 2 months and less than 6 months	Chilled water system	Filled with water	
	Cooling water system		
	Steam line	Pressurized with N2 (1.5-3 psig)	
	Inside of shells	Vacuum	
Storage period: More than 6 months	Chilled water system	Filled with water	
	Cooling water system		
	Steam line	Dried and pressurized with N2 (1.5-3 psig)	
	Inside of shells	Pressurized with N2 (1.5-3 psig)	

Table 44: Dry storage method

	Part	Storage method	Notes
Storage period: Less than 2 months	Chilled water system	Dried and pressurized with N2 (1.5-3 psig)	1. Chilled water and cooling water systems must be drained completely and dried by nitrogen blow, then pressurized with nitrogen and left as is. Depending on the water quality, hard scale may be fixed on the inside surface of tubes by drying and it can be removed by chemical cleaning only. For more than 1 year's storage, it is necessary to, after cleaning the tubes, drain completely, dry the inside by nitrogen blow, then pressurize with N2 and leave as is. 2. The main supply valve supplying steam must be closed. 3. If the storage period exceeds 6 months, apply pressure 1.5-3 Psig with N2 inside the shells and leave as is. Internal-pressure must be checked (at least once a week) to confirm no pressure drop occurs. 4. The manual valve on the purge piping must be fully closed.
	Cooling water system		
	Steam line	Vacuum	
	Inside of shells		
Storage period: More than 2 months and less than 6 months	Chilled water system	Dried and pressurized with N2 (1.5-3 psig)	
	Cooling water system		
	Steam line		
	Inside of shells	Vacuum	
Storage period: More than 6 months	Chilled water system	Dried and pressurized with N2 (1.5-3 psig)	
	Cooling water system		
	Steam line		
	Inside of shells	Pressurized with N2 (1.5-3 psig)	

Figure 97: Duhring diagram / PTX chart (°F)

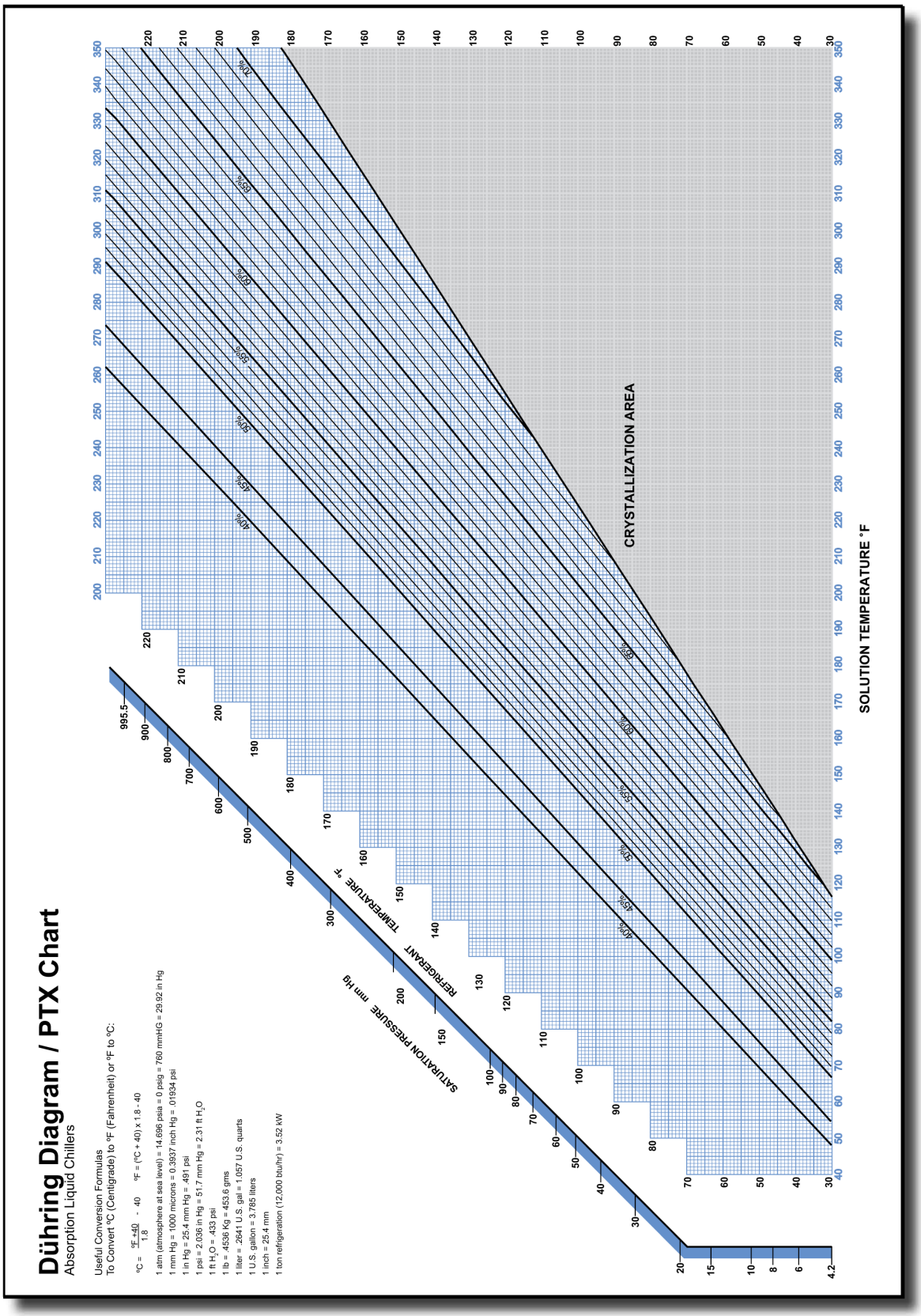


Figure 98: Duhring diagram / PTX chart (°C)

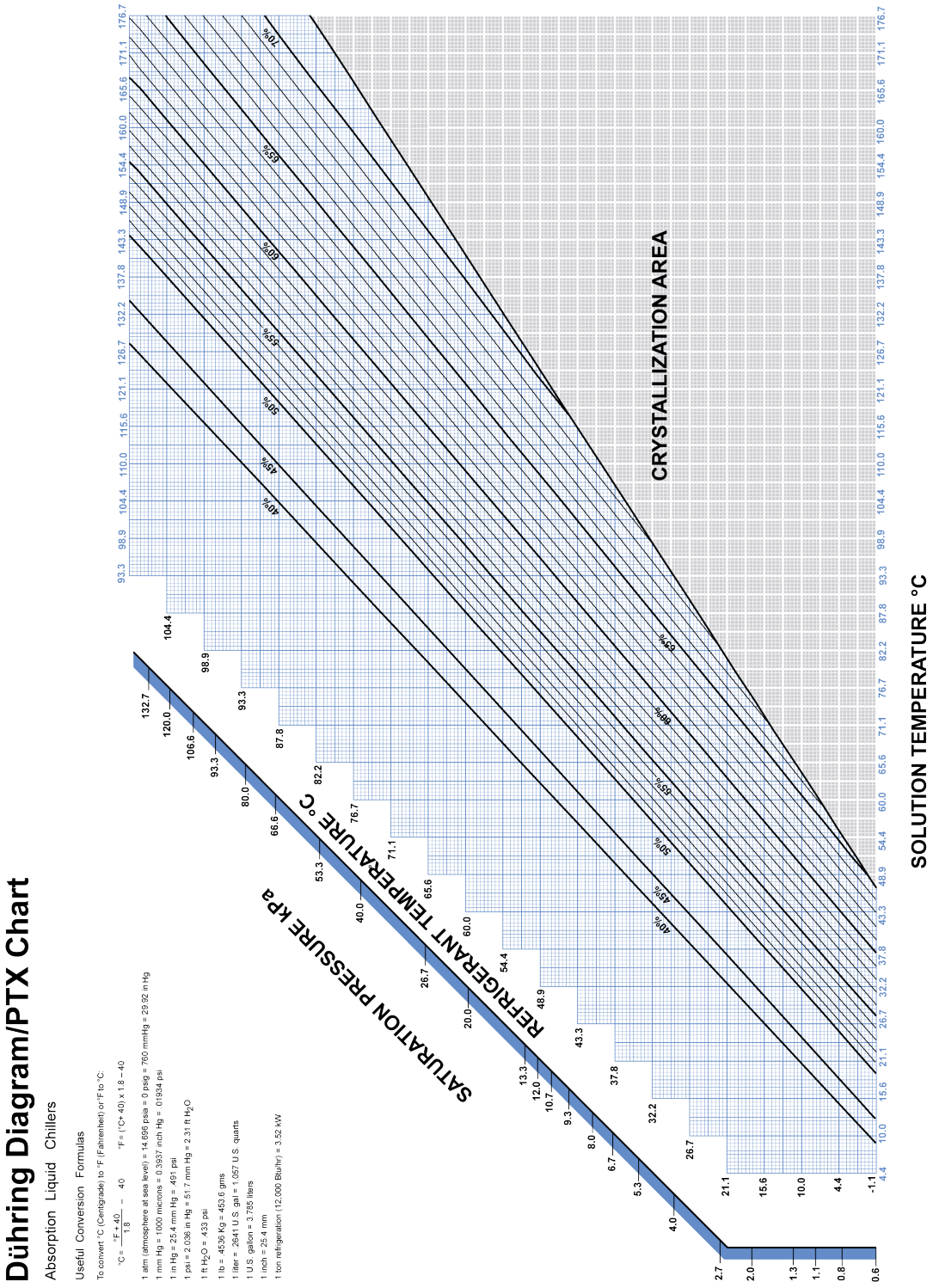


Figure 99: Specific gravity - concentration (°F)

SPECIFIC GRAVITY - CONCENTRATION TABLES
AQUEOUS LiBr SOLUTIONS

Refrigerant Table (%LiBr by Weight)

Temperature ˚F

S.G.	40	45	50	55	60	65	70	75	80	85	90	95	100
1.00	—	—	—	—	—	—	0.08	0.18	0.28	0.37	0.47	0.57	0.67
1.01	0.98	1.08	1.17	1.27	1.37	1.47	1.56	1.66	1.76	1.85	1.95	2.05	2.15
1.02	2.43	2.52	2.62	2.72	2.82	2.91	3.01	3.11	3.20	3.30	3.40	3.50	3.59
1.03	3.84	3.94	4.03	4.13	4.23	4.33	4.42	4.52	4.62	4.72	4.81	4.91	5.01
1.04	5.22	5.32	5.42	5.51	5.61	5.71	5.81	5.90	6.00	6.10	6.19	6.29	6.39
1.05	6.57	6.67	6.77	6.87	6.96	7.06	7.16	7.26	7.35	7.45	7.55	7.64	7.74

Solution Tables

Temperature ˚F

S.G	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
1.350	37.27	37.5	37.75	37.98	38.21	38.44	38.67	38.90	39.13	39.35	39.58	39.80	40.02	40.24	40.46	40.68	40.90	41.11	41.33
1.360	38.03	38.26	38.50	38.73	38.96	39.19	39.42	39.64	39.87	40.09	40.31	40.53	40.75	40.97	41.19	41.41	41.62	41.83	42.05
1.370	38.78	39.01	39.24	39.47	39.70	39.93	40.15	40.38	40.60	40.82	41.04	41.26	41.48	41.69	41.91	42.12	42.34	42.55	42.76
1.380	39.52	39.75	39.98	40.20	40.43	40.66	40.88	41.10	41.32	41.54	41.76	41.98	42.20	42.41	42.62	42.83	43.04	43.25	43.46
1.390	40.25	40.48	40.70	40.93	41.16	41.38	41.60	41.82	42.04	42.26	42.48	42.69	42.90	43.12	43.33	43.54	43.75	43.95	44.16
1.400	40.97	41.20	41.42	41.65	41.87	42.09	42.31	42.53	42.75	42.97	43.18	43.39	43.61	43.82	44.03	44.23	44.44	44.64	44.85
1.410	41.69	41.91	42.14	42.36	42.58	42.80	43.02	43.24	43.45	43.67	43.88	44.09	44.30	44.51	44.72	44.92	45.12	45.33	45.53
1.420	42.39	42.62	42.84	43.06	43.28	43.50	43.72	43.93	44.15	44.36	44.57	44.78	44.99	45.19	45.40	45.60	45.80	46.00	46.20
1.430	43.10	43.32	43.54	43.76	43.98	44.19	44.41	44.62	44.83	45.04	45.25	45.46	45.67	45.87	46.07	46.27	46.47	46.67	46.87
1.440	43.79	44.01	44.23	44.45	44.66	44.88	45.09	45.30	45.51	45.72	45.93	46.13	46.34	46.54	46.74	46.94	47.14	47.33	47.53
1.450	44.47	44.69	44.91	45.13	45.34	45.55	45.76	45.97	46.18	46.39	46.59	46.80	47.00	47.20	47.40	47.60	47.79	47.99	48.18
1.460	45.15	45.37	45.58	45.80	46.01	46.22	46.43	46.6	446.85	47.05	47.25	47.46	47.66	47.85	48.05	48.25	48.44	48.63	48.82
1.470	45.82	46.03	46.25	46.46	46.67	46.88	47.09	47.30	47.50	47.70	47.91	48.11	48.30	48.50	48.70	48.89	49.08	49.27	49.46
1.480	46.48	46.69	46.91	47.12	47.33	47.54	47.74	47.95	48.15	48.35	48.55	48.75	48.94	49.14	49.33	49.52	49.71	49.90	50.09
1.490	47.13	47.35	47.56	47.77	47.97	48.18	48.38	48.59	48.79	48.99	49.19	49.38	49.58	49.77	49.96	50.15	50.34	50.53	50.71
1.500	47.78	47.99	48.20	48.41	48.61	48.82	49.02	49.22	49.42	49.62	49.82	50.01	50.20	50.39	50.58	50.77	50.96	51.14	51.33
1.510	48.42	48.63	48.84	49.04	49.25	49.45	49.65	49.85	50.05	50.24	50.44	50.63	50.82	51.01	51.20	51.38	51.57	51.75	51.93
1.520	49.05	49.26	49.46	49.67	49.87	50.07	50.27	50.47	50.66	50.86	51.05	51.24	51.43	51.62	51.80	51.99	52.17	52.35	52.53
1.530	49.67	49.88	50.08	50.28	50.49	50.68	50.88	51.08	51.27	51.46	51.66	51.84	52.03	52.22	52.40	52.59	52.77	52.95	53.12
1.540	50.29	50.49	50.69	50.89	51.09	51.29	51.49	51.68	51.87	52.06	52.25	52.44	52.63	52.81	52.99	53.18	53.36	53.53	53.71
1.550	50.89	51.10	51.30	51.50	51.69	51.89	52.08	52.28	52.47	52.66	52.84	53.03	53.21	53.40	53.58	53.76	53.94	54.11	54.29
1.560	51.49	51.69	51.89	52.09	52.29	52.48	52.67	52.86	53.05	53.24	53.43	53.61	53.79	53.97	54.15	54.33	54.51	54.68	54.86
1.570	52.09	52.28	52.48	52.68	52.87	53.06	53.25	53.44	53.6	353.82	54.00	54.18	54.37	54.55	54.72	54.90	55.07	55.25	55.42
1.580	52.67	52.87	53.06	53.26	53.45	53.64	53.83	54.02	54.20	54.39	54.57	54.75	54.93	55.11	55.28	55.46	55.63	55.80	55.97
1.590	53.25	53.44	53.64	53.83	54.02	54.21	54.39	54.58	54.77	54.95	55.13	55.31	55.49	55.66	55.84	56.01	56.18	56.35	56.52
1.600	53.81	54.01	54.20	54.39	54.58	54.77	54.95	55.14	55.32	55.50	55.68	55.86	56.04	56.21	56.38	56.55	56.72	56.89	57.06
1.610	54.37	54.57	54.76	54.95	55.13	55.32	55.50	55.69	55.87	56.05	56.23	56.40	56.58	56.75	56.92	57.09	57.26	57.43	57.59
1.620	54.93	55.12	55.31	55.49	55.68	55.86	56.05	56.23	56.41	56.59	56.76	56.94	57.11	57.28	57.45	57.62	57.79	57.95	58.12
1.630	55.47	55.66	55.85	56.03	56.22	56.40	56.58	56.76	56.94	57.12	57.29	57.46	57.64	57.81	57.97	58.14	58.31	58.47	58.63
1.640	56.01	56.20	56.38	56.57	56.75	56.93	57.11	57.29	57.46	57.64	57.81	57.98	58.15	58.32	58.49	58.66	58.82	58.98	59.14
1.650	56.54	56.72	56.91	57.09	57.27	57.45	57.63	57.81	57.98	58.15	58.33	58.50	58.67	58.83	59.00	59.16	59.32	59.49	59.65
1.660	57.06	57.25	57.43	57.61	57.79	57.97	58.14	58.32	58.49	58.66	58.83	59.00	59.17	59.33	59.50	59.66	59.82	59.98	60.14
1.670	57.58	57.76	57.94	58.12	58.29	58.47	58.65	58.82	58.99	59.16	59.33	59.50	59.66	59.83	59.99	60.15	60.31	60.47	60.63
1.680	58.08	58.26	58.44	58.62	58.79	58.97	59.14	59.31	59.48	59.65	59.82	59.99	60.15	60.31	60.48	60.64	60.79	60.95	61.11
1.690	58.58	58.76	58.94	59.11	59.29	59.46	59.63	59.80	59.97	60.14	60.30	60.47	60.63	60.79	60.95	61.11	61.27	61.43	61.58
1.700	59.07	59.25	59.42	59.60	59.77	59.94	60.11	60.28	60.45	60.61	60.78	60.94	61.10	61.26	61.42	61.58	61.74	61.89	62.05
1.710	59.55	59.73	59.90	60.08	60.25	60.42	60.59	60.75	60.92	61.08	61.25	61.41	61.57	61.73	61.89	62.04	62.20	62.35	62.50
1.720		60.20	60.38	60.55	60.72	60.88	61.05	61.22	61.38	61.54	61.71	61.87	62.03	62.18	62.34	62.50	62.65	62.80	62.95
1.730		60.67	60.84	61.01	61.18	61.34	61.51	61.67	61.84	62.00	62.16	62.32	62.48	62.63	62.79	62.94	63.09	63.25	63.40
1.740		61.13	61.30	61.46	61.63	61.80	61.96	62.12	62.28	62.44	62.60	62.76	62.92	63.07	63.23	63.38	63.53	63.68	63.83
1.750			61.74	61.91	62.08	62.24	62.40	62.56	62.72	62.88	63.04	63.20	63.35	63.51	63.66	63.81	63.96	64.11	64.26
1.760				62.35	62.51	62.68	62.84	63.00	63.16	63.31	63.47	63.62	63.78	63.93	64.08	64.23	64.38	64.53	64.68
1.770				62.78	62.94	63.10	63.26	63.42	63.58	63.74	63.89	64.04	64.20	64.35	64.50	64.65	64.80	64.95	65.09
1.780					63.37	63.52	63.68	63.84	64.00	64.15	64.30	64.46	64.61	64.76	64.91	65.06	65.21	65.35	65.50
1.790					63.78	63.94	64.09	64.25	64.40	64.56	64.71	64.86	65.01	65.16	65.31	65.46	65.60	65.75	65.89
1.800						64.34	64.50	64.65	64.81	64.96	65.11	65.26	65.41	65.56	65.70	65.85	66.00	66.14	66.28
1.810							64.89	65.05	65.20	65.35	65.50	65.65	65.80	65.94	66.09	66.24	66.38	66.52	66.67
1.820								65.43	65.58	65.73	65.88	66.03	66.18	66.32	66.47	66.61	66.76	66.90	67.04
1.830				**CRYSTALLIZATION AREA**					65.96	66.11	66.26	66.41	66.55	66.70	66.84	66.98	67.13	67.27	67.41
1.840										66.48	66.63	66.77	66.92	67.06	67.20	67.35	67.49	67.63	67.77
1.850											66.99	67.13	67.27	67.42	67.56	67.70	67.84	67.98	68.12

LD14222

Figure 100: Specific gravity - concentration (°C)

SPECIFIC GRAVITY – CONCENTRATION TABLES
AQUEOUS LiBr SOLUTIONS
Refrigerant Table (%LiBr by Weight)
Temperature °C

S.G.	4.4	7.2	10.0	12.8	15.6	18.3	21.1	23.9	26.7	29.4	32.2	35.0	37.8
1.00							0.08	0.18	0.28	0.37	0.47	0.57	0.67
1.01	0.98	1.08	1.17	1.27	1.37	1.47	1.56	1.66	1.76	1.85	1.95	2.05	2.15
1.02	2.43	2.52	2.62	2.72	2.82	2.91	3.01	3.11	3.2	3.3	3.4	3.5	3.59
1.03	3.84	3.94	4.03	4.13	4.23	4.33	4.42	4.52	4.62	4.72	4.81	4.91	5.01
1.04	5.22	5.32	5.42	5.51	5.61	5.71	5.81	5.9	6	6.1	6.19	6.29	6.39
1.05	6.57	6.67	6.77	6.87	6.96	7.06	7.16	7.26	7.35	7.45	7.55	7.64	7.74

Solution Tables
Temperature °C

S.G.	15.6	21.1	26.7	32.2	37.8	43.3	48.9	54.4	60.0	65.6	71.1	76.7	82.2	87.8	93.3	98.9	104.4	110.0	115.6
1.35	37.27	37.50	37.75	37.98	38.21	38.44	38.67	38.90	39.13	39.35	39.58	39.80	40.02	40.24	40.46	40.68	40.90	41.11	41.33
1.36	38.03	38.26	38.50	38.73	38.96	39.19	39.42	39.64	39.87	40.09	40.31	40.53	40.75	40.97	41.19	41.41	41.62	41.83	42.05
1.37	38.78	39.01	39.24	39.47	39.70	39.93	40.15	40.38	40.60	40.82	41.04	41.26	41.48	41.69	41.91	42.12	42.34	42.55	42.76
1.38	39.52	39.75	39.98	40.20	40.43	40.66	40.88	41.10	41.32	41.54	41.76	41.98	42.20	42.41	42.62	42.83	43.04	43.25	43.46
1.39	40.25	40.48	40.70	40.93	41.16	41.38	41.60	41.82	42.04	42.26	42.48	42.69	42.90	43.12	43.33	43.54	43.75	43.95	44.16
1.40	40.97	41.20	41.42	41.65	41.87	42.09	42.31	42.53	42.75	42.97	43.18	43.39	43.61	43.82	44.03	44.23	44.44	44.64	44.85
1.41	41.69	41.91	42.14	42.36	42.58	42.80	43.02	43.24	43.45	43.67	43.88	44.09	44.30	44.51	44.72	44.92	45.12	45.33	45.53
1.42	42.39	42.62	42.84	43.06	43.28	43.50	43.72	43.93	44.15	44.36	44.57	44.78	44.99	45.19	45.40	45.60	45.80	46.00	46.20
1.43	43.10	43.32	43.54	43.76	43.98	44.19	44.41	44.62	44.83	45.04	45.25	45.46	45.67	45.87	46.07	46.27	46.47	46.67	46.87
1.44	43.79	44.01	44.23	44.45	44.66	44.88	45.09	45.30	45.51	45.72	45.93	46.13	46.34	46.54	46.74	46.94	47.14	47.33	47.53
1.45	44.47	44.69	44.91	45.13	45.34	45.55	45.76	45.97	46.18	46.39	46.59	46.80	47.00	47.20	47.40	47.60	47.79	47.99	48.18
1.46	45.15	45.37	45.58	45.80	46.01	46.22	46.43	46.60	46.85	47.05	47.25	47.46	47.66	47.85	48.05	48.25	48.44	48.63	48.82
1.47	45.82	46.03	46.25	46.46	46.67	46.88	47.09	47.30	47.50	47.70	47.91	48.11	48.30	48.50	48.70	48.89	49.08	49.27	49.46
1.48	46.48	46.69	46.91	47.12	47.33	47.54	47.74	47.95	48.15	48.35	48.55	48.75	48.94	49.14	49.33	49.52	49.71	49.90	50.09
1.49	47.13	47.35	47.56	47.77	47.97	48.18	48.38	48.59	48.79	48.99	49.19	49.38	49.58	49.77	49.96	50.15	50.34	50.53	50.71
1.50	47.78	47.99	48.20	48.41	48.61	48.82	49.02	49.22	49.42	49.62	49.82	50.01	50.20	50.39	50.58	50.77	50.96	51.14	51.33
1.51	48.42	48.63	48.84	49.04	49.25	49.45	49.65	49.85	50.05	50.24	50.44	50.63	50.82	51.01	51.20	51.38	51.57	51.75	51.93
1.52	49.05	49.26	49.46	49.67	49.87	50.07	50.27	50.47	50.66	50.86	51.05	51.24	51.43	51.62	51.80	51.99	52.17	52.35	52.53
1.53	49.67	49.88	50.08	50.28	50.49	50.68	50.88	51.08	51.27	51.46	51.66	51.84	52.03	52.22	52.40	52.59	52.77	52.95	53.12
1.54	50.29	50.49	50.69	50.89	51.09	51.29	51.49	51.68	51.87	52.06	52.25	52.44	52.63	52.81	52.99	53.18	53.36	53.53	53.71
1.55	50.89	51.10	51.30	51.50	51.69	51.89	52.08	52.28	52.47	52.66	52.84	53.03	53.21	53.40	53.58	53.76	53.94	54.11	54.29
1.56	51.49	51.69	51.89	52.09	52.29	52.48	52.67	52.86	53.05	53.24	53.43	53.61	53.79	53.97	54.15	54.33	54.51	54.68	54.86
1.57	52.09	52.28	52.48	52.68	52.87	53.06	53.25	53.44	53.60	53.82	54.00	54.18	54.37	54.55	54.72	54.90	55.07	55.25	55.42
1.58	52.67	52.87	53.06	53.26	53.45	53.64	53.83	54.02	54.20	54.39	54.57	54.75	54.93	55.11	55.28	55.46	55.63	55.80	55.97
1.59	53.25	53.44	53.64	53.83	54.02	54.21	54.39	54.58	54.77	54.95	55.13	55.31	55.49	55.66	55.84	56.01	56.18	56.35	56.52
1.60	53.81	54.01	54.20	54.39	54.58	54.77	54.95	55.14	55.32	55.50	55.68	55.86	56.04	56.21	56.38	56.55	56.72	56.89	57.06
1.61	54.37	54.57	54.76	54.95	55.13	55.32	55.50	55.69	55.87	56.05	56.23	56.40	56.58	56.75	56.92	57.09	57.26	57.43	57.59
1.62	54.93	55.12	55.31	55.49	55.68	55.86	56.05	56.23	56.41	56.59	56.76	56.94	57.11	57.28	57.45	57.62	57.79	57.95	58.12
1.63	55.47	55.66	55.85	56.03	56.22	56.40	56.58	56.76	56.94	57.12	57.29	57.46	57.64	57.81	57.97	58.14	58.31	58.47	58.63
1.64	56.01	56.20	56.38	56.57	56.75	56.93	57.11	57.29	57.46	57.64	57.81	57.98	58.15	58.32	58.49	58.66	58.82	58.98	59.14
1.65	56.54	56.72	56.91	57.09	57.27	57.45	57.63	57.81	57.98	58.15	58.33	58.50	58.67	58.83	59.00	59.16	59.32	59.49	59.65
1.66	57.06	57.25	57.43	57.61	57.79	57.97	58.14	58.32	58.49	58.66	58.83	59.00	59.17	59.33	59.50	59.66	59.82	59.98	60.14
1.67	57.58	57.76	57.94	58.12	58.29	58.47	58.65	58.82	58.99	59.16	59.33	59.50	59.66	59.83	59.99	60.15	60.31	60.47	60.63
1.68	58.08	58.26	58.44	58.62	58.79	58.97	59.14	59.31	59.48	59.65	59.82	59.99	60.15	60.31	60.48	60.64	60.79	60.95	61.11
1.69	58.58	58.76	58.94	59.11	59.29	59.46	59.63	59.80	59.97	60.14	60.30	60.47	60.63	60.79	60.95	61.11	61.27	61.43	61.58
1.70	59.07	59.25	59.42	59.60	59.77	59.94	60.11	60.28	60.45	60.61	60.78	60.94	61.10	61.26	61.42	61.58	61.74	61.89	62.05
1.71	59.55	59.73	59.90	60.08	60.25	60.42	60.59	60.75	60.92	61.08	61.25	61.41	61.57	61.73	61.89	62.04	62.20	62.35	62.50
1.72		60.20	60.38	60.55	60.72	60.88	61.05	61.22	61.38	61.54	61.71	61.87	62.03	62.18	62.34	62.50	62.65	62.80	62.95
1.73		60.67	60.84	61.01	61.18	61.34	61.51	61.67	61.84	62.00	62.16	62.32	62.48	62.63	62.79	62.94	63.09	63.25	63.40
1.74		61.13	61.30	61.46	61.63	61.80	61.96	62.12	62.28	62.44	62.60	62.76	62.92	63.07	63.23	63.38	63.53	63.68	63.83
1.75			61.74	61.91	62.08	62.24	62.40	62.56	62.72	62.88	63.04	63.20	63.35	63.51	63.66	63.81	63.96	64.11	64.26
1.76				62.35	62.51	62.68	62.84	63.00	63.16	63.31	63.47	63.62	63.78	63.93	64.08	64.23	64.38	64.53	64.68
1.77				62.78	62.94	63.10	63.26	63.42	63.58	63.74	63.89	64.04	64.20	64.35	64.50	64.65	64.80	64.95	65.09
1.78					63.37	63.52	63.68	63.84	64.00	64.15	64.30	64.46	64.61	64.76	64.91	65.06	65.21	65.35	65.50
1.79					63.78	63.94	64.09	64.25	64.40	64.56	64.71	64.86	65.01	65.16	65.31	65.46	65.60	65.75	65.89
1.80						64.34	64.50	64.65	64.81	64.96	65.11	65.26	65.41	65.56	65.70	65.85	66.00	66.14	66.28
1.81							64.89	65.05	65.20	65.35	65.50	65.65	65.80	65.94	66.09	66.24	66.38	66.52	66.67
1.82								65.43	65.58	65.73	65.88	66.03	66.18	66.32	66.47	66.61	66.76	66.90	67.04
1.83									65.96	66.11	66.26	66.41	66.55	66.70	66.84	66.98	67.13	67.27	67.41
1.84										66.48	66.63	66.77	66.92	67.06	67.20	67.35	67.49	67.63	67.77
1.85											66.99	67.13	67.27	67.42	67.56	67.70	67.84	67.98	68.12

CRYSTALLIZATON AREA

LD20924

Troubleshooting

If the chiller malfunctions or an abnormal condition is detected while it operates, locate the cause. Use the following procedures to fix the problem.

If the cause is not clear, using the countermeasure will not repair the problem, or if the chiller seems to have a serious malfunction, contact your local Johnson Controls service center immediately.

If the chiller stops because of a problem, wait until the chilled water pump, cooling water pump, and chiller stop completely, then verify the following items.

Causes of lighting of trouble indicator lamps on control panel of absorption chiller and countermeasures against them.

Several items must be checked routinely whenever the chiller experiences any trouble or abnormality.

- Check to see if the main steam valve was closed by mistake.
- Open the main valve.

  Note: Check the causes in order. Any of these causes will state the diluting operation automatically then stop the chiller. Check that the diluting operation was completed, and if not, dilute the solution according to the Manual refrigerant blow down and diluting method.

- See if the valves of the chilled water system and cooling water system are set correctly. Verify the flow rate.
- See if the cooling tower is operating normally.
- Check the valves and pumps of the cooling water system. Verify the flow rate.

Contact your local Johnson Controls service center if any of the following apply:

- The water flow rate setting is unknown.
- Restoring operations takes 30 minutes or more.
- Solution is crystallized.
- The cause of the trouble is not readily apparent.

Table 45: Troubleshooting the high temperature generator

Item	Cause	Solution
1	Cooling water is insufficient or suspended.	• See if the cooling water supply rate conforms to the specification. Check the flow meter, discharge pressure of the cooling water pump, current,and other applicable pumps or pressures. • If the flow rate is insufficient, check the opening ratio of the flow controller valve and check the strainer for clogging.
2	Cooling water temperature at inlet is high.	Check the capacity of the cooling tower.
3	Non-condensable gas stays in the machine.	• Check the capacity of the vacuum pump. • Check the purge unit. • Purge air from the chiller (See Maintenance). • If partial load operation is continued for a long period, non-condensable gas tends to stay in the absorber. In this case, purge directly from the low pressure side (according to instructions in Maintenance).
4	Heat exchange tube is dirty (chilled water, cooling water).	Contact your local Johnson Controls service center.
5	Solution is crystallized.	
6	Corrosion inhibitor is worn.	
7	Air leaks in absorption chiller.	

Table 46: Chilled water overcooling or refrigerant overcooled

Item	Cause	Solution
1	Chilled water flow rate lowers or changes sharply.	See if the chilled water flow rate changes sharply (particularly in the case of variable flow rate specification). If it changes sharply, apply a limit of the change rate to the chilled water flow control or take another measure.
2	Cooling water temperature at inlet changes sharply.	• See if the cooling water temperature at inlet changes sharply. Checking the start and stop of the fan). • If the chiller refrigerant temperature is low, the chiller stops immediately but does not perform the diluting operation. If left as it is, the solution may crystallize in 4 to 5 hours. To prevent this, dilute the solution according to the procedure shown in Manual refrigerant blow down and diluting method.
3	Load lowers sharply.	See if the load changes sharply.
4	Refrigerant is contaminated with solution for EX(S) and EXW(S). Refrigerant is too high for EX(S)L and EXW(S)L.	See if the refrigerant refining operation has been performed. ⓘ **Note:** Do not loosen the bolts around the flange or remove the disk from the holder. If the disk is removed for any reason, it must be replaced with a new one.
5	Heat exchange tube is dirty (chilled water).	Contact your local Johnson Controls service center.
6	Temperature controller or safety switch is broken.	

In the case of chilled water suspension, the absorption chiller does not perform the dilution operation. It stops immediately. If the absorption chiller is left as it is, the solution may crystallize in 4 to 5 hours. To prevent this, dilute the solution. Use the procedure shown in Manual refrigerant blow down and diluting method.

Table 47: Chilled water suspension

Item	Cause	Solution
1	Chilled water pump has a problem.	Check the chilled water pump for a problem.
2	Chilled water flow rate is low.	Check to see if the chilled water flow rate is below the set point of the water suspension switch. If it is low, check the flow controller, check the strainer for clogging, and check the opening ratio of the flow control valve.
3	Pressure transfer pipe of water suspension switch is clogged.	Contact your local Johnson Controls service center.
4	Water suspension switch is broken.	

If the chiller has a pump problem it does not perform the dilution operation. It stops immediately. If left as is, the solution may crystallize in 4 to 5 hours. To prevent this, contact your local Johnson Controls service center immediately.

Table 48: Pumps overloaded or overheated

Item	Cause	Solution
1	Bearings of the pump are worn or clogged.	Contact your local Johnson Controls service center.
2	Pump is damaged by cavitation caused by low liquid level.	
3	Thermal switch is not set correctly.	
4	Internal cycle control valve is not set correctly.	
5	Filter in the pump is clogged.	
6	Solution is crystallized.	
7	Circuit breaker has tripped.	

Table 49: Chilled water time out or cooling water time out

Item	Cause	Solution
1	Pump abnormal	Check the water pump
2	Insufficient water flow	Check the water line and check the water flow
3	Water suspension relay abnormal	Check the water suspension relay. Check to see if the pipe is clogged or not.
4	Water pump interlock abnormal	Check the water pump.

Table 50: Pump interlocks

Item	Cause	Solution
1	Water pump interlock was not established	Check the water pump interlock.

Table 51: Low cooling water inlet temperature

Item	Cause	Solution
1	Cooling water inlet temperature control system is abnormal	Check the cooling water inlet temperature control system. If this problem occurs, the absorption chiller performs the diluting operations automatically, and then stops. Go to the Control Center immediately and confirm that the diluting operation took place. If the diluting operation did not occur, dilute the solution according to the procedure shown in Manual refrigerant blow down and diluting method.

If these problems occur, the absorption chiller performs the dilution operation automatically and stops. Go to the Control Center immediately and confirm that the dilution took place. If the dilution operation did not run, dilute the solution. Use the instructions shown in Manual refrigerant blow down and diluting method.

Table 52: Abnormal control sensor

Item	Cause	Solution
1	Contact failure	Tighten terminal in control panel.
2	Sensor abnormal or disconnected	Contact your local Johnson Controls service center.
3	Inductive noise	

Table 53: CPU abnormal

Item	Cause	Solution
1	Control board malfunction	Contact your local Johnson Controls service center.

Troubleshooting performance issues

If the performance is insufficient while the steam control valve is fully opened or if the steam control valve does not fully open while the load is sufficient, check numbers 1 to 7 in the following table in order. If the cause of the malfunction is other than numbers 1 to 7, it may be one of number 8 to 14. In this case, contact your local Johnson Controls Service Center immediately.

Table 54: Troubleshooting performance issues

Item	Cause	Countermeasure
1	Cooling water temp. is high.	Check the capacity of the cooling tower.
2	Cooling water flow rate is too low.	See if the cooling water supply rate matches the specification. Check the flow meter, discharge pressure of the cooling water pump, current, and other relevant water gauges. If the flow rate is insufficient, check the opening ratio of the flow controller valve and check the strainer for clogging.
3	Cooling water heat exchange tube is dirty.	Contact your local Johnson Controls service center.

Table 54: Troubleshooting performance issues

Item	Cause	Countermeasure
4	Non-condensable gas remains in machine.	• See Purge procedure. • Check the capacity of the vacuum pump. • Check the purge unit for a problem. • Purge air from the absorption chiller. If partial-load operation is continued for a long period, non-condensable gas tends to stay in the absorber. In this case, purge directly from the low-pressure side (absorber), see Purge procedure. Even if the automatic purge unit is installed, purge from the lower pressure side (absorber) manually.
5	Chilled water outlet temperature controller is not set correctly.	Be certain that each setting parameter of the chilled water outlet temperature controller is set correctly.
6	Manual refrigerant blow valves are kept open.	Check that manual refrigerant blow valve V8 is fully closed.
7	The Refrigerant Pump **Stop** button is pressed.	Press the Refrigerant Pump **Auto** button.
8	Corrosion inhibitor is depleted.	Contact your local Johnson Controls service center.
9	Surface active agent is depleted.	
10	Refrigerant is contaminated with solution for EX(S) and EXW(S). Refrigerant is too high for EX(S)L and EXW(S)L.	
12	Chilled water outlet temperature controller is broken.	
11	Internal cycle control valve is not set correctly.	
13	Solution is crystallized.	
14	Air leaks in absorption chiller.	

Vacuum pump

When the **Purge Abnormal** alarm button lights, the vacuum pump needs to be disassembled for inspection. Contact your local Johnson Controls service center. When the **Abnormal Purge Freq.** alarm button lights or the vacuum level of the purging line did not reach the specified level during the vacuum pump capacity, check to see if the entire purge line needs to be inspected. See Table 55.

Table 55: Vacuum pump troubleshooting

Item	Cause	Countermeasure
1	Deterioration of vacuum pump oil	Replace the vacuum pump oil.
2	Incorrect operation of purging line switching when vacuum pump capacity was checked.	See Purge procedure. Confirm the valves are open or closed.
3	Deterioration of vacuum pump belt	Contact your local Johnson Controls service center.
4	Leakage in purge pipe lines.	
5	Solenoid valve or check valve in the purge line is clogged.	

Abnormal solution and refrigerant levels

Causes of abnormal levels of solution and refrigerant and countermeasures against them are shown in Table 56. If the level of the solution or refrigerant is incorrect, correct it according to the following procedure.

Table 56: Abnormal solution refrigerant levels

Section	Normal condition	Abnormal condition	Cause	Countermeasure
Refrigerant Overflow (G101)			High temperature of cooling water inlet temperature.	• See if the cooling water supply rate is conformed to the specification. Check the flow meter, discharge pressure of the cooling water pump, current, and other relevant water gauges. If the flow rate is low, check the opening ratio of the flow controller valve and check the strainer for clogging. • Check the capacity of the cooling tower. • See Purge procedure. • Check the capacity of the vacuum pump. • Check the purge unit for trouble. • Purge air from the absorption chiller. If partial-load operation is continued for a long period, non-condensable gas tends to stay in the absorber. In this case, purge directly from the low pressure side (absorber), see Purge procedure.
			Low temperature of chilled water outlet temperature.	
			Cooling water tube fouling	
			Purge trouble	
			Air leakage	
Refrigerant Tank (G102)			Cooling water inlet temperature is low. Setpoint error of automatic start and stop switch.	• Check cooling water inlet temperature. • Check the setpoint.
Solution Tank (G103)			Purging is insufficient.	See Purge procedure.
			Adjusting valve opening setting error.	Contact your local Johnson Controls service center.
			Solution is crystallized.	

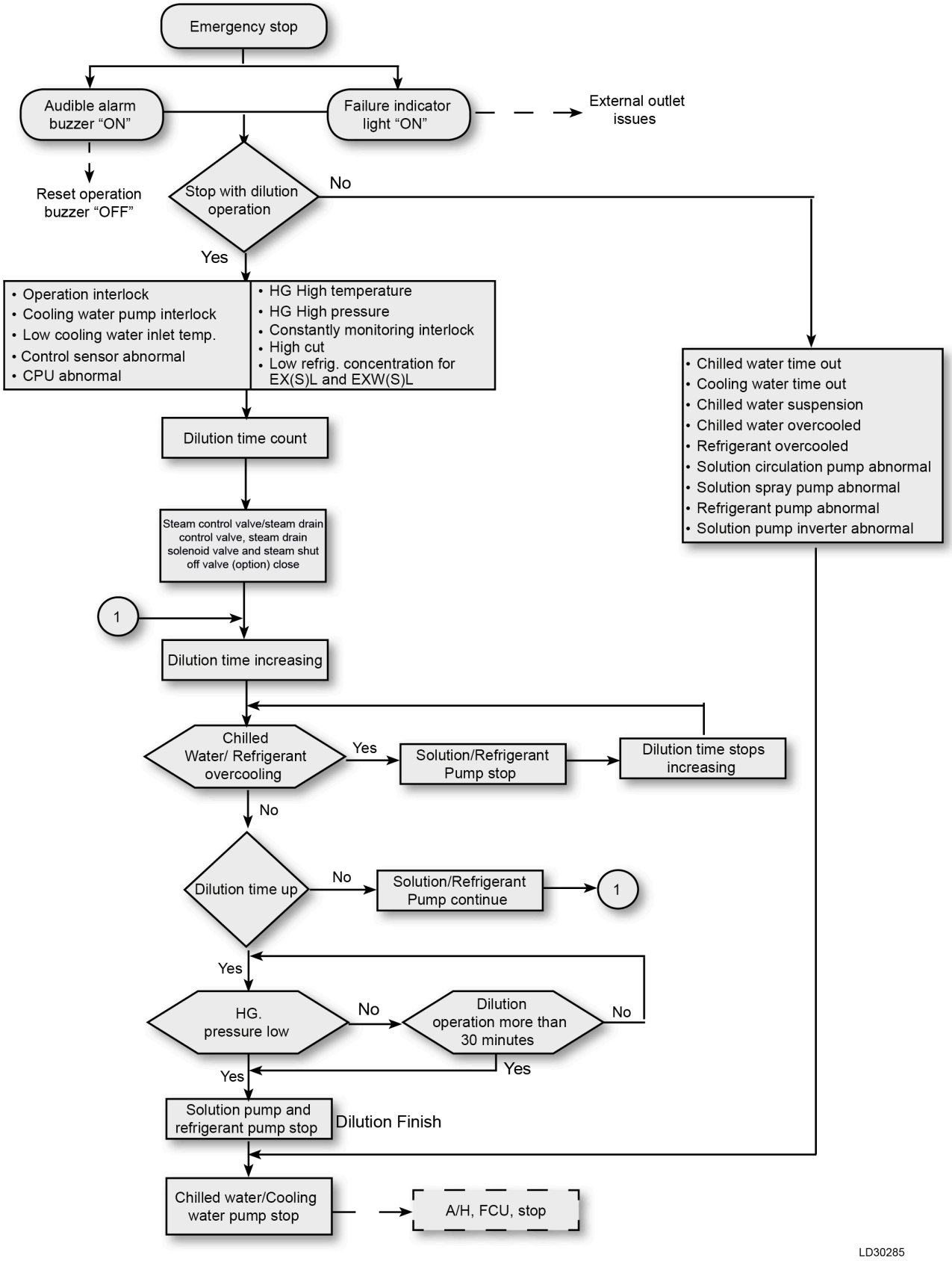
Insufficient vacuum levels

Causes of insufficient vacuum level of purging line and countermeasures against them.

Table 57: Insufficient vacuum levels

Item	Cause	Countermeasure
1	Purge pump trouble.	Contact your local Johnson Controls service center.
2	Deterioration of vacuum pump oil.	Replace the vacuum pump oil.
3	Incorrect operation of purging line switching when vacuum pump capacity was checked.	• See Purge procedure. • Confirm that the valves are either open or closed.
4	Deterioration of vacuum pump belt.	Contact your local Johnson Controls service center.
5	Leakage in purge pipe line.	
6	Blocked or broken purge solenoid valves.	
7	Check valve does not open.	
8	Valve V21 left open by mistake.	• See Purge procedure. • Confirm that the valves are either open or closed.

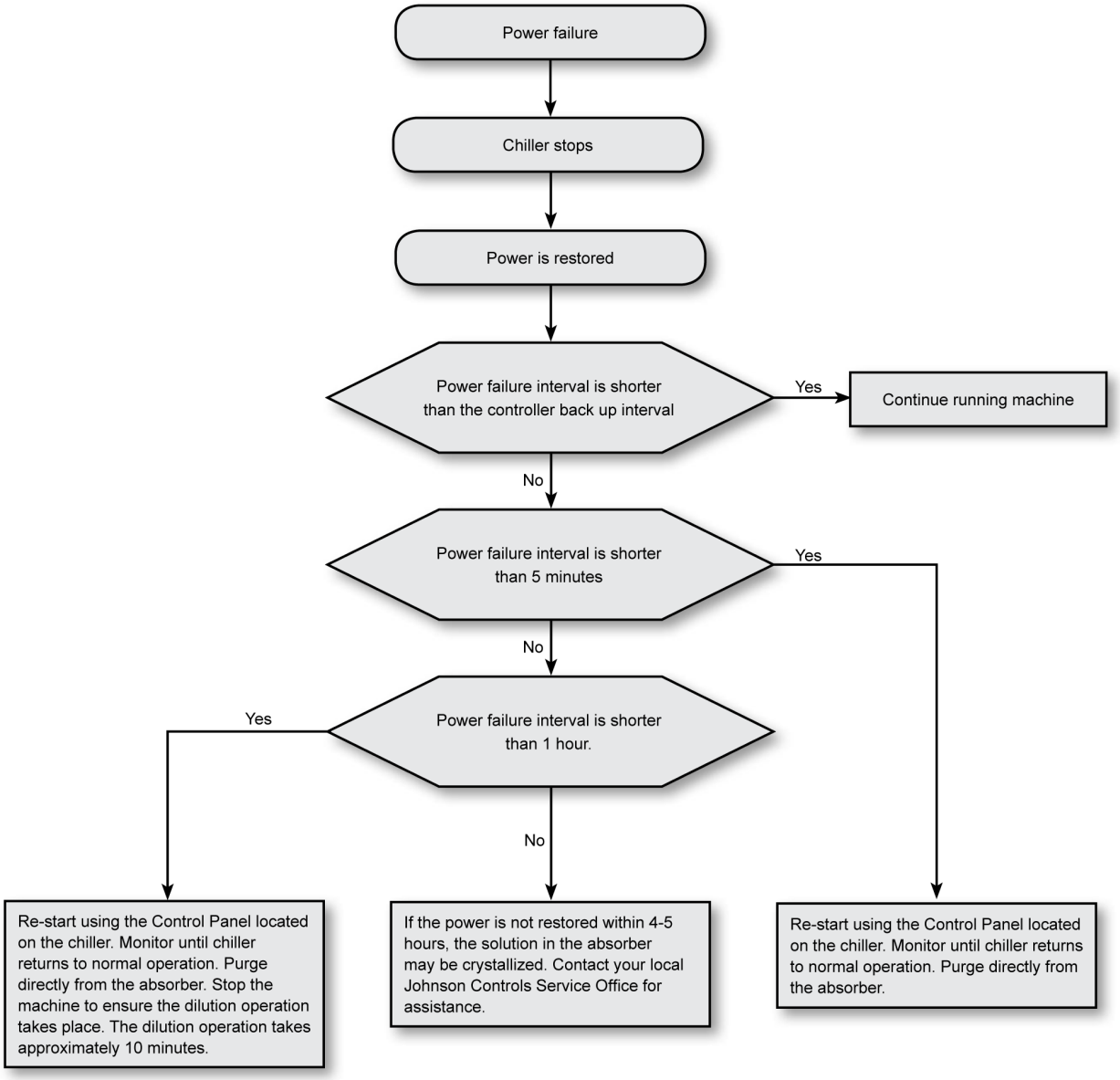
Figure 101: Troubleshooting sequence flow chart



Actions to take during a power failure

If the main power fails, take the following actions.

Figure 102: Actions to take during a power failure flow chart



Note: If the chilled water design is less than 37.4°F (3 °C) and uses pure water, add the UPS for the chilled water pump to avoid freezing. In the event of power failure, the steam supply must shut off automatically.

Decommissioning, dismantling, and disposal

Unless otherwise indicated, the operations described in the following section can be performed by any trained maintenance technician.

1. Isolate all sources of electrical supply to the chiller, including any control system supplies switched by the chiller. Make sure that all points of isolation are secured in the OFF position.
2. Disconnect and remove the supply cables. For connection points, see Handling, storage, installation, and reassembly.
3. Fill the interior of the chiller with N2 gas to pressurize up to 1.5-3 psig.
4. Prepare a suitable container. See and .
5. Drain the remainder of the solution and refrigerant in the chiller from each service valve as completely as possible into the container.
6. Dispose of the refrigerant and solution in a suitable and safe manner.
7. Isolate the unit heat exchanger from the external water systems. Drain the heat exchanger section of the system. If no isolation valves are installed it may be necessary to drain the complete system.
8. If glycol was used in the water system, or chemical additives are contained, dispose of the solution in a suitable and safe manner. After draining, disconnect and remove the water.

   ⓘ **Note:** Do not, under any circumstances, drain any system containing glycol directly into domestic waste or natural water systems.

9. Remove fixing down bolts. Lift the chiller from position, using the points provided and equipment with adequate lifting capacity.

See Handling, storage, installation, and reassembly for chiller installation instructions, see Table 7 and Table 8 for chiller weights.

Chillers that cannot be removed in one piece after disconnection, must be dismantled in position. Handle each component carefully. Where possible, dismantle chillers in the reverse order of installation.

Make sure that while components are being removed, the remaining parts are supported in a safe manner.

⚠ CAUTION

Only use lifting equipment of adequate capacity.

After removing the chiller from position, dispose of the chiller parts according to local laws and regulations.

Optional applications - low chilled water supply

By applying the low temperature chilled water supply option for the EX(S)L and EXW(S)L models, the chiller can supply 33.8°F to 39.2°F of the chilled water constantly without freezing the refrigerant water.

To prevent freezing of refrigerant in the evaporator, a small amount of LiBr solution is mixed with refrigerant in the evaporator and its concentration must be monitored and kept within appropriate range. The Coriolis mass flow meter is equipped to detect the density of the refrigerant in the evaporator and it is used to calculate and monitor the concentration of the refrigerant evaporator. See Table 58.

Table 58: Refrigerant Density setting table for Model EX(S)L/EXW(S)L

Specification chilled water outlet temperature °F (°C)	Appropriate range of refrigerant density lb/in^3 (kg/L)
32 to 33.6 (0.0 to 0.9)	39.54 to 40.26 (1.095 to 1.115)
33.8 to 35.4 (1.0 to 1.9)	38.93 to 39.65 (1.078 to 1.098)
35.6 to 37.2 (2.0 to 2.9)	38.27 to 39.00 (1.060 to 1.080)
37.4 to 39.0 (3.0 to 3.9)	37.59 to 38.31 (1.041 to 1.061)

To control the concentration of the refrigerant in the evaporator, the solution blow solenoid valve is equipped. This valve is opened if the density of the refrigerant in the evaporator falls to its set point. While this density is no higher than its set point, the `Low Refrigerant Concentration Prevention` alarm is activated. If this density does not increase to its set point even after opening the solution blow solenoid valve for its set time, the chiller is stopped with `Low Refrigerant Concentration` failure activation.

The lower absorber pressure sensor is equipped to detect the precise pressure in the lower absorber and it is used to calculate and monitor the concentration in lower absorber. If the calculated concentration rises to its set point, the `High Absorber Concentration Prevention` alarm is activated and the load limit operation is applied to prevent the crystallization of the solution.

Figure 103: Main screen for model EX(S)L EXW(S)L

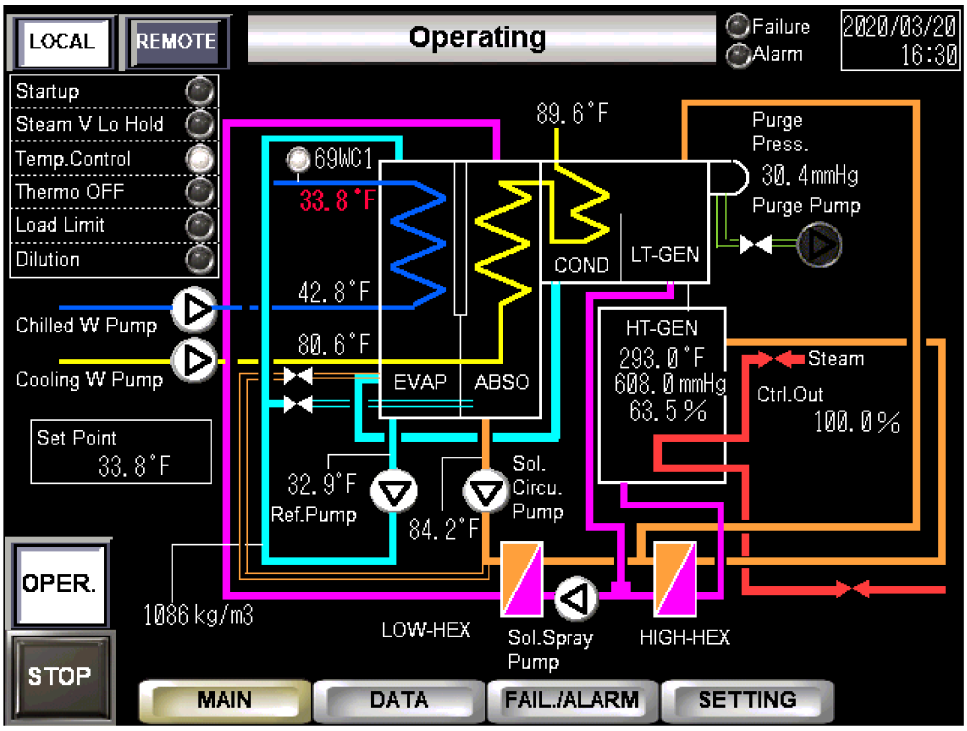


Figure 104: Data screen for model EX(S)L and EXW(S)L

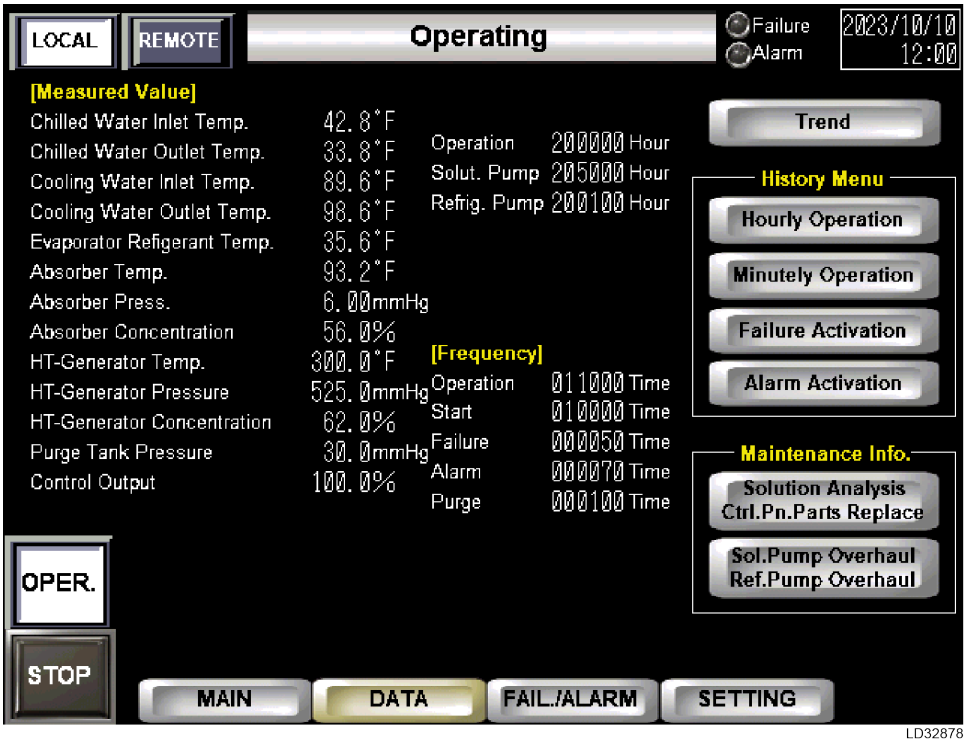


Figure 105: Failure/alarm screen for model EX(S)L and EXW(S)L

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Figure 106: Double effect steam chiller, circle diagram for EXL and EXWL

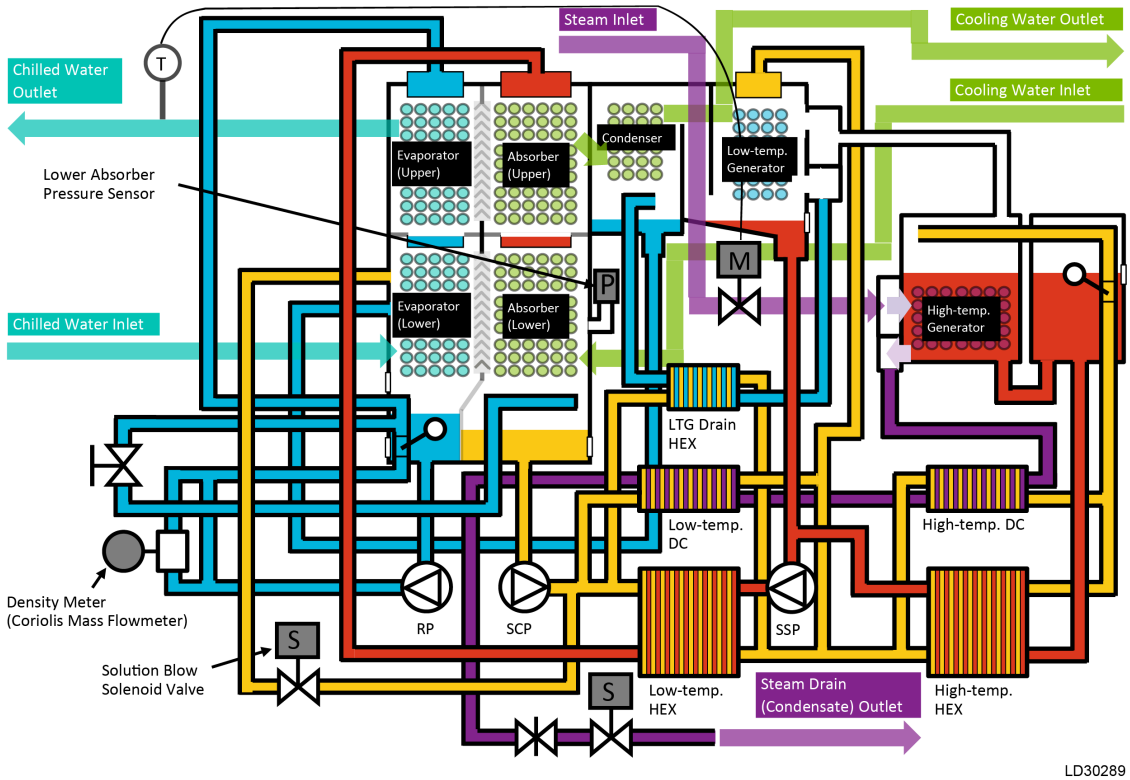

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Figure 107: Process and instrumentation diagram for EXL and EXWL